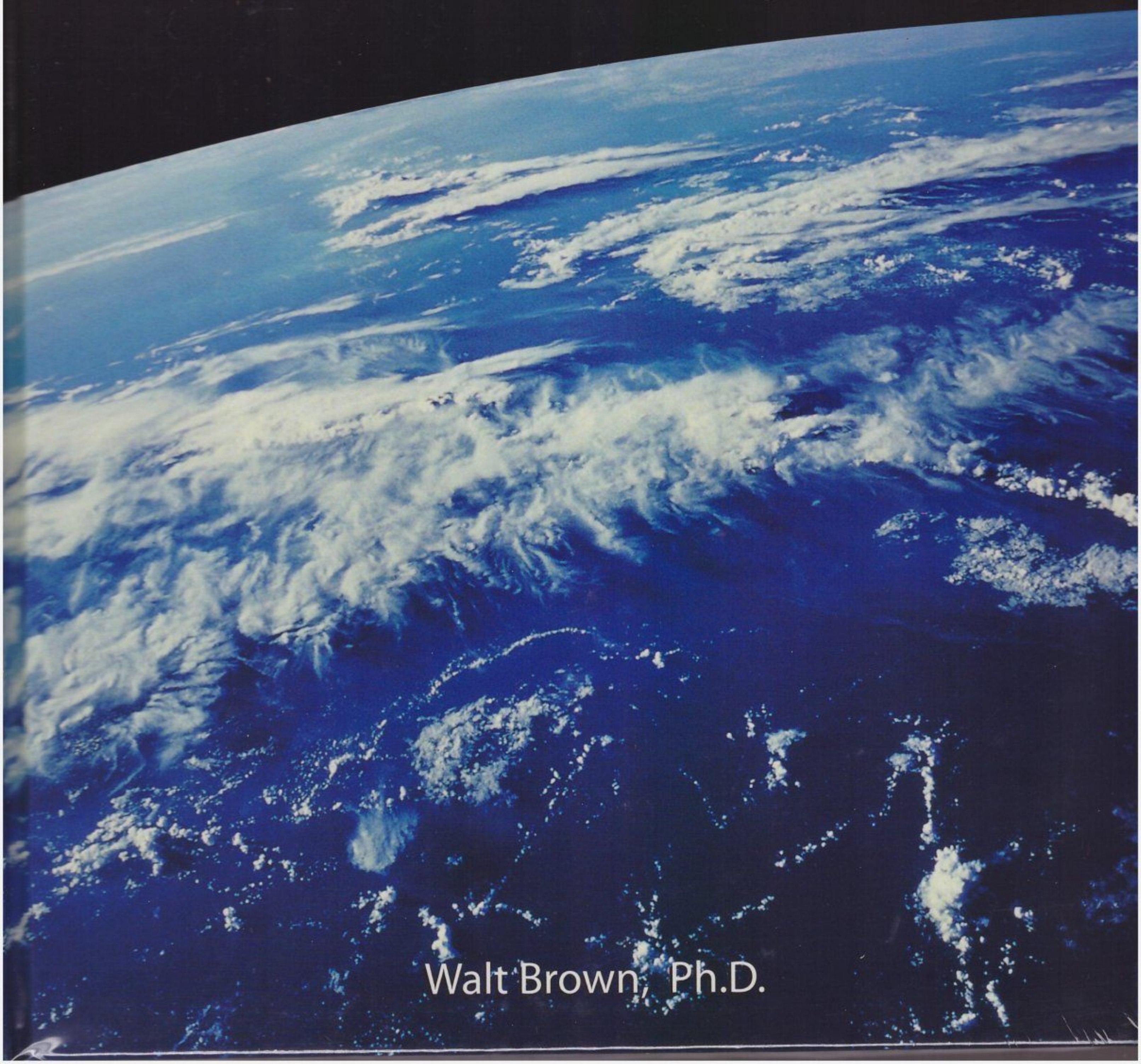
IN THE BEGINNING

Compelling Evidence for Creation and the Flood



Walt Brown, Ph.D.

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In this expanded 8th edition, evidence that revolutionizes our understanding of origins is carefully explained. Part I discusses, in quick overview, 131 categories of evidence from biology, astronomy, earth science, and the physical sciences.

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Part II describes the hydroplate theory, developed during 35 years of study and research by Walt Brown. This theory explains a catastrophic event in earth's history and solves a host of recognized problems. For decades, evolutionists complained that creationists only criticized evolution and did not offer sound scientific theories of their own. The hydroplate theory ends that complaint.

- If there was a global flood, where did all the water come from? Where did it go?
- What were the powerful *fountains of the great deep?*
- How was the Grand Canyon carved in weeks after a post-flood lake (Grand Lake) breached?
- What evidence shows that the material in comets, asteroids, and meteoroids came from Earth?
- What suddenly froze and buried the mammoths? How could they have survived the 6-month winter nights inside the Arctic Circle?
- How did mountain ranges, volcanoes, submarine canyons, coal and oil deposits, and deep ocean trenches form?
- What process sorted fossils and produced layered strata?

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- Have scientific tools detected genetic traces of Adam and Eve within us?
- Is evolution compatible with the Bible?
- How accurate is radiocarbon dating?
- What about the dinosaurs?
- What hydroplate predictions have been confirmed?

Walt Brown received a Ph.D. in mechanical engineering from the Massachusetts Institute of Technology (MIT), where he was a National Science Foundation Fellow. He has taught college courses in physics, mathematics, and computer science. Brown is a retired Air Force full colonel, West Point graduate, and former Army Ranger and paratrooper. Assignments during his 21 years of military service included: Director of Benét Laboratories (a major research, development, and engineering facility); tenured associate professor at the U.S. Air Force Academy; and Chief of Science and Technology Studies at the Air War College. For much of his life Walt Brown was an evolutionist, but after years of study, he became convinced of the scientific validity of creation and a global flood. Since retiring from the military, Brown has been the Director of the Center for Scientific Creation and has worked full time in research, writing, and teaching on origins. His biography is in *Christian Men of Science: Eleven Men Who Changed the World* by Mulfinger and Orozco.

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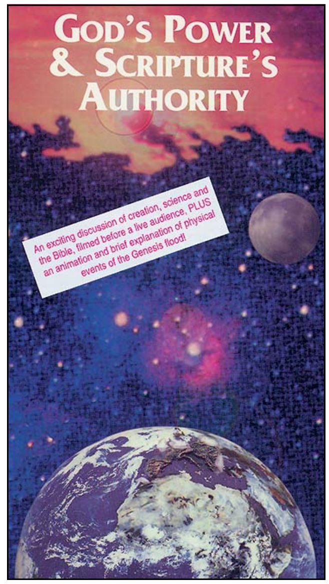

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In the Beginning

Compelling Evidence for Creation and the Flood

Walt Brown, Ph.D.

Walt and Peggy Brown with their children and grandchildren

To my grandchildren:

Jared, Seth, Luke, Adam, and Andrew Brown

Sean, Ryan, Laney, Trent, and Lily McDowell

Preston Kulesha
Faith, Gunnar, and Benjamin Johnson

Above Photo: Rob Brown and Jim McDowell

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Preface

You may have several questions about this book: Why was it written? How is it organized and why? For whom is it intended? Where is the creation-evolution issue headed?

This study began unexpectedly in June 1970. I was a Christian, an evolutionist, and a new professor at the U.S. Air Force Academy. I heard surprising claims that Noah's Ark rested near the 14,000-foot level of Mount Ararat in eastern Turkey. If a gigantic boat had ever been at that elevation, a huge flood must have occurred. However, the biblical flood was always hard for me to imagine. After all, where could so much water come from? Where did it all go? Every attempt I had heard to answer the first question was shallow at best. Few, if any, ever tried to adequately answer the second.

For two years I pondered these issues, reading most of what was written about claimed Ark sightings and talking with many "Ark hunters." Almost daily I gazed up at 14,000-foot Rocky Mountain peaks and tried to imagine, at one of their summits, an object large enough to fill a football stadium. The case for the Ark's existence grew stronger as many of my questions were answered.

With this growing possibility came a problem. If that much water sloshed over the earth for a year, many dead animals and plants would have been buried in vast amounts of mud and other sediments. This could explain how almost all fossils formed, especially those on the highest mountains. But the fossil record was supposedly the best evidence for evolution, a theory I had passively accepted. If a global flood produced most fossils, where was the evidence for evolution? The more I struggled with this question, the more amazed I became at the lack of evidence supporting evolution and the abundant evidence supporting creation. By 1972, I had become a creationist.

As I began to talk with friends and colleagues about origins, invitations to speak arose. Speaking publicly on the subject forced me to organize my thoughts. In this way, the first edition of this book began to "evolve."

In 1978, my wife and I decided the subject was so broad and important that I should pursue it full time, and, therefore, leave a demanding, interesting, and successful military career at the first opportunity. That occurred in 1980. Since then, I have kept busy with study, writing, debates, speaking engagements, and research (particularly development of the *hydroplate theory,* which deals with the flood). It has been exciting to see how greater awareness of creation profoundly affects so many people. You may experience this yourself.

Initially, those attending the full-day "*In the Beginning" Seminar* were given material summarizing the seminar content and answering many frequently asked questions. The first three editions of this book served that purpose. Later, outside requests for the book grew to the point that it had to be modified for those who had not attended. However, the book's basic organization still follows the seminar format—an ideal format for learning this subject.

Part I of this book begins with a summary of the scientific evidence dealing with origins. That evidence falls into nine areas: three in the life sciences, three in the astronomical and physical sciences, and three in the earth sciences. Figure 1 on page viii shows this organization. Part II contains the most popular of those nine areas, as demonstrated in 200 seminars and by letters, emails, and phone calls we receive daily. Scientists, in particular, are struck by the number and diversity of problems the hydroplate theory easily solves. Part III contains 38 questions most frequently asked during question-and-answer sessions at seminars and in media interviews—questions not already answered in Parts I and II.

This format and a comprehensive index allow a reader to focus on areas of primary interest while keeping the "big picture" in mind. Parts I, II, and III, which are quite different, may be read independently and in any order. Difficult parts can be skipped. Readers are often amazed at the endnotes, which contain many revealing and surprising quotations—usually from evolutionists.

The intended reader is anyone interested in the subject of origins—from high school students with little scientific background to people with multiple Ph.D.s in science. Parents have even paraphrased topics for their children at mealtime or bedtime.

Here is an offer for students, parents, and educators who read the entire book. Rather than place you in the awkward position of debating with science teachers or professors who are evolutionists, let me suggest an interesting alternative. As you read this book, identify questions to ask educators. If they object to any scientific information or conclusion in the book, I will be happy to discuss it with them by telephone, provided you are part of our three-way conversation. With their permission, you may record our conversation for the entire class. If nothing else, this will sharpen everyone's critical thinking skills, put more information "on the table," and move us a little closer to the truth.

Where is the creation-evolution controversy headed? I believe the battle will be won—not in courts, legislatures, boards of education, or church councils—but by grass-roots science education. Yes, today evolutionists generally control higher education, science journals, and the media, but the scientific evidence overwhelmingly supports creation and a global flood. (If you find someone who disagrees, please refer them to the preceding paragraph and to pages 473–476. *Challenge them*—then watch what happens.) Throughout the history of science, controversies have raged. Perhaps none has had the profound social consequences—and, therefore, the interest and emotion—of this origins debate. In the end, the side with the scientific evidence has always prevailed. The Galileo episode is one example.

Our task, then, is to educate the public, including students. People who are aware of this evidence will inevitably bring pressure and embarrassment on the entrenched interests, starting in the classroom. This is already happening. How can more be done? Many of the pictures in this book could be fascinating subjects for a grade-school child's classroom report. High school students could go further by reading and analyzing articles and reports related to such pictures. College students could extend this by interviewing and critiquing scientists specializing in the subject. Adults will enjoy explaining these and hundreds of other points of evidence to friends. (Many conduct courses using this book.) As more people learn, more will want to learn. Increasingly, the public will ask—or tell—educators, publishers, museums, and the media to educate themselves and stop perpetuating misinformation and bad science.

Although many people helped with this book and offered constructive suggestions, six should be mentioned. Brad Anderson's creativity and unparalleled expertise with computers and book design are seen on each page. Jon Schoenfield skillfully and meticulously checked and frequently improved all parts of the text. Also of great assistance were Peggy Brown, David Hull, Kevin Lea and Stuart Patterson. My family's support has been invaluable. To them and many others who helped, I am immensely grateful. The mistakes, of course, are mine alone.

My hope is that *In the Beginning: Compelling Evidence for Creation and the Flood* will help you, the reader, as you explore the amazing events "in the beginning."

Walt Brown

The entire book is at CSC's website
www.creationscience.com
The web version of the book will be periodically updated.
There is no charge for reading or printing any or all portions of it.

A CD-ROM containing most of the figures and tables in this book may be purchased. For details, see page 518.

Those who are teaching from this book and have related questions may call CSC at (602) 955-7663.

Teachers may arrange—at no cost—for students who have read this book to question Dr. Brown by phone. Before the course begins, teachers should contact CSC, describe their class, and arrange for a mutually agreeable time to call near the end of the course. At the arranged hour, simply have a speakerphone in the classroom, so all students can participate.

HERE'S WHAT OTHERS SAY ABOUT THIS EXCITING BOOK

Walt Brown's book is the rarest of species: It is the most complete reference work I have encountered on the scientific aspects of the multifaceted subject of origins. At the same time it presents a comprehensive theoretical framework (his hydroplate theory) for reconciling the many seemingly unrelated, and sometimes apparently contradictory, facts that bear on these questions. This book is essential for any teacher or student who is serious about resolving these issues on the basis of the evidences rather than on opinions or unsubstantiated or unverifiable hypotheses.

Dr. C. Stuart Patterson, former Academic Dean and Professor of Chemistry, Emeritus, Furman University

The subject of origins is not peripheral; it is foundational. I have spent most of my adult career in universities in the U.S. and Europe (as a Fulbright scholar), and it is clear that Christianity is losing ground on college campuses. The Christian faith is becoming unraveled with bad science. I can say without reservation that *In the Beginning* is the single most useful resource I know of on this subject, bar none. Walt is both diligent and creative and you will find the arguments concise and thought provoking. The material is helpful on almost any level, and the references will be invaluable to those wishing to dig deeper. If I had to send my child off with only two books, they would be the Bible and *In the Beginning*.

Dr. Kent Davey, Senior Research Scientist, The Center for Electromechanics, University of Texas at Austin

In the Beginning is a great creation science book for teens and adults. It's easy to read, carefully researched, meticulously documented, and offers answers to the most important questions of the origins controversy. Besides the usual creation-science approach to questions about the historicity of Genesis and what happened to make the dinosaurs extinct, the book is unique in explaining for the first time how twenty-six major earth features—including mountains, volcanoes, the Grand Canyon, and ice ages—resulted from a worldwide flood. At the same time, it reveals serious yet little-known problems with many evolutionist ideas about earth history and the origin of life—including many ideas that evolutionists themselves have discarded, but are still taught as fact in children's textbooks. You owe it to yourself to get this book.

Mary Pride's Big Book of Home Learning, *Science Reviews*

Classic uniformitarian geology has failed to solve a number of problems in geology. By contrast, using catastrophic basic assumptions, Dr. Brown has given scientists a way of addressing many problems that is philosophically sound and scientifically acceptable to objective thinkers. Never before have I encountered a more intellectually satisfying and respectable attack on a broad spectrum of geologic and biologic problems that are laid bare in this work.

Dr. Douglas A. Block, Geology Professor, Emeritus, Rock Valley College

Of the many sources that exist to strengthen the Christian's position for creation, I believe that Walt Brown's is one of the clearest presentations available. The material in this book is not nebulous. On the contrary, it is precise. Walt has a knack for making what would, otherwise, be a complex subject into one easy to grasp. I wholeheartedly recommend this book.

Skip Heitzig, Senior Pastor, Calvary of Albuquerque

Dr. Walt Brown uses three striking gifts in his creation science research and teaching: (1) a highly organized mind, (2) the ability to consider scientific evidence without the encumbrance of conventional paradigms, and (3) the ability to articulate the material with complete clarity. Walt is a born teacher. This enables him to develop significant new theories, such as the hydroplate theory, and to present them with remarkable clarity in both his seminars and this book. I am convinced that everyone needs to be familiar with the landmark work documented in this book.

Dr. Stanley A. Mumma, Professor of Architectural Engineering, Pennsylvania State University

I know on the basis of conversations with high school and college students that Walt Brown's excellent book deals with issues they have to face. I gave one of my copies to a teenager who is fascinated by science. His mother called to tell me she is having trouble getting him to turn out the light at night. He is devouring it.

Donald Cole, Radio Pastor, Moody Broadcasting Network, Chicago, Illinois

The CSC classic, *In the Beginning*, provides perhaps the most useful analysis ever written on the subject of theistic evolution.

Dr. D. James Kennedy, author and former Senior Pastor, Coral Ridge Presbyterian Church, Fort Lauderdale

Books uncovering the false claims of evolutionists have become so numerous that well-prepared summaries are greatly needed, especially for introductory and classroom purposes. Admirably designed to meet this need is Walt Brown's *In the Beginning*. For me, the most spectacular section is its unfolding of the hydroplate theory in connection with the great universal flood. Brown's presentation is an astonishing explanation of where the water may have come from and where it went. It does forcefully replace the water-canopy theory, which has obvious problems connected with it.

Msgr. John F. McCarthy, J.C.D., S.T.D., Editor, *Living Tradition*, Rome, Italy

Dr. Walt Brown's seminal text, *In the Beginning: Compelling Evidence for Creation and the Flood* has developed into a mature exposition of an important new approach to the geological sciences. The hydroplate theory is an alternate explanation of events of the Noahic flood, present-day geological features of the world, and actual mechanisms that operated then and continue to do so now. It directly challenges the current plate tectonics model of large-scale geology, and suggests a major revamping of the geological events associated with the flood God sent upon the world in light of the clear text of Genesis. It represents, then, a serious attempt at reconstructing the science of geology from the ground up.

Martin G. Selbrede, "Reconstructing Geology: Dr. Walt Brown's Hydroplate Theory," *Chalcedon Report*

The subject of origins is inherently interesting to all of us, yet this topic is so broad that one can get lost in the sheer volume of information. As a biologist and a Christian, I find *In the Beginning: Compelling Evidence for Creation and the Flood* to be the most concise, scholarly treatment of the scientific evidence supporting creation that I have ever read. This book is a must for anyone who is serious about understanding the creation/evolution debate. Science teachers, regardless of religious affinities, should also find this excellent resource a valuable addition to their reference libraries.

Terrence R. Mondy, Outstanding Biology Teacher for Illinois, 1999–2000

Dr. Brown is delightfully straightforward about science and creation. His analysis is both thoughtful and faithful. Every informed Christian should have access to this insightful material.

Dr. Stu Weber, author of *Tender Warrior*, Senior Pastor, Good Shepherd Community Church, Boring, Oregon

The way to refute evolution: Don't bother. Let Dr. Walt Brown do it. Actually, anyone can vaporize the lies of the evolutionists with this most impressive layman's guide to scientific creation. If you have ever wondered how to reconcile the truths of Genesis with the rigors of the scientific method, then stop scratching your post-Neanderthal skull and see it explained fully. You will find that Dr. Brown has rooted out perplexing mysteries that most knowledgeable scientists are afraid to address. His book is loaded with irrefutably logical arguments.

Brother John Mary, M.I.C.M., Saint Benedict Center, Richmond, New Hampshire

Dr. Walt Brown is eminently qualified to write a book such as this. Just check his credentials. He carefully presents the facts in a manner that even I, who had trouble with science in school, can understand. I would particularly call your attention to the chapter on theistic evolution. Dr. Brown destroys that comfortable ground so many Bible believers love to stand on. This book should be in the hands of every truth-seeking student in the world.

Larry Wright, Bible teacher, founder of Abundant Life, Inc., Phoenix, Arizona

Let me recommend for your reading *In the Beginning*. As I observe the latent indifference to the preciousness of life, I see the results of our exposure to the evolution dogma. To believe we are a result of a random process removes all sense of moral consciousness and spiritual motivation. The research of Dr. Walt Brown is crucial, not just to academic discussion, but to the survival of our culture.

Dr. Darryl DelHousaye, author of *Today for Eternity*, President of Phoenix Seminary, Phoenix, Arizona

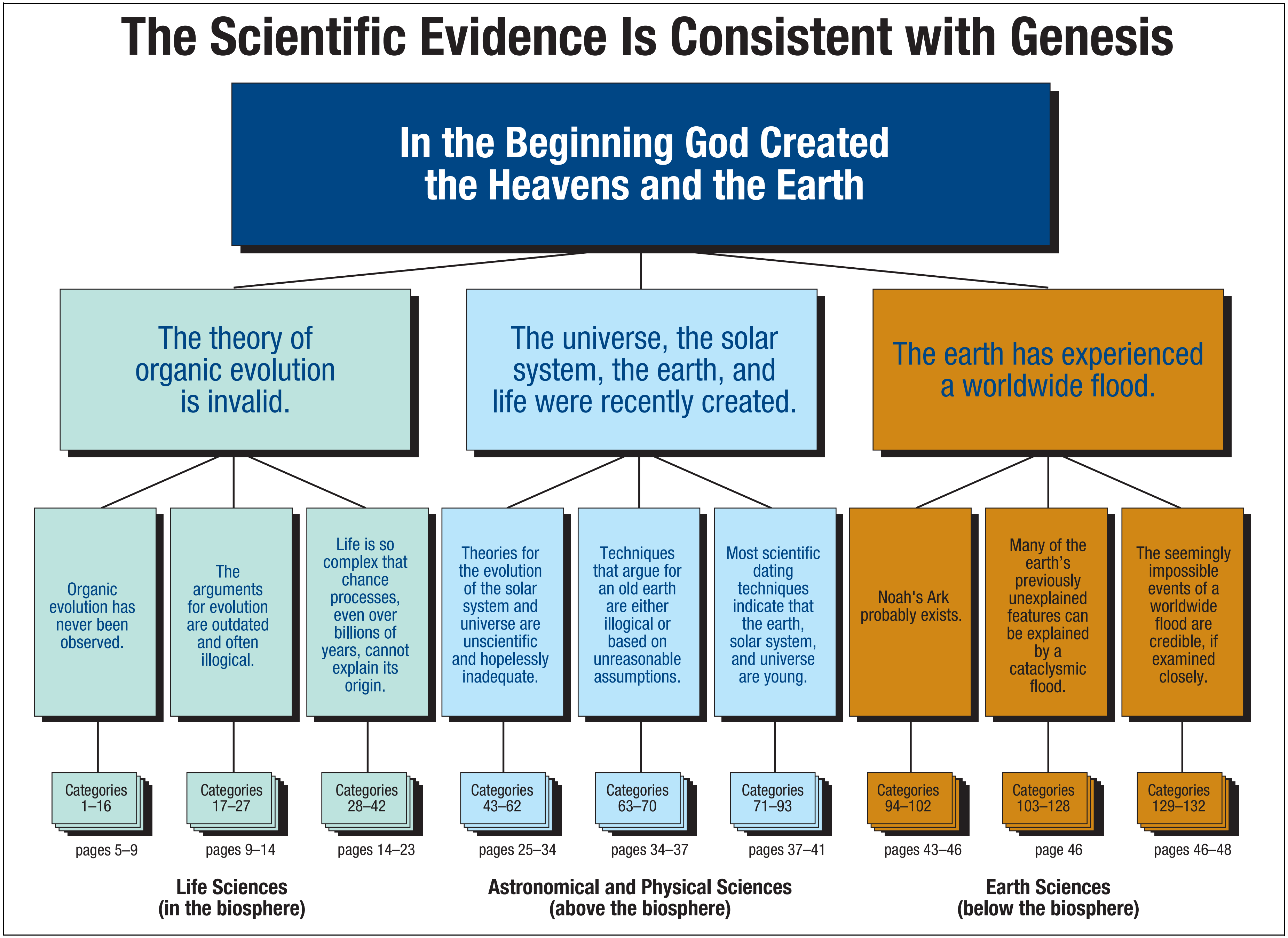


Figure 1: Organization of the Scientific Case for Creation.

Part I:

The Scientific Case for Creation

Part I is a brief summary, in outline form, of 132 categories of scientific evidence that support a sudden creation and oppose gradual evolution. As Figure 1 shows, categories 1–42 relate to the ***life sciences***, 43–93 relate generally to the ***astronomical and physical sciences***, and 94–132 relate to the ***earth sciences***.

Quotations, references, and notes on pages 51–105 provide supporting details for specific conclusions. Usually, these details are based on research done by evolutionists who are experts in a relevant field. Choosing evolutionists rather than creationists will minimize charges of bias. (Besides, no testimony is more convincing than that from a "hostile witness.") Most people find the quotations, highlighted in blue type, fascinating.

For many years, students, teachers, and professors have been unaware of most of this information, especially the broader conclusions that can be reached. Those conclusions are stated in Figure 1 and in large, bold headings on the following pages. The larger the heading, the broader the conclusion. There is one overall conclusion for the life sciences, one for the astronomical and physical sciences, and one for the earth sciences. Each has three supporting conclusions, for a total of nine. A typical supporting conclusion is based upon about a dozen categories of evidence. All 132 are summarized in the following pages. Figure 1 shows the relationships of these 3 + 9 broad conclusions and the 132 categories of evidence.

Scientific information cannot be suppressed for long, so it is not surprising to see a growing awareness and excitement concerning this information. Some evidence involves new discoveries. Other evidence, discovered long ago, has been poorly disseminated. If all this information were openly presented in science classrooms, better education would result. Regardless of your age or education, you can learn and help others learn this information about a subject that holds great interest for most people—the subject of origins.

Figure 2: Depictions of Saturn, DNA, and the Ark.

Introduction

The scientific evidence showing the hand of the Creator falls into three major areas: life sciences, astronomical and physical sciences, and earth sciences. Generally speaking, the life sciences relate to the biosphere (the atmosphere, oceans, and other surface waters); astronomical sciences deal with phenomena above the biosphere; and earth sciences deal with phenomena below the biosphere.

Three fascinating objects are depicted on the opposite page—one representing each of these three areas of science. Each involves new discoveries which excite layman and scientist alike. Each object is an amazing reminder of a designer whose attributes are too big, too complex, and too powerful for the mind of man to grasp.

Life Sciences

Shown in the circular inset near the bottom of Figure 2 is the double helix representing DNA (deoxyribonucleic acid). Duplicate copies of this long tape of coded information are coiled up in each of the 100,000,000,000,000 (one hundred trillion) cells in your body. You have 46 segments of DNA in almost all of your cells. You received 23 segments from your mother and 23 from your father. DNA contains the unique information that determines what you look like, much of your personality, and how every cell in your body is to function throughout your life.

If all the DNA in one of your cells were uncoiled, connected, and stretched out, it would be about 7 feet long. It would be so thin its details could not be seen, even under an electron microscope. If all this very densely coded information from *one cell* of one person were written in books, it would fill a library of about 4,000 books. If all the DNA *in your body* were placed end-to-end, it would stretch from here to the Moon more than 500,000 times! In book form, that information would fill the Grand Canyon almost 100 times. If one set of DNA (one cell's worth) from every person who ever lived were placed in a pile, the final pile would weigh less than an aspirin! Understanding DNA is just one small reason for believing that you are *"fearfully and wonderfully made."* (Ps 139:14) [See **"Genetic Information"** on page 77 for the above calculations.]

Astronomical and Physical Sciences

Space exploration has brought into our living rooms some of the marvels of the universe. Few people, however, appreciate how many of these recent discoveries were not what evolution theory had predicted. The phrase "back to the drawing board" often follows discoveries in space. Saturn, shown on the opposite page, has provided many such examples.

Early space exploration programs were attempts to learn how the Earth, Moon, and solar system evolved. Ironically, not one of these questions has been answered, and for scientists who start with evolutionary assumptions, many perplexing problems have arisen. For example, after the $20,000,000,000 lunar exploration program, no evolutionist can explain with any knowledge and confidence how the Moon formed. Those who try either encounter a barrage of scientific objections or resort to philosophical speculations. Isn't it ironic that many science teachers and professors *uncritically* teach outdated and illogical theories in the very subject—science—that should encourage critical thinking? Far too many textbook authors and popular science commentators, who influence teachers and students alike, do not understand that *"the heavens are telling of the glory of God."* (Ps 19:1)

Earth Sciences

The center object on the opposite page represents Noah's Ark. This drawing is based on a detailed and convincing description by a man who claimed to have walked on the Ark twice in the early 1900s. His information has been checked in ways he could never have imagined. Every known detail has supported his story. We must emphasize, however, there is no proof the Ark exists, although there have been many alleged sightings. We must patiently wait for a verifiable discovery of this huge object that may be buried under rock and ice near the 14,000-foot level of rugged Mount Ararat in a remote part of eastern Turkey.

The implications of a worldwide flood for the earth sciences, for the theory of evolution, and for mankind in general, deserve the serious reflection of every thoughtful person. Earth has many features which scientists with evolutionary presuppositions cannot explain. But these features can be explained by a gigantic flood—the most cataclysmic and literally earthshaking event the world has ever experienced—which also formed deep ocean trenches, most mountains, and many other amazing features.

A detailed and scientific reconstruction of these events now can be made independently of Scripture. This reconstruction, based only on what is seen on Earth today, is explained in Part II, "**The Fountains of the Great Deep**," on pages 107–326. If you study both this explanation and the biblical descriptions of the flood—two completely different perspectives—you may be startled by their agreement and the sheer power and violence of that event. Both biblical scholars and scientists have been surprised at the extent to which each perspective illuminates the other. After reading **"The Fountains of the Great Deep,"** you will more deeply appreciate what the psalmist wrote 3,000 years ago: *"The waters were standing above the mountains. At Thy rebuke they fled; at the sound of Thy thunder they hurried away. The mountains rose; the valleys sank down ...* [so the waters] *may not return to cover the earth."* (Ps 104:6–9)

Figure 3: Dog Variability. When bred for certain traits, dogs become different and distinctive. This is a common example of microevolution—changes in size, shape, and color—or minor genetic alterations. It is not macroevolution: an upward, beneficial increase in complexity, as evolutionists claim happened millions of times between bacteria and man. Macroevolution has never been observed in any breeding experiment.

Life Sciences

Before considering how life began, we must first understand the term "organic evolution." Organic evolution, as theorized, is a naturally occurring, beneficial change that produces increasing and inheritable complexity. Increased complexity would be shown if the offspring of one form of life had a different and improved set of vital organs. This is sometimes called the molecules-to-man theory—or *macroevolution*. [See Figure 4 on page 6.] Microevolution, on the other hand, does not involve increasing complexity. It involves changes only in size, shape, or color, or minor genetic alterations caused by a few mutations. Macroevolution requires thousands of "just right" mutations. Microevolution can be thought of as "horizontal" (or even downward) change, whereas macroevolution, if it were ever observed, would involve an "upward," beneficial change in complexity. Notice that microevolution plus time will not produce macroevolution. (micro + time $\neq$ macro)

Creationists and evolutionists agree that microevolution (and natural selection) occur. Minor change has been observed since history began. But notice how often evolutionists give evidence for microevolution to support macroevolution. It is macroevolution—which requires new abilities and increasing complexity, resulting from new genetic information—that is at the center of the creation-evolution controversy. Therefore, in this book, ***the term "organic evolution" will mean macroevolution.***

(Most readers will want to read the accompanying references, quotations, and notes beginning on page 51.)

The Theory of Organic Evolution Is Invalid.

Organic Evolution Has Never Been Observed.

1. The Law of Biogenesis

Spontaneous generation (the emergence of life from nonliving matter) has never been observed. All observations have shown that life comes only from life. This has been observed so consistently it is called *the law of biogenesis*. The theory of evolution conflicts with this scientific law when claiming that life came from nonliving matter through natural processes.[a]

Evolutionary scientists reluctantly accept the law of biogenesis.[b] However, some say that future studies may show how life could come from lifeless matter, despite the virtually impossible odds. Others say that their theory of evolution doesn't begin until the first life *somehow* arose. Still others say the first life was created, then evolution occurred. All evolutionists recognize that, based on scientific observations, *life comes only from life*.

2. Acquired Characteristics

Acquired characteristics—characteristics gained after birth—cannot be inherited.[a] For example, large muscles acquired by a man in a weight-lifting program cannot be inherited by his child. Nor did giraffes get long necks because their ancestors stretched to reach high leaves. While almost all evolutionists agree that acquired characteristics cannot be inherited, many unconsciously slip into this false belief. On occasion, Darwin did.[b]

However, stressful environments for some animals and plants cause their offspring to express various defenses.

New genetic traits are not created; instead, the environment can switch on genetic machinery *already present*. The marvel is that optimal[c] genetic machinery already exists to handle some contingencies, not that time, the environment, or "a need" can produce the machinery.[d]

Also, rates of variation within a species (microevolution, not macroevolution) increase enormously when organisms are under stress, such as starvation.[e] Stressful situations would have been widespread in the centuries after a global flood.

3. Mendel's Laws

Mendel's laws of genetics and their modern-day refinements explain almost all physical variations occurring within species. Mendel discovered that genes (units of heredity) are merely reshuffled from one generation to another. Different ***combinations*** are formed, not different genes. The different combinations produce many variations within each kind of life, as in the dog family. [See Figure 3 on page 4.] A logical consequence of Mendel's laws is that there are ***limits*** to such variation.[a] Breeding experiments[b] and common observations[c] also confirm these boundaries.

4. Bounded Variations

Not only do Mendel's laws give a *theoretical* explanation for why variations are limited, broad *experimental* verification also exists.[a] For example, if evolution happened, organisms (such as bacteria) that quickly produce the most offspring should have the most variations and mutations. Natural selection would then select the more favorable changes, allowing organisms with those traits to survive, reproduce, and pass on their beneficial genes. Therefore, organisms that have allegedly evolved the most should have short reproduction cycles and many offspring. We see the opposite. In general, more complex organisms, such as humans, have fewer offspring and longer reproduction cycles.[b] Again, variations within organisms appear to be bounded.

Organisms that occupy the most diverse environments in the greatest numbers for the longest times should also, according to macroevolution, have the greatest potential for evolving new features and species. Microbes falsify this prediction as well. Their numbers per species are astronomical, and they are dispersed throughout almost all the world's environments. Nevertheless, the number of microbial species is relatively few.[c] New features apparently don't evolve.

5. Natural Selection

An offspring of a plant or animal has characteristics that vary, often in subtle ways, from those of its "parents." Because of the environment, genetics, and chance circumstances, some of these offspring will reproduce more than others. So, a species with certain characteristics will tend, on average, to have more "children." In this sense, nature "selects" genetic characteristics suited to an environment—and, more important, eliminates unsuitable genetic variations. Therefore, an organism's gene pool is constantly decreasing. This is called *natural selection*.[a]

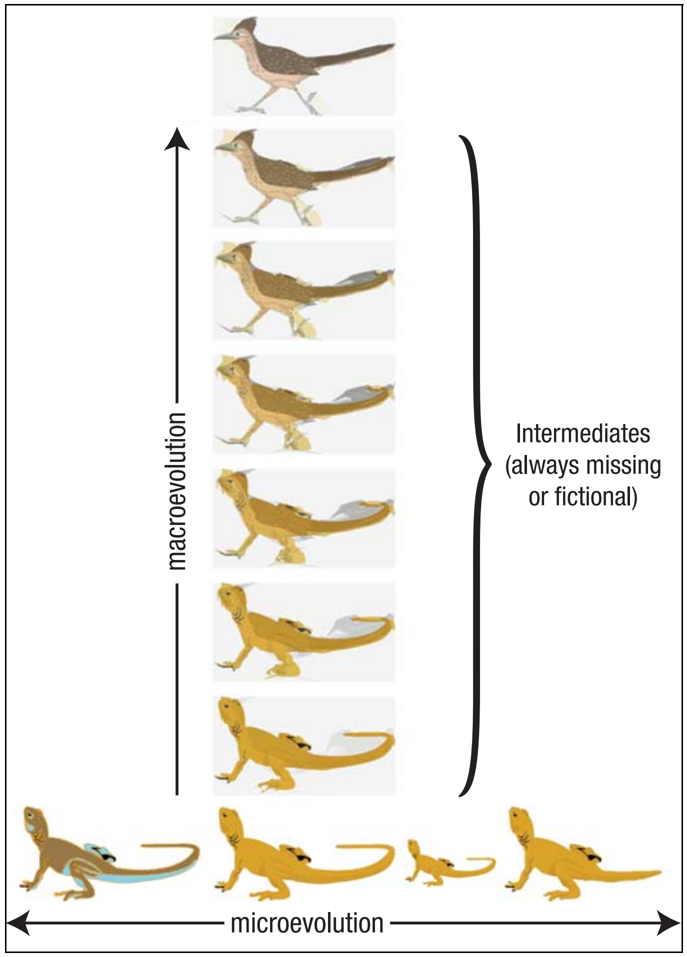


Figure 4: Microevolution vs. Macroevolution. Notice that macroevolution would require an upward change in the complexity of certain traits and organs. Microevolution involves only "horizontal" (or even downward) changes—no increasing complexity. Also note that all creationists agree that natural selection occurs. While natural selection does not result in macroevolution, it accounts for many variations within a very narrow range.

Science should always base conclusions on what is seen and reproducible. So what is observed? We see variations in lizards, four of which are shown at the bottom. We also see birds, represented at the top. In-between forms (or intermediates), which should be vast in number if macroevolution occurred, are never seen as fossils or living species. A careful observer can usually see unbelievable discontinuities in these claimed upward changes, as well as in the drawing above.

Ever since Darwin, evolutionists have made excuses for why the world and our fossil museums are not overflowing with intermediates.

Notice, natural selection cannot produce *new* genes; it *selects* only among preexisting characteristics. As the word "selection" implies, variations are reduced, not increased.[b]

For example, many mistakenly believe that insect or bacterial resistances evolved in response to pesticides and antibiotics. Instead,

- a lost capability was reestablished, making it appear that something evolved,[c] or
- a mutation reduced the ability of certain pesticides or antibiotics to bind to an organism's proteins, or
- a mutation reduced the regulatory function or transport capacity of certain proteins, or
- a damaging bacterial mutation or variation reduced the antibiotic's effectiveness even more,[d] or
- a few resistant insects and bacteria were already present when the pesticides and antibiotics were first applied. When the vulnerable insects and bacteria were killed, resistant varieties had less competition and, therefore, proliferated.[e]

While natural selection occurred, nothing evolved and, in fact, some biological diversity was lost.

The variations Darwin observed among finches on different Galapagos islands is another example of natural selection producing micro- (***not*** macro-) evolution. While natural selection sometimes explains the survival of the fittest, it does not explain the *origin* of the fittest.[f] Today, some people think that because natural selection occurs, evolution must be correct. Actually, natural selection *prevents* major evolutionary changes.[g]

6. Mutations

Mutations are the only known means by which new genetic material becomes available for evolution.[a] Rarely, if ever, is a mutation beneficial to an organism in its natural environment. Almost all observable mutations are harmful; some are meaningless; many are lethal.[b] No known mutation has ever produced a form of life having greater complexity and viability than its ancestors.[c]

7. Fruit Flies

A century of fruit fly experiments, involving 3,000 consecutive generations, gives absolutely no basis for believing that any natural or artificial process can cause an increase in complexity and viability. No clear genetic improvement has ever been observed in any form of life, despite the many unnatural efforts to increase mutation rates.[a]

8. Complex Molecules and Organs

Many molecules necessary for life, such as DNA, RNA, and proteins, are incredibly complex—so complex that claims they have evolved are absurd. Furthermore, those claims lack experimental support.[a]

There is no reason to believe that mutations or any natural process could ever produce any new organs—especially those as complex as the eye,[b] the ear, or the brain.[c] For example, an adult human brain contains over 10^{14} (a hundred thousand billion) electrical connections,[d] more than all the soldered electrical connections in the world. The human heart, a ten-ounce pump that will operate without maintenance or lubrication for about 75 years, is another engineering marvel.[e]

9. Fully-Developed Organs

All species appear fully developed, not partly developed. They show design.[a] There are no examples of half-developed feathers, eyes,[b] skin, tubes (arteries, veins, intestines, etc.), or any of the vital organs (dozens in humans alone). Tubes that are not 100% complete are a liability; so are partially developed organs and some body parts. For example, if a leg of a reptile were to evolve into a wing of a bird, it would become a bad leg long before it became a good wing.[c] [See Figure 4.]

Figure 5: Duckbilled Platypus. The duckbilled platypus is found only in Tasmania and eastern Australia. European scientists who first studied platypus specimens thought that a clever taxidermist had stitched together parts of different animals—a logical conclusion if one believed that each animal must be very similar to other animals. In fact, the platypus is perfectly designed for its environment.

10. Distinct Types

If evolution happened, one would expect to see gradual transitions among many living things. For example, variations of dogs might blend in with variations of cats. In fact, some animals, such as the duckbilled platypus, have organs totally unrelated to their alleged evolutionary ancestors. The platypus has fur, is warm-blooded, and suckles its young as do mammals. It lays leathery eggs, has a single ventral opening (for elimination, mating, and birth), and has claws and a shoulder girdle as most reptiles do. The platypus can detect electrical currents (AC and DC) as some fish can, and has a bill somewhat like a that of a duck—a bird. It has webbed forefeet like those of an otter and a flat tail like that of a beaver. The male platypus can inject poisonous venom like a pit viper. Such "patchwork" animals and plants, called *mosaics*, have no logical place on the so-called "evolutionary tree."

There is no direct evidence that any major group of animals or plants arose from any other major group.[a] Species are observed only going out of existence (extinctions), never coming into existence.[b]

11. Altruism

Humans and many animals will endanger or even sacrifice their lives to save another—sometimes the life of another species.[a] Natural selection, which evolutionists say selects individual characteristics, should rapidly eliminate altruistic (self-sacrificing) "individuals." How could such risky, costly behavior ever be inherited? Its possession tends to prevent the altruistic "individual" from passing on its genes for altruism?[b] If evolution were correct, selfish behavior should have completely eliminated unselfish behavior.[c] Furthermore, cheating and aggression should have "weeded out" cooperation. Altruism contradicts evolution.[d]

12. Extraterrestrial Life?

No verified form of life which originated outside of earth has ever been observed. If life evolved on earth, one would expect that the elaborate experiments sent to the Moon and Mars might have detected at least simple forms of life (such as microbes) that differ in some respects from life on earth.[a] [See **"Is There Life in Outer Space?"** on page 444.]

13. Language

Children as young as seven months can understand and learn grammatical rules.[a] Furthermore, studies of 36 documented cases of children raised without human contact (feral children) show that language is learned only from other humans; humans do not automatically speak. So, the first humans must have been endowed with a language ability. There is no evidence language evolved.[b]

Nonhumans communicate, but not with language. True language requires both *vocabulary* and *grammar*. With great effort, human trainers have taught some gorillas and chimpanzees to recognize a few hundred spoken words, to point to up to 200 symbols, and to make limited hand signs. These impressive feats are sometimes exaggerated by editing the animals' successes on film. (Some early demonstrations were flawed by the trainer's hidden promptings.[c])

Wild apes have not shown these vocabulary skills, and trained apes do not pass their vocabulary on to others.

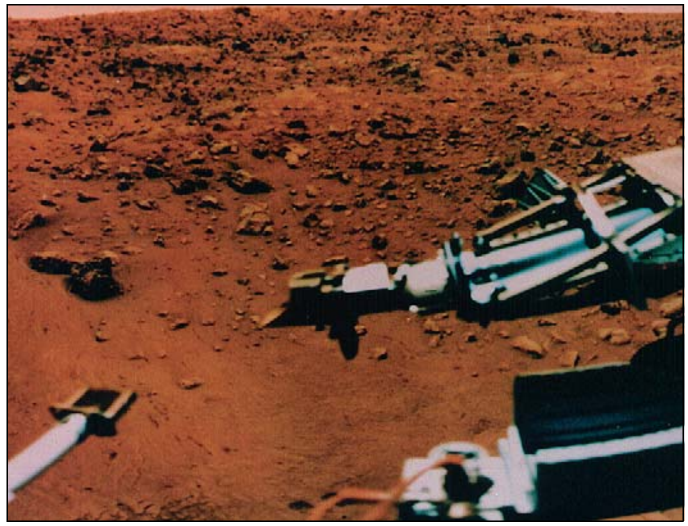


Figure 6: Mars Lander. Many people, including Carl Sagan, predicted the Viking landers would find life on Mars. They reasoned that because life evolved on Earth, some form of life must have evolved on Mars. That prediction proved to be false. The arms of the Viking 1 Lander, shown above, sampled Martian soil. Sophisticated tests on those samples did not find even a trace of life.

If traces of life are found on Mars, they may have come from comets and asteroids launched from Earth during the flood—as did salt and water found on Mars. [A prediction, later supported by a NASA discovery, is on page 284. For a full understanding, see pages 271–326.]

When a trained animal dies, so does the trainer's investment. Also, trained apes have essentially no grammatical ability. Only with grammar can a few words express many ideas. No known evidence shows that language exists or evolves in nonhumans, but all known human groups have language.[d]

Furthermore, only humans have different modes of language: speaking/hearing, writing/reading, signing, touch (as with Braille), and tapping (as with Morse code or tap-codes used by prisoners). When one mode is prevented, as with the loss of hearing, others can be used.[e]

If language evolved, the earliest languages should be the simplest. But language studies show that the more ancient the language (for example: Latin, 200 B.C.; Greek, 800 B.C.; Linear B, 1200 B.C.; and Vedic Sanskrit, 1500 B.C.), the more complex it is with respect to syntax, case, gender, mood, voice, tense, verb form, and inflection. The best evidence shows that languages devolve; that is, they become simpler instead of more complex.[f] Most linguists reject the idea that simple languages evolve into complex languages.[g] [See Figure 204 on page 448.]

If humans evolved, then so did language. All available evidence indicates that language did not evolve, so humans probably did not evolve either.

14. Speech

Speech is uniquely human.[a] Humans have both a "prewired" brain capable of learning and conveying abstract ideas, and the physical anatomy (mouth, throat, tongue, larynx, etc.) to produce a wide range of sounds. Only a few animals can approximate some human sounds.

Because the human larynx is low in the neck, a long air column lies above the vocal cords. This helps make vowel sounds. Apes cannot make clear vowel sounds, because they lack this long air column. The back of the human tongue, extending deep into the neck, modulates the air flow to produce consonant sounds. Apes have flat, horizontal tongues, incapable of making consonant sounds.[b]

Even if an ape could evolve all the physical equipment for speech, that equipment would be useless without a "prewired" brain for learning language skills, especially grammar and vocabulary.

15. Codes, Programs, and Information

In our experience, codes are produced only by intelligence, not by natural processes or chance. *A **code** is a set of rules for converting information from one useful form to another.* Examples include Morse code and Braille. Code makers must simultaneously understand at least two ways of representing information and then establish the rules for converting from one to the other and back again.

The genetic material that controls the physical processes of life is coded information. Also coded are very complex[a] and completely different functions: the transmission, translation, correction, and duplication systems, without which the genetic material would be useless, and life would cease.[b] It seems obvious that *the genetic code* and the accompanying transmission, translation, correction, and duplication systems were produced simultaneously in each living organism by an extremely high intelligence.[c]

Likewise, no natural process has ever been observed to produce a program. *A **program** is a planned sequence of steps to accomplish some goal.* Computer programs are common examples. Because programs require foresight, they are not produced by chance or natural processes. The information stored in the genetic material of all life is a complex program. Therefore, it appears that an unfathomable intelligence created these genetic programs.[d]

Life contains matter, energy, and ***information***.[e] All isolated systems, including living organisms, have specific, but perishable, amounts of information. No isolated system has ever been shown to increase its information content significantly.[f] Nor do natural processes increase information; they destroy it. Only outside intelligence can significantly increase the information content of an otherwise isolated system. All scientific observations are consistent with this generalization, which has three corollaries:

- Macroevolution cannot occur.[g]
- Outside intelligence was involved in the creation of the universe and all forms of life.[h]
- Life could not result from a "big bang."[i]

16. Compatible Senders and Receivers

As explained above, only intelligence creates codes, programs, and information (CP&I). Each involves senders and receivers. Senders and receivers can be people, animals, plants, organs, cells, or certain molecules. (The DNA molecule is a prolific sender.) The CP&I in a message must be understandable *and* beneficial to both sender *and* receiver; otherwise, the effort expended in transmitting and receiving messages (written, chemical, electrical, magnetic, visual, and auditory) will be wasted.

Consider the astronomical number of links (message channels) that exist between potential senders and receivers: from the cellular level to complete organisms, from bananas to bacteria to babies, and across all of time since life began. All must have compatible understandings (CP&I) and equipment (matter and energy). Designing compatibilities of this magnitude requires one or more *super*intelligences who completely understand how matter and energy behave over time. In other words, the superintelligence(s) must have made, or at least mastered, the laws of chemistry and physics wherever senders and receivers are found. The simplest, most parsimonious way to *integrate all of life* is for there to be only one superintelligence.

Also, the sending and receiving equipment, including its energy sources, must be in place and functional before communication begins. But the preexisting equipment provides no benefit until useful messages begin arriving. Therefore, intelligent foresight (planning) is mandatory—something nature cannot do.

The Arguments for Evolution Are Outdated and Often Illogical.

17. Convergent Evolution or Intelligent Design?

When the same complex capability is found in unrelated organisms but not in their alleged evolutionary ancestors, evolutionists say that a common need caused identical complexities to evolve. They call this *convergent evolution*.

For example, wings and flight occur in some birds, insects, and mammals (bats). Pterosaurs, an extinct reptile, also had wings and could fly. These capabilities have not been

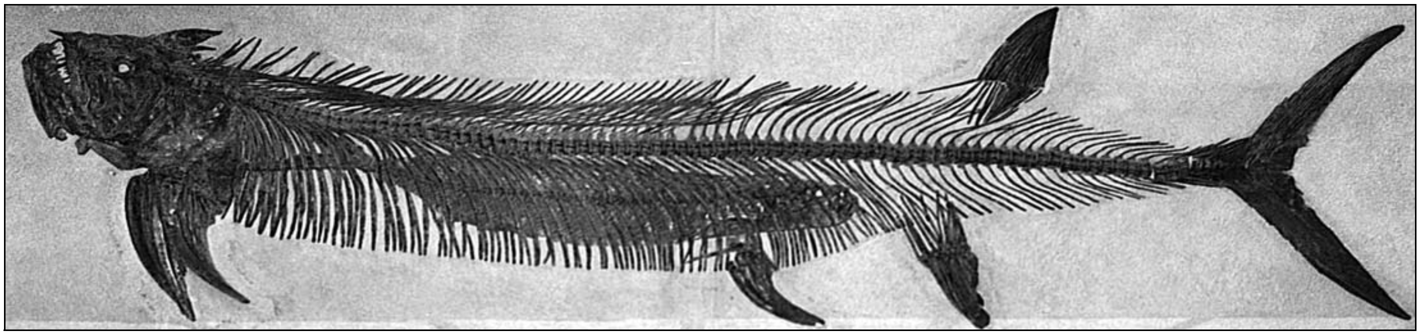


Figure 7: Fish in Long Fish. In the belly of the above 14-foot-long fish is a smaller fish, presumably the big fish's breakfast. Because digestion is rapid, fossilization must have been even more so.

Figure 8: Fish in Curved Fish. The curved back shows that this fish died under stress.

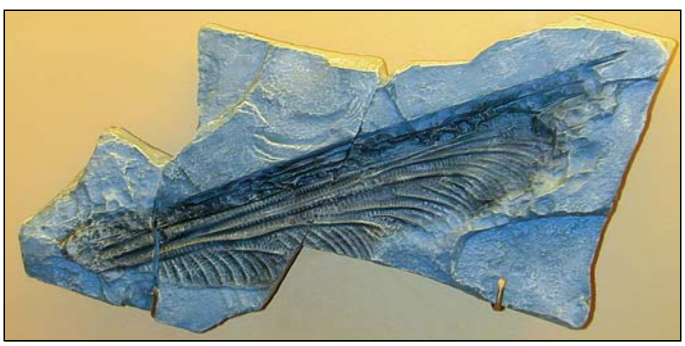


Figure 9: Dragonfly Wing. This delicate, 1½-foot-long wing must have been buried rapidly and evenly to preserve its details. Imagine the size of the entire dragonfly!

Figure 10: Fossil of Fish Swallowing Fish. The fossilization process must have been quite rapid to have preserved a fish in the act of swallowing another fish. Thousands of such fossils have been found.

found in any of their alleged common ancestors. Other examples of supposedly convergent evolution are the three tiny bones in the ears of mammals: the stapes, incus, and malleus. Their complex arrangement and precise fit give mammals the unique ability to hear a wide range of sounds. Evolutionists say that those bones evolved from bones in a reptile's jaw. If so, the process must have occurred at least twice[a]—but left no known transitional fossils. How did the transitional organisms between reptiles and mammals hear during those millions of years?[b] Without the ability to hear, survival—and reptile-to-mammal evolution—would cease.

Concluding that a miracle—or any extremely unlikely event—happened once requires strong evidence or faith; claiming that a similar "miracle" happened repeatedly requires either incredible blind faith or a cause common to each event, such as a common designer.

Furthermore, it is illogical to maintain that similarities between different forms of life always imply a common ancestor;[c] such similarities may imply a common designer and show efficient design. In fact, where similar structures are known to be controlled by different genes[d] or are developed from different parts of embryos,[e] a common designer is a much more likely explanation than evolution.

18. Vestigial Organs

Some structures in humans were once thought to have no function but to have been derived from functioning organs in claimed evolutionary ancestors.[a] They were called *vestigial organs*. As medical knowledge has increased, at least some function has been discovered for all alleged vestigial organs.[b] For example, the human appendix was once considered a useless remnant from our evolutionary past. The appendix plays a role in antibody production, protects part of the intestine from infections and tumor growths,[c] and safely stores "good bacteria" that can replenish the intestines following bouts of diarrhea, for example.[d] Indeed, the absence of true vestigial organs implies evolution never happened.

19. Two-Celled Life?

Many single-celled forms of life exist, but no known forms of animal life have 2, 3, 4, or 5 cells.[a] Known forms of life with 6–20 cells are parasites, so they must have a complex animal as a host to provide such functions as respiration and digestion. If macroevolution happened, one should find many transitional forms of life with 2–20 cells—filling the gap between one-celled and many-celled organisms.

20. Embryology

Evolutionists have taught for over a century that as an embryo develops, it passes through stages that mimic an evolutionary sequence. In other words, in a few weeks an unborn human repeats stages that supposedly took millions of years for mankind. A well-known example of this ridiculous teaching is that embryos of mammals have "gill slits," because mammals supposedly evolved from fish. (Yes, that's faulty logic.) Embryonic tissues that resemble "gill slits" have nothing to do with breathing; they are neither gills nor slits. Instead, those embryonic tissues develop into parts of the face, bones of the middle ear, and endocrine glands.

Embryologists no longer consider the superficial similarities between a few embryos and the adult forms of simpler animals as evidence for evolution.[a] Ernst Haeckel, by deliberately falsifying his drawings,[b] originated and popularized this incorrect but widespread belief. Many modern textbooks continue to spread this false idea as evidence for evolution.[c]

21. Rapid Burial

Fossils all over the world show evidence of rapid burial. Many fossils, such as fossilized jellyfish,[a] show by the details of their soft, fleshy portions[b] that they were buried rapidly, before they could decay. (Normally, dead animals and plants quickly decompose.) The presence of fossilized remains of many other animals, buried in mass graves and lying in twisted and contorted positions, suggests violent and rapid burials over large areas.[c] These observations, together with the occurrence of compressed fossils and fossils that cut across two or more layers of sedimentary rock, are strong evidence that the sediments encasing these fossils were deposited rapidly—not over hundreds of millions of years. Furthermore, almost all sediments that formed today's rocks were sorted by water. The worldwide fossil record is, therefore, evidence of rapid death and

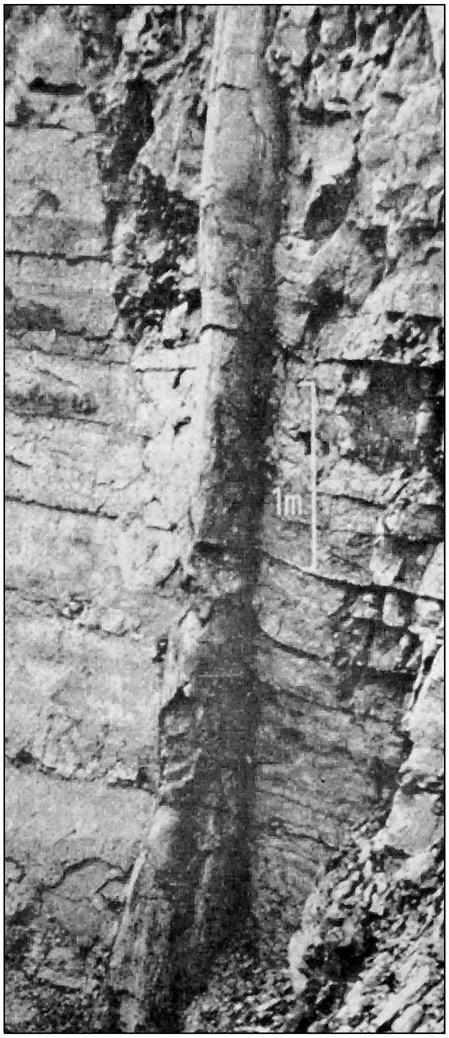


Figure 11: Polystrate Fossil. Fossils crossing two or more sedimentary layers (strata) are called *poly-* (many) *strate* (strata) fossils. Consider how quickly this tree trunk in Germany must have been buried. Had burial been slow, the tree top would have decayed. Obviously, the tree could not have grown up through the strata without sunlight and air. The only alternative is **rapid burial**. Some polystrate trees are upside down, which could occur in a large flood. Soon after Mount St. Helens erupted in 1980, scientists saw trees being buried in a similar way in the lake-bottom sediments of Spirit Lake. Polystrate tree trunks are found worldwide. (Notice the 1-meter scale bar, equal to 3.28 feet, in the center of the picture.)

burial of animal and plant life by a worldwide, catastrophic flood. The fossil record is not evidence of slow change.[d]

22. Parallel Strata

The earth's sedimentary layers are typically parallel to adjacent layers. Such uniform layers are seen, for example, in the Grand Canyon and in road cuts in mountainous terrain. Had these parallel layers been deposited slowly over thousands of years, erosion would have cut many

Figure 12: Insect in Amber. The best-preserved fossils are encased in amber, protected from air and water and buried in the ground. Amber, a golden resin (similar to sap or pitch) usually from conifer trees such as pines, may also contain other preservatives. No transitional forms of life have been found in amber, despite evolutionary-based ages of 1.5–300 million years. Animal behaviors, unchanged from today, are seen in three-dimensional detail. For example, ants in amber show the same social and work patterns as ants today.

Experts bold enough to explain how these fossils formed say that hurricane-force winds must have snapped off trees at their trunks, causing huge amounts of resin to spill out and act like flypaper. Debris and small organisms were blown into the sticky resin, which was later covered by more resin and finally buried. (Part II of this book will show that such conditions arose during the flood.)

In a clean-room laboratory, 30–40 dormant, *but living*, bacteria species were removed from intestines of bees encased in amber from the Dominican Republic. When cultured, the bacteria grew! [See **"Old DNA, Bacteria, and Proteins?"** on page 37.] This amber is claimed to be 25–40 million years old, but I suspect it formed at the time of the flood, only thousands of years ago. Is it more likely that bacteria can be kept alive thousands of years or many millions of years? Metabolism rates, even in dormant bacteria, are not zero.

channels in the topmost layers. Their later burial by other sediments would produce nonparallel patterns. Because parallel layers are the general rule, and the earth's surface erodes rapidly, one can conclude that almost all sedimentary layers were deposited rapidly relative to the local erosion rate—not over long periods of time. (The mechanism involved is explained on pages 175–187.)

23. Fossil Gaps

If evolution happened, the fossil record should show continuous and gradual changes from the bottom to the top layers. Actually, many gaps or discontinuities appear throughout the fossil record.[a] At the most fundamental level, a big gap exists between forms of life whose cells have nuclei (eukaryotes, such as plants, animals, and fungi) and those that don't (prokaryotes such as bacteria and blue-green algae).[b] Fossil links are also missing between large groupings of plants,[c] between single-celled forms of life and invertebrates (animals without backbones), among insects,[d] between invertebrates and vertebrates (animals with backbones),[e] between fish and amphibians,[f] between amphibians and reptiles,[g] between reptiles and mammals,[h] between reptiles and birds,[i] between primates and other mammals,[j] and between apes and other primates.[k] In fact, *chains* are missing, not *links*. The fossil record has been studied so thoroughly that it is safe to conclude that these gaps are real; they will never be filled.[l]

24. Missing Trunk

The "evolutionary tree" has no trunk. In what evolutionists call the earliest part of the fossil record (generally the lowest sedimentary layers of Cambrian rock), life appears suddenly, full-blown, complex, diversified,[a] and dispersed—worldwide.[b] Evolution predicts that minor variations should slowly accumulate, eventually becoming major categories of organisms. Instead, the opposite is found. Almost all of today's plant and animal phyla—including flowering plants,[c] vascular plants,[d] and vertebrates[e]—appear at the base of the fossil record. In fact, many more phyla are found in the Cambrian than exist today.[f] Complex species, such as fish,[g] worms, corals, trilobites, jellyfish,[h] sponges, mollusks, and brachiopods appear suddenly, with no sign anywhere on earth of gradual development from simpler forms. Insects, a class comprising four-fifths of all known animal species (living and extinct), have no known evolutionary ancestors.[i] Insects found in supposedly 100-million-year-old amber look like those living today.[j] The fossil record does not support evolution.[k]

25. Out-of-Place Fossils

Frequently, fossils are not vertically sequenced in the assumed evolutionary order.[a] For example, in Uzbekistan, 86 consecutive hoofprints of horses were found in rocks dating back to the dinosaurs.[b] A leading authority on the Grand Canyon published photographs of horselike hoofprints visible in rocks that, according to the theory of evolution, predate hoofed animals by more than 100 million years.[c] Dinosaur and humanlike footprints were found together in Turkmenistan[d] and Arizona.[e] Sometimes, land animals, flying animals, and marine animals are fossilized side-by-side in the same rock.[f] Dinosaur, whale, elephant, horse, and other fossils, plus crude human tools, have reportedly been found in phosphate beds in South Carolina.[g] Coal beds contain round, black lumps called *coal balls*, some of which contain flowering plants that allegedly evolved 100 million years after the coal bed was formed.[h] Amber, found in Illinois coal beds, contain

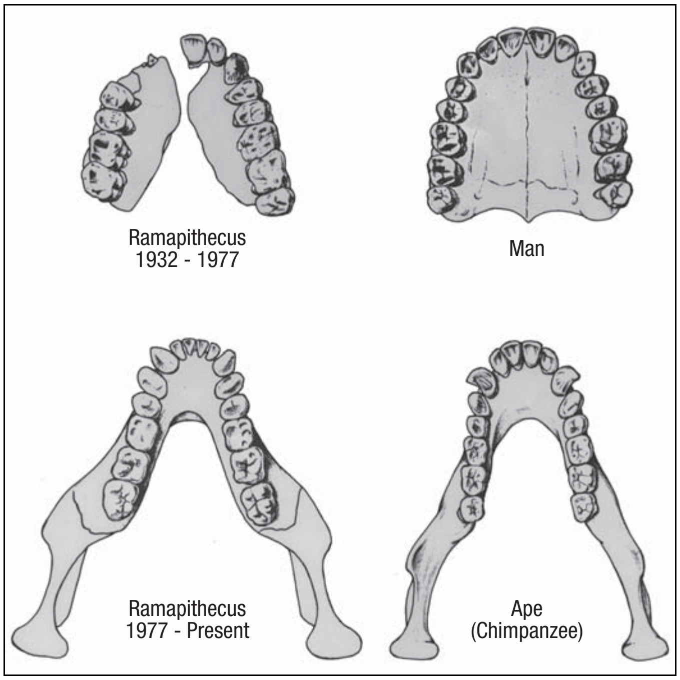


Figure 13: *Ramapithecus*. Some textbooks still claim that *Ramapithecus* is man's ancestor, an intermediate between man and some apelike ancestor. This mistaken belief resulted from piecing together, in 1932, fragments of upper teeth and bones into the two large pieces shown in the upper left. This was done so the shape of the jaw resembled the parabolic arch of man, shown in the upper right. In 1977, a complete lower jaw of *Ramapithecus* was found. The true shape of the jaw was not parabolic, but rather U-shaped, distinctive of apes.

chemical signatures showing that the amber came from flowering plants, but flowering plants supposedly evolved 170 million years after the coal formed.[i] In the Grand Canyon, in Venezuela, in Kashmir, and in Guyana, spores of ferns and pollen from flowering plants are found in Cambrian[j] rocks—rocks supposedly deposited before flowering plants evolved. Pollen has also been found in Precambrian[k] rocks deposited before life allegedly evolved.

Petrified trees in Arizona's Petrified Forest National Park contain fossilized nests of bees and cocoons of wasps. The petrified forests are reputedly 220 million years old, while bees (and flowering plants, which bees require) supposedly evolved almost 100 million years later.[l] Pollinating insects and fossil flies, with long, well-developed tubes for sucking nectar from flowers, are dated 25 million years before flowers are assumed to have evolved.[m] Most evolutionists and textbooks systematically ignore discoveries which conflict with the evolutionary time scale.

26. Ape-Men?

For over a century, studies of skulls and teeth have produced unreliable conclusions about man's origin.[a] Also, fossil evidence allegedly supporting human evolution is fragmentary and open to other interpretations. Fossil evidence showing the evolution of chimpanzees, supposedly the closest living relative to humans, is nonexistent.[b]

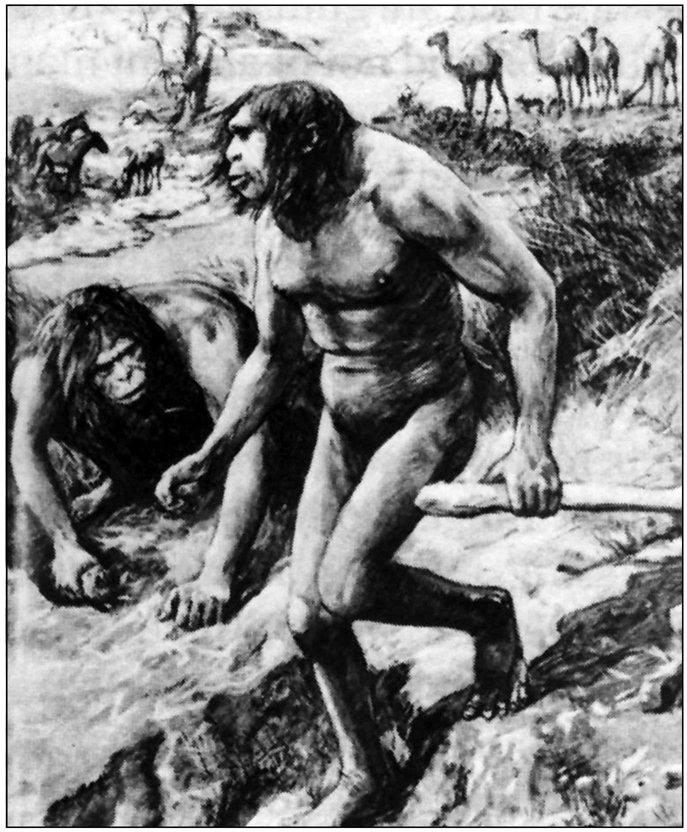


Figure 14: Nebraska Man. Artists' drawings, even those based on speculation, powerfully influence the public. Nebraska man was mistakenly based on one tooth of an extinct pig. Yet in 1922, *The Illustrated London News* published this picture showing our supposed ancestors. Of course, it is highly unlikely that any fossil evidence could support the image conveyed here of a naked man carrying a club.

Stories claiming that fossils of primitive, apelike men have been found are overstated.[c]

- It is now universally acknowledged that Piltdown "man" was a hoax, yet Piltdown "man" was in textbooks for more than 40 years.[d]
- Before 1977, evidence for *Ramapithecus* was a mere handful of teeth and jaw fragments. We now know these fragments were pieced together incorrectly by Louis Leakey[e] and others into a form resembling part of the human jaw.[f] *Ramapithecus* was just an ape.[g] [See Figure 13.]
- The only remains of Nebraska "man" turned out to be a pig's tooth. [See Figure 14.]
- Forty years after he discovered Java "man," Eugene Dubois conceded that it was not a man, but was similar to a large gibbon (an ape). In citing evidence to support this new conclusion, Dubois admitted that he had withheld parts of four other thigh bones of apes found in the same area.[h]

- Many experts consider the skulls of Peking "man" to be the remains of apes that were systematically decapitated and exploited for food by true man.[i] Its classification, *Homo erectus,* is considered by most experts to be a category that should never have been created.[j]
- The first confirmed limb bones of *Homo habilis* were discovered in 1986. They showed that this animal clearly had apelike proportions[k] and should never have been classified as manlike (*Homo*).[l]
- The australopithecines, made famous by Louis and Mary Leakey, are quite distinct from humans. Several detailed computer studies of australopithecines have shown that their bodily proportions were not intermediate between those of man and living apes.[m] Another study, which examined their inner ear bones, used to maintain balance, showed a striking similarity to those of chimpanzees and gorillas, but great differences from those of humans.[n] Likewise, their pattern of dental development corresponds to chimpanzees, not humans.[o] Claims were made—based on one australopithecine fossil (a 3½-foot-tall, long-armed, 60-pound adult called *Lucy)*—that all australopithecines walked upright in a human manner. However, studies of Lucy's entire anatomy, not just a knee joint, now show that this is very unlikely. She likely swung from the trees[p] and was similar to pygmy chimpanzees.[q] The australopithecines are probably extinct apes.[r]
- For about 100 years the world was led to believe that Neanderthal man was stooped and apelike. This false idea was based upon some Neanderthals with bone diseases such as arthritis and rickets.[s] Recent dental and x-ray studies of Neanderthals suggest that they were humans who matured at a slower rate and lived to be much older than people today.[t] Neanderthal man, Heidelberg man, and Cro-Magnon man are now considered completely human. Artists' drawings of "ape-men," especially their fleshy portions, are often quite imaginative and are not supported by the evidence.[u]

Furthermore, the techniques used to date these fossils are highly questionable. [See pages 36–43.]

27. Fossil Man

Bones of modern-looking humans have been found deep in undisturbed rocks that, according to evolution, were formed long before man began to evolve. Examples include the Castenedolo skeletons,[b] Reck's skeleton,[c] and possibly others.[u] Remains such as the Swanscombe skull, the Steinheim fossil, and the Vertesszöllos fossil present similar problems.[d] Evolutionists almost always ignore these remains.

Life Is So Complex That Chance Processes, Even over Billions of Years, Cannot Explain Its Origin.

28. Chemical Elements of Life

The chemical evolution of life, as you will see in the next few pages, is ridiculously improbable. What could improve the odds? One should begin with an earth having high concentrations of the key elements comprising life, such as carbon, oxygen, and nitrogen.[a] However, the more closely one examines these elements, the more unlikely evolution appears.

Carbon. Rocks that supposedly preceded life have very little carbon.[b] One must imagine a toxic, carbon-rich atmosphere to supply the needed carbon if life evolved. For comparison, today's atmosphere holds only 1/80,000 of the carbon that has been on the earth's surface since the first fossils formed. [See Table 6 on page 230.]

Oxygen. No evolutionary theory has been able to explain why earth's atmosphere has so much oxygen. Too many substances should have absorbed oxygen on an evolving earth.[c] Besides, if the early earth had oxygen in its atmosphere, compounds (called *amino acids*) needed for life to evolve would have been destroyed by oxidation.[d] But if there had been no oxygen, there would have been no ozone (a form of oxygen) in the upper atmosphere. Without ozone to shield the earth, the Sun's ultraviolet radiation would quickly destroy life.[e] The only known way for both ozone and life to be here is for both to come into existence simultaneously—in other words, by creation.

Nitrogen. Clays and various rocks absorb nitrogen. Had millions of years passed before life evolved, the sediments that preceded life should be filled with nitrogen. Searches have never found such sediments.[f]

Basic chemistry does not support the evolution of life.[g]

29. Proteins

Living matter is composed largely of proteins, which are long chains of amino acids. Since 1930, it has been known that amino acids cannot link together if oxygen is present. That is, proteins could not have evolved from chance chemical reactions if the atmosphere contained oxygen. However, the chemistry of the earth's rocks, both on land and below ancient seas, shows that the earth had oxygen before the earliest fossils formed.[a] Even earlier, solar radiation would have broken water vapor into oxygen and hydrogen. Some hydrogen, the lightest of all chemical elements, would then have escaped into outer space, leaving behind excess oxygen.[b]

To form proteins, amino acids must also be highly concentrated in an extremely pure liquid.[c] However, the early oceans or ponds would have been far from pure and would have diluted amino acids, so the required collisions between amino acids would rarely occur.[d] Besides, amino acids do not naturally link up to form proteins. Instead, proteins tend to break down into amino acids.[e] Furthermore, the proposed energy sources for forming proteins (earth's heat, electrical discharges, or solar radiation) destroy the protein products thousands of times faster than they could have formed.[f] The many attempts to show how life might have arisen on earth have instead shown (a) the futility of that effort,[g] (b) the immense complexity of even the simplest life,[h] and (c) the need for a vast intelligence to precede life.

30. The First Cell

If, despite virtually impossible odds, proteins arose by chance processes, there is not the remotest reason to believe they could ever form a membrane-encased, self-reproducing, self-repairing, metabolizing, living cell.[a] There is no evidence that any stable states exist between the assumed formation of proteins and the formation of the first living cells. No scientist has ever demonstrated that this fantastic jump in complexity could have happened—even if the entire universe had been filled with proteins.[b]

31. Barriers, Buffers, and Chemical Pathways

Living cells contain thousands of different chemicals, some acidic, others basic. Many chemicals would react with others were it not for an intricate system of chemical barriers and buffers. If living things evolved, these barriers and buffers must also have evolved—but at just the right time to prevent harmful chemical reactions. How could such precise, seemingly coordinated, virtually miraculous events have happened for each of millions of species?[a]

All living organisms are maintained by thousands of chemical pathways, each involving a long series of complex chemical reactions. For example, the clotting of blood, which involves 20–30 steps, is absolutely vital to healing a wound. However, clotting could be fatal if it happened inside the body. Omitting one of the many steps, inserting an unwanted step, or altering the timing of a step would probably cause death. If one thing goes wrong, all the earlier marvelous steps that worked flawlessly were in vain. Evidently, these complex pathways were created as an intricate, highly integrated system.[b]

32. Genetic Distances

Similarities between different forms of life can now be measured with sophisticated genetic techniques.

Proteins. "Genetic distances" can be calculated by taking a specific protein and examining the sequence of its components. The fewer changes needed to convert a protein of one organism into the corresponding protein of another organism, supposedly the closer their relationship. These studies seriously contradict the theory of evolution.[a]

An early computer-based study of cytochrome c, a protein used in energy production, compared 47 different forms of life. This study found many contradictions with evolution based on this one protein. For example, according to evolution, the rattlesnake should have been most closely related to other reptiles. Instead, of these 47 forms (all that were sequenced at that time), the one most similar to the rattlesnake was man.[b] Since this study, experts have discovered hundreds of similar contradictions.[c]

DNA and RNA. Comparisons can also be made between the genetic material of different organisms. The list of organisms that have had all their genes sequenced and entered in databases, such as "GenBank," is doubling each year. Computer comparisons of each gene with all other genes in the database show too many genes that are completely unrelated to any others.[d] Therefore, an evolutionary relationship between genes is highly unlikely. Furthermore, there is no trace at the molecular level for the traditional evolutionary series:[e] simple sea life → fish → amphibians → reptiles → mammals. Each organism appears to be almost equally isolated.[f]

Humans vs. Chimpanzees. Evolutionists say that the chimpanzee is the closest living relative to humans. For two decades (1984–2004), evolutionists and the media claimed that human DNA is about 99% similar to chimpanzee DNA. These false statements had little scientific justification, because they were made before anyone had completed the sequencing of human DNA and long before the sequencing of chimpanzee DNA had begun.

Chimpanzee and human DNA have now been completely sequenced and compared. The *overall* differences are far greater and more complicated than evolutionists suspected.[g] Divergencies include about "thirty-five million single-nucleotide changes, five million insertions or deletions, and various chromosomal rearrangements."[h] Although it is only 4% of the DNA, a vast DNA chasm of critical differences separates humans from chimpanzees.

Moreover, differences between the male portion of the human and chimpanzee sex chromosome are huge! More than 30% of those sequences, in either the human or the chimpanzee, do not match the other at all, and those that do, contain massive rearrangements.[i] The genetic differences are comparable to those between the nonsex chromosomes in chickens and humans.[j]

Finally, evolutionary trees, based on the outward appearance of organisms, can now be compared with the organisms' genetic information. They conflict in major ways.[k]

33. Genetic Information

The genetic information in the DNA of each human cell is roughly equivalent to a library of 4,000 books.[a] Even if matter and life (perhaps a bacterium) somehow arose, the probability that mutations and natural selection produced this vast amount of information is essentially zero.[b] It would be analogous to continuing the following procedure until 4,000 books were produced:[c]

a. Start with a meaningful phrase.
b. Retype it, but make some errors and insert a few letters.
c. See if the new phrase is meaningful.
d. If it is, replace the original phrase with it.
e. Return to step "b."

To produce just the enzymes in one organism would require more than $10^{40,000}$ trials.[d] (To begin to understand how large $10^{40,000}$ is, realize that the visible universe has fewer than 10^{80} atoms in it.)

In 1972, evolutionists, out of ignorance,[e] began referring to large segments of DNA as "junk" DNA, because that DNA supposedly had no purpose and was left over from our evolutionary past. What evolutionists called "junk" DNA is now known to produce microRNA which is vital for each organism's health and also controls to a large extent the production of proteins. Cancers (lung, breast, stomach, prostate, colon, pancreatic, and brain) are frequently a result of damaged microRNA.[f]

34. DNA and Proteins

DNA cannot function without hundreds of preexisting proteins,[a] but proteins are produced only at the direction of DNA.[b] Because each needs the other, a satisfactory explanation for the origin of one must also explain the origin of the other.[c] Therefore, the components of these manufacturing systems must have come into existence simultaneously. This implies creation.

Some of these necessary protein systems decode the DNA, transcribe it into messenger RNA, and assemble it using extremely complex ribosomes, which are composed of proteins.

One of the most studied proteins in mammals, including humans, is called p53. It binds to thousands of DNA sites and influences cell growth, death, and structure. It is involved in fertility and early embryonic development. It also stifles cancers by repairing DNA, suppressing tumors, and killing genetically damaged cells.[d] How could DNA have survived unless p53 and its many functions already existed?

In each human, tens of thousands of genes are damaged daily by toxins, radiations, strand breaks, etc![e] Also, when a cell divides, its DNA at times is copied with errors. Every organism has machinery that identifies and repairs damaged and mistranslated DNA.[f] Without such repair systems, the organism would quickly deteriorate and die. If evolution happened, each organism would have become extinct before these DNA repair mechanisms could evolve.

Life's complexity is mind boggling—not something that random process could ever produce.

35. Handedness: Left and Right

Genetic material, DNA and RNA, is composed of nucleotides. In living things, nucleotides are always "right-handed." (They are called *right-handed*, because a beam of polarized light passing through them rotates like a right-handed screw.) Nucleotides rarely form outside life, but when they do, half are left-handed, and half are right-handed. If the first nucleotides formed by natural processes, they would have "mixed-handedness" and therefore could not evolve life's genetic material. In fact, "mixed" genetic material cannot even copy itself.[a]

Each type of *amino acid*, when found in nonliving material or when synthesized in the laboratory, comes in two chemically equivalent forms. Half are right-handed, and half are left-handed—mirror images of each other. However, amino acids in life, including plants, animals, bacteria, molds, and even viruses, are almost all left-handed[b]—*except in some diseased or aging tissue.*[c] No known natural process can isolate either the left-handed or right-handed variety. The mathematical probability that chance processes could produce merely one tiny protein molecule with only left-handed amino acids is virtually zero.[d]

A similar observation can be made for a special class of organic compounds called *sugars*. In living systems, sugars are all right-handed. Based on our present understanding, natural processes produce an equal number of left-handed and right-handed sugars. Because sugars in living things are right-handed, random natural processes apparently did not produce life.

If any living thing took in (or ate) amino acids or sugars with the wrong handedness, the organism's body could not process it. Such food would be useless, if not harmful. Because evolution favors slight variations that enhance survivability and reproduction, consider how beneficial a

Figure 15: Metamorphosis. Many animals experience an amazing transformation that refutes evolution. One example is the monarch butterfly. As a two-week-old caterpillar (left), it builds a chrysalis around itself (center). Then its complex organs disintegrate. From an evolution perspective, this should cause the insect's extinction—a thousand times over. Two weeks later, a beautiful butterfly emerges with different and even more remarkable capabilities (right). Some people might believe that a complex machine, such as an automobile, evolved by natural processes, but if they saw that machine disintegrate and quickly reemerge as an airplane, only the most naive and unscientific would still believe that natural processes could produce such marvelous designs.

Table 1. Contrast between a Typical Larva and Adult

Larva	Adult Insect
a chewing mouth	a sucking tube
a few simple eyes	two compound eyes (often with thousands of lenses capable of seeing all colors and ultraviolet light in almost all directions)
no true legs	six segmented legs
can't reproduce	reproduces
a crawler	a capable flyer

mutation might be that switched (or inverted) a plant's handedness. "Inverted" (or wrong-handed) trees would proliferate rapidly, because they would no longer provide nourishment to bacteria, mold, or termites. "Inverted" forests would fill the continents. Other "inverted" plants and animals would also benefit and would overwhelm the balance of nature. Why do we not see such species with right-handed amino acids and left-handed sugars? Similarly, why are there not more poisonous plants? Why don't beneficial mutations let most carriers defeat their predators? Beneficial mutations are rarer than most evolutionists believe. [See "**Mutations**" on page 7.]

36. Improbabilities

To claim that life evolved is to demand a miracle. The simplest conceivable form of single-celled life should have at least 600 different protein molecules. The mathematical probability that even one typical protein could form by chance arrangements of amino acid sequences is essentially zero[a]—far less than 1 in 10^{450}. To appreciate the magnitude of 10^{450}, realize that the visible universe is about 10^{28} inches in diameter.

From another perspective, suppose we packed the entire visible universe with a "simple" form of life, such as bacteria. Next, suppose we broke all their chemical bonds, mixed all their atoms, then let them form new links. If this were repeated a billion times a second for 20 billion years under the most favorable temperature and pressure conditions throughout the visible universe, would even one bacterium of any type reemerge? The chances[b] are much less than one in $10^{99,999,999,873}$. Your chances of randomly drawing one preselected atom out of a universe packed with atoms are about one chance in 10^{112}—much better.

37. Metamorphosis

Most insects (87%) undergo complete metamorphosis. It begins when a larva (such as a caterpillar) builds a cocoon around itself. Then its body inside disintegrates into a thick, pulplike liquid. Days, weeks, or months later, the adult insect emerges—one that is dramatically different (as shown in Table 1), amazingly capable, and often beautiful, such as a butterfly. Food, habitat, and behavior of the larva also differ drastically from those of the adult.

Evolution claims that:

> *Mutations slightly alter an organism's genetic material, which later generations inherit. On rare occasions the alterations are beneficial, enabling those offspring to reproduce more of themselves and the improved genetic material.* [Supposedly] *after many generations, dramatic changes, even new organs, accumulate.*

If this were true, each organism must be able to reproduce and must be superior, in some sense, to its ancestors. How then could metamorphosis evolve in many stages?[a]

What mutations could improve a larva? Certainly none that destroyed its nerves, muscles, eyes, brain, and most other organs, as occurs within a cocoon. So, even if a larva improved, it later ends up as "mush." From an evolutionary standpoint, liquefying complex organs is a giant step backwards. As Michael Pitman wryly noted,

> *Maggots will more or less dissolve themselves when developing into a fly. Was the process pre-programmed from the first "production run"? Or was the ancestral fly a dissolved maggot?*[b]

The millions of changes inside the thick liquid never produce something survivable or advantageous in the outside world until the adult completely forms. How did the genetic material for both larva and adult develop? Which came first, larva or adult? What mutations could transform a crawling larva into a flying monarch butterfly that can accurately navigate 3,000 miles using antennae and a tiny brain?[c] Indeed, why should a larva evolve in the first place, because it cannot reproduce?[d]

Charles Darwin wrote,

> *If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous successive, slight modifications, my theory would absolutely break down.*[e]

Based on metamorphosis alone, evolution "breaks down."

Obviously, the vast amount of information that directs every stage of a larva's and an adult's development, including metamorphosis, must reside in its genetic material at the beginning. This fits only creation.

38. Symbiotic Relationships

Different forms of life are completely dependent upon each other. At the broadest level, the animal kingdom depends on the oxygen produced by the plant kingdom. Plants, in turn, depend on the carbon dioxide produced by the animal kingdom.

More local and specific examples include fig trees and the fig gall wasp,[a] the yucca plant and the yucca moth,[b] many parasites and their hosts, and pollen-bearing plants and the honeybee. Even members of the honeybee family, consisting of the queen, workers, and drones, are interdependent. If one member of each interdependent group evolved first (such as the plant before the animal, or one member of the honeybee family before the others), it could not have survived. Because all members of the group obviously have survived, they must have come into existence at essentially the same time. In other words, creation.

39. Sexual Reproduction

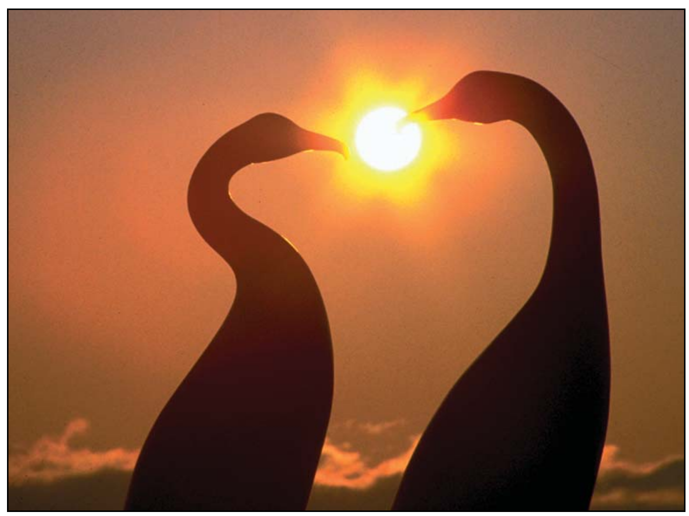


Figure 16: Male and Female Birds. Even evolutionists admit that evolution seems incompatible with sexual reproduction. For example, how could organisms evolve to the point where they could reproduce *before* they could reproduce?

If sexual reproduction in plants, animals, and humans is a result of evolutionary sequences, an unbelievable series of chance events must have occurred at each stage.

a. The amazingly complex, radically different, yet complementary reproductive systems of the male and female must have ***completely*** and ***independently*** evolved at each stage at about the ***same time*** and ***place***. Just a slight incompleteness in only one of the two would make both reproductive systems useless,

The Elephant in the Living Room

Writer George V. Caylor interviewed Sam, a molecular biologist. George asked Sam about his work. Sam said he and his team were scientific "detectives," working with DNA and tracking down the cause of disease. Here is their published conversation.

G: "Sounds like pretty complicated work."

S: "You can't imagine how complicated!"

G: "Try me."

S: "I'm a bit like an editor, trying to find a spelling mistake inside a document larger than four complete sets of *Encyclopedia Britannica*. Seventy volumes, thousands and thousands of pages of small print words."

G: "With the computer power, you can just use 'spell check'!"

S: "There is no 'spell check' because we don't know yet how the words are supposed to be spelled. We don't even know for sure which language. And it's not just the 'spelling error' we're looking for. If any of the punctuation is out of place, or a space out of place, or a grammatical error, we have a mutation that will cause a disease."

G: "So how do you do it?"

S: "We are learning as we go. We have already 'read' over two articles in that encyclopedia, and located some 'typo's'. It should get easier as time goes by."

G: "How did all that information happen to get there?"

S: "Do you mean, did it just happen? Did it evolve?"

G: "Bingo. Do you believe that the information evolved?"

S: "George, nobody I know in my profession truly believes it evolved. It was engineered by 'genius beyond genius,' and such information could not have been written any other way. The paper and ink did not write the book. Knowing what we know, it is ridiculous to think otherwise. A bit like Neil Armstrong believing the moon is made of green cheese. He's been there!"

G: "Have you ever stated that in a public lecture, or in any public writings?"

S: "No. It all just evolved."

G: "What? You just told me —?"

S: "Just stop right there. To be a molecular biologist requires one to hold on to two insanities at all times. One, it would be insane to believe in evolution when you can see the truth for yourself. Two, it would be insane to say you don't believe in evolution. All government work, research grants, papers, big college lectures—everything would stop. I'd be out of a job, or relegated to the outer fringes where I couldn't earn a decent living."

G: "I hate to say it, Sam, but that sounds intellectually dishonest."

S: "The work I do in genetic research is honorable. We will find the cures to many of mankind's worst diseases. But in the meantime, we have to live with the 'elephant in the living room'."

G: "What elephant?"

S: "Design. It's like the elephant in the living room. It moves around, takes up an enormous amount of space, loudly trumpets, bumps into us, knocks things over, eats a ton of hay, and smells like an elephant. And yet we have to swear it isn't there!"

George V. Caylor, "The Biologist," *The Ledger*, Vol. 2, Issue 48, No. 92, 1 December 2000, p. 2. (www.ontherightside.com) Printed with permission.

and the organism would become extinct.

b. The physical, chemical, and emotional systems of the male and female would also need to be compatible.[a]
c. The millions of complex products of a male reproductive system (pollen or sperm) must have an affinity for and a mechanical, chemical,[b] and electrical[c] compatibility with the eggs of the female reproductive system.
d. The many intricate processes occurring at the molecular level inside the fertilized egg would have to work with fantastic precision—processes that scientists can describe only in a general sense.[d]
e. The environment of this fertilized egg, from conception through adulthood and until it also reproduced with another sexually capable adult (who also "accidentally" evolved), would have to be tightly controlled.
f. This remarkable string of "accidents" must have been repeated for millions of species.

Either this series of incredible and complementary events happened by random, evolutionary processes, or sexual reproduction was designed by intelligence.

Furthermore, if sexual reproduction evolved even once, the steps by which an embryo becomes either a male or female should be similar for all animals. Actually, these steps vary among animals.[e]

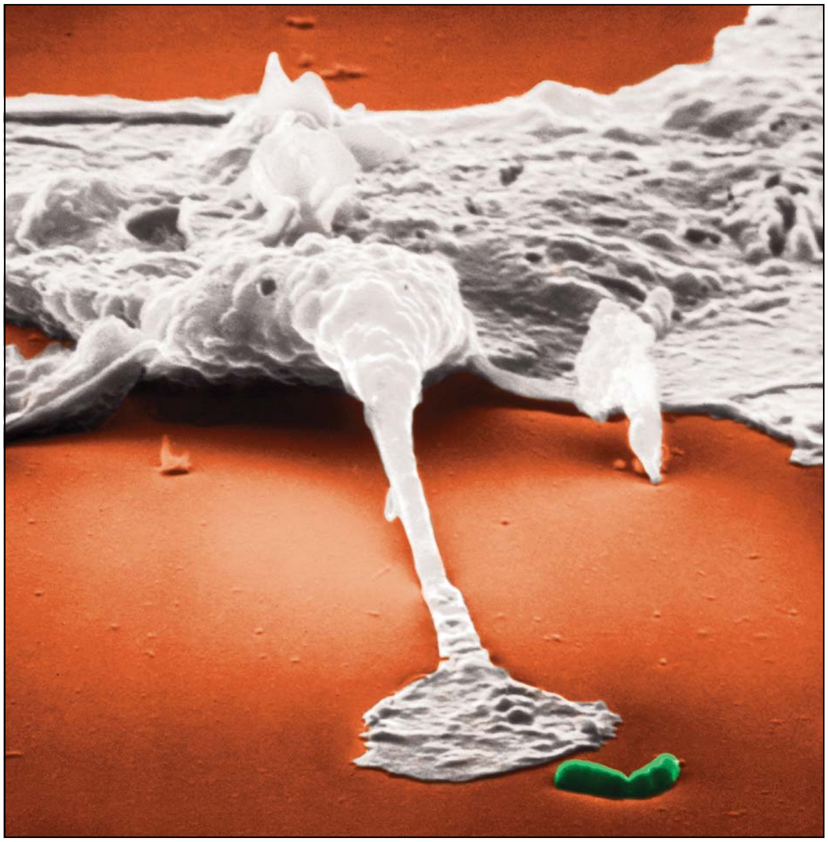


Figure 17: White Blood Cell. A white blood cell is stalking the green bacterium, shown at the lower right. Your health, and that of many animals, depends on the effectiveness of these "search-and-destroy missions." Consider the capabilities and associated equipment this white blood cell must have to do its job. It must identify friend and foe. Once a foe is detected, the white blood cell must rapidly locate and overtake the invader. Then the white blood cell must engulf the bacterium, destroy it, and have the endurance to repeat this many times. Miniaturization, fuel efficiency, and compatibility with other parts of the body are also key requirements. The equipment for each function requires careful design. Unless all this worked well from the beginning of life, **a requirement that rules out evolution**, bacteria and other agents of disease would have won, and we would not be here to marvel at these hidden abilities in our bodies.

A few "stem cells" in your bone marrow produce more than 100 billion of these and other types of blood cells every day. Each white blood cell moves on its own at up to 30 microns (almost half the diameter of a human hair) each minute. So many white blood cells are in your body that their total distance traveled in one day would circle the earth twice.

Evolution theory predicts nature would select asexual rather than sexual reproduction.[f] But if asexual reproduction (splitting an organism into two identical organisms) evolved before sexual reproduction, how did complex sexual diversity arise—or survive?

If life evolved, why would any form of life live long beyond its reproductive age, when beneficial changes cannot be passed on? All the energy expended, supposedly over millions of years, to allow organisms to live beyond reproductive age would be a waste. In other words, why haven't all organisms evolved reproductive systems that last a lifetime?

Finally, to produce the first life form would be one miracle. But for natural processes to produce life that could reproduce itself would be a miracle on top of a miracle.[g]

40. Immune Systems

How could immune systems of animals and plants have evolved? Each immune system can recognize invading bacteria, viruses, and toxins. Each system can quickly mobilize the best defenders to search out and destroy these invaders. Each system has a memory and learns from every attack.

If the many instructions that direct an animal's or plant's immune system had not been preprogrammed in the organism's genetic system when it first appeared on earth, the first of thousands of potential infections would have killed the organism. This would have nullified any rare genetic improvements that might have accumulated. In other words, the large amount of genetic information governing the immune system could not have accumulated in a slow, evolutionary sense.[a] Obviously, for each organism to have survived, all this information must have been there from the beginning. Again, creation.

41. Living Technology

Most complex phenomena known to science are found in living systems—including those involving electrical, acoustical, mechanical, chemical, and optical phenomena. Detailed studies of various animals also have revealed certain physical equipment and capabilities that the world's best designers, using the most sophisticated technologies, cannot duplicate. Examples of these designs include molecular-size motors in most living organisms;[a] advanced technologies in cells;[b] miniature and reliable sonar systems of dolphins, porpoises, and whales; frequency-modulated "radar" and discrimination systems of bats;[c] efficient aerodynamic capabilities of hummingbirds; control systems, internal ballistics, and the combustion chambers of bombardier beetles;[d] precise and redundant navigational systems of many birds, fish, and insects;[e] and especially the self-repair capabilities of almost all forms of life. No component of these complex systems could have evolved without placing the organism

Figure 18: Arctic Tern Migration Routes and Cockpit. The Arctic Tern, a bird of average size, navigates across oceans, as shown above, with the skill normally associated with navigational equipment in modern intercontinental aircraft. A round trip for the tern might be 22,000 miles. The tern's "electronics" are highly miniaturized, extremely reliable, maintenance free, and easily reproduced. Furthermore, this remarkable bird needs no training. If the equipment in the lower picture could not have evolved, how could the tern's more amazing "equipment" have evolved?

Equally amazing is the monarch butterfly which flies thousands of miles from breeding grounds in Canada to wintering grounds in Mexico. In its pinhead-size brain, the butterfly processes information from its antennae and navigates using a magnetic compass and sunlight.

at a selective disadvantage until the component's evolution was complete. All evidence points to intelligent design.

Many bacteria, such as *Salmonella, Escherichia coli*, and some *Streptococci,* propel themselves with miniature motors at up to 15 body-lengths per second,[f] equivalent to a car traveling 150 miles per hour—in a liquid. These extremely efficient, reversible motors rotate at up to 100,000 revolutions per minute.[g] Each shaft rotates a

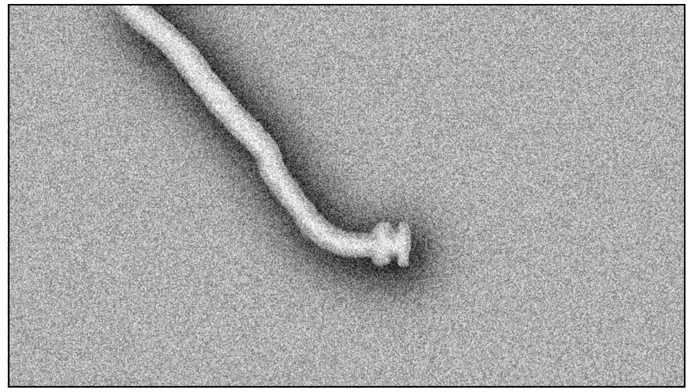


Figure 19: Bacterial Motor. Drawing based on a microphotograph of the flagellum of a salmonella bacterium.

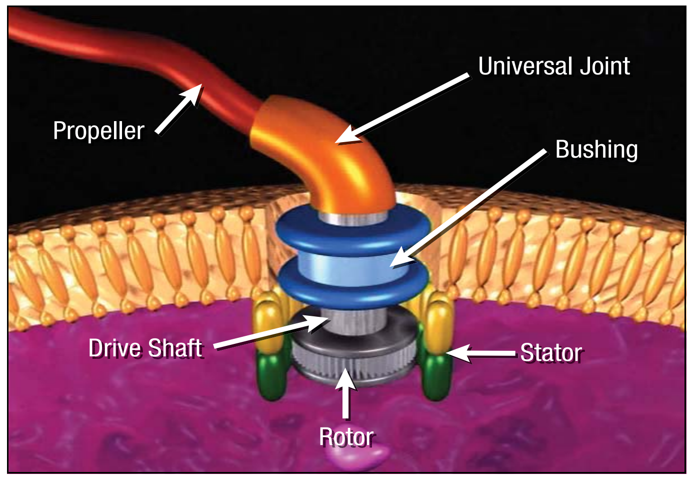


Figure 20: Illustration of a Bacterial Motor. Although no one completely understands how these tiny motors work, many studies have deduced the presence of the above components.

bundle of whiplike flagella that acts as a propeller. The motors, having rotors and stators, are similar in many respects to electrical motors.[h] However, their electrical charges come from a flow of protons, not electrons. The bacteria can stop, start, and change speed, direction, and even the "propeller's" shape.[i] They also have intricate sensors, switches, control mechanisms, and a short-term memory. All this is highly miniaturized. ***Eight million*** of these bacterial motors would fit inside the circular cross section of a human hair.[j]

Evolutionary theory teaches that bacteria were one of the first forms of life to evolve, and, therefore, they are simple. While bacteria are small, they are not simple. They can even communicate among themselves using chemicals.[k]

Some plants have motors that are one-fifth the size of bacterial motors.[l] Increasing worldwide interest in nanotechnology is showing that living things are remarkably designed—beyond anything Darwin could have imagined.

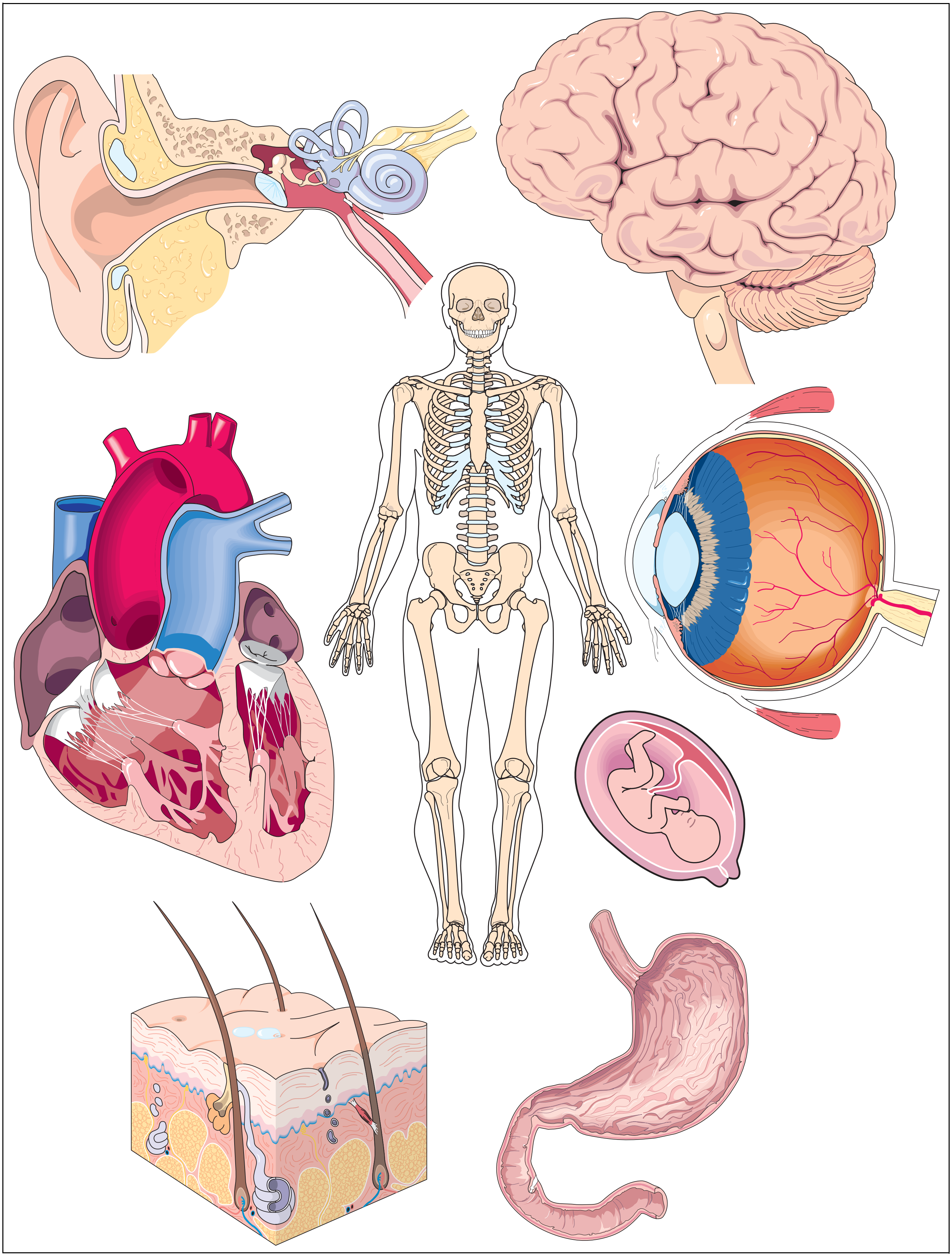


Figure 21: Integration and Compatibility. An organ is a complex structure of different types of tissues and cells, all of which work together to perform a specific function such as seeing, hearing, digesting, or pumping. (Shown are a few of the amazing human organs: eye, ear, stomach, heart, skin, and brain.) A system, such as the nervous system, circulatory system, skeletal system, or reproductive system, consists of related organs and other tissues and cells that have even broader functions. In a healthy body, all systems work properly. Life depends on a broad, compatible, and complex hierarchy: molecules → cells → tissues → organs → systems → body → other organisms → the environment. All are carefully balanced and integrated with each other.

Arbitrarily changing one component at any level will often be harmful at that level and to the vertical hierarchy. For example, change one type of molecule throughout a category of cells, and the result may be damaged cells and a diseased body. Environmentalists and ecologists are aware of this critical balance (regarding, say, the spotted owl and the environment), but often they fail to ask, "Who or what created this balance?" Some fail to see the incredible complexity, integration, and systems engineering that extends throughout the universe—from carbon atoms to galaxies to physical laws.

Humans are only one of millions of different organisms. To integrate all organisms into a living ecosystem requires stupendous design and balance. If evolution happened, time and natural processes alone must have maintained a livable environment for most forms of life as each new organism came into existence and proliferated. No global contaminants, plagues, predators, or famines could be allowed for billions of years. Imagine what would happen if a few organisms at the base of the food chain became extinct.

Who or what has the ability to design, construct, and harmoniously integrate and maintain all of life? Time and natural processes, as evolution states, or an infinitely intelligent Creator?

42. The Validity of Thought

If life is the result of natural processes or chance, then so is thought. Your thoughts—including what you are thinking now—would ultimately be a consequence of a long series of irrational causes. Therefore, your thoughts would have no validity, including the thought that life is a result of chance or natural processes.[a] By destroying the validity of ideas, evolution undercuts even the idea of evolution. "Science itself makes no sense if the scientific mind is itself no more than the product of irrational material forces."[b]

A related issue is the flexibility and redundancy of the human brain, which evolution or natural selection would not produce. For example, every year brain surgeons successfully remove up to half of a person's brain. The remaining half gradually takes over functions of the removed half. Also, brain functions are often regained after portions of the brain are accidently destroyed. Had humans evolved, such accidents would have been fatal before these amazing capabilities developed. Darwin recognized an aspect of this phenomenal capability of the brain.[c]

Life Science Conclusions

When Darwin published *The Origin of Species* in 1859, the "evolutionary tree" had only a few gaps. Believers in his new theory thought that these gaps would be filled as scientific knowledge increased. Just the opposite has happened. As science has progressed, these "missing links" have multiplied enormously, and the obstacles to "bridging" these gaps have become even more obvious. For example, in Darwin's day, all life fell into two categories (or kingdoms): animals and plants. Today, it is generally accepted that life falls into five radically different kingdoms, of which animals and plants comprise only two. (None of the five include viruses, which are complex and unique in their own way.) In the 1800s, the animal kingdom was divided into four animal phyla; today there are about forty.

Darwin suggested that the first living creature evolved in a "warm little pond." Today, almost all evolutionary biologists will privately admit that science has no explanation for how life evolved. We now know that the chance formation of the first living cell is a gigantic leap, vastly more improbable than for bacteria to evolve into humans. In Darwin's day, a cell was thought to be about as simple as a ping-pong ball. Even today, many evolutionists say that bacteria are simple and one of the first forms of life to evolve. However, bacteria are marvelously integrated and complex manufacturing facilities with many mysteries yet to be understood, such as bacterial motors and communication among bacteria. Furthermore, cells come in two radically different types—those with a nucleus and those without. The evolutionary leap from one to the other is staggering to imagine.

The more evolutionists learn about life, the greater complexity they find. A century ago there were no sophisticated microscopes. Consequently, gigantic leaps from single- to multiple-cell organisms were grossly underestimated. Each type of cell in a multicellular organism has a unique job that is controlled by only part of the organism's DNA. If that organism evolved, its delicate controls (directing which of the myriad of DNA instructions to follow, which to ignore, and when) must also have evolved. Had it not evolved perfectly the first time, that organism would have been diseased. If that first unique cell could not reproduce, the new function would disappear. If just one reproducing cell is out of control, the organism would have one type of cancer.

Development of the computer has also given us a better appreciation of the brain's intricate electronics, extreme miniaturization, and vast storage capabilities. The human eye, which Darwin admitted made him shudder, was only a single jump in complexity. [See Endnote 9b on page 57.] We now know there are at least a dozen radically different kinds of eyes, each requiring similar jumps if evolution happened. Likewise, the literal leap we call "flight" must have evolved not once, but on at least four different occasions: for birds, some insects, mammals (bats), and reptiles (pterosaurs). Fireflies produce light without heat, a phenomenon called *bioluminescence*. Other species, including certain fish, crustaceans, squids, plants, bacteria, and fungi, also have lighting systems. Did all these remarkable capabilities evolve independently?

Before 1977, it was thought that sunlight provided the energy for all life. We now know that some organisms, living at widely separated locations on the dark ocean floor, use only chemical and thermal energy. For one energy-conversion system to evolve into another would be like changing, by thousands of rare accidents, the wood-burning heating systems of widely separated homes to electricity—but slowly, one accident each year. The occupants would risk freezing every winter. How such a system could evolve on different ocean floors, without solar energy, and in a cold, diluting environment has yet to be explained.

In 2010, tiny animals, called loriciferans, were found living under the Mediterranean seabed. They apparently live their entire life without oxygen! In that same year, bacteria were found whose bodies were missing one of the six essential elements of all of life (as we previously knew it). Instead, the element phosphorus has been replaced by the normally toxic element arsenic. If it is ridiculously unlikely to evolve life as we knew it, imagine how improbable it is to evolve life as we find it.

If evolution happened, many other giant leaps must also have occurred: the first photosynthesis, cold-blooded to warm-blooded animals, floating marine plants to vascular plants, placental mammals to marsupials, egg-laying animals to animals that bear live young, insect metamorphosis, the transition of mammals to the sea (whales, dolphins, porpoises, seals, sea lions, and manatees), the transition of reptiles to the sea (plesiosaurs, ichthyosaurs), and on and on.

Gaps in the fossil record are well known. A century ago, evolutionists argued that these gaps would be filled as knowledge increased. The same gaps persist, and most paleontologists now admit that those predictions failed. Of course, the most famous "missing link" is between man and apes, but the term is deceiving. There is not merely one missing link, but thousands—a long chain—if the evolutionary tree were to connect man and apes (with their many linguistic, social, mental, and physical differences).

Scientific advancements have shown that evolution is an even more absurd theory than it seemed in Darwin's day. *It is a theory without a mechanism.* Not even appeals to long periods of time will allow simple organisms to "jump gaps" and become more complex and viable. In fact, as the next section will show, long periods of time make such leaps even less likely. Later in this book, you will see that those long, unimaginable time periods in which evolution was claimed were a result of a scientific blunder—failure to understand the origin of earth's radioactivity.

All the breeding experiments that many hoped would demonstrate macroevolution have failed. The arguments used by Darwin and his followers are now discredited or, at best, in dispute, even among evolutionists. Finally, research during the last several decades has shown that the requirements for life are incredibly complex. Just the design that most people can see around them obviously implies a designer. Oddly enough, evolutionists still argue against this design by using arguments which they spent a great deal of time designing. *The theory of organic evolution is invalid.*

As we leave the life sciences and examine the astronomical and physical sciences, we will see many other serious problems with evolutionary theories. If the Earth, the solar system, our galaxy, the universe, or even the heavier chemical elements could not have evolved, as now seems to be the case, then organic evolution could not even have begun.

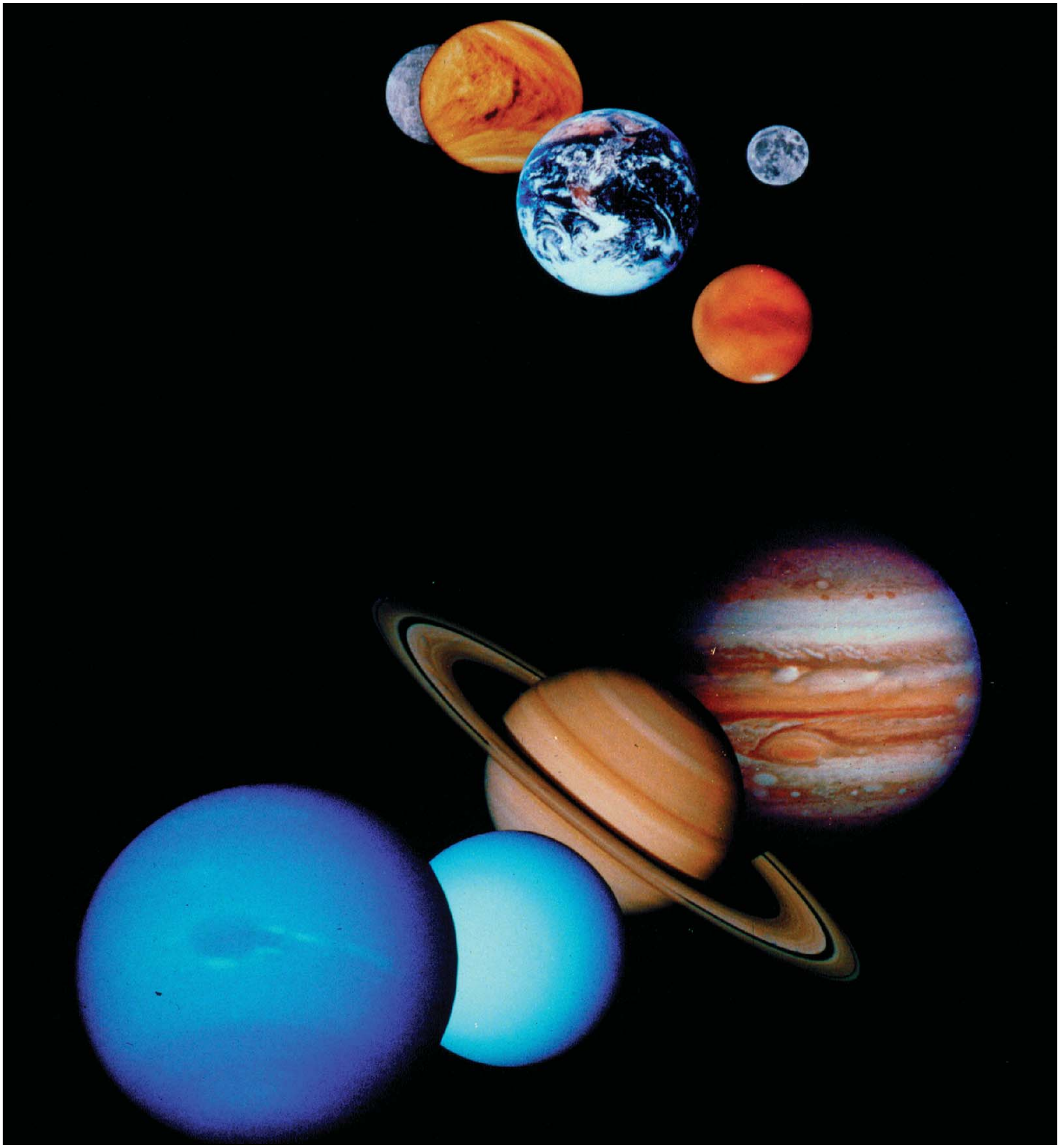


Figure 22: Unique Planets. This is a composite photograph (not-to-scale) of all planets in the solar system, except Pluto. They are, from top to bottom: Mercury, Venus, Earth (with the Moon to the right), Mars, Jupiter, Saturn, Uranus, and Neptune. The photos were taken by Mariner 10 (Mercury), Pioneer Venus Orbiter (Venus), Apollo 17 astronauts (Earth), Earth-based telescopes (Moon and Mars), and the two Voyager spacecraft (the four giant planets).

Each planet is unique. Similarities that would be expected if the planets had evolved from the same swirling dust cloud are seldom found. Yet most planetary studies begin by assuming that the planets evolved and are therefore similar. Typical arguments are as follows: "By studying the magnetic field (or any other feature) of Planet X, we will better understand how Earth's magnetic field evolved." Actually, each magnetic field is surprisingly different. "By studying Earth's sister planet, Venus, we will see how plate tectonics shaped its surface and better understand how plate tectonics works on Earth." It is now recognized that plate tectonics does not occur on Venus. (Part II of this book will show that the plate tectonic theory is incorrect.)

Astronomical and Physical Sciences

The Universe, the Solar System, the Earth, and Life Were Recently Created.

Theories for the Evolution of the Solar System and Universe Are Unscientific and Hopelessly Inadequate.

43. Strange Planets

Many undisputed observations contradict current theories on how the solar system evolved.[a] One theory says that planets formed when a star, passing near our Sun, tore matter from the Sun. More popular theories hold that the solar system formed from a cloud of swirling gas, dust, or larger particles. If the planets and their known moons evolved from the same material, they should have many similarities. After several decades of planetary exploration, this expectation is now recognized as false.[b] [See Figure 22.] According to these evolutionary theories:

Backward-Spinning Planets. All planets should spin in the same direction, but Venus, Uranus,[c] and Pluto rotate backwards.[d] [See **"Is Pluto a Planet?"** on page 28.]

Backward Orbits. Each of the almost 200 known moons in the solar system should orbit its planet in the same direction, but more than 30 have backward orbits.[e] Furthermore, Jupiter, Saturn, Uranus, and Neptune have moons orbiting in both directions.

Tipped Orbits.

- ***Moons.*** The orbit of each of these moons should lie very near the equatorial plane of the planet it orbits, but many, including the Earth's moon, are in highly inclined orbits.[f]
- ***Planets.*** The orbital planes of the planets should lie in the equatorial plane of the Sun. Instead, the orbital planes of the planets typically deviate from the Sun's equatorial plane by 7 degrees, a significant amount.

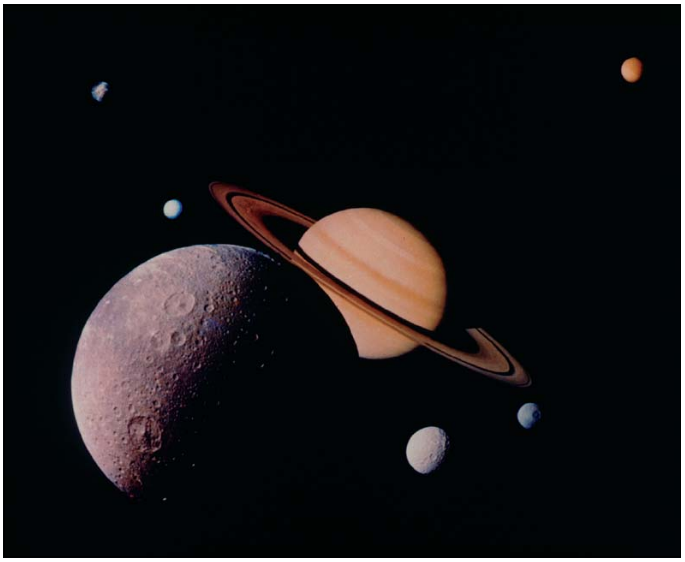


Figure 23: Saturn and Six of Its Moons. Saturn has 60 known moons. One of them, named Phoebe, has an orbit almost perpendicular to Saturn's equator. This is difficult for evolutionist astronomers to explain.

Angular Momentum. The Sun should have about 700 times more angular momentum than all the planets combined. Instead, the planets have 50 times more angular momentum than the Sun.[g]

44. Earth: The Water Planet

The amount of water on Earth greatly exceeds that known on or within any other planet in the solar system. Liquid

Is Pluto a Planet?

In 2006, after years of internal debate, 4% of the members of the International Astronomical Union (IAU)—those meeting in Prague—voted to no longer call Pluto a planet. Instead, they said Pluto is a *transneptunian object.* [See Endnote 43h on page 84.]

The IAU had no jurisdiction to change the definition of "planet" for the rest of the world. It is fine for an organization to tell others what it considers a word to mean, but common usage is the basis for definitions. Our language is filled with scientific words whose meanings have changed based on new discoveries and broader understandings. Few meanings have changed based on an organization's vote.

Since Pluto's discovery 76 years earlier, Pluto has been a thorn in the side of astronomers trying to explain how planets evolve, because so many characteristics of Pluto do not fit into evolutionary scenarios. No longer calling Pluto a planet (even though it is spherical, has three known moons, and orbits the Sun in the right direction) may reduce those man-made problems, but now calls attention to the more difficult question of how a thousand transneptunian objects evolved.

In 1930, after astronomers had been searching for a suspected ninth planet for 25 years, a tenacious farm boy from Kansas, Clyde W. Tombaugh (1906–1997), discovered Pluto. He later became one of my favorite professors. Going to his backyard to use his handmade 9-inch telescope was memorable. Professor Tombaugh was a warm, unpretentious man with the biggest smile you have ever seen. However, in class, he sometimes became irate at astronomers who made pronouncements but seldom touched a telescope.

Classification can be a useful tool, but at other times it leads to endless arguments, because the world (or, in this case, the solar system) is usually more complicated than theories imply. We can call Pluto anything we wish, but tens of thousands of books and hundreds of millions of students have called Pluto a planet.

What is a planet? Its original meaning was "wandering star." I will always associate Pluto with Clyde Tombaugh and the worldwide excitement of finally discovering the ninth *planet.* For historical reasons, if nothing else, I suspect that millions of others will continue to call Pluto a planet as well as a transneptunian object.

Semantics aside, the scientific question remains: how could Pluto evolve?

water, which is essential for life to survive, has unique and amazing properties; it covers 70% of Earth's surface. *Where did all Earth's water come from?*

If the Earth and solar system evolved from a swirling cloud of dust and gas, almost no water would reside near Earth's present orbit. Any water (liquid or ice) that close to the Sun would vaporize and be blown by solar wind to the outer reaches of the solar system,[a] as we see happening with water vapor in the tails of comets.

Did comets or meteorites deliver Earth's water? Although comets contain considerable water,[b] comets did not provide much of the Earth's water, because comet water contains too much heavy hydrogen, relatively rare in Earth's oceans. Comets also contain too much argon. If comets provided only 1% of Earth's water, then our atmosphere should have 400 times more argon than it does.[c] The few types of meteorites that contain water also have too much heavy hydrogen.[d] [Pages 271–326 explain why comets and some types of meteorites contain so much water and heavy hydrogen. Heavy hydrogen is described on page 280.]

These observations have caused some to conclude that water was transported from the outer solar system to Earth by objects that no longer exist.[e] If so, many of these "water tankers" should have collided with the other inner planets (Mercury, Venus, and Mars), producing water characteristics similar to those of Earth. In fact, their water characteristics are not like those of Earth.[f] Instead of imagining "water tankers" that conveniently disappeared, perhaps we should ask if the Earth was created with its water already present.

45. Molten Earth?

For decades, textbooks have taught that the early Earth was molten for 500,000,000 years, because it formed by meteoritic bombardment.[a] If so, the heat released by the impacts would have melted the entire Earth many times over.[b] Had Earth ever been molten, dense, nonreactive chemical elements such as gold would have sunk to Earth's core. Gold is 70% denser than lead, yet is found at the Earth's surface.[c] Therefore, the entire Earth was never molten and did not form by meteoritic bombardment.

Radioactive dating of certain zircon minerals also contradicts a molten Earth. Trace elements within those zircons show that the zircons formed on a cold Earth (less than 212°F).[d] However, based on radioactive dating, those zircons formed on an extremely young Earth, when, according to evolutionists, it should have been molten (exceeding 1,800°F)—an obvious contradiction. Either the molten Earth idea or the radioactive dating method must be wrong; perhaps both are wrong.

Meteorites contain much more of the element xenon than Earth's surface rocks, relative to other noble (inert) gases such as helium, neon, and argon. Had Earth formed by meteoritic bombardment, Earth's surface rocks would have a different composition, and our atmosphere would contain up to ten times more xenon than it has.[e] If Earth did not evolve by meteoritic bombardment, it may have begun as one large body. [See **"Melting the Inner Earth"** on pages 496–498.]

46. Evolving Planets?

Contrary to popular opinion, planets should not form from just the mutual gravitational attraction of particles orbiting the Sun.[a] Orbiting particles are much more likely to be scattered or expelled by their gravitational attraction than they are to be permanently pulled together. Experiments have shown that colliding particles almost always fragment rather than stick together.[b] (Similar difficulties exist in trying to form a moon from particles orbiting a planet.)

Despite these problems, let us assume that pebble-size to moon-size particles somehow evolved. "Growing a planet" by many small collisions will produce an almost *nonspinning* planet, because spins imparted by impacts will be largely self-canceling.[c]

The growth of a large, gaseous planet (such as Jupiter, Saturn, Uranus, or Neptune) far from the central star is especially difficult for evolutionist astronomers to explain for several reasons.[d]

a. Gases dissipate rapidly in the vacuum of outer space, especially the lightest two gases—hydrogen and helium, which comprise most of the mass of the giant planets.
b. Because gas molecules orbiting a star do not gravitationally pull in (or merge with) other gas molecules in the orbiting ring, a rocky planet, about ten or more times larger than Earth, must first form to attract all the gas gravitationally. This must happen very quickly, before the gas dissipates.[e] (Jupiter's hydrogen and helium are 300 times more massive than the entire Earth.)
c. Stars like our Sun—even those which evolutionists say are young—do not have enough orbiting hydrogen or helium to form one Jupiter.[f]

Computer simulations show that Uranus and Neptune could not have evolved anywhere near their present locations.[g] The planets that have been found outside our solar system also contradict the theories for how planets supposedly evolve. [See **"Have Planets Been Discovered Outside the Solar System?"** on page 403.]

Based on demonstrable science, gaseous planets and the rest of the solar system did not evolve.

47. Planetary Rings

Planetary rings have long been associated with claims that planets evolved. Supposedly, after planets formed from a swirling dust cloud, rings remained, as seen around the giant planets: Saturn, Uranus, Jupiter, and Neptune.[a] [See Figure 24.] Therefore, some believe that because we see rings, planets must have evolved.[b]

Actually, rings have nothing to do with a planet's origin. Rings form when material is expelled from a moon by a volcano, a geyser, or the impact of a comet or meteorite.[c] Debris that escapes a moon because of its weak gravity and a giant planet's gigantic gravity then orbits that planet as a ring. If these rings were not periodically replenished, they would be dispersed in less than 10,000 years.[d] Because a planet's gravity pulls escaped particles away from its moons, particles orbiting a planet could never form moons—as evolutionists assert.

48. Origin of the Moon

Evolutionary theories for the origin of the Moon are highly speculative and completely inadequate.[a] The Moon could not have spun off from Earth, because its orbital plane is too highly inclined. Nor could it have formed from the same material as Earth, because the relative abundances of its elements are too dissimilar from those of Earth.[b] The Moon's nearly circular orbit is also strong evidence that it was never torn from nor captured by Earth.[c] If the Moon formed from particles orbiting Earth, other particles should be easily visible inside the Moon's orbit; none are.

Some claim that the Moon formed from debris splashed from Earth by a Mars-size impactor. If so, many small moons should have formed.[d] The impactor's glancing blow would either be too slight to form our large Moon, or so violent that Earth would end up spinning too fast.[e] Also, small particles splashed from Earth would have completely melted, allowing any water inside them to escape into the vacuum of space. However, Apollo astronauts found on the Moon tiny glass beads that had erupted as molten material from inside the Moon but had dissolved water inside! The total amount of water that was once inside the moon probably equaled that in the Caribbean Sea.[f]

These explanations have many other problems. Understanding them caused one expert to joke, "The best explanation [for the Moon] was observational error—the Moon does not exist."[g] Similar difficulties exist for evolutionary explanations of the other (almost 200) known moons in the solar system.

But the Moon does exist. If it was not pulled or splashed from Earth, was not built up from smaller particles near its present orbit, and was not captured from outside its

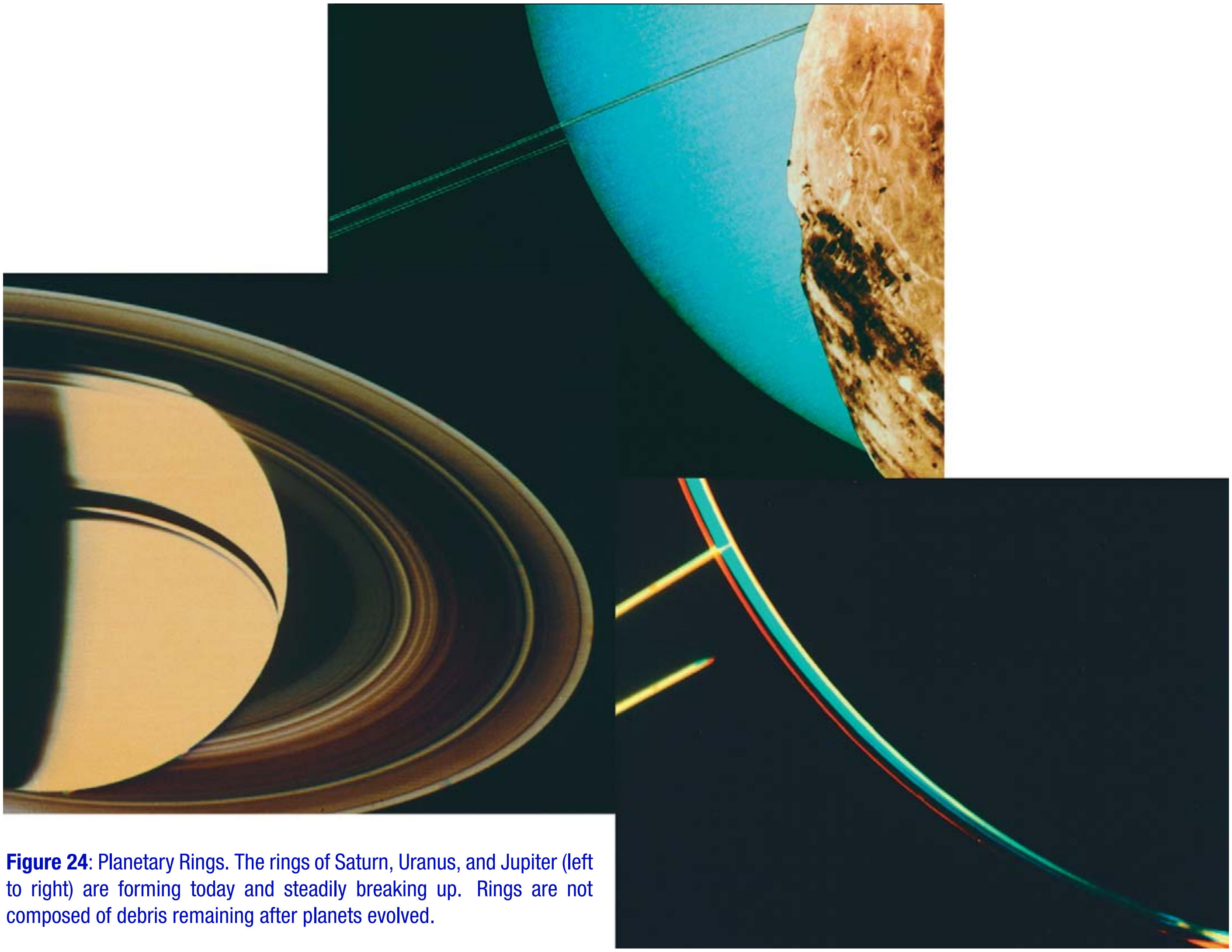


Figure 24: Planetary Rings. The rings of Saturn, Uranus, and Jupiter (left to right) are forming today and steadily breaking up. Rings are not composed of debris remaining after planets evolved.

present orbit, only one hypothesis remains: the Moon was created in its present orbit. [See **"Evolving Planets?"** on page 29, and **"Moon Recession," "Moon Dust and Debris,"** and **"Hot Moon"** on page 41.]

49. Evolution of the Solar System?

Evolutionists claim that the solar system condensed out of a vast cloud of swirling dust about 4,600,000,000 years ago. If so, many particles that were not swept up as part of a planet should now be spiraling in toward the Sun. Colliding asteroids also would create dust particles that, over millions of years, would spiral in toward the Sun. (To understand why, see **"Poynting-Robertson Effect"** on page 42.) Particles should still be falling into the Sun's upper atmosphere, burning up, and giving off an easily measured infrared glow. Measurements taken during the solar eclipse of 11 July 1991 showed no such glow.[a] So, the assumed "millions of years" and this explanation for the solar system's origin are probably wrong.

Disks of gas and dust surround some stars. That does not mean planets are forming in those disks. Some disks formed from matter suddenly expelled from the star.[b] Other disks formed from impact debris or other matter near the star. Early astronomers called the disks *planetary nebula*, because they mistakenly thought they contained evolving planets.

50. Faint Young Sun

If, as evolutionists teach, the solar system evolved from a spinning cloud of dust and gas 4.5 billion years ago, the slowly condensing Sun would have radiated 25–30% less heat during its first 600 million years than it radiates today.[a] (A drop in the Sun's radiation of *only a few percent* would freeze all our oceans.) Had this happened anytime in the past, let alone for 600 million years, the ice's mirrorlike surfaces would have reflected more of the Sun's radiation into outer space, cooling Earth even more in a permanent, runaway deep-freeze. If it had, all agree that life could not have evolved.

Evolutionists first tried to solve this "faint young Sun" problem by assuming that Earth's atmosphere once had up to a thousand times more heat-trapping carbon dioxide than today. No evidence supports this, and much opposes it.[b] Actually, large amounts of carbon dioxide on a cool Earth would have produced "carbon dioxide ice clouds high in the atmosphere, reflecting the Sun's radiation into outer space and locking Earth into a permanent ice age."[c]

A second approach assumes that Earth's atmosphere had a thousand times more ammonia and methane, other heat-trapping gases. Unfortunately, sunlight quickly destroys both gases, and at high concentrations methane produces a haze that would have cooled Earth's surface rather than warming it.[d] Besides, ammonia would readily dissolve in water, making oceans toxic.[e]

A third approach assumes that Earth had no continents, had much more carbon dioxide in its atmosphere, and rotated once every 14 hours, so most clouds were concentrated at the equator. With liquid water covering the entire Earth, more of the Sun's radiation would be absorbed, raising Earth's temperature slightly. All three assumptions are questionable.[f]

Evolutionists have never explained in any of these approaches how such drastic changes could occur in almost perfect step with the slow increase in the Sun's radiation. Until some evidence supports such "special pleadings," it does not appear that the Sun evolved.[g]

If the Sun, a typical and well-studied star, did not evolve, then why presume that all other stars did?

51. Mountains of Venus

Venus must have a strong crust to support its high, dense[a] mountains. One mountain, Maat Mons, rises higher than Earth's Mount Everest does above sea level. Because Venus is relatively near the Sun, its atmosphere is 860°F—so hot its *surface* rocks must be weak or "tarlike." (Lead melts at 622°F and zinc at 787°F.) Only if Venus' *subsurface* rocks are cold and strong can its mountains defy gravity. This allows us to draw two conclusions, both of which contradict major evolutionary assumptions.

First, evolutionists assume that planets grew (evolved) by the gradual accumulation of rocky debris falling in from outer space, a process called *gravitational accretion*. Heat generated by a planet's worth of impacts would have left the rocky planets molten. However, Venus was never molten. Had it been, its hot atmosphere would have prevented its subsurface rocks from cooling enough to support its mountains. So, Venus did not evolve by gravitational accretion.

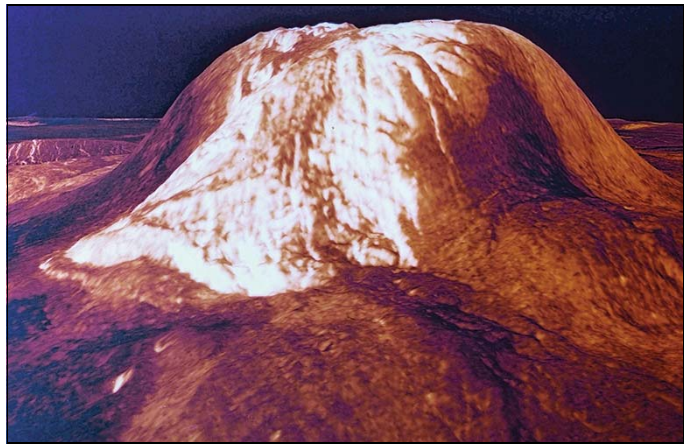


Figure 25: Maat Mons on Venus. If Venus' mountains were composed of lighter material, they would "float" in the denser rock below, similar to an iceberg floating in denser liquid water. (Mountains on Earth are buoyed up, because they have a density of about 2.7 gm/cm^3 and "float" in rock that is about 3.3 gm/cm^3.) Data from the Magellan spacecraft that orbited and mapped Venus for several years showed that Venus' mountains are composed of rock that is too dense to "float." So, what supports them? It must be Venus' strong crust—despite Venus' extremely hot atmosphere. This implies Venus is not old and did not evolve.

Secondly, evolutionists believe that the entire solar system is billions of years old. If Venus were billions of years old, its atmospheric heat would have "soaked" deeply enough into the planet to weaken its subsurface rocks. If so, not only could Venus' crust not support mountains, the hot mountains themselves could not maintain their steep slopes. Venus must be relatively young.

52. Space, Time, and Matter

No scientific theory exists to explain the origin of space, time, or matter. Because each is intimately related to or even defined in terms of the others, a satisfactory explanation for the origin of one must also explain the origin of the others.[a]

53. A Beginning

Heat always flows from a hot body to a cold body. If the universe were infinitely old—has always been here—everything would have the same temperature. Because temperatures vary, the universe is not infinitely old. Therefore, the universe had a beginning. (A beginning suggests a Creator.)[a]

54. First Law of Thermodynamics

The first law of thermodynamics tells us that the total energy in the universe, or in any isolated part of it, remains constant. In other words, energy (or its mass equivalent) is not now being created or destroyed; it simply changes form. Countless experiments have verified this.

A corollary of the first law is that natural processes cannot create energy. Therefore, energy must have been created in the past by some agency or power outside and independent of the natural universe. Furthermore, if natural processes cannot produce mass and energy—the relatively simple inorganic portion of the universe—then it is even less likely that natural processes can produce the much more complex organic (or living) portion of the universe.

55. Second Law of Thermodynamics

If the entire universe is an isolated system, then, according to the second law of thermodynamics, the energy in the universe available for work has always been decreasing. However, as one goes back in time, the energy available for useful work would eventually exceed the total energy in the universe, which, according to the first law of thermodynamics, remains constant. This is an impossible condition, implying the universe had a beginning.[a]

A further consequence of the second law is that soon after the universe began, it was more organized and complex than it is today—not in a highly disorganized and random state as assumed by evolutionists and proponents of the big bang theory.[b]

56. Big Bang?

The big bang theory, now known to be seriously flawed,[a] was based on three observations: the redshift of light from distant stars, the cosmic microwave background (CMB) radiation, and the amount of helium in the universe. All three have been poorly understood.

Redshift. The redshift of starlight is usually interpreted as a Doppler effect;[b] that is, stars and galaxies are moving away from Earth, stretching out (or reddening) the wavelengths of light they emit. Space itself supposedly expands—so the total potential energy of stars, galaxies, and other matter increases today with no corresponding loss of energy elsewhere.[c] Thus, the big bang violates the law of conservation of energy, probably the most important of all physical laws.

Conservation of energy is violated in another important way. If a big bang happened, distant galaxies should not just be receding from us, they should be decelerating. Measurements show the opposite; they are accelerating from us. [See **"Dark Thoughts"** on page 33.]

Many objects with high redshifts seem connected, or associated, with objects having low redshifts. They could not be traveling at such different velocities and stay connected for long. [See **"Connected Galaxies"** and **"Galaxy Clusters"** on page 43.] For example, many quasars have very high redshifts, and yet they statistically cluster with galaxies having low redshifts.[d] Some quasars seem to be connected to galaxies by threads of gas.[e] Many quasar redshifts are so great that the massive quasars would need to have formed too soon after the big bang—a contradiction of the theory.[f]

Finally, redshifted light from galaxies has some strange features inconsistent with the Doppler effect. If redshifts are from objects moving away from Earth, one would expect redshifts to have continuous values. Instead, redshifts tend to cluster at specific, evenly-spaced values.[g] Much remains to be learned about redshifts.

CMB. All matter radiates heat, regardless of its temperature. Astronomers can detect an extremely uniform radiation, called *cosmic microwave background* (*CMB*) *radiation*, coming from all directions. It appears to come from perfectly radiating matter whose temperature is 2.73 K—nearly absolute zero. Many incorrectly believe that the big bang theory predicted this radiation.[h]

Matter in the universe is highly concentrated into galaxies, galaxy clusters, and superclusters—as far as the most powerful telescopes can see.[i] Because the CMB is so uniform, many thought it came from evenly spread matter soon after a big bang. But such uniformly distributed matter would hardly gravitate in any direction; even after tens of billions of years, galaxies and much larger structures would not evolve. In other words, the big bang did not produce the CMB.[j] [See pages 389–391.]

Helium. Contrary to what is commonly taught, the big bang theory does not explain the amount of helium in the universe; the theory was adjusted to fit the amount of helium.[k] Ironically, the lack of helium in certain types of stars (B type stars)[l] and the presence of beryllium and boron in "older" stars[m] contradicts the big bang theory.

A big bang would produce only hydrogen, helium, and lithium, so the first generation of stars to somehow form after a big bang should consist only of those elements. Some of these stars should still exist, but despite extensive searches, none has been found.[n]

Other Problems. If the big bang occurred, we should not see massive galaxies at such great distances, but such galaxies are seen. [See **"Distant Galaxies"** on page 385.] A big bang should not produce highly concentrated[o] or rotating bodies.[p] Galaxies are examples of both. Nor should a big bang produce tightly clustered galaxies.[q] Also, a large volume of the universe should not be—but evidently is—moving sideways, almost perpendicular to the direction of apparent expansion.[r]

If a big bang occurred, equal amounts of matter and ***antimatter*** should have been made. For every charged particle in the universe, the big bang should have produced an identical particle but with the opposite

Dark Thoughts

For decades, big bang theorists said that the amount of mass in a rapidly expanding universe must be enough to prevent all matter from flying apart; otherwise, matter could not come together to form stars and galaxies. Estimates of the universe's actual mass always fell far short of that minimum amount. This "missing mass" is often called *dark matter*, because no one could see it or even detect it. Actually, "missing mass" had to be "created" to preserve the big bang theory. [See **"Missing Mass"** on page 33.] The media's frequent reference to "dark matter" enshrined it in the public's consciousness, much like the supposed "missing link" between apes and man.

The big bang has struck again by devising something new and imaginary to support the theory. Here's why. The big bang theory predicts that the universe's expansion must be slowing, just as a ball thrown upward must slow as it moves away from the Earth. For decades, cosmologists tried to measure this deceleration. The shocking result is now in—and the answer has been rechecked in many ways. The universe's expansion is not decelerating; it is accelerating![v] Therefore, to protect the theory, something must again be invented. Some energy source that counteracts gravity must continually accelerate stars and galaxies away from each other. This energy, naturally enough, is called *dark energy*.

Neither "dark matter" (created to hold the universe together) nor "dark energy" (created to push the universe apart) has been seen or measured.[w] We are told that "most of the universe is composed of invisible dark matter and dark energy."[x] Few realize that both mystical concepts were devised to preserve the big bang theory.

Rather than cluttering textbooks and the public's imagination with statements about things for which no objective evidence exists, wouldn't it be better to admit that the big bang is faulty? Of course. But big bang theorists want to maintain their reputations, careers, and worldview. If the big bang is discarded, only one credible explanation remains for the origin of the universe and everything in it. That thought sends shudders down the spines of many evolutionists. (Pages 383–388 give an explanation for the expansion, or "stretching out," of the universe.)

electrical charge.[s] (For example, the negatively charged electron's antiparticle is the positively charged positron.) Only trivial amounts of antimatter have ever been detected, even in other galaxies.[t]

If a big bang occurred, what caused the bang? Stars with enough mass become black holes, so not even light can escape their enormous gravity. How then could anything escape the trillions upon trillions of times greater gravity caused by concentrating all the universe's mass in a "cosmic egg" that existed before a big bang?[u]

If the big bang theory is correct, one can calculate the age of the universe. This age turns out to be younger than objects in the universe whose ages were based on other evolutionary theories. Because this is logically impossible, one or both sets of theories must be incorrect.[y] All these observations make it doubtful that a big bang occurred.[z]

57. Missing Mass

Imagine seeing several rocks in outer space, moving radially away from Earth. If the rocks were simultaneously blasted away from Earth, their masses, changing velocities, and distances from Earth would have a very precise mathematical relationship with each other. When a similar relationship is checked for billions of observable galaxies, an obvious conclusion is that these galaxies did not explode from a common point in a huge "big bang."[a] It is even more obvious that if such an explosion occurred, it must have been much, much less than billions of years ago.

Evolutionists try to fix this problem in two ways. They assume that the universe is filled with at least ten times as much matter as can be seen. This is maintained even though three decades of searching for this "missing mass" have turned up nothing other than the conclusion that it does not exist.[b]

A second "fix attempt" assumes that the rocks (or, in the real problem, all particles in the universe) were briefly, almost magically, accelerated away from some point. This process, called *inflation*, supposedly reached speeds billions of trillions of times *faster than the speed of light*.[c] In instant later, and for no apparent reason, inflation stopped. All this happened by an unknown, untestable phenomenon—not by a blast. Then this matter became controlled by gravity after it reached just the right speed to give the universe an apparent age (based on one set of assumptions) of about 13.7 billion years.[d] Such flights of imagination and speculation are common in the field of cosmology.

58. Heavy Elements

Evolutionists historically have had difficulty explaining the origin of heavy elements. (A big bang would produce only the three lightest elements: hydrogen, helium, and lithium.) The other 100+ elements supposedly formed deep inside stars and during stellar explosions. This theory is hard to verify, because stellar interiors and explosions cannot be carefully analyzed. However, a vast region of gas containing the mass of 300,000,000,000,000 suns has been found that is quite rich in iron and other heavy elements. The number of nearby visible stars is a thousand times too small to account for the heavy elements in that huge region.[a] Heavy elements are even relatively abundant in nearly empty regions of space that are farthest from stars and galaxies.[b]

Most hydrogen atoms weigh one atomic mass unit, but some, called *heavy hydrogen*, weigh two units. If everything in the universe came from a big bang or a swirling gas cloud, heavy hydrogen should be uniformly mixed with normal hydrogen. It is not.[c] Comets have twice the concentration of heavy hydrogen as oceans. Oceans have 10–50 times the concentration as the solar system and interstellar matter. [See **"Heavy Hydrogen"** on page 280.]

59. Interstellar Gas

Detailed analyses have long shown that neither stars nor planets could form from interstellar gas clouds.[a] To do so, either by first forming dust particles[b] or by direct gravitational collapse of the gas,[c] would require vastly more time than the alleged age of the universe. An obvious alternative is that stars and planets were created.

60. Fast Binaries

In our galaxy, about 60% of all stars are grouped in closely spaced pairs called *binaries*. Fortunately, our Sun does not have a binary partner. If it did, temperatures on Earth would vary too much to support life. The mutual gravitational attraction between stars in a binary pair causes them to orbit each other, just as the Moon orbits Earth. The closer paired stars are to each other, the faster they orbit. Their orbits do not change appreciably, even over long periods of time.

Two particular stars are so close that they orbit each other every 11 minutes! This implies their centers are about 80,000 miles apart.[a] By way of comparison, our Sun, a typical star, is more than 800,000 miles in diameter. Other close binaries are also known.[b]

The theory of stellar evolution was developed by arranging (on paper) different types of stars in a sequence according to brightness and color. Stellar evolutionists believe that stars slowly change from one type to another. However, scientists have never observed such changes, and many stars do not fit this pattern. According to stellar evolution, a typical star's volume, late in its lifetime, expands to about a million times that of our Sun and finally collapses to become a small star about the size of Earth (a white dwarf) or even smaller (a neutron star).

Only such tiny stars could have their centers 80,000 miles apart and still orbit each other. Obviously, these fast binary stars did not evolve from larger stars, because larger stars orbiting so closely would collide. If two stars cannot evolve into a condition that has them orbiting each other every 11 minutes, one wonders whether stars evolve at all.

61. Star Births? Stellar Evolution?

Evolutionists claim that stars form from swirling clouds of dust and gas. For this to happen, vast amounts of energy, angular momentum, and residual magnetism must be removed from each cloud. This is not observed today, and astronomers and physicists have been unable to explain, in an experimentally verifiable way, how it all could happen.[a]

The most luminous stars in our galaxy, called *O stars*, are "burning fuel" hundreds of thousands of times faster than our Sun. This is so rapid that they must be quite young on an evolutionary time scale. If these stars evolved, they should show easily measurable characteristics such as extremely high rates of rotation and enormous magnetic fields. Because these characteristics are not observed, it seems quite likely these stars did not evolve.

If stars evolve, star births should about equal star deaths. Within our Milky Way Galaxy alone, about one star dies each year and becomes an expanding cloud of gas and dust.[b] Deaths of more massive stars are much brighter, more violent explosions called *supernovas*. Star births, on the other hand, would appear as new starlight not present on the many photographic plates made decades earlier. Instruments which could detect dust falling into and forming supposedly new stars have not done so.[c] Actually, stars that some astronomers believe are very new are expelling matter. We have seen hundreds of stars die, but we have never seen a star born.[d]

Also, some stars are found where astronomers agree they could not evolve, near the center of our galaxy. These short-lived stars orbit a massive black hole, where gravity is so strong that gas and dust clouds could never evolve into a star. Instead, the black hole's massive gravity would pull such clouds (supposedly evolving stars) apart.[e]

Nor could stars have evolved in globular clusters, where up to a million stars occupy a relatively small volume of space. [See Figure 191 on page 392.] Wind and radiation pressure from the first star in the cluster to evolve would have blown away most of the gas needed to form the other stars in the cluster.[f] In other words, if stars evolved, we should not see globular clusters, yet our galaxy has about 200 globular clusters. To pack so many stars that tightly

Stellar Nursery, or Is the Emperor Naked?

The popular media frequently claim that stars are actually seen evolving and that pictures of these "stellar nurseries" prove it. Impressive pictures of the Eagle Nebula (Figure 26) are usually shown. Many people accept the claim without asking themselves, "Do the pictures contain anything that shows stars evolving?" Of course not. If stars were evolving, other physical measurements could confirm it. Where are those measurements? Silence.

This willingness to accept what others tell us reminds one of the tale in which citizens told their naked emperor he was nicely dressed. Rather than believing or reporting what their eyes clearly told them, people preferred to accept what others said—or at least not object. Better not disagree or even ask questions; it could be embarrassing.

Why do some astronomers say stars are evolving? Until recently, the atmosphere prevented astronomers from seeing infrared radiation from space. Then, in the late 1960s, satellites outside the atmosphere made infrared sky surveys that showed some surprisingly warm clouds of dust and gas in our galaxy. Several things could cause this heating. Perhaps a dim star (a *brown dwarf*) is behind the cloud, maybe something nearby exploded, or a star is dying as it is being pulled into a massive black hole. Those who struggled to understand how stars evolved had a different interpretation: "Gravity is collapsing the cloud, raising its temperature. In thousands of years, it will become a star." Still other interpretations are possible.

NASA's claim in 1995 that these pictures (Figure 26) showed hundreds to thousands of stars forming was based on the speculative "EGG-star formation theory." It has recently been tested independently with two infrared detectors that can see inside the dusty pillars. Few stars were there, and 85% of the pillars had too little dust and gas to support star formation. "The new findings also highlight how much astronomers still have to learn about star formation." [Ron Cowen, "Rethinking an Astronomical Icon: The Eagle's EGG, Not So Fertile," *Science News*, Vol. 161, 16 March 2002, pp. 171–172.]

What prevents stellar evolution? Just as the Sun's gravity does not pull planets into the Sun, gravity does not automatically pull orbiting gas and dust into a tight ball that then ignites as a star. Each cloud of dust and gas in space has a specific amount of kinetic and potential energy, angular momentum, and magnetic energy that must be removed for even a slight collapse. Evidence of that removal is missing. Furthermore, any collapse would only increase the cloud's temperature and pressure, which, in turn, would expand the cloud. For more details on these processes, see **"Interstellar Gas"** and **"Star Births? Stellar Evolution?"** on page 34, and *especially all related endnotes starting on page 93*.

If someone tells you that the emperor is well dressed, ask questions and insist on seeing real evidence.

Figure 26: Gas and Dust Clouds in the Eagle Nebula.

together requires that they all came into existence at about the same time.

A similar problem exists for stars that are more than twenty times more massive than our sun. After a star grew to 20 solar masses, it would exert so much radiation pressure and emit so much stellar wind that additional mass could not be pulled in to allow it to grow.[g] Many stars are heavier than a hundred suns. Some black holes have millions or billions of times more mass than the sun.

Poor logic is involved in arguing for stellar evolution, which is assumed in estimating the ages of stars. These ages are then used to establish a framework for stellar evolution. That is circular reasoning.[h]

In summary, there is no evidence that stars evolve, there is much evidence that stars did not evolve, and there are no experimentally verifiable explanations for how they could evolve and seemingly defy the laws of physics.[i]

62. Galaxies

Figure 27: Spiral Galaxies.

Evolutionists now admit that galaxies cannot evolve from one type to another.[a] There are also good reasons why natural processes cannot form galaxies.[b] Furthermore, if spiral galaxies were billions of years old, their arms or bars would be severely twisted.[c] [See Figure 189 on page 380.] Because they have maintained their shape, either galaxies are young, or unknown physical phenomena are occurring within galaxies.[d] Even structures composed of galaxies are now known to be so amazingly large and so elongated that they could not have formed by slow gravitational attraction.[e] *Slow, natural* processes cannot form such huge galactic structures; rapid, supernatural processes may have.

Techniques That Argue for an Old Earth Are Either Illogical or Based on Unreasonable Assumptions.

63. Radiometric Dating

To date an event or thing that preceded written records, one must assume that the dating clock has operated at a known rate, that the clock's initial setting is known, and that the clock has not been disturbed. These three assumptions are almost always unstated, overlooked, or invalid.

For the past century, a major (but incorrect) assumption underlying all radioactive dating techniques has been that decay rates, which have been essentially constant over the past 100 years, have also been constant over the past 4,600,000,000 years. Unfortunately, few have questioned this huge and critical assumption.

It is also critical that one understands how a dating clock works. For radiometric dating clocks on Earth, this is explained in the chapter **"The Origin of Earth's Radioactivity"** on pages 329–371. After studying that chapter, you will see that Earth's radioactivity—and the many daughter products that misled so many into thinking that the Earth was billions of years old—are a result of powerful electrical activity during the flood, only about 5,000 years ago.

64. Corals and Caves

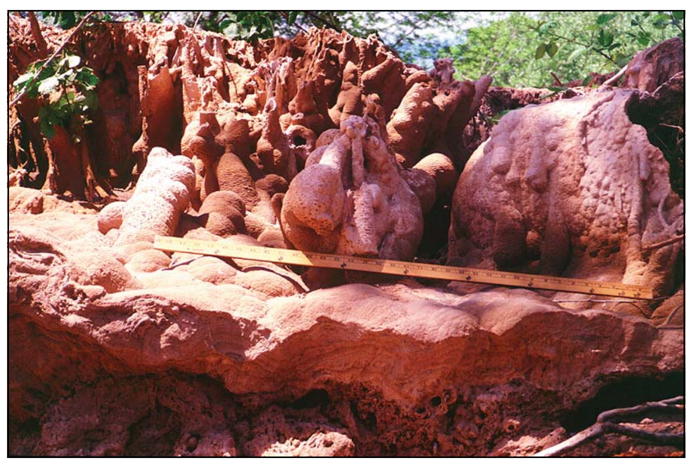


Figure 28: Stalagmites. Water from an underground spring was channeled to this spot on a river bank for only one year. In that time, limestone built up around sticks lying on the bank. Limestone deposits can form rapidly if the groundwater's chemistry is favorable. Just because stalactites and stalagmites are growing slowly today does not mean they must be millions of years old. As we will see in Part II, conditions after the flood provided the ideal chemistry for rapidly forming such features.

Estimated old ages for the Earth are frequently based on "clocks" that today are ticking at extremely slow rates. For example, coral growth rates were thought to have *always* been very slow, implying that some coral reefs must be hundreds of thousands of years old. More accurate

Figure 29: 70,000,000-Year-Old Fish? Thought to have been extinct for 70,000,000 years, the coelacanth (SEE-la-kanth) was first caught in 1938, deep in the Indian Ocean, northwest of Madagascar. Rewards were then offered for coelacanths, so hundreds were caught and sold. In 1998, they were also found off the coast of Indonesia.[c] How could the ancestors of these coelacanths leave no fossils for 70,000,000 years? (Endnotes here are under **"Index Fossils"** on pages 95–97.)

Before coelacanths were caught, evolutionists incorrectly believed that the coelacanth had lungs, a large brain, and four bottom fins *about to evolve into legs*.[d] Evolutionists reasoned that the coelacanth, or a similar fish, crawled out of a shallow sea and filled its lungs with air, becoming the first four-legged land animal. Millions of students have been incorrectly taught that this fish was the ancestor of all amphibians, reptiles, dinosaurs, birds, and mammals, including people. (Was your ancestor a fish?)

J. L. B. Smith, a well-known fish expert from South Africa, studied the first two captured coelacanths (nicknamed the coelacanth "Old Fourlegs") and wrote a book by that title in 1956. When dissected, did they have lungs and a large brain? Not at all.[e] Furthermore, in 1987, a German team filmed six coelacanths in their natural habitat. They were *not* crawling on all fours![f]

Before living coelacanths were found in 1938, evolutionists dated any rock containing a coelacanth fossil as at least 70,000,000 years old. It was an index fossil. Today, evolutionists frequently express amazement that coelacanth fossils look so much like captured coelacanths—despite more than 70,000,000 years of evolution.[g] If that age is correct, billions of coelacanths would have lived and died. Some should have been fossilized in younger rock and should be displayed in museums. Their absence implies that coelacanths have not lived for 70,000,000 years.

measurements of these rates under favorable growth conditions now show that no known coral formation need be older than 3,400 years.[a] A similar comment can be made for growth rates of stalactites and stalagmites in caves.[b] [See Figure 131 on page 231.]

65. Index Fossils

In the early 1800s, some observers in Western Europe noticed that certain fossils are usually preserved in sedimentary rock layers that, when traced laterally, typically lie above somewhat similar fossils. Decades later, after the theory of evolution was proposed, many concluded that the lower organism must have evolved before the upper organism. These early geologists did not realize that a hydrodynamic mechanism, *liquefaction*, helped sort organisms in that order during the flood. [For an explanation, see pages 175–187.]

Geologic ages were then associated with each of these "index fossils." Those ages were extended to other animals and plants buried in the same layer as the index fossil. For example, a coelacanth fossil, an index fossil, dates its layer at 70,000,000 to 400,000,000 years old. [See Figure 29.] Today, geologic formations are almost always dated by their fossil content[a]—which, as stated above, assumes evolution. Yet, evolution is supposedly shown by the sequence of fossils. Because this reasoning is *circular,*[b] many discoveries, such as living coelacanths,[c–g] were unexpected. [See **"Out-of-Place Fossils"** on page 12.]

66. Humanlike Footprints

Humanlike footprints, supposedly 150–600 million years old, have been found in rock formations in Utah,[a] Kentucky,[b] Missouri,[c] and possibly Pennsylvania.[d] At Laetoli, in the east African country of Tanzania, a team headed by Mary Leakey found a sequence of humanlike footprints.[e] They were dated at 3.7 million years. If human feet made any of these prints, then evolutionary chronology is drastically wrong.

67. Geologic Column

Practically nowhere on Earth can one find the so-called "*geologic column*."[a] Most "geologic periods" are missing at most continental locations. Only 15–20% of Earth's land surface has even one-third of these periods in the correct order.[b] Even within the Grand Canyon, 150 million years of this imaginary column are missing. Using the assumed geologic column to date fossils and rocks is fallacious.

68. Old DNA, Bacteria, Proteins, and Soft Tissue?

DNA. When an animal or plant dies, its DNA begins decomposing.[a] Before 1990, almost no one believed that DNA could last 10,000 years.[b] This limit was based on

Figure 30: Humanlike Footprints with Trilobite. In 1968, 43 miles northwest of Delta, Utah, William J. Meister found this and other apparent human shoe prints inside a 2-inch-thick slab of rock. Also in that slab were obvious trilobite fossils, one of which was squashed under the "heel." The 10-inch-long shoe print is at the left, and its rock mold is to its right. According to evolutionists, trilobites became extinct 240 million years *before* humans evolved. Notice how the back of the heel is worn, just as most of our shoes wear today. The heel was indented in the rock about an eighth of an inch deeper than the sole. Others have since made similar discoveries at this location, although this is the only fossil where a trilobite was *inside* an apparent shoe print.

measuring DNA disintegration rates in *well-preserved* specimens of known age such as Egyptian mummies. DNA has now been reported in supposedly 17-million-year-old magnolia leaves[c] and 11-to-425-million-year-old salt crystals.[d] Dozens of plants and animals have left their DNA in sediments claimed to be 30,000–400,000 years old.[e] DNA fragments are also said to be in alleged 80-million-year-old dinosaur bones buried in a coal bed[f] and in the scales of a 200-million-year-old fossilized fish.[g] DNA is frequently reported in insects and plants encased in amber, both assumed to be 25–120 million years old.[h]

These discoveries have forced evolutionists to reexamine the 10,000-year limit.[i] They now claim that DNA can be preserved longer if conditions are dryer, colder, and freer of oxygen, bacteria, and background radiation. However, measured disintegration rates of DNA, under these more ideal conditions, do not support this claim.[j]

Bacteria. Even living bacterial spores have been recovered, cultured, and identified in intestines of bees preserved in supposedly 25–40-million-year-old amber.[k] The same bacteria, *Bacillus*, have been found alive in rocks allegedly 250 million and 650 million years old.[l] Italian scientists have recovered 78 different types of dormant, but living, bacteria in two meteorites that are presumed to be 4.5 billion years old.[m] Anyone who accepts such old ages for these rocks must also accept that some bacteria are practically immortal—an obviously absurd conclusion. (Because these "old" bacteria and the various DNA specimens closely match those of today, little evolution has occurred.)

Proteins and Soft Tissue. Evolutionists face similar contradictions with proteins,[n] soft tissue,[o] and blood compounds[p] preserved in dinosaur bones and a large marine reptile.[q] As with DNA, these remains should not last 65–150 million years, as is ridiculously claimed.[r]

69. Human Artifacts

At various times and places, man-made objects have been found encased in coal. Examples include a thimble,[a] an iron pot,[b] an iron instrument,[c] an 8-karat gold chain,[d] three throwing-spears,[e] and a metallic vessel inlaid with silver.[f] Other "out-of-place artifacts" have been found inside deeply buried rocks: nails,[g] a screw,[h] a strange coin,[i] a tiny ceramic doll,[j] and other objects of obvious human manufacture.[k] By evolutionary dating techniques, these objects would be hundreds of millions of years older than man. Again, something is wrong.

70. Parallel Layers

Because no worldwide or even continental unconformity exists in earth's sedimentary layers, those layers must have been deposited rapidly. (An ***unconformity*** represents a time break of unknown duration—for example, an erosional surface between two adjacent strata.) Parallel layers (called *conformities*) imply continuous, relatively rapid deposition. Because unconformities are simply local phenomena,[a] one can trace continuous paths, which sometimes move horizontally, from the bottom to the top of the stratigraphic record that avoid these time breaks. The sedimentary layers along those paths must have been deposited rapidly and continuously as a unit.[b]

Frequently, two adjacent and parallel sedimentary layers contain such different index fossils that evolutionists conclude they were deposited hundreds of millions of years apart. However, because the adjacent layers are conformable, they must have been deposited without interruption or erosion. [For an explanation of how conformable layers can have such different fossils, see pages 175–187.] Often, in sequences showing no sign of disturbance, the layer considered older by evolutionists is on top! [See **"Out-of-Place Fossils"** on page 12.] Evolutionary dating rules are self-contradictory.[c]

Most Scientific Dating Techniques Indicate That the Earth, Solar System, and Universe Are Young.

For the last 150 years, the age of the Earth, as assumed by evolutionists, has been doubling at roughly a rate of once every 15 years. In fact, since 1900 this age has multiplied by a factor of 100!

Evolution requires an old Earth, an old solar system, and an old universe. Nearly all informed evolutionists will admit that without billions of years their theory is dead. Yet, hiding the "origins question" behind a vast veil of time makes the unsolvable problems of evolution difficult for scientists to see and laymen to imagine. Our media and textbooks have implied for over a century that these almost unimaginable ages are correct. Rarely do people examine the shaky assumptions and growing body of contrary evidence. Therefore, most people today almost instinctively believe that the Earth and universe are billions of years old. Sometimes, these people are disturbed, at least initially, when they see the actual evidence.

Actually, most dating techniques indicate that the Earth and solar system are young —possibly less than 10,000 years old. Here are some of these points of evidence.

71. Helium

One product of radioactive decay within rocks is helium, a light gas. This helium enters the atmosphere at a much faster rate than helium escapes the atmosphere. (Large amounts of helium should not escape into outer space, even when considering helium's low atomic weight.) Radioactive decay of only uranium and thorium would produce all the atmosphere's helium in only 40,000 years. Therefore, the atmosphere appears to be young.[a]

72. Lead and Helium Diffusion

Lead diffuses (or leaks) from zircon crystals at known rates that increase with temperature. Because these crystals are found at different depths in the Earth, those at greater depths and temperatures should have less lead. If the Earth's crust is just a fraction of the age claimed by evolutionists, measurable differences in the lead content of zircons should exist in the top 4,000 meters. Instead, no measurable difference is found.[a]

Similar conclusions are reached based on the helium content in these same zircon crystals.[b] Because helium escapes so rapidly and so much helium is still in zircons, they (and the Earth's crust) must be less than 10,000 years old.[c] Furthermore, the radioactive decay that produced all that helium must have happened quite rapidly, because the helium is trapped in *young* zircons.

73. Excess Fluid Pressure

Abnormally high oil, gas, and water pressures exist within relatively permeable rock.[a] If these fluids had been trapped more than 10,000 to 100,000 years ago, leakage would have dropped these pressures far below what they are today. This oil, gas, and water must have been trapped suddenly and recently.[b]

74. Volcanic Debris

Volcanoes eject almost a cubic mile of material into the atmosphere each year, on average. At this rapid rate, about 10 times the entire volume of Earth's sedimentary rock should be produced in 4.5 billion years. Actually, only about 25% of Earth's sediments are of volcanic origin, and much greater volcanic activity existed in the past. No means have been proposed for removing or transforming all the missing volcanic sediments. Therefore, Earth's sediments seem to be much younger than 4.5 billion years.[a]

75. River Sediments

More than 27 billion tons of river sediments enter the oceans each year. Probably the rate of sediment transport is diminishing as looser topsoil is removed and as erosion smooths out Earth's terrain. Even if erosion has been constant, the sediments now on the ocean floor would have accumulated in only 30 million years. No process has been proposed which can remove 27 billion tons of ocean sediments each year. So, the oceans cannot be hundreds of millions of years old.[a]

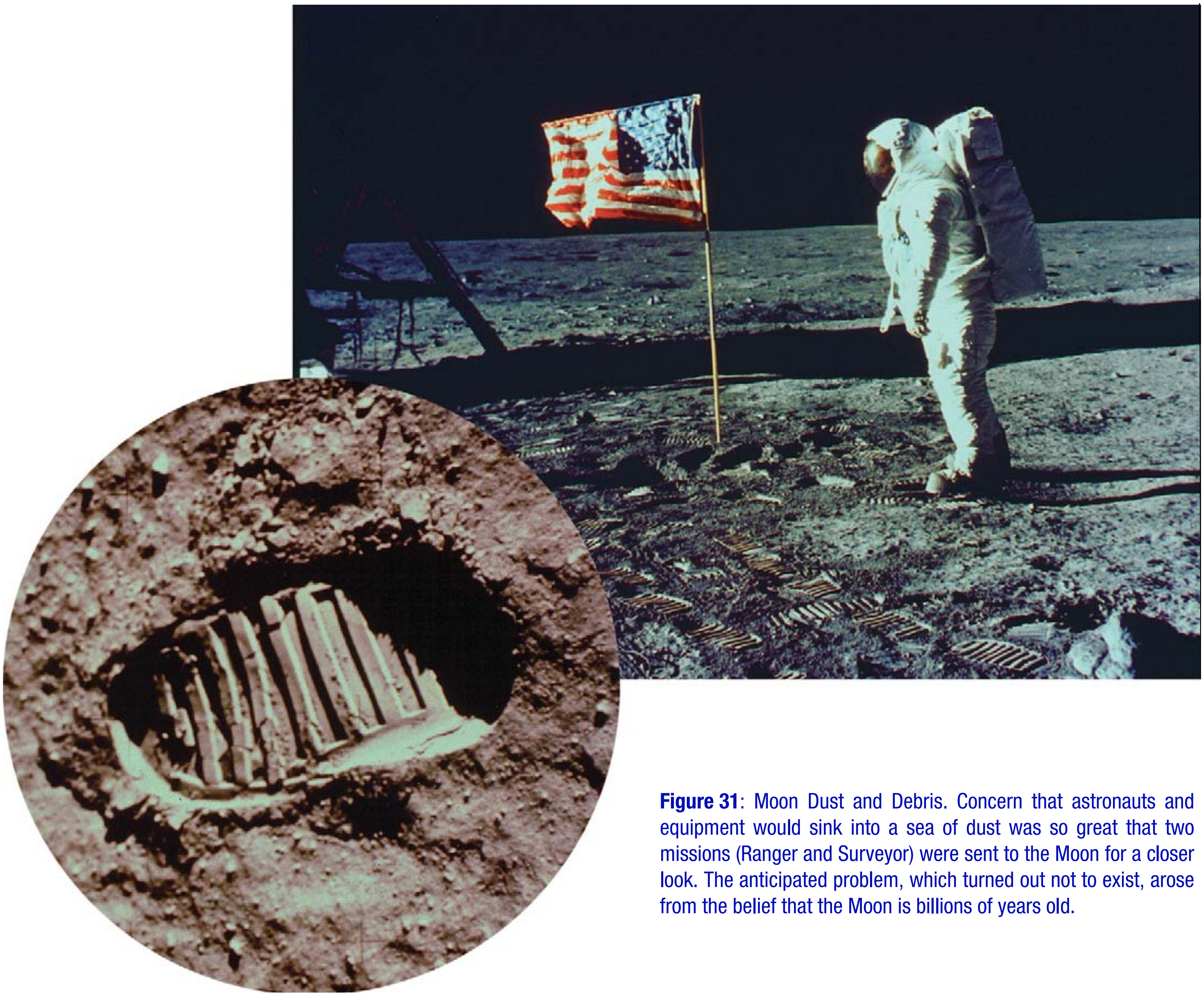


Figure 31: Moon Dust and Debris. Concern that astronauts and equipment would sink into a sea of dust was so great that two missions (Ranger and Surveyor) were sent to the Moon for a closer look. The anticipated problem, which turned out not to exist, arose from the belief that the Moon is billions of years old.

76. Continental Erosion

The continents are eroding at a rate that would level them in much less than 25 million years.[a] However, evolutionists believe that fossils of animals and plants at high elevations have somehow avoided this erosion for more than 300 million years. Something is wrong.

77. Dissolved Metals

Rivers carry dissolved elements such as copper, gold, lead, mercury, nickel, silicon, sodium, tin, and uranium into the oceans at very rapid rates when compared with the small quantities of these elements already in the oceans. In other words, far fewer than a million years' worth of metals are dissolved in the oceans.[a] There is no known means by which large amounts of these elements can come out of solution. Therefore, the oceans must be much younger than a million years.

78. Shallow Meteorites

Meteorites are steadily falling onto Earth. This rate was probably much greater in the past, because planets have swept from the solar system much of the original meteoritic material. Therefore, experts have expressed surprise that meteorites are almost always found in young sediments, very near Earth's surface.[a] (Unsuccessful searches have been made for these deep—and very valuable—meteorites, including in the Grand Canyon and along conveyor belts in coal processing plants.) Even meteoritic particles in ocean sediments are concentrated in the topmost layers.[b] If Earth's sediments, which average about a mile in thickness on the continents, were deposited over hundreds of millions of years, as evolutionists believe, we would expect to find many deeply buried iron meteorites. Because this is not the case, the sediments were probably deposited rapidly, followed by "geologically recent" meteorite impacts. Also, because no meteorites are found directly above the basement rocks on which these sediments rest, those basement rocks were not exposed to meteoritic bombardment for any great length of time.

Similar conclusions can be made about ancient rock slides which are frequently found on Earth's surface, but are generally absent from supposedly old rock.[c]

79. Meteoritic Dust

Meteoritic dust is accumulating on Earth so fast that, after 4 billion years (at today's low and diminishing rate), the equivalent of more than 16 feet of this dust should have accumulated. Because this dust is high in nickel, Earth's crust should have abundant nickel. No such concentration has been found on land or in the oceans. Therefore, Earth appears to be young.[a]

80. Rapid Cooling

If the Earth began in a molten state, it would have cooled to its present condition in much less than 4.5 billion years. This conclusion holds even if one makes liberal assumptions about the amount of heat generated by radioactive decay within Earth.[a] The known temperature pattern inside Earth is consistent only with a young Earth.

81. Moon Recession

As tidal friction gradually slows Earth's spin, the laws of physics require the Moon to recede from Earth. (Edmond Halley first detected this recession in 1695.) Even if the Moon began orbiting near Earth's surface, the Moon should have moved to its present distance from Earth in billions of years less time than the 4.5-billion-year age evolutionists assume for the Earth and Moon. So, the Earth-Moon system must be much younger than most evolutionists assume. [For details, see pages 477–481.]

82. Moon Dust and Debris

If the Moon were billions of years old, it should have accumulated a thick layer of dust and debris from meteoritic bombardment. Before instruments were placed on the Moon, some scientists were very concerned that astronauts would sink into a sea of dust—possibly a mile in thickness.[a] This did not happen. Very little meteoritic debris is on the Moon. In fact, after examining rocks and dust brought back from the Moon, scientists learned that only about 1/67 of the dust and debris came from outer space. Recent measurements of the influx rate of meteoritic material on the Moon also do not support an old Moon. [For more details, see pages 482–484.]

83. Crater Creep

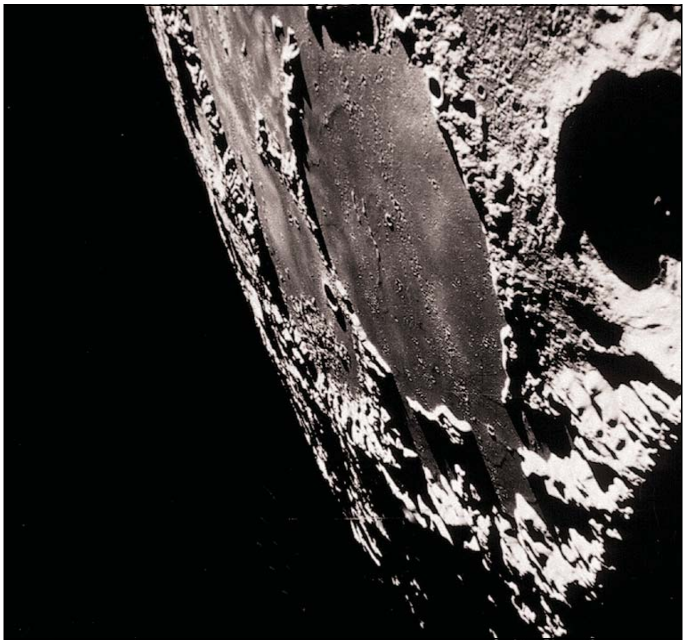


Figure 32: Young Craters. Large craters on the Moon have high, steep walls that should be slowly slumping and deep floors that should be bulging upward. Little deformation exists, so these craters appear relatively young. Similar conclusions can be drawn for Venus and Mercury.

A tall pile of tar will slowly flow downhill, ultimately spreading into a nearly horizontal sheet of tar. Most material, under pressure, "creeps" in this way, although rocks deform very, very slowly.

Calculations show that the growing upward bulges of large crater floors on the Moon should reach their current extent in only 10,000 to 10,000,000 years.[a] Large, steep-walled craters exist even on Venus and Mercury, where temperatures are hot enough to melt lead. Therefore, creep rates on those planets should be even greater. Most large craters on the Moon, Venus, and Mercury are thought to have formed more than 4,000,000,000 years ago. Because these craters show no sign of "creep," these bodies seem to be relatively young.

84. Hot Moon

A surprising amount of heat is flowing out of the Moon from just below its surface, and yet the Moon's interior is relatively cold.[a] Because it has not yet cooled off, the Moon is much younger than most people had guessed, or relatively recent events have altered the Moon's heat flow[b]— or both.

85. Young Comets

As comets pass near the Sun, some of their mass vaporizes, producing a long tail and other debris.[a] Comets also fragment frequently or crash into the Sun[b] or planets. Typical comets should disintegrate after several hundred orbits. For many comets this is less than 10,000 years. There is no evidence for a distant shell of cometary material surrounding the solar system, and there is no known way to add comets to the solar system at rates that even remotely balance their destruction.[c] Actually, the gravity of planets tends to expel comets from the solar system rather than capture them.[d] So, comets and the solar system appear to be less than 10,000 years old. [For more on comets, see **"The Origin of Comets"** on pages 271–302.]

86. Small Comets

Photographs taken from Earth-orbiting satellites show small, ice-filled comets striking Earth's upper atmosphere at an average rate of one every three seconds.[a] [See Figure 33.] Each comet adds 20–40 tons of water to the Earth's atmosphere. If this influx began when evolutionists say the Earth started to evolve, all our oceans would have come from small comets. Actually, impact rates were undoubtedly greater in the past, because the planets have swept many of these comets from the solar system. Therefore, small comets would have placed much more water on Earth than is here today. Obviously, this did not happen, so oceans look young. [See also pages 279 and 287.]

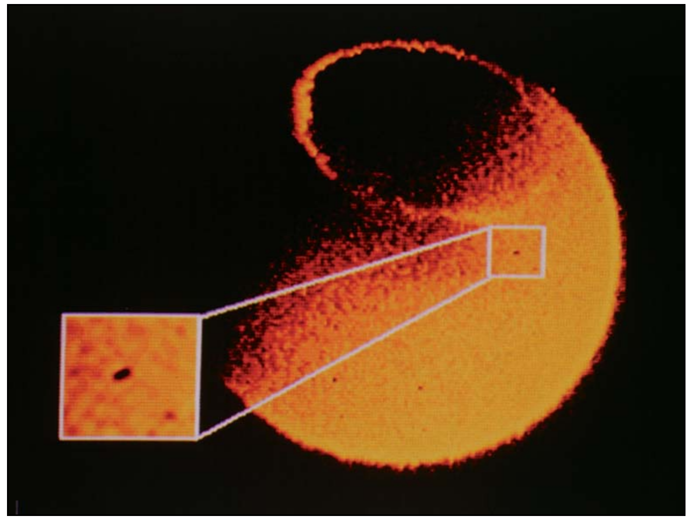


Figure 33: Small Comets. The Dynamic Explorer satellite took this picture in ultraviolet light showing small comets (the dark spots) colliding with Earth's upper atmosphere. The comets begin to break up 800 miles above the Earth's surface, then frictional heating vaporizes the pieces and their descent stops at an elevation of about 35 miles. The water vapor, which soon dissipates, blocks ultraviolet light from Earth, producing the dark spots. The northern lights are shown by the halo.

87. Hot Planets

Jupiter, Saturn, and Neptune each radiate away more than twice the heat energy they receive from the Sun.[a] Uranus[b] and Venus[c] also radiate too much heat. Calculations show that it is very unlikely that this energy comes from nuclear fusion,[d] radioactive decay, gravitational contraction, or phase changes[e] within those planets. This suggests that these planets have not existed long enough to cool off.[f]

88. Solar Wind

The Sun's radiation applies an outward force on particles orbiting the Sun. Particles less than about one 100,000th of a centimeter in diameter should have been "blown out" of the solar system if it were billions of years old. Yet these particles are still orbiting the Sun.[a] Conclusion: the solar system appears young.

89. Poynting-Robertson Effect

Dust particles larger than about one 100,000th of a centimeter in diameter form a large disk-shaped cloud that orbits the Sun between the orbits of Venus and the asteroid belt. This cloud produces *zodiacal light*.[a] Forces acting on these particles should spiral most of them into the Sun in less than 10,000 years. (This is called *the Poynting-Robertson effect*.) Known forces and sources of replenishment cannot maintain this cloud, so the solar system is probably less than 10,000 years old.

This is how the Poynting-Robertson effect works: Rain falling on a speeding car tends to strike the front of the car and slow it down slightly. Likewise, the Sun's rays that strike particles orbiting the Sun tend to slow them down, causing them to spiral into the Sun. Thus, the Sun's radiation and gravity act as a giant vacuum cleaner that pulls in about 100,000 tons of nearby micrometeoroids per day. Disintegrating comets and asteroids add dust at less than half the rate it is being destroyed.[b]

A disintegrating comet becomes a cluster of particles called a *meteor stream*. The Poynting-Robertson effect causes smaller particles in a meteor stream to spiral into the Sun more rapidly than larger particles. After about 10,000 years, these orbits should be visibly segregated by particle size. Because this segregation is generally not seen, meteor streams are probably a recent phenomenon.[c]

Huge quantities of microscopic dust particles also have been discovered around some stars.[d] Yet, according to the theory of stellar evolution, those stars are many millions of years old, so that dust should have been removed by stellar wind and the Poynting-Robertson effect. Until some process is discovered that continually resupplies vast amounts of dust, one should consider whether the "millions of years" are imaginary.

90. Supernova Remnants

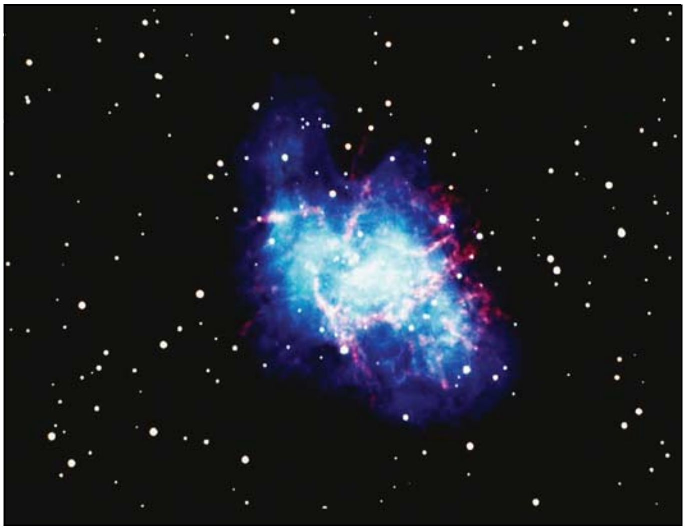


Figure 34: The Crab Nebula. In A.D. 1054, Chinese observers (and perhaps Anasazi Indians in New Mexico and Arizona) witnessed and described a supernova. It was visible in daylight for 23 days and briefly was as bright as a full moon. Today, the remnants from that explosion comprise the Crab Nebula.

Thanks to radio telescopes, most of these remnants should be visible for a million years. At the rate supernovas are occurring in galaxies like ours, we have only about 7,000 years' worth of remnants.

In galaxies similar to our Milky Way Galaxy, a star will explode violently every 26 years or so.[a] These explosions, called *supernovas*, produce gas and dust that expand outward thousands of miles per second. With radio telescopes, these remnants in our galaxy should be visible for a million years. However, only about 7,000 years' worth of supernova debris are seen.[b] So, the Milky Way looks young. [See Figure 34.]

91. Connected Galaxies

Galaxies frequently appear connected or aligned with other galaxies or quasars that have vastly different redshifts. This happens too often for all examples to be coincidences.[a] If redshifts imply velocities (which is most likely), these galaxies and quasars have not been moving apart for very long. If redshifts do not always imply velocities, many astronomical conclusions are in error.

92. Unstable Galaxies

Computer simulations of the motions of spiral galaxies show them to be highly unstable; they should completely change their shape in only a small fraction of the universe's assumed evolutionary age.[a] The simplest explanation for so many spiral galaxies, including our Milky Way Galaxy, is that they and the universe are much younger than has been assumed.

93. Galaxy Clusters

Hundreds of rapidly moving galaxies often cluster tightly together. Their relative velocities, as inferred by the redshifts of their light, are so high that these clusters should be flying apart, because each cluster's visible mass is much too small to hold its galaxies together gravitationally.[a] Because galaxies within clusters are so close together, they have not been flying apart for very long.

A similar statement can be made concerning many stars in spiral galaxies and gas clouds that surround some galaxies.[b] These stars and gas clouds have such high relative velocities that they should have broken their "gravitational bonds" long ago if they were billions of years old. If the redshift of starlight always indicates a star's velocity, then a multi-billion-year-old universe is completely inconsistent with what is observed.

These observations have led some to conclude, not that the universe is young, but that unseen, undetected mass is holding these stars and galaxies together. For this to work, the hidden mass, sometimes called *dark matter*, must be 10–100 times greater than all visible mass, and the hidden mass must be in the right places. However, many experiments have shown that the needed "missing mass" does not exist.[c] Some researchers are still searching, because the alternative is a young universe. [See **"Missing Mass"** on page 33.]

Conclusion

All dating techniques, especially the few that suggest vast ages, presume that a process observed today has proceeded at a known, but not necessarily constant, rate. This assumption may be grossly inaccurate. Projecting present processes and rates far back in time is more likely to produce errors than extrapolation over a much shorter time. Furthermore, a much better understanding usually exists for dating "clocks" that show a young Earth and a young universe.

This contrary evidence understandably disturbs those who have always been told that the Earth is billions of years old. Can you imagine how disturbing such evidence is to confirmed evolutionists?

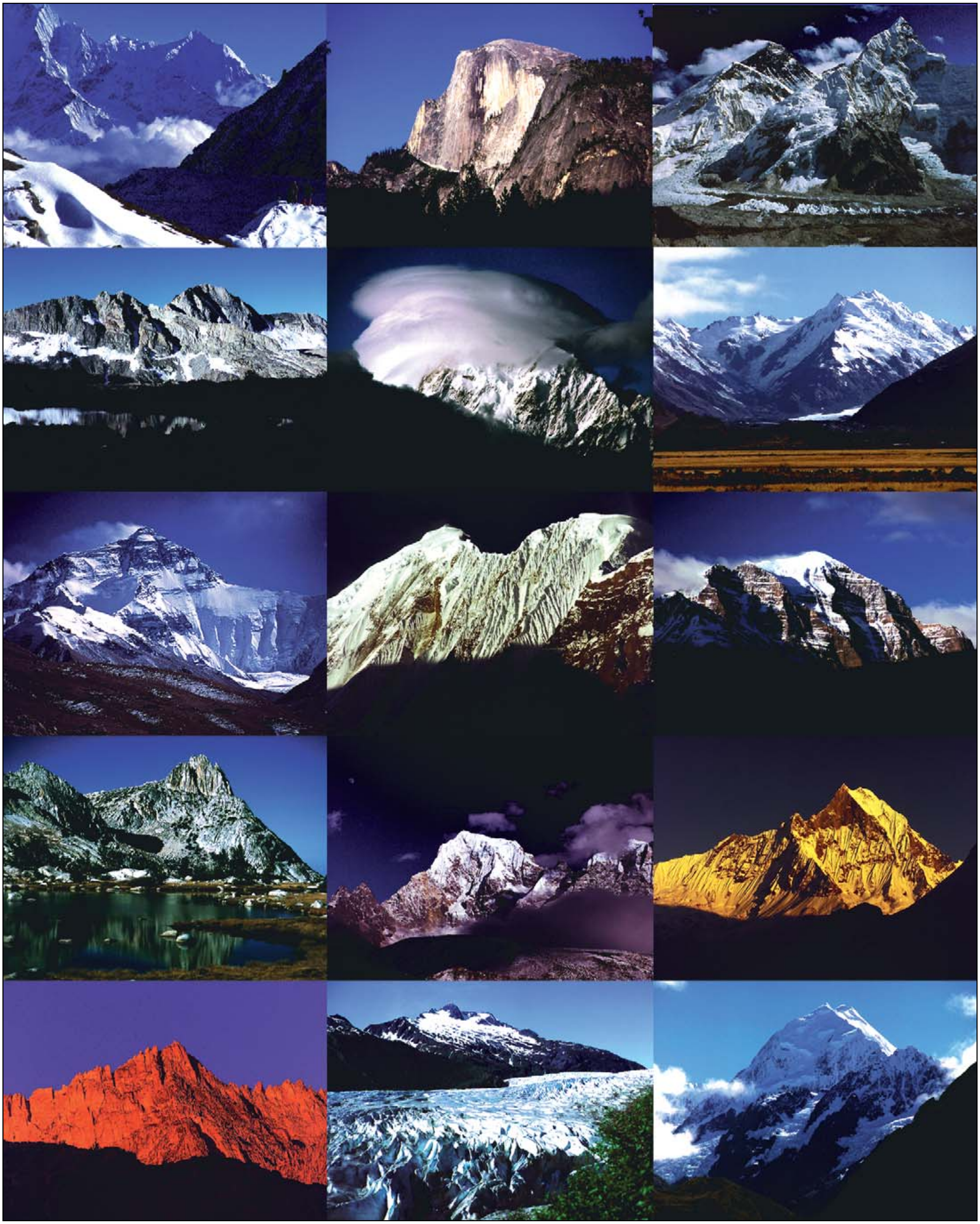


Figure 35: Mountains of the World.

Earth Sciences

The Earth Has Experienced a Worldwide Flood.

Noah's Ark Probably Exists.[a]

The precise location of the Ark is an open question. While most sightings point to Mount Ararat in eastern Turkey, consideration should also be given to a few nearby mountains in western Iran. The following are the more credible claimed sightings. Some are undoubtedly mistaken. The search continues.

94. Ancient Historians

Ancient historians, such as Josephus, the Jewish-Roman historian, and his earlier historical sources, wrote that the Ark existed. Marco Polo was also told that the Ark was on a very high, perpetually snow-covered mountain in central Armenia.[a] From A.D. 200 to 1700, more than a dozen other Christian and Jewish leaders wrote that the Ark was still preserved, although few claimed to have seen it.

95. British Scientists

In about 1856, three skeptical British scientists and two Armenian guides climbed Mount Ararat to show that the Ark did not exist. Allegedly, the Ark was found, and the British scientists threatened to kill the guides if they reported the find. Years later, one of the Armenians (then living in the United States) and one of the British scientists independently reported they had found the Ark.

Figure 36: Mount Ararat in Eastern Turkey. The 17,000-foot peak of Greater Ararat is just above my head. Even in August, snow and ice cover the top 3,000 feet. For one week in 1990, this Soviet helicopter and its crew flew our eight-man team over and around Ararat. Evaporation from the ice cap produces clouds around the peak for most of the day—complicating the search for the Ark. Another difficulty is the hostility between Kurds who live in this region and the Turkish government. Both sides claim control over the mountain and insist that only their exploration permits are valid.

96. James Bryce

Sir James Bryce, a noted British scholar and traveler of the mid-nineteenth century, conducted extensive library research concerning the Ark. He became convinced that the Ark was preserved on Mount Ararat. Finally, in 1876, he climbed Ararat and found, at the 13,000-foot level (2,000 feet above the timberline), a piece of hand-tooled wood, four feet long, that he believed might be from the Ark.

97. Turkish Commissioners

In 1883, a series of newspaper articles reported that a team of Turkish commissioners, while investigating avalanche conditions on Mount Ararat, unexpectedly came upon the Ark projecting out of melting ice after an unusually warm summer. They claimed they entered and examined part of the Ark.

98. George Hagopian

In an unusually warm summer (about 1904), a 10-year-old Armenian boy, George Hagopian, and his uncle climbed Mount Ararat and supposedly reached the Ark. The boy climbed on top of it and described the structure as a flat-bottomed, petrified barge without nails. It had many windows on top, each "big enough for a cow to walk through." [See Figures 38 and 40.] Two years later, Hagopian again visited the Ark. Shortly before his death in 1972, his detailed testimony was tape recorded. A voice analyzer test (PSE test) gave no indication of lying.[a]

99. Russian Expeditions

A Russian pilot flying over Ararat in World War I (1916) thought he saw the Ark. News of his discovery reached the Czar, who sent two large expeditions to the site. The soldiers found and explored the boat, but before they could report to the Czar, the Russian Revolution of 1917 began. Their report disappeared, and the soldiers scattered. Some eventually reached the United States and Canada. Although a much later magazine account had a few fictional elements, further investigations have confirmed the primary details.[a] In February 2000, Joseph Kulik, an alleged expedition member, was interviewed. Details he provided duplicate those in other accounts.[b]

100. Ed Davis

In July 1943, Ed Davis, a sergeant in the U.S. Army, was stationed in Iran. There he developed a close friendship with some Lur tribesmen who said they knew the location of Noah's Ark. (The Lurs are related to the Kurds.) When Davis asked to see the Ark, they first took him to their village. There Davis claims he saw items from the Ark: a cage door, latches, a metal hammer, dried beans, shepherd staffs, oil lamps, bowls, and pottery jars still containing honey. This Muslim tribe considered it a religious duty to prevent outsiders from seeing the Ark, even if killing was necessary. However, their close friendship with Davis made him an exception.

Tribal leader Abas-Abas and his seven sons took Davis on a three-day climb up the northeast side of what Davis *thought* was Mount Ararat. (Based on Davis' description of his trip, he probably was on a mountain in Iran.)[a] Steep, slick rocks, made worse by cold rain, prevented them from getting closer than one-half mile from the Ark. Two broken portions of the Ark, lying on their sides and one-third of a mile apart, were visible during moments when fog and clouds lifted. Wooden beams, three decks, and rooms were seen. Abas-Abas told Davis other details: the Ark's wood was extremely hard; wooden pegs were used in its construction instead of nails; its large, side door opened from the bottom outward (like a garage door); and the human quarters consisted of 48 compartments in the middle of the top deck. In 1986, several dozen Ark researchers questioned Davis extensively, and in 1989 he passed a lie detector test.[b] (On two occasions, once in his home, I also questioned Davis.)

Figure 37: Ed Davis with Elfred Lee in 1986. Artist Elfred Lee (right) drew this picture based on the claimed eyewitness account of Ed Davis (left). In 1970, Lee also drew a picture of the Ark in the presence of another claimed eyewitness, George Hagopian. (The Ark depicted on page 49 is based on Lee's drawing for Hagopian.) Because both Hagopian and Davis were present as Lee made each drawing, they requested many on-the-spot changes. As Lee was completing Davis' drawing, he suddenly felt that each man was describing the same object. This, Lee said, made the hair on the back of his neck stand up.

101. George Greene

George Greene, an oil geologist, reportedly took several photographs of the Ark in 1953 from a helicopter. After returning to the United States, Greene showed his photographs to many people but could not raise financial backing for a ground-based expedition. Finally, he went to South America where he was killed. Although his pictures have not been found, more than 30 people have given sworn, written testimony that they saw these photographs that clearly showed the Ark protruding from melting ice at the edge of a precipice.

The CIA's "Ararat Anomaly"

In 1974, during a private meeting with William Colby, Director of the Central Intelligence Agency (CIA), I asked if he was aware of the claimed sightings of Noah's Ark. He said he was not. After summarizing several "sightings," I stated that a dangerous and expensive search for an object with profound international importance could be done safely and cheaply with technology Colby controlled. Perhaps the CIA already had information in its files that could help in this search.

Weeks later, I was contacted by a man I will call H.S. He said that Director Colby asked him to see if any information could be provided. In our discussions, H.S. asked many questions. About a year later he called to say his work was completed and to invite me to CIA headquarters in Langley, Virginia. In his office, H.S. said he had examined all photography of the Mount Ararat region. He could not be sure if an object he was seeing was the Ark or a rock. I asked H.S. if, after studying the information on the various claimed sightings, he thought the Ark was on Ararat. He said, "Yes." I asked why, because he had just told me that no photographs clearly showed the Ark. H.S. responded (with obvious reference to the many consistent, but unverified, claims of Ark sightings), "There is too much smoke for there not to be fire." I had great confidence in his analytical rigor and candor. Suggestions that any agency of the U.S. government would (or could for long) withhold conclusive evidence that Noah's Ark exists are implausible.

[For details on what follows, see Timothy W. Maier, "Anomaly or Noah's Ark?" *Insight*, 20 November 2000, pp. 10–14, 25–27.] The CIA calls this object the "Ararat Anomaly." It was first photographed by a fixed-wing aircraft in 1949 and later by a U-2 in 1956. Satellites photographed it in 1973, 1976, 1990, and 1992. Some of the low-resolution, 1949 photographs have been released to the public, thanks to the efforts of law professor Porcher Taylor. In 1999 and 2000, private funds paid for the best private sector satellite (IKONOS) to photograph the object at a resolution of 1 meter. (Some CIA photographs had a 6-inch resolution—enough magnification to see a soccer ball from space.)

Insight asked seven diverse photo analysts to independently study the available low-resolution photographs. Two analysts said it was likely a rock, four said it could be a man-made object, and one called the evidence inconclusive. Some factors considered were: shape, dimensions, shadows, color, surface texture, thermal characteristics, nearby snow and rock patterns, and possible movement of the object.n the News

This is probably not the Ark, because it has too little in common with the most credible sightings, especially its specific location on Ararat. Nevertheless, whenever the Turkish government gives permission, an expedition can go to the location of the "Ararat Anomaly" (39.703°N, 44.275°E, 15,300 feet elevation) and dig into the ice. Unfortunately, the Kurdish rebellion in eastern Turkey and the Turkish military's tight control have prevented access to important areas on Mount Ararat.

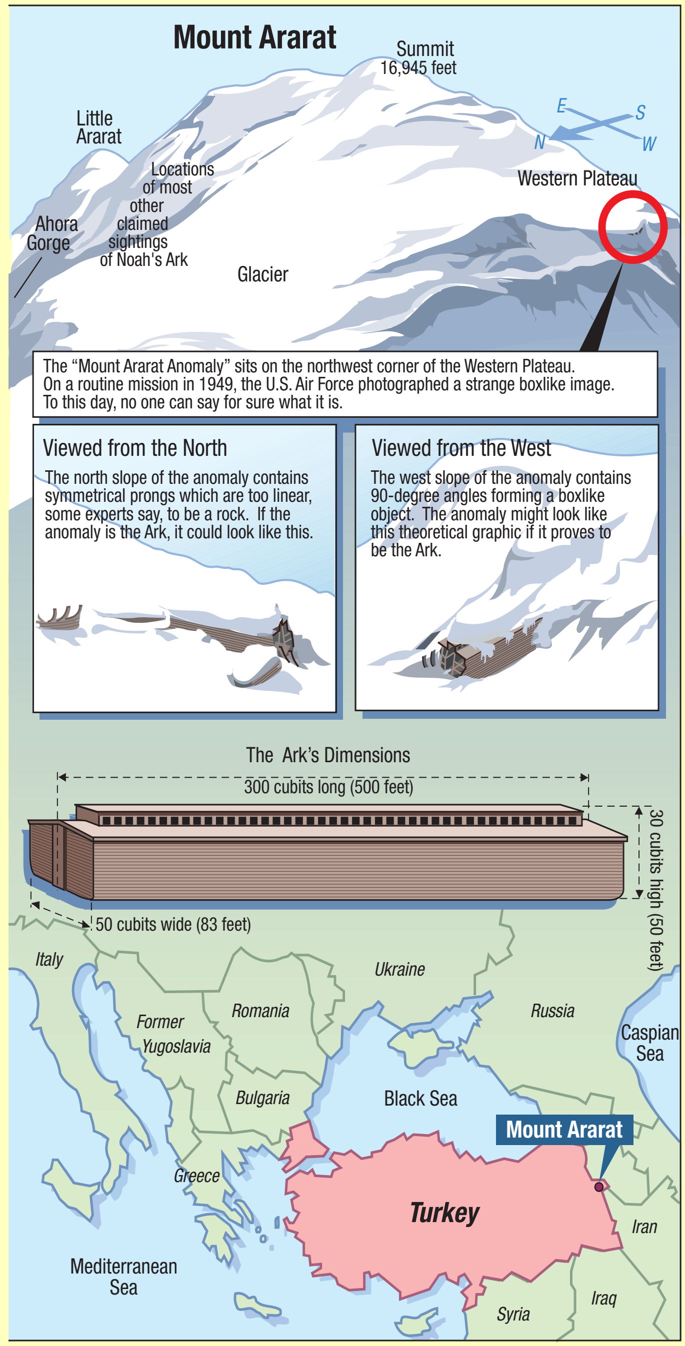


Figure 38: Is the "Ararat Anomaly" Noah's Ark?

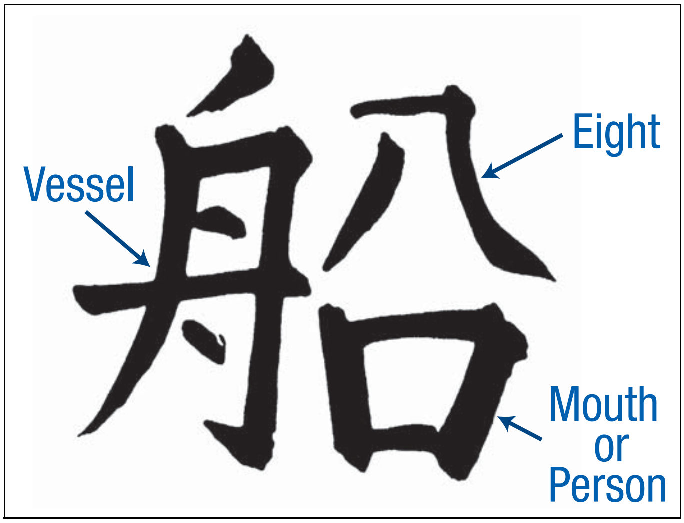


Figure 39: Chinese Word for Boat. Classical Chinese, dating to about 2500 B.C., is one of the oldest languages known. Its "words," called *pictographs*, are often composed of smaller symbols that themselves have meaning and together tell a story. For example, the classical Chinese word for boat, shown above, is composed of the symbols for "vessel," "eight," and "mouth" or "person." Why would the ancient Chinese refer to a boat as "eight-person-vessel"? How many people were on the Ark?

102. Gregor Schwinghammer

Gregor Schwinghammer claims he saw the Ark from an F-100 aircraft in the late 1950s, while assigned to the 428th Tactical Fighter Squadron based in Adana, Turkey. Schwinghammer said it looked like an enormous boxcar lying in a gully high up on Mount Ararat. He said U-2 pilots had photographed it.

Note: Many others claim to have seen the Ark. Some stories are of questionable validity, and others are inconsistent with many known details. Only the most credible are summarized above.

Many of the Earth's Previously Unexplained Features Can Be Explained by a Cataclysmic Flood.

The origin of each of the following is a subject of controversy within the earth sciences. Each has many aspects inconsistent with standard explanations. Yet all appear to be consequences of a sudden and unrepeatable event—a cataclysmic flood whose waters erupted from interconnected, worldwide subterranean chambers with an energy release exceeding the explosion of 1,500 trillion hydrogen bombs. Consequences of this event included the rapid formation of the features listed below. The mechanisms involved are well understood.

103. The Grand Canyon and Other Canyons
104. Mid-Oceanic Ridge
105. Earth's Major Components
106. Ocean Trenches and the Ring of Fire
107. Earthquakes
108. Magnetic Variations on the Ocean Floor
109. Submarine Canyons
110. Coal and Oil
111. Methane Hydrates
112. Ice Age
113. Frozen Mammoths
114. Major Mountain Ranges
115. Overthrusts
116. Volcanoes and Lava
117. Geothermal Heat
118. Strata and Layered Fossils
119. Limestone
120. Metamorphic Rock
121. Plateaus
122. The Moho and Black Smokers
123. Salt Domes
124. Jigsaw Fit of the Continents
125. Changing Axis Tilt
126. Comets
127. Asteroids and Meteoroids
128. Earth's Radioactivity

For details on the above, see pages 107–326.

The Seemingly Impossible Events of a Worldwide Flood Are Credible, If Examined Closely.

129. Water above Mountains?

Is there enough water to cover all the earth's preflood mountains in a global flood? Most people do not realize that the volume of water on earth is ten times greater than the volume of all land above sea level.

Most of the earth's mountains consist of tipped and buckled sedimentary layers. Because these sediments were initially laid down through water as nearly horizontal layers, those mountains must have been pushed up after the sediments were deposited. [See pages 109–147.]

If the effects of compressing the continents and buckling up mountains were reversed, the oceans would again flood the entire earth. Therefore, the earth has enough water to cover the smaller mountains that existed before the flood. (If the solid earth were perfectly smooth, the water depth would be about 9,000 feet everywhere.)

130. Shells on Mountains

Every major mountain range on earth contains fossilized sea life—far above sea level and usually far from the

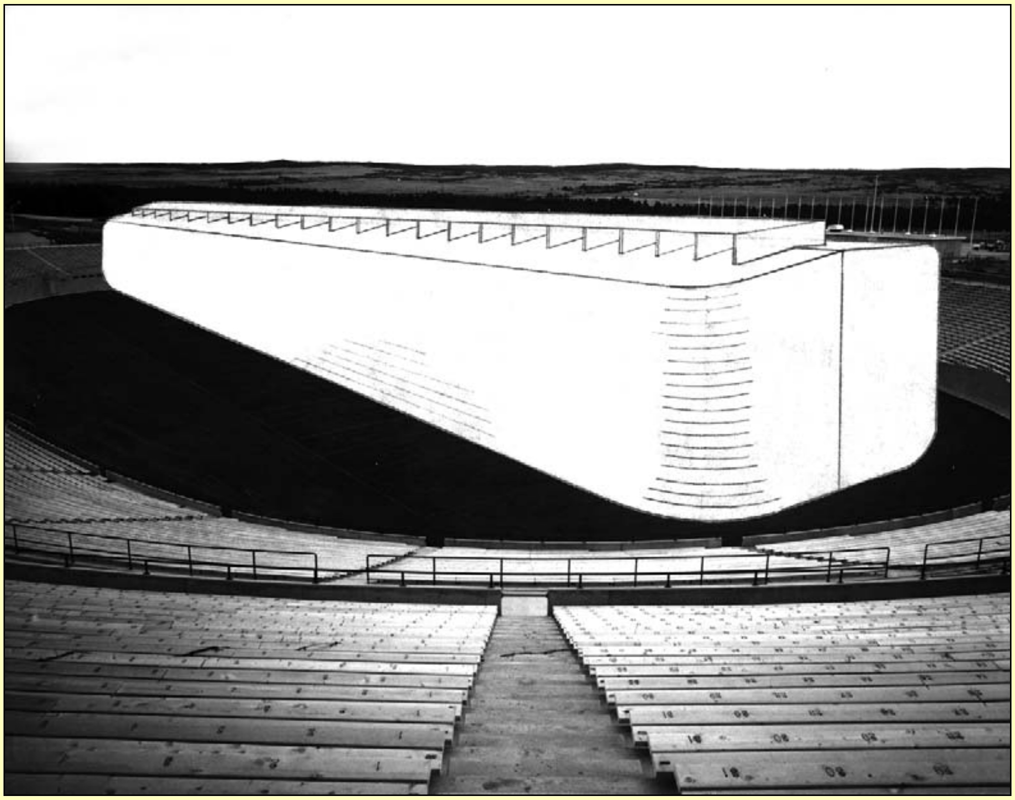


Figure 40: Ark in Football Stadium. This sketch shows how the Ark would fit into a football stadium. The Ark is frequently depicted as a small boat by those who have not bothered to check its dimensions. It was 300 cubits long, 50 cubits wide, and 30 cubits tall. While there were several ancient cubits (generally the distance from a man's elbow to his extended fingers), a cubit was typically 1.5 feet or slightly longer. The 500-foot-long Ark would snugly fit in a football stadium and would be taller than a four-story building.

This sketch of the Ark is based on George Hagopian's credible account (page 46). This Ark does not look like a boat. It has a flat bottom, is not streamlined, and has windows in its top. The flat bottom would have made loading on dry land possible. Streamlined shapes are important only for ships designed for speed and fuel efficiency—neither of which applied to the Ark. Windows in the side might be nice for the passengers (or for the proverbial giraffes to stick their necks out), but side windows limit the depth of submergence and the maximum load. Riding low in the water gives a boat great stability. Actually, the Hebrew word for Ark does not mean *boat*; it means *box*, *coffin*, or *chest*—an apt description unknown to Hagopian.

nearest body of water. Attempts to explain "shells on mountaintops" have generated controversy for centuries.[a]

An early explanation was that a global flood covered these mountains, allowing clams and other sea life to "crawl" far and high. However, as Leonardo da Vinci wrote,[b] under the best conditions, clams move too slowly to reach such heights, even if the flood lasted hundreds of years; besides, the earth does not have enough water to cover these mountains. Others said that some sea bottoms sank, leaving adjacent sea bottoms (loaded with sea creatures) relatively high—what we today call mountains. How such large subterranean voids formed to allow this sinking was never explained. Still others proposed that sea bottoms rose to become mountains. Mechanisms for pushing up mountains were also never satisfactorily explained. Because elevations on earth change slowly, some wondered if sea bottoms could rise miles into the air, perhaps over millions of years. However, mountaintops erode relatively rapidly—and so should fossils slowly lifted by them. Furthermore, mountaintops accumulate few sediments that might protect such fossils. Some early authorities, in frustration, said the animals grew inside rocks—or the rocks simply *look like* clams, corals, fish, and ammonites. Some denied the evidence even existed.

The means by which mountains were pushed up in hours during a global flood will soon be presented. The mechanism is simple, the energy and forces are sufficient, and supporting evidence (pages 107–326) is voluminous—not just sea shells on mountains.

131. Flood Legends

A gigantic flood may be the most common of all legends—ever. Almost every ancient culture had legends telling of a traumatic flood in which only a few humans survived in a large boat.[a] This cannot be said for other types of catastrophes, such as earthquakes, fires, volcanic eruptions, disease, famines, or drought. More than 230 flood legends contain many common elements, suggesting they have a common historical source that left a vivid impression on survivors of that catastrophe.

132. Was There Room?

Could the Ark have held all the animals? Easily. [See Figure 40.] A few humans, some perhaps hired by others, could build a boat[a] large enough to hold representatives of every air-breathing land animal—perhaps 16,000 animals in all. (Of course, sea creatures did not need to be on the Ark. Nor did insects or amphibians. Only mammals, birds, reptiles, and humans. Much plant life survived the flood in a surprisingly simple way.)[b] The Ark, having at least 1,500,000 cubic feet of space, was adequate to hold these animals, their provisions, and all their other needs for one year.[c]

Since the flood, many offspring of those on the Ark would have become reproductively isolated to some degree due to mutations, natural genetic variations, and geographic dispersion. Thus, variations within a kind have proliferated. Each variation or species we see today did not have to be on the Ark. For example, a pair of wolflike animals were probably ancestors of the coyotes, dingoes, jackals, and hundreds of varieties of domestic dogs. (This is microevolution, not macroevolution, because each member of the dog kind can interbreed and has the same organs and genetic structure.) Could the Ark have held dinosaurs and elephants? Certainly, if they were young.

References and Notes

(To locate specific authors, consult the index.)

1. The Law of Biogenesis

a. And yet, leading evolutionists are forced to accept some form of spontaneous generation. For example, a former Harvard University professor and Nobel Prize winner in physiology and medicine acknowledged the dilemma.

> *The reasonable view* [during the two centuries before Louis Pasteur] *was to believe in spontaneous generation; the only alternative, to believe in a single, primary act of supernatural creation. There is no third position.* George Wald, "The Origin of Life," *Scientific American*, Vol. 190, August 1954, p. 46.

Wald rejects creation, despite the impossible odds of spontaneous generation.

> *One has only to contemplate the magnitude of this task to concede that the spontaneous generation of a living organism is impossible. Yet here we are—as a result, I believe, of spontaneous generation.* Ibid.

Later, Wald appeals to huge amounts of time to accomplish what seemed to be the impossibility of spontaneous generation.

> *Time is in fact the hero of the plot. ... Given so much time, the "impossible" becomes possible, the possible probable, and the probable virtually certain. One has only to wait: time itself performs the miracles.* Ibid., p. 48.

What Wald did not appreciate in 1954 (before, as just one example, the genetic code was discovered) was how the complexity in life is vastly greater than anyone at that time could have imagined. [See also pages 14–23.] So, today, the impossibility of spontaneous generation is even more firmly established, regardless of the time available. But unfortunately, several generations of professors and textbooks with Wald's perspective have so impacted our universities that it is difficult for evolutionists to change direction.

Evolutionists also do not recognize:
- ❖ that with increasing time (their "miracle maker") comes increasing degradation of the fragile environment on which life depends, and
- ❖ that creationists have much better explanations (such as the flood) for the scientific observations that evolutionists thought showed increasing time.

Readers will later see this.

b. *"The beginning of the evolutionary process raises a question which is as yet unanswerable. What was the origin of life on this planet? Until fairly recent times there was a pretty general belief in the occurrence of 'spontaneous generation.' It was supposed that lowly forms of life developed spontaneously from, for example, putrefying meat. But careful experiments, notably those of Pasteur, showed that this conclusion was due to imperfect observation, and it became an accepted doctrine* [the law of biogenesis] *that life never arises except from life. So far as actual evidence goes, this is still the only possible conclusion. But since it is a conclusion that seems to lead back to some supernatural creative act, it is a conclusion that scientific men find very difficult of acceptance. It carries with it what are felt to be, in the present mental climate, undesirable philosophic implications, and it is opposed to the scientific desire for continuity. It introduces an unaccountable break in the chain of causation, and therefore cannot be admitted as part of science unless it is quite impossible to reject it. For that reason most scientific men prefer to believe that life arose, in some way not yet understood, from inorganic matter in accordance with the laws of physics and chemistry."* J. W. N. Sullivan, *The Limitations of Science* (New York: The Viking Press, Inc., 1933), p. 94.

2. Acquired Characteristics

a. The false belief that acquired characteristics can be inherited, called *Lamarckism*, would mean that the environment can directly and beneficially change egg and sperm cells. Only a few biologists try to justify Lamarckism. The minor acquired characteristics they cite have no real significance for any present theory of organic evolution. For example, see "Lamarck, Dr. Steel and Plagiarism," *Nature*, Vol. 337, 12 January 1989, pp. 101–102.

b. *"This hypothesis* [which Darwin called *pangenesis*] *maintained the idea of inheritance of acquired characteristics."* A. M. Winchester, *Genetics*, 5th edition (Boston: Houghton Mifflin Co., 1977), p. 24.

c. In writing about this amazing capability, Queitsch admits:

> *... it is a perplexing evolutionary question how a population might move to a different local optimum without an intervening period of reduced fitness (adaptive valley).* Christine Queitsch et al., "Hsp90 as a Capacitor of Phenotypic Variation," *Nature*, Vol. 417, 6 June 2002, p. 623.

d. *"... genes that were switched on in the parent to generate the defensive response are also switched on in the offspring."* Erkki Haukioja, "Bite the Mother, Fight the Daughter," *Nature*, Vol. 401, 2 September 1999, p. 23.

◆ *"... non-lethal exposure of an animal to carnivores, and a plant to a herbivore, not only induces a defence, but causes the attacked organisms to produce offspring that are better defended than offspring from unthreatened parents."* Anurag A. Agrawal et al., "Transgenerational Induction of Defences in Animals and Plants," *Nature*, Vol. 401, 2 September 1999, p. 60.

- *"... hidden genetic diversity exists within species and can erupt when* [environmental] *conditions change."* John Travis, "Evolutionary Shocker?: Stressful Conditions May Trigger Plants and Animals to Unleash New Forms Quickly," *Science News*, Vol. 161, 22 June 2002, p. 394.

- *"Environmental stress can reveal genetic variants, presumably because it compromises buffering systems. If selected for, these uncovered phenotypes can lead to heritable changes in plants and animals (assimilation)."* Queitsch et al., p. 618.

e. Marina Chicurel, "Can Organisms Speed Their Own Evolution?" *Science*, Vol. 292, 8 June 2001, pp. 1824–1827.

3. Mendel's Laws

a. Monroe W. Strickberger, *Genetics*, 2nd edition (New York: Macmillan Publishing Co., 1976), p. 812.

- Alfred Russel Wallace, who independently proposed the theory of organic evolution slightly before Charles Darwin, was opposed to Mendel's laws of genetics. Wallace knew Mendel's experiments showed that the general characteristics of an organism remained within distinct boundaries. In a letter to Dr. Archdall Reid on 28 December 1909, Wallace wrote:

  > *But on the general relation of Mendelism to Evolution, I have come to a very definite conclusion. This is, that it has no relation whatever to the evolution of species or higher groups, but is really antagonistic to such evolution! The essential basis of evolution, involving as it does the most minute and all-pervading adaptation to the whole environment, is extreme and ever-present plasticity, as a condition of survival and adaptation. But the essence of Mendelian characters is their rigidity. They are transmitted without variation, and therefore, except by the rarest of accidents, can never become adapted to ever varying conditions.* James Marchant, *Letters and Reminiscences* (New York: Harper & Brothers, 1916), p. 340.

b. *"Every series of breeding experiments that has ever taken place has established a finite limit to breeding possibilities."* Francis Hitching, *The Neck of the Giraffe: Where Darwin Went Wrong* (New Haven, Connecticut: Ticknor and Fields, 1982), p. 55.

- *"All competent biologists acknowledge the limited nature of the variation breeders can produce, although they do not like to discuss it much when grinding the evolutionary ax."* William R. Fix, *The Bone Peddlers: Selling Evolution* (New York: Macmillan Publishing Co., 1984), pp. 184–185.

- *"A rule that all breeders recognize, is that there are fixed limits to the amount of change that can be produced."* Lane P. Lester and Raymond G. Bohlin, *The Natural Limits to Biological Change* (Grand Rapids: Zondervan Publishing House, 1984), p. 96.

- Norman Macbeth, *Darwin Retried: An Appeal to Reason* (Ipswich, Massachusetts: Gambit, 1971), p. 36.

- William J. Tinkle, *Heredity* (Houston: St. Thomas Press, 1967), pp. 55–56.

c. *"... the distinctions of specific forms and their not being blended together by innumerable transitional links, is a very obvious difficulty."* Charles Darwin, *The Origin of Species*, 6th edition (New York: Macmillan Publishing Co., 1927), p. 322.

- *"Indeed, the isolation and distinctness of different types of organisms and the existence of clear discontinuities in nature have been self-evident for centuries, even to non-biologists."* Michael Denton, *Evolution: A Theory in Crisis* (London: Burnett Books, 1985), p. 105.

4. Bounded Variations

a. *"... the discovery of the Danish scientist W. L. Johannsen that the more or less constant somatic variations upon which Darwin and Wallace had placed their emphasis in species change cannot be selectively pushed beyond a certain point, that such variability does not contain the secret of 'indefinite departure.'"* Loren Eiseley, *Darwin's Century* (Garden City, New York: Doubleday & Co., Inc., 1958), p. 227.

b. *"The awesome morphological complexity of organisms such as vertebrates that have far fewer individuals on which selection can act therefore remains somewhat puzzling (for me at least), despite the geological time scales available ..."* Peter R. Sheldon, "Complexity Still Running," *Nature*, Vol. 350, 14 March 1991, p. 104.

c. Bland J. Finlay, "Global Dispersal of Free-Living Microbial Eukaryote Species," *Science*, Vol. 296, 10 May 2002, pp. 1061–1063.

5. Natural Selection

a. In 1835 and again in 1837, Edward Blyth, a creationist, published an explanation of natural selection. Later, Charles Darwin adopted it as the foundation for his theory, evolution by natural selection. Darwin failed to credit Blyth for his important insight. [See evolutionist Loren C. Eiseley, *Darwin and the Mysterious Mr. X* (New York: E. P. Dutton, 1979), pp. 45–80.]

   Darwin also largely ignored Alfred Russel Wallace, who had independently proposed the theory that is usually credited solely to Darwin. In 1855, Wallace published the theory of evolution in a brief note in the *Annals and Magazine of Natural History*, a note that Darwin read. Again, on 9 March 1858, Wallace explained the theory in a letter to Darwin, 20 months before Darwin finally published his more detailed theory of evolution.

   Edward Blyth also showed why natural selection would limit an organism's characteristics to only slight deviations from those of all its ancestors. Twenty-four years later, Darwin tried to refute Blyth's explanation in a chapter in *The Origin of Species by Means of Natural Selection* (24 November 1859).

   Darwin felt that, with enough time, gradual changes could accumulate. Charles Lyell's writings (1830) had persuaded

Darwin that the earth was at least hundreds of thousands of years old. James Hutton's writings (1788) had convinced Lyell that the earth was extremely old. Hutton felt that certain geological formations supported an old earth. Those geological formations are explained, not by time, but by a global flood. [See pages 107–326.]

- *"Darwin was confronted by a genuinely unusual problem. The mechanism, natural selection, by which he hoped to prove the reality of evolution, had been written about most intelligently by a nonevolutionist* [Edward Blyth]. *Geology, the time world which it was necessary to attach to natural selection in order to produce* [hopefully] *the mechanism of organic change, had been beautifully written upon by a man* [Charles Lyell] *who had publicly repudiated the evolutionary position."* Eiseley, p. 76.

- Charles Darwin also plagiarized in other instances. [See Jerry Bergman, "Did Darwin Plagiarize His Evolution Theory?" *Technical Journal*, Vol. 16, No. 3, 2002, pp. 58–63.]

b. "[Natural selection] *may have a stabilizing effect, but it does not promote speciation. It is not a creative force as many people have suggested."* Daniel Brooks, as quoted by Roger Lewin, "A Downward Slope to Greater Diversity," *Science*, Vol. 217, 24 September 1982, p. 1240.

- *"The essence of Darwinism lies in a single phrase: natural selection is the creative force of evolutionary change. No one denies that natural selection will play a negative role in eliminating the unfit. Darwinian theories require that it create the fit as well."* Stephen Jay Gould, "The Return of Hopeful Monsters," *Natural History*, Vol. 86, June–July 1977, p. 28.

c. G. Z. Opadia-Kadima, "How the Slot Machine Led Biologists Astray," *Journal of Theoretical Biology*, Vol. 124, 1987, pp. 127–135.

d. Eric Penrose, "Bacterial Resistance to Antibiotics—A Case of *Un*-Natural Selection," *Creation Research Society Quarterly*, Vol. 35, September 1998, pp. 76–83.

e. Well-preserved bodies of members of the Franklin expedition, frozen in the Canadian Arctic in 1845, contain bacteria resistant to antibiotics. Because the first antibiotics were developed in the early 1940s, these resistant bacteria could not have evolved in response to antibiotics. Contamination has been eliminated as a possibility. [See Rick McGuire, "Eerie: Human Arctic Fossils Yield Resistant Bacteria," *Medical Tribune*, 29 December 1988, p. 1.]

- *"The genetic variants required for resistance to the most diverse kinds of pesticides were apparently present in every one of the populations exposed to these man-made compounds."* Francisco J. Ayala, "The Mechanisms of Evolution," *Scientific American*, Vol. 239, September 1978, p. 65.

f. *"Darwin complained his critics did not understand him, but he did not seem to realize that almost everybody, friends, supporters and critics, agreed on one point, his natural selection cannot account for the origin of the variations, only for their possible survival. And the reasons for rejecting Darwin's proposal were many, but first of all that many innovations cannot possibly come into existence through accumulation of many small steps, and even if they can, natural selection cannot accomplish it, because incipient and intermediate stages are not advantageous."* Søren Løvtrup, *Darwinism: The Refutation of a Myth* (New York: Croom Helm, 1987), pp. 274–275.

- *"It was a shock to the people of the 19th century when they discovered, from observations science had made, that many features of the biological world could be ascribed to the elegant principle of natural selection. It is a shock to us in the twentieth century to discover, from observations science has made, that the fundamental mechanisms of life cannot be ascribed to natural selection, and therefore were designed. But we must deal with our shock as best we can and go on. The theory of undirected evolution is already dead, but the work of science continues."* Michael J. Behe, "Molecular Machines," *Cosmic Pursuit*, Spring 1998, p. 35.

g. In 1980, the "Macroevolution Conference" was held in Chicago. Roger Lewin, writing for *Science*, described it as a *"turning point in the history of evolutionary theory."* He went on to say:

> *The central question of the Chicago conference was whether the mechanisms underlying microevolution can be extrapolated to explain the phenomena of macroevolution. At the risk of doing violence to the positions of some of the people at the meeting, the answer can be given as a clear, No.* Roger Lewin, "Evolution Theory under Fire," *Science*, Vol. 210, 21 November 1980, p. 883.

"In a generous admission Francisco Ayala, a major figure in propounding the Modern Synthesis [neo-Darwinism] *in the United States, said 'We would not have predicted stasis* [the stability of species over time] *from population genetics, but I am now convinced from what the paleontologists say that small changes do not accumulate.'"* Ibid., p. 884.

As stated earlier, micro + time ≠ macro.

- *"One could argue at this point that such 'minor' changes* [microevolution], *extrapolated over millions of years, could result in macroevolutionary change. But the observational evidence will not support this argument ...* [examples given] *Thus, the changes observed in the laboratory are not analogous to the sort of changes needed for macroevolution. Those who argue from microevolution to macroevolution may be guilty, then, of employing a false analogy—especially when one considers that microevolution may be a force of stasis* [stability], *not transformation. ... For those who must describe the history of life as a purely natural phenomenon, the winnowing action of natural selection is truly a difficult problem to overcome. For scientists who are content to describe accurately those processes and phenomena which occur in nature (in particular, stasis), natural selection acts to prevent major evolutionary change."* Michael Thomas, "Stasis Considered," *Origins Research*, Vol. 12, Fall/Winter 1989, p. 11.

6. Mutations

a. *"Ultimately, all variation is, of course, due to mutation."* Ernst Mayr, "Evolutionary Challenges to the Mathematical Interpretation of Evolution," *Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution*, editors Paul S. Moorhead and Martin M. Kaplan, proceedings of a symposium held at the Wistar Institute of Anatomy and Biology, 25–26 April, 1966 (Philadelphia: The Wistar Institute Press, 1967), p. 50.

- *"Although mutation is the ultimate source of all genetic variation, it is a relatively rare event, ..."* Ayala, p. 63.

b. *"The process of mutation is the only known source of the raw materials of genetic variability, and hence of evolution. ... the mutants which arise are, with rare exceptions, deleterious to their carriers, at least in the environments which the species normally encounters."* Theodosius Dobzhansky, "On Methods of Evolutionary Biology and Anthropology," *American Scientist*, December 1957, p. 385.

- *"In molecular biology, various kinds of mutations introduce the equivalent of noise pollution of the original instructive message. Communication theory goes to extraordinary lengths to prevent noise pollution of signals of all kinds. Given this longstanding struggle against noise contamination of meaningful algorithmic messages, it seems curious that the central paradigm of biology today attributes genomic messages themselves solely to noise."* David L. Abel and Jack T. Trevors, "Three Subsets of Sequence Complexity and Their Relevance to Biopolymeric Information," *Theoretical Biology & Medical Modelling*, Vol. 2, 11 August 2005, p. 10. (Also available at www.tbiomed.com/content/2/1/29.)

- *"Accordingly, mutations are more than just sudden changes in heredity; they also affect viability, and, to the best of our knowledge, invariably affect it adversely."* C. P. Martin, "A Non-Geneticist Looks at Evolution," *American Scientist*, January 1953, p. 102.

  "Mutation does produce hereditary changes, but the mass of evidence shows that all, or almost all, known mutations are unmistakably pathological and the few remaining ones are highly suspect." Ibid., p. 103.

  "[Although mutations have produced some desirable breeds of animals and plants,] *all mutations seem to be in the nature of injuries that, to some extent, impair the fertility and viability of the affected organisms. I doubt if among the many thousands of known mutant types one can be found which is superior to the wild type in its normal environment, only very few can be named which are superior to the wild type in a strange environment."* Ibid., p. 100.

- *"If we say that it is only by chance that they* [mutations] *are useful, we are still speaking too leniently. In general, they are useless, detrimental, or lethal."* W. R. Thompson, "Introduction to *The Origin of Species*," Everyman Library No. 811 (New York: E. P. Dutton & Sons, 1956; reprint, Sussex, England: J. M. Dent and Sons, Ltd., 1967), p. 10.

- Visible mutations are easily detectable genetic changes such as albinism, dwarfism, and hemophilia. Winchester quantifies the relative frequency of several types of mutations.

  > *Lethal mutations outnumber visibles by about 20 to 1. Mutations that have small harmful effects, the detrimental mutations, are even more frequent than the lethal ones.* Winchester, p. 356.

- John W. Klotz, *Genes, Genesis, and Evolution*, 2nd edition, revised (St. Louis: Concordia Publishing House, 1972), pp. 262–265.

- *"... I took a little trouble to find whether a single amino acid change in a hemoglobin mutation is known that doesn't affect seriously the function of that hemoglobin. One is hard put to find such an instance."* George Wald, as quoted by Murray Eden, "Inadequacies of Neo-Darwinian Evolution as a Scientific Theory," *Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution*, editors Paul S. Moorhead and Martin M. Kaplan, pp. 18–19.

  However, evolutionists have taught for years that hemoglobin alpha changed through mutations into hemoglobin beta. This would require, at a minimum, 120 point mutations. In other words, the improbability Wald refers to above must be raised to the 120th power to produce just this one protein!

- *"Even if we didn't have a great deal of data on this point, we could still be quite sure on theoretical grounds that mutants would usually be detrimental. For a mutation is a random change of a highly organized, reasonably smoothly functioning living body. A random change in the highly integrated system of chemical processes which constitute life is almost certain to impair it—just as a random interchange of connections in a television set is not likely to improve the picture."* James F. Crow (Professor of Genetics, University of Wisconsin), "Genetic Effects of Radiation," *Bulletin of the Atomic Scientists*, Vol. 14, January 1958, pp. 19–20.

- *"The one **systematic** effect of mutation seems to be a tendency towards degeneration ..."* [emphasis in original] Sewall Wright, "The Statistical Consequences of Mendelian Heredity in Relation to Speciation," *The New Systematics*, editor Julian Huxley (London: Oxford University Press, 1949), p. 174.

  Wright then concludes that other factors must also have been involved, because he believes evolution happened.

- In discussing the many mutations needed to produce a new organ, Koestler says:

  > *Each mutation occurring alone would be wiped out before it could be combined with the others. They are all interdependent. The doctrine that their coming together was due to a series of blind coincidences is an affront not only to common sense but to the basic principles of scientific explanation.* Arthur Koestler, *The Ghost in the Machine* (New York: Macmillan Publishing Co., 1968), p. 129.

c. *"There is no single instance where it can be maintained that any of the mutants studied has a higher vitality than the* *mother species."* N. Heribert Nilsson, *Synthetische Artbildung* (Lund, Sweden: Verlag CWK Gleerup, 1953), p. 1157.

"It is, therefore, absolutely impossible to build a current evolution on mutations or on recombinations." [emphasis in original] Ibid., p. 1186.

- *"No matter how numerous they may be, mutations do not produce any kind of evolution."* Pierre-Paul Grassé, *Evolution of Living Organisms* (New York: Academic Press, 1977), p. 88.
- *"I have seen no evidence whatsoever that these* [evolutionary] *changes can occur through the accumulation of gradual mutations."* Lynn Margulis, as quoted by Charles Mann, "Lynn Margulis: Science's Unruly Earth Mother," *Science*, Vol. 252, 19 April 1991, p. 379.
- *"It is true that nobody thus far has produced a new species or genus, etc., by macromutation. It is equally true that nobody has produced even a species by the selection of micromutations."* Richard B. Goldschmidt, "Evolution, As Viewed by One Geneticist," *American Scientist*, Vol. 40, January 1952, p. 94.
- *"If life really depends on each gene being as unique as it appears to be, then it is too unique to come into being by chance mutations."* Frank B. Salisbury, "Natural Selection and the Complexity of the Gene," *Nature*, Vol. 224, 25 October 1969, p. 342.
- *"Do we, therefore, ever see mutations going about the business of producing new structures for selection to work on? No nascent organ has ever been observed emerging, though their origin in pre-functional form is basic to evolutionary theory. Some should be visible today, occurring in organisms at various stages up to integration of a functional new system, but we don't see them: there is no sign at all of this kind of radical novelty. Neither observation nor controlled experiment has shown natural selection manipulating mutations so as to produce a new gene, hormone, enzyme system or organ."* Michael Pitman, *Adam and Evolution* (London: Rider & Co., 1984), pp. 67–68.

7. Fruit Flies

a. *"Most mutants which arise in any organism are more or less disadvantageous to their possessors. The classical mutants obtained in Drosophila* [the fruit fly] *usually show deterioration, breakdown, or disappearance of some organs. Mutants are known which diminish the quantity or destroy the pigment in the eyes, and in the body reduce the wings, eyes, bristles, legs. Many mutants are, in fact, lethal to their possessors. Mutants which equal the normal fly in vigor are a minority, and mutants that would make a major improvement of the normal organization in the normal environments are unknown."* Theodosius Dobzhansky, *Evolution, Genetics, and Man* (New York: John Wiley & Sons, 1955), p. 105.

- *"A review of known facts about their* [mutated fruit flies'] *ability to survive has led to no other conclusion than that they are always constitutionally weaker than their parent form or species, and in a population with free competition they are eliminated. Therefore they are never found in nature (e.g., not a single one of the several hundreds of Drosophila mutations), and therefore they are able to appear only in the favourable environment of the experimental field or laboratory ..."* Nilsson, p. 1186.
- *"In the best-known organisms, like Drosophila, innumerable mutants are known. If we were able to combine a thousand or more of such mutants in a single individual, this still would have no resemblance whatsoever to any type known as a* [new] *species in nature."* Goldschmidt, p. 94.
- *"It is a striking, but not much mentioned fact that, though geneticists have been breeding fruit-flies for sixty years or more in labs all round the world—flies which produce a new generation every eleven days—they have never yet seen the emergence of a new species or even a new enzyme."* Gordon Rattray Taylor (former Chief Science Advisor, BBC Television), *The Great Evolution Mystery* (New York: Harper & Row, 1983), p. 48.
- *"Fruit flies refuse to become anything but fruit flies under any circumstances yet devised."* Hitching, p. 61.
- *"The fruitfly (Drosophila melanogaster), the favorite pet insect of the geneticists, whose geographical, biotopical, urban, and rural genotypes are now known inside out, seems not to have changed since the remotest times."* Grassé, p. 130.

8. Complex Molecules and Organs

a. *"There has never been a meeting, or a book, or a paper on details of the evolution of complex biochemical systems."* Michael J. Behe, *Darwin's Black Box* (New York: The Free Press, 1996), p. 179.

- *"Molecular evolution is not based on scientific authority. There is no publication in the scientific literature—in prestigious journals, specialty journals, or book—that describes how molecular evolution of any real, complex, biochemical system either did occur or even might have occurred. There are assertions that such evolution occurred, but absolutely none are supported by pertinent experiments or calculations. Since no one knows molecular evolution by direct experience, and since there is no authority on which to base claims of knowledge, it can truly be said that—like the contention that the Eagles will win the Super Bowl this year—the assertion of Darwinian molecular evolution is merely bluster."* Behe, pp. 186–187.

b. *"While today's digital hardware is extremely impressive, it is clear that the human retina's real-time performance goes unchallenged. Actually, to simulate 10 milliseconds (ms) of the complete processing of even a single nerve cell from the retina would require the solution of about 500 simultaneous nonlinear differential equations 100 times and would take at least several minutes of processing time on a Cray supercomputer. Keeping in mind that there are 10 million or more such cells interacting with each other in complex ways, it would take a minimum of 100 years of* [1985] *Cray time to simulate what takes place in your eye many times every second."* John K. Stevens, "Reverse Engineering the Brain," *Byte*, April 1985, p. 287.

- *"The retina processes information much more than anyone has ever imagined, sending a dozen different movies to the brain."* Frank Werblin and Botond Roska, "The Movies in Our Eyes," *Scientific American*, Vol. 296, April 2007, p. 73.

- *"Was the eye contrived without skill in opticks* [optics]*, and the ear without knowledge of sounds?"* Isaac Newton, *Opticks* (England: 1704; reprint, New York: McGraw-Hill, 1931), pp. 369–370.

- *"Certainly there are those who argue that the universe evolved out of a random process, but what random process could produce the brain of a man or the system of the human eye?"* Wernher von Braun (probably the rocket scientist most responsible for the United States' success in placing men on the Moon) from a letter written by Dr. Wernher von Braun and read to the California State Board of Education by Dr. John Ford on 14 September 1972.

- *"What random process could possibly explain the simultaneous evolution of the eye's optical system, the nervous conductors of the optical signals from the eye to the brain, and the optical nerve center in the brain itself where the incoming light impulses are converted to an image the conscious mind can comprehend?"* Wernher von Braun, foreword to *From Goo to You by Way of the Zoo* by Harold Hill (Plainfield, New Jersey: Logos International, 1976), p. xi.

- *"The probability of dust carried by the wind reproducing Dürer's 'Melancholia' is less infinitesimal than the probability of copy errors in the DNA molecule leading to the formation of the eye; besides, these errors had* ***no relationship whatsoever*** *with the function that the eye would have to perform or was starting to perform. There is no law against daydreaming, but science must not indulge in it."* [emphasis in original] Grassé, p. 104.

- *"It must be admitted, however, that it is a considerable strain on one's credulity to assume that finely balanced systems such as certain sense organs (the eye of vertebrates, or the bird's feather) could be improved by random mutations. This is even more true for some of the ecological chain relationships (the famous yucca moth case, and so forth). However, the objectors to random mutations have so far been unable to advance any alternative explanation that was supported by substantial evidence."* Ernst Mayr, *Systematics and the Origin of Species* (New York: Dover Publications, 1942), p. 296.

- Although Robert Jastrow generally accepts Darwinian evolution, he acknowledges that:

  > *It is hard to accept the evolution of the human eye as a product of chance; it is even harder to accept the evolution of human intelligence as the product of random disruptions in the brain cells of our ancestors.* Robert Jastrow, "Evolution: Selection for Perfection," *Science Digest*, December 1981, p. 87.

- Many leading scientists have commented on the staggering complexity of the human eye. What some do not appreciate is how many diverse types of eyes there are, each of which adds to the problem for evolution.
  - One of the strangest is a multiple-lensed, compound eye found in fossilized worms! [See Donald G. Mikulic et al., "A Silurian Soft-Bodied Biota," *Science*, Vol. 228, 10 May 1985, pp. 715–717.]
  - Another type of eye belonged to some trilobites, a thumb-size, extinct, sea-bottom creature. Evolutionists claim that they were very early forms of life. Trilobite eyes had ***compound lenses***, sophisticated designs for eliminating image distortion (spherical aberration). Only the best cameras and telescopes contain compound lenses. Some trilobite eyes contained 280 lenses, allowing vision in all directions, day and night. [See Richard Fortey and Brian Chatterton, "A Devonian Trilobite with an Eyeshade," *Science*, Vol. 301, 19 September 2003, p. 1689.] Trilobite eyes *"represent an all-time feat of function optimization."* [Riccardo Levi-Setti, *Trilobites*, 2nd edition (Chicago: The University of Chicago Press, 1993), pp. 29–74.] Shawver described trilobite eyes as having *"the most sophisticated eye lenses ever produced by nature."* [Lisa J. Shawver, "Trilobite Eyes: An Impressive Feat of Early Evolution," *Science News*, Vol. 105, 2 February 1974, p. 72.] Gould admitted that *"The eyes of early trilobites, for example, have never been exceeded for complexity or acuity by later arthropods. … I regard the failure to find a clear 'vector of progress' in life's history as the most puzzling fact of the fossil record."* [Stephen Jay Gould, "The Ediacaran Experiment," *Natural History*, Vol. 93, February 1984, pp. 22–23.]
  - The brittlestar, an animal similar to a 5-arm starfish, has, as part of its skeleton, thousands of eyes, each smaller than the diameter of a human hair. Each eye consists of a calcium carbonate crystal that acts as a compound lens and precisely focuses light on a bundle of nerves. If an arm is lost, a new arm regenerates along with its array of eyes mounted on the upper-back side of the arm. While evolutionists had considered these animals primitive, Sambles admits that *"Once again we find that nature foreshadowed our technical developments."* Roy Sambles, "Armed for Light Sensing," *Nature*, Vol. 412, 23 August 2001, p. 783. The capabilities of these light-focusing lenses exceed today's technology.

c. *"To my mind the human brain is the most marvelous and mysterious object in the whole universe and no geologic period seems too long to allow for its natural evolution."* Henry Fairfield Osborn, an influential evolutionist speaking to the American Association for the Advancement of Science in December 1929, as told by Roger Lewin, *Bones of Contention* (New York: Simon and Schuster, Inc., 1987), p. 57. [Even greater capabilities of the brain have been discovered since 1929. Undoubtedly, more remain.]

- *"And in Man is a three-pound brain which, as far as we know, is the most complex and orderly arrangement of matter in the universe."* Isaac Asimov, "In the Game of Energy and Thermodynamics You Can't Even Break Even," *Smithsonian*, August 1970, p. 10.

Asimov forgot that the brain, and presumably most of its details, is coded by only a fraction of an individual's DNA. Therefore, it would be more accurate to say that DNA is the most complex and orderly arrangement of matter known in the universe.

- The human brain is frequently likened to a supercomputer. In most respects the brain greatly exceeds any computer's capabilities. Speed is one area where the computer beats the brain—at least in some ways. For example, few of us can quickly multiply 0.0239 times 854.95. This task is called *a floating point operation*, because the decimal point "floats" until we (or a computer) decide where to place it. The number of floating point operations per second (FLOPS) is a measure of a computer's speed. As of this writing, an IBM computer can achieve 3,000 trillion FLOPS (3 petaFLOPS). One challenge is to prevent these superfast computers from overheating. Too much electrically generated heat is dissipated in too small a volume.

Overall, the human brain seems to operate at petaFLOPS speeds—without overheating. One knowledgeable observer on these ultrafast computers commented:

> *The human brain itself serves, in some sense, as a proof of concept* [that cool petaFLOPS machines are possible]. *Its dense network of neurons apparently operates at a petaFLOPS or higher level. Yet the whole device fits in a 1 liter box and uses only about 10 watts of power. That's a hard act to follow.* Ivars Peterson, "PetaCrunchers: Setting a Course toward Ultrafast Supercomputing," *Science News*, Vol. 147, 15 April 1995, p. 235.

How, then, could the brain have evolved?

d. *"The human brain consists of about ten thousand million nerve cells. Each nerve cell puts out somewhere in the region of between ten thousand and one hundred thousand connecting fibres by which it makes contact with other nerve cells in the brain. Altogether the total number of connections in the human brain approaches 10^{15} or a thousand million million. … a much greater number of specific connections than in the entire communications network on Earth."* Denton, pp. 330–331.

- *"… the human brain probably contains more than 10^{14} synapses …"* Deborah M. Barnes, "Brain Architecture: Beyond Genes," *Science*, Vol. 233, 11 July 1986, p. 155.

e. Marlyn E. Clark, *Our Amazing Circulatory System*, Technical Monograph No. 5 (San Diego: Creation-Life Publishers, 1976).

9. Fully-Developed Organs

a. William Paley, *Natural Theology* (England: 1802; reprint, Houston: St. Thomas Press, 1972).

This work by Paley, which contains many powerful arguments for a Creator, is a classic in scientific literature. Some might feel that because it was written in 1802, it is out of date. Not so. Hoyle and Wickramasinghe compared Darwin's ideas with those of Paley as follows:

> *The speculations of **The Origin of Species** turned out to be wrong, as we have seen in this chapter. It is ironic that the scientific facts throw Darwin out, but leave William Paley, a figure of fun to the scientific world for more than a century, still in the tournament with a chance of being the ultimate winner.* Fred Hoyle and N. Chandra Wickramasinghe, *Evolution from Space: A Theory of Cosmic Creationism* (New York: Simon and Schuster, 1981), pp. 96–97.

b. Asa Gray, a famous Harvard botany professor, who was to become a leading theistic evolutionist, wrote to Darwin expressing doubt that natural processes could explain the formation of complex organs such as the eye. Darwin expressed a similar concern in his return letter of February 1860.

> *The eye to this day gives me a cold shudder, but when I think of the fine known gradations* [Darwin believed possible if millions of years of evolution were available], *my reason tells me I ought to conquer the cold shudder.* Charles Darwin, The Life and Letters of Charles Darwin, Vol. 2, editor Francis Darwin (New York: D. Appleton and Co., 1899), pp. 66–67.

And yet, Darwin admitted that:

> *To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest degree.* Charles Darwin, *The Origin of Species*, p. 175.

Darwin then proceeded to speculate on how the eye might nevertheless have evolved. However, no evidence was given. Later, he explained how his theory could be falsified.

> *If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down.* Charles Darwin, *The Origin of Species*, p. 179.

- *"It's one of the oldest riddles in evolutionary biology: How does natural selection gradually create an eye, or any complex organ for that matter? The puzzle troubled Charles Darwin, who nevertheless gamely nailed together a ladder of how it might have happened—from photoreceptor cells to highly refined orbits—by drawing examples from living organisms such as mollusks and arthropods. But holes in this progression have persistently bothered evolutionary biologists and left openings that creationists have been only too happy to exploit."* Virginia Morell, "Placentas May Nourish Complexity Studies," *Science*, Vol. 298, 1 November 2002, p. 945.

David Reznick, an evolutionary biologist at the University of California (Riverside), explained to Virginia Morell:

> *Darwin had to use organisms from different classes, because there isn't a living group of related organisms that have all the steps for making an eye.* Ibid.

To solve this dilemma, Reznick points to different species of a guppylike fish, some of which have no placenta and others that have *"tissues that might become placentas."* However, when pressed, *"Reznick admits that the* [guppy-like fish's] *placenta might not be as sophisticated as the mammalian placenta"* [or the eye of any organism]. Ibid.

- *"The eye, as one of the most complex organs, has been the symbol and archetype of his* [Darwin's] *dilemma. Since the eye is obviously of no use at all except in its final, complete form, how could natural selection have functioned in those initial stages of its evolution when the variations had no possible survival value? No single variation, indeed no single part, being of any use without every other, and natural selection presuming no knowledge of the ultimate end or purpose of the organ, the criterion of utility, or survival, would seem to be irrelevant. And there are other equally provoking examples of organs and processes which seem to defy natural selection. Biochemistry provides the case of chemical synthesis built up in several stages, of which the intermediate substance formed at any one stage is of no value at all, and only the end product, the final elaborate and delicate machinery, is useful—and not only useful but vital to life. How can selection, knowing nothing of the end or final purpose of this process, function when the only test is precisely that end or final purpose?"* Gertrude Himmelfarb, *Darwin and the Darwinian Revolution* (Garden City, New York: Doubleday, 1959), pp. 320–321.

c. *"Of what possible use are the imperfect incipient stages of useful structures? What good is half a jaw or half a wing?"* Stephen Jay Gould, "The Return of Hopeful Monsters," p. 23.

10. Distinct Types

a. *And let us dispose of a common misconception. The complete transmutation of even one animal species into a different species has never been directly observed either in the laboratory or in the field."* Dean H. Kenyon (Professor of Biology, San Francisco State University), affidavit presented to the U.S. Supreme Court, No. 85–1513, *Brief of Appellants*, prepared under the direction of William J. Guste Jr., Attorney General of the State of Louisiana, October 1985, p. A-16. Kenyon has repudiated his earlier book advocating evolution.

- *"Thus so far as concerns the major groups of animals, the creationists seem to have the better of the argument. There is not the slightest evidence that any one of the major groups arose from any other. Each is a special animal complex related, more or less closely, to all the rest, and appearing, therefore, as a special and distinct creation."* Austin H. Clark, "Animal Evolution," *Quarterly Review of Biology*, Vol. 3, December 1928, p. 539.

- *"When we descend to details, we cannot prove that a single species has changed; nor can we prove that the supposed changes are beneficial, which is the groundwork of the theory* [of evolution]." Charles Darwin, *The Life and Letters of Charles Darwin*, Vol. 1, p. 210.

- *"The fact that all the individual species must be stationed at the extreme periphery of such logic* [evolutionary] *trees merely emphasized the fact that the order of nature betrays no hint of natural evolutionary sequential arrangements, revealing species to be related as sisters or cousins but* ***never*** *as ancestors and descendants as is required by evolution."* [emphasis in original] Denton, p. 132.

b. *"... no human has ever seen a new species form in nature."* Steven M. Stanley, *The New Evolutionary Timetable* (New York: Basic Books, Inc., 1981), p. 73.

11. Altruism

a. *"... the existence of altruism between different species—which is not uncommon—remains an obstinate enigma."* Taylor, p. 225.

- Some inherited behavior is lethal to the animal but beneficial to unrelated species. For example, dolphins sometimes protect humans from deadly sharks. Many animals (goats, lambs, rabbits, horses, frogs, toads) scream when a predator discovers them. This increases their exposure but warns other species.

b. From an evolutionist's point of view, a very costly form of altruism occurs when an animal forgoes reproduction while caring for another individual's young. This occurs in some human societies where a man has multiple wives who share in raising the children of one wife. More well-known examples include celibate individuals (such as nuns and many missionaries) who devote themselves to helping others. Such traits should never have evolved, or if they accidentally arose, they should quickly die out.

Adoption is another example.

> *From a Darwinian standpoint, going childless by choice is hard enough to explain, but adoption, as the arch-Darwinist Richard Dawkins notes, is a double whammy. Not only do you reduce, or at least fail to increase, your own reproductive success, but you improve someone else's. Since the birth parent is your rival in the great genetic steeplechase, a gene that encourages adoption should be knocked out of the running in fairly short order.* Cleo Sullivan, "The Adoption Paradox," *Discover*, January 2001, p. 80.

Adoption is known even among mice, rats, skunks, llamas, deer, caribou, kangaroos, wallabies, seals, sea lions, dogs, pigs, goats, sheep, bears, and many primates. Altruism is also shown by some people who have pets—a form of adoption—especially individuals who have pets instead of having children.

- Humans, vertebrates, and invertebrates frequently help raise the *unrelated* young of others.

> *... it is not clear that the degree of relatedness is consistently higher in cooperative breeders than in other species that live in stable groups but do not breed cooperatively. In many societies of vertebrates as well as invertebrates, differences in contributions to rearing young do not appear to vary with the relatedness of helpers, and several studies of cooperative*

birds and mammals have shown that helpers can be unrelated to the young they are raising and that the unrelated helpers invest as heavily as close relatives. Tim Clutton-Brock, "Breeding Together: Kin Selection and Mutualism in Cooperative Vertebrates," *Science*, Vol. 296, 5 April 2002, p. 69.

Six different studies were cited in support of the conclusions above.

c. *"Ultimately, moral guidelines determine an essential part of economic life. How could such forms of social behavior evolve? This is a central question for Darwinian theory. The prevalence of altruistic acts—providing benefits to a recipient at a cost to the donor—can seem hard to reconcile with the idea of the selfish gene, the notion that evolution at its base acts solely to promote genes that are most adept at engineering their own proliferation. Benefits and costs are measured in terms of the ultimate biological currency—reproductive success. Genes that reduce this success are unlikely to spread in a population."* Karl Sigmund et al., "The Economics of Fair Play," *Scientific American*, Vol. 286, January 2002, p. 87.

d. Some evolutionists propose the following explanation for this long-standing and widely recognized problem for evolution: *"Altruistic behavior may prevent the altruistic individual from passing on his or her genes, but it benefits the individual's clan that carries a few of those genes."* This hypothesis has five problems—the last two are fatal.
   - Observations do not support it. [See Clutton-Brock, pp. 69–72.]
   - *"... altruistic behavior toward relatives may at some later time lead to increased competition between relatives, reducing or even completely removing the net selective advantage of altruism."* Stuart A. West et al., "Cooperation and Competition between Relatives," *Science*, Vol. 296, 5 April 2002, p. 73.
   - If individual X's altruistic trait was inherited, that trait should be carried recessively in only half the individual's brothers and sisters, one-eighth of the first cousins, etc. The key question then is: Does this "fractional altruism" benefit these relatives enough that they sire enough children with the altruistic trait? On average, one or more in the next generation must have the trait, and no generation can ever lose the trait. Otherwise, the trait will become extinct.
   - From an evolutionist's perspective, all altruistic traits originated as a mutation. The brothers, sisters, or cousins of the first person to have the mutation would not have the trait. Even if many relatives benefited from the altruism, the trait would not survive the first generation.
   - The hypothesis fails to explain altruism between different species. Without discussing examples that require a knowledge of the life patterns of such species, consider the simple example above of humans who forgo having children in order to care for animals.

- Edward O. Wilson, an early proponent of this evolutionary explanation for altruism, now recognizes its failings.

  I found myself moving away from the position I'd taken 30 years ago, which has become the standard theory. What I've done is to say that maybe collateral kin selection is not so important. These ants and termites in the early stages of evolution—they can't recognize kin like that. There's very little evidence that they're determining who's a brother, a sister, a cousin, and so on. They are not acting to favor collateral kin. Edward O. Wilson, "The Discover Interview," *Discover*, June 2006, p. 61.

12. Extraterrestrial Life?

a. The widely publicized claims, made by NASA in 1996, to have found fossilized life in a meteorite from Mars are now largely dismissed. [See Richard A. Kerr, "Requiem for Life on Mars? Support for Microbes Fades," *Science*, Vol. 282, 20 November 1998, pp. 1398–1400.]

13. Language

a. G. F. Marcus et al., "Rule Learning by Seven-Month-Old Infants," *Science*, Vol. 283, 1 January 1999, pp. 77–80.

b. Arthur Custance, *Genesis and Early Man* (Grand Rapids: Zondervan Publishing House, 1975), pp. 250–271.

- *"Nobody knows how* [language] *began. There doesn't seem to be anything like syntax in non-human animals and it is hard to imagine evolutionary forerunners of it."* Richard Dawkins, *Unweaving the Rainbow* (Boston: Houghton Mifflin Co., 1998), p. 294.

c. *"Projects devoted to teaching chimpanzees and gorillas to use language have shown that these apes can learn vocabularies of visual symbols. There is no evidence, however, that apes can combine such symbols in order to create new meanings. The function of the symbols of an ape's vocabulary appears to be not so much to identify things or to convey information as it is to satisfy a demand that it use that symbol in order to obtain some reward."* H. S. Terrance et al., "Can an Ape Create a Sentence?" *Science*, Vol. 206, 23 November 1979, p. 900.

- *"... human language appears to be a unique phenomenon, without significant analogue in the animal world."* Noam Chomsky, *Language and Mind* (Chicago: Harcourt, Brace & World, Inc., 1968), p. 59.

d. *"No languageless community has ever been found."* Jean Aitchison, *The Atlas of Languages* (New York: Facts on File, Inc., 1996), p. 10.

- *"There is no reason to suppose that the 'gaps'* [in language development between apes and man] *are bridgeable."* Chomsky, p. 60.

e. *"...* [concerning imitation, not language] *only humans can lose one modality (e.g., hearing) and make up for this deficit by communicating with complete competence in a different modality (i.e., signing)."* Marc D. Hauser et al., "The Faculty of Language: What Is It, Who Has It, and How Did It Evolve?" *Science*, Vol. 298, 22 November 2002, p. 1575.

f. David C. C. Watson, *The Great Brain Robbery* (Chicago: Moody Press, 1976), pp. 83–89.

◆ George Gaylord Simpson acknowledged the vast gulf that separates animal communication and human languages. Although he recognized the apparent pattern of language development from complex to simple, he could not digest it. He simply wrote, *"Yet it is incredible that the first language could have been the most complex."* He then shifted to a new subject. George Gaylord Simpson, *Biology and Man* (New York: Harcourt, Brace & World, Inc., 1969), p. 116.

◆ *"Many other attempts have been made to determine the evolutionary origin of language, and all have failed. ... Even the peoples with least complex cultures have highly sophisticated languages, with complex grammar and large vocabularies, capable of naming and discussing anything that occurs in the sphere occupied by their speakers. ... The oldest language that can reasonably be reconstructed is already modern, sophisticated, complete from an evolutionary point of view."* George Gaylord Simpson, "The Biological Nature of Man," *Science*, Vol. 152, 22 April 1966, p. 477.

◆ *"The evolution of language, at least within the historical period, is a story of progressive simplification."* Albert C. Baugh, *A History of the English Language*, 2nd edition (New York: Appleton-Century-Crofts, Inc., 1957), p. 10.

◆ *"The so-called primitive languages can throw no light on language origins, since most of them are actually more complicated in grammar than the tongues spoken by civilized peoples."* Ralph Linton, *The Tree of Culture* (New York: Alfred A. Knopf, 1957), p. 9.

g. *"It was Charles Darwin who first linked the evolution of languages to biology. In **The Descent of Man** (1871), he wrote, 'the formation of different languages and of distinct species, and the proofs that both have been developed through a gradual process, are curiously parallel.' But linguists cringe at the idea that evolution might transform simple languages into complex ones. Today it is believed that no language is, in any basic way, 'prior' to any other, living or dead. Language alters even as we speak it, but it neither improves nor degenerates."* Philip E. Ross, "Hard Words," *Scientific American*, Vol. 264, April 1991, p. 144.

◆ *"Noam Chomsky ... has firmly established his point that grammar, and in particular syntax, is innate. Interested linguistics people ... are busily speculating on how the language function could have evolved ... Derek Bickerton (Univ. Hawaii) insists that this faculty must have come into being all at once."* John Maddox, "The Price of Language?" *Nature*, Vol. 388, 31 July 1997, p. 424.

14. Speech

a. Mark P. Cosgrove, *The Amazing Body Human* (Grand Rapids: Baker Book House, 1987), pp. 106–109.

"If we are honest, we will face the facts and admit that we can find no evolutionary development to explain our unique speech center [in the human brain]." Ibid., p. 164.

b. Jeffrey T. Laitman, "The Anatomy of Human Speech," *Natural History*, Vol. 93, August 1984, pp. 20–26.

◆ *"Chimpanzees communicate with each other by making vocal sounds just as most mammals do, but they don't have the capacity for true language, either verbally or by using signs and symbols. ... Therefore, the speech sound production ability of a chimpanzee vocal tract is extremely limited, because it lacks the ability to produce the segmental contrast of consonants and vowels in a series. ... I conclude that all of the foregoing basic structural and functional deficiencies of the chimpanzee vocal tract, which interfere or limit the production of speech sounds, also pertain to all of the other nonhuman primates."* Edmund S. Crelin, *The Human Vocal Tract* (New York: Vantage Press, 1987), p. 83.

15. Codes, Programs, and Information

a. In 2010, another level of complexity was discovered in the genetic code. On a strand of DNA, a sequence of three adjacent nucleotides form a unit in the genetic code called a *codon*. Prior to 2010, some codons were thought to have the same function as others. That turns out to not be the case.

> *... synonymous codon changes can so profoundly change the role of a protein* [that it] *adds a new level of complexity to how we interpret the genetic code.* Ivana Weygand-Durasevic and Michael Ibba, "New Roles for Codon Usage," *Science*, Vol. 329, 17 September 2010, p. 1474. Also see Fangliang Zhang et al., "Differential Arginylation of Actin Isoforms Is Regulated by Coding Sequence-Dependent Degradation," *Science*, Vol. 329, 17 September 2010, p. 1734–1537.

b. *"Genomes* [all the DNA of a species] *are remarkable in that they encode most of the functions necessary for their interpretation and propagation."* Anne-Claude Gavin et al., "Proteome Survey Reveals Modularity of the Yeast Cell Machinery," *Nature*, Vol. 440, 30 March 2006, p. 631.

c. The genetic code is remarkably insensitive to translation errors. If the code were produced by random processes, as evolutionists believe, life would have needed about a million different starts before a code could have been stumbled on that was as resilient as the code used by all life today. [See Stephen J. Freeland and Laurence D. Hurst, "Evolution Encoded," *Scientific American*, Vol. 290, April 2004, pp. 84–91.]

◆ *"This analysis gives us a reason to believe that the A–T and G–C choice forms the best pairs that are the most different from each other, so that their ubiquitous use in living things represents **an efficient and successful choice rather than an accident of evolution**."* [emphasis added] Larry Liebovitch, as quoted by David Bradley, "The Genome Chose Its Alphabet with Care," *Science*, Vol. 297, 13 September 2002, p. 1790.

d. *"No matter how many 'bits' of possible combinations it has, there is no reason to call it 'information' if it doesn't at least have the potential of producing something useful. What kind of information produces function? In computer science, we* *call it a 'program.' Another name for computer software is an 'algorithm.' No man-made program comes close to the technical brilliance of even Mycoplasmal genetic algorithms. Mycoplasmas are the simplest known organisms with the smallest known genome, to date. How was its genome and other living organisms' genomes programmed?"* Abel and Trevors, p. 8.

- *"No known hypothetical mechanism has even been suggested for the generation of nucleic acid algorithms."* Jack T. Trevors and David L. Abel, "Chance and Necessity Do Not Explain the Origin of Life," *Cell Biology International*, Vol. 28, 2004, p. 730.

e. How can we measure information? A computer file might contain information for printing a story, reproducing a picture at a given resolution, or producing a widget to specified tolerances. Information can usually be compressed to some degree, just as the English language could be compressed by eliminating every "u" that directly follows a "q". If compression could be accomplished to the maximum extent possible (eliminating all redundancies and unnecessary information), the number of bits (0s or 1s) would be a measure of the information needed to produce the story, picture, or widget.

Each living system can be described by its age and the information stored in its DNA. Each basic unit of DNA, called a *nucleotide*, can be one of four types. Therefore, each nucleotide represents two ($\log_2 4 = 2$) bits of information. Conceptual systems, such as ideas, a filing system, or a system for betting on race horses, can be explained in books. Several bits of information can define each symbol in these books. *The number of bits of information, after compression, needed to duplicate and achieve the purpose of a system will be defined as its information content. That number is also a measure of the system's **complexity**.*

Objects and organisms are not information. Each is a complex combination of matter and energy that the proper equipment—and information—could theoretically produce. Matter and energy alone cannot produce complex objects, living organisms, or information.

While we may not know the precise amount of information in different organisms, we do know those numbers are enormous and quite different. Simply changing (mutating) a few bits to begin the gigantic leap toward evolving a new organ or organism would likely kill the host.

- *"Information is information, not matter or energy. No materialism which does not admit this can survive at the present day."* Norbert Wiener, *Cybernetics; or, Control and Communication in the Animal and the Machine*, 2nd edition (Cambridge, Massachusetts: MIT Press, 1948), p. 132.

- Werner Gitt (Professor of Information Systems) describes man as the most complex information processing system on earth. Gitt estimated that about 3×10^{24} bits of information are processed daily in an average human body. That is thousands of times more than all the information in all the world's libraries. [See Werner Gitt, *In the Beginning Was Information*, 2nd edition (Bielefeld, Germany: CLV, 2000), p. 88.]

f. *"There is no known law of nature, no known process and no known sequence of events which can cause information to originate by itself in matter."* Ibid., p. 107.

g. Because macroevolution requires increasing complexity through natural processes, the organism's information content must spontaneously increase many times. However, natural processes cannot significantly increase the information content of an isolated system, such as a reproductive cell. Therefore, macroevolution cannot occur.

- *"The basic flaw of all evolutionary views is the origin of the information in living beings. It has never been shown that a coding system and semantic information could originate by itself in a material medium, and the information theorems predict that this will never be possible. A purely material origin of life is thus precluded."* Gitt, p. 124.

h. Based on modern advances in the field of information theory, the only known way to decrease the entropy of an isolated system is by having intelligence ***in*** that system. [See, for example, Charles H. Bennett, "Demons, Engines and the Second Law," *Scientific American*, Vol. 257, November 1987, pp. 108–116.] Because the universe is far from its maximum entropy level, a vast intelligence is the only known means by which the universe could have been brought into being. [See also **"Second Law of Thermodynamics"** on page 32.]

i. If the "big bang" occurred, all the matter in the universe was at one time a hot gas. A gas is one of the most random systems known to science. Random, chaotic movements of gas molecules contain virtually no useful information. Because an isolated system, such as the universe, cannot generate nontrivial information, the "big bang" could not produce the complex, living universe we have today, which contains astronomical amounts of useful information.

17. Convergent Evolution or Intelligent Design?

a. *"... the definitive mammalian middle ear evolved independently in living monotremes and therians (marsupials and placentals)."* Thomas H. Rich et al., "Independent Origins of Middle Ear Bones in Monotremes and Therians," *Science*, Vol. 307, 11 February 2005, p. 910.

- *"Because of the complexity of the bone arrangement, some scientists have argued that the innovation arose just once—in a common ancestor of the three mammalian groups. Now, analyses of a jawbone from a specimen of **Teinolophos trusleri**, a shrew-size creature that lived in Australia about 115 million years ago, have dealt a blow to that notion."* Sid Perkins, "Groovy Bones," *Science News*, Vol. 167, 12 February 2005, p. 100.

b. Also, for mammals to hear requires the organ of Corti and complex "wiring" in the brain. No known reptile (the supposed ancestor of mammals), living or fossil, has anything resembling this amazing organ.

c. *"By this we have also proved that a morphological similarity between organisms cannot be used as proof of a phylogenetic* [evolutionary] *relationship … it is unscientific to maintain that the morphology may be used to prove relationships and evolution of the higher categories of units, …"* Nilsson, p. 1143.

◆ *"But biologists have known for a hundred years that homologous* [similar] *structures are often not produced by similar developmental pathways. And they have known for thirty years that they are often not produced by similar genes, either. So there is no empirically demonstrated mechanism to establish that homologies are due to common ancestry rather than common design."* Jonathan Wells, "Survival of the Fakest," *The American Spectator*, December 2000/January 2001, p. 22.

d. Fix, pp. 189–191.

◆ Denton, pp. 142–155.

◆ *"Therefore,* ***homologous structures need not be controlled by identical genes, and homology of phenotypes does not imply similarity of genotypes.*** [emphasis in original] *It is now clear that the pride with which it was assumed that the inheritance of homologous structures from a common ancestor explained homology was misplaced; for such inheritance cannot be ascribed to identity of genes. … But if it is true that through the genetic code, genes code for enzymes that synthesize proteins which are responsible (in a manner still unknown in embryology) for the differentiation of the various parts in their normal manner, what mechanism can it be that results in the production of homologous organs, the same 'patterns', in spite of their not being controlled by the same genes? I asked this question in 1938, and it has not been answered."* [Nor has it been answered today.] Gavin R. deBeer, formerly Professor of Embryology at the University of London and Director of the British Museum (Natural History), *Homology, An Unsolved Problem* (London: Oxford University Press, 1971), p. 16.

e. *"Structures as obviously homologous as the alimentary canal in all vertebrates can be formed from the roof of the embryonic gut cavity (sharks), floor (lampreys, newts), roof and floor (frogs), or from the lower layer of the embryonic disc, the blastoderm, that floats on the top of heavily yolked eggs (reptiles, birds). It does not seem to matter where in the egg or the embryo the living substance out of which homologous organs are formed comes from. Therefore,* ***correspondence between homologous structures cannot be pressed back to similarity of position of the cells of the embryo or the parts of the egg out of which these structures are ultimately differentiated."*** [emphasis in original] Ibid., p. 13.

18. Vestigial Organs

a. *"The existence of functionless 'vestigial organs' was presented by Darwin, and is often cited by current biology textbooks, as part of the evidence for evolution. … An analysis of the difficulties in unambiguously identifying functionless structures and an analysis of the nature of the argument, leads to the conclusion that 'vestigial organs' provide no evidence for evolutionary theory."* S. R. Scadding, "Do 'Vestigial Organs' Provide Evidence for Evolution?" *Evolutionary Theory*, Vol. 5, May 1981, p. 173.

b. Jerry Bergman and George Howe, *"Vestigial Organs" Are Fully Functional* (Terre Haute, Indiana: Creation Research Society Books, 1990).

c. *"The appendix is not generally credited with substantial function. However, current evidence tends to involve it in the immunologic mechanism."* Gordon McHardy, "The Appendix," *Gastroenterology*, Vol. 4, editor J. Edward Berk (Philadelphia: W. B. Saunders Co., 1985), p. 2609.

◆ *"Thus, although scientists have long discounted the human appendix as a vestigial organ, a growing quantity of evidence indicates that the appendix does in fact have a significant function as a part of the body's immune system."* N. Roberts, "Does the Appendix Serve a Purpose in Any Animal?" *Scientific American*, Vol. 285, November 2001, p. 96.

d. *"… the human appendix is well suited as a 'safe house' for commensal bacteria, providing support for bacterial growth and potentially facilitating re-inoculation of the colon in the event that the contents of the intestinal track are purged following exposure to a pathogen. … the appendix … is not a vestige."* R. Randal Bollinger et. al., "Biofilms in the Large Bowel Suggest an Apparent Function of the Human Vermiform Appendix," *Journal of Theoretical Biology*, Vol. 249, 2007, p. 826.

19. Two-Celled Life?

a. E. Lendell Cockrum and William J. McCauley, *Zoology* (Philadelphia: W. B. Saunders Co., 1965), p. 163.

◆ Lynn Margulis and Karlene V. Schwartz, *Five Kingdoms: An Illustrated Guide to the Phyla of Life on Earth* (San Francisco: W. H. Freeman and Co., 1982), pp. 178–179.

◆ Perhaps the simplest forms of multicellular life are the Myxozoans, which have 6–12 cells. While they are quite distinct from other multicellular life, they are even more distinct from single-celled life (kingdom Protista). [See James F. Smothers et al., "Molecular Evidence That the Myxozoan Protists are Metazoans," *Science*, Vol. 265, 16 September 1994, pp. 1719–1721.] So, if they evolved from anywhere, it would most likely have been from higher, not lower, forms of life. Such a feat should be called *devolution*, not evolution.

Colonial forms of life are an unlikely bridge between single-celled life and multicelled life. The degree of cellular differentiation between colonial forms of life and the simplest multicellular forms of life is vast. For a further discussion, see Libbie Henrietta Hyman, *The Invertebrates: Protozoa through Ctenophora*, Vol. 1 (New York: McGraw-Hill, 1940), pp. 248–255.

◆ Nor do Diplomonads (which have two nuclei and four flagella) bridge the gap. Diplomonads are usually parasites.

20. Embryology

a. *"This generalization was originally called the biogenetic law by Haeckel and is often stated as 'ontogeny* [the development of an embryo] *recapitulates* [repeats] *phylogeny* [evolution].*' This crude interpretation of embryological sequences will not stand close examination, however. Its shortcomings have been almost universally pointed out by modern authors, but the idea still has a prominent place in biological mythology."* Paul R. Ehrlich and Richard W. Holm, *The Process of Evolution* (New York: McGraw-Hill, 1963), p. 66.

- *"It is now firmly established that ontogeny does **not** repeat phylogeny."* [emphasis in original] George Gaylord Simpson and William S. Beck, *Life: An Introduction to Biology* (New York: Harcourt, Brace & World, Inc., 1965), p. 241.

- Hitching, pp. 202–205.

- *"The enthusiasm of the German zoologist, Ernst Haeckel, however, led to an erroneous and unfortunate exaggeration of the information which embryology could provide. This was known as the 'biogenetic law' and claimed that embryology was a recapitulation of evolution, or that during its embryonic development an animal recapitulated the evolutionary history of its species."* Gavin R. deBeer, *An Atlas of Evolution* (New York: Nelson, 1964), p. 38.

- *"… the theory of recapitulation has had a great and, while it lasted, regrettable influence on the progress of embryology."* Gavin R. deBeer, *Embryos and Ancestors*, revised edition (London: Oxford University Press, 1951), p. 10.

- *"Moreover, the biogenetic law has become so deeply rooted in biological thought that it cannot be weeded out in spite of its having been demonstrated to be wrong by numerous subsequent scholars."* Walter J. Bock, "Evolution by Orderly Law," *Science*, Vol. 164, 9 May 1969, pp. 684–685.

- *"… we no longer believe we can simply read in the embryonic development of a species its exact evolutionary history."* Hubert Frings and Marie Frings, *Concepts of Zoology* (Toronto: Macmillan Publishing Co., 1970), p. 267.

- *"The type of analogical thinking which leads to theories that development is based on the recapitulation of ancestral stages or the like no longer seems at all convincing or even interesting to biologists."* Conrad Hal Waddington, *Principles of Embryology* (London: George Allen and Unwin Ltd., 1956), p. 10.

- *"Surely the biogenetic law is as dead as a doornail."* Keith Stewart Thomson, "Ontogeny and Phylogeny Recapitulated," *American Scientist*, Vol. 76, May–June 1988, p. 273.

- *"The biogenetic law—embryologic recapitulation—I think, was debunked back in the 1920s by embryologists."* David Raup, as taken from page 16 of an approved and verified transcript of a taped interview conducted by Luther D. Sunderland on 27 July 1979. [See also Luther D. Sunderland, *Darwin's Enigma* (San Diego: Master Book Publishers, 1984), p. 119.]

- *"The theory of recapitulation was destroyed in 1921 by Professor Walter Garstang in a famous paper. Since then no respectable biologist has ever used the theory of recapitulation, because it was utterly unsound, created by a Nazi-like preacher named Haeckel."* Ashley Montagu, as quoted by Sunderland, p. 119.

b. Haeckel, who in 1868 advanced this "biogenetic law" that was quickly adopted in textbooks and encyclopedias worldwide, distorted his data. Thompson explains:

> *A natural law can only be established as an induction from facts. Haeckel was of course unable to do this. What he did was to arrange existing forms of animal life in a series proceeding from the simple to the complex, intercalating* [inserting] *imaginary entities where discontinuity existed and then giving the embryonic phases names corresponding to the stages in his so-called evolutionary series. Cases in which this parallelism did not exist were dealt with by the simple expedient of saying that the embryological development had been falsified. When the "convergence" of embryos was not entirely satisfactory, Haeckel altered the illustrations of them to fit his theory. The alterations were slight but significant. The "biogenetic law" as a proof of evolution is valueless.* W. R. Thompson, p. 12.

- *"To support his case he* [Haeckel] *began to fake evidence. Charged with fraud by five professors and convicted by a university court at Jena, he agreed that a small percentage of his embryonic drawings were forgeries; he was merely filling in and reconstructing the missing links when the evidence was thin, and he claimed unblushingly that 'hundreds of the best observers and biologists lie under the same charge'."* Pitman, p. 120.

- M. Bowden, *Ape-Men: Fact or Fallacy?* 2nd edition (Bromley, England: Sovereign Publications, 1981), pp. 142–143.

- Wilbert H. Rusch, Sr., "Ontogeny Recapitulates Phylogeny," *Creation Research Society Quarterly*, Vol. 6, June 1969, pp. 27–34.

- *"… ontogeny recapitulates phylogeny, meaning that in the course of its development* [ontogeny] *an embryo recapitulates* [repeats] *the evolutionary history of its species* [phylogeny]. *This idea was fathered by Ernst Haeckel, a German biologist who was so convinced that he had solved the riddle of life's unfolding that he doctored and faked his drawings of embryonic stages to prove his point."* Fix, p. 285.

- *"* [The German scientist Wilhelm His] *accused Haeckel of shocking dishonesty in repeating the same picture several times to show the similarity among vertebrates at early embryonic stages in several plates of* [Haeckel's book]*."* Stephen Jay Gould, *Ontogeny and Phylogeny* (Cambridge, Massachusetts: The Belknap Press of Harvard University Press, 1977), p. 430.

- *"It looks like it's turning out to be one of the most famous fakes in biology."* Michael K. Richardson, as quoted by

Elizabeth Pennisi, "Haeckel's Embryos: Fraud Rediscovered," *Science*, Vol. 277, 5 September 1997, p. 1435.

- *"When we compare his* [Haeckel's] *drawings of a young echidna embryo with the original, we find that he removed the limbs (see Fig. 1). This cut was selective, applying only to the young stage. It was also systematic because he did it to other species in the picture. Its intent is to make the young embryos look more alike than they do in real life."* Michael K. Richardson and Gerhard Keuck, "A Question of Intent: When Is a 'Schematic' Illustration a Fraud?" *Nature*, Vol. 410, 8 March 2001, p. 144.

c. *"Another point to emerge from this study is the considerable inaccuracy of Haeckel's famous figures. These drawings are still widely reproduced in textbooks and review articles, and continue to exert a significant influence on the development of ideas in this field."* Michael K. Richardson et al., "There Is No Highly Conserved Embryonic Stage in the Vertebrates," *Anatomy and Embryology*, Vol. 196, August 1997, p. 104.

21. Rapid Burial

a. Thousands of jellyfish, many bigger than a dinner plate, are found in at least seven different horizons of *coarse-grained, abrasive* sandstone in Wisconsin. [See James W. Hagadorn et al., "Stranded on a Late Cambrian Shoreline: Medusae from Central Wisconsin," *Geology*, Vol. 30, February 2002, pp. 147–150.]

Coarse grains slowly covering a jellyfish would allow atmospheric oxygen to migrate in and produce rapid decay. Burial in clay or mud would better shield an organism from decay. If coarse-grain sand buried these jellyfish in a storm, turbulence and abrasion by the sand grains would tear and destroy the jellyfish. To understand how thousands of jellyfish were gently collected and preserved in coarse-grained sand, see pages 175–187.

Charles Darwin recognized the problem of finding fossilized soft-bodied organisms such as jellyfish. He wrote:

> *No organism wholly soft can be preserved.* Charles Darwin, *The Origin of Species*, p. 330.

Once again, a prediction of evolution is seen to be wrong.

- Preston Cloud and Martin F. Glaessner, "The Ediacarian Period and System: Metazoa Inherit the Earth," *Science*, Vol. 217, 27 August 1982, pp. 783–792. [See also the cover of that issue.]

- Martin F. Glaessner, "Pre-Cambrian Animals," *Scientific American*, Vol. 204, March 1961, pp. 72–78.

b. Donald G. Mikulic et al., "A Silurian Soft-Bodied Biota," *Science*, Vol. 228, 10 May 1985, pp. 715–717.

- *"... preconditions for the preservation of soft-bodied faunas: rapid burial of fossils in undisturbed sediment; deposition in an environment free from the usual agents of immediate destruction—primarily oxygen and other promoters of decay, and the full range of organisms, from bacteria to large scavengers, that quickly reduce most carcasses to oblivion in nearly all earthly environments; and minimal disruption by the later ravages of heat, pressure, fracturing, and erosion. ... But the very conditions that promote preservation also decree that few organisms, if any, make their natural homes in such places."* Stephen Jay Gould, *Wonderful Life* (New York: W. W. Norton & Co., 1989), pp. 61–62.

c. Presse Grayloise, "Very Like a Whale," *The Illustrated London News*, 1856, p. 116.

- Sunderland, pp. 111–114.

- David Starr Jordan, "A Miocene Catastrophe," *Natural History*, Vol. 20, January–February 1920, pp. 18–22.

- Hugh Miller, *The Old Red Sandstone, or New Walks in an Old Field* (Boston: Gould and Lincoln, 1858), pp. 221–225.

d. Harold G. Coffin, *Origin By Design* (Washington, D.C.: Review and Herald Publishing Assn., 1983), pp. 30–40.

23. Fossil Gaps

a. *"But, as by this theory innumerable transitional forms must have existed, why do we not find them imbedded in countless numbers in the crust of the earth?"* Darwin, *The Origin of Species*, p. 163.

"... the number of intermediate varieties, which have formerly existed [must] *truly be enormous. Why then is not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any such finely-graduated organic chain; and this, perhaps, is the most obvious and serious objection which can be urged against the theory* [of evolution]*."* Ibid., p. 323.

Darwin then explained that he thought that these gaps existed because of the "imperfection of the geologic record." Early Darwinians expected the gaps would be filled as fossil exploration continued. Most paleontologists now agree that this expectation has not been fulfilled.

- The Field Museum of Natural History in Chicago has one of the largest collections of fossils in the world. Consequently, its former dean, Dr. David Raup, was highly qualified to discuss the absence of transitions in the fossil record.

> *Well, we are now about 120 years after Darwin and the knowledge of the fossil record has been greatly expanded. We now have a quarter of a million fossil species but the situation hasn't changed much. The record of evolution is still surprisingly jerky and, ironically, we have even fewer examples of evolutionary transition than we had in Darwin's time. By this I mean that some of the classic cases of darwinian change in the fossil record, such as the evolution of the horse in North America, have had to be discarded or modified as a result of more detailed information—what appeared to be a nice simple progression when relatively few data were available now appears to be much more complex and much less gradualistic. So Darwin's problem has not been alleviated in the last 120 years and we still have a record which does show change but one that can hardly be looked upon as the most reasonable*

consequence of natural selection. David M. Raup, "Conflicts Between Darwin and Paleontology," *Field Museum of Natural History Bulletin*, Vol. 50, January 1979, p. 25.

- *"Surely the lack of gradualism—the lack of intermediates—is a major problem."* Dr. David Raup, as taken from page 16 of an approved and verified transcript of a taped interview conducted by Luther D. Sunderland on 27 July 1979.

- *"In fact, the fossil record does not convincingly document a single transition from one species to another."* Stanley, p. 95.

- *"But fossil species remain unchanged throughout most of their history and the record fails to contain a single example of a significant transition."* David S. Woodruff, "Evolution: The Paleobiological View," *Science*, Vol. 208, 16 May 1980, p. 716.

- Dr. Colin Patterson, a senior paleontologist at the British Museum (Natural History), was asked by Luther D. Sunderland why no evolutionary transitions were included in Dr. Patterson's recent book, *Evolution*. In a personal letter, Patterson said:

  I fully agree with your comments on the lack of direct illustration of evolutionary transitions in my book. If I knew of any, fossil or living, I would certainly have included them. You suggest that an artist should be asked to visualise such transformations, but where would he get the information from? I could not, honestly, provide it, and if I were to leave it to artistic licence, would that not mislead the reader? … Yet Gould and the American Museum people are hard to contradict when they say that there are no transitional fossils. As a palaeontologist myself, I am much occupied with the philosophical problems of identifying ancestral forms in the fossil record. You say that I should at least "show a photo of the fossil from which each type organism was derived." I will lay it on the line—there is not one such fossil for which one could make a watertight argument. Copy of letter, dated 10 April 1979, from Patterson to Sunderland.

- *"But the curious thing is that there is a consistency about the fossil gaps:* ***the fossils go missing in all the important places****. When you look for links between major groups of animals, they simply aren't there; at least, not in enough numbers to put their status beyond doubt. Either they don't exist at all, or they are so rare that endless argument goes on about whether a particular fossil is, or isn't, or might be, transitional between this group or that."* [emphasis in original] Hitching, p. 19.

- *"There is no more conclusive refutation of Darwinism than that furnished by palaeontology. Simple probability indicates that fossil hoards can only be test samples. Each sample, then, should represent a different stage of evolution, and there ought to be merely 'transitional' types, no definition and no species. Instead of this we find perfectly stable and unaltered forms persevering through long ages, forms that have not developed themselves on the fitness principle, but* ***appear suddenly and at once in their definitive shape****; that do not thereafter evolve towards better adaptation, but become rarer and finally disappear, while quite different forms crop up again. What unfolds itself, in ever-increasing richness of form, is the great classes and kinds of living beings which* ***exist aboriginally and exist still, without transition types****, in the grouping of today."* [emphasis in original] Oswald Spengler, *The Decline of the West*, Vol. 2 (New York: Alfred A. Knopf, 1966), p. 32.

- *"This regular absence of transitional forms is not confined to mammals, but is an almost universal phenomenon, as has long been noted by paleontologists. It is true of almost all orders of all classes of animals, both vertebrate and invertebrate. A fortiori, it is also true of the classes, themselves, and of the major animal phyla, and it is apparently also true of analogous categories of plants."* George Gaylord Simpson, *Tempo and Mode in Evolution* (New York: Columbia University Press, 1944), p. 107.

  "… the geologic record did not then and still does not yield a finely graduated chain of slow and progressive evolution. In other words, there are not enough intermediates. There are very few cases where one can find a gradual transition from one species to another and very few cases where one can look at a part of the fossil record and actually see that organisms were improving in the sense of becoming better adapted." Ibid., p. 23.

- *"… there are about 25 major living subdivisions (phyla) of the animal kingdom alone, all with gaps between them that are not bridged by known intermediates."* Francisco J. Ayala and James W. Valentine, *Evolving, The Theory and Processes of Organic Evolution* (Menlo Park, California: The Benjamin Cummings Publishing Co., 1979), p. 258.

  "Most orders, classes, and phyla appear abruptly, and commonly have already acquired all the characters that distinguish them." Ibid., p. 266.

- *"All paleontologists know that the fossil record contains precious little in the way of intermediate forms; transitions between major groups are characteristically abrupt."* Gould, "The Return of Hopeful Monsters," p. 23.

- *"The extreme rarity of transitional forms in the fossil record persists as the trade secret of paleontology. The evolutionary trees that adorn our textbooks have data only at the tips and nodes of their branches; the rest is inference, however reasonable, not the evidence of fossils. … We fancy ourselves as the only true students of life's history, yet to preserve our favored account of evolution by natural selection we view our data as so bad that we never see the very process we profess to study."* Stephen Jay Gould, "Evolution's Erratic Pace," *Natural History*, Vol. 86, May 1977, p. 14.

  "New species almost always appeared suddenly in the fossil record with no intermediate links to ancestors in older rocks of the same region." Ibid., p. 12.

- *"The absence of fossil evidence for intermediary stages between major transitions in organic design, indeed our inability, even in our imagination, to construct functional intermediates in many cases, has been a persistent and* *nagging problem for gradualistic accounts of evolution."* Stephen Jay Gould, "Is a New and General Theory of Evolution Emerging?" *Paleobiology*, Vol. 6, No. 1, 1980, p. 127.

- In a published interview, Dr. Niles Eldredge, an invertebrate paleontologist at the American Museum of Natural History, stated:

  But the smooth transition from one form of life to another which is implied in the theory is ... not borne out by the facts. The search for "missing links" between various living creatures, like humans and apes, is probably fruitless ... because they probably never existed as distinct transitional types ... But no one has yet found any evidence of such transitional creatures. This oddity has been attributed to gaps in the fossil record which gradualists expected to fill when rock strata of the proper age had been found. In the last decade, however, geologists have found rock layers of all divisions of the last 500 million years and no transitional forms were contained in them. If it is not the fossil record which is incomplete then it must be the theory. "Missing, Believed Nonexistent," *Manchester Guardian* (The Washington Post Weekly), Vol. 119, 26 November 1978, p. 1.

  Gould and Eldredge claimed transitional fossils are missing because relatively rapid evolutionary jumps (which they called *punctuated equilibria*) occurred over these gaps. They did not explain how this could happen.

  Many geneticists are shocked by the proposal of Gould and Eldredge. Why would they propose something so contradictory to genetics? Gould and Eldredge were forced to say that evolution must proceed in jumps. Never explained, in genetic and mathematical terms, is how such large jumps could occur. To some, this desperation is justified.

- *"... the gradual morphological transitions between presumed ancestors and descendants, anticipated by most biologists, are missing."* David E. Schindel (Curator of Invertebrate Fossils, Peabody Museum of Natural History), "The Gaps in the Fossil Record," *Nature*, Vol. 297, 27 May 1982, p. 282.

- *"Despite the bright promise that paleontology provides a means of 'seeing' evolution, it has presented some nasty difficulties for evolutionists the most notorious of which is the presence of 'gaps' in the fossil record. Evolution requires intermediate forms between species and paleontology does not provide them."* David B. Kitts (School of Geology and Geophysics, University of Oklahoma), "Paleontology and Evolutionary Theory," *Evolution*, Vol. 28, September 1974, p. 467.

- *"In spite of the immense amount of the paleontological material and the existence of long series of intact stratigraphic sequences with perfect records for the lower categories, transitions between the higher categories are missing."* Goldschmidt, p. 98.

  "When a new phylum, class, or order appears, there follows a quick, explosive (in terms of geological time) diversification so that practically all orders or families known appear suddenly and without any apparent transitions." Ibid., p. 97.

- *"There is no fossil record establishing historical continuity of structure for most characters that might be used to assess relationships among phyla."* Katherine G. Field et al., "Molecular Phylogeny of the Animal Kingdom," *Science*, Vol. 239, 12 February 1988, p. 748.

b. *"The prokaryotes came first; eukaryotes (all plants, animals, fungi and protists) evolved from them, and to this day biologists hotly debate how this transition took place, with about 20 different theories on the go. ...* [What was thought to be an intermediate between prokaryotes and eukaryotes] *is no longer tenable."* Katrin Henze and William Martin, "Essence of Mitochondria," *Nature*, Vol. 426, 13 November 2003, p. 127.

c. If evolution happened, nonvascular plants should have preceded vascular plants. However, fossils of nonvascular plants are not found in strata evolutionists believe were deposited before the earliest vascular plants appeared.

  The bryophytes [nonvascular plants] *are presumed to have evolved before the appearance and stabilization of vascular tissue—that is, before the appearance of these tracheophytes* [vascular plants]*—although there is no early bryophyte* [nonvascular plant] *fossil record.* Lynn Margulis and Karlene V. Schwartz, p. 250.

  "The actual steps that led to the origin of seeds and fruits are not known ..." Ibid.

- *"It has long been hoped that extinct plants will ultimately reveal some of the stages through which existing groups have passed during the course of their development, but it must be freely admitted that this aspiration has been fulfilled to a very slight extent, even though paleobotanical research has been in progress for more than one hundred years. As yet we have not been able to trace the phylogenetic history of a single group of modern plants from its beginning to the present."* Chester A. Arnold, *An Introduction to Paleobotany* (New York: McGraw-Hill, 1947), p. 7.

- *"... to the unprejudiced, the fossil record of plants is in favour of special creation. If, however, another explanation could be found for this hierarchy of classification, it would be the knell* [the death signal] *of the theory of evolution. Can you imagine how an orchid, a duckweed, and a palm have come from the same ancestry, and have we any evidence for this assumption? The evolutionist must be prepared with an answer, but I think that most would break down before an inquisition. Textbooks hoodwink."* E. J. H. Corner, "Evolution," *Contemporary Botanical Thought*, editors Anna M. MacLeod and L. S. Cobley (Chicago: Quadrangle Books, 1961), p. 97.

- *"The absence of any known series of such intermediates imposes severe restrictions on morphologists interested in the ancestral source of angiosperms* [flowering plants] *and leads to speculation and interpretation of homologies and relationships on the basis of the most meager circumstantial* *evidence."* Charles B. Beck, *Origin and Early Evolution of Angiosperms* (New York: Columbia University Press, 1976), p. 5.

- *"The origin of angiosperms, an 'abominable mystery' to Charles Darwin, remained so 100 years later and is little better today."* Colin Patterson et al., "Congruence between Molecular and Morphological Phylogenies," *Annual Review of Ecology and Systematics*, Vol. 24, 1993, p. 170.

d. *"The insect fossil record has many gaps." "Insects: Insect Fossil Record," Britannica CD, Version 97* (Chicago: Encyclopaedia Britannica, Inc., 1997).

e. Speaking of the lack of transitional fossils between the invertebrates and vertebrates, Smith admits:

> *As our present information stands, however, the gap remains unbridged, and the best place to start the evolution of the vertebrates is in the imagination.* Homer W. Smith, *From Fish to Philosopher* (Boston: Little, Brown, and Co., 1953), p. 26.

- *"How this earliest chordate stock evolved, what stages of development it went through to eventually give rise to truly fishlike creatures we do not know. Between the Cambrian when it probably originated, and the Ordovician when the first fossils of animals with really fishlike characteristics appeared, there is a gap of perhaps 100 million years which we will probably never be able to fill."* Francis Downes Ommanney, *The Fishes*, Life Nature Library (New York: Time, Inc., 1963), p. 60.

- *"Origin of the vertebrates is obscure—there is no fossil record preceding the occurrence of fishes in the late Ordovician time."* Arthur N. Strahler, *Science and Earth History: The Evolution/Creation Controversy* (Buffalo, New York: Prometheus Books, 1987), p. 316.

f. *"... there are no intermediate forms between finned and limbed creatures in the fossil collections of the world."* Taylor, p. 60.

g. Evolutionists believe that amphibians evolved into reptiles, with either *Diadectes* or *Seymouria* as the transition. By the evolutionists' own time scale, this "transition" occurs 35 million years (m.y.) ***after*** the earliest reptile, *Hylonomus* (a cotylosaur). A parent cannot appear 35 million years after its child! The scattered locations of these fossils also present problems for the evolutionist.

Table 2. Reptile Transition?

What	Name	When	Where
Earliest Reptile	Hylonomus	lower Pennsylvanian 315 m.y.	Nova Scotia
Transition?	Diadectes	lower Permian 280 m.y.	Texas
Transition?	Seymouria	lower Permian 280 m.y.	Texas

[See Steven M. Stanley, *Earth and Life Through Time* (New York: W. H. Freeman and Co., 1986), pp. 411–415. See also Robert H. Dott Jr. and Roger L. Batten, *Evolution of the Earth*, 3rd edition (New York: McGraw-Hill, 1981), p. 356.]

It is true that skeletal features of some amphibians and some reptiles are similar. However, huge differences exist in their soft internal organs, such as their circulatory and reproductive systems. For example, no evolutionary scheme has ever been given for the development of the many unique innovations of the reptile's egg. [See Denton, pp. 218–219 and Pitman, pp. 199–200.]

h. *"Gaps at a lower taxonomic level, species and genera, are practically universal in the fossil record of the mammal-like reptiles. In no single adequately documented case is it possible to trace a transition, species by species, from one genus to another."* Thomas S. Kemp, *Mammal-Like Reptiles and the Origin of Mammals* (New York: Academic Press, 1982), p. 319.

i. *"The* [evolutionary] *origin of birds is largely a matter of deduction. There is no fossil evidence of the stages through which the remarkable change from reptile to bird was achieved."* W. E. Swinton, "The Origin of Birds," *Biology and Comparative Physiology of Birds*, editor A. J. Marshall (New York: Academic Press, 1960), Vol. 1, Chapter 1, p. 1.

- Some have claimed birds evolved from a two-legged dinosaur known as a *theropod*. However, several problems exist.
  - A theropod dinosaur fossil found in China showed a lung mechanism completely incompatible with that of birds. [See John A. Ruben et al., "Lung Structure and Ventilation in Theropod Dinosaurs and Early Birds, *Science*, Vol. 278, 14 November 1997, pp. 1267–1270.] In that report, *"Ruben argues that a transition from a crocodilian to a bird lung would be impossible, because the transitional animal would have a life-threatening hernia or hole in its diaphragm."* [Ann Gibbons, "Lung Fossils Suggest Dinos Breathed in Cold Blood," *Science*, Vol. 278, 14 November 1997, p. 1230.]
  - Bird and theropod "hands" differ. Theropods have "fingers" I, II, and III (having lost the "ring finger" and little finger), while birds have fingers II, III, and IV. *"The developmental evidence of homology is problematic for the hypothesized theropod origin of birds."* [Ann C. Burke and Alan Feduccia, "Developmental Patterns and the Identification of Homologies in the Avian Hand," *Science*, Vol. 278, 24 October 1997, pp. 666–668.] *"... this important developmental evidence that birds have a II-III-IV digital formula, unlike the dinosaur I-II-III, is the most important barrier to belief in the dinosaur origin* [for birds] *orthodoxy."* [Richard Hinchliffe, "The Forward March of the Bird-Dinosaurs Halted?" *Science*, Vol. 278, 24 October 1997, p. 597.]
  - Theropod "arms" (relative to body size) are tiny, compared with the wings of supposedly early birds.
  - *"... most theropod dinosaurs and in particular the birdlike dromaeosaurs are all very much later in the fossil record than Archaeopteryx* [the supposed first bird]*."* Hinchliffe, p. 597.
  - See **"What Was Archaeopteryx?"** on pages 394–397.
  - Birds have many unique features difficult to explain from any evolutionary perspective, such as feathers, tongues, and egg shell designs.

j. *"When and where the first Primates made their appearance is also conjectural. ... It is clear, therefore, that the earliest Primates are not yet known ..."* William Charles Osman Hill, *Primates* (New York: Interscience Publishers, Inc., 1953), Vol. 1, pp. 25–26.

- *"The transition from insectivore to primate is not clearly documented in the fossil record."* A. J. Kelso, *Physical Anthropology*, 2nd edition (New York: J. B. Lippincott Co., 1974), p. 141.

- *"Modern apes, for instance, seem to have sprung out of nowhere. They have no yesterday, no fossil record. And the true origin of modern humans—of upright, naked, toolmaking, big-brained beings—is, if we are to be honest with ourselves, an equally mysterious matter."* Lyall Watson, "The Water People," *Science Digest*, May 1982, p. 44.

k. *"At any rate, modern gorillas, orangs and chimpanzees spring out of nowhere, as it were. They are here today; they have no yesterday, unless one is able to find faint foreshadowings of it in the dryopithecids."* Donald Johanson and Maitland Edey, *Lucy: The Beginnings of Humankind* (New York: Simon and Schuster, 1981; reprint, New York: Warner Books, 1982), p. 363.

l. *"It may, therefore, be firmly maintained that it is not even possible to make a caricature of an evolution out of palaeobiological facts. The fossil material is now so complete that it has been possible to construct new classes and the lack of transitional series cannot be explained as due to the scarcity of the material. The deficiencies are real; they will never be filled."* Nilsson, p. 1212.

- *"... experience shows that the gaps which separate the highest categories may never be bridged in the fossil record. Many of the discontinuities tend to be more and more emphasized with increased collecting."* Norman D. Newell (former Curator of Historical Geology at the American Museum of Natural History), "The Nature of the Fossil Record," *Adventures in Earth History*, editor Preston Cloud (San Francisco: W. H. Freeman and Co., 1970), pp. 644–645.

- *"A person may choose any group of animals or plants, large or small, or pick one at random. He may then go to a library and with some patience he will be able to find a qualified author who says that the evolutionary origin of that form is not known."* Bolton Davidheiser, *Evolution and Christian Faith* (Phillipsburg, New Jersey: The Presbyterian and Reformed Publishing Co., 1969), p. 302.

  On pages 303–309, Davidheiser, a Ph.D. zoologist and creationist, lists 75 other forms of life whose ancestry is unknown.

24. Missing Trunk

a. *"There is another and allied difficulty, which is much more serious. I allude to the manner in which species belonging to several of the main divisions of the animal kingdom suddenly appear in the lowest known fossiliferous rocks."* Darwin, *The Origin of Species*, p. 348.

"The abrupt manner in which whole groups of species suddenly appear in certain formations, has been urged by several palaeontologists—for instance, by Agassiz, Pictet, and Sedgwick—as a fatal objection to the belief in the transmutation of species. If numerous species, belonging to the same genera or families, have really started into life at once, the fact would be fatal to the theory of evolution through natural selection." Ibid., p. 344.

"To the question why we do not find rich fossiliferous deposits belonging to these assumed earliest periods prior to the Cambrian system, I can give no satisfactory answer." Ibid., p. 350.

"The case at present must remain inexplicable, and may be truly urged as a valid argument against the views here entertained." Ibid., p. 351.

- *"The most famous such burst, the Cambrian explosion, marks the inception of modern multicellular life. Within just a few million years, nearly every major kind of animal anatomy appears in the fossil record for the first time ... The Precambrian record is now sufficiently good that the old rationale about undiscovered sequences of smoothly transitional forms will no longer wash."* Stephen Jay Gould, "An Asteroid to Die For," *Discover*, October 1989, p. 65.

- *"And we find many of them* [Cambrian fossils] *already in an advanced state of evolution, the very first time they appear. It is as though they were just planted there, without any evolutionary history. Needless to say, this appearance of sudden planting has delighted creationists."* Richard Dawkins, *The Blind Watchmaker* (London: W.W. Norton & Co., 1987), p. 229.

- Richard Monastersky, "Mysteries of the Orient," *Discover*, April 1993, pp. 38–48.

- *"One of the major unsolved problems of geology and evolution is the occurrence of diversified, multicellular marine invertebrates in Lower Cambrian rocks on all the continents and their absence in rocks of greater age."* Daniel I. Axelrod, "Early Cambrian Maine Fauna," *Science*, Vol. 128, 4 July 1958, p. 7.

- *"Evolutionary biology's deepest paradox concerns this strange discontinuity. Why haven't new animal body plans continued to crawl out of the evolutionary cauldron during the past hundreds of millions of years? Why are the ancient body plans so stable?"* Jeffrey S. Levinton, "The Big Bang of Animal Evolution," *Scientific American*, Vol. 267, November 1992, p. 84.

- *"Granted an evolutionary origin of the main groups of animals, and not an act of special creation, the absence of any record whatsoever of a single member of any of the phyla in the Pre-Cambrian rocks remains as inexplicable on orthodox grounds as it was to Darwin."* T. Neville George, "Fossils in Evolutionary Perspective," *Science Progress*, Vol. 48, January 1960, p. 5.

b. Strange Cambrian fossils, thought to exist only in the Burgess Shale of western Canada, have been discovered in southern China. See:
   - L. Ramsköld and Hou Xianguang, "New Early Cambrian Animal and Onychophoran Affinities of Enigmatic Metazoans," *Nature*, Vol. 351, 16 May 1991, pp. 225–228.
   - Jun-yuan Chen et al., "Evidence for Monophyly and Arthropod Affinity of Cambrian Giant Predators," *Science*, Vol. 264, 27 May 1994, pp. 1304–1308.

   Evolving so many unusual animals during a geologic period is mind-boggling. But doing it twice in widely separated locations stretches credulity to the breaking point. According to the theory of plate tectonics, China and Canada were even farther apart during the Cambrian.

c. *"... it is well known that the fossil record tells us nothing about the evolution of flowering plants."* Corner, p. 100.

- A. K. Ghosh and A. Bose, "Occurrence of Microflora in the Salt Pseudomorph Beds, Salt Range, Punjab," *Nature*, Vol. 160, 6 December 1947, pp. 796–797.

- A. K. Ghosh, J. Sen, and A. Bose, "Evidence Bearing on the Age of the Saline Series in the Salt Range of the Punjab," *Geological Magazine*, Vol. 88, March–April 1951, pp. 129–133.

- J. Coates et al., "Age of the Saline Series in the Punjab Salt Range," *Nature*, Vol. 155, 3 March 1945, pp. 266–267.

- Clifford Burdick, in his doctoral research at the University of Arizona in 1964, made discoveries similar to those cited above. [See Clifford Burdick, "Microflora of the Grand Canyon," *Creation Research Society Quarterly*, Vol. 3, May 1966, pp. 38–50.] Burdick was denied a doctor's degree at the University of Arizona because of these discoveries. [See Jerry Bergman, "Clifford Burdick: Unjustly Expelled Twice," Parts I and II, *Creation Matters*, September/October and July/August 2010.

d. S. Leclercq, "Evidence of Vascular Plants in the Cambrian," *Evolution*, Vol. 10, June 1956, pp. 109–114.

e. John E. Repetski, "A Fish from the Upper Cambrian of North America," *Science*, Vol. 200, 5 May 1978, pp. 529–531.

- *"Vertebrates and their progenitors, according to the new studies, evolved in the Cambrian, earlier than paleontologists have traditionally assumed."* Richard Monastersky, "Vertebrate Origins: The Fossils Speak Up," *Science News*, Vol. 149, 3 February 1996, p. 75.

- *"Also, the animal explosion caught people's attention when the Chinese confirmed they found a genus now called Yunnanzoon that was present in the very beginning. This genus is considered a chordate, and the phylum Chordata includes fish, mammals and man. An evolutionist would say the ancestor of humans was present then. Looked at more objectively, you could say the most complex animal group, the chordates, were represented at the beginning, and they did not go through a slow gradual evolution to become a chordate."* Paul Chien (Chairman, Biology Department, University of San Francisco), "Explosion of Life," www.origins.org/articles/chien_explosionoflife.html, p. 3. Interviewed 30 June 1997.

- *"At 530 million years, the 3-centimeter-long Haikouichthys appears to be the world's oldest fish, while another new specimen, Myllokunmingia, has simpler gills and is more primitive. To Conway Morris and others, the presence of these jawless fish in the Early Cambrian suggests that the origin of chordates lies even farther back in time."* Erik Stokstad, "Exquisite Chinese Fossils Add New Pages to Book of Life," *Science*, Vol. 291, 12 January 2001, p. 233.

- *"The* [500] *specimens* [of fish] *may have been buried alive, possibly as a result of a storm-induced burial. ... The possession of eyes (and probably nasal sacs) is consistent with Haikouichthys being a craniate, indicating that vertebrate evolution was well advanced by the Early Cambrian."* D. G. Shu et al., "Head and Backbone of the Early Cambrian Vertebrate *Haikouichthys*," *Nature*, Vol. 421, 30 January 2003, pp. 527, 529.

- D. G. Shu et al., "Lower Cambrian Vertebrates from South China," *Nature*, Vol. 402, 4 November 1999, pp. 42–46.

f. *"Compared with the 30 or so extant phyla, some people estimate that the Cambrian explosion may have generated as many as 100."* Roger Lewin, "A Lopsided Look at Evolution," *Science*, Vol. 241, 15 July 1988, p. 291.

- *"A simple way of putting it is that currently we have about 38 phyla of different groups of animals, but the total number of phyla discovered during that period of time* [Cambrian] *(including those in China, Canada, and elsewhere) adds up to over 50 phyla. That means* [there are] *more phyla in the very, very beginning, where we found the first fossils* [of animal life]*, than exist now.*

  "Stephen Jay Gould has referred to this as the reverse cone of diversity. The theory of evolution implies that things get more complex and get more and more diverse from one single origin. But the whole thing turns out to be reversed—we have more diverse groups in the very beginning, and in fact more and more of them die off over time, and we have less and less now." Chien, p. 2.

  "It was puzzling for a while because they [evolutionary paleontologists] *refused to see that in the beginning there could be more complexity than we have now. What they are seeing are phyla that do not exist now—that's more than 50 phyla compared to the 38 we have now."* Ibid., p. 3.

g. *"But whatever ideas authorities may have on the subject, the lung-fishes, like every other major group of fishes that I know, have their origins firmly based in* ***nothing****, a matter of hot dispute among the experts, each of whom is firmly convinced that everyone else is wrong ... I have often thought of how little I should like to have to prove organic evolution in a court of law."* [emphasis in original] Errol White, "A Little on Lung-Fishes," *Proceedings of the Linnean Society of London*, Vol. 177, Presidential Address, January 1966, p. 8.

- *"The geological record has so far provided no evidence as to the origin of the fishes ..."* J. R. Norman, *A History of Fishes*, 3rd edition (New York: John Wiley & Sons, 1975), p. 343.

- *"All three subdivisions of the bony fishes first appear in the fossil record at approximately the same time. They are already widely divergent morphologically, and they are heavily armored. How did they originate? What allowed them to diverge so widely? How did they all come to have heavy armor? And why is there no trace of earlier, intermediate forms?"* Gerald T. Todd, "Evolution of the Lung and the Origin of Bony Fishes—A Causal Relationship?" *American Zoologist*, Vol. 20, No. 4, 1980, p. 757.

h. Cloud and Glaessner, pp. 783–792.

i. *"There are no fossils known that show what the primitive ancestral insects looked like ... Until fossils of these ancestors are discovered, however, the early history of the insects can only be inferred."* Peter Farb, *The Insects*, Life Nature Library (New York: Time, Inc., 1962), pp. 14–15.

- *"There is, however, no fossil evidence bearing on the question of insect origin; the oldest insects known show no transition to other arthropods."* Frank M. Carpenter, "Fossil Insects," *Insects* (Washington, D.C.: U.S. Government Printing Office, 1952), p. 18.

j. *"For the most part, an ant* [trapped in amber] *living 100 million years ago looks like an ant today."* Paul Tafforeau, as quoted by Amy Barth, *Discover*, July/August 2009, p. 38.

k. *"If there has been evolution of life, the absence of the requisite fossils in the rocks older than the Cambrian is puzzling."* Marshall Kay and Edwin H. Colbert, *Stratigraphy and Life History* (New York: John Wiley & Sons, 1965), p. 103.

25. Out-of-Place Fossils

a. Walter E. Lammerts has published eight lists totaling almost 200 wrong-order formations in the United States alone. [See "Recorded Instances of Wrong-Order Formations or Presumed Overthrusts in the United States: Parts I–VIII," *Creation Research Society Quarterly*, September 1984, p. 88; December 1984, p. 150; March 1985, p. 200; December 1985, p. 127; March 1986, p. 188; June 1986, p. 38; December 1986, p. 133; and June 1987, p. 46.]

- *"In the fossil record, we are faced with many sequences of change: modifications over time from A to B to C to D can be documented and a plausible Darwinian interpretation can often be made after seeing the sequence. But the predictive (or postdictive) power of theory is almost nil."* David M. Raup, "Evolution and the Fossil Record, *Science*, Vol. 213, 17 July 1981, p. 289.

- *"Fossil discoveries can muddle our attempts to construct simple evolutionary trees—fossils from key periods are often not intermediates, but rather hodgepodges of defining features of many different groups."* Neil Shubin, "Evolutionary Cut and Paste," *Nature*, Vol. 394, 2 July 1998, p. 12.

b. Y. Kruzhilin and V. Ovcharov, "A Horse from the Dinosaur Epoch?" *Moskovskaya Pravda* [*Moscow Truth*], 5 February 1984.

c. Edwin D. McKee, *The Supai Group of Grand Canyon*, Geological Survey Professional Paper 1173 (Washington, D.C.: U.S. Government Printing Office, 1982), pp. 93–96, 100.

d. Alexander Romashko, "Tracking Dinosaurs," *Moscow News*, No. 24, 1983, p. 10. [For an alternate but equivalent translation published by an anti-creationist organization, see Frank Zindler, "Man—A Contemporary of the Dinosaurs?" *Creation/Evolution*, Vol. 6, No. 1, 1986, pp. 28–29.]

e. Paul O. Rosnau et al., "Are Human and Mammal Tracks Found Together with the Tracks of Dinosaurs in the Kayenta of Arizona?" Parts I and II, *Creation Research Society Quarterly*, Vol. 26, September 1989, pp. 41–48 and December 1989, pp. 77–98.

- Jeremy Auldaney et al., "More Human-Like Track Impressions Found with the Tracks of Dinosaurs in the Kayenta Formation at Tuba City Arizona," *Creation Research Society Quarterly*, Vol. 34, December 1997, pp. 133–146 and back cover.

f. Andrew Snelling, "Fossil Bluff," *Ex Nihilo*, Vol. 7, March 1985, p. 8.

- Carol Armstrong, "Florida Fossils Puzzle the Experts," *Creation Research Society Quarterly*, Vol. 21, March 1985, pp. 198–199.

- Pat Shipman, "Dumping on Science," *Discover*, December 1987, p. 64.

g. Francis S. Holmes, *Phosphate Rocks of South Carolina and the "Great Carolina Marl Bed"* (Charleston, South Carolina: Holmes' Book House, 1870).

- Edward J. Nolan, "Remarks on Fossils from the Ashley Phosphate Beds," *Proceedings of the Academy of Natural Sciences of Philadelphia*, 1876, pp. 80–81.

- John Watson did extensive library research on the relatively unknown fossil discoveries in these beds. Their vast content of bones provides the rich phosphate content. Personal communications, 1992.

h. A. C. Noé, "A Paleozoic Angiosperm," *Journal of Geology*, Vol. 31, May–June 1923, pp. 344–347.

i. *"A type of amber thought to have been invented by flowering plants may have been en vogue millions of years before those plants evolved ... When the researchers analyzed the amber, though, they discovered a chemical signature know only from the amber of flowering plants."* Rachel Ehrenberg, "Flowerless Plants Also Made Form of Fancy Amber," *Science News*, Vol. 176, 24 October 2009, p. 5.

- "[The Illinois amber] *has a molecular composition that has been seen only from angiosperms, which appeared much later in the Early Cretaceous. ...* [Amber resins] *are so diverse that those from each plant species have a distinctive Py-GC-MS fingerprint that can be used to identify the plants that produced various ambers around the world."* David Grimaldi, "Pushing Back Amber Production," *Science*, Vol. 326, 2 October 2009, p. 51.

j. R. M. Stainforth, "Occurrence of Pollen and Spores in the Roraima Formation of Venezuela and British Guiana," *Nature*, Vol. 210, 16 April 1966, pp. 292–294.

◆ A. K. Ghosh and A. Bose, pp. 796–797.

◆ A. K. Ghosh and A. Bose, "Spores and Tracheids from the Cambrian of Kashmir," *Nature*, Vol. 169, 21 June 1952, pp. 1056–1057.

◆ J. Coates et al., pp. 266–267.

k. George F. Howe et al., "A Pollen Analysis of Hakatai Shale and Other Grand Canyon Rocks," *Creation Research Society Quarterly*, Vol. 24, March 1988, pp. 173–182.

l. Stephen T. Hasiotis (paleobiologist, U.S. Geological Survey, Denver), Personal communication, 27 May 1995.

◆ Carl Zimmer, "A Secret History of Life on Land," *Discover*, February 1998, pp. 76–83.

m. Dong Ren, "Flower-Associated Brachycera Flies as Fossil Evidence for Jurassic Angiosperm Origins," *Science*, Vol. 280, 3 April 1998, pp. 85–88.

26. Ape-Men?

a. *"… existing phylogenetic hypotheses about human evolution* [based on skulls and teeth] *are unlikely to be reliable."* Mark Collard and Bernard Wood, "How Reliable Are Human Phylogenetic Hypotheses?" *Proceedings of the National Academy of Sciences*, Vol. 97, 25 April 2000, p. 5003.

◆ In 1995, nine anthropologists announced their discovery of early representatives of *Homo habilis* and *Homo ergaster* in China. [See Huang Wanpo et al., "Early Homo and Associated Artifacts from Asia," *Nature*, Vol. 378, 16 November 1995, pp. 275–278.] Fourteen years later the same journal published a retraction. The discovery was of a "mystery ape." [See Russell L. Ciochon, "The Mystery Ape of Pleistocene Asia," *Nature*, Vol. 459, 18 June 2009, pp. 910–911.]

How many more mystery apes are there, and do they explain other so-called "ape-men"?

b. *"Fossil evidence of human evolutionary history is fragmentary and open to various interpretations. Fossil evidence of chimpanzee evolution is absent altogether."* Henry Gee, "Return to the Planet of the Apes," *Nature*, Vol. 412, 12 July 2001, p. 131.

c. Lord Zuckerman candidly stated that if special creation did not occur, then no scientist could deny that man evolved from some apelike creature *"without leaving any fossil traces of the steps of the transformation."* Solly Zuckerman (former Chief Scientific Advisor to the British Government and Honorary Secretary of the Zoological Society of London), *Beyond the Ivory Tower* (New York: Taplinger Publishing Co., 1970), p. 64.

◆ Bowden, pp. 56–246.

◆ Duane T. Gish, *Battle for Creation*, Vol. 2, editor Henry M. Morris (San Diego: Creation-Life Publishers, 1976), pp. 193–200, 298–305.

d. Speaking of Piltdown man, Lewin admits a common human problem even scientists have:

> *How is it that trained men, the greatest experts of their day, could look at a set of modern human bones—the cranial fragments—and "see" a clear simian signature in them; and "see" in an ape's jaw the unmistakable signs of humanity? The answers, inevitably, have to do with the scientists' expectations and their effects on the interpretation of data.* Lewin, *Bones of Contention*, p. 61.

◆ Since 1953, when Piltdown man was discovered to be a hoax, at least eleven people have been accused of perpetrating the hoax. These included Charles Dawson, Pierre Teilhard de Chardin, and Sir Arthur Conan Doyle, creator of Sherlock Holmes.

The hoaxer now appears to have been Martin A. C. Hinton, who had a reputation as a practical joker and worked in the British Museum (Natural History) when Piltdown man was discovered. In the mid-1970s, an old trunk, marked with Hinton's initials, was found in the museum's attic. The trunk contained bones stained and carved in the same detailed way as the Piltdown bones. [For details, see Henry Gee, "Box of Bones 'Clinches' Identity of Piltdown Palaeontology Hoaxer," *Nature*, Vol. 381, 23 May 1996, pp. 261–262.]

e. Allen L. Hammond, "Tales of an Elusive Ancestor," *Science 83*, November 1983, pp. 37, 43.

f. Adrienne L. Zihlman and J. Lowenstein, "False Start of the Human Parade," *Natural History*, Vol. 88, August–September 1979, pp. 86–91.

g. Hammond, p. 43.

◆ *"The dethroning of Ramapithecus—from putative* [supposed] *first human in 1961 to extinct relative of the orangutan in 1982—is one of the most fascinating, and bitter, sagas in the search for human origins."* Lewin, *Bones of Contention*, p. 86.

h. Java man consisted of two bones found about 39 feet apart: a skull cap and femur (thighbone). Rudolf Virchow, the famous German pathologist, believed that the femur was from a gibbon. By concurring, Dubois supported his own non-Darwinian theory of evolution—a theory too complex and strange to discuss here.

Whether or not the bones were from a large-brained gibbon, a hominid, another animal, or two completely different animals is not the only issue. This episode shows how easily the person who knew the bones best could shift his interpretation from Java "man" to Java "gibbon." Even after more finds were made at other sites in Java, the total evidence was so fragmentary that many interpretations were possible.

◆ *"Pithecanthropus* [Java man] *was not a man, but a gigantic genus allied to the Gibbons, superior to its near relatives on* *account of its exceedingly large brain volume, and distinguished at the same time by its erect attitude."* Eugene Dubois, "On the Fossil Human Skulls Recently Discovered in Java and Pithecanthropus Erectus," *Man*, Vol. 37, January 1937, p. 4.

"Thus the evidence given by those five new thigh bones of the morphological and functional distinctness of Pithecanthropus erectus furnishes proof, at the same time, of its close affinity with the gibbon group of anthropoid apes." Ibid., p. 5.

- *"The success of Darwinism was accompanied by a decline in scientific integrity ... A striking example, which has only recently come to light, is the alteration of the Piltdown skull so that it could be used as evidence for the descent of man from the apes; but even before this a similar instance of tinkering with evidence was finally revealed by the discoverer of Pithecanthropus* [Java man]*, who admitted, many years after his sensational report, that he had found in the same deposits bones that are definitely human."* W. R. Thompson, p. 17.

  W. R. Thompson, in his "Introduction to *The Origin of Species*" by Charles Darwin, refers to Dubois' discovery in November 1890 of part of a lower jaw containing the stump of a tooth. This was found at Kedung-Brubus (also spelled *Kedeong Broboes*), 25 miles east of his find of Java "man" at Trinil, eleven months later. Dubois was confident it was a human jaw of Tertiary age. [See Herbert Wendt, *In Search of Adam* (Westport, Connecticut: Greenwood Publishers, 1955), pp. 293–294.] Dubois' claims of finding "the missing link" would probably have been ignored if he had mentioned this jaw. Similar, but less convincing, charges have been made against Dubois concerning his finding of obvious human skulls at Wadjak, 60 miles from Trinil.

- C. L. Brace and Ashley Montagu, *Human Evolution*, 2nd edition (New York: Macmillan Publishing Co., 1977), p. 204.
- Bowden, pp. 138–142, 144–148.
- Hitching, pp. 208–209.
- Patrick O'Connell, *Science of Today and the Problems of Genesis*, 2nd edition (Roseburg, Oregon: self-published, 1969), pp. 139–142.

i. Ibid., pp. 108–138.

- Bowden, pp. 90–137.
- Marcellin Boule and Henri V. Vallois, *Fossil Men* (New York: The Dryden Press, 1957), p. 145.

j. "[The reanalysis of Narmada Man] *puts another nail in the coffin of Homo erectus as a viable taxon."* Kenneth A. R. Kennedy, as quoted in "*Homo Erectus* Never Existed?" *Geotimes*, October 1992, p. 11.

k. Donald C. Johanson et al., "New Partial Skeleton of *Homo Habilis* from Olduvai Gorge, Tanzania," *Nature*, Vol. 327, 21 May 1987, pp. 205–209.

l. *"We present a revised definition, based on verifiable criteria, for Homo and conclude that two species, Homo habilis and Homo rudolfensis, do not belong in the genus* [Homo]*."* Bernard Wood and Mark Collard, "The Human Genus," *Science*, Vol. 284, 2 April 1999, p. 65.

m. Dr. Charles Oxnard and Sir Solly Zuckerman, referred to below, were leaders in the development of a powerful multivariate analysis technique. A computer simultaneously performs millions of comparisons on hundreds of corresponding dimensions of the bones of living apes, humans, and the australopithecines. Their verdict, that the australopithecines are not intermediate between man and living apes, is quite different from the more subjective and less analytical visual techniques of most anthropologists. To my knowledge, this technique has not been applied to the most famous australopithecine, commonly known as "Lucy."

- *"... the only positive fact we have about the Australopithecine brain is that it was no bigger than the brain of a gorilla. The claims that are made about the human character of the Australopithecine face and jaws are no more convincing than those made about the size of its brain. The Australopithecine skull is in fact so overwhelmingly simian as opposed to human that the contrary proposition could be equated to an assertion that black is white."* Zuckerman, p. 78.
- *"Let us now return to our original problem: the Australopithecine fossils. I shall not burden you with details of each and every study that we have made, but ... the conventional wisdom is that the Australopithecine fragments are generally rather similar to humans and when different deviate somewhat towards the condition in the African apes, the new studies point to different conclusions. The new investigations suggest that the fossil fragments are usually uniquely different from any living form ..."* Charles E. Oxnard (Dean of the Graduate School, University of Southern California, Los Angeles, and from 1973 to 1978 a Dean at the University of Chicago), "Human Fossils: New Views of Old Bones," *The American Biology Teacher*, Vol. 41, May 1979, p. 273.
- Charles E. Oxnard, "The Place of the Australopithecines in Human Evolution: Grounds for Doubt?" *Nature*, Vol. 258, 4 December 1975, pp. 389–395.
- *"For my own part, the anatomical basis for the claim that the Australopithecines walked and ran upright like man is so much more flimsy than the evidence which points to the conclusion that their gait was some variant of what one sees in subhuman Primates, that it remains unacceptable."* Zuckerman, p. 93.
- *"His Lordship's* [Sir Solly Zuckerman's] *scorn for the level of competence he sees displayed by paleoanthropologists is legendary, exceeded only by the force of his dismissal of the australopithecines as having anything at all to do with human evolution. 'They are just bloody apes,' he is reputed to have observed on examining the australopithecine remains in South Africa."* Lewin, *Bones of Contention*, pp. 164–165.
- *"This Australopithecine material suggests a form of locomotion that was not entirely upright nor bipedal. The Rudolf Australopithecines, in fact, may have been close to*

the 'knuckle-walker' condition, not unlike the extant African apes." Richard E. F. Leakey, "Further Evidence of Lower Pleistocene Hominids from East Rudolf, North Kenya," *Nature*, Vol. 231, 28 May 1971, p. 245.

n. *"Among the fossil hominids, the australopithecines show great-ape-like proportions* [based on CAT scans of their inner ears] *and H. erectus shows modern-human-like proportions."* Fred Spoor et al., "Implications of Early Hominid Labyrinthine Morphology for Evolution of Human Bipedal Locomotion," *Nature*, Vol. 369, 23 June 1994, p. 646. [Many *H. erectus* bones are probably those of *H. sapiens.*]

o. *"The closest parallel today to the pattern of dental development of* [australopithecines] *is not in people but in chimpanzees."* Bruce Bower, "Evolution's Youth Movement," *Science News*, Vol. 159, 2 June 2001, p. 347.

p. William L. Jungers, "Lucy's Limbs: Skeletal Allometry and Locomotion in *Australopithecus Afarensis*," *Nature*, Vol. 297, 24 June 1982, pp. 676–678.

◆ Jeremy Cherfas, "Trees Have Made Man Upright," *New Scientist*, Vol. 93, 20 January 1983, pp. 172–178.

◆ Jack T. Stern Jr. and Randall L. Susman, "The Locomotor Anatomy of *Australopithecus Afarensis*," *American Journal of Physical Anthropology*, Vol. 60, March 1983, pp. 279–317.

q. Adrienne Zihlman, "Pigmy Chimps, People, and the Pundits," *New Scientist*, Vol. 104, 15 November 1984, pp. 39–40.

r. *"At present we have no grounds for thinking that there was anything distinctively human about australopithecine ecology and behavior. …* [T]*hey were surprisingly apelike in skull form, premolar dentition, limb proportions, and morphology of some joint surfaces, and they may still have been spending a significant amount of time in the trees."* Matt Cartmill et al., "One Hundred Years of Paleoanthropology," *American Scientist*, Vol. 74, July–August 1986, p. 417.

◆ *"The proportions calculated for africanus turned out to be amazingly close to those of a chimpanzee, with big arms and small legs. … 'One might say we are kicking Lucy out of the family tree,' says Berger."* James Shreeve, "New Skeleton Gives Path from Trees to Ground an Odd Turn," *Science*, Vol. 272, 3 May 1996, p. 654.

◆ *"There is indeed, no question which the Australopithecine skull resembles when placed side by side with specimens of human and living ape skulls. It is the ape—so much so that only detailed and close scrutiny can reveal any differences between them."* Solly Zuckerman, "Correlation of Change in the Evolution of Higher Primates," *Evolution as a Process*, editors Julian Huxley, A. C. Hardy, and E. B. Ford (London: George Allen and Unwin Ltd., 1954), p. 307.

"We can safely conclude from the fossil hominoid material now available that in the history of the globe there have been many more species of great ape than just the three which exist today." Ibid., pp. 348–349.

s. Francis Ivanhoe, "Was Virchow Right About Neanderthal?" *Nature*, Vol. 227, 8 August 1970, pp. 577–578.

◆ William L. Straus Jr. and A. J. E. Cave, "Pathology and the Posture of Neanderthal Man," *The Quarterly Review of Biology*, Vol. 32, December, 1957, pp. 348–363.

◆ Bruce M. Rothschild and Pierre L. Thillaud, "Oldest Bone Disease," *Nature*, Vol. 349, 24 January 1991, p. 288.

t. Jack Cuozzo, *Buried Alive: The Startling Truth about Neanderthal Man* (Green Forest, Arkansas: Master Books, 1998).

◆ Jack Cuozzo, "Early Orthodontic Intervention: A View from Prehistory," *The Journal of the New Jersey Dental Association*, Vol. 58, No. 4, Autumn 1987, pp. 33–40.

u. Boyce Rensberger, "Facing the Past," *Science 81*, October 1981, p. 49.

27. Fossil Man

a. Bowden, pp. 78–79.

◆ Frank W. Cousins, *Fossil Man* (Emsworth, England: A. E. Norris & Sons Ltd., 1971),pp. 48–50, 81.

◆ Sir Arthur Keith correctly stated the dilemma evolutionists face with the Castenedolo skeletons.

> *As the student of prehistoric man reads and studies the records of the "Castenedolo" find, a feeling of incredulity rises within him. He cannot reject the discovery as false without doing an injury to his sense of truth, and he cannot accept it as a fact without shattering his accepted beliefs.* Arthur Keith, *The Antiquity of Man* (London: Williams and Norgate, Ltd., 1925), p. 334.

However, after examining the strata above and below the Castenedolo skeletons, and after finding no indication that they were intrusively buried, Keith surprisingly concluded that the enigma must be resolved by an intrusive burial. He justified this by citing the unfossilized condition of the bones. However, these bones were encased in a clay layer. Clay would prevent water from transporting large amounts of dissolved minerals into the bone cells and explain the lack of fossilization. Again, fossilization depends much more on chemistry than age.

b. Bowden, pp. 183–193.

c. Ibid., pp. 79–88.

◆ J. D. Whitney, "The Auriferous Gravels of the Sierra Nevada of California," *Memoirs of the Museum of Comparative Zoology of Harvard College*, Vol. 6, 1880, pp. 258–288.

◆ Bowden, pp. 76–78.

◆ Cousins, pp. 50–52, 82, 83.

◆ W. H. B., "Alleged Discovery of An Ancient Human Skull in California," *American Journal of Science*, Vol. 2, 1866, p. 424.

- Edward C. Lain and Robert E. Gentet, "The Case for the Calaveras Skull," *Creation Research Society Quarterly*, Vol. 33, March 1997, pp. 248–256.

- Cousins and Whitney state that the Calaveras was fossilized. This does not mean that it was preflood. Fossilization depends on chemistry much more than time.

  For many years, a story circulated that the Calaveras skull, buried 130 feet below ground, was a practical joke. This tidy explanation conveniently overlooks the hundreds of human bones and artifacts (such as spearheads, mortars and pestles, and dozens of bowls made of stone) found in that part of California. These artifacts have been found over the years under undisturbed strata and a layer of basaltic lava that evolutionists would date at 25 million years old—too old to be human. See, for example:

  - Whitney, pp. 262–264, 266, 274–276.
  - G. Frederick Wright, *Man and the Glacial Period* (New York: D. Appleton and Co., 1897), pp. 294–301.
  - George F. Becker, "Antiquities from under Tuolumne Table Mountain in California," *Bulletin of the Geological Society of America*, Vol. 2, 20 February 1891, pp. 189–200.

d. Fix, pp. 98–105.

- J. B. Birdsell, *Human Evolution* (Chicago: Rand McNally, 1972), pp. 316–318.

28. Chemical Elements of Life

a. The four most abundant chemical elements, by weight, in the human body are oxygen (65%), carbon (18%), hydrogen (10%), and nitrogen (3%).

b. Carbon is only the 18th most abundant element, by weight, in the earth's crust. Furthermore, almost all carbon is tied up in organic matter, such as coal and oil, or in sediments deposited after life began, such as limestone or dolomite.

c. *"The cause of the initial rise in oxygen concentration presents a serious and unresolved quantitative problem."* Leigh Van Valen, "The History and Stability of Atmospheric Oxygen," *Science*, Vol. 171, 5 February 1971, p. 442.

d. Since 1930, knowledgeable evolutionists have realized that life could not have evolved in the presence of oxygen. [See **"Proteins"** on page 14.] If no oxygen was in the atmosphere as life evolved, how did the atmosphere get its oxygen?

   Cyanobacteria break down carbon dioxide and water and release oxygen. In 1987, William J. Schopf claimed that he and his graduate student had discovered fossils of 3.4-billion-year-old cyanobacteria. This, he said, is how the atmosphere gained its oxygen after these bacteria—shielded by a shallow sea from ultraviolet radiation—evolved. Evolutionists eagerly accepted this long-awaited discovery as a key part of their theory of how life evolved.

   Schopf's former graduate student and other experts have now charged Schopf with withholding evidence that those fossils were *not* cyanobacteria. Most experts feel betrayed by Schopf, who now accepts that his *"specimens were not oxygen-producing cyanobacteria after all."* [See Rex Dalton, "Squaring Up over Ancient Life," *Nature*, Vol. 417, 20 June 2002, pp. 782–784.] A foundational building block in the evolution story—that had become academic orthodoxy—has crumbled.

e. Hitching, p. 65.

f. *"If there ever was a primitive soup* [to provide the chemical compounds for evolving life]*, then we would expect to find at least somewhere on this planet either massive sediments containing enormous amounts of the various nitrogenous organic compounds, amino acids, purines, pyrimidines and the like, or alternatively in much metamorphosed sediments we should find vast amounts of nitrogenous cokes. In fact no such materials have been found anywhere on earth. Indeed to the contrary, the very oldest of sediments … are extremely short of nitrogen."* J. Brooks and G. Shaw, *Origin and Development of Living Systems* (New York: Academic Press, 1973), p. 359.

- *"No evidence exists that such a soup ever existed."* Abel and Trevors, p. 3.

g. *"The acceptance of this theory* [life's evolution on earth] *and its promulgation by many workers* [scientists and researchers] *who have certainly not always considered all the facts in great detail has in our opinion reached proportions which could be regarded as dangerous."* Ibid., p. 355.

   Certainly, ignoring indisputable, basic evidence in most scientific fields is expensive and wasteful. Failure to explain the evidence to students betrays a trust and misleads future teachers and leaders.

   Readers should consider why, despite the improbabilities and lack of proper chemistry, many educators and the media have taught for a century that life evolved on earth. Abandoning or questioning that belief leaves only one strong contender—creation.Questioning evolution in some circles invites ostracism, much like stating that the proverbial emperor "has no clothes."

29. Proteins

a. An authoritative study concluded that the early biosphere contained oxygen before the earliest fossils (bacteria) formed. Iron oxides were found that *"imply a source of oxygen enough to convert into insoluble ferric material the ferrous solutions that must have first formed the flat, continuous horizontal layers that can in some sites be traced over hundreds of kilometers."* Philip Morrison, "Earth's Earliest Biosphere," *Scientific American*, Vol. 250, April 1984, pp. 30–31.

- Charles F. Davidson, "Geochemical Aspects of Atmospheric Evolution," *Proceedings of the National Academy of Sciences*, Vol. 53, 15 June 1965, pp. 1194–1205.

- Steven A. Austin, "Did the Early Earth Have a Reducing Atmosphere?" *ICR Impact*, No. 109, July 1982.

- *"In general, we find no evidence in the sedimentary distributions of carbon, sulfur, uranium, or iron, that an oxygen-free atmosphere has existed at any time during the span of geological history recorded in well-preserved sedimentary rocks."* Erich Dimroth and Michael M. Kimberley, "Precambrian Atmospheric Oxygen: Evidence in the Sedimentary Distributions of Carbon, Sulfur, Uranium, and Iron," *Canadian Journal of Earth Sciences*, Vol. 13, September 1976, p. 1161.

- *"What is the evidence for a primitive methane-ammonia atmosphere on earth? The answer is that there is* ***no*** *evidence for it, but much against it."* [emphasis in original] Philip H. Abelson, "Chemical Events on the Primitive Earth," *Proceedings of the National Academy of Sciences*, Vol. 55, June 1966, p. 1365.

b. R. T. Brinkmann, "Dissociation of Water Vapor and Evolution of Oxygen in the Terrestrial Atmosphere," *Journal of Geophysical Research*, Vol. 74, 20 October 1969, pp. 5355–5368.

c. *"It is difficult to imagine how a little pond with just these components, and no others* [no contaminants]*, could have formed on the primitive earth. Nor is it easy to see exactly how the precursors would have arisen."* Francis Crick, *Life Itself* (New York: Simon and Schuster, 1981), p. 85.

d. *"But when multiple biopolymers must all converge at the same place at the same time to collectively interact in a controlled biochemical cooperative manner, faith in 'self-organization' becomes 'blind belief.' No empirical data or rational scientific basis exists for such a metaphysical leap."* Abel and Trevors, p. 9.

e. *"I believe this* [the overwhelming tendency for chemical reactions to move in the direction opposite to that required for the evolution of life] *to be the most stubborn problem that confronts us—the weakest link at present in our argument* [for the origin of life]*."* George Wald, "The Origin of Life," p. 50.

f. *"The conclusion from these arguments presents the most serious obstacle, if indeed it is not fatal, to the theory of spontaneous generation. First, thermodynamic calculations predict vanishingly small concentrations of even the simplest organic compounds. Secondly, the reactions that are invoked to synthesize such compounds are seen to be much more effective in decomposing them."* D. E. Hull, "Thermodynamics and Kinetics of Spontaneous Generation," *Nature*, Vol. 186, 28 May 1960, p. 694.

- Pitman, p. 140.

- Duane T. Gish, *Speculations and Experiments Related to Theories on the Origin of Life*, ICR Technical Monograph, No. 1 (El Cajon, California: Institute for Creation Research, 1972).

g. *"An honest man, armed with all the knowledge available to us now, could only state that in some sense, the origin of life appears at the moment to be almost a miracle, so many are the conditions which would have had to have been satisfied to get it going."* Crick, p. 88.

Francis Crick, a Nobel Prize winner and the co-discoverer of the DNA molecule, did not give up. He reasoned that if life could not have evolved on earth, it must have evolved somewhere else in our galaxy and been transported to earth—an old theory called *panspermia*. Just how life evolved on a distant planet is never explained. Crick proposed *directed* panspermia—that an *advanced civilization* sent bacteria to earth. Crick (p. 15) recognized that *"it is difficult to see how viable spores could have arrived here, after such a long journey in space, undamaged by radiation."* He mistakenly thought that a spacecraft might protect the bacteria from cosmic radiation. Crick grossly underestimated the problem. [See Eugene N. Parker, "Shielding Space Travelers," *Scientific American*, Vol. 294, March 2006, pp. 40–47.]

h. Robert Shapiro, *Origins* (New York: Bantam Books, 1986).

- The experiments by Harold Urey and Stanley Miller are often mentioned as showing that the "building blocks of life" can be produced in the laboratory. Not mentioned in these misleading claims are:
  - Organic molecules in life are of two types: proteins and nucleic acids (DNA and RNA). Nucleic acids, which are incredibly complex, were not produced, nor would any knowledgeable person expect them to be produced.
  - The protein "building blocks" were merely the simpler amino acids. The most complex amino acids have never been produced in the laboratory.
  - Most products of these chemical reactions are poisonous to life.
  - Amino acids are as far from a living cell as bricks are from the Empire State Building.
  - Half the amino acids produced have the wrong handedness. [See **"Handedness: Left and Right"** on page 16.]
  - Urey and Miller's experiments contained a reducing atmosphere, which the early earth did not have (see Endnote "a" above), and components, such as a trap, that do not exist in nature. (A ***trap*** quickly removes chemical products from the destructive energy sources that make the products.)

  All of the above show why intelligence and design are necessary to produce even the simplest components of life.

- *"The story of the slow paralysis of research on life's origin is quite interesting, but space precludes its retelling here. Suffice it to say that at present the field of origin-of-life studies has dissolved into a cacophony of conflicting models, each unconvincing, seriously incomplete, and incompatible with competing models. In private even most evolutionary biologists will admit that science has no explanation for the beginning of life."* Behe, "Molecular Machines," pp. 30–31.

- Rick Pierson, "Life before Life," *Discover*, August 2004, p. 8.

30. The First Cell

a. *"Biology is the study of complicated things that give the appearance of having been designed for a purpose. ... We have seen that living things are too improbable and too* *beautifully 'designed' to have come into existence by chance."* Dawkins, *The Blind Watchmaker,* pp. 1, 43.

Yet, after such acknowledgments, Dawkins, an avowed atheist and perhaps the world's leading Darwinian, tries to show that life came about by chance without intelligent design. Dawkins fails to grasp the complexity in life.

- *"The complexity of the simplest known type of cell is so great that it is impossible to accept that such an object could have been thrown together suddenly by some kind of freakish, vastly improbable, event. Such an occurrence would be indistinguishable from a miracle."* Denton, p. 264.

  "Is it really credible that random processes could have constructed a reality, the smallest element of which—a functional protein or gene—is complex beyond our own creative capacities, a reality which is the very antithesis of chance, which excels in every sense anything produced by the intelligence of man? Alongside the level of ingenuity and complexity exhibited by the molecular machinery of life, even our most advanced artefacts appear clumsy. We feel humbled, as neolithic man would in the presence of twentieth-century technology. It would be an illusion to think that what we are aware of at present is any more than a fraction of the full extent of biological design. In practically every field of fundamental biological research ever-increasing levels of design and complexity are being revealed at an ever-accelerating rate." Ibid., p. 342.

- *"We have seen that self-replicating systems capable of Darwinian evolution appear too complex to have arisen suddenly from a prebiotic soup. This conclusion applies both to nucleic acid systems and to hypothetical protein-based genetic systems."* Shapiro, p. 207.

  "We do not understand how this gap in organization was closed, and this remains the most crucial unsolved problem concerning the origin of life." Ibid., p. 299.

- *"More than 30 years of experimentation on the origin of life in the fields of chemical and molecular evolution have led to a better perception of the immensity of the problem of the origin of life on Earth rather than to its solution. At present all discussions on principal theories and experiments in the field either end in stalemate or in a confession of ignorance."* Klaus Dose, "The Origin of Life: More Questions Than Answers," *Interdisciplinary Science Reviews*, Vol. 13, No. 4, 1988, p. 348.

b. *"The events that gave rise to that first primordial cell are totally unknown, matters for guesswork and a standing challenge to scientific imagination."* Lewis Thomas, foreword to *The Incredible Machine*, editor Robert M. Pool (Washington, D.C.: National Geographic Book Service, 1986), p. 7.

- *"No experimental system yet devised has provided the slightest clue as to how biologically meaningful sequences of subunits might have originated in prebiotic polynucleotides or polypeptides."* Kenyon, p. A-20.

- *"If we can indeed come to understand how a living organism arises from the nonliving, we should be able to construct one—only of the simplest description, to be sure, but still recognizably alive. This is so remote a possibility now that one scarcely dares to acknowledge it; but it is there nevertheless."* George Wald, "The Origin of Life," p. 45.

- Experts in this field hardly ever discuss publicly how the first cell could have evolved. However, the world's leading evolutionists know the problems. For example, on 27 July 1979, Luther D. Sunderland taped an interview with Dr. David Raup, Dean of the Field Museum of Natural History in Chicago. This interview was later transcribed and authenticated by both parties. Sunderland told Raup, *"Neither Dr. Patterson* [of the British Museum (Natural History)] *nor Dr. Eldredge* [of the American Museum of Natural History] *could give me any explanation of the origination of the first cell."* Dr. Raup replied, *"I can't either."*

- *"However, the macromolecule-to-cell transition is a jump of fantastic dimensions, which lies beyond the range of testable hypothesis. In this area all is conjecture. The available facts do not provide a basis for postulating that cells arose on this planet."* David E. Green and Robert F. Goldberger, *Molecular Insights Into the Living Process* (New York: Academic Press, 1967), pp. 406–407.

- *"Every time I write a paper on the origins of life I swear I will never write another one, because there is too much speculation running after too few facts, though I must confess that in spite of this, the subject is so fascinating that I never seem to stick to my resolve."* Crick, p. 153.

  This fascination explains why the "origin of life" topic frequently arises—despite so much evidence showing that it cannot happen by natural processes. Speculations abound.

31. Barriers, Buffers, and Chemical Pathways

a. This delicate chemical balance, upon which life depends, was explained to me by biologist Terrence R. Mondy.

b. Behe, pp. 77–97.

32. Genetic Distances

a. Dr. Colin Patterson—Senior Principal Scientific Officer in the Palaeontology Department at the British Museum (Natural History)—gave a talk on 5 November 1981 to leading evolutionists at the American Museum of Natural History. He compared the amino acid sequences in several proteins of different animals. The relationships of these animals, according to evolutionary theory, have been taught in classrooms for decades. Patterson explained to a stunned audience that this new information contradicts the theory of evolution. In his words, *"The theory makes a prediction; we've tested it, and the prediction is falsified precisely."* Although he acknowledged that scientific falsification is never absolute, he admitted *"evolution was a faith,"* he was *"duped into taking evolutionism as revealed truth in some way,"* and *"evolution not only conveys no knowledge but seems somehow to convey anti-knowledge, apparent knowledge which is harmful to systematics* [the science of classifying different forms of life]." "Prominent

British Scientist Challenges Evolution Theory," Audio Tape Transcription and Summary by Luther D. Sunderland, Personal communication. For other statements from Patterson's presentation, see Tom Bethell, "Agnostic Evolutionists," *Harper's Magazine*, February 1985, pp. 49–61.

◆ *"... it seems disconcerting that many exceptions exist to the orderly progression of species as determined by molecular homologies ..."* Christian Schwabe, "On the Validity of Molecular Evolution," *Trends in Biochemical Sciences*, July 1986, p. 280.

"It appears that the neo-darwinian hypothesis is insufficient to explain some of the observations that were not available at the time the paradigm [the theory of evolution] *took shape. ... One might ask why the neo-darwinian paradigm does not weaken or disappear if it is at odds with critical factual information. The reasons are not necessarily scientific ones but rather may be rooted in human nature."* Ibid., p. 282.

◆ *"Evolutionary trees constructed by studying biological molecules often don't resemble those drawn up from morphology."* Trisha Gura, "Bones, Molecules ... or Both?" *Nature*, Vol. 406, 20 July 2000, p. 230.

b. Robert Bayne Brown, *Abstracts: 31st International Science and Engineering Fair* (Washington, D.C.: Science Service, 1980), p. 113.

◆ Ginny Gray, "Student Project 'Rattles' Science Fair Judges," *Issues and Answers*, December 1980, p. 3.

◆ While the rattlesnake's cytochrome c was most similar to man's, man's cytochrome c was most similar to that of the rhesus monkey. (If this seems like a contradiction, consider that City B could be the closest city to City A, but City C might be the closest city to City B.)

c. *"As morphologists with high hopes of molecular systematics, we end this survey with our hopes dampened. Congruence between molecular phylogenies is as elusive as it is in morphology and as it is between molecules and morphology."* Colin Patterson et al., p. 179.

d. Gregory J. Brewer, "The Imminent Death of Darwinism and the Rise of Intelligent Design," *ICR Impact*, No. 341, November 2001, pp. 1–4.

◆ Field, pp. 748–753.

e. Denton, p. 285.

f. *"The really significant finding that comes to light from comparing the proteins' amino acid sequences is that it is impossible to arrange them in any sort of evolutionary series."* Ibid., p. 289.

"Thousands of different sequences, protein and nucleic acid, have now been compared in hundreds of different species but never has any sequence been found to be in any sense the lineal descendant or ancestor of any other sequence." Ibid., pp. 289–290.

"Each class at a molecular level is unique, isolated and unlinked by intermediates. Thus molecules, like fossils, have failed to provide the elusive intermediates so long sought by evolutionary biology." Ibid., p. 290.

"There is little doubt that if this molecular evidence had been available one century ago it would have been seized upon with devastating effect by the opponents of evolution theory like Agassiz and Owen, and the idea of organic evolution might never have been accepted." Ibid., pp. 290–291.

"In terms of their biochemistry, none of the species deemed 'intermediate', 'ancestral' or 'primitive' by generations of evolutionary biologists, and alluded to as evidence of sequence in nature, show any sign of their supposed intermediate status." Ibid., p. 293.

g. After sequencing just the first chimpanzee chromosome, surprises were apparent.

> *Surprisingly, though, nearly 68,000 stretches of DNA do differ to some degree between the two species ... Extra sections of about 300 nucleotides showed up primarily in the human chromosome ... Extra sections of other sizes—some as long as 54,000 nucleotides—appear in both species.* Bruce Bower, "Chimp DNA Yields Complex Surprises," *Science News*, Vol. 165, 12 June 2004, p. 382.

◆ *"Indeed, 83% of the 231 coding sequences, including functionally important genes, show differences* [even] *at the amino acid sequence level. ... the biological consequences due to the genetic differences are much more complicated than previously speculated."* H. Watanabe et al., "DNA Sequence and Comparative Analysis of Chimpanzee Chromosome 22," *Nature*, Vol. 429, 27 May 2004, pp. 382, 387.

h. Tarjei S. Mikkelsen et al., "Initial Sequence of the Chimpanzee Genome and Comparison with the Human Genome," *Nature*, Vol. 437, 1 September 2005, p. 69.

i. *"Surprisingly, however, >30% of chimpanzee MSY* [male-specific portion of the Y chromosome] *sequence has no homologous, alignable counterpart in the human MSY, and vice versa. ... Moreover, the MSY sequences retained in both lineages have been extraordinarily subject to rearrangement ... ."* Jennifer F. Hughes et al., "Chimpanzee and Human Y Chromosomes Are Remarkably Divergent in Structure and Gene Content," *Nature*, Vol. 463, 28 January 2010, p. 537.

j. "*... the difference in MSY gene content in chimpanzee and human is more comparable to the difference in autosomal gene content in chicken and human, at 310 million years of separation."* Ibid., p. 538.

k. *"Instead, the comparisons* [using DNA] *have yielded many versions of the tree of life that differ from the rRNA tree and conflict with each other as well."* Elizabeth Pennisi, "Is It Time to Uproot the Tree of Life?" *Science*, Vol. 284, 21 May 1999, p. 1305.

33. Genetic Information

a. Carl Sagan showed, using straightforward calculations, why one cell's worth of genetic information approximates 4,000 books of printed information. Each of Sagan's 4,000 books had 500 pages with 300 words per page. [See Carl Sagan, *The Dragons of Eden* (New York: Random House, 1977), p. 25.]

Each book would have a volume of about 50 cubic inches. An adult human's body contains about 10^{14} cells. About 800 cubic miles have been eroded from the Grand Canyon. Therefore, we can say that if every cell in one person's body were reduced to 4,000 books, they would fill the Grand Canyon 98 times

$$\frac{10^{14} \times 4{,}000 \times 50 \text{ inches}^3}{800 \text{ mile}^3} \times \left(\frac{\text{mile}}{5{,}280 \times 12 \text{ inches}}\right)^3 = 98$$

The Moon is 240,000 miles from Earth. If the DNA in a human cell were stretched out and connected, it would be more than 7 feet long. If all the DNA in one person's body were placed end-to-end, it would extend to the Moon 552,000 times.

$$\frac{10^{14} \times 7 \text{ feet}}{240{,}000 \text{ miles}} \times \frac{\text{mile}}{5{,}280 \text{ feet}} = 552{,}000$$

The DNA in a human cell weighs 6.4×10^{-12} grams. [See Monroe W. Strickberger, *Genetics*, 2nd edition (New York: Macmillan Publishing Co., 1976), p. 54.] Probably less than 50 billion people have lived on earth. If so, one copy of the DNA of every human who ever lived—enough to define the physical characteristics of all those people in microscopic detail—would weigh only

$$6.4 \times 10^{-12} \times 50 \times 10^9 = 0.32 \text{ grams}$$

This is less than the weight of one aspirin.

- *"... there is enough information capacity in a single human cell to store the Encyclopaedia Britannica, all 30 volumes of it, three or four times over. ... There is enough storage capacity in the DNA of a single lily seed or a single salamander sperm to store the Encyclopaedia Britannica 60 times over. Some species of the unjustly called 'primitive' amoebas have as much information in their DNA as 1,000 Encyclopaedia Britannicas."* Dawkins, *The Blind Watchmaker,* pp. 116–117.

b. *"Biochemical systems are exceedingly complex, so much so that the chance of their being formed through random shufflings of simple organic molecules is exceedingly minute, to a point indeed where it is insensibly different from zero."* Hoyle and Wickramasinghe, p. 3.

"No matter how large the environment one considers, life cannot have had a random beginning. Troops of monkeys thundering away at random on typewriters could not produce the works of Shakespeare, for the practical reason that the whole observable universe is not large enough to contain the necessary monkey hordes, the necessary typewriters, and certainly the waste paper baskets required for the deposition of wrong attempts. The same is true for living material." Ibid., p. 148.

Not mentioned by Hoyle and Wickramasinghe is the simple fact that even a few correct words typed by the hordes of monkeys would decay long before a complete sentence of Shakespeare was completed. Correspondingly, a few correct sequences of amino acids would decay long before a complete protein was completed, not to mention all the thousands of proteins that must be in their proper place to have a living cell (minus, of course, its DNA).

"From the beginning of this book we have emphasized the enormous information content of even the simplest living systems. The information cannot in our view be generated by what are often called 'natural' processes, as for instance through meteorological and chemical processes occurring at the surface of a lifeless planet. As well as a suitable physical and chemical environment, a large initial store of information was also needed. We have argued that the requisite information came from an 'intelligence', the beckoning spectre." Ibid., p. 150.

"Once we see, however, that the probability of life originating at random is so utterly minuscule as to make the random concept absurd, it becomes sensible to think that the favourable properties of physics on which life depends are in every respect deliberate." Ibid., p. 141.

Hoyle and Wickramasinghe go on to say that our own intelligences must reflect some sort of vastly superior intelligence, *"even to the extreme idealized limit of **God**."* They believe that life was created by some intelligence somewhere in outer space and later was transported to Earth. [emphasis in original] Ibid., p. 144.

- *"All point mutations that have been studied on the molecular level turn out to reduce the genetic information and not to increase it."* Lee Spetner, *Not by Chance* (Brooklyn, New York: The Judaica Press, Inc., 1996), p. 138.

c. Murray Eden, as reported in "Heresy in the Halls of Biology: Mathematicians Question Darwinism," *Scientific Research*, November 1967, p. 64.

- *"It is our contention that if 'random' is given a serious and crucial interpretation from a probabilistic point of view, the randomness postulate is highly implausible and that an adequate scientific theory of evolution must await the discovery and elucidation of new natural laws—physical, physico-chemical, and biological."* Murray Eden, "Inadequacies of Neo-Darwinian Evolution as a Scientific Theory," *Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution*, editors Paul S. Moorhead and Martin M. Kaplan, June 1967, p. 109.

d. *"The trouble is that there are about two thousand enzymes, and the chance of obtaining them all in a random trial is only one part in $(10^{20})^{2{,}000} = 10^{40{,}000}$, an outrageously small probability that could not be faced even if the whole universe consisted of organic soup. If one is not prejudiced either by social beliefs or by a scientific training into the conviction that life originated on the Earth* [by chance or natural processes], *this simple calculation wipes the idea entirely out of court."* Hoyle and Wickramasinghe, p. 24.

"Any theory with a probability of being correct that is larger than one part in $10^{40{,}000}$ must be judged superior to random

shuffling [of evolution]. *The theory that life was assembled by an intelligence has, we believe, a probability vastly higher than one part in $10^{40,000}$ of being the correct explanation of the many curious facts discussed in preceding chapters. Indeed, such a theory is so obvious that one wonders why it is not widely accepted as being self-evident. The reasons are psychological rather than scientific."* Ibid., p. 130.

- After explaining the above to a scientific symposium, Hoyle said that evolution was comparable with the chance that *"a tornado sweeping through a junk-yard might assemble a Boeing 747 from the materials therein."* Fred Hoyle, "Hoyle on Evolution," *Nature*, Vol. 294, 12 November 1981, p. 105.

e. *"The failure to recognize the importance of introns* [so-called *junk DNA*] *may well go down as one of the biggest mistakes in the history of molecular biology."* John S. Mattick, as quoted by W. Wayt Gibbs, "The Unseen Genome: Gems among the Junk," *Scientific American*, Vol. 289, November 2003, pp. 49–50.

"What was damned as junk because it was not understood may, in fact, turn out to be the very basis of human complexity." Ibid., p. 52.

- *"Noncoding RNAs (ncRNAs)* [so-called *junk RNA*] *have been found to have roles in a great variety of processes, including transcription regulation, chromosome replication, RNA processing and modification, messenger RNA stability and translation, and even protein degradation and translocation. Recent studies indicate that ncRNAs are far more abundant and important than initially imagined."* Gisela Storz, "An Expanding Universe of Noncoding RNAs," *Science*, Vol. 296, 17 May 2002, p. 1260.

- *"The term 'junk DNA' is a reflection of our ignorance."* Gretchen Vogel, "Why Sequence the Junk?" *Science*, Vol. 291, 16 February 2001, p. 1184.

- *"... non-gene sequences* [what evolutionists called 'junk DNA'] *have regulatory roles."* John M. Greally, "Encyclopaedia of Humble DNA," *Nature*, Vol. 447, 14 June 2007, p. 782.

f. Gary Taubes, "RNA Revolution," *Discover*, October 2009, pp. 47–52.

34. DNA and Proteins

a. Ribosomes, complex structures that assemble proteins, have or require about 200 different proteins. The number depends somewhat on whether the organism is a bacterium, eukaryote, or archaea.

b. Richard E. Dickerson, "Chemical Evolution and the Origin of Life," *Scientific American*, Vol. 239, September 1978, p. 73.

- *"The amino acids must link together to form proteins, and the other chemicals must join up to make nucleic acids, including the vital DNA. The seemingly insurmountable obstacle is the way the two reactions are inseparably linked—one can't happen without the other. Proteins depend on DNA for their formation. But DNA cannot form without pre-existing protein."* Hitching, p. 66.

c. *"The origin of the genetic code presents formidable unsolved problems. The coded information in the nucleotide sequence is meaningless without the translation machinery, but the specification for this machinery is itself coded in the DNA. Thus without the machinery the information is meaningless, but without the coded information the machinery cannot be produced! This presents a paradox of the 'chicken and egg' variety, and attempts to solve it have so far been sterile."* John C. Walton, (Lecturer in Chemistry, University of St. Andrews, Fife, Scotland), "Organization and the Origin of Life," *Origins*, Vol. 4, No. 1, 1977, pp. 30–31.

- *"Genes and enzymes are linked together in a living cell—two interlocked systems, each supporting the other. It is difficult to see how either could manage alone. Yet if we are to avoid invoking either a Creator or a very large improbability, we must accept that one occurred before the other in the origin of life. But which one was it? We are left with the ancient riddle: Which came first, the chicken or the egg?"* Shapiro, p. 135.

- *"Because DNA and proteins depend so intimately on each other for their survival, it's hard to imagine one of them having evolved first. But it's just as implausible for them to have emerged simultaneously out of a prebiotic soup."* Carl Zimmer, "How and Where Did Life on Earth Arise?" *Science*, Vol. 309, 1 July 2005, p. 89.

d. Erika Check Hayden, "Life Is Complicated," *Nature*, Vol. 464, 1 April 2010, pp. 664–667.

e. "*... the human body receives tens of thousands of DNA lesions per day."* Stephen P. Jackson and Jiri Bartek, "The DNA-Damage Response in Human Biology and Disease," *Nature*, Vol. 461, 22 October 2009, p. 1071.

f. Tomas Lindahl and Richard D. Wood, "Quality Control by DNA Repair," *Science*, Vol. 286, 3 December 1999, pp. 1897-1905.

35. Handedness: Left and Right

a. *"Equally disappointing, we can induce copying of the original template only when we run our experiments with nucleotides having a right-handed configuration. All nucleotides synthesized biologically today are right-handed. Yet on the primitive earth, equal numbers of right- and left-handed nucleotides would have been present."* Leslie E. Orgel, "The Origin of Life on the Earth," *Scientific American*, Vol. 271, October 1994, p. 82.

- *"There is no explanation why cells use L* [left-handed] *amino acids to synthesize their proteins but D* [right-handed] *ribose or D-deoxyribose to synthesize their nucleotides or nucleic acids. In particular, the incorporation of even a single L-ribose or L-deoxyribose residue into a nucleic acid, if it should ever occur in the course of cellular syntheses, could seriously interfere with vital structure-function relationships. The well-known double helical DNA structure does not allow the presence of L-deoxyribose; the replication and transcription mechanisms generally require that any wrong sugar such as L-deoxyribose has to be* *eliminated, that is, the optical purity of the D-sugars units has to be 100%."* Dose, p. 352.

b. An important exception occurs in a component in cell membranes of eubacteria. There the amino acids are right-handed. This has led many to conclude that they must have evolved separately from all other bacteria. Because evolving the first living cell is so improbable, having it happen twice, in effect, compounds the improbability. [See Adrian Barnett, "The Second Coming: Did Life Evolve on Earth More Than Once?" *New Scientist*, Vol. 157, 14 February 1998, p. 19.]

c. Recent discoveries have found that some amino acids, most notably aspartic acid, flip (at certain locations in certain proteins) from the normal left-handed form to the right-handed form. Flipping increases with age and correlates with disease, such as Alzheimer's disease, cataracts, and arteriosclerosis. As one ages, flipping even accumulates in facial skin, but not other skin. [See Noriko Fujii, "D-Amino Acid in Elderly Tissues," *Biological and Pharmaceutical Bulletin*, Vol. 28, September 2005, pp. 1585–1589.]

If life evolved, why did this destructive tendency to flip not destroy cells long before complete organisms evolved?

d. *"Many researchers have attempted to find plausible natural conditions under which* [left-handed] *L-amino acids would preferentially accumulate over their* [right-handed] *D-counterparts, but all such attempts have failed. Until this crucial problem is solved, no one can say that we have found a naturalistic explanation for the origin of life. Instead, these isomer preferences point to biochemical creation."* Kenyon, p. A-23.

◆ Evolutionists who work in this field are continually seeking a solution. From time to time someone claims that it has been solved, but only after checking the details does one find that the problem remains. In Germany, in 1994, a doctoral candidate, Guido Zadel, claimed he had solved the problem. Supposedly, a strong magnetic field will bias a reaction toward either the left-handed or right-handed form. Origin-of-life researchers were excited. Zadel's doctorate was awarded. At least 20 groups then tried to duplicate the results, always unsuccessfully. Later, Zadel admitted that he had dishonestly manipulated his data. [See Daniel Clery and David Bradley, "Underhanded 'Breakthrough' Revealed," *Science*, Vol. 265, 1 July 1994, p. 21.]

◆ James F. Coppedge, *Evolution: Possible or Impossible?* (Grand Rapids: Zondervan Publishing House, 1973), pp. 71–79.

◆ A. E. Wilder-Smith, *The Natural Sciences Know Nothing of Evolution* (San Diego: Master Book Publishers, 1981), pp. 15–32, 154–160.

◆ Dickerson, p. 76.

36. Improbabilities

a. Coppedge, pp. 71–72.

◆ *"Whether one looks to mutations or gene flow for the source of the variations needed to fuel evolution, there is an enormous probability problem at the core of Darwinist and neo-Darwinist theory, which has been cited by hundreds of scientists and professionals. Engineers, physicists, astronomers, and biologists who have looked without prejudice at the notion of such variations producing ever more complex organisms have come to the same conclusion: The evolutionists are assuming the impossible. Even if we take the simplest large protein molecule that can reproduce itself if immersed in a bath of nutrients, the odds against this developing by chance range from one in 10^{450} (engineer Marcel Goulay in Analytical Chemistry) to one in 10^{600} (Frank Salisbury in American Biology Teacher)."* Fix, p. 196.

◆ *"I don't know how long it is going to be before astronomers generally recognize that the combinatorial arrangement of not even one among the many thousands of biopolymers on which life depends could have been arrived at by natural processes here on the Earth. Astronomers will have a little difficulty at understanding this because they will be assured by biologists that it is not so, the biologists having been assured in their turn by others that it is not so. The 'others' are a group of persons who believe, quite openly, in mathematical miracles. They advocate the belief that tucked away in nature, outside of normal physics, there is a law which performs miracles (provided the miracles are in the aid of biology). This curious situation sits oddly on a profession that for long has been dedicated to coming up with logical explanations of biblical miracles."* Fred Hoyle, "The Big Bang in Astronomy," *New Scientist*, Vol. 92, 19 November 1981, p. 526.

◆ *"The origin of life by chance in a primeval soup is impossible in probability in the same way that a perpetual motion machine is impossible in probability. ... A practical person must conclude that life didn't happen by chance."* Hubert P. Yockey, *Information Theory and Molecular Biology* (Cambridge, UK: Cambridge University Press, 1992), p. 257.

b. Harold J. Morowitz, *Energy Flow in Biology: Biological Organization as a Problem in Thermal Physics* (New York: Academic Press, 1968), pp. 2–12, 44–75.

37. Metamorphosis

a. *"Certainly it* [metamorphosis] *demonstrates the absurdity of invoking natural selection by successive mutation to explain such an obviously, yet subtly programmed, process. Why on that basis, should the ancestral insect have survived the mutations that projected it into the chrysalid stage, from which it could not yet develop into an adult? Where was natural selection then? How could pre-programmed metamorphosis, in insect, amphibian or crustacean, ever have evolved by chance? Indeed, how could development have evolved piece-meal? The ball is in the evolutionist's court, tangled in a net of inexplicability."* Pitman, p. 71.

◆ *"Apart from the many difficulties in understanding how such a radical change* [as metamorphosis] *comes about, there is the larger question of why it should happen. Can*

References and Notes

there really be an evolutionary advantage in constructing one sort of organism and then throwing it away and starting again?" Taylor, p. 177.

- *"There is no evidence of how such a remarkable plan of life* [metamorphosis] *ever came about ..."* Peter Farb, *The Insects*, Life Nature Library (New York: Time, Inc., 1962), p. 56.

- *"Does any one really believe that the ancestors of butterflies were as adults just masses of pulp enveloped in cases, having no means of procuring external nourishment? If not, it is for the evolutionist to explain how the process of metamorphosis became intercalated in the life-history of the caterpillar."* Douglas Dewar, *The Transformist Illusion* (Murfreesboro, Tennessee: DeHoff Publications, 1957), p. 213.

- Finding how metamorphosis evolved in one species, genus, family, order, or class is just the first question. Because many different larva-to-adult patterns exist, many other explanations are also needed.

b. Pitman, pp. 193–194.

c. Christine Merlin et al., "Antennal Circadian Clocks Coordinate Sun Compass Orientation in Migratory Monarch Butterflies," *Science*, Vol. 325, 25 September 2009, pp. 1700–1704.

- Jules H. Poirier, *From Darkness to Light to Flight: Monarch—the Miracle Butterfly* (El Cajon, California: Institute for Creation Research, 1995).

d. An evolutionist might claim that larvae once reproduced, but then lost that capability. If so, why is there no sign of any remnant reproductive equipment in any of the hundreds of thousands of larva types?

e. Charles Darwin, *The Origin of Species*, 6th edition (New York: Macmillan Publishing Co., 1927), p. 179.

38. Symbiotic Relationships

a. Oscar L. Brauer, "The Smyrna Fig Requires God for Its Production," *Creation Research Society Quarterly*, Vol. 9, September 1972, pp. 129–131.

- Bob Devine, *Mr. Baggy-Skin Lizard* (Chicago: Moody Press, 1977), pp. 29–32.

b. Jerry A. Powell and Richard A. Mackie, *Biological Interrelationships of Moths and Yucca Whipplei* (Los Angeles: University of California Press, 1966).

39. Sexual Reproduction

a. In humans and in all mammals, a mother's immune system, contrary to its normal function, must learn not to attack her unborn baby—half of whom is a "foreign body" from the father. If these immune systems functioned "properly," mammals—including each of us—would not exist.

> *The mysterious lack of rejection of the fetus has puzzled generations of reproductive immunologists and no comprehensive explanation has yet emerged.* [Charles A. Janeway Jr. et al., *Immuno Biology* (London: Current Biology Limited, 1997), p. 12:24.]

b. N. W. Pixie, "Boring Sperm," *Nature*, Vol. 351, 27 June 1991, p. 704.

c. Meredith Gould and Jose Luis Stephano, "Electrical Responses of Eggs to Acrosomal Protein Similar to Those Induced by Sperm," *Science*, Vol. 235, 27 March 1987, pp. 1654–1656.

d. For example, how could meiosis evolve?

e. *"But the sex-determination genes in the fruit fly and the nematode are completely unrelated to each other, let alone to those in mammals."* Jean Marx, "Tracing How the Sexes Develop," *Science*, Vol. 269, 29 September 1955, p. 1822.

f. *"This book is written from a conviction that the prevalence of sexual reproduction in higher plants and animals is inconsistent with current evolutionary theory."* George C. Williams, *Sex and Evolution* (Princeton, New Jersey: Princeton University Press, 1975), p. v.

- *"So why is there sex? We do not have a compelling answer to the question. Despite some ingenious suggestions by orthodox Darwinians (notably G. C. Williams, 1975; John Maynard Smith, 1978), there is no convincing Darwinian history for the emergence of sexual reproduction. However, evolutionary theorists believe that the problem will be solved without abandoning the main Darwinian insights—just as early nineteenth-century astronomers believed that the problem of the motion of Uranus could be overcome without major modification of Newton's celestial mechanics."* Philip Kitcher, *Abusing Science: The Case Against Creationism* (Cambridge, Massachusetts: The MIT Press, 1982), p. 54.

- *"The evolution of sex is one of the major unsolved problems of biology. Even those with enough hubris to publish on the topic often freely admit that they have little idea of how sex originated or is maintained. It is enough to give heart to creationists."* Michael Rose, "Slap and Tickle in the Primeval Soup," *New Scientist*, Vol. 112, 30 October 1986, p. 55.

- *"Indeed, the persistence of sex is one of the fundamental mysteries in evolutionary biology today."* Gina Maranto and Shannon Brownlee, "Why Sex?" *Discover*, February 1984, p. 24.

- *"Sex is something of an embarrassment to evolutionary biologists. Textbooks understandably skirt the issue, keeping it a closely guarded secret."* Kathleen McAuliffe, "Why We Have Sex," *Omni*, December 1983, p. 18.

- *"From an evolutionary viewpoint the sex differentiation is impossible to understand, as well as the structural sexual differences between the systematic categories which are sometimes immense. We know that intersexes* [organisms that are partly male and partly female] *within a species must be sterile. How is it, then, possible to imagine bridges between two amazingly different structural types?"* Nilsson, p. 1225.

- *"One idea those attending the sex symposium seemed to agree on is that no one knows why sex persists."* [According to evolution, it should not.] Gardiner Morse, "Why Is Sex?" *Science News*, Vol. 126, 8 September 1984, p. 155.

g. *"In the discipline of developmental biology, creationist and mechanist concur except on just one point—a work of art, a machine or a body which can reproduce itself cannot first make itself."* Pitman, p. 135.

40. Immune Systems

a. *"We can look high or we can look low, in books or in journals, but the result is the same. The scientific literature has no answers to the question of the origin of the immune system."* Behe, p. 138.

◆ *"Unfortunately, we cannot trace most of the evolutionary steps that the immune system took. Virtually all the crucial developments seem to have happened at an early stage of vertebrate evolution, which is poorly represented in the fossil record and from which few species survive. Even the most primitive extant vertebrates seem to rearrange their antigen receptor genes and possess separate T and B cells, as well as MHC molecules. Thus has the immune system sprung up fully armed."* Avrion Mitchison, "Will We Survive?" *Scientific American*, Vol. 269, September 1993, p. 138.

41. Living Technology

a. *"Life implies movement. Most forms of movement in the living world are powered by tiny protein machines known as molecular motors."* Manfred Schliwa and Günther Woehlke, "Molecular Motors," *Nature*, Vol. 422, 17 April 2003, p. 759.

b. *"We would see* [in cells] *that nearly every feature of our own advanced machines had its analogue in the cell: artificial languages and their decoding systems, memory banks for information storage and retrieval, elegant control systems regulating the automated assembly of parts and components, error fail-safe and proof-reading devices utilized for quality control, assembly processes involving the principle of prefabrication and modular construction. In fact, so deep would be the feeling of* ***deja-vu****, so persuasive the analogy, that much of the terminology we would use to describe this fascinating molecular reality would be borrowed from the world of late twentieth-century technology.*

"What we would be witnessing would be an object resembling an immense automated factory, a factory larger than a city and carrying out almost as many unique functions as all the manufacturing activities of man on earth. However, it would be a factory which would have one capacity not equalled in any of our own most advanced machines, for it would be capable of replicating its entire structure within a matter of a few hours. To witness such an act at a magnification of one thousand million times would be an awe-inspiring spectacle." Denton, p. 329.

c. *"Ounce for ounce, watt for watt, it* [the bat] *is millions of times more efficient and more sensitive than the radars and sonars contrived by man."* Pitman, p. 219.

d. Robert E. Kofahl and Kelly L. Segraves, *The Creation Explanation* (Wheaton, Illinois: Harold Shaw Publishers, 1975), pp. 2–9.

◆ Thomas Eisner and Daniel J. Aneshansley, "Spray Aiming in Bombardier Beetles: Jet Deflection by the Coanda Effect," *Science*, Vol. 215, 1 January 1982, pp. 83–85.

◆ Behe, pp. 31–36.

e. Jason A. Etheredge et al., "Monarch Butterflies (*Danaus plexippus L.*) Use a Magnetic Compass for Navigation," *Proceedings of the National Academy of Sciences*, Vol. 96, 23 November 1999, pp. 13845–13846.

f. David H. Freedman, "Exploiting the Nanotechnology of Life," *Science*, Vol. 254, 29 November 1991, pp. 1308–1310.

◆ Tom Koppel, "Learning How Bacteria Swim Could Set New Gears in Motion," *Scientific American*, Vol. 265, September 1991, pp. 168–169.

◆ Howard C. Berg, "How Bacteria Swim," *Scientific American*, Vol. 233, August 1975, pp. 36–44.

g. Y. Magariyama et al., "Very Fast Flagellar Rotation," *Nature*, Vol. 371, 27 October 1994, p. 752.

h. Could a conventional electrical motor be scaled down to propel a bacterium through a liquid? No. Friction would overcome almost all movement. This is because the ratio of inertial-to-viscous forces is proportional to scale. In effect, the liquid becomes stickier the smaller you get. Therefore, the efficiency of the bacterial motor itself, which approaches 100% at slow speeds, is remarkable and currently unexplainable.

i. C. Wu, "Protein Switch Curls Bacterial Propellers," *Science News*, Vol. 153, 7 February 1998, p. 86.

j. Yes, you read this correctly. The molecular motors are 25 nanometers in diameter while an average human hair is about 75 microns in diameter.

k. *"Bacteria can organize into groups, they can communicate. ... How could this have evolved?"* E. Peter Greenberg, "Tiny Teamwork," *Nature*, Vol. 424, 10 July 2003, p. 134.

◆ Bonnie L. Bassler, "How Bacteria Talk to Each Other: Regulation of Gene Expression by Quorum Sensing," *Current Opinion in Microbiology*, Vol. 2, 1 December 1999, pp. 582–587.

l. *"... the smallest rotary motors in biology. The flow of protons propels the rotation ..."* Holger Seelert et al., "Proton-Powered Turbine of a Plant Motor," *Nature*, Vol. 405, 25 May 2000, pp. 418–419.

◆ *"The ATP synthase* [motor] *not only lays claim to being nature's smallest rotary motor, but also has an extremely important role in providing most of the chemical energy that aerobic and photosynthetic organisms need to stay alive."* Richard L. Cross, "Turning the ATP Motor," *Nature*, Vol. 427, 29 January 2004, pp. 407–408.

42. The Validity of Thought

a. *"But then arises the doubt, can the mind of man, which has, as I fully believe, been developed from a mind as low as that possessed by the lowest animals, be trusted when it draws such grand conclusions? I cannot pretend to throw the least light on such abstruse problems."* Charles Darwin, *The Life and Letters*, Vol. 1, p. 313.

◆ *"For if my mental processes are determined wholly by the motions of atoms in my brain, I have no reason to suppose that my beliefs are true. They may be sound chemically, but that does not make them sound logically. And hence I have no reason for supposing my brain to be composed of atoms."* J. B. S. Haldane, *Possible Worlds* (London: Chatto & Windus, 1927), p. 209.

◆ *"If the solar system was brought about by an accidental collision, then the appearance of organic life on this planet was also an accident, and the whole evolution of Man was an accident too. If so, then all our present thoughts are mere accidents—the accidental by-product of the movement of atoms. And this holds for the thoughts of the materialists and astronomers as well as for anyone else's. But if their thoughts—i.e. of Materialism and Astronomy—are merely accidental by-products, why should we believe them to be true? I see no reason for believing that one accident should be able to give me a correct account of all the other accidents."* C. S. Lewis, *God In the Dock* (Grand Rapids: Eerdmans Publishing Co., 1970), pp. 52–53.

◆ *"Each particular thought is valueless if it is the result of irrational causes. Obviously, then, the whole process of human thought, what we call Reason, is equally valueless if it is the result of irrational causes. Hence every theory of the universe which makes the human mind a result of irrational causes is inadmissible, for it would be a proof that there are no such things as proofs. Which is nonsense. But Naturalism* [evolution]*, as commonly held, is precisely a theory of this sort."* C. S. Lewis, *Miracles* (New York: Macmillan Publishing Co., 1947), p. 21.

◆ C. S. Lewis, "The Funeral of a Great Myth," *Christian Reflections* (Grand Rapids: Eerdmans Publishing Co., 1968), p. 89.

◆ *"If the universe is a universe of thought, then its creation must have been an act of thought."* James H. Jeans, *The Mysterious Universe*, new revised edition (New York: Macmillan Publishing Co., 1932), p. 181.

◆ *"A theory that is the product of a mind can never adequately explain the mind that produced the theory. The story of the great scientific mind that discovers absolute truth is satisfying only so long as we accept the mind itself as a given. Once we try to explain the mind as a product of its own discoveries, we are in a hall of mirrors with no exit."* Phillip E. Johnson, *Reason in the Balance: The Case Against Naturalism in Science, Law & Education* (Downers Grove, Illinois: InterVarsity Press, 1995), p. 62.

◆ *"One of the absurdities of materialism* [the belief that nothing exists except the material] *is that it assumes that the world can be rationally comprehensible only if it is entirely the product of irrational, unguided mechanisms."* Phillip E. Johnson, "The Wedge in Evolutionary Ideology: Its History, Strategy, and Agenda," *Theology Matters*, Vol. 5, March/April 1999, p. 5.

Phillip E. Johnson has also made the point that intelligence might produce intelligence. However, for lifeless, inorganic matter to produce intelligence, as the theory of evolution claims, would be an astounding miracle.

b. Phillip Johnson, "The Demise of Naturalism," *World*, 3 April 2004, p. 38.

c. *"Behind Darwin's discomfiture* [on how the human brain evolved] *was the dawning realization that the evolution of the brain vastly exceeded the needs of prehistoric man. This is, in fact, the only example in existence where a species was provided with an organ that it still has not learned how to use."* Richard M. Restak, *The Brain: The Last Frontier* (Garden City, New York: Doubleday & Co., Inc., 1979), p. 59.

43. Strange Planets

a. *"... most every prediction by theorists about planetary formation has been wrong."* Scott Tremaine, as quoted by Richard A. Kerr, "Jupiters Like Our Own Await Planet Hunters," *Science*, Vol. 295, 25 January 2002, p. 605.

◆ *"To sum up, I think that all suggested accounts of the origin of the Solar System are subject to serious objections. The conclusion in the present state of the subject would be that the system cannot exist."* Harold Jeffreys, *The Earth: Its Origin, History, and Physical Constitution*, 6th edition (Cambridge, UK: Cambridge University Press, 1976), p. 387.

◆ *"But if we had a reliable theory of the origin of planets, if we knew of some mechanism consistent with the laws of physics so that we understood how planets form, then clearly we could make use of it to estimate the probability that other stars have attendant planets. However, no such theory exists yet, despite the large number of hypotheses suggested."* R. A. Lyttleton, *Mysteries of the Solar System* (Oxford, England: Clarendon Press, 1968), p. 4.

◆ *"A great array of observational facts must be explained by a satisfactory theory* [on the evolution of the solar system]*, and the theory must be consistent with the principles of dynamics and modern physics. All of the hypotheses so far presented have failed, or remain unproved, when physical theory is properly applied."* Fred L. Whipple, *Earth, Moon, and Planets*, 3rd edition (Cambridge, Massachusetts: Harvard University Press, 1968), p. 243.

◆ *"Attempts to find a plausible naturalistic explanation of the origin of the Solar System began about 350 years ago but have not yet been quantitatively successful, making this one of the oldest unsolved problems in modern science."* Stephen G. Brush, *A History of Modern Planetary Physics*, Vol. 3 (Cambridge, UK: Cambridge University Press, 1996), p. 91.

b. *"The most striking outcome of planetary exploration is the diversity of the planets."* David Stevenson, as quoted by

Richard A. Kerr, "The Solar System's New Diversity," *Science*, Vol. 265, 2 September 1994, p. 1360.

"I wish it were not so, but I'm somewhat skeptical that we're going to learn an awful lot about Earth by looking at other planetary bodies. The more that we look at the different planets, the more each one seems to be unique." Ibid.

◆ *"Stevenson and others are puzzling out how subtle differences in starting conditions such as distance from the sun, along with chance events like giant impacts early in the solar system history, can send planets down vastly different evolutionary paths."* Kerr, "The Solar System's New Diversity," p. 1360.

"You put together the same basic materials and get startlingly different results. No two [planets] *are alike; it's like a zoo."* Alexander Dessler, as quoted by Richard A. Kerr, Ibid., p. 1361.

c. Uranus' spin axis is "tilted" 98°. In other words, Uranus spins on its side and slightly backwards. Evolutionists have incorrectly speculated that Uranus must have been tipped over by a giant impact. However, such an impact would not have changed the orbital planes of Uranus' larger moons, which are also "tipped over."

d. *The Astronomical Almanac for the Year 2003* (Washington, D.C.: U.S. Government Printing Office, 2003), p. F2.

e. Ibid.

f. Ibid.

◆ The Moon's orbital plane is inclined 18.5° – 28.5° to the Earth's *equatorial* plane. (The Moon's orbital plane precesses between those values over an 18.6-year cycle.) This is a considerable inclination when one recognizes that the Moon possesses 82.9% of the angular momentum of the Earth-Moon system. No other planet-satellite system comes close to this amount.

Theories that for centuries claimed to show how the Moon evolved can now be rejected because of this fact alone. A more recent theory claims that a Mars-size body collided with the early Earth and kicked up debris that formed the Moon. Ward and Canup acknowledge that

> *Recent models of this process predict that the orbit of the newly formed Moon should be in, or very near* [less than 1°]*, the Earth's equatorial plane.* William R. Ward and Robin M. Canup, "Origin of the Moon's Orbital Inclination from Resonant Disk Interactions," *Nature*, Vol. 403, 17 February 2000, p. 741.

Nevertheless, speculative ways to circumvent this problem continue to be suggested. Even if some theory could explain the Moon's high orbital inclination and angular momentum, other problems remain. [See **"Origin of the Moon"** on page 29.]

g. Lyttleton, p. 16.

◆ Fred Hoyle, *The Cosmology of the Solar System* (Hillside, New Jersey: Enslow Publishers, 1979), pp. 11–12.

◆ *"One of the detailed problems is then to explain how the Sun itself acquires nearly 99.9% of the mass of the solar system but only 2% of its angular momentum."* Frank D. Stacey, *Physics of the Earth* (New York: John Wiley & Sons, 1969), p. 4.

◆ Some have proposed transferring angular momentum from the Sun to the planets by "magnetic linking." McCrea states:

> *However, I scarcely think it has yet been established that the postulated processes would inevitably occur, or that if they did they would operate with the extreme efficiency needed in order to achieve the required distribution of angular momentum.* William Hunter McCrea, "Origin of the Solar System," *Symposium on the Origin of the Solar System* (Paris, France: Centre National de la Recherche Scientifique, 1972), p. 8.

h. Far more astronomers and planetary scientists quickly signed a petition opposing the IAU's vote. They said,

> *We, as planetary scientists and astronomers, do not agree with the IAU's definition of a planet, nor will we use it.*

Jenny Hogan, "Pluto: The Backlash Begins," *Nature*, Vol. 442, 31 August 2006, pp. 965.

◆ A transneptunian object is a body that orbits the Sun—usually beyond the orbit of the planet Neptune, about 30 astronomical units, or 2.8 billion miles, from the Sun.

◆ Contributing to the IAU's decision to remove Pluto's status as a planet was its small size (two-thirds the diameter of our moon) and the discovery, beginning in 1992, of what are now more than a thousand transneptunian objects, at least two of which are larger than Pluto. All are much farther from the Sun than Pluto.

A simple fix for the IAU would have been to define transneptunian objects as those bodies that *always* orbit the Sun beyond the orbit of Neptune. (Pluto's orbit sometimes comes inside Neptune's orbit.) Also, an honest acknowledgement that all planets are unique would have clarified matters. Even the many planets that have been discovered outside the solar system are completely different from those inside the solar system. Evolutionary process will not explain them all. [See **"Have Planets Been Discovered Outside the Solar System?"** on page 403.]

44. Earth: The Water Planet

a. *"Earth has substantially more water than scientists would expect to find at a mere 93 million miles from the sun."* Ben Harder, "Water for the Rock: Did Earth's Oceans Come from the Heavens?" *Science News*, Vol. 161, 23 March 2002, p. 184.

b. The water content of Comet Tempel 1 was 38% by mass. [See Endnote 4 on page 294.]

c. *"Hence, if comets like Hale-Bopp brought in the Earth's water, they would have brought in a factor of 40,000 times more argon than is presently in the atmosphere."* T. D. Swindle and D. A. Kring, "Implications of Noble Gas Budgets for the Origin of Water on Earth and Mars," *Eleventh Annual V. M. Goldschmidt Conference,* Abstract No. 3785 (Houston: Lunar and Planetary Institute, 20–24 May 2001). [To learn how comets probably collected argon, see Endnote 39 on page 297.]

d. *"Oxygen, D/H and Os* [osmium] *isotopic ratios all … rule out extant meteoritic material as sources of the Earth's water."* Michael J. Drake and Kevin Righter, "Determining the Composition of the Earth," *Nature*, Vol. 416, 7 March 2002, p. 42.

D/H is the ratio of heavy hydrogen (also called *deuterium*, or D) to normal hydrogen (H). Drake and Righter give many other reasons why meteorites could not have provided much of Earth's water.

e. *"If existing objects in space couldn't have combined to make Earth's unique mix of water and other elements, the planet must have formed from—and entirely depleted—an ancient supply of water-rich material that has no modern analog, Drake and Righter argue."* Harder, p. 185.

f. *"If water came from millions of comets or small asteroids, the same steady rain would have bombarded Mercury, Venus, Earth, and Mars, so they would all have begun with the same water characteristics, he says. However, the waters of those four planets now have dissimilar profiles, Owen and other geochemists have found."* Ibid.

After reading pages 271–326, you will see that the water in comets, asteroids, and meteoroids—as well as some water detected elsewhere in the inner solar system—came primarily from the subterranean water chambers. During the flood, this subterranean water mixed with Earth's surface water, giving our surface water different isotope characteristics from water in comets, asteroids, and meteoroids.

"The carrier's [the tanker's] *elemental and isotopic characteristics would have to have been unlike those of any object that researchers have yet found in the solar system. … it doesn't seem geochemically plausible …"* Ibid., p. 186.

45. Molten Earth?

a. *"The textbook view that the earth spent its first half a billion years drenched in magma could be wrong."* John W. Valley, "A Cool Early Earth?" *Scientific American*, Vol. 294, October 2005, p. 59.

b. *"The kinetic energy (~5×10^{38} ergs) released in the largest impacts (1.5×10^{27} g at 9 km/sec) would be several times greater than that required to melt the entire Earth."* George W. Wetherill, "Occurrence of Giant Impacts during the Growth of the Terrestrial Planets," *Science*, Vol. 228, 17 May 1985, p. 879.

c. If gold were found only near volcanoes, then one might claim that gold was brought up to the Earth's surface by volcanoes. However, gold is seldom found near volcanoes.

Suppose that extremely hot water (932°F or 500°C) circulated under the crust—a crust that had never been molten. Gold in high concentrations could go into solution. If the solution then came up to the Earth's surface fast enough, little gold would precipitate as the water's pressure dropped. If this happened, about 250 cubic miles of water must have burst forth to account for the gold found in just one gold mining region in Canada. [See Robert Kerrich, "Nature's Gold Factory," *Science*, Vol. 284, 25 June 1999, pp. 2101–2102.] If these ideal pressure-temperature conditions did not exist, even more water must come up faster to account for the Earth's gold deposits. These are hardly the slow processes that evolutionists visualize. On pages 109–147 and 433–437, you will see how, why, and when vast amounts of hot water burst up through faults.

About 40% of all gold mined in the world is from the Witwatersrand Basin in South Africa. This gold, deposited in compressional fractures within the basin, precipitated from water whose temperature exceeded 300°C. [See A. C. Barnicoat et al., "Hydrothermal Gold Mineralization in the Witwatersrand Basin," *Nature*, Vol. 386, 24 April 1997, pp. 820–824.]

◆ Robert R. Loucks and John A. Mavrogenes, "Gold Solubility in Supercritical Hydrothermal Brines Measured in Synthetic Fluid Inclusions," *Science*, Vol. 284, 25 June 1999, pp. 2159–2163.

d. John W. Valley, "A Cool Early Earth?" *Scientific American*, Vol. 294, October 2005, pp. 58–65.

e. *"Meteorites, he notes, contain 10 times as much xenon, relative to other noble gasses, than occurs in Earth's atmosphere. In addition, the relative abundance of xenon isotopes found in meteorites doesn't jibe with the pattern found on Earth. If meteorites did deliver most of the water to our planet, they also would have provided xenon, and our atmosphere would have to have a very different composition, Owen maintains."* Ron Cowen, "Found: Primordial Water," *Science News*, Vol. 156, 30 October 1999, p. 285.

46. Evolving Planets?

a. Very special conditions are required to capture and then merge orbiting bodies. They are discussed more fully starting on page 274.

b. John F. Kerridge and James F. Vedder, "An Experimental Approach to Circumsolar Accretion," *Symposium on the Origin of the Solar System* (Paris, France: Centre National de la Recherche Scientifique, 1972), pp. 282–283.

◆ *"It turns out to be surprisingly difficult for planetesimals to accrete mass during even the most gentle collisions."* Erik Asphaug, "The Small Planets," *Scientific American*, Vol. 282, May 2000, p. 54.

c. Tim Folger, "This Battered Earth," *Discover*, January 1994, p. 33.

◆ *"'We came to the conclusion,' says Lissauer, 'that if you accrete planets from a uniform disk of planetesimals,* [the observed] *prograde rotation just can't be explained.' The simulated bombardment leaves a growing planet spinning once a week at most, not once a day."* Richard A. Kerr, "Theoreticians Are Putting a New Spin on the Planets," *Science*, Vol. 258, 23 October 1992, p. 548.

◆ Luke Dones and Scott Tremaine, "Why Does the Earth Spin Forward?" *Science*, Vol. 259, 15 January 1993, pp. 350–354.

◆ Some believe that the inner planets (Mercury, Venus, Earth, and Mars) gained their spins through a few very large and improbable impacts. However, this appeal to large, improbable impacts will not work for the giant outer planets (Jupiter, Saturn, Uranus, and Neptune), which have the most spin energy. Such impacts on these gaseous planets would be even more improbable, because they move more slowly and are so far from the center of the solar system. Besides, impacts from large rocks would not account for the composition of the giant planets—primarily hydrogen and helium.

d. *"Building Jupiter has long been a problem to theorists."* George W. Wetherill, "How Special Is Jupiter?" *Nature*, Vol. 373, 9 February 1995, p. 470.

◆ *"Talk about a major embarrassment for planetary scientists. There, blazing away in the late evening sky, are Jupiter and Saturn—the gas giants that account for 93% of the solar system's planetary mass—and no one has a satisfying explanation of how they were made."* Richard A. Kerr, "A Quickie Birth for Jupiters and Saturns," *Science*, Vol. 298, 29 November 2002, p. 1698.

e. This idea has a further difficulty. If, as the solar system began to form, a large, rocky planet quickly formed near Jupiter's orbit, why didn't a rocky planet form in the adjacent asteroid belt where we see more than 200,000 rocky bodies (asteroids) today?

f. B. Zuckerman et al., "Inhibition of Giant-Planet Formation by Rapid Gas Depletion around Young Stars," *Nature*, Vol. 373, 9 February 1995, pp. 494–496.

g. *"In the best simulations of the process* [of evolving Uranus and Neptune]*, cores for Uranus and Neptune fail to form at their present positions in even 4.5 billion years,* [what evolutionists believe is] *the lifetime of the solar system. 'Things just grow too slowly' in the outermost solar system, says Weidenschilling. 'We've tried to form Uranus and Neptune at their present locations and failed miserably.'"* Stuart Weidenschilling, as quoted by Richard A. Kerr, "Shaking Up a Nursery of Giant Planets," *Science*, Vol. 286, 10 December 1999, p. 2054.

◆ Renu Malhotra, "Chaotic Planet Formation," *Nature*, Vol. 402, 9 December 1999, pp. 599–600.

47. Planetary Rings

a. William K. Hartmann, *Moons and Planets*, 3rd edition (Belmont, California: Wadsworth Publishing Co., 1993), p. 143.

b. Similar faulty logic claims that, because we see comets, asteroids, and meteoroids, the solar system must have evolved.

c. *"Geysers on Enceladus replenish the E ring."* Richard A. Kerr, "At Last, a Supportive Parent for Saturn's Youngest Ring," *Science*, Vol. 309, 9 September 2005, p. 1660.

◆ *"Saturn's moons are bombarded by comets or micro-meteoroids. Those collisions knock off ice particles and send them into orbit around Saturn, forming rings."* Ron Cowen, "Ring Shots," *Science News*, Vol. 170, 21 October 2006, p. 263.

◆ This has also been observed for Jupiter's rings. Jupiter has a few moons large enough to be hit frequently by meteoroids or comets, small enough to have little gravity so the debris can escape the moon, and close enough to Jupiter that tidal effects can spread the moon's debris into rings. [See Ron Cowen, "Mooning Over the Dust Rings of Jupiter," *Science News*, Vol. 154, 12 September 1998, pp. 182–183. See also Gretchen Vogel, "Tiny Moon Source of Jupiter's Ring," *Science*, Vol. 281, 25 September 1998, p. 1951.]

d. *"Yet nonstop erosion poses a difficult problem for the very existence of Saturn's opaque rings—the expected bombardment rate would pulverize the entire system in only 10,000 years! Most of this material is merely redeposited elsewhere in the rings, but even if only a tiny fraction is truly lost (as ionized vapor, for example), it becomes a real trick to maintain the rings since the formation of the solar system* [as imagined by evolutionists]*."* Jeffrey N. Cuzzi, "Ringed Planets: Still Mysterious—II," *Sky & Telescope*, Vol. 69, January 1985, p. 22.

◆ Jeffrey N. Cuzzi, "Saturn: Jewel of the Solar System," *The Planetary Report*, July/August 1989, pp. 12–15.

◆ Also, water in Saturn's rings is rapidly ionized and transported along magnetic lines to certain latitudes on Saturn. The Hubble Space Telescope has detected this water concentration in Saturn's atmosphere. [See Richard A. Kerr, "Slow Leak Seen in Saturn's Rings," *Science*, Vol. 274, 29 November 1996, p. 1468.]

◆ Richard A. Simpson and Ellis D. Miner, "Uranus: Beneath That Bland Exterior," *The Planetary Report,* July/August 1989, pp. 16–18.

◆ *"Saturn's rings (as well as the recently discovered ring system around Uranus) are unstable, therefore recent formations."* S. K. Vsekhsvyatsky, "Comets and the Cosmogony of the Solar System," *Comets, Asteroids, Meteorites*, editor A. H. Delsemme (Toledo, Ohio: The University of Toledo, 1977), p. 473.

48. Origin of the Moon

a. *"The whole subject of the origin of the moon must be regarded as highly speculative."* Robert C. Haymes, *Introduction to Space Science* (New York: John Wiley & Sons, 1971), p. 209.

◆ On 10 November 1971, Dr. Harold Urey, a Nobel prize-winning chemist and lunar scientist, stated *"I do not know the origin of the moon, I'm not sure of my own or any other's models, I'd lay odds against any of the models proposed* *being correct."* Robert Treash, "Magnetic Remanence in Lunar Rocks," *Pensee*, Vol. 2, May 1972, p. 22.

◆ *"In astronomical terms, therefore, the Moon must be classed as a well-known object, but astronomers still have to admit shamefacedly that they have little idea as to where it came from. This is particularly embarrassing, because the solution of the mystery was billed as one of the main goals of the US lunar exploration programme."* David W. Hughes, "The Open Question in Selenology," *Nature*, Vol. 327, 28 May 1987, p. 291.

b. Haymes, p. 209.

c. Paul M. Steidl, *The Earth, the Stars, and the Bible* (Grand Rapids: Baker Book House, 1979), pp. 77–79.

◆ M. Mitchell Waldrop, "The Origin of the Moon," *Science*, Vol. 216, 7 May 1982, pp. 606–607.

◆ *"If the Moon had separated from the Earth, it would either have broken away completely or returned, but it could not have gone into orbit."* Stacey, p. 38.

d. *"We conclude that an Earth system with multiple moons is the final result unless some particularly severe constraints on initial conditions in the disk are met."* Robin M. Canup and Larry W. Esposito, "Accretion of the Moon from an Impact-Generated Disk," *Icarus*, Vol. 119, February 1996, p. 427.

e. *"… no reasonable means to rid the Earth/Moon system of this excess angular momentum has yet been proposed."* Shigeru Ida et al., "Lunar Accretion from an Impact-Generated Disk," *Nature*, Vol. 389, 25 September 1997, p. 357.

f. *"This is a problem for the giant impact theory, says* [Erik] *Hauri. 'It's hard to imagine a scenario in which a giant impact melts, completely, the moon, and at the same time allows it to hold onto its water,' he says. 'That's a really, really difficult knot to untie.'"* Nell Greenfieldboyce, quoting Erik Hauri, "Glass Beads from Moon Hint of Watery Past," www.npr.org/templates/story/story.php?storyId=92383117, 12 July 2008. [See Endnote 17 on page 294.]

g. Jack J. Lissauer, "It's Not Easy to Make the Moon," *Nature*, Vol. 389, 25 September 1997, pp. 327–328.

49. Evolution of the Solar System?

a. *"For decades, astronomers have speculated that debris left over from the formation of the solar system or newly formed from colliding asteroids is continuously falling toward the sun and vaporizing. The infrared signal, if it existed, would be so strong at the altitude of Mauna Kea* [Hawaii]*, above the infrared-absorbing water vapor in the atmosphere, that the light-gathering power of the large infrared telescopes would be overkill. … In the case of the infrared search for the dust ring,* [Donald N. B.] *Hall* [Director of the University of Hawaii's Institute for Astronomy] *was able to report within days that 'the data were really superb.' They don't tell an entirely welcome story, though. 'Unfortunately, they don't seem to show any dust rings at all.'"* Charles Petit, "A Mountain Cliffhanger of an Eclipse," *Science*, Vol. 253, 26 July 1991, pp. 386–387.

◆ *"… interplanetary dust is not highly concentrated around the sun. In situ measurements made with impact detectors aboard the two Helios probes, which reached a heliocentric distance of 60* [solar radii]*, have also shown that the spatial IDP* [interplanetary dust particle] *density gradually levels off inside ~100 solar radii.*

"Our two-dimensional IR [infrared] *observations have shown unambiguously that a prominent circumsolar dust ring did not exist at the time of the 11 July 1991 solar eclipse. Consistent with these results, a second recent IR eclipse experiment also found no evidence of surface brightness enhancements."* P. Lamy et al., "No Evidence of a Circumsolar Dust Ring from Infrared Observations of the 1991 Solar Eclipse," *Science*, Vol. 257, 4 September 1992, p. 1379.

b. L. F. Miranda et al., "Water-Maser Emission from a Planetary Nebula with a Magnetic Torus," *Nature*, Vol. 414, 15 November 2001, pp. 284–286.

50. Faint Young Sun

a. Gregory S. Jenkins et al., "Precambrian Climate: The Effects of Land Area and Earth's Rotation Rate," *Journal of Geophysical Research*, Vol. 98, 20 May 1993, pp. 8785–8791.

This paper acknowledges that if the Earth rotated almost twice as fast as it does today, this problem would be lessened—but not solved. Still required are a flooded Earth and an atmosphere with 30–300 times more carbon dioxide than today.

b. Let's assume an old Earth and at least a fifth of the atmospheric carbon dioxide needed to prevent a runaway ice age had been present throughout the Earth's first 2,750,000,000 years. That carbon dioxide would have combined with weathered rocks to produce large amounts of the mineral siderite ($FeCO_3$). Siderite is missing from ancient soils, showing that the concentrations of carbon dioxide needed to prevent a frozen Earth were never present. [See Rob Rye et al., "Atmospheric Carbon Dioxide Concentrations before 2.2 Billion Years Ago," *Nature*, Vol. 378, 7 December 1995, pp. 603–605.]

◆ *"There is no direct evidence to show that carbon dioxide levels were ever a thousand times higher."* Gregory Jenkins, as quoted by Tim Folger, "The Fast Young Earth," *Discover*, November 1993, p. 32.

c. William R. Kuhn, "Avoiding a Permanent Ice Age," *Nature*, Vol. 359, 17 September 1992, p. 196.

d. *"The methane greenhouse effect is limited, however, because organic haze starts to form* [chemically] *at CH_4/CO_2 ratios higher than ~0.1, and this creates an anti-greenhouse effect that cools the surface if the haze becomes too thick."* James F. Kasting, "Faint Young Sun Redux," *Nature*, Vol. 464, 1 April 2010, p. 688.

e. In 1972, Carl Sagan and George H. Mullen first proposed that the early Earth had lots of heat-trapping methane and ammonia. They had no evidence for early methane and ammonia; they simply were looking for something that might have warmed the Earth, so there would have been no runaway deep freeze and life could have evolved. At the time of Sagan's death (1996), he was still looking.

f. *"Despite all of these proposed warming mechanisms, there are still reasons to think that the faint young Sun problem is not yet solved. Ice albedo feedback has been neglected in all of these one-dimensional climate calculations."* Kasting, p. 688.

g. For a frank admission of these and other "special pleadings," see Carl Sagan and Christopher Chyba, "The Early Faint Sun Paradox: Organic Shielding of Ultraviolet-Labile Greenhouse Gases," *Science*, Vol. 276, 23 May 1997, pp. 1217–1221.

51. Mountains of Venus

a. Richard A. Kerr, "A New Portrait of Venus: Thick-Skinned and Decrepit," *Science*, Vol. 263, 11 February 1994, pp. 759–760.

52. Space, Time, and Matter

a. Nathan R. Wood, *The Secret of the Universe*, 10th edition (Grand Rapids: Eerdmans Publishing Co., 1936).

53. A Beginning

a. *"So long as the universe had a beginning, we could suppose it had a creator."* Stephen W. Hawking, *A Brief History of Time* (New York: Bantam Books, 1988), pp. 140–141.

55. Second Law of Thermodynamics

a. *"The more orthodox scientific view is that the entropy of the universe must forever increase to its final maximum value. It has not yet reached this: we should not be thinking about it if it had. It is still increasing rapidly, and so must have had a beginning; there must have been what we may describe as a 'creation' at a time not infinitely remote."* Jeans, p. 181.

b. *"A final point to be made is that the second law of thermodynamics and the principle of increase in entropy have great philosophical implications. The question that arises is how did the universe get into the state of reduced entropy in the first place, since all natural processes known to us tend to increase entropy? … The author has found that the second law tends to increase his conviction that there is a Creator who has the answer for the future destiny of man and the universe."* Gordon J. Van Wylen, *Thermodynamics* (New York: John Wiley & Sons, 1959), p. 169.

◆ *"The time asymmetry of the Universe is expressed by the second law of thermodynamics, that entropy increases with time as order is transformed into disorder. The mystery is not that an ordered state should become disordered but that the early Universe apparently was in a highly ordered state."* Don N. Page, "Inflation Does Not Explain Time Asymmetry," *Nature*, Vol. 304, 7 July 1983, p. 39.

"There is no mechanism known as yet that would allow the Universe to begin in an arbitrary state and then evolve to its present highly-ordered state." Ibid., p. 40.

◆ *"The real puzzle is why there is an arrow of time at all; that is, why the Universe is not simply a thermodynamic equilibrium at all times (except during the inevitable local fluctuations). The theory of nonequilibrium systems* [such as those described by Ilya Prigogine] *may tell us how such systems behave, given that there are some; but it does not explain how they come to be so common in the first place (and all oriented in the same temporal direction). This is 'time's greatest mystery', and for all its merits, the theory of nonequilibrium systems does not touch it. What would touch it would be a cosmological demonstration that the Universe was bound to be in a low-entropy state after the Big Bang."* Huw Price, "Past and Future," *Nature*, Vol. 348, 22 November 1990, p. 356.

56. Big Bang?

a. *"Observations only recently made possible by improvements in astronomical instrumentation have put theoretical models of the Universe* [the big bang] *under intense pressure. The standard ideas of the 1980s about the shape and history of the Universe have now been abandoned—and cosmologists are now taking seriously the possibility that the Universe is pervaded by some sort of vacuum energy, whose origin is not at all understood."* Peter Coles, "The End of the Old Model Universe," *Nature*, Vol. 393, 25 June 1998, p. 741.

◆ *"Astronomy, rather cosmology, is in trouble. It is, for the most part, beside itself. It has departed from the scientific method and its principles, and drifted into the bizarre; it has raised imaginative invention to an art form; and has shown a ready willingness to surrender or ignore fundamental laws, such as the second law of thermodynamics and the maximum speed of light, all for the apparent rationale of saving the status quo. Perhaps no 'science' is receiving more self-criticism, chest-beating, and self-doubt; none other seems so lost and misdirected; trapped in debilitating dogma."* Roy C. Martin Jr., *Astronomy on Trial: A Devastating and Complete Repudiation of the Big Bang Fiasco* (New York: University Press of America, 1999), p. xv.

b. Redshifts can be caused by other phenomena. [See Jayant V. Narlikar, "Noncosmological Redshifts," *Space Science Reviews*, Vol. 50, August 1989, pp. 523–614.] However, large redshifts are probably the result of the Doppler effect.

c. *"… energy in recognizable forms (kinetic, potential, and internal) in an expanding, spatially unbounded, homogeneous universe is not conserved."* Edward R. Harrison, "Mining Energy in an Expanding Universe," *The Astrophysical Journal*, Vol. 446, 10 June 1955, p. 66.

d. *"The evidence is accumulating that redshift is a shaky measuring rod."* Margaret Burbidge (former director of the Royal Greenwich Observatory and past president of the American Association for the Advancement of Science), as quoted by Govert Schilling, "Radical Theory Takes a Test," *Science*, Vol. 291, 26 January 2001, p. 579.

e. Halton M. Arp, *Quasars, Redshifts, and Controversies* (Berkeley, California: Interstellar Media, 1987).

f. Michael D. Lemonick, "Star Seeker," *Discover*, November 2001, p. 44.

g. William G. Tifft, "Properties of the Redshift," *The Astrophysical Journal*, Vol. 382, 1 December 1991, pp. 396–415.

h. *"The big bang made no quantitative prediction that the 'background' radiation would have a temperature of 3 degrees Kelvin (in fact its initial prediction* [by George Gamow in 1946] *was 30 degrees Kelvin); whereas Eddington in 1926 had already calculated that the 'temperature of space' produced by the radiation of starlight would be found to be 3 degrees Kelvin."* Tom Van Flandern, "Did the Universe Have a Beginning?" *Meta Research Bulletin*, Vol. 3, 15 September 1994, p. 33.

"Despite the widespread acceptance of the big bang theory as a working model for interpreting new findings, not a single important prediction of the theory has yet been confirmed, and substantial evidence has accumulated against it." Ibid., p. 25.

◆ *"History also shows that some BB* [big bang] *cosmologists' 'predictions' of MBR* [microwave background radiation] *temperature have been 'adjusted' after-the-fact to agree with observed temperatures."* William C. Mitchell, "Big Bang Theory Under Fire," *Physics Essays*, Vol. 10, June 1997, pp. 370–379.

◆ *"What's more, the big bang theory can boast of no quantitative predictions that have subsequently been validated by observation."* Eric J. Lerner et al., "Bucking the Big Bang," *New Scientist*, Vol. 182, 22 May 2004, p. 20. [This blistering article critiquing the big bang theory was originally signed by 33 scientists from 10 countries. Later 374 other scientists, engineers, and researchers endorsed the article. See www.cosmologystatement.org.]

i. *"In each of the five patches of sky surveyed by the team, the distant galaxies bunch together instead of being distributed randomly in space. 'The work is ongoing, but what we're able to say now is that galaxies we are seeing at great distances are as strongly clustered in the early universe as they are today,' says Steidel, who is at the California Institute of Technology in Pasadena."* Ron Cowen, "Light from the Early Universe," *Science News*, Vol. 153, 7 February 1998, p. 92.

◆ *"In fact, studies we have done show that the distribution of matter is fractal, just like a tree or a cloud."* [Patterns that repeat on all scales are called *fractal*.] Francesco Sylos Labini, as quoted by Marcus Chown, "Fractured Universe," *New Scientist*, Vol. 163, 21 August 1999, p. 23.

"If this dissenting view is correct [that the universe is fractal] *and the Universe doesn't become smoothed out on the very largest scales, the consequences for cosmology are profound. 'We're lost,' says* [Professor of Astrophysics, Peter] *Coles. 'The foundations of the big bang models would crumble away. We'd be left with no explanation for the big bang, or galaxy formation, or the distribution of galaxies in the Universe.'"* Ibid.

j. Margaret J. Geller and John P. Huchra, "Mapping the Universe," *Science*, Vol. 246, 17 November 1989, pp. 897–903. [See also M. Mitchell Waldrop, "Astronomers Go Up Against the Great Wall," *Science*, Vol. 246, 17 November 1989, p. 885.]

◆ John Travis, "Cosmic Structures Fill Southern Sky," *Science*, Vol. 263, 25 March 1994, p. 1684.

◆ Will Saunders et al., "The Density Field of the Local Universe," *Nature*, Vol. 349, 3 January 1991, pp. 32–38.

◆ *"But this uniformity* [in the cosmic microwave background radiation, CMB] *is difficult to reconcile with the obvious clumping of matter into galaxies, clusters of galaxies and even larger features extending across vast regions of the universe, such as 'walls' and 'bubbles'."* Ivars Peterson, "Seeding the Universe," *Science News*, Vol. 137, 24 March 1990, p. 184.

◆ As described below, one of the largest structures in the universe, "The Great Wall," was discovered in 1989. It consists of tens of thousands of galaxies lined up in a wall-like structure, stretching across half a billion light-years of space. It is so large that none of its edges have been found. An even larger structure, the Sloan Great Wall, was discovered in 2003 and is the largest structure known in the universe.

"The theorists know of no way such a monster [the Great Wall] *could have condensed in the time available since the Big Bang, especially considering that the 2.7 K background radiation reveals a universe that was very homogeneous in the beginning."* M. Mitchell Waldrop, "The Large-Scale Structure of the Universe Gets Larger—Maybe," *Science*, Vol. 238, 13 November 1987, p. 894.

"The map's most eye-catching feature is the Sloan Great Wall of galaxies, a clustering of galaxies that stretches 1.37 billion light-years across the sky and is the largest cosmic structure ever found. Astronomers worried that such a humongous structure, 80 percent bigger than the famous Great Wall of galaxies first discerned in a sky survey 2 decades ago, might violate the accepted model of galaxy evolution." Ron Cowen, "Cosmic Survey," *Science News*, Vol. 164, 1 November 2003, p. 276.

◆ James Glanz, "Precocious Structures Found," *Science*, Vol. 272, 14 June 1996, p. 1590.

◆ For many years, big bang theorists searched in vain with increasingly precise instruments for temperature concentrations in the nearly uniform CMB. Without concentrations, matter could never gravitationally contract around those concentrations to form galaxies and galaxy clusters. Finally, in 1992, with great fanfare, an announcement was made in the popular media that slight concentrations were discovered. Major shortcomings were not mentioned:

❖ The concentrations were only one part in 100,000—not much more than the errors in the instruments. Such slight concentrations could not be expected to initiate much clustering. As Margaret Geller stated, *"Gravity can't, over the age of the universe, amplify these irregularities enough* [to form huge clusters of galaxies]*."* Travis, p. 1684.

- "[The] *data are notoriously noisy, and the purported effect looks remarkably like an instrumental glitch: it appears only in one small area of the sky and on an angular scale close to the limit of the satellite's resolution."* George Musser, "Skewing the Cosmic Bell Curve," *Scientific American*, Vol. 281, September 1999, p. 28.
- Slight errors or omissions in the many data processing steps could easily account for the faint signal.
- Reported variations in the CMB spanned areas of the sky that were 100 or 1,000 times too broad to produce galaxies.
- *"... mysterious discrepancies have arisen between* [the inflationary big bang] *theory and observations ... It looks like inflation is getting into a major jam."* Glen D. Starkman and Dominik J. Schwarz, "Is the Universe Out of Tune?" *Scientific American*, Vol. 293, August 2005, pp. 49, 55.

The slight temperature variations (0.00003°C) detected have a strong statistical connection with the solar system. [Ibid., pp. 52–55.] They probably have nothing to do with a big bang.

k. *"And no element abundance prediction of the big bang was successful without some ad hoc parameterization to 'adjust' predictions that otherwise would have been judged as failures."* Van Flandern, p. 33.

- *"It is commonly supposed that the so-called primordial abundances of D, ^{3}He, and ^{4}He and ^{7}Li provide strong evidence for Big Bang cosmology. But a particular value for the baryon-to-photon ratio needs to be assumed ad hoc to obtain the required abundances."* H. C. Arp et al., "The Extragalactic Universe: An Alternative View," *Nature*, Vol. 346, 30 August 1990, p. 811.

- *"The study of historical data shows that over the years predictions of the ratio of helium to hydrogen in a BB* [big bang] *universe have been repeatedly adjusted to agree with the latest available estimates of that ratio as observed in the real universe. The estimated ratio is dependent on a ratio of baryons to photons (the baryon number) that has also been arbitrarily adjusted to agree with the currently established helium to hydrogen ratio. These appear to have not been predictions, but merely adjustments of theory ('retrodictions') to accommodate current data."* Mitchell, p. 7.

l. Steidl, pp. 207–208.

- D. W. Sciama, *Modern Cosmology* (London: Cambridge University Press, 1971), pp. 149–155.

m. *"Examining the faint light from an elderly Milky Way star, astronomers have detected a far greater abundance* [a thousand times too much] *of beryllium atoms than the standard Big Bang model predicts."* Ron Cowen, "Starlight Casts Doubt on Big Bang Details," *Science News*, Vol. 140, 7 September 1991, p. 151.

- Gerard Gilmore et al., "First Detection of Beryllium in a Very Metal Poor Star: A Test of the Standard Big Bang Model," *The Astrophysical Journal*, Vol. 378, 1 September 1991, pp. 17–21.

- Ron Cowen, "Cosmic Chemistry: Closing the Gap in the Origin of the Elements," *Science News*, Vol. 150, 2 November 1996, pp. 286–287.

n. *"One might expect Population III stars* [stars with only hydrogen and helium and no heavier elements] *to have the same sort of distribution of masses as stars forming today, in which case some should be small enough (smaller than 0.8 the mass of the Sun) still to be burning their nuclear fuel. The problem is that, despite extensive searches, nobody has ever found a zero-metallicity star."* Bernard Carr, "Where Is Population III?" *Nature*, Vol. 326, 30 April 1987, p. 829.

- *"Are there any stars older than Population II* [i.e., Population III stars]*? There should be, if our ideas about the early history of the universe* [i.e., the big bang theory] *are correct. ... There is no statistically significant evidence for Population III objects* [stars]*."* Leif J. Robinson, "Where Is Population III?" *Sky and Telescope*, July 1982, p. 20.

- *"Astronomers have never seen a pure Population III star, despite years of combing our Milky Way galaxy."* Robert Irion, "The Quest for Population III," *Science*, Vol. 295, 4 January 2002, p. 66.

Supposedly, Population II stars, stars having slight amounts of some heavy elements, evolved after Population III stars. Predicted characteristics of Population II stars have never been observed.

> *Spectral studies of ancient* [Population II] *stars in the Milky Way haven't turned up anything so distinctive* [as the chemical elements that should be present], [Timothy] *Beers notes, but the search continues.* Ibid., p. 67.

o. *"There shouldn't be galaxies out there at all, and even if there are galaxies, they shouldn't be grouped together the way they are."* James Trefil, *The Dark Side of the Universe* (New York: Charles Scribner's Sons, 1988), p. 3.

- Geoffrey R. Burbidge, "Was There Really a Big Bang?" *Nature*, Vol. 233, 3 September 1971, pp. 36–40.

- Ben Patrusky, "Why Is the Cosmos 'Lumpy'?" *Science 81*, June 1981, p. 96.

- Stephen A. Gregory and Laird A. Thompson, "Superclusters and Voids in the Distribution of Galaxies," *Scientific American*, Vol. 246, March 1982, pp. 106–114.

p. *"Galaxy rotation and how it got started is one of the great mysteries of astrophysics. In a Big Bang universe, linear motions are easy to explain: They result from the bang. But what started the rotary motions?"* William R. Corliss, *Stars, Galaxies, Cosmos: A Catalog of Astronomical Anomalies* (Glen Arm, Maryland: The Sourcebook Project, 1987), p. 177.

q. *"One of the great challenges for modern cosmology is to determine how the initial power spectrum evolved into the spectrum observed today. ... the universe is much clumpier on those scales* [600–900 million light-years] *than current theories can explain."* Stephen D. Landy, "Mapping the Universe," *Scientific American*, Vol. 280, June 1999, p. 44.

r. Alan Dressler, "The Large-Scale Streaming of Galaxies," *Scientific American*, Vol. 257, September 1987, pp. 46–54.

s. *"It is a fundamental rule of modern physics* [namely, the big bang theory] *that for every type of particle in nature there is a corresponding 'antiparticle'."* Steven Weinberg, *The First Three Minutes* (New York: Bantam Books, Inc., 1977), p. 76.

◆ *"If the universe began in the big bang as a huge burst of energy, it should have evolved into equal parts matter and antimatter. But instead the stars and nebulae are made of protons, neutrons and electrons and not their antiparticles (their antimatter equivalents)."* Kane, pp. 73–74.

◆ *"But to balance the cosmic energy books—and to avoid violating the most fundamental laws of physics—matter and antimatter should have been created* [in a big bang] *in exactly equal amounts. And then they should have promptly wiped each other out. Yet here we are."* Tim Folger, "Antimatter," *Discover*, August 2004, p. 68.

t. *"Within our galaxy, we can be confident that there are no stars of antimatter; otherwise, the pervasive interstellar medium would instigate annihilation and ensuing gamma-ray emission at a rate far in excess of that observed. ... One difficulty with the idea of antigalaxies lies in maintaining their separation from galaxies. Empty space may now separate them, but in the early universe, these regions must have been in relatively close contact. Annihilation seems difficult to avoid, particularly because we now know that many regions of intergalactic space are occupied by a tenuous gas. Interaction with the gas would make annihilation inevitable in antimatter regions, with the consequent emission of observable gamma radiation."* Joseph Silk, *The Big Bang* (San Francisco: W. H. Freeman and Co., 1980), p. 115.

◆ *"Also, as far as we know, there is no appreciable amount of antimatter in the universe."* Weinberg, p. 88.

u. One might also ask where the "cosmic egg" came from if there was a big bang. Of course, the question is unanswerable. Pushing any origin explanation back far enough raises similar questions—all scientifically untestable. Thus, the question of ***ultimate*** origins is not a purely scientific matter. What science can do is test possible explanations once the starting assumptions are given. For example, if a tiny "cosmic egg" (having all the mass in the universe) existed, it should not explode, based on present understanding. Claiming that some strange, new phenomenon caused an explosion (or inflation) is philosophical speculation. While such speculation may or may not be correct, it is not science. [See **"How Can the Study of Creation Be Scientific?"** on page 376.]

v. *"Three years ago, observations of distant, exploding stars blew to smithereens some of astronomers' most cherished ideas about the universe* [the big bang theory]. *To piece together an updated theory, they're now thinking dark thoughts about what sort of mystery force may be contorting the cosmos.*

"According to the standard view of cosmology, the once infinitesimal universe has ballooned in volume ever since its fiery birth in the Big Bang, but the mutual gravitational tug of all the matter in the cosmos has gradually slowed that expansion.

"In 1998, however, scientists reported that a group of distant supernovas were dimmer, and therefore farther from Earth, than the standard theory indicated. It was as if, in the billion or so years it took for the light from these exploded stars to arrive at Earth, the space between the stars and our planet had stretched out more than expected. That would mean that cosmic expansion has somehow sped up, not slowed down. Recent evidence has only firmed up that bizarre result." Ron Cowen, "A Dark Force in the Universe," *Science News*, Vol. 159, 7 April 2001, p. 218.

◆ *"Not only don't we see the universe slowing down; we see it speeding up."* Adam Riess, as quoted by James Glanz, "Astronomers See a Cosmic Antigravity Force at Work," *Science*, Vol. 279, 27 February 1998, p. 1298.

◆ *"In one of the great results of twentieth century science, NSF-funded astronomers have shown both that the universe does not contain enough matter in the universe to slow the expansion, and that the rate of expansion actually increases with distance. Why? Nobody knows yet."* National Science Foundation Advertisement, "Astronomy: Fifty Years of Astronomical Excellence," *Discover*, September 2000, p. 7.

◆ *"The expansion of the universe was long believed to be slowing down because of the mutual gravitational attraction of all the matter in the universe. We now know that the expansion is accelerating and that whatever caused the acceleration (dubbed "dark energy") cannot be Standard Model physics."* Gordon Kane, "The Dawn of Physics Beyond the Standard Model," *Scientific American*, Vol. 288, June 2003, p. 73.

w. *"... dark matter has not been detected in the laboratory, and there is no convincing theoretical explanation of dark energy."* Carlton Baugh, "Universal Building Blocks," *Nature*, Vol. 421, 20 February 2003, p. 792.

◆ *"We know little about that sea. The terms we use to describe its components, 'dark matter' and 'dark energy,' serve mainly as expressions of our ignorance."* David B. Cline, "The Search for Dark Matter," *Scientific American,* Vol. 288, March 2003, p. 52.

x. Wayne Hu and Martin White, "The Cosmic Symphony," *Scientific American*, Vol. 290, February 2004, p. 50.

y. "Big Bang Gone Quiet," *Nature*, Vol. 372, 24 November 1994, p. 304.

- Michael J. Pierce et al., "The Hubble Constant and Virgo Cluster Distance from Observations of Cepheid Variables," *Nature*, Vol. 371, 29 September 1994, pp. 385–389.
- Wendy L. Freedman et al., "Distance to the Virgo Cluster Galaxy M100 from Hubble Space Telescope Observations of Cepheids," *Nature*, Vol. 371, 27 October 1994, pp. 757–762.
- N. R. Tanvir et al., "Determination of the Hubble Constant from Observations of Cepheid Variables in the Galaxy M96," *Nature*, Vol. 377, 7 September 1995, pp. 27–31.
- Robert C. Kennicutt Jr., "An Old Galaxy in a Young Universe," *Nature*, Vol. 381, 13 June 1996, pp. 555–556.
- James Dunlop, "A 3.5-Gyr-Old Galaxy at Redshift 1.55," *Nature*, Vol. 381, 13 June 1996, pp. 581–584.
- *"It's clear to most people that you can't be older than your mother. Astronomers understand this, too, which is why they're so uncomfortable these days. The oldest stars in globular clusters seem to date back 15 billion years. The universe appears to be only 9 billion to 12 billion years old. At least one of those conclusions is wrong."* William J. Cook, "How Old Is the Universe?" *U.S. News & World Report*, 18–25 August 1997, p. 34.

z. *"I have little hesitation in saying that a sickly pall now hangs over the big-bang theory. When a pattern of facts becomes set against a theory, experience shows that the theory rarely recovers."* Fred Hoyle, "The Big Bang Under Attack," *Science Digest*, May 1984, p. 84.

57. Missing Mass

a. This problem was first explained by R. H. Dicke, "Gravitation and the Universe: The Jayne Lectures for 1969," *American Philosophical Society of Philadelphia*, 1970, p. 62. Alan Guth's attempt to solve it (see "d" below) led to the "inflationary big bang theory."

b. This missing mass is called *dark matter*, because it cannot be seen and, so far, has not been detected. Candidates for "missing mass" include neutrinos, black holes, dead stars, low-mass stars, and various subatomic particles and objects dreamed up by cosmologists simply to solve this problem. Each candidate has many scientific problems.

One study of two adjacent galaxies shows that they have relatively little dark matter. [See Ron Cowen, "Ringing In a New Estimate for Dark Matter," *Science News*, Vol. 136, 5 August 1989, p. 84.] Another study found no missing mass within 150 million light-years of Earth. [See Eric J. Lerner, "COBE Confounds the Cosmologists," *Aerospace America*, March 1990, pp. 40–41.] A third study found no dark matter in a large elliptical galaxy, M105. [See "Dark Matter Isn't Everywhere," *Astronomy*, September 1993, pp. 19–20.] A fourth study found no dark matter in the main body of our galaxy. [See Alexander Hellemans, "Galactic Disk Contains No Dark Matter," *Science*, Vol. 278, 14 November 1997, p. 1230.] A fifth study, after cataloging the positions and distances of 100 million galaxies, concluded that the needed mass does not exist. [See Ron Cowen, "Whole-Sky Catalog," *Science News*, Vol. 155, 6 February 1999, pp. 92–93.] A sixth study, the most sensitive ever conducted on Earth, found no dark matter. [See Charles Seife, "Once Again, Dark Matter Eludes a Supersensitive Trap," *Science*, Vol. 304, 14 May 2004, p. 950.]

- *"Of all the many mysteries of modern astronomy, none is more vexing than the nature of dark matter. Most astronomers believe that large quantities of some unidentified material pervade the universe. ... Yet this dark matter has eluded every effort by astronomers and physicists to bring it out of the shadows. A handful of us suspect that it might not really exist, and others are beginning to consider this possibility seriously."* Mordehai Milgrom, "Does Dark Matter Really Exist?" *Scientific American*, Vol. 287, August 2002, p. 43.
- *"Even the most enthusiastic cosmologist will admit that current theories of the nature of the universe have some big holes. One such gap is that the universe seems to be younger than some of the objects contained within it.* [See **"How Old Do Evolutionists Say the Universe Is?"** on page 392.] *Another problem is that the observed universe just doesn't appear to have enough matter in it to explain the way it behaves now, nor the way theorists predict it will evolve."* Robert Matthews, "Spoiling a Universal 'Fudge Factor,'" *Science*, Vol. 265, 5 August 1994, pp. 740–741.

c. Supposedly, nothing can exceed the speed of light. Advocates of "*the inflationary big bang*" get around this problem by claiming that space expanded much faster than the speed of light, but the speed of matter *relative to that space* did not expand faster than the speed of light. They liken matter to raisins in a ball of dough. As the dough (representing space) rises (or expands), the raisins move outward with the dough but do not move relative to the dough.

"Inflation" has no experimental or observational support and supposedly happened before the laws of physics came into existence. Therefore, "inflation" lies outside the scientific realm. "Inflation" is a relatively recent "patch job," a nonscientific speculation inserted to get around a scientific problem. Here, the scientific problem is that nothing can exceed the velocity of light (except possibly the expansion rate of space). In science, a "patch job" is usually a warning that a theory is in trouble.

d. The inflationary big bang was proposed by Alan H. Guth in a paper titled "A Possible Solution to the Horizon and Flatness Problem" in *Physical Review, D*, Vol. 23, 15 January 1981, pp. 348–356.

- The "missing mass problem" can be stated more directly. If the big bang occurred, the total mass of the expanding universe should have a very precise relationship with the outward velocities and distances of all galaxies and other matter. This mass must not deviate from this amount by even one part in 10^{55} (ten thousand million billion trillion trillion trillion).

If the mass were slightly greater than this critical value (the closed condition):
i. gravity would have quickly collapsed all the matter in the universe into one big ball, perhaps within seconds,
ii. we would not be here to wonder how everything began.

If the mass were slightly less than this critical value (the open condition):
i. particles would have expanded indefinitely,
ii. stars and galaxies would not have formed, and
iii. we would not be here to think about it.

The estimated mass of the visible universe is less than a tenth of this critical value. Stars and galaxies exist. Therefore, the big bang probably did not occur. Faith in the big bang theory requires believing that a vast amount of invisible, unmeasurable mass is hidden somewhere.

This problem can be viewed another way. If the universe began in a big bang billions of years ago, it should:
i. have collapsed on itself (closed), or
ii. have expanded so much that stars and galaxies could never have formed (open), or
iii. have expansion velocities for most visible particles in the universe that lie within a ridiculously tight one part in 10^{55} of their escape velocities!

Consequently, the universe probably did not begin in a big bang billions of years ago.

58. Heavy Elements

a. *"Given that the cluster apparently comprises few galaxies, yet contains a large amount of iron, a new type of astronomical object is implied by our results. A revision of theoretical models of the metal* [heavy element] *enrichment process in galaxy clusters may therefore be required,"* M. Hattori et al., "A Dark Cluster of Galaxies at Redshift z=1," *Nature*, Vol. 388, 10 July 1997, p. 146.

b. Lennox L. Cowie and Antoinette Songaila, "Heavy-Element Enrichment in Low-Density Regions of the Intergalactic Medium," *Nature*, Vol. 394, 2 July 1998, pp. 44–46.

c. *"In both cases, the scatter of the observed values* [of heavy hydrogen] *is quite large and seems to reach a factor of 10. Although it is already surprising to see such variations within ~1000 pc from the sun, this looks unbelievable within only 30 pc from the sun."* [1 pc (or parsec) = 3.258 light-years] A. Vidal-Madjar, "Interstellar Helium and Deuterium," *Diffuse Matter in Galaxies*, editors J. Audouze et al. (Boston: D. Reidel Publishing Co., 1983), pp. 77–78.

59. Interstellar Gas

a. *"The process by which an interstellar cloud is concentrated until it is held together gravitationally to become a protostar is not known. In quantitative work, it has simply been assumed that the number of atoms per cm^3 has somehow increased about a thousand-fold over that in a dense nebula. The two principal factors inhibiting the formation of a protostar are that the gas has a tendency to disperse before the density becomes high enough for self-gravitation to be effective, and that any initial angular momentum would cause excessively rapid rotation as the material contracts. Some mechanism must therefore be provided for gathering the material into a sufficiently small volume that self-gravitation may become effective, and the angular momentum must in some way be removed."* Eva Novotny, *Introduction to Stellar Atmospheres and Interiors* (New York: Oxford University Press, 1973), pp. 279–280.

b. Martin Harwit, *Astrophysical Concepts* (New York: John Wiley & Sons, 1973), p. 394.

◆ *"... there is no reasonable astronomical scenario in which mineral grains can condense."* Fred Hoyle and Chandra Wickramasinghe, "Where Microbes Boldly Went," *New Scientist*, Vol. 91, 13 August 1981, p. 413.

c. *"Contemporary opinion on star formation holds that objects called protostars are formed as condensations from the interstellar gas. This condensation process is very difficult theoretically, and no essential theoretical understanding can be claimed; in fact, some theoretical evidence argues strongly against the possibility of star formation. However, we know that the stars exist, and we must do our best to account for them."* John C. Brandt, *The Physics and Astronomy of the Sun and Stars* (New York: McGraw-Hill, 1966), p. 111.

60. Fast Binaries

a. A. R. King and M. G. Watson, "The Shortest Period Binary Star?" *Nature*, Vol. 323, 4 September 1986, p. 105.

◆ Dietrick E. Thomsen, "A Dizzying Orbit for a Binary Star," *Science News*, Vol. 130, 11 October 1986, p. 231.

◆ "Ultrafast Binary Star," *Sky & Telescope*, February 1987, p. 154.

b. Jonathan Eberhart, "Now You See It, Now You Don't," *Science News*, Vol. 135, 7 January 1989, p. 13.

◆ Patrick Moore, *The New Atlas of the Universe* (New York: Arch Cape Press, 1988), p. 176.

61. Star Births? Stellar Evolution?

a. *"The universe we see when we look out to its furthest horizons contains a hundred billion galaxies. Each of these galaxies contains another hundred billion stars. That's 10^{22} stars all told. The silent embarrassment of modern astrophysics is that we do not know how even a single one of these stars managed to form."* Martin Harwit, Book Reviews, *Science*, Vol. 231, 7 March 1986, pp. 1201–1202.

Harwit also lists three formidable objections to all modern theories of star formation:

i. *"The contracting gas clouds must radiate energy in order to continue their contraction; the potential energy that is liberated in this pre-stellar phase must be observable somehow, but we have yet to detect and identify it.*

ii. *"The angular momentum that resides in typical interstellar clouds is many orders of magnitude higher than the angular momentum we compute for the relatively slowly spinning young stars; where and how has the protostar shed that angular momentum during contraction?*

iii. *"Interstellar clouds are permeated by magnetic fields that we believe to be effectively frozen to the contracting gas; as the gas cloud collapses to form a star, the magnetic field lines should be compressed ever closer together, giving rise to enormous magnetic fields, long before the collapse is completed. These fields would resist further collapse, preventing the formation of the expected star; yet we observe no evidence of strong fields, and the stars do form, apparently unaware of our theoretical difficulties."*

b. These explosions were misnamed "*planetary nebula*," because early astronomers with evolutionary ideas thought that these clouds were forming planets around new stars. [See Bruce Balick and Adam Frank, "The Extraordinary Deaths of Ordinary Stars," *Scientific American*, Vol. 291, July 2004, pp. 50–59.]

"Herschel … speculated they might be planetary systems taking shape around young stars. The name stuck even though the opposite turned out to be true; this type of nebula consists of gas molted from dying stars. … [Planetary nebula] *pose challenges to stellar evolution theory, the physics that describes the life story of stars."* Ibid., p. 52.

c. *"… no one has unambiguously observed material falling onto an embryonic star, which should be happening if the star is truly still forming. And no one has caught a molecular cloud in the act of collapsing."* Ivars Peterson, "The Winds of Starbirth," *Science News*, Vol. 137, 30 June 1990, p. 409.

◆ *"Precisely how a section of an interstellar cloud collapses gravitationally into a star—a double or multiple star, or a solar system—is still a challenging theoretical problem. … Astronomers have yet to find an interstellar cloud in the actual process of collapse."* Fred L. Whipple, *The Mystery of Comets* (Washington, D.C.: Smithsonian Institution Press, 1985), pp. 211–212, 213.

d. *"The origin of stars represents one of the most fundamental unsolved problems of contemporary astrophysics."* Charles J. Lada and Frank H. Shu, "The Formation of Sunlike Stars," *Science*, Vol. 248, 4 May 1990, p. 564.

"Most disturbing, however, is the fact that, despite numerous efforts, we have yet to directly observe the process of stellar formation. We have not yet been able to unambiguously detect the collapse of a molecular cloud core or the infall of circumstellar material onto an embryonic star. Until such an observation is made, it would probably be prudent to regard our current hypotheses and theoretical scenarios with some degree of suspicion." Ibid., p. 572.

e. *"In fact, given our current understanding of how stars form and the properties of the galactic center, it's* [stellar evolution near the galactic center is] *not allowed to happen."* Andrea M. Gaze, as quoted by Ron Cowen, "Mystery in the Middle," *Science News*, Vol. 163, 21 June 2003, p. 394.

◆ *"For example, no one can explain how the stars—which are 15 times heftier than our sun—got there* [near the center of our galaxy]. *According to most astronomical models, they are too big to have formed in the chaos of the galactic center but appear to be too young to have moved there from farther out."* Robert Irion, "The Milky Way's Dark, Starving Pit," *Science*, Vol. 300, 30 May 2003, p. 1356.

"The bizarre question of the hour is what the young stars are doing there at all. Clouds of gas need a calm and cold setting to collapse into a ball dense enough to ignite nuclear fusion. Yet gravitational tidal forces—from the black hole and from stars in the galaxy's nucleus—make the galactic center the antithesis of such a [stellar] *nursery."* Ibid., p. 1357.

◆ *"Ironically, stars such as these have no business being so close to a black hole … there is no plausible explanation of how and why the hot, young stars near the centre of the Milky Way and Andromeda got there."* Fulvio Melia, "Odd Company," *Nature*, Vol. 437, 20 October 2005, p. 1105.

f. *"Little is known about the origins of globular clusters, which contain hundreds of thousands of stars in a volume only a few light years across. Radiation pressure and winds from luminous young stars should disperse the star-forming gas and disrupt the formation of the cluster."* J. L. Turner et al., "An Extragalactic Supernebula," *Nature*, Vol. 423, 5 June 2003, p. 621.

g. *"Once a protostar reaches a threshold of about 20 solar masses, the pressure exerted by its radiation should overpower gravity and prevent it from growing any bigger. In addition to the radiation pressure, the winds that so massive a star generates disperse its natal cloud, further limiting its growth as well as interfering with the formation of nearby stars."* Erick T. Young, "Cloudy with a Chance of Stars: Making a Star Is No Easy Thing," *Scientific American*, Vol. 302, February 2010, p. 40.

◆ *"Nascent stars above 20 solar masses are so luminous that they would be expected to disrupt their own formation, as well as that of nearby stars."* Ibid., p. 37.

h. Steidl, pp. 134–136.

i. *"Nobody really understands how star formation proceeds. It's really remarkable."* Rogier A. Windhorst, as quoted by Corey S. Powell, "A Matter of Timing," *Scientific American*, Vol. 267, October 1992, p. 30.

◆ *"If stars did not exist, it would be easy to prove that this is what we expect."* Geoffrey R. Burbidge, as quoted by R. L. Sears and Robert R. Brownlee in *Stellar Structure*, editors Lawrence H. Aller and Dean McLaughlin (Chicago: University of Chicago Press, 1965), p. 577.

◆ *"We don't understand how a single star forms, yet we want to understand how 10 billion stars form."* Carlos Frenk, as quoted by Robert Irion, "Surveys Scour the Cosmic Deep," *Science*, Vol. 303, 19 March 2004, p. 1750.

62. Galaxies

a. *"There is much doubt, however, that galaxies evolve from one type to another at all."* George Abell, *Exploration of the Universe*, 2nd edition (New York: Holt, Rinehart, and Winston, 1969), p. 629.

◆ *"Our conclusions, then, are that the sequence of the classification of galaxies is not an evolutionary sequence …"* Paul W. Hodge, *The Physics and Astronomy of Galaxies and Cosmology* (New York: McGraw-Hill, 1966), p. 122.

b. "*The problem of explaining the existence of galaxies has proved to be one of the thorniest in cosmology. By all rights, they just shouldn't be there, yet there they sit. It's hard to convey the depth of frustration that this simple fact induces among scientists."* Trefil, p. 55.

Trefil explains the basis for this frustration in his fourth chapter, titled, "Five Reasons Why Galaxies Can't Exist."

◆ *"We cannot even show convincingly how galaxies, stars, planets, and life arose in the present universe."* Michael Rowan-Robinson, "Review of the Accidental Universe," *New Scientist*, Vol. 97, 20 January 1983, p. 186.

◆ *"A completely satisfactory theory of galaxy formation remains to be formulated."* Silk, *The Big Bang*, p. 22.

◆ *"The theory of the formation of galaxies is one of the great outstanding problems of astrophysics, a problem that today seems far from solution."* Weinberg, p. 68.

◆ Fifty cosmologists attended a conference on galaxy formation. After summarizing much observational data, two of the most respected authorities optimistically estimated the probability that any existing theory on galaxy formation is correct is about 1 out of 100. [See P. J. E. Peebles and Joseph Silk, "A Cosmic Book," *Nature*, Vol. 335, 13 October 1988, pp. 601–606.]

c. Hodge, p. 123.

d. Harold S. Slusher, "Clues Regarding the Age of the Universe," *ICR Impact*, No. 19, January 1975, pp. 2–3.

◆ Steidl, pp. 161–187.

e. *"In its simplest form, the Big Bang scenario doesn't look like a good way to make galaxies. It allows too little time for the force of gravity by itself to gather ordinary matter—neutrons, protons and electrons—into the patterns of galaxies seen today. Yet the theory survives for want of a better idea."* Peterson, "Seeding the Universe," p. 184.

◆ *"It* [the Great Wall, composed of tens of thousands of galaxies] *is far too large and too massive to have formed by the mutual gravitational attraction of its member galaxies."* M. Mitchell Waldrop, "Astronomers Go Up Against the Great Wall," *Science*, Vol. 246, 17 November 1989, p. 885. [See also Margaret J. Geller and John P. Huchra, "Mapping the Universe," *Science*, Vol. 246, 17 November 1989, pp. 897–903.]

63. Radiometric Dating

a. Larry Vardiman et al., *Radioisotopes and the Age of the Earth*, (El Cajon, California: Institute for Creation Research, 2005).

◆ For earlier work that showed that radioactive decay rates were much faster in the past, see:
  ❖ **"Lead and Helium Diffusion"** on page 39.
  ❖ Robert V. Gentry, "On the Invariance of the Decay Constant over Geological Time," *Creation Research Society Quarterly*, Vol. 5, September 1968, pp. 83–84.
  ❖ Robert V. Gentry, *Creation's Tiny Mystery*, 2nd edition (Knoxville, Tennessee: Earth Sciences Associates, 1988), p. 282.
  ❖ Paul A. Ramdohr, "New Observations on Radioactive Halos and Radioactive Fracturing," *Oak Ridge National Laboratory Translation* (ORNL-tr-755), 26 August 1965, pp. 16–25.

64. Corals and Caves

a. Ariel A. Roth, "Coral Reef Growth," *Origins*, Vol. 6, No. 2, 1979, pp. 88–95.

◆ J. Th. Verstelle, "The Growth Rate at Various Depths of Coral Reefs in the Dutch East Indian Archipelago," *Treubia*, Vol. 14, 1932, pp. 117–126.

b. Ian T. Taylor, *In the Minds of Men* (Toronto: TFE Publishing, 1984), pp. 335–336.

◆ Larry S. Helmick et al., "Rapid Growth of Dripstone Observed," *Creation Research Society Quarterly*, Vol. 14, June 1977, pp. 13–17.

65. Index Fossils

a. *"Ever since William Smith* [the founder of the index fossil technique] *at the beginning of the 19th century, fossils have been and still are the best and most accurate method of dating and correlating the rocks in which they occur. … Apart from very 'modern' examples, which are really archaeology, I can think of no cases of radioactive decay being used to date fossils."* Derek V. Ager, "Fossil Frustrations," *New Scientist*, Vol. 100, 10 November 1983, p. 425.

b. *"It cannot be denied that from a strictly philosophical standpoint geologists are here arguing in a circle. The succession of organisms has been determined by a study of their remains embedded in the rocks, and the relative ages of the rocks are determined by the remains of organisms that they contain."* R. H. Rastall, "Geology," *Encyclopaedia Britannica*, Vol. 10, 1954, p. 168.

◆ *"Are the authorities maintaining, on the one hand, that evolution is documented by geology and, on the other hand, that geology is documented by evolution? Isn't this a circular argument?"* Larry Azar, "Biologists, Help!" *BioScience*, Vol. 28, November 1978, p. 714.

◆ *"A circular argument arises: interpret the fossil record in the terms of a particular theory of evolution, inspect the interpretation, and note that it confirms the theory. Well, it* *would, wouldn't it?*

"... the fossils do not form the kind of pattern that would be predicted using a simple NeoDarwinian model." Thomas S. Kemp, "A Fresh Look at the Fossil Record," *New Scientist*, Vol. 108, 5 December 1985, p. 66.

- *"The intelligent layman has long suspected circular reasoning in the use of rocks to date fossils and fossils to date rocks. The geologist has never bothered to think of a good reply, feeling that explanations are not worth the trouble as long as the work brings results. This is supposed to be hard-headed pragmatism."* J. E. O'Rourke, "Pragmatism Versus Materialism in Stratigraphy," *American Journal of Science*, Vol. 276, January 1976, p. 47.

  "The rocks do date the fossils, but the fossils date the rocks more accurately. Stratigraphy cannot avoid this kind of reasoning, if it insists on using only temporal concepts, because circularity is inherent in the derivation of time scales." Ibid., p. 53.

  Although O'Rourke attempts to justify the practices of stratigraphers, he recognizes the inherent problems associated with such circular reasoning.

- *"But the danger of circularity is still present. For most biologists the strongest reason for accepting the evolutionary hypothesis is their acceptance of some theory that entails it. There is another difficulty. The temporal ordering of biological events beyond the local section may critically involve paleontological correlation, which necessarily presupposes the non-repeatability of organic events in geologic history. There are various justifications for this assumption but for almost all contemporary paleontologists it rests upon the acceptance of the evolutionary hypothesis."* Kitts, p. 466.

- *"It is a problem not easily solved by the classic methods of stratigraphical paleontology, as obviously we will land ourselves immediately in an impossible circular argument if we say, firstly that a particular lithology is synchronous on the evidence of its fossils, and secondly that the fossils are synchronous on the evidence of the lithology."* Derek V. Ager, *The Nature of the Stratigraphical Record*, 3rd edition (New York: John Wiley & Sons, 1993), p. 98.

- *"The charge that the construction of the geologic scale involves circularity has a certain amount of validity."* David M. Raup, "Geology and Creationism," *Field Museum of Natural History Bulletin*, Vol. 54, March 1983, p. 21.

- In a taped, transcribed, and approved 1979 interview with Dr. Donald Fisher, the state paleontologist for New York, Luther Sunderland asked Fisher how he dated certain fossils. Answer: *"By the Cambrian rocks in which they were found."* When Sunderland asked if this was not circular reasoning, Fisher replied, *"Of course; how else are you going to do it?"* "The Geologic Column: Its Basis and Who Constructed It," *Bible-Science News Letter*, December 1986, p. 6.

- *"The prime difficulty with the use of presumed ancestral-descendant sequences to express phylogeny is that biostratigraphic data are often used in conjunction with morphology in the initial evaluation of relationships, which leads to obvious circularity."* Bobb Schaeffer, Max K. Hecht, and Niles Eldredge, "Phylogeny and Paleontology," *Evolutionary Biology*, Vol. 6 (New York: Appleton-Century-Crofts, Inc., 1972), p. 39.

c. Peter Forey, "A Home from Home for Coelacanths," *Nature*, Vol. 395, 24 September 1998, pp. 319–320.

- Since the above discovery near Indonesia in 1998, most coelacanths are being caught off the coast of northern Tanzania, 500 miles north of what was thought to be their old habitats. [See Constance Holden, "Saving the Coelacanth," *Science*, Vol. 316, 8 June 2007, p. 1401.]

d. *"Zoologists originally thought that the paired fins of coelacanths and the fossil lobe-fins functioned as true limbs, as props to lever the fish against the solid substrate of the bottom sand or against rocks."* Keith S. Thomson, *Living Fossil: The Story of the Coelacanth* (New York: W. W. Norton & Co., Ltd., 1991), p. 160.

- *"... much attention has been focused on their fins in the hope that they will tell more about how fins became limbs."* Ommanney, p. 74.

- *"For the coelacanth was a member of a very ancient class of fishes which was supposed to have disappeared some 70 million years ago. This great group of fishes, called crossopterygians, flourished during that decisive era in the history of the earth—when the fish, taking on legs and lungs, went forth to conquer the continents."* Jacques Millot, "The Coelacanth," *Scientific American*, Vol. 193, December 1955, p. 34.

  Dr. Jacques Millot, who headed many detailed studies of freshly caught coelacanths, still held out hope as of 1955.

  > *Perhaps their stalked fins permit them to creep along the rocks like seals.* Ibid., p. 38.

  This myth was buried only after Dr. Hans Fricke's team observed coelacanths in their natural habitat in 1987. Their bottom fins have nothing to do with legs or creeping. Why did Millot ignore the facts he knew best? The coelacanth, he thought, solved a big problem. In 1955, Millot wrote:

  > *One of the great problems of evolution has been to find anatomical links between the fishes and their land-invading descendants ... For a long time evolutionists were troubled by this major gap between fishes and the amphibians. But the gap has now been bridged by studies of ancient fishes, and this is where the coelacanth comes in.* Ibid., pp. 35–36.

  Later (1987), after studying live coelacanths, the scientific world learned that Millot was wrong. The coelacanth did not bridge this gap. Therefore, the fish-to-amphibian problem is back.

- *"He* [J. L. B. Smith] *was able to report* [in the journal *Nature*] *that, like the lungfishes, the fish had an air bladder or lung (on the basis of the taxidermist's report of the discarded viscera), which was a median rather than paired structure."* Thomson, *Living Fossil,* p. 39. [It is now recognized that the discarded "bag" was not a lung, but an oil-filled swimming bladder.]

e. *"The brain of a 90-pound coelacanth weighs less than 50 grains* [0.11 ounces]*—that is, no more than one 15,000th of the body weight. No present-day vertebrate that we know of has so small a brain in relation to its size."* Millot, p. 39.

f. *"I confess I'm sorry we never saw a coelacanth walk on its fins."* Hans Fricke, "Coelacanths: The Fish That Time Forgot," *National Geographic*, Vol. 173, June 1988, p. 838.

"... we never saw any of them walk, and it appears the fish is unable to do so." Ibid., p. 837.

g. *"Few creatures have endured such an immense span of time with so little change as coelacanths. The cutaway drawing of a present-day specimen seems almost identical with the 140-million-year-old fossil found in a quarry in southern West Germany. ... Why have coelacanths remained virtually unchanged for eons ... 30 million generations?"* Fricke, p. 833. [Answer: They were fossilized a few thousand years ago, at the time of the flood.]

◆ *"Throughout the hundreds of millions of years the coelacanths have kept the same form and structure. Here is one of the great mysteries of evolution—that of the unequal plasticity of living things."* Millot, p. 37.

◆ *"The coelacanths have changed very little since their first known appearance in the Upper Devonian."* A. Smith Woodward, as quoted by Thomson, *Living Fossil*, p. 70.

◆ *"What is even more remarkable is that in spite of drastic changes in the world environment, the coelacanths are still much the same organically as their ancestors. ... In the meantime, research is continuing ... and will try to penetrate the secret of the adaptability which has enabled them to live through many geological eras under widely differing conditions without modifying their constitution."* Millot, p. 39.

◆ *"... the coelacanths have undergone little change in 300 million years ..."* Ommanney, p. 74.

66. Humanlike Footprints

a. Melvin A. Cook, "William J. Meister Discovery of Human Footprints with Trilobites in a Cambrian Formation of Western Utah," *Why Not Creation?* editor Walter E. Lammerts (Phillipsburg, New Jersey: Presbyterian and Reformed Publishing Co., 1970), pp. 185–193.

◆ Michael A. Cremo and Richard L. Thompson, *Forbidden Archeology* (San Diego: Bhaktivedanta Institute, 1993), pp. 810–813.

b. "Geology and Ethnology Disagree about Rock Prints," *Science News Letter*, 10 December 1938, p. 372.

c. Henry R. Schoolcraft and Thomas H. Benton, "Remarks on the Prints of Human Feet, Observed in the Secondary Limestone of the Mississippi Valley," *The American Journal of Science and Arts*, Vol. 5, 1822, pp. 223–231.

d. "Human-Like Tracks in Stone are Riddle to Scientists," *Science News Letter*, 29 October 1938, pp. 278–279.

e. *"'Make no mistake about it,' says Tim* [White, who is probably recognized as the leading authority on the Laetoli footprints]. *'They are like modern human footprints. If one were left in the sand of a California beach today, and a four-year-old were asked what it was, he would instantly say that someone had walked there. He wouldn't be able to tell it from a hundred other prints on the beach, nor would you. The external morphology is the same. There is a well-shaped modern heel with a strong arch and a good ball of the foot in front of it. The big toe is straight in line. It doesn't stick out to the side like an ape toe, or like the big toe in so many drawings you see of Australopithecines in books.'"* Johanson and Edey, p. 250.

The big toe of *Australopithecus africanus* splayed out to the side, as in apes. Obviously, the Laetoli footprints were not made by Australopithecines, as most evolutionists claim.

◆ *"In sum, the 3.5-million-year-old footprint trails at Laetoli Site G resemble those of habitually unshod modern humans. None of their features suggest that the Laetoli hominids were less capable bipeds than we are. If the G footprints were not known to be so old, we would readily conclude that they were made by a member of our genus, Homo. ... we should shelve the loose assumption that the Laetoli footprints were made by Lucy's kind, Australopithecus afarensis."* Russell H. Tuttle, "The Pitted Pattern of Laetoli Feet," *Natural History*, Vol. 99, March 1990, p. 64.

67. Geologic Column

a. *"We are only kidding ourselves if we think that we have anything like a complete succession for any part of the stratigraphical column in any one place."* Ager, *Stratigraphical Record*, p. 48.

b. John Woodmorappe, "The Essential Nonexistence of the Evolutionary-Uniformitarian Geologic Column: A Quantitative Assessment," *Creation Research Society Quarterly*, Vol. 18, June 1981, pp. 46–71.

68. Old DNA, Bacteria, Proteins, and Soft Tissue?

a. This natural process is driven by the continual thermal vibrations of atoms in DNA. Just as marbles in a vibrating container always try to find lower positions, vibrating atoms tend to reorganize into arrangements with lower energies. Thus, DNA tends to form less energetic compounds such as water and carbon dioxide.

b. Bryan Sykes, "The Past Comes Alive," *Nature*, Vol. 352, 1 August 1991, pp. 381–382.

◆ *"Many scientists still consider this idea* [that DNA could last longer than 10,000 years] *far fetched, but Poinar points out that not long ago few people believed any ancient DNA could be sequenced. 'When we started, we were told that we were crazy,' he says."* Kathryn Hoppe, "Brushing the Dust off

Ancient DNA," *Science News*, Vol. 142, 24 October 1992, p. 281.

c. Edward M. Golenberg et al., "Chloroplast DNA Sequence from a Miocene Magnolia Species," *Nature*, Vol. 344, 12 April 1990, pp. 656–658.

- DNA disintegrates faster when it is in contact with water. In commenting on the remarkably old DNA in a supposedly 17-million-year-old magnolia leaf, Svante Pääbo remarked, *"The clay* [in which the leaf was found] *was wet, however, and one wonders how DNA could have survived the damaging influence of water for so long."* Also see Svante Pääbo, "Ancient DNA," *Scientific American*, Vol. 269, November 1993, p. 92. [Maybe those magnolia leaves are not 17 million years old.]

- *"That DNA could survive for such a staggering length of time was totally unexpected—almost unbelievable."* Jeremy Cherfas, "Ancient DNA: Still Busy after Death," *Science*, Vol. 253, 20 September 1991, p. 1354.

d. *"Fragments of 16S ribosomal RNA genes were detected by polymerase chain reaction amplification of DNA extracted from halite* [salt, NaCl] *samples ranging in age from 11 to 425 Myr (millions of years)."* Steven A. Fish et al., "Recovery of 16S Ribosomal RNA Gene Fragments from Ancient Halite," *Nature*, Vol. 417, 23 May 2002, p. 432.

e. Eske Willerslev et al., "Diverse Plant and Animal Genetic Records from Holocene and Pleistocene Sediments," *Science*, Vol. 300, 2 May 2003, pp. 791–795.

f. *"Under physiological conditions, it would be extremely rare to find preserved DNA that was tens of thousands of years old."* Scott R. Woodward et al., "DNA Sequence from Cretaceous Period Bone Fragments," *Science*, Vol. 266, 18 November 1994, p. 1229.

Some have charged that the DNA Woodward recovered from a large Cretaceous bone in Utah was contaminated with human, or perhaps mammal, DNA. Several of their arguments are based on evolutionary presuppositions. Woodward rebuts those claims in "Detecting Dinosaur DNA," *Science*, Vol. 268, 26 May 1995, pp. 1191–1194.

g. Hoppe, p. 281.

- Virginia Morell, "30-Million-Year-Old DNA Boosts an Emerging Field," *Science*, Vol. 257, 25 September 1992, p. 1862.

h. Hendrick N. Poinar et al., "DNA from an Extinct Plant," *Nature*, Vol. 363, 24 June 1993, p. 677.

- Rob DeSalle et al., "DNA Sequences from a Fossil Termite in Oligo-Miocene Amber and Their Phylogenetic Implications," *Science*, Vol. 257, 25 September 1992, pp. 1933–1936.

- Raúl J. Cano et al., "Amplification and Sequencing of DNA from a 120–135-Million-Year-Old Weevil," *Nature*, Vol. 363, 10 June 1993, pp. 536–538.

i. Tomas Lindahl is a recognized expert on DNA and its rapid disintegration. He tried to solve this problem of "old" DNA by claiming that all such discoveries resulted from contamination and poor measurement techniques. He wrote, *"The apparent observation that fully hydrated plant DNA might be retained in high-molecular mass form for 20 million years is incompatible with the known properties of the chemical structure of DNA."* [See Tomas Lindahl, "Instability and Decay of the Primary Structure of DNA," *Nature*, Vol. 362, 22 April 1993, p. 714.] His claims of contamination are effectively rebutted in many of the papers listed above and by:
  - George O. Poinar Jr., in "Recovery of Antediluvian DNA," *Nature*, Vol. 365, 21 October 1993, p. 700. (The work of George Poinar and others was a major inspiration for the book and film, *Jurassic Park*.)
  - Edward M. Golenberg, "Antediluvian DNA Research," *Nature*, Vol. 367, 24 February 1994, p. 692.

The measurement procedures of Poinar and others were far better controlled than Lindahl realized. That is, modern DNA did not contaminate the fossil. However, Lindahl is probably correct in saying that DNA cannot last much longer than 10,000 years. All points of view are consistent when one concludes that these old ages are wrong.

j. *"We know from chemical experiments that it* [DNA] *degrades and how fast it degrades. After 25 million years, there shouldn't be any DNA left at all."* Rebecca L. Cann, as quoted by Morell, p. 1862.

k. Raúl J. Cano and Monica K. Borucki, "Revival and Identification of Bacterial Spores in 25- to 40-Million-Year-Old Dominican Amber," *Science*, Vol. 268, 19 May 1995, pp. 1060–1064.

Many tests were preformed to rule out contamination. [See also F. G. Priest, Andrew T. Beckenbach, and Raúl J. Cano, "Age of Bacteria from Amber," *Science*, Vol. 270, 22 December 1995, pp. 2015–2017.]

- *"When you look at them they don't look any different from the modern ones, but these bacteria are ancient* [supposedly 25–40 million years ancient] *and they're alive!"* Joshua Fischman, "Have 25-Million-Year-Old Bacteria Returned to Life?" *Science*, Vol. 268, 19 May 1995, p. 977.

l. *"There is also the question of how bacterial biopolymers can remain intact over millions of years in dormant bacteria; or, conversely, if bacteria are metabolically active enough to repair biopolymers, this raises the question of what energy source could last over such a long period."* R. John Parkes, "A Case of Bacterial Immortality?" *Nature*, Vol. 407, 19 October 2000, pp. 844–845.

- Russell H. Vreeland et al., "Isolation of a 250 Million-Year-Old Halotolerant Bacterium from a Primary Salt Crystal," *Nature*, Vol. 407, 19 October 2000, pp. 897–900.

- Other tests have confirmed Vreeland's discovery described above. [See Cindy L. Satterfield et al., "New Evidence for 250 Ma Age of Halotolerant Bacterium from a Permian Salt Crystal," *Geology*, Vol. 33, April 2005, pp. 265–268.]

m. See Endnote 88 on page 325.

n. Richard Monastersky, "Protein Identified in Dinosaur Fossils," *Science News*, Vol. 142, 3 October 1992, p. 213.

◆ Gerard Muyzer et al., "Preservation of the Bone Protein Osteocalcin in Dinosaurs," *Geology*, Vol. 20, October 1992, pp. 871–874.

o. *"'I got goose bumps,' recalls* [Mary] *Schweitzer. 'It was exactly like looking at a slice of modern bone. But, of course, I couldn't believe it. I said to the lab technician: The bones, after all, are 65 million years old. How could blood cells survive that long?'"* Virginia Morell, Dino DNA: The Hunt and the Hype," *Science*, Vol. 261, 9 July 1993, p. 160.

◆ *"Soft tissues are preserved within hindlimb elements of Tyrannosaurus rex (Museum of the Rockies specimen 1125). Removal of the mineral phase reveals transparent, flexible, hollow blood vessels …"* Mary H. Schweitzer et al., "Soft-Tissue Vessels and Cellular Preservation in *Tyrannosaurus Rex*," *Science*, Vol. 307, 25 March 2005, p. 1952.

◆ *"'I am quite aware that according to conventional wisdom and models of fossilization, these structures aren't supposed to be there, but there they are,' said Schweitzer, lead author of the paper. 'I was pretty shocked.'"* Evelyn Boswell, "Montana *T. Rex* Yields Next Big Discovery in Dinosaur Paleontology," *Montana State University News Service*, 24 March 2005, p. 1.

◆ Mary H. Schweitzer made these discoveries while completing her doctor's degree under John "Jack" R. Horner, one of the world's leading dinosaur researchers. Horner is the Curator of Paleontology at the Museum of the Rockies, and was a technical advisor for the film *Jurassic Park*.

When Schweitzer reported her discovery to Horner, he replied, *"Mary, the freaking creationists are just going to love you."* Schweitzer replied, *"Jack, its your dinosaur."* [See Jack Horner and James Gorman, *How to Build a Dinosaur* (New York: Penguin Group, 2009), pp. 80–81.

p. Mary H. Schweitzer et al., "Heme Compounds in Dinosaur Trabecular Bone," *Proceedings of the National Academy of Sciences*, Vol. 94, June 1997, pp. 6291–6296.

q. *"Here we report on an exceptionally complete specimen (LACM 128319) of the moderately derived genus Platecarpus that preserves soft tissues and anatomical details … ."* Johan Lindgren et al., "Convergent Evolution in Aquatic Tetrapods: Insights from an Exceptional Fossil Mosasaur," *PloS ONE*, 5(8) e11998, 2010.

r. *"There is still so much about ancient soft tissues that we do not understand. Why are these materials preserved when all our models say they should be degraded?"* Mary H. Schweitzer, "Blood from Stone," *Scientific American*, Vol. 303, December 2010, p. 69.

Schweitzer and the *Scientific American* editors give no answer, but think blood comes from 67-million-year-old stone. The answer is simple; the soft tissue and blood found is less than 1/10,000th of the age they assumed. They don't understand the flood and the origin of earth's radioactivity. [See pages 107–371.]

69. Human Artifacts

a. J. Q. Adams, "Eve's Thimble," *American Antiquarian,* Vol. 5, October 1883, pp. 331–332.

b. Wilbert H. Rusch, Sr., "Human Footprints in Rocks," *Creation Research Society Quarterly*, Vol. 7, March 1971, pp. 201–202.

c. John Buchanan, "Discovery of an Iron Instrument Lately Found Imbedded in a Natural Seam of Coal in the Neighbourhood of Glasgow," *Proceedings of the Society of Antiquarians of Scotland*, Vol. 1, Part 2, Section IV, 1853.

d. "A Necklace of a Prehistoric God," *Morrisonville Times* (Morrisonville, Illinois), 11 June 1891, p. 1.

e. Robin Dennell, "The World's Oldest Spears," *Nature*, Vol. 385, 27 February 1997, pp. 767–768.

◆ Hartmut Thieme, "Lower Palaeolithic Hunting Spears from Germany," *Nature*, Vol. 385, 27 February 1997, pp. 807–810.

f. "A Relic of a By-Gone Age," *Scientific American*, Vol. 7, 5 June 1852, p. 298.

g. David Brewster, "Queries and Statements Concerning a Nail Found Imbedded in a Block of Sandstone Obtained from Kingoodie (Mylnfield) Quarry, North Britain," reported to the British Association for the Advancement of Science, 1844.

◆ Rene Noorbergen, *Secrets of the Lost Races* (New York: The Bobbs-Merrill Co., Inc., 1977), p. 42.

h. Ibid.

i. J. R. Jochmans, "Strange Relics from the Depths of the Earth," *Bible-Science Newsletter*, January 1979, p. 1.

j. Robert E. Gentet and Edward C. Lain, "The Nampa Image—An Ancient Artifact?" *Creation Research Society Quarterly*, Vol. 35, March 1999, pp. 203–210.

◆ G. Frederick Wright, *Man and the Glacial Period* (New York: D. Appleton and Co., 1897), pp. 297–300.

◆ G. Frederick Wright, "The Idaho Find," *American Antiquarian*, Vol. 2, 1889, pp. 379–381.

◆ G. Frederick Wright, "An Archaeological Discovery in Idaho," *Scribner's Magazine*, Vol. 7, 1890, pp. 235–238.

k. Frank Calvert, "On the Probable Existence of Man during the Miocene Period," *Anthropological Institute Journal*, Vol. 3, 1873, pp. 127–129.

◆ J. B. Browne, "Singular Impression in Marble," *The American Journal of Science and Arts*, January 1831, p. 361.

70. Parallel Layers

a. Geologists have known this for many years. [See Archibald Geikie, *Text-Book of Geology* (London: Macmillan Publishing Co., 1882), p. 602.]

b. Henry M. Morris, *Scientific Creationism,* general edition (San Diego: Creation-Life Publishers, 1974), p. 113.

c. *"Potentially more important to geological thinking are those unconformities that signal large chunks of geological history are missing, even though the strata on either side of the unconformity are perfectly parallel and show no evidence of erosion. Did millions of years fly by with no discernible effect? A possible though controversial inference is that our geological clocks and stratigraphic concepts need working on."* William R. Corliss, *Unknown Earth* (Glen Arm, Maryland: The Sourcebook Project, 1980), p. 219.

◆ George McCready Price, *The New Geology*, 2nd edition (Mountain View, California: Pacific Press Publishing Assn., 1923), pp. 486, 500, 504, 506, 543, 620–627.

◆ George McCready Price, *Evolutionary Geology and the New Catastrophism* (Mountain View, California: Pacific Press Publishing Assn., 1926), pp. 90–104.

71. Helium

a. "What Happened to the Earth's Helium?" *New Scientist*, Vol. 24, 3 December 1964, pp. 631–632.

◆ Melvin A. Cook, *Prehistory and Earth Models* (London: Max Parrish, 1966), pp. 10–14.

◆ Melvin A. Cook, "Where is the Earth's Radiogenic Helium?" *Nature*, Vol. 179, 26 January 1957, p. 213.

◆ Joseph W. Chamberlain, *Theory of Planetary Atmospheres* (New York: Academic Press, 1987), pp. 371–372.

72. Lead and Helium Diffusion

a. *"Taken together, these results strongly suggest that there has been little or no differential Pb loss which can be attributed to the higher temperatures existing at greater depths."* Robert V. Gentry et al., "Differential Lead Retention in Zircons: Implications for Nuclear Waste Containment," *Science*, 16 April 1982, p. 296.

◆ Robert V. Gentry, "Letters," *Physics Today*, October 1982, pp. 13–14.

b. Robert V. Gentry, "Letters," *Physics Today*, April 1983, p. 13.

c. *"In fact, considering the Precambrian age of the granite cores, our results show an almost phenomenal amount of He has been retained at higher temperatures, and the reason for this certainly needs further investigation ..."* Robert V. Gentry et al., "Differential Helium Retention in Zircons," *Geophysical Research Letters*, Vol. 9, October 1982, p. 1130.

◆ Robert V. Gentry, Personal communication, 24 February 1984.

◆ D. Russell Humphreys et al., "Helium Diffusion Rates Support Accelerated Nuclear Decay," *Proceedings of the Fifth International Conference on Creationism* (Pittsburgh, Pennsylvania: Creation Science Fellowship, Inc., 2003), pp. 175–195.

73. Excess Fluid Pressure

a. *"It is certain that at the present time large areas of the Gulf Coast are underlain by zones containing water under pressure almost high enough to float the overlying rocks."* Parke A. Dickey et al., "Abnormal Pressures in Deep Wells of Southwestern Louisiana," *Science*, Vol. 160, 10 May 1968, p. 614.

b. *"Some geologists find it difficult to understand how the great pressures found in some oil wells could be retained over millions of years. Creationists also use this currently puzzling situation as evidence that oil was formed less than 10,000 years ago."* Stansfield, p. 82. [Stansfield had no alternative explanation.]

◆ Cook, *Prehistory and Earth Models*, p. 341.

74. Volcanic Debris

a. Ariel A. Roth, "Some Questions about Geochronology," *Origins*, Vol. 13, No. 2, 1986, pp. 75–76.

◆ *"It has been estimated that just four volcanoes spewing lava at the rate observed for Paricutín* [a Mexican volcano that erupted in 1943] *and continuing for five billion years could almost account for the volume of the continental crusts."* Stansfield, p. 81.

75. River Sediments

a. Stuart E. Nevins, "Evolution: The Ocean Says No!" *Symposium on Creation V* (Grand Rapids: Baker Book House, 1975), pp. 77–83.

◆ Roth, "Some Questions about Geochronology," pp. 69–71.

76. Continental Erosion

a. Nevins, pp. 80–81.

◆ George C. Kennedy, "The Origin of Continents, Mountain Ranges, and Ocean Basins," *American Scientist*, Vol. 47, December 1959, pp. 491–504.

◆ Roth, "Some Questions about Geochronology," pp. 65–67.

◆ *"North America is now being eroded at a rate that could level it in a mere 10 million years ..."* Dott and Batten, p. 133.

77. Dissolved Metals

a. *"... most metals are markedly undersaturated with respect to their least soluble compounds, and the supply of metals during geological time has been more than sufficient to attain saturation."* Peter G. Brewer, "Minor Elements in Sea Water," *Chemical Oceanography*, editors J. P. Riley and G. Skirrow, Vol. 1, 2nd edition (New York: Academic Press, 1975), p. 427.

78. Shallow Meteorites

a. Fritz Heide, *Meteorites* (Chicago: University of Chicago Press, 1964), p. 119.

- Peter A. Steveson, "Meteoritic Evidence for a Young Earth," *Creation Research Society Quarterly*, Vol. 12, June 1975, pp. 23–25.

- *"... neither tektites nor other meteorites have been found in any of the ancient geologic formations ..."* Ralph Stair, "Tektites and the Lost Planet," *The Scientific Monthly*, July 1956, p. 11.

- *"No meteorites have ever been found in the geologic column."* William Henry Twenhofel, *Principles of Sedimentation*, 2nd edition (New York: McGraw-Hill, 1950), p. 144.

- *"... the astronomer Olbers had noticed: that there are no 'fossil' meteorites known, from any period older than the middle of the Quaternary. The quantity of coal mined during the last century amounted to many billions of tons, and with it about a thousand meteorites should have been dug out, if during the time the coal deposits were formed the meteorite frequency had been the same as it is today. Equally complete is the absence of meteorites in any other geologically old material that has been excavated in the course of technical operations."* F. A. Paneth, "The Frequency of Meteorite Falls throughout the Ages," *Vistas in Astronomy*, Vol. 2, editor Arthur Beer (New York: Pergamon Press, 1956), p. 1681.

- *"I have interviewed the late Dr. G. P. Merrill, of the U.S. National Museum, and Dr. G. T. Prior, of the British Natural History Museum, both well-known students of meteorites, and neither man knew of a single occurrence of a meteorite in sedimentary rocks."* W. A. Tarr, "Meteorites in Sedimentary Rocks?" *Science*, Vol. 75, 1 January 1932, pp. 17–18.

- *"No meteorites have been found in the geological column."* Stansfield, p. 81.

- *"In view of the connection of comets, meteors, and meteorites, the absence of meteorites in old deposits in the crust of the earth is very significant. It has been estimated that at least 500 meteorites should have been found in already worked coal seams, whereas none has been identified in strata older than the Quaternary epoch (about 1 million years ago). This suggests a very recent origin of meteorites and, by inference, of comets."* N. T. Bobrovnikoff, "Comets," *Astrophysics*, editor J. A. Hynek (New York: McGraw-Hill Book Co., 1951), p. 352.

b. Hans Pettersson, "Cosmic Spherules and Meteoritic Dust," *Scientific American*, Vol. 202, February 1960, pp. 123–129.

c. *"Examples of ancient rock slides have been identified from the geologic column in few instances."* William Henry Twenhofel, *Treatise on Sedimentation*, Vol. 1, 2nd edition (New York: Dover Publications, 1961), p. 102.

79. Meteoritic Dust

a. Steveson, pp. 23–25.

80. Rapid Cooling

a. Harold S. Slusher and Thomas P. Gamwell, *Age of the Earth*, ICR Technical Monograph No. 7 (El Cajon, California: Institute for Creation Research, 1978).

- Leonard R. Ingersoll et al., *Heat Conduction: With Engineering, Geological and Other Applications*, revised edition (Madison, Wisconsin: University of Wisconsin Press, 1954), pp. 99–107.

82. Moon Dust and Debris

a. Before instruments were sent to the Moon, Isaac Asimov made some interesting, but false, predictions. After estimating the great depths of dust that should be on the Moon, Asimov dramatically ended his article by stating:

> *I get a picture, therefore, of the first spaceship, picking out a nice level place for landing purposes, coming in slowly downward tail-first and sinking majestically out of sight.* Isaac Asimov, "14 Million Tons of Dust Per Year," *Science Digest*, January 1959, p. 36.

- Lyttleton felt that the dust from only the erosion of exposed Moon rocks by ultraviolet light and x-rays *"could during the age of the moon be sufficient to form a layer over it several miles deep."* Raymond A. Lyttleton, *The Modern Universe* (New York: Harper & Brothers, 1956), p. 72.

- Thomas Gold proposed that thick layers of dust accumulated in the lunar maria. [See Thomas Gold, "The Lunar Surface," *Monthly Notices of the Royal Astronomical Society of London*, Vol. 115, 1955, pp. 585–604.]

- Fears about the dust thickness lessened when instruments were sent to the Moon from 1964 to 1968. However, some concern still remained, at least in Neil Armstrong's mind, as he stepped on the Moon. [See transcript of conversations from the Moon, Chicago Tribune, 21 July 1969, Section 1, p. 1, and Paul D. Ackerman, *It's a Young World After All* (Grand Rapids: Baker Book House, 1986), p. 19.]

83. Crater Creep

a. Glenn R. Morton, Harold S. Slusher, and Richard E. Mandock, "The Age of Lunar Craters," *Creation Research Society Quarterly*, Vol. 20, September 1983, pp. 105–108.

- The above study drew upon the work of Z. F. Danes, which was described as follows:

> *The history of a circular crater in a highly viscous medium is derived from the hydrodynamic equations of motion by Z. F. Danes. The variation in shape of the crater in the course of time is expressed as a function of a time constant, T, that involves viscosity and density of the medium, acceleration of gravity, and radius of the crater lip. Correspondence between theoretical crater shapes and the observed ones is good. However the time constant, T, is surprisingly short if commonly accepted viscosity values are used.* Geological Survey Professional Paper 550-A (Washington, D.C.: U.S. Government Printing Office, 1966), p. A 127.

Since Danes' work was published, rocks from the Moon have been returned to Earth and their viscosity has been measured. Their values fall in the range of 10^{21} to 10^{22} poises. According to the Geological Survey paper just quoted, *"If viscosities of lunar rocks were around 10^{21} to 10^{22} poises, the ages of large craters would have to be only 10^4 to 10^7 years."*

84. Hot Moon

a. "[The following is] *a somewhat surprising outcome considering the size of the Moon and the assumption that most of its heat energy had been lost. ... These unexpectedly high lunar* [heat flow] *values seem to indicate the Moon's interior is much hotter than most thermal models had anticipated. If the temperature gradient in the lower regolith is extrapolated to great depths, the lunar interior would appear to be at least partly molten—a condition contradicted by other evidence."* Nicholas M. Short, *Planetary Geology* (Englewood Cliffs, New Jersey: Prentice-Hall, 1975), p. 184.

b. The unexpectedly large heat flow may be a consequence of large impacts occurring on the lunar surface at the time of Earth's global flood. [See Figure 147 on page 273.]

85. Young Comets

a. Ron Cowen, "Comets: Mudballs of the Solar System," *Science News*, Vol. 141, 14 March 1992, pp. 170–171.

b. Ray Jayawardhana, "Keeping Tabs on Cometary Breakups," *Science*, Vol. 264, 13 May 1994, p. 907.

c. See Endnote 32 on page 296.

d. Raymond A. Lyttleton, "The Non-Existence of the Oort Cometary Shell," *Astrophysics and Space Science*, Vol. 31, December 1974, p. 393.

◆ If comet formation accompanies star formation, as evolutionists claim, then many comets should have been expelled from other stars. Some expelled comets should have passed through our solar system in recent years. No incoming comet has ever been observed with an interstellar (i.e. hyperbolic) orbit. [See Wetherill, p. 470.]

86. Small Comets

a. Louis A. Frank with Patrick Huyghe, *The Big Splash* (New York: Carol Publishing Group, 1990).

◆ Richard Monastersky, "Comet Controversy Caught on Film," *Science News*, Vol. 133, 28 May 1988, p. 340.

◆ Timothy M. Beardsley, "Ice Storm," *Scientific American*, Vol. 258, June 1988, p. 24.

◆ Jonathan Eberhart, "A Bunch of Little Comets—But Just a Little Bunch," *Science News*, Vol. 132, 29 August 1987, p. 132.

◆ Richard A. Kerr, "In Search of Elusive Little Comets," *Science*, Vol. 240, 10 June 1988, pp. 1403–1404.

◆ Richard A. Kerr, "Double Exposures Reveal Mini-Comets?" *Science*, Vol. 243, 13 January 1989, pp. 170–171.

◆ Richard Monastersky, "Small Comet Controversy Flares Again," *Science News*, Vol. 137, 9 June 1990, p. 365.

87. Hot Planets

a. H. H. Aumann and C. M. Gillespie Jr., "The Internal Powers and Effective Temperatures of Jupiter and Saturn," *The Astrophysical Journal*, Vol. 157, July 1969, pp. L69–L72.

◆ *"Jupiter radiates into space rather more than twice the energy it receives from space."* G. H. A. Cole, *The Structure of Planets* (New York: Crane, Russak & Co., Inc., 1978), p. 114.

◆ M. Mitchell Waldrop, "The Puzzle That Is Saturn," *Science*, 18 September 1981, p. 1351.

◆ Jonathan Eberhart, "Neptune's Inner Warmth," *Science News*, Vol. 112, 12 November 1977, p. 316.

b. Ibid.

c. "The Mystery of Venus' Internal Heat," *New Scientist*, Vol. 88, 13 November 1980, p. 437.

d. To initiate nuclear fusion, a body must be at least ten times as massive as Jupiter. [See Andrew P. Ingersoll, "Jupiter and Saturn," *Scientific American*, Vol. 245, December 1981, p. 92.]

e. Ingersoll and others once proposed that Saturn and Jupiter could generate internal heat if their helium gas liquefied or their liquid hydrogen solidified. Neither is possible, because each planet's temperature greatly exceeds the critical temperatures of helium and hydrogen. (The critical temperature of a particular gas is that temperature above which no amount of pressure can squeeze it into a liquid or solid.) Even if the temperature were cold enough for gases to liquefy, what could initiate nucleation? When I mentioned this in a private conversation with Ingersoll in December 1981, he quickly acknowledged his error.

f. Paul M. Steidl, "The Solar System: An Assessment of Recent Evidence—Planets, Comets, and Asteroids," *Design and Origins in Astronomy*, editor George Mulfinger Jr. (Norcross, Georgia: Creation Research Society Books, 1983), pp. 87, 91, 100.

◆ Jupiter would have rapidly cooled to its present temperature, even if it had been an unreasonably hot 20,000 kelvins when it formed. Evolutionary models require too much time. [See Edwin V. Bishop and Wendell C. DeMarcus, "Thermal Histories of Jupiter Models," *Icarus*, Vol. 12, May 1970, pp. 317–330.]

88. Solar Wind

a. After showing abundant photographic evidence for the presence of micrometeorites as small as 10^{-15} g that *"struck every square centimeter of the lunar surface,"* Stuart Ross Taylor stated:

> *It has been thought previously that radiation pressure would have swept less massive particles out*

of the inner solar system, but there is a finite flux below 10^{-14} g. Stuart Ross Taylor, *Lunar Science: A Post-Apollo View* (New York: Pergamon Press, Inc., 1975), p. 90.

Large lunar impacts are continually churning up and overturning the lunar surface. Therefore, for these micrometeorite impacts to blanket the surface so completely, they must have been recent. For more details, see Figure 147 on page 273.

89. Poynting-Robertson Effect

a. See **"Evolution of the Solar System?"** Endnote "a" on page 87. To understand the origin of zodiacal light, see page 308.

b. Steidl, *The Earth, the Stars, and the Bible*, pp. 60–61.

- Harold S. Slusher and Stephen J. Robertson, *The Age of the Solar System: A Study of the Poynting-Robertson Effect and Extinction of Interplanetary Dust*, ICR Technical Monograph No. 6, revised edition (El Cajon, California: Institute for Creation Research, 1978).

c. Stanley P. Wyatt Jr. and Fred L. Whipple, "The Poynting-Robertson Effect on Meteor Orbits," *The Astrophysical Journal*, Vol. 3, January 1950, pp. 134–141.

- Ron Cowen, "Meteorites: To Stream or Not to Stream," *Science News*, Vol. 142, 1 August 1992, p. 71.

d. David A. Weintraub, "Comets in Collision," *Nature*, Vol. 351, 6 June 1991, pp. 440–441.

90. Supernova Remnants

a. *"An application of the present results to the* [Milky Way] *Galaxy yields one supernova per 26 (± 10 estimated error) years in very good agreement with the evidence from historical supernovae."* G. A. Tammann, "On the Frequency of Supernovae as a Function of the Integral Properties of Intermediate and Late Type Spiral Galaxies," *Astronomy and Astrophysics,* Vol. 8, October 1970, p. 458.

- A more recent technique that surveyed thousands of galaxies, including smaller galaxies, concluded that

  … the time between [supernova] *explosions is 100 years or more."* Michael S. Turner, "Yes, Things Really Are Going Faster," *Science*, Vol. 299, 31 January 2003, p. 663.

b. Keith Davies, "Distribution of Supernova Remnants in the Galaxy," *Proceedings of the Third International Conference on Creationism* (Pittsburgh, Pennsylvania: Creation Science Fellowship, Inc., 1994), pp. 175–184.

- *"Where have all the remnants gone?"* Astronomy Survey Committee of the National Research Council, *Challenges to Astronomy and Astrophysics* (Washington, D.C.: National Academy Press, 1983), p. 166.

91. Connected Galaxies

a. Arp, *Quasars, Redshifts, and Controversies*.

- Fred Hoyle and Jayant V. Narlikar, "On the Nature of Mass," *Nature*, Vol. 233, 3 September 1971, pp. 41–44.

- William Kaufmann III, "The Most Feared Astronomer on Earth," *Science Digest*, July 1981, pp. 76–81, 117.

- Geoffrey Burbidge, "Redshift Rift," *Science 81*, December 1981, p. 18.

92. Unstable Galaxies

a. David Fleischer, "The Galaxy Maker," *Science Digest*, October 1981, Vol. 89, pp. 12, 116.

93. Galaxy Clusters

a. *"In 1933 the late Fritz Zwicky pointed out that the galaxies of the Coma cluster are moving too fast: there is not enough visible mass in the galaxies to bind the cluster together by gravity. Subsequent observations verified this 'missing' mass in other clusters."* M. Mitchell Waldrop, "The Large-Scale Structure of the Universe," *Science*, Vol. 219, 4 March 1983, p. 1050.

b. Faye Flam, "NASA PR: Hype or Public Education?" *Science*, Vol. 260, 4 June 1993, pp. 1417–1418.

- *"It turns out that in almost every case the velocities of the individual galaxies are high enough to allow them to escape from the cluster. In effect, the clusters are 'boiling.' This statement is certainly true if we assume that the only gravitational force present is that exerted by visible matter, but it is true even if we assume that every galaxy in the cluster, like the Milky Way, is surrounded by a halo of dark matter that contains 90 percent of the mass of the galaxy."* Trefil, p. 93.

- Gerardus D. Bouw, "Galaxy Clusters and the Mass Anomaly," *Creation Research Society Quarterly*, Vol. 14, September 1977, pp. 108–112.

- Steidl, *The Earth, the Stars, and the Bible*, pp. 179–185.

- Silk, *The Big Bang*, pp. 188–191.

- Arp, *Quasars, Redshifts, and Controversies*.

- Halton M. Arp, "NGC-1199," *Astronomy*, Vol. 6, September 1978, p. 15.

- Halton M. Arp, "Three New Cases of Galaxies with Large Discrepant Redshifts," *Astrophysical Journal*, 15 July 1980, pp. 469–474.

c. A huge dust ring has been observed orbiting two galaxies. The measured orbital velocity of this ring allows the calculation of the mass of the two galaxies and any hidden mass. There was little hidden mass. Statistical analyses of 155 other small galactic groups also suggest that there is not enough hidden mass to hold them together. [See Stephen E. Schneider, "Neutral Hydrogen in the M96 Group: The Galaxies and the Intergalactic Ring," *The Astrophysical Journal*, Vol. 343, 1 August 1989, pp. 94–106.]

94–102. Reports of Claimed Ark Sightings

a. Violet M. Cummings, *Noah's Ark: Fact or Fable?* (San Diego: Creation-Science Research Center, 1972).

◆ Tim LaHaye and John D. Morris, *The Ark on Ararat* (San Diego: Creation-Life Publishers, 1976).

◆ John Warwick Montgomery, *The Quest for Noah's Ark* (Minneapolis: Bethany Fellowship, Inc., 1972).

◆ Rene Noorbergen, *The Ark File* (Mountain View, California: Pacific Press Publishing Assn., 1974).

◆ Violet M. Cummings, *Has Anybody Really Seen Noah's Ark?* (San Diego: Creation-Life Publishers, 1982).

◆ Dave Balsiger and Charles E. Sellier Jr., *In Search of Noah's Ark* (Los Angeles: Sun Classic Books, 1976).

◆ Charles E. Sellier and David W. Balsiger, *The Incredible Discovery of Noah's Ark* (New York: Dell Publishing, 1995).

◆ Richard C. Bright, *The Ark, A Reality?* (Guilderland, New York: Ranger Associates, Inc., 1989).

◆ Bill Crouse, editor, *Ararat Report*, Vols. 1–32, 1986–present, published by CIS, 2050 N. Collins Blvd., Suite 100, Richardson, Texas 75080.

◆ Bill Crouse, *Project Ararat* (Richardson, Texas: CIS, 1985).

◆ Charles Berlitz, *The Lost Ship of Noah: In Search of the Ark at Ararat* (New York: G. P. Putnam's Sons, 1987).

◆ B. J. Corbin, *The Explorers of Ararat and the Search for Noah's Ark,* 2nd edition (Long Beach, California: Great Commission Illustrated Books, 1999).

94. Ancient Historians

a. Marco Polo, *The Travels of Marco Polo* (New York: The Orion Press, 1958), p. 21.

98. George Hagopian

a. Noorbergen, *Secrets of the Lost Races*, pp. 74–91.

99. Russian Expeditions

a. Cummings, *Has Anybody Really Seen Noah's Ark?* pp. 61–108.

b. Personal communication, Rex Geissler, 10 February 2000.

100. Ed Davis

a. Robert Cornuke and David Halbrook, *Lost Mountains of Noah* (Nashville: Broadman & Holman Publishers, 2001).

b. Don Shockey, *Agri-Dagh (Mount Ararat): The Painful Mountain* (Fresno, California: Pioneer Publishing Co., 1986), pp. 1–88.

130. Shells on Mountains

a. Alan Cutler, *The Seashell on the Mountaintop* (New York: Dutton, 2003).

◆ *"Nothing is so high, nothing is so far from the sea that we cannot find [shells] of those creatures that only live in sea water."* Jan Van Gorp (1569), as quoted by Cutler, p. 59.

◆ John Woodward, *An Essay Towards a Natural History of the Earth* (London: 1695; reprint, New York: Arno Press, 1978), pp. 3–74.

b. During the period 1508 to 1515, Leonardo da Vinci carefully studied the shells he found high in the Italian mountains. He raised valid arguments against all the hypotheses that others were proposing to explain shells on mountains, but he offered no explanation of his own. [See Leonardo da Vinci, *The Notebooks of Leonardo Da Vinci*, Vol. 2, editor Jean Paul Richter (New York: Dover Publications, 1970), pp. 208–218.]

131. Flood Legends

a. *"It has long been known that legends of a great flood, in which almost all men perished, are widely diffused over the world ..."* James George Frazer, *Folk-Lore in the Old Testament*, Vol. 1, (London: Macmillan Publishing Co., 1919), p. 105.

◆ Byron C. Nelson, *The Deluge Story in Stone* (Minneapolis: Bethany Fellowship, Inc., 1968), pp. 169–190.

◆ *"... there are many descriptions of the remarkable event* [the Genesis Flood]. *Some of these have come from Greek historians, some from the Babylonian records; others from the cuneiform tablets, and still others from the mythology and traditions of different nations, so that we may say that no event has occurred either in ancient or modern times about which there is better evidence or more numerous records, than this very one which is so beautifully but briefly described in the sacred Scriptures. It is one of the events which seems to be familiar to the most distant nations—in Australia, in India, in China, in Scandinavia, and in the various parts of America. It is true that many look upon the story as it is repeated in these distant regions, as either referring to local floods, or as the result of contact with civilized people, who have brought it from historic countries, and yet the similarity of the story is such as to make even this explanation unsatisfactory."* Stephen D. Peet, "The Story of the Deluge," *American Antiquarian*, Vol. 27, July–August 1905, p. 203.

◆ C. H. Kang and Ethel R. Nelson, *The Discovery of Genesis* (St. Louis: Concordia Publishing House, 1979). This excellent book shows that the classical Chinese pictographs contain many stories and details found in the early chapters of Genesis. The earliest people of China, 4,000–5,000 years ago, brought with them stories of past events that became embedded in their language. [See Figure 39 on page 48.]

132. Was There Room?

a. Actually, the Hebrew word for Ark (*tebah*) does not mean *boat*. It means "box," "chest," or "coffin." Notice how the Ark depicted in Figure 40 on page 49 looks like a box, chest, or coffin. In the Bible, *tebah* occurs in only one other context besides the flood. (The "ark of the covenant" is a different Hebrew word.) Moses was saved as a baby in a pitch-covered ark, *tebah* (Exodus 2:3,5). Sometimes *tebah* is translated into a different English word, such as *basket*. Moses, perhaps acting as an editor, wrote the flood account. Do you suppose that Moses had a special interest in describing how a few people, his ancestors and ours, were saved in a *tebah*—as he was?

b. At the onset of the flood, the powerful fountains of the great deep scattered seeds and spores throughout and even above the atmosphere. They undoubtedly settled through the atmosphere for many months afterward. [See pages 109–147 for details.] Fortunately, the 46,000-mile-long fountains were at almost all latitudes. Had they followed an east-west (latitudinal) path, such as along the preflood equator, many plants we now have would have become extinct.

c. The most detailed study of the many logistical requirements for the Ark and the number of animals on board is by John Woodmorappe, *Noah's Ark: A Feasibility Study* (El Cajon, California: Institute for Creation Research, 1996).

Figure 41: Fountains of the Great Deep. Notice the bulge of western Africa beginning to form.

Part II:

Fountains of the Great Deep

If a culture ignored, for any reason, a past event as cataclysmic as a global flood, major errors or misunderstandings would creep into science and society. One of the first would be the explanation for fossils. Typically, Fossil A lies below Fossil B, which lies below Fossil C, etc. If flood explanations were weak or disallowed, then evolution would provide an answer: Organism A evolved into B, which later evolved into C. Fossil layers would represent vast amounts of time. Other geologic features could then be easily fit into that time frame. With so much time available, possible explanations multiply—explanations not easily tested in less than a million years. A century after Darwin, evolutionary explanations would be given for the universe, chemical elements, heavenly bodies, earth, and life. Part I of this book shows that these ideas are false.

Part II will show, in ways an interested layman can understand, the flaws in these geologic explanations and that *a global flood, with vast and unique consequences, did occur*. For example, coal, oil, and methane did not form over hundreds of millions of years; they formed in months. Fossils and layered strata did not form over a billion years; they formed in months. The Grand Canyon did not form in millions of years; it formed in weeks. Major mountain ranges did not form over hundreds of millions of years; each formed in hours. These statements may appear shocking, until one has examined the evidence in Part II. If you feel there must be experts who can refute this scientific evidence, then see pages 473–476. You will be hard-pressed to find anyone willing to accept those sincere and fair debate offers.

Ironically, some leading creationists who *believe* in a global flood have contributed to its frequent rejection by advocating unsound *mechanisms* for the flood. They have failed to clearly answer people's most basic questions: *"Where did so much water come from, and where did it go?"*

One such explanation is the canopy theory. (Pages 424–432 examine its many problems.) Others, who know of these problems, have proposed an equally weak explanation called *catastrophic plate tectonics*. Basically, it is the flawed plate tectonic theory speeded up a millionfold by unworkable mechanisms and assumed miracles. Authors of these flood explanations have thus far declined to compare and publish joint critiques of our respective theories.

Past failure to answer honest flood questions opened the door to evolution and old-earth beliefs. Answering those questions will begin to (1) reestablish the flood as earth's defining geological event, and (2) reverse serious errors that have crept into science and society. Don't be surprised at how catastrophic the flood was. Just follow the evidence.

Figure 42: Grand Canyon. Probably the most spectacular of the seven wonders of the natural world is the Grand Canyon. It is awesome when viewed from its rim, but even more so from the air. From above, new insights become obvious, as you will see. For example, have you ever wondered how the Grand Canyon formed? Since the late 1800s, the standard answer has been that primarily the Colorado River carved the Grand Canyon over millions of years. If that happened, wouldn't you expect to find a gigantic river delta where the Colorado River enters the Gulf of California? It's not there. Nor can geologists find it anywhere else. Where did all the dirt—800 cubic miles of it—go?

Notice the four segments of this river near the center of the picture. Compare the thin river with the canyon's vast expanse. Could that relatively small river carve such a huge, wide, and deep canyon? If so, why has the same thing not happened along dozens of faster and larger rivers? Why do hundreds of large side canyons, with no visible water source to erode them, enter the Grand Canyon?

In studying this chapter, you will see a gigantic, focused water source and a surprisingly simple, but complete, explanation for the Grand Canyon's rapid formation as well as where all the dirt went. As you might expect, the Grand Canyon's origin is directly related to the origin of many other amazing and mysterious sights in the southwestern United States.

The Hydroplate Theory: An Overview

New evidence shows that the earth has experienced a devastating, worldwide flood, whose waters violently burst forth from under the earth's crust. Standard "textbook" explanations for many of earth's major features are scientifically flawed. We can now explain, using well-understood phenomena, how this cataclysmic event rapidly formed so many features. These and other mysteries, listed below and briefly described in the next 11 pages, are best explained by an earthshaking event, far more catastrophic than almost anyone has imagined. Later chapters are devoted to topics italicized below.

- ***The Grand Canyon (pages 189–227)***
- **Mid-Oceanic Ridge**
- **Earth's Major Components**
- ***Ocean Trenches and Ring of Fire*** *(pages 149–173)*
- **Earthquakes**
- **Magnetic Variations on the Ocean Floor**
- **Submarine Canyons**
- **Coal and Oil**
- **Methane Hydrates**
- **Ice Age**
- ***Frozen Mammoths*** *(pages 237–269)*
- **Major Mountain Ranges**
- **Overthrusts**
- **Volcanoes and Lava**
- **Geothermal Heat**
- ***Strata and Layered Fossils*** *(pages 175–187)*
- ***Limestone*** *(pages 229–235)*
- **Metamorphic Rock**
- **Plateaus**
- **The Moho and Black Smokers**
- **Salt Domes**
- **Jigsaw Fit of the Continents**
- **Changing Axis Tilt**
- ***Comets*** *(pages 271–302)*
- ***Asteroids and Meteoroids*** *(pages 305–326)*
- ***Earth's Radioactivity*** *(pages 329–371)*

Each appears to be a consequence of a sudden, unrepeatable event—a global flood whose waters erupted from interconnected, worldwide subterranean chambers with an energy release exceeding the explosion of 1,500 trillion hydrogen bombs.[1] ***The hydroplate theory,*** explained later in this chapter, will resolve all these mysteries.

But first, what is a ***hydroplate***? Before the global flood, considerable water was under the earth's crust. Pressure increases in this subterranean water ruptured that crust, breaking it into *plates*. The escaping water flooded the earth. Because *hydro* means water, those crustal plates will be called *hydroplates*. Where they broke, how they moved, and hundreds of other details and evidence—all consistent with the laws of physics—constitute the hydroplate theory and explain to a great extent why the earth looks as it does.

A Few of the Mysteries

The Grand Canyon and Other Canyons. See Figure 42 and pages 189–227.

Mid-Oceanic Ridge. One of our planet's most dramatic features, the ***Mid-Oceanic Ridge,*** was discovered in the 1950s. It wraps around the earth and is the world's longest mountain range—46,000 miles. [See Figure 43 on page 110.] Unlike most mountains, it is composed of a type of rock called *basalt*. Because most of the ridge lies on the ocean floor, relatively few people know it exists. How did it get there? Why is it primarily on the ocean floor? Why does it intersect itself in a Y-shaped junction in the Indian Ocean? The portion in the Atlantic Ocean is called the ***Mid-Atlantic Ridge.*** Is it just a coincidence that it splits the Atlantic from north to south and is generally perpendicular to and bisected by the equator? If Europe, Africa, and the Americas were once connected, how did they break apart?

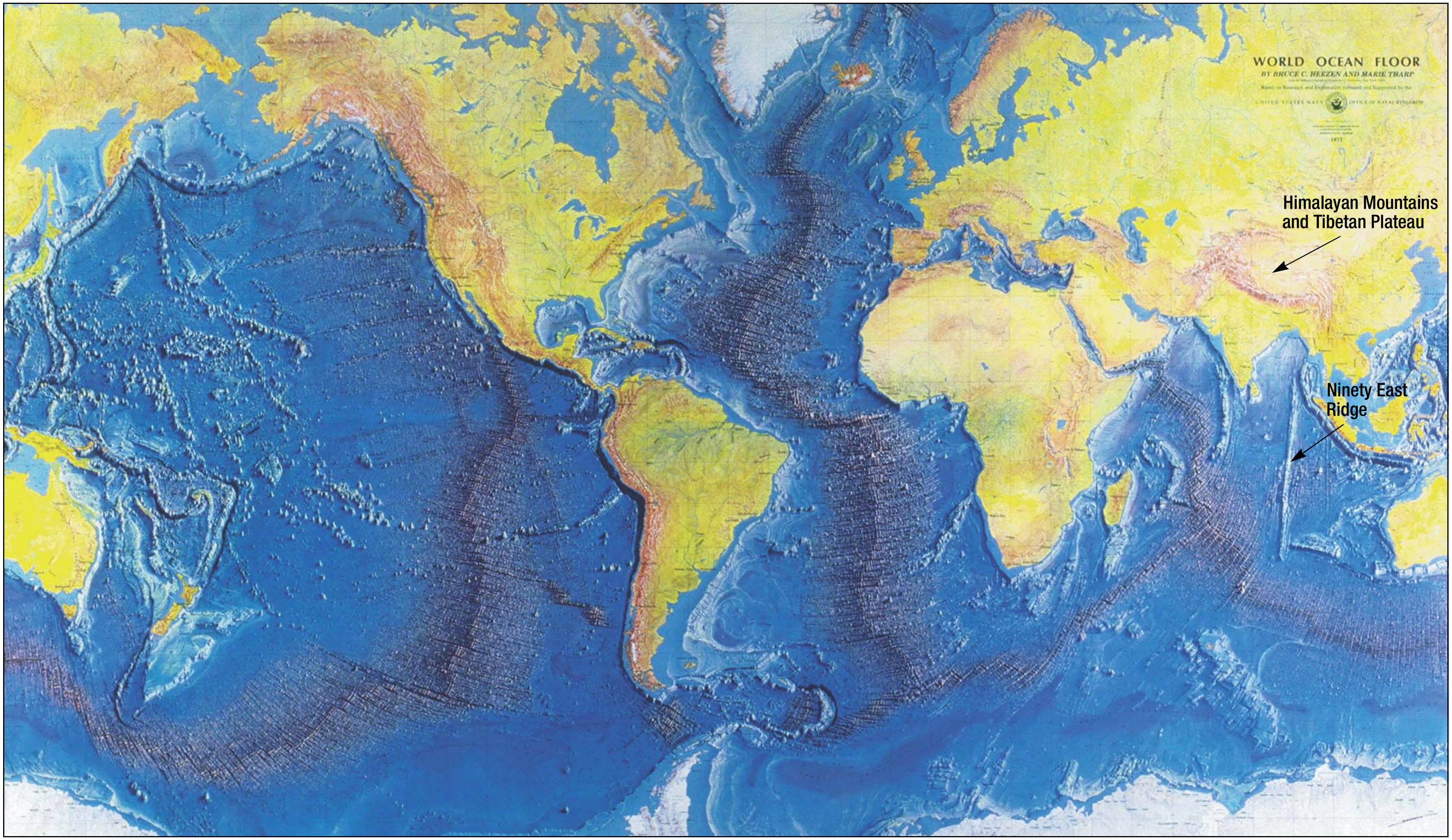


Figure 43: World Ocean Floor. Notice the characteristic margins of each continent. Seaward from each ocean beach is a shallow, gradually sloping *continental shelf*, then a relatively steep drop, called the *continental slope*. This strange pattern is worldwide. Why? For a better look at the typical shape of this margin, see Figure 46 on page 113. Also notice the different characteristics of (1) the continents and ocean basins, and (2) the Atlantic and Pacific basins. *Ninety East Ridge* is so named because it lies almost exactly along 90ºE longitude. Its straight, 3,000-mile length, and curious north-south orientation aimed at the Himalayas are important clues to past events on earth. (Note: As one moves toward polar regions on this type of map projection, distances are stretched and do not reflect true distances.)

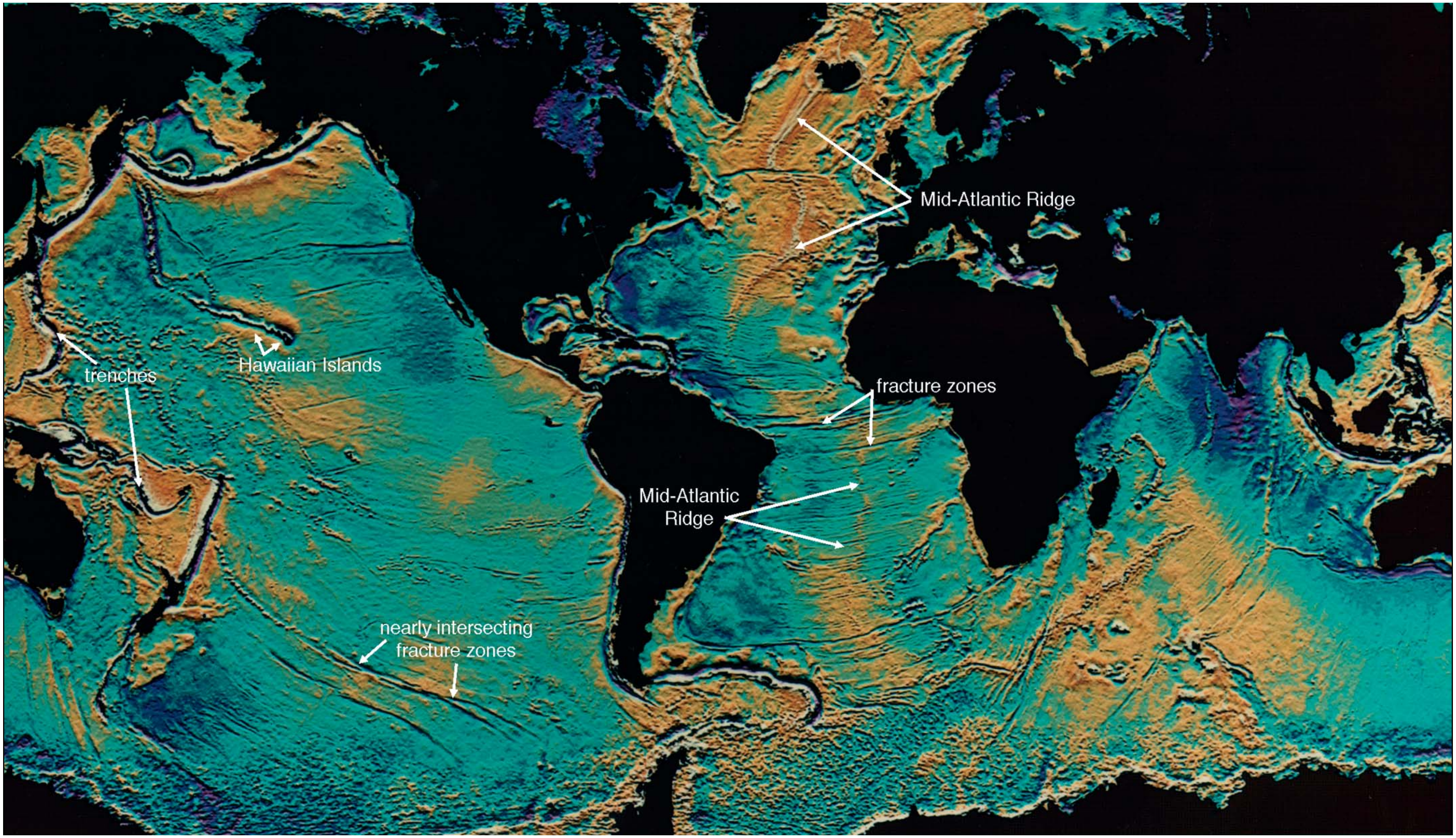


Figure 44: "Unlevel" Sea Level. An amazing technological development reveals details on ocean floors. The U.S. Navy's SEASAT satellite measured with a radar altimeter the satellite's distance above the ocean surface with an accuracy of several inches! "Sea level" is far from level. Instead, the ocean surface "humps up" over mountains on the ocean floor and is depressed over trenches. The gravitational attraction of the Hawaiian Islands, for example, pulls the surrounding water toward it. This raises sea level there about 80 feet higher than it would be otherwise. The satellite's data have been color coded to make this spectacular "picture" of the ocean surface. Darker areas show depressions in sea level. Notice that the ocean surface is depressed over long scars, called *fracture zones*, running generally perpendicular to the Mid-Oceanic Ridge. Which theory explains this—the plate tectonic theory or the hydroplate theory? Also consider the nearly intersecting fracture zones in the South Pacific. Which theory explains them?

Plate tectonics, currently the most popular theory in earth science, offers unsatisfactory answers to these and other questions. According to this theory, earth's crust is composed of many plates,[2] each 30–60 miles thick. They move relative to each other, about an inch per year—at the rate a fingernail grows. Continents and oceans ride on top of these plates. Sometimes a continent, such as North America, is on more than one plate. For example, different parts of North America, separated by the San Andreas Fault running up through western California, are sliding past each other. (A fault is a fracture in the earth's crust along which movement has occurred.) Supposedly, material deep inside the earth is rising toward the crest of the entire Mid-Oceanic Ridge. Once it reaches the crest, it moves laterally away from the ridge. This claimed motion is similar to that of a conveyor belt rising from under a floor and then moving horizontally along the floor. However, many little-known problems, discussed below, accompany plate tectonics.

Cutting across the Mid-Oceanic Ridge at almost right angles are hundreds of long cracks, called *fracture zones*. Whenever the axis of the Mid-Oceanic Ridge is offset, it is always along a fracture zone. [See Figure 44 on page 111.] Why? According to plate tectonics, plates move parallel to fracture zones. But fracture zones are not always parallel. Sometimes they are many degrees "out of parallel."[3] How then can solid plates be bounded by and move in the direction of these fracture zones? Can a train move on tracks that aren't parallel? Notice the white arrows in Figure 44 showing nearly intersecting fracture zones.

In at least eight places on the Atlantic and Pacific floors, segments of the Mid-Oceanic Ridge overlap for about 10 miles. These are called *overlapping spreading centers*.[4] [See Figure 45.] If plates are moving away from the Mid-Oceanic Ridge, then the distance between overlapping segments must be increasing. However, overlapping regions are always near each other.

Two of the most perplexing questions in the earth sciences today are barely verbalized in classrooms and textbooks: "What force moves plates over the globe? What is the mechanism and energy source?" The hydroplate theory gives a surprisingly simple answer. It involves gravity, the Mid-Atlantic Ridge, and water—lots of it.

Earth's Major Components. What accounts for earth's crust, mantle, and core (inner and outer) and earth's oceans and continents and their boundaries (shelves and slopes)? Why are all continental shelves and slopes so similar? [See Figures 43 and 46 and Figure 84 on page 153.]

Ocean Trenches. Ocean trenches are long, narrow depressions on the ocean floor, some of which are several times deeper than the Grand Canyon. They can be seen in the western Pacific in Figures 43, 44, and 80. Plate tectonics claims that a trench forms when a plate dives down into the mantle at a 35°–60° angle below the horizontal, a process advocates call ***subduction***. How this dive begins is never explained. This would be similar to pushing a 30-mile-thick shovel into the ground. What pushes a continental-size plate down at such a steep angle? If subduction occurs, why do instruments detect almost no distortion of the horizontal sedimentary layers in trenches? Worse yet, if any plate reached a depth of only several miles, the pressure would be so great that frictional forces would exceed the rock's strength. Therefore, large-scale sliding of a slab by pushing, pulling, or dragging should be impossible. [See page 486.] This is similar to trying to push our 30-mile-thick shovel, now squeezed in the jaws of a vise, down farther. It may break, buckle, deform, or crush, but it will not slip.

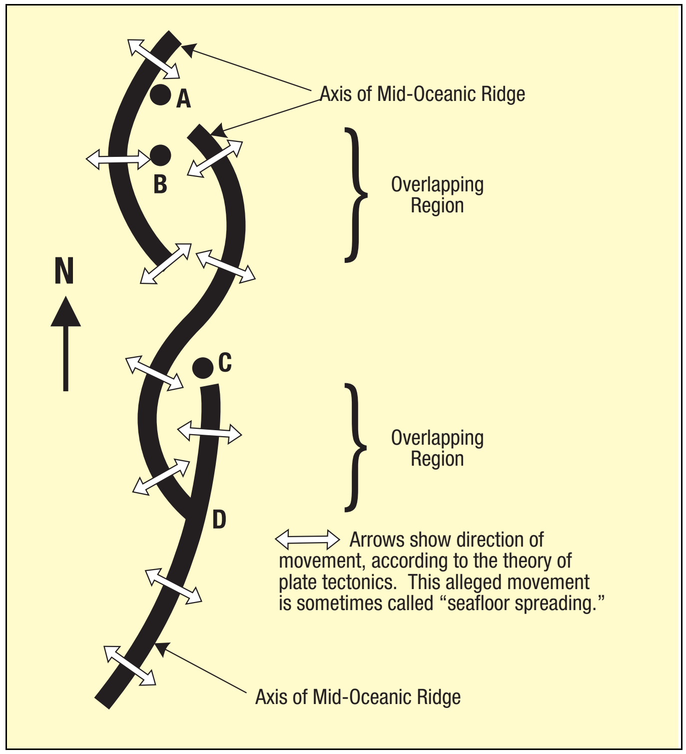


Figure 45: Overlapping Spreading Centers. Bold lines represent the axes of the Mid-Oceanic Ridge. According to plate tectonics, the ocean floor is moving in the direction of the hollow arrows—away from the Mid-Oceanic Ridge. If so, in which direction is point B moving? If B is stationary, and A is moving east, why is there no fault between them? What could possibly be happening at C and D if the plate tectonic theory is correct?

Earthquakes. The major goal of earthquake research is to predict earthquakes. Normally, the best way to predict something is to understand how it works. However, earthquakes are poorly understood. Consequently, much effort is spent trying to learn what precedes an earthquake. Earthquakes are frequently preceded by an abrupt change in water depth in wells, swelling of the ground, and sudden irregularities in local geyser eruptions.[5]

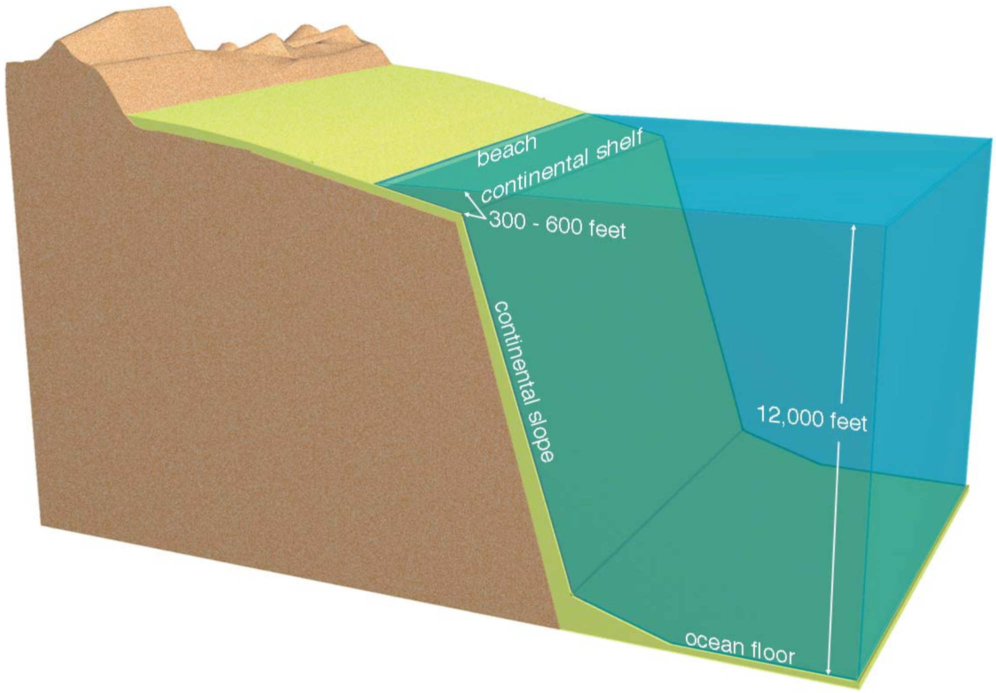


Figure 46: Continental Margin. The typical shape of ocean-continent boundaries is shown here. The actual continental boundary is generally considered to be halfway down the continental slope. Compare this figure with Figure 43 on page 110, and notice that Asia and North America would become connected by a wide land bridge if sea level were lowered about 300 feet. Australia and Asia would be almost connected. Sediments and sedimentary rock are shown in yellow.

Plate tectonic theory claims that earthquakes occur when plates rub against each other, temporarily lock, and then jerk loose. If so, why are some powerful earthquakes far from plate boundaries?[6] Why do local earthquakes sometimes occur when water is forced into the ground after large water reservoirs are built and filled?[7]

Shallow earthquakes sometimes displace the ground horizontally along a fault, as occurred along the San Andreas Fault during the great San Francisco earthquake of 1906. Western California slid northward relative to the rest of North America. The San Andreas Fault has several prominent bends, so just as two interlocking pieces of a jigsaw puzzle cannot slip very far relative to each other, neither can both sides of the curved San Andreas Fault. Furthermore, if slippage has occurred along the San Andreas Fault for eons, friction should have greatly heated the sliding surfaces. Drilling into the fault has not detected that heat.[8] Evidently, movement has not occurred for millions of years and/or the walls of the fault were lubricated.

Deep earthquakes occur at depths of 250–400 miles where pressures are so great that cracks should not be able to open. Also, temperatures should be so uniformly high that rock would not break, but would deform (like putty). Concentrated stresses that might trigger a deep earthquake should deform rocks instead, slowly and quietly. How then do deep earthquakes occur?[9]

Magnetic Variations on the Ocean Floor. At a few places along the Mid-Oceanic Ridge, magnetic patterns on one side of the ridge are almost a mirror image of those on the other side. The plate tectonic theory gained wide acceptance in the 1960s when this surprising discovery was misinterpreted.

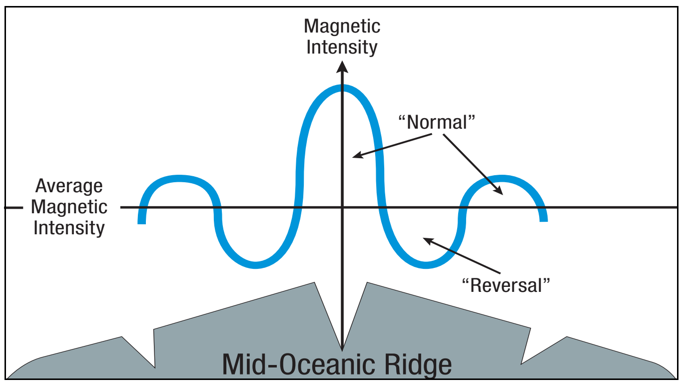


Figure 47: Magnetic Anomalies. Notice the fluctuations in magnetic intensity as one moves across the Mid-Oceanic Ridge. The so-called *reversals* are simply regions of lower magnetic intensity. Why should the intensity usually be greatest along the crest of the ridge?

Some people proposed that these variations were caused by periodic reversals of the earth's magnetic field, although there is no theoretical understanding of how that could happen. Supposedly, over millions of years, molten material rises at the ridge, solidifies, and then divides and moves in opposite directions away from the ridge. As the magma solidifies, its magnetic orientation locks in the orientation of the earth's magnetic field at the time. Thus, a record of past "flips" of earth's magnetic field is preserved in the rocks at different distances from the ridge.

That explanation is wrong, as detailed magnetic maps clearly show. There are no magnetic reversals on the ocean floor, and no compass would reverse direction if brought near an alleged reversed band. However, as one moves across the Mid-Oceanic Ridge, magnetic intensities fluctuate, as shown in Figure 47. Someone merely drew a line through these fluctuations and labeled everything below this average intensity as a "reversal." The false but widespread impression exists that these slight deviations below the average represent magnetic fields that reversed millions of years ago. Calling these fluctuations reversals causes one to completely miss a more likely explanation.

Although textbooks show these so-called "reversals" as smooth bands paralleling the Mid-Oceanic Ridge, there is nothing smooth about them. Some "bands" are even perpendicular to the ridge axis—the opposite of what plate tectonics predicts. Also, the perpendicular "bands" correspond to fracture zones.[10] The hydroplate theory offers an explanation for these magnetic anomalies.

A few lava flows show that rapid but limited changes in earth's magnetic field have occurred. Lava cools at known rates, from the outside of the flow toward its center. Magnetic particles floating in lava align themselves with the earth's magnetic field. When the lava cools and solidifies, that orientation becomes fixed. Knowing this cooling rate and measuring the changing direction of the magnetic fields within several solidified lava flows, we can see that at one time the earth's magnetic field changed rapidly—by up to 6 degrees per day for several days.[11]

Submarine Canyons. The ocean floor has hundreds of canyons, some that exceed the Grand Canyon in both length and depth. One submarine canyon is ten times longer (2,300 miles), so long it would stretch nearly across the United States.[12] Many of these V-shaped canyons are extensions of major rivers. Examples include the Amazon Canyon, Hudson Canyon, Ganges Canyon, Congo Canyon, and Indus Canyon. How were canyons gouged out, sometimes 15,000 feet below sea level? Did ancient rivers (or major drainage paths) cut these canyons when sea level was lower or the ocean floor was higher? If so, why did those elevations change? Swift rivers supposedly cut most continental canyons. However, currents measured in submarine canyons are too slow, generally less than one mile per hour. Frequently, the flow is in the wrong direction. Submarine landslides that produce dense, muddy currents sometimes occur. However, they would not form the long, tributary patterns that characterize river systems and submarine canyons. Furthermore, experiments with thick, muddy water in submarine canyons have not demonstrated any canyon-cutting ability.

Coal and Oil Formations. Large fossilized trees are found near the North and South Poles.[13] In Antarctica, some fossilized trees are 24 feet long and 2 feet thick! Nearby are 30 layers of anthracite (or high-grade) coal, each 3–4 feet thick.[14] Buried redwood forests, with trees more than 100 feet long and root structures showing that they grew in place, are found on Canadian islands well inside the Arctic Circle.[15] Much oil is also found inside the Arctic Circle. Was it once warm enough for trees to grow in Antarctica or inside the Arctic Circle? If so, how could so much vegetation grow where it is nighttime 6 months of the year? Were these cold lands once at temperate latitudes? Not according to plate tectonics, which places both regions near their present latitudes when their now-fossilized forests were growing.[16]

Methane Hydrates. Some bacteria live without oxygen. They feed on organic matter and produce methane gas, a combustible fuel. Since 1970, methane has been discovered in ice lying on, or hundreds of feet below, the deep ocean floor off coastlines. The ice molecules form tiny cagelike structures encasing one or more methane molecules. The total energy value of this methane-ice combination, called *methane hydrate*, is at least twice that in all the world's known coal and oil combined![17]

Why is so much methane buried along coastlines? How did all those bacteria get there, and what was their gigantic source of food? The largest single deposit known, named "Hydrate Ridge," lies off Oregon's coast. According to plate tectonics, that part of the seafloor is sliding under North America. If so, why is so much methane hydrate along Oregon's coast, just as it is along other coasts worldwide where seafloors are not supposedly subducting? [See Figure 48.]

Ice Age. An ice age implies extreme snowfall which, in turn, requires cold temperatures and heavy precipitation. Heavy precipitation can occur only if oceans are warm enough to produce equally heavy evaporation. How could warm oceans exist with cold atmospheric temperatures?

Another problem is stopping an ice age once it begins—or beginning a new ice age after one ends. As glaciers expand, they reflect more of the Sun's radiation away from earth, lower temperatures and cause glaciers to grow even more. Eventually the entire globe should freeze. Conversely, if glaciers shrink, as they have in recent decades, the earth should reflect less heat into space, warm up, and melt all glaciers forever.

Frozen Mammoths. Fleshy remains of about 50 elephant-like animals called *mammoths*, and a few rhinoceroses, have been found frozen and buried in Siberia and Alaska. One mammoth still had identifiable food in its mouth and digestive tract. To reproduce this result, one would have to *suddenly* push a well-fed elephant (dead or alive) into a very large freezer that had somehow been precooled to *-150°F.* Anything less severe would result in the animal's internal heat and stomach acids destroying the food. If the animal remained alive for more than a few minutes, one would not expect to find food in its mouth. What could cause such a large and sudden temperature drop? Even if

Figure 48: Flaming Ice. This ice contains methane, a flammable gas. Water will freeze at slightly warmer temperatures if it is under high pressure and contains dissolved methane. Such temperatures and pressures exist 2,000 feet or more below sea level. There, vast methane deposits are found trapped in ice on and under the deep seafloor, primarily along coastlines. How did so much methane get there?

the Sun suddenly stopped shining, earth's temperature would not drop rapidly enough to produce such effects. Finally, these giant animals would have to be buried in what was presumably frozen ground—quite a trick.

How could large herds of elephant-like animals, each requiring much food, live in the Arctic? Even if the Arctic were warm, the lack of winter sunlight would allow far less vegetation to grow than is needed to sustain so many large animals. Today, the average January temperature in northern Siberia is -28°F. Your nose gets cold after a few minutes in +32°F weather. Consider how you would feel if your nose were a 6-foot-long trunk and the average temperature were a frigid 60°F *colder* for weeks. Where would you, or a mammoth, find drinking water?

Major Mountain Ranges. How did mountain ranges form? Major mountains are often crumpled like an accordion. [See Figure 49.] Satellite photos of mountain ranges show that some resemble throw rugs that have been pushed against walls. But what force could push a long, thick slab of rock and cause it to buckle and sometimes fold back on itself? Besides, any force large enough to overcome the friction at the base of the slab, would crush the end being pushed before movement could even begin. Therefore, a mountain would not form.

We can see, especially in mountains and road cuts, thinly layered rocks folded like doubled-over phone books. Other "bent" rocks are small enough to hold in one's hand. The tiny, crystalline grains in those folds are not stretched. So, how could brittle rock, showing little evidence of heating or cracking, fold? Rocks are strong in compression but weak in tension, so their stretched outer surfaces should have easily fractured. Bent sedimentary rocks, found worldwide, often look as if they had the consistency of putty when they were compressed. They must have been squeezed and folded soon after the sediments were laid down, but before they hardened chemically. What squeezed and folded them?

Overthrusts. A similar problem exists for large blocks of rock called *overthrusts* that appear to have slid horizontally over other rocks for many miles. Such large sliding blocks should have considerable rubble under them. Many have none.

Standard geology has never adequately explained why overthrusts occur. Again, anything pushing a large slab of rock with enough force to overcome frictional resistance would crush the slab before it would move. [See page 487.] Those who appreciate this problem simply say that the pore pressure of water in the rocks lubricated the sliding, and perhaps the slab slid downhill. What is overlooked is that rocks do not contain nearly enough water to do this, and overthrusted blocks are seldom on steep slopes.

Volcanoes and Lava. Erupting lava usually exceeds 2,000°F. Where does it come from, and why is it so hot? The earth's mantle and inner core are essentially solid. Only the outer core, which lies 1,800–3,200 miles below the earth's surface, is a liquid. The standard explanation is that lava (called *magma* when it is inside the earth) originates in hot pockets, called *magma chambers*, at depths of about 60 miles, but how did it get there? Then, how could magma escape to the surface? A key fact to remember is that at depths greater than about 5 miles, pressures are so great that all empty channels through which magma might rise should be squeezed shut. Even if a crack could open, the magma must rise through colder rock. Unless this happened quite rapidly, magma would cool, solidify, and plug up the crack. Also, heat diffuses. So, what concentrated enough heat to create the "hot pockets" and melt the vast volumes of rock that erupted in the past?

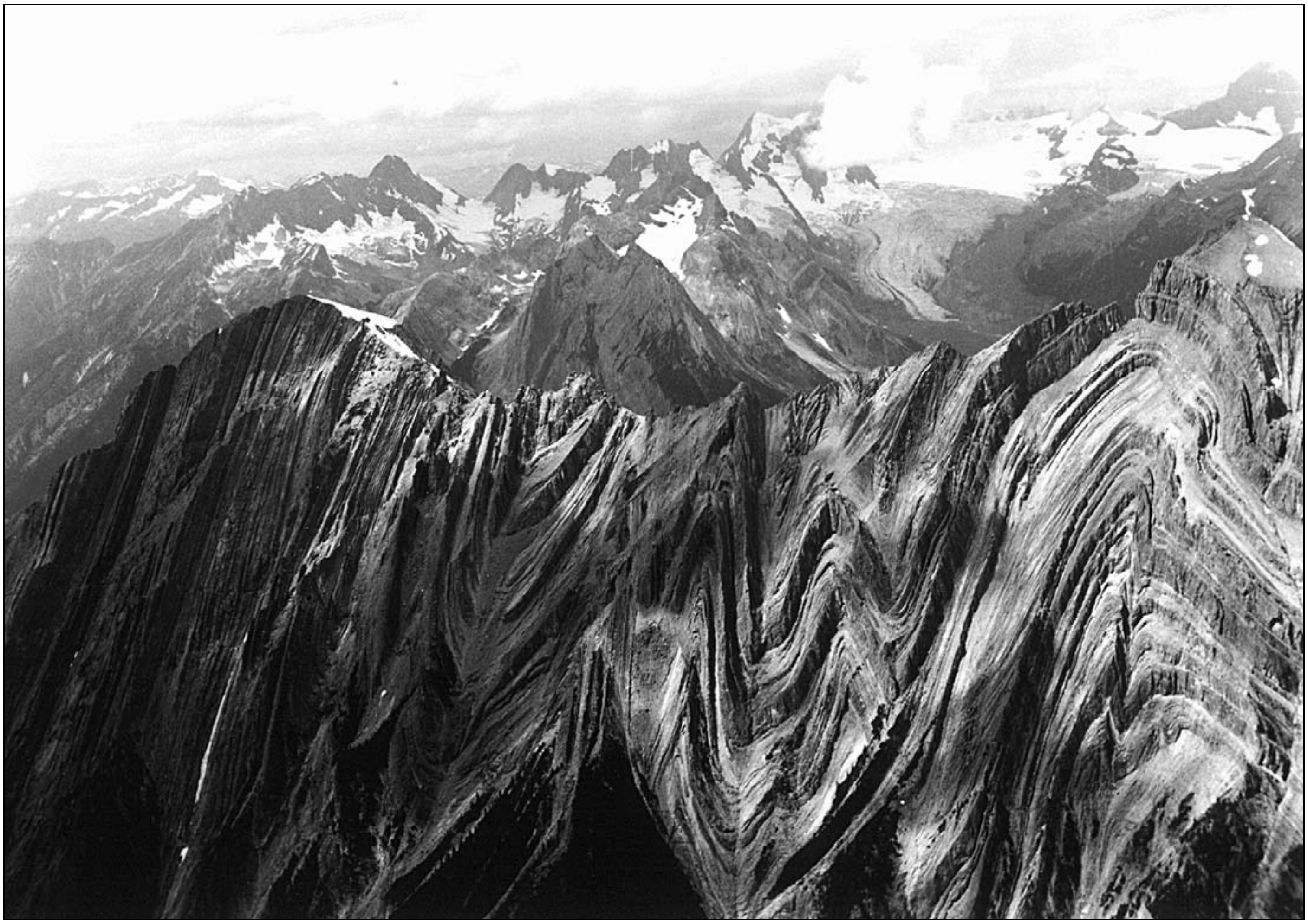


Figure 49: Buckled Mountain. Textbooks and museums frequently refer to some uplifting force that formed mountains. Can you see that an uplifting force, by itself, would not produce this pattern? Horizontal compression was needed to buckle these sedimentary layers near the Sullivan River in southern British Columbia, Canada. The layers must have been soft, like wet sand, at the time of compression. Today, surface rocks are brittle.

On the Columbia Plateau in the northwestern United States, 64,000 square miles of lava, with an average depth of ⅔ mile, spilled out rapidly under water.[18] On the Deccan Plateau in western India, 200,000 square miles have been flooded with lava to an average depth of ¾ mile. In southwestern Siberia, lava deposits are many times larger. The floor of the Pacific has even larger examples. Escaping magma at the Ontong-Java Plateau, on the floor of the western Pacific, was four times more extensive than on the Deccan Plateau. How did so much magma form, and how did it get out?

The world's two deepest drill holes are on the Kola Peninsula in northern Russia and in Germany's northeastern Bavaria.[19] They were drilled to depths of 7.6 miles and 5.7 miles, respectively. (Such deep holes, when quickly filled with water or dense mud, will stay open.) Deep in the Russian hole, to everyone's surprise, was hot, salty water flowing through ***crushed*** granite.[20] Why was the granite crushed? In the German hole, the drill encountered cracks throughout the lower few miles. All cracks contained salt water having concentrations about ***twice that of seawater***. Remember, surface waters cannot seep deeper than 5 miles, because the weight of overlying rock squeezes shut even microscopic flow channels.

Geologists are mystified by this deep salt water. Another surprise was the greater-than-expected increase in the granite's temperature with increasing depth—so much so that each drilling project was terminated early. This raises the question of why the earth's crust is so hot. The hydroplate theory provides simple answers.

Geothermal Heat. Heat inside the earth is called *geothermal heat*. In general, the deeper man has gone into the earth—first in deep caves and mines and later with drills—the hotter the rock gets. What is the origin of geothermal heat? As children, most of us were told the earth slowly grew (evolved) by meteoritic impacts that melted the earth, so geothermal heat is what remains after billions of years.

This popular story has several problems. First, the rate of temperature increase with depth, called the *temperature gradient*, varies, even in rock far from volcanoes, by at least a factor of six.[21] If the earth has been cooling for billions of years, one would expect very uniform temperature increases with depth at most locations. Unusually hot or cold regions should not exist, because heat diffuses from hotter to colder regions.

Had the earth ever been molten, denser materials would have sunk toward the earth's center, and lighter materials would have floated upward. One should not find dense, fairly nonreactive metals, such as gold, at the earth's surface. [See **"Molten Earth?"** on page 85.] Even granite, the basic continental rock, is a mixture of many minerals with varying densities. If melted granite slowly cooled, a "layer cake" of minerals, vertically sorted by density, would form instead of granite. So, earth's crust was never molten.

Mathematical solutions for heat conduction in spheres, such as the earth, are well known. These solutions can incorporate many facts, such as the earth's thermal properties, radioactive heat generation, and temperatures at the earth's surface. Such analyses are hopelessly inconsistent with the "molten-earth" story and "billions of years of cooling." [See **"Molten Earth?"** on page 28 and **"Rapid Cooling"** on page 41.] What then generated geothermal heat, and why does it still vary so widely?

Strata. Earth's crust is frequently stratified with layered rock (or ***strata***) composed of *cemented sediments*. These layers are typically uniform, parallel, vast in area, thin, and tipped at all angles within mountains and under valleys. Often one layer rests on another having a completely different texture, color, and mineral content. What global process sorted and cemented these sediments? Present processes do not.

Why are strata so uniform in hardness? If truckloads of sand and other dry sediments were dumped on your yard and bags of cement were placed in another pile, anyone would have difficulty mixing them uniformly. Without a uniform mixture of cementing agent, concrete (and sedimentary rock) would quickly crumble.

Limestone. A typical cementing agent in sedimentary rock is calcium carbonate ($CaCO_3$)—commonly called *limestone*. Any geologist who stops to think about it should realize that, based on present processes, the earth has too much limestone. Sediments and sedimentary rock on the continents average about a mile in thickness and contain 10–15% limestone.[22] How did so much limestone form—much of it quite pure? Limestone, without the impurities that normally drift in, suggests rapid burial. Most limestone is in vast layers, tens of thousands of square miles in area and hundreds of feet thick. Today, limestone forms either as it precipitates out of seawater or as sea creatures manufacture shells and corals containing limestone. In either case, oceans supply limestone sediments, but oceans already contain about as much dissolved limestone as they can possibly hold. So, where did all the limestone come from, especially its calcium and carbon, which are relatively rare outside of limestone?

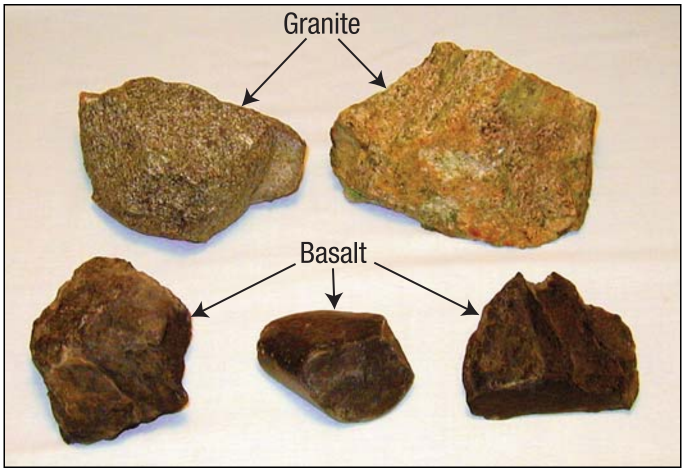


Figure 50: Granite and Basalt. Granite, the primary continental rock, has a grayish-to-pinkish color. Coarse grains of quartz, which have a glassy luster, occupy about 27% of granite's volume. Basalt, the most common rock beneath oceans today, is solidified lava—a dark, fine-grained rock. The hydroplate theory assumes that before the flood, granite was above the subterranean water and the mantle was below. As you will see, during and after the flood, molten basalt spilled out onto the chamber floor, so most ocean floors today are paved with basalt.

Metamorphic Rock. Rocks change structurally and chemically when their temperatures and/or pressures exceed certain high values. The new rock is called a *metamorphic rock*. For example, limestone becomes marble (a metamorphic rock) when its temperature exceeds 1,600°F and the confining pressure corresponds to the weight of a 23-mile-high column of rock. Diamonds, another metamorphic rock, form under confining pressures corresponding to the weight of a 75-mile-high column of rock and 1,600°F, yet diamonds are found in crustal rocks that were never deep.[23] Most metamorphic rocks were formed in the presence of water, often flowing water.[24] What accounts for the extreme temperature, pressure, and abundance of water?

The standard answer is that the original rock, such as limestone, was heated and compressed under a tall mountain or deep in the earth. Later, either the mountain eroded away or the deep rock rose to the earth's surface. That would take millions of years. It is difficult to imagine mountains 23 or 75 miles high, because the world's tallest mountain, Mount Everest, is only 5½ miles high. Raising buried layers of rock 23 or 75 miles to the earth's surface is even more difficult to explain, but with millions of years supposedly available to do it, few consider it a problem; even fewer address the problem.

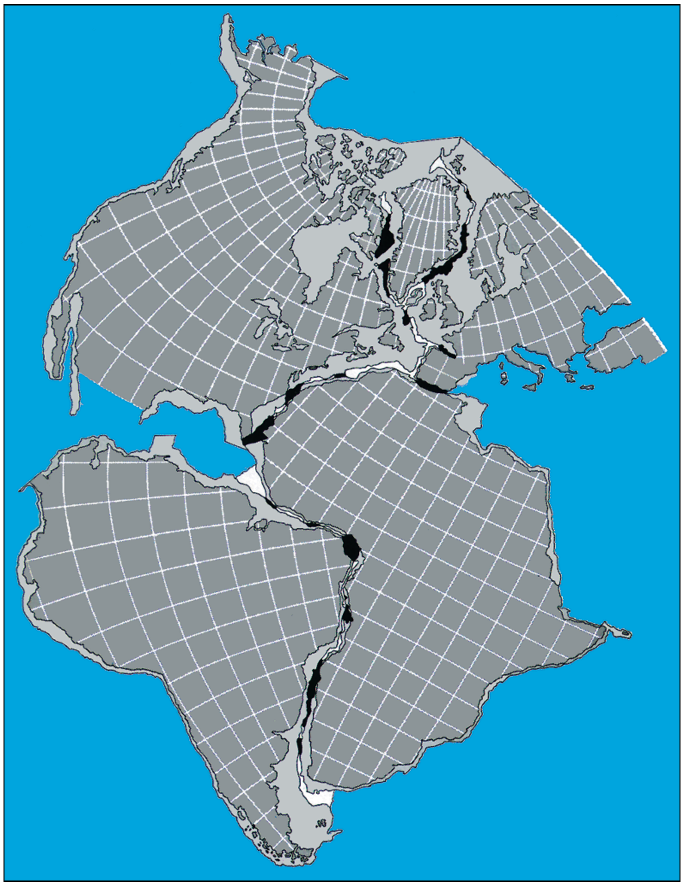


Figure 51: Continental Fit Proposed by Edward Bullard. Can you identify four distortions in this popular explanation of how the continents once fit together? First, Africa was shrunk in area by 35%. Second, Central America, southern Mexico, and the Caribbean Islands were removed. Third, a slice was made through the Mediterranean, and Europe was rotated counterclockwise and Africa was rotated clockwise. Finally, North and South America were rotated relative to each other. (Notice the rotation of the north-south and east-west lines.) Overlapping areas are shown in black.

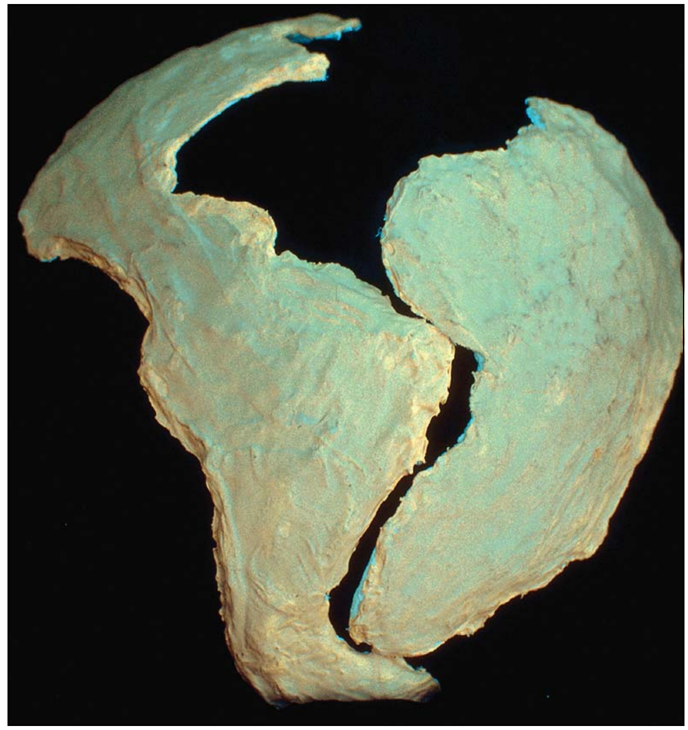


Figure 52: Continental Plates Made on a Globe. Notice that the fit of the actual continents is not as good as Bullard proposed. [See Figure 51.]

Plateaus. Plateaus are relatively flat regions of extensive area that have been uplifted (not buckled) more than 500 feet relative to surrounding regions. A plateau contains nearly horizontal rock layers. The same sequence of layers surrounds the plateau, but at a lower elevation. Professor George C. Kennedy explains some of the problems associated with plateaus quite well.

> *The problem of the uplift of large plateau areas is one which has puzzled students of the Earth's crust for a very long time. ... Given an Earth with sialic* [granitic] *continents floating in denser simatic* [basaltic] *substratum, what mechanism would cause a large volume of low standing continents to rise rapidly a mile in the air? Furthermore, evidence from gravity surveys suggests that the rocks underlying the Colorado plateau are in isostatic balance, that is, this large area is floating at its correct elevation in view of its mass and density. Recent seismic evidence confirms this, in that the depth to the M discontinuity* [the Moho, explained below] *under the Colorado plateau is approximately 10 kilometers* [6 miles] *greater than over most of continental North America. Thus, appropriate roots of light rock extend into the dense substratum to account for the higher elevation of the Colorado plateau. We have then a double-ended mystery, for the Colorado plateau seems to have grown downward at the same time that its emerged part rose upward. This is just as startling as it would be to see a floating cork suddenly rise and float a half inch higher in a pan of water. To date, the only hypothesis to explain the upward motion of large regions like the Colorado plateau is that of convection currents. Slowly moving convection currents in the solid rock, some 40 to 50 kilometers* [25 to 30 miles] *below the surface of the Earth, are presumed to have swept a great volume of light rock from some unidentified place and to have deposited it underneath the Colorado plateau. A total volume of approximately 2,500,000 cubic miles of sialic rock is necessary to account for the uplift of the Colorado plateau. While it is not hard to visualize rocks as having no great strength at the high pressures and temperatures existing at depths of 40 to 50 kilometers, it is quite another matter to visualize currents in solid rock of sufficient magnitude to bring in and deposit this quantity of light material in a relatively uniform layer underneath the entire Colorado plateau region.*

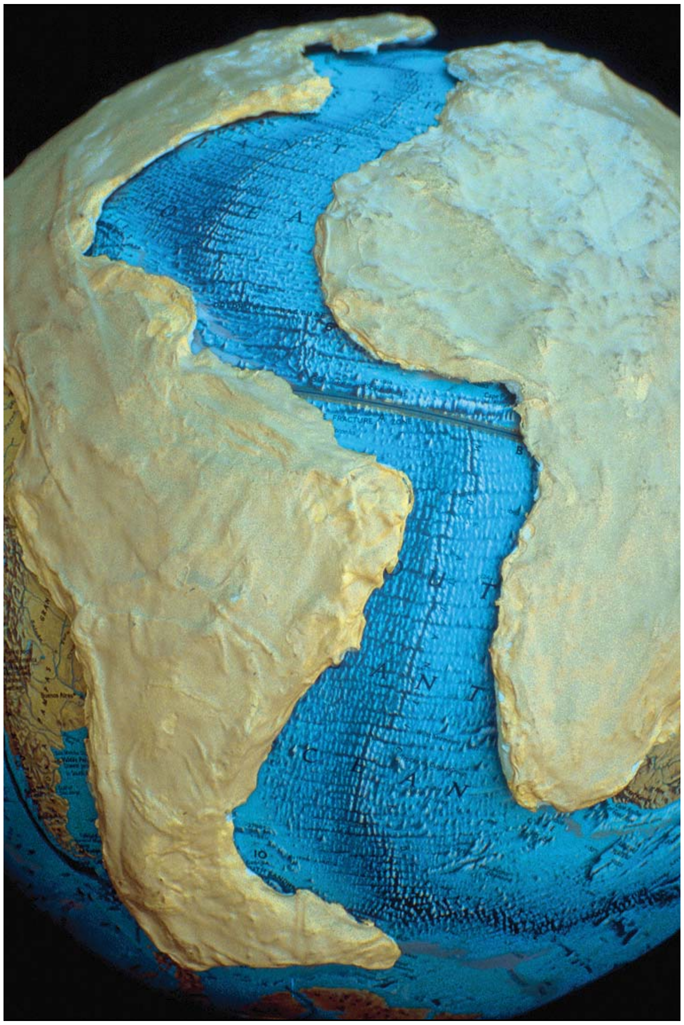


Figure 53: Continental Plates on a Globe. By far the best fit of the continents is with the base of the Mid-Atlantic Ridge—not with other continents, as shown in Figure 52.

The Tibetan plateaus present a similar problem, but on a vastly larger scale. There, an area of 750,000 square miles has been uplifted from approximately sea level to a mean elevation of roughly three miles, and the Himalayan mountain chain bordering this region has floated upward some five miles, and rather late in geologic time, probably within the last 20,000,000 years. The quantity of light rock which would need to be swept underneath these plateaus by convection currents to produce the effects noted would be an order of magnitude greater than that needed to uplift the Colorado plateau, that is, approximately 25,000,000 cubic miles. Even more troublesome than the method of transporting all this light rock at shallow depths below the surface of the Earth is the problem of its source. The region from which the light rock was moved should have experienced spectacular subsidence, but no giant neighboring depressions are known. A lesser but large problem is how such enormous quantities of light rock can be dispersed so uniformly over so large an area.[25]

The Moho and Black Smokers. The Mohorovicic discontinuity, usually called *the Moho*, is the boundary between the earth's crust and mantle. The Moho was discovered in 1909 by seismologist Andrija Mohorovicic. He noticed that earthquake waves travel noticeably faster below the Moho than above. In the early 1960s, efforts were made to drill deep enough to penetrate and examine the Moho, but cost overruns and alleged mismanagement shut the project down. Today, drilling efforts are finding that above the Moho the "rock had been thoroughly fractured and was saturated with water, and free water should not be found at these depths!"[26] What is the Moho, why is the rock above fractured, and why does it contain liquid water? Figure 55 describes black smokers.

Salt Domes. Vast salt layers are sometimes buried as much as several miles below the earth's surface. In the Gulf of Mexico is a single salt layer, called "*the mother salt layer*." It is typically 20,000 below sea level, 100,000 square miles in area, and 1,000 feet thick![27] Many tall salt domes rise several miles above the mother salt layer. Large salt deposits are not being laid down today, even in the Great Salt Lake. What concentrated so much deep salt? Certainly 20,000 feet of water did not evaporate.

A thicker "mother salt layer" with dozens of salt domes is also found under the Mediterranean Sea. A codiscoverer of these deposits, using refuted arguments,[28] claims that the Mediterranean must have evaporated 8–10 times to deposit so much salt.[29] His estimate is probably low, but even so, why didn't each refilling of the Mediterranean basin redissolve the salt residue left from prior evaporations, allowing currents to remove the basin's salt?

Jigsaw Fit of the Continents. For centuries, beginning possibly with Francis Bacon in 1620, many have noticed the approximate jigsaw fit of the continents bordering the Atlantic. It is only natural that bold thinkers, such as Alfred Wegener in 1915, would propose that the continents were once connected as shown in Figure 51, and somehow they broke apart and moved to their present positions. But would continents, including their broad but submerged continental shelves, really fit together as shown in textbooks? Distances are distorted when a globe is flattened into a two-dimensional map. Therefore, to answer this question, I formed two plates on a globe, matching the true shape and curvature of the continents. [See Figure 52.]

The classical fit (Figure 51), proposed by Sir Edward Bullard, appears at first glance to be a better fit of the continents than my plates. However, notice in Figure 51's description the great "latitude" Bullard took in juggling continents. Were these distortions made to improve the fit? Few, if any, textbooks inform us of these distortions.

Instead of fitting the continents to each other, notice in Figure 53 how well they each fit the base of the Mid-Atlantic Ridge. The hydroplate theory proposes that:

a. These continents were once in the approximate positions shown in Figure 53.
b. They were connected by rock that was rapidly eroded and transported worldwide by erupting subterranean water.
c. As these eroded sediments were deposited, they trapped and buried plants and animals. The sediments became today's sedimentary rock, and buried organisms became fossils.
d. The continents quickly slid on a layer of water (rapid continental drift) away from the rising Mid-Atlantic Ridge and toward the subsiding Pacific floor. They came to rest near their present locations.

Details and evidence will be given later in this chapter.

Layered Fossils. Fossils rarely form today, because dead plants and animals decay before they are buried in enough sediments to preserve their shapes. We certainly do not observe fossils forming in layered strata that can be traced over thousands of square miles. How, then, did so many fossils form? It will soon become apparent why animals and plants were trapped and buried in sediments that were quickly cemented to form the fossil record and why fossils of sea life are found on every major mountain range.

Changing Axis Tilt. George F. Dodwell served as the Government Astronomer for South Australia from 1909 to 1952. In the mid-1930s, he became interested in past changes in the tilt of the earth's axis. He collected almost 100 astronomical measurements made over a 4,000-year period. Those measurements show that the tilt of the earth's axis smoothly decayed from 25°10′ to its present value of 23°27′. Based on the shape of the decay curve, Dodwell estimated that this axis shift began in about the year 2345 B.C.[30]

The gravitational forces of the Sun, Moon and planets do change the tilt of the earth's axis, but much more slowly than those Dodwell measured. An extraterrestrial body striking the earth would provide an abrupt change in axis orientation, not the smooth changes Dodwell measured. Also, only a massive and fast asteroid striking the earth at a favorable angle would tilt the axis this much. However, the resulting pressure pulse would pass through the entire atmosphere and quickly kill most air-breathing animals—a recent extinction without evidence.

Comets, Asteroids, and Meteorites. These strange bodies, sometimes called "the mavericks of the solar system," have several remarkable similarities with planet earth. They contain considerable water. (About 38% of the mass of comet Tempel 1 is frozen water.[31]) Water is rare in the universe, but both common and concentrated on earth—often called "the water planet." Most of the remaining mass of a comet is dust, primarily the crystalline mineral olivine. Solid material that formed in space would not be crystalline. Olivine may be the most abundant of the more than 4,400 known minerals in the earth's crust and mantle. Asteroids and meteorites are similar in many ways to earth rocks. Surprisingly, a few meteorites contain salt crystals, liquid water, and living bacteria![33] Some asteroids have a chemical substance (kerogen) found in plants.

Earth's Radioactivity. Few people realize that the origin of earth's radioactivity and the origin of the heavier

Why Do We Have Radioactivity on Earth?

This questions stuns most people. Hasn't radioactivity always been? Not according to evolutionists. They say everything began with the big bang, which produced only the three lightest chemical elements: hydrogen, helium, and a trace of lithium. There are 91 other naturally occurring elements, some radioactive. How did they get here?

Claims that those 91 elements formed inside stars are probably not correct, even if one accepts the big bang theory and ignores its many problems; we only know how the lightest 26 elements *might be* produced in stars. (Fusion—the squeezing together of light elements to make heavier elements—cannot be sustained inside stars to produce the 68 heaviest elements.) For example, how did radioactive uranium, the 92nd heaviest element form? This is a problem.[32]

Those who recognize the problem usually say that the heavier elements formed when stars exploded as supernovas, but that is an unscientific guess, because such a production process has never been observed. Besides, (1) gigantic explosions are much more likely to scatter the lighter elements than to force them together, (2) the powerful electrical forces that oppose the merging of atomic nuclei become even stronger as nuclei become heavier, and (3) stars would not form after a big bang.

So what is the origin of earth's radioactivity? It is a consequence of the global flood. [For details, see pages 329–371.] I suggest you first examine all other chapters in Part II. Then, if you study the more difficult radioactivity chapter, you will receive three bonuses: an awareness of (1) the power of the flood, (2) the staggering amount of nuclear energy released, and (3) the scientific errors made by those claiming that radioactive dating shows the earth is billions of years old.

chemical elements on earth have never been explained.[32] Furthermore, radiometric dating assumes that radioactive decay rates have always been constant. A careful understanding of the flood will show how and why earth acquired its heaviest chemical elements and radioactive materials, and why the "constant rate" assumption (and, therefore, radiometric dating) is grossly in error. This understanding will also show (1) just how powerful the fountains of the great deep were and (2) how the flood destroyed the earth in ways that are still being felt.

Summary. These are a few of the mysteries associated with the 26 topics listed on page 109. The hydroplate theory will explain these mysteries and tie together the causes and effects of this dramatic, global catastrophe.

How to Evaluate Theories

To explain scientifically an unobserved event that cannot be repeated, we must first assume the conditions existing before that event. From these assumed starting conditions, we then try to determine what should happen according to the laws of physics. Three criteria should be used to evaluate the proposed explanation.

Criterion 1: Process. If we can explain all relevant observations better than any other proposed explanation, confidence in our explanation increases. However, if these starting conditions and the operation of physical laws (or known processes) should have produced results that are not present, then confidence in our explanation decreases.

For example, a frequent and intriguing question is, "What caused the extinction of the dinosaurs?" (We will not address that question now, but will use it to show how to evaluate scientific theories attempting to explain unobserved and unrepeatable events.) Some dinosaur extinction theories assume large climatic changes. While many types of climate variation might kill all dinosaurs, we must also (by Criterion 1) look at other consequences of large climatic changes. Flowering plants and many small animals are more vulnerable to large climatic changes than dinosaurs. Because most plants and animals did not become extinct with the dinosaurs, "climatic change" theories for dinosaur extinctions are weakened.

Criterion 2: Parsimony. (*Parsimony* here means "the use of few assumptions.") If a few assumptions allow us to explain many things, then confidence in the explanation will be great. Conversely, if many assumptions are used to explain a few observations, or if we must continually add new assumptions or modify our proposed theory as new observations are made, then we should have little confidence in the explanation.

For example, some say that a large asteroid or comet struck the earth and killed all the dinosaurs. Supposedly, the asteroid or comet, containing the rare element iridium, kicked up a worldwide dust cloud that blocked sunlight for several years, reduced photosynthesis on earth, and choked off the dinosaurs' food chain. Support for this theory comes from layers of clay, containing iridium, in Europe, New Zealand, and elsewhere. Iridium-rich layers sometimes contain dinosaur fossils and are dated, using evolutionary assumptions, as about 65 million years old.

An asteroid or comet striking the earth might explain the worldwide extinction of the dinosaurs and some iridium layers containing dinosaur fossils. In other words, one starting condition (an impact of a large asteroid or comet) explains two important observations: dinosaur extinctions and iridium layers. This is good.

But there are some hidden assumptions. While most meteorites contain iridium, it has not been detected in asteroids or comets. So, advocates of the impact theory must assume that asteroids or comets have large amounts of iridium (or that meteorites came from comets or asteroids). Other iridium-rich layers have since been discovered too far above *and below* the layer thought to mark the extinction of the dinosaurs. Further studies have found few iridium-rich layers near known impact craters. (Scientists have recently learned that airborne particles expelled by volcanoes contain considerable iridium and other rare chemical elements that are found in the iridium-rich layers.)[34]

Also, many marine plants require daily sunlight.[35] How could they have survived a global dust cloud that killed the dinosaurs? Each problem might be solved by adding new assumptions. However, by Criterion 2, this lowers our confidence in the theory.

Criterion 3: Prediction. A legitimate theory allows us to predict unusual things we should soon see if we look in the right places and take the right measurements. Verified predictions will greatly increase our confidence in an explanation. *Published predictions are the most important test of any scientific theory.* Few evolutionists make predictions that can be tested within a thousand years.

What predictions can be made based on the "climatic variation" and "impact" theories? Few, if any, have been made publicly. This does not inspire confidence in these explanations. Rarely do predictions accompany explanations of ancient, unobserved events.

However, the impact theory can produce predictions. For example, a very large impact crater should be found whose age corresponds to the time of the extinction of the dinosaurs. Fossils of many forms of life should be concentrated near the crater or, at least, in the hemisphere containing the crater. However, dinosaur fossils are *uniformly* distributed worldwide,[36] a point worth remembering.

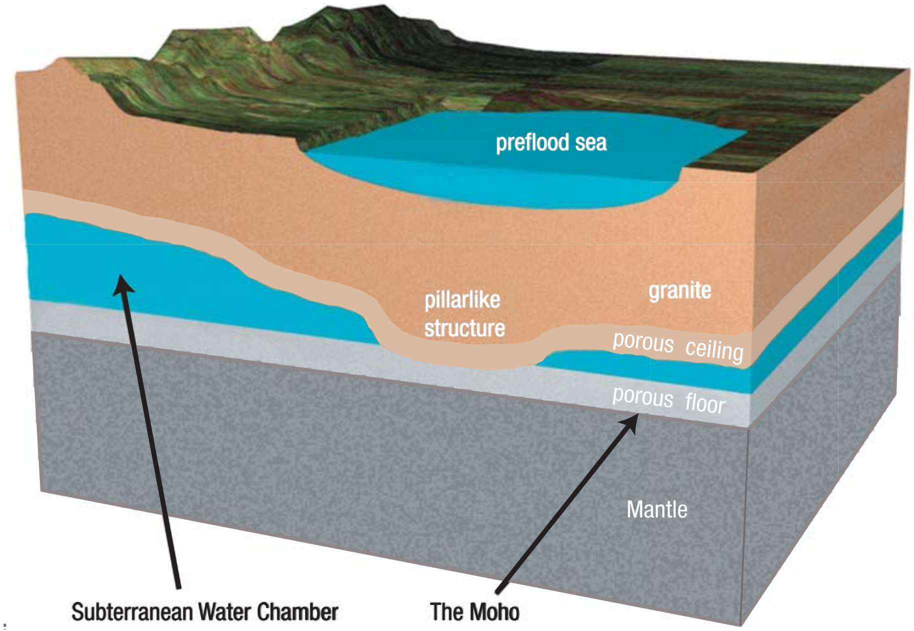


Figure 54: Cross Section of the Preflood Earth. (Not to scale.) Several aspects of the early earth are shown here. The thickness of the subterranean chamber varied. Huge pillarlike formations, joining the chamber's floor and roof, partially supported the roof. (The confined, high-pressure subterranean water provided most of the support.) Unlike cylindrical pillars we see in buildings, the subterranean pillars were tapered downward. [Pages 433–437 explain how, why, and when pillars formed.]

Supercritical water (SCW) in the subterranean chamber dissolved certain minerals in the chamber's floor and ceiling—giving that rock a spongelike appearance. [SCW is explained on pages 124–125.] High-pressure water filled these voids and supported the porous rock. The Moho, about 3 miles below the chamber floor, marks the bottom of this porous layer. Today, seismic waves naturally travel more slowly through that porous layer above the Moho.

Quartz was one of the first minerals to dissolve. This opened up tiny grain-size pockets totaling 27% of the volume of granite. Other minerals undoubtedly also dissolved, so the chamber floor and ceiling must have looked like sponges—each a few miles thick. [An interesting ancient writing touches on this. See the quote from *The Book of the Cave of Treasures* on page 435.] Trapped SCW that filled these tiny pockets remains today. In fact, in 2008, SCW was discovered two miles under the Atlantic floor. Scientists were shocked at finding the first naturally occurring SCW.[53] This vast, steady source of superhot water, thick with dissolved minerals (and sometimes hydrocarbons[54]), is jetting up through the ocean floors as *black smokers*. [See Figure 55.]

When the flood began, these pockets, a few miles above and below the subterranean chamber, contained much water. To escape to the earth's surface after the flood, that water had to traverse microscopic, tortuous paths through compressed rock—a very slow process even for a gas or SCW. Black smokers we see today show that relatively small amounts of the subterranean water are still escaping from what was the floor of the subterranean chamber.

For several years, no suitable crater could be found.[37] Finally, in 1990, an impact site was proposed on Mexico's Yucatán Peninsula, centered near the village of Chicxulub (CHICK-shoo-loob). Evolutionists initially dated the site as 40–50 million years *before* dinosaurs became extinct. No crater shape was visible, but a buried crater was claimed based on slightly circular magnetic and gravitational patterns, much imagination, and the desire to explain dinosaur extinctions. Impact advocates then redated the region and, in effect, predicted that drilling in and around Chicxulub would reveal an iridium layer and a buried impact crater. Later drilling projects found neither.[38]

Other dinosaur extinction theories have even more problems. Our purpose in this section is not to settle this issue but to show how scientific reasoning should be applied to unobserved, nonreproducible events. Incidentally, another theory on dinosaur extinction will soon become obvious—a theory involving a global flood and the harsh conditions afterward. [For more on dinosaurs, see **"What about the Dinosaurs?"** on page 406.]

Scientific explanations are never certain or final, and the overused word "prove" is never justified except possibly in mathematics or a court of law. Science is even less certain when dealing with ancient, unrepeatable events, because other starting conditions might work as well or better than the proposed starting conditions. Perhaps we have overlooked a physical consequence or have improperly applied the laws of physics. Certainly we can never consider all the possibilities or have all the data.

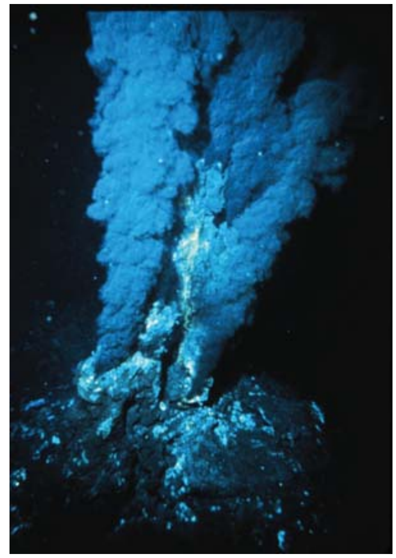
So, to try to scientifically understand unobservable, unrepeatable events, we should consider many sets of starting conditions, estimate the consequences of each based on physical laws, and then see how well those consequences meet the above three criteria. Ancient records, such as the Mosaic account in the Bible or legends, do not give ***scientific*** support for the truth or falsity of an ancient event. Such records may provide important ***historical*** support to people with confidence in a particular ancient record. This, however, is not science. Here in Part II, we will focus on science.

The Hydroplate Theory: Key Assumption

Starting assumptions, as explained above, are always required to explain ancient, unrepeatable events. The hydroplate theory has one main starting assumption. All else follows from that assumption and the laws of physics. Theories of past events always have some initial conditions. Usually they are not mentioned.

Figure 55: Black Smoker. Black smokers, some as hot as 867°F (464°C), were discovered in 1977 jetting up on a portion of the Mid-Oceanic Ridge in the Pacific. Many other black smokers have since been found along the entire, globe-encircling Mid-Oceanic Ridge, even inside the Arctic Circle. As the hot water shoots up into the frigid ocean, dissolved minerals (and on rare occasions, asphalt) precipitate out, giving the smoker its black color. It is now known that the water was initially supercritical water (SCW)[53] that held vast volumes of dissolved minerals such as copper, iron, zinc, sulfur, and sometimes hydrocarbons. SCW has been produced by man in strong, *closed containers*, but it has never before been seen in its natural state, even around volcanoes.

According to evolutionary geology, water **not in a closed container** seeps down **against a powerful increasing pressure gradient** a few miles below the ocean floor. There, magma (molten rock) heats the water to these incredible temperatures, forcing it back up through the floor. (SCW could not form by such a process, because of the two conditions highlighted in bold above. Uncontained liquid water, heated while slowly seeping downward, would expand, rise, and cool, long before it became supercritical.) Figure 54 gives a simple explanation. Besides, if the evolutionary explanation were true, the surface of the magma body would quickly cool, form a crust, and soon be unable to transfer much heat to the circulating water. (This is why people can walk over magma days after a crust has formed. The crust insulates the hot magma.) However, black smokers are active for many years, because large ecosystems, composed of complex life forms, such as clams, giant tubeworms, and simpler forms of life, have had time to become established around the base of the smoker.



Assumption: Subterranean Water. *About half the water now in the oceans was once in interconnected chambers about 10 miles below the entire earth's surface. At thousands of locations, the chamber's sagging ceiling pressed against the chamber's floor. These extensive, solid contacts will be called* ***pillars****. The average thickness of the subterranean water was at least ¾ mile. Above the subterranean water was a granite crust; beneath the water was earth's mantle.* [See Figure 54.]

Europe, Asia, Africa, and the Americas were generally in the positions shown in Figure 53 on page 119, but were joined across what is now the Atlantic Ocean. On the preflood crust were deep and shallow seas, and mountains, generally smaller than those of today, but some perhaps 5,000 feet high.

All 26 major mysteries described earlier, such as major mountain ranges, ice ages, comets, and the Grand Canyon, are consequences of this basic assumption. The chain of events that flows naturally from this starting condition will now be described as an observer might relate those events. The events fall into four phases.

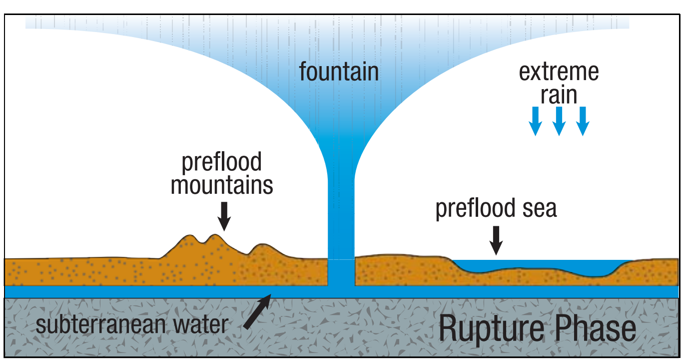


Figure 56: Rupture Phase of the Flood. This 46,000-mile-long rupture encircled the earth near what is now the Mid-Oceanic Ridge.

Phases of the Hydroplate Theory: Rupture, Flood, Drift, and Recovery

Rupture Phase. Centuries of tidal pumping (explained on page 124 and pages 488–489) powerfully increased the pressure in the subterranean water. This stretched the overlying crust, just as a balloon stretches when the pressure inside increases. Eventually, this shell of rock reached its failure point. Failure began with a microscopic crack at the earth's surface. Because stresses in such cracks are concentrated at each end of the crack, each end grew rapidly—at about 3 miles per second. Within seconds, this crack penetrated down to the subterranean chamber and then followed the path of least resistance. The rupture probably completed its path around the earth in about 2 hours.[55] Initial stresses were largely relieved when one end of the crack ran into the path left by the other end. In other words, the crack traveled a path that intersected itself at a large angle, forming a "T" or "Y" on the opposite side of the earth from where the rupture began.

As the crack raced around the earth, the 10-mile-thick crust opened like a rip in a tightly stretched cloth. Pressure in the subterranean chamber directly beneath the rupture suddenly dropped to nearly atmospheric pressure. This caused supercritical water to explode with great violence out of the 10-mile-deep "slit" that wrapped around the earth like the seam of a baseball.

All along this globe-circling rupture, whose path approximates today's Mid-Oceanic Ridge,[56] a fountain of water jetted supersonically into *and far above* the atmosphere. Some of the water fragmented into an "ocean" of droplets that fell as rain great distances away. This produced torrential rains such as the earth has never experienced—before or after.

Three Common Questions

Those not familiar with the behavior of high-pressure fluids sometimes raise three questions.

1. How could rock float on water? The crust did not float on water; water was trapped and sealed under the crust. (Water pressure and pillars supported the crust.) The crust was like a thin slab of rock resting on and covering an entire waterbed. As long as the water mattress does not rupture, the dense slab will rest on top of less-dense water. Unlike a waterbed's seal, which is only a thin sheet of rubber, the chamber's seal was compressed rock almost 10 miles thick. Pressures in the crust 5 miles or more below the earth's surface are so great that the rock can deform like highly compressed, extremely stiff putty. So the slightest tension crack could not open *from below*.

2. Temperatures increase with depth inside the earth. Subterranean water about 10 miles deep would have been extremely hot. Wouldn't all life on earth have been scalded if that water flooded the earth? No. Today's geothermal heat is a result of the flood. To understand why and to see why life was not scalded, one must first understand *tidal pumping* and *supercritical water* (SCW)—a very high-energy, explosive form of water that was discovered in 1822.[39] One should also understand why the continents and preflood mountains sank as the subterranean water escaped. [See Endnote 67 on page 226.]

Tidal Pumping.[40] Tides in the subterranean water lifted and lowered the massive crust twice daily, stretching and compressing the pillars, thereby generating heat and raising temperatures in the subterranean water. As certain minerals dissolved, this hot, high-pressure water, increasingly contained the ingredients for limestone ($CaCO_3$), salt (NaCl), and quartz (SiO_2). In a few chapters, you will see why, after the flood, this dissolved quartz petrified some wood and cemented flood sediments into sedimentary rocks.

SCW. At a pressure of one atmosphere—about 1.01 bar or 14.7 psi (pounds per square inch)—water boils at a temperature slightly above 212°F (100°C). As pressure increases, the boiling point rises. At a pressure of 3,200 psi (220.6 bars) the boiling temperature is 705°F (374°C). Above this pressure-temperature combination, called the *critical point*, water is *supercritical* and cannot boil.

The initial pressure in the 10-mile-deep subterranean chamber was about 62,000 psi (4,270 bars)—far above the critical pressure. After about a century[40] of tidal pumping, the subterranean water exceeded the critical temperature, 705°F. As the temperature continued to increase, the pressure grew, ***the crust stretched and weakened***, and the energy from tidal pumping increasingly ***ionized the water.***[41]

SCW can dissolve much more salt (NaCl) per unit volume than normal water—up to about 840°F (450°C). At higher temperatures, all salt precipitates out.[42] (In a few pages, this fact will show why so much salt is concentrated on the earth and how salt domes formed.)

Hot liquids cool primarily by evaporation from their surfaces.[43] ***SCW consists of microscopic liquid droplets dispersed within water vapor.*** Most hot objects cool at a rate proportional to their total surface area. The smaller a particle, the larger its surface area is relative to its volume, so more of its heat can be quickly transferred to its surroundings. The *liquid* in SCW has an area-to-volume ratio that is ***a trillion (10^{12}) times greater*** than that of the flood water that covered the earth's surface. Consequently, the liquid in SCW cools almost instantly if its pressure drops. This is because the myriad of shimmering liquid droplets, each surrounded by vapor, can simultaneously evaporate. A typical SCW droplet at 300 bars and 716°F (380°C) consists of 5–10 molecules. These droplets evaporate, break up, and reform continually.[44]

This explains how the escaping supercritical *liquid* transferred its energy into supercritical *vapor*. How did the vapor lose its energy and cool? Rapid expansion. A remarkable characteristic of supercritical fluids is that a small decrease in pressure produces a gigantic increase in volume—and cooling. So, as the SCW flowed toward the base of the rupture, its pressure dropped and the vapor portion expanded and cooled. As it expanded, it pushed on the surrounding fluid (gas and liquid), giving all fluid downstream *ever increasing kinetic energy*.

Eventually, the horizontally flowing liquid-gas mixture began to flow upward through the rupture. As the fluid rose, its pressure dropped to almost zero in seconds, so the electrical energy of ionization was released. The 10,000-fold expansion was a weeks-long, focused explosion of indescribable magnitude, accelerating the mixture, including rocks and dirt, into the vacuum of space.[45]

In summary, as the flood began, SCW jetted up through a globe-encircling rupture in the crust—as from a ruptured pressure cooker. This huge acceleration expanded the spacing between water molecules, allowing flash evaporation, sudden and extreme cooling, followed by even greater expansion, acceleration, and cooling. Therefore, most of the vast thermal, electrical, chemical, and surface energy[46] in the subterranean water ended up *not as heat at the earth's surface but as extreme kinetic energy in all the fountains of the great deep.* As you will see, these velocities were high enough to launch rocks into outer space—the final dumping ground for most of the energy in the SCW.

3. What happens as a fluid becomes supercritical?

Key Experiments. In 1822, French Baron Cagniard de la Tour first performed the following experiment.[39] A specific amount of liquid was sealed inside a strong glass tube. The meniscus (the boundary between the liquid below and the vapor above) was visible. As the tube was heated, some liquid evaporated and the pressure increased. *The vapor's lower density increased rapidly, while the liquid's higher density decreased slowly.* The two densities met at a temperature and pressure called the *critical point.* At that critical point, the meniscus disappeared. Was the substance a liquid, a vapor, or something else? For almost two centuries, no one knew.[47]

By 2005, the results of sophisticated experiments on supercritical water were published. That work by scientists in Germany, France, Sweden, the Netherlands, and the United States showed that both liquid and vapor were present. The liquid consisted of microscopic droplets dispersed—actually floating—throughout the dense vapor.[44]

A Thought Experiment. What follows is conjecture. To my knowledge, no one has described the microscopic behavior of supercritical fluids (SCFs) as I will below, but based on the 2005 experiments, the physics now seems clear. If we could view the meniscus in microscopic detail as the temperature approached the critical point, I believe we would see the following:

The liquid below the meniscus becomes increasingly agitated and resembles a choppy lake on a windy day. The liquid and vapor are nearly in equilibrium, so about as many molecules evaporate from the liquid as enter the liquid from the vapor. At these very high temperatures, vapor molecules strike the liquid surface at a furious rate and splash droplets of liquid up into the dense vapor. As the vapor's density approaches the liquid's density, *the droplets float in the vapor!* This process continues until all the liquid below the meniscus is dispersed as tiny droplets in the vapor, so the meniscus suddenly disappears. The shimmering droplets, suspended in the vapor, are then bombarded from all directions by vapor molecules acting as bullets. When these "bullets" strike a droplet, they either fragment the droplet, stick to it, or bounce off the droplet. Droplets quickly fragment, merge, or evaporate.[48]

Would these microscopic droplets float to the top of the vapor? No, but let's assume they did. It would mean that the vapor was denser than the liquid droplets. Vapor molecules would be closer to each other, on average, than liquid molecules. Therefore, vapor molecules would frequently bond with each other and become liquid droplets. The presence of liquid droplets *throughout* the supercritical vapor contradicts our assumption that all the liquid had floated to the top of the vapor. With a little thought, it should become clear that liquid droplets almost instantaneously form and disappear within the dense vapor. In the process, many molecules ionize.

As temperatures rise, the vapor molecules travel faster and fragment more droplets. The droplets become, on average, even smaller. They also collide and merge more frequently, so at each new temperature, an equilibrium is quickly reached between droplets forming and disappearing.

Energy is expended in fragmenting droplets, because work must be done in stretching and breaking molecular bonds in the liquid phase. Most of the energy expended in fragmenting molecules becomes ionization (electrical) energy. If the pressure drops, electrical energy is recovered and surface energy is given up; the volume expands rapidly and enormously. The faster the pressure drops, the more explosive—and cooler—the expansion.

When the flood began, the pressure in the jetting SCW dropped in seconds from at least 62,000 psi (4,270 bars) to almost zero. The energy released was huge. Because the 46,000-mile-long fountains continued this release for several weeks, one should not think of it as a single explosion. Instead, the jetting water was a powerful, earth-size engine that launched considerable mass from earth.

Great Solubility. Today, SCFs (usually water and carbon dioxide) are studied primarily because of their great dissolving power. In 1879, J. B. Hannay and J. Hogarth first demonstrated this. When they rapidly dropped the pressure in a SCF, the dissolved material precipitated as "snow."[49] Why is the solubility of SCFs so great, and why did the solute precipitate so rapidly?

Supercritical liquid droplets impacting solids (like bullets) will break up and dissolve more of the solids than relatively stagnant liquid.[50] Also, as described above, the liquid droplets almost instantaneously form and evaporate. When they evaporate, the dissolved solids (solutes) precipitate as sediments onto a floor.[51] When new droplets form from merging vapor molecules, they contain no solute and can then dissolve more of the solid they encounter. Later, during the flood, the escaping subterranean waters swept most of these loose, precipitated sediments on the chamber floor up to the earth's surface.

Therefore, supercritical fluids can dissolve large quantities of organic material and certain minerals.[52] If the pressure in the supercritical fluid suddenly drops, the liquid evaporates explosively and the solid precipitates as "snow." Three common precipitates from the subterranean water were limestone ($CaCO_3$), salt (NaCl), and quartz (SiO_2).

Figure 57: Jetting Fountains. For a global perspective of what this may have looked like, see page 106.

Other jetting water rose above the atmosphere, where it froze and then fell on various regions of the earth as huge masses of extremely cold, muddy "hail." That hail buried, suffocated, and froze many animals, including some mammoths. [For details, see **"Frozen Mammoths"** on pages 237–269.] The most powerful jetting water and rock debris escaped earth's gravity and became the solar system's comets, asteroids, and meteoroids. [For details, see **"The Origin of Comets"** on pages 271–302, and **"The Origin of Asteroids and Meteoroids"** on pages 305–327.] To understand the gigantic energy source that launched this material, one must study **"The Origin of Earth's Radioactivity"** on pages 329–371.

Flood Phase. Each side of the rupture was basically a 10-mile-high cliff. Compressive, vibrating[57] loads greatly exceeded the rock's crushing strength in the bottom half of the cliff face, so the bottom half continually crumbled, collapsed, and spilled out into the jetting fountains. That removed support for the top half of the cliff, so it also fragmented and fell into the pulverizing supersonic flow. Consequently, the 46,000-mile-long rupture rapidly grew to an average width of about 800 miles all around the earth.

Water trapped in the spongelike openings in the chamber's roof and floor was steadily forced into the chamber during the flood, so the hydroplates settled slowly.[58] Sediments swept up in the escaping flood waters gave the water a thick, muddy consistency. These sediments rapidly settled out over the earth's surface, trapping and burying many plants and animals. The world's fossils then began to form.

The rising flood waters eventually blanketed the jetting fountains, although water still surged out of the rupture. Because today's major mountains had not yet formed, global flooding covered the earth's relatively smooth topography.

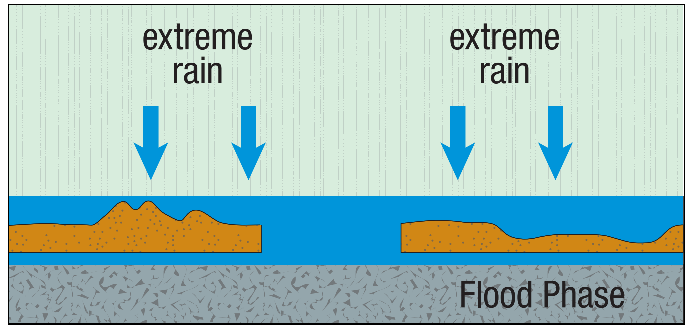


Figure 58: Flood Phase. Sediments in the escaping water increased until their volume nearly equaled the volume of water gushing out. These suspended particles quickly settled and buried plants and animals in a chaotic mixture. During this phase, a phenomenon called *liquefaction* sorted sediments, animals, and plants into horizontal layers that are more uniform and cover a much larger area than sedimentary layers laid down today. Traces of these dead organisms are called *fossils*. Global liquefaction is explained on pages 175–187.

As explained on page 124, salt had precipitated out of the supercritical subterranean water before the flood began, covering the chamber floor with solid, but mushy, salt. Escaping water swept much of it out of the chambers. When sediments falling through the flood waters blanketed the pasty, relatively low-density salt, an unstable arrangement arose, much like having a layer of light oil beneath a denser layer of water. A slight jiggle will cause the lighter layer below to flow up as a plume through the denser layer above. In the case of salt, that plume is called a *salt dome*. Deep salt layers—some 20,000 feet below sea level[27]—are resting on what was the much deeper chamber floor. Wherever the chamber roof was removed, the floor below rose. Two such places are now the Gulf of Mexico and the Mediterranean Sea.

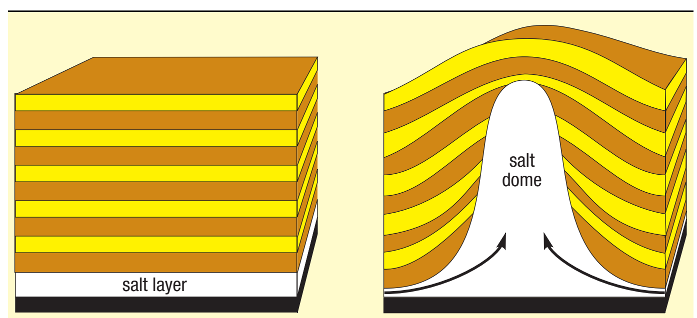


Figure 59: Salt Dome. Just as a cork released at the bottom of a swimming pool will float up through water, wet salt can float up through denser, freshly deposited sediments. A salt dome begins to form when a small part of a wet salt layer rises. Other salt in the layer then flows horizontally and up into a rising plume. If the salt is thick and saturated with water, friction offers little resistance, and salt will continue to feed into the rising plume. The upturned (or bowl-shaped) layers next to the salt dome can become traps in which oil collects, so understanding salt domes has great economic value.

The supercritical water (SCW) in the subterranean chamber had also dissolved minerals containing calcium,

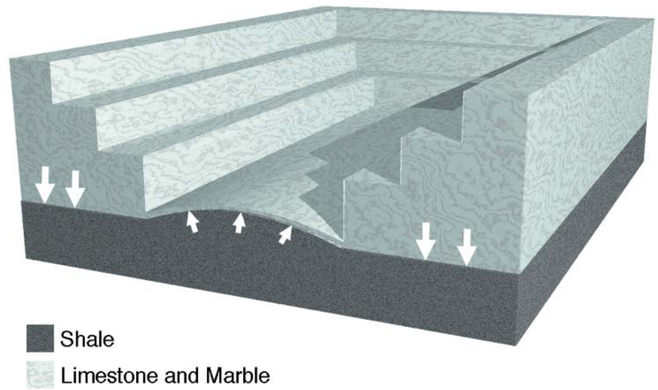
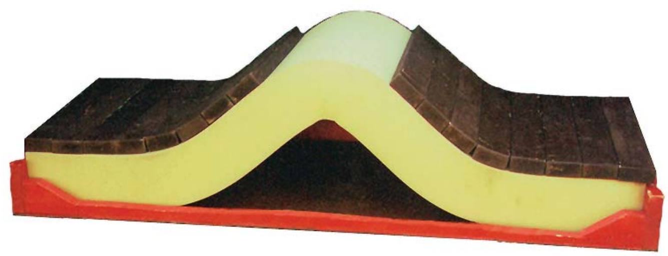


Figure 60: Buckling. The upward buckling of a deep rock floor has been observed. A limestone quarry floor buckled upward in Yorkshire, England, in 1887.[59] The explanation is quite simple. Shale, which lay beneath the floor, consists of platelike particles that can slide over each other like playing cards in a deck. The weight of the quarry's walls squeezed shale toward the center of the quarry, increasing the upward pressure on the quarry floor. Once the slightest upward buckling began, the limestone floor weakened, allowing the shale to push up even more.

In the flood cataclysm, the "quarry" was about 10 miles deep, hundreds of miles wide, and 46,000 miles long. The high upward pressure on the "exposed" portion of the subterranean chamber floor was no longer balanced by the weight of the crust pressing down. Therefore, that portion of the chamber floor increasingly bulged upward, as happened in the quarry. Eventually, the hydroplates, still supported by high-pressure water, began to slide downhill, away from the rapidly rising bulge. This removed even more weight from the chamber floor, accelerating its upward bulging. Today, the upbuckled region is the globe-encircling Mid-Oceanic Ridge.



Mechanical and civil engineers call this phenomenon "the buckling of a plate on an elastic foundation."[60] I have often demonstrated this to audiences by placing long bricks on top of a foam mattress compressed in a rigid box. Then I slowly remove the bricks from the foam mattress, beginning at the center and moving outward. When enough bricks are removed, the mattress suddenly springs upward, raising the remaining bricks. If these bricks were on a frictionless surface, they would slide downhill, just as continents (hydroplates) did during the continental-drift phase.

Although a void opens up under the upbuckled foam mattress, no void would open up deep inside the earth, because pressures are too great. Consequently, high-pressure rock from below would buckle up to fill the space. That would not leave a void farther down, because even deeper rock would be squeezed up to fill the space. Ultimately, mass from the opposite side of the earth must depress to compensate for the rising of the Mid-Atlantic Ridge and *the entire Atlantic floor*. Therefore, the Pacific and Indian Oceans rapidly formed. Evidence and details are given on pages 149–173.

carbon, and oxygen. They, too, had precipitated out of the SCW as temperatures rose, lining the chamber floor with limestone ($CaCO_3$) particles. As the flood waters escaped, these particles were also swept out and up onto the earth's surface. The total volume of limestone on the earth today is staggering and cannot be explained by processes occurring at the earth's surface. But, of course, the limestone we see today did not originate at the earth's surface. [See **"The Origin of Limestone"** on pages 229–235.]

Today, on the floor of the Gulf of Mexico, SCW sometimes escapes up through salt domes and precipitates asphalt (tar), the least volatile component of petroleum.[54] What is the hydrocarbon source? Organic material. Recall that black smokers—escaping SCW—are usually surrounded by buried vegetation and large ecosystems, such as swarms of giant tubeworms feeding on chemicals dissolved in the SCW. That organic material is quickly dissolved by the SCW when the vents shift locations. As the SCW jets up into the cold sea water and cools, hydrocarbons quickly precipitate, paving the sea floor with a tar residue.

Flooding uprooted most of earth's abundant vegetation and transported it to regions where it accumulated in great masses. [Pages 175–187 explain how this vegetation was collected and sorted into thin layers within the sediments.] Later, at the end of the continental-drift phase, buried layers of vegetation were rapidly compressed and heated, precisely the conditions that laboratory experiments have shown will form coal and oil.[61] The flood phase ended with the continents near the positions shown in Figure 53 and the top frame of Figure 63.

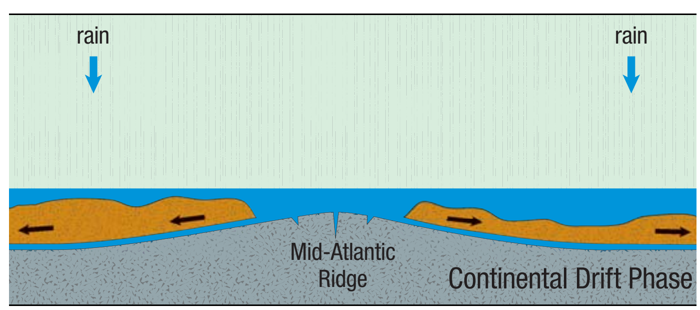
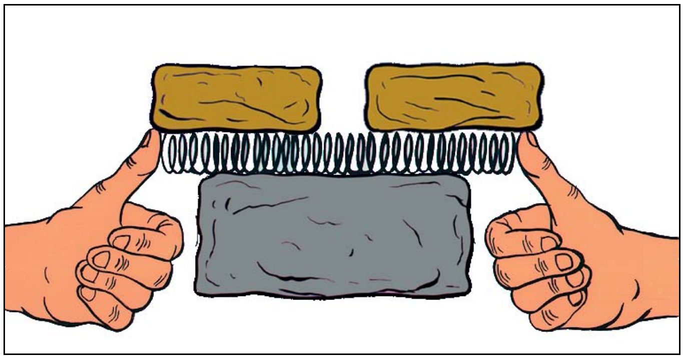
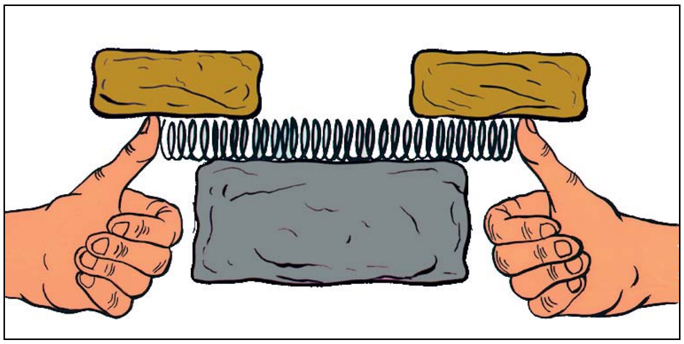


Figure 61: Continental-Drift Phase of the Flood.

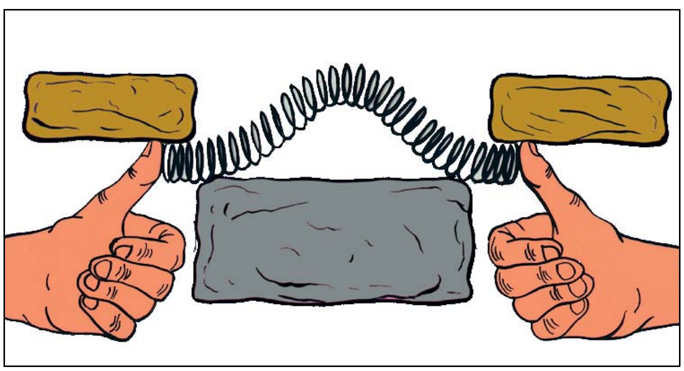
Continental-Drift Phase. Material within the earth is compressed by overlying rock. Rock's slight elasticity gives it springlike characteristics.[62] The deeper the rock, the more weight above, so the more tightly compressed the "spring"—all the way down to the center of the earth.



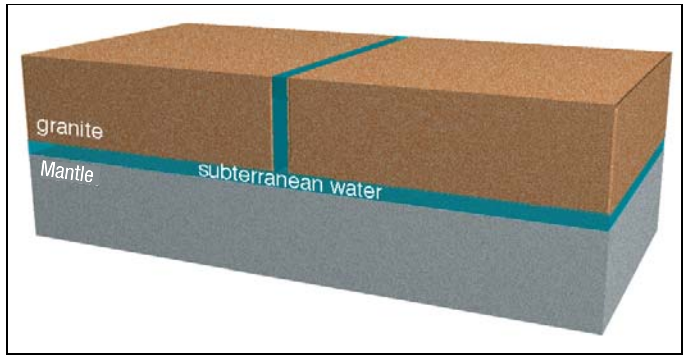
a) Overlying rocks keep a compressed spring horizontal.



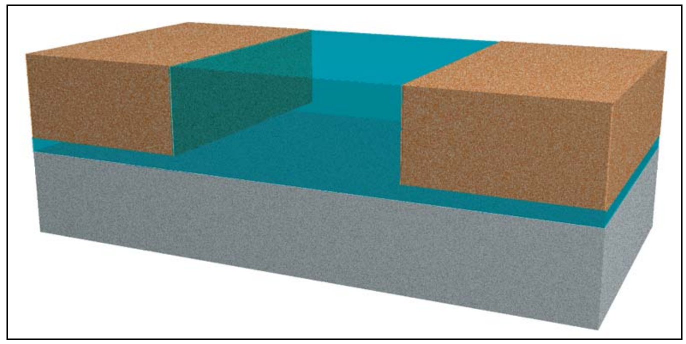
b) The spring remains aligned and compressed as the gap between the rocks widens.



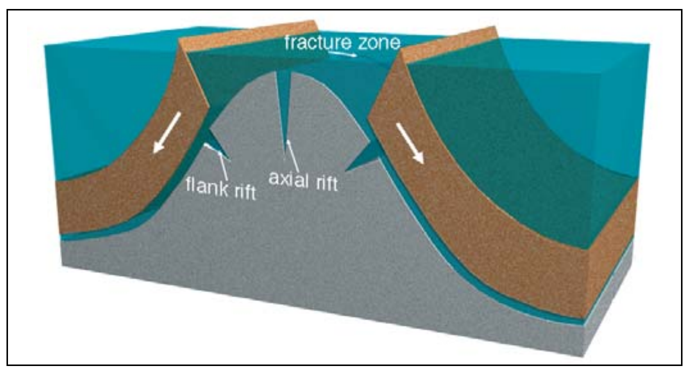
c) When the gap reaches a certain critical width, the spring suddenly buckles upward. Now consider thousands of similar springs lined up behind the first spring—all linked together and repeating, in unison, steps a–c. The upward buckling of any spring will cause adjacent springs to become unstable and buckle up themselves. They, in turn, will lift the next spring, and so on, in ripple fashion.



d) Rupture completed. Jetting water not shown.



e) The rupture's path widens by the erosion, crumbling, and collapse of the vertical walls, exposing part of the chamber floor. Most of earth's sediments are quickly produced by escaping, high-velocity waters—the fountains of the great deep.



f) Continental-drift phase begins. The Mid-Atlantic Ridge "springs" upward, releasing the large amounts of energy contained in compressed rock. Fracture zones form perpendicular to the ridge axis; rifts form along the ridge axis.[63] The massive hydroplates, lubricated by water, begin to accelerate downhill. As more and more weight slides away from the newly-formed ridge, the exposed chamber floor quickly rises several miles, accelerating the hydroplates even more, and becomes the Atlantic floor. (In the next chapter, you will see why events in the Pacific greatly steepened the downhill slope and opened up more space for the plates to slide.)

Figure 62: Spring Analogy Showing Development of the Mid-Atlantic Ridge.

The rupture path continually widened during the flood phase. [See Figure 62e.] Eventually, the width was so great, and so much of the surface weight had been removed, that the compressed rock beneath the exposed floor of the subterranean chamber sprung upward. [See Figure 62f.]

As the Mid-Atlantic Ridge began to rise, the granite ***hydroplates*** started to slide downhill on the steepening slopes. This removed even more weight from what was to become the floor of the Atlantic Ocean, so the floor rose faster, the slopes increased, and the hydroplates accelerated, removing even more weight, etc. The entire Atlantic floor rapidly rose almost 10 miles.

When the first segment of the Mid-Atlantic Ridge began to rise, it helped lift adjacent portions of the chamber floor just enough for them to become unstable and spring upward. This process continued all along the rupture path, forming the Mid-Oceanic Ridge. Also formed were fracture zones and the ridge's strange offsets at fracture zones.[63] Soon afterward, magnetic anomalies (Figure 47 on page 113) began to develop.[64]

The sliding hydroplates were almost perfectly lubricated by water still escaping from beneath them. (Remember, the water trapped in spongelike pockets in the chamber floor and ceiling was slowly squeezed out. See Figure 54 on page 122.) This sliding process resembled the following:

> *A long train sits at one end of a very long, level track. If we could somehow just barely lift the end of the track under the train and the wheels were frictionless, the train would start rolling downhill. Then we could lift the end of the track even higher, causing the train to accelerate more. If this continued, the high-speed train would eventually crash into something. The long train of boxcars would suddenly decelerate, compress, crush, and "jackknife."*

Continental plates accelerated away from the widening Atlantic. Recall that the rupture encircled the earth, and the escaping subterranean water widened that rupture to an average of about 800 miles—on both the Atlantic *and Pacific* sides of the earth. Plates then slid away from the rising Mid-Atlantic Ridge and toward that 800-mile-wide gap on the Pacific side of the earth.[65] The next chapter will explain why the Pacific floor simultaneously dropped as the Atlantic floor rose, steepening the downhill slide and removing obstacles to the accelerating hydroplates.

Eventually, the hydroplates ran into resistances of two types. The first happened as the water lubricant beneath each sliding plate was depleted. The second occurred when a plate collided with something. As each massive hydroplate decelerated, it experienced a gigantic *compression event*—buckling, crushing, and thickening each plate.

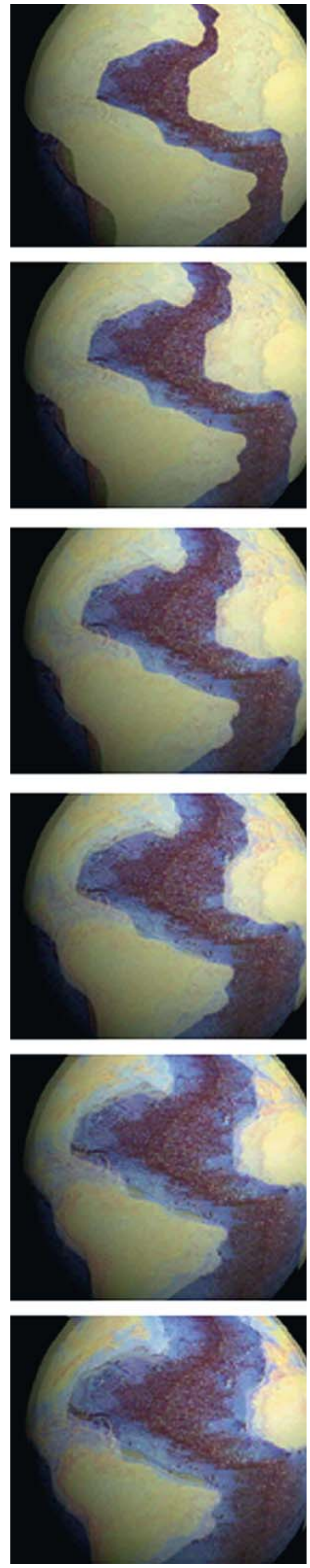


Figure 63: Computer Animation of the Continental-Drift Phase. The top frame shows one side of the earth at the end of the flood phase. Because the rupture encircled the earth, a similar eroded gap existed between the continental plates on the other side of the globe. The Mid-Oceanic Ridge rose first in the Atlantic, hours or days before the ends of the rising ridge extended into what is now the Pacific. This caused the hydroplates to accelerate downhill on a layer of lubricating water, away from the widening Atlantic and into the gap on the opposite side of the earth.

The continental-drift phase ended (bottom frame) with the dramatic ***compression event*** that squeezed up the earth's major mountain ranges. These six frames simply rotate the present continents about today's polar axis. Therefore, greater movement occurs at lower latitudes. Movement begins from where the continents best fit against today's base of the Mid-Atlantic Ridge (see Figure 53 on page 119) and ends near their present locations.

Not shown are other consequences of the compression event. For example, the compression squeezed and thickened continents, narrowing the widths of major continents and widening the Atlantic. Of course, regions where mountains formed thickened the most, but nonmountainous regions thickened as well. Regions that did not thicken are now part of the shallow ocean floor. [See Figure 43 on page 110.]

While it may seem strange to think of squeezing, thickening, and shortening granite, one must understand the gigantic forces required to decelerate sliding continental plates. If compressive forces are great enough, granite deforms, much like putty, on a global scale. On a human scale, however, one would not see smooth, puttylike deformation; instead, one would see and hear blocks of granite fracturing and sliding over each other. Some blocks would be the size of a small state or province, many would be the size of a house, and even more would be the size of a grain of sand. Friction at all sliding surfaces would generate heat. At great depths, this would melt rock. Liquid rock (magma) would squirt up and fill spaces between the blocks. This is seen in most places where basement rocks are exposed, as in the Black Canyon of the Gunnison and the inner gorge of the Grand Canyon (shown on pages 132 and 133).

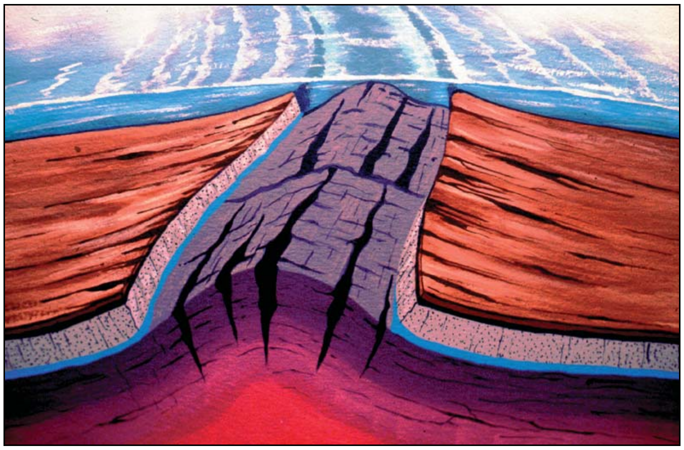


Figure 64: Birth of Mid-Atlantic Ridge.

To illustrate this extreme compression, imagine yourself in a car traveling at 45 miles per hour. You gently step on the brake as you approach a stop light and brace yourself by straightening and stiffening your arms against the steering wheel. You might feel 15 pounds of compressive force in each arm, about what you would feel lifting 15 pounds above your head with each hand. If we repeated your gentle deceleration at the stop light, but each time doubled your weight, the compressive force in your arms would also double each time. After about six doublings, especially if you were sitting on a lubricated surface, your arm bones would break. If your bones were made of steel, they would break after nine doublings. If your arm bones were one foot in diameter and made of granite, a much stronger material, 17 doublings would crush them. This compression would be comparable to that at the top of each decelerating hydroplate. Consequently, crashing hydroplates at the end of the continental-drift phase crushed and thickened each hydroplate for many minutes. Mountains were quickly squeezed up.

While the new postflood continents rose out of the flood waters, water drained into newly opened ocean basins. For each cubic mile of land that rose out of the flood waters, one cubic mile of flood water could drain. (Note: The volume of all land above sea level today is only one-tenth the volume of water on earth.)

Compressing a long, thin object, such as a yardstick, produces no bending or displacement until the compressive force reaches a certain critical amount. Once this threshold is exceeded, the yardstick (or any compressed beam or plate) suddenly arches into a bowed position. Further compression bows it up even more. Buckling a hydroplate at one point also bends adjacent portions.

Therefore, mountain chains were pushed up by the *crushing* of hydroplates. Where the compression exceeded the crushing strength of granite, the plate thickened and shortened. The collapse of strength in the crushed region increased the load on adjacent regions, causing them to crush and the mountain chain to lengthen. Therefore, bending and crushing rapidly lifted mountain chains. Naturally, the long axis of each buckled mountain was generally perpendicular to its hydroplate's motion—that is, parallel to the portion of the Mid-Oceanic Ridge from which it slid. So, the Rocky Mountains, Appalachians, and Andes have a north-south orientation. (Later sections of this book will explain why, in the years after the flood, melting deep inside the earth produced the earth's core and further vertical changes at the earth's surface.)

As explained earlier, the forces acting during this dramatic event were not applied to stationary (static) continents resting on other rocks. The forces were dynamic, produced by rapidly decelerating hydroplates riding on lubricating water that had not yet escaped.

As mountains buckled up, the remaining water under the plates tended to fill large voids. Some pooled water should still be in cracked and contorted layers of rock. [See Figures 66 and 65.] This would partially explain the reduced mass beneath mountains that gravity measurements have shown for over a century.[66]

PREDICTION 1: Beneath major mountains are large volumes of pooled salt water.[67] (Recent discoveries support this prediction, first published in 1980. Supercritical salt water appears to be about 10 miles below the Tibetan Plateau, which is bounded on the south by the largest mountain range on earth.)[68]

PREDICTION 2: Salty water frequently fills cracks in granite, 5-10 miles below the earth's surface (where surface water should not be able to penetrate).

(Note: Each of the 46 predictions in this book is marked by an icon at the left representing Figure 41 on page 106.)

Friction at the base of skidding hydroplates and below sinking mountains generated immense heat, enough to melt rock, produce huge volumes of magma, and begin earth's volcanic activity. Crushing produced similar effects, as broken and extremely compressed blocks and particles slid past each other. The deeper the sliding, the greater the pressure pushing the sliding surfaces together, and the greater the frictional heat generated. In some regions, high temperatures and extreme pressures from the compression event formed metamorphic rock, such as marble and diamonds. Where heat was most intense, rock melted. High-pressure magma squirted up through cracks between broken blocks. Sometimes magma escaped to the earth's surface, producing volcanic activity and "floods" of lava outpourings, called *flood basalts*, as seen on the Pacific floor and the Columbia and Deccan Plateaus. (The next chapter will explain the simultaneous production of

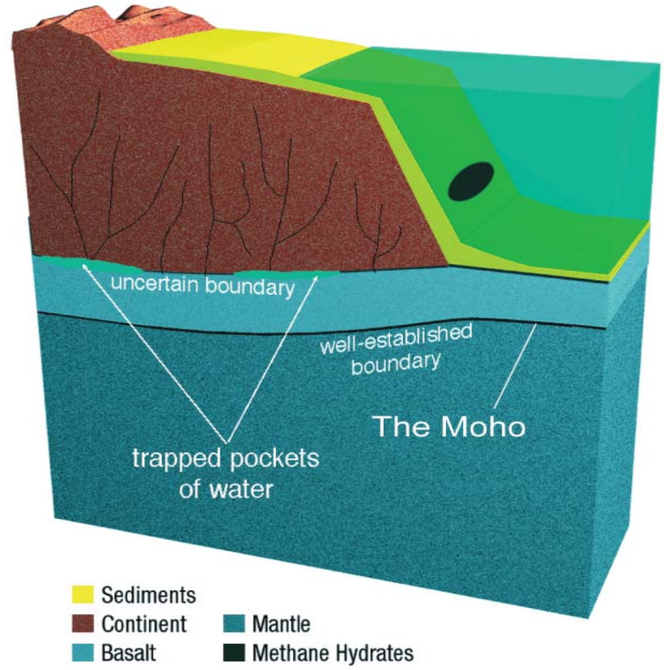


Figure 65: Typical Cross Section of Today's Continents and Oceans. Notice the relative depths of the Moho. It is deepest under major mountains and shallowest under the ocean floor. Although some boundaries are uncertain, most of these general characteristics are well known. Notice also that large pockets of water should be under major mountains.

deeper and far greater amounts of magma, some of which also escaped to the earth's surface as flood basalts.)

Some high-pressure subterranean water was quickly injected *up* into cracks in the crushed granite. This explains the concentrated salt water discovered in cracks 7.6 and 5.7 miles under Russia and Germany, respectively. Remember, *surface* water cannot seep deeper than 5 miles, implying that *subsurface* water was the source. This explains why the water's salt concentration in these cracks was about twice that of seawater. Because that high concentration of subterranean salt water mixed during the flood with an approximately equal volume of preflood surface water (which had little dissolved salt), the new oceans achieved much of their present salt concentration.

As the Mid-Atlantic Ridge and Atlantic floor rose, mass had to shift within the earth toward the Atlantic. Subsidence occurred on the opposite side of the earth, especially in the western Pacific, where a granite plate buckled downward, forming trenches. [For details and evidence, see **"The Origin of Ocean Trenches and the Ring of Fire"** on pages 149–173.]

Surrounding the Pacific is the "ring of fire," containing the greatest concentration of volcanic activity on earth. On the floor of the Pacific and surrounded by the ring of fire, are vast, thick lava flows and 40,000 volcanoes, each taller than 1 kilometer. Frictional heating caused by high-pressure movements under the Pacific floor generated these lava outpourings that covered the hydroplate.

Therefore, the western Pacific floor is littered with volcanic cones composed of minerals typically found in granite and basalt. Continental crust has been discovered under the Pacific floor. [See Endnote 22 on page 169, and the prediction on page 161.]

Recovery Phase. ***Where did the water go?*** When the compression event began on a particular hydroplate, the plate crushed, thickened, buckled, and rose out of the water. As it did, the flood waters receded.

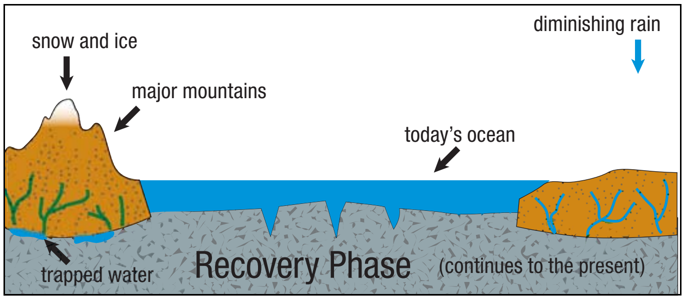


Figure 66: Recovery Phase of the Flood.

Simultaneously, the upward-surging, subterranean water was "choked off" as the plates settled onto the subterranean chamber floor. With the water source shut off, the deep, newly-opened basins between the continents became reservoirs into which the flood waters returned.

As you will recall, the floor of the subterranean chamber was about 10 miles below the earth's surface. Consequently, a few centuries after the flood, sea level was several miles lower than it is today. This provided land bridges between continents, allowing animal and human migration for perhaps several centuries.

Sediments, mixed with organic matter and its bacteria, were swept with draining flood waters onto the new ocean floors. There, the bacteria fed on the organic matter and produced methane. Since then, much of this methane combined with cold, deep ocean waters to become vast amounts of methane hydrates along coastlines.

Flood waters draining down the steep continental slopes eroded deep channels, especially downstream of drainage channels which are now major rivers. Today, we call these deep channels *submarine canyons*.

After the flood, hydroplates rested on portions of the former chamber floor and oceans covered most other portions. Because the thickened hydroplates applied greater pressure to the floor than did the water, the hydroplates slowly sank into the chamber floor (the mantle) over the centuries, lifting other parts of the deep ocean floor. (Imagine covering half of a waterbed with a cloth and the

A Picture with a Story

Figure 67: Black Canyon of the Gunnison.

Here at the Black Canyon of the Gunnison in Colorado, cliffs are exposed for up to 2,700 feet above the Gunnison River. Their marble-cake appearance comes from melted rock, primarily quartz, that was forced up through cracks in the darker rock.[73] To appreciate the size of this cliff, notice the trees, 10–15 feet tall, at the top of the cliff.

Now, let's put aside all prior opinions and ask, "What caused this marble-cake pattern?" First, deep magma must be present or be produced.

Second, the black rock must be fractured. This obviously takes gigantic forces acting over a large area, but the forces must be of a special kind. A tensile (stretching) force would produce one crack, or at most a few evenly-spaced cracks. At the instant of breakage, the pieces would scatter. (Try breaking something by pulling on it. When it breaks, the pieces will fly apart.) This leaves us with only one viable type of force—compression.[74]

If compressive forces acted equally in all directions, no breaks would occur. For example, deep sea creatures, living under high compressive pressure (inside and out), are not crushed. Also not crushed are many delicate pieces of pottery and other objects found in sunken vessels on the ocean floor.

If compressive forces acted slowly but were almost evenly balanced, slight but slow movements would occur at the molecular level, a phenomenon called *creep*. The rock would slowly flow like putty, until the forces balanced.

Some channels (or cracks) are wider than others. Normally, the largest channels provide the least flow resistance, so all the magma from below should have spilled out through them. (Pump a liquid into a closed container until it cracks. You will see only one or at most a few major cracks, not many little cracks.) If the magma had been contained in a chamber below, just waiting for a crack to appear, the first crack should release all the magma, unless it solidified on its way up through the colder rock.

other half with a thick metal plate. The sinking metal plate will lift the cloth.)

As sea level rose in the centuries after the flood, animals were forced to higher ground and were sometimes isolated on islands far from present continental boundaries. Classic examples of this are finches and other animals Charles Darwin found on the Galapagos Islands, 650 miles off the coast of Ecuador. Today, those islands are the only visible remains of a submerged South American peninsula. Darwin believed that the finches were blown there during a giant storm. Even if Darwin's unlikely storm happened, both a male and female finch, rugged enough to survive the traumatic trip, must have ended up on the same island.

The more sediments that continents carried and the thicker the continents grew during the compression event, the deeper continents sank. This also depressed the Moho beneath them. Newly formed mountains sank even more, depressing the Moho as deep as 50 miles below the earth's surface. [See Figure 65.] As the ocean floors rose in compensation, the Moho below them rose as well. This is why continents are so different from ocean bottoms and why the Moho (where it can be detected) is so deep beneath mountains and yet so shallow beneath the ocean floor.

Many other things were far from equilibrium after the continental-drift phase. Over the centuries, the new mountain ranges and thickened continental plates settled slowly toward their equilibrium depth—just as a person's body sinks into a waterbed. Sinking mountains increased the pressure under the crust on both sides of mountain ranges, so weaker portions of the overlying crust fractured and rose, forming plateaus. In other words, ***as continents and mountains sank, plateaus rose.*** This explains the otherwise strange aspects of plateaus noted by George

But if all cracks formed simultaneously, then magma would fill most cracks. All this leaves us with one conclusion for how the fractures occurred—***rapid crushing***.

Next, magma must rapidly squirt up through the cracks in the black rock. If it happened slowly, or even at the rate a river flows, the front edge of the upward-flowing magma would solidify, stopping the flow. If water is dissolved in any molten rock, its melting temperature is lowered considerably. Therefore, melted quartz *with dissolved water* would be more likely to complete the cold, upward journey.

Each channel (or vein) at the Black Canyon has a fairly uniform thickness. This reveals that the liquid's pressure exceeded the rock's pressure by nearly the same amount all along the channel. Again, this would not happen if the flow were slow or had the consistency of cold tar.

This marble-cake appearance is exposed for at least 50 miles along the Gunnison River, so the compressive force must have been about the same over at least those 50 miles. Magma, if it came from one spot below, would tend to escape through the shortest cracks leading to the surface. Instead, magma has filled cracks over a 50-mile range. Consequently, the magma source and any water were probably spread over a large area directly below.

Because similar structures are seen where other deep basement rocks are exposed at the earth's surface, these gigantic forces either "cropped up" many times at different places or this happened once on a continental or global scale. The parsimony criterion (looking for the simplest explanation) leads us to favor one big event. We will call this ***the compression event***.

Figure 68: Inner Gorge of the Grand Canyon. The same marble-cake pattern exists in the inner gorge of the Grand Canyon, but with less color contrast than in the Black Canyon of the Gunnison.

We can conclude that ***this crustal rock was rapidly crushed over a wide area. Magma (probably containing dissolved water) was then quickly injected up through the cracks.***

In studying this effect—an immense layer of "marble-cake rock"—we tried to deduce its cause. One can easily err when reasoning from effect back to cause. Another approach, reasoning from cause to effect, requires starting assumptions. We began this on page 122 with only one assumption and then looked at its logical consequences. When "cause-to-effect reasoning" is consistent with "effect-to-cause reasoning," as it is here, confidence in our conclusion increases greatly.

Kennedy on page 118 and why plateaus are adjacent to major mountain ranges. For example, the Tibetan Plateau, the largest in the world, is next to the most massive mountain range in the world—the Himalayas. The Tibetan Plateau covers 750,000 square miles and rose to an elevation of about 3 miles. The Colorado Plateau, next to the Rocky Mountains, and the Columbia Plateau, next to the Cascade Mountains, are other dramatic examples. (**"Plateau Uplift,"** beginning on page 200provides more details.)

Earth Roll. The sudden formation of major mountains altered the spinning earth's balance,[69] causing the earth to slowly roll about 35°–45°. The North Pole, then in what is now central Asia, began a slow shift to its present position.[70] (The shift produced a 6° precession of the earth's axis that Dodwell discovered from studying almost 100 astronomical measurements made over the last 4,000 years.) This is why coal,[13] dinosaur fossils,[71] and other temperate fossils[72] are found near today's South Pole. Many researchers have also discovered vast dinosaur and mammoth remains inside the Arctic Circle. All were at temperate latitudes before and immediately after the flood.

The direction and magnitude of the roll are also shown by fossils found inside the Arctic Circle of animals and plants that today live at specific temperate latitudes. Remains of a horse, bear, beaver, badger, shrew, wolverine, rabbit, and considerable temperate vegetation are found on Canada's Ellesmere Island, inside the Arctic Circle. Such animals and plants today require temperatures about 27°F warmer in the winter and 18°F warmer in the summer.[75] Also found are remains of "large lizards, constrictor snakes, tortoises, alligators, tapirs, and flying lemurs—now found only in Southeast Asia."[76] Isotopic studies of the cellulose in redwood trees on Axel Heiberg Island, just west of Ellesmere Island, show that they grew in a climate similar to that of today's coastal forests of Oregon (35° farther south in latitude).[77]

Ellesmere Island and Axel Heiberg Island may have the largest known contrast between current temperatures and inferred ancient temperatures based on fossils. Both islands straddle 85°W longitude. Therefore, regions near this longitude experienced large northward shifts after the flood. On the opposite side of the earth, the preflood North Pole rolled south near 95°E longitude while, points along 85°W longitude (including today's North Pole) rolled to the north. Also implied is a roll of at least 35°. Physics,[69] geology,[70] and biology,[71–77] give a similar picture.

An ancient historical record tells of a catastrophic flood and an apparent earth roll. Famous linguist Charles Berlitz reports that early Jesuit missionaries in China located a 4,320-volume work "compiled by Imperial Edict" and containing "all knowledge." It states,

> *The Earth was shaken to its foundations. The sky sank lower toward the north. The sun, moon, and stars changed their motions. The Earth fell to pieces and the waters in its bosom rushed upward with violence and overflowed the Earth. Man had rebelled against the high gods and the system of the Universe was in disorder.* [78]

Endnote 69 explains why the Asian sky began "sinking" toward the north immediately after the flood.

Canyons. Drainage of the waters that covered the earth left every continental basin filled to the brim with water. Some of these postflood lakes lost more water by evaporation and seepage than they gained by rainfall and drainage from higher elevations. Consequently, they shrank over the centuries. A well-known example was former Lake Bonneville, part of which is now the Great Salt Lake.

Through rainfall and drainage from higher terrain, other lakes gained more water than they lost. Thus, water overflowed each lake's rim at the lowest point on the rim. The resulting erosion at that point on the rim allowed more water to flow over it. This eroded the cut in the rim even deeper and caused much more water to cut it faster. Therefore, the downcutting accelerated catastrophically. The entire lake quickly dumped through a deep slit, which we today call a canyon. These waters spilled into the next lower basin, causing it to breach its rim and create another canyon. It was like falling dominoes. The most famous canyon of all, the Grand Canyon, formed primarily by the dumping of what we will call ***Grand Lake***. It occupied much of southeast Utah, parts of northeastern Arizona, and small areas of Colorado and New Mexico. [See the map on page 188 and pages 189–227.] Grand Lake, standing at an elevation of 5,700 feet above today's sea level, quickly eroded its natural dam 22 miles southwest of what is now Page, Arizona. As a result, the northwestern boundary of former Hopi Lake (elevation 5,950 feet) was eroded, releasing waters that occupied the present valley of the Little Colorado River.

With thousands of large, high lakes after the flood, many other canyons were carved. "Lake California" filling the Great Central Valley of California carved a canyon (now filled with sediments) under what is now the Golden Gate Bridge in San Francisco. The Strait of Gibraltar was a breach point as the rising Atlantic Ocean eventually spilled eastward into the Mediterranean Basin. The Mediterranean Sea, in turn, spilled eastward over what is now the Bosporus and Dardanelles, forming the Black Sea.

> **PREDICTION 3:** The crystalline rock under Gibraltar, the Bosporus and Dardanelles, and the Golden Gate bridge will be found to be eroded into a V-shaped notch. (This prediction, first published in 1995, was confirmed concerning the Bosporus and Dardanelles in 1998[79] and concerning Gibraltar in 2009.[80])

Earthquakes. The flood produced great mass imbalances on earth, and these cause earthquakes. Continents sank into the mantle and lifted ocean floors. Mountain ranges sank into the mantle and raised plateaus. [See **"Plateau Uplift"** beginning on page 200.] Shifting material within the earth is the root cause of earthquakes and the slow shifting of continents.[81] Both phenomena have been misinterpreted as supporting plate tectonics. (The next chapter explains this in greater detail, especially deep earthquakes and the melting and contraction within the earth.)

Shallow earthquakes involve a different phenomenon.[82] Trapped subterranean water, unable to escape during the flood, slowly seeps upward through cracks and faults formed during the crushing of the compression event. (Seismographs on the Pacific Ocean floor have measured tremors from such seepings.)[83] The higher this water migrates through a crack, the more its pressure exceeds that in the walls of the crack trying to contain it. Consequently, the crack spreads and lengthens. (So, before an earthquake, the ground often bulges slightly, water levels sometimes change in wells, and geyser eruptions may become more irregular.) Simultaneously, stresses build up in the crust, again driven ultimately by gravity and mass imbalances produced by the flood. Once compressive stresses have risen enough, the cracks have grown enough, and the frictional locking of cracked surfaces has diminished enough, sudden movement occurs. Water acts as a lubricant. (Therefore, large temperature increases are not found along the San Andreas Fault.) Sliding friction instantly heats the water, converts it to steam at an even higher pressure, and initiates a runaway process called a *shallow earthquake*. [For more details, see **"The Origin of Ocean Trenches and the Ring of Fire"** on pages 149–173.]

Lake Kashmir

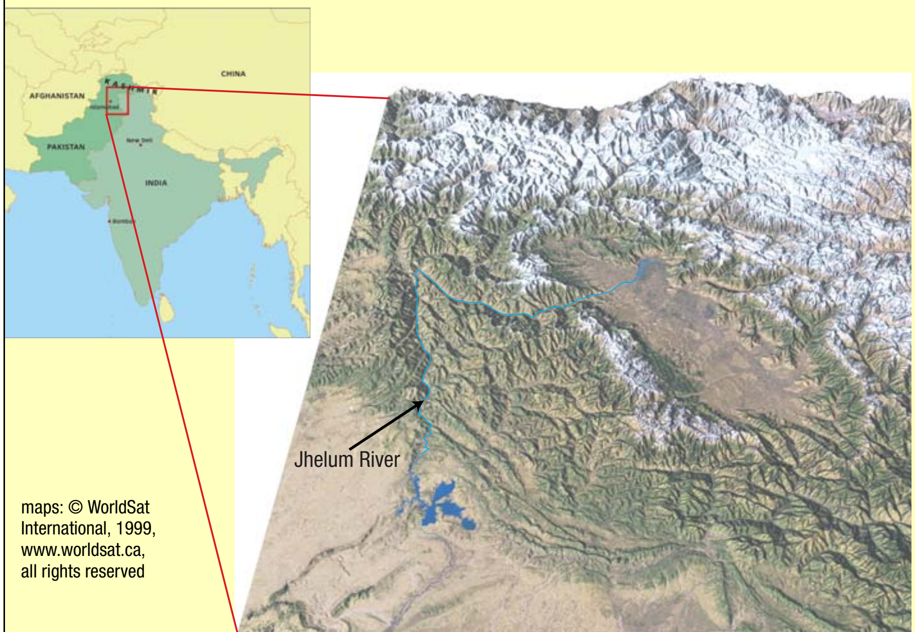


Figure 69: Kashmir Basin Today. Consider whether this region and its bowl-shaped depression quickly rose several miles, carrying in its basin flood waters and fish. If so, the potential existed for "Lake Kashmir" to later overflow its rim and quickly carve a huge canyon, leaving the Jhelum River as a remnant of that event.

While legends and geological facts are consistent with this scenario, two questions remain. What could quickly lift the Himalayas, the most massive mountain range on earth? Can conventional geology explain these geological facts?

This chapter has answered the first question. Details below address the second question. The Grand Canyon and many other canyons are prime exhibits showing that they too are best explained by a similar catastrophic event. Wouldn't it be nice if eye witnesses could confirm this event? Consider the legend described below.

Kashmir, a disputed territory high on the borders of northern India and Pakistan, has an interesting geological and cultural history. Half of Kashmir's seven million people live in an oval valley the size of Delaware, more than one mile above sea level. That valley is surrounded by high mountains containing fossils of sea life. Rain falling into this bowl-shaped region eventually enters the Jhelum River which flows out between almost vertical canyon walls, 7,000 feet high, in a channel cut through the rim of the bowl.

The Nilamata Purana, written sometime between the sixth and eighth century, contains many Hindu legends. Verses 138–180 tell of a vast, ancient lake that once filled this valley and contained a demonic sea monster who ate people. Hindu gods decided to help the people by cutting an outlet for the lake's waters through the surrounding mountains. Once the lake drained, the hero killed the immobilized monster. Since then, the lake's bottom has been a fertile home for the people of Kashmir, most of whom know this story.

Geologists have confirmed that the valley once held a giant lake! The thinly layered strata (of clay, limestone, and shale containing microscopic seashells) show that the valley was once under water. Was this just a lucky guess by the ancient writers of *The Nilamata Purana* myth? Did they understand geology and create a story to fit the evidence? They would have needed a microscope to see much of the evidence. Perhaps some truth lies behind this myth.

Geologists claim that the entire region, including the bordering Himalayan Mountains, rose millions of years ago. If so, the fossils on top should have eroded away, because erosion occurs rapidly in mountainous terrain subject to many freezing-thawing cycles. What lifted this region? How could a lake—and fish—accumulate in a high, remote, draining valley? Even if the valley's outlet had not yet formed, why would a large lake form at that cold, high elevation? Snow or glaciers might accumulate, but rarely a large lake. At high elevations, evaporation rates are generally faster and precipitation rates slower. (Today, the world's largest lake a mile or higher above sea level is Lake Titicaca,[86] astride the border of Bolivia and Peru. Kashmir's ancient lake was probably larger.) If such a high lake could not form, or if it breached before it rose millions of years before humans evolved, why does a human account, historical or mythical, speak of the lake and the cutting of the canyon?

The hydroplate theory unifies, clarifies, and provides additional details to this cultural and geological picture. As the crashing hydroplates crushed, thickened, and buckled, the Himalayan Mountains rose and the waters drained off the continents. Every basin became a lake, regardless of elevation. Kashmir's lake was immediately full and could have held fish. Later, after people migrated to the region, the lake breached part of its boundary and quickly cut its canyon. Today, the upper Jhelum River is a remnant of that lake. Undoubtedly, other canyons of the world, including the Grand Canyon, formed in a similar way.

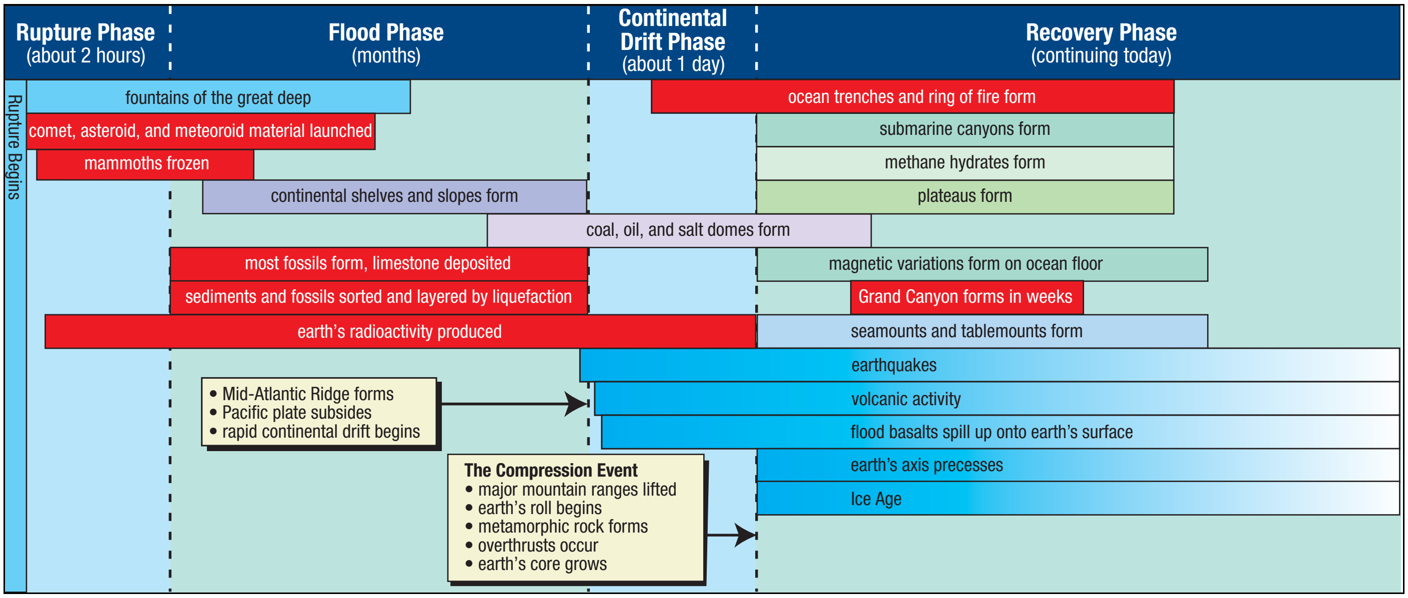


Figure 70: Sequence of Events. Although the flood's consequences, displayed above, are correctly sequenced, each phase has a different time scale. Each consequence shown in red is the subject of a later chapter. (Notice that the mammoths were frozen during the rupture phase, but the Ice Age began during the recovery phase and is diminishing today. See **"Is Global Warming Occurring? If So, What Causes It?"** on pages 400–403.)

Ice Age. As mentioned on page 114, an ice age requires cold continents and warm oceans. Indeed, even the Arctic Ocean was a warm 73°F (23°C) soon after the Mid-Oceanic Ridge formed. While standard climate models, even making use of liberal assumptions, fail to explain this discovery,[84] the flood does.

Sliding hydroplates generated frictional heat, as did movements within the earth resulting from the rising of the Atlantic floor and subsiding of the Pacific Ocean floor. Floods of lava spilling out, especially onto the Pacific floor, became vast reservoirs of heat that maintained elevated temperatures in certain ocean regions for centuries—the ultimate and first "El Niño."[85] Warm oceans produced high evaporation rates and heavy cloud cover.

Temperatures drop as elevation increases. For example, for every mile one climbs up a mountain, the air becomes about 28°F colder.[87] Therefore, after the flood, the elevated continents were colder than today. Conversely, lowered sea levels meant warmer oceans. Also, volcanic debris in the air and heavy cloud cover shielded the earth's surface from much of the Sun's rays.

At higher latitudes and elevations, such as the newly elevated and extremely high mountains, this combination of high precipitation and low temperatures produced immense snow falls—perhaps 100 times those of today. Large temperature differences between the cold land and warm oceans generated high winds that rapidly transported moist air up onto the elevated, cool continents where heavy snowfall occurred, especially over glaciated areas. As snow depths increased, glaciers moved in periodic spurts, much like an avalanche. During summer months, rain caused some glaciers to melt partially and retreat, marking the end of that year's "ice age."

What's Ahead

Twenty-six mysteries related to the earth have been briefly described, solved, and interrelated. Each of the next eight chapters will examine one of these mysteries in detail: ocean trenches and the ring of fire, strata and layered fossils, the Grand Canyon, limestone, frozen mammoths, comets, asteroids and meteoroids, and finally, earth's radioactivity. Each chapter will contrast the hydroplate theory with all leading explanations and will add a surprising new dimension to the hydroplate theory and to the flood's destructiveness. As you read these chapters, keep in mind that all the theory's details and events were consequences of only one key assumption (page 122) and the laws of physics.

References and Notes

1. See **"How Much Energy?"** on page 343 for an explanation.

2. Plate tectonics, as first proposed, had 6 to 8 plates. This number has grown as followers of the theory have applied it to specific regions of the earth and found problems with the theory. Although textbooks usually mention only about a dozen plates, the theory now requires more than 100, most of them small.

   This is reminiscent of the use of epicycles, from A.D. 150 to 1543, to explain planetary motion. Ptolemy (A.D. 100–175) explained that planets revolved about the earth on *epicycles*—wheels that carried planets and rode on the circumferences of other wheels. As more was learned about planetary motion, more epicycles were required to protect Ptolemy's geocentric theory. Of course, any theory can appear to explain facts if the theory has enough variables (adjustable parameters).

   Both the plate tectonic theory and the hydroplate theory claim that plates have moved over the globe. The plate tectonic theory says that plates move, by an unknown mechanism, slowly for hundreds of millions of years. The hydroplate theory, using an understood mechanism, says that a few hydroplates moved rapidly at the end of a global flood. Upon collision, they fragmented into pieces which today are shifting slowly, but in jerks, toward equilibrium.

   As historians of science know, old theories frequently accumulate many anomalies—discoveries that oppose the theory. These problems do not overthrow the old theory until a new theory comes along that can explain all that the old theory did *plus* the anomalies. [See Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1970).] Plate tectonics is becoming more complex as new information is learned, a sign that "epicycles" are with us again. This has caused a growing number of international scientists to announce that *"a lot of phenomena and processes are incompatible with this theory* [plate tectonics] … *we must develop competitive hypotheses."* [A. Barto-Kyriakidis, editor, *Critical Aspects of the Plate Tectonics Theory,* Vol. I (Athens, Greece: Theophrastus Publications, 1990), p. v.]

3. W. Jason Morgan, "Rises, Trenches, Great Faults, and Crustal B," *Journal of Geophysical Research,* Vol. 73, 15 March 1968, p. 1973.

   ◆ Jürgen Friedrich and Guy G. Leduc, "Curvilinear Patterns of Oceanic Fracture Zones," *Journal of Geodynamics*, Vol. 37, 2004, pp. 169–179.

4. Ken C. Macdonald and P. J. Fox, "Overlapping Spreading Centers," *Nature,* Vol. 302, 3 March 1983, pp. 55–58.

5. Paul G. Silver and Nathalie J. Valette-Silver, "Detection of Hydrothermal Precursors to Large Northern California Earthquakes," *Science*, Vol. 257, 4 September 1992, pp. 1363–1368.

6. On 25 March 1998, the largest earthquake in 4 years and one of the largest ever recorded on the ocean floor struck inside the Antarctic plate, 350 kilometers from the nearest plate boundary. [See Richard Monastersky, "Great Earthquake Shakes Off Theories," *Science News*, Vol. 154, 5 September 1998, p. 155.] Powerful intraplate earthquakes have also occurred near Lisbon, Portugal (1755), New Madrid, Missouri (1811, 1812), and Charleston, South Carolina (1886).

7. Richard Monastersky, "Reservoir Linked to Deadly Quake in India," *Science News*, Vol. 145, 9 April 1994, p. 229.

8. Mark D. Zoback, "State of Stress and Crustal Deformation Along Weak Transform Faults," *Philosophical Transactions of the Royal Society of London,* Vol. 337, 15 October 1991, pp. 141–150.

9. "[Deep earthquakes] *have posed a fruitful puzzle since their discovery 60 years ago. How can rock fail at the temperatures and pressures that prevail hundreds of kilometers down?"* Cliff Frohlich, "Deep Earthquakes," *Scientific American*, Vol. 260, January 1989, p. 48.

10. Arthur D. Raff, "The Magnetism of the Ocean Floor," *Scientific American,* October 1961, pp. 146–156.

11. R. S. Coe and M. Prevot, "Evidence Suggesting Extremely Rapid Field Variations during a Geomagnetic Reversal," *Earth and Planetary Science Letters*, Vol. 92, 1989, pp. 292–298.

    ◆ R. S. Coe, M. Prevot, and P. Camps, "New Evidence for Extraordinarily Rapid Change of the Geomagnetic Field during a Reversal," *Nature*, Vol. 374, 20 April 1995, pp. 687–692.

    ◆ Roger Lewin, "Earth's Field Flipping Fast," *New Scientist*, Vol. 133, 25 January 1992, p. 26.

12. The Mid-Ocean Canyon begins between Canada and Greenland and extends 2,300 miles to the south.

13. Quinn A. Blackburn, "The Thorne Glacier Section of the Queen Maud Mountains," *The Geographical Review,* Vol. 27, 1937, p. 610.

    ◆ Ernest Henry Shackleton, *The Heart of the Antarctic,* Vol. 2 (New York: Greenwood Press, 1909), p. 314.

    ◆ Stefi Weisburd, "A Forest Grows in Antarctica," *Science News,* Vol. 129, 8 March 1986, p. 148.

    ◆ Richard S. Lewis, *A Continent for Science: The Antarctic Adventure* (New York: Viking Press, 1965), p. 134.

14. Lewis, p. 130.

15. "[Canada's Ellesmere Island, well inside the Arctic Circle, was] *warm enough throughout the year to sustain palm trees and other tropical flora and fauna."* Daniel B. Kirk-Davidoff et al., "On the Feedback of Stratospheric

Clouds on Polar Climate," *Geophysical Research Letters*, Vol. 29, 15 June 2002, p. 51–1.

- *"On eastern Axel Heiberg Island* [in Canada], *... fossil forests are found. ... just 680 miles from the North Pole. The stumps of ancient trees are still rooted in the soil and leaf litter where they once grew. ... many trees reaching more than a hundred feet in height."* Jane E. Francis, "Arctic Eden," *Natural History*, Vol. 100, January 1991, pp. 57–58.

16. Carl K. Seyfert and Leslie A. Sirkin, *Earth History and Plate Tectonics*, 2nd edition (New York: Harper & Row, 1979), p. 312.

17. *"Estimates vary widely, but most experts agree that marine gas hydrates collectively harbor twice as much carbon as do all known natural gas, crude oil and coal deposits on earth."* Erwin Suess et al., "Flammable Ice," *Scientific American*, Vol. 281, November 1999, p. 78.

- *"... even by the most conservative estimates, the energy dormant in natural gas hydrates worldwide is double that of all conventional fossil fuel deposits combined."* Matthew R. Walsh et al., "Microsecond Simulations of Spontaneous Methane Hydrate Nucleation and Growth," *Science*, Vol. 326, 20 November 2009, p. 1095.

18. John Woodmorappe and Michael J. Oard, "Field Studies in the Columbia River Basalt, North-West USA," *Technical Journal*, Vol. 16, No. 1, 2002, pp. 103–110.

19. Richard A. Kerr, "Looking—Deeply—into the Earth's Crust in Europe," *Science*, Vol. 261, 16 July 1993, pp. 295–297.

- Richard A. Kerr, "German Super-Deep Hole Hits Bottom," *Science*, Vol. 266, 28 October 1994, p. 545.

- Richard Monastersky, "Inner Space," *Science News,* Vol. 136, 21 October 1989, pp. 266–268.

- Richard A. Kerr, "Continental Drilling Heading Deeper," *Science*, Vol. 224, 29 June 1984, p. 1418.

20. Yevgeny A. Kozlovsky, "Kola Super-Deep: Interim Results and Prospects," *Episodes*, Vol. 5, No. 4, 1982, pp. 9–11.

21. The geothermal gradient in a few continental regions far from volcanoes varies from 10° to 60°C per kilometer.

22. Harvey Blatt, *Sedimentary Petrology* (New York: W. H. Freeman and Co., 1982), pp. 3, 6, 241.

23. In Norway, China, and Kazakhstan, tiny diamond grains have been found in nonvolcanic, metamorphosed, crustal rocks that were once sediments. [See Larissa F. Dobrzhinetskaya et al., "Microdiamond in High-Grade Metamorphic Rocks of the Western Gneiss Region, Norway," *Geology*, Vol. 23, July 1995, pp. 597–600 and Richard Monastersky, "Microscopic Diamonds Crack Geologic Mold," *Science News*, Vol. 148, 8 July 1995, p. 22.]

24. John V. Walther and Philip M. Orville, "Volatile Production and Transport in Regional Metamorphism," *Contributions to Mineralogy and Petrology*, Vol. 79, 1982, pp. 252–257.

25. George C. Kennedy, "The Origin of Continents, Mountain Ranges, and Ocean Basins," *American Scientist*, Vol. 47, December 1959, pp. 493–495.

26. Larry Gedney, "The World's Deepest Hole," *Alaska Science Forum*, Article 725, 15 July 1985, p. 2.

27. *"... we estimate the depth of the mother salt layer as about 20,000 feet in the Texas Gulf Coast. This is in general agreement with estimates on the same basis made by Barton."* L. L. Nettleton, "Fluid Mechanics of Salt Domes," *Bulletin of the American Association of Petroleum Geologists*, Vol. 18, September 1934, p. 1177.

28. *"As the name suggests, it was once thought that evaporites formed exclusively from the drying out of enclosed marine basins. This required improbably large volumes of seawater to provide the resultant evaporites."* R. C. Selley, "Mineralogy and Classification," *Encyclopedia of Geology* (Amsterdam: Elsevier, 2005), p. 31.

- Robert S. Dietz and Mitchell Woodhouse, "Mediterranean Theory May Be All Wet," *Geotimes*, May 1988, p. 4.

29. Kenneth J. Hsu, *The Mediterranean Was a Desert* (Princeton, New Jersey: Princeton University Press, 1983).

30. Barry Setterfield, "An Investigation That Led to Unexpected Results by the Late Mr. G. F. Dodwell, B.A., F.R.A.S., South Australian Government Astronomer, 1909–1952," *Bulletin of the Astronomical Society of South Australia*, September 1967.

- Another data point that could be added to Dodwell's long list is the Great Pyramid of Egypt. For it to line up with today's cardinal directions, it would need to be rotated about 3 degrees counterclockwise. The pyramid's builders were much too skilled to have made such a large error.

31. See Endnote 4 on page 294.

32. The United States National Research Council, in 2000, compiled a list of the eleven "Greatest Unanswered Questions of Physics." This listing included such questions as "What Is Dark Matter?" "What Is Dark Energy?" and "How Did the Universe Begin?" This book points out the faulty science that led to these unanswerable questions.

    Another of those eleven unanswered questions is relevant to the flood: "How Were the Heavy Elements from Iron to Uranium Made?"

    > *But when fusion creates elements that are heavier than iron, it requires an excess of neutrons. Therefore, astronomers assume that heavier atoms are minted in supernova explosions, where there is a ready supply of neutrons, although the specifics of how this happens are unknown.* [See Eric Haseltine, "The Greatest Unanswered Questions of Physics," *Discover*, February 2002, p. 40.]
    >
    > *Where the heaviest elements, such as uranium and lead, came from still remains something of a mystery.* Ibid., p. 41.

33. See **"Meteorites Return Home"** on page 316.

34. *"Strikingly large concentrations of iridium were also observed* [in the eruption debris of Hawaii's Kilauea volcano]*, the ratio of iridium to aluminum being 17,000 times its value in Hawaiian basalt."* William H. Zoller et al., "Iridium Enrichment in Airborne Particles from Kilauea Volcano: January 1983," *Science*, Vol. 222, 9 December 1983, p. 1118.

◆ Charles Officer and Jake Page, *The Great Dinosaur Extinction Controversy* (Reading, Massachusetts: Addison-Wesley Publishing Co., Inc., 1996), pp. 110–124.

35. Ibid., pp. 98, 114–115, 117–121.

36. "*Taken together, our analyses indicate that the end-Cretaceous mass extinction was a globally uniform event.*" David M. Raup and David Jablonski, "Geography of End-Cretaceous Marine Bivalve Extinctions," *Science*, Vol. 260, 14 May 1993, p. 973.

37. Sometimes, the popular press has announced the discovery of craters that might explain the extinction of dinosaurs. Usually, after the initial fanfare, other discoveries falsified the explanation.

38. Officer and Page, pp. 151–156.

◆ Rex Dalton, "Hot Tempers, Hard Core," *Nature*, Vol. 425, 4 September 2003, pp. 13–14.

◆ *"To date, no one has found iridium associated with Chicxulub."* Gerta Keller as quoted by Barry DiGregorio, "Doubts on Dinosaurs," *Scientific American*, Vol. 292, May 2005, p. 28.

39. Robert Vickers Dixon, *Treatise on Heat* (Dublin: Hodges and Smith, 1849), pp. 143–144.

40. For more on tidal pumping, see pages 488–489.

41. In water at room temperature and atmospheric pressure, about one in a billion water molecules is *ionized*. That is, the random vibrations of water molecules sometimes break a molecule (H_2O), which has no net electrical charge, into H^+ and OH^-, which have a positive and negative charge, respectively. Because they are electrically charged, the particles are said to be *ionized*. The more ionized the water, the easier it is for water to conduct an electrical current.

Energy is required to pull the positive and negative charged particles apart, but that energy is recovered if those charges recombine, as positive and negative charges always try to do. If you expend energy by rubbing your shoes on a carpet, some electrons from the carpet stick to your shoes. Your body becomes negatively charged and your hair will tend to stick out. Then, if you touch the nose of your unsuspecting sister, a spark will jump between your finger and her nose; energy is released instantly, much to your sister's surprise.

As the temperature of the subterranean water increased, its ionization increased. At the temperatures and pressures in the subterranean water, the ionization of each gram of water is hundreds of millions of times greater than that of the water you drink. When the flood began, the temperature and pressure of the water jetting up through the rupture suddenly dropped, allowing the electrical charges to recombine. Ionization energy was then released as heat that accelerated the water to even greater speeds.

◆ For a good discussion of the ionization of water at high temperatures and pressures, see E. U. Franck, "Fluids at High Pressures and Temperatures," *Pure and Applied Chemistry*, Vol. 59, No. 1, 1987, pp. 25–34.

42. *"Both numerical simulations and laboratory experiments confirm that supercritical out-salting is a viable process of geological significance for the formation and accumulation of evaporites."* Martin Hovland et al., "Sub-Surface Precipitation of Salts in Supercritical Seawater," *Basin Research*, Vol. 18, 2006, p. 221. (Figure 2 on page 223 shows the pressure-temperature curve at which "out-salting" occurs.)

43. Conduction and convection (including boiling within the liquid) remove relatively little heat *from the liquid*; radiation at these temperatures is small.

44. Ph. Wernet et al., "Spectroscopic Characterization of Microscopic Hydrogen-Bonding Disparities in Supercritical Water," *The Journal of Chemical Physics*, Vol. 123, 12 October 2005, pp. 154503-1–154503-7.

What this paper calls "small patches of hydrogen bonded water molecules," I am calling shimmering, microscopic droplets.

◆ M. C. Bellissent-Funel, "Structure of Supercritical Water," *Journal of Molecular Liquids*, Vol. 90, February 2001, pp. 313–322.

45. [See **"The Origin of Earth's Radioactivity"** on pages 329–371 and Figure 179 on page 344.] Because the expanding vapor had such high kinetic energy, the mass of rocks that escaped earth's gravity was comparable to the mass of jetting water.

46. The energy in the subterranean chamber was vastly greater than one would suspect by simply examining a steam table. Steam tables do not include the dominant forms of energy that were in the subterranean water, namely (1) ionization energy, explained above (sometimes called energy of dissociation); (2) surface energy; (3) chemical energy from burning within the SCW; and (4) nuclear energy. [See **"Energy in the Subterranean Water"** on pages 490–495 and **"The Origin of Earth's Radioactivity"** on pages 329–371.]

What is surface energy? Energy is required to create a surface—to break chemical bonds and thereby form a surface. Immediately before the rupture, the total surface area of all *microscopic* liquid bundles in the SCW was about a trillion times greater than before tidal heating began. (Furthermore, the polar nature of water molecules gives liquid water unusually high surface energy.) Therefore, as tidal pumping and chemical burning added energy to the SCW, most of that energy (1) ionized both the liquid and vapor, and (2) increased the total surface area of the liquid bundles by further fragmenting the microscopic liquid particles. Consequently, temperatures did not rise as much as one might expect. Based on the Widmanstätten patterns found in iron meteorites (which came from subterranean

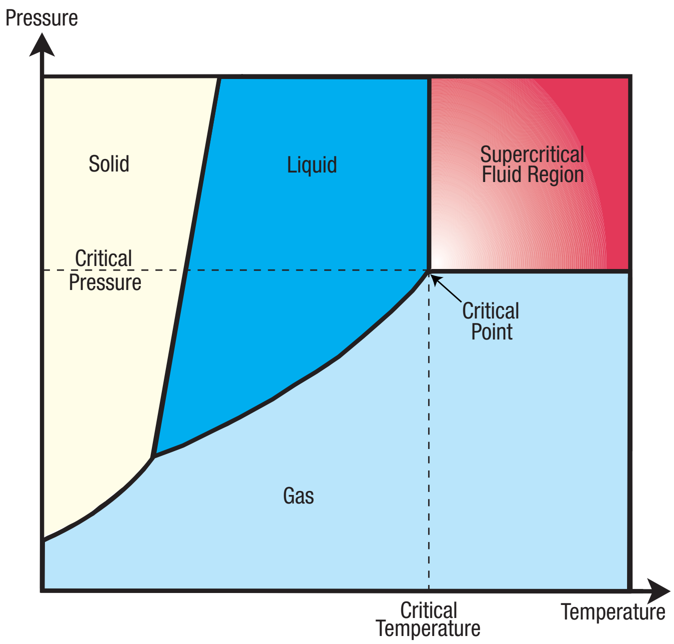


Figure 71: Supercritical Fluid Region. Most of us were taught as children that pure substances can be one of three forms: a solid, liquid, or gas. Almost always omitted was a fourth form: supercritical fluids. Although supercritical fluids were discovered in 1822, teachers are usually unaware of their existence. Any pure substance (such as water, carbon dioxide, or lead) is supercritical when its pressure and temperature exceed those of its critical point—the pressure-temperature combination at which *the density of the liquid and vapor are equal.* The critical point for water is 705°F (374°C) and 3,200 psi (220.6 bars). For carbon dioxide, the critical point is 88°F (31°C) and 1,072 psi (74 bars).

pillars), temperatures exceeded 1,300°F. [See Figure 159 on page 308.]

47. Baron Cagniard de la Tour and most researchers before 2005 thought supercritical fluids (SCFs) were gases. They were wrong, although at the macroscopic level, SCFs behave in many ways as gases. Unseen were microscopic droplets of liquid floating throughout the dense vapor. These droplets account for many of the amazing properties of SCFs.

    De la Tour's fluids included ether and alcohol. With water, he was unable to reach the critical point, because of its high temperature and pressure—705°F (374°C) and 3,200 psi (220.6 bars). Also, his glass tubes were attacked by the high solubility of water as it approached the critical point.

48. A well-known novelty item, the lava lamp, demonstrates some aspects of this. A lava lamp is a vertical, transparent tube containing two brightly colored liquids with slightly different densities. A light bulb at the bottom heats the denser liquid, causing it to expand, become less dense, and float up into the liquid above. Because the densities are almost equal, a slight undulation in the lower liquid will rise far into the liquid above and then pinch off to become a droplet. Sometimes droplets collide and merge.

49. *"When the solid is precipitated by suddenly reducing the pressure, it is crystalline, and may be brought down as a 'snow' in the gas, or on the glass as a 'frost,' but it is always easily redissolved by the gas on increasing the pressure."* J. B. Hannay and James Hogarth, "On the Solubility of Solids in Gases," *Proceedings of the Royal Society*, Vol. 29, 1879, pp. 324–326.

50. Extremely high-velocity water droplets can cut steel and other hard solids, much like a knife cuts butter.

51. The brief lifetimes of the microscopic droplets, especially their hydrogen bonds, also reduced the ability of the normally bipolar water molecules to dissolve solids.

52. In 1964, one of the first solids dissolved in a SCF for economic purposes was caffeine from coffee beans. This produced decaffeinated coffee. Organic wastes and toxic substances (such as the agents in chemical weapons) can be dissolved in SCFs and rendered harmless. The SCF is usually carbon dioxide (CO_2), because it is cheap, nontoxic, nonflammable, and its critical point, 88°F (31°C) and 1,072 psi (74 bars), is so low.

53. *"The stability of the high-heat flow vapor-emanation phase for at least 4 years calls for an unusually large and constant heat source beneath this area."* Andrea Koschinsky et al., "Hydrothermal Venting at Pressure-Temperature Conditions above the Critical Point of Seawater, 5°S on the Mid-Atlantic Ridge," *Geology*, Vol. 36, August 2008, p. 617.

    - *"Even Jules Verne didn't foresee this. Down at the bottom of the Atlantic Ocean is the hottest water on Earth, in a 'supercritical' state never seen before in nature ... and could offer a glimpse of how minerals such as gold, copper and iron are leached out of the entrails of the Earth and released into the oceans. Its water, but not as we know it ... ."* Catherine Brahic, "Superheated Water Spews from the Seabed," *New Scientist*, Vol. 198, 9 August 2009, p. 14.

54. *"Some tubeworm aggregations were completely embedded in solidified tar, indicating that they were later overcome by flows."* I. R. MacDonald et al., "Asphalt Volcanism and Chemosynthetic Life in the Campeche Knolls, Gulf of Mexico," *Science*, Vol. 304, 14 May 2004, p. 1000.

    - Martin Hovland et al., "Chapopote Asphalt Volcano May Have Been Generated by Supercritical Water," *Eos*, Vol. 86, 18 October 2005, pp. 397–398.

55. Large earthquakes rupture (in both directions) at speeds approaching 3 mi/sec—nearly the speed of sound in rock. [See Michel Bouchon and Martin Vallée, "Observation of Long Supershear Rupture during the Magnitude 8.1 Kunlunshan Earthquake," *Science*, Vol. 301, 8 August 2003, pp. 824–826.]

    As the flood began, the crack's two ends circumscribed the globe and produced the 46,000-mile rupture in about 2 hours.

$$\frac{46{,}000 \text{ mi}}{2 \times 3.0 \frac{\text{mi}}{\text{sec}} \times 3600 \frac{\text{sec}}{\text{hr}}} = 2.1 \text{ hours}$$

    Of course, the pressure that ruptured the crust began dropping in the subterranean chamber immediately after the rupture began. This pressure drop propagated through the liquid shell at the much slower speed of sound in water, which is only about a third of the speed of sound in rock.

The *rupture* did not begin in what is now the Atlantic as some people have thought. (It was the later upbuckling of the *Mid-Oceanic Ridge* that began in the Atlantic.) Notice on the map on page 110 that the Mid-Oceanic Ridge intersects itself only once (in the Indian Ocean). The end of the crack that passed south of what is now Africa must have reached that intersection *after* the other end of the crack had passed by that point as it traveled to the northwest. Therefore, if the rupture began anywhere between what is now the North Pole and Alaska, the two ends of the crack (traveling at the same speed) would have formed that intersection in the Indian Ocean.

Also, by starting anywhere in that 2,500-mile region, *the crack always raced ahead of the dropping pressure in the subterranean water.* In other words, both ends of the growing crack propagated through the crust that was still pressurized from below—still in tension. *Cracks grow only through solids that are in tension.*

56. Yes, the Mid-Oceanic Ridge encircles the earth, generally along a great-circle path. On maps showing details of the ocean floor, the Mid-Oceanic Ridge may seem to disappear along the northwest coast of North America. However, if you place red dots everywhere an earthquake occurs, many dots will form a continuous red line along the Mid-Oceanic Ridge. That line goes under the northwest coast of North America. So, the ridge is hidden under California, western Canada, and Alaska. The North American plate probably overrode that segment of the ridge at the end of the continental drift phase.

57. Vibrating aspects of hydroplates are explained on page 285. [See **"What Is Flutter"** and **"Water Hammers."**]

58. Consider a semi-infinite hydroplate, settling at a rate R and overlying a water layer of thickness t. A water particle exactly below the center of the plate will not move, because it is "undecided" whether to flow to the right or left, but the farther a particle is from the center, the faster it will flow. A conservation-of-mass calculation shows that a typical water particle a distance x from the plate's center will move with a velocity of $\frac{x}{t}R$.

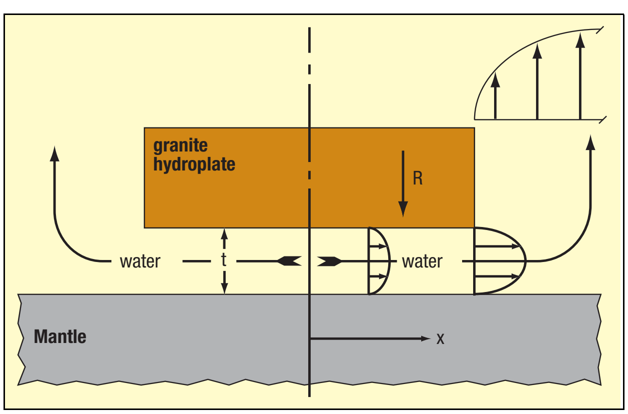


Figure 72: Water Flowing from under a Hydroplate.

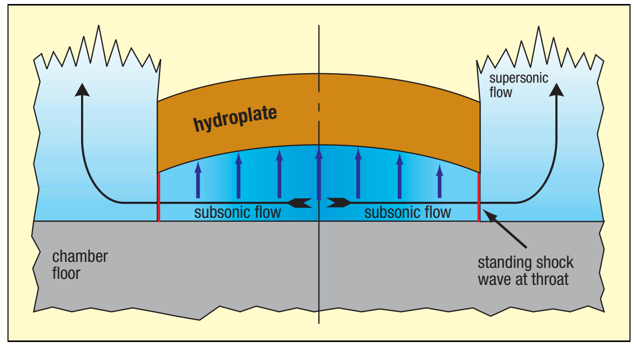


Figure 73: Subsonic-Supersonic Transition at Edge of Hydroplate.

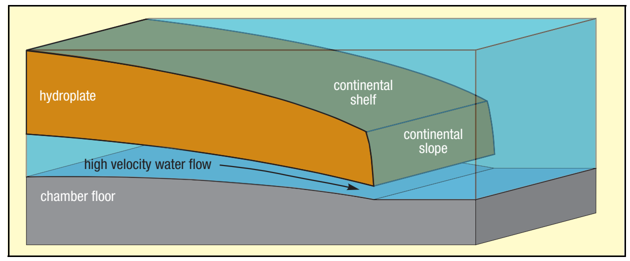


Figure 74: Regions of Greatest Erosion. The water's horizontal velocity and erosion power increase to the right. Because the water's pressure decreases as it approaches the right edge, the hydroplate will sag downward, constricting the flow and increasing erosion even more. The bottom right of the hydroplate will, in effect, be beveled by the erosion, causing the top to incline downward. This process formed continental shelves and continental slopes around the world.

However, the plate settles slowly, because the water's maximum velocity *under* the hydroplate will be limited by viscosity, rubble from crushed pillars, the mass of sediments carried, the choked flow, and the phenomenal back pressure from the accelerating fountains. As more water escapes, pillars are increasingly crushed and the flow steadily slows.

Because the water's pressure decreases in the direction of flow, edges of the hydroplate have less pressure support from below (blue vertical arrows in Figure 73). The plate became concave downward. Flow below the plate is in converging channels, and therefore, subsonic, until the edge of the plate is reached. This edge becomes the ***throat*** (shown in red) of a converging-diverging "nozzle." There the flow is *choked*; that is, it cannot exceed the relatively slow velocity of sound in water. However, as water passes that constriction, it accelerates supersonically. (For details, consult any textbook on compressible flow.) The *volume* of water accelerates upward and expands powerfully, because so much nuclear energy (in the form of heat and pressure) was added to that water as the water escaped from under the crust. [See **"The Origin of Earth's Radioactivity"** on pages 329–371.] As the plate settles toward the chamber floor, the throat's area narrows, so the mass of water flowing out from under the plate decreases. Therefore, the plate settles even more slowly.

Velocity and erosion from the upward expanding flow will increase as the top edge of the plate is approached. When the plate finally settles onto the chamber floor, it will have a continental shelf and a continental slope. (Compare erosion patterns in Figure 74 with Figure 46 on page 113.)

59. T. McKenny Hughes, "Bursting Rock Surfaces," *Geological Magazine*, Vol. 3, 1887, pp. 511–512.

60. J. P. Den Hartog, *Advanced Strength of Materials* (New York: McGraw-Hill, 1952), pp. 141–171.

61. John Larsen, "From Lignin to Coal in a Year," *Nature*, Vol. 314, 28 March 1985, p. 316.

62. Compressed solids, liquids, and gases store energy. Springs are common examples. If a force, F, compresses some material by a small amount, D, the additional energy stored in the material is F × D. If the compressed material is rock, D will be small, but F will be huge. The product of the two could be very large. The compressive energy stored in the earth's mantle and core is immense.

 Just before the rupture, the strain energy in the crust would have been about 2×10^{29} ergs. The released energy, as the Mid-Oceanic Ridge sprung upward, was about 10^{33} ergs. (This is explained beginning on page 128.) Only a small fraction of this energy was needed to form mountains. (In International Standard Units, a 1-megaton hydrogen bomb releases 4.184×10^{22} ergs of energy.) Two of the most violent volcanic eruptions in modern times, Tambora in 1815 and Krakatau in 1883, released about 8.4×10^{26} ergs and 10^{25} ergs, respectively.) [Gordon A. Macdonald, *Volcanoes* (Englewood Cliffs, New Jersey: Prentice-Hall, 1972), p. 60.]

63. As the Mid-Oceanic Ridge rose, its surface stretched in two perpendicular directions. Because rock is weak in tension, two types of cracks grew, each perpendicular to a direction of stretching. Both types of cracks are shown in Figures 43, 62f, 64, and 75.

 Just as the tops of the coils of the spring are farther apart on page 128 in (c) than (a) or (b), so the surface of the ridge was stretched perpendicular to its axis. One can also feel this type of stretching by grabbing a phone book firmly in both hands and arching it. The outer cover is placed in tension.

 The other type of stretching was along the ridge axis. A circle's circumference increases as its radius grows. Likewise, the entire length of the ridge's crest was stretched as the ridge moved farther from the center of the earth.

 Each type of crack began as a microscopic opening with stress concentrations at both ends. As the ridge rose, both types of cracks grew perpendicular to each other. Cracks along the ridge axis, called *axial rifts*, began at different locations along the ridge crest. Later, *flank rifts,* also parallel to the ridge axis, formed farther down the flanks of the ridge. Axial rifts formed before flank rifts because the greatest curvature, and therefore, greatest tension, occurs at the ridge crest. Rifts stopped growing when they ran into the perpendicular cracks called *fracture zones*. However, fracture zones never ran into axial rifts, because fracture zones always began at the crest, where the ridge was farthest from the center of the earth. [See A1–A3 in Figure 75.] Both types of cracks are still growing, although

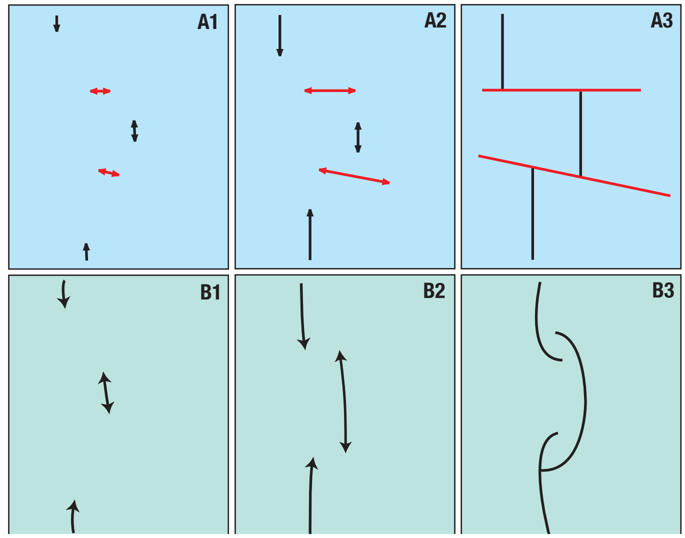


Figure 75: Growth of Two Types of Cracks along Mid-Oceanic Ridge. Figures A1–A3 illustrate the growth of fracture zones (shown in red) and the formation of the offset pattern all along the Mid-Oceanic Ridge. (Compare A3 with Figure 43 on page 110.) If no cracks form perpendicular to the rising ridge, as shown in B1–B3, the axial rifts will often grow past each other, forming overlapping spreading centers as shown in B3 and in Figure 45 on page 112.

sporadically and at a much slower rate. This is due to cooling and thermal contraction, and it accounts for much earthquake activity along the ridge.

As the ridge rose, hundreds of short axial rifts began growing at different places along the rupture path. The more the ridge rose, the longer and wider these cracks became. This created a line of bending weakness, which caused the ridge to rise symmetrically with the axial rift. In general, each axial rift did not align with the next axial rift, so segments of the Mid-Oceanic Ridge are offset from each other at fracture zones.

Lengthening axial rifts also explain overlapping spreading centers (OSCs), where two portions of the ridge axis overlap. Macdonald and Fox, who first reported on OSCs, demonstrated how the overlaps occur. [See Endnote 4 on page 137.] They took a knife and made two parallel cuts in the top of a block of frozen wax—one cut ahead of the other. The block was then pulled perpendicular to both cuts, causing adjacent cuts to grow slightly past each other. Overlapping ends then turned toward each other. Sometimes they intersected. [See Figure 45 on page 112 and B1–B3 in Figure 75.] This suggests that OSCs were formed by lengthening axial rifts as the ridge rose. OSCs contradict the plate tectonic theory.

Another test of the hydroplate theory vs. the plate tectonic theory concerns the cross-sectional profile of fracture zones. According to the hydroplate theory, fracture zones are tension cracks formed when the ridge suddenly rose and was stretched parallel to the ridge axis. The cracks grew from the surface downward. Consequently, their profiles should be V-shaped or trough-shaped. [See Figure 76 (a).] Relatively shallow cracks will be V-shaped; deep cracks will be trough-shaped, because the pressure is

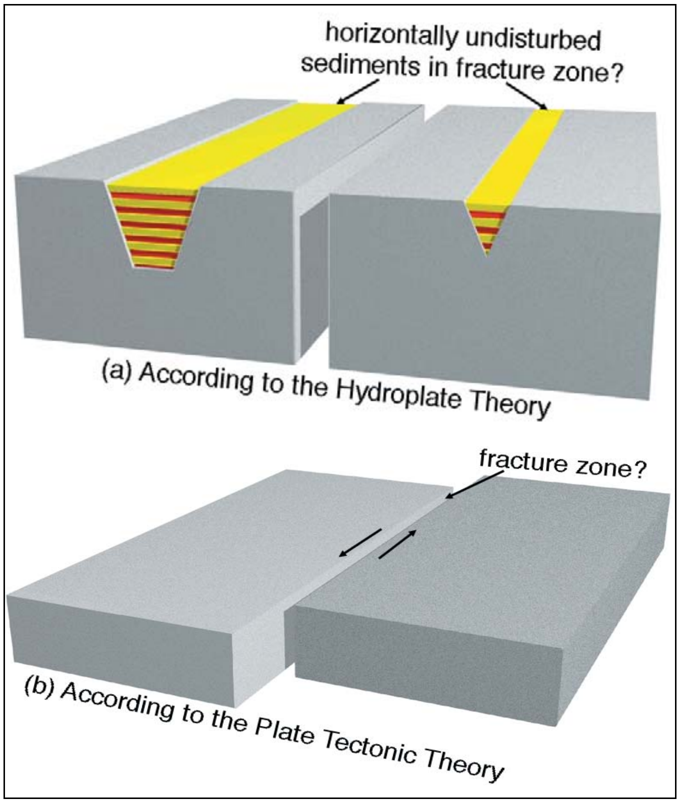


Figure 76: Two Possible Cross Sections of Fracture Zones. Figure 44's description on page 111 explains why fracture zones have less mass along their lengths. Water-saturated sediments, shown in red and yellow layers in Figure (a) above, are much less dense than the crystalline rock below the ocean floor. Therefore, only Figure (a) explains the large absence of mass along fracture zones.

so great at the base of the crack that the rock would flow as the sides of the crack are pulled apart. (The next chapter will explain why movements occur along fracture zones and throughout the mantle.) On the other hand, the plate tectonic theory says that a fracture zone formed by horizontal shearing. If so, the profile should look as shown in Figure 76 (b). These two predictions were jointly made on April 30, 1986 with the late Robert S. Dietz, one of the founders of the plate tectonic theory. Bob Dietz and I then set out to learn the actual shape of fracture zones.

The true profiles confirm the hydroplate prediction. [See Tjeerd H. van Andel et al., "The Intersection between the Mid-Atlantic Ridge and the Vema Fracture Zone in the North Atlantic," *Journal of Marine Research*, Vol. 25, 15 September 1967, pp. 343–351. See also A. A. Meyerhoff and Howard A. Meyerhoff, "Tests of Plate Tectonics," *Plate Tectonics: Assessments and Reassessments*, editor Charles F. Kahle, p. 108.]

This exercise produced two other surprising confirmations of the hydroplate theory. First, the actual fracture zones were trough-shaped near the ridge axis where the fractures should be deepest. At the ends of fracture zones, the profiles were V-shaped. The second surprise was the presence of undeformed, layered sediments inside fracture zones. If the opposite sides of a fracture zone are sliding past each other, as plate tectonics claims, sediments caught between the sliding plates would be highly deformed.

Plate tectonic theory predicts and some textbooks erroneously claim that earthquakes in fracture zones occur only between the two offset ridge axes, where the plates, according to plate tectonics, are moving in opposite directions. To the contrary, earthquakes occur all along fracture zones, as the hydroplate theory predicts.

Also confirming the hydroplate explanation is the map on page 111 which shows that fracture zones lack mass. Figure 76 (a), not Figure 76 (b), fits this observation.

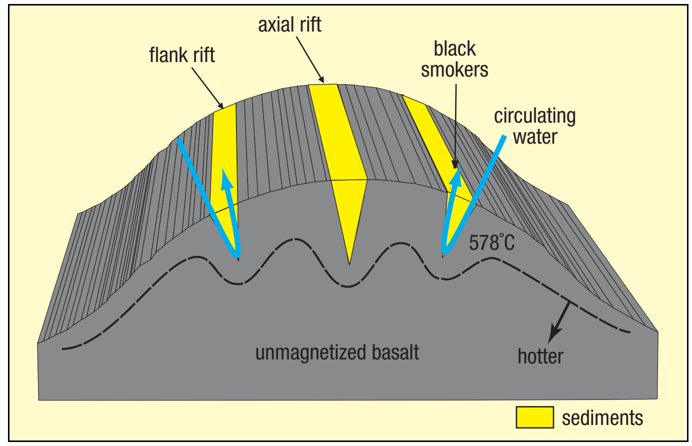


Figure 77: Curie Point under the Mid-Oceanic Ridge.

64. Basalt is highly magnetic because it contains magnetite and hematite. Magnetic material will lose its magnetism if its temperature exceeds a certain value, called the *Curie point*. Increasing the pressure raises the Curie Point. At the earth's surface, the Curie point for basalt is near 578°C.

A typical cross section of the Mid-Oceanic Ridge is shown in Figure 77. The ridge's temperature generally increases with depth. However, the walls of the cracks in the Mid-Oceanic Ridge are, in general, cooled by cold water circulating down into and up out of them by natural convection. After several thousand years of cooling, the constant temperature line corresponding to the Curie point is shown by the dashed line. As a rock particle cools from 579°C to 577°C, for example, it takes on the magnetism of the earth's magnetic field at that point. Therefore, more magnetized material is near each crack. Magnetic anomalies also occur *perpendicular to the ridge*, along fracture zones. According to plate tectonics, such perpendicular magnetic anomalies should not exist. Naturally, if a device measuring magnetic intensity (a *magnetometer*) is towed across the ridge, it will show the magnetic anomalies of Figure 47 on page 113. These magnetic anomalies, however, are not magnetic reversals.

PREDICTION 4: Fracture zones and axial and flank rifts will always be along lines of high magnetic intensity.

PREDICTION 5: The magnetic intensity above black smokers slowly increases because the rock below, fractured since the flood a few thousand years ago, is cooling.

65. Other factors complicate the movement.
    - The rupture didn't necessarily widen by the same amount all along its path.
    - The Mid-Oceanic Ridge, especially in the Pacific, would not exactly follow the path of the rupture.
    - A large plate moving over the earth's surface is actually part of a spherical shell rotating about an imaginary axis passing through the center of the earth. Points on the plate far from the poles of that axis move farther and faster than those near the poles.
    - Depending on exactly where the Mid-Atlantic Ridge began to rise, the hydroplates would not necessarily slide perpendicular to the entire Mid-Atlantic Ridge. In fact, the Americas Plate rotated about 10° clockwise during its slide, and the European-Asian-African Plate rotated about 10° counterclockwise. (This implies that the Mid-Atlantic Ridge began to rise south of the centers of mass of each hydroplate, very near the present equator.)

66. In 1749, Pierre Bouger discovered that the gravitational attraction of the Andes Mountains attracted a plumb bob from the vertical far less than expected. In 1854, a similar discovery was made concerning the Himalayan Mountains. Geologists then began to realize that some mass is missing beneath mountains. Since then, more precise measurements on many mountains have confirmed this.

67. In past years, the United States Government has considered funding a 3-year, 45-million-dollar project to drill a deep hole into the southern Appalachian Mountains. The hole was intended:

    > *... to test, among other things, the hypothesis that a sheet of crystalline rock about 10 kilometers thick was shoved 225 kilometers westward over underlying sedimentary rock by a continental collision. In 1979, despite the seeming improbability that such a thin sheet would hold together like that, deep seismic reflection profiling revealed a layer that is presumably the previously proposed boundary between the crystalline sheet and the underlying sedimentary rock. The hole would penetrate this reflector of seismic waves at a depth of about 8 or 9 kilometers and return samples to verify its nature.* Richard A. Kerr, "Continental Drilling Heading Deeper," *Science*, Vol. 224, 29 June 1984, p. 1418.

    The hydroplate theory explains why and how a thin sheet of rock moved westward. It was not "shoved," for reasons given on page 487. It gained its velocity by gravitational sliding and, therefore, experienced little internal stress. The movement of a 10-kilometer layer for 225 kilometers should no longer be an enigma.

    Such a drilling project could be extremely dangerous. If the prediction of water under buckled portions of mountains is correct, then this drilling project might have disastrous consequences. Upward-escaping, high-pressure water would quickly erode and greatly enlarge the drilled hole. As water escaped from beneath the mountain range, major earthquakes could occur.

68. *"A layer of aqueous fluids could produce the conductance observed in Tibet with a lower fluid fraction and/or layer thickness than considered above for partial melt. For example, a layer only 1.6 km thick containing 10% of 100 S/m brine would be needed to yield the observed 10,000-S conductance."* Wenbo Wei et al., "Detection of Widespread Fluids in the Tibetan Crust by Magnetotelluric Studies," *Science*, Vol. 292, 27 April 2001, p. 718.

    - *"Our results imply that of the order of 10% volume of free aqueous fluids in the Tibetan middle crust produces the observed bright spot reflections. The presence of relatively large quantities of free aqueous fluids, presumably mostly saline supercritical H_2O, does not preclude the presence of melt but does constrain the maximum temperature at the bright spots to the wet granite solidus (about 650°C)."* Yizhaq Makovsky and Simon L. Klemperer, "Measuring the Seismic Properties of Tibetan Bright Spots: Evidence for Free Aqueous Fluids in the Tibetan Middle Crust," *Journal of Geophysical Research*, Vol. 104, No. B5, 10 May 1999, p. 10,795.

69. As each mountain quickly rose, its distance from the earth's spin axis increased. This, in turn, increased the mountain's centrifugal force (blue arrow in Figure 78A), a force that always acts away from and perpendicular to the spin axis. (Likewise, a rock whirled at the end of a string produces a centrifugal force that pulls the string taut.)

    Part of each new mountain's centrifugal force acted tangentially to the earth's surface and tended to roll the earth. Because mountains are scattered around the earth, many of these "rolling" forces counterbalanced each other. However, the Himalayan Mountains and Tibetan Plateau are so massive that their effect dominates that of all other mountains. (The world's ten highest peaks relative to sea level—including Mount Everest—are part of the Himalayas.) In other words, crashing hydroplates thickened continents and created today's mountain ranges. Their net centrifugal force rolled the earth so that the Himalayas moved toward today's equator. Also, the thickened, massive Eurasian hydroplate helped roll the globe in the same direction.

    Fortunately, the earth's spin creates an equatorial bulge that acts like a huge gyroscope stabilizing the earth. As the earth began a slight roll immediately after the compression event, the equatorial bulge also rotated, so it was no longer perpendicular to the spin axis. The more the bulge rotated, the more its centrifugal force resisted the rolling force due to the Himalayas and the thickened Eurasian hydroplate. (Please study all of Figure 78.)

    Once the liquid outer core had begun to form, it partially isolated the solid inner core from this rolling action. However, as the outer earth began its slow 35°–45° roll, it would have received, as it slipped over the core, a large, sudden torque from inside. The law of conservation of angular momentum required the outer earth's spin axis to precess, with the North Pole in Figure 78C precessing "into the page." (The last paragraph in Figure 78 explains how the amount of precession, 6°, was determined.)

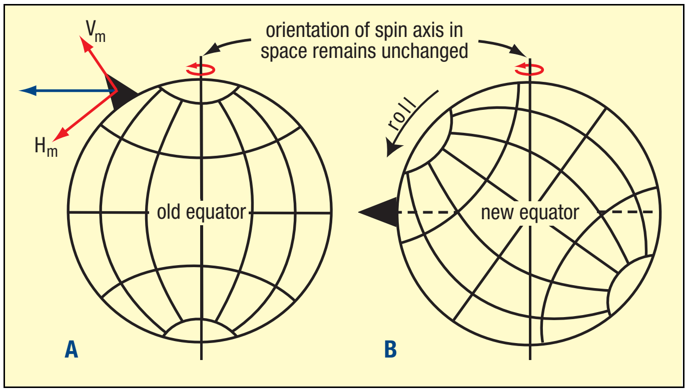
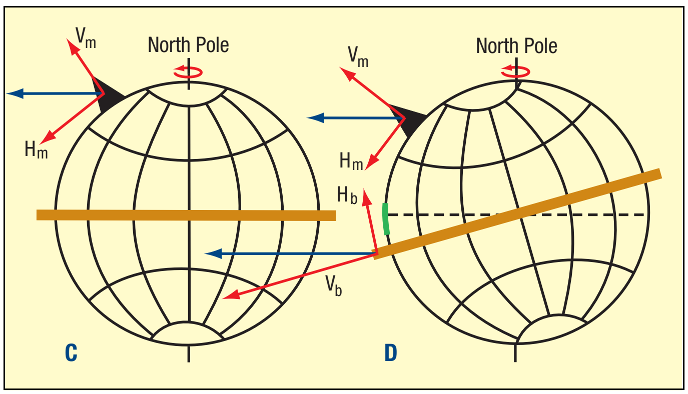


Figure 78: Earth's Big Roll. (A) If the earth were perfectly spherical and the black mountain (black triangle) suddenly formed, the earth would become unbalanced and start "rolling" counterclockwise. This happens because a centrifugal force, shown in blue, acts on the mountain. That blue force is equivalent to the combined forces H_m and V_m (red arrows). Force H_m is always directed toward the new equator, shown in (B). The roll, which rebalances the earth, *would not change earth's north-south spin axis* or its yearly orbit around the Sun. [See Figure 79.]



(C) *However, the earth is not a perfect sphere, but has an equatorial bulge, which gives our planet great stability.* We can think of the bulge as a big, brown hoop around the equator. This bulge, exaggerated above, is produced by centrifugal forces acting to deform every particle inside the earth. (D) The more the black mountain rolled the earth, the more the bulge tilted and the greater its force H_b became. When H_b equaled H_m in magnitude, the roll temporarily stopped. This roll angle was small, because the bulge is so much more massive than any mountain.

The equatorial bulge did not stay tipped, as shown in (D), for long. Remember, the bulge exists because every particle inside and on the earth has its own centrifugal force, which tries to move each particle as far from the earth's axis as gravity will allow. Material inside the earth deformed as the bulge slowly reoriented itself toward a new equator, perpendicular to the north-south spin axis. (The brown hoop can be thought of as slipping over the spherical portion of the earth toward the new equator when H_b becomes large enough to overcome friction.) Each slight reduction in the bulge's tilt reduced H_b, so the mountain rolled the earth counterclockwise another small increment. The North Pole, the point where the spin axis penetrates the Northern Hemisphere, shifted. This cycle continued many times until, after a few centuries and 35°–45° of total roll, all the earth's mass was balanced.

Because the diameter of the equatorial bulge is 26.5 miles greater than the polar diameter, the brittle crust stretched and ripped a short distance with each cycle. That rip's beginning is shown in green in Figure 78D. Fracture mechanics caused it to begin slightly north of the old equator and extend north to and slightly beyond the new equator. Magma quickly flowed up into this rip, which eventually grew 3,000 miles long and is today called *Ninety East Ridge*. It is inclined 6º to longitude 90ºE and can be seen in Figure 43 on page 110. Notice how Ninety East Ridge points toward the Himalayas, earth's dominant mountain range, represented by the black mountain in (A)–(D). The rip at 90ºE longitude reduced the stress that was tending to cause a similar rip on the opposite side of the earth.

Figure 79: Fixed Spin Axis. Some have expressed surprise that the earth's spin axis in Figure 78B would keep its north-south orientation during earth's slow 35°–45° roll. A simple experiment demonstrates this, and shows that *one good experiment is worth a thousand expert opinions*. Drill two shallow holes on opposite sides of a croquet ball and fill both holes with lead. If the ball is spun with the lead-filled holes not at the equator, the spin axis does not change as the ball quickly rotates so the lead is at the equator. (When spinning, the white stripes reveal the orientation of the ball and axis.) However, the quickest way to understand that the earth's spin axis would not change its orientation is to apply the law of conservation of angular momentum. It assures us that a rigid body's spin axis will not change unless an external torque acts on the body.

An equal and opposite torque was applied by the outer earth to the inner core, causing its axis to precess in the opposite direction *more than a thousand times faster*, because the inner core's moment of inertia is less than one thousandth of that of the outer earth. So, the outer earth and the inner core developed different spin orientations soon after the compression event. This difference gradually diminished as the liquid in the outer core transmitted torque between the two spinning bodies (the inner core and outer earth), *slowly reversing the earlier precessions*. The data Dodwell gathered from ancient astronomers showed this reversed precession; Dodwell concluded that it began in about the year 2345 B.C.

The precession, when viewed from above the Indian Ocean, very slowly shifted the northern hemisphere to the west and the southern hemisphere to the east. Consequently, that rip has a slight curvature and is not a perfectly straight line. As the rip progressed northward, it curved slightly to the east. *This curvature can be seen on very accurate maps of the Indian Ocean floor. For example, Google Earth shows the slight curvature not only at Ninety East Ridge but also along parallel stress fractures east of Ninety East Ridge.*

The following chapter (pages 149–173) explains why the earth's magnetic field emanates from the inner core. Therefore, the initial precession of the inner core probably produced the rapid drifting of the earth's magnetic field described on page 114. The rate of this reverse precession has greatly diminished, but it is probably seen in today's slight westward drift of the earth's magnetic field, the so-called *secular variation of the magnetic field*.

Earth's slow roll after the flood would have changed the paths of the Sun and stars across the sky. Attempts to measure those irregularities may have led to the construction of ancient observatories such as Stonehenge.

In addition to pushing up mountains, the crashing hydroplates crushed and thickened continents, especially in weak regions. Each plate moving on the surface of a sphere has an *axis of rotation*. Because the driving forces that moved the two largest hydroplates came from the sudden upbuckling of the same ridge (the Mid-Atlantic Ridge), both hydroplates had almost the same axis of rotation. The fastest plate movement and the most thickening would have occurred near the equator of that axis of rotation. After the compression event, centrifugal forces rolled the temporarily out-of-balance earth, so the axis of plate rotation approximately aligned with the earth's spin axis. Therefore, today's equator approximately bisects and is perpendicular to the Mid-Atlantic Ridge. Since the compression event, isostatic adjustments have tended to smooth out the earth's surface to some extent, but imbalances and adjustments—such as earthquakes—continue within the earth.

70. As explained in Figure 78, the southern extreme of Ninety East Ridge (85°E, 32.5°S) was slightly north of the old equator, and the Himalayas (centered at 89°E, 33°N) was slightly south of the old North Pole but near what is now 89°E longitude. This would place the North Pole, before the big roll *but after the continental drift phase*, near the line segment lying between 85°E, 57.5°N and 89°E, 33°N—basically central Asia. The preflood North Pole, *before the continental drift phase*, would have been about 18° (based on today's globe) of longitude to the west of that point.

As the equatorial bulge shifted north near 90°E longitude, the northern tip of Ninety East Ridge experienced the greatest tearing stress. This continues and may explain why one of the largest earthquakes in recent years occurred near that point on 26 December 2004, causing a tsunami that killed 300,000 people. The flood is still producing death and destruction. Indeed, *all earthquakes, tsunamis, and most natural disasters are a consequence of the flood.*

Just as the earth roll produced stretching and tearing along Ninety East Ridge, it produced compression and buckling near both poles. At the South Pole, that compression buckled the crust downward, forming a long basin which holds a 76-mile-long subsurface (*unfrozen*) lake, appropriately named "90°E Lake." Parallel and adjacent to that lake is another long, subsurface, Antarctic lake named Sovetskaya Lake. An earlier study recognized that these lakes were produced by stresses in the earth's crust, not by glacial scouring or meteorite impacts. [See Robin E. Bell et al., "Tectonically Controlled Subglacial Lakes on the Flanks of the Gamburtsev Subglacial Mountains, East Antarctica," *Geophysical Research Letters*, Vol. 33, 28 January 2006, pp. L02504–L02507.] Perhaps a compensating upward buckling at the North Pole produced the remarkably straight 1,000-mile-long Lomonosov Ridge.

71. William R. Hammer and William J. Hickerson, "A Crested Theropod Dinosaur from Antarctica," *Science*, Vol. 264, 6 May 1994, pp. 828–830.

72. Allan C. Ashworth and F. Christian Thompson, "A Fly in the Biogeographic Ointment," *Nature*, Vol. 423, 8 May 2003, p. 135.

73. Some geologists have wondered if quartz migrated out of the black rock. One look at the sharp boundary between the light veins and the dark host rock should eliminate that possibility. Also, quartz is the first common mineral to melt as rock heats up and the last to solidify as it cools.

74. Shearing forces would produce fairly smooth, straight crack patterns, not the "tangled" patterns see at the Black Canyon of the Gunnison. Other forces (viscous, thermal, gravitational, electrical, and magnetic stresses) can be eliminated on other grounds. Because few would even entertain them as a means of breaking so much rock, we will not discuss them here.

75. Richard H. Tedford and C. Richard Harington, "An Arctic Mammal Fauna from the Early Pliocene of North America," *Nature*, Vol. 425, 25 September 2003, pp. 388–390.

76. L. David Mech, "Life in the High Arctic," *National Geographic*, Vol. 173, June 1988, p. 757.

77. A. Hope Jahren, "Humidity Estimate for the Middle Eocene Arctic Rain Forest," *Geology*, Vol. 31, May 2003, pp. 463–466.

- See also Endnote 15 on page 137.

78. Charles Berlitz, *The Lost Ship of Noah: In Search of the Ark at Ararat* (New York: G. P. Putnam's Sons, 1987), p. 126.

79. For details, see William Ryan and Walter Pitman, *Noah's Flood* (New York: Simon & Schuster, 1998). These authors correctly conclude that the Mediterranean Sea breached its boundary, carved the Bosporus and Dardanelles Straits, and flooded the shores of the Black Sea. *"The channel cut through bedrock"* and formed a *"gorge more than 350 feet deep"* (p. 65).

Ryan and Pitman incorrectly conclude that this led to the "myth" of Noah's flood. Instead, the local flood they discovered around the Black Sea was a consequence of the global flood, and bears no resemblance to many details in famous flood legends, secular or otherwise. Nor would any *local* flood explain the uncanny similarity of flood stories in almost every ancient culture *around the world*. A global flood does. Furthermore, a child could have walked away unscathed from Ryan and Pitman's flood, which they admit rose only 6 inches a day. No doubt, the Middle East has experienced many local floods. Why pick one and claim that it led to the world-famous story of Noah's flood?

80. A buried, 125-mile-long, 650-foot-deep channel across the Gibraltar Strait shows that the Atlantic Ocean spilled into the Mediterranean Basin at 1,000 times the flow rate of the Amazon River. [See D. Garcia-Castellanos et al., "Catastrophic Flood of the Mediterranean after the Messinian

Salinity Crisis," *Nature*, Vol. 462, 10 December 2009, pp. 778–781.]

81. These microscopic movements inside the earth generate heat thousands of times faster than heat escapes at the earth's surface. This increasing heat melts rock, which can then lubricate and facilitate further internal movements. We have no evidence that earthquakes are occurring at a greater rate than 100 or 1,000 years ago, although today we can better detect earthquakes and broadcast their consequences. Also, larger population densities result in greater destruction from earthquakes, which, along with greater global communications, have led some to conclude incorrectly that earthquake frequencies and/or intensities have increased. Still, they could someday increase substantially, because heat should be building up inside the earth.

82. Earthquakes occur through two mechanisms. This is best shown by the depths at which they originate within the earth. Earthquake frequencies peak at *two* depths: 35 kilometers and 600 kilometers. Directly above and below each of these depths, fewer earthquakes (and aftershocks) occur. [See Frohlich, p. 52.]

83. Maya Tolstoy et al., "Breathing of the Seafloor: Tidal Correlations of Seismicity at Axial Volcano," *Geology*, Vol. 30, June 2002, pp. 503–506.

84. Corings into the portion of the Mid-Oceanic Ridge beneath the Arctic Ocean have revealed ferns and algae that required these warm temperatures.

    ... extremely warm polar temperatures indicate that, despite much recent progress, feedbacks responsible for early Palaeogene mid- to high-latitude warmth remain poorly understood and are not implemented in existing climate models. Appy Sluijs et al., "Subtropical Arctic Ocean Temperatures during the Palaeocene/Eocene Thermal Maximum," *Nature*, Vol. 441, 1 June 2006, p. 612.

    - Chert forms when silica precipitates from sea water. The ratio of oxygen-18 to oxygen-16 in chert indicates that the water temperatures were once as high as 60-80 degrees C. This is confirmed independently by silicon isotopes ratios as well. [See Christina L. De La Rocha, "In Hot Water," *Nature*, Vol. 443, 26 October 2006, pp. 920–921.]

85. An "El Niño" is the sudden warming of waters in the western Pacific. Today, it occurs every few years and alters climate worldwide, especially precipitation rates.

86. When stocking Lake Titicaca with trout in 1939, officials noticed the presence of *Orestias,* a genus of killifish. How did killifish get into such a remote lake, 2.3 miles above sea level—naturally, or by man? Humans have little desire for killifish for food or sport. Besides, men would have difficulty keeping any fish or their eggs alive while transporting them by foot from some distant source to Lake Titicaca. Did the fish swim there? Hardly. Because of strong winds, intense sunshine, and low atmospheric pressure, 95% of Lake Titicaca's water leaves by evaporation. Only 5% trickles into a distant, shrinking, brackish lake with no outlet to the sea.

    Evidently, Lake Titicaca rose along with the Andes. Did this happen thousands or millions of years ago? Knowing how rapidly environments can change and destroy habitats, one would be wise to bet on a recent date.

87. Of the various lapse rates (temperature change per unit change in elevation), the *dry adiabatic* lapse rate, 28.3°F per mile, or 9.8°C per kilometer, is most appropriate for this illustration.

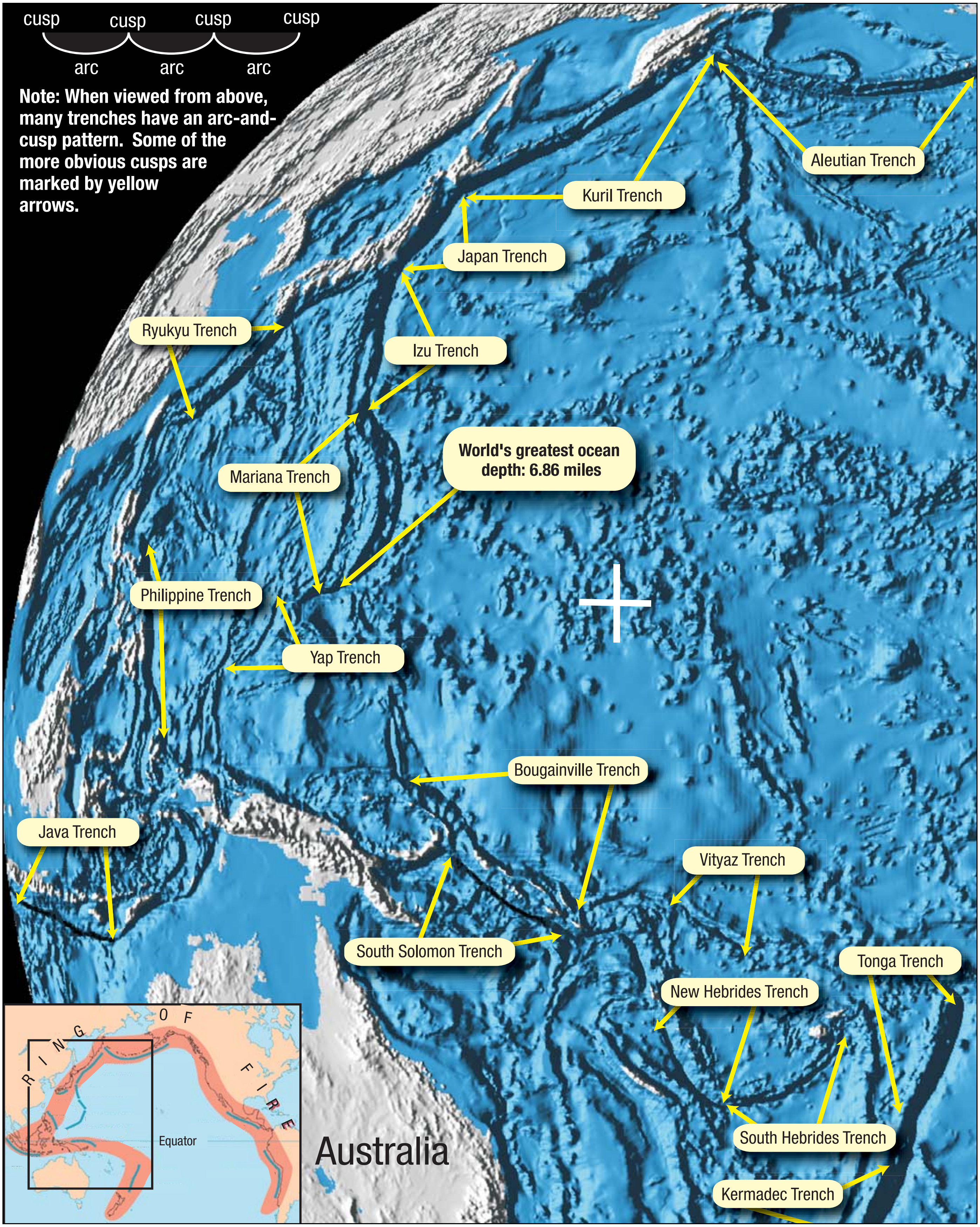


Figure 80: Trenches of the Western Pacific. Sixteen ocean trenches are concentrated in the western Pacific. Four others are located elsewhere.[1] The area above, with 40,000 volcanoes taller than 1 kilometer, has obviously been greatly disturbed. The white cross marks the center of this concentrated trench region. Visualize earth as a sphere, not a flat map. Why is the center of this trench region almost exactly opposite the center of the Atlantic Ocean, both in latitude and longitude? The inset map shows a few trenches in green and, in orange, the ring of fire—a band of extreme volcanic and earthquake activity.

The Origin of Ocean Trenches and the Ring of Fire

SUMMARY: Deep folds, up to thousands of miles long and several miles deep, lie on the floor of the western Pacific Ocean, in an area centered directly opposite the center of the Atlantic Ocean. The plate tectonic theory claims that plates drifting on the earth's surface dive into the earth and drag down the folds. Fifteen reasons will be given that show why this idea cannot be correct.

As the flood increasingly altered the earth's balanced, spherical shape, growing gravitational forces tended to squeeze the earth back toward a more spherical shape. Once a "tipping point" was reached, that portion of the subterranean chamber floor with the most overlying rock removed rose at least 8 miles to become today's Atlantic floor. This caused the Pacific floor—the region inside the ring of fire—to subside (sink) and buckle inward, producing folds called ocean trenches. (Measurements and discoveries near trenches confirm this subsidence and the absence of diving plates.) Shifts of material inside the earth began producing "oceans" of magma that became earth's outer core. Some magma escaped to the earth's surface, especially onto the subsided Pacific floor. Mass imbalances in the earth remain, so earthquakes now occur and continents sporadically shift—not drift—toward the trench region of the western Pacific.

Imagine standing at the edge of a vast depression that reminds you of the Grand Canyon, but this "canyon" is several times deeper. Its smoother walls are almost as steep as the Grand Canyon's, but the view across the 60-mile-wide depression is never obstructed by intermediate land forms. This "canyon," thousands of miles longer than the Grand Canyon, does not have sharp turns. Such depressions, called ***ocean trenches,*** would be the leading natural wonders of the world if water did not hide them. (Average ocean depth is 2.5 miles; the deepest trench reaches 6.86 miles below sea level.) Sixteen trenches are concentrated on the western Pacific floor. Why are so many trenches in the Western Pacific?

Drifting vs. Shifting

The distinction between drifting and shifting is subtle but important. A box drifts on the sea, but a box shifts on a ship's deck. Drifting is a continuing movement on or in a fluid, often for a great distance, while shifting is a slight, limited, but significant lateral movement on or in a solid. Drifting is caused by a steady, unyielding, outside force, while shifting is usually caused by gravity and a change in equilibrium. Drifting requires a continuing energy source, but shifting requires a disturbance. The plate tectonic theory says that continents steadily drift. The hydroplate theory says crustal plates drifted rapidly, but briefly, on a layer of escaping, high-pressure water near the end of the flood. This drifting produced imbalances. Since then, these and other imbalances caused by the flood sporadically shift continents and everything below.

Surprisingly, trenches contain shallow-water fossils.[2]

> *Materials* [like fossils] *which are usually supposed to be deposited only in shallow water have actually been found on the floor of some of the deep trenches.*[3]

Why are such unlikely fossils in a remote part of the ocean—a thousand times deeper than one would expect?

Today, most of the earth's crust is vertically balanced, like blocks floating in a pan of water. Less dense blocks "float" higher up, while denser blocks sink deeper. This is called *isostatic equilibrium*. However, ocean trenches are earth's most glaring departure from this equilibrium and may be an important clue for how trenches formed. As various authorities have written:

> *… trenches are characterized by large negative gravity anomalies. That is, there appears to be a mass deficiency beneath the trenches, and thus something must be holding the trenches down or else they would rise in order to restore isostatic equilibrium.* [4]

> *The most striking phenomenon associated with the trenches is a deficiency in gravity ... Measurements of gravity near trenches show pronounced departures from the expected values. These gravity anomalies are among the largest found on earth. It is clear that isostatic equilibrium does not exist near the trenches. The trench-producing forces must be acting ... to pull the crust under the trenches downward!*[5]

In other words, something has pulled, not pushed, trenches down. Today, the downward pull of gravity in and above trenches is less than expected even after adjusting for the trench's shape, so less mass exists under trenches than one would expect. It is as if something deep inside the earth "sucked" downward the material directly below trenches. This would reduce the mass below trenches. (If you want to show a slight weight loss, weigh yourself while on a ship sailing over a trench.)

A useful illustration is to think of a slight vacuum, or reduced mass, under trenches—much like a partial vacuum, which "nature abhors." That is, nature always tries to move material to fill a vacuum. If one waited long enough, material inside the earth would flow in under trenches to fill this "partial vacuum." Today, crustal plates move an inch or so each year toward trenches, so this "partial vacuum" is slowly being filled in modern times. Later, we will see where the missing mass under trenches went and what created the "partial vacuum." Clearly, this "filling in" has not been going on for millions of years.

A technique called *seismic tomography* has shown that rock in the upper mantle is denser under continents than under oceans. The technique uses earthquake waves to "see" inside the earth, just as a CAT scan uses x-rays from many angles to "see" inside your body. Each earthquake radiates waves through the earth. Knowing the precise time of an earthquake and the times the waves reach seismometers around the world, scientists can calculate each wave's average velocity along a specific path. After many earthquakes and knowing the velocities along thousands of different paths, a computer can estimate the wave speed at every point inside the earth. Higher speeds imply colder and/or denser rock. Earthquake waves travel faster under continents. Some increases in speed are too great to be caused entirely by colder temperatures.[6]

Almost 90% of all earthquake energy is released under trenches. Earthquakes often occur near sloping planes, called *Benioff zones*, that intersect a trench. These earthquake zones enter the mantle at 30°–60° angles below the horizontal and extend to depths of about 420 miles.

A fault is a fracture in the earth's crust along which movement has occurred. During an earthquake, opposite sides of a fault "unlock" and rapid sliding begins. If the side of a fault nearest a distant seismometer moves toward

Figure 81: Spin. A spinning body, such as a figure skater or the earth, spins faster if it becomes more compact about its spin axis. This skater starts a spin with outstretched arms. Then, as she pulls her arms in near her spin axis, she spins so fast she becomes a blur.

Gravity tries to make the earth as compact and round as possible. Earthquakes cause the earth to become more compact and spin slightly faster.[7] Therefore, the farther back in time we look, the less compact we should find the earth, at least until we arrive at the time the out-of-balance condition arose. Because earthquakes can occur deep within the earth, the out-of-balance condition affected the entire earth and, as you will see, produced trenches and the ring of fire.

the seismometer, a compression wave will be detected first. If that side moves away from the seismometer, a tension wave will be detected first. By examining the first wave to reach many seismometers, one can deduce the orientation of the fault plane and whether the earthquake was triggered by compression or tension. *Earthquakes near a trench are almost always due to horizontal tension (at the trench location) perpendicular to the trench axis.*[8] *Measurements also show that microearthquakes on the ocean floor tend to occur at low tide.*[9]

A prominent feature on all ocean floors is the Mid-Oceanic Ridge. One characteristic of the ridge figures prominently in two competing theories for how trenches formed. As explained in the preceding chapter, the ridge is cracked in a strange pattern. Some cracks are nearly perpendicular to the ridge axis, while other cracks are parallel to it. Their shapes and orientation are best explained by the stretching of the ridge.[10] What would stretch the ridge in two perpendicular directions? These cracks are easily seen along the Mid-Oceanic Ridge in Figure 43 on page 110.

More than 40,000 submarine volcanoes, called *seamounts,* litter the Pacific floor. Some rise higher above the seafloor than Mount Everest rises above sea level. Strangely, the Atlantic has few seamounts. If, as the plate tectonic theory claims, one plate dives (subducts) beneath another, why aren't seamounts and soft sediments scraped off the top of the descending plate?

About 2,000 *flat-topped* seamounts, called *tablemounts*, have tops that are 3,000–6,000 feet below sea level. Evidently, as these volcanoes tried to grow above sea level, wave action planed off their tops. Either sea level was once much lower, or ocean floors were higher, or both. Each possibility raises new and difficult questions.

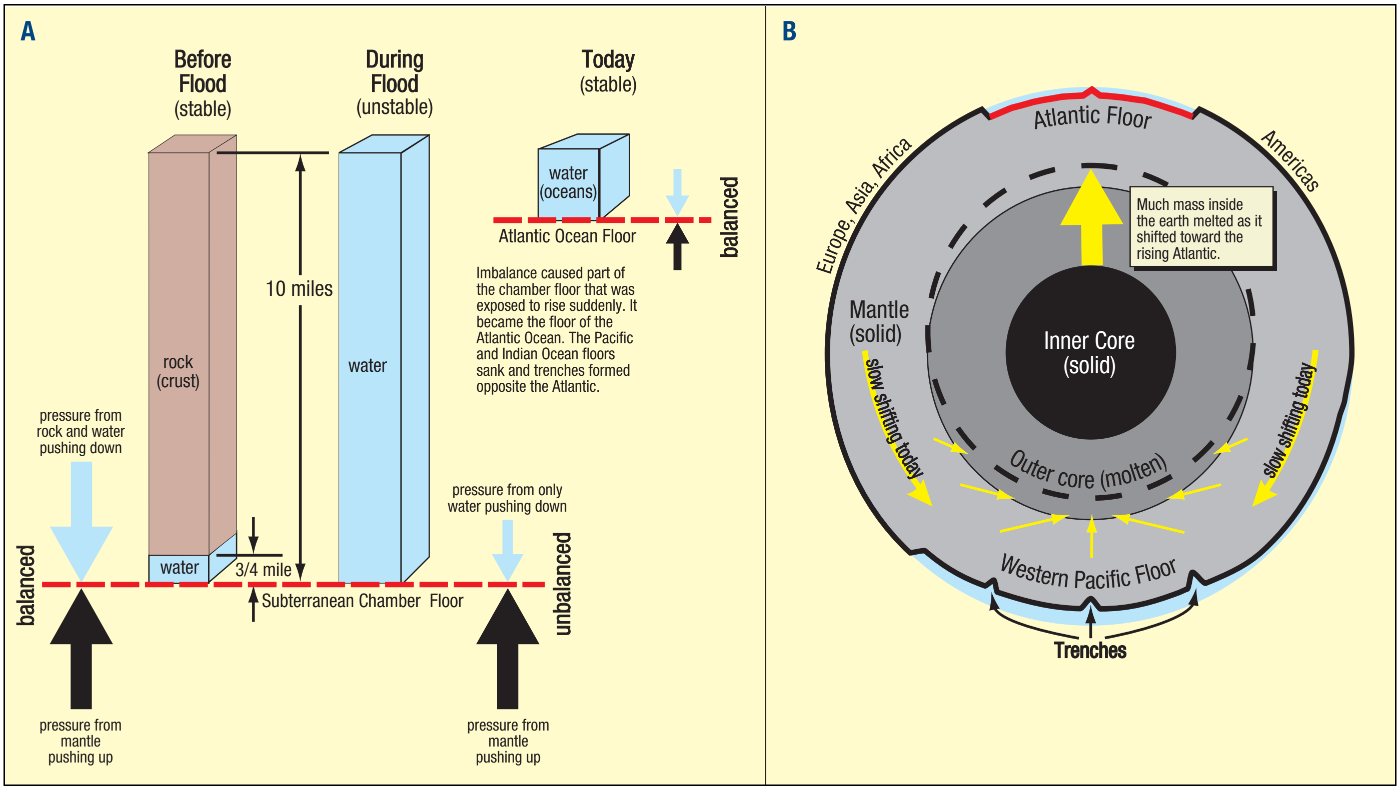


Figure 82: Hydroplate Explanation for Trenches. (A) Before the flood, the weight of rock and water, pushing down on the subterranean chamber's floor, balanced the floor's upward pressure. The rupture destroyed that equilibrium. Directly below the rupture, the imbalance grew as escaping, high-velocity water and the crumbling of unsupportable walls widened the globe-encircling rupture hundreds of miles. Eventually, the imbalance overwhelmed the strength of the floor. First, the Mid-Atlantic Ridge buckled, or sprang, upward. Then, as Europe, Africa, and Asia slid eastward and the Americas plate slid westward (based on today's directions), weight was removed from the rising floor, causing it to rise faster, and accelerating the hydroplates even more. Pressure directly under the floor, represented by the large black arrows, naturally decreased as the floor rose.

(B) During the flood phase, frictional heating in the inner earth began melting and contracting solid rock, as explained in **"Magma Production and Movement"** on pages 152–153. Because of this contraction, the crust on the Pacific side of the earth (hereafter called *the Pacific plate*) fractured at many places within the boundaries of the ring of fire and settled (downward, toward the Atlantic) by at least 10 miles![11] That drop steepened the downhill slope of the sliding hydroplates and allowed them to slide into the Pacific region without major obstructions. Downward buckling and deep faulting formed trenches. Soon, huge volumes of magma began erupting onto the days-old Pacific floor. During the next few years, frictional heating melted much of the inner earth. All this melting lubricated the shifts inside the earth and allowed gravitational settling, which released much more heat, increased earth's spin rate, and converted the inner earth to today's inner and outer core—monumental changes. The thick layer of magma that spilled onto the top of the sunken Pacific plate provided most of the heat that drove the ice age and accounts for almost 40,000 volcanoes. Even today, magma breaks out and escapes upward, heating part of the ocean and creating "El Niño" weather conditions.[12]

More than half of the world's active and dormant land volcanoes and 90% of the world's earthquakes occur along the ring of fire, shown in the inset map on page 148. Obviously, that 25,000-mile-long, horseshoe-shaped path is a region that was violently disturbed in the past.

From deep in the mantle, enormous amounts of melted basalt, called *flood basalts*, rapidly[13] spilled up onto the earth's crust—especially onto the Pacific basin. *Above sea level*, some "spills" that we can examine today are large enough to cover the eastern United States to the height of the Appalachian Mountains—from Atlanta to New York City and from the Appalachian Mountains to the Atlantic Ocean. More than a dozen of these convulsions have occurred at different places on land, dwarfing in volume the total magma in all volcanic cones. The volume of all "spills" below sea level may be a hundred times greater.

Rocks are composed of various minerals, some containing molecules of water. These minerals would not feel wet to the touch, because each water molecule is locked separately in a mineral's crystalline structure, and the water occupies only about one-thousandth of the rock's volume. Nevertheless, the inner earth is so large that it probably contains several oceans' worth of water. This may explain why a large amount of water (equal to the water in the Arctic Ocean) appears to be disbursed 500–750 miles under eastern Asia and part of western North America.[14]

Magma Production and Movement

Magma's Compressibility. Magma—melted rock inside the earth—is compressible under high pressure. Rock that melts under the extreme pressures near the center of the earth will contract and occupy a smaller volume than it did before melting! At intermediate pressures corresponding to those in the earth's mantle, melted rock occupies nearly the same volume as the original solid rock. At atmospheric pressure, rock expands by 7–17% when it is heated and melts. The density where the rock's volume does not change as it melts is called the *crossover density*. It occurs about 400 miles below the earth's surface. The exact *crossover depth* depends on the minerals present. Because of magma's compressibility, *magma below this depth is too dense to rise, so magma cannot circulate inside the mantle*,[15] contrary to what has been taught for 50 years!

Earth's magma began to be produced during the flood. [See **"Melting the Inner Earth"** on pages 496–498.] The magma's final volume was more than 120 times greater than all the water in today's oceans! With so much more liquid rock inside the earth than liquid water on earth, we need to understand how magma forms and why it moves.

Where Did All the Magma Go? The denser (deeper) magma and the denser unmelted minerals in the magma slowly fell into what grew to become earth's outer and inner core, respectively. The less dense magma that formed above the crossover depth tended to escape upward to the earth's surface as volcanoes or flood basalts. For years after the flood, most eruptions spilled onto the Pacific floor—a floor littered today with 40,000 volcanic cones, each taller than 1 kilometer! The following analogy explains why.

A Cable Analogy. Imagine a long, unbreakable cable passing through the center of the earth before the flood. One end is anchored to the portion of the subterranean chamber floor that will rise to become the floor of the Atlantic Ocean. The other end attaches to the Pacific plate on the opposite side of the earth. When the Atlantic floor is forced upward at the end of the flood, the Pacific floor will be pulled down.

Gravity produces the same effect as our imaginary cable. Gravity produces so much compression deep inside the earth that voids cannot open up; rock is always squeezed against rock (including melted rock). However, compressed rock can shear. For example, if a deck of vertical cards is compressed horizontally in a vise, space cannot open up between the cards, but a relatively small vertical force can cause the cards to slip—or shear. Friction from shearing and deformations deep in the earth always melts the sliding surfaces. The magma produced then lubricates those surfaces, so they slip more easily.

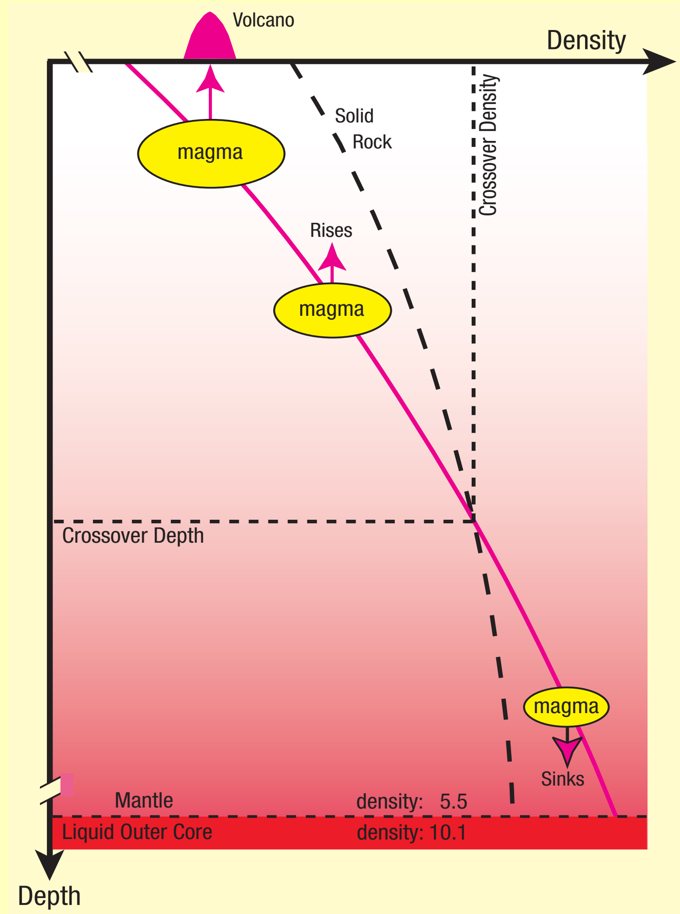


Figure 83: Crossover Depth. This graph shows how the density of liquid rock (magma) changes with depth below the earth's surface. Above the crossover depth, magma is less dense than solid rock at the same depth and will try to rise through the cracks where the magma was produced by sliding friction; below the crossover depth, magma is denser than solid rock and will sink toward the liquid outer core. Magma that drains down into the liquid outer core becomes almost twice as dense as the solid rock at the base of the mantle. [See the highlighted yellow cells on page 497.]

Shearing. Now let's imagine that many evenly spaced cables connect the rising Atlantic floor to the broader, subsiding Pacific plate. (The upward pull from the rising Atlantic floor widens with depth;[16] *this is why the Pacific has a larger area than the Atlantic.*) These cables shorten by varying amounts, because of magma's compressibility and the variations in frictional heating along their lengths. The farther a cable segment is from the Atlantic floor, the more likely it will move at a different rate than a corresponding segment on an adjacent cable, thereby shearing the rock between them, and produce magma. (Each segment's movement is the sum of the separate expansions or contractions of all the cable's segments between that point and the Atlantic floor—plus the movement of the attachment point at the Atlantic floor. Therefore, the farther a segment is from the Atlantic floor, the more likely shearing becomes.) Thus, shearing and magma production are extreme in and under the Pacific plate.

Large shearing offsets that reached the Pacific floor formed ocean trenches. Benioff zones under trenches are shearing surfaces (fault planes), not subducting plates, as commonly taught.[17] Island chains often formed where magma escaped upward along these cracks. The Hawaiian Islands and the Emperor Seamounts are prime examples.

Deep Movements during the Flood Phase. As the subterranean water escaped during the flood phase, the rupture steadily widened. This removed more and more weight from the chamber floor directly below, so that portion of the floor increasingly bulged upward. For a while, two types of forces resisted the rising of what would become the Atlantic floor: (1) the strength of the rock between that floor and the Pacific side of the earth, and (2) the weight of the stationary hydroplates that still lay above most of what would become the Atlantic floor.

Fractures and melting occurred deeper and deeper beneath the bulging chamber floor on the Atlantic side. Magma produced below the crossover depth contracted, so deeper fracturing, melting, and contraction occurred at an accelerating rate. By the end of the flood phase, the Pacific plate's sagging foundation had fractured in millions of places, and the magma generated along the deep sliding surfaces instantly contracted. Therefore, the Pacific plate, lacking support, rapidly subsided and sheared around its perimeter—now called **the ring of fire**. This shearing suddenly increased the upward pressure under the rising Atlantic floor, so the hydroplates began to accelerate away from the rising Mid-Atlantic Ridge. That also removed weight from above the Atlantic floor, so it rose even faster.

Because so much compressible magma was quickly produced under the Pacific plate, that plate subsided (caved in) *faster* than the Atlantic floor rose. In hours, the downhill slope on which the hydroplates slid steepened, and the sheared Pacific basin, surrounded by the ring of fire, became so deep that it did not obstruct the hydroplates sliding away from the rising Mid-Atlantic Ridge.

After the flood, magma under the Pacific floor, but above the crossover depth, erupted onto the Pacific floor. (To a much lesser extent, eruptions continue today, so in those places, ocean temperatures rise temporarily, a phenomenon called *El Niño*.[12]) Magma below the crossover depth drains down into the outer core, *so the outer core is slowly growing*. Simultaneously, melting is shrinking the total volume below the crossover depth, so the crust is compressing like the wrinkling skin of a drying (shrinking) apple. Also, the continents, thickened during the compression event, are still sinking into and laterally displacing the mantle. So the mantle is being squeezed downward from above and upward by the growing outer core. Mantle volume is also being lost primarily from the Pacific mantle by draining below the crossover depth and by eruptions above the crossover depth. Therefore, the

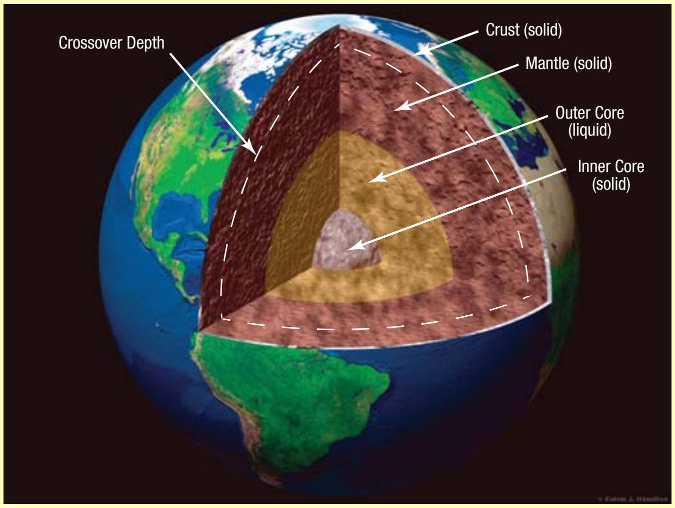


Figure 84: Inner Earth. The dashed white line marks the crossover depth. Magma generated above that line is less dense than the surrounding rock and will try to rise to the earth's surface. Magma generated below that line contracts and becomes denser, so it drains into the outer core (a liquid). Standard explanations for the shifting of continents and for so much liquid 1,800–3,200 miles under our feet are full of scientific problems.[18] [See **"Molten Earth"** on page 28; **"Plate Tectonics"** on page 112; and **"Melting the Inner Earth"** on pages 496–498.]

mantle is shifting an inch or so a year, in general, toward the Pacific to replace that escaping volume. [See Figure 87 on page 161.] These movements and stresses produce earthquakes. Slowly shifting continents led to the mistaken belief that the entire *solid* mantle somehow circulates as if it were a liquid—and, over millions of years, drifted continents over the face of the earth.

Since the flood, magma that spilled up onto the Pacific floor has raised sea level relative to the subsided Pacific plate that lies a few miles below the Pacific floor. This slow rise allowed today's coral islands on top of tablemounts to grow upward—fast enough to maintain the sunlight they needed for optimal growth. The coral depth below one of these islands, Eniwetok Atoll, is 4,600 feet.[19]

Rapid Cooling. Some claim that if magma spilled out only about 5,000 years ago, heat would still be present. The lack of heat, they assert, shows that millions of years have elapsed. They have overlooked that magma's contents: (a) crystals of unmelted minerals with high melting temperatures, (b) rock fragments, called *xenoliths* (ZEN-oh-liths), dislodged by the violent shearing and crushing, and (c) water absorbed by the rising magma as it passed up through what remained of the subterranean water chamber. (This is why volcanoes emit so much water vapor; typically 70% of all the gas released by volcanoes is water vapor.)[20] Because water lowers magma's melting temperature, the magma remained a liquid at temperatures below the rock's normal melting temperature. The solid crystals and rock fragments absorbed heat from the magma, so it quickly cooled and solidified.

Theories Attempting to Explain Ocean Trenches

Two broad theories propose explanations for ocean trenches. Each explanation will be given as its advocates would. Then we will test these conflicting explanations against physical observations and the laws of physics.

The Hydroplate Theory. [For a summary of the hydroplate theory, see pages 109–147.] At the end of the flood phase, crumbling, unsupportable walls and erosion from escaping high-velocity water had widened the globe-encircling rupture to an average of about 800 miles. Exposed at the bottom of this wide, water-filled gap was the subterranean chamber floor, about 10 miles below the earth's surface. Before the rupture, the gigantic upward pressure directly under the floor balanced the weight of almost 10 miles of rock and at least ¾ mile of water that pressed down on the floor. Afterward, with the overlying rock suddenly gone, only the strength of the upward-bulging chamber floor and 10 miles of water on top of it resisted this upward pressure. Consequently, as the rupture widened, the Mid-Oceanic Ridge suddenly buckled upward. [See pages 127–131.]

The continental-drift phase began with hydroplates sliding "downhill" on a layer of water, away from the rising Mid-Atlantic Ridge and toward the subsiding Pacific plate. This removed more weight from the rising portion of the subterranean chamber floor, causing it to rise even faster, accelerating the hydroplates even more. As that part of the chamber floor rose to become the Atlantic floor, it stretched horizontally in all directions, just as a balloon stretches when its radius increases. This stretching produced cracks parallel and perpendicular to the Mid-Oceanic Ridge. The rising began in the Atlantic, so the Mid-Atlantic Ridge and its cracks are the most prominent of the oceanic ridge system.

The rising Atlantic floor pulled even deeper material upward. As material shifted within the inner earth toward the rising Atlantic floor, a broader, but initially shallow, depression formed on the opposite side of the earth—the Pacific and Indian Oceans. Just as the Atlantic floor stretched horizontally as it rose, the western Pacific floor compressed horizontally as it subsided (sank).

When the slope between the upward bulging Atlantic floor and the subsiding Pacific floor became great enough, the continental drift phase began and even more dramatic events occurred. (Figure 49 on page 116 is one small, but telling, "snapshot" of what happened.) The continental drift phase resembled a large, flat rock resting in the center of a horizontal teeter-totter. Slight imbalances (corresponding to the nonsymmetrical widening of the rupture during the flood phase and the shifting of water from the Atlantic side to the Pacific side) slowly tip the teeter-totter. A point is reached where the rock rapidly accelerates downhill and the tipping increases even more.

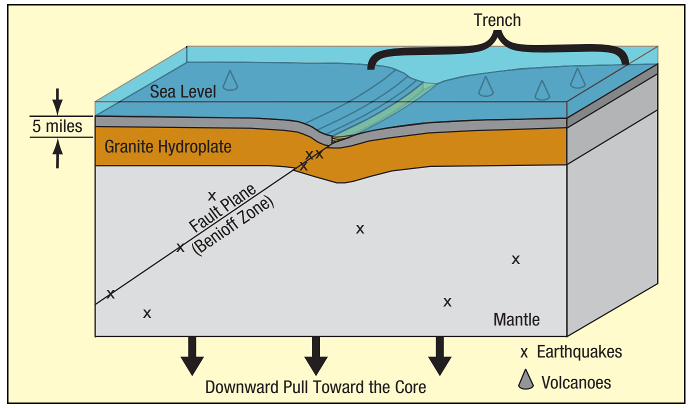


Figure 85: Trench Cross Section Based on Hydroplate Theory. Notice that the trench axis will generally not be a straight line. Sediments (green) hide the top of a fault plane that would otherwise rise up to a few hundred feet above the floor. Other sediments (not shown) and flood basalts (dark gray) cover most of the western Pacific floor. The three large black arrows show the direction of the rising Atlantic and the forces that downwarped the mantle and the Pacific plate. Earthquakes occur on the many faults produced, especially in Benioff zones and at low tides. Most volcanoes are not above Benioff zones, but are near a myriad of other faults near the center of the western Pacific, where downwarping and shearing were greatest.

Yes, right after the continental drift phase, the earth had departed significantly from a spherical shape, but, in the following months and years, gravity restored almost all of that spherical shape.

The trench region of the western Pacific lies near the center of the combined Pacific and Indian Oceans. As material beneath the western Pacific subsided, it sheared and buckled downward in some places, forming trenches. The Atlantic Ocean (centered at 21.5°W longitude and 10°S latitude) is almost exactly opposite this trench region (centered at 159°E longitude and 10°N latitude). [See Figure 80 on page 148.]

A simple, classic experiment illustrates some aspects of this event.

> *A cup of water is poured into an empty 1-gallon can. The can is heated from below until steam flows out the opening in the top. The heat is turned off, and the cap is quickly screwed onto the top of the can, trapping hot steam in the metal can. As this steam cools, a partial vacuum forms inside the can. The can's walls buckle inward, forming wrinkles in the metal—"miniature trenches."*

The upper 5 miles of the earth's crust is hard and brittle. Below the top 5 miles, the large confining pressure will deform rock if pressure *differences* are great enough. Consequently, as the western Pacific floor sank, it sheared and buckled into "downward creases," forming trenches. The hard crust and deformable mantle frequently produced trenches with an "arc and cusp" shape. The brittle crust cracked and slid in many places, *especially along paths called Benioff zones*.[21]

High-pressure deformations inside the earth produced faulting and, therefore, extreme friction—and heat.

> *To appreciate the amount of heat generated, slide a brick one foot along a sidewalk. The brick and sidewalk will warm slightly. Sliding a brick an inch but with a mile of rock squarely on top would melt part of the brick and sidewalk. Earth's radius is almost 4,000 miles. Place a few thousand of those miles of rock on top of the brick and slide it* ***only one thousandth of an inch.*** *The heat generated would melt the entire brick and much of the sidewalk below.*

Small movements deep inside the solid earth, even microscopic, puttylike deformations, melted huge volumes of minerals. This released the water locked within the crystalline structure of certain minerals.

Some magma (liquid rock) flowed upward onto the granite Pacific plate. Researchers have begun to detect this granite under the floors of the Pacific and Indian Oceans.[22]

Let's suppose that the inner earth initially had a more uniform mixture of minerals throughout. Melting of minerals with lower melting temperatures would allow denser grains to settle and lighter material to rise, a process called *gravitational settling*. This would generate much more heat and produce more faulting, melting, and gravitational settling. After many such cycles, the earth's core would form with solid, denser minerals (containing iron and nickel) settling to form the inner core with the melt forming the liquid outer core. Shifting so much mass toward the center of the earth and doubling the density of the rock that melts below the crossover depth would increase the earth's rotational speed. Today, the earth spins 365.256 times each year, but there are historical reasons for thinking a year once had 360 days.[23] [For details, see **"Melting the Inner Earth"** on pages 496–498.]

We saw that the skater in Figure 81 spins faster as she draws her arms closer to her spin axis. Likewise, as denser minerals settled through the magma toward the center of the earth, the inner core spun faster than the outer earth. The inner core is still spinning faster (by about 0.4° per year),[24] because the liquid outer core allows slippage.

In the mid-1980s, seismologists noticed that seismic waves pass through the inner core about 4 seconds faster when traveling along the axis of the magnetic poles.[25] Other tests showed that this was because crystals in the inner core have a preferred orientation.[26] That direction is slowly changing, so the inner core must be spinning relative to the rest of the earth. **"The Origin of Earth's Powerful Magnetic Field"** explains how this alignment arose. Other evidence, explained in Endnote 18, supports these powerful movements inside the earth.

The Origin of Earth's Powerful Magnetic Field

The earth's magnetic strength today is 2,000 times greater than that of all the solar system's other rocky planets combined. No doubt the earth had a magnetic field before the flood,[27] but how and when did it become so large? Also, why do seismic waves pass through the inner core much faster when traveling parallel to the axis of the magnetic poles?[25–26]

A common and dense mineral that settled through the increasing melt in the inner earth was magnetite (Fe_3O_4). [See preceding paragraphs.] Magnetite has a high melting temperature and, as its name implies, is highly magnetic. The pressure surrounding each falling magnetite crystal naturally increased as it fell toward the center of the earth. This steadily increased each crystal's melting temperature.[28] (Magnetite retains its magnetic strength as long as its temperature remains slightly below its melting temperature.)

As each magnetite crystal fell, it oscillated like a tiny compass needle seeking the north magnetic pole. However, the viscous magma dampened those oscillations, so each crystal's magnetic field quickly aligned with the earth's existing magnetic field. That field grew in strength as each tiny magnet was added to the inner core.[29]

In summary, before the earth's core began to form, trillions upon trillions of tiny magnetite crystals were somewhat randomly oriented inside the earth, so their magnetic strengths were self-canceling to some degree. When melting and gravitational settling ended, many of those crystals had fallen onto the inner core and aligned with the earth's growing magnetic field. Thus, (1) the magnetic field increased greatly, and (2) crystals in the inner core are aligned parallel to the axis of the magnetic poles.

Gravity is the basic driving mechanism that formed trenches and slowly shifts the crust. Gravity always tries to make the earth more compact (or spherical).[30] If you suddenly removed a bucket of water from a swimming pool (or even a 10-mile-thick layer of rock lying above what is now the Atlantic floor), gravity would tend to smooth out the irregularity. Because massive volumes of rock inside the earth do not flow as fast as water in a swimming pool, mass deficiencies, which we might think of as slight partial vacuums, still exist under trenches. Today, especially at low tide (when the water's pressure on the ocean floor is a minimum), mantle material flows in very slightly under trenches to reduce these "partial vacuums." This stretches the crust above, produces extensional earthquakes near trenches, shifts plates toward trenches, and makes the earth measurably rounder.[31]

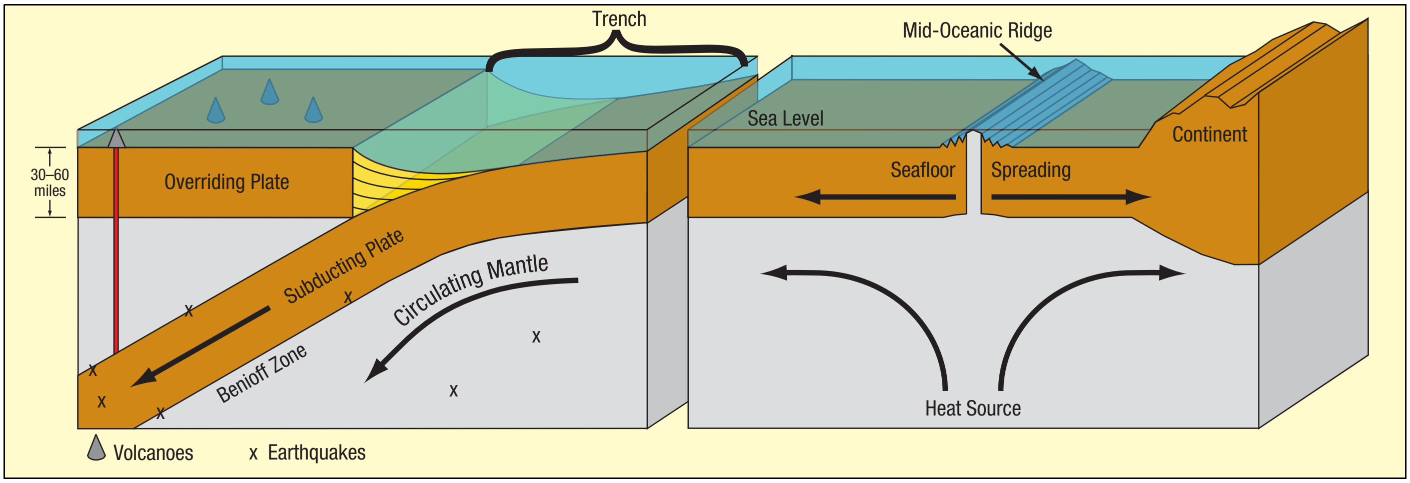


Figure 86: Plate Tectonic Explanation for Trenches. Internal heat circulates the mantle, causing large plates to drift over the earth's surface. Consequently, material rises at oceanic ridges, forcing the seafloor to spread, so plates must subduct at ocean trenches, allowing layered sediments, shown in yellow, to collect. Earthquakes occur where plates subduct (Benioff zones) and at other plate boundaries. Subducting plates also melt rock, and the resulting magma rises to form volcanoes.

[Response: Actually, most volcanoes are not above Benioff zones. If this theory were correct, the yellow sediments would hide a cliff face that is at least 30 miles high and the trench axis should be a straight line.]

Both the hydroplate theory and the plate tectonic theory are explained as their advocates would explain the theories. One should critically question every detail of both theories, and not accept either until all available evidence has been considered.

The Plate Tectonic Theory. The earth's crust is broken into rigid plates, 30–60 miles thick, some with an area roughly the size of a continent. Some plates carry portions of oceans and continents. Plates move relative to each other over the earth's surface, an inch or so per year.

Heat is the basic driving mechanism that formed trenches and moves plates. Just as hot water circulates in a pan on a stove, hot rock circulates slowly inside the earth's mantle. Radioactive decay warms some parts of the mantle more than others. The warmer rock expands, becomes less dense (more buoyant), and slowly rises, as a cork rises when submerged in water. Sometimes, plumes of hot rock rising from the outer core break through the earth's crust as flood basalts. Conversely, relatively cold rock descends. Rising and descending rock inside the mantle forms circulation cells (convection cells) which drag plates forward. Currents within the mantle rise at oceanic ridges, create new crust, and produce seafloor spreading.

Because new crust forms at oceanic ridges, old crust must be consumed somewhere. This happens wherever two plates converge. The older plate is denser, because it had more time to cool. Therefore, it sinks below the younger plate and subducts into the mantle, forming a trench. A cold, sinking edge will pull the rest of the plate and enhance circulation in the mantle. Earthquakes occur under trenches when subducting plates slip along Benioff zones. At great depths, subducting plates melt, releasing magma, which migrates up to the earth's surface to form volcanoes. Most of the ring of fire is produced by subducting plates. Of course, such slow processes require hundreds of millions of years to produce what we see today.

Evaluation of Evidence vs. Theories

The preceding discussions raise many issues and questions concerning trenches and the ring of fire. Each issue, summarized below in italics and given a blue title, is examined from the perspective of the hydroplate theory (HP) and the plate tectonic theory (PT). My subjective judgments, coded in green, yellow, and red circles (reminiscent of a traffic light's go, caution, and stop) provide a starting point for your own evaluations. Numbers in Table 3 refer to explanations that follow. Any satisfactory explanation for the origin of trenches and the ring of fire should resolve or credibly address the italicized issues below.

Table 3 will help us compare the evidence with two completely different explanations for ocean trenches. Too often, alternative theories are never known or sought, or a theory is justified based on only *some* of the relevant evidence. Then all other evidence is ignored or interpreted to support that theory. When this happens, doctrine reigns and critical thinking ceases. Please alter Table 3 by adding or removing evidence or theories (rows or columns) as you see fit.

Table 3. Evidence vs. Theories: Origin of Ocean Trenches and the Ring of Fire

	Theories	
	Hydroplate Theory Trenches and Ring of Fire Formed by Movements Inside the Earth and the Subsidence of Western Pacific Floor Driven by Gravity	**Plate Tectonic Theory** Trenches and the Ring of Fire Formed by Subduction of Plates Driven by Heat
Evidence to be Explained		
The Ring of Fire	🟢 1	❌ 2
Gravity Anomalies	🟢 3	❌ 4
Core-Mantle Boundary	🟢 5	❌ 6
Flood Basalts	🟢 7	❌ 8
Water in the Upper Mantle	🟡 9	❌ 10
Seamounts and Tablemounts	🟢 11	❌ 12
Stretched Oceanic Ridges	🟢 13	❌ 14
Scattered Volcanoes	🟢 15	❌ 16
Continental Material under Ocean Floor	🟡 17	❌ 18
Images of Earth's Interior	🟢 19	🟡 20
Fast Seismic Waves	🟢 21	❌ 22
Fossils in Trenches	🟢 23	❌ 24
Earthquake Driving Force	🟢 25	❌ 26
Tension Failures	🟢 27	❌ 28
Wide Earthquakes	🟢 29	❌ 30
Reasonable Driving Mechanism	🟢 31	❌ 32
Displaced Material	🟢 33	❌ 34
Frictional Resistance	🟢 35	❌ 36
Arcs and Cusps	🟢 37	❌ 38
Concentrated Trenches	🟢 39	❌ 40
Undistorted Layers in Trenches	🟢 41	❌ 42
Initiation	🟢 43	❌ 44
"Fossil" (Ancient) Trenches	🟢 45	❌ 46
Other	🟢 47–48	❌ 49–52

Key:
🟢 Theory explains this item.
🟡 Theory has moderate problem with this item.
❌ Theory has serious problems with this item.
Numbers in this table refer to amplifying explanations on pages 158–166.

Evidence Requiring an Explanation

The Ring of Fire. *What accounts for this most volcanically violent and seismically active region on earth, and why does it surround all but the southern side of the Pacific basin?*

🟢 ***1. HP:*** The ring of fire marks where the Pacific plate sheared as deep runaway melting and contraction began. This happened at the start of the continental drift phase. Months earlier, the rupture fractured that plate's *southern* boundary, so it did not experience violent shearing.

❌ ***2. PT:*** Subducting plates mark most of the ring of fire. The southern Pacific is complex.

[Response: Table 4 on page 165 gives 15 reasons why plates have not subducted.]

Gravity Anomalies. *The greatest mass deficiencies on earth exist under trenches, even after adjusting for the shape of trenches.*

- ***3. HP:*** As the Atlantic floor rose, *all the material* below it had to rise as well, so trenches in the western Pacific were pulled down (toward the rising Atlantic). This created a mass deficiency below trenches.

- ***4. PT:*** Plates are subducting into the mantle, so mass is continually added and compacted under trenches. However, other factors may be playing a role.

Core-Mantle Boundary. *The density of material just below the core-mantle boundary is almost twice that directly above the boundary. Gravitational settling and the compressibility of magma presumably account for this major discontinuity within the earth, but the heat released by gravitational settling would have melted much of the earth.* [See pages 496–498.] *How can this be explained?*

- ***5. HP:*** The heat released by gravitational settling was released primarily in the core. Except for flood basalts and earthquakes, the rest of the earth's surface has been relatively unaffected by this heat. The outer earth was never molten.

- ***6. PT:*** The early earth was molten for hundreds of millions of years, because it formed by meteoritic bombardment. In that liquid state, gravitational settling occurred within the earth. Over billions of years, the earth cooled.

  [Response: Problems with this position are explained at **"Molten Earth?"** on page 28.]

Flood Basalts. *Almost unbelievable amounts of melted basalt rapidly spilled up onto the (solid) earth's surface, especially in and surrounding the western Pacific. How did this happen, and why was it so rapid?*

- ***7. HP:*** Magma outpourings resulted from the following chain of events:
  - the bulging of the chamber floor in what was to become the Mid-Atlantic Ridge,
  - the runaway faulting (shearing) and frictional heat production deep in the earth,
  - the contraction of magma below the crossover depth, and the eruption of magma above the crossover depth,
  - the resulting subsidence of the Pacific plate, and
  - the accelerating of hydroplates away from the rapidly rising Atlantic floor and toward the subsiding Pacific.

  This explanation answers all the questions raised on page 115 in the **"Volcanoes and Lava"** discussion. Because these deep faults often intersect the earth's surface as linear features, we have many linear island chains, but with different orientations.

- ***8. PT:*** As explained in **"Magma Production and Movement"** on page 152, *below the crossover depth, magma is too dense to rise.* Even if a hot plume of magma could slowly rise through the entire mantle, the plume would lose heat to colder, overlying rock. This heat loss would exceed the excess heat in the plume. Calculations show that hot plumes cannot rise from the outer core and produce flood basalts.[32] Nor will current processes open cracks in the mantle so a plume can rise. Confining pressures under the crust are simply too great.

  An old, now discredited,[33] idea used in popularizing plate tectonics was that fixed "hotspots" exist inside the earth. Supposedly, plumes of hot, melted rock continually rise from the earth's core upward through the mantle. Over millions of years, as a plate somehow slid over a hotspot, the plate melted along a line and produced volcanoes and flood basalts.

  The Hawaiian Islands were considered the best example of this.[34] Not explained were the long chains of submarine volcanoes that intersected the Hawaiian chain—some at large angles. It is now recognized that if hotspots exist, they must move.[35] Other volcanic chains, such as the Bermuda Rise, are almost perpendicular to the claimed movements of their plates.[36]

  If the mantle circulates enough to move a plate, why is a hotspot's plume in that moving mantle fixed? If a chain of volcanoes means its plate is drifting, does an isolated volcano mean that its plate is not drifting? Faster moving plates should have fewer volcanic cones "burned" through them than slower plates. Just the opposite is the case.[37] Also, the chemistry of rocks comprising these "hotspot" chains indicates that the magma originated from the upper mantle, not the lower mantle boundary as claimed by plate tectonics.[38] Endnote 32 explains the most compelling objection to the hotspot idea—the absence of a physical mechanism.

Water in the Upper Mantle. *What concentrated so much water 500–750 miles below eastern Asia and parts of western North America?*

- ***9. HP:*** Rapid melting of the inner earth released large amounts of the sparsely distributed water locked within minerals. That water rose because of its low density. Most spilled into the Pacific basin along with flood basalts, but some water was, and still is, trapped under continental regions bordering the Pacific Ocean.

- ***10. PT:*** Subducting plates carried ocean water down into the mantle where it was released under eastern Asia and western North America.

The Origin of Tablemounts

Tablemounts, also called *guyots* (GHEE-ohs), are flat-topped volcanic cones that lie 3,000–6,000 feet below sea level and rise 9,000–15,000 feet above the ocean floor. Experts agree that their tops were planed off (truncated) by wave action. This also explains why shallow-water corals and fossils and rounded cobbles and pebbles often cover tablemounts. Therefore, each tablemount was at one time 3,000–6,000 feet higher relative to sea level.

Most of the 2,000 known tablemounts are concentrated in the western Pacific, between Hawaii and Japan and between 8° and 27° north latitude. This is the center of the ocean-trench region, directly opposite the center of the Atlantic Ocean on the other side of the earth. The following scenario seems to explain when and how tablemounts, with their strange elevations, formed.

> *Hydroplates, lubricated below by water, accelerated down opposite flanks of the rising Mid-Atlantic Ridge and toward the deepening Pacific plate. With so much weight sliding away, the Atlantic floor rose and pulled down the Pacific plate on the opposite side of the earth even more, forming trenches and steepening the downhill slope for the sliding hydroplates. As the continental plates met resistance, they crashed, crushed, and thickened, similar to an avalanche of snow sliding down a mountainside.*
>
> *All the fracturing and shifting deep within the earth produced frictional heating, gravitational settling, and huge amounts of magma. Most of that magma now constitutes the earth's outer core.* [See ***"Melting the Inner Earth"*** on pages 496–498.] *For years after the flood, much magma escaped upward along faults, especially in the Pacific, which had the fastest-sinking and most fractured portion of the crust. Volcanic cones rapidly rose,[39] many reaching the ocean's surface, where large waves leveled the volcanic peaks. Over the next few years, the Pacific plate, with thick, dense magma on top and the mantle below, sank into the growing liquid outer core. That sinking pulled tablemounts down 3,000–6,000 feet below sea level. The tablemount and trench region is several thousand feet lower than the average depth of the Pacific.*
>
> *Today, magma that lines faults in the mantle is slowly leaving the mantle—draining into the outer core when below the crossover depth, and tending to rise and spill onto the earth's surface when above the crossover depth. Because this occurs primarily under the Pacific Ocean, continents tend to shift toward the Pacific to fill the vacated space in the mantle. This explains today's slight continental shifts and major earthquake and volcanic activity around the Pacific—along* ***the ring of fire****.*

Other observations support this scenario:

a. Submarine canyons show that sea levels were once at least 15,000 feet lower relative to the continents.

b. Eniwetok Atoll, composed of corals almost a mile deep,[19] lies in the tablemount region and rests on a tablemount.[40] To grow, most corals must be within 160 feet of the ocean surface.[41] Under ideal conditions today, corals can grow 1.3 feet per year.[42] Therefore, at Eniwetok, the last mile of relative elevation change was slow enough for corals to grow continually, up to the present time.

c. Tablemounts are not drowned coral atolls, as once proposed and finally rejected by Harry Hess, who discovered tablemounts.[43] Tablemounts and atolls have different shapes. The depths of tablemounts below sea level increased rapidly; otherwise, most would have coral growths rising to near sea level.

d. Clustered tablemounts sometimes differ in elevation and depth by 1,000–2,000 feet,[44] so they apparently formed at different times while local ocean depths were changing rapidly. This probably happened during the years after the compression event as the Pacific plate and the mantle below it sank into the growing liquid outer core. As new cracks formed, more magma escaped upward, so seamounts grew from different depths. Therefore, the first tablemounts that formed were usually shorter than tablemounts that formed after the plate had been pulled deeper. Earlier tablemounts were then pulled down farther than those that formed later. Consequently, short tablemounts can be far below sea level, while nearby, taller tablemounts can have their tops at shallower depths.

e. Sediments, including dead organisms, continually fall onto ocean floors, but tablemounts have few sediments.[45] Currents over tablemounts are too slow to sweep off sediments. (This implies that tablemounts formed recently, but after the flood phase when most sediments were deposited through the flood waters.)

f. Every few years, large and sudden temperature rises, called *El Niños*, occur in the waters of the western Pacific, because magma, much of it generated at the end of the flood, still erupts.[12]

g. Researchers on the deep-sea submersible, *Alvin*, found ripple marks, corals, and shallow-water algae 10,000 feet below today's sea level (but on the continental slope), 400 miles east of New York City.[46] Presumably, those features formed before North America settled into the mantle.

h. If parts of the Mid-Oceanic Ridge in the Pacific were once above sea level, as Hopi legends suggest,[47] then sea level has risen and/or the Pacific floor subsided.

[Response: Table 4 on page 165 gives 15 reasons why plates have not subducted.]

Seamounts and Tablemounts. *Why are 40,000 seamounts (undersea volcanoes) on the floor of the Pacific Ocean? Tablemounts show that either sea level rose by 3,000–6,000 feet or the ocean floor dropped by 3,000–6,000 feet—or some combination of both. How could this have happened?*

- ***11. HP:*** See **"The Origin of Tablemounts"** on page 159.

- ***12. PT:*** Seamounts are thought to form when a plume of molten material erupts onto the ocean floor from (a) the earth's core or (b) a subducting plate. Item 8 above explains the problems with (a). Table 4 on page 165 summarizes 15 problems with (b).

  Even if plate tectonics could explain seamounts, why did their elevations change enough to form tablemounts? The leading hypothesis is that as ocean floors age, they cool, shrink, and sink deeper. As volcanic islands sink, wave action flattens them. Those favoring the plate tectonics explanation admit that the heights of tablemounts and their supposed ages are not completely consistent with this hypothesis.[48]

Stretched Oceanic Ridges. *The topography along oceanic ridges is best explained by stretching the ocean floors in two perpendicular directions. How could that happen?*

- ***13. HP:*** As the Atlantic floor and Mid-Oceanic Ridge rose, they stretched in all directions, for the same reason an expanding balloon stretches in all directions.

- ***14. PT:*** Plate tectonics describes this stretching as seafloor spreading—movement of the ocean floor away from the ridge.

  [Response: Even if seafloor spreading occurs, it would only account for one stretching direction (perpendicular to the ridge), not two. See Figure 86 on page 156.]

  Plate tectonics proposes three possible means for moving plates: push, pull, or drag. Each has problems.

  Push. If material rising from below the ridge is somehow pushing ocean crust away from the ridge, ocean crust would be compressed by the push, not stretched.

  Pull. If crust is being pulled away from the ridge, what is the pulling force? Some believe that plates are pulled down under trenches. However, rocks are weak in tension, so they can pull very little without breaking. Even if this were not a problem, many evenly spaced cracks (flank rifts) lie parallel to the ridge axis. Once the first crack begins, it should grow and eventually break the plate completely. The plate should be pulled apart and not have parallel, multiple cracks as seen at flank rifts. (Fifteen reasons will soon be given why plates cannot subduct.)

  Drag.[49] If the mantle is circulating below the ocean floor and dragging the underside of the ocean crust away from the ridge, that drag would not stretch the ocean crust. For example, drag acts on a block of wood drifting in a stream. The wood is not stretched.

  Consequently, plate tectonic theory can point to no force that will stretch oceanic ridges in even one direction, let alone two.

Scattered Volcanoes. *On the western Pacific floor are 40,000 volcanoes taller than 1 kilometer. They lie among trenches, not on only one side of trenches.*

- ***15. HP:*** The rising of the Atlantic floor not only caused the subsidence that formed the Pacific and Indian Oceans; it also depressed, cracked, and distorted the entire western Pacific. Frictional melting produced large volumes of magma that spilled out on top of the Pacific plate. Some of that magma formed volcanoes.

  Geologists refer to a line running down the west central Pacific as the "***andesite line***." It has this name because eruptive rocks west of it are primarily andesite, whereas rocks to the east are primarily basalt. Andesite contains minerals such as hornblende and biotite that are present in granite, *but not in basalt*. These minerals come from the granite plate several miles below the Pacific Ocean. The andesite line "has been viewed as the dividing line between oceanic and continental crusts."[50]

- ***16. PT:*** If subducting plates generate magma that forms volcanoes, then volcanoes should lie on the side of the trench above the descending plate. [See Figure 86 on page 156.] Actually, most volcanoes in the western Pacific lie on the opposite side of trenches. Also, most volcanoes in the western Pacific are interior to a plate—contradicting plate tectonics, which says volcanoes should usually form near plate boundaries.

Continental Material under Ocean Floor. *Some granitic, or continental, rock is found under the floors of the western Pacific and southern Indian Oceans.*[22]

- ***17. HP:*** Basalt, not granite, lies below sediments that continually fall onto the floors of the Pacific and Indian Oceans. However, the basalt recovered by deep-sea drilling is not oceanic crust. Instead, it is basalt that once flowed as a liquid onto the ocean floor,[51] just as much of western Siberia is paved with basaltic lava flows. A granite hydroplate, about 10 miles thick, must lie a few miles under the lava flows coating the western Pacific floor. This has not yet been verified, because drilling into the Pacific and Indian Ocean floors

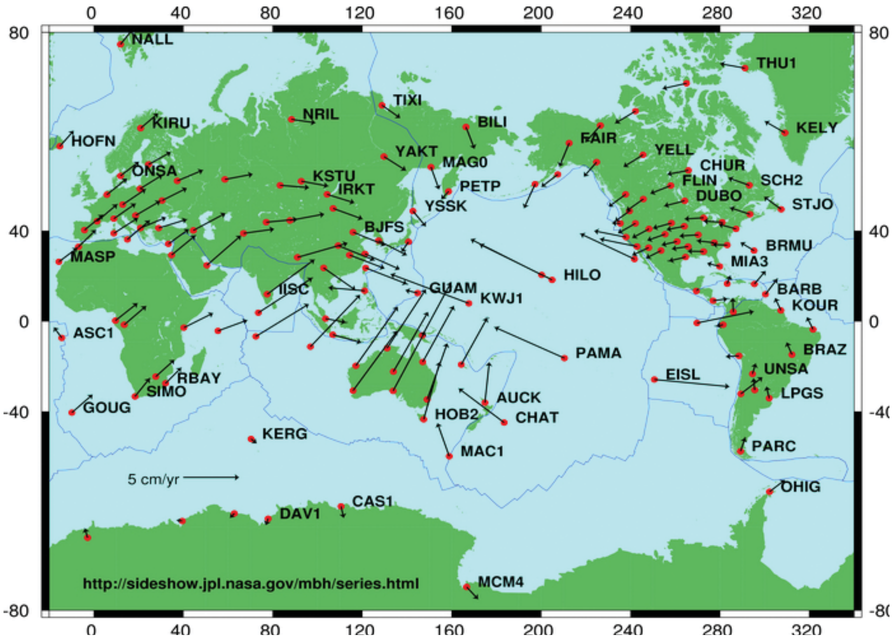


Figure 87: Global Shifts. Each arrow shows the average direction and speed of several years' worth of shifting at one of about 150 locations worldwide. All measurements were made using the Global Positioning System (GPS), the most accurate of several methods for measuring these movements.

Notice that the arrows point in different directions, although most are toward the Pacific. This shows that material deep in the earth shifts in various directions, but generally toward the Pacific. If the entire mantle were circulating, greater uniformity would be seen in speed and direction. The plate tectonic theory considers the plates, outlined in blue, as rigid, but the variations in the measured movements show that the plates are not rigid.[52] For the plates to be moving, pressure differences must exist. Either the pressure around the Pacific is greater than normal or the pressure under the Pacific is less than normal—or both. The hydroplate theory explains why both are true.

seldom exceeds a mile in depth. Current drilling, typically only 0.11 mile deep, penetrates primarily ooze and other sediments that have settled onto the ocean floor in the last several thousand years.[53] Nevertheless, some continental material has been discovered, to the surprise of most geologists.[22]

PREDICTION 6: A 10-mile-thick granite layer (a hydroplate) will be found a few miles under the Pacific floor inside the ring of fire.

18. PT: Little granite has been found.

[Response: The presence of even a little granite under the ocean floor, especially near the Mid-Oceanic Ridge, contradicts the plate tectonic theory, which says the ocean floor forms from melted basalt rising at oceanic ridges. No one has been able to demonstrate that granite can form from a melt, even though students are taught that granite is an igneous material—meaning "formed from a melt."[54] See **"Geothermal Heat"** on page 116.]

Images of Earth's Interior. *Seismic tomography should be able to show if plates do or do not subduct.*

19. HP: Table 4 on page 165 gives 15 reasons why plates have not subducted. Each reason is a strong case against plate tectonics, which requires subduction.

20. PT: Great efforts have been made, using seismic tomography, to discover cold, subducting plates inside the mantle, specifically along Benioff zones. The results are ambiguous.[55] Most studies find little that could be interpreted as a *three-dimensional*, subducting plate. Sometimes, scientific journals will identify a two-dimensional linear feature beneath a trench, not a three-dimensional plate. However, similar linear features are also found far from trenches, and each linear feature could be a fault.

Fast Seismic Waves. *The upper mantle is denser beneath continents than beneath oceans.*

21. HP: After the continental-drift phase, the crushed, thickened, buckled, and sediment-laden continents slowly settled into the mantle, compressing the mantle more than normal. Consequently, seismic waves travel faster under continents.[6]

22. PT: Mantle properties under continents do not vary by much.

[Response: Why should seismic waves travel faster under continents if the mantle has been circulating and mixing for hundreds of millions of years? Mantle properties should be fairly uniform.]

Fossils in Trenches. *Fossils of shallow-water plants are found in trenches. How did they get there?*

23. HP: Fossilization requires special conditions. It should be no surprise that the global flood, which fossilized trillions of animals worldwide, also formed fossils in places that later became ocean trenches. Rapid burial, necessary to form and preserve fossils, was quickly followed by the subsidence of the Pacific plate and the downward buckling of trenches.

PREDICTION 7: Fossils of land animals, not just shallow-water plant fossils, will be found in and near trenches.

24. PT: Because plants float and quickly disintegrate, they should not be buried and preserved in one of the deepest parts of the Pacific Ocean.

Earthquake Driving Force. *Most earthquake energy is released under trenches, often along sloping planes called Benioff zones. However, some earthquakes occur far below the centers of plates, and some small earthquakes in the Pacific tend to occur at low tide.*[9]

25. HP: The entire mantle is being compressed and, as shown in Figure 87, laterally displaced generally toward the Pacific. [See **"Magma Production and Movement"** on page 152. This is why earthquakes sometimes occur far below plate *interiors*—at such large depths and pressures that cracks should not open up. This mantle flow is naturally greatest at low tides and under the Pacific. This is why earthquakes on the Pacific floor tend to occur at low tides.

26. PT: Viscous drag acting on the bottom of a plate would apply only a constant force, just as a river's current applies a constant force on an anchored boat. So whatever force drives earthquakes must increase with time, because nearby rock stretches weeks and months before an earthquake, much as a rubber band stretches before it snaps. Obviously, that force is not restricted to plate boundaries as plate tectonics claims, because powerful earthquakes sometimes occur hundreds of miles below the center of plates. Clearly, material moves far beneath plate interiors.

Is mantle material circulating or shifting? If it is circulating, as the plate tectonic theory claims, some energy source must drive the circulation. Adding energy, such as heat, to the mantle would not make the earth more compact or rounder, as happens during all large earthquakes.[7,31] Besides, billions of years of movement should make the earth about as compact as it could become.

However, shifting, driven by gravity, would make the earth increasingly more compact and round. If the earth's mass became unbalanced during a global flood only about 5,000 years ago, shifts might still occur. Indeed, the global positioning system (involving at least 24 earth-orbiting satellites that can measure crustal movements with centimeter precision) shows that, at least in Asia, and perhaps most other places on earth, gravity drives crustal movements generally toward the Pacific.[56] [See Figure 87.]

Tension Failures. *Earthquakes near trenches are primarily due to horizontal tension perpendicular to the trench axis.*[8]

27. HP: Trenches are formed by long, deep faults, not by subduction. Millions of other faults exist, especially on and under the Pacific floor. Movement and friction have melted rock along those faults, lining them with magma. Magma below the crossover depth drains into the outer core and expands the outer core slightly. This, in turn, stretches the fractured mantle horizontally. Magma rising above the crossover depth expands the walls of the fault and produces *tension failures—earthquakes—perpendicular to a trench axis.*

Figure 88: Pressure Differences. Only huge pressure differences cause thick, viscous material to flow. Toothpaste, squeezed from a tube, flows out the opening at a velocity that depends not on how great the pressure is, but on the *difference* between the pressure at the squeeze point and the pressure at the opening. Therefore, squeezing toothpaste inside the sunken Titanic, where pressures are high, or on the Moon, where pressures are low, would be no harder or easier than at your bathroom sink. Because rock is so stiff, or viscous, it flows only under extreme pressure differences, such as existed under the floor of the widening Atlantic. Tiny pressure differences, claimed by plate tectonics, can do little to overcome the strength of crystalline rock, even over billions of years.

28. PT: If plates converge, so that one plate is forced under the other, earthquakes near trenches should be compression failures.

Wide Earthquakes. *Some earthquakes beneath trenches rupture very broad regions.*

29. HP: Mantle material has shifted over a very broad area, especially in the western Pacific, so some earthquakes should rupture broad regions.

30. PT: Some earthquakes beneath trenches rupture regions much broader than the thickness of any hypothetical subducting plate. Therefore, earthquakes do not seem to be caused by breaks inside subducting plates or by slippage along their surfaces.[57]

Reasonable Driving Mechanism. *Forces should exist to form trenches.*

31. HP: After the flood phase, extremely large, unbalanced forces quickly lifted the lightly-loaded portion of the chamber floor that then became the Atlantic floor. Once movement began, frictional heating and gravitational settling produced magma, which then contracted far below the Pacific plate.

Subsidence, faulting, and horizontal compression, especially in the western Pacific, formed trenches. All movements and forces were driven by gravity.

32. PT: In a liquid, small forces can produce small movements, which conceivably could become large movements if billions of years were available.

[Response: Large, unbalanced forces are needed for crystalline rock to "flow" at the rate observed. Plate tectonic theory does not explain such forces. Researchers who believe that the mantle circulates like to think of the *solid* mantle as a liquid. That assumption simplifies their mathematics and removes the need for large unbalanced forces, if millions of years are available.

Just because heat circulates water simmering in a pan, we cannot presume that heat circulates deep rock. The analogy breaks down, because temperature variations on the water's surface change its surface tension which, in turn, circulates the water in the pan.[58] Rocks do not have a corresponding force. Also, rock's viscosity[59] is 23 orders of magnitude greater than that of water! Therefore, it is doubtful that heat irregularities deep in the mantle could be large enough to circulate the mantle at the required velocities.

If the mantle circulates, adjacent cells must circulate in opposite directions, just as two simple interlocking gears must rotate in opposite directions. Cells circulating in opposite directions under a large plate would tend to cancel each other's tendency to move the plate, so a large plate would retard mantle circulation. (Worse yet, subducting plates would obstruct mantle circulation.)

Could one circulating cell be under each plate? A large plate, such as the Pacific plate, would need to have a much larger cell width than a plate one-thousandth as large. However, the circulating (or convection) cells we see, such as within the atmosphere or a pan of simmering water, have height-to-width ratios of nearly 1:1, not 1:10 or 100:1, as plate tectonics requires.

Tectonic plates, as hypothesized, vary in thickness. For example, a plate might be 60 miles thick under mountains but only 30 miles thick under oceans. Therefore, dragging a plate with a mountain "on board" would encounter great resistance. If we tried to slide one heavy washboard (or corrugated board) over another, their parallel ridges would interlock and resist movement. Also, if one plate stopped, the resulting "log jam" would stop all plates.]

Displaced Material. *Large volumes of rock must have been removed to form trenches. Where did it go?*

Figure 89: Deforming a Sphere Inward. When the hard, outer shell of a ping-pong ball is depressed on one side, it usually deforms in an arc-and-cusp pattern. Materials always deform in a way that minimizes the energy required.

The earth's crust is also a hard spherical shell, so it too will deform in an arc-and-cusp pattern if the crust is pulled down. Because many trenches under the western Pacific Ocean have arc-and-cusp shapes, they probably formed by subsidence of the western Pacific floor, not by subduction.

33. HP: The rock removed to form trenches shifted toward the rising Atlantic floor. Also, rock that melts below the crossover depth contracts.

34. PT: Geophysicists have often asked, "Where did that material go?" Plate tectonics has given no answer. A subducting plate, or anything pushed into the mantle, would add, not remove, material under a trench.

Frictional Resistance. *To form trenches and move so much rock, great frictional resistance must be overcome.*

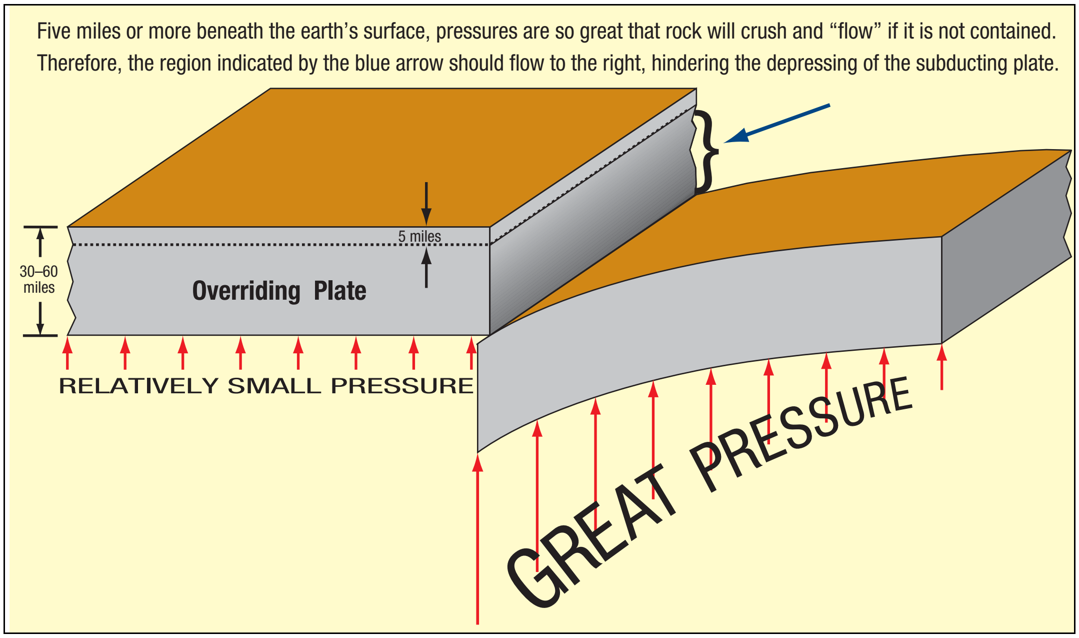


Figure 90: Subducting Plate. Pressure inside the earth increases with depth. So, if one tried to depress a plate 30 miles or more below another plate, tremendous upward pressure from below would quickly prevent that much depression. Consequently, subduction—necessary for plate tectonics—could not begin, even if the plate were colder and, therefore, denser.

From this figure, can you see why no continental cliff can be more than 5 miles high? (No cliff under water could be more than 8 miles high.)[60]

35. HP: A block placed on an inclined plane will slide downhill if the gravity-related force exceeds the frictional resistance. Likewise, a big pit will be filled in if gravity forces can overcome the frictional resistance and strength of the walls and floor. The deeper and wider the pit, the greater the forces its walls and floor must resist. As with the sliding block, once movement begins, friction decreases, so movement speeds up. Also, the increasing momentum acts to maintain movement. If rock deep inside the earth breaks and slides ever so slightly, friction will melt the sliding surfaces. The magma produced then acts as a lubricant, speeding movement even more.

During the early days of the flood, the upward-jetting water removed the rubble from the rupture's crumbling, unsupportable walls, so the pit continually widened. Eventually, the floor was so wide it buckled upward, pushed the hydroplates aside, and widened the big pit even more. With less and less weight on the widening floor, it had to rise, and a corresponding depression had to occur over a broader, but shallower, region on the opposite side of the earth. Today, gravity continually tries to squeeze the earth back toward a spherical shape.

36. PT: See the technical note on page 486.

Arcs and Cusps. *Some trenches, such as the New Hebrides/South Hebrides Trenches, are "U-shaped" when seen from above or on a map. Other trenches have arcs and cusps.* [See Figure 80 on page 148.] *What caused those shapes?*

37. HP: Visualize a growing partial vacuum inside a sealed metal can, as described on page 154. Its walls will buckle inward in a variety of curved shapes. Likewise, the floor of the western Pacific, as it was "sucked" down toward the rising Atlantic, buckled downward in many curved shapes, as seen from above or on a map. When a hard, spherical shell (such as the earth's crust or even a ping-pong ball) buckles inward, the deformation pattern is often one of arcs and cusps.

Just as the maximum depression on a ping-pong ball is deeper than the depression at any of its cusps (Figure 89), so the western Pacific was initially deeper than the trench cusps. As the continents sank into the mantle in the centuries after the flood, the western Pacific floor has risen.

38. PT: All portions of a plate cannot slide toward (or away from) the center of an arc without shrinking (or stretching) the width of the plate. If plates could subduct, they could do so only along a straight line.

Concentrated Trenches. *What concentrated so many trenches in the western Pacific?*

39. HP: The continental-drift phase began when the subterranean floor became unstable and rose in what is now the Atlantic. This immediately lessened the tendency for the subterranean floor to become unstable and rise elsewhere. A corresponding depression had to occur on the opposite side of the earth, especially in the western Pacific.

40. PT: There is no reason plates should prefer to subduct in the western Pacific. Oceanic ridges exist in all oceans, so trenches should be equally dispersed. If rock rises at ridges and subducts at trenches, why is the total ridge length (about 46,000 miles) so much longer than the total trench length (about 15,000 miles)?

Table 4. Subduction: Possible or Impossible?

Why Plates Have Not Subducted	See Pages
1. A subducting plate would experience too much resistance in diving down through just the top of the mantle. The blunt front end alone would stop movement. The unspecified force needed to overcome these resistances would (if a pushing force) crush the plate or (if a pulling force) pull the plate apart.	160, 162–163, 486
2. Sediments, volcanoes, and plateaus have not been scraped off "subducting" plates in trenches.	165
3. Sedimentary layers in trenches are undisturbed. These layers would be mangled if plates subducted.	165
4. No known forces are available to break the crust into plates and separate those plates from their bases.	165
5. One plate cannot even begin its dive under an adjacent plate that is 30–60 miles thick, because cliffs cannot be higher than 5 miles.	165–164
6. Subduction cannot occur along an arc. Subduction is geometrically possible only along a straight line. (The arc-and-cusp pattern of ocean trenches shows subsidence, not subduction.)	164
7. Most volcanoes are on the wrong side of trenches if subducting plates produce volcanoes.	160
8. Below trenches are mass deficiencies, not mass excesses as subduction would produce.	149–150, 158, 163
9. Beneath trenches, earthquakes sometimes occur across a much broader region than the width of a plate.	162
10. Seismic tomography has not shown unambiguous subducted plates in even two dimensions. If plates subducted, seismic tomography could convincingly and dramatically show them in three dimensions.	161
11. Some Benioff zones are nearly horizontal. Subducting plates should always move on a downward slope.	166
12. Thick, buoyant continents would prevent subduction.	166
13. Trenches and ridges do not have corresponding lengths and locations as plate tectonic theory requires.	164, 166
14. At three locations on earth, a trench (and, according to plate tectonics, a descending plate) intersects a ridge (where material is supposedly rising). Material cannot be going up and down at the same time.	166
15. Ancient trenches have never been found.	165

Undistorted Layers in Trenches. *Sedimentary layers in trenches are usually horizontal and undistorted.*

● ***41. HP:*** Since the flood, the sediments in trenches have settled onto a relatively stationary ocean floor.

⊗ ***42. PT:*** If subduction occurs at trenches, the overriding plate should scrape off the layered sediments, volcanic cones, and oceanic plateaus riding on the subducting plate. Seismic reflection profiles show that trenches contain horizontal, undistorted layers with no sign of subduction. Nor are scraped-off volcanic cones collecting in trenches. As H. W. Menard stated,

> *... it would seem that the sediment sliding into the bottom of the trench should be folded into pronounced ridges and valleys. Yet virtually undeformed sediments have been mapped in trenches by David William Scholl and his colleagues at the U.S. Naval Electronics Laboratory Center. Furthermore, the enormous quantity of deep-ocean sediment that has presumably been swept up to the margins of trenches cannot be detected on sub-bottom profiling records.*[61]

Other authorities have made similar observations.[62]

Initiation. *How does a trench start to form?*

● ***43. HP:*** Trenches began to form as the Atlantic floor rose at the beginning of the rapid continental-drift phase. The western Pacific floor then subsided, producing horizontal compression, downward buckling, shearing (faulting), and trenches.

⊗ ***44. PT:*** For subduction to begin, the earth's crust must first break—a herculean task for which experts on plate tectonics admit they have no "sound quantitative" explanation.

> *The initiation of subduction remains one of the unresolved challenges of plate tectonics.*[63]

Next, for a broken plate to subduct, its edge, up to thousands of miles long, must be depressed at least 30 miles, the minimum thickness of these hypothetical plates. Nothing even approaching that large a topographic discontinuity has ever been seen anywhere on earth. Figure 90 explains why this could never happen.

"Fossil" (Ancient) Trenches. *If trenches have been on earth for hundreds of millions of years, many trenches should now be buried. Some should even have been lifted above sea level. Such ancient trenches have never been found.*

- ***45. HP:*** Because the flood was a single, recent event, one should not expect to find ancient trenches.

- ***46. PT:*** As Fisher and Revelle noted:

  > *Where are the trenches of yesteryear? Are we living in an exceptional geologic era; are the apparently young trenches of the present day unusual formations that have had no counterparts during most of geologic time? Such a speculation would be repugnant to many geologists, because it would be difficult to reconcile with the doctrine that the present is the key to the past. We must continue to search for ancient trenches—on the deep-sea floor, in the marginal shallow water areas and on the continents themselves.*[64]

Other*. The following details pertain primarily to one theory or the other.*

- ***47. HP:*** Earth's extremely large magnetic field formed as a direct consequence of the events that produced the ocean trenches. [See **"The Origin of Earth's Powerful Magnetic Field"** on page 155.] This also explains why the crystals in the inner core are oriented in a preferred direction—toward the magnetic poles.[26]

  The plate tectonic theory does not address the origin of the earth's magnetic field, although for decades schools have taught that it is generated by a geodynamo operating in the earth's outer core. Most experts will admit that the geodynamo theory has many problems.

- ***48. HP:*** Chekunov et al. described experiments involving fracturing in small-scale models and discussed temperature and strength variations in the crust and upper mantle. Based on these considerations, they concluded that trenches and Benioff zones imply subsidence rather than subduction.[65]

- ***49. PT:*** Ridges and trenches do not always correspond to each other, as they should if plates form at ridges and move toward and disappear under trenches.

- ***50. PT:*** If, as plate tectonics maintains, material is rising from the mantle at ridges and diving into the mantle at trenches, a contradiction occurs where a ridge and trench intersect.[66] This happens at three locations in the eastern Pacific: 50.5°N latitude and 130°W longitude, 20.5°N latitude and 107°W longitude, and 46.3°S latitude and 75.7°W longitude. The same—or even closely spaced—mantle material cannot be going both up and down at the same time.

- ***51. PT:*** A linear pattern of deep earthquakes that intersects a trench defines a Benioff zone. Most Benioff zones are steeply inclined, but one under a long portion of the west coast of South America is nearly horizontal.[67] If these earthquakes occur along the surface of a subducting plate, no portion of the Benioff zone should be nearly horizontal, because the plate is supposedly *diving* through the mantle. However, consistent with the hydroplate theory, these earthquakes could originate on a nearly horizontal fault.

- ***52. PT:*** Continents, being thick, buoyant, and *strong*, should prevent subduction. As Molnar stated:

  > *... the buoyancy of thick continental crust keeps it afloat. If continental lithosphere were strong enough to maintain its integrity at a subduction zone, the buoyant continental crust would not only resist being subducted, but the subducting plate would abruptly grind to a halt when the continental "passenger" reached the trench.*[68]

Final Thoughts

Thomas Crowder Chamberlin, former president of the University of Wisconsin and the first head of the Geology Department at the University of Chicago, published a famous paper[69] in which he warned researchers not to let one hypothesis dominate their thinking. Instead, they should always have or seek *multiple working hypotheses*. Chamberlin stated that testing competing hypotheses or theories sharpens one's analytical skills, develops thoroughness, reduces biases, and helps students and teachers learn to discriminate and think independently rather than simply memorize and conform.

Chamberlin said the danger of teaching only one explanation is especially great in the earth sciences, where much remains to be learned. The explanation for ocean trenches is an example. The plate tectonic theory dominates the earth sciences. A recent survey of scientists selected it as the most significant theory of the 20th century. Undoubtedly, Darwin's theory of organic evolution would be voted as the most significant theory of the 19th century. Both dominate, despite growing recognition of their scientific problems, because schools and the media ignore competing explanations. Chamberlin warned about the comfort of conformity.

The subject of "trenches" offers students and teachers a great opportunity. The two competing theories can be explained simply, as was done in Figures 82 and 86. More information can be added as student interest, time, and ability permit. Relevant topics could include fossils, volcanoes, earthquakes, gravity anomalies, flood basalts, seismic tomography, arcs, cusps, tides, the core-mantle boundary, earth's magnetic field, the ring of fire, the crossover depth, and many others. Students can examine and compare the evidence and tentatively decide which is the stronger theory. Teachers and parents have a simple, satisfying task: provide information, ask questions, challenge answers, and allow students the excitement of discovery.

References and Notes
(To locate specific authors, consult the index.)

1. Four trenches lie beyond this area shown in Figure 80: the Peru-Chile Trench, the Middle America Trench, the South Sandwich Trench, and the Puerto Rico Trench. (The latter may simply be a submarine canyon.)

   Why are a few trenches not in the concentrated trench region in the western Pacific? After studying this entire chapter, especially **"Magma Production and Movement"** on page 152, you will see that major faulting (shearing) deep inside the earth would not always have been under the western Pacific. On rare occasions it would have occurred elsewhere, such as along continent-plate boundaries where the Peru-Chile Trench and the Middle America Trench are today.

2. *"It is perhaps especially remarkable that some material was recovered from the depths exceeding 7000 m in the trenches, even right down to the bottom of the Philippine Trench. ... plant remnants, making them fossils* [that are] *rather surprising in the deep sea."* Anton F. Bruun, "General Introduction to the Reports and List of Deep-Sea Stations," *Galathea Report: Scientific Results of the Danish Deep-Sea Expedition Round the World 1950–1952*, editors Anton F. Bruun, Sv. Greve, and R. Spärck (Copenhagen: Nordlundes Bogtrykkeri, 1957), p. 15.

3. Robert L. Fisher and Roger Revelle, "The Trenches of the Pacific," *Continents Adrift* (San Francisco: W. H. Freeman and Company, 1972), p. 15.

4. Gordon A. Macdonald et al., *Volcanoes in the Sea*, 2nd edition (Honolulu: University of Hawaii Press, 1983), p. 330.

5. Fisher and Revelle, p. 12.

6. *"... seismic waves passing beneath continents traveled faster than those passing beneath ocean basins."* Richard A. Kerr, "The Continental Plates Are Getting Thicker," *Science*, Vol. 232, 23 May 1986, pp. 933–934.

◆ *"Seismic models of global-scale lateral heterogeneity in the mantle show systematic differences below continents and oceans that are too large to be purely thermal in origin."* Alessandro M. Forte et al., "Continent-Ocean Chemical Heterogeneity in the Mantle Based on Seismic Tomography," *Science*, Vol. 268, 21 April 1995, p. 386.

7. *"... earthquakes do indeed serve to make the Earth more compact, thus decreasing its moment of inertia and, because they leave total angular momentum unchanged, increasing the rotation speed and thus decreasing the length of the day, which is what would be expected."* John Maddox, "Earthquakes and the Earth's Rotation," *Nature*, Vol. 332, 3 March 1988, p. 11.

   While each major earthquake suddenly causes the earth to spin slightly faster, continuous tidal effects steadily slow the earth's spin. The latter effect, detected by atomic clocks, dominates over long time periods. [See pages 477–481.]

   "Meanwhile, the questions remain of why the effect of earthquakes on the Earth's rotation should have the effect of predominantly decreasing the polar moment of inertia ..." Ibid.

   Answer: Gravity always tries to squeeze the earth into a more spherical, compact shape. During the early stages of the global flood, the fountains of the great deep redistributed massive amounts of rock, making the earth less spherical. Toward the end of the flood, gravity suddenly shifted material within the inner earth, caused rapid continental drift, and formed earth's three major oceans: the Atlantic, Pacific, and Indian Oceans.

   Sporadic shifts in mass are now less intense, because each shift since the flood has reduced the imbalances and made the earth more nearly spherical. We call these shifts "earthquakes" and "plate movements."

   Today, aftershocks follow each major earthquake, as the inner earth adjusts locally to the earthquake's sudden redistribution of mass near the fault. Likewise, today's earthquakes are simply aftershocks resulting from the major shift of mass during the flood.

8. *"The available seismic data show that the primary stress field results from more or less horizontal tension—at right angles to the axis of the trench—at most depths."* William F. Tanner, "Deep-Sea Trenches and the Compression Assumption," *The American Association of Petroleum Geologists Bulletin*, Vol. 57, November 1973, p. 2195.

9. Maya Tolstoy et al., "Breathing of the Seafloor: Tidal Correlations of Seismicity at Axial Volcano," *Geology*, Vol. 30, June 2002, pp. 503–506.

◆ *"... tidal effects on earthquakes were not accepted until recently. ... The records showed high seismic activity at or just after low tide. The earthquake frequency nearly doubled at the lowest tides ..."* Junzo Kasahara, "Tides, Earthquakes, and Volcanoes," *Science*, Vol. 297, 19 July 2002, pp. 348–349.

10. *"Our main conclusion is that abyssal-hill-like topography may result from continuous stretching of a brittle layer."* W. Roger Buck and Alexei N. B. Poliakov, "Abyssal Hills Formed by Stretching Oceanic Lithosphere," *Nature*, Vol. 392, 19 March 1998, p. 275.

11. The liquid's volume in the outer core is 1.7×10^{11} km^3, the area of the Pacific Ocean is 7.3×10^{7} km^2, and the densities of the lower mantle and outer core are 5.5 and 10.1 gm/cm^3, respectively. Before the rapid continental drift began, the Pacific plate would have subsided by an average of 10 miles (16.09 km) perhaps as soon as the first 0.38 of one percent of the magma in the outer core had formed.

$$\frac{7.3 \times 10^{7} \times 16.09}{1.7 \times 10^{11}} \times \frac{5.5}{10.1} = 0.0038$$

Along with this subsidence, 10^{18} metric tons of surface water would have violently shifted from above the upward bulging chamber floor on the Atlantic side of the earth onto the Pacific plate. That massive shift in weight could have pushed the inclining hydroplates past their tipping point.

12. *"Here we present support for a response of the El Niño/Southern Oscillation (ENSO) phenomenon to forcing from explosive volcanism ... The results imply roughly a doubling of the probability of an El Niño event occurring in the winter following a volcanic eruption."* J. Brad Adams et al., "Proxy Evidence for an El Niño-Like Response to Volcanic Forcing," *Nature*, Vol. 426, 20 November 2003, p. 274.

13. S. P. Kelley and J-A. Wartho, "Rapid Kimberlite Ascent and the Significance of Ar-Ar Ages in Xenolith Phlogopites," *Science*, Vol. 289, 28 July 2000, pp. 609–611.

◆ Sylvie Demouchy et al., "Rapid Magma Ascent Recorded by Water Diffusion Profiles in Mantle Olivine," *Geology*, Vol. 34, June 2006, pp. 429–432.

14. Jesse F. Lawrence and Michael E. Wysession, "Seismic Evidence for Subducted-Transported Water in the Lower Mantle," *Earth's Deep Water Cycle,* editors Steven Jacobsen and Suzan van der Lee (Washington, D.C.: American Geophysical Union Monograph, 2006), pp. 251–261.

15. Satoru Urakawa et al., "Anomalous Compression of Basaltic Magma," *Research Frontiers 2006*, pp. 113–114. Also available at www.spring8.or.jp/pdf/en/res_fro/06/113-114.pdf.

"The basaltic magma could not ascend from a position deeper than 200 km in the Earth's interior." Ibid., p. 114.

◆ These 2006 experimental results, by themselves, should kill the idea that the mantle as a whole circulates as a convecting fluid. We all need to integrate these results into our thinking and eliminate scenarios that conflict.

16. A concentrated load on a thick solid (such as the earth) produces stresses inside the solid. Those stresses spread out roughly in proportion to their depth below the surface.

17. Rocks deep inside the earth are under high and fairly uniform compressive stresses. As explained on page 152, such solids, if they fail (break), will fail by shearing. At each point inside the earth, the maximum shearing stress occurs on a plane oriented 45° to the planes of principal stress. The principal stresses produced by the rising of the Atlantic floor and the downward pull on the Pacific plate are approximately vertical and horizontal. Therefore, maximum shearing stress—and Benioff zones—will occur at about a 45° angle to the horizontal. For more information, consult any introductory textbook on strength of materials; look for the subject of "Mohr's Circle."

One can also conclude that the principal stresses that produced Benioff zones had to be applied suddenly. Had they been applied over a period of years, slow deformations, called *creep*, would have removed the shearing stresses.

18. Based on the following, the preflood mantle probably had a more uniform density. Movements within the mantle during and soon after the flood would have generated much heat and melting. Denser elements (such as nickel and iron) would have settled gravitationally, releasing even more heat which, in turn, melted other parts of the mantle, allowing more gravitational settling. This would explain why (a) temperatures inside the earth increase with depth, (b) the earth has a core, (c) the outer core is a liquid while the inner core is a solid, (d) denser elements are concentrated nearer the center of the earth, (e) the inner core spins faster than the rest of the earth, (f) many early cultures thought the earth had a 360-day year (Endnote 23), and (g) earth's density almost doubles as one passes down through the core-mantle boundary. [See the yellow cells in Table 32 on page 497.]

Evolutionists say that the earth formed by meteoritic bombardment. While meteoritic bombardment might explain (a)–(d) above, it is contradicted by (e)–(g).

Also, meteoritic bombardment would melt the entire earth several times over.

> *The kinetic energy (~5 x 10^{38} ergs) released in the largest impacts (1.5 x 10^{27} g at 9 km/sec) would be several times greater than that required to melt the entire Earth.* George W. Wetherill, "Occurrence of Giant Impacts during the Growth of the Terrestrial Planets," *Science,* Vol. 228, 17 May 1985, p. 879.

Had that occurred, we would not find dense, nonreactive elements such as gold at the earth's surface. But we do. Besides, granite rocks have never melted. [See **"Geothermal Heat"** on page 116.] A molten earth, after billions of years of cooling, would not produce the temperature patterns we see inside the earth. [See **"Rapid Cooling"** on page 41.] Meteoritic bombardment would also add too much xenon to the earth's atmosphere. [See **"Molten Earth?"** on page 28 and page 85.] And finally, meteoritic bombardment presupposes the prior existence of meteoroids, whose origin, as currently taught, has many problems. [See pages 305–327.] Belief in a once-molten earth has led many to believe that the earth is billions of years old.

19. *"Two deep holes, drilled on opposite sides of Eniwetok Atoll, reached the basement below the cap of Recent to Eocene limestone at depths of 4,610 and 4,158 feet."* Seymour O. Schlanger, *Subsurface Geology of Eniwetok Atoll*, Geological Survey Professional Paper 260–BB (Washington, D.C.: United States Government Printing Office, 1963), p. 991.

◆ Harry S. Ladd, "Drilling of Eniwetok Atoll, Marshall Islands," *American Association of Petroleum Geologists Bulletin*, Vol. 37, October 1953, pp. 2257–2280.

20. See "Volcanic Gases" on page 230.

21. We sometimes see this on a small scale when the soil below a concrete slab settles or becomes more compact. Without support, the slab cracks vertically, and one side of the slab settles below the other. If the slab were also compressed horizontally, as was the subsiding Pacific hydroplate, the crack would depart from the vertical, at angles comparable to those of Benioff zones. Sediments blanketing the crack would take the shape of a trench.

22. *"The presence of continental-type crust in the oceans where oceanic crust might be expected has been recognized from seismic information by a number of authors."* J. M. Dickins et al., "Past Distribution of Oceans and Continents," *New Concepts in Global Tectonics*, editors S. Chatterjee and N. Hotton III (Lubbock, Texas: Texas Tech University Press, 1992), p. 193.

- *"Much sialic* [continental or granitic] *material appears beneath the oceans and we remain skeptical as to the distinction between what is designated continental and oceanic crust. We are surprised and concerned for the objectivity and honesty of science that such data can be overlooked or ignored."* Dickins et al., p. 198.

  "Miller (1970), on the basis of structural trends of pre-Mesozoic orogens [folded and faulted mountains], *concluded a former sialic (continental)* [granitelike] *crust, which has now disappeared, was present west of the present coast of Chile."* Ibid., p. 195.

- *"Possible presence of continental crust under the ocean has been postulated by Bullin (1980) and Orlenok (1983). They stated the idea that 'the oceanic crust is thin and graniteless' is a mistake."* D. R. Choi et al., "Paleoland, Crustal Structure, and Composition under the Northwestern Pacific Ocean," *New Concepts in Global Tectonics*, editors S. Chatterjee and N. Hotton III (Lubbock, Texas: Texas Tech University Press, 1992), p. 187.

  The unusual seismic characteristics of this layer in the northwestern Pacific have been noted earlier and called "*Oceanic Layer 3*." Drilling has not been deep enough to penetrate it.

- *"This 6.5- to 6.8-km/s layer* [west of Sumatra] *may be either lower continental (granitic) crust or thickened oceanic layer 3. … Although the 6.5- to 6.8-km/s velocity is high for lower continental (granitic) crust, the large thickness of this layer suggests that it is continental crust, …"* R. M. Kieckhefer et al., "Seismic Refraction Studies of the Sunda Trench and Forearc Basin," *Journal of Geophysical Research*, Vol. 85, No. B2, 10 February 1980, pp. 863, 873.

- *"The presence of continental crust in the northwestern Pacific casts doubt over the validity of the use of magnetic anomalies for determination of spreading age and rate … These anomalies are located within the area of continental crust. They appear to coincide with the major fracture patterns accompanied with intrusives …"* Choi et al., p. 188.

- *"This provides unequivocal evidence of continental crust in Elan Bank. … The garnet-biotite gneiss, in particular, indicates continental crust at this south Indian Ocean location."* Shipboard Scientific Party, "Leg 183 Summary, Kerguelen Plateau-Broken Ridge: A Large Igneous Province," *Proceedings, Ocean Drilling Program, Initial Reports*, 183, editors M. F. Coffin et al. (College Station, Texas: ODP, 2000), pp. 1–101.

  Three other papers describing this expedition's amazing discoveries of traces of continental crust are in the *Journal of Petrology*, Vol. 43, July 2002, pp. 1105-1139.

- *"Continental basement is known to outcrop at the base of the Rama ridge, the Lucipara ridge (site 304) and the Tukang Besi ridge (site 301)."* [These ridges, between Australia and Asia, are typically two or more miles below sea level.] Christian Honthaas et al., "A Neogene Back-Arc Origin for the Banda Sea Basins: Geochemical and Geochronological Constraints from the Banda Ridges (East Indonesia)," *Tectonophysics*, Vol. 298, 10 December 1998, p. 311.

- *"Bathymetry and seismic profiles suggest that continental crust forms the floor of the trenches all the way around the bend from Timor to Seram …"* Robert McCaffrey, "Active Tectonics of the Eastern Sunda and Banda Arcs," *Journal of Geophysical Research*, Vol. 93, No. B12, 10 December 1988, pp. 15, 177.

23. When the flood began, the year likely had 360 days.

- Velikovsky showed—from the writings of the Persians, Egyptians, Chinese, Chaldeans, Assyrians, Babylonians, Incas, Hebrews, Greeks, Hindus, Romans, Aztecs, Mayas, and Peruvians—that a 360-day calendar prevailed in much of the ancient world. [See Immanuel Velikovsky, "The Year of 360 Days," in *Worlds in Collision* (Garden City, New York: Doubleday & Company, Inc., 1950), pp. 330–359.]

  Velikovsky thought that gravitational encounters with Venus and Mars altered Earth's orbit and produced our 365-day year. Those promoting this idea could have demonstrated its feasibility with a computer simulation. They have not. Besides, Carl Sagan demolished Velikovsky's explanation in "An Analysis of Worlds in Collision." [See *Scientists Confront Velikovsky*, editor Donald Goldsmith (Ithaca, New York: Cornell University Press, 1977), pp. 41–104.]

- Early Egyptians assumed a 360-day year, until they realized that the Nile was flooding later and later each year according to that calendar. Because Egypt's earliest settlers probably would not have adopted a 360-day year while in Egypt, they presumably brought that outdated understanding with them. [See J. Norman Lockyer, *The Dawn of Astronomy* (Cambridge, Massachusetts: The M.I.T. Press, 1964), pp. 243–248.]

- Babylonian astronomers, thousands of years ago, divided a circle into 360 degrees. Why did they choose 360, instead of something easier such as 100 or 1,000? Probably because a year had 360 days before the flood—one degree for each day of the year. This would have been the average daily motion of the Sun among the stars, a relatively easy measurement.

  If so, either earth's spin rate or its orbital period around the Sun increased during the flood. Increasing earth's orbital period requires a large, unknown energy source; increasing the spin rate does not. Therefore, the spin rate probably increased.

- See paragraph 6 on page 412 for an insight from the most detailed record of a year in very ancient times.

24. Xiaodong Song and Paul G. Richards, "Seismological Evidence for Differential Rotation of the Earth's Inner Core," *Nature*, Vol. 382, 18 July 1996, pp. 221–224.

- *"Two years ago, a pair of seismologists discovered evidence that the inner core is dancing to its own beat, spinning measurably faster than the rest of the planet. ... Since then, two other studies have bolstered the concept of an independently rotating inner core ..."* Richard Monastersky, "The Globe Inside Our Planet: Earth's Inner Core Is Turning Out To Be an Alien World," *Science News*, Vol. 154, 25 July 1998, p. 58.

- John E. Vidale et al., "Slow Differential Rotation of the Earth's Inner Core Indicated by Temporal Changes in Scattering," *Nature*, Vol. 405, 25 May 2000, pp. 445–447.

- *"Our results confirm that Earth's inner core is rotating faster than the mantle and crust at about 0.3° to 0.5° per year."* Jian Zhang et al., "Inner Core Differential Motion Confirmed by Earthquake Waveform Doublets," *Science*, Vol. 309, 26 August 2005, p. 1357.

- The inner core's spin should be slowing relative to the rest of the earth—but very slowly, because the resisting outer core is a liquid and the inner core is so massive.

PREDICTION 8: When greater precision is achieved in measuring the inner core's rotational speed, it will be found to be slowing relative to the rest of the earth.

The slower the inner core spins, the less this decelerating torque becomes. So, after about 5,000 years, it is not surprising that this effect can be measured. However, if the inner core formed billions of years ago, no effect would be seen.

25. *"... strong evidence that seismic waves traveling through the inner core along the axis of the magnetic poles complete their trip through Earth about four seconds more quickly than do waves traveling from one side of the equator to the other."* Susan Kruglinski, "Journey to the Center of the Earth," *Discover*, June 2007, p. 55.

26. Jeff Hecht, "The Giant Crystal at the Heart of the Earth," *New Scientist*, 22 January 1994, p. 17.

- *"In the mid-1980s, scientists from Harvard University first noticed an unusual feature of Earth's core: Seismic waves tended to travel fastest when they paralleled Earth's axis of rotation. Their speed dropped by as much as 3 percent when the waves moved perpendicular to the rotation axis. The seismologists who discovered this asymmetry explained it by suggesting that the iron crystals in the core point toward the poles and thus transmit seismic waves fastest when they travel that way. This pattern may develop from the way Earth's magnetic field orients the crystals that solidify on the surface of the inner core."* Richard Monastersky, "Earth's Core Out of Kilter," *Science News*, Vol. 145, 16 April, 1994, p. 250.

- Jeroen Tromp, "Support for Anisotropy of the Earth's Inner Core from Free Oscillations," *Nature*, Vol. 366, 16 December 1993, pp. 678–681.

27. Earth's preflood magnetic field could easily have been less than one hundredth of today's magnetic field. Here's why.

Our atmosphere substantially shields earth's surface from solar and cosmic rays. At sea level, the atmosphere provides about the same shielding as 3 feet of lead. Some of the preflood atmosphere was expelled by the fountains of the great deep. Therefore, atmospheric shielding before the flood would have been somewhat greater than today.

Earth's magnetic field provides some shielding from charged particles, except near the magnetic poles. Although the moon has no atmosphere, astronauts on the moon were shielded from harmful radiation by their space suits and the moon's weak magnetic field, which is *less than one hundredth that of the earth*. Astronauts were on the moon in 1969, when solar radiation was at its 11-year solar maximum.

28. Within the inner earth, high-pressure friction heated the walls of thousands of sliding faults. Minerals with the lowest melting temperatures in those walls melted. Therefore, the melt's temperature was relatively low compared to the melting temperature of magnetite. As magnetite fell toward the center of the earth, pressures increased, phase changes occurred, and the magnetite's melting temperature increased. Magnetite is stable at pressures of 75 GPa and temperatures of 2,000 K. [See Surendra Saxena et al., "Formation of Iron Hydride and High-Magnetite at High Pressure and Temperature," *Physics of the Earth and Planetary Interiors*, Vol. 146, August 2004, pp. 313–317.]

Saxena et al. observed a high-pressure phase of magnetite forming as follows:

$$4H_2O \longrightarrow 4H_2 + 2O_2$$
$$3Fe + 2O_2 \longrightarrow Fe_3O_4 \text{ (high-pressure magnetite)}$$

In their experiments, as a hydrated mineral (brucite) was heated, the water on the left side of the first equation was released.

Water molecules locked in mantle minerals were probably released in a similar way as the inner earth melted. [See **"Water in the Upper Mantle"** on page 158.] Oxygen then combined with iron at high pressure and temperature to produce huge amounts of magnetite with high melting temperatures. The magnetite then settled onto the inner core to form the earth's gigantic magnetic field.

29. On 22 April 2007, Rod Nance, an electrical engineer, suggested to me that the earth's magnetic field somehow originates in the inner core, not the outer core, as I and most others had commonly believed. Nance was very familiar with the problems associated with the view that a geodynamo, operating in the outer core, produced the earth's magnetic field. Evolutionists have tried in vain to patch up those problems for decades. Once my focus shifted from the outer core to the inner core, I saw how the gravitational settling resulting from the melting of the inner earth produced earth's magnetic field. [See **"Melting the Inner Earth"** on page 496.]

30. The earth's spin makes the earth slightly nonspherical. Taking the earth's nonsphericity explicitly into account would not alter any conclusions in this chapter.

31. *"... the tendency of earthquakes* [is] *to make the Earth rounder, and to pull in mass toward the centre of the Earth."* B. Fong Chao and Richard S. Gross, "Changes in the Earth's Rotation and Low-Degree Gravitational Field Induced by

Earthquakes," *Geophysical Journal of the Royal Astronomical Society*, Vol. 91, 1987, p. 569.

"Why do earthquakes strive towards a rounder Earth? [Gravity strives for a rounder earth. Gravity also drives earthquakes.] *Or, conversely, does the Earth's non-sphericity have any influence on the earthquake mechanism?"* Ibid., p. 594. [It has everything to do with earthquakes and shifting continental plates. The next question one should ask is, "What caused the nonsphericity?" Answer: The flood.]

32. Calculations are sometimes put forth in an attempt to show that plumes can rise through the mantle. Usually assumed are unrealistically low values for the mantle's viscosity and density or unrealistically high values for the plume's initial temperature and volume. These claims take the position, "We know flood basalts came from the outer core, so here is how it must have happened." Others, looking at the physics involved and using the most reasonable numbers, admit they don't understand how enormous volumes of flood basalts could rise through the mantle. My calculations show that the volume of a magma plume rising buoyantly or melting its way up from the core-mantle boundary would initially have to exceed the earth's volume for just one drop of magma to reach the earth's surface. Others, cited below, have reached similar conclusions.

- *"A simple calculation shows that if ascent is governed by Stoke's law, then the great viscosity of the lithosphere (about 10^{25} poise, if it is viscous at all) ensures that the ascent velocity will be about ten thousand times smaller than that necessary to prevent solidification. A successful ascent could be made only by unrealistically large bodies of magma."* Bruce D. Marsh, "Island-Arc Volcanism," *Earth's History, Structure and Materials*, editor Brian J. Skinner (Los Altos, California: William Kaufman, Inc., 1980), p. 108.

- *"The question of where the magma comes from and how it is generated are the most speculative in all of volcanology."* Gordon A. Macdonald, *Volcanoes* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972), p. 399.

- *"All the evidence that has been used so far to support the plume model—geochemical, petrological, thermal, topographic—is equivocal at best, if indeed not contrary. The plume idea is ad hoc, artificial, unnecessary, inadequate, and in some cases even self-defeating, and should be abandoned."* H. C. Sheth, "Flood Basalts and Large Igneous Provinces from Deep Mantle Plumes: Fact, Fiction, and Fallacy," *Tectonophysics*, Vol. 311, 30 September, 1999, p. 23.

- *"Deep narrow thermal plumes are unnecessary and are precluded by uplift and subsidence data. The locations and volumes of 'midplate' volcanism appear to be controlled by lithospheric architecture, stress and cracks."* Don L. Anderson, "The Thermal State of the Upper Mantle; No Role for Mantle Plumes," *Geophysical Research Letters*, Vol. 27, 15 November 2000, p. 3623.

33. *"The plume hypothesis survived largely as a belief system and had to be extensively modified to account for unexpected observations."* G. R. Foulger and J. H. Natland, "Is 'Hotspot' Volcanism a Consequence of Plate Tectonics?" *Science*, Vol. 300, 9 May 2003, p. 921.

- *"The textbook explanation for intraplate volcanism by fixed hot spots is either entirely wrong or insufficient to explain these phenomena."* Anthony A. P. Koppers and Hubert Staudigel, "Asynchronous Bends in Pacific Seamount Trails: A Case for Extensional Volcanism?" *Science*, Vol. 307, 11 February 2005, p. 906.

34. Ian McDougall claimed scientific support for this idea in 1964. [See Ian McDougall, "Potassium-Argon Ages from Lavas of the Hawaiian Islands," *Geological Society of America Bulletin*, Vol. 75, February 1964, pp. 107–128.] He dated volcanoes on seven Hawaiian islands and said that without exception they increased in age from northwest to southeast, just as would happen if the Pacific plate drifted toward the northwest at 10–15 cm/year. Why then do other volcanic chains show no such age-distance relationship? [See William R. Corliss, *Inner Earth* (Glen Arm, Maryland: The Sourcebook Project, 1991), p. 28.]

McDougall did not subject his samples to blind testing, a standard procedure for any critical test in which an investigator's biases could influence the results, knowingly or unknowingly. While geologists hardly ever consider blind testing, which is intended to ensure accuracy and objectivity, it is standard practice for critical tests within the applied sciences, such as medicine and engineering. (Blind testing is explained on page 95.) Someone should conduct a blind test to check McDougall's results.

- *"At the present time insufficient information is available on the ages of volcanoes within these chains to fully test this* [hotspot] *theory; however, what is known of the ages generally does not support a simple hot spot origin. It has been fairly well established that the age progression associated with hot spot volcanism is not present in either the Line Islands or the Marshall Islands."* Macdonald et al., *Volcanoes in the Sea*, p. 343.

PREDICTION 9: A well-designed blind test will not support McDougall's age sequences for seven Hawaiian volcanoes.

35. *"It seems that we must abandon the convenient concept of fixed hotspots as reference points for past plate motions."* Ulrich Christensen, "Fixed Hotspots Gone with the Wind," *Nature*, Vol. 391, 19 February 1998, p. 740.

"It was later shown, however, that the Pacific hotspots move relative to those in the Atlantic at rates of 1–2 cm yr^{-1}. This is less than the speed of fast-moving plates (10 cm yr^{-1}), but enough to make the hotspot frame of reference suspect." Ibid., p. 739.

36. *"The two most difficult observations to explain in terms of hotspots are the lack of subsidence since the cessation of active volcanism 30–25 million years ago and the northeast orientation of the* [Bermuda] *rise, which is nearly at right angles to the predicted motion of the North American plate."* Randall M. Richardson, "Bermuda Stretches a Point," *Nature*, Vol. 350, 25 April 1991, p. 655.

37. *"Furthermore, a plate that drifts slowly with respect to the plume source should be more easily penetrated than one that quickly sweeps past it, allowing little time for transfer of heat and melt."* Marcia McNutt, "Deep Causes of Hotspots," *Nature*, Vol. 346, 23 August 1990, pp. 701–702.

38. Don L. Anderson, "Hotspots, Basalts, and the Evolution of the Mantle," *Science*, Vol. 213, 3 July 1981, pp. 82–89.

39. Volcanic cones growing under water will, in general, be taller and steeper, because the magma rapidly solidifies, so little flows downhill. Being under water also gives that rock a buoyancy, which helps submarine volcanoes grow taller. To demonstrate this effect, support a large rock under water with one hand. Notice how the pressure on your hand increases as you slowly lift the rock out of the water.

40. Harry Hammond Hess, "Drowned Ancient Islands of the Pacific Basin," *American Journal of Science*, Vol. 244, November 1946, pp. 779–781, 790.

41. Most corals feed on photosynthesizing algae and therefore must live within the top 160 feet of the ocean.

42. Ariel A. Roth, "Coral Reef Growth," *Origins*, Vol. 6, No. 2, 1979, pp. 88–95.

43. Hess, p. 784.

44. *"It is quite common to find groups of guyots in a relatively small area with flat tops varying several hundred fathoms from one to another among the group."* Hess, p. 777.

45. *"It is rather surprising that the normal guyots* [tablemounts] *are swept clean since water currents at such depths as these are thought to be slight."* Hess, p. 778.

46. J. R. Heirtzler et al., "A Visit to the New England Seamounts," *Earth's History, Structure and Materials*, editor Brian J. Skinner (Los Altos, California: William Kaufmann, Inc., 1980), pp. 153–159.

47. See Endnote 6, page 415.

48. *"We find that guyot* [tablemount] *heights generally increase with the age of the lithosphere upon which they were emplaced, although there is a large amount of scatter."* Jacqueline Caplan-Auerbach et al., "Origin of Intraplate Volcanoes from Guyot Heights and Oceanic Paleodepth," *Journal of Geophysical Research*, Vol. 105, No. B2, 10 February 2000, p. 2679.

49. In about 1972, I met J. Tuzo Wilson, one of the founders of the plate tectonic theory and the author of the hotspot hypothesis. Wilson stated his belief that plates are driven by drag from a circulating mantle. I explained that plates would move steadily if that were the case, not irregularly as happens today. In Iceland, astride the Mid-Atlantic Ridge, such movements could be easily measured with a laser beam and interferometer. Tourists would flock to see an instrument register continuous continental movement before their eyes. Wilson seemed slightly irritated and said, "Everyone talks about making those measurements, but no one does." Wilson then said he had been considering a new mechanism that might move plates. If the Mid-Oceanic Ridge rose, plates would move away from the ridge crest by gravity sliding on a semi-molten mantle. He thought that a few feet of elevation might set plates in motion—very slowly, of course.

    Many years later, and with a debt of gratitude, I see that this is similar in several respects to the hydroplate theory: *plates sliding downhill on liquid, away from a rising Mid-Atlantic Ridge*. However, Wilson's slowly sliding plates would not have the energy or momentum needed to form mountains. His explanation also raises more questions than it answers. Why would the Mid-Atlantic Ridge rise and why can we not detect it rising today? (Iceland, while seismically active, is not moving apart.) If other portions of the Mid-Oceanic Ridge were rising, their rise would stop continental movement. Wilson was proposing a cause that might produce a known effect, which is legitimate. However, he had no independent evidence of that cause, and his explanation solved no other problems. The hydroplate theory explains past and present plate movements and solves all 26 major mysteries listed on page 109.

50. *"The types of rock found on* [western Pacific] *islands help to determine the edge of the Pacific basin. The* ***andesite line*** *has on its ocean* [eastern] *side rocks composed primarily of basalt, whereas on the other* [western] *side they are principally andesite. This has been viewed as the dividing line between oceanic and continental crusts."* [emphasis in original] L. Don Leet and Sheldon Judson, *Physical Geology*, 4th edition (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971), p. 420.

51. *"The oceanic crust has been generated almost entirely by outpourings of mafic* [basaltic] *lavas."* Nicholas M. Short, *Planetary Geology* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1975), p. 98.

    - *"The present ocean basins are characterized by the large-scale outpouring of basalt."* Dickins et al., p. 197.
    - *"Therefore, all the basalts recovered by DSDP* [Deep Sea Drilling Project] *in the northwestern Pacific are considered to be sills or lavas that are not necessarily indicative of real oceanic crust. Similar conclusions have also been reached by several authors* [references given]*."* Choi et al., p. 187.

52. Richard G. Gordon and Seth Stein, "Global Tectonics and Space Geodesy," *Science*, Vol. 256, 17 April 1992, pp. 333–341.

53. *"There is a vast need for future Oceanic Drilling Program initiatives to drill below the base of the basaltic ocean floor crust to confirm the real composition of what is currently designated oceanic crust."* Dickins et al., p. 198.

54. When heated, granite can be deformed, even extruded, under great pressure.

55. *"Every report that someone has caught sight of a plume in seismic images of the mantle has been greeted by roughly equal portions of support and derision."* Richard A. Kerr, "Another Quarry Sighted in the Great Mantle Plume Hunt?, *Science*, Vol. 328, 25 June 2010, p. 1622.

56. Bradford Clement et al., "Neotectonics: Watching the Earth Move," *Proceedings of the National Academy of Sciences*, Vol. 96, 7 December 1999, p. 14205.

- Philip England and Peter Molnar, "Active Deformation of Asia," *Science*, Vol. 278, 24 October 1997, pp. 647–650.

57. *"... the deepest quakes should be confined to a thin layer at the center of a descending slab—and the Bolivian quake was just too big* [several times too big] *to fit."* Richard A. Kerr, "Biggest Deep Quakes May Need Help," *Science*, Vol. 267, 20 January 1995, pp. 329–330.

- *"The problem is that large deep earthquakes seem to have occurred on faults larger than expected from the competing* [plate tectonic] *models of the process causing deep earthquakes."* Seth Stein, "Deep Earthquakes: A Fault Too Big?" *Science*, Vol. 268, 7 April 1995, p. 49.

58. Myron J. Block, "Surface Tension as the Cause of Benard Cells and Surface Deformation in a Liquid Film," *Nature*, Vol. 178, 22 September 1956, pp. 650–651.

59. Viscosity is a measure of flow resistance. Water has a lower viscosity than syrup. Syrup has a lower viscosity than warm tar. Warm tar has a lower viscosity than cold tar. Air has very low viscosity. Rock, having very high viscosity, will flow only if it is highly compressed in all directions and pressure differences within it are extreme.

60. Why are cliffs on earth never higher than 5 miles? Granite has a crushing strength of about 2.11×10^8 newtons/meter^2 and weighs about 26,400 newtons/meter^3. Dividing the first by the second gives 8,000 meters (or 5 miles)—the maximum height before the granite at the base of the cliff is crushed by the load above. If the entire cliff face were under water, the cliff could be about 60% higher.

61. H. W. Menard, "The Deep-Ocean Floor," *Scientific American*, Vol. 221, September 1969, pp. 126–142.

62. *"Cloos and Saunders et al. have shown that large oceanic plateaus cannot be subducted. Such thick plateaus resist subduction, jam the trench and accrete to the arc."* Sheth, p. 16.

- *"It is disturbing that the proposed, exceedingly large differential movements between continents and ocean basins (especially where much unconsolidated sediment is involved) are not obvious. ... The present simple continental-margin model diagrammed with essentially rigid slabs does not relate well to observational data, and its value as a framework for interpreting observed structures of the continental margin is diminished by the large gap between theory and observation."* Roland von Huene, "Structure of the Continental Margin and Tectonism at the Eastern Aleutian Trench," *Geological Society of America Bulletin*, Vol. 83, December 1972, p. 3625.

- *"... slippage of the oceanic crust beneath an overlying trench fill is unsupported by observational as well as theoretical data ..."* D. W. Scholl, "Peru-Chile Trench Sediments and Sea-floor Spreading," *Geological Society of America Bulletin*, Vol. 81, 1970, pp. 1339–1360.

- A. A. Meyerhoff and Howard A. Meyerhoff, "The New Global Tectonics: Major Inconsistencies," *The American Association of Petroleum Geologists Bulletin*, Vol. 56, February 1972, pp. 269–336.

- Warren Hamilton, *Tectonics of the Indonesian Region*, Geological Survey Professional Paper 1078 (Washington, D.C.: U.S. Government Printing Office, 1979), pp. 305–306.

- V. Ye. Khain, "Plate Tectonics: Achievements and Unsolved Problems," *International Geology Review*, Vol. 27, January 1985, p. 5.

63. Klaus Regenauer-Lieb et al., "The Initiation of Subduction: Criticality by Addition of Water?" *Science*, Vol. 294, 19 October 2001, p. 578.

These authors propose that ocean water may have "softened" the earth's crust, breaking it along a narrow band all around the earth.

> *Just by adding water, we obtain a narrow faultlike zone for lithosphere separation. ... but a sound quantitative description does not exist.* Ibid., p. 580.

64. Fisher and Revelle, p. 15.

65. A. V. Chekunov et al., "Difficulties of Plate Tectonics and Possible Alternative Mechanisms," *Critical Aspects of the Plate Tectonics Theory*, Vol. II, editor A. Barto-Kyriakidis (Athens, Greece: Theophrastus Publishing & Proprietary Co., 1990), pp. 397–433.

66. In 1986, Robert S. Dietz, one of the founders of the plate tectonic theory, privately explained this problem to me. With a smile, he declined my suggestion that he publish that fact.

67. *"But between 28° and 33°S the subducted Nazca plate appears to be anomalously buoyant, as it levels out at about 100 km depth and extends nearly horizontally under the continent."* John R. Booker et al., "Low Electrical Resistivity Associated with Plunging of the Nazca Flat Slab beneath Argentina," *Nature*, Vol. 429, 27 May 2004, p. 400.

68. Peter Molnar, "Continental Tectonics in the Aftermath of Plate Tectonics," *Nature*, Vol. 335, 8 September 1988, p. 133.

69. Thomas Crowder Chamberlin, "The Method of Multiple Working Hypotheses," *Journal of Geology*, Vol. 5, 1897, pp. 837–848. This famous paper was also reprinted in *Journal of Geology*, Vol. 31, 1931, pp. 155–165 and in *A Source Book in Geology: 1400–1900*, editors Kirtley F. Mather and Shirley L. Mason (Cambridge, Massachusetts: Harvard University Press, 1967), pp. 604–630.

Figure 91: Floating Tank. During a 1964 earthquake in Niigata (NEE-gat-ah), Japan, the ground turned to a dense liquidlike substance, causing this empty concrete tank to float up from just below ground level. This was the first time geologists identified the phenomenon of ***liquefaction***, which had undoubtedly occurred in other large earthquakes. Liquefaction has even lifted empty tanks up through asphalt pavement[1] and raised pipelines and logs out of the ground.[2] In other words, buried objects that are less dense than surrounding soil rise buoyantly when that soil liquefies. ***What causes liquefaction? What would happen to buried animals and plants in temporarily liquefied sediments?***

Figure 92: Sinking Buildings. During the above earthquake, building number 3 sank in and tipped 22 degrees as the ground partially liquefied. Another building, seen at the red arrow, tipped almost 70 degrees, making its roof nearly vertical.

Liquefaction: The Origin of Strata and Layered Fossils

SUMMARY: Liquefaction—associated with quicksand, earthquakes, and wave action—played a major role in rapidly sorting sediments, plants, and animals during the flood. Indeed, the worldwide presence of sorted fossils and sedimentary layers shows that a gigantic global flood occurred. Massive liquefaction also left other diagnostic features such as cross-bedded sandstone, plumes, mounds, and fossilized footprints.

Sedimentary rocks are distinguished by sharply-defined layers, called ***strata***. Fossils almost always lie within such layers. Fossils and strata, seen globally, have many unusual characteristics. A little-known and poorly-understood phenomenon called ***liquefaction*** (lik-wuh-FAK-shun) explains these characteristics. It also explains why we do not see fossils and strata forming on a large scale today.

We will first consider several common situations that cause liquefaction on a small scale. After understanding why liquefaction occurs, we will see that a global flood would produce liquefaction—and these vast, sharply defined layers—worldwide. Finally, a review of other unusual features in the earth's crust will confirm that global liquefaction did occur.

Examples of Liquefaction

Quicksand. Quicksand is a simple example of liquefaction. Spring-fed water flowing up through sand creates quicksand. The upward flowing water lifts the sand grains very slightly, surrounding each grain with a thin film of water. This cushioning gives quicksand, and other liquefied sediments, a spongy, fluidlike texture.[3]

Contrary to popular belief and Hollywood films, a person or animal stepping into deep quicksand will not sink out of sight forever. They will quickly sink in—but only so far. Then they will be lifted, or buoyed up, by a force equal to the weight of the sand and water displaced. The more they sink in, the greater the lifting force. Buoyancy forces also lift a person floating in a swimming pool. However, quicksand's buoyancy is almost twice that of water, because the weight of the displaced sand and water is almost twice that of water alone. As we will see, fluidlike sediments produced a buoyancy that largely explains why fossils show a degree of vertical sorting and why sedimentary rocks all over the world are typically so sharply layered.

Earthquakes. Liquefaction is frequently seen during, and even minutes after, earthquakes. During the Alaskan Good Friday earthquake of 1964, liquefaction caused most of the destruction within Anchorage, Alaska. Much of the damage during the San Francisco earthquake of 1989 resulted from liquefaction. Although geologists can describe the consequences of liquefaction, few seem to understand why it happens. Levin describes it as follows:

> *Often during earthquakes, fine-grained water-saturated sediments may lose their former strength and form into a thick mobile mudlike material. The process is called liquefaction. The liquefied sediment not only moves about beneath the surface but may also rise through fissures and "erupt" as mud boils and mud "volcanoes."*[4]

Strahler says that in a severe earthquake:

> *... the ground shaking reduces the strength of earth material on which heavy structures rest. Parts of many major cities, particularly port cities, have been built on naturally occurring bodies of soft, unconsolidated clay-rich sediment (such as the delta deposits of a river) or on filled areas in which large amounts of loose earth materials have been dumped to build up the land level. These water-saturated deposits*

often experience a change in property known as liquefaction when shaken by an earthquake. The material loses strength to the degree that it becomes a highly fluid mud, incapable of supporting buildings, which show severe tilting or collapse.[5]

These are accurate descriptions of liquefaction, but they do not explain why it occurs. When we understand the mechanics of liquefaction, we will see that liquefaction once occurred continually and globally for weeks or months during the flood.

Visualize a box filled with many rocks. If the box were so full that you could not quite close its lid, you would shake the box, so the rocks settled into a denser packing arrangement. Now repeat this thought experiment, only this time all space between the rocks is filled with water. As you shake the box and the rocks settle into a denser arrangement, water will be forced up to the top by the “falling” rocks. If the box is tall, many rocks will settle, so the force of the rising water will increase. The taller column of rocks will also provide greater resistance to the upward flow, increasing the water’s pressure even more. Water pressure will exert a lifting force on the rocks for as long as the upward flow continues.[6]

This is similar to an earthquake in a region having loose, water-saturated sediments. Once upward-flowing water lifts the topmost sediments, weight is removed from the sediments below. The upward flowing water can then lift the second level of sediments. This, in turn, unburdens the particles beneath them, etc. The particles are no longer in solid-to-solid contact, but are suspended in and lubricated by water, so they can easily slip by each other.

Wave-Loading—A Small Example. You are walking barefooted along the beach. As each wave comes in, water rises from the bottom of your feet to your knees. When the wave returns to the sea, the sand beneath your feet becomes loose and mushy. As your feet sink in, walking becomes difficult. This temporarily mushy sand, familiar to most of us, is a small example of liquefaction.

Why does this happen? At the height of each wave, water is forced down into the sand. As the wave returns to the ocean, the water forced into the sand gushes back out. In doing so, it lifts the topmost sand particles, forming the mushy mixture.

If you submerged yourself face down under breaking waves but just above the seafloor, you would see sand particles rise slightly above the floor as each wave trough approached. Water just above the sand floor also moves back and forth horizontally with each wave cycle. Fortunately, the current moves toward the beach as liquefaction lifts sand particles above the floor. So, sand particles are continually nudged upslope, toward the beach. If this did not happen, beaches would not be sandy.[7]

Wave-Loading—A Medium-Sized Example. During a storm, as a large wave passes over a pipe buried offshore, water pressure increases above it. This forces more water into the porous sediments surrounding the pipe. As the wave peak passes and the wave trough approaches, pressure over the pipe drops, and the stored, high-pressure water in the sediments flows upward. This lifts the sediments and causes liquefaction. The buried pipe, “floating” upward, sometimes breaks.[8]

Wave-Loading—A Large Example. On 18 November 1929, an earthquake struck the continental slope off the coast of Newfoundland. Minutes later, transatlantic phone cables began breaking sequentially, farther and farther downslope, away from the epicenter. Twelve cables were snapped in a total of 28 places. Exact times and locations were recorded for each break. Investigators suggested that a 60-mile-per-hour current of muddy water swept 400 miles down the continental slope from the earthquake’s epicenter, snapping the cables.[9]

This event intrigued geologists. If thick muddy flows could travel that fast and far, they could erode long submarine canyons and do other geological work. Such hypothetical flows, called *turbidity currents*, now constitute a large field of study within geology. However, there are several problems with this 60-mile-per-hour, turbidity-current explanation:

- water resistance prevents even conventional nuclear-powered submarines from traveling nearly that fast,
- the ocean floor in that area off the coast of Newfoundland slopes less than 2 degrees,
- some broken cables were upslope from the earthquake’s epicenter, and
- nothing approaching a 400-mile landslide has ever been observed—let alone on a 2 degree slope or underwater.

Instead, a large wave, a tsunami,[10] would have rapidly radiated out from the earthquake’s epicenter. Below the expanding wave, sediments on the seafloor would have partially liquefied, allowing them to flow downhill.[11] This relatively slow flow of liquefied sediments loaded and eventually snapped only those cable segments that were perpendicular to the downhill flow. Other details support this explanation.

We can now see that ***liquefaction occurs whenever water is forced up through loose sediments with enough pressure to lift the topmost sedimentary particles.*** Now let’s look at a gigantic example of liquefaction, caused by many weeks of global wave-loading.

Liquefaction During the Flood

The flooded earth had enormous, unimpeded waves—not just normal waves, but waves generated by undulating

Figure 93: Liquefaction Demonstration. When the wooden blocks at the top of the horizontal beam are removed, the beam can rock like a teeter-totter. As the far end of the beam is tipped up, water flows from the far tank down through the pipe and up into a container at the left, which holds a mixture of sediments. Once liquefaction begins, sedimentary particles fall or rise relative to each other, sorting themselves into layers, each having particles with similar size, shape, and density. Buried objects with the density of plants and dead animals float up through the sediments—*until they reach a liquefaction lens*. The same would happen to plants and animals buried during the flood.

Their sorting and later fossilization might give the mistaken impression that organisms buried and fossilized in higher layers evolved millions of years after lower organisms. A school of thought, with appealing philosophical implications for some, would arise that claimed changes in living things were simply a matter of time. With so many complex differences among protons, peanuts, parrots, and people, eons of time must have elapsed. With so much time available, many other strange observations might be explained. Some would try to explain even the origin of the universe, including space, time, and matter, using this faulty, unscientific school of thought. Of course, these ideas could not be demonstrated, as liquefaction can be, because too much time would be needed.

hydroplates. (The reasons for vibrating or fluttering hydroplates is explained on page 286.) Also, the flooded earth had no coastlines, so friction did not destroy waves at the beach. Instead, waves traveled around the earth, often reinforcing other waves.

With each wave cycle during the flood, water was forced down into and up out of the seafloor. Under wave peaks, water was forced, not only down into the sediments below, but laterally through the sediments, in the direction of the temporary pressure minimum that was simultaneously occurring one half wavelength away, under the wave trough. Later, when the wave trough arrives, both effects are reversed, producing upward flowing water. Water almost completely surrounded each sediment particle deposited on the ocean floor during the flood, giving each particle maximum buoyancy. Therefore, sediments were loosely packed and held much water.

Half the time during the flood phase, water was pushed down into the sediments, stored for the other (discharge) half-cycle in which water flowed upward. During discharge, liquefaction occurred if the water's upward velocity exceeded a specific minimum. When it did, interesting things happened.

A thick, horizontal layer of sediments provides high resistance to upward flowing water, because the water must flow through tiny, twisting channels between particles. Great pressure is needed to force water up through such layers. During liquefaction, falling sediments and high waves provide the required high pressure.

If water flows up through a bed of sediments with enough velocity, water pressure will lift and support each sedimentary particle. Rather than thinking of water *flowing up* through the sediments, think of the sediments *falling down* through a very long column of water. Slight differences in density, size, or shape of adjacent particles will cause them to fall at slightly different speeds. Their relative positions will change until the water's velocity drops below a certain value or until nearly identical particles are adjacent to each other, so they fall at the same speed. ***This sorting produces the sharply-defined layering typical in sedimentary rocks.*** In other words, vast, sharply-defined, worldwide layers are unmistakable characteristics of liquefaction and a global flood.

Such sorting also explains why sudden local floods sometimes produce horizontal strata on a small scale.[12] Liquefaction can occur as mud settles through the water or as water is forced up through mud.

To understand liquefaction better, I built the simple apparatus shown in Figure 93. The 10-foot-long metal beam pivoted like a teeter-totter from the top of the 4-legged stand. Suspended from each end of the beam was a 5-gallon container, one containing water and one containing a mixture of different sediments. A 10-foot-long pipe connected the mouths of the two containers.

I lifted the water tank by gently inclining the metal beam. Water flowed down through the pipe and up through the bed of mixed sediments in the other tank. If the flow velocity exceeded a very low threshold,[13] the sediments swelled slightly as liquefaction began. Buried objects with the density of a dead animal or plant floated to the top of the tank. Once water started to overflow the sediment tank, the metal beam had to be tipped, so the water flowed back into the water tank. After repeating this cycle for 10 or 15 minutes, the mixture of sediments became visibly layered. The more cycles, the sharper the boundaries between sedimentary layers became.

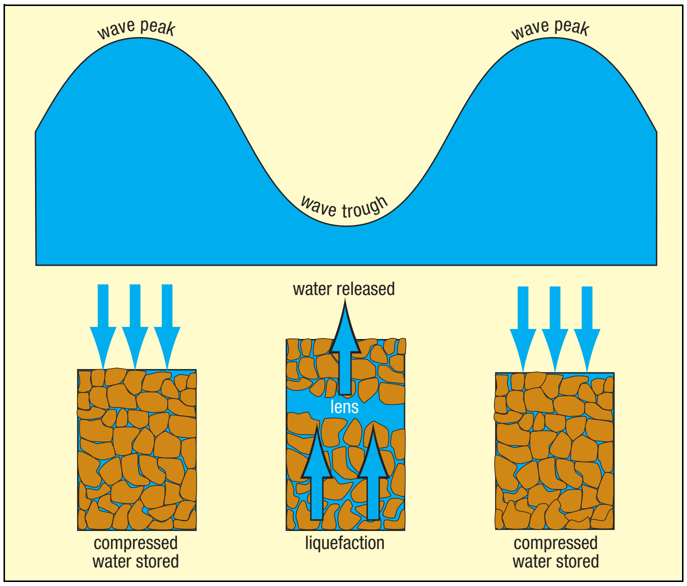


Figure 94: Liquefaction and Water Lenses. The wave cycle begins at the left with water being forced down into the seafloor. As the wave trough approaches, that compressed water is released. Water then flows up through the seafloor, lifting the sediments, starting at the top of the sedimentary column. During liquefaction, denser particles sink and lighter particles (and dead organisms, soon to become fossils) float up—***until a liquefaction lens is encountered***. Lenses of water form along nearly horizontal paths if the sediments below those horizontal paths are more permeable than those above, so more water flows up into each lens than out through its roof. Sedimentary particles and dead organisms buried in the sediments were sorted and resorted into vast, thin layers.

In an unpublished experiment at Loma Linda University, a dead bird, mammal, reptile, and amphibian were placed in an open water tank. Their buoyancy in the days following death depended on their density while living, the build-up and leakage of gases from their decaying bodies, the absorption or loss of water by their bodies, and other factors. That experiment showed that the natural order of settling following death was, from the bottom up, amphibian, reptile, mammal, and finally bird.[14] ***This order of relative buoyancy correlates closely with "the evolutionary order," but, of course, evolution did not cause it.*** Other factors, also influencing burial order at each geographical location, were: liquefaction lenses, which animals were living in the same region, and each animal's mobility before the flood overtook it.

Water Lenses

An important phenomenon, which will be called *lensing*, was observed in the sediment tank. Some layers were more porous and permeable than others. If water flowed more easily up through one sedimentary layer than the layer directly above, a lens of water accumulated between them. Multiple lenses could form simultaneously, one a short distance above the other. Water in these nearly horizontal lenses always flowed uphill.[15]

Throughout the flood, water lenses formed and collapsed with each wave cycle. [See Figure 94.] During liquefaction, organisms floated up into the lens directly above. Water's buoyant force is only about half that of liquefied sediments, so a water lens was less able to lift dead organisms into the denser sedimentary layer directly above the lens. In each geographical region, organisms with similar size, shape, and density (usually members of the same species) often ended up in the same lens. There they were swept by currents for many miles along those nearly horizontal channels.[16]

Coal. Vegetation lifted by liquefaction into a water lens spread out and formed a buoyant mat pressed up against the lens' roof. Vegetation mats, composed of thin, flat, relatively impermeable sheets, such as intertwined leaves, ferns, grass, and wood fragments, could not push through that roof. These mats also prevented sedimentary grains in the roof from falling to the floor of the lens.

Each vegetation mat acted as a *check valve*; that is, during the portion of the wave cycle when water flowed upward, the mat reduced the flow upward through the lens' roof, so the volume of lenses grew. During the other half of the wave cycle, when water flowed downward, the mat was pushed away from the roof allowing new water to enter the lens. Therefore, water lenses with vegetation mats thickened and expanded during the flood. *Vegetation mats became today's coal seams, some of which can be traced over 100,000 square miles.*

Cyclothems. Sometimes, 50 or more coal seams are stacked one above the other with a special sequence of sedimentary layers separating the coal layers. A typical sequence between coal seams (from bottom to top) is sandstone, shale, limestone, and finally denser clay graded up to finer clay. These cyclic patterns, called *cyclothems*, are in the order one would expect from liquefaction: denser, rounder, larger sedimentary particles at the bottom and less dense, flatter, finer sedimentary particles at the top. Cyclothem layers worldwide generally have the same relative order, although specific layers may be absent.

Fossils. When a liquefaction lens slowly collapsed for the last time, plants and small animals were trapped, flattened, and preserved between the lens' roof and floor.

Even footprints, ripple marks, and worm burrows were preserved at the interface *if no further liquefaction occurred there.* A particular lens might stay open through many wave cycles, long after the lens' floor last liquefied. At other places, the last (and most massive) liquefaction event was caused by the powerful compression event. Footprints formed in those huge lenses were protected, because no further liquefaction occurred.

Fossils, sandwiched between thin layers, were often spread over a wide surface, which geologists call a ***horizon.*** Thousands of years later, these horizons gave some investigators the false impression that those animals and plants died long after layers below were deposited and long before layers above were deposited. A layer with many fossils covering a vast area was misinterpreted as an extinction event or a boundary between geologic periods.

Early geologists noticed that similar fossils were often in two closely spaced horizons. It seemed obvious that the subtle differences between each horizon's fossils must have developed during the assumed long time interval between each horizon. Different species names were given to these organisms, although nothing was known about their inability to interbreed—the true criterion for identifying species. Later, in 1859, Charles Darwin claimed that a previously recognized mechanism, natural selection, accounted for the evolution of those subtle differences. ***However, if sorting by liquefaction produced those differences, Darwin's explanation is irrelevant.***

Two Faulty "Principles." Early geologists learned that fossils found above or below another type of fossil in one location were almost always in that same relative position, even many miles away. This led to the belief that the lower organisms lived, died, and were buried before the upper organisms. Much time supposedly elapsed between the two burials, because today sediments are usually deposited very slowly. Each horizon became associated with a specific time, perhaps millions of years earlier (or later) than the horizon above (or below) it. Finding so many examples of "the proper sequence" convinced early geologists they had found a new principle of interpretation, which they soon called *the principle of superposition.*

Evolutionary geology is built upon this and one other "principle," *the principle of uniformitarianism,* which states that all geological features can be explained by today's processes acting at present rates.[17] For example, today, rivers deposit sediments at river deltas. Over millions of years, thick layers of sediments would accumulate. This might explain the sedimentary rocks we now see.

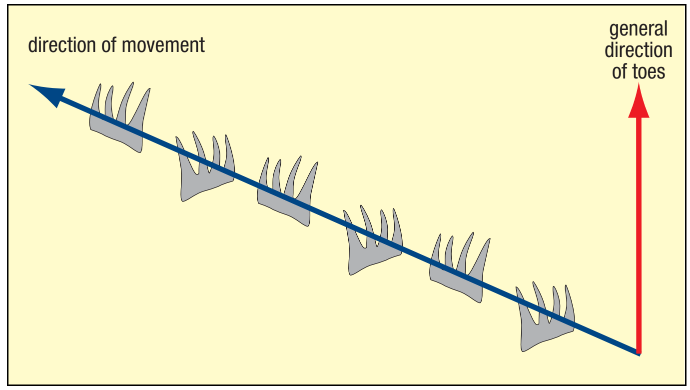


Figure 95: Drifting Footprints. Hundreds of footprints, along 44 different trackways, were discovered in cross-bedded sandstone layers of northern Arizona. Surprisingly, movement was in one direction, but the toes pointed in another direction—sometimes at almost right angles. These and other details made it clear that the animals, probably amphibians, were walking on the sand bottom of some type of lateral-flowing stream.[18] This contradicts the standard story that the cross-bedded sandstone layers were once ancient sand dunes. Almost all trackways moved uphill. Obviously, thick sediments must have *gently and quickly* blanketed the footprints to prevent their erosion—but how? This is a vexing problem for evolutionists.

How could this happen? Today, salamanders buried in muddy lake bottoms can "breathe" through their skins and hibernate for months. During liquefaction, salamander-like animals floated up into a liquefaction lens, where water always flows uphill.[15] Footprints could be made on the lens' floor for minutes, as long as the lens stayed open and no more liquefaction occurred to obscure the footprints. When the water lens slowly drained and its roof settled onto the floor, footprints and other marks were firmly protected.

After considering liquefaction, both "principles" appear seriously flawed. Within a tall liquefaction column, sediments were re-sorted and deposited almost simultaneously by a large-scale process not going on today. (These "principles" are really assumptions. Calling them "principles" gives them undeserved credibility.)

Testing the Theories

How can we compare and test the two conflicting explanations: liquefaction versus uniformitarianism and the principle of superposition over billions of years?

1. A sedimentary layer often spans hundreds of thousands of square miles. (River deltas, where sediment thicknesses are greatest, are a tiny fraction of that area.) Liquefaction during a global flood would account for the vast expanse of these thick layers. Current processes and eons of time do not.

2. One thick, extensive sedimentary layer has remarkable purity. The St. Peter sandstone, spanning about 500,000 square miles in the central United States, is composed of almost pure quartz, similar to sand on a white beach. It is hard to imagine how any geologic process, other than global liquefaction, could achieve this degree of purity over such a wide area.[19] Almost all other processes involve mixing, which destroys purity.

3. Today, sediments are usually deposited in and by rivers—along a narrow line. However, individual sedimentary rock layers are spread over large geographical areas, not along narrow, streamlike paths. Liquefaction during the flood acted on all sediments and sorted them over wide areas in weeks or months.

4. Sedimentary layers are usually thin, sharply defined, parallel, and horizontal. They are often stacked vertically for thousands of feet. If layers had been laid down thousands of years apart, surface erosion would have destroyed this parallelism. Liquefaction, *especially liquefaction lenses*, explain these sharp boundaries.

5. Sometimes adjacent, parallel layers contain such different fossils that evolutionists conclude that those layers were deposited millions of years apart, but the lack of erosion shows that the layers were deposited rapidly. Liquefaction resolves this paradox.

6. Many communities around the world get their water from deep, permeable, water-filled, sedimentary layers called *aquifers*. When water drains from an aquifer, the layer collapses, unable to support the overlying rock layers. A collapsed aquifer cannot be replenished, so how were aquifers originally filled?

   Almost all sorted sediments were deposited within water, so aquifers contained water when they first formed. Today, with aquifers steadily collapsing globally, one must question claims that they formed millions of year ago. As described in this chapter, liquefaction sorted sediments relatively recently.

7. Varves are extremely thin layers (typically 0.004 inch or 0.1 mm), which evolutionists claim are laid down *annually* in lakes. By counting varves, evolutionists believe that time can be measured. The Green River Formation of Wyoming, Colorado, and Utah, a classic varve region, contains billions of flattened, paper-thin, fossilized fish; thousands were buried and fossilized in the act of swallowing other fish. [See Figure 10 on page 10.] Obviously, burial was sudden. Fish, lying on the bottom of a lake for years, would decay or disintegrate long before enough varves could bury them. (Besides, dead fish typically float, deteriorate, and then sink.) Most fish fossilized in varves show exquisite detail and are pressed to the thinness of a piece of paper, as if they had been compressed in a collapsing liquefaction lens.

   Also, varves are too uniform, show almost no erosion, and are deposited over wider areas than where streams enter lakes—where most lake deposits occur. Liquefaction best explains these varves.

> **PREDICTION 10:** Corings taken anywhere in the bottom of any large lake will not show laminations as thin, parallel, and extensive as the varves of the 42,000-square-mile Green River Formation, perhaps the world's best known varve region.

8. In almost all cases, dead animals and plants quickly decay, are eaten, or are destroyed by the elements. Preservation as fossils requires rapid burial in sediments thick enough to preserve bodily forms. This rarely happens today. When it does, as in an avalanche or a volcanic eruption, the blanketing layers are not uniform in thickness, do not span tens of thousands of square miles, and rarely are water-deposited. (Water is needed if cementing is to occur.) Liquefaction provides a mechanism for rapid, but gentle, burial and preservation of trillions of fossils in water-saturated sedimentary layers—including fossilized footprints, worm burrows, ripple marks, and jellyfish. [See also **"Rapid Burial"** on page 11.]

   Thousands of fossilized jellyfish have been found in central Wisconsin, sorted to some degree by size into at least seven layers (spanning 10 vertical feet) of coarse-grained sediments.[20] Evolutionists admit that a fossilized jellyfish is exceedingly rare, so finding thousands of them in what was coarse, abrasive sand is almost unbelievable. Claiming that it occurred during storms at the same location on seven different occasions, but over a million years, is ridiculous.

   What happened? Multiple liquefaction lenses, vertically aligned during the last liquefaction cycle, trapped delicate animals such as jellyfish and preserved them as the roof of each water lens gently settled onto its floor.

9. Many fossilized fish are flattened between extremely thin sedimentary layers. This requires squeezing the fish to the thinness of a sheet of paper without damaging the thin sedimentary layers directly above and below. How could this happen?

   Because dead fish usually float, something must have pressed the fish onto the seafloor. Even if tons of sediments were dumped through the water and on top of the fish, thin layers would not lie above and below the fish. Besides, it would take many thin layers, not one, to complete the burial. Today's processes seem inadequate.

   However, liquefaction would sort sediments into thousands of thin layers. During each wave cycle, liquefaction lenses would simultaneously form at various depths in the sedimentary column. Fish that floated up into a water lens would soon be flattened when the lens finally drained.

10. Sediments, such as sand and clay, are produced by eroding crystalline rock, such as granite or basalt. Sedimentary rocks are cemented sediments. On the continents, they average more than a mile in thickness. Today, two-thirds of continental *surface* rocks are sedimentary; one-third is crystalline.

    Was crystalline rock, eroded *at the earth's surface*, the source of the original sediments? If it was, the first eroded sediments would blanket crystalline rock and prevent that rock from producing additional sediments. The more sediments produced, the fewer the sediments that could be produced. Exposed crystalline rock would disappear long before all today's sediments and sedimentary rocks could form. Transporting those new sediments, often great distances, is another difficulty. Clearly, most sediments did not come from the earth's surface. They must have come from powerful subsurface erosion, as explained by the hydroplate theory, when high-velocity waters escaped from the subterranean chamber.

11. Some limestone layers are hundreds of feet thick. The standard geological explanation is that regions with those deposits were covered by incredibly limy (alkaline) water for millions of years—a toxic condition not found anywhere on earth today. Liquefaction, on the other hand, would have quickly sorted limestone particles into vast sheets. [See **"The Origin of Limestone"** on pages 229–235.]

12. Conventional geology claims that coal layers, sometimes more than 100 feet thick, formed from 1,000-foot-thick layers of undecayed vegetation. Nowhere do we see that happening today. However, liquefaction would have quickly gathered vegetation buried during the early stages of the flood into thick layers, which would become coal after the confined, oxygen-free heating of the compression event.

13. Coal layers usually lie above and below *cyclothems*. Some cyclothems extend over 100,000 square miles. If coal accumulated in peat bogs over millions of years (the standard explanation), why don't we see such vast swamps today? Why would a peat bog form a coal layer that was later buried by layers of sandstone, shale, limestone, and clay (generally in that ascending order)? Why would this sequence be found worldwide and sometimes be repeated vertically 50 or more times? To deposit a different sedimentary layer would require a change in environment and/or elevation—and, of course, millions of years. Liquefaction provides a simple, complete explanation.

14. Fossils are sorted vertically to some degree. Evolutionists attribute this to macroevolution. No known mechanism will cause macroevolution, and many evidences refute macroevolution. [See pages 5–24.] Liquefaction, an understood mechanism, would tend to sort animals and plants. If liquefaction occurred, one would expect some exceptions to this sorting order, but if macroevolution happened, no exceptions to the evolutionary order should be found. Many exceptions exist. [See **"Out-of-Place Fossils"** on page 12.]

15. Animals are directly or indirectly dependent on plants for food. However, geological formations frequently contain fossilized animals *without* fossilized plants.[21] How could the animals have survived? Evidently, liquefaction sorted and separated these animals and plants before fossilization occurred.

16. Meteorites are rarely found in deep sedimentary rock. [See **"Shallow Meteorites"** on page 40.] This is consistent only with rapidly deposited sediments.

Liquefaction During the Compression Event

While liquefaction operated during the flood phase, it acted massively once during the compression event, at the end of the continental-drift phase. [See pages 109–147.]

Visualize a deck of cards sliding across a table. Friction from the table slows the bottom card. That card, in turn, applies a decelerating force on the second card from the bottom. If no card slips, the entire deck, including the top card, will decelerate as a unit. But if a lubricant somehow built up between any two adjacent cards, the cards above the lubricated layer would slide over the decelerating cards below.

Likewise, each decelerating granite hydroplate acted on the bottom sedimentary layer riding on the hydroplate. Sedimentary layers, from bottom to top, acted in turn to decelerate the topmost layers. As each water-saturated layer decelerated, it was severely compressed—similar to suddenly squeezing a wet sponge. The sediments, forced into a denser packing arrangement, released water. Sedimentary particles were crushed or broken, so their fragments filled the spaces between particles, releasing even more water. The freed water, then forced up through the sediments, caused massive liquefaction. As the

Figure 96: Transported Block. This large block, made of a very hard, dense material called *quartzite*, was lifted hundreds of feet, transported horizontally, and deposited on layers which, at the time, were soft mud. Other mud layers then blanketed the block. Notice how the layers were deformed below the lower right corner and above the upper left corner. The easiest way to lift and transport such a heavy block is in a liquefied (and therefore, very buoyant), sand/mud/water mixture. The location of the block relative to its source is shown in Figure 97.[22]

Apparently, this quartzite block was transported in a sliding sedimentary slurry above the Cambrian-Precambrian interface during the compression event. Peak decelerations occurred in the layers below the sliding slurry. This included the quartzite layer. The sudden deceleration and compression tipped those layers up, allowing them to be beveled off by the overriding layers. (Evolutionists explain the flat Cambrian-Precambrian interface as a result of hundreds of millions of years of erosion.)

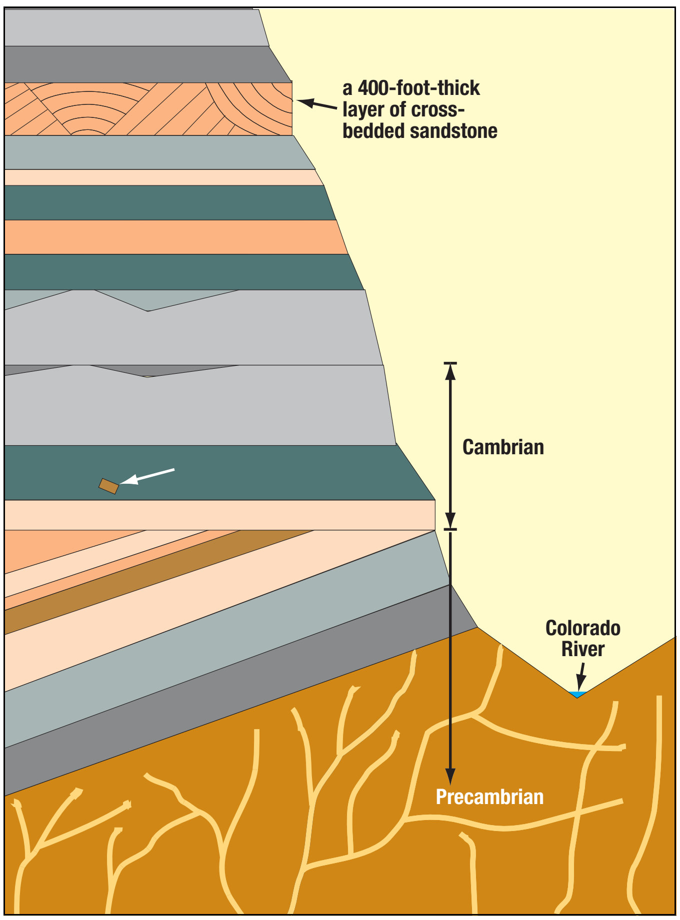


Figure 97: Grand Canyon Cross Section. The tipped and beveled layers are part of the Precambrian. The beveled plane, at the Cambrian-Precambrian interface, is sometimes called *The Great Unconformity*. A similar, but much smaller, example of tipped and beveled layers is shown in the cross-bedded sandstone in Figure 98. Beveling implies relative motion. Near the top of the Grand Canyon is a 400-foot-thick layer of cross-bedded sandstone. The white arrow points to the quartzite block shown in Figure 96.

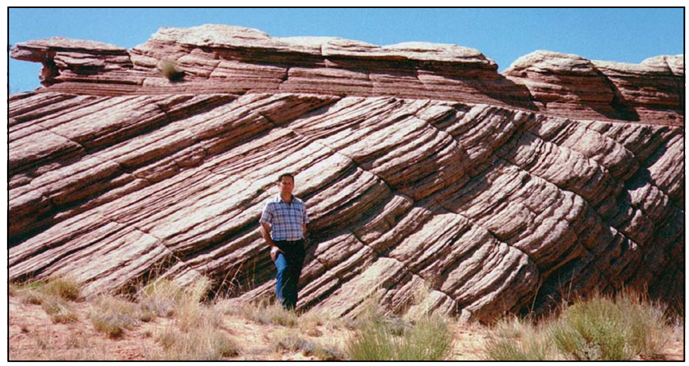


Figure 98: Cross-Bedded Sandstone. Dry sand can have a maximum slope of only 32 degrees. Cross-bedded sandstone, such as shown here, often has much greater slopes. Therefore, this sand, confined between layers that have since eroded, was probably wet when the layers tipped.

sedimentary layers decelerated and compressed, they became more and more fluid. Eventually, some layers were so fluid that slippage occurred above them, as in our deck of cards. Below that level, extreme compression and liquefaction caused fossils to float up and collect at this watery level where sliding was taking place.

The lowest slippage level was the Cambrian-Precambrian interface. Fossils are found almost exclusively above this interface. Therefore, evolutionists interpret the Precambrian as about 90% of all geologic time—a vast period, they believe, before life evolved. A few feet above this global interface are found representatives of all animal and plant phyla. [See **"Missing Trunk"** on page 12.] This presents a huge problem for evolutionists: How and why did so much life evolve so fast—a phenomenon evolutionists call "the Cambrian explosion"? Again, evolutionists are unaware of global and massive liquefaction and mistakenly measure time by sedimentary layers and their fossils.

In the Grand Canyon, the Cambrian-Precambrian interface is an almost flat, horizontal surface exposed for

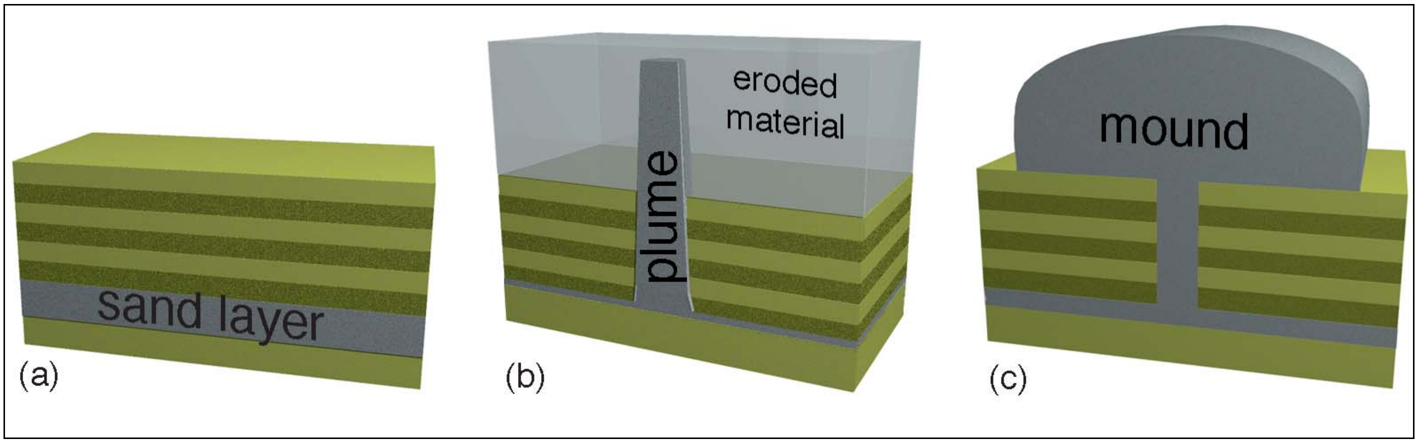


Figure 99: Formation of Liquefaction Plumes and Mounds. (a) During the flood phase, global liquefaction sorted water-saturated sediments into nearly horizontal layers. (b) During the compression event, massive liquefaction caused less dense sand/water mixtures to float up as plumes, through denser overlying layers. (Figure 59 on page 126 shows a similar phenomenon.) Later, if surface layers were not cemented as well as the sandstone plume, the surface layers could erode away, leaving the plume exposed. (c) If a plume spilled out on the ground, a mound would form.

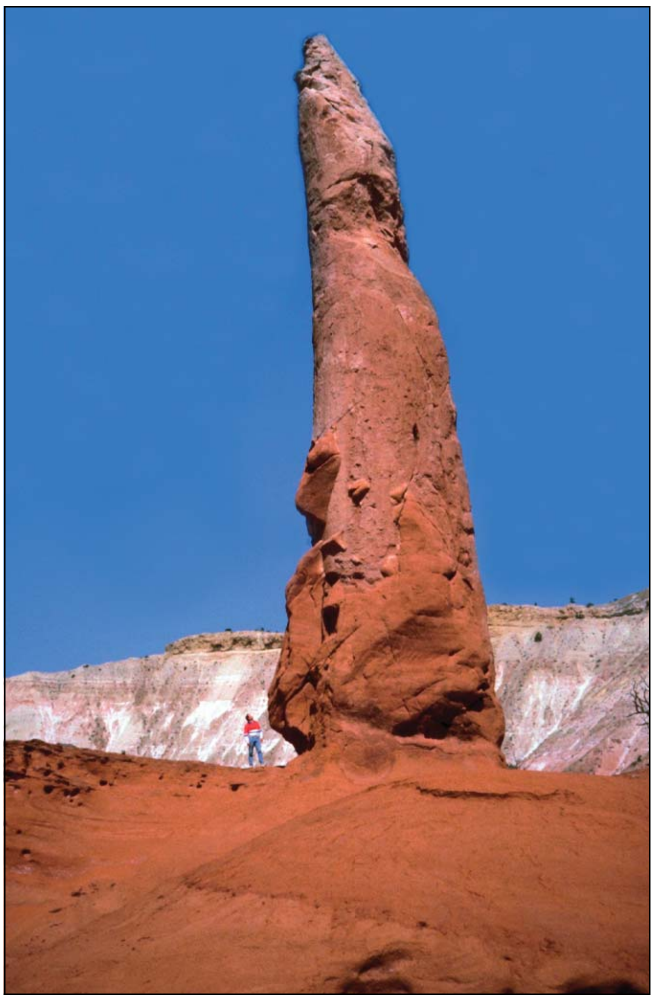


Figure 100: Liquefaction Plume 1. A hundred of these plumes are found in Kodachrome Basin State Reserve in south-central Utah, 10 miles east of Bryce Canyon National Park. I am standing at the bottom left of this tall plume.

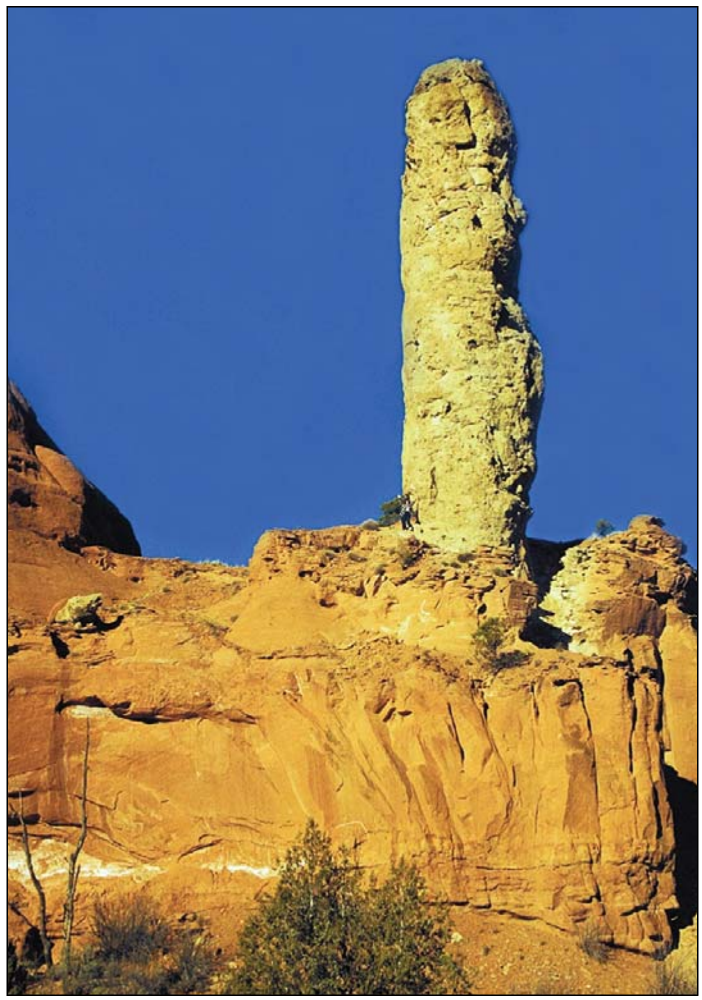


Figure 101: Liquefaction Plume 2. This plume can be traced down several hundred feet through the large rock in the bottom half of the picture. The plume grew up from a known horizontal sandstone layer that has identical chemical characteristics.[23] After the plume pushed upward, cementing took place, with the sandstone plume becoming harder than the material it penetrated. The softer layers surrounding the plume later eroded away, leaving the plume exposed. [See Figure 99b.] Notice the person waving at the bottom left of this plume.

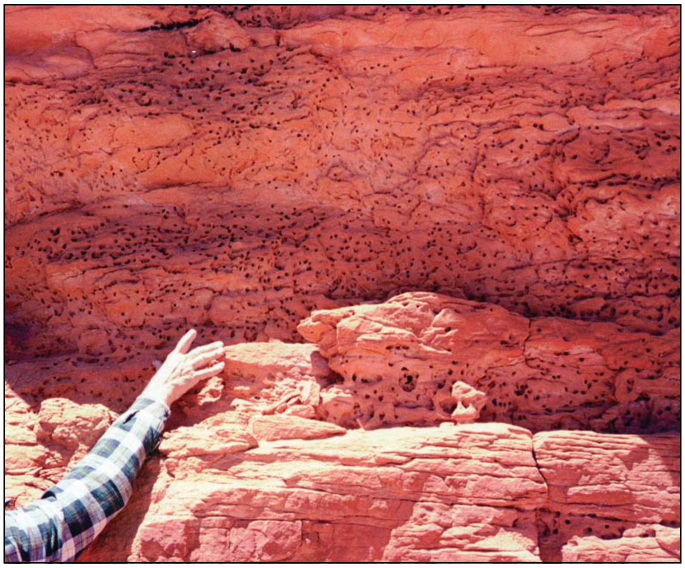


Figure 102: Small Water Vents. These water vents are smaller than a pebble; others, such as those in Ayers Rock, are larger than a car. Water vents are quite different from the shallow and smooth bowl-like depressions which wind and rain erosion produced.

66 miles above the Colorado River. Layers above the Cambrian-Precambrian interface are generally horizontal, but layers below are tipped at large angles, and their tipped edges are beveled off horizontally. Evidently, as slippage began during the compression event, layers below the slippage plane continued to compress to the point where they buckled. The sliding sedimentary block above the slippage plane beveled off the still soft layers that were being increasingly tipped by horizontal compression below the slippage plane.

Evolutionists have a different interpretation. They believe tipped, Precambrian layers are remnants of a former mountain range, because mountains today often have steeply tipped layers. [See Figure 49 on page 116.] The tipped layers are horizontally beveled, so evolutionists say that the top of the mountain must have eroded away. That, of course, would take a long time. Millions of years are also needed so seas could flood the area, because fossils of sea-bottom life are found just above the Cambrian-Precambrian interface. Within overlying layers, other fossils are found which required different environments, such as deserts and lagoons, so obviously, even more time is needed. (Unlimited time makes the nearly impossible seem possible—if you don't think too much about mechanisms.)

Cross-Bedded Sandstone. Sand layers had the greatest water content, because sand grains are somewhat rounded, leaving relatively large gaps for water between the particles. Therefore, sand layers were the most fluid during the massive liquefaction that accompanied the compression event. Deceleration forced the sand forward,

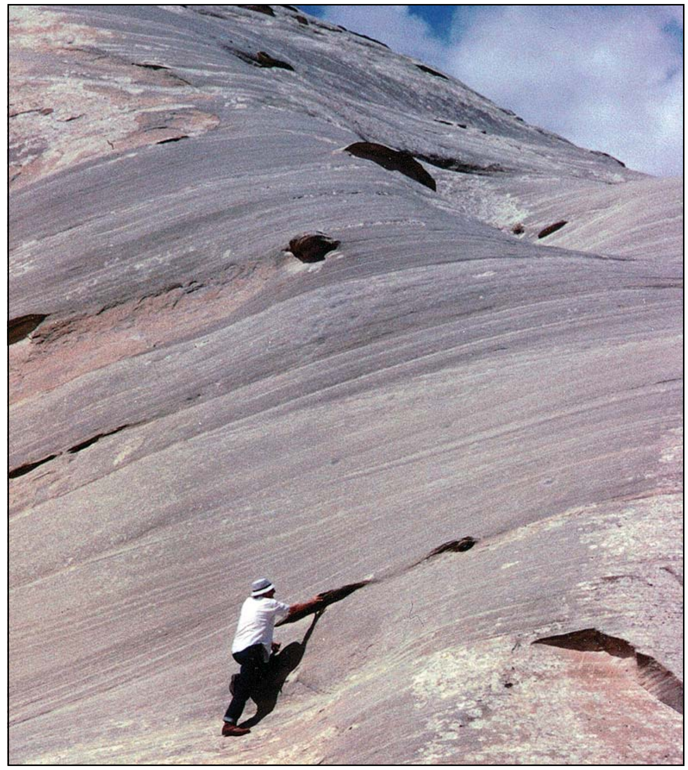


Figure 103: Medium-Sized Water Vents. Geology professor Dr. Douglas A. Block points to one of many holes in the side of a huge liquefaction mound in southern Utah. If these holes were places where rock was weakly cemented, similar holes should be on the tops of mounds. Instead, the tops are smooth. Cementing in mounds and cross-bedded sandstone is remarkably uniform and hard, showing that the cement was uniformly dissolved throughout water that saturated the sand.

displacing the water backward. Horizontally compressed sand layers would have slid, tipped, buckled, and beveled individual layers and blocks of layers, forming what is known as cross-bedded sandstone. [See Figure 98.]

Liquefaction Plumes and Mounds. The large water content of liquefied sand layers (40%) would have made them quite buoyant. Whenever a low-density, fluid layer (such as a water-sand mixture) underlies a denser, liquefied layer, the lighter fluid, if shaken, will float up in plumes through the denser fluid. Sand plumes that penetrated overlying layers are seen in many places on earth. [See Figures 99–101.]

Some plumes, especially those rising from thick, laterally extensive sand layers, spilled onto the earth's surface. This spilling-out resembled volcanic action, except water-saturated sand erupted, not lava. Small ***liquefaction mounds***, as they will be called, appear when liquefaction occurs during earthquakes.[24] [See Levin's description on page 175.] Hundreds of liquefaction mounds are found in basins in the southwestern United States.

Why basins? During the compression event, liquefied water-sand mixtures in many places erupted like small

Figure 104: Liquefaction Mound.[25] This and hundreds of similar sandstone mounds occupy the basin of the former Grand Lake. The breaching of Grand Lake carved the Grand Canyon. [See pages 189–227.]

The compression event produced massive liquefaction in water-saturated sand layers. During the few minutes the liquefaction lasted, some sand-water mixtures erupted, much like a volcano. Here, the eruption was onto the floor of Grand Lake. The large, mushy pile of sand quickly settled into the shape of an upside-down bowl. As the flood waters drained off the continents, this large, wet sand pile was protected, because it was deep in a lake. As the warm lake cooled, silica dissolved in the water was forced out of solution, thereby cementing the mound's sand grains. Later, when Grand Lake spilled out, rushing water around the mound eroded the softer sediments on which the mound rested, producing the deep "**moat**" that separates the man at the lower right from the mound.

Figure 105: Ayers Rock. This popular tourist attraction in central Australia is 225 miles southwest of Alice Springs. Ayers Rock rises 1,140 feet from the desert floor and has a perimeter of 5.6 miles. Geologists who try to explain the origin of Ayers Rock say its sand came from the Musgrave mountain range 60 miles to the north and was dumped by water at its present spot. To account for its vertical layers, they say the rock "tipped," but the forces, energy, and mechanisms to do this are never explained. However, most geologists admit they do not know the origin of Ayers Rock.

Ayers Rock has characteristics of both a broad ***liquefaction plume*** and a ***liquefaction mound***. Its surface layers (bedding) are nearly vertical, and they connect to a horizontal sandstone layer underground. It formed in the Amadeus Basin, which protected it while the flood waters drained from the earth. Probably most soft sediments through which the plume rose, were swept away when the basin's lake finally discharged. The many large holes in the sides of Ayers Rock show where water drained out. (Almost 20 miles away, this same, deep horizontal sandstone layer also connects to a series of liquefaction eruptions called *the Olgas*.)

The sand grains comprising Ayers Rock are jagged but, if exposed to rapid currents, would have become rounded. Had the grains been weathered for thousands of years, they would have become clay. Instead, these grain characteristics are consistent with the gentle currents produced by liquefaction and the rapid cementing in the years after the flood.

volcanoes. Being surrounded and permeated by water, they would have quickly slumped into the shape of an upside-down bowl—a liquefaction mound. As the flood waters drained at the end of the flood, most liquefaction mounds were swept away, because they did not have time to be cemented. However, mounds inside postflood lakes (basins) were cemented as each lake cooled and its dissolved silica and calcium carbonate were forced out of solution. If a lake later breached and dumped its water, the larger cemented mounds could resist the torrent of rushing water and retain their shapes. The basins that held Grand and Hopi Lakes contain hundreds of such mounds. [See Figure 106 on page 188.] The sudden breaching of those lakes several centuries after the flood carved the Grand Canyon. [See pages 189–227.]

Liquefaction mounds have holes in their sides showing where internal water escaped. The channels have collapsed except near the mound's surface where there was much less collapsing stress. Those holes now look like pock marks. Some have claimed they are erosion features from wind and rain. Obviously, wind and rain would smooth out pock marks, not make them. Besides, these "pock marks," which will be called *water vents*, are found only in the sides of mounds, not the tops, where they should be if outside erosion formed them.

Long after the flood, water would drain out of mountains and cliffs. Caves would be carved by outward flowing water. New inhabitants to an area would naturally seek out and settle around these plentiful sources of drinking water. (Thus, many ancient cultures believed that water originated in mountains and flowed out of caves.)[26] Years later, as water sources dwindled, communities would be forced to leave. Prosperous cultures, such as the Anasazi and many cliff-dwellers, would suddenly disappear from an area, causing anthropologists to wonder if disease, war, famine, or drought destroyed those ancient communities.

Final Thoughts

Before we examine the "grandest of canyons" in the greatest geological laboratory on earth, we should reflect on how the **"Two Faulty 'Principles'"** described on page 179 produced centuries of confusion within the earth sciences. Without understanding the powerful events of the flood that produced global and massive liquefaction, one had to assume that the slow, relatively uniform events we see today operated throughout earth's history (*uniformitarianism*), so each layer and its fossils were laid down sequentially worldwide over a long period of time (*superposition*). Therefore, without understanding that layers and fossils were rapidly sorted by liquefaction during the flood, people had to assume that vast amounts of time were needed for a "magically produced" single cell to *somehow* develop into all plants and animals (*evolutionism*). Correcting these errors, now ingrained in the world's social fabric, will require a willingness by many to study, educate others, and follow the evidence wherever it leads.

References and Notes

1. Ivars Peterson, "Liquid Sand," *Science News*, Vol. 128, 12 October 1985, p. 235.

2. Committee on Earthquake Engineering, George W. Housner, Chairman, Commission on Engineering and Technical Systems, National Research Council, *Liquefaction of Soils during Earthquakes* (Washington, D.C.: National Academy Press, 1985), pp. 25, 27.

3. Why does this phenomenon occur primarily with *sand* and not other sedimentary particles, such as clay? Clay particles are flat and platelike. They stack on top of each other like playing cards, so little water can flow up between the particles and produce liquefaction.

   Resistance to the upward flow of a fluid between solid particles increases enormously as the space between the particles becomes very small, as in clay. Sand particles, on the other hand, are more rounded, creating much larger gaps between particles. A pile of dry sand is so porous that air occupies 30–50% of its volume. Particles deposited in water, especially sand, will be almost completely surrounded by water, so water can flow up through sand with relative ease. Even clay particles that have settled through water will be largely surrounded by a film of water for some time. Therefore, wet clay particles will be buoyed up to some extent by the water, so liquefaction can occur.

   Some people and most animals panic when caught in quicksand. Although they sink only to about half the depth they would in pure water (which is less buoyant), thick sand-water mixtures create a suction that opposes movement. Animals frequently die of exertion or starvation. If ever caught in *true* quicksand, relax, let the sand-water mixture support your weight, be patient, and slowly "swim" out of it.

   However, a dangerous situation arises if the upward flow of water slows so that water pressure no longer lifts each sand particle. Stepping into such loose sand or mud might be like stepping into a deep pit filled with powder. The distance you sink depends on how firmly the particles compact below you as you drop.

4. Harold L. Levin, *Contemporary Physical Geology*, 2nd edition (New York: Saunders College Publishing, 1986), p. 251.

5. Arthur N. Strahler, *Physical Geology* (New York: Harper & Row, Publishers, 1981), p. 202.

6. As the rocks settle into a denser packing arrangement, their potential energy is quickly converted into the energy of pressurized water, which, in turn, will be converted into the kinetic energy of upward flowing water. That kinetic energy will be dissipated slowly as two types of friction.

   The first occurs as the water flows up around the sedimentary particles. This frictional drag tends to lift each particle, although initially the upward force may not be enough to raise any particles. The second type occurs near the top of the bed of sediments. That is the point on the flow path where the pressure suddenly drops and, therefore, the flow velocity suddenly increases. If the velocity exceeds a specific threshold, the topmost particles will be lifted. This will remove weight from the particles directly below, allowing them to also rise. This chain reaction will continue down into the bed of sediments as long as enough energy remains. Particles lifted by water drag experience liquefaction.

7. "Breakthroughs in Science, Technology, and Medicine," *Discover*, November 1992, p. 14.

8. Experiments have demonstrated this phenomenon as well. [See John T. Christian et al., "Large Diameter Underwater Pipeline for Nuclear Power Plant Designed Against Soil Liquefaction," *Offshore Technology Conference Preprints*, Vol. 2, Houston, Texas, 6–8 May 1974, pp. 597–606.]

9. Bruce C. Heezen and Maurice Ewing, "Turbidity Currents and Submarine Slumps, and the 1929 Grand Banks Earthquake," *American Journal of Science*, Vol. 250, December 1952, pp. 849–873.

10. A tsunami is often confused with a tidal wave. Tsunamis are caused by undersea earthquakes or volcanic eruptions that initiate a wave. A tidal wave is a twice-daily, long-period wave caused by tides—the gravitational pull of the Sun and Moon on the earth.

11. Because liquefied sediments will flow on gradual slopes and become increasingly horizontal, most sedimentary layers today are horizontal. Bent or steeply tipped layers resulted from the compression event described on page 130.

12. E. D. McKee et al., "Flood Deposits, Bijou Creek, Colorado, June 1965," *Journal of Sedimentary Petrology*, Vol. 37, September 1967, pp. 829–851.

    ◆ Steven A. Austin, *Grand Canyon: Monument to Catastrophe* (Santee, California: Institute for Creation Research, 1994), pp. 36–39.

13. Water would flow into the sediment tank at about a centimeter per second. With a longer column of sediments, velocities are much slower. My computer simulations of liquefaction on the flooded earth showed typical velocities of about 0.1 centimeter per second. Liquefaction would begin at the top of a thick column of sediment and would grow downward as the wave trough approached. Hundreds

of feet of sediments could experience liquefaction at one time. If the flood waters deposited more sediments on top of the column before the next liquefaction cycle began, the lowest sediments liquefied in earlier cycles might not experience liquefaction again. Thus, the least dense sediments will not all end up at the top of the sedimentary column.

14. Personal communication, Dr. Karen Jensen, 8 January 2001.

15. The old adage that water flows only downhill is not always true. Water flowed uphill in the water lens, because the pressure was highest in the lowest part of the lens where the weight of the overlying sediments was greatest.

16. When a water lens began to form, it spread rapidly over multiple liquefaction cycles, because water flowed into the lens more easily than it flowed out. This was because any flow into a lens (regardless of direction) loosened the resisting sediments and very fine particles blocking the flow channels. Water flowing out of a lens (up or down) compacted the resisting sediments and tended to allow very fine particles to plug up the flow channels. Also, water was captured in proportion to the lateral extent of the lens.

    During liquefaction, each sedimentary particle, surrounded by a thin film of water, would rotate and vibrate. The water's flow around each irregular particle varied, causing sudden pressure changes that quickly altered forces all around the particle. (These are the same fluid forces that lift a wing, curve a baseball, or slice a golf ball.) When one particle collided with an adjacent particle, the effect would ripple "down the line" to some extent.

    With all this "microagitation" and lubrication, particles would arrange themselves into a very dense packing arrangement that would drive out more water. Later, close packing would aid in cementing each horizontal stratum between former water lenses into a strong unit. [See **"The Origin of Limestone"** on pages 229–235.] This is why horizontal cracks, called *joints*, generally lie between strata.

    Evolutionists believe that the horizontal interfaces between two adjacent strata show long time intervals in which the environment changed so that different sediments would be deposited. (The sources of these new sediments are never thoroughly explained.) On the contrary, joints mark former liquefaction lenses.

17. The most authoritative source for geological definitions is the *Glossary of Geology.* It defines uniformitarianism as:

    > *The fundamental principle or doctrine that geologic processes and natural laws now operating to modify the Earth's crust have acted in the same regular manner and with essentially the same intensity throughout geologic time, and that past geologic events can be explained by phenomena and forces observable today; the classical concept that "the present is the key to the past.* [See Robert L. Bates and Julia A. Jackson, editors, *Glossary of Geology*, 2nd edition (Falls Church, Virginia: American Geological Institute, 1980), p. 677.]

    The principle of uniformitarianism was meant to exclude a global flood, which many geologists still abhor—for philosophical, not scientific reasons.

18. Leonard R. Brand and Thu Tang, "Fossil Vertebrate Footprints in the Coconino Sandstone (Permian) of Northern Arizona: Evidence for Underwater Origin," *Geology*, Vol. 19, December 1991, pp. 1201–1204.

    ◆ *"The trackways (Fig. 4a–c) that were headed across the slope but with toes pointed upslope can perhaps be best explained by animals being pushed by a water current moving at an angle to the direction of their movement."* Leonard R. Brand, "Field and Laboratory Studies on the Coconino Sandstone (Permian) Vertebrate Footprints and Their Paleoecological Implications," *Paleogeography, Paleoclimatology, Paleoecology*, Vol. 28, 1979, p. 38.

19. *"The widespread deposition of such clean sand* [in the St. Peter sandstone] *may seem strange to a modern observer, since there is no region on earth where a comparable pattern of deposition can now be found."* Steven M. Stanley, *Earth and Life through Time* (New York: W. H. Freeman and Co., 1986), pp. 355–356.

20. James W. Hagadorn et al., "Stranded on a Late Cambrian Shoreline: Medusae from Central Wisconsin," *Geology*, Vol. 30, February 2002, pp. 147–150.

21. Ariel A. Roth, "Incomplete Ecosystems," *Origins*, Vol. 21, No. 1, 1994, pp. 51–56.

22. Arthur V. Chadwick, "Megabreccias: Evidence for Catastrophism," *Origins*, Vol. 5, No. 1, 1978, pp. 39–46.

23. Dwight Hornbacher, *Geology and Structure of Kodachrome Basin State Reserve and Vicinity, Kane and Garfield Counties, Utah* (Master's thesis, Loma Linda University, California, 1985).

24. George Sheppard, "Small Sand Craters of Seismic Origin," *Nature*, Vol. 132, 30 December 1933, p. 1006.

25. This mound is located at 36°45'15.40"N, 109°34'45.87"W.

26. *"Spanish documents from the 16th century and scientists' interviews of the area's current inhabitants* [descendants of ancient Mayan (A.D. 200–900) peoples of central Mexico and Central America] *reveal a longstanding regional belief that water originates in mountains and issues out of caves."* Bruce Bower, "Openings to the Underworld," *Science News*, Vol. 161, 18 May 2002, pp. 314–315.

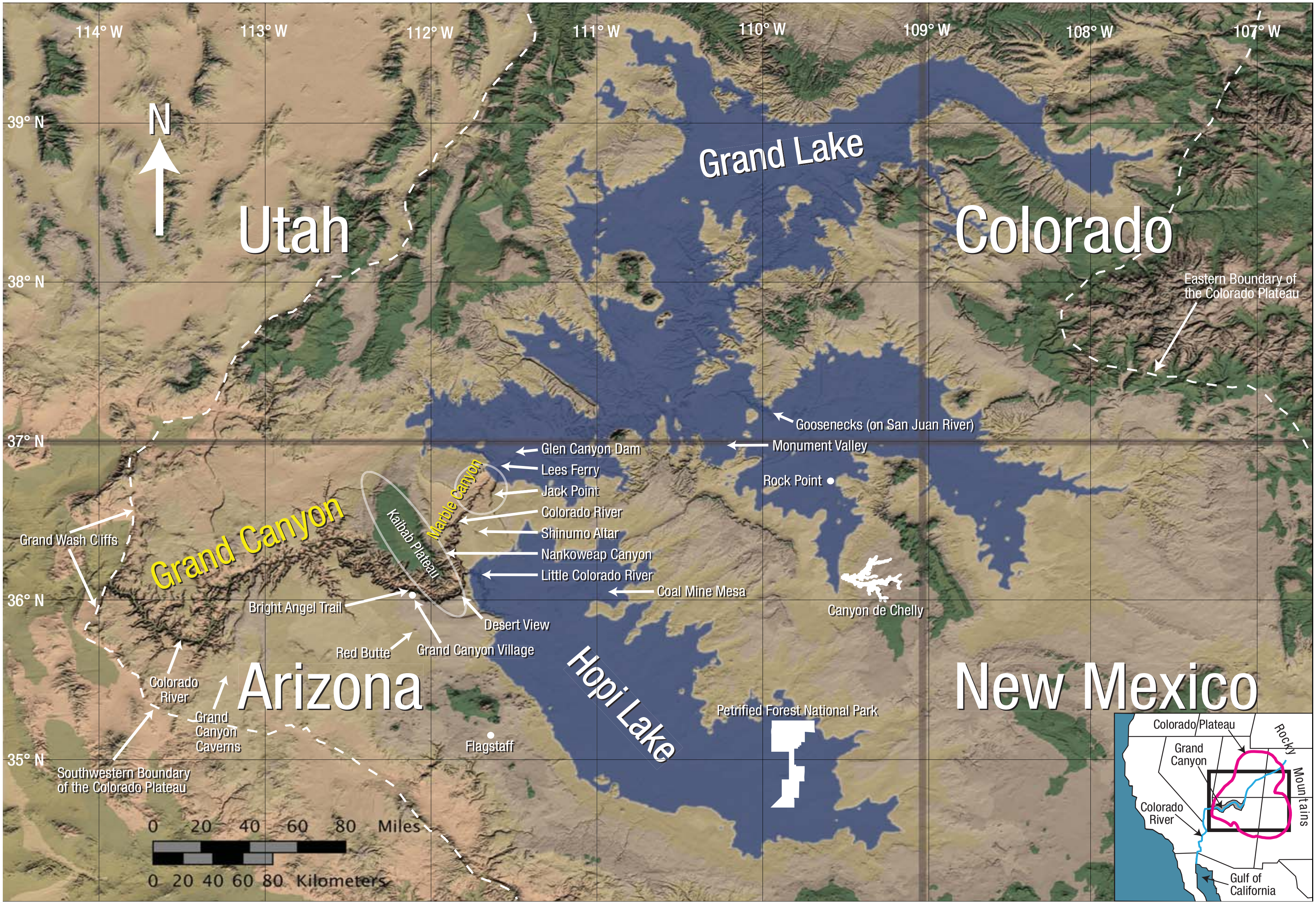


Figure 106: Geographic Features. Significant geographic features described in this chapter are shown above. Two lakes, Grand Lake and Hopi Lake, which may have existed in the past, are superimposed on today's terrain, shown in nearly true color. The white oval encloses the high Kaibab Plateau, which extends slightly south of the Colorado River. The circle marks the north half of Marble Canyon, about a dozen barbed canyons, the funnel, and parts of Echo Cliffs and Vermilion Cliffs. All will be discussed later. The dashed line marks part of the boundary of the uplifted, roughly circular Colorado Plateau.

The Origin of the Grand Canyon

SUMMARY: Geologists admit that they do not know how the Grand Canyon formed, but for the last 140 years, they have insisted that the Colorado River carved the canyon over millions of years and somehow removed the evidence.[1] (Several obvious problems with this idea are mentioned in Figure 42's description on page 108.) To these so-called experts, the canyon's birth remains a "hazy mystery, cloaked in intrigue, and filled with enigmatic puzzles."[2] After studying those puzzles, we will examine the eight main proposals for the Grand Canyon's origin and why they are rejected by almost all experts. Finally, we will consider two ancient, postflood lakes—Grand Lake and Hopi (HO-pee) Lake—that successively breached their boundaries and carved the Grand Canyon in weeks. This explanation not only unravels the confusion, but solves other major puzzles not previously associated with the Grand Canyon.

The Grand Canyon is the best and most famous earth science laboratory in the world. Although a few canyons are deeper or longer or steeper or wider, none can compare with the Grand Canyon's scenic variety, massiveness, beauty, and three-dimensional exposure. It is 216 miles long,[3] 4–18 miles wide, and about 1 mile in depth. Writers describe the canyon in such lofty terms as *magnificent*, *majestic*, *stupendous*, *inspirational*, *sublime*, *breath-taking*, *awesome*, *spellbinding*, and *earth's greatest celebration of geology*. The first reaction of most of the nearly 5 million annual visitors to the canyon is stunned silence.

Probably the foremost question visitors have is, "How did this happen?" Bruce Babbitt, former Governor of Arizona (1978–1987) and U.S. Secretary of the Interior (1993–2001), relates the answer given by John Hance. In 1883, Hance became the first person of European descent to live at the canyon. He was one of the canyon's most colorful personalities, tour guides, and explorers.

> *Children loved John Hance, and to them he always explained how the canyon came into being. "I dug it," he would say simply. This story worked well for years until one little four-year-old girl asked seriously, "And where did you put the dirt?" Hance had no ready answer; he never used that story again. But it bothered him the rest of his life, and when he was dying he whispered to his waiting friends, "Where do you suppose I could have put that dirt?"*[4]

That question still bothers geologists, because if the Colorado River carved the canyon, as commonly assumed, there should be a gigantic river delta where the Colorado River enters the Gulf of California. Instead, the delta is relatively tiny.

Colorado River. In fact, the puzzle is much more difficult. Geologists now agree that the Colorado River began flowing out of the western Grand Canyon only recently. Here's why. Before the Glen Canyon Dam was built upstream from the Grand Canyon in 1963, the gritty Colorado River carried an average of 550,000 tons of sediment (sand, silt, and clay) out of the canyon each day—or 6 tons each second![5] Directly to the west of the Grand Canyon, the Colorado River cuts through a 650-foot-thick layer of Hualapai (WALL-uh-pie) Limestone whose topmost layers have been dated, using radiometric techniques, as less than 5,900,000 years old.[6] If the river flowed through a lake that supposedly deposited this relatively pure limestone, why are common river sediments not found in that limestone?[7] Obviously, the river must have begun flowing there *after* that limestone was deposited—in geologic terms, recently. How recently? According to most geologists, within the last one-thousandth of the earth's history![8]

Groups of relatively young, water-transported rocks are on opposite edges of the western Grand Canyon—rocks that could not have been transported from one location to the other if the canyon blocked the way.[9] Therefore, those rocks were first transported, then the Grand Canyon was cut and the Colorado River began flowing out of the western end of the Canyon. Since 1934, geologists have been trying unsuccessfully to find a previous location for the river or to learn why the river began so recently.[10]

Kaibab (KI-bab) Plateau. A quick look at a relief map raises another question. *Why and how did the powerful Colorado River, flowing southward into northern Arizona along the east side of the Kaibab Plateau, suddenly make a right turn and flow west, up and over (or through) the high Kaibab Plateau?* Rivers don't flow uphill. Desert View, an overlook on the Kaibab Plateau just south of the Colorado River, rises 5,800 feet above the river. Just across the river, the land rises even higher.

All explanations for the Grand Canyon's origin try to answer this question.[11] Some say that the river was once a mile or more higher, and the land it flowed over eroded away. As it did, the river settled down on top of the Kaibab Plateau and cut through it—a process called *superposition*. Others say the river cut through the Kaibab Plateau along a fault (or crack). However, faults are generally perpendicular to the Colorado River, not parallel. Some believe that the land under the river rose, forming the Kaibab Plateau. As it did, the river cut down through the rising plateau. Two theories say that a stream flowing down a western slope of the Colorado Plateau continually eroded *eastward* 130 miles and eventually cut through the Kaibab Plateau—a process called *headward erosion*. (Notice how dependent these explanations are on millions of years of time, and how many untestable explanations can be proposed if millions of years are imagined.)

Missing Mesozoic Rock. Actually, cutting through the Kaibab Plateau is a relatively minor problem, and carving the entire Grand Canyon is not even half the problem. The Grand Canyon's rim consists of hard *Kaibab Limestone*, typically 350 feet thick. When you walk to the canyon's edge and look in, you are standing on Kaibab Limestone. It extends away from the canyon in all directions, covering about 10,000 square miles. However, rising 1,000 feet above this Kaibab Limestone at a few dozen isolated spots are softer (crumbly or weakly cemented) Mesozoic rocks; they are always capped on top by a very hard rock, such as lava. Obviously, lava did not flow up to the top; lava, which flows downhill, collected in a depression and hardened. Later, a fast-moving sheet of water flowed over northern Arizona and swept all the soft Mesozoic rock off the hard Kaibab Limestone—except for the few dozen spots that were capped and protected by hard rock.

Why must it have been a sheet of water? Falling rain would cut only channels. Flowing rivers or streams, even if they meandered for millions of years, would not sweep 1,000 feet or more of material off almost all of these 10,000 square miles of the fairly flat Kaibab Limestone. Besides, meandering rivers would produce meandering patterns. Therefore, before you can excavate 800 cubic miles of rock below the rim to form the Grand Canyon, something must sweep off almost all the Mesozoic rock above—a much larger excavation project. Oddly enough, the Mesozoic rock has also been swept off the Kaibab Plateau. How could water get so high? Maybe the Kaibab Plateau rose after the sweeping process—the Great Denudation.

The Great Denudation: Time or Intensity?

In 1882, pioneering geologist Clarence Edward Dutton observed the now-accepted fact that almost all Mesozoic rock (at least 2,000 cubic miles) had been swept off about 10,000 square miles of fairly flat Kaibab Limestone. This happened before the Grand Canyon was excavated by the removal of another 800 cubic miles of rock. (To appreciate these volumes, recognize that all the water in the earth's rivers totals only about 300 cubic miles.[12]) Dutton called this sweeping process *the Great Denudation*. He assumed that so much erosion required a very long time, but he overlooked another possibility: lots of violently flowing water spread over a wide area for a short time.

Few people realize that the Grand Canyon can deepen only when the water flow is intense. Bedrock under the Colorado River is blanketed by up to 75 feet of silt, sand, gravel, and boulders. Unless a violent flow removes that protective coating, the bedrock below cannot be scoured. Even before the Glen Canyon Dam was built, periodic floods produced little bedrock scouring. What would produce such a violent flow?

Marble Canyon. To form the Grand Canyon requires first forming Marble Canyon, which is directly upstream (northeast) of the Grand Canyon. The two canyons join where the Little Colorado River enters the Colorado River. John Wesley Powell, who led the first documented expedition through these canyons in 1869, gave them different names, because they are so dissimilar.[13] Marble Canyon, 61 miles long and fairly straight, is much narrower and its vertical walls are steeper. The two canyons are like two adjoining pipes; any explanation for one pipe should also explain the other pipe, even if they have differing shapes.

All the thin strata in and around Marble Canyon tip in directions that form a curious, but consistent, pattern. People floating southward inside Marble Canyon sense that they are falling. That sensation is caused by an optical illusion. The strata inside the walls of Marble Canyon tip up to the south, so as one floats downstream, one rapidly moves lower and lower *relative to the layers in*

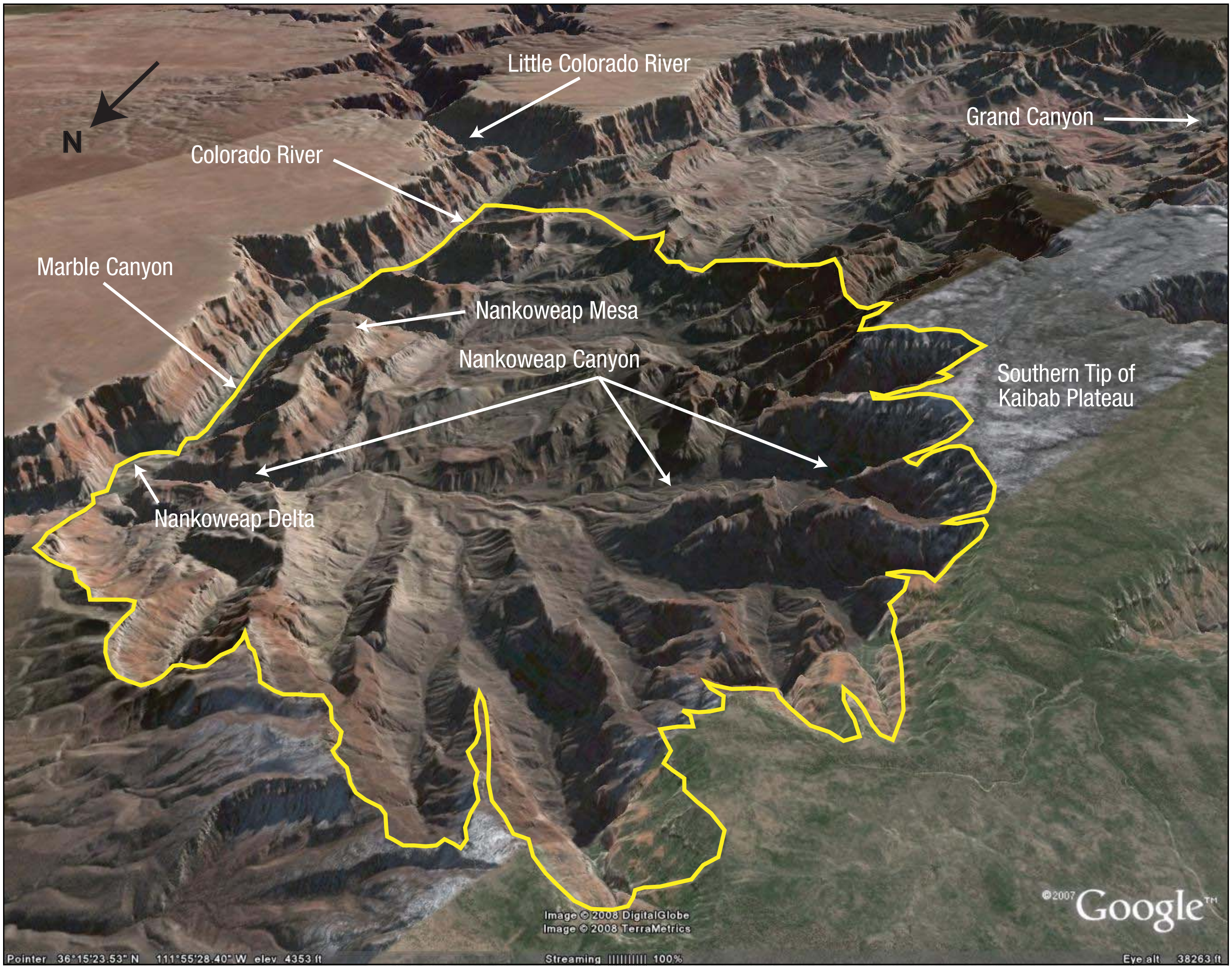


Figure 107: Region of Unusual Erosion. This view is looking southeast from 4,400 feet above the ground. The Little Colorado River enters the southern end of Marble Canyon at the top center. The yellow line encloses a region of unusual erosion. Notice that on the top of the high Kaibab Plateau, streams do not flow into the many canyons that are cut into this southeastern portion of the Kaibab Plateau. So, what cut these side canyons, and why are they in such a localized area? Why would the terrain east of Marble Canyon (at least 2,000 feet below the top of the Kaibab Plateau and most of this erosion) be so smooth? On top of Nankoweap Mesa are slumps, landslides, and rockfalls. How can rocks fall and mud flow onto the top of a mesa?

the narrow walls to the immediate left and right. Relative to a fixed point on the ground, one is actually dropping only about 8 feet each mile, a hardly perceptible rate.

Easily seen from above Marble Canyon are layers in Echo Cliffs (to the east) and Vermilion Cliffs (to the west) that tip up toward Marble Canyon. At the southern end of these cliffs, the layers also tip up to the south, toward the Grand Canyon 30 miles away.

Another unusual feature of these cliffs and others in the region is the lack of rubble, called *talus*, at the base of the cliffs. One would expect that freezing and thawing cycles alone, acting on the cliff faces for millions of years, would have reduced each vertical cliff to a sloping pile of loose rocks. Even if the cliffs were young, the process of lifting up or carving cliffs should have left considerable talus.

Side Canyons. Dozens of large side canyons intersect the main trunk of Grand and Marble Canyons and cut down to the level of the Colorado River. These side canyons also have their own side canyons, all connected like branches on a big, bushy tree. Surprisingly, most side canyons, at least today, have no source of water that could have carved them—or basins above that could have held much water.

Had these side canyons formed *before* the main trunk of Grand and Marble Canyons, most would extend through to the opposite side of the main trunk. They don't. Had these side canyons formed *after* Grand Canyon and Marble Canyon formed, many would not cut down to the Colorado River, especially with no visible source of water to carve them. Therefore, these side canyons probably formed at the same time as Grand and Marble Canyons.

Distant Cavern Connection

In 1958, the U. S. Army Corps of Engineers, in preparing a fallout shelter, set off red smoke bombs inside Dinosaur Caverns, a large limestone cavern far south of the Grand Canyon. Two weeks later, park rangers saw that red smoke exiting into the Grand Canyon, **63 miles** from the cavern. These caverns were then renamed Grand Canyon Caverns. Four larger cavern systems lie up to 1,500 feet below this first cavern.[14]

Obviously, the uplift of the Colorado Plateau predated the Grand Canyon, the Grand Canyon predated this 63-mile-long, underground drainage system, and a large volume of ground water (5,400 feet above sea level and at least 63 miles long) was needed to form this deep, multilevel cavern system. Millions of years of rainfall would not have accomplished much deep excavation; this cavern is one of the driest in the world. Besides, all sedimentary layers south of the Grand Canyon slope down to the south, so rain water would not drain north toward the Grand Canyon. [See Figure 108.]

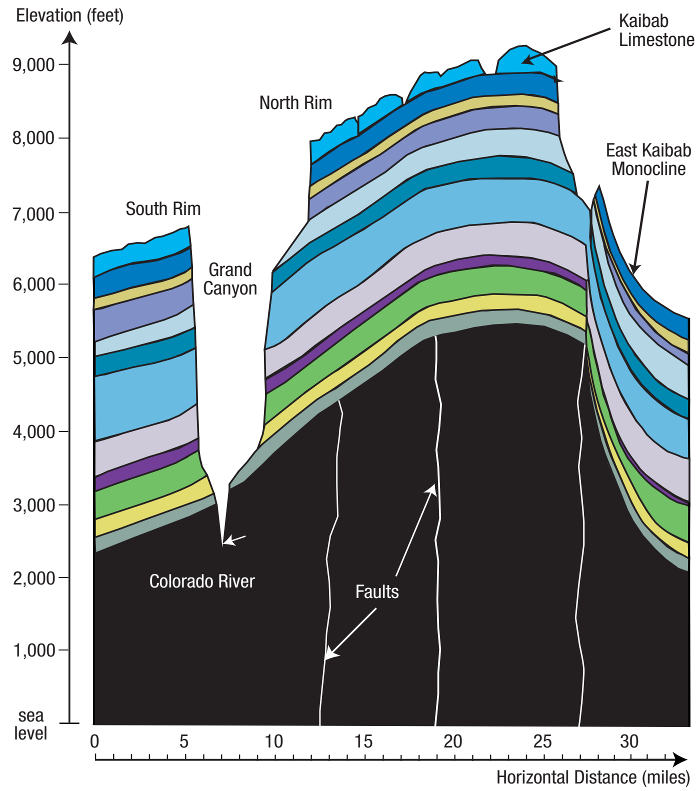


Figure 108: Grand Canyon Profile. This profile, showing the thickness, shape, and elevation of each of the major sedimentary layers, extends from 36°00'N, 112°17'W to 36°24'N, 111°56'W.[17] Basement rock is in black. Note the differing scales (vertical in feet and horizontal in miles). At these scales, the Colorado River, at the tip of the left arrow above, would be smaller than the period at the end of this sentence. (Could that "dot of a river" cut the huge, wide canyon above it?) In general, Grand and Marble Canyons cut into a broad arch that extends for the length of those canyons. This particular profile cuts across faults; one of the most dramatic aligns with the East Kaibab Monocline, which will be discussed later. Notice how the layers under the monocline thin to the left.

Some side canyons, called *slot canyons*, are much narrower than they are high. [See Figure 125 on page 211.] The narrower they are, the less water was needed to carve them. How then, with so little water, were some slot canyons carved so deeply?

A few side canyons are "barbed." That is, they connect to the main canyon "backwards," similar to the barbs in barbed wire or fishhooks. Tributaries almost always enter rivers at acute angles, but the barbed canyons are oriented at obtuse angles. Very strange.[15] What happened?

One large side canyon, *Nankoweap* (NAN-ko-weep) *Canyon*, enters the Colorado River from the west, near the southern end of Marble Canyon. Nankoweap Canyon has more than 40 archaeological sites, including granaries, but today is usually dry and barren. (At times, Nankoweap Creek flows in Nankoweap Canyon.)

Nankoweap Canyon begins high on the southeastern slope of the Kaibab Plateau. [See Figure 107.] The flow that cut this side canyon came from many directions and had to be voluminous, recent, and violent. The water was voluminous and recent, because it produced the Grand Canyon's *largest tributary delta*—which, to this day, has not been swept away by the powerful Colorado River. The flow was violent, because large, partially rounded boulders are stacked 100–200 feet high on both sides of the last 1,000 feet of Nankoweap Creek.[16] To transport such large boulders requires an "avalanche" of water and/or mud flowing off or out of the Kaibab Plateau.

The Great Unconformity. Fossils are found only in the layers above an almost perfectly horizontal plane named *the Great Unconformity.* At the Grand Canyon, it lies about 4,000 feet below the rim and is exposed above the Colorado River for 66 miles. Above the Great Unconformity the layers are all sedimentary and almost always horizontal; below the Great Unconformity lie either basement rock or thick, steep (10°–20° slope) sedimentary layers *with no fossils.*

Arching. Researchers have long noted that Grand Canyon and Marble Canyon lie on a long, 277-mile arch. Vertical cross sections (perpendicular to the Colorado River) show how the sedimentary layers and basement rock directly below, arch upward.[18] Each cross section differs slightly, depending upon where it is drawn. For 46 miles along the highest portion of the arch, the canyon descends into the dark basement rock itself—a steep slot (up to 1,200 feet deep) called *the inner gorge.* [See Figure 109.] Above the gorge lies the Great Unconformity, and above that boundary lie horizontal sedimentary layers stacked almost a mile high.

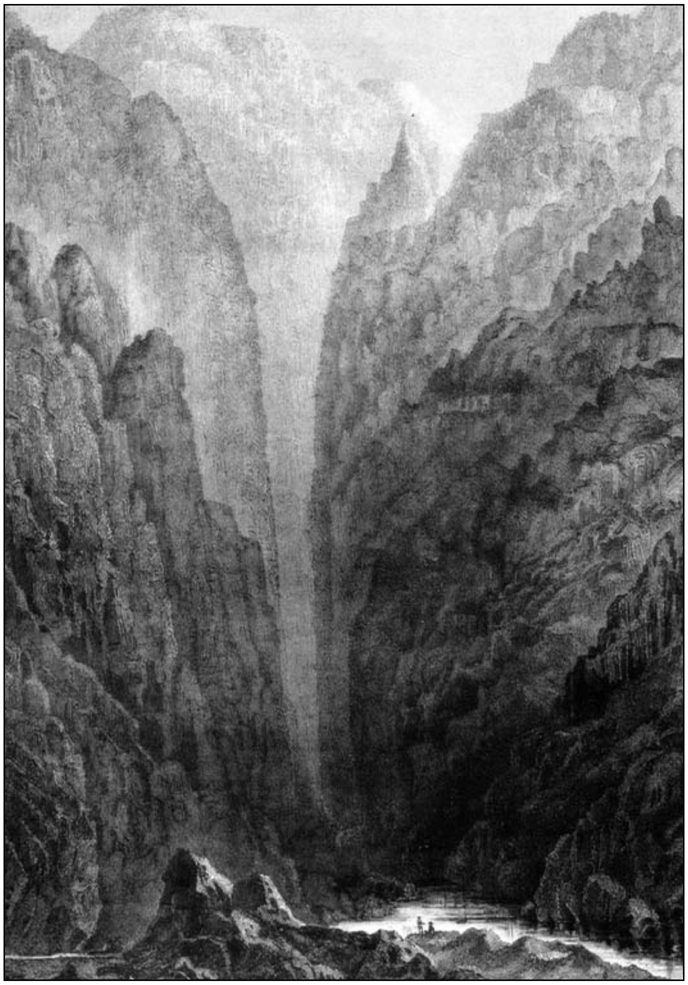


Figure 109: Inner Gorge. How could a river cut a slot, up to 1,200 feet deep, into such hard rock? As a river, eroding downward through relatively soft sedimentary layers, encountered the hard basement rock, further erosion should be primarily horizontal, into the softer, flanking sedimentary layers. When the widening river finally did begin to erode down into the harder rock, the river should erode a shallow, bowl-shaped channel, not a deep, nearly vertical cut. Either way, the eroded walls should be smooth, not jagged as are the walls of the inner gorge. If the river did begin to cut a deep slot, boulders (not easily moved by even a fast-flowing river) should fill up at least the bottom of that slot, thereby preventing further scouring and deepening of the slot. Instead, the inner gorge looks as if it cracked vertically as the rock below arched upward.

Our Focus. While the key question concerning the Grand Canyon is how it formed, other matters can easily distract us: the canyon's beauty, modern history, early habitation, and exploration; the mind-numbing list of geologic terms and terrain names; and the excitement and stress of navigating its many trails and the Colorado River itself. Hundreds of books have told and retold these stories, so we will avoid those fascinating diversions and focus on the key question of the Grand Canyon's origin. A reward may await us. As usually happens in science, when a persistent enigma is finally solved, answers to seemingly unrelated problems are also discovered.

Evidence Requiring an Explanation

Summarized below are the hard-to-explain details which any satisfactory explanation for the origin of the Grand Canyon should answer.

Layering. Probably the most striking sight at the Grand Canyon is the vastness of the parallel, multicolored, sedimentary layers. (Their differing mineral and chemical content produces the variety of colors.) Any explanation for the Grand Canyon's layers must also explain the similar stratification seen worldwide.

Limestone. The Hualapai Limestone, to the west of the Grand Canyon, was deposited before the Colorado River flowed out the western end of the Grand Canyon. Also, many layers in the canyon consist primarily of limestone hundreds of feet thick.[19] What is the source of so much limestone, and what concentrated it? If these limestone layers were deposited in shallow inland seas—the standard explanation—then the Colorado Plateau had to rise and fall many times. Explaining one lift is difficult enough.[20]

Marble Canyon. How does the origin of the nearly straight Marble Canyon and its narrow, vertical walls relate to the origin of the adjoining, but broader, Grand Canyon? What accounts for the strange pattern of tipped layers in the walls of Marble Canyon and Echo and Vermilion Cliffs?

Distant Cavern Connection. How could an underground drainage system develop 5,400 feet above sea level and flow 63-miles between a cavern and the Grand Canyon?

Side Canyons. Why do Grand Canyon and Marble Canyon have so many side canyons that were cut as deeply as the main canyons but without a visible source of water?

Barbed Canyons. Why does Marble Canyon have large, barbed (backward) side canyons?

Slot Canyons. How did such narrow side canyons with jagged walls capture enough water to cut deep channels that drain into the Colorado River? Why are most of the world's slot canyons on the Colorado Plateau?

Perpendicular Faults. Why are dozens of faults in the Grand Canyon generally perpendicular to the Colorado River, and why does the river hardly ever flow along the "easier" paths provided by these faults?[21]

Arching. Why are Grand and Marble Canyons cut into and along the top of a broad arch that extends, in general, for the 277-mile length of those canyons?

Inner Gorge. Why are the walls of the inner gorge so deep, steep, narrow, and rough? How could a river cut so deeply into such hard rock at the inner gorge but not as deeply either upstream or downstream?

Nankoweap Canyon. What provided a violent, multidirectional flow of water able to (1) carve Nankoweap Canyon and its side canyons, (2) create a large delta that still remains despite the cross-flowing Colorado River, and (3) stack boulders 100–200 feet high along Nankoweap Creek? Why would humans choose to live in this desolate canyon?

Unusual Erosion. Why are slumps, landslides, and rockfalls found on the top of Nankoweap Mesa? Why does the Colorado River sharply delineate this eroded region to the west from the smooth, lower region to the east?

Forces, Energy, and Mechanisms. Each explanation for the Grand Canyon requires lifting the Colorado Plateau more than a mile in the air and excavating and transporting thousands of cubic miles of rock. Are the forces, energy, and mechanisms for these movements known—or merely inferred or assumed? Without a knowledge of the underlying physics, which must conform to scientific laws, major errors can creep in. Even if the inferences or assumptions are correct, ignorance of the actual forces, energy, and mechanisms will blind us to root causes, rates, and other consequences. Predictions will not present themselves; modeling and testing become limited. Such explanations can only be described as "half baked."[22]

Why Here? Why is the Grand Canyon where it is, and why are there not many other "grand canyons" worldwide?[23] The canyon receives little rain. If an explanation claims that a set of conditions, such as a fast-flowing river and millions of years, produced the Grand Canyon, then dozens of other "Grand Canyons" should exist where those conditions are even more extreme.

Why So "Recently"? If the Grand Canyon was carved during the last one-thousandth of earth's history, why were no other "Grand Canyons" carved earlier?

Missing River. Limestone deposits directly west of the Grand Canyon show that the Colorado River did not flow beyond the Grand Canyon before the canyon was excavated. Where was the river? What brought it to its present location? How was the western Grand Canyon carved?

Missing Talus. In the canyon region, why do steep cliffs such as Echo Cliffs, Vermilion Cliffs, and others have little talus (rubble) at their bases?

Kaibab Plateau. Why and how did the Colorado River make a right turn and cut through the Kaibab Plateau, which rises more than a mile on either side of the river?

Missing Mesozoic Rock. What swept off a soft Mesozoic layer, at least 1,000 feet thick, from atop 10,000 square miles of hard, horizontal Kaibab Limestone? What swept the Mesozoic rock off the high Kaibab Plateau?

Missing Dirt. About 800 cubic miles of material were removed in carving the Grand Canyon through and below the Kaibab Limestone. The Colorado River's delta does not contain even 1% of this missing material. Where did it go?

Fossils. Why are fossils found only above the Great Unconformity?

Tipped Layers. Why are sedimentary layers, hundreds of feet thick, tipped at steep angles below portions of the Great Unconformity, while all the layers above (averaging 4,000 feet in total depth) are essentially horizontal?

Time or Intensity? A satisfactory proposal for carving the Grand Canyon must show, in a self-consistent way, that eons of time transpired, or a brief, intensely violent flow of water occurred.

Proposals for the Origin of the Grand Canyon

Although not addressing the Grand Canyon, several early geologists suggested a mechanism for carving a canyon: breaching a large lake's boundary. If a large lake spills over the lowest point on its boundary, a notch will be cut that will allow more water to flow through the notch faster, eroding the notch even deeper. If the lake is large, the initial loss of water will not lower the lake's level too much, but the notch will deepen rapidly. The lake will discharge catastrophically through a deep slit—quickly forming a canyon.[24] The process is similar to the collapse of a dam. Modern examples of breached dams include the 1889 Johnstown Flood in Pennsylvania, which killed at least 2,200 people, and the 1976 Teton Flood in Idaho, which killed fourteen people and left 25,000 homeless.

In 1861, John Strong Newberry proposed an explanation for the relatively tiny canyons and basins along the Colorado River *far south and west of the Grand Canyon.* He wrote:

> *Doubtless in earlier times* [the Colorado River] *filled these basins to the brim, thus irrigating and enriching all its course. In the lapse of ages, however, its accumulated waters, pouring over the lowest points in the barriers which opposed their progress towards the sea, have cut them down from summit to base forming that remarkable series of deep and narrow cañons through which its turbid waters now flow, with rapid and almost unobstructed current, from source to mouth.*[25]

Newberry also wrote that the Grand Canyon, which he called *The Great Cañon,* was "wholly due to the action of water. Probably nowhere in the world has the action of this agent [water] produced results so surprising, both as regards their magnitude and their peculiar character."[26]

In 1923, another geologist, J Harlen Bretz, proposed that a network of canyons had been carved in Washington State by the breaching of a natural dam. He said that an ice dam impounded a lake in Montana and northern Idaho. The lake, which Bretz called *Lake Missoula*, was about half the size of Lake Michigan. When Lake Missoula breached, canyons and other terrain, called *the Channeled Scablands*, were carved. Because Bretz's explanation was too catastrophic, geologists rejected his views for more than 40 years. Today, his views are widely accepted.[27] (Invoking catastrophes violated a "sacred" rule in geology; i.e., explanations should involve only processes that we see today. Evolutionary geologists believe that eons of time were available. Unfortunately, this assumption, called *uniformitarianism*, still underlies much of geology.)

The following are the best-known published proposals for the origin of the Grand Canyon. Most assume that the Colorado River carved the canyon. All theories try to explain how the Colorado River traversed the high Kaibab Plateau. Some proposals contain few details, because relatively little was known about the canyon and surrounding region when those proposals were published.

John Wesley Powell (1869). Over geologic time, thousands of feet of limestone, shale, and sandstone layers were deposited. The earth, cooling from its earlier molten state, was contracting and shriveling, like a dried-up, wrinkled apple. As the Colorado River flowed along its present course 65,000,000 years ago, surface rocks began folding, uplifting, and tilting. The Colorado Plateau rose so slowly that the river was never blocked. As it did, the river cut through the rising land, leaving the Grand Canyon.[28]

In fairness to Powell, the mechanism he proposed for the Grand Canyon's origin was based on the terrain he saw two months before he entered the Grand Canyon and 400 miles to the northeast. When he and his group reached the Grand Canyon, they were in a race for their lives, rations were running low, the rapids were treacherous, moral was low, escape routes were limited, and constraining canyon walls permitted little exploration. Two weeks later, three team members were killed as they tried to leave that hostile environment.

Grove Karl Gilbert (1875). Faults developed in the Colorado Plateau as it rose over long periods of time. These cracks allowed the Colorado River's to flow through the Kaibab Plateau and carve the Grand Canyon.[29]

Samuel Franklin Emmons (1897). To form the Grand Canyon, either the Colorado River cut down through the land below, or the land below rose up and was cut by the river. Powell maintained the latter, but he misread specific geologic features. [Emmons provided valid but complex details.[30]] Therefore, the river settled down through the land and carved the Grand Canyon by superposition.

Eliot Blackwelder (1934). Up until 1.8 million years ago, the Colorado River did not exist. Then, as the Rocky Mountains rose their last mile or so, they intercepted much more moisture from the westerly winds. Rivers flowing down the western slopes of the Rockies became longer and more powerful. River drainage into basins west of the Rockies increased, while the cold, ice age climate reduced evaporation. Therefore, western lakes grew and sometimes breached their banks, carving canyons down to the next lower lake. Eventually, the Grand Canyon was carved and the Colorado River flowed as it does today.[31]

Edwin D. McKee (1964). The early Colorado River flowed into the Gulf of Mexico along a path that began east of the Kaibab Plateau, then continued along the valley of the Little Colorado River, and finally flowed into the Rio Grande. During the next 8,000,000 years, the Colorado Plateau rose and some streams flowed westward off the Colorado Plateau. One stream eroded headward (upstream) 300 miles northward from the Gulf of California, then 130 miles eastward through the Kaibab Plateau. The stream eventually captured the waters of the Colorado River, which then changed course and began flowing to the west, where it eroded the Grand Canyon.[32]

Charles B. Hunt (1976). The Grand Canyon was carved in segments. First, the eastern part was partially carved both by superposition and by the land rising as the river cut down through it. The river ponded in a large basin north of Kingman, Arizona. Later, that lake tunneled northward through caverns and limestone deposits, exiting as a spring feeding another lake just beyond today's western end of the Grand Canyon. This is how and where the Hualapai Limestone accumulated. When the flow from east of today's Grand Canyon increased, lakes overflowed, cutting the western Grand Canyon. Over the next few million years, the Colorado River cut the canyon to its present depth.[33]

Ivo Lucchitta (1988). The early Colorado River flowed southwest across a flatter Kaibab Plateau, cutting down through it by superposition. West of that plateau, the river flowed to the northwest. Faulting and volcanism have since erased that path.

About 5 million years ago, a stream began to flow south into the newly opened Gulf of California. That stream eroded headward along what is now the Colorado River's path after it leaves the Grand Canyon. Further headward erosion to the east allowed the stream to intersect and capture, west of the Kaibab Plateau, the Colorado River, which then carved the Grand Canyon.[34]

Norman Meek and John Douglass (2000). About 6,000,000 years ago, the Colorado River drained into Hopi Lake. Eventually the lake breached, spilling over the Kaibab Plateau to the west. The released water filled other basins downstream, forming lakes that breached successively. The region west of today's Grand Canyon may have subsided by almost one mile and the Colorado Plateau

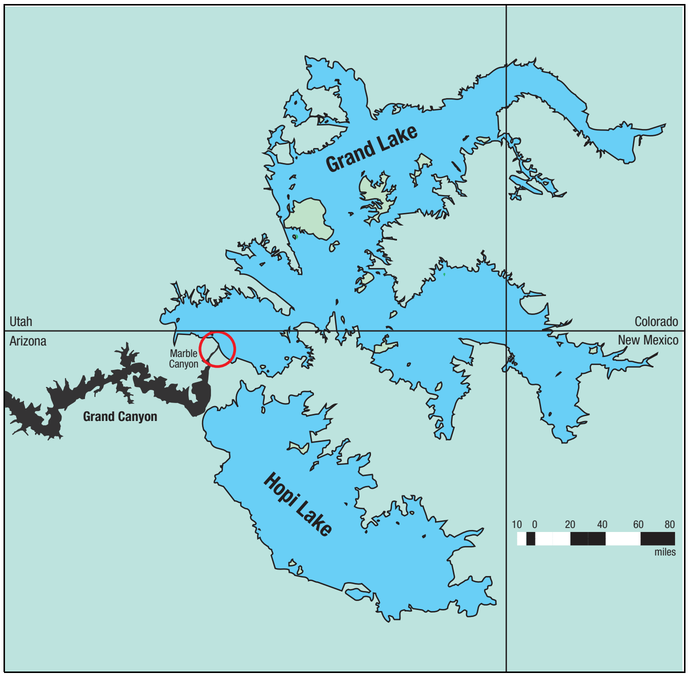


Figure 110: Grand and Hopi Lakes. The funnel region (marked by the red circle) was carved by water suddenly released from Grand Lake. [See Figures 106, 111, 112, and 114 for different perspectives of the funnel.] The region covered by this map lies in the southwest portion of the Colorado Plateau, which has an average elevation of 6,200 feet and an area the size of Germany or New Mexico.

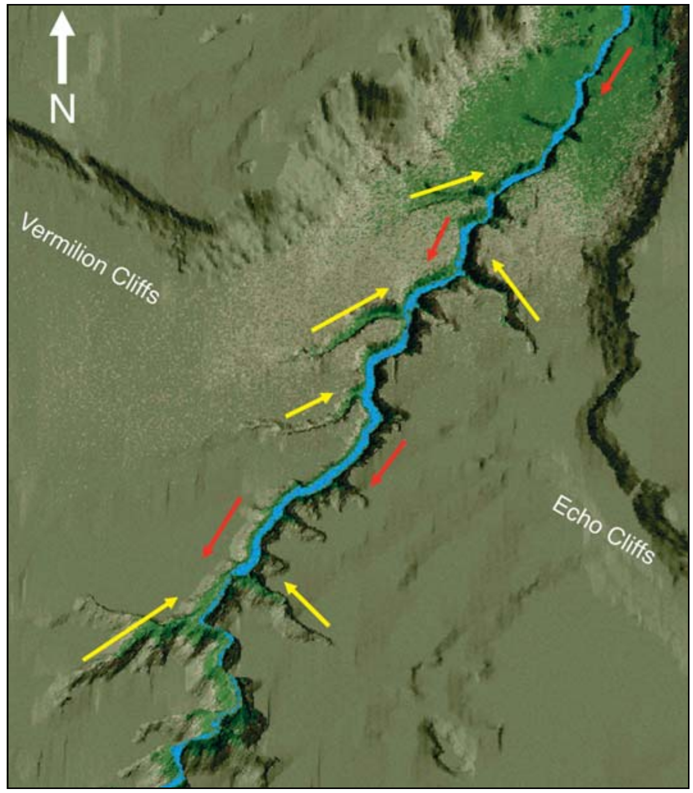


Figure 111: The Funnel and Barbed Canyons. This computer-generated picture resembles a photograph taken from 35,000 feet above the "barbed" side canyons feeding into the Colorado River. (The diagnostic importance of barbed canyons will soon be explained.) Flowing surface *and subsurface* water carved the barbed canyons in a direction (yellow arrows) opposite to the flow of the Colorado River today (red arrows). Notice that Echo Cliffs and Vermilion Cliffs nearly align. The funnel-shaped opening in the top right corner cut through a single cliff system, giving us these two sets of cliffs today. A giant, high-pressure hose, gushing from the upper right corner in the direction of the red arrows, would carve the funnel nicely.

may have tipped to the southwest, giving the waters from the upper Colorado River enough energy to carve the Grand Canyon.[35]

Walt Brown (1989)—Hydroplate Theory (summarized on pages 109–147).[36] Sediments, produced during the flood phase, settled through the flood waters, grain by grain. Liquefaction sorted those sediments into layers totaling, on average, a mile in thickness. About 20% of the flood water was trapped between those grains at the end of the flood. As that subsurface water escaped during the following years, much of today's terrain was sculpted.

Near the end of the flood, continent-size hydroplates (lubricated below by water) accelerated downhill, away from the rising Mid-Atlantic Ridge and toward the sinking Pacific plate. Within hours, the hydroplates met resistances and crashed. This *compression event* crushed, thickened, and buckled the hydroplates, pushing up earth's major mountain ranges. [For details, see pages 109–147 and 175–187.]

A series of major events then occurred which produced the Grand Canyon.

1. The flood's surface waters drained, leaving behind postflood lakes in every continental basin.
2. The Rocky Mountains settled into the mantle. As they did, they hydraulically lifted the Colorado Plateau an average of 6,200 feet. Carried on top were two large, growing lakes—Grand Lake and Hopi Lake.
3. Later, Grand Lake breached its southwestern boundary, causing Hopi Lake to also breach. The lakes' escaping waters spilled off the western edge of the Colorado Plateau, first sweeping off the soft Mesozoic sediments south and west of the lakes (the Great Denudation), then carving the Grand Canyon in weeks. Therefore, the Colorado River was born—a consequence, *not the cause*, of the carving of the Grand Canyon.

To understand the Grand Canyon's origin, we must first recognize and explain many strange terrain features surrounding the Grand Canyon.

Colorado Plateau. Immediately after the flood, each newly formed mountain range began the slow process of settling into the upper mantle. (Mountains have "roots" that descend into the mantle, a fact known for over a

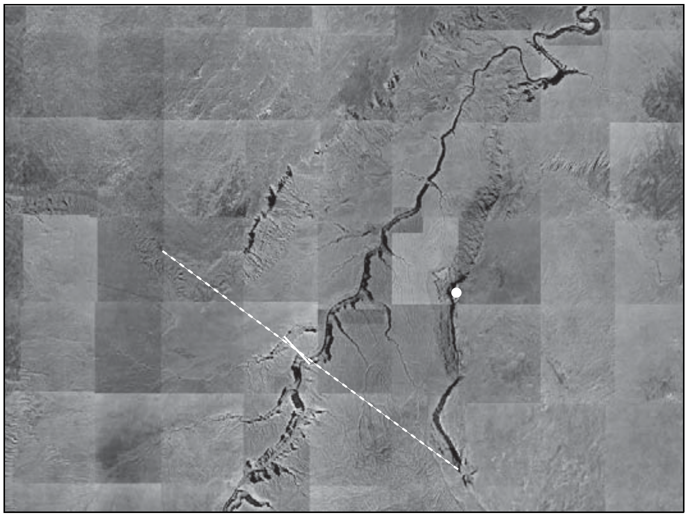


Figure 112: Aerial Photograph of the Funnel and the "Backward" Barbed Canyons. The dashed white line shows approximately where the Echo-Vermilion Cliffs were connected before the funnel was cut. This was confirmed during a field study by finding a long, vertical fault (marked by the solid white line).[37]

Figure 113: Potholes. Here, at almost the highest point on Echo Cliffs (the point marked by the white dot in Figure 112), is a weathered pothole.[39] Partially seen at the bottom left and right are two similar potholes. A pothole forms when whirling rocks, caught in an eddy or vortex of a fast-flowing stream, grind down, carving a cylindrical depression.[40] Why was water flowing so rapidly this high (6,654 feet above sea level) and at the upper edge of a 2,000-foot cliff? (In the extreme top left corner, you can see the edge of the cliff—and far below.)

When Grand Lake breached and began spilling over the Echo-Vermilion Cliff system, marked by the dashed white line in Figure 112, south-flowing water carved these potholes. During the following weeks, the miles-wide funnel was carved to the west of these potholes. Had the funnel been a few feet wider at this location, the rock where my geologist friend is standing would have been swept away.

At least 2,000 cubic miles of soft Mesozoic sediments were swept off the hard Kaibab Limestone. Then, as the Grand Canyon began to be carved 30 miles to the south, land under the Grand Canyon rose, lifting the south end of the funnel. This is why the funnel's floor of hard Kaibab Limestone now rises more than 1,000 feet as one proceeds southward along the top of Marble Canyon. Echo and Vermilion Cliffs—and these potholes—also rose. All the layers exposed in these cliffs and in the walls of Marble Canyon show this dramatic tipping.

century. The hydroplate theory explains the forces, energy, and mechanism that sank those roots and when it happened.) The mass pushed aside by a sinking mountain range increased the mantle's upward pressure next to that range, causing the weakest portion of the crust to break and rise. Thus, plateaus[38] rose next to settling mountain ranges. Examples include the Columbia Plateau next to the Cascades, the Tibetan Plateau (the largest, highest plateau in the world) next to the Himalayan Mountains (the most massive and highest mountain range in the world), and, pertinent to the origin of the Grand Canyon, the Colorado Plateau next to the Rocky Mountains. These uplifts were accompanied by considerable faulting and extreme frictional heating. As a result, melting and volcanic activity occurred within each plateau. Large blocks, when lifted and tilted, became cliffs and mountains—called *block-faulted mountains*. North of the Grand Canyon are many examples: Utah's Book Cliffs, Roan Cliffs, the Grand Staircase (Vermilion Cliffs, White Cliffs, Grey Cliffs, and Pink Cliffs), and others. As the flood waters drained, continental basins became postflood lakes; some were quite large.

The Funnel. Imagine a postflood lake with the area and volume of Lake Michigan, 5,700 feet above today's sea level, high on the Colorado Plateau. We will call this lake *Grand Lake*.[36] About 15–20 miles southwest of Grand Lake is the top of the long Echo-Vermilion Cliff. Despite losses from evaporation and drainage, the lake's level is maintained (or raised) by rainfall and drainage from higher elevations. Water drains from under Grand Lake, emerging as springs from the face of this 2,000-foot cliff system. Increasingly, the ground sinks along a path between the lake and the cliff. Suddenly, Grand Lake breaches a point on its bank and catastrophically erodes the soft Mesozoic sediments, forming a gigantic spillway—a steep, 18-mile-long channel shaped like a widening funnel. The escaping water's large volume and high velocity erodes the far end of the funnel within weeks to a width of 12 miles and a depth of 2,000 feet.

Marble Canyon. The originally horizontal sedimentary layers below the floor of the funnel steadily arch upward as weight is removed by this downward erosion. Eventually, the funnel's floor—hard, brittle Kaibab Limestone—cracks in tension, splitting open the entire floor parallel to the funnel's axis, forming Marble Canyon. [See Figure 114.]

Aquifers (porous, water-saturated, sedimentary layers) cut by this deep vertical crack begin rapidly spilling their waters, like large ruptured water mains, into the newly

Figure 114: The Big Crack: Where Marble Canyon Began. Water from Grand Lake spilled out near the top right corner of this picture and flowed violently toward the bottom left corner, eroding this funnel-shaped region. As huge amounts of material were removed, the horizontal sedimentary layers below—no longer pressed down by so much weight—arched upward, stretched, *and cracked*. *Subsurface* water then began spilling into this deep, minutes-old crack, now called *Marble Canyon*. Notice the many small "sink valleys" and their tiny tributaries near the edge of Marble Canyon. Channels that captured a large portion of the water spilling out of Vermilion Cliffs (at the top of the picture) and Echo Cliffs (at the bottom right) grew larger, allowing them to capture even more water. They became barbed canyons. Can you see why they are somewhat evenly spaced along Marble Canyon?

Thirty miles to the south, Marble Canyon joins the Grand Canyon (where, today, the Little Colorado River joins the Colorado River). [See Figure 106.] Vermilion Cliffs and Echo Cliffs were previously joined, but today mark the funnel's western and eastern boundaries. Visitors can easily see the upward arching in these layers from nearby Highway 89A that extends into the funnel in the shape of a hairpin.

formed Marble Canyon. Subsurface channels draining into Marble Canyon begin to form. (Initially, this underground flow is perpendicular to the canyon walls. Later, as explained in Figure 113, these thick sedimentary layers will rise to the south, so the underground flow will be primarily to the north but will then "hook in" and enter Marble Canyon at right angles.) Directly above these underground drainage channels, the earth sinks, forming north-draining valleys entering Marble Canyon. Instead of "sinkholes," we have hundreds of shallow "sink valleys." [See Figures 114 and 115.] The underground channels, in effect, grow in diameter as subsurface water flows through them, so the larger underground "pipes" capture even more water. Eventually, only a few very large, subsurface drainage channels are spilling out at fairly even intervals along Marble Canyon. Also, water pouring out of the sides of the funnel spill into some sink valleys more than others, eroding and deepening those valleys, allowing them to capture more surface water and erode even deeper. [See Figure 114.]

Grand Canyon. The south-flowing torrent of water spilling from Grand Lake undercuts the northwestern corner of Hopi Lake (elevation 5,950 feet), releasing its waters as well. Their combined waters, now sweeping westward over

Figure 115: Inside a Barbed Canyon. Notice the unusual curved layers bending up the sides of North Canyon, a barbed canyon that enters Marble Canyon one mile behind my camera.

How did these layers form? Rapid erosion of the funnel stretched and cracked open the ground where Marble Canyon is today. Water began draining into Marble Canyon through a 450-foot layer of limestone that lies not far below our feet. Some of that limestone dissolved, just as draining water forms caves in thick limestone deposits today. All the pliable, obviously uncemented layers above sank and tipped, forming a sink valley. Torrents of *surface* water then entered this sink valley, eroded it deeper, and carved, from the surface down, most of this barbed canyon in weeks. The other barbed canyons formed in a similar way.

northern Arizona, first remove at least 1,000 feet of the soft Mesozoic sediments above the hard Kaibab Limestone. As this weight is removed from almost 10,000 square miles south and west of the funnel, deeper sedimentary layers arch upward, stretching and in many places cracking open the hard, brittle Kaibab Limestone above.

Near the breach point on Hopi Lake's high shoreline, a waterfall, about thirteen times higher (with possibly a hundred times greater flow rate) than Niagara Falls bursts forth. "Hopi Falls" removes so much Kaibab Limestone and overlying material that the weaker, compressed layers below begin rising to form the Kaibab Plateau, whose Mesozoic layers had been swept off days earlier.[41] Figure 60 on page 127 demonstrates the mechanics of the process. [See **"Plateau Uplift"** on pages 200–201.] Rushing water from both lakes is channeled through the lowest path, cutting downward as fast as the land rises. This focuses the westward, erosive flow of these escaping waters.

About 20% of the volume of the rapidly rising Kaibab Plateau is subsurface water. The higher the plateau rises, the greater the water's energy and eroding potential. Landslides, slumps, and mudflows spill down the rising slopes of the Kaibab Plateau from multiple directions for weeks. Powerful springs are released around the base and sides of the plateau; many springs will flow without major seasonal variations for centuries, making Nankoweap basin, for a time, an excellent habitat for humans. Some drainage carves deep channels around Nankoweap Mesa, which is topped with the earlier slumps, landslides, and rockfalls. Other powerful springs carve Nankoweap Canyon, cutting through thick mud and slump deposits, leaving boulders stacked up to 200 feet high along Nankoweap Creek. Rocks, mud, and water spilling eastward off the plateau can go no farther than Marble Canyon, which acts as a gutter, channeling and intensifying the southward flow. Therefore, the land east of Marble Canyon is shielded from spillage off the higher, rising Kaibab Plateau.

Meanwhile, cascading waters from Grand and Hopi Lakes have begun eroding a 216-mile path to—and down through—the western edge of the Colorado Plateau. The deeper the waters cut below the high postflood water table, the more high-pressure water is released from the flanks of the lengthening channel. Each sedimentary particle becomes a cutting tool carried by the rapidly-flowing (and falling) water. As more sediments are eroded, more "liquid sandpaper" becomes available to erode more sediments. Additional energy is provided by the release of this mile-high, *subsurface* water. *In weeks, 800 cubic miles of sediments from the Kaibab Limestone and below are removed, forming the Grand Canyon.*

Although Marble Canyon adjoins the Grand Canyon, their different shapes and widths earned them different names. The canyons' differences are explained when one realizes that the change occurs where the northwest corner of the higher Hopi Lake was undercut by the rushing waters from Grand Lake—where the Little Colorado River now joins the Colorado River. In other words, the waters of Grand Lake helped carve Marble Canyon; the merged waters of both Grand and Hopi Lakes helped carve the Grand Canyon. Today, the basin that held Grand Lake is drained by the Colorado River and several of its tributaries; the basin that held Hopi Lake is drained by the Little Colorado River. Both basins were once filled with silica-rich water that quickly escaped. Supporting evidence—mesas, buttes, spires, petrified forests, extreme meandering rivers, side canyons, and hundreds of huge "pits" excavated by powerful, erupting springs—will now be explained. [Mounds, another category of evidence, are explained on pages 183–185.]

Plateau Uplift

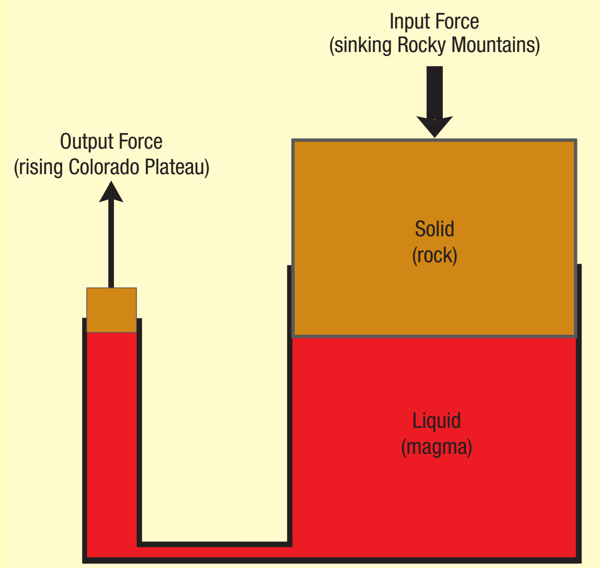


Figure 116: Hydraulic Lift. Hydraulic lifts are commonly found in elevators, car jacks, automobile brakes, and mechanisms that launch planes from aircraft carriers. In this schematic of a hydraulic lift, a large downward force (on the right) moves a short distance and lifts a lighter object (on the left) a long distance. Other hydraulic lifts use a weaker force moving a long distance to lift a heavy object a short distance. The liquids transmitting the force can be water, oil, or, in the case of rising plateaus, magma.

The sinking Rocky Mountains acted as a gigantic force that pushed 2,500,000 cubic miles of material under the Colorado Plateau, lifting the plateau an average of 6,200 feet above sea level. The world's other plateaus rose in a similar manner—all driven by gravity, beginning immediately after the hydroplates crashed. Although the roof of the subterranean chamber almost completely collapsed onto its floor by the end of the flood, high-pressure magma easily migrated between those surfaces.[42]

Sinking of the massive Himalayas pushed about 25,000,000 cubic miles of magma and crushed rocks under Asia's Tibetan Plateau, lifting it 3 miles! To understand why plateaus perplex geologists, see Professor Kennedy's candid statement of the problems on page 118. The hydroplate theory provides a simple explanation.

The uplift of the Kaibab Plateau must be seen in the context of the rising of the much larger Colorado Plateau. Likewise, the rising Colorado Plateau must be seen in the context of the sinking, much heavier, Rocky Mountains, which were initially higher than they are today. Near the end of the flood, as accelerating hydroplates crashed and buckled, mountain ranges rapidly rose. (Pages 109–147 summarize the hydroplate theory.)

As the Rocky Mountains slowly settled into the upper mantle, the Colorado Plateau rose as if it were resting on thousands of independent hydraulic lifts. Below the sinking Rockies, rock was crushed. Where resisting forces were weakest (*between the former floor and roof of the subterranean water chamber*),[42] deep, crushed rock was pushed to the side. Frictional heating immediately melted the surfaces of those sliding rock fragments. That liquid rock (magma) lubricated and swept the flow of crushed rocks away from the flanks of the sinking Rockies.[43] Each narrow channel of flowing rocks and magma constituted one "hydraulic lift." Most of the energy expended by the sinking Rockies was ultimately converted into heat and the lifting of the Colorado Plateau.

The Colorado Plateau did not rise as one solid block, because the pressure below grew at various rates at thousands of locations. Whenever the pressure at one location became large enough to fracture the rock above, a sudden *but limited* upward movement occurred. Each fracture event was *an earthquake*, and each sliding surface was *a fault*. Thousands of faults have been identified and mapped on the Colorado Plateau. Undoubtedly, thousands more are hidden under the sandy soil. Many uplifted and tipped blocks, some hundreds of square miles in area (such as Utah's Grand Staircase), dramatically show what happened.

Side Canyons of Marble Canyon and Grand Canyon. Marble Canyon and Grand Canyon were rapidly cut thousands of feet below the high postflood water table. Subsurface water, some traveling great distances,[14] exited from flanks of these canyons and may have exceeded the water in both Grand and Hopi Lakes combined. That escaping water cut dozens of large, previously unexplained side canyons that now enter Marble and Grand Canyons *at the level of the Colorado River.* Most of these side canyons have no appreciable water source today. A few are "backward."

Barbed Canyons. With all this weight quickly removed from the Grand Canyon region, the rock layers below rose, so layers north of the Grand Canyon sloped down to the north. Thus, subsurface water near Marble Canyon (and the sink valleys above) drained northward. Water spilling out of the funnel walls—Vermilion Cliffs on the west and Echo Cliffs on the east—flowed into and deepened the northward-draining sink valleys, giving them the shape of the barbs in barbed wire. Although tributaries almost always enter rivers at acute angles, the barbed canyons are oriented at obtuse angles to the Colorado River; they are "backward." Some barbed canyons are huge—a mile wide and 1,700 feet deep where they enter Marble Canyon.

Side Canyons into Grand and Hopi Basins. After Grand and Hopi Lakes quickly emptied, the water table surrounding those basins, in effect, rose hundreds of feet. Perhaps several Great-Lakes' worth of high-pressure subsurface water began seeking underground escape routes into those

Why was the uplift limited? Sometimes the irregular sides of a rising block wedged against an adjacent block. In most cases, magma (“hydraulic fluid”) was not generated fast enough to replace losses and to keep the channels (“hydraulic lines”) pressurized. For example, some magma escaped into cracks or up to the earth’s surface as a volcano or lava flow. [Page 115 lists some long-standing mysteries concerning **“Volcanoes and Lava”** that the hydroplate theory now explains.] At least 76 lava flows are in the Grand Canyon area.[44] Finally, the higher a block rose, the greater the pressure needed to lift it higher. Therefore, the magma below (containing dissolved water[45]) spread laterally, so adjacent blocks which had not risen as much were lifted instead. The spreading magma was like an expanding ink spot. Thus, the Colorado Plateau—and other plateaus—are generally circular.

A block rose when the upward force (produced by the magma’s increasing pressure below that block) exceeded the total downward force (the block’s weight plus the resisting stress and friction). Both the upward force and the downward resisting forces usually grew in unison—were balanced—so there was no upward movement. But the instant either the resisting stresses or friction reached a “breaking point,” a small movement occurred. Equilibrium was quickly restored, because the hydraulic pressure below suddenly dropped with each upward jerk. (The Rocky Mountains were higher than the Colorado Plateau, so the pressure under each block tended to increase.)[46]

Directly west of the breach at “Hopi Falls,” rock was eroded and weight was removed so rapidly that the upward forces exceeded the downward forces for days. The faster blocks rose along that downstream path, the more their tops were eroded and swept away by the violent waters spilling out of Grand and Hopi Lakes. Therefore, these vertical imbalances became even larger, deeper, and broader, resulting in the rapid uplift of the Kaibab Plateau.[47]

Farther downstream, blocks rose and were eroded along a wider path as a huge volume of subsurface water from the flanks of the deepening, 216-mile-long Grand Canyon escaped into the flow. As the broad uplift increased, the basement rock directly below arched upward and cracked in tension, forming the Grand Canyon’s steep-walled inner gorge. [See Figure 68 on page 133 and Figure 109 on page 193.] This is a long-overlooked geological phenomenon: upward-arching and tension cracks produced when high-velocity water removes massive amounts of overlying material. [For three other examples, see Figures 114 and 129 and Endnote 63 on page 142.][48]

After the inner gorge cracked open, the water-saturated, flood-deposited layers above that crack were easily attacked and undercut from below by the eroding torrent, widening the canyon. As weight was removed, hydraulic lifting became easier. Below that 216-mile path, blocks fractured as they were forced up, producing dozens of faults perpendicular to today’s Colorado River.[21] These faults (often more than 50 miles long) provided deep, initially narrow channels for transporting subsurface water down into the main flow that carved the Grand Canyon. One fault, the 180-mile-long Bright Angel Fault, allowed construction of the popular Bright Angel Trail.

Dozens of other major faults allowed vast amounts of water inside the Colorado Plateau to escape *from its periphery*. (About 20% of the plateau’s volume—or about 30,000 cubic miles—was water temporarily trapped between the sedimentary grains deposited during the flood.) The escaping water widened those underground channels, allowing even more water to escape. The results of three large escape channels are seen today in Zion and Bryce National Parks in Utah and Oak Creek Canyon in Arizona. This loss of internal water lightened the plateau, making its hydraulic lifting easier. It was analogous to water draining from a sponge as it is lifted out of a lake.

basins. Weak spots and tiny channels were exploited by the groundwater. Underground channels, many miles long, opened up and became destinations for even more escaping groundwater. The more water that flowed through these channels and their tributaries, the larger they became. In this way, hundreds of canyons formed that today enter the basins of the former Grand and Hopi Lakes.

One of the most picturesque is Canyon de Chelly (de-SHAY), a group of canyons up to 25 miles long that radiate to the east of Chinle, Arizona. Canyon de Chelly enters Grand Lake’s basin from the east, near its southernmost location in Arizona. [See Figure 106.] Streams and rivers produce canyons with V-shaped cross sections, but most of Canyon de Chelly has a U-shaped cross section. U-shaped cross sections are produced by glaciers or by groundwater flowing out from and undercutting canyon walls. Because no other glacial characteristics are found within 500 miles, subsurface flow—not glaciers—probably carved Canyon de Chelly.

Also, Canyon de Chelly has abundant rock debris at the base of its upstream walls but little debris at the downstream end. This is because only the downstream end was swept by the force of *all the water* flowing out from the walls along the canyon. Relatively little high-velocity water would have passed through the upstream portions of the canyon. Subsurface flow is also inferred at a few points on the south rim of Canyon de Chelly where side canyons begin at ridge lines.[49] (Little *surface* water flows from a ridge line, but much *subsurface* water can flow from beneath a ridge line.)

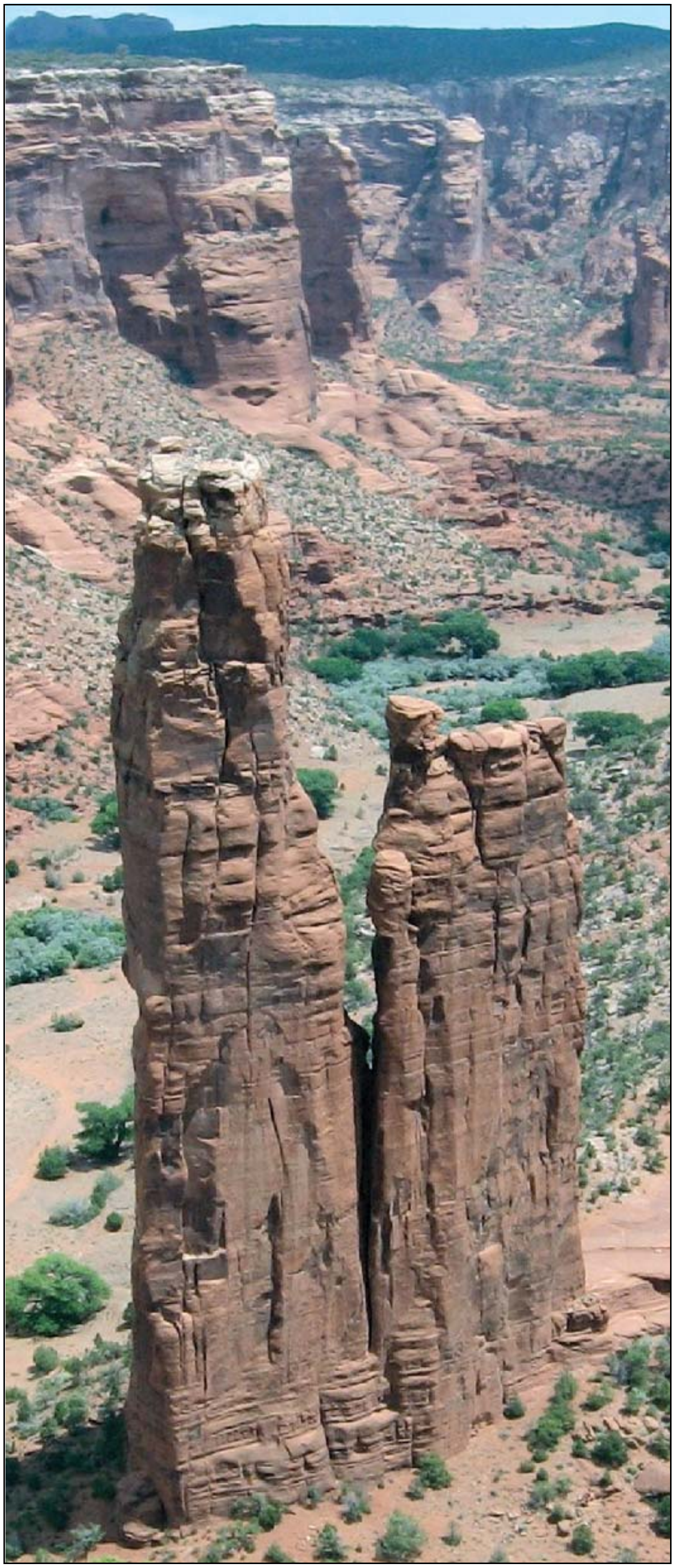


Figure 117: Spider Rock in Canyon de Chelly. Five side canyons (not shown) converge on this 800-foot spire: from the north, northeast, east, southeast, and south. It is hard to imagine terrain that would allow five surface streams to carve canyons that converge at the same point from such different directions. However, subsurface flow, which is directed by subsurface porosity more than surface topography, could produce this effect. Obviously, Spider Rock was cemented before the water that carved these canyons swept through this location.

Mesas, Buttes, and Spires. No land features symbolize the American Southwest more than mesas, buttes, and spires. [See Figure 118.] A *mesa*, which means *table* in Spanish, is a flat-topped feature, formed by erosion, which rises above the surrounding terrain. A mesa is wider than it is tall.[50] A *butte* is similar, but its height exceeds its width. A very slender butte is a *spire*.

The towering walls of these formations are strikingly vertical. How and when did they form? Two dramatically different choices are proposed—millions of years or several weeks.[51] Why are buttes and spires concentrated in Grand Lake's basin? There, adjacent buttes contain corresponding horizontal layers at the same level, showing that they were once connected. What removed the huge volume of sediments between the buttes, and where did the sediments go? The perimeters of buttes are not streamlined, but scalloped and irregular, so streams did not carve them. (Besides, rivers and streams do not meander enough or flow in circles—a necessary first step if rivers carved buttes.) Nor did wind carve these features, because large sand dunes are missing. What happened?

Beneath Grand Lake's basin today is a 1,400-foot-thick layer of sandstone. When Grand Lake was present, that sand was uncemented and saturated with water. Sand grains are hard and somewhat rounded, so water-saturated sand layers contain about 40% water by volume. As the lake emptied, the relatively large channels between these grains allowed the high-pressure water under Grand Lake to rapidly discharge upward,[52] through the lowest portions of the lake bottom—the easiest routes of escape. With those upward torrents of high-pressure water came swirling sand and dirt that was quickly swept out of Grand Lake and down through the Grand Canyon, which was forming 100–250 miles to the southwest. The highest portions of the lake bottom, including islands, offered the greatest resistance to the upward-surging flow; consequently, those high regions remained intact. Cliffs (along some of the lake boundaries) and mesas and buttes (internal to the lake) began to take shape.

Imagine sitting on the bottom of a shallow swimming pool. Your head barely sticks out of the water and, therefore, is an island. You exert little pressure on the bottom of the pool, because your body is buoyed up by the surrounding water pressure. (Such buoyancy is commonly called *Archimedes' principle*.) In other words, you almost float. Suddenly, someone pulls the plug, and the pool rapidly drains; now your entire weight presses against the floor of the pool. Had you been a newly forming butte resting on the floor of the rapidly draining Grand Lake, you would quickly press down on 1,400 feet of water-saturated sediments. It would be as if, over a period of weeks, a 250,000,000-ton rock, with only a ¼-square-mile base, settled down on a water-saturated, 1,400-foot-thick

Figure 118: Mesas, Buttes, and Spires. Monument Valley, on the Arizona-Utah border, is the most famous location in the world for mesas, buttes, and spires. These features, also abundant over thousands of square miles surrounding Monument Valley, are inside the basin that held Grand Lake, a lake that existed for probably a few centuries after the flood. The long cliff spanning the horizon marks a small part of Grand Lake's boundary. As Grand Lake spilled and began carving the Grand Canyon 100–250 miles to the southwest of Monument Valley, groundwater surged upward through the lower portions of the lake floor and carried off the material that once connected these stark and magnificent land forms. All were carved in weeks. Since Grand Lake drained a few thousand years ago, weathering has produced the piles of debris at the base of each mesa, butte, and spire.

sponge. Water would surge upward and erode the sides of the rock, making the butte slender, its perimeter scalloped, and its walls vertical. The banks of Grand Lake, now quite high, would also increase the pressure on the 1,400 feet of water directly below. If that water could escape upward, a bank segment would become a cliff. (Under special conditions, a relatively few mesas and buttes formed beyond Grand Lake as the flood waters drained from the earth.)

Petrified Forest. Probably the world's largest concentration of petrified wood is in the Petrified Forest National Park in Arizona. (Trainloads of petrified wood were removed before the region became a protected park in 1906.) Few people realize that this park lies inside the former Hopi Lake. Why does wood petrify, and how were these unusual conditions met in Hopi Lake?

Wood petrifies when (1) mineral-rich water saturates wood and (2) some of those dissolved minerals precipitate into the tiniest voids in the wood's cells.[53] Usually the water is rich in silica (SiO_2), which forms quartz when it comes out of solution. (The solubility of quartz in water increases enormously as the water's temperature rises. Conversely, silica is forced out of a saturated solution[54] and becomes quartz as the water cools.[55])

Today, a log floating in a lake will not petrify, but will eventually disintegrate. To petrify a log, considerable silica must be dissolved in water that saturates the log, and that silica must come out of solution before the log disintegrates. (Some petrified wood shows intricate cellular detail, indicating rapid petrification *before* the wood had time to decay.[56]) Silica comes out of a saturated solution that cools, but today's lakes are already relatively cool and contain little dissolved silica. How, then, did petrification occur?

Consider the extremely hot, high-pressure water in the subterranean chamber before the flood. [See page 124 for information on supercritical water.] The chamber's roof and pillars were granite. About 27% of granite's volume is quartz. Quartz in contact with hot, high-pressure water quickly dissolves.[57] Although the temperature of the

Figure 119: Broken Logs in Arizona's Petrified Forest. For a log to snap this cleanly, it must be brittle, as a petrified log would be. To petrify, a log must be saturated with a silica-rich solution, probably in a lake. Then the silica must come out of solution, which requires the water to cool. A petrifying log would settle gently onto the lake's floor and not break. Because this log broke into many similar-length (but reoriented) pieces, the entire petrified log probably received a powerful impact.

A heavy, petrified log lying on a lake floor seems unlikely to break into many pieces that are later reoriented. However, if the boundary of a large lake breached, as in the collapse of a dam, the water would rush out in a torrent, carrying even sunken petrified logs for some distance. A rapidly moving petrified log "crashing" back onto the lake bottom would break up, much as an aircraft crashing in a field.

Figure 120: Petrified Wood on a Butte (Shinumo Altar). Obviously, tons of petrified wood did not wash up onto the top of this 500-foot-high butte. Nor is there reason to believe that a major lake with silica-rich water and floating logs was once on its very flat top. Instead, shortly before the butte formed, water from the breaching of Grand Lake (11 miles to the north) transported petrified logs to this spot. About 17 miles to the south, the escaping water undercut the northwestern corner of Hopi Lake. Surging waters from both lakes rapidly carved the Grand Canyon.

supercritical waters dropped sharply as they expanded and spilled onto the earth, those flood waters, *super*saturated[58] with silica, were still warm. Therefore, floating logs in postflood lakes could easily petrify as temperatures dropped. That occurred in the former Hopi Lake, as seen in today's Petrified Forest National Park.

Researchers using silica-rich solutions have duplicated petrification in laboratories. If we did not realize (1) all the silica that was dissolved in the hot subterranean water and (2) the role played by large *preflood* trees[59] floating in warm *postflood* lakes, petrification would be a mystery supposedly hidden behind "millions of years."

Finally, notice in Figure 106 on page 188 that Petrified Forest National Park lies in the southeastern end of Hopi Lake's basin, where prevailing winds (which are from the west) would have drifted the floating logs.[60] Also, petrified logs lying on the bottom at that end of the lake would be least disturbed by the waters spilling out the opposite end. This accounts for the high concentration of petrified wood in this most famous petrified forest.

Grand Lake's basin also contains Utah's Escalante Petrified Forest and petrified wood along the Green River. At times petrified wood is found outside a former lake basin. For example, between the points where Grand Lake breached and Hopi Lake breached is Shinumo Altar, a 500-foot-high butte capped by hard rock.[61] Petrified wood is scattered over its flat top. (Nearby residents report that petrified logs 7–10 feet long were once on the butte, but a helicopter removed them in about 1999.[62]) As Grand Lake's waters spilled toward Hopi Lake, petrified wood lying on the bottom of Grand Lake was swept onto flat ground that became the top of Shinumo Altar. [See Figure 120 and, on page 188, Figure 106.] Days or weeks later, the butte formed as the cascading water stripped off 500 feet of the surrounding, softer Mesozoic rocks that were not protected by a hard cap.

Figure 121: Goosenecks. One of the world's most famous meandering rivers or streams is the San Juan River, which flows entirely within the basin of the former Grand Lake. Here, near the town of Mexican Hat, Utah, is a section of the river, called *Goosenecks*, where the river has cut down through 1,000 feet of sediments and meanders 5 miles over a distance of only one straight mile. Similar meandering extends 11 miles upstream and 11 miles downstream from this location. Is there a reason for such extreme meandering in Grand Lake's basin?

Meandering Rivers. Several rivers within the basins of the former Grand and Hopi Lakes meander dramatically. Goosenecks State Park, along the San Juan River, contains the western hemisphere's most extreme segment of a meandering river or stream. Why do rivers meander, and what conditions could produce such extreme *and deep* meandering in a river that today is so small and sluggish?

A river flows faster on the outside of even slight bends than on the inside, just as the outside of a merry-go-round travels faster than the inside. The centrifugal force (pushing outward) raises the water level on the outside of a bend. Therefore, the river's *surface* water flows toward the outside of a bend, and the *bottom* water completes the circulation by flowing toward the inside. In other words, the river flows in a corkscrew (spiral) pattern.

Sediments eroded by the faster flow, along the outer bank, are transported to and deposited near the inner bank, where the flow is slower and less able to carry sediments. Even on rivers that are initially fairly straight, slight curves expand and meandering increases, if the flow is *fast, high, and steady*.

Meanders occur on broad, flat floodplains. Deep meanders, as seen in Figure 121, require a large floodplain with deep, loose sediments. The flow out of Grand Lake encountered a major bottleneck, slightly downstream from what is now the Goosenecks region. [See Figure 106 on page 188.] This bottleneck slowed the upstream flow, so sediments were dropped, but through the bottleneck the flow was rapid, so sediments were scoured and the channel deepened.

After the lake emptied, *subsurface* water steadily drained into the large San Juan basin all along its $1{,}000^{+}$-mile perimeter, making the San Juan a powerful river for centuries, especially along the steep channel eroded down through the bottleneck and slightly beyond. This steepness, slight headward erosion back through the still loose sediments, and the high volume of water provided the considerable energy needed to excavate the meandering river's outer banks to the extreme extent seen today.

Why did the Goosenecks develop such uniform and symmetrical meanders? Today, rivers are fed primarily by surface flow, so their volume flow rate, depth, and sediment load are *seasonal*. This produces varying meander patterns. However, the early San Juan was fed largely by *subsurface* water steadily draining into the large San Juan basin, so centuries of fast, *steady* flow conditions produced uniform, symmetrical meandering patterns.

The Algodones (Al-ga-DOE-nez) Sand Dunes (which include California's Imperial Sand Dunes). This is one of the largest sand dune complexes in North America, covering 200 square miles and containing about 2.5 cubic miles of sand. It extends 45 miles up the Imperial Valley between Yuma, Arizona and the Salton Sea.

In his geology textbook, Richard Flint estimates that wind slowly blew all that sand in over "at least 160,000 years."[63] He does not identify the source of the sand, why wind concentrated it there, or why little dirt was blown in. Others say that an extinct lake they call Lake Cahuilla (ka-WEE-ah) was fed by the Colorado River and provided the sand. (But lakes rarely have the energy to break up rock to produce all that sand, and even if they could, they couldn't separate much sand from the mud and clay that is also produced.) But there is a complete explanation with abundant scientific evidence.

The sudden breaching of Grand and Hopi Lakes carved the Grand Canyon and gave birth to the Colorado River. A

Figure 122: Algodones Sand Dunes (California's Imperial Sand Dunes). Where did all this clean, pure sand (2.5 cubic miles worth) come from? Why is it here in a 45-mile-long and 5-mile-wide valley?

few thousand cubic miles of sand and other sediments were transported south, along the Arizona-California border (the path now occupied by the Colorado River). That surge far into the Gulf of California also flooded the long, Imperial Valley that extends northwest of Yuma. Sediment-laden water quickly filled that valley, because its entire length is about 700 feet lower than the Colorado River as it exits the Grand Canyon, and much of the valley is below today's sea level. Within the standing water temporarily filling the flooded valley, sand (as opposed to mud and clay) would have quickly settled out of the water. [See Endnote 5 on page 218 to recall how gritty the Colorado River is.] After the flooding Colorado River crested at the southeast end of the valley, most of the valley's waters would have drained back into the Colorado River and ultimately into the Gulf of California. Left behind in the valley were large volumes of sand and the Salton Sea, whose surface today is about *220 feet below sea level*.

Mud settles slowly out of standing water. Because little mud lies in the dunes area, the valley was probably filled with gritty water only briefly. This is consistent with the few weeks I estimate it took to carve most of the Grand Canyon. Since this flooding, winds concentrated the sands a few miles to the east, along the western side of the Chocolate Mountains, which parallel the Imperial Valley and act as a barrier to the prevailing winds blowing eastward.

PREDICTION 11: A chemical and isotope analysis of the sand dunes will show that the sand came from the Grand Canyon.

Question 1: Was the Grand Canyon formed by draining water at the end of the flood?

A little thought will show that the Grand Canyon was not carved simply by draining surface water at the end of the flood. If flood waters draining all over the earth at the end of the flood carved the Grand Canyon, there should be hundreds of similar huge canyons worldwide. (Attempts to show that the canyon formed at the end of the flood have produced no evidence, but the answer to Question 2 below provides evidence that the Grand Canyon was carved a few centuries after the flood.)

Water draining from a swimming pool or continent does not achieve high, erosive velocities *interior* to the pool or continent; such velocities occur only at the downstream edge of the pool or continent. Because water is much more viscous (resistant to flow) than air, water cutting through air and spilling onto dry land would attain higher velocities than water trying to cut through water. The result: erosive sheet flow. This would account for "the Great Denudation" over 10,000 square miles—in the funnel and south and west of the funnel. Also, 2,000-foot waterfalls spilling from both Grand and Hopi Lakes would have had great eroding power, because the flood waters had already drained.

Everyone agrees that water carved the Grand Canyon, but there would be no Grand Canyon if it were not sitting on a mile-high plateau. (Great height gives water the great energy needed to carve and remove so much material.) So,

a. how and when[64] was the Colorado Plateau lifted an average of 6,200 feet above today's sea level, and
b. how did so much water rise that high?

Figure 123: A Very Deep Pit. Along Grand Lake's eastern boundary, just east of Rock Point, Arizona, are perhaps a hundred huge pits. (A 20-story building could be dropped into this pit.[65]) These pits have no visible source of water that could have carved them, nor could the terrain direct much surface water to this spot. *If surface water could not have eroded these pits, then subsurface water did.* My camera is looking over a small portion of Grand Lake's basin in the distance. Behind me, the land rises steeply to the east, reaching 9,412 feet, 24 miles away. [See Figure 106.] As Grand Lake discharged, a huge reservoir of subsurface water, at the lake's level but beyond the lake's boundary, erupted as powerful springs into Grand Lake's draining basin, excavating these pits. Obviously, the lake had to have been present for some time in order to establish the water table far beyond the lake's shoreline.

(The list of **"Evidence Requiring an Explanation"** on page 193 gives many reasons why the water source could not have been the Colorado River.)

Today, if all land were pushed down below sea level, sea level would rise in compensation. Eventually, water would again flood the earth, even though *sea level would rise only 800 feet*.[66] The 6,200-foot-high Colorado Plateau, littered with marine fossils, is today far above the level that water would rise on a flooded earth. Therefore, the plateau must have risen after the flood by more than a mile. For a time, the flood waters covered all *preflood* mountains,[67] but rapidly drifting hydroplates, crashing and thickening at the end of the flood, pushed up out of the flood waters *today's* major mountains and continents. (If you think the flood waters were above the Colorado Plateau and carved the Grand Canyon as the water drained from the land, then you are imagining too much water and will not be able to explain where all the water went after the flood.)

Right after the flood, lakes were much more abundant than today, because continental basins (formed primarily during the compression event) retained much of the draining flood water. Over time, some of these lakes lost water by evaporation, seepage, or breaching. However, lakes on the upwind side of mountain ranges received much of the heavy, postflood precipitation the mountains intercepted. Those lakes likely grew, even at high elevations.

Question 2: When did Grand Lake breach its natural dam?

After the flood, several time-consuming processes had to occur before Grand Lake breached.

a. The Rocky Mountains had to sink into the mantle enough to lift the Colorado Plateau 6,200 feet above sea level. (As Professor Kennedy explained on page 118, this involved the injection of 2,500,000 cubic miles of material under the rising plateau.) Waters on the high plateau then had enough energy to erode at least 2,000 cubic miles of soft Mesozoic rock over almost 10,000 square miles, and to erode another 800 cubic miles to form the Grand Canyon.
b. Enough time had to pass to cement certain objects exposed to the torrent of water from Grand and Hopi Lakes. Had tall spires, Shinumo Altar, boulders stacked above Nankoweap Creek, and thousands of giant caves in cliffs not been firmly cemented, they would have collapsed or eroded when these lakes discharged. Grand Lake's basin contains hundreds of massive ***liquefaction mounds***, explained on page 185. They must also have been firmly cemented when the basin's water spilled out.
c. Enough time had to pass for the 350-foot-thick layer of Kaibab Limestone to harden in the presence of so much subsurface water, including water in the thick Mesozoic sediments above. (Hardening made the limestone brittle, so it cracked as shown in Figure 114 on page 198. Cementing also allowed the limestone to resist the torrent of water that swept over northern Arizona during "the Great Denudation.") Hardening had to occur before the potholes shown in Figure 113 could form.
d. Enough time had to pass for Hopi Lake to cool and its silica-rich waters to soak into and petrify floating logs. Arizona's world-famous Petrified Forest National Park is in the basin that held Hopi Lake. Some smaller petrified forests are in Grand Lake's basin.
e. The production, eruption, and solidification of lava had to occur at a few dozen isolated parts of

Figure 124: Floor of Hopi Lake. Here, at a place called *Coal Mine Mesa*, inside the basin of the former Hopi Lake, several hundred square miles were torn up, pulverized, and removed by subsurface water escaping upward through the floor of Hopi Lake as it catastrophically drained. (No surface water exists today to do this excavation.) The geologist at the extreme right gives the scale at one of these many ripped-up areas that stretch in some directions as far as the eye can see. The region's predominantly shale sediments, which contain petrified wood and a thin layer of coal, are much less porous than the 1,400-foot-thick layer of water saturated sand that lay directly beneath Grand Lake. Therefore, as Hopi Lake discharged, high-pressure water, hundreds of feet below the floor, flowed upward through a relatively small portion of the floor. Eroded material was then transported through the rapidly forming Grand Canyon, 50–200 miles to the west. (Because relatively little water spilled out of Hopi Lake's shoreline, few cliffs formed.)

northern Arizona before Grand and Hopi Lakes breached. Otherwise, the softer rock below those lava flows would have eroded. For example, Red Butte, 16 miles south of Grand Canyon Village, rises 1,000 feet above the surrounding terrain. It was already capped by hardened lava when the torrent of water spilled out of Grand Lake.

f. Time was required for animal migration to the Grand Canyon region. Some squirrels may have completed their migration before the canyon formed.[68]

g. Three legends of Native American tribes living near the Grand Canyon contain surprising elements consistent with the scientific evidence concerning the canyon's formation.[69] This suggests that humans were living in the region when the Grand Canyon formed. If so, some length of time was needed for them to migrate to the Grand Canyon region.

For these reasons, the Grand Canyon probably formed centuries after the flood.

Question 3: Why do we not see clear shorelines around the boundaries of the former Grand and Hopi Lakes?

Shorelines can be seen at scattered locations around several extinct lakes, such as Lake Bonneville and Lake Missoula, but the situations at these lower lakes were quite different. After the flood, *the rising Colorado Plateau slowly lifted Grand and Hopi Lakes more than one mile.* No doubt, this altered the shapes of their basins—and shifted their shorelines. Shifting shorelines have less time to leave permanent etchings in the rocks at each level. Tipping the rising plateau about one centrally-located axis by *only one-tenth of one degree* (0.1°) would have shifted shorelines horizontally at Grand Lake and Hopi Lake by an average of several miles.[70] Multiple tippings about different axes or about an axis far from the lakes' centers would multiply this effect. *Lake Bonneville and Lake Missoula were not on rising—and, therefore, tipping—plateaus.* Faulting and volcanism among the thousands of uplifted and tipped blocks of the Colorado Plateau further changed shorelines.

Also, despite the greater evaporation on the high plateau, the volume of water in Grand and Hopi Lakes probably increased from the heavy postflood rainfall on the upwind side of the higher Rocky Mountains, the drainage from higher elevations, and the breaching of higher lakes. Therefore, *lake levels rose and shorelines expanded and shifted for many years after the flood.*

Lake Bonneville and Lake Missoula most likely breached centuries after Grand and Hopi Lakes, giving Bonneville and Missoula more time to etch their shorelines. After Grand and Hopi Lakes breached, the frequent thunderstorms in that region would have had more time to erode and erase any shoreline markings.

As Grand and Hopi Lakes emptied, subsurface water surrounding their basins automatically became higher relative to the dropping lake levels. Therefore, powerful springs erupted into the draining basins. That water often removed shoreline segments and undercut the basins' steeper slopes, forming cliffs in and around these lakes, and sweeping debris (talus) away. Consequently, many shorelines of Grand and Hopi Lakes are marked—not by small shelves as with Lake Bonneville and Lake Missoula—but by cliffs. Supporting this explanation is Dr. Edmond W. Holroyd's detailed study[71] showing that a remarkable number of cliffs lie on the proposed boundary of Grand Lake. Hopi Lake's proposed boundary is not as dramatically marked. Figure 124's description may explain why.

Travelers driving through or flying over the basins of Grand and Hopi Lakes see land that differs from adjacent terrain. The basins have a smoother texture, lighter color, and sparser vegetation. A frequent comment is, "It looks like a lake bottom." Indeed, Holroyd, using satellite photographs, observed that "the 'lake' outlines surround naturally bright regions of the Colorado Plateau."[72] Nearby regions at the same elevations, but outside these basins, do not have these "bright" characteristics.

PREDICTION 12: The soil chemistry in the basins that held Grand and Hopi Lakes will be found to be distinctly different from that of their surroundings.

Evaluation of Evidence vs. Proposals

Table 5 summarizes how well each of nine proposals explains the many strange features of the Grand Canyon. Each column corresponds to a proposal, and each row represents evidence requiring an explanation. A green circle means that, in my opinion, the column's proposal reasonably explains that row's diagnostic detail. Yellow and red circles indicate moderate and serious problems, respectively. Numbers in Table 5 refer to additional information below.

Readers should make their own judgments and independently assess each proposal's plausibility. For example, if you feel that a detail or proposal has been omitted or misstated, modify the table. This approach focuses future discussions on areas of critical disagreement. It also helps keep all details and competing views in mind, encouraging balance and thoroughness. Sometimes a disagreement over one detail becomes moot when one recognizes other facts that oppose a proposal. Often, when a theory is presented, only the details supporting it and opposing one competing view are mentioned. Table 5 contrasts the best-known published proposals with all the **"Evidence Requiring an Explanation"** beginning on page 193.

Details Relating to Brown's Proposal (Hydroplate Theory)

1. ● Layering, ● Fossils. Pages 175–187 explain how the flood produced sharp, parallel, generally uniform sedimentary layers, each with different mineral and fossil contents. If the Canyon's strata formed over millions of years, irregular surface erosion by wind and water would now be seen between all these layers.

Figure 108 on page 192 accurately shows how relatively cut up the top layer (Kaibab Limestone) is, relative to all the smooth, parallel, generally softer layers below. Despite the hardness of Kaibab Limestone, its exposure to erosive elements has been much greater than that of the layers below, which some people mistakenly believe were each top layers for millions of years.

2. ● Limestone. As pages 229–235 explain, way too much limestone exists *on* earth to have been produced by processes and chemistry at the earth's surface. Almost all limestone came from the subterranean water chamber (including the relatively pure Hualapai Limestone) and was deposited during the flood, before the Grand Canyon and Colorado River existed.

3. ● Why Here? ● Forces, Energy, and Mechanisms. At the end of the flood, crashing hydroplates lifted mountains and thickened continents. As the flood waters drained off these continents, basins were left full of water. Therefore, lakes were abundant immediately after the flood. Later, many lakes breached their banks and carved relatively small canyons. Massive mountain ranges settled into the upper mantle, hydraulically lifting adjacent regions, forming plateaus.

Atop the Colorado Plateau were two very large lakes: Grand Lake and Hopi Lake. They had great potential energy *relative to the base of the plateau* and, therefore, great potential erosive power. (The higher the water, the greater its potential energy.) That energy was "cashed in" as Grand and Hopi Lakes breached and discharged down a near (western) edge of the mile-high Colorado Plateau. Also released were large volumes of high-pressure subsurface water surrounding Grand and Hopi Lakes and the freshly cut canyons. Because of the high postflood water table, the volume of subsurface water released into the Grand Canyon may have exceeded the water in Grand and Hopi Lakes combined. The resulting 216-mile "gully" extending down through the western edge of the Colorado Plateau is the Grand Canyon.

Although lakes at high altitudes experience high evaporation, the newly formed Rocky Mountains intercepted the moist eastward-moving winds generated by the warm Pacific Ocean, which was heated by extensive flood basalts for centuries after the flood. [See pages 149–173.] This produced considerable precipitation and drainage west of the Rockies, feeding lakes on the western slopes.

Grand Lake's breaching triggered the breaching of Hopi Lake. (Spillage from other lakes higher in the Rocky Mountains or other topographic changes produced by the rising Colorado Plateau, including earthquakes and volcanic activity, probably contributed to the final

Table 5. Evidence vs. Proposals for the Origin of the Grand Canyon

Evidence to Be Explained	Proposals: Brown (Hydroplate) 1989	Powell 1869	Gilbert 1875	Emmons 1897	Blackwelder 1934	McKee 1964	Hunt 1976	Lucchitta 1978	Meek/ Douglass 2000
Layering	🟢 1	⊗ 17	⊗ 25	⊗ 34	⊗ 42	⊗ 51	⊗ 60	⊗ 69	⊗ 78
Limestone	🟢 2	⊗ 17	⊗ 25	⊗ 34	⊗ 42	⊗ 51	⊗ 60	⊗ 69	⊗ 78
Why Here?	🟢 3	⊗ 17	⊗ 25	⊗ 34	⊗ 42	⊗ 51	⊗ 60	⊗ 69	🟡 78
Why So Relatively Recent?	🟢 4	🟡 17	🟡 25	🟡 34	🟡 42	🟡 51	🟡 60	🟡 69	🟡 78
Forces, Energy, and Mechanisms	🟢 3	⊗ 19	⊗ 27	⊗ 36	⊗ 44	⊗ 53	⊗ 62	⊗ 71	⊗ 80
Marble Canyon	🟢 5	🟡 17	🟡 25	🟡 34	🟡 42	🟡 51	🟡 60	🟡 69	🟡 78
Side Canyons	🟢 6	🟡 18	🟡 26	🟡 35	🟡 43	🟡 52	🟡 61	🟡 70	🟡 79
Barbed Canyons	🟢 6	⊗ 18	⊗ 26	⊗ 35	⊗ 43	⊗ 52	⊗ 61	⊗ 70	⊗ 79
Distant Cavern Connection	🟢 6	⊗ 17	⊗ 25	⊗ 34	⊗ 42	⊗ 51	⊗ 60	⊗ 69	⊗ 78
Slot Canyons	🟢 7	⊗ 18	⊗ 26	⊗ 35	⊗ 43	⊗ 52	⊗ 61	⊗ 70	⊗ 79
Missing Mesozoic Rock	🟢 8	⊗ 21	⊗ 30	⊗ 37	⊗ 45	⊗ 56	⊗ 63	⊗ 73	🟡 82
Perpendicular Faults	🟢 9	🟡 17	🟡 25	🟡 34	🟡 42	🟡 51	🟡 60	🟡 69	🟡 78
Arching	🟢 9	🟡 17	🟡 25	🟡 34	🟡 42	🟡 51	🟡 60	🟡 69	🟡 78
Inner Gorge	🟢 9	⊗ 17	⊗ 25	⊗ 34	⊗ 42	⊗ 51	⊗ 60	⊗ 69	⊗ 78
Missing River	🟢 10	⊗ 20	⊗ 28	⊗ 38	🟢	⊗ 54	🟡 64	⊗ 74	🟢
Missing Talus	🟢 11	🟡 17	🟡 25	🟡 34	🟡 42	🟡 51	🟡 60	🟡 69	🟡 78
Kaibab Plateau	🟢 11	🟢	⊗ 29	🟢	🟢	⊗ 55	🟢	⊗ 72	🟡 81
Unusual Erosion	🟢 12	⊗ 17	⊗ 25	⊗ 34	⊗ 42	⊗ 51	⊗ 60	⊗ 69	⊗ 78
Nankoweap Canyon	🟢 12	⊗ 17	⊗ 25	⊗ 34	⊗ 42	⊗ 51	⊗ 60	⊗ 69	⊗ 78
Missing Dirt	🟢 13	⊗ 20	⊗ 28	⊗ 38	🟢	🟢	⊗ 64	⊗ 74	🟢
Fossils	🟢 1	⊗ 22	⊗ 31	⊗ 39	⊗ 46	⊗ 57	⊗ 65	⊗ 75	⊗ 83
Tipped Layers below Unconformity	🟢 14	⊗ 23	⊗ 32	⊗ 40	⊗ 47	⊗ 58	⊗ 66	⊗ 76	⊗ 84
Time or Intensity?	🟢 15	🟡 24	🟡 33	🟡 41	🟡 48	🟡 59	🟡 67	🟡 77	🟡 85
Other	🟢 16				🟡 49–50		⊗ 68		⊗ 86–87

Key:
🟢 The proposal explains this item.
🟡 The proposal has moderate problems with this item.
⊗ The proposal has serious problems with this item.
Numbers in this table refer to amplifying information on pages 209–217.

breaching of Grand Lake.) Surging water from both giant lakes quickly swept off the Mesozoic sediments from at least 10,000 square miles south and west of the funnel.

4. 🟢 ***Why So "Recently"?*** Did the Grand Canyon form during the last one-thousandth of the earth's history? Only if one accepts radiometric dating and assumes that the Colorado River carved the canyon. Both of these ideas are problematic for other reasons already explained in this book. [See especially **"The Origin of Earth's Radioactivity"** on pages 329–371.] Besides, so many earlier rivers, having more time to flow, should have carved many deeper and longer "Grand Canyons." Actually, the Grand Canyon was carved several centuries after the flood.

5. 🟢 ***Marble Canyon.*** Marble Canyon began as a tension fracture. Therefore, Marble Canyon has narrow vertical walls and follows a fairly straight path. (The Nankoweap Canyon region, at the southwestern end of Marble Canyon, is an exception that is explained in item 12 below.) Marble Canyon ends where Hopi Lake breached—at "Hopi Falls"—where today the Little Colorado River intersects the Colorado River. Notice in Figure 107 on page 191 that the torrent flowing away from "Hopi Falls" eroded and smoothed out the region south of the yellow perimeter.

Figure 125: Slot Canyons. Slot canyons have rugged, vertical sandstone walls and can be hundreds of feet deep but only a few feet wide. They are usually found on the Colorado Plateau, along tributaries that feed into the Colorado River. The above pictures (in true color) were taken in Antelope Canyon, 3 miles east of Glen Canyon Dam. Conventional thinking says that slot canyons were carved by streams or flash floods eroding down from the surface. However, that would produce V-shaped canyons with relatively smooth walls, not extremely narrow, vertical canyons with jagged walls (as seen, for example, at the black arrow). Also, why would slot canyons be cut primarily through warped sandstone layers on the Colorado Plateau? Why are slot canyons not more uniformly scattered worldwide?

"Plateau Uplift" on page 200 explains why hydraulic uplifting of the Colorado Plateau warped horizontal layers and produced vertical fractures through those sedimentary layers. After Grand Lake breached, thin, vertical fractures that had penetrated wet layers of porous sand (aquifers) would have become drainage channels if drainage could occur down to the Colorado River. Drainage along those fractures eroded slot canyons and exposed warped, curved layers that were later cemented into sandstone by the silica-rich subsurface water. These vertical fractures produced slot canyons and streams; streams did not produce slot canyons. If all this happened millions of years ago, slot canyons would be much wider and shallower.

All the thin strata in the walls of Marble Canyon and in Echo and Vermilion Cliffs rise to the south, because so much mass was rapidly removed from the south—the region occupied by the Grand Canyon. These strata also rise toward Marble Canyon, because the spillage from Grand Lake stripped off so much mass above what is now Marble Canyon. Also, Marble Canyon is a deep vertical crack and, thus, a line of bending weakness and uplift. Had these $2{,}800^+$ ($2{,}000^+ + 800$) cubic miles of debris been removed over millions of years, rather than in weeks, the slow buildup of stresses would have been distributed over a wider area, resulting in less dramatically tipped layers.

6. ● Side Canyons, ● Barbed Canyons, ● Distant Cavern Connection. Subsurface water—released by faulting and the rapid downcutting of Marble Canyon and Grand Canyon far below the high postflood water table—carved dozens of large side canyons. They, in turn, released groundwater on their flanks. Some subsurface drainage flowed counter to today's flow of the Colorado River, thereby carving barbed canyons.

PREDICTION 13: After the flood, hydraulic pressure 10 miles below the earth's surface produced thousands of vertical fractures and lifted the Colorado Plateau. Drainage of ground water through those cracks eroded slot canyons. Therefore, cracks up to 10 miles deep should be found below slot canyons. Slot canyons are slowly filling up with sediments deposited by wind, intermittent streams, and flash floods.

7. ● Slot Canyons. See Figure 125.

8. ● Missing Mesozoic Rock. Sheet flow from the sudden breaching of Grand and Hopi Lakes could easily sweep 99% of the Mesozoic sediments (at least 1,000 feet thick) off the hard, flat Kaibab Limestone. On the Colorado Plateau, these sediments are generally missing southwest of Grand Lake's basin and west of Hopi Lake's basin, but almost nowhere else. Millions of years of rainfall and meandering rivers would not do the job and would leave meandering erosion patterns.

9. ● Perpendicular Faults, ● Arching, ● Inner Gorge. With so much material removed by the eroding waters of Grand and Hopi Lakes and by escaping subsurface water, the basement rock, directly below all the flood-deposited sedimentary layers, arched upward and cracked. This opened the deep, steep, narrow, and rough inner gorge of the Grand Canyon, allowing even more erosion and removal of sediments above the crack. Hydraulic pressure, driven by the sinking Rocky Mountains, uplifted deep blocks, whose tops were then eroded by the violent water, thereby continuing the uplift. (These blocks were fractured along the vertical planes of greatest weakness—perpendicular to the 216-mile long axis of the canyon.)

PREDICTION 14: The inner gorge is a tension crack. Acoustical and/or seismic instruments should be able to detect this deep V-shaped crack far below the bed of the Colorado River.

The Colorado River seldom turns and follows these faults, because the violent, draining waters had already carved most of its channel down off the western rim of the Colorado Plateau before the faults formed.

10.* ● *Missing River. There is no evidence for a precanyon Colorado River, because the river never existed before the Grand Canyon was excavated. *The river is a consequence of that excavation, not its cause.*

11.* ● *Missing Talus,* ● *Kaibab Plateau. The torrent of water spilling southward from Grand Lake swept away much of the talus that would otherwise be at the base of Echo and Vermilion Cliffs. That torrent undercut Hopi Lake's northwestern boundary, releasing a wide, powerful waterfall. (It was roughly thirteen times higher than Niagara Falls and, for a few weeks, discharged more than a hundred times more water each second than Niagara Falls.) The resulting deep excavation caused the layers below to buckle upward. (Figures 60 and 62 on pages 127 and 128 explain this well-understood engineering phenomenon—the buckling of a plate on an elastic foundation.) The violent flow of water to the west eroded a path through the rising land that would become the Kaibab Plateau. John Wesley Powell correctly explained this process, although he had no idea that the Kaibab Plateau rose rapidly and contained so much water. Nor did he know about Hopi Lake or the forces, energy, and mechanisms involved. Thus, he invoked the standard "explanation"—millions of years.

***12.* ● *Unusual Erosion,* ● *Nankoweap Canyon*.** Had the water that carved Nankoweap Canyon and its side canyons originated from one locale, such as a lake, multidirectional erosion would not have occurred. Had rainfall, over long periods of time, provided the water that carved these canyons, the erosion would not have been concentrated in the relatively small region of unusual erosion. [See Figure 107 on page 191.] However, *subsurface water* inside the rapidly rising Kaibab Plateau would drain from many directions, but Marble Canyon would act as a gutter, preventing spillage onto the lower terrain east of the Colorado River.

The vast volume of subsurface water in the Kaibab Plateau could excavate Nankoweap Canyon and its tributaries, support humans and their agriculture for decades, carve a channel through thick mud deposits (thereby exposing rounded boulders 200 feet high along Nankoweap Creek), deposit slumps, landslides, and rockfalls on top of what later became Nankoweap Mesa, and create the largest delta along the Grand Canyon portion of the Colorado River. (Because all of this happened only a few thousand years ago, the Colorado River has not yet removed Nankoweap Delta.) Humans left Nankoweap Canyon when their water source could no longer support them.

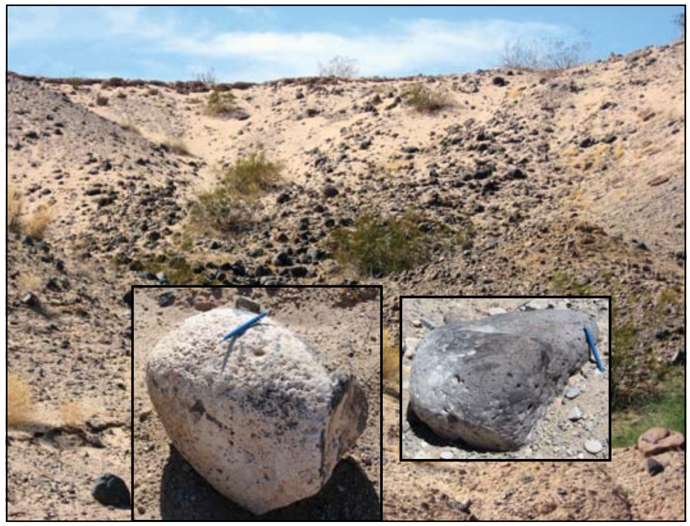


Figure 126: High-Velocity Flow. After the Colorado River exits the Grand Canyon, it turns sharply south and travels 310 miles to the Gulf of California. Much of the land east and west of the river resembles a wide, flat floodplain, but the volume of sediments there falls far short of the 2,800 cubic miles excavated to form the Grand Canyon. Here, south of Bullhead City, Arizona, 1 mile east of the Colorado River and 100 feet above it, are well-rounded boulders whose transport required extremely high-velocity water. But where is all the dirt?

13.* ● *Missing Dirt. At least 2,000 cubic miles of Mesozoic sediments were stripped off the layers surrounding and above what is now the Grand Canyon, and then 800 cubic miles of sediments were removed from inside the Grand Canyon. All that dirt was spread downstream from the Grand Canyon, primarily into the northernmost 220 miles of the Gulf of California.

A smaller fraction of those downstream sediments are exposed along the Colorado River as it flows south toward the Gulf of California. Rounded boulders mixed with sand and clay are often seen where today's side streams have cut channels 100–200 feet deep. Rounded boulders show that they were tumbled and transported by high-velocity water. Unsorted mixtures of sand, clay, and boulders show that the turbulent, muddy water suddenly slowed, depositing the unsorted mixture. [See Figures 126 and 127.]

14.* ● *Tipped Layers below the Great Unconformity. This tipping is explained on pages 181–184, beginning with the

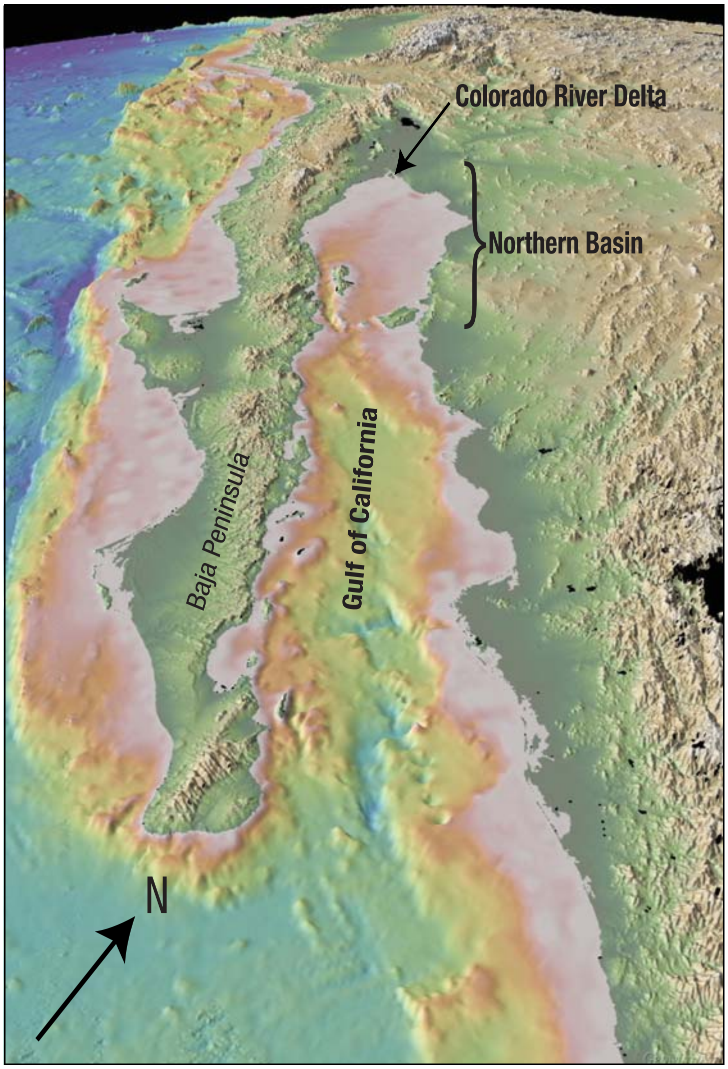


Figure 127: Here's the Dirt. It's right where we would expect it, if we understood the Grand Canyon's rapid and violent formation. Hidden beneath the flat floor of the Gulf of California's Northern Basin are at least 6,000 cubic miles of sediments. That basin, bounded on the south by the largest islands in the Gulf, has an area of 15,000 square miles (220 miles long and 60–100 miles wide). Sediment depths are up to 1.2 miles thick![73] About half the basin's sediments were rapidly transported from the Grand Canyon (on the figure's northern horizon), along the path now occupied by the Colorado River.

Why is the Northern Basin's 15,000-square-mile floor so flat? Within weeks, a few thousand cubic miles of sediments were swept into the basin. The larger particles settled out first, near today's shoreline. Finer particles settled out last, but until they did, the muddy water flowed to the basin's deeper regions where the mud eventually settled—smoothing the seafloor.

At the end of the global flood, draining surface water swept sediments to lower elevations. For years afterward, swollen rivers, flowing down to the lowered sea level, cut channels and small canyons into these deposits. Over the next few centuries, sea level rose and covered some of these channels; today, they are called *submarine canyons*. [For details and evidence, see the Hydroplate Overview chapter.] The Gulf of California has many submarine canyons, but all are in the southern end of the Gulf.[74] Why? The submarine canyons that were cut into the Northern Basin were later buried by the sediments that were swept into that basin as the Grand Canyon formed, centuries after the flood.

Had the relatively shallow Colorado River—which today flows slowly in its 310-mile southward journey—deposited these sediments over millions of years, we would see a river delta hundreds of miles long rising slightly out of the water. Waves and tides would have formed many fan-shaped channels. The delta that has built up since the Grand Canyon formed is the tiny dot shown by the arrow at the extreme northern end of the Gulf.

section entitled **"Liquefaction During the Compression Event."**

15.* ● *Time or Intensity? Intensity: The sudden release of the mile-high water in Grand and Hopi Lakes quickly produced a tremendous amount of erosion, beginning with the Great Denudation. Also, the volume of subsurface water released into the Grand Canyon might have exceeded that of all the lake water. The deeper the erosion, the more subsurface water was released.

16.* ● *Other. The Colorado River and its tributaries flow through and cut the rims of many basins upstream from the Grand Canyon. This strongly suggests that lakes breached after the flood waters drained. The breaching of one lake would suddenly add water to a lower lake, causing it to breach. Many lakes probably breached sequentially, like falling dominoes. Two of the Colorado Plateau's last big lakes to breach were Grand and Hopi Lakes.

Details Relating to Powell's Proposal

17.* ⊗ *Layering,* ⊗ *Limestone,* ⊗ *Why Here?* ○ *Why So "Recently"?* ○ *Marble Canyon,* ⊗ *Distant Cavern Connection,* ○ *Perpendicular Faults,* ○ *Arching,* ⊗ *Inner Gorge,* ○ *Missing Talus,* ⊗ *Unusual Erosion,* ⊗ *Nankoweap Canyon,* ⊗ *California's Imperial Sand Dunes. This proposal does not address the obvious questions associated with these aspects of the Grand Canyon and nearby regions. [See **"Evidence Requiring an Explanation"** beginning on page 193.]

18.* ○ *Side Canyons,* ⊗ *Barbed Canyons,* ⊗ *Slot Canyons. Some believe that erosion rates in side canyons must have been greater in the past. Others say that sudden storms above dry side canyons can produce flash floods. The intensity of flow then produces considerable erosion all the way down to the Colorado River. While such events do happen, one would not expect the drainage to flow counter to the Colorado River as we see in the gigantic barbed canyons. Slot canyons also have many characteristics that are inconsistent with this explanation. [See Figure 125 on page 211.]

One proposal for the barbed canyons is that the Colorado River flowed to the north when those canyons were carved. However, this raises other troubling questions: What would tip the Colorado Plateau so the river flowed in precisely the opposite direction today? Why would the barbed canyons always "hook in" and enter the Colorado River at almost exactly right angles?

These questions and others can be neatly resolved. As thousands of cubic miles of rock were removed from the Grand Canyon area, the land below it rose. That lifting tipped the land around Marble Canyon, so *subsurface* water drained northward (although the Colorado River's flow has always been southward through Marble Canyon). Those subsurface flows then joined the subsurface flow already spilling out of the newly opened walls of Marble Canyon. Naturally, the east wall's water was spilling to the west, and the west wall's water was spilling to the east. Therefore, the generally northward path of the subsurface flow hooks in and enters Marble Canyon at right angles. With so much material removed by this subsurface flow, the land above those flows sank, becoming sink valleys, which then captured most of the water spilling out of the walls of Echo and Vermilion Cliffs.

19. ⊗ Forces, Energy, and Mechanisms. Powell and most geologists between the mid-1800s and 1960 were misled by a theory proposed by James Dwight Dana in 1847. Dana, a Yale geology professor, said that the earth contracted as it cooled from its molten state, much like the wrinkled skin of a dried-up apple. Powell thought this accounted for the uplift of the Colorado Plateau and the Kaibab Plateau. A simple calculation would have shown that the thermal contraction of rock is too small to produce mountains or plateaus. [Page 28 (**"Molten Earth?"**) and page 117 explain why the earth was never molten.]

20. ⊗ Missing River, ⊗ Missing Dirt. Since 1934, discoveries have shown that the western Grand Canyon and beyond were not cut by the Colorado River.[7–10] Nor does the Colorado River delta contain even 1% of the dirt excavated from the Grand Canyon.

21. ⊗ Missing Mesozoic Rock. Millions of years of rainfall and meandering rivers would not sweep 99% of the Mesozoic sediments (at least 1,000 feet thick) off the fairly flat Kaibab Limestone. Besides, why would at least 2,000 cubic miles of Mesozoic rock, spread over 10,000 square miles, be missing around and to the east of the Grand Canyon—including on top of the high Kaibab Plateau—and yet generally remain elsewhere?

22. ⊗ Fossils. This proposal for the Grand Canyon is linked with the bankrupt theory of evolution. Both require hundreds of millions of years of time. The Great Unconformity is said to mark the time when life began. Fossils are not found below that plane, because life supposedly had not yet evolved. Pages 5–24 and 175–187 give many reasons why this theory is untenable.

Notice that the theory of evolution relies upon many other theories, each proposed in an attempt to solve a large class of problems: how space and matter came into being (such as the big bang theory), how chemical elements formed, how stars, galaxies, earth, and life began, how *macro*evolution (not *micro*evolution) might happen, why transitional fossils are missing, why vital organs and DNA exist, what produced irreducible complexity, and why, directly above the Great Unconformity, all animal and plant phyla are suddenly found (the Cambrian explosion). Consequently, each evolutionary link in this assumed chain of origins—from protons to planets to people—must be shown before one can conclude that animals and plants evolved after the Great Unconformity somehow formed. This proposal for the Grand Canyon accepts the evolutionary explanation for fossils and is dependent upon the correctness of all those evolutionary "subtheories." (Part I of this book shows why each is incorrect.)

All of this should be contrasted with the hydroplate theory—a single, broad, self-consistent theory that explains the origin of the Grand Canyon and thousands of other pieces of evidence, including layered fossils.

23. ⊗ Tipped Layers below the Great Unconformity. The uplift of the Colorado Plateau would not tip the thick layers below the Great Unconformity while leaving the layers above horizontal.

An old, discredited explanation for the tipped layers was proposed in 1889 by William Morris Davis, head of the geology department at Harvard. Davis said that even mountainous regions eventually erode down to what he called a *peneplain* (meaning "almost a plain"). The Great Unconformity, according to Davis, was such a plain, formed over a vast time period. Later, the horizontal layers were deposited, mostly below sea level, and then the Colorado River carved the canyon. He proposed that the tipped layers below the Great Unconformity were portions of mountains that were not completely eroded.

One reason geologists now reject the peneplain concept is that none are seen forming today.[75] Mountainous regions do not lie below eroding surfaces that are almost plains. Another problem is that the metamorphic rock below the Great Unconformity formed under great pressure. The topic **"Metamorphic Rock"** on page 117 explains why reasonable depths of overlying rock would not provide the pressure required. As explained on page 130, the compression event accounts for the pressure required.

24. ○ ***Time or Intensity?*** Time: If the Colorado River, flowing for almost 6,000,000 years (or, by other estimates, 1,800,000 years[10]) carved the Grand Canyon, the river should have produced a gigantic river delta where it enters the Gulf of California. It has not. Nor would surface erosion for 6,000,000 years produce the erosion patterns shown in Figure 107 on page 191. Intense subsurface drainage would. Why have other large, equally high and fast rivers not carved other Grand Canyons during that same time?

Despite being checked and rechecked, the radiometric dating techniques that date the Colorado River, and supposedly justify that much time, give contradictory results.

> [Upstream from the Grand Canyon] *the river shows evidence of being somewhere between 20 and 10 million years. How can a river be 20 million years in one location but no more than 6 million years downstream?*[76]

Did the Colorado River follow a different path? For the last 70 years, geologists have been looking for other paths the river could have taken. None has been found.

Radiometric dating of lava flows in the western half of the Grand Canyon also gives inconsistent dates. The potassium-argon method gives drastically different ages from those of the argon-argon method,[77] and both methods give different ages from those of cosmogenic dating. Statistical errors cannot explain any of these differences; consequently, the assumptions behind at least some of these methods must be in error. [See **"Radiometric Dating"** on page 36 for a brief description of these assumptions, and **"The Origin of Earth's Radioactivity"** on pages 329–371.]

Details Relating to Gilbert's Proposal

25. ⊗ ***Layering,*** ⊗ ***Limestone,*** ⊗ ***Why Here?*** ○ ***Why So "Recently"?*** ○ ***Marble Canyon,*** ⊗ ***Distant Cavern Connection,*** ○ ***Perpendicular Faults,*** ○ ***Arching,*** ⊗ ***Inner Gorge,*** ○ ***Missing Talus,*** ⊗ ***Unusual Erosion,*** ⊗ ***Nankoweap Canyon.*** Same as item 17.

26. ○ ***Side Canyons,*** ⊗ ***Barbed Canyons,*** ⊗ ***Slot Canyons.*** Same as item 18.

27. ⊗ ***Forces, Energy, and Mechanisms.*** Same as item 19.

28. ⊗ ***Missing River,*** ⊗ ***Missing Dirt.*** Same as item 20.

29. ⊗ ***Kaibab Plateau.*** No fault has been found that cuts through the Kaibab Plateau along the Colorado River. Faults in that region tend to run north-to-south, usually perpendicular to the river.

Rivers or streams frequently follow faults, but faults are approximately straight lines. The Colorado River curves frequently in its path through the Grand Canyon, so very little of its path is controlled by faults.

30. ⊗ ***Missing Mesozoic Rock.*** Same as item 21.

31. ⊗ ***Fossils.*** Same as item 22.

32. ⊗ ***Tipped Layers below the Great Unconformity.*** Same as item 23.

33. ○ ***Time or Intensity?*** Same as item 24.

Details Relating to Emmons' Proposal

34. ⊗ ***Layering,*** ⊗ ***Limestone,*** ⊗ ***Why Here?*** ○ ***Why So "Recently"?*** ○ ***Marble Canyon,*** ⊗ ***Distant Cavern Connection,*** ○ ***Perpendicular Faults,*** ○ ***Arching,*** ⊗ ***Inner Gorge,*** ○ ***Missing Talus,*** ⊗ ***Unusual Erosion,*** ⊗ ***Nankoweap Canyon.*** Same as item 17.

35. ○ ***Side Canyons,*** ⊗ ***Barbed Canyons,*** ⊗ ***Slot Canyons.*** Same as item 18.

36. ⊗ ***Forces, Energy, and Mechanisms.*** Same as item 19.

37. ⊗ ***Missing Mesozoic Rock.*** Same as item 21.

38. ⊗ ***Missing River,*** ⊗ ***Missing Dirt.*** Same as item 20.

39. ⊗ ***Fossils.*** Same as item 22.

40. ⊗ ***Tipped Layers below the Great Unconformity.*** Same as item 23.

41. ○ ***Time or Intensity?*** Same as item 24.

Details Relating to Blackwelder's Proposal

42. ⊗ ***Layering,*** ⊗ ***Limestone,*** ⊗ ***Why Here?*** ○ ***Why So "Recently"?*** ○ ***Marble Canyon,*** ⊗ ***Distant Cavern Connection,*** ○ ***Perpendicular Faults,*** ○ ***Arching,*** ⊗ ***Inner Gorge,*** ○ ***Missing Talus,*** ⊗ ***Unusual Erosion,*** ⊗ ***Nankoweap Canyon.*** Same as item 17.

43. ○ ***Side Canyons,*** ⊗ ***Barbed Canyons,*** ⊗ ***Slot Canyons.*** Same as item 18.

44. ⊗ ***Forces, Energy, and Mechanisms.*** Same as item 19.

45. ⊗ ***Missing Mesozoic Rock.*** Same as item 21.

46. ⊗ ***Fossils.*** Same as item 22.

47. ⊗ ***Tipped Layers below the Great Unconformity.*** Same as item 23.

48. ○ ***Time or Intensity?*** Same as item 24.

49. ○ ***Other.*** Blackwelder did not show where any lakes west of the Rockies were or where they breached.

50. ○ ***Other.*** Without giving an explanation (energy, forces, mechanism), Blackwelder said that the Rocky Mountains rose their last mile 1,800,000 years ago. Other evolutionists say that the Rocky Mountains completed their rise at least

30,000,000 years earlier. Therefore, Blackwelder's proposal is inconsistent with the evolutionary perspective he also held.

Details Relating to McKee's Proposal

51.* ⊗ *Layering,* ⊗ *Limestone,* ⊗ *Why Here?* ○ *Why So "Recently"?* ○ *Marble Canyon,* ⊗ *Distant Cavern Connection,* ○ *Perpendicular Faults,* ○ *Arching,* ⊗ *Inner Gorge,* ○ *Missing Talus,* ⊗ *Unusual Erosion,* ⊗ *Nankoweap Canyon. Same as item 17.

52.* ○ *Side Canyons,* ⊗ *Barbed Canyons,* ⊗ *Slot Canyons. Same as item 18.

53.* ⊗ *Forces, Energy, and Mechanisms. Since 1960, geologists have claimed that plate tectonics provides the forces, energy, and mechanisms that made the Grand Canyon.[78] Supposedly, a subducting plate, which has since vanished, dove from the Pacific Ocean down about 1,000 miles into the mantle and 1,000 miles eastward. These geologists admit that the plate acted differently from any other plate in their theory when it was under North America; it crushed and buckled the Rocky Mountains[79] but only lifted the Colorado Plateau. Why the plateau's layers remained horizontal while the mountains' layers crushed and buckled is never explained.

But more to the point, *subduction is a myth.* Table 4 on page 165 summarizes 15 reasons **"Why Plates Have Not Subducted."** Details are given elsewhere in that chapter.

54.* ⊗ *Missing River. For the early Colorado River to flow southeast along the path now occupied by the Little Colorado River, as McKee proposed, would require the river to flow uphill. Even if elevations changed so the river once flowed downhill to the southeast, it would have to flow up over the continental divide to reach the Rio Grande. Finally, "studies along this postulated course have failed to yield any evidence of southeastward drainage."[80]

Many geologists are not embarrassed to claim, with no supporting evidence, that rivers once flowed in directions that today would be uphill, over mile-high mountains. These geologists simply claim that, with millions of years, things *could have been* different.

> *To be sure, today that would be impossible, for the Colorado River would have had to run uphill. But what is now uphill, in a geologic yesterday, may well have been downhill. Even geologists must remind themselves that the present is merely one insignificant moment out of hundreds of millions of years.*[81]

Outside of geology, certainly in the applied sciences, such wild, unscientific speculation would result in canceled contracts, rejected proposals, disbelief, or laughter.

55.* ⊗ *Kaibab Plateau. This proposal also requires a river west of the Grand Canyon to carve eastward (upstream) 130 miles. Supposedly, the river climbed over high cliffs and plateaus by headward erosion and captured the water of the early Colorado River in north-central Arizona. "No one has lived long enough to see even one stream work its way upslope and capture another."[82]

The Grand Wash Cliffs mark the western boundary of the Grand Canyon and the Colorado Plateau. Those 4,000-foot cliffs would have been the first major obstacle if headward erosion occurred. Other canyons cut only slightly into the Grand Wash Cliffs. If headward erosion was so efficient in cutting a path for the Colorado River, it should have been equally efficient for other canyons directly north, because they had similar weather and rocks.[83]

Had 130 miles of headward erosion occurred, the basin that contains the Hualapai Limestone would have been quickly filled with sediments from that excavation. Little room would have remained for depositing limestone.[84]

56.* ⊗ *Missing Mesozoic Rock. Same as item 21.

57.* ⊗ *Fossils. Same as item 22.

58.* ⊗ *Tipped Layers below the Great Unconformity. Same as item 23.

59.* ○ *Time or Intensity? Same as item 24.

Details Relating to Hunt's Proposal

60.* ⊗ *Layering,* ⊗ *Limestone,* ⊗ *Why Here?* ○ *Why So "Recently"?* ○ *Marble Canyon,* ⊗ *Distant Cavern Connection,* ○ *Perpendicular Faults,* ○ *Arching,* ⊗ *Inner Gorge,* ○ *Missing Talus,* ⊗ *Unusual Erosion,* ⊗ *Nankoweap Canyon. Same as item 17.

61.* ○ *Side Canyons,* ⊗ *Barbed Canyons,* ⊗ *Slot Canyons. Same as item 18.

62.* ⊗ *Forces, Energy, and Mechanisms. Same as item 53.

63.* ⊗ *Missing Mesozoic Rock. Same as item 21.

64.* ⊗ *Missing River, Missing Dirt. Same as item 20.

Hunt proposed what he admitted was an "outrageous" idea;[85] namely, that the 650-foot-thick Hualapai Limestone was deposited just outside the western edge of the Grand Canyon by underground drainage from a higher lake far to the south. Why that underground drainage channel did not become clogged with all the sediments entering from the upper lake was never explained. Nor have underground channels been found there, and no evidence has turned up to support Hunt's proposed path for the early Colorado River.[86]

The Hualapai Limestone is found at several locations, not only outside the mouth of the Grand Canyon. Usually, underground drainage occurs along the first path to develop, not on multiple paths to several distant lakes. Also, the Hualapai Limestone occurs in layers that lie at different depths just west of the Grand Canyon, not simply at the top of that section, as Hunt claimed.[87]

65.* ⊗ *Fossils. Same as item 22.

66.* ⊗ *Tipped Layers below the Great Unconformity. Same as item 23.

67.* ○ *Time or Intensity? Same as item 24.

68.* ⊗ *Other. Hunt's explanation is based to a large extent on his claim that the early Colorado River flowed far south of its present course and ponded in a large basin north of Kingman, Arizona. To support this contention, Hunt cited a Ph.D. thesis being written by Richard Young. Young had concluded that the 70-mile-long channel into this lake sloped in a direction that would not have allowed the flow that Hunt wanted. Hunt simply claimed the opposite and cited Young as supporting his view. Young, inexperienced and intimidated by the senior Hunt, admits that he acquiesced and reworded his conclusion in a fuzzy way that let Hunt reach his desired conclusion.[88] Young has admitted that his true conclusion was "enough to falsify the core of Hunt's theory."[89] Unfortunately, stature and the desire to advance sometimes trump truth.

Details Relating to Lucchitta's Proposal

69.* ⊗ *Layering,* ⊗ *Limestone,* ⊗ *Why Here?* ○ *Why So "Recently"?* ○ *Marble Canyon,* ⊗ *Distant Cavern Connection,* ○ *Perpendicular Faults,* ○ *Arching,* ⊗ *Inner Gorge,* ○ *Missing Talus,* ⊗ *Unusual Erosion,* ⊗ *Nankoweap Canyon. Same as item 17.

70.* ○ *Side Canyons,* ⊗ *Barbed Canyons,* ⊗ *Slot Canyons. Same as item 18.

71.* ⊗ *Forces, Energy, and Mechanisms. Same as item 53.

72.* ⊗ *Kaibab Plateau. Same as item 55.

73.* ⊗ *Missing Mesozoic Rock. Same as item 21.

74.* ⊗ *Missing River,* ⊗ *Missing Dirt. Same as item 20.

No evidence has been found that the Colorado River flowed to the northwest after crossing the Kaibab Plateau.[90]

75.* ⊗ *Fossils. Same as item 22.

76.* ⊗ *Tipped Layers below the Great Unconformity. Same as item 23.

77.* ○ *Time or Intensity? Same as item 24.

Details Relating to the Meek/Douglass Proposal

78.* ⊗ *Layering,* ⊗ *Limestone,* ○ *Why Here?* ○ *Why So "Recently"?* ○ *Marble Canyon,* ⊗ *Distant Cavern Connection,* ○ *Perpendicular Faults,* ○ *Arching,* ⊗ *Inner Gorge,* ○ *Missing Talus,* ⊗ *Unusual Erosion,* ⊗ *Nankoweap Canyon. Same as item 17.

79.* ○ *Side Canyons,* ⊗ *Barbed Canyons,* ⊗ *Slot Canyons. Same as item 18.

80.* ⊗ *Forces, Energy, and Mechanisms. Same as item 53.

No explanation is given as to why the region west of the Grand Canyon could have subsided almost a mile or why the Colorado Plateau might have tipped down to the southwest—something a subducting plate would not produce.

81.* ○ *Kaibab Plateau. Today, eroded portions of the Kaibab Plateau rise 1,700 feet higher than Hopi Lake could have been, *so the Kaibab Plateau must have risen after Hopi Lake began spilling westward.* (Had Hopi Lake been higher than about 6,000 feet, it would have spilled out to the north instead of over the 7,700-foot-high Kaibab Plateau to the west.)

82.* ○ *Missing Mesozoic Rock. Water spilling out of Hopi Lake would not sweep off the Mesozoic rock in the funnel, south of the funnel, or west of the funnel, or off the Kaibab Limestone north of the Grand Canyon, including off the high Kaibab Plateau. For example, Shinumo Altar lies near the wide end of the funnel, far from where Hopi Lake's waters would have traveled. Mesozoic rock has been removed from all around Shinumo Altar. (The Mesozoic rock in that butte was preserved because it was, and is, capped by hard rock.[61]) [See Figure 120 on page 204.]

83.* ⊗ *Fossils. Same as item 22.

84.* ⊗ *Tipped Layers below the Great Unconformity. Same as item 23.

85.* ○ *Time or Intensity? Same as item 24.

86.* ⊗ *Other. Today, the Colorado River would have to flow 2,400 feet uphill if it were to flow into the basin that once held Hopi Lake.

87.* ⊗ *Other. The Colorado River, with its heavy sediment load, could not have flowed into the basin that held Hopi Lake for long without filling it completely with sediments.

Final Thoughts

Probably more geology has been exposed and studied in the Grand Canyon than in any other place on earth. Therefore, the Grand Canyon is an excellent laboratory for testing the methods and explanations geologists have taught for the last century. What is the verdict?

In words that few geologists would dispute, the Grand Canyon is a "hazy mystery, cloaked in intrigue, and filled with enigmatic puzzles."[2] Despite a century of concentrated effort by so many, their methods have produced recognized contradictions, and they have left much evidence completely unexplained. [See, for example, item 17 on page 213.]

What's wrong?

a. As explained on page 179, evolutionary geology has been largely based on two faulty "principles," which are actually assumptions—uniformitarianism and superposition.
b. The global flood has been rejected out of hand as a possibility.
c. Most geologists show little concern that they do not understand the forces, energy, and mechanisms that produced movements on and inside the earth. Examples include continental drift, other plate movements, the production and release of magma, faulting, earthquakes, and the movements described in Endnote 22. on page 220.

While some will say that these are difficult matters, the problems would be far less difficult if the above errors were not made. When the geological understanding of such a well-studied region as the Grand Canyon is so poor, what confidence should we have in explanations for less-studied regions?

It should be no surprise that the unexcelled Grand Canyon and the water in the two huge, high-elevation, postflood lakes that formed the Grand Canyon are related to the most famous petrified forest and the best known mesa, butte, and spire region in the world—Monument Valley. Conversely, if mesas, buttes, and spires were formed over millions of years by meandering streams—the "textbook" explanation—then mesas, buttes, and spires should be more evenly distributed worldwide, not disproportionally concentrated in this one basin on the Colorado Plateau.

Tourists gaze and geologists attempt to describe these magnificent, massive, and startling features, as well as the Goosenecks, petrified forests, slot canyons, Zion and Bryce National Parks, other canyons in the region, huge sand dunes, and hundreds of mounds, and "pits." How did they form? Also, archaeologists have wondered for a century why the people who lived in the Nankoweap basin suddenly left. Seldom understood are how all these matters are related; the stupendous forces, energy, and mechanisms involved; and the event behind it all. Part II of this book describes that event.

Historians of science have frequently noted that once a persistent enigma is resolved, seemingly unrelated mysteries are also resolved. Science then takes a giant step forward in what is called a *paradigm shift*, but the changed thinking doesn't happen overnight. It takes scientists and laymen (1) willing to reexamine old explanations in light of the new perspective and to follow the evidence where it leads, (2) ready to inform others of this new explanation and its supporting evidence, and (3) able to withstand scorn and misrepresentation from those whose income and prestige are tied to the old paradigm.

The origin of the Grand Canyon has been such an enigma, but it is just one piece of a much larger puzzle. Part II of this book (beginning on page 107) describes twenty-five other interlocking pieces. Their snug fit gives credibility to the explanations for all pieces. Collectively, they clearly show a global flood—earth's defining geological event.

References and Notes

1. *"Though scientists have studied the canyon for more than 150 years, a definitive answer as to how or when the canyon formed eludes them. The one thing scientists do agree on is that the canyon was carved by the erosive power of the Colorado River, but the river itself has carried away the evidence of its earlier history."* Wayne Ranney, *Carving the Grand Canyon: Evidence, Theories, and Mystery* (Grand Canyon, Arizona: Grand Canyon Association, 2005), back cover.

◆ *"Grand Canyon is somewhat unique among our national parks because of the lack of a single, scientific theory regarding its origin."* Ranney, p. 20.

2. Ranney, p. 11.
3. The length of the Grand Canyon (216 miles) should not be confused, as it often is, with the combined length (277 miles) of the Grand Canyon plus Marble Canyon. Both lie within Grand Canyon National Park.
4. Bruce Babbitt, *Grand Canyon: An Anthology* (Flagstaff, Arizona: Northland Press, 1978), p. 50.
5. *"... the suspended load carried by the river is prodigious. For the water year ending September 30, 1957, this load averaged more than 425,000 tons a day, or almost five tons each second. ... Average figures for a 50-year span are even higher—about 550,000 tons per day ...."* John S. Shelton, *Geology Illustrated* (San Francisco: W. H. Freeman and Co., 1966), p. 30.

- Some have joked that the Colorado River is too thick to drink, but too thin to plow.

6. Layers of volcanic ash were found and dated in the limestone. [See Jon E. Spencer et al., "$^{40}Ar/^{39}Ar$ Geochronology of the Hualapai Limestone and Bouse Formation and Implications for the Age of the Lower Colorado River," *Colorado River: Origin and Evolution*, editors Richard A. Young and Earle E. Spamer, proceedings of a symposium held at Grand Canyon National Park in June 2000 (Grand Canyon, Arizona: Grand Canyon Association, 2001), pp. 89–91.]

- Stephen B. Castor and James E. Faulds, "Post-6 Ma Limestone along the Southeastern Part of the Las Vegas Valley Shear Zone, Southern Nevada," in Young and Spamer, pp. 77–79.

7. R. J. Rice, "The Canyon Conundrum," *The Geographic Magazine*, Vol. 55, June 1983, pp. 288–292.

- "*... the Hualapai* [Limestone] *contains no evidence for a major river emptying into the lake in which the limestone precipitated.*" Ivo Lucchitta, "History of the Grand Canyon and of the Colorado River in Arizona," *Grand Canyon Geology*, editors Stanley S. Beus and Michael Morales (New York: Oxford University Press, 2003), p. 270.

8. *"Probably the most interesting discovery is that a canyon as deep and impressive as the Grand Canyon can be carved in just a few* [1.7–4.5] *million years—even in rocks that do not yield easily to erosion."* Ivo Lucchitta, *Canyon Maker: A Geological History of the Colorado River* (Flagstaff, Arizona: Museum of Northern Arizona, 1988), p. 30.

9. These rocks are of three types: (1) rim gravels, (2) a type of lava that caps gravel and colluvium, and (3) a debris fan that spilled out of Pierce Canyon and is deposited across the mouth of the Grand Canyon. [For details, see Lucchitta, "History of the Grand Canyon and of the Colorado River in Arizona," pp. 269–270.]

10. According to one famous geologist, no Colorado River sediments existed even 1,800,000 years ago.

    > *Did the Colorado River exist anywhere in Pliocene time? If not, how and when may it have come on the scene? ... There are, so far as known, no true river deposits older than Pleistocene along the entire course of the Colorado River—that is, deposits of the specific type that such a river normally lays down.* Eliot Blackwelder, "Origin of the Colorado River," *Bulletin of the Geological Society of America*, Vol. 45, 30 June 1934, pp. 554, 557.

11. *"Under ordinary circumstances an uplifted plateau acts as a barrier to a river's course, causing it to flow around that barrier through lower ground. Rivers do not normally flow into elevated plateaus but the Colorado River is not a normal river. It appears to cut right through this uplifted wall of rock, which lies three thousand feet above the adjacent Marble Platform to the east. This odd scenario was the foremost problem recognized by the very first geologists who saw the Grand Canyon. Why does the Colorado River seem to flow into the heart of an uplifted plateau?"* Ranney, p. 22.

12. *The 1989 Information Please Almanac* (Boston: Houghton Mifflin Co., 1989), p. 544.

13. John Wesley Powell mistakenly thought that some of the limestone, polished by water, was marble and, therefore, named the canyon Marble Canyon.

14. The entrance to Grand Canyon Caverns is located at 35°31'42.25"N, 113°13'59.81"W. The red smoke exited at 36°20'44.86"N, 112°43'17.78"W and undoubtedly traveled along Havasu Fault, which also exits at that point. [See Gary A. David, "A Dilemma of Horns," *Four Corners Magazine*, February-March 2006, p. 4. Also see Pam Powers, *Recollections of the Grand Canyon Caverns* (Peach Springs, Arizona: Grand Canyon Caverns & Inn, 2006), pp. 4, 43.]

15. *"Additionally, in Marble Canyon, many tributary streams come into the Colorado River flowing generally to the north, against the southerly flow of the modern river. This creates a pattern of drainage known to geologists as 'barbed' tributaries. The Marble Platform, into which the tributaries have been carved, also slopes down to the northeast exactly opposite the flow direction of the modern river."* Ranney, p. 23.

16. Troy L. Péwé, *Colorado River Guidebook* (Phoenix: Sims Printing Co., Inc., 1969), p. 44. (Péwé showed me these stacked boulders, but unfortunately I took no pictures.)

17. All dimensions for this profile were taken from Profile B–B' on the outstanding "Geologic Map of the Eastern Part of the Grand Canyon," 1986 edition, produced by the Grand Canyon Association.

18. See, for example, Stanley S. Beus and Michael Morales, *Grand Canyon Geology* (New York: Oxford University Press, 1990), p. 5.

19. Along the Bright Angel Trail, from top to bottom, those thick limestone layers are Kaibab Limestone (350 feet), Toroweap Formation (250 feet), Redwall Limestone (450 feet), Temple Butte Limestone (35 feet), and Muav Limestone (375 feet). Limestone forms only in the presence of water, but earth's sedimentary rocks contain so much limestone that earth's waters would need to be toxic a thousand times over before limestone first formed. [See pages 229–235.]

20. *"The forces that drove rock uplift of the low-relief, high-elevation, tectonically stable Colorado Plateau are the subject of long-standing debate."* Mousumi Roy et al., "Colorado Plateau Magmatism and Uplift by Warming of Heterogeneous Lithosphere," *Nature*, Vol. 459, 18 June 2009, p. 978.

21. *"Another curiosity with the Colorado River's course is that it disregards the fault lines that cross its path. ... The Colorado River within the Grand Canyon crosses dozens of faults, many of them at right angles, and continues on downstream through blocks of strata that are solid and unbroken by faults."* Ranney, p. 22.

- Several of these more prominent, nearly vertical faults that are perpendicular to the Colorado River are 19-Mile Fault, Bright Angel Fault, Grand Wash Fault, Havasu Fault, Hurricane Fault, Muav Fault, Sevier Fault, Paunsaugunt

Fault, and Toroweap Fault. Most of these named faults are more than 50 miles long. Probably dozens of side canyons that are perpendicular to the Colorado River were initiated by faults that are no longer visible.

22. So-called explanations in geology frequently use words such as uplift, collision, convulsions, upheaval, subsidence, subduction, drift, tectonics, and orogeny but do not convey an understanding of the *forces, energy, and mechanisms* that would produce these movements. Nor is the physics explained by using more specific terms, such as crustal movements, stresses within the earth, and mountain building. When hearing or reading such terms, one should ask whether a scientific, cause-to-effect understanding exists for the claimed motion. A mere assumption that the motion was imperceptibly slow and occurred over millions of years is not an explanation, even if accompanied by impressive sounding, but irrelevant, technical terms.

    Conversely, one might ask if action words used in explaining the hydroplate theory have the same problem. A careful study will show that they don't. In fact, the force invoked in most cases is ultimately gravity; the mechanisms and energy involved are consistent with physics and have been seen by most of us on a small scale.

23. *"Oddly enough, the Grand Canyon is located in a place where it seemingly shouldn't be."* Ranney, p. 20.

24. *"It doesn't take millions of years to create an impressive channel. Flowing liquid can do a lot of work in a short period of time."* Alan D. Howard, as quoted by Sid Perkins, "Texas Flood Carves Canyon in Days," *Science News*, Vol. 178, 17 July 2010, p. 15.

25. John S. Newberry, "Part 3: Geological Report," in *Report upon the Colorado River of the West, Explored in 1857 and 1858 by Joseph C. Ives* (Washington, D.C.: U.S. Government Printing Office, 1861; reprint, Ann Arbor, Michigan: University of Michigan, 2006), pp. 19–20.

26. Ibid., p. 45.

27. John Eliot Allen et al., *Cataclysms on the Columbia* (Portland, Oregon: Timber Press, 1986).

28. John Wesley Powell, *The Exploration of the Colorado River and Its Canyons* (1875; reprint, New York: Viking Penguin, 1987), pp. 89–90.

29. Carol S. Breed, "A Century of Conjecture on the Colorado River in Grand Canyon," Four Corners Geological Society Guidebook (Flagstaff, Arizona: Museum of Northern Arizona, 1969), p. 63.

30. S. F. Emmons, "The Origin of Green River," *Science*, Vol. 6, 2 July 1897, pp. 19–21.

31. Blackwelder, pp. 551–566.

32. This proposal was the consensus of experts on the Grand Canyon who attended a symposium led by Edwin D. McKee. [See Edwin D. McKee et al., *Evolution of the Colorado River in Arizona: A Hypothesis Developed at the Symposium on Cenozoic Geology of the Colorado Plateau in Arizona* (Flagstaff, Arizona: Northern Arizona Society of Science and Art, 1964).]

33. Charles B. Hunt, "Grand Canyon and the Colorado River, Their Geologic History," *Geology of the Grand Canyon* (Flagstaff, Arizona: Grand Canyon Natural History Association, 1976), pp. 129–141.

34. Ivo Lucchitta, *Canyon Maker*, pp. 1–32.

    ◆ Lucchitta, "History of the Grand Canyon and of the Colorado River in Arizona," pp. 260–274.

35. Norman Meek and John Douglass, "Lake Overflow: An Alternative Hypothesis for Grand Canyon Incision and Development of the Colorado River," in Young and Spamer, pp. 199–204.

36. I first proposed the hydroplate theory in 1972. In the fall of 1988, I described, in lectures and radio broadcasts on more than a hundred different stations, the location of the former—now extinct—Grand Lake and how I believe its breaching formed the Grand Canyon. After a year of study and field work in Arizona, Utah, and Colorado, I located the lake's boundaries using geological and topological features. This explanation for the Grand Canyon was published for the first time in July 1989. [See Walt Brown, *In the Beginning*, 5th edition (Phoenix: The Center for Scientific Creation, 1989), pp. 75–76, 83.] Another extinct lake, Hopi Lake, had been described earlier. [See R. B. Scarborough, "Cenozoic Erosion and Sedimentation in Arizona," *Arizona Bureau of Geology and Mineral Technology,* 16 November 1984.]

    Dr. Steven A. Austin of the Institute for Creation Research (ICR), as he eventually admitted in writing, purchased the 5th edition of *In the Beginning* "in August 1989, a few weeks after it had been published." [Steven Austin, personal correspondence, 29 August 1994.] In early 1990, Austin published, as if they were his, some key ideas of mine concerning Grand Lake and the formation of the Grand Canyon. I learned this on 7 May 1990, but said nothing to anyone about it for three years. On 4 November 1990, two people told me that Austin, on the previous day, had publicly said I had taken those key ideas *from him*. Again, I kept silent.

    By mid-June 1993, I realized that Austin's false allegations against me were spreading and starting to hurt others. (Austin was also the unnamed geologist mentioned in Endnote 134 on page 268.) For example, in September 1992, Dr. Robert V. Gentry filmed me at the Grand Canyon presenting the Grand Lake explanation, as part of a professional and very expensive video production. Then, on 10 June 1993, Gentry told me that Dr. D. Russell Humphreys (who had worked closely with Austin and is now at ICR) was reporting that I had plagiarized ideas of Austin's. (Humphreys later wrote that he did not use the word "plagiarize," but Gentry insists that was the intended meaning.) Gentry told Humphreys that he did not believe that was true, but Gentry was naturally concerned about the consequences of those allegations for his production, so he appealed for me to help. ***I then realized that the issue had to be addressed.***

By way of background, geologists have known since at least 1861 that canyons can be carved by the breaching of a lake. [See Newberry, Endnote 25.] The discoveries of J Harlen Bretz in 1923 have shown generations of undergraduate geology students how a breaching lake can produce canyons in weeks. [See Endnote 27.]

In the early 1980s, Austin and many others saw that a small lake on Mount St. Helens had breached and that the escaping water had quickly carved a small canyon. In 1985, John H. Whitmore, a student of Austin's, wondered in a term paper if Hopi Lake, the extinct but previously discovered lake directly east of the Grand Canyon, could have breached the Kaibab Plateau and carved the Grand Canyon. That would have been highly unlikely, because (1) the Kaibab Plateau is about 2,000 feet higher than the lake could have been, (2) the water would have had to penetrate through 30 miles of hard rock that was denser than concrete, and (3) any spillage down such a gradual slope to the west would erode little. In 1986, Dr. Edmond W. Holroyd told Austin that if a dam were built across the Colorado River near Grand Canyon Village, a very large lake would form. (Its area would have included and been larger than the combination of both Hopi Lake and what I later identified as Grand Lake.) Holroyd drew his big lake on a map and noted that some thought that if a very long east-west fault had then developed between what are now the north and south rims of the Grand Canyon, the lake's escaping waters might have carved the Grand Canyon. However, such an east-west fault has never been found, and faults in the Grand Canyon region typically run perpendicular to the canyon, not parallel. Furthermore, a canyon that eroded along a fault would not bend or meander, as the Grand Canyon does.

The work of Newberry and Bretz and the ideas of Whitmore and Holroyd led Austin to wonder in a very tentative way (as his writings show) if the breaching of Hopi Lake, directly east of the Grand Canyon, had carved the Grand Canyon. Any proposal suggesting that the Grand Canyon was carved when Hopi Lake breached would contain serious flaws (such as those mentioned above), which Austin knew. He did not realize that a much larger ***and separate*** lake was once north of Hopi Lake. (Austin was never able to produce any spoken or written record showing that he knew, before 1989, anything about Grand Lake, yet in 1990, he published a map—remarkably similar to the one I had published in 1989—showing, as he labeled it, "Grand Lake.") In 1988, I discovered not only the boundaries of that extinct lake, but also its breach point. I named the lake *Grand Lake*.

When Grand Lake breached, the escaping torrent of water quickly brought about the breaching of the western end of Hopi Lake as well. Both breach points are easily seen at the extreme north and south ends of Marble Canyon. I call the northern breach point (where Grand Lake spilled) *the funnel*. It is shown on pages 196–198. The southern breach point (where Hopi Lake spilled) is marked by the unique terrain where the Little Colorado River enters the Colorado River. After both lakes breached, the escaping waters and ensuing events formed the Grand Canyon in weeks and lifted (the Kaibab Plateau. This chapter presents two dozen other evidences, which I gathered over a year's time (1988–1989), that support the Grand Lake explanation.

The chapter **"The Hydroplate Theory: An Overview"** on pages 109–147 and the chapters on liquefaction (pages 175–187) and limestone (pages 229–235) fit together other necessary pieces of the puzzle—What produced all the sediments? What layered the strata and sorted the fossils? What cemented the rocks so uniformly? Why does the Grand Canyon expose so much limestone? And what were the forces, energies, and mechanisms that lifted the Rocky Mountains and raised the Colorado Plateau so high? *Today's Grand Canyon would not exist if the Colorado Plateau had not first risen more than a mile above sea level.* If the Grand Canyon is a consequence of a global flood, where did all the water come from, and where did it go afterwards? Any attempt to explain the Grand Canyon without answering these broader questions is shallow at best. And, of course, any explanation that is not accompanied by definite predictions is hollow.

After pondering Bob Gentry's appeal for me to respond to Humphreys' allegation, I realized that I had to go to the source and address Austin's spreading accusations. ***(If I had simply been seeking priority over a lake's name, as some have implied, I would have done so years earlier.)*** So, on 18 June 1993, I wrote Austin explaining the seriousness of the matter and asked if these stories I had heard were true. That same day, I also wrote ICR's then-Director, Dr. Henry M. Morris (now deceased), to inform him of this issue.

In all, Morris, Austin, and I exchanged six letters during the summer of 1993. Austin always denied that he had accused me of plagiarism, although I explained how he could contact the witnesses who heard him and were shocked by what he had said. He never contacted those witnesses. He also denied taking any ideas of mine, even though some of the new details he had published were so specific that they obviously had come from my work. (Mapmakers usually place on their maps tiny, unique details—even intentional errors—so that anyone who copies the map will be clearly shown to be guilty of copyright infringement.) Austin tried in several deceptive ways to show that he had come up with the Grand Lake explanation first. All were easily shown to be false—as a reading of our correspondence clearly shows. (All relevant correspondence is posted at www.calvarypo.org. Also available there is a booklet published by Pastors Kevin Lea and Diego Rodriguez, which analyzes and dissects all the correspondence, other documents, and events pertaining to this dispute.)

By 19 August 1993, it was clear that we would not be able to resolve the issue ourselves, so I proposed in a letter to Morris and Austin that we put the messy matter into the hands of an independent Christian arbitrator to thoroughly study and resolve. Morris and Austin flatly refused. Denials and "bobbing and weaving" continued. Finally, after we had exchanged thirteen more letters, I told Morris and Austin that if they did not allow this matter to be arbitrated so it would not create further dissension and confusion, and so that behind-the-scenes accusations against me and my associates would cease, I would make the issue public. They reluctantly agreed, but, in various ways, Morris and Austin thwarted all efforts to seek arbitration. For example, after consulting with their lawyer, and only four days before the arbitration was to take place, they backed out of their written agreement to arbitrate and announced that they would participate only in *nonbinding mediation.* (Arbitration is binding.) After months of effort, and having finally reached agreement on the time, place, and arbitrator, I felt betrayed. With plane reservations made and all preparations in place, I decided to proceed anyway, hoping mediation would produce an agreement. This mediation took place on 21 June 1994.

However, by 28 September 1994, Austin had clearly broken even the agreement we signed at the mediation, as a reading of our correspondence will show. I also wrote everyone involved that Austin had broken the agreement. As of this writing (2008), misinformation is still coming out of ICR. Therefore, to answer questions from those now hearing this misinformation, the entire matter will be placed on the table for anyone to examine. People can reach their own conclusions.

(Notice that I have followed the procedure laid out in Matthew 18:15-17. First, privately speak to the party you believe acted wrongly. Second, if he denies the allegations, present one or two witnesses to verify those allegations. Third, if that does not produce change, tell the church. I am now telling the church—the body of believers. Anyone wishing to receive a free CD-ROM containing all pertinent correspondence and writings can simply mail a stamped, self-addressed CD mailer containing a blank CD-ROM and case to: CSC, 5612 N. 20th Place, Phoenix, AZ 85016.)

Some may wonder why Austin and I have never worked together.

- My first attempt toward that end was in the summer of 1976. I flew to ICR in San Diego, in part to meet a "Stuart E. Nevins." At the time, I did not know that Austin had been writing under that fictitious name to conceal his identity as a creationist. At lunch with Henry Morris, I said that I would like to meet "Stuart Nevins." Morris, hiding the true situation, simply said that "Nevins" was out of town.
- In 1980, I flew to ICR for a series of meetings with its leadership. In an informal gathering, a person asked me to explain the hydroplate theory to those standing around. I declined, saying that I could not explain it in the brief time available. The group urged me to do so anyway; I again declined. Austin then walked in and also urged me to explain it, saying that he knew all the ideas about the flood and would quickly recognize what I had in mind. I began, but had completed only a few sentences when Austin interrupted to tell the group a related story. A minute or two later, he stopped talking and excused himself to catch his ride home. Our gathering dispersed.
- In March 1981, an acquaintance of Austin's had just attended a full-day seminar I had conducted in Chicago. Afterward, he called Austin and urged him to learn about the hydroplate theory. Austin's response was simply, "I wish these nongeologists would stay out of our business." Later, on two occasions, I related this to Austin, but heard no denial or retraction—only silence.
- Since 1984, false comments, derogatory letters, and negative innuendos about me have periodically come from ICR. Most recently, ICR has written that the hydroplate theory is "laughable." The specifics of these comments show that the writers have not read the hydroplate theory.

On several occasions, I have offered to debate the scientific merits of our respective understandings of the flood, but ICR always declines. One simple, quick format is explained

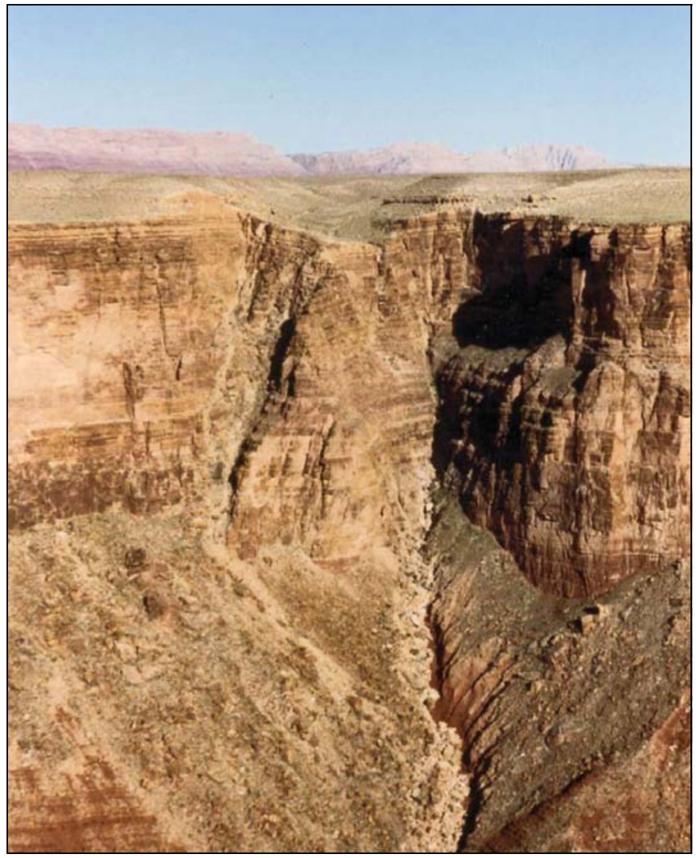


Figure 128: 19-Mile Fault. This fault crosses the Colorado River 19 miles downstream from Lees Ferry, which lies at the north end of the funnel. Here, looking southeast across Marble Canyon and the Colorado River, we can see the vertical line of subsurface drainage and mass removal along 19-Mile Fault. The fault continues along the solid white line shown in Figure 112 on page 197. On the ground, that line is marked by a broad depression (as seen above) and many sinkholes and hollow flow channels, all showing that water drainage removed considerable subsurface mass. At the northwest end of that white line (one mile behind my camera), is Rider Canyon where the fault is again exposed.

Figure 129: Deep Tension Fractures. Looking west near the east edge of Rider Canyon and ¼ mile southwest of 19-Mile Fault, the ground split open in several places. This deep, 1,500-foot-long crack is almost parallel to Rider Canyon and Marble Canyon. Fifty feet northeast of this crack is a parallel crack; a 500-foot-long parallel crack is on the opposite (west) edge of Rider Canyon. The sides of these cracks have not been offset vertically or horizontally, showing that they are tension fractures. As mass was removed when Rider Canyon and the funnel were rapidly carved, uplift, arching, and stretching occurred—producing the cracks. (The tall block in the center is tipping toward Rider Canyon.)

in **"What Is the Recorded and Transcribed Oral/Phone Debate Offer?"** on page 476. Another format would have a panel of independent experts (from a variety of relevant fields) examine the hydroplate theory and the two flood theories that ICR has advanced: the canopy theory since 1972, and catastrophic plate tectonic theory since 1994. Each expert's 1–2-page conclusion could then be published in one of several journals. Again, ICR declines. My debate offer still stands.

37. As the Colorado Plateau was uplifted, block faulting may have produced a cliff along the dashed white line in Figure 112 on page 197. If so, this dashed line would also mark a vertical fault, the top of which (a cliff) was eroded into the shape of a funnel when Grand Lake breached.

    In 1987, I asked the State Geologist for Arizona, Larry D. Fellows, if a fault was in that region. After checking his files, he told me that he found no record of a fault. Months later, I found an old river-runner map that showed a fault, called *19-Mile Fault,* where the Colorado River crosses the solid white line. During a raft trip down the Colorado River, I verified that the fault existed, but the opposite sides of the fault were displaced only about 100 feet (up to the north). [See Figure 128.]

    If the fault extended along the dashed white line, it would be exposed inside Rider Canyon, the barbed canyon to the northwest. Later, during a trip into Rider Canyon, the fault—and much more—were found!

    Between Rider Canyon and Marble Canyon is what I will call a peninsula. If you look closely in Figure 112, you will see that it narrows, or "necks down," along the solid white line. [See also Figure 111 on page 196.] Along that line are many sinkholes and a long depression. They show that subsurface water drained below that line and removed considerable material, as if the line marked a nearly vertical fault (a plane of weakness, slippage, and drainage). Drainage would have spilled out where the solid-white line segment intersected Marble and Rider Canyons, undercutting and removing material, thereby narrowing (necking) the peninsula.

    Also, vertical cracks, several hundred feet deep, have dramatically opened along the edge of Rider Canyon. [See Figure 129.] Some large blocks have fallen, or are about to fall, into Rider Canyon. The tension that split open and formed Marble Canyon no doubt produced these parallel cracks.

    If block faulting produced the 2,000-foot Echo-Vermilion Cliff system as the Colorado Plateau was hydraulically uplifted, why was the fault's offset, as seen at the Colorado River, only about 100 vertical feet and not 2,000 feet? Answer: As Grand Lake's breaching removed mass south of the funnel, the south side of the fault steadily rose and arched upward, reducing the original offset. More mass was eroded as the ground rose, so even more ground rose. Movement stopped when the south side of the slightly *reversed* fault slammed into the north side. (Note: For upward movement to occur, block faulting will produce a slightly *reversed* fault, not a *normal* fault. Consult a physical geology textbook to understand the difference between normal and reverse faults.) **"Plateau Uplift"** on pages 200–201 explains the mechanics of block faulting.

    These discoveries along the solid-white line segment in June 1988, convinced me that block faulting had occurred and that Echo and Vermilion Cliffs had been joined along the dashed white line. (Block faulting obviously occurred at several places directly north in Utah: Book Cliffs, Roan Cliffs, and the Grand Staircase.) The funnel also supports the presence of Grand Lake whose shoreline was 15–20 miles to the northeast. The funnel was carved as Grand Lake breached the 2,000-foot-high Echo-Vermilion Cliff. This led to the formation of Marble Canyon and the Grand Canyon.

38. The most authoritative source for geological definitions is the *Glossary of Geology.* It defines a plateau as:

    Any comparatively flat area of great extent and elevation; specifically, an extensive land region considerably elevated (more than 150–300 meters in altitude) above the adjacent country or above sea level. [See Robert L. Bates and Julia A. Jackson, editors, *Glossary of Geology*, 2nd edition (Falls

Church, Virginia: American Geological Institute, 1980), p. 482.]

39. The coordinates of this location (named Jack Point) are 36°41′56.76″N, 111°37′57.84″W.

40. H. S. Alexander, "Pothole Erosion," *Journal of Geology*, Vol. 40, January–December 1932, pp. 305–337.

41. Massive amounts of rock were removed between the breach points of Grand and Hopi Lakes; even greater amounts of rock were removed by the more violent, combined waters flowing westward from "Hopi Falls." This reduced the downward pressure miles inside the earth—not only directly below, but also at small angles to the side. Therefore, when the southern flow suddenly turned and flowed west at "Hopi Falls," the reduction of downward pressure to the north of that westward flow combined with the reduced downward pressure to the west of the southern flow. The combined force imbalance simply overwhelmed the strength of the deep rock, causing it to rise to became the southern portion of the Kaibab Plateau. The more it rose, the more mass the torrents remove, so the greater the force imbalance. Eventually, the entire Kaibab Plateau rose.

42. The Colorado Plateau has been lifted an average of 6,200 feet above sea level, *but the portion of the Moho directly below has been correspondingly depressed.* [See Professor George C. Kennedy's statement on page 118.] This means that the plateau was lifted by material injected between the plateau and the Moho.

    Several miles above the Moho was the subterranean water chamber. [See Figure 54 on page 122.] The chamber largely collapsed toward the end of the flood and became a thin, ready-made conduit, corresponding to the thin, horizontal channel in Figure 116 on page 200. Undoubtedly, some water remained at the floor-roof interface, but even with no water, the interface would have been the easiest path for magma to escape from beneath the sinking Rockies.

43. Angular rock fragments, called *xenoliths* (ZEN-oh-liths), are often found in magma flows. These fragments, which are millimeters to meters in diameter, sometimes contain diamonds. Geologists have always had difficulty visualizing how flowing magma could fragment and pluck out pieces of its conduit's thick wall. It is almost as strange as turning on your faucet and seeing pipe fragments—some of which contain diamonds—spilling into your sink.

    Maybe flowing magma did not produce xenoliths. Perhaps some xenoliths were the result of very young, sinking mountains that crushed and slid rocks under great pressure and heat, generating magma—and diamonds.

44. George H. Billingsley, "Volcanic Rocks of the Grand Canyon Area," in Young and Spamer, pp. 223–229.

45. As magma was produced by the sinking of the Rocky Mountains, water would still have been trapped within the irregularities of the almost-collapsed subterranean water chamber. Water readily dissolves in magma. This lowers magma's freezing temperature (delays solidification) and makes magma less viscous (easier to flow). By volume, steam (water vapor) makes up approximately 70% of all gases emitted from volcanoes. [See Gordon A. Macdonald, *Volcanoes* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972), p. 50.]

46. One or more channels of magma may still connect large areas under the Rocky Mountains with large areas under the Colorado Plateau. If so, magma pressure is still tending to lift blocks in those portions of the Plateau, because the higher (heavier) Rocky Mountains would be exerting greater pressure on the magma than the lower (lighter) Colorado Plateau. Those blocks in the Plateau would be precariously locked by friction. The situation would be similar to a log jam on a large river, except that the potential movement would be upward, not horizontal.

    This also applies to other plateaus in the world. Removing enough mass from such a plateau could destabilize that plateau, the adjacent mountain range, and nearby regions. Seismic shocks, including those passing through the earth, could affect distant plateaus. The drastic case of a nuclear explosion on a large plateau could produce worldwide earthquakes.

47. While I follow convention in using the name "Kaibab Plateau," as geologists and mapmakers have for a century, technically it is not a plateau. It has, more correctly, been called the Kaibab Upwarp, Kaibab Uplift, Kaibab Arch, and Kaibab-Coconino Uplift. The upwarp aspect of the "Kaibab Plateau" can be seen in several ways, one of which is the layers in the East Kaibab Monocline that slope downward like a ski slope. A plateau's layers are generally horizontal.

    What is a monocline? Lay a book on a table; then drape a handkerchief over the book and onto the table. The handkerchief's shape is that of a monocline. [See Figure 108 on page 192.]

    What caused the bending or warping? The book on the table represents a block that rose by the hydraulic mechanism described in **"Plateau Uplift"** on pages 200–201. As the block rose, the wet, pliable layers above deformed into the shape of the handkerchief—and became a monocline.

PREDICTION 15: A very deep vertical fault lies beneath the steepest slope in the East Kaibab Monocline. Nonstratified sediments will be found on the downthrow side of the fault. Those sediments washed in to fill the void immediately after the fault formed. The edge of the uplifted block will be found to have slightly cut into the draped layer directly above.

Massive mudslides off the southeast end of the *rapidly rising* Kaibab Plateau exposed the East Kaibab Monocline. These mudslides are explained in item 12 on page 212.

Several brief conclusions can be drawn concerning the East Kaibab Monocline. A slab of hardened rock cannot be bent into the shape of this monocline without breaking it. (I will bypass my page of mathematics showing this.) The bending stresses would have fractured a solid slab of this size a hundred times over. Obviously, the layers comprising the East Kaibab Monocline were wet and unconsolidated when they were bent (warped). After the bending, chemical agents in the water that saturated those sediments cemented them into a solid, but warped, layer.

The originally wet and unconsolidated texture of the monocline's layers is confirmed by the fact that they thin to the left in Figure 108. This shows where the compression was greatest from the increasing upward hydraulic pressure that fractured the layers, producing the fault and monocline. Downward slumping also contributed to this thinning.

Figure 49 on page 116 shows other flood-deposited layers that were wet and quickly deformed before they were cemented. However, they and the earth's major mountains were produced by crashing hydroplates. Immediately afterwards, these mountains began the sinking that pushed up plateaus.

48. Figures 60 and 62 on pages 127 and 128 explain another gravity-driven phenomenon that formed the Mid-Oceanic Ridge. (The sudden formation of the Mid-Atlantic portion of this ridge resulted in rapid continental drift and crashing hydroplates. Those earthshaking forces and their consequences brought us to the topics at hand.)

49. See, for example, Tunnel Overlook at 36°09'00.77"N, 109°31'27.41"W.

50. A plateau is usually higher and more extensive than a mesa. A plateau has been uplifted. Its exposed layers correspond to those below the land surrounding the plateau. A mesa is an erosional feature.

51. Millions of years or several weeks? Anyone giving the first answer would not be expected to provide specific details and evidence, because the formation of these features allegedly happened so long ago. Mentioning a few obscure technical words is usually sufficient. Besides, we have such difficulty imagining millions of years that many of us might be impressed that "science" has supposedly figured it out. Writers often capitalize on this perception by beginning their stories with phrases such as "Millions of years ago, ..."

    Conversely, a person giving the second answer, which opposes conventional opinion and is shocking to some, is frequently expected to quickly provide convincing details and evidence. Despite this double standard, careful readers of this chapter will see the details and evidence, and why the Grand Canyon and surrounding features were carved in weeks—only a few thousand years ago.

52. The sedimentary layers under Hopi Lake contained less-porous sediments, such as shale. However, once the relatively few escape routes opened up, high-pressure water quickly followed. Thus, only parts of the lake bottom were eroded, as shown in Figure 124 on page 208.

53. *"... silicification is an impermeation (void-filling), not an organic replacement, process."* Anne C. Sigleo, "Organic Geochemistry of Silicified Wood, Petrified Forest National Park, Arizona," *Geochimica et Cosmochimica Acta*, Vol. 42, September 1978, p. 1404.

54. A *saturated* solution, at a given temperature and pressure, contains the maximum amount of a dissolved solid, liquid, or gas under equilibrium conditions.

55. Not all sand is weathered rock. Some sand grains precipitated directly out of the silica-rich flood waters.

56. *"Preservation of such detail usually requires rapid infiltration of the petrifying material. If any of the tissues had already decomposed, mineral matter would have simply filled the hollow spaces left behind, preserving the wood's form but not its cellular structure."* George Sheng, "Turning to Stone," *Science 82*, Vol. 3, March 1982, p. 69.

    - *"... silica nucleation and deposition can occur directly and rapidly on exposed cellulose surfaces."* Sigleo, p. 1404.

57. Robert O. Fournier and Jack J. Rowe, "The Solubility of Amorphous Silica in Water at High Temperatures and High Pressures," *American Mineralogist*, Vol. 62, October 1977, pp. 1052–1056.

58. As the subterranean water, saturated with silica and other minerals, escaped, its pressure suddenly dropped. As it expanded, it cooled. The liquid water remaining was then *super*saturated with silica. Dissolved silica particles would have been "frantically looking for" the tiniest cracks where they could come out of solution.

59. *"The majority of these trees* [in Petrified Forest National Park] *were very tall. On the average the logs are about 80 to 100 feet long and three to four feet in diameter, but some range up to 200 feet in length and ten feet in diameter at the base."* Sidney Ash, *Petrified Forest: The Story Behind the Scenery* (Holbrook, Arizona: Petrified Forest Museum Association, 1985), p. 20.

60. Petrified Forest National Park plans to more than double its area. The park's southern half will expand to the east and west. As one would expect, the expansion is all within the boundary of the former Hopi Lake.

61. The hard rock is Shinarump Conglomerate. Shinumo Altar is located at 36°26'16.59"N, 111°43'11.19"W.

62. Eric Donovan, Personal communication, 5 September 2006.

63. Richard Foster Flint, *Glacial and Quaternary Geology* (New York: John Wiley & Sons, 1955), pp. 249-250.

64. To be complete, both parts of this question (how and when) must be answered. Geologists feel that the "when" has already been answered; namely, "the Colorado Plateau was lifted during the last 80 million years." By locking in the timing before understanding the mechanism, they have become blinded to the physics involved. As Ranney states:

    > *The exact reason why uplift has occurred in the Grand Canyon region remains speculative but certainly the area has been significantly elevated since the sea last left the area about 80 million years ago.* Ranney, p. 44.

65. This pit is located at 36°44'50.70"N, 109°35'10.36"W.

66. About 29% of the earth's surface is above sea level. The average elevation of land above sea level is 840 meters, or 2,756 feet. Therefore, pushing all land beneath the sea would raise sea level only 0.29 × 2,756 feet (or 800 feet).

67. As subterranean water escaped upward to flood the earth, the *preflood* continents and mountains had to sink. Therefore, the flood that covered all preflood mountains was as much a consequence of sinking continents as it was of rising water. [See pages 433–437.]

68. Two varieties of squirrels, which today live in only a few distinct locations worldwide, occupy the Grand Canyon region: the white-tailed Kaibab squirrel north of the canyon and the dark-tailed Abert squirrel south of the canyon. They are obviously related and, except for coloring, are indistinguishable. Each lives on an isolated plateau separated by several hostile environments and the 277-mile-long and several-miles-wide Grand and Marble Canyons. How could even one squirrel (let alone a male and female) traverse that formidable barrier? Probably the Grand Canyon was cut a few thousand years ago through an area occupied by the common ancestors of the Kaibab and Abert squirrels. Since then, the two isolated populations, unable to interbreed and with slightly different gene pools, developed different coloring—a classic case of microevolution (not macroevolution). [See John R. Meyer, "Origin of the Kaibab Squirrel," *Creation Research Society Quarterly*, Vol. 22, September 1985, pp. 68–78.]

69. A Navajo legend about the Grand Canyon may give another reason for dating it several centuries after the global flood.

> *A great* [local] *flood threatened to drown the Navajo's ancestors. Suddenly an outlet was formed by rushing waters. The Navajo survived the flood by being transformed temporarily into fish. The outlet the flood waters formed is the Grand Canyon.* Dan Goldblatt, *Grand Canyon*, Great National Parks Series (Pleasantville, New York: The Reader's Digest Association, Inc., 1988), video.

This legend implies that a local flood inundated northern Arizona. (Was it from the breaching of Grand and Hopi Lakes?) Survivors discovered the newly formed Grand Canyon, still carrying runoff from that local flood. If the legend is even partially true, the Grand Canyon formed recently, while people occupied that area, not millions of years ago.

Descendants of other early Americans who live near the Grand Canyon have similar legends that tell of a large flood. The Hualapai legend says that the Creator sent word to dig a huge hole to drain the land. As the waters receded, the Grand Canyon was left behind. The Havasupai tribe also tells of the Grand Canyon forming after a single, catastrophic flood. [See Ranney, pp. 84–85.]

70. This also applies if only a portion of the Colorado Plateau that held Grand or Hopi Lake tipped by 0.1°. If a block inside the lake tipped by this amount, shorelines would change to a lesser extent. Within Grand Lake's basin are large blocks that are faulted and tipped by *many degrees*. One example is Book Cliffs, so named because they resemble a row of books that partially toppled onto their sides after a bookend was removed. The 250-mile-long Book Cliffs are the longest continuous escarpment in the world.

71. Edmond W. Holroyd, III, "A Remote Sensing Search for Extinct Lake Shore Lines on the Colorado Plateau," *Proceedings of the Third International Conference on Creationism* (Pittsburgh, Pennsylvania: Creation Science Fellowship, Inc., 1994), pp. 243–254.

72. Ibid., p. 245.

73. M. S. Steckler et al., "Multi-Channel Seismic Reflection Database for the Northern Gulf of California, a Highly-Sedimented Oblique Rift," *Geophysical Research Abstracts*, Vol. 5, 2003, pp. 1–2.

74. *"… the submarine canyons in the Gulf of California exist only at the southern end."* Charles A. Anderson et al., "1940 E. W. Scripps Cruise to the Gulf of California," *Geological Society of America Memoir 43* (New York: Geological Society of America, 1950), p. 361.

75. *"*[William Morris Davis] *and his followers found peneplains often in the geologic past, but, tellingly, nowhere in the present. The paradigm of a geologic cycle ending in a peneplain was to dominate the theory of physical geology for half a century."* James Lawrence Powell, *Grand Canyon: Solving Earth's Grandest Puzzle* (New York: Pi Press, 2005), p. 155.

"… modern geologists do not find peneplains." Ibid., p. 156.

76. Ranney, p. 23.

77. *"New ^3He_c* [cosmogenic] *and $^{39}Ar/^{40}Ar$* [argon-argon] *ages show that volcanism and lava damming in this region occurred between 1 and 630 ka* [1,000–630,000 years ago], *rather than between 10 ka and 1.8 Ma* [10,000–1,800,000 years ago based on potassium-argon dating] *as previously reported."* Cassandra R. Fenton et al., "Geochemical Discrimination of Five Pleistocene Lava-Dam Outburst-Flood Deposits, Western Grand Canyon, Arizona," *Journal of Geology*, Vol. 112, 2004, p. 91.

- *"K-Ar dating of basalts in the Uinkaret volcanic field is known to be problematic owing to excess ^{40}Ar incorporated into large phenocrysts from the magmatic environment and abundant glassy groundmass. Anomalously old ages for young basalts in other volcanic fields have been attributed to excess argon and low potassium concentrations."* Cassandra R. Fenton et al., "Cosmogenic ^{3}He Dating of Western Grand Canyon Basalts," in Young and Spamer, p. 147.

78. *"Let us turn from speculation to what we can say with confidence. It is that the ultimate cause of the Grand Canyon is plate tectonics."* James Lawrence Powell, p. 252.

79. [Once upon a time] *"some 30 million years ago the Farallon Plate lay between the American and Pacific Plates. The two converged along a subduction zone that gradually consumed the Farallon Plate. By about 20 million years ago, it had vanished, leaving behind two smaller remnants: the Juan de*

Fuca and Cocos Plates. The Farallon Plate eventually traveled east for 1,500 kilometers, so far underneath North America that it caused the uplift of the Rocky Mountains." Ibid., p. 213.

80. Ivo Lucchitta, "Development of Landscape in Northwest Arizona: The Country of Plateaus and Canyons," *Landscapes of Arizona: The Geological Story,* editors T. L. Smiley et al. (London: University Press of America, 1984), pp. 269-301.

◆ See Endnote 86.

81. James Lawrence Powell, p. 191.

82. Ibid., p. 256.

83. *"There is no obvious reason to expect more rapid headward erosion from the drainage that became the Colorado River because this drainage incised the same rock units at Pigeon, Hidden, and Hobble Canyons farther north, descended from cliffs of similar or lower height, reached the same structural trough, and was subjected to the same climatic conditions."* Jon E. Spencer and Philip A. Pearthree, "Headward Erosion Versus Closed-Basin Spillover as Alternative Causes of Neogene Capture of the Ancestral Colorado River by the Gulf of California," in Young and Spamer, p. 218.

84. *"The idea of McKee and others that this basin received flow from the upper ancestral Colorado River cannot be justified based on … the lack of basin accumulation space for the assumed sediment carrying capacity of an ancestral upper Colorado River."* Todd A. Dallegge et al., "Age and Depositional Basin Morphology of the Bidahochi Formation and Implications for the Ancestral Upper Colorado River," in Young and Spamer, p. 51.

85. Hunt, p. 137.

86. *"But both authors* [McKee and Hunt] *had arrived at their theories partly by elimination and partly by inference: no direct evidence ever turned up to support either."* James Lawrence Powell, p. 206.

87. *"However, the Hualapai is not restricted to the mouth of the Grand Canyon, but occurs over a wide area. It also contains evidence suggesting deposition in a number of separate lakes. It is difficult to attribute all these lakes to springs near the mouth of the Grand Canyon resulting from piping of the Colorado. Furthermore, the Hualapai does not occur only at the top of the interior-basin sequence, as stated by Hunt, but throughout the exposed section* [in some layers below the top]*."* Lucchitta, "Development of Landscape," p. 294.

88. James Lawrence Powell, p. 200.

89. James Lawrence Powell, p. 205.

90. *"Geologist George Billingsley mapped these same plateaus without finding outcrops of confirmed river gravel. As with the McKee and Hunt theories, the key evidence that would support Lucchitta's idea has yet to appear, though it still could."* James Lawrence Powell, p. 210.

Figure 130: White Cliffs. An extensive layer of limestone is exposed on both sides of the English Channel: in the cliffs of Normandy, France (top) and the White Cliffs of Dover, England (bottom). This 600–1,000-foot layer extends under the Channel and into England and France. Was this region a shallow sea that somehow accumulated all this limestone, or did the chemistry for this limestone come from subterranean water chambers by an understood process? Answering this question will provide insight on the geologic history of the entire earth—and much more.

The Origin of Limestone

SUMMARY: Too much limestone exists on earth to have been formed, as evolutionists claim, by present processes on the earth's surface, such as the accumulation of pulverized corals and shells. Before the flood, supercritical water in the subterranean chamber steadily dissolved certain minerals in the chamber's floor and ceiling. The floor and ceiling became increasingly porous and spongelike,[1] allowing even deeper dissolving. As explained on pages 124–125, rising temperatures in the chamber caused more and more limestone (and salt) to precipitate onto the chamber floor. During the flood, the escaping subterranean water swept the precipitated limestone up to the earth's surface.

Limestone[2] and similar minerals account for 10–15% of all sedimentary rock.[3] Any satisfactory explanation for the world's fossils and sedimentary layers should also explain the enclosed limestone layers and limestone cement. This requires answering two questions, rarely asked and perhaps never before answered:

1. *What is the origin of the earth's limestone?* Remarkably, earth's limestone holds a thousand times more calcium and carbon than today's atmosphere, oceans, coal, oil, and living matter combined. A simple, visual examination of limestone grains shows that few are ground-up seashells or corals, as some believe.

2. *How were sediments cemented to form rocks?* Specifically, how were large quantities of cementing agents (usually limestone and silica) produced, transported, and deposited, often quite uniformly, between sedimentary grains worldwide? Especially perplexing has been finding the source of so much silica and the water to distribute it. Geologists call this "the quartz problem."[4]

Answering these questions in the context of the hydroplate theory will answer another question: What was the source of the carbon dioxide (CO_2) needed to reestablish vegetation after the flood? Remember, most preflood vegetation was buried during the flood, most of it becoming coal, oil, and methane.

Limestone Chemistry. Limestone, sometimes called calcium carbonate ($CaCO_3$), is difficult to identify by sight, but is quickly identified by the "acid test." If a drop of any acid, such as vinegar, is placed on limestone or a rock containing limestone, it will fizz. The acid combines with the limestone to release fizzing bubbles of CO_2 gas. As you will see, limestone and CO_2 gas are intimately related.

Another common chemical reaction involving limestone begins when CO_2 dissolves in water, forming a weak acid (carbonic acid). If that slightly acidic solution seeps through ground containing limestone, limestone will dissolve until the excess CO_2 is consumed. If that solution then seeps into a cave, evaporation and loss of CO_2 will reverse the reaction and precipitate limestone, often forming spectacular stalactites and stalagmites.

A third example of this basic reaction is "acid rain." With the increase in atmospheric CO_2 in recent decades, especially downwind from coal-burning power plants, CO_2 dissolves in rain, forming "acid rain." Acid rain can harm vegetation and a region's ecology if not neutralized, for example, by coming into contact with limestone.

Finally, limestone sometimes precipitates along the coasts of some eastern Caribbean islands, making their normally clear coastal waters suddenly cloudy white. Studies of this phenomenon have shown that limestone precipitates when CO_2 suddenly escapes from carbonate-saturated groundwater near the beach.[5]

These four examples are expressed by the following reversible chemical reaction.

$$H_2O(l) + CO_2(aq) + CaCO_3(s) \rightleftarrows \underbrace{Ca^{2+}(aq) + 2HCO_3^{1-}(aq)}_{\text{ions in solution}}$$

In other words, when **l**iquid water [$H_2O(l)$] containing dissolved (or **aq**ueous) CO_2 [$CO_2(aq)$] comes in contact with **s**olid limestone [$CaCO_3(s)$], the limestone dissolves and the chemical reaction moves to the right. Conversely, for every 44 grams of CO_2 that escape the solution, 100 grams of limestone precipitate and the reaction moves back to the left. Little temperature change occurs with either reaction.[6]

A Scenario. Supercritical water (SCW) readily dissolves certain minerals and other solids. [See pages 124–125.] As temperatures rise or as pressures drop in the SCW, these dissolved substances precipitate as "snow." In the years before the flood, tiny limestone particles precipitated to the subterranean chamber floor as the temperature in the SCW steadily rose. During the flood, the pressure in the escaping water rapidly dropped, so more limestone precipitated and CO_2 gas escaped. Simultaneously, limestone sediments on the chamber floor were swept up to the earth's surface, where liquefaction sorted the limestone particles into more uniform layers. [See pages 175–187.]

Sediments, eroded during the initial stages of the flood, settled through the flood waters all over the earth. After most of these waters drained into the newly formed ocean basins, limy (CO_2-rich) water filled and slowly migrated through pore spaces between sedimentary particles.

Plentiful amounts of CO_2 in the atmosphere after the flood provided the necessary "food" to help reestablish earth's vegetation, including forests. As plants grew and removed CO_2 from the atmosphere, surface waters released additional CO_2, thereby precipitating more limestone. Limestone that precipitated between loose sedimentary grains cemented them together into rocks. Earth's surface waters are still huge reservoirs of CO_2. Oceans, lakes, rivers, and groundwater hold 50 times more CO_2 than our atmosphere.

Tiny particles of precipitated limestone are excellent cementing agents when near-saturation conditions exist. Smaller and more irregular particles of limestone readily dissolve; larger particles grow, sealing cracks and gaps. Precipitation within a closely packed bed of sediments (cementation) occurs more readily than precipitation outside the bed.

Eight Observations Explained by This Scenario

1. Volcanic Gases. By volume, CO_2 makes up a approximately 20% of all volcanic gases; 70% is steam.[7] This water and CO_2 probably came from the subterranean water.

2. Carbon Distribution. Could today's surface waters have always been at the earth's surface while the earth's limestone slowly precipitated? Not based on the surprising distribution of carbon on earth. Table 6 shows that much more carbon exists in limestone than in all other sources combined.

Table 6. Approximate Distribution of Earth's Carbon[8]

Place	Amount of Carbon (10^{15} grams)
Atmosphere	720
Animals and Plants (living and dead)	2,000
Coal and Oil	4,130
Oceans (inorganic)	37,400
Sediments (primarily limestone)	> 60,000,000

Here is the problem. The above chemical equation shows that for every carbon atom precipitated in limestone, a carbon atom is released in CO_2. At the earth's surface, this gas enters the atmosphere. Had all limestone slowly precipitated in *surface* waters, as much carbon would have been released into the atmosphere (as CO_2) as was precipitated in limestone (as $CaCO_3$). The earth's limestone contains more than $60{,}000{,}000 \times 10^{15}$ grams of carbon. That amount of carbon in the atmosphere and seas would have made them toxic hundreds of times over. Today, the atmosphere and seas contain only $(720 + 37{,}400) \times 10^{15}$ grams of carbon.

However, before the flood the precipitation of limestone onto the floor of the subterranean chamber released CO_2 back into the subterranean water. There, that CO_2 helped dissolve more minerals in the chamber's floor and ceiling. As the flood waters escaped upward, limestone precipitation released CO_2, which escaped into the atmosphere or dissolved in water. The atmosphere gained tolerable amounts of CO_2.

3. Rapid Stalactite and Stalagmite Formation. Frequently the claim is made that stalactites and stalagmites required millions of years to form. More and more people recognize that this conclusion assumes that these limestone formations always grew at today's extremely slow rates. [See Figure 28 on page 36 and Figure 131.] With so much water draining through freshly deposited limestone after the flood, stalactites and stalagmites grew rapidly.

Acidic groundwater, plentiful in the centuries after the flood, frequently seeped into cracks in limestone rocks,

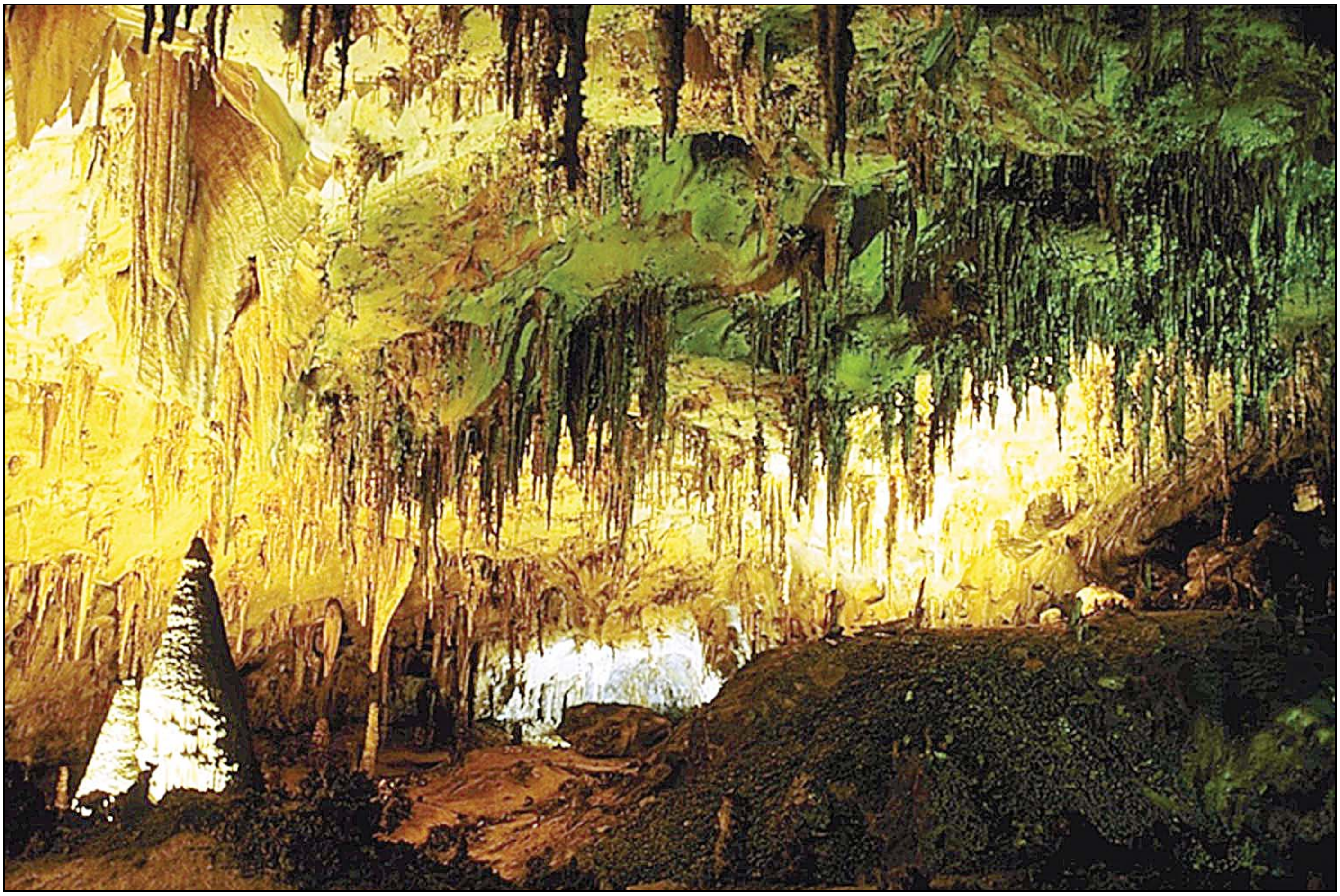


Figure 131: Carlsbad Caverns, New Mexico. *"… one of the most controversial points is how long it takes for a cave such as S.P.* [Kartchner Caverns in Arizona] *to form. What geologists used to believe was fact, in terms of dating a cave, now is speculation,* [cave expert, Jerry] *Trout says. … From 1924 to 1988, there was a visitor's sign above the entrance to Carlsbad Caverns that said Carlsbad was at least 260 million years old. … In 1988, the sign was changed to read 7 to 10 million years old. Then, for a little while, the sign read that it was 2 million years old. Now the sign is gone. In short, he says, geologists don't know how long cave development takes. And, while some believe that cave decorations such as S.P.'s beautiful icicle-looking stalactites take years to form, Trout says that through photo-monitoring, he has watched a stalactite grow several inches in a matter of days."* [9] [Also see Figure 28 on page 36.]

dissolved limestone, and formed underground caverns. As ventilation in caverns improved and plant growth removed CO_2 from the atmosphere, CO_2 escaped from this groundwater. Large quantities of limestone precipitated, rapidly forming stalactites and stalagmites worldwide.

4. Organic Limestone. Shallow-water organisms, such as corals, shelled creatures, and some types of algae, remove dissolved limestone from seawater to build hard body parts. (The more abundant the dissolved limestone, the faster the growth rates. Thus, coral growth rates were much higher after the flood.) Because some organisms produce limestone, evolutionists conclude that almost all limestone came from organisms, so hundreds of millions of years are needed to explain thick deposits of limestone. Instead, organic limestone is a result of the presence of inorganic limestone, not its cause. Inorganic limestone precipitated rapidly from the subterranean water released during the flood. Surface waters could not have held the $60{,}000{,}000 \times 10^{15}$ grams of carbon needed to produce today's limestone without making them hundreds of times too toxic for sea life to exist.

For two other reasons, we can reject the common belief that most limestone has an organic origin. Wave action and predators can fragment shells and other hard parts of marine organisms. However, as fragments become smaller, it is more difficult to break them into smaller pieces. With increasingly smaller pieces, the forces required to break them again become unreasonably large before the pieces reach the size of typical limestone grains.

Finally, organic limestone is structurally different from and more intricate than inorganic limestone. Organic limestone crystals are more uniformly sized, oriented, and packaged—characteristics now detectable with high magnification.[10] Earth's vast limestone layers are overwhelmingly inorganic.

Figure 132: Redwall Limestone Exposed in and around the Grand Canyon. Stained red from iron oxide impurities, the 400-foot-thick Redwall Limestone extends over most of northern Arizona. If it formed in a shallow sea (25–50 feet deep), how did such great thicknesses develop? How could another famous limestone formation, the 6-mile-thick Bahamas Bank, form?

In summary, while much limestone precipitated during the flood, seawater still contains dissolved inorganic limestone. Algae, corals and shelled creatures take in these dissolved chemicals and produce intricate organic limestone.

5. Thick Limestone Banks and Chalk. Scattered off the east coast of the United States are thick limestone deposits. Most dramatic is the Bahamas Bank, an area 250 by 800 miles, where "seismic evidence suggests that carbonate strata may extend down as far as 10 kilometers [6 miles]."[11]

If limestone formed organically in shallow seas (the prevailing view), why would the seafloor slowly subside almost 6 miles to allow these accumulations? Subsidence rates would have to be just right during the millions of years needed for organisms to grow and accumulate to such depths. Besides, the seafloor cannot subside unless the rock below it gets out of the way. That rock would have nowhere to go.

Apparently, the flood waters escaping from under the northeastern edge of the Americas hydroplate dumped limestone at the Bahamas Bank.[12] Similarly, waters escaping from under the northwestern edge of the European-Asian-African hydroplate dumped limestone in the vicinity of the English Channel. Later, in warm surface waters, rich in dissolved limestone, vast algae blooms—perhaps daily—produced the soft, fine-grained type of limestone known as chalk. Most famous are the exposed layers in England's White Cliffs of Dover and France's Normandy coast. [See Figure 130 on page 228.]

Some deep-sea sediments include the components of chalk: silicate and calcareous (limestone) structures secreted by tiny organisms such as foraminifera and coccoliths (a type of algae). Today, when they die, their hard body parts settle to the ocean floor too slowly to (1) bury and fossilize larger animals or (2) achieve the purity seen in famous chalk deposits. Because thick and very pure chalk deposits worldwide preserve many large fossils, including soft-body animals, deposition had to be rapid. Secondly, the microscopic organisms that make up chalk had to have abundant sources of dissolved limestone and silica—exactly what algae blooms require and the waters from the subterranean chambers provided. Powerful wave action, driven by the fluttering crust (explained on page 286) and mountain building events, could have easily scoured, transported, and dumped these low-density sediments into thick, fairly pure, fossil-bearing, chalk deposits.

6. The Dolomite Problem. If a microscopic limestone crystal grows in a magnesium-rich solution, magnesium ions will, under certain conditions, occupy or replace exactly half the calcium ion locations in limestone, forming a common mineral called *dolomite*.

Geologists frequently refer to "the dolomite problem." Why is it a problem? Dolomite is not secreted by any known organism. If organisms deposited almost all limestone over hundreds of millions of years, how did dolomite form?

Dolomite is frequently found in contact with limestone and is strangely distributed on earth. It has hardly ever formed in recent times.[13] Therefore, magnesium-rich solutions must have been much more abundant when older rocks were deposited. [See Table 7.]

Some geologists reject precipitation of dolomite because of "the great thicknesses of dolomite rock that are found in the geologic record."[14] Others say that a lot of magnesium-rich water trickled through limestone, but that raises even more problems. How did it trickle so uniformly through such great depths? Why would this "trickling" happen so often near limestone—and primarily in the ancient past? What was the source of the magnesium?

Basalt contains large amounts of magnesium, so the supercritical water dissolved minerals containing magnesium. Therefore, the presence of dolomite near limestone and the even distribution of magnesium in what would otherwise be limestone is easily understood.

Table 7. Dolomite: Observations and Explanations

Observations[15]	Hydroplate Explanations
"Dolomites are associated almost exclusively with two other rock types: limestone and evaporites [such as salt]."	Similar conditions were involved in depositing large amounts of dolomite, salt, and limestone.
"Dolomites occur in approximately the same tectonic and physiographic settings as limestones: on the shallow shelves of low-lying continents, most commonly far from the nearest convergent plate margin [ocean trenches]."	Dolomite and limestone are often found near the edge of a hydroplate. They would rarely be found near ocean trenches (so-called "convergent plate margins").
"[Dolomite] is rare in modern carbonate environments [but is abundant in lower layers]."	Little dolomite forms today, because the magnesium was released in the subterranean chamber where it was quickly consumed by limestone to form dolomite.
"Fossils are noticeably less common in dolomites [than in limestone]."	Fossils found in limestone are usually organisms that thrive in limy waters: corals, foraminifers, bryozoans, and crinoids. They evidently were buried by post-flood deposition of limestone.
"The contacts [of dolomites] with limestone above and below are usually sharp."	Liquefaction produced sharp contacts.

7. Worldwide Cement. Evolutionists believe that most limestone was produced organically in shallow seas, because corals and shelled creatures live in shallow seas, which are generally warmer and have higher evaporation rates. With greater evaporation, the remaining solution is more likely to reach concentrations at which organisms can produce shells and other forms of limestone.

Organic limestone is primarily produced within 30 degrees of the equator. However, limestone layers and cement are not concentrated near the equator. Rocks are just as likely to be held together with limestone cement at all latitudes. Obviously, whatever produced limestone was global in scope.

8. Limestone and Silica Cement. As dissolved CO_2 slowly escaped the flood waters, limestone precipitated into the tiniest cracks it could find. In this way, cementing occurred.

After limestone, silica (SiO_2) is the second most common cementing agent in rocks. Derived from quartz, silica dissolves only 6 parts per million in pure water at 77°F (25°C). As temperatures rise, more silica goes into solution. At 300°F (150°C), silica concentrations reach 140 parts per million. If a silica-rich solution occupied the pore space between sand grains, silica would precipitate on their solid surfaces as the water cooled, cementing loose grains into rocks.

Only under high pressure can water reach such high temperatures. The hydroplate theory shows how both high temperature and pressure conditions existed in the subterranean chamber. [See page 124.] Also, frictional sliding of deep rock surfaces and plastic deformations generated enormous heat, which melted rock, forming magma. These hot surfaces heated deep, high-pressure water containing abundant quartz grains.

Sediments fell through silica-rich water. Therefore, the cementing solution was automatically in place between deposited sedimentary particles. It is difficult to imagine another scenario in which so much superheated liquid water could dissolve silica, distribute silica-rich solutions worldwide, and then, before they cooled, force them down into sediments where cementing could occur.

Silica also plays a role in the petrification of wood. As the flood waters drained, continental basins became lakes. Trees floating in warm postflood lakes often became saturated with silica-rich solutions. Petrification occurred as the water cooled and silica precipitated on cellulose surfaces. Petrification has been duplicated in the laboratory when silica concentrations reach 140 parts per million.[16] Arizona's famous petrified forest lies in the center of what was Hopi Lake, while the petrified logs in Utah's Escalante Petrified Forest and along the Green

River both lie in what was Grand Lake. The sudden emptying of both lakes eroded the Grand Canyon. [For many more details about petrified wood and the formation of the Grand Canyon, see pages 189–226.]

Final Thoughts

We have seen the consequences of the flood at the earth's surface and below. In this chapter, we saw that earth's vast limestone deposits are not adequately explained by evolutionary scenarios, but are best explained by the hydroplate theory.

In later chapters, we will look far above and see in many ways that the fountains of the great deep—powerful beyond description—expelled muddy water and rocks far into outer space. Some of those rocks, called *meteorites*, have since fallen back to earth. Those that were in contact with the subterranean water before the flood contain traces of the substances dissolved in that water. Some even contain small quantities of water and limestone. [See **"Meteorites Return Home"** on page 316.]

Up until the last few years, meteorites were mishandled in the laboratory, so these traces were lost. Sadly, meteorites were cut open using saws lubricated and cooled by water. The water redissolved the chemical traces in the meteorite and carried them down the drain.

In 2000, a meteorite was discovered containing traces of many salts found in our oceans. As one authority stated, "The salts we found mimic the salts in Earth's ocean fairly closely."[17] However, there was one big difference; *limestone traces were a hundred times more abundant than expected.*[18] *Again, this is consistent with the hydroplate explanation that most limestone came from the subterranean water chamber.*

Incidentally, some meteorites are said to be from Mars. Before you accept that assertion, please read **"Are Some Meteorites from Mars?"** on page 318. The so-called "Martian meteorites" all "show evidence of being subjected to liquid water containing carbonate, sulfate, and chloride ... ."[19] Therefore, rather than coming from Mars, they were probably part of the rock in direct contact with the subterranean water before the flood.

Communications with Dr. C. Stuart Patterson (former Academic Dean at Furman University and Professor of Chemistry, Emeritus) have been extremely helpful in developing many ideas in this chapter.

References and Notes

1. See the description for Figure 54 on page 122.
2. The generic term "limestone" is used instead of specific varieties of $CaCO_3$, such as calcite, aragonite, vaterite, chalk, oolites, pisoliths, travertine, and marble.
3. *"Carbonate rocks (limestone and dolomites) total 10–15% of the sedimentary column and are nearly always quite pure."* Harvey Blatt, *Sedimentary Petrology* (New York: W. H. Freeman and Co., 1982), p. 241.
4. *"The debate over the role of fluid flow in the precipitation of diagenetic cements is a longstanding one that arose because it is often difficult to find a sufficient local source of cement to account for observed cement volumes, and it is equally difficult to justify the large volume of pore waters required to transport the necessary chemical components from distant sources. The debate has been particularly heated in cases where cement sources and sinks are not readily apparent. ... Was large-scale fluid flow required, or was temperature the dominant factor, with silica being locally redistributed from sources not immediately obvious from petrographic examination?"* Lori L. Summa, "Diagenesis and Reservoir Quality Prediction," *Reviews of Geophysics and Space Science*, Vol. 33, February 1995, p. 88.

   Note: A very large amount of water was involved (a global flood), and the source of the silica was quartz dissolved in extremely hot, subterranean supercritical water. (Granite contains about 27% quartz by volume.) This solves the "quartz problem."
5. Jeffrey S. Hanor, "Precipitation of Beachrock Cements: Mixing of Marine and Meteoric Waters vs. CO_2-Degassing," *Journal of Sedimentary Petrology*, Vol. 48, June 1978, pp. 489–501.
6. This reaction, in either direction, is accompanied by a small heat effect (±4.34 Kcal/mole at 25°C and 1 atmosphere) and thus is relatively insensitive to temperature change. While the reaction changes from endothermic to exothermic with increasing temperature, the escape of CO_2 from an aqueous to a gas phase is always endothermic and hence is always favored by increasing temperature. C. Stuart Patterson, Personal communication, 2 November 1999.

◆ C. S. Patterson et al., "Carbonate Equilibria in Hydrothermal Systems: First Ionization of Carbonic Acid in NaCl Media to 300°C," *Geochimica et Cosmochimica Acta*, Vol. 46, 1982, pp. 1653–1663.

◆ C. S. Patterson et al., "Second Ionization of Carbonic Acid in NaCl Media to 250°C," *Journal of Solution Chemistry*, Vol. 13, No. 9, 1984, pp. 647–661.

7. Gordon A. Macdonald, *Volcanoes* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972), p. 50.

8. P. Falkowski et al., "The Global Carbon Cycle: A Test of Our Knowledge of Earth as a System," *Science*, Vol. 290, 13 October 2000, p. 293.

- Other estimates, all consistent with the above, can be found in:
  - U. Siegenthaler and J. L. Sarmiento, "Atmospheric Carbon Dioxide and the Ocean," *Nature*, Vol. 365, 9 September 1993, pp. 119–125.
  - Bert Bolin, *The Global Carbon Cycle* (New York: John Wiley & Sons, 1979), p. 5.
  - Bert Bolin, "The Carbon Cycle," *Scientific American*, Vol. 223, March 1970, pp. 125–132.

9. Marilyn Taylor, "Descent," *Arizona Highways*, Vol. 69, January 1993, pp. 10–11.

10. Michael Rubner, "Synthetic Sea Shell," *Nature*, Vol. 423, 26 June 2003, pp. 925–926.

11. Arthur N. Strahler, *Physical Geology* (New York: Harper & Row, Publishers, 1981), p. 247.

12. As a hydroplate approached and even scraped along the chamber floor, the eroding power of the escaping waters beneath it reached a maximum. [See Endnote 58 on page 141.] When the plates approached their present location, the last waters to escape would, therefore, have carried the greatest load of suspended solids. So, the last material expelled was a huge slurry of water-saturated limestone.

13. *"Prior to 1964, dolomite was unknown as a significant deposit in Holocene* [recent] *sediments and a major concern of sedimentologists was 'The Dolomite Problem'."* Blatt, p. 332.

14. *"Dolomite ... poses a problem of origin, because the mineral is not secreted by organisms as shell material. Direct precipitation from solution in seawater is not considered adequate to explain the great thicknesses of dolomite rock that are found in the geologic record."* Strahler, pp. 117–118.

15. Blatt, pp. 306, 307, 316.

16. Anne C. Sigleo, "Organic Geochemistry of Silicified Wood, Petrified Forest National Park, Arizona," *Geochimica et Cosmochimica Acta*, Vol. 42, September 1978, pp. 1397–1405.

17. Carleton Moore as reported at www.cnn.com on 23 June 2000. (See also: www.chron.com/content/interactive/space/astronomy/news/2000/solarsys/20000623.html.) For details, see Douglas J. Sawyer et al., "Water Soluble Ions in the Nakhla Martian Meteorite," *Meteoritics & Planetary Science*, Vol. 35, July 2000, pp. 743–747.

18. *"The primary observation is that the suite of species found in Nakhla* [this meteorite] *is similar to most common ions present in contemporary terrestrial seawater ... . In addition, the relative magnitude of the species is similar to that of seawater, except for the amount of calcium cation (Ca^{2+}), carbonate, and the silicate anion. These are unexpectedly high ..."* Ibid., p. 745.

19. Ibid., p. 744.

Figure 133: Berezovka Mammoth. This is the most famous of all mammoths, the frozen Berezovka (bear-uh-ZOVE-kuh) mammoth. He is displayed in the Zoological Museum in St. Petersburg, Russia, in the struggling position in which he was found near Siberia's Berezovka River, just inside the Arctic Circle. His trunk and much of his head, reconstructed in this display, had been eaten by predators before scientists arrived in 1901. After a month of excavation, ten pony-drawn sleds hauled most of his cut-up carcass more than 2,000 miles south to the Trans-Siberian Railroad. From there he was taken to St. Petersburg's Zoological Museum, today's leading institution for studying frozen mammoths. The handle (extreme bottom center) of the shovel used in the excavation provides the scale. Inches above the handle is Berezovka's penis, flattened like a long tail of a beaver. While in the museum, I saw this reproductive organ's condition and realized that its state helps explain how Berezovka and other frozen mammoths died.

Figure 134: Dima, Baby Mammoth (right). In 1977, the first of two complete baby mammoths was found—a 6–12-month-old male named "Dima." His flattened, emaciated, but well-preserved body was encased in a lens of ice, 6 feet below the surface of a gentle mountainous slope.[1] "Portions of the ice were clear and others quite brownish yellow with mineral and organic particles."[2] Silt, clay, and small particles of gravel were found in his digestive and respiratory tracts (trachea, bronchi, and lungs). These details are important clues in understanding frozen mammoths.

Most mammoths were fat and well fed, but before being frozen, Dima may have suffered from one of the many problems common to baby elephants. (Within their first year of life, up to 36% of elephants die.[3])

Frozen Mammoths

SUMMARY: Muddy water from the fountains of the great deep jetted above the atmosphere where it froze into extremely cold hail. Within hours, mammoths, which could not have lived in today's Arctic climates or at Arctic latitudes, were buried alive and quickly frozen as some of this muddy hail fell back to earth in a gigantic hail storm. (As Endnote 69 on page 144 explains, latitudes changed soon after the flood.) Past attempts to explain the frozen mammoths ignored many established facts.

For centuries, stories have been told of frozen carcasses of huge, elephant-like animals called ***mammoths***,[4] buried in the tundra of northeastern Siberia.[5] These mammoths, with curved tusks sometimes more than 13 feet long, were so fresh-looking that many believed they were simply large moles living underground. Some called them "ice-rats."[6] People thought that when mammoths surfaced and saw daylight, they died. Dr. Leopold von Schrenck, Chief of the Imperial Academy of Sciences at Petrograd (today's St. Petersburg, Russia), published the following account in 1869: "The mammoth ... is a gigantic beast which lives in the depths of the earth, where it digs for itself dark pathways, and feeds on earth ... They account for its corpse being found so fresh and well preserved on the ground that the animal is still a living one."[7] Some even thought that rapid tunneling by mammoths produced earthquakes.[8]

This was an early explanation for the frozen mammoths. As people learned other strange details, theories multiplied. Unfortunately, theories that explained some details could not explain others. Some explanations, such as the one above, appear ludicrous today.

To learn what froze the mammoths, we must first understand much of what is known about them. This is summarized immediately below. Then we will distill the key details requiring an explanation. Finally, we will examine ten proposed theories. Initially, many may seem plausible, but their flaws will become apparent when we systematically compare how effectively they explain each detail. We will see that the hydroplate theory, summarized on pages 109–147, best explains all the details.

General Description

What Is Found. Since 1800, at least 11 scientific expeditions have excavated fleshy remains of extinct mammoths.[9] Most fleshy remains were buried in the permafrost of northern Siberia, inside the Arctic Circle. The remains of six mammoths have been found in Alaska. Only a few complete carcasses have been discovered. Usually, wild animals had eaten the exposed parts before scientists arrived.

If we look in the same region for frozen soft tissue of other animals, we learn that several rhinoceroses have been found, some remarkably preserved. (Table 8 on page 239 summarizes 58 reported mammoth and rhinoceros discoveries.) Other fleshy remains come from a horse,[10] a young musk ox,[11] a wolverine,[12] voles,[13] squirrels, a bison,[14] a rabbit, and a lynx.[15]

If we now look for the bones and ivory of mammoths, not just preserved flesh, the number of discoveries becomes enormous, especially in Siberia and Alaska. Nikolai Vereshchagin, Chairman of the Russian Academy of Science's Committee for the Study of Mammoths, estimated that more than half a million tons of mammoth tusks were buried along a 600-mile stretch of the Arctic coast.[16] Because the typical tusk weighs 100 pounds, this implies that about 5 million mammoths lived in this small region. Even if this estimate is high or represents

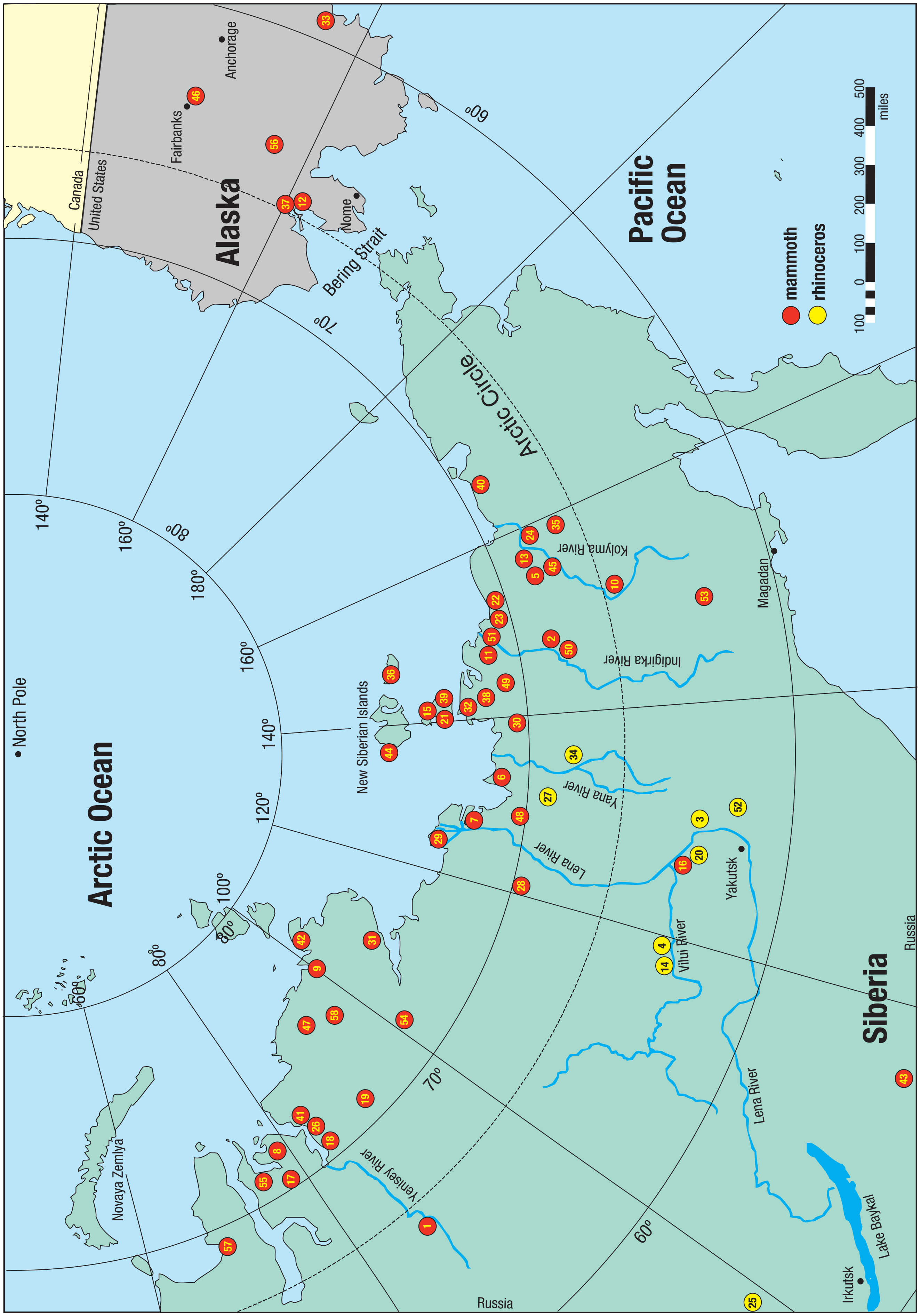


Figure 135: Map of Frozen Mammoth and Rhinoceros Finds. Circled numbers refer to rows in Table 8.

Table 8. Reports of Frozen Mammoths and Rhinoceroses

	Date[a]	Name[b]	Description (Pertains to mammoths unless stated otherwise.)	Reference[c]
1	1693[d]	Ides	frozen head and leg[e]	Ides, 25–27
2	1723	Messerschmidt	frozen head and big pieces of skin with long hair	Breyne, 138
3	1739	Laptev	several rhinoceros heads	T, 22
4	1771	Pallas	complete rhinoceros; suffocated; hairy head and two feet recovered	Eden;[17] H, 44, 82, 184
5	1787	Sarychev	complete when first seen; upright[e]	H, 82–83; T, 23
6	1800	Potapov	"on the shores of the Polar Sea"; skin and hair recovered	T, 25
7	1805	Adams	complete when first seen; 70-year-old male; 35,800 RCY; upright[e]	T, 23–25; H, 83–85
8	1839	Trofimov	complete; in a river bank; hair, bones, pieces of flesh and brain recovered	H, 85; T, 26
9	1843	Middendorff	a half-grown mammoth; most of the flesh had decayed, eyeball recovered	H, 85–86; Eden, 104
10	1845[d]	Khitrof	well preserved when found; food between teeth	H, 86
11	1846	Benkendorf	complete; upright; see page 242	HD, 32–38; D, 97–103
12	1847[d]	Goodridge	AK; "a skull with a quantity of hair"	Maddren[18]
13	1854	Khitrovo	a foot covered with hair; from a mammoth in good condition	T, 27
14	1858	Vilui	rhinoceros; a complete skeleton with some ligaments	T, 27
15	1860	Boyarski	upright in the face of an island's coastal cliff	T, 32
16	1861[d]	Golubef	"a huge beast covered with skin" in a river bank	H, 86
17	1864	Schmidt-1	PC; only skin and hair recovered a year later	T, 28; D, 108–110
18	1865	Koschkarof	PC; largely decomposed a year later	H, 86–87
19	1866	Schmidt-2	recovered on a lake shore; bones and hair of various lengths	T, 28; P, 8
20	1866	Kolesov	a large mammoth or rhinoceros, covered with skin	T, 27
21	1866	Bunge-1	"pieces of skin and plenty of hair"	T, 32
22	1869	Von Maydell-1	PC; upright; three years later, only a large hairy hide recovered	D, 80–95; H, 87–89
23	1869	Von Maydell-2	PC; only two legs found a year later	D, 80–95; H, 87–89
24	1870	Von Maydell-3	PC; only a leg was recovered three years later	D, 80–95; H, 87–89
25	1875	Tscherski	rhinoceros found in the frozen ground in a cave; hair and a piece of hide recovered	T, 29
26	1876	Nordenskiold	inch-thick hide near skull of a musk sheep	Nordenskiold, 310; H, 89
27	1877	Von Schrenck	complete rhinoceros; the head was thoroughly studied; apparent suffocation	H, 89; T, 30–31
28	1879	Bunge-2	tusks chopped off; reported to authorities four years later	T, 31
29	1884	Bunge-3	PC; first seen by natives 27 years earlier; two-inch-thick skin claimed	T, 16, 31
30	1886	Toll-1	23 years after natives' discovery, a few soft parts and hair were recovered	T, 32
31	1889	Burimovitch	reportedly complete; Toll's bad health prevented him from reaching the site	T, 33
32	1893	Toll-2	damaged bones, hairy skin, and other hair	T, 33
33	1894	Dall	AK; disintegrated muscle tissue, bones, and 300 pounds of fat	Dall[19]
34	1901	Pfizenmayer	rhinoceros; "a few fragments of ligaments and other soft parts"	P, 53–54; T, 35
35	1901	Berezovka	almost complete; upright; late summer death; 44,000 RCY; see page 243	HE, 611–625; D, 111–136
36	1902	Brusnev	hair recovered, mixed with mud	T, 36
37	1908	Quackenbush	AK; pieces of flesh; tendons, skin, tail, and hair recovered	A, 299; Q, 107–113
38	1908	Vollosovitch-1	small female; pieces scattered; died at end of summer; 29,500 and 44,000 RCY	P, 146–164; D, 211–212
39	1910	Vollosovitch-2	late summer death; well-preserved eye, four legs, trunk, food in stomach	P, 241–246; T, 37–38
40	1910	Soloviev	PC; young mammoth; reported to but not pursued by scientists	T, 39
41	1913	Goltchika	PC; "dogs and foxes got at it and ate pretty well all the lot"	T, 38; D, 212
42	1915	Transehe	PC; found in 30- to 50-foot cliff on the Arctic Ocean; never excavated	T, 39; Transehe[20]
43	1922	Kara	carcass reported to scientists, but only hard parts remained four years later	T, 39–40
44	1923	Andrews	ivory traders sold skull still containing ligaments to British museum	T, 39
45	1924	Middle Kolyma	scrap of trunk remained; no record of original discovery	VT, 19; G, 26
46	1948	Fairbanks Creek	AK; 200-pound, 6-month-old; head, trunk, and one leg; 15,380 RCY and 21,300 RCY	A, 299–300; G, 38–41
47	1949	Taimir	50-year-old male; tendons (11,500 RCY), hair, and an almost complete skeleton	VT, 20; Lister and Bahl[21]
48	1960	Chekurov	carcass of a young female; very small tusks; hair dated at 26,000 RCY	Vinogradov[22]
49	1970	Berelekh	a cemetery of at least 156 mammoths; minor hair and flesh remains	U, 134–148; S, 66–68
50	1971	Terektyakh	pieces of muscle, ligament, and skin; some around head	S, 67
51	1972	Shandrin	old; 550 pounds of internal organs and food preserved; 32,000 RCY and 43,000 RCY	U, 67–80; G, 27–29
52	1972	Churapachi	old rhinoceros, probably a female; "lower legs were in fair condition"	G, 34–37
53	1977	Dima	complete; 6-to-8-month-old male; 26,000 RCY and 40,000 RCY; see page 236	G, 7–24; U, 40–67
54	1978	Khatanga	55- to 60-year-old male; left ear, two feet; trunk in pieces; 45,000 RCY and 53,000 RCY	U, 30–40; G, 24–27
55	1979	Yuribei	12-year-old female; green-yellow grass in stomach; hind quarters preserved	U, 12–13, 108–134; VT, 22
56	1983	Colorado Creek	AK; two males; bones, hair, and gut contents recovered; 16,150 RCY and 22,850 RCY	Thorson and Guthrie[23]
57	1988	Mascha	3- to 4-month-old female; complete except for trunk, tail, and left ear	LB, 46–47; VT, 25
58	1999	Jarkov	fragments of a 47-year-old male; removed in a 23-ton block of permafrost by helicopter	Stone[24]

Some references in the right column are abbreviated: A=Anthony, D=Digby, G=Guthrie, H=Howorth, HD=Hornaday, HE=Hertz, LB=Lister and Bahl, P=Pfizenmayer, Q=Quackenbush, S=Stewart, 1977, T=Tolmachoff, U=Ukraintseva, VT=Vereshchagin and Tikhonov. Page numbers follow each abbreviation. See endnotes for complete citation. Other abbreviations are AK=found in Alaska, PC=possibly complete when first seen, RCY=radiocarbon years (most radiocarbon ages are from VT: 17–25).

Footnotes: a. Usually the year of excavation. First sighting often occurred earlier. b. The name given is usually the discoverer's, a prominent person involved in reporting the discovery, or a geographical name such as that of a river. c. No more than the two best references are given. The more complete reference is listed first. d. An approximate date. e. Referred to other carcasses but details are lacking.

thousands of years of accumulation, we can see that large herds of mammoths must have thrived along what is now the Arctic coast. Mammoth bones and ivory are also found in Europe, North and Central Asia, and in North America, as far south as Mexico City.

Dense concentrations of mammoth bones, tusks, and teeth are also found on remote Arctic islands. Obviously, today's water barriers were not always there. Many have described these mammoth remains as the main substance of the islands.[25] What could account for any concentration of bones and ivory on barren islands well inside the Arctic Circle? Also, more than 200 mammoth molars were dredged up along with oysters from the Dogger Bank in the North Sea.[26]

The northern portions of Europe, Asia, and North America contain bones of many other animals along with those of mammoths. A partial listing includes tiger,[27] antelope,[28] camel, horse, reindeer, giant beaver, fox, giant bison, giant ox, musk sheep, musk ox, donkey, badger, ibex, woolly rhinoceros, lynx, leopard, wolverine, Arctic hare, lion, elk, giant wolf, ground squirrel, cave hyena, bear, and many types of birds. Friend and foe, as well as young and old, are found together. Carnivores are sometimes buried with herbivores. Were their deaths related? Rarely are animal bones preserved; preservation of so many different types of animal bones suggests a common explanation.

Finally, corings, 100 feet into Siberia's permafrost, have recovered sediments mixed with ancient DNA of mammoths, bison, horses, other temperate animals, and the lush vegetation they require. Nearer the surface, these types of DNA are absent, but DNA of meager plants able to live there today is present.[29] The climate must have suddenly and permanently changed to what it is today.

Mammoth Characteristics and Environment. The common misconception that mammoths lived in areas of extreme cold comes primarily from popular drawings of mammoths living comfortably in snowy, Arctic regions. The artists, in turn, were influenced by earlier opinions based on the mammoth's hairy coat, thick skin, and a 3.5-inch layer of fat under the skin. However, animals with these characteristics do not necessarily live in cold climates. Let's examine these characteristics more closely.

Hair. The mammoth's hairy coat no more implies an Arctic adaptation than a woolly coat does for a sheep. Mammoths lacked erector muscles that fluff up an animal's fur and create insulating air pockets. Neuville, who conducted the most detailed study of mammoth skin and hair, wrote: "It appears to me impossible to find, in the anatomical examination of the skin and pelage [hair], any argument in favor of adaptation to the cold."[30] Long hair on a mammoth's legs hung to its toes.[33] Had it walked in snow, snow and ice would have caked on its hairy "ankles." Each step into and out of snow would have pulled or worn away the "ankle" hair. All hoofed animals living in the Arctic, including the musk ox, have fur, not hair, on their legs.[34] Fur, especially oily fur, holds a thick layer of stagnant air (an excellent insulator) between the snow and skin. With the mammoth's greaseless hair, much more snow would touch the skin, melt, and increase the heat transfer 10- to 100-fold. Later refreezing would seriously harm the animal.

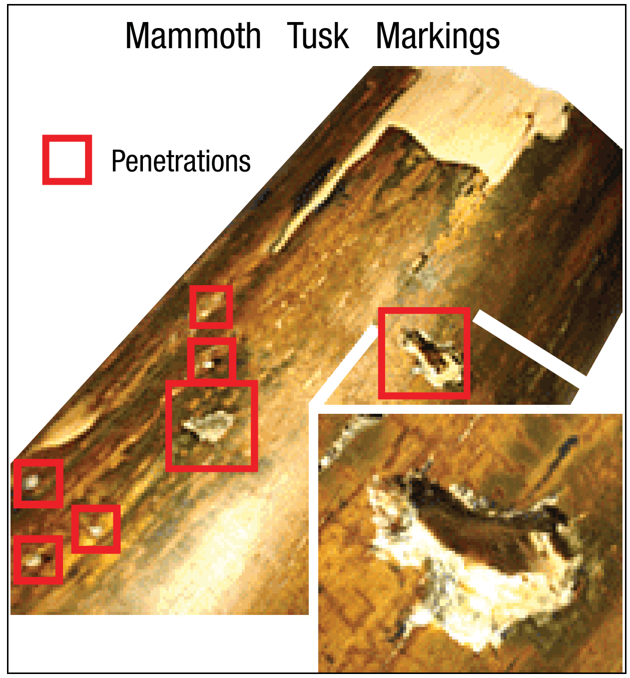


Figure 136: Peppered Mammoth Tusk. Scientists are finding, over wide geographical areas, mammoth tusks embedded on one side with millimeter-size particles rich in iron and nickel. This has led some to wonder if meteorites exploding high in the atmosphere punctured those tusks.[31] The British Broadcasting Corporation stated, "Startling evidence has been found which shows mammoth and other great beasts from the last ice age were blasted with material that came from space."[32] But is there a more complete explanation?

Skin. Mammoth and elephant skin are similar in thickness and structure.[35] Both lack oil glands, making them vulnerable to cold, damp climates. Arctic mammals have both oil glands and erector muscles—equipment *absent* in mammoths.[36]

Fat. Some animals living in temperate or even tropical zones, such as the rhinoceros, have thick layers of fat, while many Arctic animals, such as reindeer and caribou, have little fat. Thick layers of fat under the skin simply show that ***food was plentiful***. Abundant food implies a temperate climate.

Figure 137: Fossil Forest, New Siberian Islands. Vast, floating remains of forests have washed up on the New Siberian Islands, well inside the Arctic Circle and thousands of miles from comparable forests today. This driftwood was washed ashore on Bolshoi Lyakhov Island, one of the New Siberian Islands. The wood was probably buried under the muck that covers northern Siberia. Later, northward flowing Siberian rivers, during early summer flooding, eroded the muck, releasing the buried forests. "Fossil wood," as it is called, is a main source of fuel and building material for many Siberians.

Figure 138: Fossil Forest, Kolyma River. Here, driftwood is at the mouth of the Kolyma River, on the northern coast of Siberia. Today, no trees of this size grow along the Kolyma. Leaves, and even fruit (plums), have been found on such floating trees.[43] One would not expect to see leaves and fruit if these trees had been carried far by rivers. Why didn't these trees decay?

Elephants. The elephant, which is closely related to the mammoth,[37] lives in tropical or temperate regions, not the Arctic. It requires "a climate that ranges from warm to very hot," and "it gets a stomach ache if the temperature drops close to freezing."[38] Newborn elephants are susceptible to pneumonia and must be kept warm and dry.[39] Hannibal, who crossed the Alps with 37 elephants, lost all but one due to cold weather.[40]

Water. If mammoths lived in an Arctic climate, their drinking water in the winter must have come from eating snow or ice. A wild elephant requires 30–60 gallons of water each day.[41] The heat needed to melt snow or ice and warm it to body temperature would consume about half a typical elephant's calories. The mammoth's long, vulnerable trunk would bear much of this thermal (melting) stress. Nursing elephants require about 25% more water.

Salt. How would a mammoth living in an Arctic climate satisfy its large salt appetite? Elephants dig for salt using their sharp tusks.[42] In rock-hard permafrost this would be almost impossible, summer or winter, especially with curved tusks.

Nearby Plants and Animals. The easiest and most accurate way to determine an extinct animal's or plant's environment is to identify familiar animals and plants buried nearby. For the mammoth, this includes rhinoceroses, tigers, horses, antelope,[44] bison, and temperate species of grasses. All live in warm climates. Some burrowing animals are frozen, such as voles, which would not burrow in rock-hard permafrost. Even larvae of the warble fly have been found in a frozen mammoth's intestine—larvae identical to those found in tropical elephants today.[45] No one argues that animals and plants buried near the mammoths were adapted to the Arctic. Why do so for mammoths?

Temperature. The *average* January temperature in northeastern Siberia is about -28°F (60°F *below* freezing)! During the Ice Age, it was much colder. The long, slender trunk of the mammoth was particularly vulnerable to cold weather. A six-foot-long nose could not survive even one cold night, let alone an eight-month-long Siberian winter or a sudden cold snap. For the more slender trunk of a young mammoth, the heat loss would be more deadly. An elephant usually dies if its trunk is seriously injured.[46]

No Winter Sunlight. Cold temperatures are one problem, but six months of little sunlight during Arctic winters is quite another. While some claim that mammoths were adapted to the cold environment of Siberia and Alaska, vegetation, adapted or not, does not grow during the months-long Arctic night. In those regions today, vegetation is covered by snow and ice ten months each year. Mammoths had to eat voraciously. Elephants in the wild spend about 16 hours a day foraging for food in relatively lush environments, summer *and* winter.[47]

Three Problems. Before examining other facts, we can see three curious problems. First, northern Siberia today is cold, dry, and desolate. Vegetation does not grow during dark Arctic winters. How could millions of mammoths and other animals, such as rhinoceroses, horses, bison, and antelope, feed themselves? But if their environment was more temperate and moist, why did it change?

Second, the well-preserved mammoths and rhinoceroses must have been completely frozen soon after death or their soft internal parts would have quickly decomposed. Guthrie has written that an unopened animal continues to decompose long after a fresh kill, even in very cold temperatures, because its internal heat can sustain microbial and enzyme activity as long as the carcass is completely covered with an insulating pelt.[48] Because mammoths had such large reservoirs of body heat, the freezing temperatures must have been extremely low.

Finally, their bodies were buried and protected from predators, including birds and insects. Such burials could not have occurred if the ground were perpetually frozen as it is today. Again, this implies a major climate change, but now we can see that it must have changed dramatically and suddenly. How were these huge animals quickly frozen and buried—almost exclusively in **muck**, a dark soil containing decomposed animal and vegetable matter?

Muck. Muck is a major geological mystery. It covers one-seventh of the earth's land surface—all surrounding the Arctic Ocean. Muck occupies treeless, generally flat terrain, with no surrounding mountains from which the muck could have eroded. Russian geologists have drilled through 4,000 feet of this muck without hitting solid rock. Where did so much eroded material come from? What eroded it?

Oil prospectors, drilling through Alaskan muck, have "brought up an 18-inch-long chunk of tree trunk from almost 1,000 feet below the surface. It wasn't petrified—just frozen."[49] The nearest forests are hundreds of miles away. Williams describes similar discoveries in Alaska:

> *Though the ground is frozen for 1,900 feet down from the surface at Prudhoe Bay, everywhere the oil companies drilled around this area they discovered an ancient tropical forest. It was in frozen state, not in petrified state. It is between 1,100 and 1,700 feet down. There are palm trees, pine trees, and tropical foliage in great profusion. In fact, they found them lapped all over each other, just as though they had fallen in that position.*[50]

How were trees buried under a thousand feet of hard, frozen ground? We are faced with the same series of questions we first saw with the frozen mammoths. Again, it seems there was a sudden and dramatic freezing accompanied by rapid burial in muck, now frozen solid.

Some Specifics

We cannot minimize the frozen mammoth mystery by saying, "Only a few complete mammoths have been reported." One good case would be enough. Undoubtedly, hundreds of past discoveries went unreported, because many Siberians believed that looking at a mammoth's face brought death or misfortune. Fear of being forced by scientists to dig a mammoth out of frozen ground suppressed other discoveries. Also, Siberia and Alaska are sparsely populated and relatively unexplored. Flowing rivers are the primary excavators, so man has seen only a tiny sample of what is buried. Siberian geologists report that "work at the gold mines uncovers frozen corpses every year, but because the arrival of scientists can delay and complicate the mining, most [frozen mammoths] are lost to science."[51]

Widespread freezing and rapid burial are also inferred when commercial grade ivory is found. Ivory tusks, unless frozen and protected from the weather, dry out, lose their animal matter and elasticity, crumble, crack, and become useless for carving.[52] Between about 1750 and 1917, trade in mammoth ivory prospered over a wide geographical region, yielding an estimated 96,000 mammoth tusks.[53] Therefore, the extent and speed of freezing and burial is greater than most people have imagined.

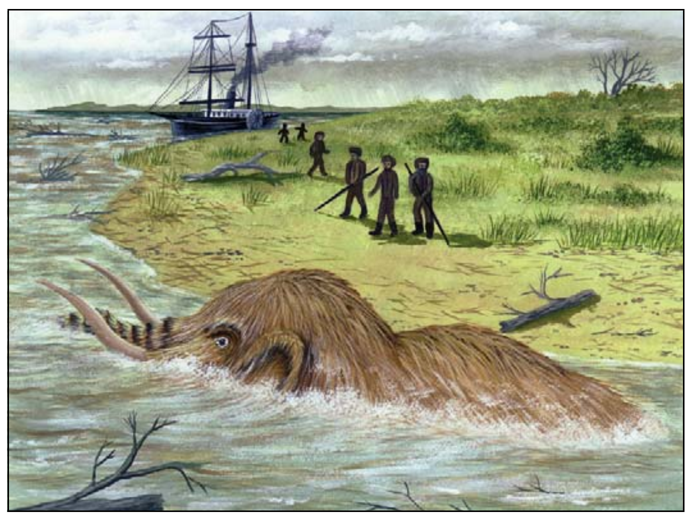


Figure 139: Depiction of the Recovery of the Benkendorf Mammoth.

The Benkendorf Mammoth.[54] In May 1846, a surveyor named Benkendorf and his party camped along Siberia's Indigirka River. The spring thaw and unusually heavy rains caused the swollen river to erode a new channel. Benkendorf noticed a large object bobbing slowly in the water. As the "black, horrible, giantlike mass was thrust out of the water [they] beheld a colossal elephant's head, armed with mighty tusks, with its long trunk moving in an unearthly manner, as though seeking something lost therein." They tried to pull the mammoth to shore with ropes and chains but soon realized that its hind legs were frozen in the river bottom ***in a standing position.***

Twenty-four hours later, the river bottom thawed and eroded, freeing the mammoth. A team of 50 men and their horses pulled the mammoth onto dry land, 12 feet from shore. The 13-foot-tall, 15-foot-long beast was fat and perfectly preserved. Its "widely opened eyes gave the animal an appearance of life, as though it might move in a moment and destroy [them] with a roar." They removed the tusks and opened its *full* stomach containing "young shoots of the fir and pine; and a quantity of young fir cones, also in a chewed state ..." Hours later and without warning, the river bank collapsed, because the river had slowly undercut the bank. The mammoth was carried off toward the Arctic Ocean, never to be seen again.

The Berezovka Mammoth. The most famous, accessible, and studied mammoth is a 50-year-old[55] male, found in a freshly eroded bank, 100 feet above Siberia's Berezovka River in 1900. A year later an expedition, led by Dr. Otto F. Herz, painstakingly excavated the frozen body and transported it to the Zoological Museum in St. Petersburg, Russia.[56] [See Figure 133 on page 236.]

Berezovka was upright, although his back was excessively humped and his straightened hind legs were rotated forward at the hips into an almost horizontal position. This strange, contorted position was further exaggerated by his raised and spread front legs. Several ribs, a shoulder blade, and pelvis were broken.[57] Amazingly, the long bone in his right foreleg was crushed into about a dozen pieces, without noticeably damaging surrounding tissue.[58] "There had been considerable bleeding between the muscles and the fatty and connective tissues."[59] His shaggy, wirelike hair, some of it 20 inches long, was largely intact.[60] His erect penis was horizontally flattened.[61] (This organ in a live elephant is round, S-shaped, and never horizontal.)[62]

What can we conclude from these unusual details? To crush a slender rod, which the long leg bones resemble, requires axial compression while the rod (or bone) is encased in some material that prevents bending and snapping. To demonstrate this, place a long, straight stick vertically on a table and see how difficult it is to compress and break it into a dozen or so pieces. Instead, it will snap at the weakest point. If the stick has a slight bend, as do the long leg bones, crushing becomes almost impossible. Something must prevent the stick or bone from bending as the compressive load increases. Evidently, Berezovka's leg bone was severely compressed lengthwise while rigidly encased.[63] The "considerable bleeding" shows that this crushing occurred before or soon after death.

Slow suffocation of males can produce penile erection.[64] Tolmachoff concluded that, "The death [of Berezovka] by suffocation is proved by the erected male genital, a condition inexplicable in any other way."[65] But why was the penis horizontally flattened? It had to be pressed between two horizontal surfaces, one of which was probably his abdomen. Again, considerable vertical compression must have acted within some medium that encased the entire body.

Suffocation is also implied with four other frozen giants in this region. Vollosovitch (Table 8) concluded that his second buried mammoth, found with a penile erection on Bolshoi Lyakhov Island, had suffocated.[66] A third example is provided by Dima, whose "pulmonary alveoli suggested death by asphyxia" after "great exertion just before death."[67] The Pallas rhinoceros also showed symptoms of asphyxiation.

> *The blood-vessels and even the fine capillaries were seen to be filled with brown coagulated blood, which, in many places still preserved its red colour. This is exactly the kind of evidence we look for when we want to know whether an animal has been drowned or suffocated. Asphyxia is always accompanied by the gorging of the capillaries with blood.*[68]

Von Schrenck's rhinoceros was found with expanded nostrils and an open mouth. Investigators concluded, "that the animal died from suffocation, which it tried to avoid by keeping the nostrils wide asunder."[69] In all, three mammoths and two rhinoceroses apparently suffocated. No other cause of death has been shown for the remaining frozen giants.[70]

Sanderson describes another strange aspect of Berezovka.

> *Much of the head, which was sticking out of the bank, had been eaten down to the bone by local wolves and other animals, but most of the rest was perfect. Most important, however, was that the lips, the lining of the mouth and the tongue were preserved. Upon the last, as well as between the teeth, were portions of the animal's last meal, which for some almost incomprehensible reason it had not had time to swallow. The meal proved to have been composed of delicate sedges and grasses ...*[71]

Another account states that the mammoth's "mouth was filled with grass, which had been cropped, but not chewed and swallowed."[72] The grass froze so rapidly that it still had "the imprint of the animal's molars."[73] Hapgood's translation of a Russian report mentions eight well-preserved bean pods and five beans found in its mouth.[74]

Twenty-four pounds of undigested vegetation were removed from Berezovka and analyzed by Russian scientist V. N. Sukachev. He identified more than 40 different species of plants: herbs, grasses, mosses, shrubs, and tree leaves. Many no longer grow that far north; others grow both in Siberia and as far south as Mexico. Dillow[75] draws several conclusions from these remains:

- *The presence of so many varieties* [of plants] *that generally grow much to the south indicates that the climate of the region was milder than that of today.*
- *The discovery of the ripe fruits of sedges, grasses, and other plants suggests that the mammoth died during the second half of July or the beginning of August.*
- *The mammoth must have been overwhelmed suddenly with a rapid deep freeze and instant death. The sudden death is proved by the unchewed bean pods still containing the beans that were found between its teeth, and the deep freeze is suggested by the well-preserved state of the stomach contents and the presence of edible meat* [for wolves and dogs].

At normal body temperatures, stomach acids and enzymes break down vegetable material within an hour. What inhibited this process? The only plausible explanation is for the stomach to cool to about 40°F in ten hours or less.[76] But because the stomach is protected inside a warm body (96.6°F for elephants), how cold must the outside air become to drop the stomach's temperature to 40°F? Experiments have shown that the outer layers of skin would have had to drop *suddenly* to at least -175°F![77]

Independently, Sanderson concluded, "The flesh of many of the animals found in the muck must have been very rapidly and deeply frozen, for its cells had not burst. ... Frozen-food experts have pointed out that to do this, starting with a healthy, live specimen, you would have to suddenly drop the temperature of the surrounding air to well below minus 150 degrees Fahrenheit."[78]

The ice layer directly under the Berezovka mammoth contained some hair still attached to his body. Below his right forefoot was "the end of a very hairy tail ... of a bovine animal, probably [a] bison."[79] Also under the body were "the right forefoot and left hind foot of a reindeer ... The whole landslide on the Berezovka [River] was the richest imaginable storehouse of prehistoric remains."[80] In the surrounding, loamy soil was an antelope skull,[81] "the perfectly preserved upper skull of a prehistoric horse to which fragments of muscular fibre still adhered,"[82] tree trunks, tree fragments, and roots.[83] This vegetation differed from the amazingly well-preserved plants in the mammoth's mouth and stomach.

Geographical Extent. We should also notice the broad geographical extent over which these strange events occurred. [See map on page 238.] They were probably not separate, unrelated events. As Sir Henry Howorth stated:

> *The instances of the soft parts of the great pachyderms being preserved are not mere local and sporadic ones, but they form a long chain of examples along the whole length of Siberia, from the Urals to the land of the Chukchis* [the Bering Strait], *so that we have to do here with a condition of things which prevails, and with meteorological conditions that extend over a continent.*
>
> *When we find such a series, ranging so widely, preserved in the same perfect way, and all evidencing a sudden change of climate from a comparatively temperate one to one of great rigour, we cannot help concluding that they all bear witness to a common event. We cannot postulate a separate climate cataclysm for each individual case and each individual locality, but we are forced to the conclusion that the now permanently frozen zone in Asia became frozen at the same time from the same cause.*[84]

Actually, northern portions of Asia, Europe, and North America contain "the remains of extinct species of the elephant [mammoth] and rhinoceros, together with those of horses, oxen, deer, and other large quadrupeds."[85] So, the event may have been even more widespread than Howorth believed.

Rock Ice. In Siberia and Alaska, scientists have found a strange type of ice in and under the muck containing mammoth remains.[86] Tolmachoff called it *rock ice*.[87] Rock ice often has a yellow tinge and contains round or elongated bubbles. Some bubbles are connected, while others, an inch or so long, are vertically streaked.[88] When exposed to the Sun, rock ice showed "a polyhedral, granular structure at the surface, and these granules could usually be easily rubbed off with the finger."[89] It looked ***"like compacted hail."***[90] Mammoth remains have been found above, below, beside, partially in,[91] and, in one case, within[92] rock ice.

Horizontal layers of rock ice are most easily seen in bluffs along the Arctic coast and nearby rivers.[93] Some subsurface ice layers are more than 2 miles long and 150 feet thick.[94] A several-foot-thick layer of structureless clay or silt is sometimes above the rock ice. How was this clay or silt deposited? If it settled out of a lake or stream, as normally happens, it should have many thin layers, but it does not. Furthermore, the slow settling of clay and silt through water should have provided enough time for the water to melt all the ice below. Sometimes rock ice contains plant particles[95] and thin layers of sand or clay. Had the water frozen in a normal way, the dirt would have settled out and the vegetable matter would have floated upward. Obviously, this rock ice froze rapidly and was never part of a lake or stream.

Several feet beneath the Berezovka mammoth was a layer of rock ice, sloping more than 180 feet down to the river. Herz and Pfizenmayer,[96] after digging into it, reported perhaps the strangest characteristic of rock ice.

> *Deeper down in the cliff the ice becomes more solid and transparent, in some places entirely white and brittle. After remaining exposed to the air even for a*

short time this ice again assumes a yellowish-brown color and then looks like the old ice.[97]

Obviously, something in the air (probably oxygen) reacted chemically with something in the ice. Why was air (primarily oxygen and nitrogen) not already dissolved in the ice? Just as liquid water dissolves table salt, sugar, and many other solids, water also dissolves gases in contact with it. For example, virtually all water and ice *on* earth are nearly saturated with air. Had air been dissolved in Herz's rock ice before it suddenly turned yellowish-brown, the chemical reaction would have already occurred.

Table 9 compares the characteristics of rock ice with those of the three generic types of ice. A careful study of this table suggests that rock ice is a Type 3 ice. Because such thick layers of rock ice still exist, an enormous amount of water probably froze while moving through cold air or outer space.

Yedomas and Loess. In Siberia, frozen mammoths are frequently found in strange hills, 30–260 feet high, which Russian geologists call yedomas (yeh-DOME-uhs). For example, the mammoth cemetery, containing remains of 156 mammoths, was in a yedoma.[98] [See line 49, Table 8, page 239.] It is known that these hills were formed under cold, windy conditions, because they are composed of a powdery, homogeneous soil, honeycombed with thick veins of ice. Sometimes the ice, which several Russian geologists have concluded was formed simultaneously with the soil, accounts for 90% of the yedoma's volume.[99] Some yedomas contain many broken trees "in the wildest disorder."[100] The natives call them "wood hills" and the buried trees "Noah's wood."[101] Yedoma soil is similar to muck.[102] It contains tiny plant remains, is high in salt and carbonate,[103] and has more than two and a half times the carbon that is in all the world's tropical forests![104] The Berezovka mammoth was found in a similar soil.[105]

This soil has been identified as loess[106] (a German term, pronounced "LERSE"). Little is known about its origin. Most believe it is a windblown deposit spread under cold, glacial conditions over huge regions of the earth. However, Siberia was scarcely glaciated, and normal winds would deposit loess too slowly to protect so many frozen animals from predators. Loess often blankets formerly glaciated regions, such as Wisconsin, Illinois, Iowa, Kansas, and Alaska. It lacks internal layering (stratification) and is found at all elevations—from just above sea level to hillsides at 8,000 feet elevation. Because loess is at many elevations and its tiny particles are not rounded by thousands of years of exposure to water and wind, some have proposed that loess came recently from outer space.[107] Loess, a fertile soil rich in carbonates, has a yellow tinge caused by the oxidation of iron-bearing minerals after deposition.[108] China's Yellow River and Yellow Sea are so named because of the loess suspended in them. Why is there an apparent relationship between frozen mammoths, yedomas, and loess?

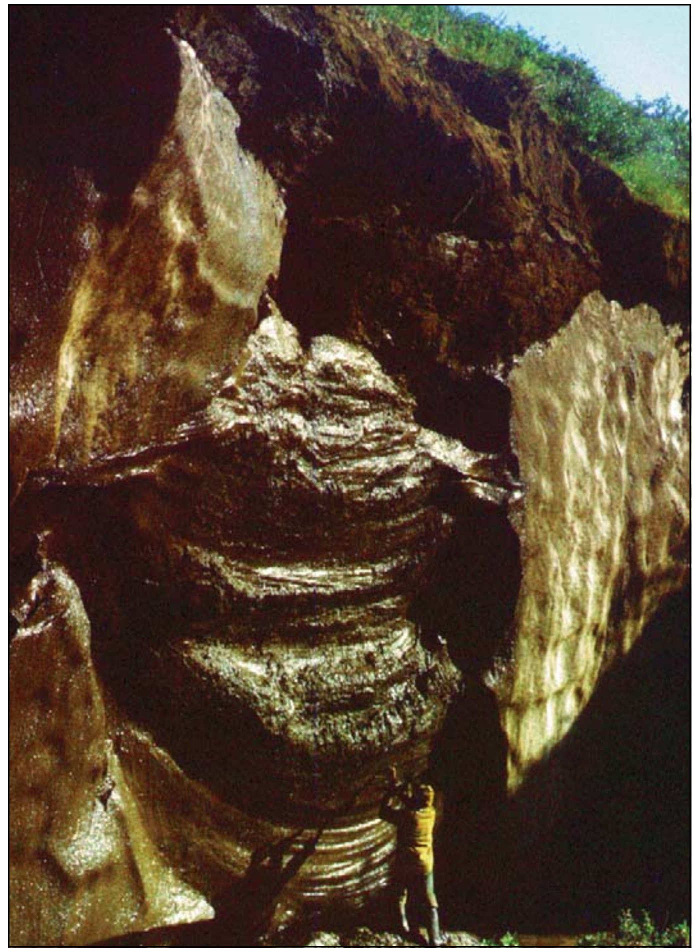


Figure 140: A Yedoma. These Siberian hills, called *yedomas*, are honeycombed with ice. The ice and soil layering seen within yedomas (for example, left of the man) suggests that high winds accompanied the deposition of the material. Remains of forests, mammoths, and other animals are frequently found in yedomas.

The ice and mud were not deposited as hills. Instead, they were deposited as one thick layer. Later, as the ice began to melt in spots, water collected in the depressions, accelerating the melting near them. What is now left, after thousands of years of summer melting, are these hills. Because some yedomas are 260 feet tall, the initial deposition in the windy environment was at least 260 feet thick.

Conclusion. This brief survey raises several intriguing but perplexing problems. How could mammoths have lived at Arctic latitudes, especially during the dark winters? What killed them, and how were they buried in such a peculiar manner? Some must have frozen within hours after their deaths, because significant decay or mutilation by scavengers did not occur. However, just before the mammoths were frozen, during that late summer or early fall, conditions in Siberia were not cold. What happened?

Table 9. Characteristics of Rock Ice vs. Three Types of Ice

Some Characteristics of Ice [a]	**Type 1**: A body of stationary or slowly moving liquid water freezes. Examples: frozen rivers and lakes, ice cubes, subsurface water [b]	**Type 2**: Water vapor condenses and freezes on microscopic particles in air, forming a type of ice called snow. (Its volume can decrease enormously by compaction, partial melting, and refreezing.) Examples: glaciers, icebergs, ice on winter roads	**Type 3**: Many small drops of water freeze while moving rapidly through cold air or outer space. Examples: hail, sleet, windblown spray just above a choppy lake	**Rock Ice**[c]
Bubble Numbers and Sizes	a few the size of a pin head	many tiny air pockets	large pockets trapped between ice particles	many large bubbles[d]
Bubble Percentage	less than 6%	about 6% for glacier ice	much more than 6%	16%
Dissolved Air	saturated	saturated	depends on water source	undersaturated
Granularity	no grains	very tiny grains	very granular	very granular, "like compacted hail"[90]
Color	usually clear	usually white	depends on the impurities dissolved in the liquid [e]	usually has a yellow tinge
Dirt Content	slight	very little when it first forms	depends on the liquid water's dirt content [e]	dirt and plant particles easily seen

a. Ice has other characteristics. For example, the atoms in ice can have 15 possible crystalline patterns, depending upon the temperature and pressure at which the ice formed. They are called Ice I, Ice II, Ice XV, etc. Unfortunately, the crystallographic structure of rock ice is not yet known. Only the characteristics listed in the table are known for rock ice.

b. Many subsurface ice features are not rock ice: ice wedges, segregated ice (Taber ice), vein ice, pingos, and glaciers covered with dirt. Their characteristics, especially their shapes and sizes, clearly differentiate them from rock ice and show how they formed.

c. For details see Cantwell, "Ice Cliffs," pp. 345–346; Cantwell, "Exploration," pp. 551–554; Dall, pp. 107–109; Digby, pp. 93–95, 116, 120–124, 151; Dubrovo, p. 630; Herz, pp. 613, 616, 618, 622; Howorth, p. 53; Maddren, pp. 15, 32, 38–40, 51–54, 58–64, 67–117; Pfizenmayer, 88–90; Quackenbush, pp. 97–103; and Tolmachoff, pp. 51–55.

d. Sometimes these bubbles are connected or form vertical streaks. Their shapes apparently formed over centuries as gravity deformed the ice plastically.

e. Hail, sleet, and ice formed from a lake or ocean spray usually have very little visible dirt or impurities. Ice formed from sprays from other sources might have impurities and color.

Evidence Requiring an Explanation

Summarized below are the hard-to-explain details which any satisfactory theory for the frozen mammoths should explain.

Abundant Food. A typical wild elephant requires about 330 pounds of food per day. Therefore, vast quantities of food were needed to support the estimated 5,000,000 mammoths that lived in just a small portion of northern Siberia. Adams' mammoth, discovered in 1799, "was so fat ... that its belly hung below its knees."[109] How was abundant food available inside the Arctic Circle, especially during winter months when the Sun rarely shines?

Warm Climate. Abundant food requires a temperate climate, much warmer than northern Siberia today—or during the Ice Age. Little of the food found in Berezovka's mouth and stomach grows near the Arctic Circle today. Furthermore, the flower fragments in its stomach show that it died during warm weather. Despite the popular misconception, the mammoth was a temperate—not an Arctic—animal.

Away From Rivers. Although most frozen remains are found along river banks where excavations naturally occur, some frozen remains are found far from rivers.

Yedomas and Loess. Frozen mammoths are frequently found in yedomas and loess. What accounts for this and the strange properties of yedomas and loess? What is the source of so much loess?

Elevated Burials. Mammoth and rhinoceros bodies are often found on the highest levels of generally flat, low plateaus.[110] Examples include dense concentrations of mammoth and rhinoceros remains in yedomas and the interior of Arctic islands. Dima was discovered in a mountainous region.

Multi-Continental. Soft parts of large animals have been preserved over a 3,000-mile-wide zone involving three continents (Asia, Europe, and North America). It is unlikely that many unrelated local events would produce such similar results over such a broad geographical area.

Rock Ice. Strange, granular, Type 3 ice containing clay, sand, and a large volume of air pockets is sometimes found near frozen mammoths. [See Table 9 on page 246.]

Figure 141: Extensive Loess Deposits. Another property of loess is its ability to maintain a vertical cliff. This is seen here in agricultural terraces in northern China, south of Huang Ho. Some historians maintain that the loess deposits helped establish early Chinese civilization, because the fertility of loess soil allows two or three crops a year—without fertilizers. Homes, even furniture, have been carved out of loess hillsides, sometimes 200 feet underground. Entire villages are cut into loess cliffs. Several million people have lived in loess dwellings. While such homes are cheap, insulated, militarily defensible, and may last for generations, they are unstable and dangerous. For example, 180,000 died in the 1920 Kansu earthquake, primarily from the collapse of loess dwellings.[111]

Frozen Muck. Mammoth carcasses are almost exclusively encased in frozen muck.[112] Also buried in muck are huge deposits of trees and other animal and vegetable matter. The origin of muck is a mystery.

Sudden Freezing. Some frozen mammoths and rhinoceroses had food preserved in their mouths, stomachs, or intestines.[113]

Suffocation. At least three mammoths and two rhinoceroses suffocated. No other cause of death has been established for the remaining frozen giants.

Dirty Lungs. Dima's respiratory and digestive tract contained silt, clay, and small particles of gravel. Just before he died, Dima breathed air and/or ate food containing such matter.

Peppered Tusks. Why, over wide geographical areas, did millimeter-size particles (rich in iron and nickel) become embedded in one side of some mammoth tusks?

-150°F. Temperatures surrounding some mammoths must have plunged below -150°F.

Large Animals. Most frozen remains are from the larger, stronger animals such as mammoths and rhinoceroses.

Summer-Fall Death. Vegetation in the stomachs and intestines of preserved mammoths implies that they died in late summer or early fall,[114] perhaps in August[115] or even late July.[116]

Animal Mixes. Bones of many types of animals, friends and foes, are frequently found near the mammoths.

Upright. Several frozen mammoths, and even mammoth skeletons,[117] were found upright. Despite this posture, the Berezovka mammoth had a broken pelvis and shoulder blade, and *a crushed* leg. Surprisingly, he was not lying on his side in a position of agony.

Vertical Compression. Berezovka's crushed leg bone and horizontally flattened penis show severe vertical compression before or soon after death. Dima was also compressed and flattened.

Eighteen pieces of the problem are now before us. Fitting this centuries-old jigsaw puzzle together will be our final task. As you will see, clever and imaginative proposals have been made, but most address only a few pieces of the puzzle.

Theories Attempting to Explain Frozen Mammoths

Ten theories have been proposed to explain the frozen mammoth puzzle. Each will be described below as an advocate would.

Fruitful theories answer not only the obvious, initial questions but also solve perplexing and seemingly unrelated problems. As we unravel the mystery of the frozen mammoths, we may answer broader questions and even uncover a sequence of dramatic, global events.

Robust theories also provide details that result in surprising and testable predictions. Keep this in mind as we examine all ten explanations. With each, ask yourself, "What predictions can this theory make?" If few predictions are forthcoming, the theory is probably weak.[118] If theories could not be published unless they included many

What Happened?

Two strange, but admittedly secondary, reports may relate to the frozen mammoth problem. Each is so surprising that one might dismiss it as a mistake or hoax, just as with any single report of a frozen mammoth. However, because both reports are so similar yet originated from such different sources, it is probably best to reserve judgment. Each report was accepted as credible and published by an eminent scientific authority. Each involved the sudden freezing of a river *in apparent defiance of the way bodies of water freeze*. Each contained frozen animals in transparent ice, yet natural ice is rarely transparent. Each discovery was in a cold, remote part of the world. One was in the heart of Siberia's frozen mammoth country.

The brief reports will be given exactly as they were written and translated. The first was published by the former Soviet Academy of Sciences. Alexander Solzhenitsyn, winner of the Nobel Prize for Literature in 1970, recalled this report (as best he could remember it) in the first paragraph of his preface to *The Gulag Archipelago*. Unfortunately, Solzhenitsyn did not give the report's date, so I began a difficult search. The report was finally found in Moscow's Lenin State Library.

Y. N. Popov, author of this report, was discussing the scientific importance of finding mammals frozen in Siberia. He then described some frozen fish:

Figure 142: Fish Frozen in Underground Ice.

> *There are some cases of finds of not only dead mammals, but also fishes, unfortunately lost for science. In 1942, during road construction in the Liglikhtakha River valley (the Kolyma Basin) an explosion opened a subterranean lens of transparent ice encasing frozen specimens of some big fishes. Apparently the explosion opened an ancient river channel with representatives of the ancient ichthyological fauna* [fish]. *The superintendent of construction reported the fishes to be of amazing freshness, and the chunks of meat thrown out by the explosion were eaten by those present.*[119]

details and specific predictions, we would be mercifully spared many distractions and false ideas.

Hydroplate Theory. [For a more complete description of the hydroplate theory, read pages 109–147.] On that terrible day, the rupture of the earth's crust passed between what is now Siberia and Alaska in minutes. Jetting water from the fountains of the great deep first fell as rain. During the next few hours, some of the accelerating and expanding subterranean water that went above the atmosphere (where the effective temperature is several hundred degrees below zero Fahrenheit) froze and fell as hail.[120] Some animals were suddenly buried, suffocated, frozen, and compressed by tons of cold, muddy ice crystals from the gigantic "hail storm." Dirt in this ice prevented it from floating as the flood waters submerged these regions after days and weeks. Blankets of this muddy ice, hundreds of feet thick, insulated and preserved many animals during the flood phase. As the topmost layers of ice melted, the dirt in that ice remained and settled—blanketing and further insulating the deeper ice and buried animals.

Months later, after mountains were suddenly pushed up, the earth's balance shifted, the earth slowly "rolled" 35°–45°, so Siberia and Alaska moved from temperate latitudes (similar to south-central Canada and central United States today) to their present positions. [For details, see Endnote 69 on page 144.] As the flood waters drained off the continents, the icy graves in warmer climates melted, and buried animals decayed. However, many animals, buried in what are now permafrost regions, were preserved.

These conclusions can be reached quite simply. The evidence showing compression and suffocation of the frozen mammoths implies rapid burial. Rapid burial and sudden freezing suggest a supercold "ice dump."

compression + suffocation = rapid burial
rapid burial + sudden freezing = an "ice dump"

Lake Drowning Theory.[121] No catastrophe occurred. The well-preserved mammoths, with food in their stomachs and between their teeth, died suddenly, probably from asphyxiation resulting from drowning in a partially frozen lake, river, or bog. Such burials can preserve animal—and even human—tissue for thousands of years.

The second report comes from M. Huc, a missionary traveler in Tibet in 1846. Sir Charles Lyell, often called the "father of geology," also quoted this same story in the 11th edition of his *Principles of Geology*. After many of Huc's party had frozen to death, survivors pitched their tents on the banks of the Mouroui-Oussou (which lower down becomes the famous Blue River). Huc reported:

> *At the moment of crossing the Mouroui-Oussou, a singular spectacle presented itself. While yet in our encampment, we had observed at a distance some black shapeless objects ranged in file across the great river. No change either in form or distinctness was apparent as we advanced, nor was it till they were quite close that we recognized in them a troop of wild oxen. There were more than fifty of them encrusted in the ice. No doubt they had tried to swim across at the moment of congelation* [freezing], *and had been unable to disengage themselves. Their beautiful heads, surmounted by huge horns, were still above the surface; but their bodies were held fast in the ice, which was so transparent that the position of the imprudent beasts was easily distinguishable; they looked as if still swimming, but the eagles and ravens had pecked out their eyes.*[123]

Any explanation for these strange discoveries must recognize that streams freeze from the top down.[124] The ice formed floats and then insulates the warmer liquid water below. The thicker the ice grows, the harder it is for the liquid's heat to pass up through the ice layer and into the cold air. Freezing a stream fast enough to trap more than fifty upright oxen *in the act of swimming across* seems impossible, especially because a stream's velocity varies considerably across its width. Therefore, different parts of the stream should freeze over many days or hours. Freezing a river so fast that many large fish are frozen, edible, and underground, defies belief. However, the similarities with the frozen mammoths are so great that these reports may be related. An explanation will follow shortly.

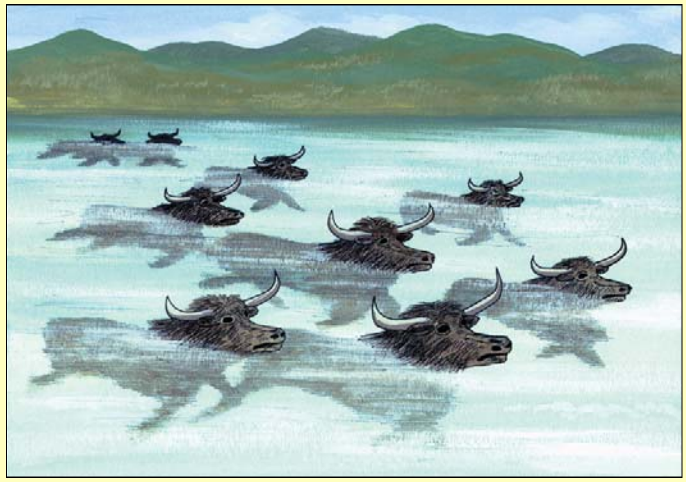


Figure 143: Frozen Oxen Found in Tibet in 1846.

Crevasse Theory. Some mammoths fell into ice crevasses or deep snowdrifts. This protected them from predators, while ice preserved them for thousands of years.[122]

Mud Burial Theory. In Siberian summers, the top foot or so of tundra thaws, so larger animals, even men, can easily become stuck—standing upright. Herds of mammoths, rhinoceroses, and buffalo made summer migrations to northern Siberia and Alaska. Some became stuck in this mud; others were overwhelmed and suffocated in mudslides. Still others died for various reasons and were then buried in slow mudflows during several summer thaws. Sudden cold spells—sometimes followed by long, cold winters—froze and preserved many mammoths.[125]

River Transport Theory. Mammoths and other animals lived farther south in the temperate zone of Asia where food was abundant. Flooding rivers floated their remains from Central Siberia on the north flowing rivers.[126]

Extinction-by-Man Theory. Man exterminated mammoths, just as man almost exterminated the buffalo. Man, in hunting mammoths, pursued and pushed them north into Siberia and Alaska. There they died from harsh weather, lack of food, or the direct killing by man.[127]

Bering Barrier Theory. As ice accumulated on continents during the last Ice Age, sea level was lowered by 300 feet and the Bering Strait was closed. This newly created land bridge allowed people and animals, including mammoths, to migrate between Siberia and Alaska and onto Arctic islands. Because the warmer Pacific waters could no longer mix through the Bering Strait with the cold Arctic Ocean, the Pacific waters became even warmer and the Arctic waters even colder. The resulting heavy evaporation from the Pacific caused extreme snow falls on higher, colder land masses north of the Bering barrier. Mammoths and others were buried in severe snow storms early one fall. As the Ice Age ended, heavy rains washed soil down on top of compacted snow deposits, forming rock ice. Some frozen mammoths and rock ice are still preserved. Since then, glacial melting raised sea levels and reestablished the Bering Strait.[128]

Mild Ice Age Theory.[129] During snow and dust storms about 700 years after the global flood, some mammoths were frozen, buried, suffocated, and preserved—a few standing up. Here is how it happened.

The flood waters were warm, if not hot, because they came from 3,000–10,000 feet below the earth's crust where temperatures are 30–100°F hotter. Warm, postflood oceans produced both heavy evaporation and snow fall. As snow depths increased, the Ice Age began;[130] it lasted about 700 years—until the oceans cooled sufficiently. Thick ice sheets built up in continental interiors and lowered sea levels somewhat. During those 700 years, mammoths migrated from the mountains of Ararat to northern Siberia and from there to Alaska during a brief exposure of a land bridge across the Bering Strait. With warm winds off the warm Arctic Ocean producing a tolerable climate for the ice age mammoths, their numbers grew to about 10 million. Other temperate animals were also able to live at those high latitudes. As the oceans cooled, fierce storms developed. Blowing dust, called *loess*, suffocated and buried most mammoths, some standing up. Other storms converted the dust to permafrost.

Shifting Crust Theory. Before the last Ice Age, the Hudson Bay was at the North Pole. Siberia and Alaska were farther south and supported abundant vegetation and large herds of mammoths. As vast amounts of ice accumulated at what was then the North Pole, the crust on the spinning earth became unbalanced and slid, moving Siberia northward. Because the earth is slightly flattened at the poles and bulges at the equator, the shifting crust produced many ruptures. Volcanic gas was thrown above the atmosphere where it cooled and descended as a supercold "blob." Airborne volcanic dust lowered temperatures on earth and caused phenomenal snow storms. Mammoths and other animals living in Siberia and Alaska were suddenly frozen and buried in extremely cold snow. Some are still preserved.[131]

Meteorite Theory. At the end of the last Ice Age, a large iron meteorite hit earth's atmosphere. The resulting heat temporarily melted the top layers of the frozen tundra, causing mammoths to sink into muck. Poor visibility caused others "to blunder to their deaths in icy bogs."[132]

Evaluation of Evidence vs. Theories

Table 10 summarizes how well each theory explains the many strange things associated with frozen mammoths. Each column corresponds to a theory, and each row represents an unusual detail that requires an explanation. As with a traffic light, a green circle means "go." That is, in my opinion, the column's theory reasonably explains that row's diagnostic detail. Yellow (caution) and red (stop) circles indicate moderate and serious problems, respectively. Numbers in Table 10 refer to additional information below. Table 10 shows both details and the broad perspective—"the trees *and* the forest."

Readers may make their own judgments and independently assess each theory's plausibility. For example, if you feel that a detail or theory has been omitted or misstated, modify the table. This approach focuses future discussions on areas of critical disagreement. It also helps keep all details and competing theories in mind, encouraging balance and thoroughness. Often a disagreement becomes moot when one realizes that other facts oppose some theory. When a theory is proposed, usually only the details supporting it and opposing competing theories are mentioned. Table 10 contrasts all published theories with all known diagnostic details.

In seeking the cause of many strange and related details, one is tempted to use a separate explanation for each detail. Throughout the history of science, experience has shown that the simplest theory explaining the most details is probably correct. For example, a sudden rash of fires in a city may all be unrelated. However, most investigators would instinctively look for a common explanation. Centuries ago, each newly discovered detail of planetary motion required, in effect, a new theory. Later, one theory (Newton's Law of Gravitation) provided a simple explanation for all these motions.

Details Relating to the Hydroplate Theory

1. ● Abundant Food. Winter sunlight inside the Arctic Circle is so scarce that vegetation hardly grows, regardless of temperature. How could mammoths survive during even a warm winter? Clearly, mammoths were living at temperate latitudes before the flood.

As explained on pages 109–147, toward the end of the flood, major mountains suddenly formed, so the earth became slightly unbalanced and began a slow 35°–45° roll. Although the earth's spin axis did not change its orientation in space, the land at the preflood North Pole shifted to central Asia while some mammoths' temperate habitats shifted northward to near the Arctic Circle. This roll also explains why dinosaur remains are found inside Antarctica and the Arctic Circle. [See Endnotes 69–70 on page 144 for details and evidence.]

(The shifting crust theory recognizes this problem of feeding millions of mammoths during winter months. That theory says the earth's crust must have shifted, moving Siberia and Alaska northward. However, no force could slide the entire earth's crust—rock on rock.)

2. ● Yedomas and Loess. (These terms are explained on page 245. Pages 229-235 explain why the subterranean water was saturated with carbon dioxide.) The extreme pressure in the subterranean chamber accelerated the

Why Did It Get So Cold So Quickly?

Let's put aside all possible explanations for the frozen mammoths and just ask what must happen for atmospheric temperatures to drop to at least -150°F (so rapidly that large animals and the food in their warm bodies are preserved).

Temperatures can drop for several reasons: ***expansion of a gas, evaporation of a liquid***, chemical reactions, reduction of heat from the Sun, or the transfer of heat. First, let's eliminate a few possibilities. Chemical reactions within the atmosphere have trivial thermal consequences. Could the Sun have suddenly put out less heat, thereby lowering the temperature of Siberia and Alaska? That happens every night, but temperatures drop too slowly.

If heat was transferred away from Siberia and Alaska, **where** and **how** was it transferred? Heat, which always travels from hot bodies to cold bodies, is transferred by three means: conduction, radiation, and convection. *Conduction* mainly applies to solids, as when heat travels (conducts) along a metal rod whose tip is held in a fire. Conduction would not play a big role for a large volume of gas such as the atmosphere. *Radiation* transfers too little heat too slowly at atmospheric temperatures.

Convection occurs when a moving fluid (liquid or gas) transfers heat from a hot to a cold region. For example, heat is transferred by convection up a chimney. The heat is transported from the hot air just above the fire to the cold air outside the chimney. If, at one time, Siberia and Alaska cooled to -150°F by convection, an even colder region had to absorb the heat; engineers call this a *heat sink*. Finding a supercold sink would be even more difficult than explaining a temperature drop to only -150°F. No sufficiently cold sink exists in or below the atmosphere, but such a sink lies above the atmosphere—in the vacuum of space—where temperatures are much colder than -150°F. This may answer the "**where**" question.

We could not eliminate the two possibilities highlighted above: ***expansion of a gas, and evaporation of a liquid***. Both would drop temperatures drastically if enough water was very rapidly accelerated out of the atmosphere. That is precisely what the fountains of the great deep did. Supercritical water accelerated and expanded explosively into space, and about half the portion that was liquid water flashed (evaporated) into expanding water vapor. By the end of Part II of this book, you will see that nuclear energy provided these astonishing accelerations and expansions, thereby answering the difficult "**how**" and "**where**" questions.

escaping carbon-rich water to supersonic speeds, rapidly eroding rocks. Eroded dirt particles of various sizes were swept up by the water and expelled into and above the atmosphere. As you will see, the higher a muddy droplet rose, the more likely it was to lose the larger particles carried inside. Therefore, droplets that rose above the atmosphere and froze contained the powdery dirt particles that comprise yedoma hills and the world's loess.

Visualize a water droplet jetting up through the atmosphere. Atmospheric pressure drops as it goes higher, so some water evaporates from its surface. Evaporation cools the droplet, just as evaporating perspiration cools a person. Gusts of air and water vapor strike the droplet from differing directions, each time dragging its surface around toward the opposite, or downwind side. This creates a strong and complicated circulation within the droplet and chaotic waves on its surface. Sometimes the droplet fragments into two or more pieces, but the smaller each piece becomes, the stronger the molecular forces (the surface tension) holding it together.

In the droplet are many tiny dirt particles. The flow within the droplet carries the smaller particles more smoothly than larger particles,[135] while the larger particles are sometimes shaken out of the buffeted droplet. When the droplet finally freezes high above the atmosphere, only the smallest dirt particles remain. Being encased in ice, they are protected from water erosion that would round and smooth their sharper corners.

Much of this dirt and dirty ice fell to earth in a giant hail and wind storm as the flood began. Trees and vegetation were ripped up, pulverized, and mixed with the fallen, muddy hail. Animals froze and suffocated. The thick, muddy ice insulated much of the deeper ice when the waters temporarily flooded the land. Ice that melted, during or after the flood, left behind tiny, angular dirt particles (now called *loess*) and dissolved salts.

After the flood, some ice layers that had not yet melted began melting in many isolated locations. Water, collected in these depressions during the summer, accelerated nearby melting. Today's hilly yedomas remain. Therefore, in Arctic regions where little summer melting occurs, loess, salt, vegetation, and mammoth remains are preserved in cold yedomas.

Loess is often found near formerly glaciated areas, especially downwind of ice age drainage channels, such as the Mississippi and Missouri Rivers. In warmer climates, wind removed the loess, rain leached salts from the soil, and the organic material decayed.

Table 10. Evidence vs. Theories: Frozen Mammoths

Evidence to Be Explained	Theories: Hydroplate	Lake Drowning	Crevasse	Mud Burial	River Transport	Extinction by Man	Bering Barrier	Mild Ice Age	Shifting Crust	Meteorite
Abundant Food	🟢 1	❌ 12	❌ 20	🟢	🟢	❌ 56	❌ 70	❌ 79	🟢	❌ 99
Warm Climate	🟢	❌ 13	❌ 21	🟢	🟢	🟢	🟡 70	❌ 79	🟢	🟡 99
Away from Rivers	🟢	🟢	🟢	❌ 33	❌ 45	🟢	🟢	🟢	🟢	🟢
Yedomas and Loess	🟢 2	🟡 14	🟡 22	🟡 34	🟡 45	🟡 57	🟡 71	❌ 80	🟡 93	🟡 100
Elevated Burial	🟢 3	🟢	🟡 23	🟡 33	🟡 46	🟡 58	🟢	🟢	🟢	🟢
Multi-Continental	🟢	🟡 14	🟡 22	🟡 34	🟡 45	🟢	🟡 72	🟡 79	🟢	🟢
Rock Ice	🟢 4	❌ 15	❌ 24	❌ 35	❌ 47	❌ 59	🟡 73	🟡 81	🟡 94	❌ 101
Frozen Muck	🟢 3	🟡 14	🟡 25	🟡 34	🟡 45	❌ 60	❌ 74	🟡 82	❌ 95	🟡 100
Sudden Freezing	🟢	🟡 16	🟡 26	❌ 36	🟢	🟢	🟢	❌ 83	🟢	🟢
Suffocation	🟢 5	🟢	🟡 22	🟢	🟢	🟡 61	🟡 75	🟡 84	🟢	🟡 100
Dirty Lungs	🟢 6	🟡 17	❌ 27	🟡 37	🟡 48	❌ 62	🟡 76	🟢	🟢	🟢
Peppered Tusks	🟢 6	❌ 17	❌ 27	❌ 37	❌ 48	❌ 62	❌ 76	❌ 80	❌ 93	🟢
-150°F	🟢 7	❌ 16	❌ 28	❌ 34	❌ 45	❌ 57	❌ 72	❌ 85	❌ 93	❌ 102
Large Animals	🟢 7	🟢	❌ 29	🟢	❌ 45	❌ 57	🟡 77	🟡 86	❌ 93	🟢
Summer-Fall Deaths	🟡 8	🟢	🟢	🟢	🟡 49	🟢	🟢	🟡 87	🟡 96	🟢
Animal Mixes	🟢 3	❌ 18	❌ 30	❌ 38	🟢	❌ 63	🟢	🟢	🟢	❌ 103
Upright	🟢 9	🟡 14	🟡 31	🟡 39	🟡 50	❌ 64	🟢	🟢	🟢	🟢
Vertical Compression	🟢 9	❌ 19	🟡 22	🟡 40	🟡 45	🟡 57	🟡 72	🟡 88	🟡 93	🟡 100
Other	🟡 10–11		🟡 32	🟡 41–44	🟡 51–55	🟡 65–69	🟡 78	❌ 89–92	🟡 97–98	🟡 104

Key:
- 🟢 Theory explains this item.
- 🟡 Theory has moderate problem with this item.
- ❌ Theory has serious problems with this item.

Numbers in this table refer to amplifying explanations on pages 250–261.

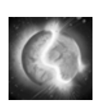
Frozen Mammoths

PREDICTION 16: High concentrations of *loess* particles will be found in the bottom several hundred feet of most ice cores drilled in Antarctica and Greenland.

The bottom layers of ice sheets in Greenland, Canada, and Antarctica contain up to 50 times more microparticles than the glacial ice above.[136] Ice crystals containing these microparticles are much smaller than normal glacial ice crystals. This suggests that the hail that buried and froze the mammoths was smaller than normal hail. Another study found that the lower portion of the Greenland ice sheet contains abnormally high amounts of dust, sea salt, and other chemicals.[137]

3. 🟢 Elevated Burials, 🟢 Frozen Muck, 🟢 Animal Mixes. Bones, ivory, and flesh are found on higher ground, such as in yedomas and on Arctic islands. (The preceding paragraphs explains why mammoth remains are found in yedomas.) Prey and predator may also have sought protection from the greater common enemy—rising waters from rain that preceded the muddy hail, and noxious gases evaporating from the hail. Larger animals, such as mammoths and rhinoceroses, in rushing to higher ground, crushed and buried smaller animals in mud and ice. This may explain the antelope skull under Berezovka.

Fine sediments in the muddy rain and ice mixed with pulverized vegetation to form *muck*. This cold, soupy mixture, along with ripped up forests, flowed into valleys and other low areas, smoothing the topography into flat, low plateaus. Later this muck froze, preserving to this day its distinguishing organic component and loess.



PREDICTION 17: Muck on Siberian plateaus should have a wide range of thicknesses. The greatest thickness will be in former valleys. Preflood hilltops will have the thinnest layers of muck. Drilling or seismic reflection techniques should confirm this.

4. Rock Ice. Table 9 on page 246 shows why rock ice is a Type 3 ice. As stated on page 125, the subterranean waters contained large quantities of dissolved salt and carbon dioxide. Carbon dioxide contributed to the carbonates found in loess.

PREDICTION 18: Rock ice will be found to be salty.[138]

Before the flood, the subterranean water, sealed off from the atmosphere, contained no dissolved air. As the fountains of the great deep exploded up through the atmosphere, rapid and steady evaporation from the rising liquid forced gases away from, rather than toward, each rising liquid particle. Therefore, the water that froze above the atmosphere had little dissolved air but much carbon dioxide. Both froze to become a mixture of water-ice and frozen carbon dioxide, or "dry ice."

Ice absorbs air very slowly, especially the inner portion of a large volume of falling ice particles, so little air was absorbed as muddy hail fell to earth. Once the ice was on the warm ground, some "dry ice" and water-ice slowly evaporated as white clouds. As ice depths increased to perhaps several hundred feet, these clouds billowed up through gaps between the ice particles, forcing out any air that might have been between them. Eventually, the weight of the topmost layers of ice essentially sealed the lower ice from the air above. This is why Herz saw the ice under Berezovka turn yellow-brown as the ice first contacted and reacted chemically with air.

PREDICTION 19: Bubbles in rock ice will be found to contain less air and much more carbon dioxide than normally found in ice bubbles formed today.

The Ice Age followed the flood. Since then, the surface of the ground in Siberia and Alaska has melted slightly each summer. In some parts of Siberia and Alaska, this included several feet of rock ice. When a layer of this dirty ice melted, the water drained away, leaving particles of dirt and vegetation behind. This remaining clay and silt provided an insulating blanket, causing less ice to melt each succeeding year. Most of the unsorted clay and silt above rock ice came from melted rock ice.

PREDICTION 20: Dirt and organic particles in rock ice will closely resemble those in the overlying muck.

5. Suffocation. Suffocation could have occurred three ways: (a) being buried alive in muddy hail, (b) breathing too much carbon dioxide from evaporating "dry ice," or (c) lung tissue freezing so oxygen could not diffuse into the blood and/or carbon dioxide could not diffuse out of the blood.

6. Dirty Lungs, Peppered Tusks. The jetting fountains of the great deep produced extreme winds. Dirt filled the atmosphere for a few hours before rain, ice, and falling dirt landed. This explains why Dima's entire digestive and respiratory tract contained silt, clay, and small particles of gravel, and why high-velocity dirt particles peppered animals and even left "shrapnel," on one side of hard mammoth tusks. [See Figure 136 on page 240.]

7. -150°F, Large Animals. Almost all the energy of a falling hail particle ends up accelerating air downward, not heating the particle.[133] The result was violent downdrafts of cold air.

Larger, stronger animals, such as mammoths and rhinoceroses, best withstood the driving rain and cold wind as they sought safety. Smaller animals would be tossed about more by the high winds and would suffocate sooner because their bodies process the noxious gases faster. Death, burial, and, therefore, decay in the warmer deposits would come earlier for the smaller animals.

Mammoths and rhinoceroses were still standing as the colder hail began piling up—hail with temperatures that dropped in hours to about -150°F. This supercold ice pressing against their bodies rapidly froze even their internal organs.

Extremely cold, muddy hail fell to the bottoms of streams, rivers, and lakes, quickly freezing the water from within; cool air did not freeze the water from above. The hail did not float, because it contained dirt. [See **"What Happened?"** on pages 248 and 249.]

8. Summer-Fall Deaths. According to this theory, all frozen mammoths died almost simultaneously. However, the different methods investigators have for estimating the season of death give slightly different times. Some differences may be because preflood climates differed from those of today. A larger sampling with more consistent method is needed. One possibility would be to examine the outermost growth ring on hundreds of ivory tusks. This examination should include the isotope abundances across each ring.

9. Upright, Vertical Compression. The massive, violent hail storm buried mammoths and rhinoceroses alive, many standing up and compressed from all sides. Babies, such as Dima, were flattened. Exposed parts of adult bodies, unsupported by bone, were vertically flattened. Sometimes even strong bones were crushed by axial compression. Encasement in muddy ice maintained the alignment of Berezovka's leg bone as it was crushed lengthwise, before or soon after death.

Ice slowly flows downhill as, for example, in glaciers. Such a downward flow, pushing Berezovka tail first as he tried to climb to higher ground, would explain his forward swept hind legs, humped back, displaced vertebrae, and spread front legs bent at the "ankles."

10. Other/Fossils. The hydroplate theory states that the frozen animals were buried in muddy hail as the flood began. During the following months, sedimentary layers and their fossils were deposited on top of this ice and sorted by liquefaction. [See pages 175–187.]

> **PREDICTION 21:** One should not find marine fossils, layered strata, oil, coal seams, or limestone directly beneath undisturbed rock ice or frozen mammoth carcasses.[134]

This is a severe test for this theory, because a few crude geologic maps of Siberia imply that marine fossils lie within several miles of the frozen remains. How accurate are these geologic maps in this relatively unexplored region, and what deposits lie *directly beneath* frozen carcasses? (If dead mammoths floated on the flood waters, their flesh would not be preserved, but their bones might be found above marine fossils, coal, etc.)

Sedimentary layers generally extend over large areas and sometimes contain distinctive fossils. One can construct a plausible geologic map of an area (a) if many deep layers are exposed as, for example, in the face of a cliff, (b) if similar vertical sequences of fossils and rock types are found in nearby exposures, and (c) if no intervening crustal movement has occurred. If all three conditions are satisfied, then the layers with similar distinctive fossils are probably connected. To my knowledge, such layers have not been found beneath any frozen mammoth.

Nor is there any known report of marine fossils, limestone deposits, or coal seams directly beneath any frozen mammoth or rhinoceros remains. Tolmachoff, in his chapter on the geology of the Berezovka site, wrote that "Marine shells or marine mammals have never been discovered in [deposits having frozen mammoths]."[139] Hern von Maydell, reporting on his third frozen mammoth, wrote, "despite my thorough search, not a single shell or fossil was found."[140] Beneath the Fairbanks Creek mammoth, sediments down to bedrock contained no marine fossils, layered strata, coal seams, or limestone.[141]

11. Other/Radiocarbon. According to the hydroplate theory, all frozen mammoths and rhinoceroses died simultaneously. However, their radiocarbon ages vary. [See Table 8 on page 239.] For an explanation of radiocarbon dating and its assumptions, see pages 416–419. Those pages explain why 40,000 radiocarbon years (RCY) is a typical radiocarbon age for most frozen remains, and why 40,000 radiocarbon years correspond to about 5,000 actual years. A slight amount of contamination of the remains, for example, by groundwater, would lower their radiocarbon age considerably, especially something living as the flood began. This probably explains why different parts of the first Vollosovitch mammoth had widely varying radiocarbon ages—29,500 and 44,000 RCY.[142] One part of Dima was 44,000 RCY, another was 26,000 RCY, and "wood found immediately around the carcass" was 9,000–10,000 RCY.[143] Food in the Shandrin mammoth gave radiocarbon ages that differed by 10,000 years.[144] The lower leg of the Fairbanks Creek mammoth had a radiocarbon age of 15,380 RCY, while its skin and flesh were 21,300 RCY.[145] The two Colorado Creek mammoths had radiocarbon ages of 22,850 ± 670 and 16,150 ± 230 years.[146] Because a bone fragment at one burial site fit precisely with a bone at the other site 30 feet away,[147] and the soil had undergone considerable compression and movement, both mammoths probably died simultaneously.

> **PREDICTION 22:** Blind radiocarbon dating of different parts of the same mammoth will continue to give radiocarbon ages that differ by more than statistical variations would reasonably allow. [Endnote 124 on page 370 describes blind testing.] Contamination by groundwater will be most easily seen if the samples came from widely separated parts of the mammoth's body with different water-absorbing characteristics.

Note: From here to page 261, the reader may wish to examine only discussions concerning theories of personal interest.

Details Relating to the Lake Drowning Theory

12. Abundant Food. Lack of winter sunlight inside the Arctic Circle would choke off the mammoth's food supply each winter, even if temperatures were warm or the mammoth was "adapted" to the cold.

13. Warm Climate. Vegetation in the digestive tracts of frozen mammoths shows that they died in a mild climate during the late summer or early fall when frozen lakes or rivers would not exist. Many weeks of freezing temperatures are needed to form ice thick enough for a large, hoofed animal to venture far enough from shore to drown.

14. Yedomas and Loess, Multi-Continental, Frozen Muck, Upright. The lake drowning theory does not explain why mammoths, yedomas, and loess are related, why these peculiar events occurred over such wide areas on three continents, where so much muck originated, why muck has sometimes buried forests, why yedomas contain so much carbon, or why so many mammoth bodies and skeletons were found upright.

15. Rock Ice. The ice near several carcasses was not lake or river ice. It was Type 3 ice, not Type 1 ice.

Table 11. Mammoth Myths vs. Mammoth Facts

Mammoth Myths	Facts
1. Fresh buttercups were in the mouth and stomach of the Berezovka mammoth.	Its stomach contained three *seeds* from plants that produce delicate, yellow buttercups. Fragments of other flowers were in its stomach. No large flowers were in its mouth.
2. People have been served mammoth steaks.[148]	These reports persist but are never specific enough to verify. For example, Lydekker reported that "sleigh dogs, as well as Yakuts themselves, have often made a hearty meal on mammoth flesh thousands of years old."[149] Lydekker never visited Russia, let alone Siberia. The following report by Herz appears valid. Herz wrote in his diary that the Berezovka mammoth "looks as fresh as well-frozen beef or horse meat. It looked so appetizing that we wondered for some time whether we should not taste it, but no one would venture to take it into his mouth, and horse flesh was given in the preference. The dogs cleaned up whatever mammoth meat was thrown them."[150] In 1982, construction workers in Siberia uncovered a frozen mammoth and fed it to dogs.[151]
3. Mammoths are encased in ice. Their preservation is complete.	Charles Lyell popularized this myth by writing that mammoth remains are found in icebergs and frozen gravel.[152] There are very few reports of complete encasement in ice.[153] Other mammoths were near or partially in ice. Herz and Pfizenmayer only *believed* that their Berezovka mammoth was once fully encased in ice. Most frozen mammoths are found partially preserved in frozen muck or sediments.
4. The mammoth's small ears, short tail and legs, and anal flap reduced its heat loss in cold Arctic air. This shows that the mammoth was an Arctic animal.	Animals with large ears and long tails, such as hares and foxes, survive quite well in the Arctic. The legs and tails of Arctic foxes are similar to those of foxes living in warmer climates. While a slight correlation exists between smaller ears in colder habitats, other factors play a stronger role, such as metabolic efficiency, food availability, and adjustable insulation. The African elephant also has a prominent anal flap.[154]
5. Mammoths used their long curved tusks to remove snow from plants they ate on the ground. Most tusks show these wear marks.	Wild elephants live far from snow, yet they also have wear marks on their shorter, less vulnerable tusks. Mammoth tusks do not show extreme abrasion from being scraped over rocky soil in search of food under snow. (Besides, "shoveling" snow with a long, curved stick is a good way to break the stick.) A wild elephant spends about 16 hours a day eating and searching for food.[155] If food were buried under snow, mammoths would not have enough hours in the day to gather sufficient food to survive.
6. The curve in the mammoth tusks almost forms a circle.	"Not one tusk in ten forms a third of a circle, not one in twenty even a semicircle."[156] Artists and museums have popularized this misconception.
7. The wool on woolly mammoths protected them from the Siberian cold.	The term "woolly" is misleading because true wool has tiny, overlapping scales that interlock and trap air, making it an excellent insulator. Unlike sheep's wool, mammoth "wool" is only short, coarse underhair. Mammoth hair, some of it long and bristly, has relatively few fibers per square inch.
8. A mammoth's thick skin and hairy body protected it from the Arctic cold.	See the earlier section titled "Mammoth Characteristics and Environment" on page 240.
9. Mammoths were larger than today's elephants.	Mammoths were larger than Asian elephants, but smaller than African elephants. Usually, mammoths' tusks and heads were larger than those of all elephants.[157]
10. Larger animals generate more heat per unit of body surface area. Therefore, the mammoth would stay warm, even in the Arctic winter.	The first sentence is true. However, an Arctic mammal must avoid having its warm skin melt snow, as explained earlier. The mammoth's skin would tend to melt snow, especially if the animal lay down. Its high ground pressure would compress and reduce the insulation provided by its hair. (Elephants doze standing up, but when they feel safe, they will lie down for a few hours of sleep.) Sick or injured mammoths, unable to stand, would probably not have survived. Young mammoths were even more vulnerable. They generated less heat per unit of body surface area and probably spent more time lying down. Newborn mammoths, wet and initially unable to walk, could not have survived for long lying on permafrost, especially if they were born during the long winter. (Elephants are born at all times of the year.)

16. Sudden Freezing, -150°F. Although burial in peat bogs can retard bacterial decay and preserve bodies for thousands of years, only a rapid and extreme temperature drop can stop the destructive activity of enzymes and stomach acids.

17. Dirty Lungs, Peppered Tusks. Drowning in a lake would not fire millimeter-size particles, rich in iron and nickel, into one side of mammoth tusks or force gravel into Dima's lungs. Nor would silt, clay, and gravel work their way into Dima's intestines after a sudden drowning.

18. Animal Mixes. If mammoths occasionally fell through ice on an arctic lake, why are the bones of so many temperate animals found together? Why do prey lie near their predators? Large, hoofed animals seldom venture out on frozen lakes.

19. Vertical Compression. Falling into a lake would not produce the vertical compression found in Dima and Berezovka.

Details Relating to the Crevasse Theory

20. Abundant Food. Same as item 12.

21. Warm Climate. The contents of Berezovka's stomach showed that he lived in a warm climate, not one containing ice crevasses. Furthermore, tree fragments and roots were found beneath him. Trees do not grow near icy crevasses. Glacial climates prevent tree growth. Many animals and plants buried in northern Siberia and Alaska live only in temperate climates today. Besides, mammoths were not Arctic animals.

22. Yedomas and Loess, Multi-Continental, Suffocation, Vertical Compression. The crevasse theory does not explain why mammoths, yedomas, and loess are related, why yedomas contain so much carbon, why these peculiar events occurred over such wide areas on three continents, why some of these huge animals suffocated, or what compressed Dima and Berezovka vertically.

23. Elevated Burial. Falling into a crevasse or being transported downhill in a glacier would not herd mammoths up onto islands or up near the higher elevations of flat, low plateaus. Crevasses form on steep slopes only.

24. Rock Ice. Mammoths are sometimes buried near Type 3 ice. Crevasses have only Type 2 ice.

25. Frozen Muck. Frozen mammoths are found primarily in frozen muck, not ice. Where did all the muck come from, and why are so many large trees buried in it?

26. Sudden Freezing. Let us assume that after Berezovka had eaten beans at the base of a glacier, he climbed up to a crevasse, fell in, and died. His stomach acids and enzymes would have destroyed his food in a few hours. Because crevasses are not at the base of glaciers, Berezovka's long trip up the glacier and subsequent freezing must have been unbelievably rapid to prevent this destruction. Besides, what could motivate a grazing beast to climb a long, steep, icy slope?

27. Dirty Lungs, Peppered Tusks. Falling into a crevasse would not fire millimeter-size particles (rich in iron and nickel) into mammoth tusks, put gravel in Dima's lungs or silt, clay, and gravel in Dima's intestines.

28. -150°F. Snow is a surprisingly good insulator, as those who live in igloos know. Also, transferring heat from a solid object, such as a mammoth's body, to stagnant air is a slow process. Both conditions would exist if a mammoth fell into a crevasse. Steep crevasse walls would shield the body from cold winds, and glacial ice and stagnant air would insulate the mammoth from sharp drops in the outside temperature. Eventually, the carcass would freeze, but the residual heat in its huge body would delay freezing and cause putrefaction. Hoyle explains:

> *I have been informed that, today, when reindeer fall down crevasses in the Greenland ice, they are subsequently found to be in an unpleasantly putrefied condition. It seems that, no matter how cold the air is, the body heat of the dead animal is sufficient to promote bacterial decomposition.*[158]

Warmer internal organs, such as the stomach, experience even more decay. Furthermore, this theory cannot begin to explain a sudden temperature drop to -150°F.

29. Large Animals. The crevasse theory does not explain why primarily larger animals fell into icy crevasses and froze. Actually, the larger the animal, the greater its internal heat and the more the animal should decay.

30. Animal Mixes. If an occasional mammoth fell into an ice crevasse, why are bones of so many kinds of animals found together? While some might argue that an adult mammoth climbed up a glacier, why would a rhinoceros or a baby such as Dima do so? A heavy, low-slung rhinoceros could not walk in deep snow. Beavers, squirrels, and birds do not fall into crevasses, but all have been found near frozen mammoths.

31. Upright. Herz, who excavated and analyzed the Berezovka mammoth, felt it had fallen into a crevasse, because it had several broken bones, was frozen, and was found in an upright, although contorted, position. Normally, with a broken pelvis, a broken shoulder, a few broken ribs, and a crushed leg bone, he should have been lying on his side. However, a fall would rarely break bones in different parts of the body. To break so many bones requires many large forces acting from different directions. A blow received from a fall might explain a few fractures, but probably not all, especially the aligned, but crushed fractures of a leg.

32. Other/Glaciers. Only a few mountains in north-eastern Siberia show evidence of former glaciers.

Details Relating to the Mud Burial Theory

33. Away From Rivers, Elevated Burials. A very large mudslide, such as might occur near a river bank, is required to suffocate and bury large animals. Yet frozen remains of mammoths and rhinoceroses are sometimes found in the interior of hilly islands, or on high ground far from rivers and river mud. Besides, northern Siberian rivers transport relatively little mud.[159] Mud moves slowly, if at all, on cold, flat, low plateaus. Rhinoceroses do not live far above the level of rivers or oceans.

34. Yedomas and Loess, Multi-Continental, Frozen Muck, -150°F. The mud burial theory does not explain why mammoths, yedomas, and loess are related, why yedomas contain so much carbon, why these peculiar events occurred over such wide areas on three continents, where so much muck originated, why it contains buried forests, or why temperatures dropped rapidly to -150°F.

35. ⊗ Rock Ice. Burial in mud that later froze would produce Type 1 ice, not Type 3 ice.

36. ⊗ Sudden Freezing. The coldest a mud flow could be is 32°F. The air would be even warmer. If Berezovka had been encased in mud, a good insulator, his stomach contents would have taken at least 20 times longer to cool enough to stop acids and enzymes from destroying the vegetable matter in his stomach. In other words, burial in even cold, flowing mud could not freeze a mammoth rapidly enough. Even if the atmospheric temperature dropped to -200°F after the mammoth was buried, freezing would not be rapid enough to overcome the mud's insulating effect.

37. ○ Dirty Lungs, ⊗ Peppered Tusks. One researcher used the mud burial theory to explain why Dima had silt, clay, and small particles of gravel in his respiratory and digestive tract.[160] While these particles might enter the upper digestive tract, they would not enter the lungs and lower digestive tract. Such particles would need to be in the air for some time, as would occur during sustained high winds—such as the greatest storm the earth has ever experienced. Nor would burial in mud fire millimeter-size particles, rich in iron and nickel, into mammoth tusks.

38. ⊗ Animal Mixes. Many animals, such as beavers, marmots, voles, and squirrels, whose bones lie near frozen mammoths, do not create enough ground pressure to sink into mud.

39. ○ Upright. The upright Berezovka mammoth suffocated. Burial in a mudslide might explain his suffocation, but it would not explain his upright posture. Becoming stuck in shallow mud might explain the upright posture, but it would not explain the suffocation. The Benkendorf mammoth and others were also upright. [See Table 8 on page 239.]

40. ○ Vertical Compression. Burial in a typical mud flow would not flatten Dima or produce the severe vertical compression found in Berezovka.

41. ○ Other/Feet. Elephants rarely become stuck in mud, because their feet expand as weight is placed on them and narrow as they are lifted. In northern Siberia only a thin layer of soil thaws in the summer.

42. ○ Other/Mouth. A large animal trapped in mud would probably live for hours, if not days. Therefore, food should not be preserved in its mouth and digestive tract, as occurred for a rhinoceros and several mammoths.

43. ○ Other/Scavengers. Large animals buried in mud flows should frequently show marks of scavengers on the top parts of their bodies where mud had not yet reached. No known report has described such a pattern.

44. ○ Other/Rhinoceroses. Rhinoceroses and babies (such as Dima) do not migrate as this theory proposes.

Details Relating to the River Transport Theory

45. ⊗ Away From Rivers, ○ Yedomas and Loess, ○ Multi-Continental, ○ Frozen Muck, ⊗ -150°F, ⊗ Large Animals, ○ Vertical Compression. The river transport theory does not explain why frozen mammoths are often found far from rivers, why mammoths, yedomas, and loess are related, why these peculiar events occurred over such wide areas on three continents, why yedomas contain so much carbon, where so much muck originated, why muck has sometimes buried forests, why temperatures suddenly dropped to -150°F, why primarily the larger animals were frozen and preserved, or what compressed Dima and crushed Berezovka before or soon after death.

46. ○ Elevated Burials. Rivers would not deposit large carcasses on the higher levels of plateaus. A few mammoths are found 1,000 feet above nearby rivers.[161]

47. ⊗ Rock Ice. With the river transport theory, one would expect to find Type 1 ice, not Type 3 ice.

48. ○ Dirty Lungs, ⊗ Peppered Tusks. If Dima drowned, silt and clay might have entered his lungs, but not gravel. Nor would drowning distribute those particles within his intestines or embed "shrapnel" in mammoth tusks.

49. ○ Summer-Fall Deaths. How could so many animals, washed far north by rivers, get buried *and preserved* in hard, frozen muck? Even if flooding rivers buried mammoths under sediments that permanently froze the following winter, their bodies would have decayed after a summer or fall death. Besides, river flooding usually occurs in the spring, not late summer or fall, and rivers do not deposit muck. The organic component in muck would separate and float to the surface.

50. ○ Upright. Mammoths, transported by rivers, would not be deposited upright, as some were.

51. ○ Other/Fossils. No fossils of marine animals have been reported in deposits containing frozen mammoths.[162]

52. ○ Other/South. The frozen mammoths are not from the south, because their teeth and tusks differ considerably from those found in southern Siberia.

53. ○ Other/Float. Cold Siberian and Alaskan rivers would minimize the buildup of gas in a decaying carcass. This is why "bodies ordinarily do not float in very cold water."[163] Even if these remains floated for hundreds of miles, why were some found along very short rivers flowing directly into the Arctic Ocean?[164] Why was their long hair not worn off? Why were frozen mammoths found on the New Siberian Islands in the Arctic Ocean, more than 150 miles from the mainland? Their bones do not show the wear associated with transport or water erosion. If an unusually strong river carried floating carcasses to these islands, the carcasses should have been found only along beaches. Instead, remains are found in the interior of islands, the largest of which is 150 miles long and 75 miles wide.[165]

54. ○ Other/Alaskan Rivers. Parts of six frozen mammoths have been found in Alaska, far from where rivers could originate even if temperatures were warm.

55. ○ Other/Swimmers. Elephants are, and presumably mammoths were, excellent swimmers.

Details Relating to the Extinction-by-Man Theory

56. ⊗ Abundant Food. There is little precedent for believing that man would push any animal population into a harsh environment having little food. Only Dima, a baby, appeared underfed. Most frozen mammoths that were complete enough to evaluate were well fed.

57. ○ Yedomas and Loess, ⊗ -150°F, ⊗ Large Animals, ○ Vertical Compression. The extinction-by-man theory does not explain the relationship between mammoths, yedomas, and loess, the sudden drop in temperature to -150°F, the vertical compression found in Dima and Berezovka, or the preservation of larger, harder-to-freeze animals.

58. ○ Elevated Burials. Even if man pushed these animals north into Siberia and Alaska, why would a disproportionate number be buried on the higher elevations of generally flat plateaus?

59. ⊗ Rock Ice. With this theory, one would expect Type 1 or 2 ice, not Type 3 ice.

60. ⊗ Frozen Muck. If man killed the mammoths, how were mammoths and even forests buried under frozen muck? Where did so much muck come from?

61. ○ Suffocation. If humans killed mammoths and rhinoceroses, why did at least five suffocate?

62. ⊗ Dirty Lungs, ⊗ Peppered Tusks. Being hunted by man would not explain silt, clay, and small gravel particles in Dima's respiratory and digestive tracts or millimeter-size particles embedded in mammoth tusks.

63. ⊗ Animal Mixes. Mammoth remains are often found near bones of animals that man would probably not have simultaneously pursued. Examples include rhinoceroses, horses, tigers, badgers, bears, wolves, hyenas, lynxes, etc. Why would a hunted horse be frozen?[166] Today, wild horses live only in mild climates.

64. ⊗ Upright. Mammoths killed by man would not be found standing up, especially in muck.

65. ○ Other/No Human Signs. It is doubtful that primitive man could have exterminated the formidable, even dangerous, mammoth in a remote, frigid, and vast region. Yes, man almost exterminated the less imposing buffalo—with guns in a temperate climate. No human remains (even bones or teeth), no weapons (arrows or knives), and no other artifacts (pottery, utensils, or art) have been found alongside frozen mammoth and rhinoceros remains. Besides, most primitive arrows and spears would do little damage after penetrating the mammoth's thick skin and fat layers. Nor are the distinctive marks of man's ax or knife clearly seen on mammoth bones and ivory. If man exterminated mammoths, some signs of human activity should occasionally be found among the millions of mammoth remains. To capture or kill large animals, humans often dig deep pits, which would be difficult in permafrost.

66. ○ Other/Unpopulated. Humans in today's heavily populated areas might try to exterminate mammoths and rhinoceroses. But why would man do this thousands of years ago in barren and sparsely populated regions of northern Siberia?

67. ○ Other/Logic. Humans do not travel to desolate regions for food, especially food difficult to preserve and transport. Even if man occupied these regions, less dangerous and more desirable game would have been available. In Africa today, man has no great desire for elephant or rhinoceros meat. In fact, before the day of the rifle and the ivory market, man generally avoided these huge African animals. If man killed mammoths for their ivory tusks, why were so many tusks left behind? Why would man kill rhinoceroses?

68. ○ Other/DNA Shift. Corings into the Siberian permafrost have shown a sudden change in DNA with depth. Below a certain level, DNA is from mammoths and lush, temperate vegetation. Above that level, the DNA matches Siberian vegetation today. As one writer concluded:

> *The DNA documents a dramatic shift from a landscape of mostly herbaceous plants to dominant shrubs and mosses. ... This lends credibility to the idea that environmental change associated with climatic events was responsible* [for the extinction of the mammoth]*, not human hunting, as many have claimed.*[167]

69. ○ Other/South. Same as item 52.

Details Relating to the Bering Barrier Theory

70. ⊗ ***Abundant Food,*** ○ ***Warm Climate.*** This theory places the mammoth's extinction at the peak of the last Ice Age when northern Siberia and Alaska had a colder climate and even less vegetation. During the dark, winter months, food and drinking water would not have been available inside the Arctic Circle, and yet mammoths were well fed. Many animal and plant species buried there live only in temperate climates today.

71. ○ ***Yedomas and Loess.*** Soils washed down on top of ice would show stratification and some sorting of particles by size. Loess, in contrast, consists of very fine and uniform particles. In yedomas, ice and loess are mixed. Besides, yedomas contain too much carbon.

72. ○ ***Multi-Continental,*** ⊗ ***-150°F,*** ○ ***Vertical Compression.*** The Bering barrier theory does not explain why these peculiar events occurred over such wide areas on three continents, the rapid drop in temperature to -150°F, or the vertical compression found in Dima and Berezovka.

73. ○ ***Rock Ice.*** This theory might explain Type 2 ice near mammoths, but it does not explain rock ice (Type 3 ice).

74. ⊗ ***Frozen Muck.*** If a gigantic snow storm buried many mammoths, why are almost all carcasses encased in frozen muck? Where does so much muck come from, and why are forests buried under muck?

75. ○ ***Suffocation.*** Large animals caught in a sudden snow storm would die of starvation and exposure, not suffocation.

76. ○ ***Dirty Lungs,*** ⊗ ***Peppered Tusks.*** Sudden snowfalls would remove dust from the air and bury other dirt particles under a blanket of snow. How then did silt, clay, and gravel enter Dima's digestive and respiratory tracts, and how did "shrapnel" become embedded in hard tusks?

77. ○ ***Large Animals.*** Sudden snow storms would preferentially entomb and freeze smaller animals, because they have less internal heat per unit surface area.

78. ○ ***Other/Winds.*** Prevailing winds at the Bering Strait blow to the east. Therefore, storms from the Pacific should dump snow primarily on Alaska, not Siberia. However, 90% of all known frozen mammoths and all known frozen rhinoceroses are in Siberia.

Details Relating to the Mild Ice Age Theory

79. ⊗ ***Abundant Food,*** ⊗ ***Warm Climate,*** ○ ***Multi-Continental.*** Same as item 70.

Without explaining **how**, Michael Oard,[129] the author of this theory, claims that Siberia and Alaska must have had "mild winters" and little or no permafrost, because those normally frigid lands contain carcasses, abundant bones, large trees in growth positions, and insects and other animals that live in warmer climates.[168] "Mild winters," a phrase Oard uses often, would still be deadly winters in Siberia and Alaska. Sustained and unseasonably warm winter days *and nights* are required—without a single exception in 700 years. Are "mild winters" reasonable at those high latitudes during the peak of the Ice Age?

How does food grow in a vast, barren wilderness during the long, dark winter? Each of the millions of mammoths required hundreds of pounds of suitable vegetation daily. Today's bog vegetation is unsuitable and insufficient. Why didn't earlier, milder dust storms—as during America's Dust Bowl Era—destroy the mammoth's food supply? Also, Oard's logic avoids the catastrophic implications seen across a 3,000-mile stretch of three continents. [See **"Geographical Extent"** on page 244.]

80. ⊗ ***Peppered Tusks,*** ⊗ ***Yedomas and Loess.*** Dust and snow storms would not embed "shrapnel" in mammoth tusks or deposit the vast amount of carbon and organic matter found in yedomas, especially inside the Arctic Circle during the Ice Age. Also, loess is qualitatively different from storm generated dust. Loess particles are angular, giving them the ability to form vertical surfaces such as in cliffs, loess dwellings, and furniture. [See Figure 141 on page 247.] Most dust particles are rounded by years of erosion. What was the source of so much loess?

81. ○ ***Rock Ice.*** Same as item 73.

82. ○ ***Frozen Muck.*** This theory does not explain why 4,000-foot layers of muck have been found. If even a few hundred of feet of blowing dust accumulated in some places, that dust would have prevented the erosion of more dust directly below. Why would so much vegetation be mixed in the blowing dust?

83. ⊗ ***Sudden Freezing.*** Snow and dust are excellent insulators, because they trap so much air. Large animals suddenly buried in thick layers of snow and dust would be insulated from the cold atmosphere. Their residual body heat would promote decay, delay freezing, and hinder preservation. [See Hoyle's comments on page 256.]

84. ○ ***Suffocation.*** Large animals killed in sudden snow or dust storms would die from exposure and starvation, not suffocation.

85. ⊗ ***-150°F.*** Sudden storms which drop temperatures to -150°F are unheard of, even in Antarctica. [To understand why, see **"Why Did It Get So Cold So Quickly?"** on page 251.] If temperatures at the peak of the Ice Age (700 years after the flood) were that severe, why didn't the mammoths (and other temperate animals buried nearby) die centuries earlier by starvation when temperatures were warmer than -150°F but still deadly cold?

According to this theory, the greatest temperature differences between oceans and continents would have been soon after the flood, not 700 years later, after the oceans had cooled. Storm intensities would have diminished during those 700 years. Mammoths, and the other temperate animals found with them, attempting to migrate from the "mountains of Ararat" to their present graveyards, should have died before they reached their destination and before 700 years had passed—long before the mammoth population increased to 10 million.

86.* ○ *Large Animals. Same as item 77.

87.* ○ *Summer-Fall Deaths. Oard acknowledges that most of the known times of deaths were in the late summer or early fall, even though the most dangerous season in Siberia and Alaska is winter, especially during the Ice Age.

88.* ○ *Vertical Compression. Burial in a dust storm should not produce—before or soon after death—the vertical compression, crushing, and bleeding found in Berezovka.

89.* ⊗ *Other/Migration to North America. How did mammoths migrate from Siberia to North America? Oard argues that the maximum volume of ice stored on the continents during the Ice Age was much less than most experts estimate. (Their estimates, if correct, would lower today's sea level 300–400 feet, enough to open up a wide land bridge at the Bering Strait.)[169] Oard admits the difficulty he has in explaining the migration,[170] but believes that at the peak of the mild Ice Age, a narrow land bridge briefly opened.[171] At another point, he claims that "... mammoths and other animals had thrived and migrated over the entire Northern Hemisphere *at the beginning of the Ice Age*."[172] [my emphasis] (The hydroplate theory and simple geometry explain *why* sea level following the flood was *much lower*, making migrations between Asia and the Americas possible for a few centuries and creating the land bridge at the Bering Strait more than 1,000 miles wide.)

90.* ⊗ *Other/Deep Freezing. If the present cold temperatures of Siberia and Alaska began after a global flood about 5,000 years ago, trees and soil 1,900 feet below the earth's surface would not have had time to freeze, and the buried trees should have decayed. However, if preflood forests were buried in extremely cold, muddy hail at the beginning of the flood, as explained by the hydroplate theory, the deep frozen forests and soil, described on page 242, would be explained.

91.* ○ *Other/Cold Winds. This theory claims that a warm Arctic Ocean would produce warm winds that would make Siberia and Alaska tolerable. Actually, a warm Arctic Ocean would have the opposite effect. Strong updrafts over the Arctic Ocean would pull cold air from the surrounding continents in over coastal regions.

92.* ○ *Other/Population Increase. It is doubtful that mammoths and their young migrated 4,500 miles from "the mountains of Ararat" to Siberia during the Ice Age and increased their numbers to 10 million—all in just 700 years. Where have such large animals, that did not have to migrate, ever increased their numbers that much and that quickly, even in a favorable environment? Extrapolating population growth rates and appealing to geometric progressions overlooks the requirements for abundant food, liquid water, and temperate habitats. Obviously, photosynthesis does not occur inside the Arctic Circle in the dead of winter, Ice Age or no Ice Age.

Details Relating to the Shifting Crust Theory

93.* ○ *Yedomas and Loess,* ⊗ *-150°F,* ⊗ *Large Animals,* ○ *Vertical Compression. The shifting crust theory does not explain why mammoths, yedomas, and loess are related, why yedomas contain so much carbon, why temperatures suddenly drop to -150°F, why primarily the larger, harder-to-freeze animals were frozen and preserved, why "shrapnel" was imbedded in mammoth tusks, or why Dima and Berezovka were compressed vertically.

94.* ○ *Rock Ice. Same as item 73.

95.* ⊗ *Frozen Muck. Same as item 74.

96.* ○ *Summer-Fall Death. Sliding the entire earth's crust would produce ruptures in both Northern and Southern Hemispheres. Volcanic activity and storms should have been equally intense and nearly simultaneous in both hemispheres. Because this catastrophic event probably occurred in July, August, or September, summer storms should have occurred in the Northern Hemisphere and winter storms in the Southern Hemisphere. Therefore, we should find frozen carcasses in the Southern Hemisphere, not the Northern Hemisphere.

97.* ○ *Other/Wrong Direction. Frozen remains of mammoths and other animals were found in northern Alaska. If the crust shifted so that Hudson Bay moved from the North Pole to its present position, Alaska would not move appreciably northward. Why then would northern Alaska suddenly shift from a temperate to an Arctic climate?

98.* ○ *Other/No Ruptures. If the crust shifted and ruptured, where are the ruptures?

Details Relating to the Meteorite Theory

99.* ⊗ *Abundant Food,* ○ *Warm Climate. Same as item 70 on page 259.

100. ○ Yedomas and Loess, ○ Frozen Muck, ○ Suffocation, ○ Vertical Compression. The meteorite theory does not explain why mammoths, yedomas, and loess are related, why yedomas contain so much carbon, where so much muck originated, why muck has sometimes buried forests, why at least some of these huge animals suffocated, or why Dima and Berezovka are compressed vertically.

101. ⊗ Rock Ice. The meteorite theory might explain why Type 1 ice melted and allowed mammoths to sink into icy bogs, but Type 3 ice is not explained.

102. ⊗ -150°F. This theory tries to explain a sudden warming trend. It does not explain why temperatures went *suddenly* in the other direction to -150°F.

103. ⊗ Animal Mixes. A sudden warming at the end of the Ice Age might have caused some animals "to blunder to their deaths in icy bogs."[173] It does not explain why this happened to so many different types of animals that are quick, surefooted, or mobile (such as birds).

104. ○ Other/No Burial. The rapid jump in atmospheric temperature required to melt permafrost to a depth necessary to bury 13-foot-tall mammoths would have incinerated their bodies.

Were Mammoths Frozen after the Flood?

A few people believe that mammoths were frozen and buried *after* the flood. They give three arguments.

Postflood carvings of mammoths are found on cave walls in France. Response: Some mammoths lived after the flood, multiplied, and were seen by humans centuries later.

Mammoth remains are recent, because they are found near the top of the ground. Response: Don't confuse elevation with time. Deep excavation is difficult and rare in these permafrost regions where mammoth flesh could be preserved. Besides, each year frozen mammoths are uncovered in gold mines, but seldom reported.[51] I know of no frozen mammoth or rhinoceros remains lying directly above layered strata containing marine fossils, oil, coal seams, or limestone.[134] [See Prediction 21 on page 254.] Those who have searched for such deposits below frozen mammoths have found none.

Most fossils buried during the flood had their organic material replaced by minerals. Only a few mammoth bones and ivory have experienced this mineral replacement (called permineralization). Response: This is what one would expect. During and long after the flood, warm, mineral-rich waters soaked into most buried organic tissue. As the water slowly cooled, dissolved minerals were forced out of solution, replacing organic tissue. The frozen mammoth remains in Siberia and Alaska were buried in muddy ice, not liquid water. This prevented their permineralization. [To understand why the flood waters were warm and mineral-rich, see page 125.]

Final Thoughts

Earth science students are frequently discouraged from considering alternative explanations such as we have examined concerning the frozen mammoths. ***Too often, students are told what to think, rather than taught how to think.*** Why is this?

Before the field of geology began in the early 1800s, a common explanation for major geological features was a global flood. Early geologists were hostile to such explanations for three reasons. First, many geologists were opposed to the Bible, which spoke of a global flood. Second, flood explanations seemed, and sometimes were, scientifically simplistic. Finally, because a global flood is an unrepeatable catastrophe, it cannot be studied directly.

Rather than appear closed-minded by disallowing flood explanations, a more subtle approach was simply to disallow global catastrophes. This rationale was more justifiable, because modern science requires experimental repeatability. By definition, catastrophes are large, rarely repeated, and difficult to reproduce. The flaw in this exclusionary logic is that catastrophes can occur, involve many phenomena, and leave widespread wreckage and strange details that require an explanation. (You have seen many relating to frozen mammoths.) Most of these phenomena are testable and repeatable on a smaller scale. Some are so well tested and understood that mathematical calculations and computer simulations can be made at any scale.

How were catastrophes disallowed? Professors in the new and growing field of geology were primarily selected from those who supported the anticatastrophe doctrine. These professors did not advance students who espoused catastrophes. An advocate of a global flood was branded a "biblical literalist" or "fuzzy thinker"—not worthy of an academic degree. Geology professors also influenced, through the peer review process, what papers could be published. Textbooks soon reflected their orthodoxy, so few students became "fuzzy thinkers." This practice continues to this day, because a major criterion for selecting professors is the number of their publications.

This anticatastrophe doctrine is called *uniformitarianism*. Since 1830, it has been summarized by the phrase, "The present is the key to the past." In other words, only processes observable today and acting at present rates can be used to explain past events. Because some catastrophes, such as large impacts from outer space, are now fashionable, many now recognize uniformitarianism as a poor, arbitrary assumption—a stifling requirement.[174]

This presents geologists with a dilemma. Because uniformitarianism is foundational to geology, should the entire field be reexamined? Uniformitarianism was intended to banish the global flood. Will the death of uniformitarianism allow scholarly consideration of evidence that implies a global flood? Most geologists object to such a possibility. They either deny that a problem exists or hope it will go away. Some try to redefine uniformitarianism to mean that only the laws of physics observed today can be used to explain past geological events—an obvious principle of science long before uniformitarianism was sanctified. [See Endnote 17 on page 187.] The problem will not go away, but will fester even more until enough geologists recognize that catastrophes were never the problem. Early geologists simply, and arbitrarily, wanted to exclude the global flood, not catastrophes.[175]

Ruling out catastrophes in general (and the flood specifically), even before all facts are in, has stifled study and understanding. The "frozen mammoth issue" is one of many examples. Disallowing catastrophes also produces a mind-set where strange observations are ignored, or considered unbelievable, rather than viewed as possibly important *diagnostic details* worthy of testing and consideration.

Table 10 on page 252 is a broad target for anyone who wishes to grapple with ideas. Notice that it invites, not suppresses, critiques. All theories should be subject to analysis, critique, and refinement. We can focus on the more likely theories, on any misunderstandings or disagreements, on diagnostic details that need further verification, and on the expensive process of testing predictions. With theories and their predictions clearly enumerated, field work becomes more exciting and productive. Most important, those who follow us will have something to build upon. They will not be told what to think.

References and Notes

1. Valentina V. Ukraintseva, *Vegetation Cover and Environment of the "Mammoth Epoch" in Siberia* (Hot Springs, South Dakota: The Mammoth Site of Hot Springs, 1993), pp. 12–13.

◆ N. A. Dubrovo et al., "Upper Quaternary Deposits and Paleogeography of the Region Inhabited by the Young Kirgilyakh Mammoth," *International Geology Review*, Vol. 24, June 1982, p. 630.

2. R. Dale Guthrie, *Frozen Fauna of the Mammoth Steppe* (Chicago: The University of Chicago Press, 1990), p. 9.

3. S. Keith Eltringham, *Elephants*, editor Jeheskel Shoshani (Emmaus, Pennsylvania: Rodale Press, 1992), p. 102.

4. Some people split mammoths into various species, such as *Mammuthus primigenius* (woolly mammoth) and *Mammuthus columbi* (Columbian mammoth). *Members of a species can interbreed with each other, but not with others.* Obviously, no one can say that the woolly mammoth could not produce offspring with the Columbian mammoth or even that the Columbian mammoth did not have a hairy coat similar to that of the woolly mammoth. Their differences were slight. Artificially "creating" new species without some genetic or experimental justification seems unwise.

   Although African and Asian elephants are designated as different species, on at least one occasion they interbred successfully. (Unfortunately, that offspring died ten days after birth.) Therefore, African and Asian elephants should not be regarded as different species. If they occupied the same territory, no doubt other hybrids would be born.

◆ According to *Webster's Third New International Dictionary* (Unabridged; 1964 edition, p. 1369), the word "mammoth" comes from "mamma," which means "earth" to the Yakut people of northeastern Siberia. "Mammoth" also relates to the word "behemoth" used in Job 40:15 to describe a huge animal. See:
   - ❖ Henry H. Howorth, *The Mammoth and the Flood* (London: Samson Low, Marston, Searle, and Rivington, 1887), pp. 2–4, 74–75.
   - ❖ A. E. Nordenskiold, *The Voyage of the Vega Round Asia and Europe*, translated from Swedish by Alexander Leslie (New York: Macmillan and Co., 1882), p. 302.
   - ❖ Willy Ley, *Exotic Zoology* (New York: The Viking Press, 1959), p. 152.

5. E. Ysbrants Ides, *Three Years* [of] *Land Travels from Moscow Over-Land to China* (London: W. Freeman, 1706) English edition. In 1692, Russia's Czar Peter the Great directed Ides to explore the vast eastern region of Russia. The natives told Ides (p. 26) that mammoth carcasses were found, *"sometimes whole," "among the hills* [yedoma]," along four named rivers and the Arctic coast. The bones in one mammoth's head were *"somewhat red, as tho' they were tinctured with blood"* and a forefoot, cut from a leg, was as big around as a man's waist.

◆ One of the earliest descriptions of frozen mammoths, written in 1724, was authenticated by Dr. Daniel Gottlieb Messerschmidt, a naturalist sent to Siberia by Czar Peter the Great to inquire, among other things, into the frozen mammoth stories. Although Messerschmidt did not personally see the frozen partial remains, his eyewitness, Michael Wolochowicz, described the find in a short report. The report's credibility is enhanced by its similarity with many later, thoroughly verified accounts. [See John Breyne, "Observations on the Mammoth's Bones and Teeth Found in Siberia," *Philosophical Transactions of the Royal Society of London*, Vol. 40, January–June 1737, pp. 125–138.]

6. E. W. Pfizenmayer, *Siberian Man and Mammoth*, translated from German by Muriel D. Simpson (London: Black & Son Limited, 1939), p. 4.

7. Howorth, p. 76.

8. Basset Digby, *The Mammoth* (New York: D. Appleton and Co., 1926), pp. 17–18, 79.

9. Five expeditions occurred in the 1970s, two in the 1980s, one in 1990, and one in 1999.

10. Ukraintseva, pp. 80–98.

◆ Guthrie, pp. 10, 30–32.

11. *Science News Letter*, Vol. 55, 25 June 1949, p. 403.

12. John Massey Stewart, "Frozen Mammoths from Siberia Bring the Ice Ages to Vivid Life," *Smithsonian*, 1977, p. 67.

13. N. K. Vereshchagin and G. F. Baryshnikov, "Paleoecology of the Mammoth Fauna in the Eurasian Arctic," *Paleoecology of Beringia*, editors David M. Hopkins et al. (New York: Academic Press, 1982), p. 276.

14. Harold E. Anthony, "Nature's Deep Freeze," *Natural History*, Vol. 58, September 1949, p. 300.

15. Michael R. Zimmerman and Richard H. Tedford, "Histologic Structures Preserved for 21,300 Years," *Science*, Vol. 194, 8 October 1976, pp. 183–184.

16. Stewart, p. 68.

17. Charles H. Eden, *Frozen Asia* (New York: Pott, Young & Co., 1879), pp. 97–100.

18. A. G. Maddren, "Smithsonian Exploration in Alaska in 1904 in Search of Mammoth and Other Fossil Remains," *Smithsonian Miscellaneous Collections*, Vol. 49, 1905, p. 101.

19. W. H. Dall, "Presentation to the Biological Society of Washington," *Science*, 8 November 1895, pp. 635–636.

20. N. A. Transehe, "The Siberian Sea Road: The Work of the Russian Hydrographical Expedition to the Arctic 1910–1915," *The Geographical Review*, Vol. 15, 1925, p. 392.

21. Adrian Lister and Paul Bahn, *Mammoths* (New York: Macmillan, 1994), p. 46.

22. A. P. Vinogradov et al., "Radiocarbon Dating in the Vernadsky Institute I–IV," *Radiocarbon*, Vol. 8, 1966, pp. 320–321.

23. Robert M. Thorson and R. Dale Guthrie, "Stratigraphy of the Colorado Creek Mammoth Locality, Alaska," *Quaternary Research*, Vol. 37, March 1992, pp. 214–228.

24. Richard Stone, "Mammoth Hunters Put Hopes on Ice," *Science*, Vol. 291, 12 January 2001, pp. 229–230.

25. Howorth, pp. 50–54.

26. Ley, p. 169.

27. I. P. Tolmachoff, *The Carcasses of the Mammoth and Rhinoceros Found in the Frozen Ground of Siberia* (Philadelphia: The American Philosophical Society, 1929), p. 71.

28. Maddren, p. 60.

29. Eske Willerslev et al., "Diverse Plant and Animal Genetic Records from Holocene and Pleistocene Sediments," *Science*, Vol. 300, 2 May 2003, pp. 791–795.

◆ *"... climate change played a big role in the mass extinction of mammoths, ground sloths, and other large North American mammals ..."* Erik Stokstad, "Ancient DNA Pulled from Soil," *Science*, Vol. 300, 18 April 2003, p. 407.

30. H. Neuville, "On the Extinction of the Mammoth," *Annual Report of the Smithsonian Institution*, 1919, p. 332.

31. Richard B. Firestone et al., "Evidence for an Extraterrestrial Impact 12,900 Years Ago That Contributed to the Megafaunal Extinctions and the Younger Dryas Cooling," *Proceedings of the National Academy of Science*, Vol. 104, 9 October 2007, pp. 16016–16021.

32. http://news.bbc.co.uk/2/hi/science/nature/7130014.stm

33. Nikolai K. Vereshchagin and Alexei N. Tikhonov, *The Exterior of Mammoths* (Yakutsk, Siberia: Merelotovedenia Institute, 1990), p. 18. (Russian)

◆ Pfizenmayer, p. 162.

◆ Hair on the rhinoceros leg also hung to the feet. [See Eden, pp. 99–100.]

34. Hans Krause, *The Mammoth—In Ice and Snow?* (Stuttgart, Germany: self-published, 1978), p. 53.

35. Neuville, pp. 327–338.

36. Krause, pp. 51–52.

37. A comparative study of 350 mitochondrial DNA nucleotides indicates that the mammoth is closely related to the African and Indian elephants. Dima, a woolly mammoth, differed from both African and Indian elephants by only four or five nucleotides. [See Jeremy Cherfas, "If Not a Dinosaur, a Mammoth?" *Science*, Vol. 253, 20 September 1991, p. 1356.] A recent Japanese study extracted longer strands of nuclear DNA, which showed the mammoth to be more closely related to the Indian elephant than the African elephant.

38. Ralph S. Palmer, "Elephant," *The World Book Encyclopedia*, Vol. 6 (Chicago: Field Enterprises Educational Corporation, 1973), pp. 178, 178d.

39. Cynthia Moss, *Elephants*, editor Jeheskel Shoshani, (Emmaus, Pennsylvania: Rodale Press, 1992), p. 115.

40. Harold Lamb, *Hannibal: One Man Against Rome* (New York: Doubleday & Co., Inc., 1958), pp. 83–108.

41. Redmond, p. 27.

42. Redmond, p. 42.

43. Anonymous, “Much About Muck,” *Pursuit*, Vol. 2, October 1969, p. 69.

44. Digby, p. 151.

45. Stewart, p. 68.

46. Redmond, p. 19.

47. Some have speculated that an asteroid struck the earth and tipped its axis, so mammoths were suddenly at Arctic latitudes. Seldom considered are the earth’s gigantic polar moment of inertia and angular momentum. For an impactor to tip such a stable body more than 5 degrees would require a massive and fast asteroid striking earth at a favorable glancing blow. The resulting pressure pulse would pass through the entire atmosphere and kill almost all air-breathing animals. This proposal also overlooks the question of the origin of asteroids. [See pages 305–326.]

48. Guthrie, p. 84.

49. Anonymous, “Much About Muck,” pp. 68–69.

50. Lindsey Williams, *The Energy Non-Crisis*, 2nd edition (Kasilof, Alaska: Worth Publishing Co., 1980), p. 54.

51. Lister and Bahn, p. 47.

52. R. Lydekker, “Mammoth Ivory,” *Annual Report of the Board of Regents of the Smithsonian Institution for the Year Ending June 30, 1899* (Washington, D.C.: Government Printing Office, 1901), pp. 361–366.

53. Vera Rich, “Gone to the Dogs,” *Nature*, Vol. 301, 24 February 1983, p. 647.

54. Two very similar accounts describe this discovery. [See Digby, pp. 97–103, or William T. Hornaday, *Tales from Nature’s Wonderlands* (New York: Charles Scribner’s Sons, 1926), pp. 32–38.] The latter was translated from a Russian report held in the American Museum of Natural History.

55. Ages of mammoths, elephants, and mastodons can be estimated by counting the rings in their tusks. This method was first used on Berezovka. [See Vereshchagin and Tikhonov, p. 17.] Some scientists question whether one ring always implies one year.

56. Peter the Great, Russia’s most famous and influential czar, founded this museum and initiated formal mammoth studies. His strong interest in science, and mammoths in particular, led in 1714 to the systematic study and exhibition in St. Petersburg of unusual and exotic animals.

57. O. F. Herz, “Frozen Mammoth in Siberia,” *Annual Report of the Board of Regents of the Smithsonian Institution* (Washington, D.C.: Government Printing Office, 1904), pp. 617, 620, 622.

◆ Digby, pp. 123, 126, 131.

58. Personal communication with Alexei N. Tikhonov, zoologist and mammoth specialist at the Zoological Institute, Russian Academy of Sciences, St. Petersburg, 12 November 1993.

59. Pfizenmayer, p. 104.

60. Vereshchagin and Tikhonov, p. 17.

61. Herz, p. 623.

◆ Digby, p. 182.

62. Jeheskel Shoshani, *Elephants* (Emmaus, Pennsylvania: Rodale Press, 1992), pp. 79, 80, 97.

63. Readers may want to consider other explanations for the crushed leg bone, such as impacts or pinching forces perpendicular to the crushed bone. The flesh surrounding the bone was not visibly mangled, and the leg was still in its shoulder socket. Axial compression might crush a short, weak beam. However, to crush a long beam requires considerable lateral support.

64. Animals are amazingly designed to survive by regulating internal functions during a crisis. For example, all organs require oxygen. Some organs, such as the brain or heart, have a more critical need for oxygen than other body parts. So, when the mammoths were short on oxygen, their brains reduced the oxygen consumption of lower-priority systems, causing penile erection.

    Specifically, venules lie between the venous capillaries and veins leading back to the heart. Venules contract when certain organs send a message that they are running low on oxygen. These contractions slow the flow of blood through the organs (allowing them to extract more oxygen) and increase the blood pressure upstream from the venules. Capillaries, the penis, and other organs become engorged with blood. [Personal communication with pathologist Dudley A. DuPuy Jr., M.D., 5 August 1995.]

65. Tolmachoff, p. 35.

66. Tolmachoff, p. 57.

67. Guthrie, p. 13.

68. *Proceedings of the Berlin Academy*, 1846, p. 223, cited by Howorth, p. 184.

69. Leopold von Schrenck, *Memoirs of St. Petersburg Academy*, Vol. 17, pp. 48–49, cited by Howorth, p. 185.

70. William R. Farrand, “Frozen Mammoths and Modern Geology,” *Science*, 17 March 1961, p. 734.

71. Ivan T. Sanderson, “Riddle of the Frozen Giants,” *Saturday Evening Post*, 16 January 1960, p. 82.

72. A. S. W., *Nature*, Vol. 68, 30 July 1903, p. 297.

73. Lister and Bahn, p. 74.

74. Charles H. Hapgood, *The Path of the Pole* (Philadelphia: Chilton Book Co., 1970), p. 267.

75. Joseph C. Dillow, *The Waters Above: Earth’s Pre-Flood Vapor Canopy* (Chicago: Moody Press, 1981), pp. 371–377.

76. Dillow, pp. 380–381.

77. Dillow, pp. 383–396.

78. Sanderson, 1960, pp. 82, 83.

◆ When an animal dies and decay begins, decomposing amino acids in each cell produce water that ruins the meat's taste. Water expands as it freezes. If a cell freezes after enough water has accumulated, the expansion will tear the cell, showing that a certain amount of time elapsed between death and freezing. This characteristic was absent in the Berezovka mammoth, and the meat was edible—at least for dogs. These mammoths must have frozen before much decay occurred.

79. Pfizenmayer, pp. 105–106.

80. Ibid., p. 106.

81. Maddren, p. 60.

82. Pfizenmayer, p. 176.

83. Herz, pp. 613, 615.

84. Howorth, p. 96.

85. Maddren, p. 87.

86. L. S. Quackenbush, "Notes on Alaskan Mammoth Expeditions of 1907 and 1908," *Bulletin American Museum of Natural History*, Vol. 26, 1 September 1901, pp. 87–127.

◆ Tolmachoff, pp. 51–55.

◆ Herz, pp. 615, 616, 618.

87. Some have called it *fossil ice*. Pfizenmayer, who was on the Berezovka expedition, called it *diluvial ice*. The term "diluvial" refers to the biblical flood (deluge). A common belief among Siberians was that the frozen mammoths were killed and buried during the biblical flood, after which Siberian weather became much colder. So, the term "diluvial" is often associated with buried animals and ice in Siberia. Even today, geologists use the word "diluvium" to refer to glacial deposits, believed in the 1800s to be laid down during Noah's flood.

    Baron Eduard Toll, in the late 1800s, may have been the first to write about this strange ice. He called it *stone ice*. Toll and his three companions disappeared in 1903 while on a mammoth expedition to Bennett Island, an Arctic island off the north coast of Siberia. A rescue attempt failed. Toll's diary, found on Bennett Island three years later, reported that another frozen mammoth had been discovered (not listed in Table 8). Few details were given. [See, for example, Digby, p. 147.]

88. Herz, p. 618.

89. Quackenbush, p. 101.

90. W. H. Dall, "Extract from a Report to C. P. Patterson, Supt. Coast and Geodetic Survey," *American Journal of Science*, Vol. 21, 1881, p. 107.

91. A. S. W., p. 297.

92. Dubrovo et al., pp. 630, 632.

93. An early report of these thick layers of buried ice came from an expedition led by Lieutenant J. C. Cantwell. He concluded that, *"The formation of the remarkable ice-cliffs in the lower country* [of northern Alaska] *is, however, a geological nut which the writer admits his inability to crack."* "Ice-Cliffs on the Kowak River," *National Geographic Magazine*, Vol. 7, October 1896, pp. 345–346. [See also J. C. Cantwell, "Exploration of the Kowak River," *Science*, Vol. 4, 19 December 1884, pp. 551–554.]

    Some, but not all, of these reported ice layers may be the vertical faces of ice wedges. When found along coastlines, the two are easily confused. As the Arctic winter approaches and temperatures drop, the ground contracts, sometimes splitting open with a loud crack. Water later fills the vertical crack, freezes, and forms an ice wedge. Years later, this fracture, which is a vertical plane of weakness, might be exposed along a coastline by the undercutting of waves. Viewed from a boat far from the coast, the side of the ice wedge might seem to be the edge of a horizontal layer of ice. Only by tracing the ice inland for hundreds of feet can the "ice wedge explanation" be rejected. Dall (p. 107) and Maddren (pp. 15–117) did this.

94. Dall, p. 107.

◆ Maddren, p. 104.

◆ Cantwell, "Ice-Cliffs," p. 345.

95. Cantwell, "Ice-Cliffs," p. 346.

96. Pfizenmayer, pp. 89–90.

97. Herz, p. 618.

98. Stewart, p. 68.

99. *"The yedoma deposits could only have been formed by cryogenous-eolian* [cold and windy] *processes."* V. K. Ryabchun, "More about the Genesis of the Yedoma Deposit," *The Second International Conference on Permafrost: USSR Contribution, 13–28 July 1973* (Washington, D.C.: National Academy of Sciences, 1978), pp. 816–817.

100. Adolph Erman, *Travels in Siberia*, Vol. 1 (London: Longman, Brown, Green, and Longmans, 1848), pp. 379–380.

101. Nordenskiold, pp. 26, 311.

102. Paul A. Colinvaux, "Land Bridge of Duvanny Yar," *Nature*, Vol. 314, 18 April 1985, p. 581.

103. Ryabchun, p. 817.

◆ S. V. Tomirdiaro, "Evolution of Lowland Landscapes in Northeastern Asia During Late Quaternary Time," *Paleoecology of Beringia,* editors David M. Hopkins et al. (New York: Academic Press, 1982), pp. 29–37.

104. Elise Kleeman, "Siberian Thaw Releases Methane and Accelerates Global Warming," *Discover*, January 2006, p. 34.

105. A. I. Popov, "Origin of the Deposits of the Yedoma Suite on the Primor'Ye Floodplain of Northern Yakutia," *The Second International Conference on Permafrost: USSR Contribution*,

13–28 July 1973 (Washington, D.C.: National Academy of Sciences, 1978), p. 825.

106. S. V. Tomirdiaro, "Cryogenous-Eolian Genesis of Yedoma Deposits," *The Second International Conference on Permafrost: USSR Contribution*, 13–28 July 1973 (Washington, D.C.: National Academy of Sciences, 1978), pp. 817–818.

◆ Colinvaux, p. 582.

◆ Tomirdiaro, "Evolution of Lowlands," pp. 22–37.

◆ Troy L. Péwé, *Origin and Character of Loesslike Silt in Unglaciated South-Central Yakutia, Siberia, U.S.S.R.*, Geological Survey Professional Paper 1262 (Washington, D.C.: United States Government Printing Office, 1983).

107. John B. Penniston, "Note on the Origin of Loess," *Popular Astronomy*, Vol. 39, 1931, pp. 429–430.

◆ John B. Penniston, "Additional Note on the Origin of Loess," *Popular Astronomy*, Vol. 51, 1943, pp. 170–172.

108. Richard Foster Flint and Brian J. Skinner, *Physical Geology* (New York: John Wiley & Sons, Inc., 1974), p. 190.

109. Digby, p. 107.

110. Tolmachoff, p. 51.

◆ *"Experience has also shown that more* [and better mammoth bones] *are found in elevations situated near higher hills than along the low coast or on the flat tundra."* Ferdinand von Wrangell, *Narrative of an Expedition to the Polar Sea, in the Years 1820, 1821, 1822, & 1823*, 2nd edition (London: James Madden and Co., 1884), p. 275.

111. Don DeNevi, *Earthquakes* (Millbrae, California: Celestial Arts, 1977), pp. 56, 67.

112. Sanderson, 1960, p. 82.

◆ Tolmachoff, pp. 51, 59.

113. Tolmachoff, pp. 48, 49.

114. Stewart, "Frozen Mammoths from Siberia," p. 68.

115. John Massey Stewart, "A Baby That Died 40,000 Years Ago Reveals a Story," *Smithsonian*, 1978, p. 126.

116. Hapgood, p. 268.

117. Tolmachoff, pp. 26, 56–57.

◆ Howorth, pp. 61, 82–83, 158, 185.

118. For example, one might ask, "What predictions can the theory of organic evolution make?" Few, if any, although Darwin predicted that the gaps in the fossil record would soon be filled. Obviously, he was wrong. Evolutionists today are quick to explain why they make no predictions. Evolution happens over geologic time—*so slowly* that they cannot see it on a human time scale, even after breeding thousands of generations of many organisms. Yet, when asked why many gaps exist in the fossil record, their typical answer is that evolution happens *so rapidly* that the important fossils are seldom preserved. Unwillingness to make predictions shows a lack of scientific rigor and confidence. Successful predictions are the best test of a theory's strength and fruitfulness.

119. Y. N. Popov, "New Finds of Pleistocene Animals in Northern USSR," *Nature*, No. 3, 1948, p. 76. This is the former Soviet (not the British) journal *Nature*.

120. Temperatures in outer space are often misunderstood. For example, a physicist might say that the temperature 200 miles above the earth's surface is 2,000°F. However, a thermometer, shielded from direct rays of the Sun, might register a drastically colder -150°F. The confusion results from different definitions of temperature and different ways of transferring heat.

The physicist defines temperature as the average kinetic energy of molecules. Because molecules in the extreme upper atmosphere are heated by the Sun's direct rays, they travel very fast and register a very high temperature. Typically, they travel many miles before colliding with another molecule, so little slows them down. At those altitudes, the air is so thin (only one 100,000,000,000th as dense as air at sea level) that little heat is transferred.

A thermometer 200 miles above the earth's surface might read a frigid -150°F, because it *radiates* so much heat into far outer space, where the effective temperature is near absolute zero (-460°F). A thermometer warmer than -150°F would radiate more heat into far outer space than it receives from rare impacts of fast air molecules. Consequently, its temperature would drop. Only when the thermometer's temperature drops to -150°F will the heat added by fast gas molecules balance the heat lost by radiation. An astronaut without a heated space suit would "feel" the same temperature as the thermometer.

A fraction of each liquid droplet suddenly expelled into the vacuum of outer space will rapidly—but only partially—evaporate. (The technical term is "flash.") This cools the liquid, just as perspiring cools our skin. Water's temperature drops about 1°F for every thousandth of its volume that evaporates. This is a strong effect, because the faster (hotter) liquid molecules jump out of the liquid, expending much of the liquid's internal energy. The water does not freeze until it is below its normal freezing point because (a) the water circulates, and (b) the minerals in solution lower the freezing point, just as antifreeze prevents your car's radiator fluid from freezing. Once frozen, evaporation slows greatly. With dirt mixed in the liquid, the ice quickly becomes encrusted and sealed inside some of the dirt left behind; evaporation ceases. This is why comet nuclei still contain much water ice and are dark in color.

121. Tolmachoff, p. 64.

122. Charles Lyell, the most influential founder of modern geology, advocated this theory to explain some frozen mammoths. [See Charles Lyell, *Principles of Geology* (reprint, New York: Verlag von J. Cramer, 1970), pp. 96–99.]

Herz also used it to explain the Berezovka mammoth. [See Herz, p. 614.]

123. M. Huc, *Recollections of a Journey through Tartary, Thibet* [Tibet], *and China, During the Years 1844, 1845, and 1846*. Vol. 2 (New York: D. Appleton & Co., 1852), pp. 130–131.

- Charles Lyell, *Principles of Geology*, 11th edition, Vol. 1 (New York: D. Appleton and Co., 1872), p. 188. Some earlier editions did not contain this report.

124. Streams, rivers, lakes, and oceans freeze from the top down, because water reaches its maximum density at 39°F—seven degrees *above* its normal freezing point. As cold air further lowers the water's temperature, water defies the behavior of most liquids and expands. This less dense water "floats" on top of the denser water. Eventually, it freezes into ice, which is even less dense.

    Fortunately, water behaves in this unusual way. If water continued to contract as it became colder and froze, as most liquids do, ice would sink. Bodies of water would freeze from the bottom up. Surface water would quickly freeze, then sink. During the summer, the overlying liquid water would insulate the ice and delay its melting. Each winter more ice would collect at the bottom. This would first occur at polar latitudes, but over the years would spread toward the equator as surface ice reflected more of the Sun's rays back into space, cooling the earth. Sea life would eventually cease. Evaporation and rain would diminish, turning the land into a cold, lifeless desert.

125. Tolmachoff, pp. 56, 57.

126. This theory was first proposed by Ides. Middendorff, Lyell, and Bunge also favored it in some cases. [See Tolmachoff, pp. viii–ix, 56.]

127. Tolmachoff, p. 66.

128. George M. Dawson, "Notes on the Occurrence of Mammoth Remains in the Yukon District of Canada and in Alaska," *The Quarterly Journal of the Geological Society of London*, Vol. 50, 1894, pp. 1–9.

129. Michael Oard, *Frozen in Time* (Green Forest, Arkansas: Master Books, 2004).

- Oard recognizes most of the problems associated with the frozen mammoths. For example, he states:

    > *Why would the woolly mammoth, bison, woolly rhinoceros, and horse be attracted to Siberia? Today, Siberia is a barren, blizzard-scourged wilderness. How could the animals have endured the extremely cold winters? What would they eat? Where would the beasts locate the prodigious quantities of water they require when the land is imprisoned in snow and ice. Even the rivers are covered with several feet of ice every winter. Most puzzling of all is how did the mammoths and their companions die en mass and how could they have become encased in the permafrost?* Oard, p. 13.

    > *Birds Eye Frozen Foods Company ran the calculations and came up with a staggering -150°F (-100°C). Once again, the scientists were puzzled. How could such temperatures be reached on earth, especially when they were in a fairly temperate environment before the quick freeze?* Oard, p. 14.

    > *A number of carcasses, as well as a few skeletons, have been discovered in a general **standing position**.* [emphasis in original] Oard, p. 19.

    > *Strangely, scientists investigating three woolly mammoths and two woolly rhinos, including the Berezovka mammoth, found they all died by **suffocation**.* [emphasis in original] Oard, p. 20.

    > *Mammoths and the many other types of mammals are ill suited for* [even] *summer conditions in Siberia. What are millions of them doing in Siberia? … paradoxically, they lived during the Ice Age. … The bog vegetation that dominates Siberia's summers would provide woefully inadequate nutrition for the well-dressed giants.* Oard, pp. 26–27, 51–52.

130. To the best of my knowledge, Michael Oard was the first to publish the proposal that ***warm waters coming from under the earth's crust during the flood contributed to the only Ice Age.*** For this, he deserves full credit. [See Michael J. Oard, "A Rapid Post-Flood Ice Age," *Creation Research Society Quarterly*, Vol. 16, June 1979, pp. 29–37. Also see Michael J. Oard, *An Ice Age Caused by the Genesis Flood* (El Cajon, California: Institute for Creation Research, 1990).]

    In 1972, after reading Dolph Earl Hooker's book, *Those Astounding Ice Ages* (New York: Exposition Press, 1958), I reached a similar conclusion. Since 1972, every one of my several hundred lectures on the flood explained how the flood produced the Ice Age—or more precisely, produced an Ice Age each winter for many years after the flood.

    In 1976, I flew to the Institute for Creation Research (ICR) and spent a day with Drs. Henry M. Morris, Duane T. Gish, and Harold S. Slusher explaining what I believed happened during and following the flood—including the Ice Age. At the end of the day, Morris urged me to publish the explanation in a technical monograph that ICR would publish. Unfortunately, my family and Air Force responsibilities made that impossible. I also felt that a much more detailed, interdisciplinary study of the mechanisms and consequences of the flood should be completed before anything was published. Primarily for that reason, I retired from the Air Force at the first opportunity, in 1980, and began my present work.

    Michael Oard and I agree that the global flood produced the Ice Age, in part because warm flood waters came from inside the earth. However, Oard overlooks an equally important factor: high and, therefore, *cold continents*. Centuries were required for the crushed, thickened—and, therefore, higher—hydroplates to sink into the mantle. (Each continent was also elevated an additional mile, on average, by a mile-thick layer of flood sediments.) Warm oceans and cold continents produced powerful winds which, in turn, transported vast amounts of moisture up onto the cold continents where snow and ice accumulated.

Oard suggests that the preflood subterranean water was 3,000–10,000 feet below the earth's surface [Oard, *Frozen in Time*, p. 75]. He believes that a deeper source of the flood water would have been too hot for present sea life to have survived. However, water at 3,000–10,000 feet depths would easily and quickly escape to the earth's surface through the slightest crack, but at depths greater than 5 miles, pressures are so great that rock is sealed like highly compressed putty. For various reasons, I have estimated that the preflood subterranean water was about 10 miles below the earth's surface. Page 124 explains why the hot subterranean waters did not scald the earth.

Much heat is needed to produce the evaporation needed for the Ice Age. Pages 149–173 explain why that heat was not concentrated in surface water after the flood. Instead, considerable heat was in the voluminous flood basalts, especially those on the floor of the western Pacific. Heat leaked slowly, keeping Pacific waters warm for centuries. Today's El Niños are a small reminder of that process.

PREDICTION 23: General circulation models of the earth's weather will be able to demonstrate that an ice age would have occurred if warm oceans, vast flood basalts, and high, cold continents once existed.

131. Hapgood, *The Path of the Pole,* 1970, pp. 249–270.

132. Fred Hoyle, *Ice* (New York: The Continuum Publishing Co., 1981), pp. 159, 160.

133. What little heating occurred acted only on the leading edge of the giant mass of infalling hail—specifically, the outer surface of each ice particle in that leading edge. These relatively few outer surfaces acted much like an ablative shield that protects a reentering space ship from friction and heat, with two important differences: (a) the ice is very cold, so the initial ice absorbed heat from the atmosphere and became rain, and (b) the ice particles had no kinetic energy at the top of their trajectory, but a spacecraft has a gigantic amount at the same altitude. Therefore, relatively little heat was transferred to the atmosphere.

134. One geologist, trying to falsify this prediction, drafted an article claiming that a geologic map showed layered, fossil-bearing strata under the Colorado Creek mammoths. He misread his geologic map. Had he read it correctly, he would have seen that it supported this prediction. The article was never published and that geologist has stopped spreading the misinformation.

135. Smaller dirt particles have a much greater ratio of viscous-to-inertial forces acting on them. Thus, the liquid seems more viscous to smaller particles. Sudden movements of the droplet carry the smaller dirt particles with the liquid, while larger particles, which have higher inertial forces, could be thrown out of the liquid.

136. Niels Reeh, "Was the Greenland Ice Sheet Thinner in the Late Wisconsinan Than Now?" *Nature*, Vol. 317, 31 October 1985, p. 797.

◆ R. M. Koerner and D. A. Fisher, "Discontinuous Flow, Ice Texture, and Dirt Content in the Basal Layers of the Devon Island Ice Cap," *Journal of Glaciology*, Vol. 23, No. 89, 1979, pp. 209–219.

137. P. A. Mayewski et al., "Changes in Atmospheric Circulation and Ocean Cover over the North Atlantic During the Last 41,000 Years," *Science*, Vol. 263, 25 March 1994, pp. 1747–1751.

138. Besides being salty, rock ice will contain carbon dioxide and many dissolved minerals, will have a crystallographic structure showing that it formed at very low pressures and temperatures, and will have large hydrogen and oxygen isotope variations. Such variations have already been reported at the bottom of ice cores on Devon Island in Arctic Canada. The same ice layer has a high silt content. [See Koerner and Fisher.] Also, ice cores from Byrd Station in Antarctica contain large oxygen (O^{18}/O^{16}) and hydrogen (H^2/H^1) variations in the bottom half of the ice sheet. [See Samuel Epstein et al., "Antarctic Ice Sheet," *Science*, Vol. 168, 26 June 1970, pp. 1570–1572.] The bottom ice in some ice wedges in Siberia is abnormally salty. [See Yu. K. Vasilchuk and V. T. Trofimov, "Cryohydrochemical Peculiarities of Ice Wedge Polygon Complexes in the North of Western Siberia," *Permafrost: Fourth International Conference Proceedings* (Washington, D.C.: National Academy Press, July 17–22, 1983), pp. 1303–1308.]

139. Tolmachoff (p. 51) reported, *"The uppermost position of mammoth-bearing deposits* [cover the] *sediments of the Arctic transgression ..."* This has caused some confusion in North America where "transgression" means the advance of the sea over the land. Such an advance might deposit sediments and fossils unconformably. To Europeans (and presumably the European-trained Tolmachoff) the term "transgression" simply means an unconformity—basically, dirt that is not layered. [See "transgression," in Robert L. Bates and Julia A. Jackson, editors, *Glossary of Geology*, 2nd edition (Falls Church, Virginia: American Geological Institute, 1980), p. 660.] In other words, rocks under the mammoths are not stratified. Tolmachoff attributed this to glacial activity, but described nothing diagnostic of glacial activity.

140. Digby, p. 93.

141. Troy L. Péwé, *Quaternary Geology*, Geological Survey Professional Paper 835 (Washington, D.C.: United States Government Printing Office, 1975), pp. 41–42.

142. Vereshchagin and Tikhonov, p. 18.

143. N. A. Dubrovo et al., p. 633.

144. Ibid.

145. Troy L. Péwé, *Quaternary Stratigraphic Nomenclature in Unglaciated Central Alaska*, Geological Survey Professional

Paper 862 (Washington, D.C.: United States Government Printing Office, 1975), p. 30.

◆ Guthrie, p. 38.

146. Thorson and Guthrie, p. 222.

147. Ibid., p. 221.

148. One questionable story came from an exhibit of frozen mammoth remains that toured the United States in 1992. The official brochure stated without elaboration, *"Portions of a mammoth thousands of years old that was discovered in permafrost were defrosted, cooked and served at a banquet honoring scientists."* Hapgood (*The Path of the Pole*, p. 261) made a similar statement but mentioned the name of the man who claimed to have eaten mammoth steak in Moscow in the 1930s.

149. Lydekker, p. 363.

150. Herz, p. 621.

151. Rich, p. 647.

152. Charles Lyell, *Principles of Geology* (New York: Verlag von J. Cramer, reprint edition, 1970), p. 97.

153. Guthrie, pp. 9, 11, 12, 20.

◆ Georges Cuvier, *Essay on the Theory of the Earth*, reprint edition (New York: Arno Press, 1978), pp. 274–276.

154. Krause, p. 88.

155. S. Keith Eltringham, *Elephants*, editor Jeheskel Shoshani, (Emmaus, Pennsylvania: Rodale Press, 1992), p. 126.

156. Digby, 171.

◆ Charles H. Hapgood, "The Mystery of the Frozen Mammoths," *Coronet*, September 1960, pp. 71–78.

◆ Sanderson, 1960, p. 83.

157. Henryk Kubiak, "Morphological Characters of the Mammoth," *Paleoecology of Beringia*, editors David M. Hopkins et al. (New York: Academic Press, 1982), p. 282.

158. Hoyle, p. 160.

159. Howorth, p. 182.

160. Guthrie, p. 17.

161. Tolmachoff, p. 52.

162. Tolmachoff, p. 52.

163. Hapgood, *The Path of the Pole,* p. 258.

164. Howorth, p. 61.

165. Hapgood, *The Path of the Pole*, p. 257.

166. Guthrie, pp. 30–32.

167. Jocelyn Selim, "Land of the Lost ... and Found," *Discover*, July 2003, p. 11.

168. Oard, *Frozen in Time,* pp. 141–143.

169. Ibid., pp. 91–94.

170. *"The migration of the mammoths into the United States is the main challenge."* Ibid., p. 140.

171. Ibid., p. 130.

172. Ibid., p. 172.

173. Hoyle, p. 160.

174. *"As is now increasingly acknowledged, however, Lyell* [the father of geology] *also sold geology some snake oil. He convinced geologists that because physical laws are constant in time and space and current processes should be consulted before resorting to unseen processes, it necessarily follows that all past processes acted at essentially their current rates (that is, those observed in historical time). This extreme gradualism has led to numerous unfortunate consequences, including the rejection of sudden or catastrophic events in the face of positive evidence for them, for no reason other than that they were not gradual."* Warren D. Allmon, "Post-Gradualism," *Science*, Vol. 262, 1 October 1993, p. 122.

175. See, for example, Rudwick's introduction to Charles Lyell's influential *Principles of Geology* (1830; reprint, Martin J. S. Rudwick, Chicago: The University of Chicago Press, 1990), pp. xvi–xvii. Chapter 3 of Lyell's *Principles* (pp. 21–54) is particularly revealing.

Figure 144: Comets. A) Comet Halley in Milky Way, February 1986; B) Comet Halley, February 1986; C) Comet West, March 1976; D) Comet Kohoutek, June 1973; E) Comet Ikeya-Seki, November 1965; F) Comet West, computer enhanced; G) Comet LINEAR, July 2000; H) Comet Hale-Bopp, March 1997.

The Origin of Comets

SUMMARY: Past explanations for how comets began have serious problems. After a review of some facts concerning comets, a new explanation for comet origins will be proposed and tested. It appears that the fountains of the great deep and the sustained power of an "ocean" of high-pressure, supercritical water jetting into the vacuum of space launched comets into the solar system as the flood began. Other known forces would have assembled the expelled rocks and muddy droplets into larger bodies resembling comets in size, number, density, composition, spin, texture, strength, chemistry (organic and inorganic), and orbital characteristics. After a comparison of theories with evidence, problems with the earlier explanations will become apparent.

Comets may be the most dynamic, spectacular, variable, and mysterious bodies in the solar system. They even contain organic matter—including trace amounts of the amino acid glycine, a complex building block of life on earth.[1] Early scientists discovered other types of organic matter in comets, and concluded that they came from "decomposed organic bodies."[2] Today, a popular belief is that comets brought life to Earth. Instead, comets may have traces of life *from* Earth.[3]

Comets orbit the Sun. When closest to the Sun, some comets travel more than 350 miles *per second*. Others, at their farthest point from the Sun, spend years traveling less than 15 miles per hour. A few comets travel so fast they will escape the solar system. Even fast comets, because of their great distance from Earth, appear to "hang" in the night sky, almost as stationary as the stars. Comets reflect sunlight and fluoresce (glow). They are brightest near the Sun and sometimes visible in daylight.

A typical comet, when far from the Sun, resembles a dirty, misshapen snowball, a few miles across. About 38% of its mass[4] is frozen water—but this ice is extremely fluffy, with

Figure 145: Arizona's Meteor Crater. Comets are not meteors. Comets are like giant, dirty, exceedingly fluffy "snowballs." Meteors are rock fragments, usually dust particles, falling through the atmosphere. "Falling stars" streaking through the night sky are usually dust particles thrown off by comets years ago. In fact, every day we walk on comet dust. House-size meteors have formed huge craters on Earth, the Moon, and elsewhere. Meteors that strike the ground are renamed "meteorites," so the above crater, ¾ mile wide, should be called a "meteorite" crater.

On the morning of 14 December 1807, a huge fireball flashed across the southwestern Connecticut sky. Two Yale professors quickly recovered 330 pounds of meteorites, one weighing 200 pounds. When President Thomas Jefferson heard their report, he allegedly said, "It is easier to believe that two Yankee professors would lie than that stones would fall from heaven." Jefferson was mistaken, but his intuition was no worse than ours would have been in *his* time. Today, many would say, "The Moon's craters show that it must be billions of years old" and "What goes up must come down." Are these simply mistakes common in *our* time?

As you read this chapter, test such intuitive ideas and alternate explanations against evidence and physical laws. Consider the explosive and sustained power of the fountains of the great deep. You may also see why the Moon is peppered with craters, as if someone had fired large buckshot at it. Question: Are comets "out of this world"?

much empty space between ice particles. The rest is dust and various chemicals. As a comet approaches the Sun, a small fraction of the snowball (or ***nucleus***) evaporates, forming a gas and dust cloud, called a ***coma***, around the nucleus. The cloud and nucleus together are called the ***head***. The head's volume can be larger than a million Earths. Comet ***tails*** are sometimes more than an ***astronomical unit*** (AU) long (93,000,000 miles), the Earth-Sun distance. One tail was 3.4 AU long—enough to stretch around Earth 12,500 times.[5] Solar wind and radiation propels comet tails away from the Sun, so comets traveling away from the Sun move tail-first.

Comet tails are extremely tenuous—giant volumes of practically nothing. Stars are sometimes observed through comet heads and tails; comet shadows on Earth, even when expected, have never been seen. One hundred cubic miles of comet Halley's tail contains much less matter than in a cubic inch of air we breathe—and is even less dense than the best laboratory vacuum.

In 1998, billions of tons of water-ice mixed with the soil were found in deep craters near the Moon's poles. As one writer visualized it,

> *Comets raining from the sky left pockets of frozen water at the north and south poles of the moon, billions of tons more than previously believed, Los Alamos National Laboratory researchers have found.*[6]

Later, thin traces of water were found at all lunar latitudes by three different spacecraft.[7] Comets are a likely source, but this raises perplexing questions. Ice should evaporate from the Moon faster than comets currently deposit it, so why does so much ice remain?[8] Also, ice seems to have been discovered in permanently shadowed craters on Mercury,[9] the closest planet to the Sun. Ice that near the Sun is even more difficult to explain.

Fear of comets as omens of death existed in most ancient cultures.[10] Indeed, comets were called "disasters," which in Greek means "evil" (*dis*) "star" (*aster*). Why fear comets and not other more surprising celestial events, such as eclipses, supernovas, or meteor showers? When Halley's comet appeared in 1910, some people worldwide panicked; a few even committed suicide. In Texas, police arrested men selling "comet-protection" pills. Rioters then freed the salesmen. Elsewhere, people quit jobs or locked themselves in their homes as the comet approached.

Comets are rapidly disappearing. Some of their mass is "burned off" each time they pass near the Sun, and they frequently collide with planets, moons, and the Sun. Comets passing near large planets often are torn apart or receive gravity boosts that fling them, like slingshots, out of the solar system forever. Because we have seen so many comets die, we naturally wonder, "How were they born?"

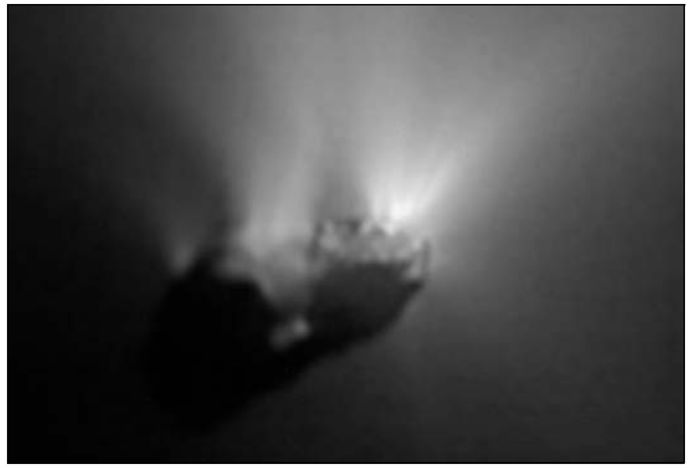


Figure 146: Nucleus of Halley's Comet. When this most famous of all comets last swung by the Sun in 1986, five spacecraft approached it. From a distance of a few hundred miles, *Giotto*, a European Space Agency spacecraft, took six pictures of Halley's black, 9 x 5 x 5 mile, potato-shaped nucleus. This first composite picture of a comet's nucleus showed 12–15 jets venting gas at up to 30 tons per second. (Venting and tail formation occur only when a comet is near the Sun.) The gas moved away from the nucleus at almost a mile per second to become part of the comet's head and tail. Seconds after these pictures were taken, *Giotto* slammed into the gas, destroying the spacecraft's cameras.

Textbooks and the media confidently explain, in vague terms, how comets began. Although comet experts worldwide know those explanations lack details and are riddled with scientific problems, most experts view the problems, which few others appreciate, as "future research projects."

To learn the probable origin of comets, we should:

a. Understand these problems. (This will require learning how gravity moves things in space, often in surprising ways.)
b. Learn a few technical terms related to comets, their orbits, and their composition.
c. Understand and test seven major theories for comet origins.

Only then will we be equipped to decide which theory best explains the origin of comets.

Gravity: How and Why Most Things Move

Gravity pulls us toward Earth's surface. This produces *friction*, a force affecting and slowing every movement we make. Since we were babies, we have assumed that everything behaves this way. Indeed, none of us could have taken our first steps without friction and the downward pull of gravity. Even liquids (such as water) and gases (such as air) create a type of friction called *drag*, because gravity also pulls liquids and gases toward Earth's solid surface.

In space, things are different. If we were orbiting Earth, its gravity would still act on us, but we would not feel it. We might think we were "floating" when, in fact, we would be

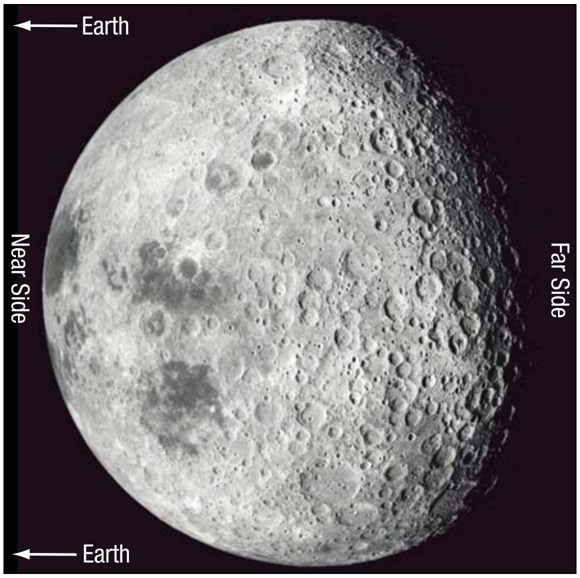


Figure 147: Near and Far Sides of the Moon. Today, the same side of the Moon always faces Earth during the Moon's monthly orbit. Surprisingly, the near and far sides of the Moon are quite different. Almost all deep moonquakes are on the near side.[11] The surface of the far side is rougher, while the near side has most of the Moon's volcanic features, lava flows, dome complexes, and giant, multiringed basins. Lava flows (darker regions) have smoothed over many craters on the near side.[12]

Some have proposed that the Moon's crust must be thinner on the near side, so lava can squirt out more easily on the near side than on the far side. However, no seismic, gravity, or heat flow measurements support that hypothesis, and the deeper lunar interior is cold and solid. The Moon's density throughout is almost as uniform as that of a billiard ball,[13] showing that little distinctive crust exists. Not only did large impacts form the giant basins, but much of their impact energy melted rock and generated lava flows. This is why the lava flows came after the craters formed. These impacts appear to have happened recently. [See **"Hot Moon"** on page 41.]

Contemporaries of Galileo misnamed these lava flows "maria" (MAHR-ee-uh), or "seas," because these dark areas looked smooth and filled low-lying regions. Maria give the Moon its "man-in-the-moon" appearance. Of the Moon's 31 giant basins, only 11 are on the far side.[14] (See if you can flip 31 coins and get 11 or fewer tails. Not too likely. It happens only about 7% of the time.) Why should the near side have so many more giant impact features, almost all the maria,[15] and almost all deep moonquakes? Opposite sides of Mars and Mercury are also different.[16]

If the impacts that produced these volcanic features occurred *slowly* from any or all directions, all sides would be equally hit. Only if the impacts occurred rapidly from a specific direction would large impact features be concentrated on one side of the Moon. Of course, large impacts would kick up millions of smaller rocks that would themselves create impacts or go into orbit around the Moon and later create other impacts—even on Earth. Today, both sides of the Moon are saturated with smaller craters. Were the large lunar impactors launched from Earth?

Apparently. The Moon *as a whole* has relatively few volatile elements, such as nitrogen, hydrogen, and the noble gases. Surprisingly, lunar *soil* contains these elements—and water[17]—all implying that they came from Earth. The relative abundances of isotopes of these elements in lunar soils correspond not to the solar wind but to what is found on Earth.[18] If large impactors came from Earth recently, most moonquakes should be on the near side, and they should still be occurring. They are.[11]

falling. In a circular orbit, our velocity would carry us away from Earth as fast as we fell.

As another example, in 1965 astronaut James McDivitt tried to catch up (rendezvous) with an object orbiting far ahead of him. He instinctively increased his speed. However, this added speed moved his orbit higher and farther from Earth where gravity is weaker and orbital velocities are slower. Thus, he fell farther behind his target. Had he temporarily slowed down, he would have changed his orbit, lost altitude, sped up, and traveled a shorter route. Only by slowing down could he catch up—essentially taking a "shortcut."

All particles attract each other gravitationally. The more massive and the closer any two particles are to each other, the greater their mutual attraction. To determine the gravitational pull of a large body, one must add the effects of all its tiniest components. This seems a daunting task. Fortunately, the gravitational pull of a *distant* body behaves almost as if all its mass were concentrated at its center of mass—as our intuition tells us.

But what if we were *inside* a "body," such as the universe, a galaxy, or Earth? Intuition fails. For example, if Earth were a hollow sphere and we were inside, we would "float"! The pull from the side of the spherical shell nearest us would be great because it is close, but more mass would pull us in the opposite direction. In 1687, Isaac Newton showed that these pulls always balance.[19]

Tides. A water droplet in an ocean tide feels a stronger gravitational pull from the Sun than from the Moon. This is because the Sun's huge mass (27 million times greater than that of the Moon) more than makes up for the Sun's greater distance. However, ocean tides are caused primarily by the Moon, not the Sun. This is because the Sun pulls the droplet *and* the center of the Earth toward itself almost equally, while the much closer Moon pulls relatively more on *either* the droplet *or* the center of the Earth (whichever is nearer). We best see this effect in tides, because the many ocean droplets slip and slide so easily over each other. (To learn more about what causes tides, see page 477.)

Tidal effects act everywhere on everything: gases, liquids, solids—and comets. When a comet passes near a large planet or the Sun, the planet or Sun's gravity pulls the near side of the comet with a greater force than the far side. This difference in "pulls" stretches the comet and sometimes tears it apart. If a comet passes very near a

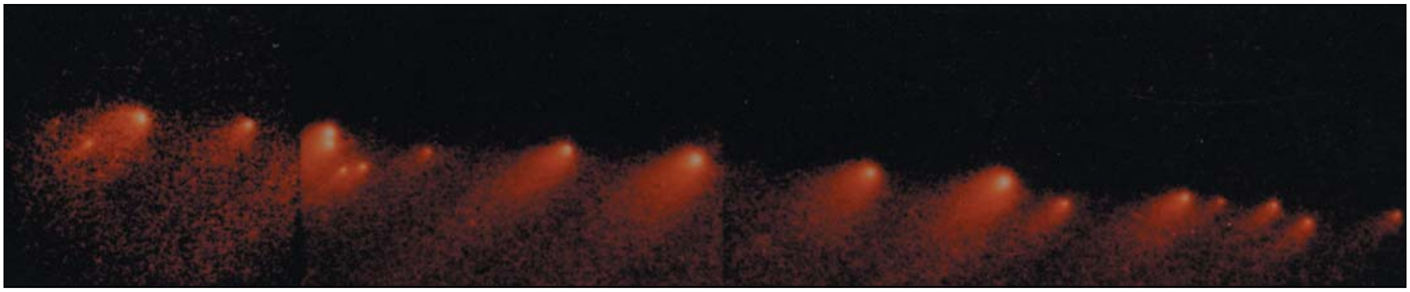


Figure 148: Weak Comets. Tidal effects often tear comets apart, showing that comets have almost no strength. Two humans could pull apart a comet nucleus several miles in diameter. In comparison, the strength of an equally large snowball would be gigantic. In 1992, tidal forces dramatically tore comet Shoemaker-Levy 9 into 23 pieces as it passed near Jupiter. Two years later, the fragments, resembling a "flying string of pearls" strung over 180,000,000 miles, returned and collided with Jupiter. A typical high-velocity piece released about 5,000 hydrogen bombs' worth of energy and became a dark spot, larger than Earth, visibly drifting for days in Jupiter's atmosphere. We will see that Jupiter, with its huge gravity and tidal effects, is a comet killer.

large body, it can be pulled apart many times; that is, pieces of pieces of pieces of comets are torn apart as shown in Figure 148.

Spheres of Influence. The Apollo 13 astronauts, while traveling to the Moon, dumped waste material overboard. As the discarded material, traveling at nearly the same velocity as the spacecraft, moved slowly away, the spacecraft's gravity pulled the material back. To everyone's surprise, it orbited the spacecraft all the way to the Moon.[20] When the spacecraft was on Earth, Earth's gravity dominated things near the spacecraft. However, when the spacecraft was far from Earth, the spacecraft's gravity dominated things near it. The region around a spacecraft, or any other body in space, where gravity can hold an object in an orbit, is called that body's *sphere of influence*.

An object's sphere of influence expands enormously as it moves farther from massive bodies. If, for many days, rocks and droplets of muddy water were expelled from Earth in a supersonic jet, the spheres of influence of the rocks and water would grow dramatically. The more the spheres of influence grew, the more mass they would capture, so the more they would grow, etc.[21]

A droplet engulfed in a *growing sphere of influence* of a rock or another droplet with a similar velocity might be captured by it. However, a droplet entering a body's *fixed sphere of influence* with even a small relative velocity would seldom be captured.[22] This is because it would gain enough speed as it fell toward that body to escape from the sphere of influence at about the same speed it entered.

Earth's sphere of influence has a radius of about 600,000 miles. A rock inside that sphere is influenced more by Earth's gravity than the Sun's. A rock entering Earth's sphere of influence at only a few feet per second would accelerate toward Earth. It could reach a speed of almost 7 miles per second, depending on how close it came to Earth. Assuming no collision, gravity would whip the rock partway around Earth so fast it would *exit* Earth's sphere of influence about as fast as it entered—a few feet per second. It would then be influenced more by the Sun and would enter a new orbit about the Sun.[23]

Exiting a sphere of influence is more difficult if it contains a gas, such as an atmosphere or water vapor. Any gas, especially a dense gas, slows an invading particle, perhaps enough to capture it. Atmospheres are often relied upon to slow and capture spacecraft. This technique, called *aerobraking*, generates much heat. However, if the "spacecraft" is a liquid droplet, evaporation cools the droplet, makes the atmosphere denser, and makes capture even easier.

A swarm of mutually captured particles will orbit their common center of mass. If the swarm were moving away from Earth, the swarm's sphere of influence would grow, so fewer particles would escape by chance interactions with other particles. Particles in the swarm, colliding with gas molecules, would gently settle toward the swarm's center of mass. How gently? More softly than large snowflakes settling onto a windless, snow-covered field. More softly, because the swarm's gravity is much weaker than Earth's gravity. Eventually, most particles in this swarm would become a rotating clump of fluffy ice particles with almost no strength. *The entire clump would stick together, resembling a comet's nucleus in strength, size, density, spin, composition, texture, and orbit.* The pressure in the center of a comet nucleus 3 miles in diameter is about what you would feel under a blanket here on Earth.

In contrast, spheres of influence hardly change for particles in nearly circular orbits about a planet or the Sun. Even on rare occasions when particles pass very near each other, capture does not occur. This is because they seldom collide and stick together, their relative velocities almost always allow them to escape each other's sphere of influence, their spheres of influence rarely expand, and gases are not inside these spheres to assist in capture. Forming stars, planets, or moons by capturing[24] smaller orbiting bodies is far more difficult than most people realize.[25]

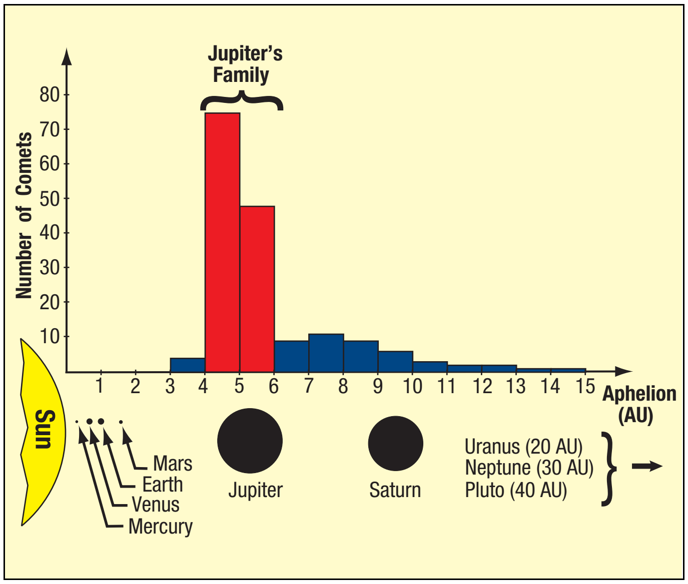


Figure 149: What Is Jupiter's Family? About 60% of all short-period comets have aphelions 4–6 AU from the Sun. (A comet's aphelion is its farthest point from the Sun.) Because Jupiter travels in a nearly circular orbit that lies near the center of that range (5.2 AU from the Sun), those comets are called *Jupiter's family*. (Comets in Jupiter's family do not travel with Jupiter; those comets and Jupiter have only one orbital characteristic in common—aphelion distance.) Is Saturn, which lies 9.5 AU from the Sun, collecting a family? See the "aphelion scale" directly above each planet.

Why should comets cluster into families defined by aphelions? Why is Jupiter's family so large? No doubt, Jupiter's enormous mass has something to do with it. Notice how large Jupiter is compared to other planets and how far each is from the Sun. (In this figure, diameters of the Sun and planets are magnified relative to the aphelion scale.)

How Comets Move

Most comets travel on long, oval paths called ***ellipses*** that bring them near the Sun and then swing them back out into deep space. [See Figure 153 on page 281.] The point nearest the Sun on an elliptical orbit is called its ***perihelion***. At perihelion, a comet's speed is greatest. After a comet passes perihelion and begins moving away from the Sun, its velocity steadily decreases until it reaches its farthest point from the Sun—called its ***aphelion***. (This is similar to the way a ball thrown up into the air slows down until it reaches its highest point.) Then the comet begins falling back toward the Sun, gaining speed until it again reaches perihelion.

Short-Period Comets. Of the almost 1,000 known comets, 205 orbit the Sun in less than 100 years. They are called *short-period comets*, because the time for each to orbit the Sun once, called the ***period***, is short—less than 100 years.[26] Short-period comets usually travel near Earth's orbital plane, called the ***ecliptic***. Almost all (190) are ***prograde***; that is, they orbit the Sun in the same direction as the planets. Surprisingly, about 60% of all short-period comets have aphelions near some point on Jupiter's orbit.[27] They are called ***Jupiter's family***. [See Figure 149.]

To understand better what is meant by "Jupiter's family," look briefly at Figure 154 on page 286. While comets A, B, and C orbit the Sun, only A and B are in Jupiter's family, because their farthest point from the Sun, their aphelion, is near Jupiter's orbit. How Jupiter collected its large family of comets presents major problems, because comets falling toward the Sun from the outer solar system would be traveling too fast as they zip inside Jupiter's orbit. To slow them down so they could join Jupiter's family would require such great deceleration forces that the comets would have to pass very near planets. But those near passes could easily tear comets apart or eject them from the solar system.[28]

Also, comets in Jupiter's family run an increased risk of colliding with Jupiter or planets in the inner solar system, or being expelled from the solar system by Jupiter's gigantic gravity. Therefore, they have a life expectancy of only about 12,000 years.[29] This presents three possibilities: (1) Jupiter's family formed less than about 12,000 years ago, (2) the family is resupplied rapidly by unknown processes, or (3) the family had many more comets prior to about 12,000 years ago—perhaps thousands of times as many. Options (2) and (3) present a terrible collection problem. In other words, too many comets cluster in Jupiter's family, precisely where few should gather or survive for much longer than about 12,000 years. Why?

Table 12. Comet Types and Characteristics

	Types of Comets		
	Short-Period	Intermediate-Period	Long-Period
Orbital Period	less than 100 years	100–700 years	more than 700 years
Number of Comets	205	50	659
Angle of Inclination to Earth's Orbital Plane	mostly very low	widely dispersed	widely dispersed
Orbit Direction Prograde Retrograde	 93% 7%	 70% 30%	 47% 53%

Long-Period Comets. Of the 659 comets with periods exceeding 700 years, fewer than half (47%) are prograde, while the rest (53%) are ***retrograde***, orbiting the Sun "backwards"—in a direction opposite that of the planets. Because no planets have retrograde orbits, we must ask why so many long-period comets are retrograde, while few short-period comets are.

Intermediate-Period Comets. Only 50 comets have orbital periods between 100 and 700 years. So, we have

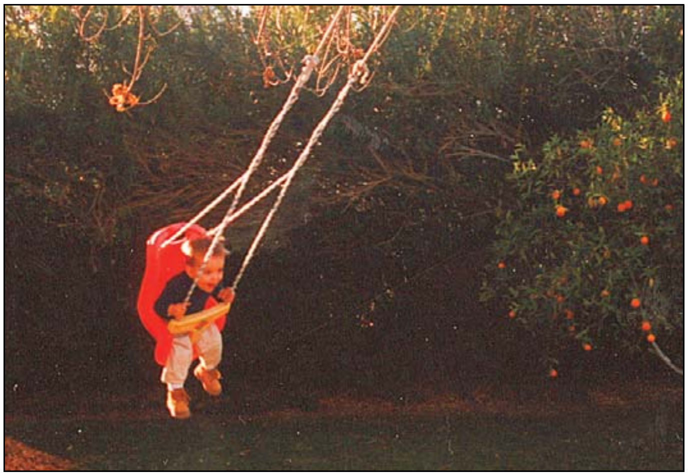


Figure 150: An Early Lesson in Conservation of Energy. At the top of his swing, my grandson Preston has a minimum of kinetic energy (energy of motion) but a maximum of potential energy (energy of height). At the bottom of his swing, where he moves the fastest, he will convert potential energy into kinetic energy. In between, he has some of both.

Eventually, friction converts both forms of energy into heat energy, slowing the swing, and making Preston unhappy. Comets also steadily exchange kinetic and potential energy, but do so with essentially no frictional loss.

two completely different populations of comets—short-period and long-period—plus a few in between.

Energy. A comet falling in its orbit toward the Sun exchanges "height above" the Sun for additional speed—just as a ball dropped from a tall building loses elevation but gains speed. Moving away from the Sun, the exchange reverses. A comet's energy has two parts: ***potential energy***, which increases with the comet's distance from the Sun, and ***kinetic energy***, which increases with speed. Kinetic energy is converted to potential energy as the comet moves away from the Sun. The beauty of these exchanges is that the sum of the two energies never changes if the comet is influenced only by the Sun; the total ***energy is conserved*** (preserved).

However, if a comet orbiting the Sun passes near a planet, energy is transferred between them. What one gains, the other loses; the energy of the comet-planet pair is conserved. A comet falling in the general direction of a planet gains speed, and therefore, energy; moving away from a planet, it loses speed and energy. We say that the planet's gravity ***perturbs*** (or alters) the comet's orbit. If the comet gains energy, *its orbit lengthens*. The closer the encounter and more massive the planet, the greater the energy exchange. Jupiter, the largest planet, is 318 times more massive than Earth and causes most large perturbations. In about half of these planetary encounters, comets gain energy, and in half they lose energy.

If a comet gains enough energy (and therefore speed), it will escape the solar system. Although the Sun's gravity pulls on the comet as it moves away from the Sun, that pull may decrease so fast with distance that the comet escapes forever. The resulting orbit is not an ellipse (a closed orbit), but a ***hyperbola*** (an open orbit). [See Figure 151.] The precise dividing line between ellipses and hyperbolas is an orbit called a ***parabola***. Most long-period comets travel on long, narrow ellipses that are almost parabolas. They are called ***near-parabolic comets***. If they had just a little more velocity, they would permanently escape the solar system on hyperbolic orbits.

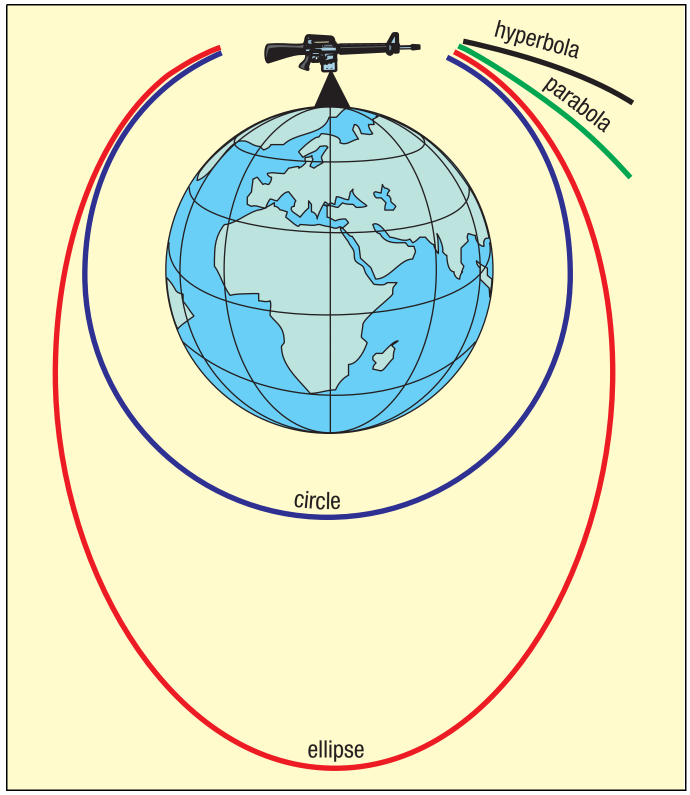


Figure 151: A Shot Fired Around the World. Imagine standing on a tall mountain rising above the atmosphere. You fire a bullet horizontally. If its speed is just right, and very fast, it will "fall" at the same rate the spherical Earth curves away. The bullet would be launched in a ***circular orbit*** (blue) around Earth. In other words, the bullet would "fall" around the Earth continually. Isaac Newton first suggested this surprising possibility in 1687. It wasn't until 1957 that the former Soviet Union demonstrated this with a satellite called *Sputnik I*.

If the bullet were launched more slowly, it would eventually hit the Earth. If the bullet traveled faster, it would be in an oval or ***elliptical orbit*** (red).[30] With even more speed, the orbit would not "loop around" and close on itself. It would be an "open" orbit; the bullet would never return. The green orbit, called a ***parabolic orbit***, is the boundary between open and closed orbits. With any greater launch velocity, the bullet would travel in a ***hyperbolic orbit***; with any less, it would be in an elliptical orbit. These orbits will be discussed in more detail later. Understanding them will help us discover how comets came to be.

Separate Populations. Few comets with short periods will ever change into near-parabolic comets, because the large boost in energy needed is apt to "throw" a comet across

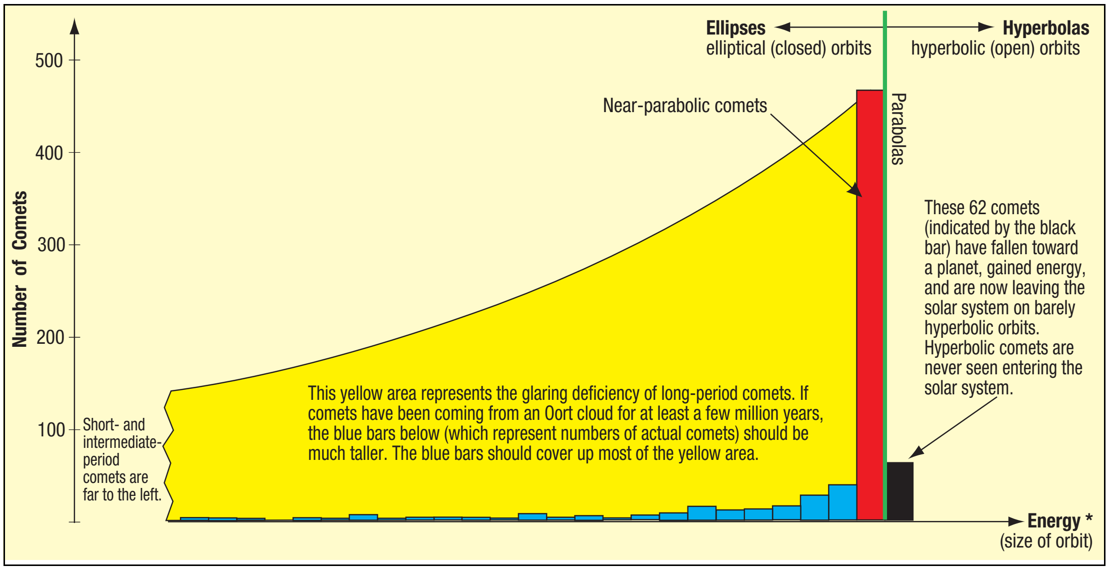


Figure 152: Energies of Long-Period Comets. The tall red bar represents 465 comets with extremely high energy—comets that could, in theory, travel far from the Sun, such as 2,000 AU, 10,000 AU, 50,000 AU, or almost ***infinity***. (As you will soon see, this great range explains why this red bar represents so many comets.) These comets, traveling on long, narrow ellipses that are almost parabolas, are called ***near-parabolic comets***. Those who believe that this tall bar locates the source of comets usually substitute "50,000 AU" for this broad (actually infinite) range and say that comets are falling in from those distances. Because near-parabolic comets fall in ***from all directions***, this possible comet source is called the "Oort shell" or "Oort cloud," named after Jan Oort who proposed its existence in 1950. (No one has detected the Oort cloud with a telescope or any other sensing device.[32] *Mathematical errors led to the belief that a cloud of cometary material, called the Oort cloud, surrounds the solar system.*[33]) All we can say is that 71% of the long-period comets, those represented by the red bar, are falling in with similar and very large energies.

As a comet "loops in" near the Sun, it interacts gravitationally with planets, gaining or losing energy. The green line represents parabolic orbits, the boundary separating elliptical orbits from hyperbolic orbits (i.e., closed orbits from open orbits). If a comet gains enough energy to nudge it to the right of the green line, it will be expelled from the solar system forever. This happened with the few ***outgoing*** hyperbolic comets represented by the short, black bar. ***Incoming hyperbolic comets have never been seen***[34]—a very important point About half of all comets will lose energy with each orbit, so their orbits shorten, making collisions with the planets and Sun more likely and vaporization from the Sun's heat more rapid. So, with each shift to the left (loss of energy), a comet's chance of survival drops. Few long-period comets would survive the many gravity perturbations needed to make them short-period comets. However, there are about a hundred times more short-period comets than one would expect based on all the gravity perturbations needed.[35] (Short-period comets would be far to the left of the above figure.)

If planetary perturbations acted on a steady supply of near-parabolic comets for millions of years, the number of comets in each interval should correspond to the shape of the yellow area.[36] The small number of actual comets in that area (shown by the blue bars) indicates how few near-parabolic comets have made multiple trips into the inner solar system. Question: Where are the many comets that should have survived their first trip but with slightly less energy? Hasn't enough time passed for them to show up? After only millions of years, blue bars should more or less fill the yellow area. Figure 152 shows us that the evidence which should be clearly seen if comets have been orbiting the Sun for only millions of years—let alone billions of years—does not exist. In other words, ***near-parabolic comets have not been orbiting the Sun for millions of years***.

Notice the tall red bar. If these 465 near-parabolic comets had made many earlier orbits, their gravitational interaction with planets would have randomly added or subtracted considerable energy, flattening and spreading out the red bar. As you can see, *those near-parabolic comets fell back* ***for the first time***.[37] Was the material from which they formed launched in a burst from near the center of the solar system, and why did they recently fall back—and why from every direction?

* The horizontal axis represents 1/a, a proxy for energy per unit mass. The term "a" is a comet's semimajor axis. Each interval has a width of 10^{-3} (1/AU).

the parabola boundary, expelling it permanently from the solar system. The energy boost would have to "snuggle" a comet up next to the parabola boundary without crossing it.[31] Likewise, few long-period comets will become short-period comets, because comets risk getting killed with each near pass of a planet. This would be especially true if such dangerous activity went on for millions of years in the "heavy traffic" of the inner solar system.

While all planets travel near Earth's orbital plane (the ecliptic), long-period and intermediate-period comets have orbital planes inclined at all angles. However, short-period comets usually travel near the ecliptic. Comet inclinations change only slightly with most planet encounters.[38] Because very few short-period comets can become long-period comets, and vice versa, most must have begun in their current category.

Comet Composition

Until a spacecraft lands on a comet's nucleus and analyzes its undisturbed structure and chemistry, much will remain unknown about comets. However, light from a comet can identify some of the gas and dust in its head and tail.

Light Analysis. Each type of molecule, or portion thereof, absorbs and gives off specific colors of light. The color combination, seen when this light passes through a prism or other instrument to reveal its spectrum, identifies some components in the comet. Even light frequencies humans cannot see can be analyzed in the tiniest detail. Some components, like sodium, are easy to identify, but others, such as chlorine, are difficult, because the light they emit is dim or masked by other radiations. Curved tails in comets have the same light characteristics as the Sun; therefore, those tails must contain solid particles (dust) which are reflecting sunlight. Also detected in comets are water, carbon dioxide, argon,[39] and many combinations of hydrogen, carbon, oxygen, and nitrogen. Some molecules in comets, such as water and carbon dioxide, have broken apart and recombined to produce many other compounds. Comets contain trace amounts of the amino acid glycine (a building block of life on earth), and methane and ethane. On Earth, bacteria produce almost all methane, and ethane comes from methane. How could comets originating in space get high concentrations of these compounds?[40]

Plumes of methane are seen escaping up into Mars' atmosphere from a few locations,[41] but, methane in Mar's atmosphere is typically destroyed in about a year, so something within Mars must be producing methane.[42] (Martian volcanoes are not, because Mars has no active or recent volcanoes. Nor do comets *today* deliver methane fast enough to replace what solar radiation is destroying.)[43] Does this mean that bacterial life is in Martian soil?[44] Probably. [See **"Is There Life on Mars?"** on page 445.] Later in this chapter, a surprising explanation will be given.

Dust particles in comets vary in size from pebbles to specks smaller than the eye can detect. How dust could ever form in space is a recognized mystery.[45] Light analysis shows that the atoms in comet dust are arranged in simple, repetitive, *crystalline* patterns, primarily that of olivine,[46] the most common of the approximately 4,300 known minerals on Earth. In fact, the type of olivine in comet dust appears to be rich in magnesium, *as is the olivine in rocks beneath oceans and in continental crust.* In contrast, most interstellar dust has no repetitive atomic patterns; it is not crystalline, and certainly not olivine.

Crystalline patterns form because atoms and ions tend to arrange themselves in patterns that minimize their total energy. An atom whose temperature and pressure allow it to move about will eventually find a "comfortable" slot next to other atoms that minimizes energy. (This is similar to the motion of marbles rolling around on a table filled with little pits. A marble is most "comfortable" when it settles into one of the pits. The lower the marble settles, the lower its energy, and the more permanent its position.) Minerals in rocks, such as in the mantle or deep in Earth's crust, have been under enough pressure to develop a crystalline pattern.[47]

Deep Impact Mission. On 4 July 2005, the Deep Impact spacecraft fired an 820-pound "bullet" into comet Tempel 1, revealing as never before the composition of a comet's surface layers.[48] The cometary material blasted into space included:

a. *silicates*, which constitute about 95% of the Earth's crust and contain considerable oxygen—a rare commodity in space
b. *crystalline* silicates that could not have formed in frigid (about - 450°F) outer space unless the temperature reached 1,300°F and then slowly cooled under some pressure
c. minerals that form only in *liquid* water,[49] such as calcium carbonates (limestone) and clays
d. organic material of unknown origin
e. sodium, which is seldom seen in space
f. very fine dirt—like talcum powder—that was "tens of meters deep" on the comet's surface

Comet Tempel 1 is fluffy and extremely porous. It contains about 60% empty space, and has "the strength of the meringue in lemon meringue pie."[50]

On 4 November 2010, the Deep Impact spacecraft passed by comet Hartley 2 and found that the most abundant of its gases being expelled was carbon dioxide (CO_2). [For details and an explanation, see Figure 164 on page 313.]

Stardust Mission. In July 2004, NASA's Stardust mission passed within 150 miles of the nucleus of comet Wild 2 (pronounced "Vilt 2"), caught dust particles from its tail, and returned them to Earth in January 2006. The dust was crystalline and contained "abundant organics,"[1] "abundant water," and many chemical elements common on Earth but rare in space: magnesium, calcium, aluminum, and titanium. Crystalline material—minerals—should not form in the cold weightlessness of outer space.[51] What can explain the observations of these two space missions?

What is "Interstellar Dust"? Is it dust? Is it interstellar? While some of its light characteristics match those of dust, Hoyle and Wickramasinghe have shown that those characteristics have a much better match with dried, frozen bacteria and ***cellulose***—an amazing match.[52]

Dust, cellulose, and bacteria may be in space, but each raises questions. If it is dust, how did dust form in space? "Cosmic abundances of magnesium and silicon [major constituents of dust] seem inadequate to give interstellar dust."[53] A standard explanation is that exploding stars (supernovas) produced dust. However, supernovas radiate the energy of about 10 billion suns, so any expelled dust or nearby rocks would vaporize. If it is cellulose, *the most* *abundant organic substance on Earth,* how could such a large, complex molecule form in space?[54] Vegetation is one-third cellulose; wood is one-half cellulose. Finally, bacteria are so complex it is absurd to think they formed in space. How could they eat, keep from freezing, or avoid being destroyed by ultraviolet radiation?

Is all "interstellar dust" interstellar? Probably not. Starlight traveling to Earth passes through regions of space that absorb specific wavelengths of light. The regions showing the spectral characteristics of cellulose and bacteria may lie within or near the solar system. Some astronomers mistakenly assume that because much absorption occurs in interstellar space, little occurs in the solar system.

Heavy Hydrogen. Water molecules (H_2O) have two hydrogen atoms and one oxygen atom. A hydrogen atom contains one proton in its nucleus. On Earth, about one out of 6,400 hydrogen nuclei has, in addition to its proton, a neutron, making that hydrogen—called ***heavy hydrogen***, or *deuterium*—twice as heavy as normal hydrogen.

Surprisingly, in comets, one out of 3,200 hydrogen atoms is heavy—*twice that in water on Earth.*[55] Therefore, comets did not deliver most of Earth's water, as many writers have speculated. In comets, the ratio of heavy hydrogen to normal hydrogen is 20–100 times greater than in interstellar space and the solar system as a whole.[56] Evidently, comets came from an isolated reservoir rich in heavy hydrogen. Many efforts by comet experts to deal with this problem are simply unscientific guesswork. No known process will greatly increase or decrease the heavy hydrogen concentration in comets.

Small Comets

Since 1981, Earth satellites have photographed tiny spots thought to be small, house-size comets striking and vaporizing in our upper atmosphere. [See Figure 33 on page 42.] On average, these strikes occur at an astonishing rate of one every three seconds![57] Surprisingly, small comets strike Earth's atmosphere ten times more frequently in early November than in mid-January[58]—too great a variation to explain if the source of small comets is far from Earth's orbit.

Small comets are controversial. Those who deny their existence argue that the spots are "camera noise,"[59] but cameras of different designs in different orbits give the same results. In three experiments, rockets 180 miles above the Earth dumped 300–600 pounds of water-ice with dissolved carbon dioxide onto the atmosphere. Ground radar looking up and satellite cameras looking down recorded the results, duplicating the spots. Ground telescopes have also photographed small comets. These comets are hitting Earth's atmosphere at a rate that would deliver, in 4.5 billion years, much more water than is on the Earth today.

Details Requiring an Explanation

Summarized below are the hard-to-explain details which any satisfactory theory for the origin of comets should explain.

Formation Mechanism. Experimentally verified explanations are needed for how comets formed and acquired water, dust particles of various sizes, and many chemicals.

Ice on Moon and Mercury. Large amounts of water-ice are in permanently shadowed craters near the poles of the Moon, and probably on planet Mercury.

Crystalline Dust. Comet dust is primarily crystalline.

Near-Parabolic Comets. Near-parabolic comets that have been observed were falling toward the Sun for the first time and from all directions. Why are so many comets represented by the tall red bar in Figure 152?

Random Perihelion Directions. Comet perihelions are scattered on all sides of the Sun.

No Incoming Hyperbolic Orbits. Although a few comets leave the solar system on hyperbolic orbits, no incoming hyperbolic comets are known. That is, no comets are known to come from outside the solar system.

Small Perihelions. Perihelions of long-period comets are concentrated near the Sun, in the 1–3 AU range, not randomly scattered over a larger range.

Orbit Directions and Inclinations. About half the long-period comets have retrograde orbits (orbit in a direction opposite to the planets), but all planets, and almost all short-period comets, are prograde. Short-period comets have orbital planes near Earth's orbital plane, while long-period comets have orbital planes inclined at all angles.

Two Separate Populations. Long-period comets are quite different from short-period comets. Even millions of years and many gravitational interactions with planets would rarely change one kind into the other.

Jupiter's Family. Jupiter recently collected a large family of comets, each with a surprisingly short life expectancy of about 12,000 years.[29] How did this happen? [See Figure 149 on page 275.]

High Loss Rates of Comets. Comets are being destroyed, diminished, or expelled from the solar system at high rates that are difficult for some theories to explain.

Composition. Comets are primarily water, silicate dust (such as olivine), carbon dioxide, sodium, and combinations of hydrogen, carbon, oxygen, and nitrogen. Comets also contain limestone and clays—and surprisingly some compounds, such as methane and the amino acid glycine that are only known to be produced by life on earth.

Heavy Hydrogen. The high concentration of heavy hydrogen in comets means comets did not come from today's known hydrogen sources—in or beyond the solar system.

Small Comets. What can explain the strange characteristics of small comets, including their abundance and nearness to Earth, but not to Mars? Small comets have never been seen impacting Mars.

Missing Meteorites. Meteor streams are associated with comets and have similar orbits. Meteorites are concentrated in Earth's topmost sedimentary layers, so they must have fallen recently, after most sediments were deposited.[60] [See **"Shallow Meteorites"** on page 40.] Comets may have arrived recently as well.

Recent Meteor Streams. As comets disintegrate, their dust particles form meteor streams which orbit the Sun. After about 10,000 years, solar radiation should segregate particles by size. Because little segregation has occurred, meteor streams, and therefore comets, must be recent. [See **"Poynting-Robertson Effect"** on page 42.]

Crater Ages. Are the ages of Earth's impact craters consistent with each comet theory?

Theories Attempting to Explain the Origin of Comets

Seven modern theories have been proposed to explain the origin of comets. Each theory will be described below as an advocate would. Later, we will test each theory with the characteristics of comets, listed above, that require an explanation.

Hydroplate Theory. Comets are literally out of this world. As the flood began, the extreme pressure in the interconnected subterranean chambers and the power of supercritical water exploding into the vacuum of space launched material that later merged to become about 50,000 comets, totaling less than 1% of the water in the chambers. (These numbers will be derived later.) This water was rich in heavy hydrogen.

As subterranean water escaped, the chambers' pillars were crushed and broken. Also, the 10-mile-high walls along the rupture were unstable, because granitic rock is not strong enough to support a cliff greater than 5 miles high. The bottom portions of the walls were crushed into large blocks which were swept up and launched by the fountains of the great deep. Carried up with the water were eroded dirt particles, pulverized organic matter (especially cellulose from preflood forests), and even bacteria.

Droplets in this muddy mixture froze quickly in outer space. The expanding spheres of influence of the larger rocks captured more and more ice particles, which later merged gravitationally to form comets. Some comets and rocks soon hit the Moon and formed large basins. Those impacts produced lava flows and debris, which then caused secondary impacts. Water vapor condensed in the permanent shadows of the Moon's polar craters.

Hyperbolic comets never returned to the solar system. Near-parabolic comets now being detected are returning to the inner solar system for the first time. Comets with slower velocities received most of their orbital velocity from Earth's orbital motion. They are short-period comets with elliptical, prograde orbits lying near the Earth's orbital plane. Since the flood, many short-period comets have been pulled gravitationally into Jupiter's family. Small comets are composed of material that escaped the earth with the least velocity. [For a more complete description of the hydroplate theory, see pages 109–147.]

Exploded Planet Theory.[61] Consistent with Bode's "law,"[62] a tenth planet once existed 2.8 AU from the Sun, between the orbits of Mars and Jupiter. It exploded about 3,200,000 years ago, spewing out comets and asteroids. Many fragments collided with other planets and moons, explaining why some planets and moons are cratered primarily on one side. The fragments visible today are those that avoided the disturbing influence of planets: those launched on nearly circular orbits (asteroids) and those launched on elongated ellipses (comets). This theory also explains the origin of asteroids and some similarities between comets and asteroids.

Volcanic Eruption Theory.[63] The large number of short-period comets, as compared with intermediate-period comets, requires their recent formation near the center of the solar system. Volcanic eruptions, probably from the giant planets (Jupiter, Saturn, Uranus, and Neptune) or their moons, periodically launch comets. Jupiter's large, recently-acquired family suggests that Jupiter was the most recent planet to erupt. The giant planets are huge reservoirs of hydrogen, a major constituent of comets. New eruptions replenish comets that are rapidly lost through collisions with planets or moons, evaporation when passing near the Sun, and ejection from the solar system.

Oort Cloud Theory.[64] As the solar system formed 4.5 billion years ago, a cloud of about 10^{12} comets also formed approximately 50,000 AU from the Sun[65]—more than a thousand times farther away than planet Pluto[66] and about one-fifth the distance to the nearest star. Stars passing near the solar system perturbed parts of this Oort cloud, sending randomly oriented comets on trajectories that pass near the Sun. This is why calculations show so many long-period comets falling into the inner solar system from about 50,000 AU away. As a comet enters the

Detecting the Hidden Mass That Comets Feel

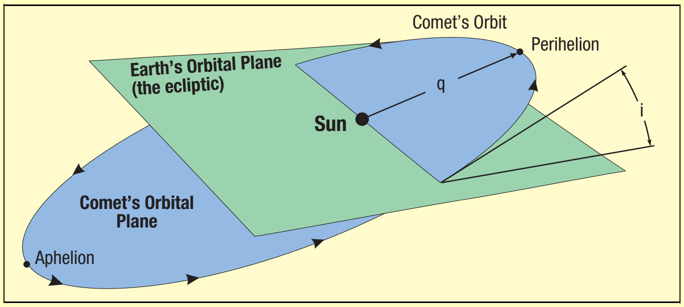


Figure 153: An Orbit's Fingerprint. A comet's orbit closely approximates an ellipse. Each ellipse and its orientation in space are defined by five numbers, two of which are shown above. The first, i, is the angle of inclination—the angle the plane of the ellipse makes with Earth's orbital plane. A second number, q, measures in astronomical units (AU) the distance from the Sun to the perihelion. The other three numbers (e, ω, and Ω) need not be defined here but are explained in most books on orbital mechanics or astronautics.

In the last 920 years, almost 1,000 different comets have been observed accurately enough to calculate these five numbers. Surprisingly, 12 pairs of comets have very similar numbers. Could some *"strange pairs"* really be the same comet on two successive orbits? The estimated orbital period (the far right column in Table 13), the time to complete one orbit, for each member of the "strange pair" is so extremely long that they should not be the same comet. However, if the comets were all different, the chance of any two randomly-selected comets having such similar orbits is about one out of 100,000.[68] The chance of getting at least 12 "strange pairs" from the vast number of possible pairings is about one out of 7,000. *If the solar system's mass has been slightly underestimated, orbital periods are much shorter, and some "strange pairs" are almost certainly the same comet.* Other reasons are given in this chapter for believing that a slight amount of extra mass exists in the solar system. It should be about the mass of 70 Jupiters but spread thinly outside the planetary region—where long-period comets spend most of their time.

Each pair of rows in Table 13 describes two sightings of comets with remarkably similar orbits. The far left column tells when, to the nearest tenth of a year, the comet passed perihelion. The next five columns specify the comet's orbit. The bottom two pairs may be the same comet seen in 1097, 1538, and 1947.

Table 13. Twelve "Strange Pairs"

Comet (year)	i (°)	q (AU)	e	ω (°)	Ω (°)	Period (year)
1877.7	102.227	1.575904	1.000000	143.204	252.710	infinite
1994.8	101.737	1.845402	0.999517	142.784	249.943	236,165
1846.4	122.377	1.375992	1.000000	78.7517	163.464	infinite
1973.4	121.598	1.382019	0.998723	74.8598	164.817	35,603
1439.4	81.0000	0.120000	1.000000	140.000	192.000	infinite
1840.3	79.8512	0.748504	1.000000	138.044	188.271	infinite
1785.1	70.2380	1.143400	1.000000	205.632	267.214	infinite
1898.6	70.0300	0.626438	1.000000	205.613	260.527	infinite
1863.0	137.541	0.803238	1.000000	230.576	357.695	infinite
1978.7	138.264	0.431870	1.000000	240.450	358.419	infinite
1304.1	65.0000	0.840000	1.000000	25.0000	88.7000	infinite
1935.2	65.4251	0.811148	0.991304	18.3969	92.4472	901
1770.9	148.555	0.528240	1.000000	260.375	111.944	infinite
1980.0	148.601	0.545164	0.987598	257.584	103.219	291
1580.9	64.6120	0.602370	1.000000	89.3670	24.9480	infinite
1890.5	63.3509	0.764087	1.000000	85.6608	15.8347	infinite
1337.5	143.600	0.749000	1.000000	79.6100	97.6100	infinite
1968.6	143.238	1.160434	1.000665	88.7151	106.747	infinite
1742.1	112.948	0.765770	1.000000	328.043	189.201	infinite
1907.2	110.057	0.923861	1.000000	328.756	190.417	infinite
1097.7	41.0000	0.300000	1.000000	298.000	352.000	infinite
1538.0	42.4600	0.147700	1.000000	287.700	356.200	infinite
1097.7	41.0000	0.300000	1.000000	298.000	352.000	infinite
1947.4	39.3015	0.559799	0.997427	303.754	353.909	3,209

planetary region (0–40 AU from the Sun), the gravity of planets, especially Jupiter, either adds energy to or removes energy from the comet. If energy is added, the comet is usually thrown from the solar system on a hyperbolic orbit. If energy is removed, the comet's orbital period is shortened. With so many comets in the initial cloud (10^{12}), some survived many passes through the inner solar system and are now short-period comets.

Revised Oort Cloud Theory.[67] As the solar system began 4.5 billion years ago, all comets formed in a comet nursery near or just beyond the outer giant planets. Because these comets were relatively near the Sun, passing stars could not eject them from the solar system. As with planets, these early comets all had prograde orbits near the plane of the ecliptic. Perturbations by the giant planets gave some comets short periods with prograde orbits near the ecliptic plane. Other perturbations ejected other comets out to form and resupply an Oort cloud, 50,000 AU from the Sun. Over millions of years, passing stars have circularized these latter orbits. Then other passing stars perturbed some Oort cloud comets back into the planetary region, as described by the original Oort cloud theory. Therefore, large numbers of near-parabolic comets are still available to fall into the inner solar system from about 50,000 AU away. An unreasonably large number of comets did not have to begin in the Oort cloud 4.5 billion years ago (where, after a few billion years, passing stars, galactic clouds, and the galaxy itself would easily strip them from the cloud). Short-period comets cannot come from the Oort cloud.

Meteor Stream Theory.[69] When particles orbiting the Sun collide, they exchange some energy and momentum. If the particles are sufficiently absorbent (squishy), their orbits become more similar.[70] After millions of years, these particles form meteor streams. Water vapor condenses on the particles in the meteor streams as they pass through the cold, outer solar system. Thus, icy comets form

Questions Precede Advances

Scientific advances require recognizing *anomalies*—observations that contradict current understanding and show a need for deeper insight. Unless anomalies are recognized, scientists lose focus, researchers become complacent, and future discoveries are delayed. Although comet experts will acknowledge many anomalies, textbooks seldom mention them, so teachers rarely hear about them. Consequently, students (and our next generation of teachers) are deprived of much of the excitement of science. Critical thinking skills are not fully developed.

Some important conclusions about comets involved several scientists and were gradually accepted. However, for simplicity and to show the flow of progress, only one scientist and date are listed in each row below. Current anomalies are italicized.

While each major discovery removes some earlier anomalies and false ideas, each discovery raises new questions. Notice how the major questions preceding 1868 have been answered. Pointing out anomalies in science may draw the wrath of some scientists, but it advances knowledge and can increase the interest and excitement of students.

Table 14. Progress and Problems in Understanding Comets

Date	Conclusions and Questions	Scientist	Reference
340 B.C.	Comets are not planets, because comets change appearance quickly and do not travel in the narrow planetary path across the sky.	Aristotle	Lee[72]
A.D. 63	Many comet characteristics show that they are not stars, planets, fires, or atmospheric phenomena. [Falsified existing theories.]	Seneca	Corcoran[73]
635	Comet tails generally point away from the Sun. [Implies that comets have some relationship to the Sun.]	Li Chung-feng	Y, 46–47
1577	Comets do not travel inside Earth's atmosphere, but far beyond the Moon and into "the realm of the planets."[74]	Brahe	B;[75] PLB[76]
1665	Specific comets reappear. [This idea is usually credited, incorrectly, to Edmond Halley. When Robert Hooke made his proposal, Halley was 9 years old.]	Hooke	Pepys;[77] SD, 48
1680	Comets do not travel in straight lines. Their paths are [almost] parabolas.	Dörffel	Y, 99; PLB, 70
1687	Because comets are usually seen near the Sun, comets orbit the Sun. Vapor surrounding the nucleus brightens when near the Sun. Comets obey Newton's law of gravity. [Because they obey fixed, natural laws, they do not portend human disasters.]	Newton	Newton[78]
1698	Six numbers, called *orbital elements*, describe a comet's movement if planetary perturbations can be neglected. Orbital elements help identify returning comets seen earlier.	Halley	W, 37–40
1705	No incoming comets are on obviously hyperbolic orbits. [No known comets come from outside the solar system.]	Halley	PLB, 124
1759	With great computational effort to adjust for planetary perturbations, comet positions can be calculated forward or backward in time with fair accuracy.	Clairaut	W, 43
1805	Comets have low densities and are [largely] made of water-ice.	Laplace	Whipple[79]
1812	Comets' elongated and widely inclined orbits are best explained by an explosion in the solar system.	Lagrange	Y, 304–305
1819	Comets shine by reflected light, not by their own light.	Arago	PLB, 167
1864	Spectral analyses of a comet's light reveal some of its chemical composition.	Donati	Y, 214; W, 106
1866	Meteor streams are associated with comets.	Schiaparelli	W, 97
1868	Comets contain organic molecules. *Why? What was the source of the carbon?*	Huggins	SD, 146–155
1884	*How could so many fragile comets be forced into Jupiter's family—and remain there today?*	Proctor	Proctor[80]
1925	*How could comets survive for billions of years?*	Russell	B, 67
1948	*Why are there so many short-period, prograde comets and so many long-period, retrograde comets?*	van Woerkom	van Woerkom[36]
1950	Near-parabolic comets fall toward the Sun with large, but remarkably similar, energies.	Oort	Oort[64]
1973	Comets cannot form far from the Sun.	Öpik	Öpik[81]
1986	About once every 3 seconds, a small comet hits the Earth's upper atmosphere and vaporizes.	Frank	Frank[57]
1986	*Why didn't small comets form more lunar craters and put more water on Earth, Venus, and Mars?*	Donahue	Donahue[82]
1998	Comets are unusually rich in heavy hydrogen. *Where did comets get it?*	Meier	Meier[55]

Abbreviations in the right column are B=Bailey et al., PLB=Peter Lancaster-Brown, SD=Sagan and Druyan, W=Whipple (Mystery of Comets), Y=Yeomans. Page numbers usually follow each abbreviation. See endnotes for complete citations.

continually. This is why so many meteor streams have cometlike orbits, and why more short-period comets exist than an Oort cloud could provide.

Interstellar Capture Theory.[71] Comets form when the Sun occasionally passes through interstellar gas and dust clouds. As seen from the Sun, gas and dust particles stream past the Sun. The Sun's gravity deflects and focuses these particles around and behind the Sun. There they collide with each other, lose velocity, enter orbits around the Sun, and merge into distinct swarms of particles held together by their mutual gravity. These swarms become comets with long and short periods, depending on how far the collisions were from the Sun.

Evaluation of Evidence vs. Theories

Table 15. Evidence vs. Theories: Origin of Comets

	Theories						
	Formed in Inner Solar System			Formed in Outer Solar System or Beyond			
Evidence to be Explained	From Earth by Fountains of the Great Deep *(Hydroplate Theory)*	From Exploded Planet between Mars and Jupiter	From Eruptions on the Giant Planets	Original Oort Cloud: Began Far Beyond Solar System	Revised Oort Cloud: Began Near Edge of Solar System	From Meteor Streams	From Interstellar Dust and Gas Clouds
Formation Mechanism	🟢 1	🟡 13	⊗ 22	⊗ 30	⊗ 45	⊗ 60	⊗ 72
Ice on Moon and Mercury	🟢 1	⊗ 14	⊗ 23	⊗ 31	⊗ 46	⊗ 61	⊗ 73
Crystalline Dust	🟢 2	🟢	⊗ 22	⊗ 32	⊗ 47	⊗ 62	⊗ 74
Near-Parabolic Comets	🟡 3	🟢	🟢	⊗ 33	🟡 48	🟢	🟢
Random Perihelion Directions	🟢 4	🟢	🟡 24	⊗ 34	🟡 49	🟡 63	⊗ 75
No Incoming Hyperbolic Orbits	🟢	🟢	🟢	⊗ 35	⊗ 50	🟢	🟢
Small Perihelions	🟢	🟢	⊗ 25	⊗ 36	⊗ 51	⊗ 64	⊗ 76
Orbit Directions and Inclinations	🟢 5	🟢	⊗ 24	🟡 37	🟢	🟡 63	⊗ 75
Two Separate Populations	🟢 5	🟢	🟢	⊗ 38	⊗ 52	🟢	🟢
Jupiter's Family	🟢 6	⊗ 15	🟢	⊗ 39	⊗ 53	⊗ 65	⊗ 77
High Loss Rates of Comets	🟢	🟢	🟡 26	🟢	⊗ 54	🟢	🟢
Composition	🟢 7	🟡 16	⊗ 27	🟡 40	🟡 55	🟡 66	🟡 78
Heavy Hydrogen	🟢 7	🟢	⊗ 27	⊗ 30	⊗ 45	⊗ 67	⊗ 79
Small Comets	🟢 8	🟡 17	⊗ 28	⊗ 41	⊗ 56	⊗ 68	⊗ 80
Missing Meteorites	🟢	⊗ 18	🟢	🟢	🟢	🟡 69	🟡 81
Recent Meteor Streams	🟢 9	🟡 19	🟡 29	🟡 42	🟡 57	🟡 70	🟡 82
Crater Ages	🟢 9	⊗ 20	🟢	🟡 43	⊗ 58	🟢	🟢
Other	🟢 10–12	⊗ 21		⊗ 44	⊗ 59	⊗ 71	

Key:
🟢 Theory explains this item.
🟡 Theory has moderate problem with this item.
⊗ Theory has serious problems with this item.
Numbers in this table refer to amplifying explanations on pages 283–292.

Table 15 summarizes how well each modern theory explains the many strange things associated with comets. Each column corresponds to a theory, and each row represents a detail that requires an explanation. A green circle means that, in my opinion, the column's theory reasonably explains that row's diagnostic detail. Yellow and red circles indicate moderate and serious problems, respectively. Numbers in Table 15 refer to additional information below. Table 15 shows both details and the broad perspective—"the trees *and* the forest."

Details Relating to the Hydroplate Theory

1. 🟢 ***Formation Mechanism,*** 🟢 ***Ice on Moon and Mercury.*** About 38% of a comet's mass is frozen water. Therefore, to understand comet origins, one must ask, "Where is water found?" Earth, sometimes called "the water planet," must head the list. (The volume of water on Earth is ten times greater than the volume of all land above sea level.) Other planets, moons, and even interstellar space[83] have only traces of water, or possible water. Some traces, instead of producing comets, may have been delivered by comets or by water vapor that the fountains of the great deep launched into space.

How could so many comets have recently hit the Moon, and probably the planet Mercury, that ice remains today? Ice on the Moon, and certainly on hot Mercury, should disappear faster than comets deposit it today. However, if the material that formed 50,000 comets were ejected recently from Earth and an "ocean" of water vapor was injected into the inner solar system, the problem disappears. On Mars, comet impacts created brief saltwater flows, which then carved "erosion" channels. [See Figure 167 on page 317.]

> **PREDICTION 24:** Soil in "erosion" channels on Mars will contain traces of earthlike soluble compounds, such as salt, from Earth's preflood subterranean chambers. Soil far from "erosion" channels will not. (This prediction was first published in April 2001. Salt was first discovered on Mars in March 2004.[84])

To form comets in space, should we start with water as a solid, liquid, or gas?

Gas. In space, gases (such as water vapor) will expand into the vacuum if not gravitationally bound to some large body. Gases by themselves would not contract to form a comet. Besides, the Sun's ultraviolet radiation breaks water vapor into hydrogen (H), oxygen (O), and hydroxyl (OH). Comets would not normally form from gases.

Solid. Comets might form by combining smaller ice particles, including ice condensed as frost on microscopic dust grains that somehow formed. However, one icy dust grain could not capture another unless their speeds and directions were nearly identical and one of the particles had a rapidly expanding sphere of influence or a gaseous envelope. Because ice molecules are loosely bound to each other, collisions among ice particles would fragment, scatter, and vaporize them—not merge them.

Liquid. Large rocks and muddy water were expelled by the fountains of the great deep. The water would partially evaporate, leave dirt behind, rapidly radiate its heat to cold outer space, and freeze. (Outer space has an effective temperature of nearly absolute zero, -460°F.) The dirt crust encasing the ice would prevent complete evaporation. (Recall that the nucleus of Halley's comet was black, and a comet's tail contains dust particles.)

High-velocity water escaping from the subterranean chamber would erode dirt and rocks of various sizes. Water vapor would concentrate around the larger rocks escaping from Earth. These "clouds" and expanding spheres of influence would capture other nearby particles moving at similar velocities. Comets would quickly form.[85]

Other reasons exist for concluding that water in a gas or solid state cannot form comets.[86] Water from the fountains of the great deep meets all requirements.

2. Crystalline Dust. Sediments eroded by high-velocity water escaping from the subterranean chamber would be crystalline, much of it magnesium-rich olivine.

3. Near-Parabolic Comets. Because the same event launched all comets from Earth, those we see falling from the farthest distance (near-parabolic comets) are falling back for the first time and with similar energy. Other comets, launched with slightly more velocity, will soon be detected.

The comets represented by the tall red bar in Figure 152 on page 277 have the largest range of aphelions and, therefore, should include more comets than are represented by all the blue bars.

> **PREDICTION 25:** Some large, near-parabolic comets, as they fall toward the center of the solar system for the first time, will have moons. Tidal effects may strip such moons from their comets as they pass the Sun. (A moon may have been found orbiting incoming comet Hale-Bopp.)[87]

If the red bar simply represented comets falling in from 50,000 AU (as claimed by the Oort Cloud theories), they would have orbital periods that are about 4 million years. How then could they have been launched from anywhere in the solar system if the flood began only about 5,000 years ago?

The distance (50,000 AU) is in error. Comets more than about 12 AU from the Sun cannot be seen, so both the distances they have fallen and their orbital periods must be calculated from the small portions of their orbits that can be observed. Both calculations are extremely sensitive to the mass of the solar system. If this mass has been underestimated by *as little as* about 17 parts in 10,000 (about the mass of two Jupiters), the true distance would be 585 AU and the period only 5,000 years.[88]

Where might the missing mass be hiding? Probably not in the planetary region. The masses of the Sun, planets, and some moons are well known, because masses in space can be accurately measured if something orbits them and the orbit is closely observed.[89] However, if extra mass is thinly spread within 40–600 AU from the Sun (beyond Pluto's orbit), only objects outside 40 AU would be gravitationally affected. (Recall the hollow sphere result on page 273.) That mass, depending on its distribution, could considerably shorten the periods of near-parabolic comets, because they spend 99% of their time at least 40 AU from the Sun.

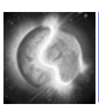
Comet Ikeya-Zhang travels about 100 AU from the Sun and last returned to the inner solar system in March 2002. It is the one periodically observed comet that ventures most deeply into this region, 40–600 AU from the Sun. Its previous return was in January 1661, 341.13 years earlier. However, its orbital period, based on the accepted mass of the solar system, should have been 366.95 years. The simplest explanation for this 25.82-year discrepancy is that some extra mass lies at least 40 AU from the Sun.

Comet Herschel-Rigollet, with the second longest period, travels 57 AU from the Sun. It last returned in August 1939, 4.2 years ahead of schedule based on the traditional mass of the solar system. It too seems to have encountered extra mass beyond 40 AU.[90]

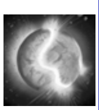
What if two comet sightings, a century or more apart, were of comets which we assumed had such long periods that they should not be the same comet, but whose orbits were so similar they probably *were* the same comet? We might suspect that both sightings were of the same comet, and it encountered some extra mass beyond 40 AU that pulled it back much sooner than expected. Twelve "strange pairs" are known, suggesting that extra, unseen mass beyond Pluto's orbit affects long-period comets but is not felt within the planetary region. These "strange pairs" are explained in Figure 153 and Table 13.

This "missing" mass could be composed of particles as small as gas molecules or as large as asteroid-size objects 100 miles wide. They would be difficult to detect with our best telescopes. However, with recent technical advances, dozens of large, asteroid-size objects are being discovered each year beyond Neptune's orbit. They are called *trans-neptunian objects*. More than 1,300 have been discovered. Of course, no one knows their total number or mass or the total mass of the smaller objects among them.

Much is unknown about the distant region 40–600 AU from the Sun. For example, spacecraft launched from Earth decades ago are now entering that region's inner fringes. These spacecraft are experiencing a slight, but additional, gravity-like acceleration toward the Sun. So far, efforts to explain this acceleration have failed. While its magnitude is too small to give near-parabolic comets 5,000-year periods, the effect is strengthening as the spacecraft begin to penetrate this region.[91]



PREDICTION 26: The mass of about 70 Jupiters (6–7% of the solar system's mass) is distributed 40–600 AU from the Sun.[88]



PREDICTION 27: Because the solar system is slightly "heavier" than previously thought, some strange comet pairs listed in Table 13 are the same comet seen on successive orbits. More "strange pairs" will be found each decade. The comet sightings of 1785 and 1898 were probably of the same comet. [See Table 13.] If so, it will return in about 2012.

4. ● Random Perihelion Directions. Comets were launched in all directions, because the rupture encircled the rotating Earth and crossed high and low latitudes.

5. ● Orbit Directions and Inclinations, ● Two Separate Populations. A ball tossed in any direction from a high-speed train will, to an observer on the ground, initially travel almost horizontally and in the train's direction. Likewise, low-velocity cometary materials launched in any direction from Earth received most of their orbital velocity from Earth's high, prograde velocity (18.5 miles per second) about the Sun. Earth, by definition, has zero angle of inclination. This is why almost all short-period comets, those launched with low velocity, are prograde and have low angles of inclination.

Cometary materials launched with greater velocities than Earth's orbital velocity traveled in all directions. They formed long-period comets with randomly inclined orbital planes. Prograde cometary materials launched with the highest velocities escaped the solar system, because they had the added velocity of Earth's motion. This is why so many of the remaining long-period comets are retrograde. [See Table 12 on page 275.] (Almost all other bodies orbiting the Sun are prograde: planets, asteroids, meteoroids, and short-period comets.)

While this explains how two populations formed, one must ask if comets could be launched from Earth with enough velocity to blast through the atmosphere, escape Earth's gravity, and enter large, even retrograde, orbits. To learn the answer, one must first recognize the huge, mind-boggling energy in the subterranean water, which, in turn, requires understanding tidal pumping and supercritical water—explained on page 124 and pages 488–489.

To escape Earth's gravity and enter only a circular orbit around the Sun requires a launch velocity of 7 miles per second. However, to produce near-parabolic, retrograde orbits requires a launch velocity of 32 miles per second! Earth's atmosphere would offer comparatively little resistance at such speeds. In seconds, the pulsating, jetting fountains would push the thin atmosphere aside, much as water from a fire hose quickly penetrates a thin wall.

Water pressurized by only the weight of 10 miles of rock would launch comets from Earth's surface at a mere 0.5 mile per second. However, calculations show that other powerful effects, including water hammers and expanding gases from supercritical water, would do the job. [See **"Energy in the Subterranean Water"** on pages 490–495.]

Water Hammers. During the early days of the subterranean chamber's collapse, giant water hammers would create enormous pressures. Today, water hammers occur, often with a loud bang, when fluid flowing in a pipe is suddenly stopped (or slowed) by a closing (or narrowing) *valve*—a device, such as a faucet, that controls the flow. A water hammer is similar to the collision of a long train with an immovable object. The faster and more massive the train (or volume of water), the greater the compression (or pressure jump) throughout the pipe. A water hammer concentrates energy, just as a hammer striking a nail concentrates energy. A moving hammer can produce

What Is *Flutter*?

Flutter occurs when a fluid (a liquid or gas) flows over a relatively thin, solid surface, such as the wing of an airplane or a flat plate, and initiates a vibration. If (a) the flowing fluid continually "thumps" or pushes the flexible surface back toward its neutral position, and (b) the "thumping" frequency approaches any natural frequency of the wing or plate, large, potentially damaging oscillations can occur. This is called *flutter*.

Water beneath the crust allowed the crust to vibrate, and a hydroplate's large area gave it great flexibility. Flowing water below the vibrating crust would have produced water hammers that "thumped" the crust at *each* of its natural frequencies. Undulations would have rippled throughout the crust, producing other water hammers, more undulations, pulsations in the fountains, and, of course, huge surface waves.

forces many times greater than a resting hammer. The subterranean chamber acted as the pipe.

Once the water began to escape upward through any crack, a chain reaction would begin. Pillars (explained in Figure 54 on page 122) would be forced to carry more and more of the crust's weight, because the subterranean water carried less. Therefore, pillars nearest the rupture would start collapsing first. Adjacent pillars, suddenly carrying additional loads, would also collapse like a house of cards. The crust would vibrate (flutter) in complex, wavelike patterns, like a flag held horizontally in a strong wind. Each narrowing of the chamber's thickness would, in effect, partially close a valve, slow trillions of tons of water, and create a water hammer.

Forces familiar to us will not compress water much. However, the weight of 10 miles of rock resting on the trapped subterranean water would compress it by about 14%.[92] Water, compressed by the vibrating crust, would act as trillions of springs. Those "springs" and the massive fluttering crust would have primary vibrational periods of about a minute. In other words, vibrations closed "valves," which created water hammers, which created more vibrations, etc. Most people have heard water pipes banging or have seen pipes burst when only a few cubic feet of water were slowed. Imagine the excruciating pressures from rapidly slowing a "moving underground ocean."[93]

6. ● ***Jupiter's Family.*** A bullet fired straight up slows to almost zero velocity near the top of its trajectory—its farthest point from Earth. A comet also moves very slowly near its aphelion. If a comet's aphelion is ever near Jupiter during any orbit, Jupiter's large gravity will pull the nearly stationary comet steadily toward Jupiter. Because a comet spends a relatively long time near its farthest point, Jupiter's gravity acts strongly for an equally long time, gently pulling the nearly stationary comet toward Jupiter's orbit. Even a comet's orbital plane is slowly but steadily aligned with Jupiter's. Thus, aphelions of short-period comets tend to be pulled toward Jupiter's nearly circular orbit, regardless of whether the aphelion is inside, outside, above, or below that circle. The closer a comet's aphelion is to Jupiter's orbit, the more likely it is that the comet will be rapidly drawn toward Jupiter's orbit. [See Figure 154.]

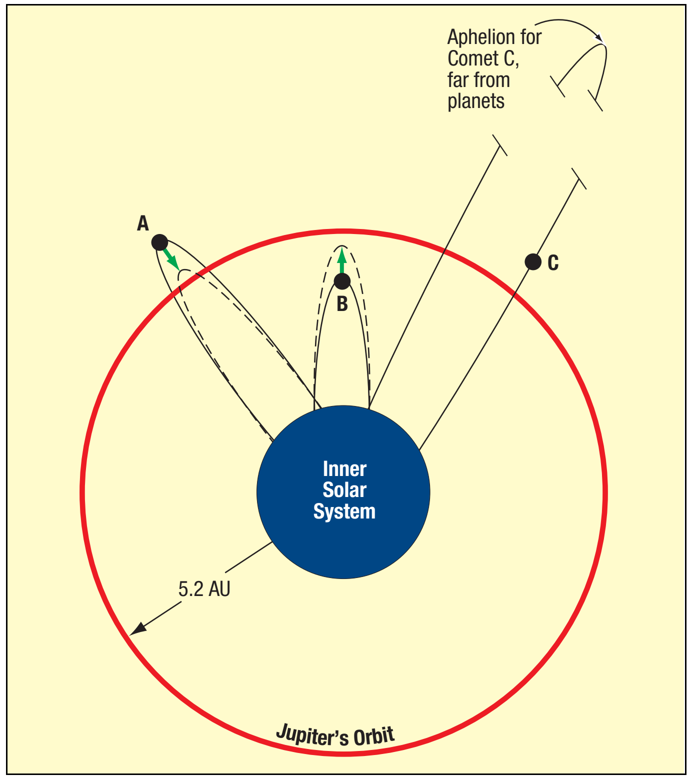


Figure 154: Adoption into Jupiter's Family of Comets. If comets were launched from anywhere in the inner solar system, many, such as comets A and B, would have aphelions within a few astronomical units (AU) of Jupiter's orbit. Comets spend much of their time near aphelion, where they move very slowly. There they often receive gentle gravitational pulls (green arrows) of long duration, toward Jupiter's orbit, 5.2 AU from the Sun.

Comet C's aphelion is far beyond the outermost planet. (At this figure's scale and based on any Oort cloud theory, Comet C would be 1/5 mile from where you are sitting.) Comet C steadily gains speed as it falls toward the inner solar system for thousands of years, crossing Jupiter's orbit at tremendous speed. To slow C down enough to join Jupiter's family would require such powerful forces that the comet would be torn apart, as shown in Figure 148 on page 274. (Comets are fragile.) Could many smaller gravitational encounters pull C into Jupiter's family? Yes, but close encounters are rare, and about half of these encounters would speed the comet up and probably throw it out of the solar system. Once in Jupiter's family, the average comet has a life expectancy of only ***about 12,000 years.***[29]

Clearly, comets must have originated recently from the inner solar system (the home of the Sun, Mercury, Venus, Earth, and Mars) to join Jupiter's family. Such comets could not have come from far beyond Jupiter's orbit.

One can think of Jupiter's mass as being spread out in a hoop that coincides with Jupiter's orbit. (This "hoop analogy" simplifies the analysis of many long-term gravitational effects.) Comets feel more pull toward the nearest part of the hoop.

My statistical examination of all historical sightings of every orbit (almost 500) of every comet in Jupiter's family confirms this effect. The hydroplate theory places the source of comets at Earth—well inside Jupiter's orbit. Therefore, many comets reach their slowest speeds within a few astronomical units of Jupiter's hoop. Thousands of years of gentle gravitational tugs by this hoop have gathered Jupiter's family. Although Jupiter sometimes destroys comets or ejects them from the solar system, many comets in its family remain, because they were recently launched. A similar but weaker effect is forming Saturn's family. [See Figure 149.]

7. Composition, Heavy Hydrogen. When the fountains of the great deep erupted, rocks were crushed, eroded, and sometimes reduced to clay. Mixed with that debris was carbonate-rich, salty, subterranean water (containing sodium, because salt, NaCl, contains sodium). Organic compounds—including methane, ethane, and the amino acid glycine—are found in comets,[1] because that water contained pulverized vegetation from preflood forests (as well as bacteria and other traces of life) from within hundreds of miles of the globe-encircling rupture.

Comets are rich in heavy hydrogen, because the water in the subterranean chambers was isolated from other water in the solar system. Our oceans have half the concentration of heavy hydrogen that comets have. So, if half the water in today's oceans came from the subterranean chambers (as assumed on page 123), then almost all heavy hydrogen came from the subterranean chambers.

PREDICTION 28: Excess heavy hydrogen will be found in salty water pockets five or more miles below the Earth's surface.

Page 278 lists six surprising materials discovered on comet Tempel 1 by the Deep Impact mission in 2005. Only the hydroplate theory seems to explain the fluffy, porous texture of comets, and items a–e on page 278: crystalline silicates, clays, calcium carbonates, organic material, sodium, oxygen, and, of course, liquid water. Dust particles brought back to Earth by the Stardust Mission in 2006 were also crystalline and contained "organics" and "water."

Item f (thick surface layers of very fine dirt with the consistency of talcum powder) is probably *loess*, a type of dirt composed of fine particles in the muddy ice that formed comets. Each time Tempel 1 came near the Sun in its 5½-year orbital period, more of the ice on the comet's surface sublimated, leaving behind the embedded powdery dirt. Loess is described in more detail on pages 245 and 250.

PREDICTION 29: Spacecraft landing on a comet's nucleus will find that comets, and therefore bodies bombarded by comets, such as Mars, contain loess, salt, and traces of vegetation and bacteria.

8. Small Comets. Muddy droplets launched with the slowest velocities could not move far from Earth, so their smaller spheres of influence produced small comets. Their orbits about the Sun tend to intersect Earth's orbit more in early November than mid-January. Because small comets have been falling on Earth for only about 5,000 years, little of our oceans' water came from them—or from any comets. Few small comets can reach Mars.

9. Recent Meteor Streams, Crater Ages. Disintegrating comets produce meteor streams. If meteor streams were older than 10,000 years, the particles in them would be sorted by size. [See **"Poynting-Robertson Effect"** on page 42.] Because this is not seen, meteor streams and comets must be younger than 10,000 years. Only the hydroplate theory claims that comets began this recently. Impact craters on Earth are also young.

10. Other/Enough Water. Did the subterranean chamber have enough water to produce all the comets the solar system ever had?

Consider these facts. The oceans contain 1.43×10^9 cubic kilometers of water. Also, Marsden and Williams' *Catalogue of Cometary Orbits* (1996 edition) lists 124 periodic comets—comets observed on at least two different passages into the inner solar system. (Halley's comet, for example, has been observed on 30 consecutive orbits dating back to 239 B.C.) In recorded history, 790 other comets have been observed with enough detail to calculate orbits. So, we know of 914 comets. (Small comets and fragments of a few comets that have been torn apart by passing too close to the Sun are numerous. However, their mass is only about 1% of the mass of all known comets combined, so they will not be considered here.)

Some comets escaped from the solar system—either directly at launch, or later when perturbed by a planet's gravity. Other comets have never been counted, because they never came close enough to Earth in modern times to be seen, or because they collided with the Sun or a planet. So, let's presume that 50,000 comets were launched.

The average radius of a short-period comet nucleus is about 4.9 kilometers.[94] If comet Tempel 1 (the most accurately measured comet as of this writing) is typical of all comets, then a comet nucleus is about 38% water by mass and has a density of about 0.62 gram per cubic centimeter.[4] If the subterranean chamber contained half of the water now in the oceans, then less than one-hundredth of the subterranean water was expelled as comets.

$$\frac{50{,}000\left(\frac{4}{3}\right)\pi\,(4.9\text{ km})^3\left(0.62\,\frac{\text{gm}}{\text{cm}^3}\right)(0.38)}{\frac{1}{2}\times 1.43\times 10^9\text{ km}^3\left(1.00\,\frac{\text{gm}}{\text{cm}^3}\right)} = 0.0081 = \frac{1}{123}$$

With such a small fraction of the available water required, the material that formed comets could have easily come from Earth.

11. Other/Death and Disaster. Comets, launched at the onset of the flood, are being steadily removed from the solar system. For centuries after the flood, comets would have been seen much more frequently than today. Some must have collided with Earth, just as Shoemaker-Levy 9 collided with Jupiter in 1994. People living soon after the flood would have seen many comets grow in size and brightness in the night sky over several weeks. Some of those frightening sights would have been followed by impacts on Earth, daytime skies darkened with water vapor dumped by comets, and dramatic stories of localized destruction. *Somehow, memories of these experiences spread worldwide.* Perhaps the founders of different cultures learned from their ancestors that comets were first observed right after the flood, so comets became associated with death and disaster worldwide—hence the word "disaster": *dis* (evil) + *aster* (star).

12. Other/Near Side of Moon. Moonquakes, lava flows, and large multiringed basins are concentrated on the side of the Moon now facing Earth. [See Figure 147 on page 273 and Figure 155.] Before the flood, the Moon's spin was probably faster. For years after the flood, large rocky debris, launched from Earth and orbiting the Sun, often intersected Earth's orbit, so many extremely high-velocity impacts occurred during the fraction of the Moon's orbit in which the Moon traveled in the opposite direction to that debris flow. The largest, most frequent, and most powerful impacts (perhaps occurring in only a few days) probably impacted the Moon's leading side, altered the Moon's spin balance, causing the heavily impacted side of the Moon to oscillate like a decaying pendulum swinging above the earth. Eventually, tidal stretching removed most of that spin energy, so the oscillations subsided and the denser, heavier side of the Moon now always faces Earth. (Five large, dense mass concentrations, called *mascons*, were discovered in 1968 just below the surface on today's near side of the Moon.[95])

The Moon has been heavily bombarded. If these impacts removed only 2% of the Moon's orbital energy, then, before the flood, the Moon's orbital period would have been 30 days, as viewed from Earth. A 30-day period, coupled with the preflood 360-day year (as explained on page 155 and Endnote 23 on page 169), would have provided excellent clocks for everyone on Earth. [See **"Did the Preflood Earth Have a 30-Day Lunar Month?"** on page 485.]

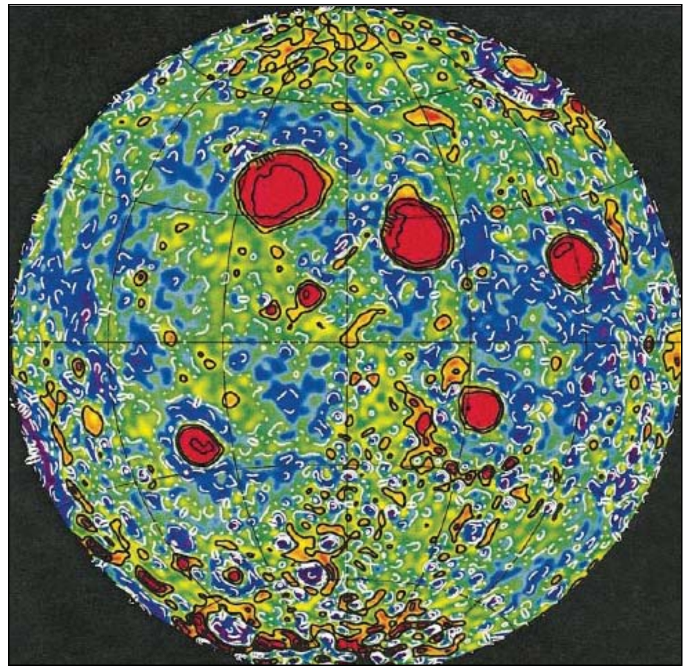


Figure 155: Mascons. Five prominent and dense concentrations of mass are on the side of the Moon that today always faces the Earth. (None on the far side of the Moon's are comparable.) This map shows how the Moon's gravity varies over its surface. Red indicates unusually strong gravity. Obviously, the Moon received five extremely powerful impacts. Rarely would five impacts be concentrated so close to each other unless the impactors were traveling on similar paths and struck the Moon at about the same time.

Note: From here to page 292, the reader may wish to examine only discussions concerning theories of personal interest.

Details Relating to the Exploded Planet Theory

13. Formation Mechanism. Explosions produce a wide range of fragment sizes. Rock fragments from an exploded planet would vary from the size of dust up to maybe a quarter of the planet itself. The rocks seen in comets and on asteroids are much more uniform in size. Also, comet dust is mixed uniformly within comet ice. How would a planet, before exploding, have dust mixed within its water?

14. Ice on Moon and Mercury. It is highly unlikely that billions of tons of ice from a distant explosion 3,200,000 years ago would still survive and be found in craters on the Moon and Mercury.

15. Jupiter's Family. If comets suddenly formed 3,200,000 years ago, why would the comets in Jupiter's family now have life spans of only about 12,000 years?

16. ◯ ***Composition.*** If comets formed as this theory claims, why would they have organic matter, including methane and ethane? Vegetation and bacteria could not originate in the cold, dim asteroid belt, 2.8 AU from the Sun. This theory does not explain any of the discoveries of the Stardust mission or the six discoveries of the Deep Impact mission listed on page 278.

17. ◯ ***Small Comets.*** Comets originating 2.8 AU or farther from the Sun 3,200,000 years ago would not concentrate small comets at Earth's orbit today. Certainly, they would not tend to strike Earth ten times more frequently in early November than in mid-January.

18. ⊗ ***Missing Meteorites.*** If comets are as old as this theory claims, many more iron meteorites should have been found deeper below the Earth's surface.

19. ◯ ***Recent Meteor Streams.*** See item 9 above.

20. ⊗ ***Crater Ages.*** If a planet exploded 3,200,000 years ago, many craters on Earth should have corresponding ages. Even if one accepts evolutionary dating techniques, craters do not cluster at that age, or at any age.[96]

21. ⊗ ***Other/Scattering.*** The total mass of all asteroids is only about 0.044% (about 1/2,300) of the Earth's mass. Combining all asteroids would hardly produce a planet.

Exploding and dispersing a typical planet requires enormous energy.[97] Even if a planet composed of pure TNT suddenly exploded, it would collapse back upon itself because of the large, mutual gravitational attraction of all its pieces. Napier and Dodd have shown that no known chemical, gravitational, or plausible nuclear source of energy appears capable of exploding and scattering any known planet.[98] A head-on collision between two planets at 2.8 AU could provide the needed energy but would not evenly disperse comet-size chunks or give them the energy distribution shown in Figure 152 on page 277.

Details Relating to the Volcanic Eruption Theory

22. ⊗ ***Formation Mechanism,*** ⊗ ***Crystalline Dust.*** The giant planets, primarily big balls of frigid gas, have little dust and are too cold to have powerful volcanoes.

23. ⊗ ***Ice on Moon and Mercury.*** Same as item 14.

24. ◯ ***Random Perihelion Directions,*** ⊗ ***Orbit Directions and Inclinations.*** A few, relatively brief, volcanic eruptions from planets or moons would launch primarily prograde comets in specific directions with similar orbital planes and perihelion directions. Instead, about half the long-period comets are retrograde and have randomly oriented orbital planes and perihelions.

The most violent volcanic eruption seen anywhere in the solar system occurred not on Earth, but on Io (EYE-oh), a moon of Jupiter. The energy released was less than a thousandth of that needed to launch even a few comets from Io. Besides, Io was expelling sulfur dioxide, not water.[99] Volcanic eruptions would lose too much energy in passing up through narrow conduits and vents. High pressures can only build up in a solid—not in a gaseous planet.

25. ⊗ ***Small Perihelions.*** Long-period comets have perihelions concentrated in the 1–3 AU range. Had they been launched from a giant planet (those lying 5–30 AU from the Sun), their perihelions would be farther from the Sun.

26. ◯ ***High Loss Rates of Comets.*** Vsekhsvyatsky, this theory's leading advocate, by assuming billions of years of comet accumulation, estimated that at least 10^{20} grams of comets are expelled *from the solar system* each year.[100] Other cometary material should have been lost by evaporation and collisions. On Earth, all volcanoes combined eject only about 3×10^{15} grams of material *into the atmosphere* each year.[101] Therefore, according to this theory, cometary material is being lost from the solar system thousands of times faster than Earth's volcanoes are ejecting material only a few miles above Earth's surface.

Matter expelled from a planet or moon might later collect gravitationally into a comet if a large amount of it traveled together. However, volcanoes eject small amounts of matter over wide angles. Ejected material must also travel far enough from the planet to have a large sphere of influence. For the giant planets, this is difficult. Jupiter's escape velocity, for example, is 38 miles per second. Astronomers have never seen matter being permanently expelled from a giant planet.

27. ⊗ ***Composition,*** ⊗ ***Heavy Hydrogen.*** The giant planets are primarily gas—hydrogen and helium. Those planets do not have the higher concentrations of heavier elements that are in comets. The ratio of heavy hydrogen to normal hydrogen in comets is 20 times greater than in Jupiter and Saturn. If oxygen, carbon, silicon, magnesium, nitrogen, sodium, and other relatively heavy elements in comets came from any giant planets, they must have come from deep within, where they would sink. Eruptions from deep within gaseous planets would be easily suppressed by viscous drag. If comets came from any giant planets or their barren moons, why would comets have organic compounds, such as methane, ethane, and the amino acid glycine? This theory does not explain any of the six discoveries of the Deep Impact mission listed on page 278.

28. ⊗ ***Small Comets.*** See item 17.

29. ◯ ***Recent Meteor Streams.*** See item 9 on page 287.

Details Relating to the Original Oort Cloud Theory

30. ⊗ Formation Mechanism, ⊗ Heavy Hydrogen. According to this theory, comets, as well as the rest of the solar system, began as a cloud of dust and gas (including water vapor) orbiting the Sun. If so, the ratio of heavy hydrogen to normal hydrogen in comets should be typical of the rest of the solar system; instead, it is 20 times greater.

Supposedly, solar radiation never broke apart (or *dissociated*) the water vapor, because it was shielded by dust particles. Water vapor could then condense as frost on the dust. However, in a virtual vacuum, dust particles coated with ice would have tiny, relatively fixed spheres of influence, so they would not capture each other to form larger clusters—let alone comets—even over billions of years. Instead, rare collisions would scatter particles held together by their weak mutual gravity. No experimental evidence has shown how, in the vacuum of space and in less than several billion years, billions of tons of particles can merge into even one comet—much less 10^{12} comets. (A similar problem exists for planets.) Also unexplained is how interstellar dust formed.

31. ⊗ Ice on Moon and Mercury. Same as item 14.

32. ⊗ Crystalline Dust. Dust that formed in outer space should be noncrystalline. Comet dust is crystalline. Therefore, comet dust did not form in outer space as this theory assumes.

33. ⊗ Near-Parabolic Comets. If comets have been falling in from an Oort cloud for only a few million years, let alone since the solar system supposedly evolved 4.5 billion years ago, many long-period comets should be coming in for the second, third ... or one hundredth time. There is a recognized lack of such comets. [See Figure 152 on page 277.]

Some believe we do not see second-pass comets because the Oort cloud was perturbed recently. This overlooks the presence of many comets in Jupiter's family and the absence of a perturbing star. [See Item 44 below.]

34. ⊗ Random Perihelion Directions. If a passing star did stir up the Oort cloud, causing many comets to fall toward the Sun, comet perihelions should cluster on one side of the Sun. Actually, comet perihelions lie on all sides.[102]

35. ⊗ No Incoming Hyperbolic Orbits. If passing stars or other gravitational disturbances "shake" comets from an Oort cloud, some of those comets should have obvious hyperbolic orbits as they enter the planetary region. None has been reported, so there is probably no Oort cloud.

Comets that formed around other stars should also be ejected by any passing stars. Such interstellar comets should enter our solar system every year or two—on hyperbolic orbits. Because incoming comets with hyperbolic orbits have never been seen, the formation processes described above probably do not happen. Leading advocates of the Oort cloud theory acknowledge this problem.[34]

36. ⊗ Small Perihelions. Using the scale in Figure 154 on page 286, visualize comets in an Oort cloud $^1/_5$ mile from the blue circle (less than an inch in diameter) representing the inner solar system. Perturbations from a passing star would not be precise and delicate enough to cluster comet perihelions inside the relatively tiny blue circle.

Fernández[103] and Weissman[104] showed, using Oort cloud theories, that perihelions of near-parabolic comets would not cluster in the 1–3 AU range (inside "the blue dot"), yet they do. Instead, the number of perihelions would increase as their distance from the Sun increases.

37. ○ Orbit Directions and Inclinations. Explaining how planets evolved is difficult enough, but at least they have some common features such as prograde orbits in planes near the ecliptic—all within 40 AU of the Sun. Also, to evolve comets 50,000 AU from the Sun, moving in randomly oriented planes, and with some in retrograde orbits, would require even more mysterious processes. Most long-period retrograde comets that "evolved" into short-period comets should still be retrograde. Few short-period comets are retrograde.

Long-period comets are inclined at all angles and rarely become short-period comets. A slight majority of observed long-period comets are retrograde. However, almost all short-period comets are prograde *and* lie near Earth's orbital plane. Gravitational interactions with planets might decrease the periods, but are unlikely to change retrograde orbits at all inclinations into prograde orbits near Earth's orbital plane.

38. ⊗ Two Separate Populations. An Oort cloud only 10,000 AU away would be too tightly bound to the Sun to allow enough stellar perturbations for this theory to work. If the cloud were 50,000 AU away, passing stars and galactic clouds would disperse the Oort cloud in a few billion years. Fernández recommended a distance of 25,000 AU, because it allows the most comets to pass through the inner solar system after 4.5 billion years. Even if that much time were available, only about 1% of the short-period comets we see would be produced. Notice that 25,000 AU is inconsistent with Oort's 50,000–150,000 AU estimate that gave birth to this theory.

39. ⊗ Jupiter's Family. Comets falling in from 50,000 AU would reach very high speeds. The only way to slow them down enough to join Jupiter's family is by gravitational interactions with planets. However, tidal effects would tear most comets apart or fling them out of the solar system. Those that slowed down over many orbits would continually risk colliding with planets and moons while slowly vaporizing with each passage near the Sun. Few comets would join Jupiter's family.

Comets in Jupiter's family have an average life span of only about 12,000 years. They could not have accumulated over millions of years.

***40.* ○ *Composition*.** Same as item 16 on page 289.

41.* ⊗ *Small Comets. See item 17 on page 289.

42.* ○ *Recent Meteor Streams. See item 9 on page 287.

43.* ○ *Crater Ages. If an Oort cloud were populated with about 10^{12} comets 4.5 billion years ago, the Earth should have been heavily bombarded. The farther back in time, the greater the bombardment rate. Craters or other evidence of this bombardment should be increasingly visible in the deeper sedimentary rock layers. Craters are almost exclusively found in surface layers.

44.* ⊗ *Other/Missing Star. If a passing star deflected comets in an Oort cloud toward the Sun, where is that star? Our nearest star, Proxima Centauri, is 4.3 light-years away, or 270,000 AU. It, and the two stars gravitationally bound to it, could not have stirred up an Oort cloud, because they are moving *toward* the Sun, not away from it. A study that projected stellar motion back 10 million years found that no star would have come within 3 light-years of the Sun. Therefore, no star would have stirred up an Oort cloud 0.8–2.4 light-years away during the last 10 million years.[105]

Details Relating to the Revised Oort Cloud Theory

45.* ⊗ *Formation Mechanism,* ⊗ *Heavy Hydrogen. Same as item 30 on page 290.

46.* ⊗ *Ice on Moon and Mercury. Same as item 14 on page 288.

47.* ⊗ *Crystalline Dust. Same as item 32 on page 290.

48.* ○ *Near-Parabolic Comets. See item 33.

49.* ○ *Random Perihelion Directions. See item 34.

50.* ⊗ *No Incoming Hyperbolic Orbits. Same as item 35 on page 290.

51.* ⊗ *Small Perihelions. Same as item 36 on page 290.

52.* ⊗ *Two Separate Populations. Short-period comets might be explained if comets formed near the giant planets. However, this would not produce the number of needed near-parabolic comets. The average comet flung out toward an Oort cloud, but not expelled from the solar system, would end up far short of where the Oort cloud supposedly is.[106] [See Figure 152 on page 277.]

53.* ⊗ *Jupiter's Family. Comets in Jupiter's family have an average life span of only about 12,000 years. They could not have accumulated over millions of years.

54.* ⊗ *High Loss Rates of Comets. Several locations for cometary nurseries in the giant-planet region have been proposed. Oort favored the asteroid belt, between Mars and Jupiter, if such a nursery was needed to supply the Oort cloud. Later, Fernández showed that, if comets were born near Jupiter, Jupiter would expel too many from the solar system. To account for today's high loss rate of comets from an Oort cloud would require 10,000 Earth masses of comets in a Jupiter birthing region 4.5 billion years ago—"too large to consider it dynamically reasonable."[107] Jupiter would have to fling 30 times its mass out to the Oort cloud! No planet's energy and angular momentum could have done the job.[108]

Fernández favored the region between Uranus and Neptune as the place where comets were born and steadily flung out to the Oort cloud. This would require the least amount of cometary birthing material—about 17 Earth masses, the mass of Neptune. However, it is doubtful that Uranus and Neptune would have had the necessary energy and angular momentum.

Overcrowding is another problem. If so many comets began in the giant planet region, they would often collide and fragment. Only about 5% of the comets needed by an Oort cloud could have been delivered to the Oort cloud.[109]

Öpik raised a more serious problem. To form comets in the Uranus-Neptune region and then eject them out to an Oort cloud would require about 100 billion years—20 times the assumed age of the solar system.[110]

In 1950, Gerard Kuiper (KI-per) theorized that material that almost formed a planet should still exist beyond Neptune, 35–50 AU from the Sun.[111] This region, which some believe is filled with comets, is now called the *Kuiper Belt*. Kuiper thought that Pluto expelled the nursery's comets out to the Oort cloud. Later it was learned that Pluto's mass was much too small for the job.

Since 1992, ground-based telescopes and the Hubble Space Telescope have detected more than 1,000 large objects in the Kuiper Belt, a region that many had hoped was the source of comets in the solar system and in the Oort cloud. Later, it was realized that these objects were ten times too large (25–1,000 miles in diameter) to be comets and too few in number. A reexamination of that region of the sky by the Hubble Space Telescope has failed to detect a comet reservoir.[112]

***55.* ○ *Composition*.** Same as item 16 on page 289.

56.* ⊗ *Small Comets. See item 17 on page 289.

57. ○ ***Recent Meteor Streams.*** See item 9 on page 287.

58. ⊗ ***Crater Ages.*** This theory requires a comet nursery containing at least 10^{13} comets.[113] As the giant planets fling some comets out to an Oort cloud, other comets would frequently bombard Earth from close range. The farther back in time, the greater the bombardment rate. As with the original Oort cloud theory, craters from this intense bombardment should be increasingly visible the deeper one looks in Earth's sedimentary layers. Instead, craters are almost exclusively found in surface layers.

59. ⊗ ***Other/Missing Star.*** Same as item 44 on page 291.

Details Relating to the Meteor Stream Theory

60. ⊗ ***Formation Mechanism.*** Particles colliding in space tend to fragment, not merge.[114] Second, even if they always stuck together, they would grow very slowly—on the order of 3 billion years for gas to form particles only 10^{-5} cm in diameter.[115] Third, dust particles that formed this way would be more uniform in size than those in comets. Fourth, colliding ice particles would vaporize the weakly bound ice molecules, destroying, not forming, comets.

61. ⊗ ***Ice on Moon and Mercury.*** Same as item 14 on page 288.

62. ⊗ ***Crystalline Dust.*** Same as item 32 on page 290.

63. ○ ***Random Perihelion Directions,*** ○ ***Orbit Directions and Inclinations.*** Particles in meteor streams were supposedly formed by the same unknown process as particles that now compose planets. If so, meteoroids and comets would have prograde orbits near the ecliptic. However, 53% of the observed long-period comets are in retrograde orbits, and almost all are far from the ecliptic.

64. ⊗ ***Small Perihelions.*** Passing stars might perturb long-period comets, but comet perihelions would be scattered—not clustered, as they are, in the 1–3 AU range.

65. ⊗ ***Jupiter's Family.*** Same as item 53 on page 291.

66. ○ ***Composition***. Same as item 16 on page 289.

67. ⊗ ***Heavy Hydrogen.*** Comets have 20 times more heavy hydrogen than this theory would predict.

68. ⊗ ***Small Comets.*** See item 17 on page 289.

69. ○ ***Missing Meteorites.*** See item 18 on page 289.

70. ○ ***Recent Meteor Streams.*** See item 9 on page 287.

71. ⊗ ***Other/Scattering.*** Solar wind, the Poynting-Robertson effect, perturbations by planets, and tidal effects disperse particles in a meteor stream, preventing them from merging to become a comet.

As the water in a short-period comet evaporates into the vacuum of space, its dust particles remain in orbits similar to the comet's orbit. Thus, comets produce meteor streams, not the reverse.

Details Relating to the Interstellar Capture Theory

72. ⊗ ***Formation Mechanism.*** In space, small particles colliding at high speeds rarely stick together. Because these particles have tiny spheres of influence, they should hardly ever capture each other to form larger particles—let alone comets—even over billions of years. Besides, collisions, which would occur only rarely, would be more likely to *scatter* any grouping of particles held together by their weak mutual gravity than to form larger particles. No experimental evidence has shown how particles could merge or condense in the vacuum of space, or how they would produce such a wide range of sizes.

Even if billions of dust particles somehow stuck together to form pebbles, each pebble would be a long way from being the size of a comet. As the pebbles fell toward the Sun, their spheres of influence would shrink, not grow. Nor would gases surround each pebble to assist in capture. Therefore, they would not merge into larger clusters to form comets.

73. ⊗ ***Ice on Moon and Mercury.*** Same as item 14 on page 288.

74. ⊗ ***Crystalline Dust.*** Same as item 32 on page 290.

75. ⊗ ***Random Perihelion Directions,*** ⊗ ***Orbit Directions and Inclinations.*** If comets formed on a converging axis between the Sun and a colliding dust or gas cloud, as this theory proposes (page 282), perihelions and orbital planes should lie in specific directions; they do not.

76. ⊗ ***Small Perihelions.*** If long-period comets formed along a converging axis that extended perhaps 50,000 AU from the Sun, many should fall directly into the Sun from a specific direction. This is not observed.

77. ⊗ ***Jupiter's Family.*** Same as item 39 on page 290.

78. ○ ***Composition***. Same as item 16 on page 289.

79. ⊗ ***Heavy Hydrogen.*** Same as item 67 on page 292.

80. ⊗ ***Small Comets.*** See item 17 on page 289.

81. ○ ***Missing Meteorites.*** See item 18 on page 289.

82. ○ ***Recent Meteor Streams.*** See item 9 on page 287.

Another Possibility: Creation

Some might say that comets were created along with the Sun, Moon, and stars, but that view cannot by itself qualify as a scientific theory. Good scientific theories relate and explain, through well-established cause-and-effect relationships (the laws of physics), many otherwise strange observations. Little, if any, historical or scientific evidence supports *or refutes* the proposal that comets were created in the beginning. Such claims raise many questions about strange comet characteristics and patterns. The simplest explanation that is consistent with the laws of physics and explains many diverse, otherwise puzzling, observations is probably the best—regardless of the starting point. [See **"How Can the Study of Creation Be Scientific?"** on page 376.]

Final Thoughts

People are surprised at how many theories try to explain comet origins. Ironically, most theories explain the facts better than the theory currently in vogue—the Oort cloud theory. Having only one theory popularized or taught, usually as a fact, leads to its dominance and continuation as the only theory taught—despite a growing number of scientific problems.

Thomas Kuhn wrote the preeminent book on how science works.[116] In it, he shows that such monopolies continue in science, often for centuries, until startling new evidence arises along with a theory that better explains all the evidence. Then a slow reeducation process begins, accompanied by hostility from those whose income, power, pride, and prestige are rooted in the old theory or ***paradigm***.

If, as you drove across the country following a map, you found more and more details contradicting your map, you might suspect that you made a wrong turn somewhere. Admitting a mistake may be difficult, and backtracking and finding the correct road can consume time and fuel. In science, ***paradigm shifts*** are costly and slow, damage some reputations and businesses, and even destroy major worldviews of certain segments of society. Fundamental changes in thinking are strenuously resisted by some, but are inevitable if the scientific evidence supports those changes.

Theories must be based on evidence, but new evidence that helps explain comet origins is rare and expensive. In 2014, the European Space Agency hopes to have the *Rosetta* spacecraft orbit comet Churyumov-Gerasimenko, take measurements, and place instruments on it. If successful, *Rosetta* will provide the critical information needed to test many theories described in this chapter. The greatest advances in understanding usually come from testing conflicting predictions of better theories.[117] This will require landing softly on a comet and sending data and samples back to Earth.

New evidence spawns new theories, and the testing cycle begins again. However, when only one explanation is taught and seldom questioned, the cycle stops. In science, we should never think we have a final or proven answer.

References and Notes

1. Scott A. Sandford et al., "Organics Captured from Comet 81P/Wild 2 by the Stardust Spacecraft," *Science*, Vol. 314, 15 December 2006, pp. 1720–1724.

◆ Bill Steigerwald, "NASA Researchers Make First Discovery of Life's Building Block's in Comet," NASA Goddard Space Flight Center, 17 August 2009, www.nasa.gov/mission_pages/stardust/news/stardust_amino_acid.html.

2. *"We know that it is hard to find a comet* ***without*** *the spectral features of* C_2*,* C_3*, and CN in their comas. Huggins was struck by the fact that the material in the comets was similar to organic matter of unquestioned biological origin on Earth. Many scientists cautiously concluded that the carbon compounds found by Huggins* [in 1868] *in the comas of comets were, as one of his contemporaries wrote, 'the result of the decomposition of organic bodies.'"* [emphasis in original] Carl Sagan and Ann Druyan, *Comet* (New York: Ballantine Books, 1997), p. 148.

◆ *"Recent observations of comet celebrities Halley, Hale-Bopp and Hyakutake* [Hyah-koo-tah-kay] *revealed that these icy visitors are rife with organic compounds. In 1986 cameras on board the Giotto and Vega spacecrafts captured images of dark material on Halley's surface that resembles the coallike kerogen in some meteorites, and mass spectrometers caught glimpses of carbon-rich molecules. More recently, ground-based telescopes inspecting the coma and tail of comets Hyakutake and Hale-Bopp distinguished a number of specific organic compounds, including methane and ethane."* Max P. Bernstein et al., "Life's Far-Flung Raw Materials," *Scientific American*, Vol. 281, July 1999, p. 45.

3. If A and B have a similar and unusual characteristic, or they correlate, some might claim that A caused B. But maybe B caused A—or C caused A and B. Perhaps no cause-and-effect link exists. Many humorous stories, scams, and even misguided scientific efforts are rooted in this logical fallacy—seeing a relationship and, with no other information, claiming a specific cause and effect.

   Because (A) traces of organic molecules are found in comets, and (B) organic molecules are found in every living thing on Earth, did comets bring life to Earth (A caused B)? ***Maybe comets and organic molecules came from Earth*** (B caused A). We should consider all possibilities. Many who leap to conclude that comets explain life on Earth know how difficult it is to explain life originating by natural processes. Most authorities will privately admit that life is so complex that they can't imagine how it could form anywhere. [See pages 14–24.] Desperation may force this

poor logic—that comets brought life to Earth. But even if comets did, how did comets acquire life? It takes more than time and distance.

Be aware that organic molecules—which simply means molecules containing hydrogen plus carbon rings or chains—are as far from becoming life as bricks are from becoming the Empire State Building. Yes, bricks might form naturally in a dried-up stream bed, but I cannot imagine the Empire State Building forming by natural processes. *If you saw a large pile of bricks mixed with steel and glass, would you conclude that a building was evolving or had been destroyed?* Great intelligence is needed to produce life.

4. The Deep Impact space mission found that the nucleus of comet Tempel 1 had a density of 0.62 gm/cm^3 and was about 60% empty space. If the dirt's density was 2.7 gm/cm^3 and the ice's density was 0.92 gm/cm^3, it can be shown that about 38% of the comet, by mass, was water. [See M. F. A'Hearn et al., "Deep Impact: Excavating Comet Tempel 1," *Science*, Vol. 310, 14 October 2005, p. 262, and Richard A. Kerr, "Deep Impact Finds a Flying Snowbank of a Comet," *Science*, Vol. 309, 9 September 2005, p. 1667.]

5. G. Gloeckler et al., "Interception of Comet Hyakutake's Ion Tail at a Distance of 500 Million Kilometers," *Nature*, Vol. 404, 6 April 2000, pp. 576–578.

6. John Fleck, "Comets Showered Ice on Moon," *ABQ Journal of Science & Technology*, 3 September 1998, p. C3.

7. *"Infrared spectroscopic measurements of the lunar surface from* [three] *spacecraft provide unambiguous evidence for the presence of hydroxyl (OH) or water* [or both]*."* Paul G. Lucey, "A Lunar Waterworld," *Science*, Vol. 326, 23 October 2009, p. 531.

8. W. C. Feldman et al., "Fluxes of Fast and Epithermal Neutrons from Lunar Prospector: Evidence for Water Ice at the Lunar Poles," *Science*, Vol. 281, 4 September 1998, p. 1496.

9. David A. Paige, "Chance for Snowballs in Hell," *Nature*, Vol. 369, 19 May 1994, p. 182.

◆ *"Radar images of Mercury show evidence of polar frost on that fiery planet."* Andrew Lawler, "Planetary Science's Defining Moment," *Science*, Vol. 295, 4 January 2002, p. 34.

10. *"But the association of comets with catastrophe remains curiously steady through the generations."* Sagan and Druyan, p. 279.

◆ *"Here, as indeed among all peoples generally, comets are regarded as omens of disaster."* Fred Hoyle and Chandra Wickramasinghe, *Lifecloud* (New York: Harper & Row, Publishers, 1978), p. 99.

11. *"For unclear reasons, deep moonquakes seem largely confined to the side of the moon facing Earth."* Elizabeth Svoboda, "New Computers Uncover Old Quakes on the Moon," *Discover*, Vol. 27, January 2006, p. 38.

◆ Seismometers left on the Moon during each Apollo landing recorded 12,500 seismic events. Then, in 1977, NASA turned the seismometers off. The moonquakes have now been reanalyzed using more powerful methods. Conclusion: Even after making the most adverse assumptions, most deep moonquakes were on the near side of the Moon and were clustered near the central portion of the near side. [See Yosio Nakamura, "Farside Deep Moonquakes and Deep Interior of the Moon," *Journal of Geophysical Research*, Vol. 110, 18 January 2005, E01001.]

12. *"Astronomers were stunned by the first images of the moon's farside, captured by the Soviet spacecraft Luna 3 in 1959. The two hemispheres seemed like different worlds. The face we see* [on Earth] *has fewer large craters and far greater areas of smooth, dark, frozen lava. Nobody really knows why."* Bob Berman, "Worlds Out of Balance," *Discover*, Vol. 24, December 2003, p. 38.

◆ Shadows in Figure 147 accentuate craters near the day-night boundary and minimize the appearance of craters on the near side. However, the Moon's near side is smoother than the far side, for reasons given in Figure 147's caption.

13. A uniform ball of mass M and radius R has a moment of inertia about any diameter of 0.4000 MR^2. The Moon's polar moment of inertia is (0.3935 ± 0.0011) MR^2—almost the same. [See J. O. Dickey et al., "Lunar Laser Ranging: A Continuing Legacy of the Apollo Program," *Science*, Vol. 265, 22 July 1994, p. 487.] Of course, pressure and density must increase with depth. This accounts for the Moon's moment of inertia being slightly less than that of a uniform ball. Little room is left over for a light crust.

14. Nicholas M. Short, *Planetary Geology* (Englewood Cliffs, New Jersey: Prentice-Hall, 1975), p. 87.

15. *"In contrast, the far side* [of the Moon] *almost completely lacks maria."* Paul D. Spudis, "The New Moon," *Scientific American*, Vol. 289, December 2003, p. 89.

16. *"A major surprise in the early days of lunar exploration was the discovery that the soft maria visible from earth were far more rare on the moon's farside, presumably because of some one-sided influence of the earth. Now refinements of Mariner 9 data show one hemisphere of Mars to be far rougher than the other, and Mariner 10 suggests the same asymmetry for Mercury. Data files grow, observes Bruce Murray of the California Institute of Technology, yet so does the mystery of hemispherical asymmetry. 'We now know,' he says, 'a little less about the moon.'"* Jonathan Eberhart, "The Mystery of the Hemispheres," *Science News*, Vol. 105, 13 April 1974, p. 241.

17. Tiny beads of lunar basalt contain about 745 parts per million of water. As impacting comets and asteroids buried themselves deeply in what is now the Moon's near side, the water-ice in those impactors mixed with the instantly created magma. Minutes or hours later, some of that magma erupted as a spray of droplets. Water molecules (and carbon, sulphur, chlorine, and fluorine) were diffusing out of the droplets as they solidified. [See Alberto E. Saal et al., "Volatile Content of Lunar Volcanic Glasses and the Presence of Water in the Moon's Interior," *Nature*, Vol. 454, 10 July 2008, pp. 192–194.]

- The D/H ratio found in apatite grains brought back by the Apollo programs matches that of comets, not earth. [See J. P. Greenwood et al., "Water in Apollo Rock Samples and the D/H of Lunar Apatite," *Proceedings of the 41st Lunar and Planetary Science Conference,* 2 March 2010, No. 2439.]

18. M. Ozima et al., "Terrestrial Nitrogen and Noble Gases in Lunar Soils," *Nature*, Vol. 436, 4 August 2005, pp. 655–659.

19. Isaac Newton, "Of the Attractive Forces of Spherical Bodies," Proposition LXX, Theorem XXX, Section XII, Book I, *The Principia* (1687; reprint, Amherst, New York: Prometheus Books, 1995), p. 154. The shell must have uniform thickness and density.

20. An oxygen tank that exploded soon after lift-off forced the Apollo 13 astronauts to abort their mission. Instead of landing on the Moon, they looped around the Moon and executed a tricky reentry back to Earth. Ground controllers had difficulty tracking the spacecraft by radar, because a cloud of urine orbited and partially hid the spacecraft. The astronauts were then told to hold all waste liquid in onboard containers. Today, astronauts avoid this problem by dumping waste material overboard just before igniting their rocket thrusters. Gravity, even that of a spacecraft, a rock, or a water droplet, acts on everything.

21. It can be shown that the radius of a sphere of influence (SoI) of a spherical rock of radius r is about

$$0.65\left(1+\frac{h}{R}\right)r$$

where R is the Earth's radius and h is the rock's height above the Earth.

When *many* particles (rocks, dirt, ice, and water molecules, all moving away from Earth) interact and exchange momentum, their velocities become more similar. The effective SoI of the combined mass increases greatly, and most of those particles will eventually merge.

22. An extremely rare exception might occur if one body strikes the other with a very delicate glancing blow. Another exception would be if a third particle passing by had just the right mass, speed, direction, and position so that its gravitational attraction could slow the droplet enough to cause capture. However, impacts and interfering third bodies are much more apt to cause scattering than capture.

23. Every body, even a dust particle or a star, has an ***escape velocity***—that is, the slowest speed needed from a specified point to escape that body and go to infinity. For Earth, from its surface, that speed is 11.2 km/sec (7.0 mi/sec). For something at the surface of the Sun to escape the solar system, it is 617.2 km/sec (383.5 mi/sec). For something 1 AU from the Sun to escape the solar system requires 42.3 km/sec (26.3 mi/sec).

24. "Capture" is the proper term. Those who say stars, planets, and moons formed through capture often use the misleading terms "accrete," "condense," and "gravitational collapse," which imply a "pulling in." These words, while sounding scientific to a layman, betray a misunderstanding of the physics. While gravity would move two isolated particles in space toward each other if their relative velocity were initially zero, particles in space are not isolated and seldom travel with the same speed and direction. For a body to capture a particle, (a) the particle must be within the body's sphere of influence, (b) the particle's velocity relative to the body must never carry it outside the sphere of influence, and (c) the body's gravitational grip on the particle must increase, so later perturbations do not strip the orbiting particle away. Requirement (c) is most easily satisfied if the body has an atmosphere—a surrounding gas.

25. *"It turns out to be surprisingly difficult for planetesimals to accrete mass during even the most gentle collisions."* Erik Asphaug, "The Small Planets," *Scientific American*, Vol. 282, May 2000, p. 54.

- In 1805, Laplace first explained the "sphere of influence" concept, or, as he called it, the "sphere of attraction." He applied it to planets acting on comets, but did not use it to show why permanent capture to form larger bodies such as comets or planets is so difficult. [See Nathaniel Bowditch, *Celestial Mechanics* by the Marquis de Laplace, Vol. 4 (Bronx, New York: Chelsea Publishing Co., 1966), pp. 417–437.]

26. Unfortunately, "short-period comets" have been arbitrarily defined as comets with periods less than 200 years. A more physically meaningful definition, used here, will be *comets with periods less than 100 years,* because there is a huge, recognized excess of such comets. Any acceptable theory of comet origins should explain this excess.

27. All orbital information is from Brian G. Marsden and Gareth V. Williams, *Catalogue of Cometary Orbits*, 11th edition (Cambridge, Massachusetts: Minor Planet Center, 1996). This catalogue was updated in 2000 with recent comet discoveries and information from the Center's website.

28. *"Jupiter's huge attractive mass has somehow collected two-thirds of all the short-period comets into a family. Saturn probably also plays a supporting role in the process. Jupiter and Saturn appear to be much more important in the story of comets than was indicated by their slight disturbances of the motion of Halley's comet. The existence of Jupiter's comet family is one of our important clues to the origin of comets."* Fred L. Whipple, *The Mystery of Comets* (Washington, D.C.: Smithsonian Institution Press, 1985), p. 74.

"What is the chance that Jupiter could catch them [comets falling from an Oort cloud] *by its gravity and tame them into short-period, prograde orbits? He* [H. A. Newton] *found that the chance is very small. Only about one in a million would have its period reduced to less than Jupiter's period of 11.86 years."* Ibid., p. 75.

29. *"By comparing the orbital element distribution of JFCs* [Jupiter's family of comets] *to that produced by our simulations we deduce that JFCs are statistically most likely to have physical lifetimes of about 12,000 years."* Harold F. Levison and Martin J. Duncan, "From the Kuiper Belt to Jupiter-Family Comets," *Icarus*, Vol. 127, May 1997, p. 13.

- *"But once so deflected* [into short-period orbits], *these comets must have comparatively short lifetimes, astronomically speaking, and probably no short-period comet can survive more than about 10,000 years."* R. A. Lyttleton, *Mysteries of the Solar System* (Oxford, England: Clarendon Press, 1968), p. 110.

30. Disregarding the effects of wind resistance, fired bullets and thrown balls are very briefly in elliptical orbits about Earth's center of mass. Once they strike the Earth's surface, their orbits end.

31. *"There is no example of a known short-period comet evolving into a long-period comet of small enough perihelion to be visible."* Edgar Everhart, "Examination of Several Ideas of Comet Origins," *The Astronomical Journal*, Vol. 78, May 1973, p. 332.

32. *"Many scientific papers are written each year about the Oort Cloud, its properties, its origin, its evolution. Yet there is not a shred of direct observational evidence for its existence."* Sagan and Druyan, p. 210.

    However, Sagan and Druyan believed that the Oort cloud exists, and went on to predict (p. 211) that *"with the refinement of our scientific instruments, and the development of space missions to go far beyond Pluto,"* the cloud will be seen, measured, and studied.

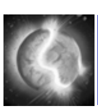
33. Raymond A. Lyttleton, "The Non-Existence of the Oort Cometary Shell," *Astrophysics and Space Science*, Vol. 31, December 1974, pp. 385–401.

    Assuming that the Oort cloud exists helps preserve the belief in a multibillion-year age for the solar system.

- *"Recently, Lyttleton (1974) confirmed our conclusion of 1954: the Oort's hypothetical cloud of comets cannot exist."* S. K. Vsekhsvyatsky, "Comets and the Cosmogony of the Solar System," *Comets, Asteroids, Meteorites*, editor A. H. Delsemme (Toledo, Ohio: The University of Toledo, 1977), p. 470.

    Vsekhsvyatsky estimated (p. 470) that considerably more than 10^{20} gm/yr of cometary matter are lost from the solar system. Over the supposed age of the solar system (4.5 billion years), lost comet mass would *"nearly correspond to the total present mass of the planets."* He believed this was unreasonable.

    "... many people would be happier if there were more objective evidence for the reality of the Oort Cloud." John Maddox, "Halley's Comet Is Quite Young," *Nature*, Vol. 339, 11 May 1989, p. 95.



PREDICTION 30: The Oort cloud will never be detected, because it does not exist.

34. *"Using current standard models for the formation of comets, a significant number of* [hyperbolic] *comets should have been observed. This lack of detections of extrasolar comets is becoming an embarrassment to the theories of solar system and cometary formation and may drive the parameters of these models."* Thomas A. McGlynn and Robert D. Chapman, "On the Nondetection of Extrasolar Comets," *Astrophysical Journal*, Vol. 346, 15 November 1989, p. L105.

- Paul R. Weissman, "Dynamical History of the Oort Cloud," *Comets in the Post-Halley Era*, Vol. 1, editors R. L. Newburn et al. (Boston: Kluwer Academic Publishers, 1991), pp. 463–486.

- *"No comet has ever been observed on a trajectory originating outside the gravitational influence of the Sun. And yet, sooner or later, such comets should be seen."* Sagan and Druyan, p. 350.

PREDICTION 31: No incoming comet will ever be seen on a distinctly hyperbolic orbit, because comets originated from Earth, not outside the solar system.

35. *"A flaw in our understanding of the orbital evolution of comets is that the number of short-period comets—those with orbital periods less than 200 years, such as comet Halley—is much greater than theory predicts. The discrepancy is enormous; the observed number is two orders of magnitude larger than expected."* Julia Heisler, "Orbital Evolution of Comets," *Nature*, Vol. 324, 27 November 1986, p. 306.

36. This expected distribution of comets, first shown mathematically by van Woerkom in 1948, has frequently been verified by powerful computer simulations. [See A. J. J. van Woerkom, "On the Origin of Comets," *Bulletin of the Astronomical Institutes of the Netherlands*, Vol. 10, 8 December 1948, pp. 445–472.]

- A few researchers once believed that second-pass comets were not visible, because they dimmed after losing volatile gases on their first pass. This early loss of volatiles happens, but the effect is not strong. Comets moving away from the Sun are not appreciably dimmer than when they approached the Sun. [See M. C. Festou, "The Derivation of OH Gas Production Rates from Visual Magnitudes of Comets," *Asteroids Comets Meteors II*, editors C. I. Lagerkvist et al. (Uppsala, Sweden: Uppsala University Press, 1986), pp. 299–303.]

    Wiegert *simulated* 125,495 artificial comets in orbits 10,000–50,000 AU from the Sun. For 5 billion simulated years, the giant planets and the galactic tide perturbed the comets. Even when simulating comets that rapidly fade in visibility, Wiegert found that neither fading nor many other effects could explain the lack of observed long-period comets that have completed more than one orbit. [Paul Arnold Wiegert, *The Evolution of Long-Period Comets* (Ph.D. dissertation, University of Toronto, 1996).]

- Thomas D. Nicholson, "Comets, Studied for Many Years, Remain an Enigma to Scientists," *Natural History*, Vol. 75, March 1966, pp. 44–46.

- Lyttleton, *Mysteries*, p. 110.

- Hannes Alfven and Gustaf Arrhenius, *Evolution of the Solar System* (Washington, D.C.: NASA, 1976), p. 234.

37. *"Since planetary perturbations typically change 1/a* [a quantity proportional to energy per unit mass] *by several hundred units during one revolution about the Sun, we were forced to conclude, following Oort, that the great majority of these comets* [the near-parabolic comets] *were making their first passage through the inner part of the solar system."* Brian G. Marsden et al., "New Osculating Orbits for 110 Comets and Analysis of Original Orbits for 200 Comets," *The Astronomical Journal*, Vol. 83, January 1978, p. 64.

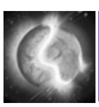
38. Harold F. Levison and Martin J. Duncan, "The Long-Term Dynamical Behavior of Short-Period Comets," *Icarus*, Vol. 108, March 1994, Figure 5, p. 25.

39. *"Hence, if comets like Hale-Bopp brought in the Earth's water, they would have brought in a factor of 40,000 times more argon than is presently in the atmosphere."* T. D. Swindle and D. A. Kring, "Implications of Noble Gas Budgets for the Origin of Water on Earth and Mars," *Eleventh Annual V. M. Goldschmidt Conference,* Abstract No. 3785 (Houston: Lunar and Planetary Institute, 20–24 May 2001).

    How did comets collect argon? Argon was probably produced by solar wind (which consists of 95% protons) striking chlorine in the frozen salt water that comprises much of a comet. Protons (p) bombarding chlorine (Cl) produce argon (Ar) and a gamma ray (γ), a process called *proton capture*. For example:

$$p + {}^{35}Cl \rightarrow {}^{36}Ar + \gamma$$

    Only the comet's outer shell would have this argon, which accumulated after comets were launched. Argon was measured in the gases that vaporized from Hale-Bopp's outer shell. Failure to recognize proton capture and the presence of 4% chlorine (by mass) in comets will lead to a false conclusion that the entire comet contains large amounts of argon.



PREDICTION 32: Argon is concentrated in the outer few meters of a comet's crust.

Sodium, which few would expect to find in outer space, was one of the first chemical elements identified in comets. [See Donald K. Yeomans, *Comets* (New York: John Wiley & Sons, Inc., 1991), p. 217.]

40. *"Comet investigators found levels of ethane in Comet Hyakutake that are about 1,000 times greater than can be explained if the molecules were formed by normal physical processes within the gases of the primordial solar nebula, the birth cloud of the Solar System."* Douglas Isbell and Jim Sahli, "Chemical Measurements of Comet Hyakutake Suggest a New Class of Comets," NASA Press Release 96–108, 31 May 1996.

41. Eric Hand, "Plumes of Methane Identified on Mars," *Nature*, Vol. 455, 23 October 2008, p. 1018.

42. *"But an old reservoir of methane* [on Mars] *is problematic, Mumma says, because it would be hard to explain how it could be steadily released over billions of years. That would suggest that if bacteria are indeed the source of the methane, the organisms are active now."* Ron Cowen, "Plumes of Martian Methane Hint at Possible Underground Microbial Life," *Science News*, Vol. 175, 14 February 2009, p. 10.

- "*... the destruction lifetime for CH_4 is much shorter than the time scale (~350 years) estimated for photochemical destruction. Another process thus must dominate removal of atmospheric CH_4 on Mars, and it must be more efficient than photochemistry by a factor > 100."* Michael J. Mumma et al., "Strong Release of Methane on Mars in Northern Summer 2003," Science, Vol. 323, 20 February 2009, p. 1044.

43. *"Krasnopolsky's team calculates that comets striking Mars couldn't deliver enough methane to replace what's lost."* Ron Cowen, "Martian Methane: Carbon Compound Hints at Life," *Science News*, Vol. 165, 10 April 2004, p. 228.

44. *"But in late March, researchers analyzing data from the European Mars Express satellite reported the planet's atmosphere contains traces of methane,* [usually] *a by-product of bacteria here on Earth. Could this be the long-awaited sign of Martian life?"* Maia Weinstock, "Our Favorite Martians," *Discover*, Vol. 25, August 2004, p. 16.

- "*Living systems produce more than 90% of Earth's atmospheric methane; the balance is of geochemical origin."* Mumma et al., p. 1041.

    It is hard to imagine the rare geochemical conditions that produce methane on Earth producing such concentrated amounts of methane on Mars.

45. *"... there is no reasonable astronomical scenario in which mineral grains can condense* [in space]*."* Fred Hoyle and Chandra Wickramasinghe, "Where Microbes Boldly Went," *New Scientist*, Vol. 91, 13 August 1981, p. 413.

- *"Although very little is known about how the* [dust] *grains are formed, observations of interstellar matter indicate that the process must be very efficient; otherwise, how could the striking depletion of the refractory elements* [such as silicon and magnesium] *in the interstellar gas be explained?"* Hubert Reeves, "Comets, Solar Wind and the D/H Ratio," *Nature*, Vol. 248, 29 March 1974, p. 398.

    My Translation: *No one knows how dust could form in space, but dust formation must be very efficient, because few of the chemical elements needed to form dust are there.* (*We know that dust formed in space, because dust is in space.* ☺)

    My Response: Maybe the dust in comets came not from almost-empty space, but from Earth.

46. *"As in the interstellar medium, much of the dust from comets consists of silicate minerals, but despite the similarities, there are puzzling differences. For example, interstellar dust shows the absorption signature of amorphous particles with a silicate composition, whereas Hale-Bopp and other comets have crystalline silicate, probably in the form of magnesium-rich olivine."* Dale P. Cruikshank, "Stardust Memories," *Science*, Vol. 275, 28 March 1997, p. 1896. [See also pp. 1904–1909.]

- Humberto Campins and Eileen V. Ryan, "The Identification of Crystalline Olivine in Cometary Silicates," *The Astrophysical Journal*, Vol. 341, 15 June 1989, pp. 1059–1066.

- *"In particular, the resonance peak seen at 11.2 μm* [in the impact debris from comet Tempel 1] *is indicative of Mg-rich crystalline olivine."* K. J. Meech et al., "Deep Impact: Observations from a Worldwide Earth-Based Campaign," *Science*, Vol. 310, 14 October 2005, p. 267.

47. Could interstellar dust, which has no crystalline pattern, have melted (or almost melted), cooled, *crystallized*, and then acted as condensation sites for water-ice that formed comets? Probably not. Had nonspherical dust particles melted, or almost melted, they would have become spherical due to their surface tension. Interstellar dust particles polarize starlight, so they must be elongated. Therefore, cometary dust is probably not derived from heated interstellar dust.

48. M. F. A'Hearn et al., pp. 258–264.

49. *"The existence of hydrated* [containing liquid water] *silicates in comets is provocative, because it would suggest the presence of abundant amounts of reactive water in the formation region of the comet or in the cometary parent body."* Carey M. Lisse et al., "Spitzer Spectral Observations of the Deep Impact Ejecta," *Science*, Vol. 313, 4 August 2006, p. 637.

    "The presence of carbonates is provocative because, like the phyllosilicates, liquid water was thought to be required to form carbonates from CO_2 in the presence of silicates." Ibid.

- These results are "provocative" only if you didn't realize that comets came from the earth—the water planet.

50. "[Comet Tempel 1 is] *the size of a mountain held together with the strength of the meringue in a lemon meringue pie."* Carey M. Lisse as quoted by Ron Cowen, "Deep Impact," *Science News*, Vol. 168, 10 September 2005, p. 169.

    "[The comet's] *structure is more fragile than that of a soufflé ...."* Jay Melosh as quoted by Ron Cowen, Ibid., p. 168.

51. *"The most abundant minerals are the crystalline silicate minerals, olivine and pyroxene, along with troilite (FeS). These are very stable phases, common in planetary materials; however, finding them here is somewhat surprising because many expected that cometary material would be similar to interstellar material, in which most silicates are believed to be amorphous. In contrast, cometary amorphous material in the returned samples is rare or nonexistent."* Don S. Burnett, "NASA Returns Rocks from a Comet," *Science*, Vol. 314, 15 December 2006, p. 1710.

52. Hoyle and Wickramasinghe, *Lifecloud*, pp. 87–113.

    For two decades, these authors led a growing belief among scientists that comets are bringing cellulose, bacteria, and other organic matter to Earth.

- Hoyle and Wickramasinghe, "Where Microbes Boldly Went," pp. 412–415.

53. Hoyle and Wickramasinghe, *Lifecloud*, p. 91.

54. *"The cellulose strand is a complex structure, and one can wonder how a giant molecule of such a highly organized form could be present in interstellar space."* Ibid., p. 94.

55. Roland Meier et al., "A Determination of the HDO/H_2O Ratio in Comet C/1995 O1 (Hale-Bopp)," *Science*, Vol. 279, 6 February 1998, pp. 842–844. [Similar and consistent measurements also have been made of comets Halley and Hyakutake.]

- Roland Meier and Tobias C. Owen, "Cometary Deuterium," *Space Science Review*, Vol. 90, Nos. 1–2, 1999, pp. 33–43.

56. A. Vidal-Madjar, "Interstellar Helium and Deuterium," *Diffuse Matter in Galaxies*, editors J. Audouze et al. (Boston: D. Reidel Publishing Co., 1983), pp. 57–94.

57. Of the hundred or so important publications on this topic, the following is most recommended: Louis A. Frank with Patrick Huyghe, *The Big Splash* (New York: Carol Publishing Group, 1990). [See also related endnotes on page 102.]

58. *"We found that there were ten times as many small comets in early November as there were in mid-January."* Frank and Huyghe, p. 187.

59. These arguments are effectively rebutted by Louis A. Frank and J. B. Sigwarth in "Atmospheric Holes: Instrumental and Geophysical Effects," *Journal of Geophysical Research*, Vol. 104, No. A1, 1 January 1999, pp. 115–141.

60. *"In view of the connection of comets, meteors, and meteorites, the absence of meteorites in old deposits in the crust of the earth is very significant. It has been estimated that at least 500 meteorites should have been found in already worked coal seams, whereas none have been identified in strata older than the Quaternary epoch (about 1 million years ago). This suggests a very recent origin* [of meteors] *and, by inference, of comets."* N. T. Bobrovnikoff, "Comets," *Astrophysics*, editor J. A. Hynek (New York: McGraw-Hill Book Co., 1951), p. 352.

61. Thomas C. Van Flandern, "A Former Asteroid as the Origin of Comets," *Icarus*, Vol. 36, October 1978, pp. 51–74.

- Tom C. Van Flandern, *Dark Matter, Missing Planets and New Comets* (Berkeley, California: North Atlantic Books, 1993), pp. 185–190.

- Van Flandern built on earlier proposals by Olbers (1796) and Ovenden (1972) that a planetary breakup produced the asteroids. Van Flandern has altered his earlier paper in several ways. For example, the exploded planet was initially 90 Earth masses. Since then, his number of exploded planets has increased and their total mass has decreased.

62. Bode's law is a simple formula which gives the approximate distance of most planets from the Sun. While Bode's law has no theoretical justification, it correctly predicted the existence and approximate orbital radius of Uranus (1781), but not Neptune (1846) and Pluto (1930). Also predicted is a planet 2.8 AU from the Sun, which closely corresponds to the average position of most asteroids. This led to the early

belief that asteroids are the remains of an exploded planet that once orbited 2.8 AU from the Sun. [For reasons given on page 305, most experts now reject this.] Bode's formula is

$$\text{Distance (AU)} = 0.4 + 0.3 \times 2^{n}$$

Consider how many thousands of other equally simple-looking formulas with arbitrary numbers (corresponding to 0.4, 0.3, 2, and the values for n) could be constructed. It should not be surprising that one of these formulas could approximate 7 of the 9 planet-Sun distances.

Bode's law, a mathematical curiosity rather than a true law, was formulated by Johann Daniel Titius in 1766 but popularized by Johann Bode in 1772. Thus, it is often called the *Bode-Titius law* or the *Titius-Bode law.*

Table 16. Bode's Law

		Distance (AU)	
Planet	**n**	**Predicted**	**Actual**
Mercury	$-\infty$	0.4	0.387
Venus	0	0.7	0.723
Earth	1	1.0	1.00
Mars	2	1.6	1.52
Asteroids	3	2.8	2.78*
Jupiter	4	5.2	5.20
Saturn	5	10.0	9.54
Uranus	6	19.6	19.17
Neptune	7	38.8	30.05
Pluto	8	77.2	39.42

**Based on the 35 largest asteroids.*

63. In 1668, Johannes Hevelius wrote that comets formed in the atmospheres of the giant outer planets and were flung into space by the planets' rotation. In 1814, French mathematician Joseph Louis Lagrange proposed a more modern version of this theory. Since then, others have refined the theory, especially S. K. Vsekhsvyatsky.

- S. K. Vsekhsvyatsky, "New Evidence for the Eruptive Origin of Comets and Meteoritic Matter," *Soviet Astronomy*, Vol. 2, No. 3, November–December 1967, pp. 473–484.
- S. K. Vsekhsvyatsky, "The Origin and Evolution of the Comets and Other Small Bodies in the Solar System," *The Motion, Evolution of Orbits, and Origin of Comets*, editors G. A. Chebotarev and E. I. Kazimirchak-Polonskaya (New York: Springer-Verlag, 1972), pp. 413–418.

64. J. H. Oort, "The Structure of the Cloud of Comets Surrounding the Solar System, and a Hypothesis Concerning Its Origin," *Bulletin of the Astronomical Institutes of the Netherlands*, Vol. 11, No. 408, 13 January 1950, pp. 91–110.

65. Oort initially estimated that 10^{11} comets formed 50,000–150,000 AU away. Later, others realized that at the more distant end of that range the Sun's gravity is so weak that passing stars, galactic clouds, and the galaxy itself would have stripped too many comets from the Oort cloud long ago. [See, for example, Julio A. Fernández, "Dynamical Aspects of the Origin of Comets," *The Astronomical Journal*, Vol. 87, September 1982, pp. 1318–1332.] To solve this problem, more comets (10^{12} comets) are usually assumed to be in the cloud initially, and the cloud is assumed to be concentrated nearer the 50,000 AU end of that distance range. Others have proposed that at least 10^{15} comets must initially populate the Oort cloud. Oort cloud theories have many variations; only the best known are described here.

66. See **"Is Pluto a Planet?"** on page 28.

67. Jack G. Hills, "Comet Showers and the Steady-State Infall of Comets from the Oort Cloud," *The Astronomical Journal*, Vol. 86, November 1981, pp. 1730–1740.

68. This high improbability can be shown two ways. First, the "back-of-the-envelope" method. The Marsden-Williams Comet Catalogue lists 774 different sightings of nonperiodic comets. One can select two out of 774 different objects 299,151 ways, or $\left(\frac{774\times773}{2}\right)$. Five numbers (i, q, e, ω, and Ω) specify an ellipse in space. Let's say that the chance that two randomly-selected comet sightings have "similar" values for the combination q and e is 0.25—at least as similar as those of the "strange pairs." Two angles (Ω and ω) have values ranging from 0 to 360 degrees and a third angle, i, ranges between 0 and 180 degrees. If each comet sighting in a "strange pair" had values for i, Ω, and ω within five degrees *on either side* of the corresponding angles of the other comet, one might expect about three "strange pairs" simply due to chance—nine more than actually observed.

$$299{,}151 \times \left[.25 \times \left(\frac{5\times2}{360}\right)^{2}\left(\frac{5\times2}{180}\right)\right] \approx 3$$

A more accurate approach involves a computer simulation. By examining the 30 recorded consecutive orbits of Halley's comet, one can see that planetary perturbations change certain orbital elements less than others. (For example, i—the angle of inclination—changes very little from orbit to orbit.) Therefore, changes in each orbital element must be weighted properly when comparing two different orbits.

Next, for all 774 comet sightings, I swapped each true orbital element with the corresponding orbital element of a randomly chosen comet. Then a count was made of how many of the 299,151 random pairings were as similar as the "strange pairs." Typically, there were three. In other words, chance can explain about three of the twelve "strange pairs" shown on page 281. That leaves about nine pairs—or nine comets that were seen on two consecutive orbits.

This is surprising, because the estimated periods for both members of each pair are too large for them to be the same comet. However, these comets spend most of their time far beyond the planets. Some very slight force, accelerating the comets for centuries, could greatly shorten their periods.

69. Hannes Alfven and Gustaf Arrhenius, pp. 231–238.

70. For example, billiard balls are very elastic (springlike), so collisions disperse the balls. However, if the balls were made of tar (inelastic), the balls would deform or even stick together on impact, so their paths would tend to merge.

71. R. A. Lyttleton, *The Comets and Their Origin* (Cambridge, England: At the University Press, 1953), pp. 62–110.

72. H. D. P. Lee, *Aristotle: Meteorologica* (Cambridge, Massachusetts: Harvard University Press, 1952), p. 43.

73. Thomas H. Corcoran, *Seneca: Natural Quaestiones* (Cambridge, Massachusetts: Harvard University Press, 1972), pp. 227–299.

74. Previously, faulty logic (traceable to the time of Aristotle) went as follows: Because bodies (stars) beyond the Moon do not change their appearance, and a comet changes weekly, comets must not lie beyond the Moon.

75. M. E. Bailey et al., "The Origin of Comets," *Vistas in Astronomy*, Vol. 29, 1986, p. 61.

76. Peter Lancaster-Brown, *Halley's Comet & the Principia* (Aldeburgh, England: Aries Press, 1986), p. 17.

77. On 1 March 1665, Samuel Pepys entered in his famous diary the following statement:

    > *At noon I* [went] *to dinner at Trinity House, and thence to Gresham College, where Mr. Hooke read a second very curious lecture about the late Comet; among other things proving very probably that this is the very same Comet, that appeared before in the year 1618, and that in such a time probably it will appear again, which is a very new opinion; but all will be in print.* Samuel Pepys, *The Diary of Samuel Pepys*, editor Henry B. Wheatley, Vol. 4, Part 2 (New York: Croscup & Sterling Co., 1946), p. 341.

    Pepys later became the president of The Royal Society (of London), the prestigious scientific body that hosted the above lecture. The idea that some comets reappear was "a very new opinion" and deserves credit for originality. While no periodic comets were visible between 1609 and 1677, Robert Hooke may have suggested the possibility to later researchers, such as Edmond Halley. Halley's correct prediction in 1705 of the return of the comet of 1682 (later called *Halley's comet*) in 1758 was one of science's classic achievements. However, Halley was criticized for making a prediction that would not be tested until after his death, "when he could no longer be embarrassed."

78. Newton, "That the Comets Are Higher Than the Moon, and in the Regions of the Planets," Proposition XXXIX, Lemma IV, Book III, *Principia*, pp. 399–401.

79. Fred L. Whipple, "Discovering the Nature of Comets," *Mercury*, Vol. 15, January–February 1986, p. 5.

80. Richard A. Proctor, "Comet Families of the Giant Planets," *Knowledge: A Monthly Record of Science*, Vol. 6, 4 July 1884, p. 5.

◆ Richard A. Proctor, "The Capture Theory of Comets," *Knowledge: A Monthly Record of Science*, Vol. 6, 8 August 1884, pp. 111–112, 126–128.

81. *"Thus, cometary nuclei could not have condensed in situ at distances exceeding 100 AU ... Direct condensation of the comets in situ, at the great distances of their aphelia in Oort's sphere, is not possible."* Ernst J. Öpik, "Comets and the Formation of Planets," *Astrophysics and Space Science*, Vol. 21, 1973, pp. 320, 394.

82. Thomas M. Donahue, "Comment on the Paper 'On the Influx of Small Comets into the Earth's Upper Atmosphere II. Interpretation' by L. A. Frank et al.," *Geophysical Research Letters*, Vol. 13, June 1986, pp. 555–557.

83. *"Although ice has been detected* [in interstellar space] *by its 3.1 μm absorption band, it is not nearly as abundant as expected."* P. G. Martin, *McGraw-Hill Encyclopedia of Science & Technology*, 6th edition (New York: McGraw-Hill Book Co., 1987), Vol. 9, p. 326.

84. *"The* [Mars] *lander found evidence that the chemical makeup of the dust on the surface of Mars resembles that of seawater, adding to the evidence that liquid water that once may have supported life flowed on the planet's surface."* Maggie Fox, "Mars Dust Resembles Seawater, NASA Extends Mission," Reuters News Service, 29 September 2008, www.news.yahoo.com/s/nm/20080929/sc_nm/us_mars_phoenix_1.

◆ *"Phoenix's instruments have also identified calcium carbonates in the soil. Carbonates are rocks that, on Earth, form mainly from calcium carbonates that precipitate out of seawater."* Ashley Yeager, "Racing Against the Martian Winter," *Science News*, http://www.sciencenews.org/view/generic/id/36595/title/Racing_against_the_Martian_winter, 10 October 2008.

◆ *"... we have identified a compositional unit on Mars that contains a mineralogical component likely attributable to chloride salts. We initially identified these deposits because of their spectral distinctiveness ... The deposits range in area from ~1 km^2 to ~25 km^2* [at about 200 locations] *and generally are topographically lower than the immediate surrounding terrain."* M. M. Osterloo et al., "Chloride-Bearing Materials in the Southern Highlands of Mars," *Science*, Vol. 319, 21 March 2008, p. 1651.

◆ "[The Mars Rover named Opportunity, operating in what appears to be a dried-up water channel,] *has uncovered soil that is more than half salt, adding to the evidence for Mars' wet past."* Guy Webster, "Mars Rovers Break Driving Records, Examine Salty Soil," *Jet Propulsion Laboratory News Release*, 2 March 2005, p. 1.

◆ *"Some rocks may be as much as 40 percent salt, he notes. 'That's an astonishing amount' and could result only from a briny solution soaking through rock and then evaporating, leaving the salt behind, Clark says."* Benton Clark as quoted by Ron Cowen, "Red Planet Makes a Splash," *Science News*, Vol. 165, 6 March 2004, p. 147.

◆ *"... the identification of halite at the martian surface indicates extreme salinity ..."* Nicholas J. Tosca et al., "Water Activity and the Challenge for Life on Early Mars," *Science*, Vol. 320, 30 May 2008, p. 1205.

◆ *"The presence of hydrated minerals on the surface of Mars implies that the crust was once altered by the action of liquid water. ... the degree of alteration of the ancient martian crust is more extensive than previously assumed."*

J. Carter et al., "Detection of Hydrated Silicates in Crustal Outcrops in the Northern Plains of Mars," *Science*, Vol. 328, 25 June 2010, pp. 1610, 1682–1686.

85. Many claim that comets had to begin outside the orbit of Mars where typically (a) temperatures are cold enough for frost to condense on dust particles in space, and (b) the Sun's ultraviolet radiation is unlikely to break water molecules apart. This belief overlooks two considerations.

    First, if water vapor condensed as frost on dust particles beyond Mars, then frost should be *commonly* detected on asteroids in the asteroid belt. Frost is seldom observed. Second, icy particles orbiting beyond Mars, will not, in general, form a comet. Long periods of time increase the chances of water vapor and ice particles disintegrating.

    On the other hand, the fountains of the great deep would quickly form comets. Water molecules would not have to be brought together; they would start together. Dirt, ice, gases, and other unlikely chemicals in comets would not need to be found and mixed uniformly together; they also would start together.

86. *"Our next worry arose because the condensation of water-ice grains in interstellar clouds of low density presented severe conceptual problems. For ice crystals less than a micrometre in size to form in a pure gas, 'condensation nuclei', about which the crystals grow, must form at an adequate rate. ... Another early objection we had against the ice-grain theory was that calculations based on this model could not reproduce the way in which the fogging, or extinction, of starlight varied with wavelength: ... Secondly, attempts to find the strong absorption band at 3.1 μm due to water ice in the spectra of heavily obscured stars consistently failed."* Hoyle and Wickramasinghe, "Where Microbes Boldly Went," p. 412.

87. Zdenek Sekanina, "Detection of a Satellite Orbiting the Nucleus of Comet Hale Bopp (C/1995 O1)," First International Conference on Comet Hale Bopp, Puerto de la Cruz, Tenerife, Canary Islands, Spain, 2–5 February 1998.

88. The energy per unit mass (E) of a comet in a closed (i.e., elliptical) orbit can be written in two independent ways:

$$E = \frac{-GM}{2a} \quad \text{and} \quad E = \frac{V^2}{2} - \frac{GM}{R}$$

    where V is its velocity, R is its distance from the center of mass of the solar system, G is the gravitational constant, M is the mass of the solar system, and a is the comet's semimajor axis. Eliminating E and solving for V^2 gives

$$V^2 = GM\left[\frac{2}{R} - \frac{1}{a}\right]$$

    Knowing a comet's velocity (V), position (R), and semimajor axis (a), we can calculate the mass of the solar system. Consider two possible values of the semimajor axis: a large value (a_L) which gives a mass M_L, and a small value (a_S) which gives a mass M_S. This gives us two equations:

$$V^2 = GM_L\left[\frac{2}{R} - \frac{1}{a_L}\right] \quad \text{and} \quad V^2 = GM_S\left[\frac{2}{R} - \frac{1}{a_S}\right]$$

    Eliminating V^2 and solving for the ratio of the two corresponding masses of the solar system gives

$$\frac{M_S}{M_L} = \frac{1 - \dfrac{R}{2a_L}}{1 - \dfrac{R}{2a_S}} \approx 1 + \frac{R}{2}\left[\frac{1}{a_S} - \frac{1}{a_L}\right]$$

    Let's say R = 1 AU when a semimajor axis is calculated from trajectory estimates. Comets with an orbital period of 5,000 years have aphelions 585 AU. If $2a_L$ = 50,000 AU and $2a_S$ = 586 AU, then the mass ratio on the left side is only 1.0017. So, if the solar system's mass is greater than usually assumed by only 17 parts in 10,000 *and is concentrated at the center of the solar system*, comets thought to be falling in for the first time from 50,000 AU with periods of about 4,000,000 years would have been launched only 5,000 years ago.

    As explained on page 284, the extra mass is probably not concentrated at the center of the solar system. In November 2005, Jon Schoenfield analyzed the situations where the mass is spherically distributed 40 AU or more from the Sun. In those cases, the required extra mass would exceed 70 Jupiters. It is much more likely that the mass is distributed as a hoop or torus. If so, the extra mass is much smaller than 70 Jupiters.

89. Actually, what is measured is not mass (M) but mass times the gravitational constant (G), or GM. Because the gravitational constant is known to only about one part in a thousand, mass is equally uncertain. However, only the GM of central bodies is of concern in calculating orbits, and those values for the Sun and planets are generally known to much higher precision.

90. My computer simulations of the solar system during its last 350 years have shown that Herschel-Rigollet did not come near enough to any planet for that gravity boost. Therefore, its gravity boost probably came from mass beyond 40 AU.

91. John D. Anderson et al., "Indication, from Pioneer 10/11, Galileo, and Ulysses Data, of an Apparent Anomalous, Weak, Long-Range Acceleration," *Physical Review Letters*, Vol. 81, No. 14, 5 October 1998, pp. 2858–2861.

◆ John D. Anderson, Personal communication, 25 September 1998.

92. Lester Haar et al., *NBS/NRC Steam Tables* (New York: Hemisphere Publishing Corporation, 1984), p. 208.

93. George E. Anderson, mechanical engineer, suggested that water hammers acted during the flood.

94. K. J. Meech, and O. R. Hainaut, "HST Imaging of Distant Comet Nuclei," *Bulletin of the American Astronomical Society*, Vol. 29, July 1997, p. 1021.

95. P. M. Muller and W. L. Sjogren, "Mascons: Lunar Mass Concentrations," *Science*, Vol. 161, 16 August 1968, pp. 680–684.

96. Richard A. F. Grieve, "The Record of Impact on Earth," *Geological Society of America*, Special Paper 190, 1982, pp. 25–37.

97. The energy required just to "disperse" a planet of uniform density, mass M, and radius R can be shown to be

$$\frac{3}{5}\frac{GM^2}{R}$$

where G is the gravitational constant. If the planet's density is greater in its core, as it is for all planets, the energy requirement increases. "Disperse" here means to accelerate each of the planet's particles to its escape velocity.

98. W. McD. Napier and R. J. Dodd, "The Missing Planet," *Nature*, Vol. 242, 23 March 1973, pp. 250–251.

A planet could explode if it contained enough fissionable material that suddenly became a critical mass. However, as Anders notes, *"such an explosion 6 million years ago* [or less] *would have left large amounts of long-lived radioactivity, such as Be^{10} and Mn^{53}, on the Earth, Moon, and meteorites."* These isotopes have not been detected. [See E. Anders, Discussions of "A Former Major Planet of the Solar System," *Comets, Asteroids, Meteorites*, editor A. H. Delsemme (Toledo, Ohio: The University of Toledo, 1977), p. 479.]

99. Jupiter generates tidal friction inside Io, which produces the heat. [See Ron Cowen, "Close Encounter: Galileo Eyes Io," *Science News*, Vol. 156, 11 December 1999, pp. 382–383.]

100. S. K. Vsekhsvyatsky, "Comets and the Cosmogony of the Solar System," *Comets, Asteroids, Meteorites*, editor A. H. Delsemme (Toledo, Ohio: The University of Toledo, 1977), p. 470.

101. Ariel A. Roth, "Some Questions about Geochronology," *Origins*, Vol. 13, No. 2, 1986, p. 75.

102. Marsden and Sekanina, p. 1123.

103. Fernández, pp. 1318, 1324.

104. Paul R. Weissman, "The Oort Cloud and the Galaxy: Dynamical Interactions," *The Galaxy and the Solar System*, editors Roman Smoluchowski et al. (Tucson, Arizona: The University of Arizona Press, 1986), p. 212.

105. Some researchers have suspected that one of two stars, Algol or Gliese 710, may have recently disturbed an Oort cloud. Actual measurements dispute this. *"The new figures reveal that neither star comes close enough to shake up the Oort Cloud and generate a comet shower."* Ron Cowen, "Dino Death: A Stellar Weapon," *Science News*, Vol. 153, 31 January 1998, p. 79.

- Jeffrey Winters, "A Brief Tour of a Bad Cosmic Neighborhood," *Discover*, Vol. 19, April 1998, p. 56.

106. Julio A. Fernández, "The Formation of the Oort Cloud and the Primitive Galactic Environment," *Icarus*, Vol. 129, September 1997, pp. 106–119.

- Everhart, p. 329.

107. Fernández, "Dynamical Aspects of the Origin of Comets," p. 1318.

108. Any giant planet would expend much of its orbital energy in flinging 10,000 Earth masses of comets out toward an Oort cloud. Also, the gravity-assisted boosts needed to give so many comets their angular momentum would shrink the planet's orbit, requiring it to have begun much farther from the Sun.

While this might help solve one aspect of the comet origin problem, it creates problems for the few astronomers trying to figure out how the giant planets evolved. These astronomers wonder how the giant planets could form where they are *now*, even if billions of years were available. That problem worsens for objects trying to form farther from the Sun, where matter is more spread out and moving even more slowly. [See Öpik, pp. 307–398. Also see Richard Greenberg, "The Origin of Comets Among the Accreting Outer Planets," *Dynamics of Comets: Their Origin and Evolution*, editors Andrea Carusi and Giovanni B. Valsecchi (Boston: D. Reidel Publishing Co., 1985), pp. 3–10.]

109. S. Alan Stern and Paul R. Weissman, "Rapid Collisional Evolution of Comets during the Formation of the Oort Cloud," *Nature*, Vol. 409, 1 February 2001, pp. 589–591.

110. *"No wastage would occur with Uranus or Neptune, but then the ejection time scale, 10^{11} yr, is prohibitive."* Öpik, p. 395.

111. Gerard P. Kuiper, "On the Origin of the Solar System," *Astrophysics,* editor J. A. Hynek (New York: McGraw-Hill Book Co., 1951), pp. 357–424.

112. Ron Cowen, "Second Look Finds No Comet Reservoir," *Science News*, Vol. 149, 22 June 1996, p. 395.

113. Weissman, p. 210.

114. John F. Kerridge and James F. Vedder, "An Experimental Approach to Circumsolar Accretion," *Symposium on the Origin of the Solar System* (Paris, France: Centre National de la Recherche Scientifique, 1972), pp. 282–283.

115. Martin Harwit, *Astrophysical Concepts* (New York: John Wiley & Sons, 1973), pp. 394–395.

116. Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1970). [Both the National Review and the Modern Library (a division of Random House) listed this book among the hundred best nonfiction books written in English during the 20th century.]

117. The theory that the material that formed comets came from Earth will be severely weakened if recovered cometary material does not contain minerals and isotope abundances that match those on Earth. However, if those minerals and isotopes are found, all other theories are weakened. Resources of time and money can be more wisely spent by testing theories that better explain all the evidence.

Figure 156: Asteroid Ida and Its Moon, Dactyl. In 1993, the Galileo spacecraft, heading toward Jupiter, took this picture 2,000 miles from asteroid Ida. To the surprise of most, Ida had a moon (about 1 mile in diameter) orbiting 60 miles away! Both Ida and Dactyl are composed of earthlike rock. We now know of 192 other asteroids that have moons; 9 asteroids have two moons.[1] According to the laws of orbital mechanics (described in the preceding chapter), capturing a moon in space is unbelievably difficult—unless both the asteroid and a nearby potential moon had very similar speeds and directions and unless gases surrounded the asteroid during capture. If so, the asteroid, its moon, and each gas molecule were probably coming from the same place and were launched at about the same time. Within a million years, passing bodies would have stripped the moons away, so these asteroid-moon captures must have been recent.

From a distance, large asteroids look like big rocks. However, many show, by their low density, that they contain either much empty space or something light, such as water-ice.[2] Also, the best close-up pictures of an asteroid show millions of smaller rocks on its surface. Therefore, asteroids are *flying rock piles* held together by gravity. Ida, about 35 miles long, does not have enough gravity to squeeze itself into a spherical shape.

The Origin of Asteroids and Meteoroids

SUMMARY: The fountains of the great deep launched rocks as well as muddy water. As rocks moved farther from Earth, Earth's gravity became less significant to them, and the gravity of nearby rocks became increasingly significant. Consequently, many rocks, assisted by their mutual gravity and surrounding clouds of water vapor, merged to become asteroids. Isolated rocks in space are meteoroids. Drag forces caused by water vapor and thrust forces produced by the radiometer effect concentrated asteroids in what is now the asteroid belt. All the so-called "mavericks of the solar system" (asteroids, meteoroids, and comets) resulted from the explosive events at the beginning of the flood.

Asteroids, also called *minor planets*, are rocky bodies orbiting the Sun. Ninety percent of their orbits lie between the orbits of Mars and Jupiter, a region called *the asteroid belt*. The largest asteroid, Ceres, is almost 600 miles in diameter and has about one-third the volume of all other asteroids combined. Orbital information is available for some 350,000 asteroids.[3] A few that cross the Earth's orbit would do great damage if they ever collided with Earth.

Two explanations are given for the origin of asteroids: (1) they were produced by an exploded planet, and (2) a planet failed to evolve completely. Experts recognize the problems with each explanation and are puzzled. The hydroplate theory offers a simple and complete—but quite different—solution that also answers other questions.

Exploded-Planet Explanation. Smaller asteroids are more numerous than larger asteroids, a pattern typical of fragmented bodies. Seeing this pattern led to the early belief that asteroids are remains of an exploded planet. Later, scientists realized that all the fragments combined would not make up one small planet.[4] Besides, too much energy is needed to explode and scatter even the smallest planet. [See Item 21 on page 289.]

Meteorites, Meteors, and Meteoroids

In space, solid bodies smaller than an asteroid but larger than a molecule are called "meteoroids." They are renamed "meteors" as they travel through Earth's atmosphere, and "meteorites" if they hit the ground.

Failed-Planet Explanation. The most popular explanation today for asteroids is that they are bodies that did not merge to become a planet. Never explained is how, in nearly empty space, matter merged to become these rocky bodies in the first place,[5] why rocky bodies started to form a planet but stopped,[6] or why it happened primarily between the orbits of Mars and Jupiter. Also, because only vague explanations have been given for how planets formed, any claim to understand how one planet failed to form lacks credibility. [See Items 43–46 on pages 27–29.] Orbiting rocks do not merge to become planets or asteroids unless special conditions are present. Only the hydroplate theory provides these unique conditions. [See page 274 and Endnote 24 on page 295.] Today, collisions fragment and scatter asteroids, just the opposite of this "failed-planet explanation." In fact, during the 4,600,000,000 years evolutionists say asteroids have existed, asteroids would have had so many collisions that they should be much more fragmented than they are today.[7]

Hydroplate Explanation. Asteroids are composed of rocks expelled from a small part of the Earth. The size distribution of asteroids does show that at least part of a planet fragmented. No known energy source is available to explode and disperse *an entire* Earth-size planet; however, the eruption of so much supercritical water (explained on page 124) from the subterranean chambers could have launched one 2,300th of the Earth—*the mass of all asteroids combined*. Astronomers have tried to describe the exploded planet, not realizing they were standing on the remaining 99.95% of it—too close to see it.[8]

As flood waters escaped from the subterranean chambers, pillars were crushed, because they were forced to carry more and more of the weight of the overlying crust. Also, the almost 10-mile-high walls of the rupture were unstable, because rock is not strong enough to support a cliff more than 5 miles high. As lower portions of the walls were crushed, large blocks[9] were swept up and launched by the jetting fountains. Unsupported rock in the top 5 miles then fragmented. The smaller the rock, the faster it accelerated and the farther it went, just as a rapidly flowing stream carries smaller dirt particles faster and farther.

Water droplets in the fountains partially evaporated and quickly froze. Large rocks had large spheres of influence which grew as the rocks traveled away from Earth. Larger rocks became "seeds" around which other rocks and ice collected as spheres of influence expanded. Because of all the evaporated water vapor and the resulting aerobraking, even more mass concentrated around the "seeds." [See page 274.] Clumps of rocks became asteroids.

Question 1: Why did some clumps of rocks and ice in space become asteroids and others become comets?

Imagine living in a part of the world where heavy frost settled each night, but the Sun shone daily. After many decades, would the countryside be buried in hundreds of feet of frost?

The answer depends on several things besides the obvious need for a large source of water. If dark rocks initially covered the ground, the Sun would heat them during the day, so frost from the previous night would tend to evaporate. However, if the sunlight was dim or the frost was thick (thereby reflecting more sunlight during the day), little frost would evaporate. More frost would accumulate the next night. Frost thickness would increase every 24 hours.

Now imagine living on a newly formed asteroid. Its spin would give you day-night cycles. After sunset, surface temperatures would rapidly drop, because asteroids do not have enough gravity to hold an atmosphere for long. With little atmosphere to insulate the asteroid, the day's heat would quickly radiate, unimpeded, into outer space. Conversely, when the Sun rose, its rays would have little atmosphere to warm, so temperatures at the asteroid's surface would rise rapidly.

As the fountains of the great deep launched rocks and water droplets, evaporation in space dispersed an "ocean" of water molecules and other gases into the inner solar system. Gas molecules that struck the cold side of your spinning asteroid would become frost.[10] Sunlight would usually be dim on rocks in larger, more elongated orbits. Therefore, little frost would evaporate during the day, and the frost's thickness would increase. Your "world" would become a comet. However, if your "world" orbited relatively near the Sun, its rays would evaporate each night's frost, so your "world" would remain an asteroid.

In general, heavier rocks could not be launched with as much velocity as smaller particles (dirt, water droplets, and smaller rocks). The heavier rocks merged to become asteroids, while the smaller particles, primarily water, merged to become comets, which usually have larger orbits. No "sharp line" separates asteroids and comets.

PREDICTION 33: Asteroids are rock piles, often with ice acting as a weak "glue" inside. Large rocks that began the capture process are nearer the centers of asteroids. Comets, which contain much ice, have rocks in their cores.

Four years after this prediction was published in 2001 (*In the Beginning*, 7th edition, page 220), measurements of the largest asteroid, Ceres, found that it does indeed have a dense, rocky core and primarily a water-ice mantle.[11]

Question 2: Wasn't asteroid Eros found to be primarily a large, solid rock?

A pile of dry sand here on Earth cannot maintain a slope greater than about 30 degrees. If it were steeper, the sand grains would roll downhill. Likewise, a pile of dry pebbles or rocks on an asteroid cannot have a slope exceeding about 30 degrees. However, 4% of Eros' surface exceeds this slope, so some scientists concluded that much of Eros must be a large, *solid* rock. This conclusion overlooks the possibility that ice is present between some rocks and acts as a weak glue—as predicted above. Ice in asteroids would also explain their low density. Endnote 9 gives another reason why asteroids are probably flying rock piles.

Question 3: Objects launched from Earth should travel in elliptical, cometlike orbits. How could rocky bodies launched from Earth become concentrated in almost circular orbits between Mars and Jupiter?

Gases, such as water vapor and its components,[12] were abundant in the inner solar system for many years after the flood. Hot gas molecules striking each asteroid's hot side were repelled with great force. This jetting action was like air rapidly escaping from a balloon, applying a thrust in a direction opposite to the escaping gas.[13] Cold molecules striking each asteroid's cold side produced less jetting. This thrusting, which I call *the radiometer effect*, was *efficiently powered by solar energy* and spiraled asteroids outward, away from the sun, concentrating them between the orbits of Mars and Jupiter.[14] [See Figures 157 and 158.]

Question 4: Could the radiometer effect push asteroids 1–2 astronomical units (AU) farther from the Sun?

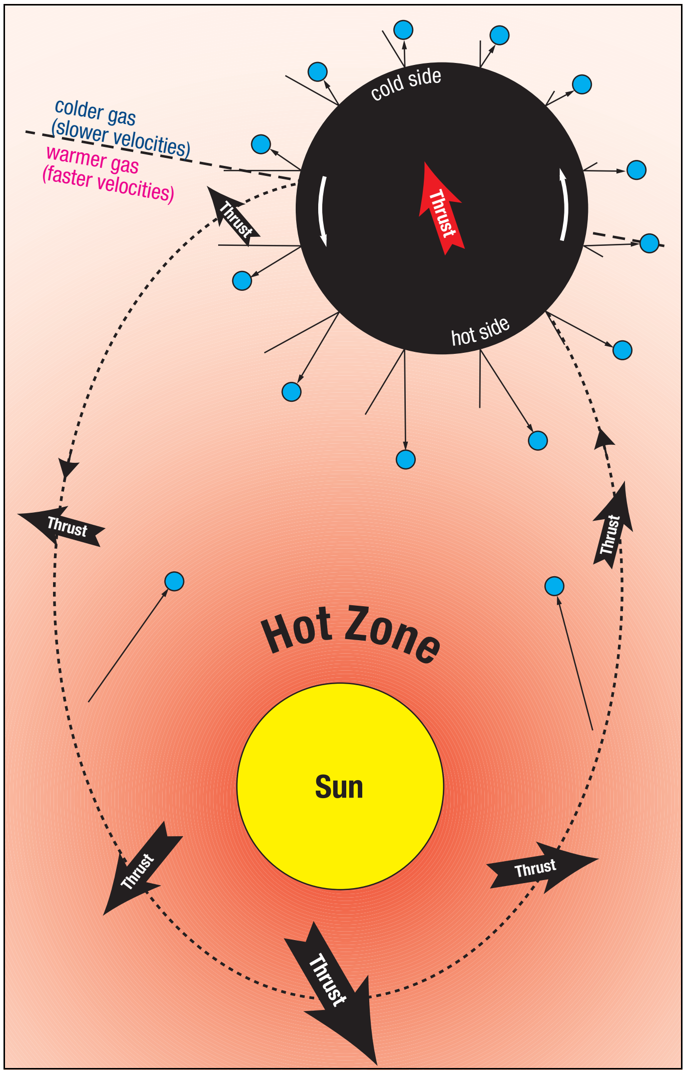


Figure 157: Thrust and Drag Acted on Asteroids. (Sun, asteroid, gas molecules, and orbit are not to scale.) The fountains of the great deep launched rocks and muddy water from Earth. The larger rocks, assisted by water vapor and other gases within the spheres of influence of these rocks, captured other rocks and ice particles. Those growing bodies that were primarily rocks became asteroids.

The Sun heats an asteroid's near side, while the far side radiates its heat into cold outer space. Therefore, large temperature differences exist on opposite sides of each rocky, orbiting body. The darker the body[15] and the slower it spins, the greater that temperature difference. (For example, temperatures on the sunny side of our Moon reach a searing 260°F, while on the dark side, temperatures can drop to a frigid -280°F.) Also, gas molecules (small blue circles) between the Sun and asteroid, *especially those coming from very near the Sun*, are hotter and faster than those on the far side of an asteroid. Hot gas molecules hitting the hot side of an asteroid bounce off with much higher velocity and momentum than cold gas molecules bouncing off the cold side. Those impacts slowly expanded asteroid orbits until too little gas remained in the inner solar system to provide much thrust. The closer an asteroid was to the Sun, the greater the outward thrust. Gas molecules, concentrated near Earth's orbit for years after the flood, created a drag on asteroids. My computer simulations have shown that this gas could slowly move asteroids from many random orbits into the asteroid belt.[16] Thrust primarily expanded the orbits. Drag circularized orbits and reduced their angles of inclination.

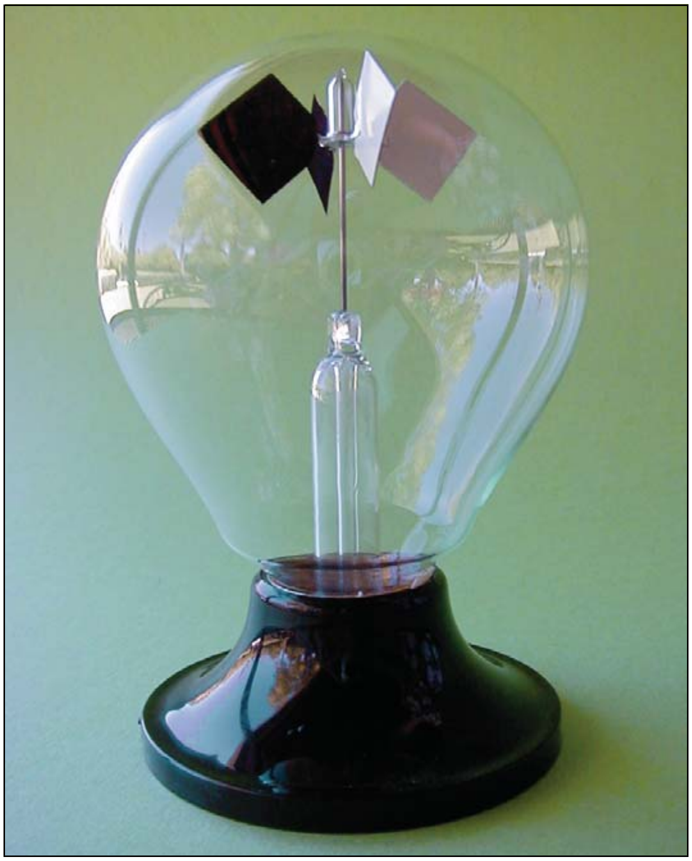


Figure 158: The Radiometer Effect. This well-known novelty, called a *radiometer*, demonstrates the unusual thrust that pushed asteroids into their present orbits. Sunlight warms the dark side of each vane more than the light side. The partial vacuum inside the bulb approaches that found in outer space, so gas molecules travel relatively long distances before striking other molecules. Gas molecules bounce off the hotter, black side with greater velocity than off the colder, white side. This turns the vanes away from the dark side.

The black side also radiates heat faster when it is warmer than its surroundings. This can be demonstrated by briefly placing the radiometer in a freezer. There the black side cools faster, making the white side warmer than the black, so the vanes turn away from the white side. In summary, the black side gains heat faster when in a hot environment and loses heat faster when in a cold environment. Higher gas pressure always pushes on the warmer side.

Each asteroid began as a swarm of particles (rocks, ice, and gas molecules) orbiting within a large sphere of influence. Because a swarm's volume was quite large, its spin was much slower than it would be as it shrank to become an asteroid—perhaps orders of magnitude slower. The slow spin produced extreme temperature differences between the hot and cold sides. The cold side would have been so cold that gas molecules striking it would tend to stick, thereby *adding* "fuel" to the developing asteroid. Because the swarm's volume was large, the radiometer pressure acted over a large area and produced a large thrust. The swarm's large thrust and low density caused the swarm to rapidly accelerate—much like a feather placed in a gentle breeze. Also, the Sun's gravity 93,000,000 miles from the

Figure 159: Hot Meteorites. Most iron-nickel meteorites display Widmanstätten patterns. That is, if an iron-nickel meteorite is cut and its face is polished and then etched with acid, the surface has the strange crisscross pattern shown above. This shows that temperatures throughout those meteorites exceeded 1,300°F.[17] Why were so many meteoroids, drifting in cold space, at one time so uniformly hot? An impact would not produce such uniformity, nor would a blowtorch. The brief heating a meteor experiences in passing through the atmosphere is barely felt more than a fraction of an inch beneath the surface. If radioactive decay generated the heat, certain daughter products should be present; they are not. Question 5 explains how these high temperatures were probably reached.

Sun (the Earth-Sun distance) is 1,600 times weaker than Earth's gravity here on Earth.[18] So, pushing a swarm of rocks and debris farther from the Sun was surprisingly easy, because there is almost no resistance in outer space.

Question 5: Why are 4% of meteorites almost entirely iron and nickel? Also, why do meteorites rarely contain quartz, which constitutes about 27% of granite's volume?

Pillars were formed in the subterranean chamber when the thicker portions of the crust were squeezed downward onto the chamber floor. [See **"What Triggered the Flood?"** on pages 433–437.] Twice daily, during the centuries before the flood, these pillars were stretched and compressed by tides in the subterranean water. This gigantic heating process steadily raised pillar temperatures. As explained in Figure 159, temperatures in what are now iron-nickel meteorites once exceeded 1,300°F, enough to dissolve quartz and allow iron and nickel to settle downward and become concentrated in the pillar tips.[19] (A similar gravitational settling process concentrated iron and nickel in the Earth's core after the flood began. See **"Melting the Inner Earth"** on pages 496–498.)

Evolutionists have difficulty explaining iron-nickel meteorites. First, everyone recognizes that a powerful heating mechanism must first melt at least some of the parent body from which the iron-nickel meteorites came, so iron and nickel can sink and be concentrated. How this could have occurred in the weak gravity of extremely cold asteroids has defied explanation.[20] Second, the concentrated iron and nickel, which evolutionists visualize in the core of a large asteroid, must then be excavated and blasted into space. The evidence shows this has not happened.[21]

Figure 160: Shatter Cone. When a large, crater-forming meteorite strikes the Earth, a shock wave radiates outward from the impact point. The passing shock wave breaks the rock surrounding the crater into meteorite-size fragments having distinctive patterns called *shatter cones*. (Until shatter cones were associated with impact craters by Robert S. Dietz in 1969, impact craters were often difficult to identify.)

If large impacts on asteroids launched asteroid fragments toward Earth as meteorites, a few meteorites should have shatter cone patterns. None has ever been reported. Therefore, *meteorites are probably not derived from asteroids.* Likewise, impacts have not launched meteorites from Mars. [For other reasons, see page 318.]

Question 6: Aren't meteoroids chips off of asteroids?

This commonly-taught idea is based on an error in logic. Asteroids and meteoroids have some similarities, but that does not mean that one came from the other. Maybe a common event produced both asteroids and meteoroids.

Also, three major discoveries suggest that meteoroids came not from asteroids, but from Earth.

1. By 1975, the Pioneer 10 and 11 spacecraft traveled out through the asteroid belt. NASA expected that the particle detection experiments on board would find 10 times more micrometeoroids in the belt than are present near Earth's orbit.[22] Surprisingly, the number of micrometeoroids diminished as the asteroid belt was approached,[23] showing that micrometeoroids are not coming from asteroids but from nearer the Earth's orbit. [See Figure 165 on page 314.]

2. A faint glow of light, called the *zodiacal light*, extends from the orbit of Venus out to the asteroid belt. The light is reflected sunlight bouncing off dust-size particles. This lens-shaped swarm of particles orbits the Sun, near Earth's orbital plane. (On dark, moonless nights, zodiacal light can be seen best in the spring in the western sky after sunset and in the fall in the eastern sky before sunrise.) Debris chipped off asteroids would have a wide range of sizes and would not be as uniform and fine as the particles reflecting

Chondrules

Figure 161: Chondrules. The central chondrule above is 2.2 millimeters in diameter, the size of this circle: ●. This picture was taken in reflected light. However, meteorites containing chondrules can be thinly sliced and polished, allowing light from below to pass through the thin slice and into the microscope. Such light becomes polarized as it passes through the minerals. The resulting colors identify minerals in and around the chondrules. [Meteorite from Hammada al Hamra Plateau, Libya.]

Chondrules (CON-drools) are strange, spherical, BB-size objects found in 86% of all meteorites. To understand the origin of meteorites we must also understand how chondrules formed.

Their spherical shape and texture show they were once molten, but to melt chondrules requires temperatures exceeding 3,000°F. How could chondrules get that hot without melting the surrounding rock, which usually has a *lower* melting temperature? Because chondrules still contain volatile substances that would have bubbled out of melted rock, chondrules must have melted and cooled quite rapidly.[24] By one estimate, melting occurred in about one-hundredth of a second.[25]

The standard explanation for chondrules is that small pieces of rock, moving in outer space billions of years ago, before the Sun and Earth formed, suddenly and mysteriously melted. These liquid droplets quickly cooled, solidified, and then were encased inside the rock that now surrounds them. Such vague conditions, hidden behind a veil of space and time, make it nearly impossible to test this explanation in a laboratory. Scientists recognize that this standard story does not explain the rapid melting and cooling of chondrules or how they were encased uniformly in rocks which are *radiometrically older* than the chondrules.[26] As one scientist wrote, "The heat source of chondrule melting remains uncertain. We know from the petrological data that we are looking for a very rapid heating source, but what?"[27]

Frequently, minerals grade (gradually change) across the boundaries between chondrules and surrounding material.[28] This suggests that chondrules melted while encased in rock. If so, the heating sources must have acted briefly and been localized near the center of what are now chondrules. But how could this have happened?

The most common mineral in chondrules is olivine.[29] Deep rocks contain many BB-size pockets of olivine. Pillars within the subterranean water probably had similar pockets. As the subterranean water escaped from under the crust, pillars had to carry more of the crust's weight. When olivine reaches a certain level of compression, it suddenly changes into another mineral, called spinel (spin-EL), and shrinks in volume by about 10%.[30] (Material surrounding each pocket would not shrink.)

Tiny, collapsing pockets of olivine transforming into spinel would generate great heat, for two reasons. First, the transformation is exothermic; that is, it releases heat *chemically*. Second, it releases heat *mechanically*, by friction. Here's why. At the atomic level, each pocket would collapse in many stages—much like falling dominos or the section-by-section crushing of a giant scaffolding holding up an overloaded roof. Within each pocket, as each microscopic crystal slid over adjacent crystals at these extreme pressures, melting would occur along sliding surfaces. The remaining solid structures in the olivine pocket would then carry the entire compressive load—quickly collapsing and melting other parts of the "scaffolding."

The fountains of the great deep expelled pieces of crushed pillars into outer space where they rapidly cooled. Their tumbling action, especially in the weightlessness of space, would have prevented volatiles from bubbling out of the encased liquid pockets within each rock. In summary, chondrules are a by-product of the mechanism that produced meteorites—a rapid process that started under the Earth's crust as the flood began.

the zodiacal light. Debris expelled by the fountains of the great deep would place fine dust particles in the Earth's orbital plane and would explain zodiacal light.

3. Many meteorites have remanent magnetism, so they must have come from a larger magnetized body. Eros, the only asteroid on which a spacecraft has landed and taken magnetic measurements, has no net magnetic field. If this is true of other asteroids as well, meteorites probably did not come from asteroids.[31] If asteroids are flying rock piles, as it now appears, any magnetic fields in the randomly oriented rocks would be largely self-canceling, so the asteroid would have no net magnetic field. Therefore,

instead of coming from asteroids, meteorites likely came from a magnetized body such as a planet. Because Earth's magnetic field is 2,000 times greater than that of all other rocky planets combined, meteorites probably came from Earth.

Remanent magnetism decays, so meteorites must have *recently* broken away from their parent magnetized body. Those who believe that meteorites were chipped off asteroids say this happened millions of years ago.

PREDICTION 34: Most rocks comprising asteroids will be found to be magnetized.

Question 7: Does other evidence support this hypothesis that asteroids and meteoroids recently came from Earth?

Yes. Here are twenty-one additional observations that either support the proposed explanation or are inconsistent with other current theories on the origin of asteroids and meteoroids:

1. For decades, astronomers have said that asteroids are rocky bodies and comets are dirty snowballs.[32] However, independent studies have found water-ice and *complex organic compounds* covering asteroids Cybele[33] and Themis,[34] two of the largest asteroids (each about 125 miles in diameter). No one suspected that water-ice could remain on asteroids orbiting that close (3.2 AU) to the Sun.[35] Again, no "sharp line" separates asteroids and comets.

   So why are ice and organic material all over the surfaces of Themis and Cybele? If ice came out from inside an asteroid, how did water get inside it in the first place? Without answering these questions, and knowing how earth could not have evolved with water, some evolutionists now say that asteroids must have brought water—and organic material (life)—to earth.[36] [See **"Earth: The Water Planet"** on page 27.] No; some water and organic matter formerly on the earth are now in comets and asteroids.

   The hydroplate theory provides a simple explanation. As the flood began, muddy water and some organic material were launched from earth. In the cold vacuum of space, about half of that water quickly evaporated and the remainder froze. Later, gravity (as explained beginning on page 274) formed asteroids and comets from some of that material. Since the flood, almost all ice on asteroid surfaces has sublimated (vaporized), leaving behind a crust of dirt that protects the deeper ice within. If internal ice is suddenly exposed by an impact or by fracturing, water vapor will briefly vent and form an atmosphere for the asteroid. Eventually, those atmospheres will leave a temporary layer of frost on the asteroid's surface, which is what was discovered on Themis and Cybele.

PREDICTION 35: Water-ice on asteroids will be rich in deuterium.

Two Interpretations

With a transmission electron microscope, Japanese scientist Kazushige Tomeoka identified several major events in the life of one meteorite. Initially, this meteorite was part of a much larger parent body orbiting the Sun. The parent body had many thin cracks, through which mineral-rich water cycled. Extremely thin mineral layers were deposited on the walls of these cracks. These deposits, sometimes hundreds of layers thick, contained calcium, magnesium, carbonates, and other chemicals. Mild thermal metamorphism in this rock shows that temperatures increased before it experienced some final cracks and was blasted into space.[37]

Hydroplate Interpretation. Earth was the parent body of all meteorites, most of which are pillar fragments. [Pages 433–437 explain how, why, when, and where pillars formed.] Twice a day before the flood, tides in the subterranean water compressed and stretched these pillars. Compressive heating occurred and cracks developed. Just as water circulates through a submerged sponge that is squeezed and stretched, mineral-laden water circulated through cracks in pillars for years before they broke up. Pillar fragments, launched into space by the fountains of the great deep, became meteoroids. [**"The Origin of Limestone"** chapter on pages 229–235 explains the presence of calcium, magnesium, and carbonates in the water.] In summary, *water did it.*

Tomeoka's (and Most Evolutionists') Interpretation. Impacts on an asteroid cracked the rock that was to become this meteorite. Ice was deposited on the asteroid. Impacts melted the ice, allowing liquid water to circulate through the cracks and deposit hundreds of layers of magnesium, calcium, and carbonate bearing minerals. A final impact blasted rocks from this asteroid into space. In summary, *impacts did it.*

PREDICTION 36: A deep, penetrating impact on a large asteroid, such as Ceres,[32] will release huge volumes of water vapor.

2. Minerals in meteorites and meteoroids are remarkably similar to those in the Earth's crust.[38] Some meteorites contain very dense elements, such as nickel and iron. Those heavy elements seem compatible only with the dense, rocky planets: Mercury, Venus, Mars, and Earth—Earth being the densest.

   A few asteroid densities have been calculated. They are generally low, ranging from 1.2 to 3.3 gm/cm^3. The higher densities match those of the Earth's crust. The lower densities imply the presence of empty space between loosely held rocks or something light such as water-ice.[39]

PREDICTION 37: Rocks in asteroids are typical of the Earth's crust. Expensive efforts to mine asteroids[40] to recover strategic or precious metals will be a waste of money.

3. Most meteorites[42] contain metamorphosed minerals, showing that they reached extremely high temperatures and pressures, despite a supposed lifetime in the "deep freeze" and weightlessness of outer space. Asteroids have also experienced extreme heating.[43] Radioactive decay within such relatively small bodies could not have produced the necessary heating, because too much heat would have escaped from their surfaces. Stranger still, liquid water altered some meteorites[44] while they and their parent bodies were heated—sometimes multiple times.[45]

   Impacts in space are often proposed to explain this mysterious heating throughout an asteroid or meteorite. However, an impact would raise the temperature only for an instant near the point of impact. Before gravel-size fragments from an impact could become uniformly hot, they would radiate their heat into outer space.[46]

   For centuries before the flood, tidal pumping generated considerable heat within pillars in the subterranean water chamber. [See Question 5 on page 308.] As the flood began, the powerful jetting water launched rock fragments into space—fragments of hot, crushed pillars and rocks from the crumbling walls of the ruptured crust. Those rocks became meteoroids and asteroids.

4. Tiny, ultrahard diamonds have been found in a meteorite, implying that both the temperature and pressure within the meteorite were greater than that which produced any known diamonds.[47] Asteroid impacts in supercold space (almost absolute zero) might produce the pressures needed, but would not produce the necessary temperatures. Meteorites entering Earth's atmosphere are heated but only on their surface, and their tumbling action would probably not produce the necessary pressure. Pounding pillars in the subterranean chamber would experience both the temperatures and pressures needed to form these superhard diamonds.

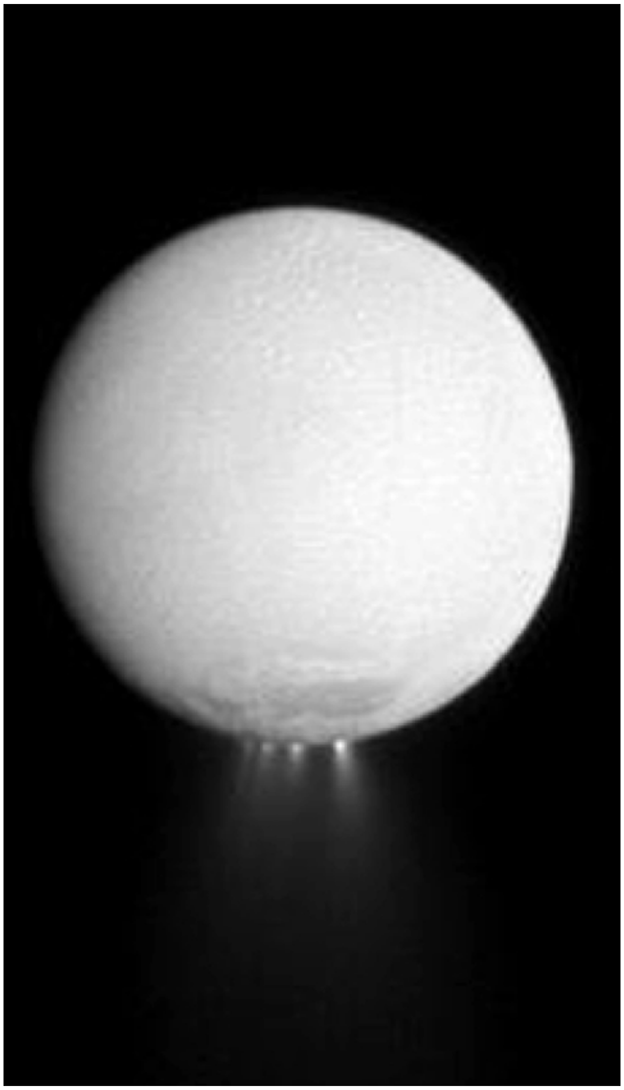
5. Because the material (that later merged to become asteroids) came from Earth, they typically spin in the same direction as Earth—counterclockwise, as seen from the North. However, collisions have undoubtedly randomized the spins of many smaller asteroids in the last few thousand years.[49]

6. Some asteroids have captured one or more moons. [See Figure 156.] Sometimes the "moon" and asteroid are similar in size. Impacts would not create equal-size fragments that could capture each other.[50] The only conceivable way for this to happen is if a potential moon enters an asteroid's expanding sphere of influence while traveling about the same speed and direction as the asteroid. If even a thin gas surrounds the asteroid, the moon will be drawn closer to the asteroid, preventing the moon from being stripped away later. An "exploded planet" would disperse relatively little gas. The "failed planet explanation" meets none of the requirements. The hydroplate theory satisfies all the requirements.

   Also, tidal effects, described on pages 477–481, limit the lifetime of the moons of asteroids to about 100,000 years.[51] This fact and the problems in capturing a moon caused evolutionist astronomers to scoff at early reports that some asteroids have moons.

7. Meteorites contain different varieties (isotopes) of the chemical element molybdenum, each isotope having a slightly different atomic weight. If, as evolutionists teach, a swirling cloud of gas and dust mixed for millions of years and produced the Sun, its planets, and meteorites, then each meteorite should have about the same combination of these molybdenum isotopes. Because this is not the case,[41] meteorites did not come from a swirling dust cloud or any source that mixed for millions of years.

   (The next chapter, **"The Origin of Earth's Radioactivity,"** will explain why different mixes of isotopes are in different meteorites, but for now remember that most meteorites are fragments of crushed pillars



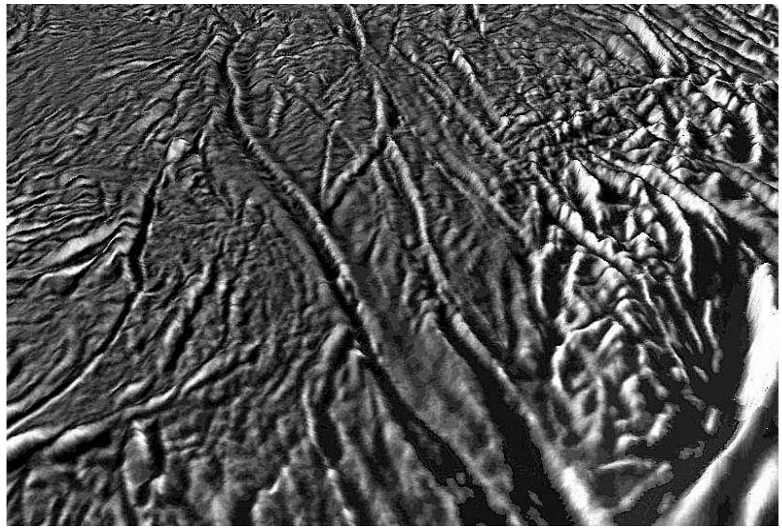


Figure 162: Enceladus, One of Saturn's Moons. (Left) Fountains of salty water (in the form of a hot plasma) are steadily ejecting from Enceladus' South Pole. *The salt concentration is similar to that in Earth's ocean*s.[56] Water that fails to escape Enceladus falls back as snow—somewhat like water that fell back from the fountains of the great deep onto earth during the global flood. Also, tidal pumping produced by Saturn's gravity produces the great heat that converts Enceladus' subsurface water ice into electrically charged plasma jets—just as tidal pumping (from the Sun's and Moon's gravity) initiated heating in the preflood subterranean water. [Tidal pumping is explained on page 124 and pages 488–489.] The fountains on Enceladus also contain "water vapor *laced with small amounts of methane as well as simple and complex organic molecules. Surprisingly, the plumes of Enceladus appear similar in make-up to many comets.*"[48] Can you guess why?

(Top) A close-up photo of Enceladus' South Pole shows what NASA calls the "tiger stripes," where the jets erupt. (Those jets are not visible under the lighting conditions of this picture.) As water is expelled from under the South Pole, the icy crust subsides and wrinkles, like the skin of a dried out, shrunken orange. (Some wrinkles, exaggerated in this photo, are about 1,600 feet high.)

and each pillar was subjected to a different isotope-producing environment when the flood began.)

8. The smaller moons of the giant planets (Jupiter, Saturn, Uranus, and Neptune) are captured asteroids. Astronomers generally accept this conclusion, but do not know how these captures could have occurred.[52]

   As explained earlier in this chapter, for decades to centuries after the flood the radiometer effect, *powered by the Sun's energy*, spiraled asteroids outward from Earth's orbit. Water vapor, around asteroids and in interplanetary space, temporarily thickened asteroid and planet atmospheres. This facilitated aerobraking [see page 274] which allowed massive planets to capture asteroids. Without these temporary atmospheres (or some yet to be explained means for removing orbital energy), capture becomes almost impossible.[54]

   Recent discoveries indicate that Saturn's 313-mile-wide moon, Enceladus (en-SELL-uh-duhs), is a captured asteroid. [See Figure 162.] Geysers at Enceladus' south pole are expelling water vapor and ice crystals which escape Enceladus and supply Saturn's E ring.[55] That water contains salts resembling Earth's ocean waters.[56] *Because asteroids are icy and weak, they would experience strong tides if captured by a giant planet.* Strong tides would have recently[57] generated considerable internal heat, slowed Enceladus' spin, melted ice, and boiled deep reservoirs of water. Enceladus' spin has almost stopped, its internal water is being launched (some so hot that it becomes a plasma),[58] and its surface near the geysers has buckled due to the loss of internal water. Because the material for asteroids and their organic matter came *recently* from Earth, water *is still* jetting from cold Enceladus' surprisingly warm south pole, and "dark green *organic* material"[59] is on its surface.

9. Mars has two tiny moons, Phobos (14 miles in diameter) and Deimos (8 miles in diameter). In 2008, a spacecraft passing near Phobos was able to measure its density; Phobos contains up to 30%

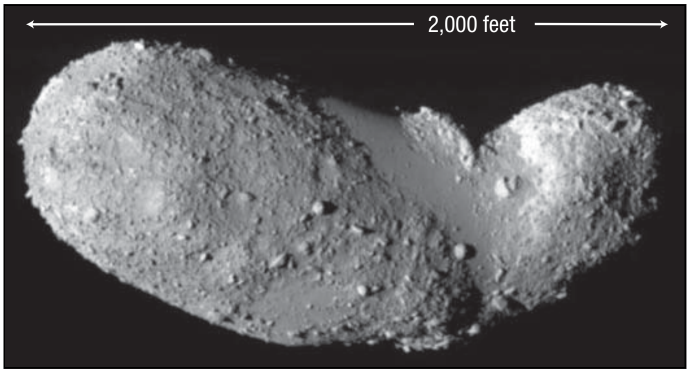


Figure 163: Asteroid Itokawa. The fountains of the great deep expelled dirt, rocks, and considerable water from Earth. About half of that water quickly evaporated into the vacuum of space, freezing the remainder. Each evaporated gas molecule became an orbiting body in the solar system. Later, as explained on pages 305–310, asteroids formed. Many are shaped like peanuts.

Gas molecules captured by asteroids or released by icy asteroids became their temporary atmospheres. Asteroids with thick atmospheres sometimes captured smaller asteroids as moons. If an atmosphere remained long enough, those moons would lose altitude and *gently* merge gravitationally with their asteroids, forming peanut-shaped asteroids. If an atmosphere dissipates before merging, a moon remains, as shown in Figure 156 on page 304. We see merging (called aerobraking) when a satellite or spacecraft reenters Earth's atmosphere, slowly loses altitude, and falls to (merges with) Earth. Without an atmosphere, merging in space becomes almost impossible.

Japan's Hayabusa spacecraft traveled alongside asteroid Itokawa for two months in 2005. Scientists studying Itokawa concluded that it consists of two smaller asteroids that merged. Donald Yeomans, a mission scientist and member of NASA's Jet Propulsion Laboratory, admitted,

> *It's a major mystery how two objects each the size of skyscrapers could collide without blowing each other to smithereens. This is especially puzzling in a region of the solar system where gravitational forces would normally involve collision speeds of 2 km/sec* [4,500 miles per hour].[53]

The mystery is solved when one understands the role that water (and the gases they produced) played in the origin of comets and asteroids.

Notice that a myriad of *rounded boulders*, some 150 feet in diameter, litter Itokawa's surface. High velocity water produces rounded boulders; an exploded planet or impacts on asteroids would produce angular rocks.

empty space[60] or something much lighter than rock, such as water-ice. Asteroids and Phobos have similar low densities and spectral similarities.[61] The surfaces of these moons and Mars are composed of different materials, showing that Phobos and Deimos did not come from material blasted off Mars.[62]

Astronomers would normally conclude that both moons are captured asteroids, except for the inconvenient laws of orbital mechanics which show that it is virtually impossible to perturb asteroids in the asteroid belt from their circular orbits and have them

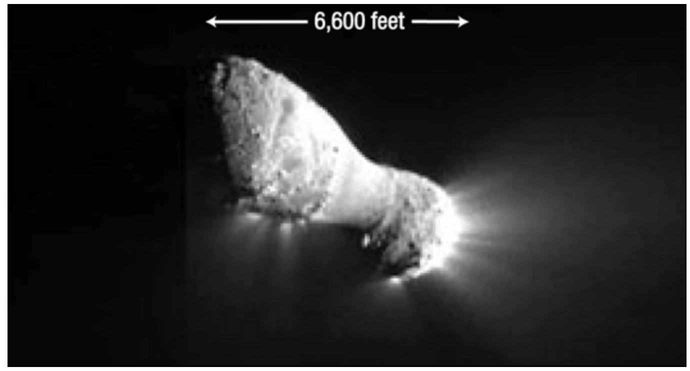


Figure 164: Comet Hartley 2. On 4 November 2010, the Deep Impact spacecraft passed within 435 miles of Comet Hartley 2 and took this photograph. Hartley 2 has a peanut shape, as does asteroid Itokawa (shown in Figure 163) and some other asteroids and comet nuclei, because they all formed by the same special mechanism.

Once launched into space by the fountains of the great deep, smaller debris gravitationally merged with large rocks traveling nearby with similar velocities and directions. The relative velocities of merging pairs were very small, because they were launched at about the same time and place and with similar directions and speeds. Smaller bodies that came within the spheres of influence of larger rocks would briefly orbit the larger bodies. Then, if the gas in those spheres of influence (gas also launched into the inner solar system) removed enough orbital energy, the larger body would capture the smaller body. Once captured, aerobraking would decay the orbits and, over weeks to years, the two would gently merge. Eventually, the larger rocks merged with enough matter (swarms of ice, dust, gases, *and organic material*) that they became large globs. The larger a glob became, the more its sphere of influence grew, so the glob could pull in even more material. Finally, if two large globs gently merged, they became peanut comets or asteroids.

If merged bodies have spent much of their lives orbiting close to the sun, their frozen surface volatiles would have completely evaporated; we call them asteroids. However, if the merged bodies spent little time near the sun, their volatiles would still be venting today when they passed near the Sun, and we call them comets. This is why asteroids and comets have so many similarities, why a few are catalogued as both comet and asteroid, and why asteroids impacted by space debris will suddenly start venting their frozen internal volatiles.

What was the source of the organic material? Probably it came from something living, although that is not absolutely necessary. Further space missions will clarify this. In the meantime, one would be wise to bet that *the organics came from life on the preflood earth, not that organics in space seeded life on earth*. The latter is absurd, because life is so complex, and organisms exposed to space radiations for millions of years would be dead.

Surprisingly, Hartley 2 is expelling more carbon dioxide (CO_2) than water vapor. Undoubtedly, other comets and asteroids once contained frozen CO_2 (dry ice). At the low pressures in space, dry ice vaporizes (sublimates) above -110°F. The fact that Hartley 2, a small comet, is still sublimating shows us that *it is very young*. The burning question is where did the CO_2 come from? **"The Origin of Limestone"** on pages 228–235 explains why the water in the subterranean chamber contained both abundant limestone and dissolved CO_2. Consequently, the water in the fountains of the great deep—and, therefore, the comets and asteroids that later formed from that water—contained abundant CO_2. Some still do.

end up in circular orbits around Mars. Astronomers are perplexed.

However, asteroids did not come from the asteroid belt; they formed from rocks and water (ice) launched from earth by the powerful fountains of the great deep. Later, the radiometer effect, powered by solar energy, spiraled them out through Mars' orbit. The fountains also placed gas in the inner solar system. Simultaneously, comets and asteroids impacting Mars added water vapor which temporarily thickened Mars' atmosphere. All those gases allowed Mars to capture Phobos and Deimos by aerobraking and placed them in circular orbits.

PREDICTION 38: Mars' smaller moon, Deimos, also will be found to have a very low density.

10. A few asteroids suddenly develop comet tails, so they are considered both asteroid and comet. The hydroplate theory says that asteroids are weakly joined piles of rocks and ice. If such a pile cracked slightly, perhaps due to an impact by space debris, then internal ice, suddenly exposed to the vacuum of space, would violently vent water vapor and produce a comet tail. The hydroplate theory explains why comets are so similar to asteroids.

11. A few comets have nearly circular orbits within the asteroid belt. Their tails lengthen as they approach perihelion and recede as they approach aphelion. If comets formed beyond Neptune, it is highly improbable that they could end up in nearly circular orbits in the asteroid belt.[63] So, these comets almost certainly did not form in the outer solar system, but again, comet ice in the inner solar system would evaporate quickly. The hydroplate theory explains how comets (icy rock piles) recently entered the asteroid belt.

12. If asteroids passing near Earth came from the asteroid belt, too many of them have diameters less than 50 meters,[64] and too many have circular orbits.[65] However, we would expect this if the rocks that formed asteroids were launched from Earth.

13. Computer simulations, both forward *and backward* in time, show that asteroids traveling near Earth have a maximum expected lifetime of only about a million years. They "quickly" collide with the Sun.[66] This raises doubts that all asteroids began 4,600,000,000 years ago as evolutionists claim—living 4,600 times longer than the expected lifetime of near-Earth asteroids.

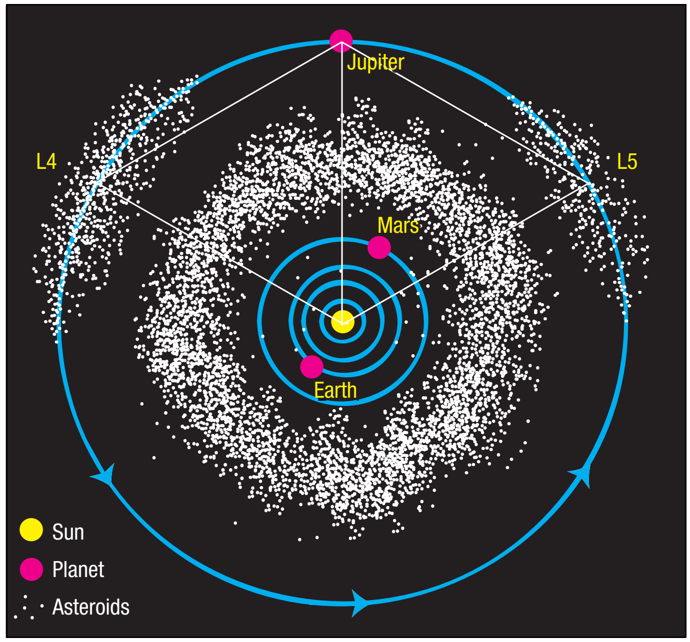


Figure 165: Asteroid Belt and Jupiter's L4 and L5. The size of the Sun, planets, and especially asteroids are magnified, but their relative positions are accurate. About 90% of the 30,000 precisely known asteroids lie between the orbits of Mars and Jupiter, a doughnut-shaped region called *the asteroid belt*. A few small asteroids cross Earth's orbit.

Jupiter's Lagrange points, L4 and L5, lie 60° ahead and 60° behind Jupiter, respectively. They move about the Sun at the same velocity as Jupiter, as if they were fixed at the corners of the two equilateral triangles shown. Items 15 and 16 explain why so many asteroids have settled near L4 and L5, and why significantly more oscillate around L4 than L5.

14. Earth has one big moon and several tiny moons—up to 650 feet in diameter.[67] The easiest explanation for the small moons is that they were launched from Earth with barely enough velocity to escape Earth's gravity. (To understand why the largest of these small moons is about 650 feet in diameter, see Endnote 9.)

15. Asteroids 3753 Cruithne and 2000 AA_{29} are traveling companions of Earth.[68] They delicately oscillate, in a horseshoe pattern, around two points that lie 60° (as viewed from the Sun) forward and 60° behind the Earth but on Earth's nearly circular orbit. These points, predicted by Lagrange in 1764 and called *Lagrange points*, are stable places where an object would not move relative to the Earth and Sun if it could once occupy either point going at zero velocity relative to the Earth and Sun. But how could a slowly moving object ever reach, or get near, either point? Most likely, it barely escaped from Earth.

Also, Asteroid 3753 could not have been in its present orbit for long, because it is so easy for a passing gravitational body to perturb it out of its barely stable niche. Time permitting, Venus will pass near this asteroid 8,000 years from now and may dislodge it.[69]

16. Jupiter has two Lagrange points on its nearly circular orbit. The first, called L4, lies 60° (as seen from the Sun) in the direction of Jupiter's motion. The second, called L5, lies 60° behind Jupiter.

    Visualize planets and asteroids as large and small marbles rolling in orbitlike paths around the Sun on a large frictionless table. At each Lagrange point is a bowl-shaped depression that moves along with each planet. Because there is no friction, small marbles (asteroids) that roll down into a bowl normally pick up enough speed to roll back out. However, if a chance gravitational encounter slowed one marble right after it entered a bowl, it might not exit the bowl. Marbles trapped in a bowl would normally stay 60° ahead of or behind their planet, gently rolling around near the bottom of their moving bowl.

    One might think an asteroid is just as likely to get trapped in Jupiter's leading bowl as its trailing bowl—a 50–50 chance, as with the flip of a coin. Surprisingly, 1068 asteroids are in Jupiter's leading (L4) bowl, but only 681 are in the trailing bowl.[70] This shouldn't happen in a trillion trials if an asteroid is just as likely to get trapped at L4 as L5. What concentrated so many asteroids near the L4 Lagrange point?

    According to the hydroplate theory, asteroids formed near Earth's orbit. Then, the radiometer effect spiraled them outward, toward the orbits of Mars and Jupiter. Some spiraled through Jupiter's circular orbit and passed near both L4 and L5. Jupiter's huge gravity would have slowed those asteroids that were moving away from Jupiter but toward L4. That braking action would have helped some asteroids settle into the L4 bowl. Conversely, asteroids that entered L5 were accelerated toward Jupiter, so they would quickly be pulled out of L5 by Jupiter's gravity. The surprising excess of asteroids near Jupiter's L4 is what we would expect based on the hydroplate theory.

17. Without the hydroplate theory, one has difficulty imagining situations in which an asteroid would (a) settle into any of Jupiter's Lagrange points (let alone one of Jupiter's symmetric Lagrange points), (b) capture a moon, especially a moon with about the same mass as the asteroid, or (c) have a circular orbit, along with its moon, about their common center of mass. If all three happened to an asteroid, astronomers would be shocked; no astronomer would have predicted that it could happen to a comet. Nevertheless, an "asteroid" discovered earlier, named 617 Patroclus, satisfies (a)–(c). Patroclus and its moon, Menoetius, have such low densities that they would float in water; therefore, both are probably comets[71]—dirty, fluffy snowballs. Paragraphs 6, 10, 11, and 16 (above) explain why these observations make perfect sense with the hydroplate theory.

18. As explained in **"Shallow Meteorites"** on page 40, meteorites are almost always found surprisingly near Earth's surface. The one known exception is in southern Sweden, where 40 meteorites and thousands of grain-size fragments of one particular type of meteorite have been found at different depths in a few limestone quarries. The standard explanation is that all these meteorites somehow struck this same small area over a 1–2-million-year period about 480 million years ago.[72]

    A more likely explanation is that some meteorites, not launched with enough velocity to escape Earth during the flood, fell back to Earth. One or more meteorites fragmented on reentering Earth's atmosphere. The pieces landed in mushy, recently-deposited limestone layers in southern Sweden.

19. Light spectra (detailed color patterns, much like a long bar code) from certain asteroids in the outer asteroid belt imply the presence of organic compounds, especially kerogen, a coal-tar residue,[73] which probably came from plant life. Life as we know it could not survive in such a cold, radiation-filled region of space, but common organic matter launched from Earth could have been preserved.

20. Many asteroids are reddish and have light characteristics showing the presence of iron.[74] On Earth, reddish rocks almost always imply iron oxidized (rusted) by oxygen gas. Today, gaseous oxygen is rare in outer space. If iron on asteroids is oxidized, what was the source of the oxygen? Answer: Water molecules, surrounding and impacting asteroids, dissociated (broke apart), releasing oxygen. That oxygen then combined chemically with iron on the asteroid's surface, giving the reddish color.

    Mars, often called the red planet, derives its red color from oxidized iron. Again, oxygen contained in water vapor launched from Earth during the flood, probably accounts for Mars' red color.

    Mars' topsoil is richer in iron and magnesium than Martian rocks beneath the surface. The dusty surface of Mars also contains carbonates, such as limestone.[75] Because meteorites and Earth's subterranean water contained considerable iron, magnesium, and carbonates, it appears that Mars was heavily bombarded by meteorites and water launched from Earth's subterranean chamber. [See

Meteorites Return Home

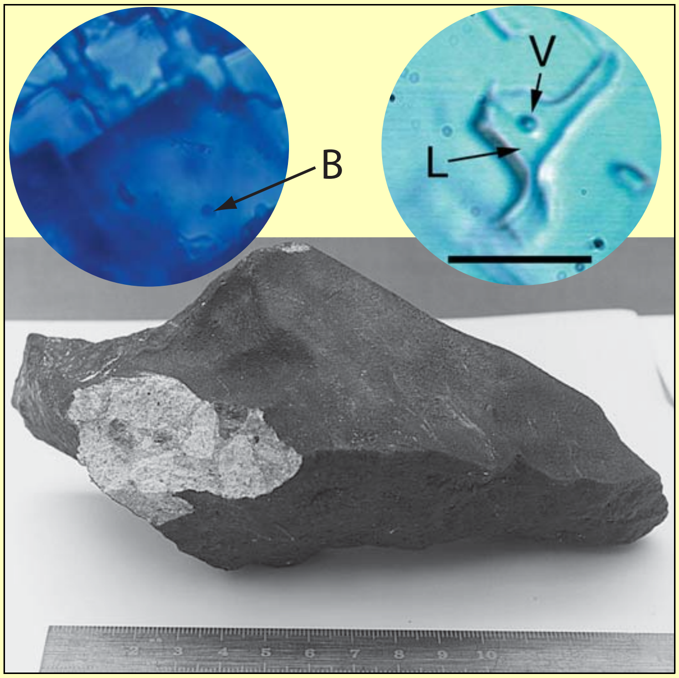


Figure 166: Salt of the Earth. On 22 March 1998, this 2¾ pound meteorite landed 40 feet from boys playing basketball in Monahans, Texas. While the rock was still warm, police were called. Hours later, NASA scientists cracked the meteorite open in a clean-room laboratory, eliminating any possibility of contamination. Inside were salt (NaCl) crystals 0.1 inch (3 mm) in diameter and liquid water![79] Some of these salt crystals are shown in the blue circle, highly magnified and in true color. Bubble (B) is inside a liquid, which itself is inside a salt crystal. Eleven quivering bubbles were found in about 40 fluid pockets. Shown in the green circle is another bubble (V) inside a liquid (L). The length of the horizontal black bar represents 0.005 mm, about 1/25 the diameter of a human hair.

NASA scientists who investigated this meteorite believe that it came from an asteroid, but that is highly unlikely. Asteroids, having little gravity and being in the vacuum of space, cannot sustain *liquid* water, which is required to form salt crystals. (Earth is the only planet, indeed the only body in the solar system, that can sustain liquid water on its surface.) Nor could surface water (gas, liquid, or solid) on asteroids withstand high-velocity impacts. Even more perplexing for the evolutionist: What is the salt's origin? Also, what accounts for the meteorite's other contents: potassium, magnesium, iron, and calcium—elements abundant on Earth, but rare in the interstellar medium?[80]

Figure 41 on page 106 illustrates the origin of meteoroids. Dust-size meteoroids often come from comets. Most larger meteoroids are rock fragments that never merged into a comet or asteroid.

Much evidence supports Earth as the origin of meteorites.

- Minerals and isotopes in meteorites are remarkably similar to those on Earth.[38]
- Some meteorites contain sugars,[81] salt crystals containing liquid water,[82] and possible cellulose.[83]
- Other meteorites contain limestone,[84] which, on Earth, forms only in liquid water. [See **"The Origin of Limestone"** on pages 229–235.]
- Three meteorites contain excess amounts of left-handed amino acids[85]—a sign of once-living matter. [See **"Handedness: Left and Right"** on page 16.]
- A few meteorites show that "salt-rich fluids analogous to terrestrial brines" flowed through their veins.[86]
- Some meteorites have about twice the heavy hydrogen concentration as Earth's water today.[87] As explained in the preceding chapter and in **"How Much Energy?"** on page 343, this heavy hydrogen came from the subterranean chambers.
- About 86% of all meteorites contain chondrules, which are best explained by the hydroplate theory. [See **"Chondrules"** on page 309.]
- Seventy-eight types of *living* bacteria have been found in two meteorites after extreme precautions were taken to avoid contamination.[88] Bacteria need liquid water to live, grow, and reproduce. Obviously, liquid water does not exist inside meteoroids whose temperatures in outer space are near absolute zero (-460°F). Therefore, the bacteria must have been living in the presence of liquid water before being launched into space. Once in space, they quickly froze and became dormant. Had bacteria originated in outer space, what would they have eaten?

Meteorites containing chondrules, salt crystals, limestone, water, possible cellulose, left-handed amino acids, sugars, living bacteria, terrestrial-like brines, excess heavy hydrogen, and Earthlike patterns of minerals, isotopes, and other components[89] implicate Earth as their source—and the fountains of the great deep as the powerful launcher.

"The Origin of Limestone" on pages 229–235.]

Those who believe that meteorites came from asteroids have wondered why meteorites do not have the red color of most asteroids.[76] The answer is twofold: (a) as explained on page 308, meteorites did not come from asteroids but both came from Earth, and (b) asteroids contain oxidized iron, as explained above, but meteorites are too small to attract an atmosphere gravitationally.

21. Mars has relatively little gravity, travels very near the asteroid belt, and has a thin atmosphere. However, Mars should not have any atmosphere if asteroids

have been pummeling it for 4.6 billion of years. Evidently, asteroids have not been around for 4.6 billion years.[77]

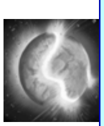
Water on Mars

Water recently and briefly flowed at various locations on Mars.[78] Photographic comparisons show that some water flowed within the last 2–5 years![90] Mars has water-ice at its poles.[91] At various latitudes, impact craters sometimes expose thin ice layers a foot or so beneath the surface.[92] Mars' stream beds usually originate on crater walls rather than in ever smaller tributaries as on Earth.[93] Rain formed other channels.[94] Martian drainage channels and layered strata are found at almost 200 isolated locations.[95] Most gullies are on crater slopes at high latitudes[96]—extremely cold slopes that receive little sunlight. One set of erosion gullies is on the central peak of an impact crater![97]

Today, Mars is cold, averaging -80°F (112 Fahrenheit degrees below freezing). Water on Mars should be ice, not liquid water. Mars' low atmospheric pressures would hasten freezing even more.[98]

Did liquid water come from below Mars' surface or above? Most believe that subsurface water on Mars migrated upward for hundreds of miles to the surface. However, this would not carve erosion gullies on a crater's central peak. Besides, the water would freeze a mile or two below the surface.[99] Even volcanic eruptions on Mars would not melt enough water fast enough to release the estimated 10–1,000 million cubic meters of water per second needed to cut each stream bed.[100] (This exceeds the combined flow rate of all rivers on Earth that enter an ocean.)

Water probably came from above. Soon after Earth's global flood, the radiometer effect caused asteroids to spiral out to the asteroid belt, just beyond Mars. This gave asteroids frequent opportunities to collide with Mars. When crater-forming impacts occurred, large amounts of debris were thrown into Mars' atmosphere. Mars' thin atmosphere and low gravity allowed the debris to settle back to the surface in vast layers of thin sheets—strata.



PREDICTION 39: Most sediments taken from layered strata on Mars and returned to Earth will show that they were deposited through Mars' atmosphere, not through water. (Under a microscope, water deposited grains have nicks and gouges, showing that they received many blows as they tumbled along stream bottoms. Sediments deposited through an atmosphere receive few nicks.)

Impact energy (and heat) from icy asteroids and comets bombarding Mars released liquid water, which often pooled inside craters or flowed downhill and eroded the planet's surface.[101] (Most liquid water soaked into the soil and froze.) Each impact was like the bursting of a large

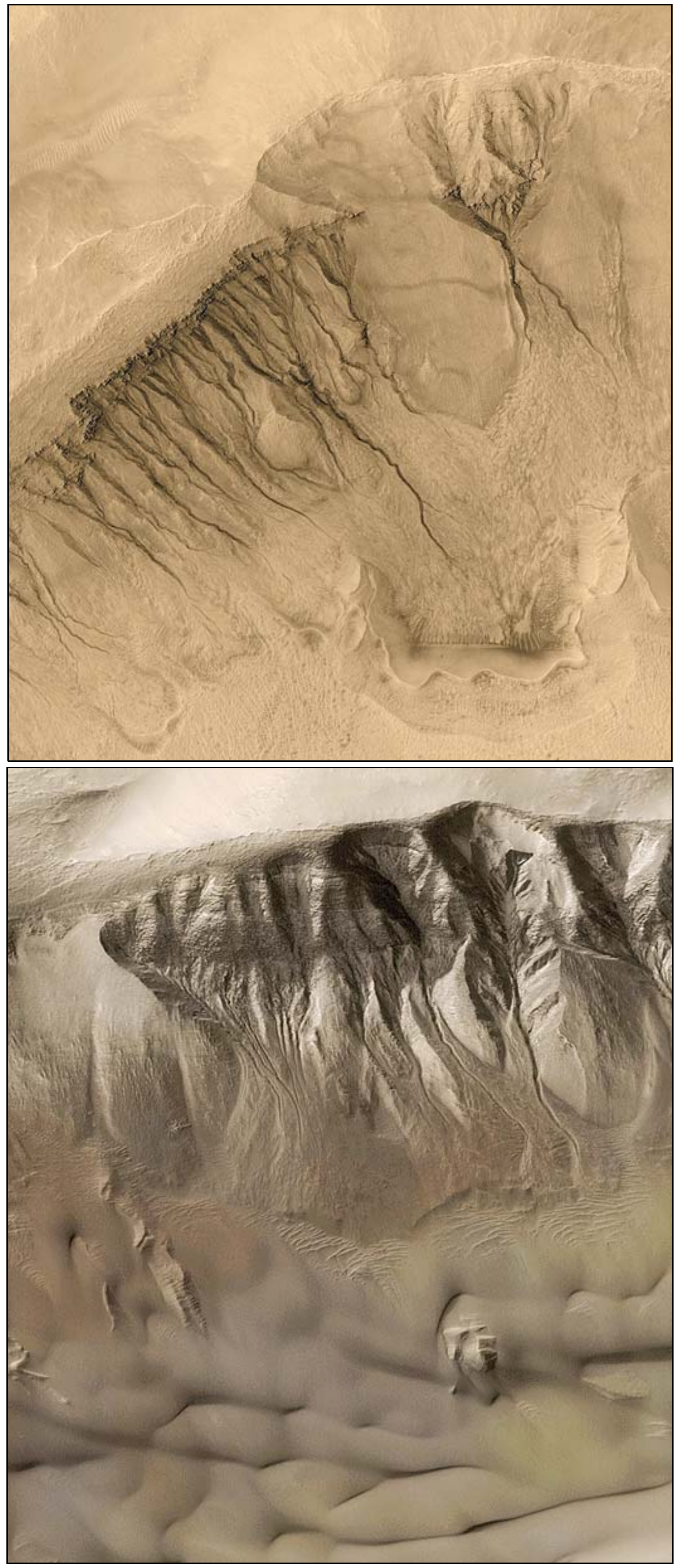


Figure 167: Erosion Channels on Mars. These channels frequently originate in scooped-out regions, called *amphitheaters*, high on a crater wall. On Earth, where water falls as rain, erosion channels begin with narrow tributaries that merge with larger tributaries and finally, rivers. Could impacts of comets or icy asteroids have formed these craters, gouged out amphitheaters, and melted the ice—each within seconds? Mars, which is much colder than Antarctica in the winter, would need a heating source, such as impacts, to produce liquid water.

Are Some Meteorites from Mars?

Widely publicized claims have been made that at least 30 meteorites from Mars have been found. With international media coverage in 1996, a few scientists also proposed that one of these meteorites, named ALH84001, contained fossils of primitive life. Later study rejected that claim.

> *The wormy-looking shapes discovered in a meteorite* [supposedly] *from Mars turned out to be purely mineralogical and never were alive.*[104]

The 30 meteorites are presumed to have come from the same place, because they contain similar ratios of three types of oxygen: oxygen weighing 16, 17, and 18 atomic mass units. (That presumption is not necessarily true, is it?) A chemical argument then indirectly links *one* of those meteorites to Mars, but the link is more tenuous than most realize.[105] That single meteorite had tiny glass nodules containing dissolved gases. A few of these gases (basically the noble gases: argon, krypton, neon, and xenon) had the same *relative* abundances as those found in Mars' atmosphere in 1976. (Actually, a later discovery shows that the mineralogy of these meteorites differs from that of almost all Martian rock.[107]) Besides, if two things are similar, it does not mean that one came from the other. Similarity in the relative abundances of the noble gases in Mars' atmosphere and in one meteorite may be because those gases originated in Earth's preflood subterranean chamber. Rocks and water from the subterranean chamber may have transported those gases to Mars.

Could those 30 meteorites have come from Mars? To escape the gravity of Mars requires a launch velocity of *3 miles per second*. Additional velocity is then needed to transfer to an orbit intersecting Earth, 34–236 million miles away. Supposedly, one or more asteroids slammed into Mars and blasted off millions of meteoroids. Millions are needed, because less than one in a million[108] would ever hit Earth, be large enough to survive reentry, be found, be turned over to scientists, and be analyzed in detail. Besides, if meteorites can come to Earth from Mars, many more should have come from the Moon—but haven't.[109]

For *an impact* suddenly to accelerate, in a fraction of a second, any solid from rest to a velocity of 3 miles per second requires such extreme shock pressures that much of the material would melt, if not vaporize.[110] All 30 meteorites should at least show shock effects. Some do not. Also, Mars should have at least six giant craters if such powerful blasts occurred, because six different launch dates are needed to explain the six age groupings the meteorites fall into (based on evolutionary dating methods). Such craters are hard to find, and large, recent impacts on Mars should have been rare.

Then there are energy questions. Almost all impact energy is lost as shock waves and ultimately as heat. Little energy remains to lift rocks off Mars. Even with enough energy, the fragments must be large enough to pass through Mars' atmosphere. To see the difficulty, imagine throwing a ball high into the air. Then visualize how hard it would be to throw a handful of dust that high. Atmospheric drag, even in Mars' thin atmosphere, absorbs too much of the smaller particles' kinetic energy. Finally, for large particles to escape Mars, the expelling forces must be focused, as occurs in a gun barrel or rocket nozzle. For best results, this should be aimed straight up, to minimize the path length through the atmosphere.

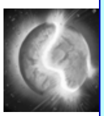
A desire to believe in life on Mars produced a type of "Martian mythology" that continues today. In 1877, Italian astronomer Giovanni Schiaparelli reported seeing grooves on Mars. The Italian word for groove is "canali"; therefore, many of us grew up hearing about "canals" on Mars—a mistranslation. Because canals are man-made structures, people started thinking about "little green men" on Mars.

In 1894, Percival Lowell, a wealthy, amateur astronomer with a vivid imagination, built Lowell Observatory primarily to study Mars. Lowell published a map showing and naming Martian canals, and wrote several books: *Mars* (1895), *Mars and Its Canals* (1906), and *Mars As the Abode of Life* (1908). Even into the 1960s, textbooks displayed his map, described vegetative cycles on Mars, and explained how Martians may use canals to convey water from the polar ice caps to their parched cities. Few scientists publicly disagreed with the myth, even after 1949 when excellent pictures from the 200-inch telescope on Mount Palomar were available. Those of us in school before 1960 were directly influenced by such myths; almost everyone has been indirectly influenced.

Artists, science fiction writers, and Hollywood helped fuel this "Martian mania." In 1898, H. G. Wells wrote *The War of the Worlds* telling of strange-looking Martians invading Earth. In 1938, Orson Welles, in a famous radio broadcast, panicked many Americans into thinking New Jersey was being invaded by Martians. In 1975, two Viking spacecraft were sent to Mars to look for life. Carl Sagan announced, shortly before the tests were completed, that he was certain life would be discovered—a reasonable conclusion, if life evolved. The prediction failed. In 1996, United States President Clinton read to a global television audience, "More than 4 billion years ago this piece of rock [ALH84001] was formed as a part of the original crust of Mars. After billions of years, it broke from the surface and began a 16-million-year journey through space that would end here on Earth." "… *broke from the surface* …"? The myth is still alive.

dam here on Earth. Brief periods of intense, hot rain and localized flash floods followed.[102] These Martian hydrodynamic cycles quickly "ran out of steam," because Mars receives relatively little heat from the Sun. While the consequences were large for Mars, the total water was small by Earth's standards—about twice the water in Lake Michigan.

Today, when meteorites strike icy soil on Mars, some of that ice melts. When this happens on a crater wall, liquid water flows down the crater wall, leaving the telltale gullies that have shocked the scientific community.[90]



PREDICTION 40: As has been discovered on the Moon and apparently on Mercury, frost, rich in heavy hydrogen, will be found within asteroids and in permanently shadowed craters on Mars. [See pages 279 and 287.]

Final Thoughts

As with the 25 other major features listed on page 109, we have examined the origin of asteroids and meteoroids from two directions: "cause-to-effect" and "effect-to-cause."

Cause-to-Effect. Given the assumption listed on page 122, consequences naturally followed: subterranean water became supercritical, the fountains of the great deep erupted; large rocks, muddy water, and water vapor were launched into space; gas and gravity assembled asteroids; and gas pressure powered by the Sun's energy (the radiometer effect) herded asteroids into the asteroid belt. Isolated rocks still moving in the solar system are meteoroids.

Effect-to-Cause. We considered twenty-one effects (pages 311–315), each incompatible with present theories on the origin of asteroids and meteoroids. Each effect was

References and Notes

1. *"About 16% of near-Earth asteroids larger than 200 meters in diameter* [those detected by Earth-based radar] *may be binary systems."* J. L. Margot, "Binary Asteroids in the Near-Earth Object Populations," *Science*, Vol. 296, 24 May 2002, p. 1445.

◆ www.johnstonsarchive.net/astro/asteroidmoons.html.

2. D. T. Britt et al., "Asteroid Density, Porosity, and Structure," Asteroids III, editors W. F. Bottke et al. (Tucson, Arizona: University of Arizona Press, 2002), pp. 485–500.

3. www.minorplanetcenter.org/iau/MPCORB.html

4. *"A common misconception is that asteroids are the remains of a large planet that mysteriously exploded long ago. Today there is hardly enough material in the asteroid belt to make a small moon."* Derek C. Richardson, "Giants in the Asteroid Belt," *Nature*, Vol. 411, 21 June 2001, p. 899.

5. Jupiter's gravity is often given as a simplistic reason a planet did not form. If that were true, why didn't Jupiter prevent even dust or the tiniest grains of sand from forming big rocks? Actually, Jupiter's gravity flings asteroids from the asteroid belt at a rate that is rapid relative to the evolutionist's age for the solar system—4,600,000,000 years.

◆ One of the big problems in the current story on how asteroids evolved is: "How do gas and dust in a hypothetical solar nebula condense into dense boulders (asteroids, planetesimals, and meteoroids)?" As one expert on meteorites admitted,

> *even Earth's most evolved brains still haven't grasped why space dust condensed into boulders.* William Speed Weed, "Philip Bland: Meteor Man," *Discover*, Vol. 22, March 2001, p. 46.

6. *"Although Jovian perturbations are widely invoked to explain* [why asteroids failed to grow and become planets in] *the asteroid belt, the precise mechanism that halted planet formation is still a subject of some dispute."* Jack J. Lissauer and Glen R. Stewart, "Growth of Planets from Planetesimals," *Protostars and Planets III*, editors Eugene H. Levy and Jonathan I. Luine (London: The University of Arizona Press, 1993), pp. 1080–1081.

   These authors then explain why the several explanations proposed are unsatisfactory.

7. *"The predicted mean time between major asteroid collisions* [for each asteroid] *is about 5% of the age of the solar system. All asteroids should already be highly fragmented unless their origin is relatively recent, as in the exploded planet theory."* Tom C. Van Flandern, *Dark Matter, Missing Planets and New Comets* (Berkeley, California: North Atlantic Books, 1993), p. 216.

8. The estimated mass of all asteroids is 2.6 x 10^{21} grams. [See page 490.] About 90% of all asteroid mass is in the main belt, between the orbits of Mars and Jupiter.

9. How large were the blocks? Clumps of rocks in space, held together by only their weak mutual gravity, will fly apart if they spin faster than ten times a day. Asteroids larger than 650 feet in diameter (200 meters) never spin faster than ten times a day, so they may be clusters of loose rocks. Asteroids smaller than 650 feet in diameter often spin hundreds of times a day. Therefore, they may be single rocks or multiple rocks held together by ice. [See Erik Asphaug, "The Small Planets," *Scientific American*, Vol. 282, May 2000, p. 48.]

10. Some of this water vapor also condensed as frost in permanently shadowed craters on the Moon, Mercury, and Mars.

11. P. C. Thomas et al., "Differentiation of the Asteroid Ceres as Revealed by Its Shape," *Nature*, Vol. 437, 8 September 2005, pp. 224–226.

12. Sunlight would quickly break down a free water molecule into hydroxyl (OH) and atomic hydrogen (H). Other gases would also be present.

13. Each particle of mass launched from Earth carried with it about the same rotational angular momentum as it had before the rupture. Later, as each swarm of particles merged in space to become an asteroid, the various spin rates and directions within a swarm homogenized, so asteroids typically had earthlike spins.

    The hottest "time of day" on a spinning asteroid was not "high noon," but "several hours after noon," as it is on Earth. Therefore, the thrust acting on asteroids had a tangential component as well as a radial component. The tangential component steadily added angular momentum to each asteroid's orbit, allowing it to spiral outward.

14. This effect is similar to the much weaker *Yarkovsky force* in which *light* provides a thrust on the hot side of an asteroid or satellite. Light's thrust is trivial as compared with that of a rarefied gas. If sunlight provided much force, radiometers (Figure 158) would spin the opposite way, because more sunlight reflects off the white side of the vanes.

15. Some asteroids, called C-type asteroids, are darker than coal! They typically lie in the outer part of the asteroid belt. Lighter-colored, S-type asteroids are generally in the inner part of the belt. Darker asteroids have both hotter hot sides and colder cold sides. [See Figure 158.] Therefore, opposite sides of darker asteroids have greater temperature differences that would have produced greater thrust and moved those asteroids farther from the Sun—accounting for their present location.

16. A body's orbital path around the Sun is described by three numbers:
    a (the semimajor axis or size of the orbit),
    e (the eccentricity or shape of the orbit), and
    i (the inclination or tilt of the orbital plane with respect to the Earth's orbital plane).

    In other words, in a special three-dimensional coordinate system (a, e, and i), every point represents a different orbit. The initial orbits of the hundreds of thousands of asteroids can be represented by hundreds of thousands of widely scattered points in an a-e-i coordinate system.

    The forces that acted on asteroids were gravity, drag, and thrust. (Today, the drag and thrust are zero.) Although gravity is easy to model, it is virtually impossible to determine what the drag and thrust were and how they diminished in the years after the flood, because so many experimentally determined relationships are involved. Also, *the amount of water vapor placed in orbit will probably never be known—even approximately.* However, drag and thrust can be described with just a few simplifying parameters. (For example, drag is equal to some parameter times velocity squared. That parameter depends on several unknowns, including the density of water vapor which diminishes over time according to a second parameter.)

    I scattered hundreds of points in the a-e-i coordinate system. By arbitrarily fine tuning several parameters for drag and thrust and then simulating the changing orbits as time progressed, I could watch on a computer monitor all those points simultaneously migrate toward the single point (a = 2.8 AU, e = 0, i = 0) representing today's asteroid belt.

    While these functional relationships for drag and thrust are not derivable, they are consistent with the way drag and thrust generally act. It was remarkable that with only a few parameters, nearly an infinite number of points could be "mapped" almost into one point. In physical terms, almost all simulated asteroids, regardless of their initial orbit somewhere in the inner solar system, slowly migrated into the asteroid belt.

17. O. Richard Norton, *The Cambridge Encyclopedia of Meteorites* (Cambridge, United Kingdom: Cambridge University Press, 2002), p. 186.

18. Consider two gravitational forces acting on a mass, m, at the Earth's surface. The first, F_E, is caused by the Earth's mass, M_E, acting, in effect, from the Earth's center—a distance D_E (4,000 miles) away. The second gravitational force, F_S, is caused by the Sun's mass, M_S, acting from a distance of D_S (93,000,000 miles). Letting G be the gravitational constant, these forces are:

$$F_E = \frac{G\,M_E\,m}{D_E^2} \qquad \text{and} \qquad F_S = \frac{G\,M_S\,m}{D_S^2}$$

    The Sun is 332,900 times more massive than Earth. Dividing the left equation by the right gives:

$$\frac{F_E}{F_S} = \frac{M_E}{M_S} \times \left(\frac{D_S}{D_E}\right)^2 = \frac{1}{332{,}900} \times \left(\frac{93{,}000{,}000}{4{,}000}\right)^2 = 1{,}600$$

    This means that a steady, 1-pound force could *lift* and *accelerate* a rock away from the Sun if the rock weighed 1,600 pounds on Earth and the rock were more than 93,000,000 miles above the Sun and far from Earth.

19. Temperatures probably reached 3,000°F (1,650°C). [See **"Chondrules"** on page 309.] If so, as temperatures steadily rose, quartz would have been the first major mineral in granite to melt.

20. Claims are sometimes made that radioactive decay generated the heat, but standard calculations that would support those speculations are never shown.

21. *"... we lack compelling scenarios leading to the origin of iron meteorites ... Early solar system collisions have been called upon to excavate this iron* [from the cores of the largest asteroids], *although numerical impact models have found this task difficult to achieve, particularly when it is required to occur many dozens of times."* Erik Asphaug et al., "Tides Versus Collisions in the Primordial Main Belt," October 2000, www.aas.org/publications/baas/v32n3/dps2000/545.htm.

22. *"*[NASA's model] *predicts a dust concentration in the asteroid belt about an order of magnitude higher than the dust density near earth."* J. S. Dohnanyi, "Sources of Interplanetary Dust: Asteroids," *Interplanetary Dust and*

Zodiacal Light, editors H. Elsässer and H. Fechtig (New York: Springer-Verlag, 1976), p. 189.

23. J. M. Alvarez, "The Cosmic Dust Environment at Earth, Jupiter and Interplanetary Space: Results from Langley Experiments on MTS, Pioneer 10 and 11," Ibid., p. 181.

◆ *"It can be seen, Fig. 2, that the number density of interplanetary dust inferred from the penetration data is a slowly decreasing function with heliocentric distance* [R] *… a distribution that varies as* R^{-1} [for 1 AU < R < 4 AU]." Dohnanyi, p. 190.

24. This is a major problem for evolutionists who visualize chondrules being formed at the extremely low pressures of outer space. (At low pressures, volatiles bubble out quickly—like gas escaping from the sudden opening of a carbonated beverage.) However, the hydroplate theory explains the retention of volatiles, because they formed under the high confining pressures inside rocks in the subterranean chamber. Also, they froze seconds after escaping from the hot, high-pressure, subterranean chamber.

25. Naoyuki Fujii and Masamichi Miyamoto, "Constraints on the Heating and Cooling Processes of Chondrule Formation," *Chondrules and Their Origins*, editor Elbert A. King (Houston: Lunar and Planetary Institute, 1983), pp. 53–60.

◆ Neither impact melting nor electrical discharges would duplicate characteristics in and around chondrules. [See J. A. Wood and H. Y. McSween Jr., "Chondrules as Condensation Products," *Comets, Asteroids, Meteorites*, editor A. H. Delsemme (Toledo, Ohio: The University of Toledo, 1977), pp. 365–373. Also see T. J. Wdowiak, "Experimental Investigation of Electrical Discharge Formation of Chondrules," *Chondrules and Their Origins*, pp. 279–283.] Donald E. Brownlee et al. give seven other reasons why impact melting did not produce chondrules. [See "Meteor Ablation Spherules as Chondrule Analogs," *Chondrules and Their Origins*, p. 23.]

26. T. D. Swindle et al., "Radiometric Ages of Chondrules," *Chondrules and Their Origins* (Houston: Lunar and Planetary Institute, 1983), pp. 246–261.

◆ *"CAIs* [calcium-aluminum-rich inclusions] *are believed to have formed about two million years before the chondrules. Here we report the discovery of a chondrule fragment embedded in a CAI."* Shoichi Itoh and Hisayashi Yurimoto, "Contemporaneous Formation of Chondrules and Refractory Inclusions in the Early Solar System," *Nature*, Vol. 423, 12 June 2003, p. 728. [See also "Mixed-Up Meteorites" on page ix and "A Question of Timing" on page 691.]

27. Richard Ash, "Small Spheres of Influence," *Nature*, Vol. 372, 17 November 1994, p. 219.

28. *"As already described, the separated chondrules in the polished mount frequently grade into material similar to the matrix around their peripheries. … boundaries between chondrules and matrix are frequently very gradational."* R. M. Housley and E. H. Cirlin, "On the Alteration of Allende Chondrules and the Formation of Matrix," *Chondrules and Their Origins*, p. 152.

29. Pyroxenes, the second most common mineral in chondrules, often form from cooling melted olivine and quartz. [See L. G. Berry et al., *Mineralogy*, 2nd edition (San Francisco: W. H. Freeman and Co., 1983), p. 475.] Why so much olivine and quartz melted and cooled in isolated pockets will soon be clear.

30. This phase transformation occurs when the pressure corresponds to that at depths in the Earth of about 400 km (250 miles). While pillars were at a depth of 16 km (10 miles), each pillar carried not just the weight of the crust *directly* above it, but up to half the weight of the crust between surrounding pillars—whatever that was. Furthermore, pillars were probably tapered to some unknown degree, somewhat like a thick icicle. [See Figure 54 on page 122.] Therefore, compressive stresses near a pillar tip would have been even greater. Finally, the loading on pillars minutes after the flood began would have been dynamic, not static. (A static hammer, resting on the head of a nail, cannot be expected to drive the nail into wood, but a moving hammer can.) The crust would have fluttered vertically, even more than with earthquakes today, giving the pillars hammerlike blows.

    The high confining pressure of the subterranean water surrounding the pillars would have delayed their fragmentation and increased the maximum compression in the pillars. Being stubby and tapered, pillars would also have resisted buckling.

31. *"Eros, indeed, has no detectable magnetic field. That's puzzling because meteorites, which are believed to be fragments of asteroids, possess magnetic fields. How could a chip of an asteroid be magnetic if the parent asteroid isn't?"* Ron Cowen, "Asteroid Eros Poses a Magnetic Puzzle," *Science News*, Vol. 159, 2 June 2001, p. 341.

32. *"However, up until recently, the general paradigm has been that asteroids are 'rocky,' inner-solar system objects and comets are 'icy' outer-solar system objects. A number of recent observations and models have significantly muddied the waters (so to speak). While ice is not found at the surface of Ceres* [the largest of all astroids]*, there is evidence* [the low density of Ceres] *that a large ice ocean is present in its subsurface … ."* A. S. Rivkin and J. P. Emery, "Water Ice on 24 Themis?" 2008. www.lpi.usra.edu/meetings/acm2008/pdf/8099.pdf

33. *"We conclude that 65 Cybele is covered by fine anhydrous silicate grains, with a small amount of water-ice and complex organic solids."* Zoe Landsman et al., "Asteroid 65 Cybele: Detection of Small Silicate Grains, Water-Ice and Organics," *Bulletin of the American Astronomical Society*, Vol. 42, 2010, p. 1035.

34. Humberto Campins et al., "Water Ice and Organics on the Surface of the Asteroid 24 Themis," *Nature*, Vol. 464, 29 April 2010, pp. 1320–1321.

◆ Andrew S. Rivkin and Joshua P. Emery, "Detection of Ice and Organics on an Asteroidal Surface," *Nature*, Vol. 464, 29 April 2010, pp. 1322–1323.

35. *"The surprise is the wide extent of ice on the surface of Themis. The average temperature of asteroids (about 150–200 kelvin) at this distance from the Sun should cause surface ice to sublimate away in a matter of a few years or less, which is inconsistent with the billions of years that Themis is thought to have spent at its current location."* Henry H. Hsieh, "A Frosty Finding," *Nature*, Vol. 464, 29 April 2010, p. 1286.

36. *"Earth is thought to have formed dry owing to its location inside the 'snow line,' which is the distance from the Sun within which it was too warm for water vapour in the nascent Solar System to condense as ice and be swept up into forming planetesimals. Therefore, the water that now fills our oceans and makes life possible must have been delivered to Earth from outside the snow line, perhaps by impacting asteroids and comets."* Hsieh, p. 1287.

37. Kazushige Tomeoka, "Phyllosilicate Veins in a CI Meteorite: Evidence for Aqueous Alteration on the Parent Body," *Nature*, Vol. 345, 10 May 1990, pp. 138–140.

38. *"Meteorites and probably all meteoroids contain the same materials as those contained in the earth itself."* Franklyn M. Branley, *Comets, Meteoroids, and Asteroids: Mavericks of the Solar System* (New York: Thomas Y. Crowell, 1974), p. 38.

◆ *"Modern mass spectrometry techniques had revealed that the isotopic compositions of many of the more refractory elements in meteorites, including a primitive class of meteorite called chondrites, are, within error, identical to those found on Earth itself."* Alex N. Halliday, "Inside the Cosmic Blender," *Nature*, Vol. 425, 11 September 2003, p. 137.

39. W. J. Merline et al., "Discovery of a Moon Orbiting the Asteroid 45 Eugenia," *Nature*, Vol. 401, 7 October 1999, pp. 565–568.

40. Some have claimed that mining asteroids could be profitable. [See John S. Lewis, *Mining the Sky: Untold Riches from the Asteroids, Comets, and Planets* (Reading, Massachusetts: Addison-Wesley, 1997).]

41. *"The most primitive meteorites, the carbonaceous chondrites, are primarily mixtures of many distinct materials that reflect a variety of solar nebular environments as well as planetary processing."* Qingzhu Yin et al., "Diverse Supernova Sources of Pre-Solar Material Inferred from Molybdenum Isotopes in Meteorites," *Nature*, Vol. 415, 21 February 2002, p. 881.

    Why do they say *"a variety of solar nebular environments"*? Had the solar system and the molybdenum isotopes found in meteorites come from the debris of one exploded star and millions of years of mixing, these different isotopes should be spread somewhat uniformly in meteorites. They are not. Therefore, many exploding stars are needed. Furthermore, evolutionists must maintain that millions of years of mixing would not have mixed the molybdenum isotopes. Every statistician knows that with enough variables (in this case, enough stars exploding in different ways for millions of years), many untestable explanations can be proposed.

42. Besides iron meteorites, which were once 1,300°F, chondrules were once about 3,000°F. [See page 309 and Figure 159 on page 308.] Also, the matrix material encasing chondrules shows thermal metamorphism requiring temperatures of at least 750°F. [See O. Richard Norton, *The Cambridge Encyclopedia of Meteorites* (Cambridge, England: Cambridge University Press, 2002), p. 92.]

43. The following concerns Vesta, the third-largest asteroid (diameter 320 miles, or 516 kilometers).

    > *Spectroscopic observations of Vesta's surface indicate that it is covered with volcanic basalt, leading researchers to conclude that Vesta's interior once melted. The cause of the heating cannot be long-lived radioisotopes; given the primordial concentrations of the isotopes and the expected rate of heat loss, calculations show that the radioactive decay could not have melted Vesta or any other asteroid. Another heating mechanism must therefore be responsible, but what is it? This question has dogged planetary scientists for decades.* Alan E. Rubin, "What Heated the Asteroids," *Scientific American*, Vol. 292, May 2005, p. 82.

    "It is thus clear that many asteroids were once quite hot. But what mechanism could have raised the temperatures of the asteroids to this extent if the rocky bodies were too small to retain the heat from long-lived radioisotopes?" Ibid., p. 84.

44. *"The water content (by weight) of the meteorites is about 11 percent for type 1 chondrites, about 9 percent for type 2, and 2 percent or less for type 3."* Ibid., p. 83.

45. *"... every metamorphosed ordinary chondrite has been shocked and subsequently heated, some of them multiple times."* Ibid., p. 86.

46. *"First, a single impact cannot raise the global temperature of an asteroid-size body by more than a few degrees. Second, the high surface-to-volume ratios of such bodies promote heat loss, so they cool quickly between successive impacts. Third, a typical impact generates minuscule amounts of melted rock relative to the volume of the impact-generated debris. And last, the low escape velocities of asteroids allow much of the most strongly heated material to escape."* Ibid., p. 86.

47. Tristan Ferroir et al., "Carbon Polymorphism in Shocked Meteorites: Evidence for New Natural Ultrahard Phases," *Earth and Planetary Science Letters*, Vol. 290, 15 February 2010, pp. 150–154.

48. Paul Schenk and the Cassini Imaging Team, http://apod.nasa.gov/apod/ap080331.html, 31 March 2008.

49. The following prediction was made on page 222 of the 7th edition of *In the Beginning*.

    > Ceres, the largest asteroid, will be found to have a very earthlike spin.

It is now known that Ceres rotates once every 9.075 hours and its spin axis points 31° from true north. [See P. C. Thomas et al., p. 224.] The Earth rotates once every 23.93 hours and its spin axis points toward true north. This prediction missed the mark more than I expected.

I selected Ceres because it is the most massive asteroid, having about 1.28% of the mass of the Moon. Therefore, Ceres is least likely to have its spin rate and spin direction altered much by the inevitable impacts within the asteroid belt. Using random guesses for the orientation of Ceres' spin axis, one could have done better 7% of the time.

50. Almost all astronomers mistakenly visualize moons of asteroids forming from an impact, in which case only a small "chip" could be expelled and, in extremely rare circumstances, placed in orbit around the main asteroid by the gravitational attraction of other debris. For example:

> *What was particularly surprising was that it* [asteroid Hermes] *was binary with equal components.* Jean-Luc Margot, as quoted by K. Ramsayer, "Out of Hiding," *Science News*, Vol. 164, 1 November 2003, p. 277.

- *"I'm stunned and astonished* [at seeing a double asteroid]*."* Planetary physicist Jay Melosh, as quoted by Richard A. Kerr, "Double Asteroid Puzzles Astronomers," *ScienceNOW*, 21 September 2000.

51. R. P. Binzel and T. C. Van Flandern, "Binary Asteroids: Evidence for Their Existence from Lightcurves," *Science*, Vol. 203, 2 March 1979, pp. 903–905.

52. The smaller moons of the giant planets tend to have irregular orbits. For example, Jupiter has at least 31 irregular moons, the largest, Himalia, is 150 kilometers (93 miles) in diameter. Their orbits generally have high inclinations and eccentricities. Many are retrograde. These characteristics show that they were captured.

To capture an asteroid, much of its orbital energy must be removed (or dissipated), so the planet's gravity can hold on to the asteroid. Captures rarely result from chance gravitational encounters with other large bodies. An easy way to dissipate an asteroid's energy is by friction with an atmosphere: the planet's, the asteroid's, or both. This is called *aerobraking*. Based on the hydroplate theory, bloated atmospheres existed for only a few centuries after the flood, so the key evidence for these captures is absent today. However, dozens of other evidences are now available, all pointing to the fountains of the great deep.

53. Craig Covault, "Historic Japanese Asteroid Data Amaze Researchers," *Aviation Week & Space Technology*, 20 March 2006, p. 28.

54. *"At present it is practically impossible for Jupiter to capture satellites permanently because no efficient dissipation mechanism exists."* Scott S. Sheppard and David C. Jewitt, "An Abundant Population of Small Irregular Satellites Around Jupiter," *Nature*, Vol. 423, 15 May 2003, p. 261.

55. *"Finding such active geology on such a tiny moon is a big surprise. ... tiny Enceladus produces a plume large enough to drench the whole Saturn system. The origin of Enceladus' internal heating is also still a major puzzle."* Joanne Baker, "Tiger, Tiger, Burning Bright," *Science*, Vol. 311, 10 March 2006, p. 1388.

- *"Enceladus has been found to be one of the most geologically dynamic objects in the solar system. Among the surprises are a watery, gaseous plume; a south polar hot spot; and a surface marked by deep canyons and thick flows."* Jeffrey S. Kargel, Enceladus: Cosmic Gymnast, Volatile Miniworld," *Science*, Vol. 311, 10 March 2006, p. 1389.
- Ten other papers in the 10 March 2006 issue of *Science*, pages 1391–1428, report on these observations from the Cassini spacecraft.

56. *"*[German scientists] *reported the clear detection of sodium in* [Saturn's] *E ring's ice particles. Six percent of the particles are rich in sodium and contain salts such as sodium chloride and sodium bicarbonate, along with smaller amounts of potassium. Cassini has traced the ice grains to a towering plume rising from Enceladus's south pole. ... The salts—resembling terrestrial* [Earth] *sea salt ..."* Richard A. Kerr, "Tang Hints of a Watery Interior for Enceladus," *Science*, Vol. 323, 23 January 2009, pp. 458–459.

- *"... although all the* [ice] *grains are dominated by water ice, about 6% of them are quite salty, containing roughly 1.5% of a mixture of sodium chloride, sodium carbonate and sodium bicarbonate."* John Spencer, "Enceladus with a Grain of Salt," *Nature*, Vol. 459, 25 June 2009, p. 1067.
- Frank Postberg et al., "Sodium Salts in E-Ring Ice Grains from an Ocean below the Surface of Enceladus," *Nature*, Vol. 459, 25 June 2009, p. 1098–1101.

57. *"... the amount of tidal energy being injected into* [Enceladus today] *falls short of the energy coming out of Enceladus's south pole by a factor of five."* Carolyn Porco, "The Restless Worlds of Enceladus," *Scientific American*, Vol. 299, December 2008, p. 60.

So what is the source of the heat energy Enceladus is expelling? Answer: The tidal heating was generated recently, since the flood and after Enceladus was captured by Saturn. Enceladus hasn't had time to cool off. (To understand tidal heating using an example closer to home, see **"Tidal Pumping"** on page 124 and pages 488–489.)

58. Margaret Galland Kivelson, "Does Enceladus Govern Magnetospheric Dynamics at Saturn?" *Science*, Vol. 311, 10 March 2006, pp. 1391–1392.

59. Baker, p. 1388.

- The plume escaping from Enceladus contains methane (CH_4) and a smattering of other organics such as propane (C_3H_8), ethane (C_2H_6), benzene (C_6H_6), and formaldehyde (CH_2O). [See Porco, p. 58.] To understand their likely origin, see pages 109–147.

60. *"The interior of Mars' moon Phobos could be as much as 30 percent empty space, new observations suggest."* Sid Perkins, "Martian Moon Is Probably Porous," *Science News*, Vol. 177, 5 June 2010, p. 11.

61. *"The surface of Phobos shows some spectral similarities to those of various asteroid types."* T. P. Andert et al., "Precise Mass Determination and the Nature of Phobos," *Geophysical Research Letters*, Vol. 37, 7 May 2010, p. L09202–3.

62. *"It's also unlikely Phobos is made solely of Mars' crust blasted into space by an impact and then reassembled, because the spectral features of the moon's rocks don't match those of the Red Planet."* Perkins, p. 11.

63. *"Could the MBCs* [main belt comets] *be comets from the Kuiper Belt or Oort Cloud that have become trapped in asteroid-like orbits? Published dynamical simulations suggest not, having failed to reproduce the transfer of comets to main-belt orbits."* Henry H. Hsieh and David Jewitt, "A Population of Comets in the Main Asteroid Belt, *Science*, Vol. 312, 28 April 2006, p. 562.

64. *"... there is an excess of Earth-approaching asteroids with diameters less than 50 m, relative to the population inferred from the distribution of larger objects."* D. L. Rabinowitz et al., "Evidence for a Near-Earth Asteroid Belt," *Nature*, Vol. 363, 24 June 1993, p. 704.

65. *"*[Based on the numbers of larger asteroids] *... current theories can't adequately explain why so many of these small bodies should follow such circular routes."* D. L. Rabinowitz, as quoted by Ron Cowen, "Rocky Relics," *Science News*, Vol. 145, 5 February 1994, p. 88.

66. *"We find that these asteroids can also undergo solar collisions, through several dynamical routes involving orbital resonances with the giant planets, on timescales of the order of* 10^6 *years."* Paolo Farinella et al., "Asteroids Falling into the Sun," *Nature*, Vol. 371, 22 September 1994, p. 315.

67. Tony Phillips, "Corkscrew Asteroid," http://science.nasa.gov/headlines/y2006/09jun_moonlets.htm.

68. Paul A. Wiegert et al., "An Asteroidal Companion to the Earth," *Nature,* Vol. 387, 12 June 1997, pp. 685–686.

69. Ron Cowen, "Hidden Companion," *Science News*, Vol. 152, 12 July 1997, p. 29.

70. *"Curiously, there are many more* [asteroids] *in the leading Lagrange point (L4) than in the trailing one (L5)."* Bill Arnett, "Asteroids," www.seds.org/nineplanets/nineplanets/asteroids.html.

- ◆ Data provided by the Harvard-Smithsonian Center for Astrophysics on 17 February 2005. See http://cfa-www.harvard.edu/iau/lists/JupiterTrojans.html.

71. Franck Marchis et al., "A Low Density of 0.8 g cm^{-3} for the Trojan Binary Asteroid 617 Patroclus," *Nature*, Vol. 439, 2 February 2006, pp. 565–567.

- ◆ Ker Than, "Asteroids Near Jupiter Are Really Comets," *Science & Space*, 1 February 2006, www.cnn.com/2006/TECH/space/02/01/jupiter.comets/index.html.

72. Birger Schmitz et al., "Sediment-Dispersed Extraterrestrial Chromite Traces a Major Asteroid Disruption Event," *Science*, Vol. 300, 9 May 2003, pp. 961-964.

73. Jonathan Gradie and Joseph Veverka, "The Composition of the Trojan Asteroids," *Nature*, Vol. 283, 28 February 1980, pp. 840–842.

74. Asphaug, "The Small Planets," p. 46.

75. Joshua L. Bandfield et al., "Spectroscopic Identification of Carbonate Minerals in the Martian Dust," *Science*, Vol. 301, 22 August 2003, pp. 1084–1087.

- ◆ *"Two Phoenix* [Mars Lander] *experiments identified calcium carbonates and clays in soil samples scooped up by the crafts robotic arm. On Earth, both minerals are associated with the presence of liquid water."* Ron Cowen, "More Clues to Martian Chemistry," *Science News*, Vol. 174, 25 October 2008, p. 13.

76. *"*[A sample of dirt from an asteroid] *could finally explain why the most common type of asteroid looks different—spectroscopically more red—from the most common type of meteorite. Apparently, some sort of 'space weathering' is reddening the surface of S-type asteroids."* Richard A. Kerr, "Beaming to Itokawa," *Science*, Vol. 309, 16 September 2005, p. 1797. [Yes, most asteroids were "weathered" (rusted) by oxygen gas in the inner solar system soon after the flood. Since then, the remaining gas has dispersed.]

77. *"Unfortunately, Mars spent its youth in a bad neighborhood near the asteroid belt, and, being small, was especially susceptible* [to asteroid impacts and the loss of its atmosphere]. *Given the expected size distribution of impactors early in a solar system's history, the planet should have been stripped of its entire atmosphere in less than 100 million years."* David C. Catling and Kevin J. Zahnle, "The Planetary Air Leak," *Scientific American*, Vol. 300, May 2009, p. 42.

    "For decades, scientists have pondered why Mars has such a thin atmosphere, but now we wonder: Why does it have any atmosphere left at all?" Ibid., p. 36.

78. *"The evidence disturbed the scientists in more than one respect. First, conditions on Mars are such that any water reaching the surface supposedly would not remain liquid for very long but would boil, freeze, or poof into vapor. Second, from the absence of craters, sand dunes, or anything else on top of the* [eroded] *gullies, they appeared to have formed very recently, possibly as recently as yesterday. ... Most of the evidence was found, strikingly, in some of the coldest places on the surface—on shadowed slopes facing the poles, in clusters scattered around latitudes higher than 30 degrees—rather than at the warmer equatorial latitudes. ... And proposals for other substances that might behave as liquids on the martian surface raised so many other questions that they failed to solve the problem."* Kathy Sawyer, "A Mars Never Dreamed Of," *National Geographic*, Vol. 199, February 2001, p. 37.

79. Michael E. Zolensky et al., "Asteroidal Water within Fluid Inclusion-Bearing Halite in an H5 Chondrite, Monahans (1998)," *Science*, Vol. 285, 27 August 1999, pp. 1377–1379.

80. *"... crystals of sylvite (KCl) are present within the* [meteorite's] *halite crystals, similar to their occurrence in terrestrial evaporites* [salt deposits on Earth]*."* Ibid., p. 1378.

81. George Cooper et al., "Carbonaceous Meteorites As a Source of Sugar-Related Organic Compounds for the Early Earth," *Nature*, Vol. 414, 20/27 December 2001, pp. 879–883.

    The sugars in these meteorites (Murchison and Murray) were rich in heavy hydrogen, another indicator that they came from the subterranean chambers. [See pages 279 and 287.]

82. James Whitby et al., "Extinct ^{129}I in Halite from a Primitive Meteorite," *Science*, Vol. 288, 9 June 2000, p. 1821.

- Ulrich Ott, "Salty Old Rocks," *Science*, Vol. 288, 9 June 2000, pp. 1761–1762.
- *"An H3–6 chondrite called Zag fell in the Moroccan Sahara desert five months* [after the Monahans meteorite] *that also had halite crystals with water inclusions."* Norton, p. 91.
- John L. Berkley et al., "Fluorescent Accessory Phases in the Carbonaceous Matrix of Ureilites," *Geophysical Research Letters*," Vol. 5, December 1978, pp. 1075–1078.
- D. J. Barber, "Matrix Phyllosilicates and Associated Minerals in C2M Carbonaceous Chondrites," *Geochimica et Cosmochimica Acta*, Vol. 45, June 1981, pp. 945–970.

83. Fred Hoyle and Chandra Wickramasinghe, *Lifecloud* (New York: Harper & Row, Publishers, 1978), p. 112.

84. Magnus Endress et al., "Early Aqueous Activity on Primitive Meteorite Parent Bodies," *Nature*, Vol. 379, 22 February 1996, pp. 701–703.

85. *"The exact mechanism of terrestrial amino acid incorporation and retention by meteorites is not known."* Jeffrey L. Bada et al., "A Search for Endogenous Amino Acids in Martian Meteorite ALH84001," *Science*, Vol. 279, 16 January 1998, p. 365.

- A. J. T. Jull et al., "Isotopic Evidence for a Terrestrial Source of Organic Compounds Found in Martian Meteorites Allan Hills 84001 and Elephant Moraine 79001," *Science*, Vol. 279, 16 January 1998, pp. 366–369.
- M. H. Engel and S. A. Macko, "Isotopic Evidence for Extraterrestrial Non-Racemic Amino Acids in the Murchison Meteorite," *Nature*, Vol. 389, 18 September 1997, pp. 265–267.

86. Ian D. Hutcheon, "Signs of an Early Spring," *Nature*, Vol. 379, 22 February 1996, pp. 676–677.

- *"The salts we found mimic the salts in Earth's ocean fairly closely."* Carleton Moore as reported at www.cnn.com on 23 June 2000. For details, see Douglas J. Sawyer et al., "Water Soluble Ions in the Nakhla Martian Meteorite," *Meteoritics & Planetary Science*, Vol. 35, July 2000, pp. 743–747.
- *"... a variety of minerals in three nakhlite meteorites, including a fragment of the Nakhla meteorite collected within days of its fall, seem to have precipitated from a brine."* Richard A. Kerr, "A Wetter, Younger Mars Emerging," *Science*, Vol. 289, 4 August 2000, p. 715.

87. E. Deloule et al., "Deuterium-Rich Water in Meteorites," *Meteoritics*, Vol. 30, September 1995, p. 502.

- Ron Cowen, "Martian Leaks: Hints of Present-Day Water," *Science News*, Vol. 158, 1 July 2000, p. 15.
- Laurie Leshin Watson et al., "Water on Mars: Clues from Deuterium/Hydrogen and Water Contents of Hydrous Phases in SNC Meteorites," *Science*, Vol. 265, 1 July 1994, pp. 86–90.

    Although Cowen and Watson believe that these meteorites came from Mars, page 318 explains why this is unlikely.

88. *"Some different microbial species, derived from samples of* [two] *meteorites, have been cultured, cloned and classified by 16S rDNA typing and found to be not essentially different from present day organisms* [here on Earth]*; they also appear sensitive to growth inhibition by specific antibiotics."* Giuseppe Geraci et al., "Microbes in Rocks and Meteorites," *Rendiconti Accademia Nazionale dei Lincei*, Vol. 12, No. 9, 2001, p. 51.

    These DNA studies also rule out contamination, because the bacteria recovered and cultured from the meteorites were sufficiently different from modern strains. Great precautions were taken to prevent contamination.

- *"Bruno D'Argenio, a geologist working for the Italian National Research Council, and Giuseppi Geraci, professor of molecular biology at Naples University, identified and brought back to life extraterrestrial microorganisms lodged inside* [a supposedly] *4.5 billion-year-old meteorites kept at Naples' mineralogical museum."* Rossella Lorenzi, "Scientists Claim to Revive Alien Bacteria," *Discovery News*, www.discovery.com, 10 May 2001.

89. *"The foregoing analysis, sketchy as it is, seems to strengthen the grounds of the old speculation—that meteorites are disrupted fragments of a planet of the terrestrial type."* Reginald A. Daly, "Meteorites and an Earth-Model," *Bulletin of the Geological Society of America*, Vol. 54, 1 March 1943, p. 425.

    Because meteorites are so similar to the material inside Earth, many researchers believe that the Earth formed from infalling meteoroids. One should also consider whether *the Earth produced meteoroids.* Failure to consider both possibilities is the same logical fallacy described in Endnote 3, page 293. Much evidence opposes the former.

90. Michael C. Malin et al., "Present-Day Impact Cratering Rate and Contemporary Gully Activity on Mars," *Science*, Vol. 314, 8 December 2006, pp. 1573–1577.

91. *"... near the poles, Mars Odyssey* [spacecraft] *has shown, as much as 50 percent of the upper meter of soil may be* [water] *ice."* Arden L. Albee, "The Unearthly Landscapes of Mars," *Scientific American*, Vol. 288, June 2003, p. 46.

92. Shane Byrne et al., "Distribution of Mid-Latitude Ground Ice on Mars from New Impact Craters," *Science*, Vol. 325, 25 September 2009, pp. 1674–1676.

93. *"Such streams typically originate in steep-walled amphitheaters rather than in ever smaller tributaries."* Arden L. Albee, p. 50.

94. Richard A. Kerr, "Signs of Ancient Rain May Stretch Mars' Balmy Past," *Science*, Vol. 305, 2 July 2004, p. 26.

95. *"But the limited amount of erosion suggests that it wasn't the result of a 'warm and wet' early Mars."* Richard A. Kerr, "Running Water Eroded a Frigid Early Mars," *Science*, Vol. 300, 6 June 2003, p. 1497.

96. *"Most of the tens of thousands of gullies identified to date occur on slopes in craters, pits, and other depressions at latitudes > 30°; a few exceptions occur at latitudes of 27° to 30°."* Malin et al., p. 1575.

97. Crater-producing impacts often leave peaks in the center of the crater as the crater floor rebounds from the impact. Seconds later, it grows upward from the inward pressure exerted by the crater walls.

- *"On the other hand, Edgett has noted a central peak of an impact crater replete with gullies. Where would the water come from to feed a seep high on a central peak, he wondered."* Richard A. Kerr, "Rethinking Water on Mars and the Origin of Life," *Science*, Vol. 292, 6 April 2001, p. 39.

98. Liquid water cannot exist for long at temperatures below 32°F or at pressures below 6 mbar (0.0888 psia). This pressure-temperature combination, called the *triple point,* allows water to exist simultaneously in three states: solid, liquid, and gas. Because the average surface temperature of Mars is -80°F and the atmospheric pressure is 6–10 mbar, liquid water would quickly freeze on Mars.

99. *"The surface of Mars is so cold—on average -70° to -100°C* [-94°F to -148°F]*—that any water within 2 or 3 kilometers of the surface, never mind a meter or two, should be permanently frozen, they noted."* Kerr, "Rethinking Water," p. 39.

- Many Mars researchers cling to the belief that Mars once had oceans or considerable subsurface water. Why? If Mars once had liquid water, they argue, life might have evolved, because life (as we know it) requires liquid water. Notice their faulty logic.

  Instead, if A (life) requires B (water), the presence of B does not demand the presence of A. (*Water is a necessary but not sufficient requirement for life.*) Ignored is life's extreme complexity. [Pages 14 – 23 explain why life is so complex that it could not have evolved anywhere in trillions upon trillions of years.] When scientists hold out hope of discovering life on Mars, funding for their research is more likely. Also, an excited media will sensationalize and publicize that research, raising hopes that life may be found on Mars.

  Most scientific researchers are in a perpetual hunt for money to fund their work and pay their salaries. If comets evolved and placed water on Mars, few evolutionists would expect to find life on Mars. Therefore, a major reason for funding the exploration of Mars disappears.

100. *"Carving them, researchers calculated, would take water gushing at 10 million to 1 billion cubic meters per second."* Richard A. Kerr, "An 'Outrageous Hypothesis' for Mars: Episodic Oceans," *Science*, Vol. 259, 12 February 1993, p. 910.

101. On 9 July 2000, after the 30 June 2000 (Volume 288) issue appeared containing pictures of erosion channels on Mars, I wrote the following letter to *Science* magazine. My letter was titled "Comets Carved the Mars' Gullies."

> Dear Editor:
>
> Why aren't comets considered as the source of the water that carved Mars' erosion features? Impact energy would convert a comet's ice to liquid water. A typical comet, perhaps 10^{16} grams and 85% H_2O, could easily provide the volume of water estimated in Endnote 35 on page 2335.
>
> Assume that large rocks are in the center of comets (a point I will not try to justify here). Those rocks, decelerating less than the surrounding ice as the comet passes through Mars' thin atmosphere, strike the ground an instant earlier than the ice and create the crater. The ice, suddenly converted to liquid and splattered onto the crater walls, carves the gullies.
>
> The typical ground temperatures of -70°C (or colder) in the gully regions is fatal to claims that large volumes of liquid water suddenly "seeped" from several hundred meters below Mars' surface. Straining to overcome this fact by imagining saline solutions, unusually high heat flow on Mars, exotic liquids, lower than expected thermal conductivities, and Mars tipped on its axis is speculation on top of speculation. Why not consider the simple possibilities first?
>
> If the water could not come from below, maybe it came from above.

Science magazine did not print this letter.

Today (2008), after the Deep Impact space mission to comet Tempel 1, the best estimate for the amount of water on a comet is 38% by mass.

102. *"... episodes of scalding rains followed by flash floods."* Teresa L. Segura et al., "Environmental Effects of Large Impacts on Mars," *Science*, Vol. 298, 6 December 2002, p. 1979.

103. *"... great craters appear to have been filled to overflowing by rain on early Mars."* Richard A. Kerr, "A Smashing Source of Early Martian Water," *Science*, Vol. 298, 6 December 2002, p. 1866.

104. Richard A. Kerr, "Minerals Cooked Up in the Laboratory Call Ancient Microfossils into Question," *Science*, Vol. 302, 14 November 2003, p. 1134.

105. R. O. Pepin, "Evidence of Martian Origins," *Nature*, Vol. 317, 10 October 1985, pp. 473–475.

106. *"... parts of ALH84001 show signs of having melted and reformed ..."* Lisa Grossman, "Martian Meteorite's Age Reduced," *Science News*, Vol. 177, 8 May 2010, p. 10.

 Where are glass nodules and melted rocks more likely to be found, on supercold Mars or in the superhot subterranean chamber?

107. Richard L. S. Taylor and David W. Mittlefehldt, "Missing Martian Meteorites," *Science*, Vol. 290, 13 October 2000, pp. 273–275.

108. *"... we estimate that the probability of finding on Earth a fragment ejected from Mars is about 10^{-6} to 10^{-7}."* James N. Head et al., "Martian Meteorite Launch: High-Speed Ejecta from Small Craters," *Science*, Vol. 298, 29 November 2002, p. 1753.

109. *"... there remains the question of whether we should not be up to our necks in lunar meteorites—that is, what would be the expected relative fluxes of objects from the Moon and Mars and why have we seen so few from the Moon?"* Pepin, p. 474.

110. *"About 20% of the ejecta are rock vapors; most of the rest is melt."* Segura et al., p. 1977.

Figure 168: What Is a *Plasma*? In addition to the three familiar states of matter—solid, liquid, and gas—there is plasma, which constitutes at least 99.9% of the matter in the visible universe. Plasma is like a hot gas, but contains a nearly equal number of free positive and negative electrical charges. It is the material of stars and thinly permeates our solar system, our galaxy, and the universe. Visible examples of plasma on earth include the glowing material inside a neon sign, a welder's arc, and a lightning bolt. Thankfully, the earth has little plasma.

During a thunderstorm, clouds build up electrical charges which differ from those in the solid earth below. If that electrical difference (or *voltage*) becomes large enough, air along one or more paths *breaks down* into flowing electrons and positive charges—atoms and molecules that have lost electrons. They collide with and heat other air molecules, stripping away more electrons and leaving behind an extremely thin trail of flowing electrical charges. Near each branch of the lightning bolt, intensely heated air expands so fast that it makes a loud crack, whose rumbling echoes are thunder.

Electrical breakdown can also occur in solids and liquids. It begins when a powerful voltage removes an electron from a neutral atom, leaving positive and negative charges called *ions*. Then these accelerating charged particles collide with other atoms, knock out more electrons, and, yes, occasionally produce new chemical elements![1] So much heat is generated that atoms lose electrons; the charged atoms and freed electrons both flow as a plasma until the voltage drops below some level. A plasma flow is like an avalanche of snow; once it begins, it will continue if there are enough electrical charges (loose snow) and the voltage (steep mountain) is high enough. Within the fluttering granite crust at the beginning of the flood, the piezoelectric effect (which will be explained later) generated high enough voltages to initiate plasma flows—electrical breakdowns—within the crust.

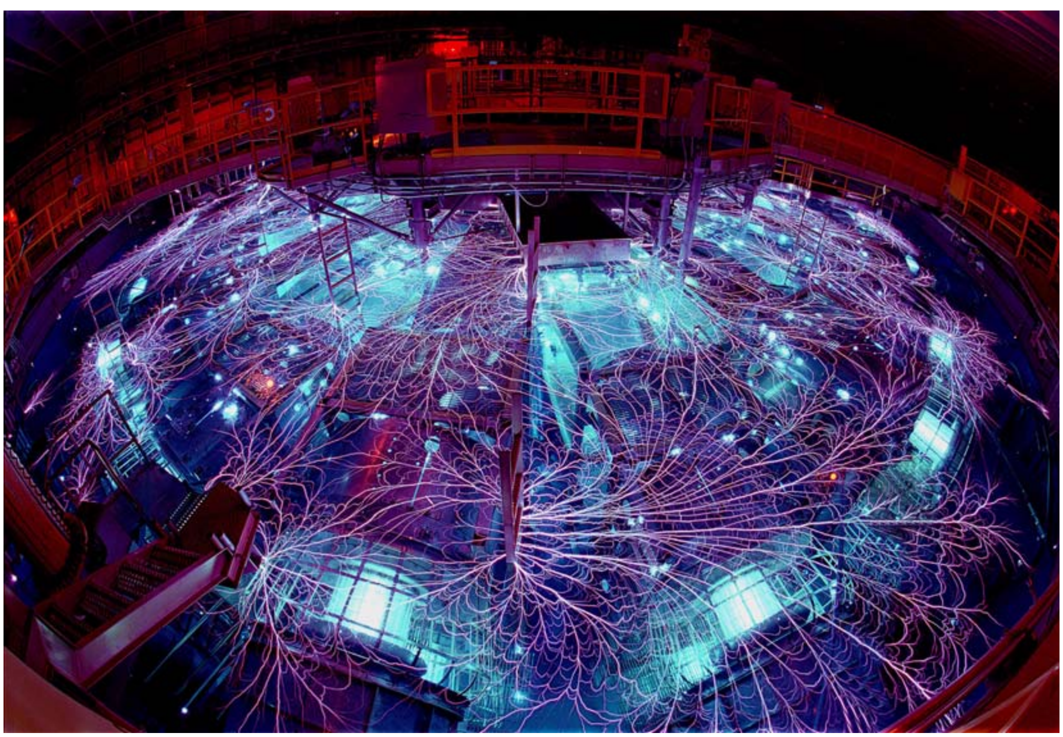


Figure 169: Arcs and Sparks at the Sandia National Laboratory. Electrical charges flowing within plasma act as if they are flowing through trillions of nearly parallel, closely packed wires. Each moving charge creates a magnetic field that cuts across nearby "wires," producing a force that steadily squeezes charges toward each other. (This same force drives electrical motors.) A high burst of current[2] through parallel wires produces a powerful force, called the **Z-pinch**, which pinches the wires together. In the Z-pinch machine at the right, the electrical surge vaporizes the wires and creates a plasma. The Z-pinch then tends to fuse atomic nuclei together. Nuclear engineers at Sandia are using this extremely powerful compressive force in plasmas to try to make a fusion reactor. If this or other technologies succeed, the world will have inexhaustible amounts of cheap, clean electrical energy.[3] This chapter will show that gigantic electrical discharges within the earth's crust during the global flood quickly produced earth's radioactivity and—based on today's extremely slow decay rates—billions of years' worth of radioactive decay products.

The Origin of Earth's Radioactivity

SUMMARY: Powerful electrical activity produced earth's radioactivity. As the flood began, stresses in the massive fluttering crust generated huge voltages via the piezoelectric effect. For weeks, this resulted in discharges of electrons within the crust and subterranean water, much like bolts of lightning. These electrical surges squeezed atomic nuclei together temporarily into very unstable, superheavy elements which quickly fissioned and decayed into subatomic particles and new radioisotopes. Each step in this process is demonstrable on a small scale. Calculations and other evidence show that these events happened on a global scale.[4] To quickly understand what happened, see "Earthquakes and Electricity" on page 335 and Figures 171, and 174–177.

The standard explanation for earth's radioactive material is that it evolved in stars and their exploded debris. Billions of years later, the earth formed from that debris. Few of these theorized steps can be demonstrated experimentally. Observations on earth and in space support the hydroplate explanation and refute the evolution explanation for earth's radioactivity.

To evaluate two radically different explanations for the origin of earth's radioactivity, some terms must first be explained. With that background, new and surprising experimental evidence will become clear. Next, the two competing theories will be summarized: the hydroplate theory and the chemical evolution theory. Readers can then judge for themselves which theory better explains the evidence. First, we need to understand a few terms concerning the atom.

The Atom. Descriptions and models of the atom differ. What is certain is that no model proposed so far is completely correct.[5] Fortunately, we need not consider these uncertainties here. Let us think of an atom as simply a ***nucleus*** surrounded by one or more shells—like layers of an onion. Each shell can hold a certain number of negatively charged ***electrons***. (The innermost shell, for example, can hold two electrons.) The tightly packed, vibrating nucleus contains ***protons***, each with a positive charge, and ***neutrons***, with no charge. (Protons and neutrons are called ***nucleons***.)

An atom is small, but a nucleus is much smaller. Two trillion (2,000,000,000,000, or 2×10^{12}) carbon atoms would fit inside the area of the period at the end of this sentence. If an atom were scaled up to the size of a football field, its nucleus—which contains about 99.98% of an atom's mass—would be the size of a tiny seed.

Atoms of the same chemical element have the same number of protons. For example, a hydrogen atom has one proton; helium, two; lithium, three; carbon, six; oxygen, eight; iron, 26; gold, 79; and uranium, 92. Today, earth has 94 naturally occurring chemical elements.[6]

A carbon-12 atom, by definition, has exactly 12.000000 ***atomic mass units (AMU)***. If we could break a carbon-12 atom apart and "weigh" each of its six protons, six neutrons, and six electrons, the sum of their masses would be 12.098940 AMU—0.098940 AMU heavier than the carbon-12 atom itself. In other words, *an atom weighs less than the sum of its parts*! To see why, we must understand ***binding energy***.

Table 17. Mass of Carbon-12 Components

Subatomic Particle	Charge	Mass of Each (AMU)	Mass of All Six (AMU)
proton	positive	1.007276	6.043656
neutron	none	1.008665	6.051990
electron	negative	0.000549	0.003294
		TOTAL:	**12.098940**

A carbon-12 atom's mass is exactly 12.000000 AMU—by definition.
In building a carbon-12 atom from 6 protons, 6 neutrons, and 6 electrons:

Loss of Mass (m) = 12.098940 − 12.000000 = 0.098940 AMU

Gain of Binding Energy (E) = $0.098940 \times c^2$

$$E = m c^2$$

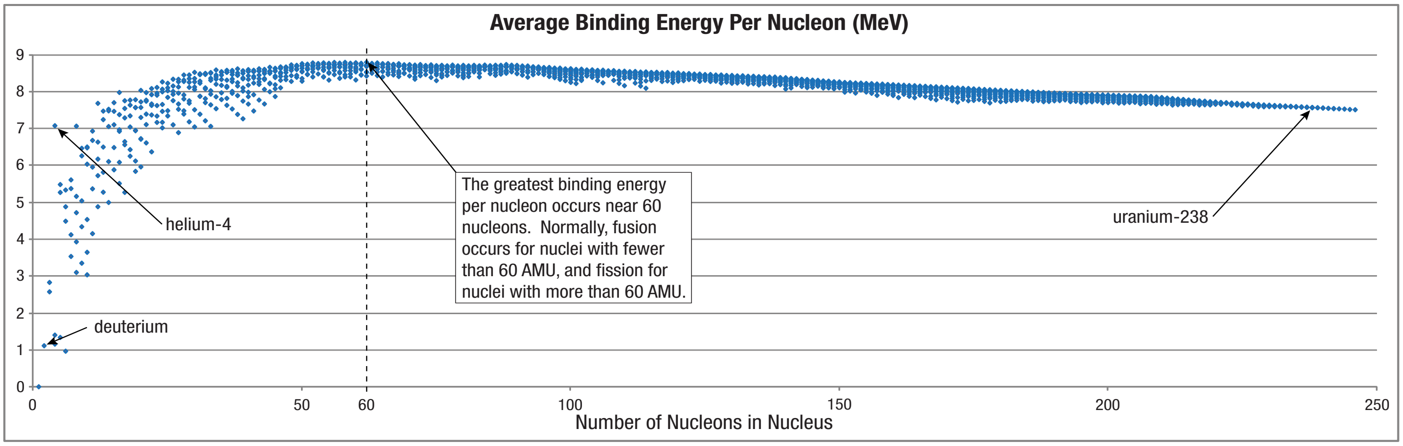


Figure 170: Binding Energy. When separate nucleons (protons and neutrons) are brought together to form a nucleus, a tiny percentage of their mass is instantly converted to a large amount of energy. That energy (usually measured in units of millions of electron volts, or MeV) is called *binding energy,* because an extremely strong force inside the nucleus tightly *binds* the nucleons together, producing a burst of heat.

For example, a deuterium (hydrogen-2) nucleus contains a proton and a neutron. Its nucleus has a total binding energy of about 2.2 MeV, so the average binding energy per nucleon is about 1.1 MeV. If two deuterium nuclei merge to become helium, 2.2 MeV + 2.2 MeV of binding energy are replaced by helium-4's average binding energy of 7.1 MeV per nucleon, or a total of 4 x 7.1 MeV. The gain in binding energy becomes emitted heat. This *merging* of light nuclei is called *fusion*. This is how the Sun derives most of its heat (fusing hydrogen into helium).[7] The peak of the binding energy curve is around 60 AMU (near iron), so except in unusual circumstances,[8] fusion cannot produce chemical elements heavier than 60 AMU.

Fission is the *splitting* of heavy nuclei. For example, when uranium fissions, the sum of the binding energies of the fragments is greater than the binding energy of the uranium nucleus, so energy is released. Fission (as well as fusion) can be sustained only if energy is released to drive more fission (or fusion).

Binding Energy. When a nucleus forms, a small fraction of its mass is converted to *binding energy*, the energy *emitted by the nucleus* when protons and neutrons bind together. It is also the energy required to break (unbind) a nucleus into separate protons and neutrons.

Generally, the closer the mass of a nucleus is to 60 AMU (similar to that of an atom of iron), the more binding energy that nucleus has per nucleon. Let's say that a very heavy nucleus, such as uranium (weighing 235.0 AMU), splits into two nuclei weighing 100.0 AMU and 133.9 AMU and a neutron (about 1.0 AMU). The 0.1 AMU of lost mass is converted to energy, according to Einstein's famous equation, $E = m c^2$, where c is the speed of light (186,000 miles per second) and E is the energy released when a mass m is converted to energy. The energy is great, because c^2 is huge. (For example, when the atomic bomb was dropped on Hiroshima, only about 700 milligrams of mass—about one-third the mass of a U.S. dime—was converted to energy.) Nuclear energy is usually released in the form of kinetic energy. The high velocity fragments generate heat as they slow down during multiple collisions.

Stated another way, a very heavy nucleus sometimes splits, a process called ***fission***. (Fission may happen spontaneously or when a heavy nucleus is hit by a neutron, or even a high-energy particle of electromagnetic radiation, called a ***photon***.) When fission occurs, mass is lost and energy is released. Likewise, when very light nuclei merge (a process called ***fusion***), mass is lost and energy is released. In an atom bomb, uranium or plutonium nuclei split (fission). In a hydrogen bomb, hydrogen nuclei merge (fuse) to become helium.

Fission inside nuclear reactors produces many free neutrons. Water is an excellent substance for absorbing the energy of fast neutrons and thereby producing heat, because water is cheap and contains so much hydrogen. (A hydrogen atom has about the same mass as a neutron, so hydrogen quickly absorbs a fast neutron's kinetic energy.) The heat can then produce steam to spin a turbine and generate electricity.

Isotopes. Atoms whose nuclei have the same number of protons but a different number of neutrons are called *isotopes*. Every chemical element has several isotopes, although most are seen only briefly in experiments. Carbon-12, carbon-13, and carbon-14 are different isotopes of carbon. All are carbon, because they have 6 protons, but respectively, they have 6, 7, and 8 neutrons—or 12, 13, and 14 nucleons. In other words, the number of protons determines the chemical element, and the number of neutrons determines the isotope.

Radioactivity. Most isotopes are radioactive; that is, their vibrating, unstable nuclei sometimes change spontaneously (***decay***), usually by emitting fast, very tiny particles—even photons (particles of light) called ***gamma rays***. Each decay, except gamma emission, converts the nucleus into a new isotope, called the ***daughter***.[9] One type of radioactive

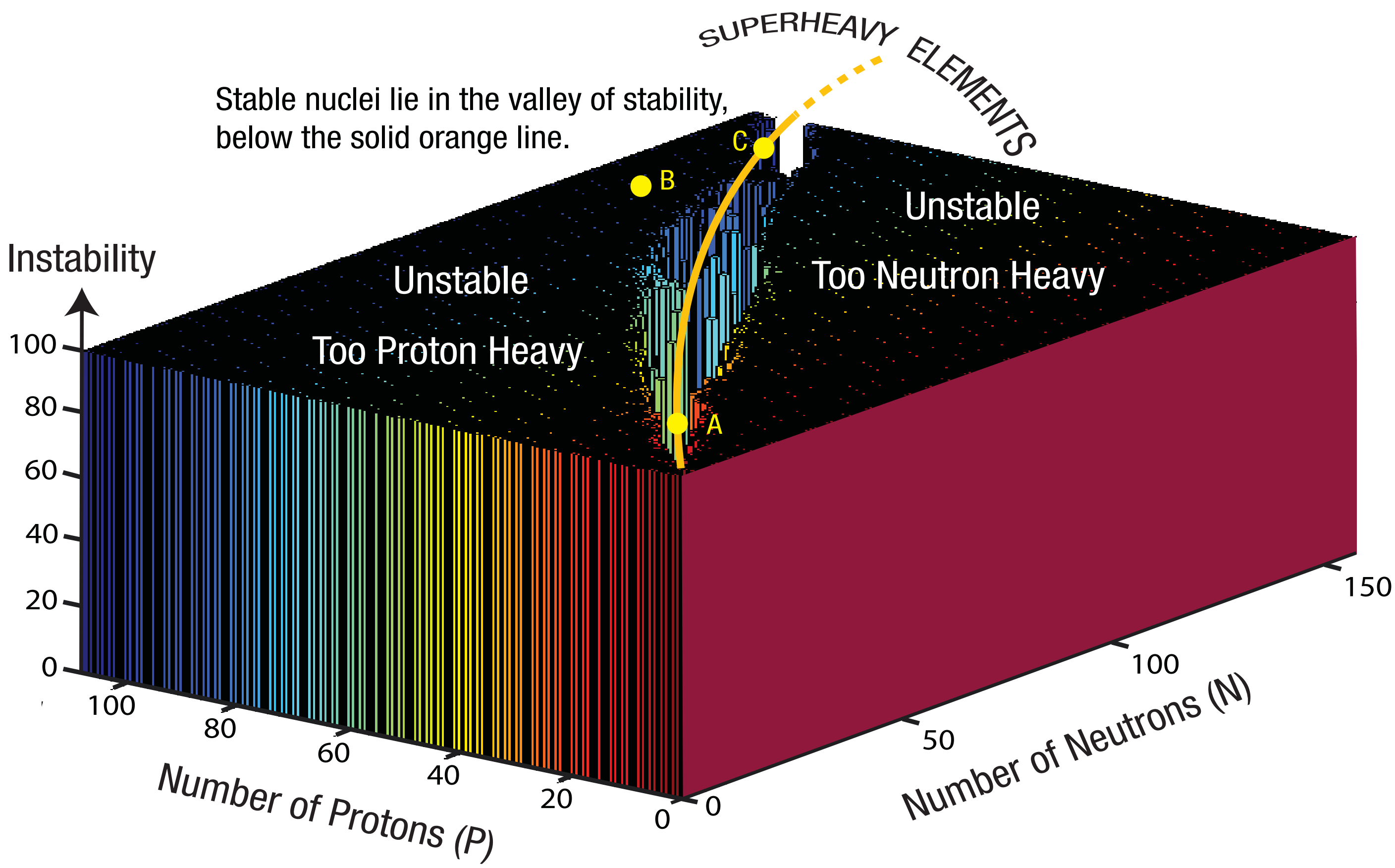


Figure 171: Valley of Stability. Each of the more than 3,100 known isotopes is defined by two numbers: the number of protons (P) and the number of neutrons (N). Think of each isotope as occupying a point on a horizontal P–N coordinate system. There, each isotope's stability can be represented by a thin, vertical bar: tall bars for isotopes that decay rapidly, shorter bars for isotopes with longer half-lives, and no vertical bars for stable isotopes.[10] Almost 300 stable isotopes lie far below the curved orange line, near the diagonal between the P axis and the N axis, in what is called *the valley of stability.*

Almost all isotopes represented by the high, flat "plateau" are hypothetical and have never been seen, but if they ever formed, they would decay instantly. Most of the thousand or so isotopes that have been briefly observed in experiments lie near the edge of the "cliff" looking down into the valley. Those on the steep slope have half-lives of seconds to billions of years. Stable isotopes are down on the valley floor.

Notice how the valley curves toward the right.[11] Light, stable nuclei have about the same number of protons as neutrons (such as carbon-12 with six protons and six neutrons); heavy nuclei that are stable have many more neutrons than protons. A key point to remember: if we could squeeze several light, stable nuclei together to make one heavy nucleus, it would lie high on the proton-heavy side of the valley and be so unstable that it would quickly decay.

For example, if the Z-pinch (described in Figure 169 on page 328) or some powerful compression suddenly merged (fused) six stable nuclei near point A, the resulting heavy nucleus would briefly lie at point B, where it would quickly decay or fission—fragment into high velocity pieces. Merged nuclei that were even heavier—*superheavy* nuclei—would momentarily lie far beyond point B, but would decay (or spontaneously fission[9]) instantly. If the valley of stability were straight and did not curve, a few light, stable nuclei that fused together would form a heavy nucleus that could still be stable (i.e., would still lie on the valley floor). Nuclei near C that fission will usually produce neutron-heavy products. As you will see, because the valley curves, we have radioactivity—another key point to remember. (Soon, you will learn about the "strong force" which produces binding energy and causes the valley to curve.)

If all earth's nuclei were initially nonradioactive, they would all have been at the bottom of the curved valley of stability. If, for weeks, chaotic discharges of electrons, driven by billions of volts of electricity, pulsed through the earth's crust, radioactive isotopes and their decay and fission products would quickly form. (How this happened will be explained later.) We can think of these new isotopes as being scattered high on the sides of the valley of stability.

It would be as if a powerful explosion, or some sudden release of energy, blasted rocks up onto the steep sides of a long valley. Most rocks would quickly roll back down. Today, rocks rarely roll down. **Wouldn't it be foolish to assume that the rubble at the bottom of the valley must have been accumulating for billions of years merely because it would take billions of years for all that rubble to collect *at the very slow rate rocks roll down today*?**

decay occurs when a nucleus expels an ***alpha particle***—a tight bundle of two protons and two neutrons, identical to the nucleus of a helium atom. In another type of decay, ***beta decay***, a neutron suddenly emits an electron and becomes a proton. ***Electron capture*** is the reverse of beta decay; that is, an electron enters the nucleus, combines with a proton, and converts it into a neutron. Few scientists realize that on rare occasions heavy nuclei will decay by emitting a carbon-14 nucleus (^{14}C).[12] This severely limits the accuracy and appropriateness of the radiocarbon dating technique. [See **"How Accurate Is Radiocarbon Dating?"** on pages 416–419.]

Radioisotopes. Radioactive isotopes are called *radioisotopes.* Only about 65 naturally occurring radioisotopes are known. However, high-energy processes (such as those occurring in atomic explosions, atomic accelerators, and nuclear reactors) have produced about 3,000 different radioisotopes, including a few previously unknown chemical elements.

Accelerated Decay Rates. Each radioisotope has a ***half-life***—the time it would take for half of a large sample of that isotope to decay *at today's rate.* Half-lives range from less than a billionth of a second to many millions of trillions of years.[13] Most attempts to change decay rates have failed. For example, changing temperatures between -427°F and +4,500°F has produced no measurable change in decay rates. Nor have accelerations of up to 970,000 g, magnetic fields up to 45,000 gauss, or changing elevations or chemical concentrations.

However, it was learned as far back as 1971 that high pressure could increase decay rates very slightly for at least 14 isotopes.[14] Under great pressure, electrons (especially from the innermost shell) are squeezed closer to the nucleus, making electron capture more likely. Also, electron capture rates for a few radioisotopes change in different chemical compounds.[15]

Beta decay rates can increase dramatically when atoms are stripped of all their electrons. In 1999, Germany's Dr. Fritz Bosch showed that, for the rhenium atom, this *decreases its half-life more than a billionfold—from 42 billion years to 33 years.*[16] The more electrons removed, the more rapidly neutrons expel electrons (beta decay) and become protons. This effect was previously unknown, because only electrically neutral atoms had been used in measuring half-lives.[17]

The alpha decay rate for silicon-32 (^{32}Si) and beta decay rate for radium-226 (^{226}Ra) and chlorine-36 (^{36}Cl) depend slightly on earth's distance from the Sun.[18] This may be an electrical effect, or a consequence of plasma or neutrinos flowing from the Sun.

Patents have been awarded to major corporations for electrical devices that are claimed to greatly accelerate alpha, beta, and gamma decay and thereby decontaminate hazardous nuclear wastes. An interesting patent awarded to William A. Barker is described as follows:[19]

> *Radioactive material is placed in or on a Van de Graaff generator where an electric potential of 50,000 – 500,000 volts is applied for at least 30 minutes. This large negative voltage is thought to lower each nucleus' energy barrier. Thus alpha, beta, and gamma particles rapidly escape radioactive nuclei.*

The technical details of these patents appear credible, but their decontamination ability and large-scale economic viability have not been demonstrated.

While these electrical devices may accelerate decay rates, a complete theoretical understanding of them does not yet exist, they are expensive, and they act only on small samples. However, *the common belief that decay rates are constant in all conditions should now be discarded.*

We can think of a large sample of a radioisotope as a slowly-leaking balloon with a meter that measures the balloon's total leakage since it was filled. Different radioisotopes have different leakage rates, or half-lives. (Stable isotopes do not leak; they are not radioactive.)

Some people may think that a balloon's age can be determined by dividing the balloon's total leakage by its leakage rate today. Here, we will address more basic issues: What "pumped up" all radioisotopes in the first place, and when did it happen? Did the pumping process rapidly produce considerable initial leakage—billions of years' worth, *based on today's slow leakage rates*?

Neutron Activation Analysis. This is a routine, nondestructive technique for determining the concentration of many chemical elements in materials. Neutrons, usually from a nuclear reactor, bombard the material to be analyzed. Some nuclei that absorb neutrons become radioactive—are driven up the neutron-heavy side of the valley of stability. [See Figure 171 on page 331.] The decay characteristics of those "pumped up" nuclei are then used to identify the atoms present.

Neutron Stars. When a very massive star begins to run out of hydrogen and other nuclear fuels, it can collapse so suddenly that almost all its electrons are driven into nuclei. This produces a "sea of neutrons" and releases the immense energy of a ***supernova***. What remains near the center of the gigantic explosion is a dense star composed of neutrons—a neutron star.

The Strong Force. Like charges repel each other, so what keeps a nucleus containing many protons from flying apart? A poorly understood force inside the nucleus must be acting over a short distance to pull protons (and, it turns out, neutrons, as well) together. Nuclear physicists

Nuclear Combustion[20]

Since February 2000, thousands of sophisticated experiments at the Proton-21 Electrodynamics Research Laboratory (Kiev, Ukraine) have demonstrated *nuclear combustion* and have produced traces of all known chemical elements and their stable isotopes.[21] In those experiments, a brief (10^{-8} second), extremely powerful electron flow self-focuses inside a hemispherical electrode target, typically 0.5 mm in diameter. For the most part, the relative abundances of chemical elements produced correspond to what is found in the earth's crust.

> *... the statistical mean curves of the abundance of chemical elements created in our experiments are close to those characteristic in the Earth's crust.*[22]

Also produced (very briefly) were ***superheavy chemical elements***, previously unknown elements, some up to 3,000 atomic mass units—12 times heavier than uranium!

Each experiment used one of 22 separate electrode materials, including copper, silver, platinum, bismuth, and lead, each at least 99.90% pure. The energy of a typical electron pulse on the target's surface was less than 300 joules (about 0.3 BTU or 0.1 watt-hour), but it was concentrated—Z-pinched—almost instantly into a "hot dot" at the center of an imploding spherical shell of superdense plasma. The "hot dot," less than one ten-millionth of a millimeter in diameter, reached temperatures of 3.5×10^8 K for less than a billionth of a second—an energy density greatly exceeding that of a supernova! The electrodes ruptured with a flash of light, including x-rays and gamma rays. Also emitted were alpha and beta particles, plasma, and dozens of transmuted chemical elements. *The total energy output was about four orders of magnitude greater than the electrical energy input!* Apparently, both fusion and fission took place.

Figure 172: Preparing for a Demonstration of Nuclear Combustion at the Proton-21 Laboratory.

Dr. Stanislav Adamenko, the laboratory's scientific director, believes that these experiments are microscopic analogues of events occurring in supernova and other phenomenon involving ***Z-pinched electrical pulses***. These discoveries may provide a means for neutralizing radioactive waste.[23]

call this *the strong force*. Binding energy, described on page 330, is the result of work done by the strong force.

Two nuclei, pushed toward each other, initially experience an increasing repulsive force—called the ***Coulomb force***. Because both nuclei have charges of the same sign (positive), the force is repulsive. However, if a powerful Z-pinch (as described in Figure 169 on page 328) acts and the nuclei are squeezed closely enough together—or collide in a turbulent, pulsating plasma flow—the strong force will pull nuclei together and merge them into larger nuclei. If the Z-pinch acts over a broad plasma flow, many nuclei could merge into *superheavy nuclei*—nuclei heavier than any chemical element found naturally. Of course, most merged nuclei would be unstable (radioactive) and would rapidly decay, because they would lie *high on the proton-heavy side of the valley of stability.* [See Figure 171 on page 331.]

While the strong force holds nuclei together and overcomes the repulsive Coulomb force, four particular nuclei are barely held together: lithium-6 (^6Li), beryllium-9 (^9Be), boron-10 (^{10}B), and boron-11 (^{11}B). Slight impacts will cause their decay.[24] The importance of these fragile isotopes will soon become clear.

Free Neutrons. Neutrons in a nucleus rarely decay, but free neutrons (those outside a nucleus) decay with a half-life of 10.25 minutes! Why should a neutron surrounded by protons and electrons often have a half-life of millions of years, but, when isolated, have a half-life of minutes?[25] This is similar to what Fritz Bosch discovered: stripping electrons from atoms accelerates decay, sometimes a billionfold. Again, for reasons that are not fully understood, the electrical environment in and around nuclei dramatically affects their stability and radioactivity.

Carbon-14. Each year, cosmic radiation striking the upper atmosphere converts about 21 pounds of nitrogen-14 into carbon-14, also called *radiocarbon*. Carbon-14 has a half-life of 5,730 years.

Individual carbon-14 atoms can now be counted by using an atomic accelerator and sensitive instruments. With this new technique called ***Accelerator Mass Spectrometry (AMS)***, radiocarbon dating has become much more precise. AMS ages for old carbon-14 specimens are all about 5,000 years. [See **"How Accurate Is Radiocarbon Dating?"** on page 416.] AMS has sometimes been able to date the same materials previously dated by earlier, less precise dating techniques. In those cases, AMS ages are usually 10–1000 times younger.[26]

Argon. About 1% of earth's atmosphere (not counting water vapor) is argon, of which 99.6% is argon-40 and only 0.3% is argon-36. Both are stable. Today, argon-40 is produced almost entirely by the decay of potassium-40. In 1966, Melvin Cook pointed out the great discrepancy in the large amount of argon-40 in our atmosphere, the relatively small amount of potassium-40 in the earth's crust, and its slow rate of decay (half-life: 1.3 billion years).

> *The earth would have to be about* 10^{10} *years old* [10 billion years, twice what evolutionists believe] *and the initial* ^{40}K [potassium-40] *content of the earth about 100 times greater than at present ... to have generated the* ^{40}Ar [argon-40] *in the atmosphere.*[27]

Since Cook published that statement, estimates of the amount of ^{40}K in the earth have been increased. Nevertheless, this glaring contradiction remains. Despite efforts by geophysicists to juggle the numbers, the small amount of ^{40}K in the earth is not enough to have produced one of the most abundant atmospheric gases (after nitrogen, oxygen, and water vapor). If ^{40}Ar has been produced by a process other than the slow decay of ^{40}K, as the evidence indicates, then the potassium-argon and argon-argon dating techniques, the most frequently used radiometric dating techniques,[28] become useless, if not deceptive.

One final point. Micrometeorites and solar wind add at least seven times more ^{36}Ar than ^{40}Ar to earth's atmosphere. Therefore, those sources provided little of the earth's ^{40}Ar,[29] because, as stated above, our atmosphere has about 300 times more ^{40}Ar than ^{36}Ar. Also, since there is relatively little ^{36}Ar in the atmosphere, whatever produced our atmosphere's argon *must have been recent.*

Zircons. Zircons are tiny, durable crystals about twice the thickness of a human hair. They usually contain uranium and thorium, some of which is assumed to have decayed at today's very slow rate to lead. If this is true, zircons are extremely old. For example, hundreds of zircons found in Western Australia would be 4.0–4.2 billion years old. Most evolutionists find this puzzling, because they have taught that the earth was largely molten prior to 3.9 billion years ago![30] These zircons also contain tiny inclusions, such as quartz, which show that they formed when the earth was relatively cool, had a granite crust, and contained water.[31] Other zircons, some supposedly as old as 4.42 billion years, contain microdiamonds with abnormally low, but highly variable amounts of ^{13}C. These microdiamonds apparently formed (1) under unusual geological conditions, and (2) under extremely high, and perhaps sudden, pressures *before* the zircons encased them.[32]

Helium Retention in Zircons. Uranium and thorium usually decay by emitting alpha particles. Each alpha particle is a helium nucleus that quickly attracts two electrons and becomes a helium atom (^{4}He). The helium gas produced in zircons by uranium and thorium decay should diffuse out relatively quickly, because helium does not combine chemically with other atoms, and it is extremely small—the second smallest of all elements by mass, and the smallest by volume!

Some zircons would be 1.5 billion years old if all the lead in them had been accumulating at ***today's*** rate. But based on the rapid diffusion of helium out of zircons, the lead was produced in only 4,000–8,000 years[33]—a clear contradiction. Also, accelerated decay in the zircons probably produced a vast amount of helium recently.

Helium-3 (^{3}He). Neither ^{3}He nor ^{4}He is radioactive. Ejected alpha particles, as stated above, quickly become ^{4}He (which constitutes 99.999863% of the earth's detectable helium). Only nuclear reactions produce ^{3}He, the remaining 0.000137% of earth's known helium.[34] Because nuclear reactions that produce ^{3}He are not known to be occurring inside the earth, some evolutionists say that ^{3}He must have been primordial—present before the earth evolved. Therefore, ^{3}He, they say, was trapped in the infalling meteoritic material that formed the earth. But helium does not combine chemically with anything, so how did such a light, volatile gas get inside meteorites? Even if helium was trapped in falling meteorites, why did it not quickly escape or bubble out when meteorites supposedly crashed into the molten, evolving earth? Even if ^{3}He is being produced inside the earth, if the mantle is circulating and mixing, why do different volcanoes expel drastically different amounts of ^{3}He?[35]

Where Is Earth's Radioactivity? Three types of measurements each show that earth's radioactivity is concentrated in the continental (granite) crust. In 1906, some scientists recognized that if the earth were millions of years old or older, more heat from radioactive decay should have accumulated and be escaping up through earth's surface.[36]

Earthquakes and Electricity

Books have been written describing thousands of strange electrical events that accompanied earthquakes.[37] Common descriptions of earthquakes worldwide include such phrases as: "flames shot out of the ground," "intense electrical activity," "the sky was alight," "ribbon-like flashes of lightning seen through a dense mist," "[a chain anchoring a boat became] incandescent and partly melted," "lightning flashes," "globes of fire and other extraordinary lights and illuminations," "sheets of flame [waved to and fro for a few minutes] on the rocky sides of the Inyo Mountains," "a stream of fire ran between both [of my] knees and the stove," "the presence of fire on the rocks in the neighborhood," "convulsions of magnetic compass needles on ships," "indefinite instantaneous illumination," "lightning and brightnings," "sparks or sprinkles of light," "thin luminous stripes or streamers," "well-defined and mobile luminous masses," "fireballs," "vertical columns of fire," "many sparks," "individuals felt electrical shocks," "luminous vapor," "bluish flames emerged from fissures opened in the ground," "flame and flash suddenly appeared and vanished at the mouth of the rent [crack in the ground]," "earthquakes [in India] are almost always accompanied by furious storms of thunder, lightning, and rain," "electrical currents rushed through the Anglo-American cables [on the Atlantic floor] toward England a few minutes before and after the shocks of March 17th, 1871," "[Charles] Lyell and other authors have mentioned that the atmosphere before an earthquake was densely charged with electricity," and "fifty-six links in the chains mooring the ship had the appearance of being melted. During the earthquake, the water alongside the chains was full of little bubbles; the breaking of them sounded like red-hot iron put into water."

The three New Madrid Earthquakes (1811–1812), centered near New Madrid, Missouri, were some of the largest earthquakes ever to strike the United States. Although relatively few people observed and documented them, the reports we do have are harrowing. For example:

> Lewis F. Linn, United States Senator, in a letter to the chairman of the Committee on Commerce, says the shock, accompanied by "flashes of electricity, rendered the darkness doubly terrible." Another evidently somewhat excited observer near New Madrid thought he saw "many sparks of fire emitted from the earth." At St. Louis, gleams and flashes of light were frequently visible around the horizon in different directions, generally ascending from the earth. In Livingston County, the atmosphere previous to the shock of February 8, 1812 contained remarkable, luminous objects visible for considerable distances, although there was no moon. "On this occasion the brightness was general, and did not proceed from any point or spot in the heavens. It was broad and expanded, reaching from the zenith on every side toward the horizon. It exhibited no flashes, but, as long as it lasted, was a diffused illumination of the atmosphere on all sides." At Bardstown there are reported to have been "frequent lights during the commotions." At Knoxville, Tennessee, at the end of the first shock, "two flashes of light, at intervals of about a minute, very much like distant lightning," were observed. Farther east, in North Carolina, there were reported "three large extraordinary fires in the air; one appeared in an easterly direction, one in the north, and one in the south. Their continuance was several hours; their size as large as a house on fire; the motion of the blaze was quite visible, but no sparks appeared." At Savannah, Georgia, the first shock is said to have been preceded by a flash of light.[38]

Why does so much electrical activity accompany many large earthquakes? Are frightened people hallucinating? Do electrical phenomena cause earthquakes, or do earthquakes cause electrical activity? Maybe something else produces both electrical activity and earthquakes. Does all this relate to the origin of earth's radioactivity?

It was then suspected that radioactive decay might be concentrated in the earth's crust, or that radioactive decay has not been going on for long—or both.

Later, holes drilled into the ocean floor showed slightly more heat coming up through the ocean floors than through the continents. But basaltic rocks under the ocean floor contain little radioactivity.[39] Apparently, radioactive decay is not the primary source of earth's geothermal heat.

A second type of measurement occurred in Germany's Deep Drilling Program. The concentration of radioactivity measured down Germany's deepest hole (5.7 miles) would account for all the heat flowing out at the earth's surface if that concentration continued down to a depth of only 18.8 miles and if the crust were 4 billion years old.[40]

However, the rate at which temperatures increased with depth was so great that if the trend continued, the rock at the top of the mantle would be partially melted. Seismic studies have shown that this is not the case.[41] Therefore, temperatures do not continue increasing down to the mantle as they would if radioisotopes were uniformly concentrated in the crust and upper mantle.

A third measurement technique, used in regions of the United States and Australia, shows a strange, but well-verified, correlation: *the amount of heat flowing out of the earth at specific locations correlates with the radioactivity in surface rocks at those locations.* In other words, wherever radioactivity is high, the heat flow will usually be high; wherever radioactivity is low, the heat flow will usually be low. *However, the amount of radioactivity at those hotter locations is far too small to account for that heat.*[42] What does this correlation mean?

First, consider what it does not necessarily mean. When two sets of measurements correlate (or correspond), people often mistakenly conclude that one of the things measured (such as radioactivity in surface rocks at one location) *caused* the other thing being measured (surface heat flow at that location). Even experienced researchers sometimes fall into this trap. Students of statistics are repeatedly warned of this common mistake in logic, and hundreds of humorous[43] and tragic examples are given; nevertheless, the problem abounds in all research fields.

This correlation could be explained if most of the heat flowing up through the earth's surface was generated, not by the radioactivity itself, but by the same events that produced that radioactivity. If more heat is coming out of the ground at one place, then more radioactivity was also produced there. As a result, radioactivity in surface rocks would correlate with surface heat flow.

The Oklo Natural "Reactor." Building a nuclear reactor requires the careful design of many interrelated components. Reactors generate heat by the controlled fission of certain isotopes such as uranium-235 (^{235}U). For some unknown reason, 0.72% of almost every uranium ore deposit in the world is ^{235}U. (About 99.27% is the more stable ^{238}U, and 0.01% is ^{234}U.) For a ^{235}U reactor to operate, the ^{235}U must usually be concentrated to at least 3–5%. This enrichment is both expensive and technically difficult.

Controlling the reactor is a second requirement. When a neutron splits a ^{235}U nucleus, heat and typically two or three other neutrons are released. If the ^{235}U is sufficiently concentrated and, on average, exactly one of those two or three neutrons fissions another ^{235}U nucleus, the reaction continues and is said to be *critical*—or self-sustaining. If this delicate situation can be maintained, considerable heat (from binding energy) is steadily released, usually for years.

In 1972, French engineers were processing uranium ore from an open-pit mine near the Oklo River in the Gabon Republic on Africa's west equatorial coast. There they discovered depleted (partially consumed) ^{235}U in isolated zones.[44] (In one zone, only 0.29% of the uranium was ^{235}U, instead of the expected 0.72%.) Many of the most common fission products from ^{235}U were mixed with the depleted ^{235}U but found nowhere else.

Nuclear engineers, aware of just how difficult it is to design and build a nuclear reactor, are amazed by what they believe was a naturally occurring reactor. But notice, we do not know that a self-sustaining, critical reactor operated at Oklo. All we know is that *considerable ^{235}U has fissioned.*

How could this have happened? Suppose, as is the case for every other known uranium mine, Oklo's uranium layer had never been critical. In other words, for every 100 neutrons produced by ^{235}U fission, 99 or fewer other neutrons were produced in the next fission cycle, an instant later. The nuclear reaction would quickly die down, i.e., it would not be self-sustaining. However, suppose that many free neutrons frequently appeared somewhere in the uranium ore layer. (How this could happen will soon be explained.) Even though the nuclear reaction would not be self-sustaining, the process would multiply the number of neutrons available to fission ^{235}U.[45] This would better match what is found at Oklo for four reasons.

First, in several "reactor" zones the ore layer was too thin to become critical. Too many neutrons would have escaped or been absorbed by all the nonfissioning material (called *poisons*) mixed in with the uranium.[46]

Second, one zone lies 30 kilometers from the other zones. Whatever strange events at Oklo depleted ^{235}U *in 16 largely separated zones* was probably common to that region of Africa and not to some specific topography. Uranium deposits are found in many diverse regions worldwide, and yet, only in the Oklo region has this mystery been observed.

Third, depleted ^{235}U was found where it should not be—near the borders of the ore deposit, where neutrons would tend to escape rather than fission ^{235}U. Had Oklo been a reactor, depleted ^{235}U should be concentrated near the center of the ore body.[47]

Fourth, at Oklo, the ratio of ^{235}U to ^{238}U in uranium ore, which should be about 0.72 to 99.27 (or 1 to 138), surprisingly varies *a thousandfold* over distances as small as 0.0004 inch (0.01 mm)![48] A. A. Harms has explained that this wide variation

> *represents strong evidence that, rather than being a* [thermally] *static event, Oklo represented a highly dynamic—indeed, possibly "chaotic" and "pulsing" —phenomenon.*[49]

Harms also explained why rapid temperature and nuclear power spikes would produce a wide range in the ratios of ^{235}U to ^{238}U over very short distances. The question yet to be answered is, what could have caused those spikes?

Radiohalos. An alpha particle shot from a radioisotope inside a rock acts like a tiny bullet crashing through the surrounding crystalline structure. The "bullet" travels for a specific distance (usually a thousandth of an inch or less) depending on the particular radioisotope and the resistance of the crystals it penetrates. If a billion copies of the same radioisotope are clustered near a microscopic point, their randomly directed "bullets" will begin to form a tiny sphere of discoloration and radiation damage called a *radiohalo*.[51]

For example, ^{238}U, after a series of eight alpha decays (and six much less damaging beta decays), will become lead-206 (^{206}Pb). Therefore, eight concentric spheres, each with a slightly different color, will surround what was a point concentration of a billion ^{238}U atoms. Under a microscope, those radiohalos look like the rings of a tiny onion. [See Figure 173.] A thin slice through the center of this "onion" resembles a bull's-eye target at an archery range. Each ring's relative size identifies the isotope that produced it.

Isolated Polonium Halos. We can think of the eight alpha decays from ^{238}U to ^{206}Pb as eight rungs on a generational ladder. Each alpha decay leads to the radioisotope that is on the ladder's next lower rung. The last three alpha decays[52] are of the chemical element polonium (Po): ^{218}Po, ^{214}Po, and ^{210}Po. Their half-lives are extremely short: 3.1 minutes, 0.000164 second, and 138 days, respectively.

However, polonium radiohalos are often found without their parents or any other prior generation! How could that be? Didn't they have parents? Radon-222 (^{222}Rn) is on the rung immediately above the three polonium isotopes, but the ^{222}Rn halo is missing. Because ^{222}Rn decays with a half-life of only 3.8 days, its halo should be found with the polonium halos. Or should it?

Dr. Robert V. Gentry, the world's leading researcher on radiohalos, has proposed the following explanation for this mystery.[53] He notes that halos cannot form in a liquid, so they could not have formed while the rock was solidifying from a molten state. Furthermore, any polonium in the molten rock would have decayed long before the liquid could cool enough to solidify. *Therefore, those rocks did not cool and solidify over eons, as is commonly taught!* Gentry believes that a solid rock containing polonium must have been created instantly—on Day 1 of the creation; within days, the polonium decayed and formed isolated (parentless) halos.

Gentry's explanation has four problems. First, to form a distinct ^{218}Po halo, for example, about a billion ^{218}Po atoms,[54] concentrated near a point, must undergo heat-releasing alpha decays, half of which would occur within 3.1 minutes. The great heat generated in such a tiny volume in just 3.1 minutes would have easily melted that entire halo unless some yet-to-be-explained heat-removal mechanism acted.[55] Obviously, melting did not occur.[56]

Second, polonium has 33 known radioisotopes, but only three (^{218}Po, ^{214}Po, and ^{210}Po) account for essentially all the isolated polonium halos. Those three are produced by

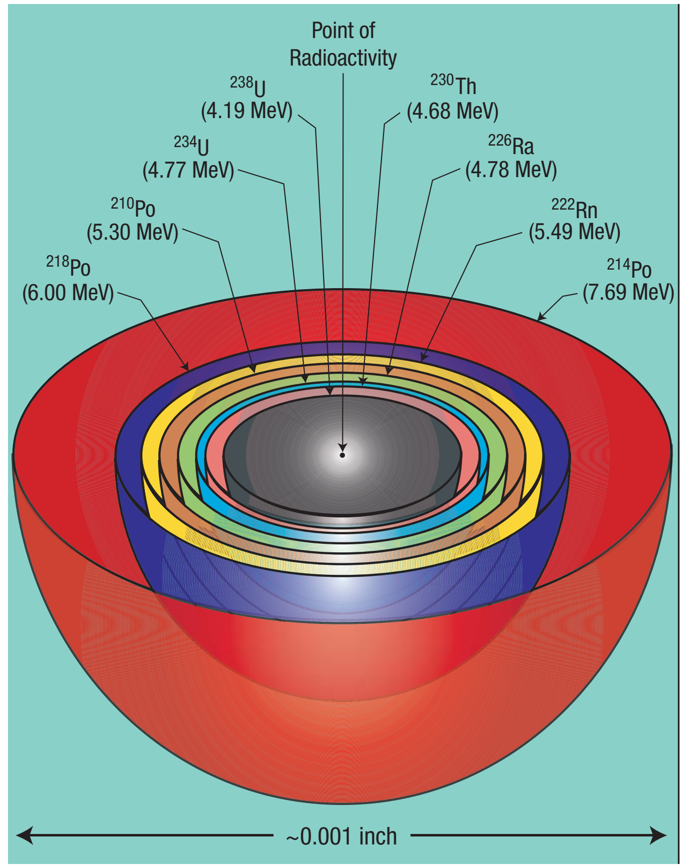


Figure 173: Radiohalos from the ^{238}U Decay Series. Suppose a billion ^{238}U atoms were concentrated at the point of radioactivity shown above. Each ^{238}U atom eventually ejects one alpha particle in a random direction, but at the specific velocity corresponding to 4.19 million electron volts (MeV) of energy—the binding energy released when ^{238}U decays. That energy determines the distance traveled, so each alpha particle from ^{238}U ends up at the gray spherical shell shown above. (Alpha particles from daughter isotopes will travel to different shells.) To form sharply defined halos, about a billion ^{238}U atoms must eject an alpha particle from the center, because each alpha particle leaves such a thin path of destruction.

A ^{238}U atom becomes ^{234}U after the alpha decay and two less-damaging beta decays. Later, that ^{234}U atom expels an alpha particle with 4.77 MeV of kinetic energy. As a billion ^{234}U atoms decay, a sharp ^{234}U halo forms. Eventually, a billion lead-206 (^{206}Pb) atoms will occupy the halo center, and each halo's radius will identify which of the eight radioisotopes produced it.

While we might expect all the halos to be nested (have a common center) as shown above, G. H. Henderson made a surprising discovery[50] in 1939: halos formed by the decay of three polonium isotopes (^{218}Po, ^{214}Po, and ^{210}Po) were often isolated, not in a "nest." Since then, the mystery has deepened, and possible explanations have generated heated controversy.

Thorium-232 (^{232}Th) and ^{235}U also occur naturally in rocks, and each begins a different decay series that produces different polonium isotopes. However, neither series produces isolated polonium halos. The solution for the isolated polonium halo mystery should explain why isolated halos occur in the ^{238}U decay series but not in other decay series. *Notice, if the earth is 4.6 billion years old and ^{235}U was produced and scattered by some super-nova billions of years earlier, ^{235}U's half-life of 700 million years is relatively short. Why is ^{235}U still around, how did it get here, what concentrated it, and where is all the lead that the ^{235}U decay series should have produced?*

only the ^{238}U decay series, and ^{238}U is often found near isolated polonium halos. Why would only those three isotopes be created instantly on Day 1? They probably were not. Instead, something produced by the ^{238}U decay series probably accounts for the isolated polonium halos.

Third, Henderson and Sparks, while doing their pioneering work on isolated polonium halos in 1939, made an important discovery.[57] They found that the centers of those halos, at least those in the biotite "books" they examined, were usually in certain "sheets" inside the biotite. (Biotite, like other micas, consists of thin "sheets" that children enjoy peeling off as if the layers were sheets in a book.)

> *In most cases it appears that they* [the centers of the isolated halos] *are concentrated in planes parallel to the plane of cleavage. When a book of biotite is split into thin leaves, most of the latter will be blank until a certain depth is reached, when signs of halos become manifest. A number of halos will then be found in a central section in a single leaf, while the leaves on either side of it show off-centre sections of the same halos. The same mode of occurrence is often found at intervals within the book.*[58]

This implies that the polonium atoms, or their parents, were flowing between sheets and frequently lodged in channel walls formed by those growing sheets. In other words, the polonium was not created inside solid rock.

Fourth, isolated polonium halos are sometimes found in intrusions—injections of magma (now solidified) that cut up through layered strata, even layers containing fossils. Because these strata were laid down during the flood, *long after the creation*, and the magma, which had to cool before solidifying, came even later, those polonium halos could not have formed minutes or days after the creation.

On 23 October 1987, after giving a lecture at Waterloo University near Toronto, Ontario, I was approached by amateur geologist J. Richard Wakefield, who offered to show me a similar intrusion. The site was inside a mine, about 150 miles to the northeast near Bancroft, Ontario, where Bob Gentry had obtained some samples of isolated polonium halos. I accepted and called my friend Bob Gentry to invite him to join us. Several days later, he flew in from Tennessee and, along with an impartial geologist who specialized in that region of Ontario, we went to the mine. Although we could not gain access into the mine, we all agreed that the intrusion cut up through the sedimentary layers.[59]

Gentry concluded (while we were there and in later writings[60]) that the sedimentary layers *with solid intrusions* must have been created supernaturally *with ^{218}Po, ^{214}Po, and ^{210}Po already present (but no other polonium isotopes present).* Then the ^{218}Po, ^{214}Po, and ^{210}Po decayed minutes or days later. Unfortunately, I had to disagree with my friend; the heat generated would have melted the entire halo.[55] Besides, I am convinced that those sedimentary layers were laid down at the time of the flood, so the intrusions came long after the creation. [See **"Liquefaction: The Origin of Strata and Layered Fossils"** on pages 175–187.] Since 1987, isolated polonium halos have been reported in other flood deposits.[61]

Dr. Lorence G. Collins has a different explanation for the polonium mystery. He first made several perceptive observations. The most important was that strange wormlike patterns were in "*all of the granites in which Gentry found polonium halos*."[62] Those microscopic patterns, each about 1 millimeter long, resembled almost parallel "*underground ant tunnels*" and were typically filled with two minerals common in granite: quartz and plagioclase [PLA-jee-uh-clase] feldspars, specifically sodium feldspars.[63] The granite had not melted, nor had magma been present. The rock that contains these wormlike patterns is called *myrmekite* [MUR-muh-kite]. Myrmekites have intrigued geologists and mineralogists since 1875. Collins does not know why myrmekite is associated with isolated polonium halos in granites.[64] You soon will.

Collins notes that those halos, in addition to being near uranium deposits, tend to be in two minerals (biotite and fluorite) in granitic pegmatites [PEG-muh-tites] and in biotite in granite *when myrmekites are present*.[65] (Pegmatites will soon be described. Biotite, fluorite, and pegmatites *form out of hot water solutions in cracks in rocks*.) Collins also knows that radon (Rn) inside the earth's crust is a gas; under such high pressures, it readily dissolves in hot water. Because radon is inert, it can move freely through solid cracks without combining chemically with minerals lining the walls of those cracks.

Collins correctly concludes that "voluminous" amounts of hot, ^{222}Rn-rich water must have surged up through sheared and fractured rocks. When ^{222}Rn decayed, ^{218}Po formed. *Some unspecified process, which I will soon identify,* then concentrated ^{218}Po at various points in particular minerals, such as biotite and fluorite, lining the walls of cracks.[66] Days later, isolated polonium halos formed.[67]

However, Collins' explanation raises five questions:

1. What was the source of all that hot, flowing water, and how could it flow so rapidly up through rock?[68]
2. Because halos are found in different geologic periods, did all this remarkable activity occur repeatedly, but at intervals of millions of years? If so, how?
3. What concentrated a billion ^{218}Po atoms at each microscopic speck that became the center of an isolated polonium halo? Why wasn't the ^{218}Po dispersed?
4. Today's extremely slow decay of ^{238}U (with a half-life of 4.5 billion years) means that its daughters,

granddaughters, etc. also form slowly. Were these microscopic specks the favored resting places for ^{218}Po for billions of years, or did the decay of ^{238}U somehow spike just before all that hot water flowed? Remember, ^{218}Po decays today with a half-life of only 3.1 minutes.

5. Why are isolated polonium halos associated with parallel and aligned myrmekite that resembles tiny ant tunnels?

Later, the answers, based on the hydroplate theory, will be given.

Elliptical Halos. Robert Gentry made several important discoveries concerning radiohalos, such as elliptical halos in coalified wood from the Rocky Mountains. In one case, he found a spherical ^{210}Po halo superimposed on an elliptical ^{210}Po halo. Apparently, a spherical ^{210}Po halo partially formed, but then was *suddenly* compressed by about 40% into an elliptical shape. Then the partially depleted ^{210}Po (whose half-life is 138 days) finished its decay, forming the halo that remained spherical.[69]

Explosive Expansion. At many places on earth, mineralogists have found radial stress fractures *surrounding* certain minerals that experienced extensive alpha decays. Halos were not seen, because the decaying radioisotopes were not concentrated at microscopic points. However, alpha decays throughout those minerals destroyed their crystalline structure, causing them to expand by up to 17% in volume.[70]

Dr. Paul A. Ramdohr, the famous German mineralogist, observed that these surrounding fractures did not occur, as one would expect, along grain boundaries or along planes of weakness. Instead, the fractures occurred in more random patterns around the expanded material. Ramdohr noted that if the expansion had been slow, only a few cracks—all along surfaces of weakness—would be seen. Because the cracks had many orientations, the expansion must have been "explosive."[71] What caused this rapid expansion?

Pegmatites. Pegmatites are rocks with large crystals, typically one inch to several feet in size. Pegmatites appear to have crystallized from hot, watery mixtures containing some chemical components of nearby granite. These mixtures penetrated large, open fractures in the granite where they slowly cooled and solidified. What Herculean force produced the fractures? Often, the granite is part of a huge block, with a top surface area of at least 100 square kilometers (40 square miles), called a ***batholith***. Batholiths are typically granite regions that have pushed up into the overlying, layered sediments, somehow removing the layers they replaced. How was room made for the upthrust granite? Geologists call this "the room problem."[72]

This understanding of batholiths and pegmatites is based primarily on what is seen today. In other words, we are trying to reason only from the *effect* we see *back to* its *cause*. A more complete picture of how and when they formed—and what other major events were happening on earth—will become apparent when we also reason in the opposite direction: from *cause to effect*. Generally, geology looks backward and physics looks forward. We will do both and will not be satisfied until a detailed picture emerges that is consistent from both vantage points. This will help bring into sharp focus "the origin of earth's radioactivity."

Theories for the Origin of Earth's Radioactivity

The Hydroplate Theory. In the centuries before the flood, supercritical water (SCW) in the subterranean chamber steadily dissolved the more soluble minerals in the rock directly above and below the chamber. [Pages 124–125 explain SCW and its extreme dissolving ability.] Thin spongelike channels, filled with high-pressure SCW, steadily grew up into the increasingly porous chamber roof and down into the chamber floor.

The flood began when pressure increases from tidal pumping in the subterranean chamber ruptured the weakening granite crust. As water escaped violently upward through the globe-encircling rupture, pillars had to support more of the crust's weight, because the subterranean water supported less. Pillars were tapered downward like icicles, so they crushed in stages, beginning at their tips. With each collapse and with each water-hammer cycle, the crust fluttered like a flag held horizontally in a strong wind. Each downward "flutter" rippled through the earth's crust and powerfully slammed what remained of pillars against the subterranean chamber floor. [See **"What Is Flutter?"** and **"Water Hammers"** on page 285.]

For weeks, compression-tension cycles within both the fluttering crust and pounding pillars generated piezoelectric voltages that easily reached granite's breakdown voltage.[73] Therefore, powerful electrical currents discharged repeatedly within the crust, along complex paths of least electrical resistance. [See Figures 174–178.]

Electrons flowing through solids, liquids, or gases are decelerated and deflected by charges in atomic nuclei. These decelerations and accelerations of electrical charges bombard atomic nuclei with *bremsstrahlung* (BREM-stra-lung) radiation which, if energetic enough, generates free neutrons.

> *Neutrons will be produced in any material struck by the electron beam or bremsstrahlung beam above threshold energies that vary from 10–19 MeV for light nuclei and 4–6 MeV for heavy nuclei.*[76]

At electrical breakdown, the energies in the fluttering crust were thousands of times greater than 10–19 MeV,[77] so for weeks after the flood began, a sea of neutrons and surging electrons was generated throughout the crust.

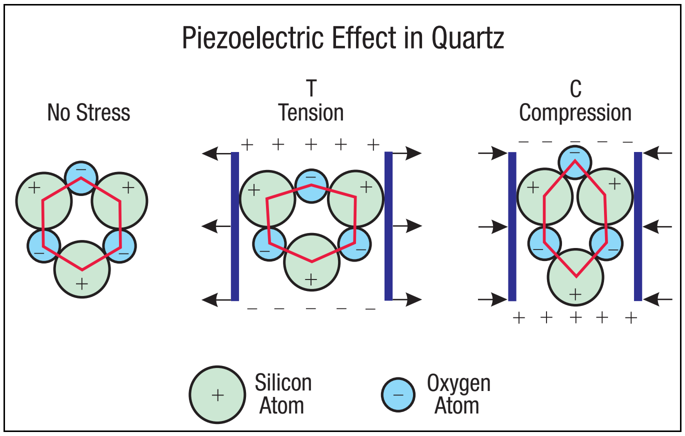


Figure 174: Piezoelectric Effect. (*Piezo* is Greek for pressure. Piezoelectricity is sometimes called *pressure electricity.*) When a nonsymmetric, nonconducting crystal, such as quartz (whose structure is shown above in simplified form) is stretched, a small voltage is generated between opposite faces of the crystal. When the tension (T) changes to compression (C), the voltage changes sign. As the temperature of quartz rises, it deforms more easily, producing a stronger piezoelectric effect. However, *once the temperature reaches about 1,063°F (573°C), the piezoelectric effect disappears.*[74]

Quartz is the only common mineral in the earth's crust that is piezoelectric. Granite contains about 27% quartz by volume. If the myriad of quartz crystals throughout the 10-mile-thick granite crust were partially aligned and cyclically and powerfully stretched and compressed, huge voltages and electric fields would rapidly build up and collapse with each flutter half-cycle. If those fields reached about 9×10^6 volts per meter, electrical resistances within the granite would break down, producing sudden discharges—electrical surges (a plasma) similar to lightning. [See Figures 168 and 177.] Even during some large earthquakes today, this piezoelectric effect in granite generates powerful electrical activity and hundreds of millions of volts.[75] [See **"Earthquakes and Electricity"** on page 335.]

Granite pillars, explained on page 435 and in Figure 54 on page 122, were formed in the subterranean water, in part, by an extrusion process. Therefore, quartz crystals in the pillars would have had a preferred orientation. Also, tidal pumping in the subterranean water compressed and stretched the pillars and crust twice a day for centuries. Such "kneading action" before the flood would align these crystals even more (a process called *poling*), just as adjacent bar magnets become aligned when cyclically magnetized. [See Figure 178.] Each quartz crystal acted like a tiny battery—one among trillions upon trillions. So, as the flood began, the piezoelectric effect within pounding pillars and fluttering granite hydroplates generated immense voltages and electric fields.

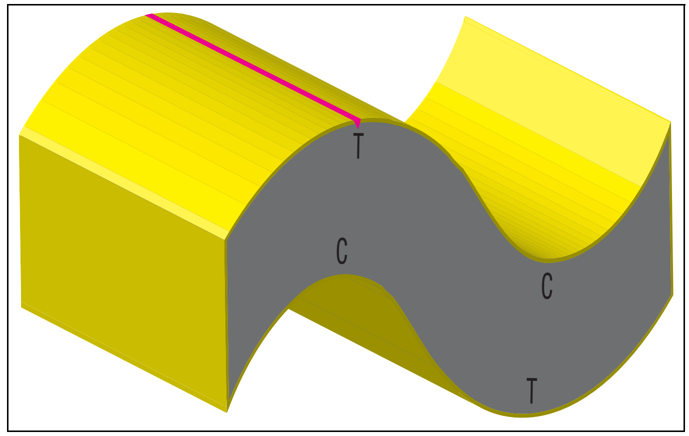


Figure 175: Fluttering Crust. Many of us have seen films showing earth's undulating crust during earthquakes. Imagine how magnified those waves would become if the crust were partially resting on a thick layer of high pressure water instead of solid rock. Then imagine how high those waves in the earth's crust would become if the "ocean" of water below the crust were flowing horizontally with great force and momentum. The crust's large area—basically the surface area of the earth (200,000,000 square miles)—gave the relatively thin crust great flexibility during the first few weeks of the flood. As the subterranean waters escaped, the crust flapped, much like a large flag held horizontally in a high wind.

Flutter began immediately after the "fountains of the great deep" erupted. [See **"What Is Flutter?"** on page 286.] Each time the crust arched downward into the escaping subterranean water, the powerful horizontal flow slammed into the dipping portion of the crust, creating a water hammer that then lifted that part of the crust. Waves rippled through the entire crust at the natural (or resonant) frequencies of the crust, multiplying and reinforcing waves and increasing their amplitudes.

Grab a phone book with both hands and arch it upward. The top cover is in tension and the bottom cover is in compression. Similarly, rock in the fluttering crust, shown above, would alternate between tension (T) and compression (C). As explained in Figure 174, huge cyclic voltages would build up and suddenly discharge within the granite crust, because granite contains so much quartz, a piezoelectric mineral. Once granite's breakdown voltage was reached, electrical current—similar to bolts of lightning—would discharge vertically through the crust. Pillars (not shown) at the base of the crust would become giant electrodes as surges of current cycled through the lower crust, which was honeycombed with tiny pockets of salty (electrically conducting) subterranean water.

Subterranean water absorbed many of these neutrons, converting normal hydrogen (^{1}H) into heavy hydrogen (^{2}H, called *deuterium*) and normal oxygen (^{16}O) into ^{18}O.

During the flood, most of this ^{2}H- and ^{18}O-rich subterranean water was swept to the surface where it mixed with surface waters. However, some subterranean water was temporarily trapped within all the mushy mineral deposits, such as salt (NaCl), that had precipitated out of the SCW and collected on the chamber floor during the years before the flood. Today, those mineral deposits are rich in ^{2}H and ^{18}O.[78]

The Ukrainian experiments described on page 333 show that a high-energy beam of electrons inside a solid produces superheavy elements that quickly fission into different elements that are typical of those in earth's crust. Fusion and fission occur simultaneously, each contributing to the other—and to rapid decay. While we cannot be certain what happens inside nuclei under the extreme and unusual conditions of these experiments, or what happened in the earth's crust during the flood, here are three possibilities:

Self-Focusing Z-Pinch

Figure 176: Z-Pinch Discovered. In 1905, lightning struck and radially collapsed part of a hollow, cylindrical, copper lightning rod (shown in this drawing[79]). Professors J. A. Pollock and S. H. E. Barraclough at the University of Sidney then showed that a strong pinching effect occurs when a powerful electrical current travels along close, parallel paths.

Later, Willard H. Bennett provided a more rigorous analysis.[80] The closer the paths, the stronger the pinch—and when the current flows through a plasma, as it did in this lightning rod, the stronger the pinch, the closer the paths. The flow **self-focuses**.

Patents have since been granted for using the Z-pinch to squeeze atomic nuclei together in fusion reactors.

In a plasma flow, trillions upon trillions of electrical charges are flowing along a long, narrow path—positive charges in one direction and negative charges (electrons) in the opposite direction. Their mutual electrical repulsions and attractions approximately balance each other. However, the magnetic fields created by each moving charge squeeze all charged particles toward the axis of the path, continually narrowing (or ***Z-pinching***) the flow. During the flood, gigantic piezoelectric voltages produced electrical breakdown in granite, so the *long flow channels became **self-focusing*** onto axes having nearly atomic thicknesses.

In that flow, nuclei of the different chemical elements that were stripped of some or all of their electrons were drawn closer and closer together. Normally, they would tend to repel each other (because of the powerful Coulomb forces), but with so many nuclei confined to increasingly smaller volumes, the net Coulomb force acting on nuclei near the axis of that flow tended to balance each other. Nuclei that almost touched each other or collided, were then pulled together by the extremely powerful ***strong force. Fusion occurred***, and even ***superheavy elements formed.*** Because superheavy elements are so unstable, they fissioned (split) and decayed an instant later.

Fusion of nuclei lighter than iron released large amounts of nuclear energy, but the fusion of nuclei heavier than iron absorbed much of the energy of fission and decay. Therefore, staggering amounts of energy were absorbed in producing heavy elements such as uranium. The more heat produced, the more heavy elements formed. By "cooking" isotopes of uranium, for example, in a "hot plasma brew," an equilibrium was achieved in the amounts of the various isotopes of uranium produced.

Lineaments

Rock is strong in compression, but weak in tension. Therefore, one might think that fluttering hydroplates should have quickly failed in tension—along the red line in Figure 175. That is only partially correct. One must also recognize that compressive stresses increase with depth, because of the weight of overlying rock. The stress at each point within a hydroplate, then, was the sum of the compressive stress due to depth plus the cyclic stress due to flutter.

Yes, tension fractures occurred at the top of each hydroplate, and the sounds and shocks must have been terrifying. However, those cracks met greater and greater compressive resistance as they tried to grow downward. Remember, tension cracks cannot grow through compressed material. Cracks at the top of arched hydroplates became lines of bending weakness, so flexing along those lines was great. *These cracks in a geographical region tended to be parallel.*

As early as the 1930s, aerial photographs of the earth's surface showed groups of linear features—slight color discontinuities that were relatively straight, *often parallel to one of a few directions*, and up to dozens of miles in length. These lines must be *recent* fractures of some sort, because they are thin paths along which natural gas and even radon[81] sometimes leak upward. The cracks are difficult to identify on the ground, because they do not correspond to terrain, geological, or man-made features, nor do they show displacements, as do faults. However, earthquakes tend to occur along them.[82] Their origin has been unknown, so they were given the innocuous name *lineaments* (LIN-ee-uh-ments). Improved satellite, photographic, and computer technologies are revealing tens of millions of lineaments throughout the earth's solid surface. [See Figure 181 on page 355.]

What gigantic stresses fractured so much rock? Several possibilities come to mind:

1. Compression. But compressive failure (crushing or impacts) would not produce long, thin cracks.
2. Shearing. But shearing would produce displacements.
3. Horizontal Tension. But horizontal tension would pull a slab of rock apart at the instant of failure.
4. Tension in Bending. Bingo!

Lineaments seem to be tension cracks formed by the fluttering crust during the early weeks of the flood. Since then, other stresses probably produced slippage (faults and earthquakes) along some former lineaments.

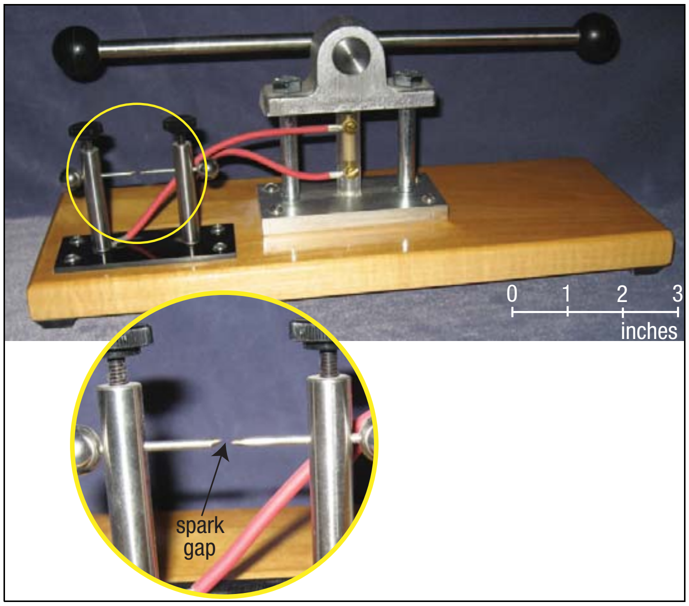


Figure 177: Piezoelectric Demonstration. When I rotate the horizontal bar of the above device, a tiny piezoelectric crystal (quartz) is compressed in the vertical column just below the bar's pivot point. The red cables apply the generated voltage across the two vertical posts mounted on the black, nonconducting platform. Once the increasing voltage reaches about 4,000 volts, a spark (a plasma) jumps the gap shown in the circular inset. When the horizontal bar is rotated in the opposite direction, the stress on the quartz crystal is reversed, so a spark jumps in the opposite direction.

In this device, a tiny quartz crystal and a relatively trivial amount of compression produces 4,000 volts and a small spark. Now consider trillions of times greater compression acting on a myriad of quartz crystals filling 27% of a 10-mile-thick crustal layer. (The greater compression results from the crust's fluttering, because an "ocean" of subterranean water escaping from below that crust creates water hammers.) The resulting gigavoltages would produce frightening electrical discharges, not through air, but through rock—and not across a little gap but throughout the entire crustal layer.

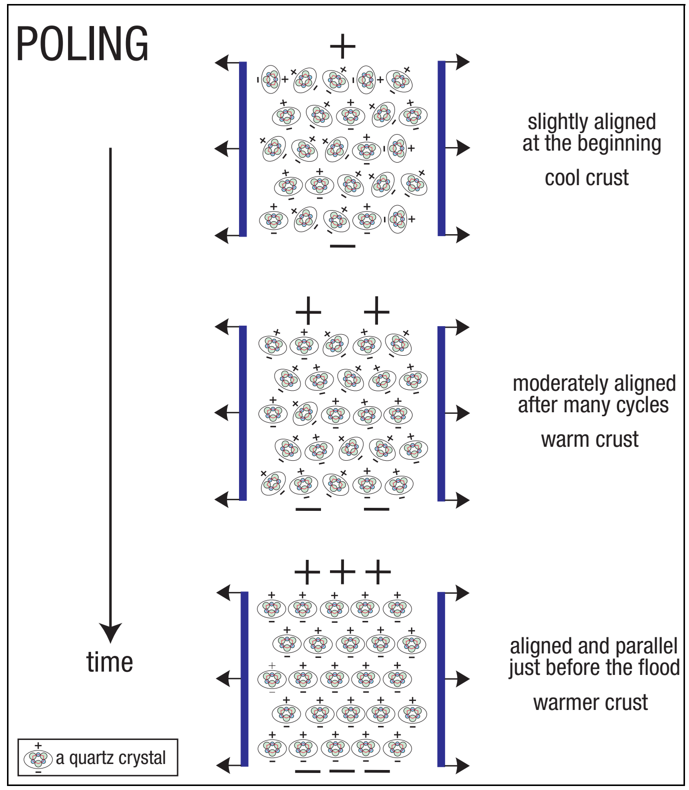


Figure 178: Poling. Poling is an industrial process that steadily aligns piezoelectric crystals so greater voltages can be produced. During the centuries before the flood, tidal stress cycles in the granite crust (tension followed by compression, twice a day) slowly aligned the quartz crystals. (A similar picture, but with arrows and positive and negative signs reversed, could be drawn for the compression half of the cycle.) Over the years, stresses heated the crust to some degree, which accelerated the alignment process. The fact that today so much electrical activity accompanies large earthquakes worldwide shows us that preflood poling was effective.

a. ***Electron Capture.*** Electrons that enter nuclei convert some protons to neutrons. (This occurs frequently, and is called *electron capture*.) Even electrons passing through nuclei reduce the net positive charges of these nuclei. (Although each penetration is brief, each electron passes through many nuclei, and many electrons do this.) This attracts, or repels with less force, nearby nuclei. Superheavy nuclei then form.

b. ***Shock Collapse.***[83] Electrical discharges through the crust vaporize rock along very thin, branching paths "drilled" by gigavolts of electricity through extremely compressed rock. Rock along those paths instantly becomes a high-pressure plasma inside thin rock channels. Just as a bolt of lightning expands the surrounding air and produces a clap of thunder, the shock wave generated by the electrical heating suddenly expands the plasma and the surrounding channel walls. As that rock rebounds inward—like a giant, compressed spring that is suddenly released—the rock collapses with enough shock energy to drive (or fuse) nuclei together at various places along the plasma paths. This happens frequently deep in the crust where the rock is already highly compressed.

Superheavy elements quickly form and then fission and decay into such elements as uranium and lead. The heat released propels the plasma and new isotopes along the channels. As the channels contract, flow velocities increase. The charged particles and new elements are transported to sites where minerals are grown, one atom at a time.

c. ***Z-Pinch.*** In terms of the Z-pinch described on page 328, the trajectory of each electrical charge in a plasma acts like a "wire." All "wires" in a channel are pinched together, but at each instant pinching forces act only at the points occupied by moving charges, and each force is the sum of the electromagnetic forces produced by all nearby moving charges. Therefore, the closer the "wires," the greater the self-focusing, pinching force, so the "wires" become even closer, until the strong force merges (fuses)

One Type of Fusion Reactor

The *shock collapse mechanism* is similar to a technique, called *magnetized target fusion* (MTF), planned for a fusion reactor. In one version of an MTF reactor—a machine that some believe "might save the world"[84]—a plasma of heavy hydrogen will be injected into the center of a 10-foot-diameter metal sphere containing spinning liquid metal. Two hundred pistons, each weighing more than a ton, will surround the sphere. The pistons will simultaneously send converging shock waves into the center of the sphere at 100 meters per second. There, the plasma will be compressed to the point where heavy hydrogen fuses into helium and releases an immense amount of heat. This cycle will be repeated every second.

Unfortunately, an MTF reactor must expend energy operating 200 pistons which, with all their moving parts (each subject to failure), must fire almost simultaneously—within a millionth of a second. However, during the flood, the plasma first expanded the rock channel, compressing the surrounding rock. That surrounding rock then rebounded onto plasma-filled channels, producing **shock collapse**—and fusion.

With shock collapse, the channel walls collapsed onto the plasma from all directions—at trillions of points. With MTF, hundreds of moving parts must act nearly simultaneously for the collapse to occur at one point.

nuclei. If the voltage is high and the plasma is deep in the already compressed earth, the pinching force is extremely powerful, so nuclei frequently collide and briefly merge into superheavy nuclei.

Of these three possible mechanisms, c has the most experimental support. Items a and b should accompany item c.

For centuries before the flood, SCW dissolved the more soluble minerals in the chamber's ceiling and floor. The resulting spongelike openings were then filled with SCW.

During the flood, that pore water provided an enormous surface area for slowing and capturing neutrons and other subatomic particles. Great heat resulted, some becoming earth's geothermal heat. Simultaneously, electrical discharges "drilled" thin plasma channels through the crust, producing other nuclear reactions and additional heat.

For weeks, all this heat expanded and further pressurized the SCW in the spongelike channels, which were connected to the subterranean chamber. Therefore higher than normal pressures in the subterranean chamber continuously accelerated the escaping subterranean water, much like a water gun. [See Figure 179.] Velocities in the expanding fountains of the great deep reached at least 32 miles per second, thereby launching the material that became comets, asteroids, and meteoroids! [See page 285.]

How Much Energy?

A small part of the nuclear energy absorbed by the subterranean water can be calculated. Our oceans have 1.43×10^{24} grams of water. For every 18 grams of water (1 mole)[86] there are 6.022×10^{23} (Avogadro's number)[86] water molecules—each with 2 hydrogen atoms. One out of every 6,400 hydrogen atoms in our oceans is heavy hydrogen (^{2}H or deuterium). Each fast neutron thermalized by water delivers at least 1 MeV of kinetic energy.[86] (1 MeV = 1.602×10^{-6} erg)[86] A hydrogen atom (^{1}H) that absorbs a fast neutron releases 2.225 MeV of binding energy and becomes deuterium. So, the amount of nuclear energy that was added to the subterranean water over several weeks, just in forming deuterium, was:

$$\frac{1.43 \times 10^{24}}{18} \times \frac{6.022 \times 10^{23}}{6{,}400} \times 2 \times (1 + 2.225) \times 1.602 \times 10^{-6}$$
$$= 7.72 \times 10^{37} \text{ ergs}$$

This is the energy that would be released by *1,500 trillion 1-megaton hydrogen bombs*![85] [See Endnote 4 on page 494.] The crust became an earth-size nuclear engine during the several weeks when this energy was being generated. This is a conservative estimate of the nuclear energy added to the subterranean water, because other products of nuclear fission and decay would have added additional energy, and some water was expelled permanently from earth. Energy was also required to form radioisotopes and, in effect, "lift" them high above the floor of the valley of stability.

(The above shows why so much deuterium was in the subterranean chamber. The comet chapter, pages 271–302, explains why the water in comets came from the subterranean chamber. Therefore, comets and asteroids contain a surprising amount of deuterium. See page 279.)

Temperatures in the accelerating SCW rose only slightly for three reasons.

1. Heat added to supercritical fluids evaporates the liquid only on the surface of the myriad of microscopic droplets floating in the supercritical vapor. We see surface evaporation on a large scale when heat is added to a pan of water simmering on the stove at 212°F (100°C). The water's temperature does not rise, but great volumes of vapor are produced.

Figure 179: Water Gun. My granddaughter, Laney, demonstrates, admittedly in a simplified form, how vast amounts of nuclear energy steadily accelerated all the fountains of the great deep during the early days of the flood. As Laney adds energy by steadily pushing on the plunger, the water in the gun's tube accelerates toward its exit into the atmosphere. Pressure does not build up excessively and rupture the tube, because the water escapes as a jet. Laney's powerful action maintains a high pressure on the water in the tube, so a jet of water—a fountain—steadily accelerates and erupts from the tube. Sometimes the jet hits her grandfather.

As the flood began, each incremental release of nuclear energy increased the pressure within the SCW in the spongelike pore spaces in the fluttering crust. This pressure increase was transferred, through those channels in the lower crust, down into the subterranean water chamber. Because the water was flowing toward the opening formed by the rupture, the increasing pressure accelerated the water. Therefore, pressures in the channel did not grow to excessive amounts and obliterate the entire crust.[87] Within weeks, more than 1,500,000,000,000,000 1-megaton hydrogen bombs' worth of energy[85] were converted **primarily to kinetic energy**. That energy expelled some water and rocky debris even into outer space.

Of course, Laney's gun is small, so the walls of the tube and nozzle produce a large amount of friction per unit of water. However, if the water gun became large enough to hold and expel an "ocean of water," the friction per unit of water would become negligible. Also, if Laney could accelerate all that water, not for a second or two, but for a few weeks, and if the pressure she applied to the plunger markedly exceeded the pressure 10 miles below the earth's surface, she, too, could expel water from the earth.

While the atmospheric turbulence must have been great, would the friction of the fountains against the atmosphere overheat the atmosphere? No. Recall how negligible the friction per unit volume of water was. Also note that the rupture—a deep tension fracture—was miles wide[88] within seconds and then grew even wider. (Tension cracks are suddenly pulled apart, just as when a stretched length of rubber snaps, its two pieces end up far apart.) Therefore, the atmosphere slowed only the outer surface of the fountains—a relatively thin boundary layer. Besides, water hammers and the fluttering crust caused the fountains to pulsate at about a cycle per minute, so most of the atmosphere was not dragged upward into outer space. These relatively quick pulsations would not overcome much of the atmosphere's considerable inertia. (To demonstrate this property of inertia, which even gases have, give a quick horizontal jerk on a tablecloth and notice how plates on the tablecloth remain motionless.)

Although Laney's gun is orders of magnitude smaller than the fountains of the great deep, the mechanism, forces, and energy are analogous.[89]

Fluid Accelerations Expand and Cool

When a fluid (liquid, vapor, or liquid/vapor mixture) flowing in a uniform channel accelerates, the fluid expands. (Its specific volume increases.) *Expansion is a powerful cooling process* that provides cooling for refrigerators and air conditioners. The greater the acceleration, the greater the expansion and cooling.

Visualize a tall waterfall, and mark one water molecule as it begins to fall over the edge. Right behind it is a second water molecule. As you watch both molecules accelerate downward, their spacing steadily increases (especially if air resistance and surface tension can be neglected). This is because the first molecule had a head start in its acceleration.

During the initial weeks of the flood, the phenomenal acceleration and expansion was horizontal in the flow under the crust and upward *and lateral* in the fountains of the great deep. (Remember, two astounding energy sources accelerated the fountains to at least 32 miles per second within seconds: (1) tidal pumping that stored energy in supercritical water before the flood, and (2) nuclear energy generated during the first few weeks of the flood.) In this explosive expansion, the initially hot subterranean water was cooled far below -150°F, the temperature of the ice that froze mammoths. [See **"Why Did It Get So Cold So Quickly?"** on page 251.]

Refrigerators and air conditioners work on this principle. A fluid is compressed and heated. Some of that heat is rejected to the atmosphere. The fluid then vents (expands) through a nozzle *as a fountain*, becomes cold, and cools your refrigerator or home. Instead of the fountains of the great deep expanding into a relatively small, closed container (as happens in your refrigerator or air conditioner), the expanding water lost energy by pushing and accelerating the jetting fluid into the cold vacuum of space.

2. SCW's ionization becomes enormous as heat is steadily added. Positive and negative electrical charges (ions) are increasingly produced and separated—an energy storage mechanism that raises temperatures only slightly. As water escaped upward during the flood and temperatures and pressures dropped, those electrical charges recombined and the energy was recovered with almost 100% efficiency.
3. As more heat was added to the escaping SCW, the fountains accelerated even more. With that greater acceleration came greater *expansion and cooling*.

Nuclear energy primarily became electrical energy and then kinetic energy. Had the nuclear energy produced heat only, much of the earth would have melted.[85] *Also remember, quartz piezoelectricity shuts off at about 1,063°F (573°C).*

What Caused Accelerated Radioactive Decay?

Fusion, fission, and accelerated decay occurred during the flood by: (1) the Z-pinching (fusing) of stable nuclei into unstable proton-heavy nuclei and superheavy nuclei, (2) the instant decay of those nuclei, (3) the decay of neutron-heavy fission fragments, (4) the "storm" of electrons and neutrons surging through the crust and colliding with unstable nuclei, and (5) the demonstrated electrical mechanisms of Fritz Bosch[17] and William Barker,[19] explained on page 332.

Chemical Evolution Theory. The current evolutionary theory for the formation of chemical elements and radioisotopes evolved from earlier theories. Each began by assuming a big bang and considering what it might produce. Years later, fatal flaws were found.

Initially (in 1946), George Gamow, a key figure in developing the big bang theory, said that during the first few seconds after the universe's hot expansion began, nuclear reactions produced all the chemical elements.[90] Two years later, Gamow retracted that explanation. Few heavy elements could have been produced, because the expansion rate was too great, and the heavier nuclei became, the more their positive charges would repel each other.[91]

In 1948, the follow-on theory assumed that a big bang produced *only neutrons*.[92] A free neutron decays in minutes, becoming a proton, an electron, and a particle (an antineutrino) that can be disregarded in this discussion. Supposedly, protons and neutrons slowly merged to become heavier and heavier elements. Later, that theory was abandoned when it was realized that any nucleus with a total of five or eight nucleons (protons or neutrons) will decay and lose one or more nucleons in about a second or less.[93] In other words, growing a nucleus by adding one nucleon at a time encounters barriers at 5 and 8 atomic mass units.

The next theory said that a big bang produced *only hydrogen*. Much later, stars evolved. They fused this hydrogen into helium, which usually has four nucleons (two protons and two neutrons). If three helium nuclei quickly merged, producing a nucleus weighing 12 AMU, these barriers at 5 and 8 AMU could be jumped. This theory was abandoned when calculations showed that the entire process, especially the production of enough helium inside stars, would take too long.

A fourth theory assumed that two helium nuclei and several neutrons might merge when helium-rich stars exploded as supernovas. This theory was abandoned when calculations showed that, just to produce the amount of helium needed, stars would have had to generate much more heat than they could reasonably produce in their lifetimes.[94]

The current evolutionary theory for earth's radioactivity, which we will analyze in detail, has the big bang producing only hydrogen, helium, and a trace of lithium. On rare occasions *inside stars*, two helium nuclei (two alpha particles) merge briefly, for about 7×10^{-17} of a second—less than one ten-millionth of a billionth of a second. If (and what a big "if" that is!), during this brief instant, a third alpha particle merges with the first two, carbon will be formed. Then the remaining chemical elements lighter than 60 AMU can be created by simply adding more protons, neutrons, and alpha particles—*but only if stars had somehow formed*. [Pages 27–36 explain why stars, galaxies, and planets would not form from the debris of a big bang.]

Assuming the formation of stars and the highly improbable triple collision of alpha particles at a rapid enough rate, stars "burning" hydrogen for billions of years might theoretically produce the rest of the 26 or so lightest chemical elements. But fusion inside stars must stop when nuclei reach about 60 AMU. How the more than 66 other naturally-occurring chemical elements (those heavier than iron) were produced is not known.[97] Charles Seife explains:

> *We are all made of starstuff. The big bang created hydrogen, helium, and a little bit of lithium and other light atoms. But everything else—the carbon, oxygen, and other elements that make up animals, plants, and Earth itself—was made by stars. The problem is that physicists aren't quite sure how stars did it.*[98]

Temperatures hundreds of times greater than those occurring inside stars are needed.[99] Exploding stars, called *supernovas*, release extreme amounts of energy. Therefore, the latest chemical evolution theory assumes that all the heavier chemical elements are produced by supernovas—and then expelled into the vacuum of space. By this thinking, radioactive atoms have been present throughout the earth since it, the Sun, and the rest of the solar system

Big Bang: The Foundation for Chemical Evolution (from the chemical evolution perspective)

In the 1920s, Edwin Hubble discovered that the universe was expanding. This meant that the farther back we look in time, the smaller—and hotter—the universe was. In fact, for some time after the big bang (about 13.7 billion years ago), matter was so hot that atoms and nuclei could not hold together. All this was confirmed in 1965 when Arno Penzias and Robert Wilson discovered the cosmic microwave background radiation—the afterglow of the big bang. Both received a Nobel Prize for their discovery.

Because hydrogen is easily the most abundant element in the universe today, it is reasonable to assume that all elements and their isotopes evolved from hydrogen (^1H).[95] During the first three minutes after the big bang, temperatures were so hot that deuterium (^2H) could not have formed, because the average energy per nucleon exceeded the binding energy of deuterium. Impacts instantly fragmented any deuterium that formed, so during this "deuterium bottleneck" nothing heavier was made. However, during the next 17 minutes, the universe expanded and cooled enough for deuterium to begin forming; the available deuterium quickly "burned" to produce helium. That ended 20 minutes after the big bang when the universe had expanded enough to stop helium production.

The amount of deuterium we see also points to the big bang as the only possible source, because too much deuterium exists—especially here on earth and in comets—to have been made in stars or by processes operating today.

> *Deuterium (or heavy hydrogen) is a fragile isotope that cannot survive the high temperatures achieved at the centers of stars. Stars do not make deuterium; they only destroy it.*[96]

In other words, the big bang produced the three lightest chemical elements: hydrogen (including deuterium), helium, and lithium. Later, after stars evolved, the next 23 lightest chemical elements evolved deep in stars; even later (during supernovas), all other chemical elements were produced.

evolved from scattered supernova debris. [But again, the theoretical understanding of how stars and the solar system formed is seriously flawed. See pages 27–36.]

Evaluation of Evidence vs. Theories

These two competing explanations for earth's radioactivity will be tested by unambiguous observations, experimental evidence, and simple logic. Each issue, summarized below in italics and given a blue title, is examined from the perspective of the ***hydroplate theory (HP)*** and the ***chemical evolution theory (CE)***. My subjective judgments, coded in green, yellow, and red circles (reminiscent of a traffic light's go, caution, and stop) simply provide a starting point for your own evaluations. Numbers in Table 18 refer to explanations that follow. Any satisfactory explanation for earth's radioactivity should credibly address the italicized issues below. Please alter Table 18 by adding or removing evidence as you see fit.

Both theories will stretch the reader's imagination. Many will ask, "Could this really have happened?" Two suggestions: First, avoid the tendency to look for someone to tell you what to think. Instead, question everything yourself, starting with this book. Second, follow the evidence. Look for several "smoking guns." I think you will find them.

Evidence Requiring an Explanation

Experimental Support. *Good theories must have experimental support.*

● ***1. HP:*** As explained in this chapter, every phenomenon involved in the hydroplate explanation for earth's radioactivity is well understood and/or demonstrable: the piezoelectric effect, poling, electron capture, flutter with high compressive and tensile stresses, Z-pinch, nuclear combustion, neutron stars, neutron production by bremsstrahlung radiation, neutron activation analysis, rapid decay of artificially produced superheavy nuclei, and increased decay rates produced by high voltages and concentrated electrical currents.

We know radioactive nuclei have excess energy, continually vibrate, and are always on the verge of "flying apart" (i.e., decaying). Atomic accelerators bombard nuclei; adding that energy produces radioisotopes and rapid decay.

● ***2. CE:*** The various scales (such as time, temperature, and size) required—for example, in and around stars hundreds of thousands of times more massive than earth—are so large that experimental support for chemical evolution is necessarily limited. Experiments using particle colliders allow investigation of the interactions of subatomic particles traveling at very great speeds. By using computer simulations and extrapolating the results of experiments to larger scales, we can draw conclusions about the kinds of elements that would have been produced at extremely high temperatures inside huge stars billions of years ago.

Table 18. Evidence vs. Theories: Origin of Earth's Radioactivity

	Theories	
	Hydroplate Theory	**Chemical Evolution**
Experimental Support	🟢 1	🟡 2
Quartz Alignment in Continental Crust	🟢 3	🟡 4
Radioactivity Concentrated in Continental Crust	🟢 5	❌ 6
Correlation of Heat Flow vs. Radioactivity	🟢 7	🟡 8
Ocean-Floor Heat	🟢 9	❌ 10
Atmospheric Argon-40 (^{40}Ar)	🟢 11	🟡 12
Oklo Natural "Reactor"	🟡 13	❌ 14
Helium-3 (^{3}He)	🟢 15	❌ 16
Zircon Characteristics	🟢 17	❌ 18
Helium Retention in Zircons	🟢 19	❌ 20
Isolated Polonium Halos	🟢 21	❌ 22
Elliptical Halos	🟢 23	❌ 24
Explosive Expansion	🟢 25	❌ 26
Uranium-235 (^{235}U)	🟢 27	❌ 28
Ratio of ^{235}U to ^{238}U	🟢 29	❌ 30
Carbon-14 (^{14}C)	🟢 31	🟡 32
Meteorites	🟢 33	❌ 34
Close Supernova?	🟢 35	❌ 36
Deuterium (^{2}H)	🟢 37	❌ 38
Oxygen-18 (^{18}O)	🟢 39	🟡 40
Lineaments	🟢 41	❌ 42
Cold Mars	🟢 43	🟡 44
Distant Chemical Elements	🟢 45	🟡 46
Forming Heavy Nuclei	🟢 47	❌ 48
^{6}Li, ^{9}Be, ^{10}B, and ^{11}B	🟢 49	❌ 50
Rising Himalayas	🟢 51	❌ 52
Pertains Primarily to One Theory:		
Earthquakes and Electricity	🟢 53	N/A
Pegmatites	🟢 54	N/A
Batholiths	🟢 55	N/A
Radioactive Moon Rocks	🟢 56	N/A
Inconsistent Dates	N/A	❌ 57
Baffin Island Rocks	N/A	❌ 58
Chemistry in the Sun	N/A	🟡 59
Chemistry in Stars	N/A	🟡 60
Star and Galaxy Formation	N/A	❌ 61
Big Bang: Foundation for Chemical Evolution	N/A	❌ 62

Key:
- 🟢 Theory explains this item.
- 🟡 Theory has moderate problem with this item.
- ❌ Theory has serious problems with this item.
- N/A Not Applicable

The numbers in this table refer to amplifying explanations on pages 346–358.

Quartz Alignment in Continental Crust. *Why are tiny quartz crystals frequently found aligned in crustal rocks?*[100]

- ***3. HP:*** As explained in Figure 178 on page 342, electric fields resulting from the cyclic compression before the flood increasingly aligned quartz crystals in granite—a process called *poling*.

- ***4. CE:*** Other explanations for the alignment of quartz crystals in granite may someday be found.

  [Response: One cannot claim that earth's crust was once molten and that millimeter-size quartz crystals in the granite aligned as the crust solidified. Had the earth cooled slowly from a molten state, the minerals in granite would not be scattered as coarse grains throughout granite as seen today. They would be sorted vertically by density and melting temperature and solidified into thick layers and very large crystals, such as pegmatites. Had very rapid cooling occurred, a rock called *rhyolite* would have formed.]

Radioactivity Concentrated in Continental Crust. *Why is earth's radioactivity concentrated in the continental crust?*

- ***5. HP:*** Earth's radioactivity was produced by powerful electrical discharges within the fluttering granite crust during the flood. Consequently, earth's radioactivity should be concentrated in the continental crust.

  The ocean floors and mantle have little radioactivity, because they did not flutter and they contain little to no quartz, so they could not produce strong electrical discharges. Also, the subterranean water absorbed most of the neutrons generated in the fluttering crust, so little radioactivity was produced below the chamber floor.

- ***6. CE:*** Stars produced radioisotopes. Later, earth formed from the debris of exploded stars—"starstuff." Why earth's radioactivity is concentrated in the continental crust is unclear.

  [Response: If earth formed from the debris of exploded stars, its radioactivity should be evenly distributed throughout the entire earth. It is not.]

Correlation of Heat Flow with Radioactivity. *The amount of heat flowing out of the earth at specific continental locations correlates with the amount of radioactivity in surface rocks at those locations.*

- ***7. HP:*** Electrical discharges within the crust generated both heat and radioactivity. The greater the electrical current at a location, the more radioactivity and heat produced. Therefore, the heat flow up through the earth's surface should correlate with radioactivity at the earth's surface.

- ***8. CE:*** This correlation may be explained as follows:
  - slow radioactive decay generated some of the heat flowing out of the earth,
  - each vertical column immediately below earth's surface has a different but uniform amount of radioactivity,
  - radioactivity varies widely over horizontal distances as short as 50 miles, and
  - enough time has passed to conduct most of that deep heat up to the surface.

  If so, radioactivity goes only 4.68 miles down.[101] If it went much deeper, the amount of heat coming out at the surface, after just a few million years of radioactive decay, would be much more than is coming out today.

  Although it is unlikely that all radioactivity is concentrated in earth's top 4.68 miles, radioactivity may decrease with depth, allowing even more time (consistent with the great age of the earth) for that deeper heat to flow to the surface. Millions of such variations could be imagined, but all visualize radioactivity as being concentrated near the surface.

  [Response: Millions of years would be required for the heat to flow up 4.68 or more miles.[102] If that much time elapsed, some locations would have eroded more than others. Arthur Lachenbruch has shown that millions of years of surface erosion would destroy the correlation unless radioactivity decreased exponentially with depth.[103] If so, too much time would be required for the deeper heat generated to reach the surface. However, Germany's Deep Drilling Program found that variations in radioactivity depended on the rock type, not depth.[104]]

Ocean-Floor Heat. *Continental (granitic) rocks have much more radioactivity than the ocean floors, so why is slightly more heat coming up through the ocean floors than through the granite continents?*

- ***9. HP:*** Electrical discharges—generated by the piezoelectric effect in the fluttering granite crust—produced earth's radioactivity in granite.

  Slightly more heat comes up through the ocean floors because of deep frictional deformation, which began during the flood and continues today. [See **"Magma Production and Movement"** on page 152.]

- ***10. CE:*** Much of the heat coming up from within the earth is produced by radioactive decay. However, Stacey has admitted:

  > *The equality of the continental and oceanic heat flows is puzzling in view of the great disparity in the total amounts of the radioactive elements uranium, thorium, and potassium in the continental* [granitic] *and oceanic* [basaltic] *crusts.*[105]

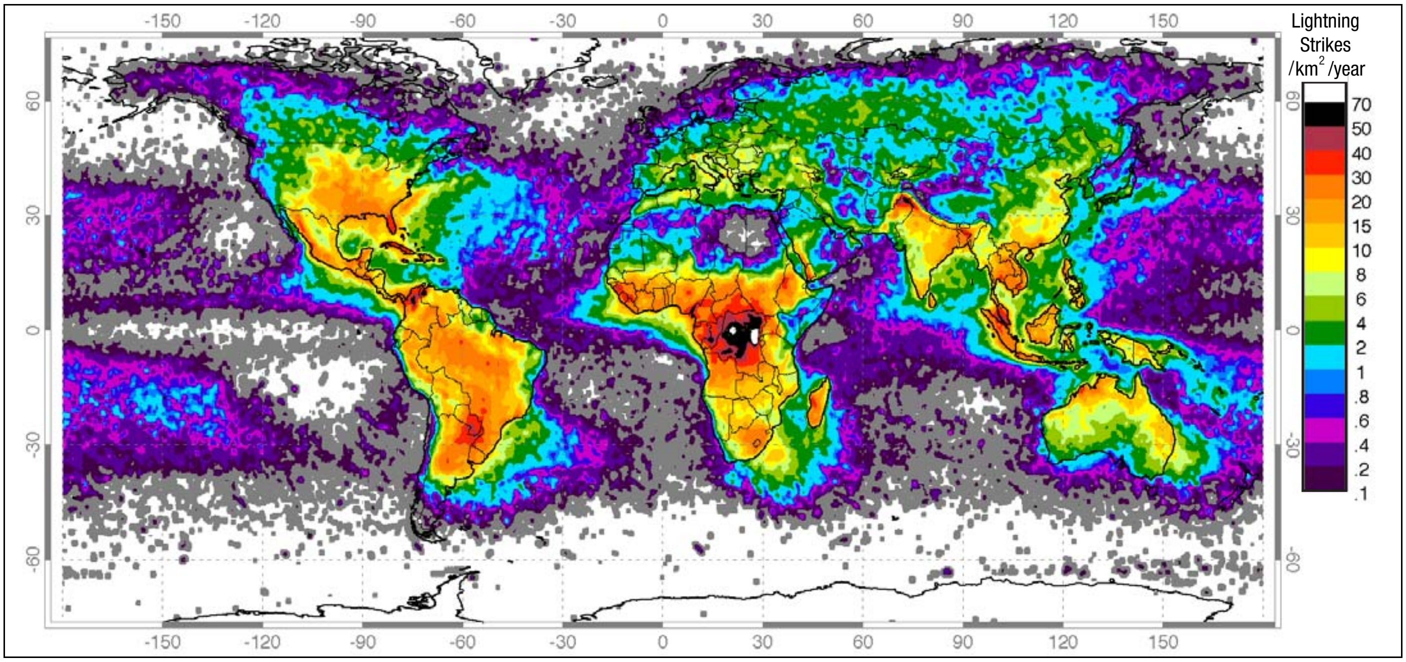


Figure 180: Lightning Frequency. Today, more lightning strikes occur along the equator in central Africa than anywhere else on earth: more than 100 strikes per square kilometer each year. The center of this region is only about 1000 miles east of Oklo. Probably more violent electrical storms occurred farther to the west soon after the flood, as warmer moist air rising off the Atlantic collided with the cold air above the temporarily high continent of Africa.

Stacey's data actually show that the oceanic heat flow is slightly greater than that coming up through the continents.

Atmospheric Argon-40 (^{40}Ar). *Today, ^{40}Ar is produced almost entirely by the decay of potassium-40 (^{40}K). Earth appears never to have had enough ^{40}K to produce all the ^{40}Ar in our atmosphere—even if the earth were twice as old as evolutionists claim.*

- ***11. HP:*** Calcium-40 (^{40}Ca) constitutes 97% of the fifth most abundant element in the earth's crust. Much of it came from the subterranean chamber, the source of earth's vast limestone ($CaCO_3$) deposits. [See **"The Origin of Limestone"** on pages 228–235.] If a ^{40}Ca nucleus captured an electron during an electrical discharge, ^{40}K would be produced. If a second electron were captured, ^{40}Ar would be produced. Alternatively, if any fission produced magnesium-40, aluminum-40, silicon-40, phosphorus-40, sulfur-40, chlorine-40, then argon-40 would be created within minutes by beta decays. Because argon is an inert gas, much of it would have been quickly transported into earth's atmosphere by the escaping subterranean water.

- ***12. CE:*** Crustal rocks contain little potassium-40, but the mantle may contain much more. Furthermore, *if about 66% of the mantle's ^{40}Ar escaped into the atmosphere*, both the atmosphere's ^{40}Ar and the needed ^{40}K in the earth's crust and mantle could be explained.[106]

  [Response: This 66% estimate is ridiculous, because argon, a large atom, is easily trapped between mineral grains and within crystal structures. Indeed, the potassium-argon dating method is based on the fact that solids retain argon over long periods of time.]

Oklo Natural "Reactor." *Can Oklo be explained? Why haven't other uranium deposits become nuclear reactors?*

- ***13. HP:*** Today, the region near Oklo receives more lightning strikes than anywhere else on earth. [See Figure 180.] For centuries after the flood, warm oceans and heavy precipitation (explained on page 136) probably generated thunderstorms that were even more frequent and severe. As lightning strikes passed down through the thin layer of uranium ore, free neutrons were produced by bremsstrahlung radiation,[107] as explained on page 339. Those neutrons then fissioned ^{235}U and initiated brief, *subcritical* chain reactions. Their consequences are now seen in *isolated* zones within 30 kilometers of the Oklo mine.

  Lightning strikes would also explain why the ratio of ^{235}U to ^{238}U at Oklo varied a thousandfold over distances of less than a thousandth of an inch.[48] Lightning branches successively into thousands of thin, fractal-like paths, some quite close together.

- ***14. CE:*** Today, 0.72% of natural uranium is ^{235}U. Because ^{235}U decays faster than the more abundant ^{238}U, a higher percentage of uranium would have been ^{235}U in the past. About 2 billion years ago, 3.7% of all uranium worldwide would have been ^{235}U, enough for uranium deposits to "go critical" if other factors were favorable. One important factor is having water saturate the uranium ore. If the ore "went critical" and heated up, the water would evaporate, so the reactor would shut down and cool off. This cycle may have repeated itself many times. When the earth's crust solidified at least 3.8 billion years ago, even more ^{235}U was concentrated. Why hundreds of other uranium ore deposits did not become natural reactors is a mystery.

[Response: Such cycles would not produce temperature variations and power surges as extreme as Harms found them to have been.[49] Certainly, we would not expect to see thousandfold variations in the ratio of ^{235}U to ^{238}U over distances of less than a thousandth of an inch, especially after 2 billion years.

Disposal of radioactive waste from nuclear reactors is a serious environmental problem. Few believe that any geological formation can contain radioactive waste for 100,000 years—even if held in thick, steel containers encased in concrete. However, at Oklo, most products of ^{235}U decay have not migrated far from the uranium deposit,[108] despite 2 billion years of assumed time.]

Helium-3 (^3He). *Because ^3He is only produced by nuclear reactions, why is so much of it inside the earth, and why does the ratio of ^3He to ^4He vary so widely from location to location?*

● ***15. HP:*** During the flood, fission and neutron production inside the earth produced ^3He. It escapes to the earth's surface along faults in the crust, so the amount of ^3He at different locations varies.

⊗ ***16. CE:*** The earth grew and evolved by meteoritic bombardment. Therefore, ^3He must have been produced in outer space and brought to the earth as it evolved by meteoritic bombardment.

[Response: Never explained is how helium, a light, inert gas, could have been trapped in meteoritic material or in a supposedly molten earth. Even if that happened, why would the ratio of ^3He to ^4He vary so widely from location to location?

One theory, which has gained little support, claims that a natural uranium reactor, 5 miles in diameter, has been operating at the center of the earth for 4.5 billion years. The lighter fission products from that reactor, such as ^3He, supposedly migrated up 4,000 miles, primarily through solid rock. One problem with this idea is that any ^3He produced near a neutron source would, after thousands of years of slow migration, absorb a neutron and become ^4He. The hypothetical reactor would itself provide those neutrons, as would any fissioning material (such as uranium, or thorium) near the ^3He's 4,000-mile upward path. Likewise, ^3He atoms that fell to the earth 4,500,000,000 years ago would have to avoid free neutrons for a long time.]

Zircon Characteristics. *Why do zircons found in western Australia contain strange isotopes and microdiamonds?*

● ***17. HP:*** Inside these zircons, more uranium and thorium decayed than almost anywhere else on earth. If that decay always occurred at today's rates, as evolutionists maintain, then those zircons formed back when the earth was probably too hot to form zircons—a logical contradiction. Therefore, at some time in the past, decay rates must have been much faster.

The high pressures required to form microdiamonds were likely produced by the compression event and/or "Shock Collapse," explained on page 342. Minerals and isotopes in these zircons show that water and granite were also present.[31] The extremely low ratio of ^{13}C to ^{12}C suggests that all these carbon isotopes were not originally present. Therefore, at least some carbon isotopes had to be produced or consumed, and that implies nuclear reactions. These zircons and their contents probably formed in the plasma channels "drilled" by the electrical discharges at the beginning of the flood.

⊗ ***18. CE:*** Organic matter contains low ratios of ^{13}C to ^{12}C. Therefore, the presence of water and the low ratio of ^{13}C to ^{12}C could imply that life was present on earth long before we evolutionists thought.

Even though the earth was extremely hot 4.0–4.4 billion years ago, some regions must have been cool enough to crystallize zircons. This could have been above ocean trenches, where the geothermal heat flow is up to 17% lower than normal.[109] If so, plate tectonics operated two billion years before we thought, although ancient trenches have never been found. [See **"'Fossil' (Ancient) Trenches"** on page 165.]

Helium Retention in Zircons. *Some rocks were dated as 1.5 billion years old, based on today's slow decay rates of uranium and thorium (in zircons), but their age based on the diffusion of helium out of those same zircons was only 4,000–8,000 years.*[33]

● ***19. HP:*** About 5,000 years ago, electrical discharges produced accelerated decay (1) as the flood began and (2) during the compression event at the end of the flood. Helium produced by the decay of uranium and thorium in zircons, which are relatively porous, is still diffusing out; very little helium has entered earth's atmosphere. [See **"Helium"** on page 39.]

⊗ ***20. CE:*** Only a few helium diffusion rates in zircons have been measured. Besides, those few measurements were not made under the high pressures that exist 1–2 miles inside the earth. Helium cannot escape rapidly through cracks in zircons under high pressures, so closed cracks could explain why helium has been retained in 1.5-billion-year-old zircons. If the diffusion rates measured in the laboratory are 100,000 times too high, the discrepancy would be explained.

[Response: Such large errors are unlikely, and hard, tiny zircons have few cracks, even at atmospheric pressure.]

Isolated Polonium Halos. *Polonium-218, -214, and -210,* (^{218}Po, ^{214}Po, and ^{210}Po) *decay with half-lives of 3.1 minutes, 0.000164 second, and 138 days, respectively. Why are their halos found without the parents of polonium?*

21. HP: During the early weeks of the flood, electrical discharges throughout the crust produced very thin plasma channels in which superheavy (extremely unstable) elements formed. Then they quickly fissioned and rapidly decayed into many relatively lighter elements, such as uranium. Simultaneously, accelerated decay occurred.

Near the end of the flood, the compression event crushed and fractured rock, producing additional electrical discharges. Hot SCW (held in the spongelike voids in the lower crust) and ^{222}Rn (an inert gas produced in plasma channels) were forced up through these channels and fractures. As the mineral-rich water rose hours and days later, its pressure and temperature dropped, so minerals such as biotite and fluorite began forming in the channels. Wormlike myrmekite also formed as quartz and feldspars precipitated in the thin, threadlike channels "drilled" by the powerful electrical discharges and by SCW (a penetrating solvent).

In biotite, for example, what concentrated a billion or so polonium atoms at each point that quickly became the center of an isolated polonium halo? Why didn't each halo melt in minutes as hundreds of millions of alpha particles were emitted? In a word, *water.*

Biotite requires water to form. Within biotite, water (H_2O or HOH) breaks into H^+ and OH^-, and the OH^- (called *hydroxide*) occupies trillions upon trillions of repetitive positions within biotite's solid lattice structure. Other water (liquid and gas) transported ^{222}Rn (which decayed with a half-life of 3.8 days) between the thin biotite sheets *as they were forming*.

Radon gas is inert, so its electrical charge is zero. When ^{222}Rn ejects an alpha particle, 5.49 MeV of kinetic energy are released and ^{222}Rn instantly becomes ^{218}Po *with a -2 electrical charge.*

$$^{222}\text{Rn}^{0} \rightarrow {}^{4}\alpha^{2} + {}^{218}\text{Po}^{2-} + 5.49\text{ MeV}$$

Recoil

Just as a rifle recoils when it fires a bullet, a free ^{222}Rn nucleus will also recoil when it expels an alpha particle. The ^{222}Rn nucleus instantly becomes ^{218}Po. Of the 5.49 MeV of kinetic energy released in this decay, 98% is transferred to the alpha particle (the bullet) and 2% to the ^{218}Po (the rifle).

If a ^{222}Rn atom decays while flowing between growing sheets of biotite, the new ^{218}Po atom could become embedded in the biotite. The concentrated heat and pressure from a crashing ^{218}Po is sufficient to remove many hydroxide ions (OH^-) which are a major part of biotite's structure—a process called *dehydroxylation.*[110] Each removal carries away one negative charge, so the ^{218}Po's impact point in biotite, which was initially electrically neutral, takes on a large positive charge and quickly attracts the negatively charged polonium atoms flowing by. (Each polonium atom initially carries a -2 charge, because an alpha particle, which carries a +2 charge, was just expelled by the polonium atom's parent.) When embedded ^{218}Po atoms and their daughters decay, their recoil energy removes additional hydroxide particles, increasing the positive charges even more.

Because both energy and linear momentum are conserved, 2% of that energy was transferred to the recoiling polonium nucleus, sometimes embedding it in an adjacent biotite sheet. That recoil energy was so great and so concentrated that it released thousands of hydroxide particles, each with one negative electrical charge.[110] Flowing water cooled the biotite and swept away the negatively charged hydroxide. The large number of positive charges remaining quickly attracted and held onto the newly formed polonium flowing by, each with a -2 electrical charge. Minutes later, the captured polonium decayed, removed more hydroxide, and repeated the process. Within days, these points with large positive charges became the centers of polonium halos. *Again, we see that the subterranean water is the key to solving this halo mystery.*[111] [See **"Rapid Attraction"** on page 499.]

Similar events happened in other micas and granitic pegmatites. Likewise, the newly formed uranium atoms readily fit in the mineral zircon as it grew, because uranium's size and electrical charge (+4) substitute nicely in the slots normally filled by zirconium atoms (after which zircons are named). Thorium also fits snugly.

Figure 173's caption (on page 337) states that both the ^{235}U decay series and the ^{232}Th decay series produce other polonium isotopes that decay in less than a second: ^{215}Po and ^{211}Po in the ^{235}U decay series and ^{216}Po and ^{212}Po in the ^{232}Th decay series. However, those isotopes produce few, if any, isolated polonium halos. Why are they missing, when isolated halos from ^{218}Po, ^{214}Po, and ^{210}Po in the ^{238}U decay series are abundant?

Again, radon and water provide the answer. Today, radon in the ^{235}U decay series (^{219}Rn) decays with a half-life of 3.96 seconds, and radon in the ^{232}Th decay series (^{220}Rn) decays with a half-life of 55.6 seconds—82,900 and 5,900 times faster, respectively, than the 3.8 day half-life of ^{222}Rn from the ^{238}U series. Therefore, ^{219}Rn and ^{220}Rn can't be scattered "all over the country-side" looking for growing sheets of biotite (or similar minerals) that need to absorb the recoil from just one radon atom to begin forming isolated polonium halos.

Indeed, as explained on page 338, Henderson and Sparks discovered that the isotopes that produced the isolated halos did flow through channels between the thin biotite sheets, because halo centers tended to cluster in a few sheets, but were largely absent from nearby parallel sheets. Therefore, it again appears that certain biotite sheets took on increasing positive charges at specific impact points. Those points then attracted negatively charged polonium still flowing by. The electrical clustering of polonium, perhaps over days or weeks, produced isolated polonium halos. Later, the high-pressure water escaped, and adjacent sheets were compressed together and weakly "glued" (by hydroxide, a derivative of water) into "books" of biotite.

Collins' limited deductions, mentioned on page 338, are largely correct, although they raise the five questions on page 338. The hydroplate theory easily answers those questions (italicized below).

1. *What was the source of all that hot, flowing water, and how could it flow so rapidly up through rock?* Answer: Water filled thin, spongelike channels formed by the great dissolving power of SCW. Other channels were "drilled" by the powerful electrical discharges and produced by fractures during the compression event. As the high-pressure water rose, the pressure inside the channels increasingly exceeded the confining pressure of the channel walls, so those walls expanded. After the flood, the water cooled and escaped, so the channels slowly collapsed.
2. *Because halos are found in different geologic periods, did all this remarkable activity occur repeatedly, but at intervals of millions of years? If so, how?* Answer: The millions of years are a fiction that largely resulted from not understanding the origin of earth's radioactivity and the accelerated decay processes.
3. *What concentrated a billion ^{218}Po atoms at each microscopic speck that became the center of an isolated polonium halo? Why wasn't the ^{218}Po dispersed?* Answer: See **"Recoil"** above.
4. *Today's extremely slow decay of ^{238}U (with a half-life of 4.5 billion years) means that its daughters, granddaughters, etc. also form slowly. Were these microscopic specks the favored resting places for ^{218}Po for billions of years, or did the decay of ^{238}U somehow spike just before all that hot water flowed? Remember, ^{218}Po decays today with a half-life of only 3.1 minutes.* Answer: As the flood began, electrical discharges instantly produced very unstable superheavy isotopes that rapidly fissioned and decayed—similar to the experiments of Dr. Fritz Bosch (in Germany), Dr. Stanislav Adamenko (in Ukraine), and William Barker (in the U.S.A.). The fission and decay products included many new isotopes and heavy chemical elements that did not exist before the flood.
5. *Why are isolated polonium halos associated with parallel and aligned myrmekite that resemble tiny ant tunnels?* Answer: Before the flood, SCW easily dissolved certain minerals in granite (such as quartz and feldspars). During the flood, those hot solutions filled the extremely thin, nearly parallel channels that extended up from the subterranean chamber. After the flood, those solutions rose, evaporated, and cooled, while quartz and feldspars precipitated in some of those channels, becoming myrmekite.

⊗ ***22. CE:*** Polonium halos are strange—but only a tiny mystery. Someday, we may understand them.

Elliptical Halos. *What accounts for an overlapping pair of ^{210}Po halos in coalified wood in the Rocky Mountains—one halo elliptical and the other spherical, but each having the same center?*

● ***23. HP:*** During the flood phase, some spherical ^{210}Po halos formed in water-saturated wood. (Water-saturated wood, when compressed, deforms like a gel.) As the Rocky Mountains buckled up during the com-pression event, that "gel" was suddenly compressed. Within seconds, partially formed spherical halos became elliptical. Then the remaining ^{210}Po (whose half-life today is 138 days, about the length of the flood phase) finished its decay by forming the spherical halos that are superimposed on the elliptical halos.

⊗ ***24. CE:*** Not many elliptical halos have been found. Again, we consider this only a tiny mystery.

Explosive Expansion. *What accounts for the many random fracture patterns surrounding minerals that experienced considerable radiation damage?*

● ***25. HP:*** Radiation damage in a mineral distorts and expands its lattice structure, just as well-organized, tightly-stacked blocks take up more space after someone suddenly shakes them.[70] Ramdohr explained how a slow expansion over many years would produce fractures along only grain boundaries and planes of weakness, but a sudden, explosive expansion would produce the many other fractures he observed.

Accelerated decay during the flood produced that sudden radiation damage— and heating.

- ***26. CE:*** Ramdohr's observations have not been widely studied or discussed by other researchers.

Uranium-235 (^{235}U). *If the earth is 4.6 billion years old and ^{235}U was produced and scattered by some supernova explosion billions of years earlier, ^{235}U's half-life of 700 million years is relatively short. Why is ^{235}U still around, how did it get here, what concentrated it in ore bodies on earth, and why do we not see much more lead associated with the uranium? Has uranium ever been observed spectroscopically in a supernova?*

- ***27. HP:*** During the flood, about 5,000 years ago, electrical discharges (generated by the piezoelectric effect)—followed by fusion, fission, and accelerated decay—produced ^{235}U and all other radioisotopes.

- ***28. CE:*** We cannot guess what happened so long ago and so far away.

  [Response: Evolution theory is filled with such guesses, but usually they are not identified as guesses. Instead, they are couched in impressive scientific terminology and hidden behind a vast veil of unimaginable time. Radioactive decay can be likened to rocks tumbling down a hill, or air leaking from a balloon. Something must first lift the rocks or inflate the balloon. Experimental support is lacking for the claim that all this happened in a distant stellar explosion billions of years ago and somehow uranium was concentrated in relatively tiny ore bodies on earth.]

Ratio of ^{235}U to ^{238}U. *Why is the ratio of ^{235}U to ^{238}U in uranium ore deposits worldwide so constant? One very precise study has shown that the ratio is 0.0072842, with a standard deviation of only 0.000017.*[112]

- ***29. HP:*** Obviously, the more time that elapses between the formation of ^{235}U and ^{238}U and the farther they are transported from where they formed to their final resting places in uranium ore bodies, the more varied the ^{235}U to ^{238}U ratio should be. The belief that these isotopes formed in a supernova explosion billions of years before the earth formed and somehow collected in relatively small ore bodies in a fixed ratio is absurd. Powerful explosions would have tended to separate the lighter ^{235}U from the heavier ^{238}U.

  Instead, fixed ratios of ^{235}U and ^{238}U were formed as equilibrium mixtures in hot plasma "brews," near the ore bodies here on earth. See **"Self-Focusing Z-Pinch"** on page 341.

- ***30. CE:*** Someday, we may discover why the ratio of ^{235}U to ^{238}U is almost constant.

Carbon-14 (^{14}C). *Where comparisons are possible, why does radiocarbon dating conflict with other radiometric dating techniques?*

- ***31. HP:*** Radiocarbon resides primarily in the atmosphere, oceans, and organic matter. Therefore, electrical discharges through the crust at the beginning of the flood did not affect radiocarbon. However, those discharges and the resulting "storm" of electrons and neutrons in the crust produced almost all other radioisotopes, disturbed their tenuous stability, and allowed them to rapidly decay—much like a sudden storm with pounding rain and turbulent wind might cause rocks to tumble down a mountainside.

  This is why very precise radiocarbon dating—atomic mass spectrometry (AMS), which counts individual atoms—gives ages that are typically 10–1000 times younger than all other radiometric dating techniques (uranium-to-lead, potassium-to-argon, etc.).

- ***32. CE:*** That radiocarbon may be contaminated.

  [Response: Before radiocarbon's precision was increased by AMS, this thousandfold conflict was attributed by some to contamination. Studies have now ruled out virtually every proposed contamination source.[26]]

Meteorites. *The radioactive decay products in some meteorites require more time to accumulate—at today's decay rates—than any other rocks ever found in the solar system.*

- ***33. HP:*** Electrical intensity, not time, produced the high concentration of decay products in some meteorites.

  During the flood, pillars within the subterranean chamber experienced the most compression and electrical discharges, which, in turn, produced the greatest number of radioactive decay products. Most meteorites originated from crushed pillars, so meteorites should have more decay products.

- ***34. CE:*** Meteorites have the oldest known radiometric ages in the solar system, so meteorites must have evolved first. This is how we know the earth and solar system began 4.6 billion years ago.

  [Response: How can gas and dust compact themselves into dense black rocks (asteroids and meteoroids) in the weightlessness of space? See **"The Origin of Asteroids and Meteoroids"** on pages 305–326.]

Close Supernova? *Today, half of iron-60 (^{60}Fe) will decay into nickel-60 (^{60}Ni) in 1,500,000 years. In two meteorites, ^{60}Ni was found in minerals that initially contained ^{60}Fe.*[113] *How could ^{60}Fe have been produced and then locked into crystals in those meteorites so quickly,*[114] *before the ^{60}Fe decayed?*

35. HP: Accelerated radioactive decay began at the onset of the flood, not only in the fluttering crust but in the pounding and crushing of pillars. As explained on page 308, iron was a common element in pillar tips. During the electrical discharges, bremsstrahlung radiation produced a sea of neutrons throughout the crust. Those neutrons converted some stable iron (^{54}Fe, ^{56}Fe, ^{57}Fe, and ^{58}Fe) into ^{60}Fe which, because of accelerated decay, quickly became ^{60}Ni. Days later, pillar fragments were launched from earth; some became meteorites.

36. CE: Iron was produced inside stars. A relatively few stars were so massive that they exploded as supernovas and expelled that iron into interstellar space. A few ten-millionths of that iron was ^{60}Fe. Before the ^{60}Fe could decay, some must have merged into dense rocks and crystallized. One of those supernovas had to be "stunningly close" to our solar system for the Sun to capture those rocks so they could later fall to earth as meteorites.[115]

[Response: How does gas from a supernova explosion, expanding at almost 20,000 miles per second, quickly merge[114] into dense rocks drifting in the vacuum of space? Why did a "stunningly close" supernova not distort, burn, or destroy our solar system? Where is the nearby supernova remnant?]

Deuterium (^{2}H). *How did deuterium (heavy hydrogen) form, and why is its concentration in comets twice as great as in earth's oceans and 20–100 times greater than in interstellar space and the solar system as a whole?*

37. HP: Deuterium formed when the subterranean water absorbed a sea of fast neutrons during the early weeks of the flood. (Powerful bremsstrahlung radiation produces free neutrons, as explained beginning on page 339.) Comets later formed from some of the deuterium-rich water that was launched from earth by the fountains of the great deep. Traces of that deuterium have been found on the Moon. [See Endnote 17 on page 294.] Most of the deuterium-rich, subterranean water mixed about 50–50 with earth's surface waters to give us the high deuterium concentrations we have on earth today. Meteorites are also rich in deuterium.[116]

38. CE: The big bang produced deuterium 3–20 minutes after the universe began, 13.7 billion years ago. During those early minutes, most deuterium was consumed in forming helium. Deuterium that ended up in stars billions of years later was destroyed. Some deuterium must have escaped that destruction, because comets and earth have so much deuterium.

Oxygen-18 (^{18}O). *What is the origin of ^{18}O and why is it concentrated in and around large salt deposits?*

39. HP: Before the flood, the supercritical subterranean water steadily "out-salted" thick layers of water-saturated minerals onto the chamber floor. This included salt crystals (NaCl). [See Endnote 42 on page 139.] The water trapped between those salt crystals absorbed many neutrons during the early weeks of the flood. Later, some of those salt deposits (including their trapped waters) were swept up to the earth's surface as thick deposits or rose from the "mother salt layer" as salt domes. Therefore, water in and near thick salt deposits is rich in ^{18}O.

PREDICTION 41: Comets will be found to be rich in ^{18}O.

40. CE: Presumably, ^{18}O was produced before the earth evolved. But why ^{18}O is concentrated around large salt deposits is unknown (if the measurements are correct).

Lineaments. *How did lineaments form?*

41. HP: Because rocks are weak in tension, fluttering hydroplates sometimes cracked along their convex surfaces when they arched up. This is why lineaments are generally straight cracks, dozens of miles long, parallel to a few directions, found all over the earth, and show no slippage along the cracks. (Faults show slippage.) Powerful stresses probably converted some long, deep lineaments into faults that produce earthquakes.

PREDICTION 42: A positive correlation will be found between lineament concentrations and earthquakes.

42. CE: While we can't be sure what produced lineaments, two possibilities have been discussed.

> *We may speculate about their* [lineament] *origins. One widely suggested hypothesis is that they reflect continuing flexure of the crust in response to the tidal cycles. ... Another view is that the fractures may stem from subtle back-and-forth tectonic tilting of the crust as it responds to gentle upwarping and downwarping on a regional basis, although the cycles of back-and-forth tilting would necessarily be vastly longer than the twice-daily cycle of the tides.*[118]

[Response: No one has observed rocks breaking because of tides or back-and-forth tilting.]

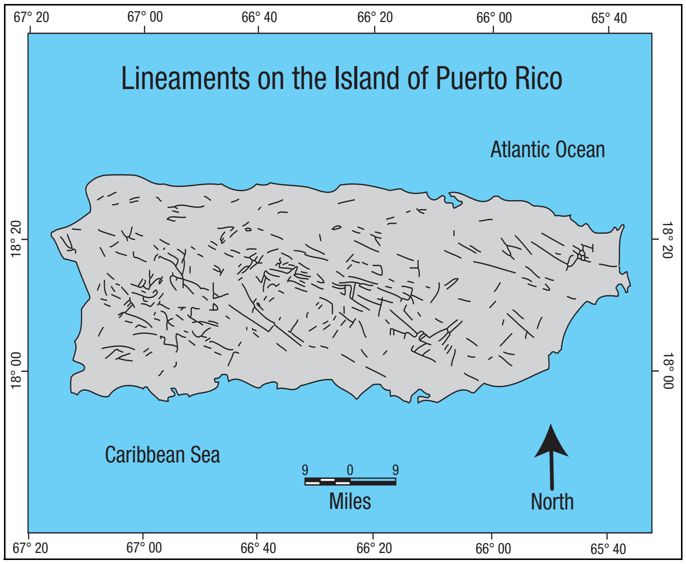


Figure 181: Lineaments. Lineaments are virtually impossible to detect from the ground, because they usually have no vertical or horizontal offsets. On Puerto Rico, the U. S. Geological Survey detected lineament segments (shown as thin black lines) using computer-processed data from side-looking airborne radar, flown 5 miles above the ground. Radar reflections from rock fractures were then digitized and processed by software that "connected the dots." The 636 lineaments identified were up to 15 miles in length. The absence of lineaments near coastlines is attributed to thick deposits of recent sediments that scattered the radar signals. No doubt some stray radar reflections were interpreted as lineaments, and segments of other lineaments were hidden.[117]

Cold Mars. *The Mars Reconnaissance Orbiter has shown that the Martian polar crust is so rigid that seasonally shifting loads of ice at the poles produce little flexure. This implies that Mars' interior is extremely cold and has experienced surprisingly little radioactive decay.*[119]

43. HP: The flood produced large-scale movements and friction within the earth. That frictional heating and the flood's electrical activity (that produced earth's radioactivity) never happened on Mars. Therefore, the interior of Mars should be very cold.

44. CE: The solar system formed from a swirling dust cloud containing heavy radioisotopes billions of years ago. Therefore, with further measurements, Mars' interior will be shown to be hot, similar to Earth's.

Distant Chemical Elements. *Stars and galaxies 12.9 billion light-years away contain chemical elements heavier than hydrogen, helium, lithium—and nickel. If those elements evolved by chemical evolution, it had to have happened within 0.8 billion years after the big bang (13.7 billion years ago) in order for their light to reach us. This is extremely fast, based on the steps required for chemical evolution.* [See **"How Old Do Evolutionists Say the Universe Is?"** on page 392.]

45. HP: Almost all chemical elements were created at the beginning, not just hydrogen, helium, and lithium.

46. CE: If the first stars to evolve were somehow extremely large, they would have exploded as supernovas in only a few tens of millions of years. That debris could then have formed second-generation stars containing these heavier chemical elements—all within 0.8 billion years. This would allow the 12.9 billion years needed for their light to reach us.

Forming Heavy Nuclei. *How do nuclei merge?*

47. HP: Both shock collapse and the Z-pinch produce extreme compression in plasmas that can overcome the repulsive (Coulomb) forces of other nuclei. When two nuclei are close enough, the strong force pulls them together. If the merged nucleus is not at the bottom of the valley of stability, it will decay or fission.

It is a mistake to think that fusion requires high temperatures ($>10^8$ K) for long times over large, stellarlike volumes. As the Ukrainian experiments have shown, with small amounts of energy, significant fusion (and fission) can occur in 10^{-8} second with a self-focused (Z-pinched) electron beam in a high-density plasma.[99]

48. CE: Supernovas provide the high temperatures and velocities needed for lighter nuclei to penetrate Coulomb barriers. Those temperatures must be hundreds of times greater than temperatures inside stars, so most chemical elements (those heavier than 60 AMU) cannot form on earth or inside stable stars.

In 1957, E. Margaret Burbidge, Geoffrey R. Burbidge, William A. Fowler, and Fred Hoyle published a famous paper in which they proposed how supernovas produce all the heavy chemical elements between iron and uranium.[120] Since then, many supernovas have been seen with powerful telescopes and instruments that can identify the elements and isotopes actually produced. So many elements and isotopes are missing that the supernova explanation must be reexamined.[97]

[Response: Supernovas present a more obvious difficulty. Their extreme explosive power should scatter and fragment nuclei, rather than drive nuclei together to form heavy elements.]

^{6}Li, ^{9}Be, ^{10}B, and ^{11}B. *Why do we have these light, fragile isotopes on earth if small impacts will fragment them?*

49. HP: Light, fragile isotopes are too fragile to be created by impacts. Either they were created at the beginning or were produced by extreme compression (shock collapse and the Z-pinch).

Rising Himalayas

During the compression event near the end of the flood, the sudden uplift of the Himalayas (today's tallest and most massive mountain range) forced the overlying flood waters to spill away from the rising peaks and down the flanks of the new mountain range. Massive amounts of sediments were carried with those violent waters and deposited in thousand-foot-thick layers at the base of the Himalayas.

The eroded sediments contained tiny mineral grains called *zircons*. Because zircons contain uranium and its decay products, zircons can be radiometrically dated. Typically 50 or more zircons were dated at each of eleven locations spanning at least 2,000 kilometers (1,250 miles) at the base of the Himalayas. Surprisingly, the ages (based on evolutionary assumptions) ranged from 300,000,000–3,500,000,000 years! Even more surprising, the distribution of ages at all eleven locations were statistically identical, showing that they came from the same source.

Geologists have concluded that "well-mixed sediments were dispersed across at least 2000 km of the northern Indian margin"[122] at the base of the Himalayas. Those geologists are mystified by how those sediments were mixed, transported, and deposited so uniformly over such large distances, and how all of that extraordinary activity could have gone on for 3,200,000,000 years?

If you reread the italicized paragraph above, you will begin to see the answer. Also, the wide range of "ages" have nothing to do with time; instead, they reflect the wide range of powerful compressive stresses—and accompanying piezoelectric surges—that pushed up the Himalayas.

Figure 182: Big Mountain, Little Girl. As my granddaughter, Lily, springs up from the bottom of the pool, the waters rushing off her demonstrate how the flood waters surged radially away from the rapidly rising Himalayas. Carried with those cascading waters were ***sea-bottom creatures*** and eroded sediments that were deposited around the base of the Himalayas.

Geologists are dismayed at learning that sediments (thousands of feet thick) at the base of the Himalayas and spread over horizontal distances of at least 1,250 miles, ***all came from the same source***. But their befuddlement will remain until they realize that today's major mountain ranges were pushed up suddenly from under the flood waters during the compression event. Of course, those geologists must also understand other aspects of the flood, including the origin of earth's radioactivity.

Yes, in gases and plasmas, high temperatures produce high particle velocities which might allow nuclei to penetrate the Coulomb barrier. However, if those velocities are slightly larger than necessary, impacted ^{6}Li, ^{9}Be, ^{10}B, and ^{11}B nuclei will fragment. Therefore, high temperatures, instead of fusing those nuclei together, will destroy them.[24]

50. CE: Some ^{6}Li, ^{9}Be, ^{10}B, and ^{11}B might be explained by interstellar cosmic rays colliding with carbon, nitrogen, and oxygen, producing ^{6}Li, ^{9}Be, ^{10}B, and ^{11}B fragments.

[Response: Studies of the abundances of these elements and isotopes in stars are inconsistent with this means of producing ^{6}Li, ^{9}Be, ^{10}B, and ^{11}B.[121]]

Rising Himalayas. *How were sediments so well mixed in a 1,250-mile-wide band (thousands of feet thick) at the southwestern base of the Himalayas?*

51. HP: Toward the end of the flood, the compression event pushed up the Himalayas in hours. The overlying flood waters rushed off of the rising peaks in all directions, carrying well-mixed, deeply-eroded sediments.

52. "Well-mixed sediments were dispersed across at least 2000 km [1,250 miles] of the northern Indian margin. ... The great distances of sediment transport and high degree of mixing of detrital zircon ages are extraordinary, and they may be attributed to a combination of widespread orogenesis associated with the assembly of Gondwana, the equatorial position of continents, potent chemical weathering, and sediment dispersal across a nonvegetated landscape."[123]

[Response: Obviously, this vague and "extraordinary" mixing could not have gone on for 3,200,000,000 years—a vast age based on evolutionary assumptions.]

The following items pertain primarily to one theory.

Earthquakes and Electricity. *Why does electrical activity frequently accompany large earthquakes?*

53. *HP:* During earthquakes, stresses within the crust can generate, through the piezoelectric effect, powerful electric fields and discharges.

Pegmatites. *How do pegmatites form?*

54. *HP:* Before the flood, SCW dissolved granite's more soluble components, such as quartz and feldspars, giving the lower crust a spongelike texture. During the compression event, high-pressure fluids that had filled those spongelike voids were injected up into fractures in the earth's crust. As the hydrothermal fluids rose, their pressures and temperatures dropped, so quartz and feldspars came out of solution and sometimes grew large crystals called *pegmatites*. This also explains the origin of most mineral-rich, hydrothermal fluids and most of earth's ore bodies.

Batholiths. *How did batholiths form?*

55. *HP:* Batholiths were pushed up during the compression event. They cooled rapidly because the water that filled channels and pore spaces rapidly escaped and evaporated. Batholiths were never completely molten.

As the granite pushed up into and displaced the water-saturated sedimentary layers above, liquefaction again occurred, but on a regional scale. The reliquefied sediments flowed off and stratified again in generally horizontal layers. [See **"Liquefaction: The Origin of Strata and Layered Fossils"** on pages 175–187.] This solves "the room problem" which has perplexed geologists for at least a century. Previously offered solutions for "the room problem" have not received general acceptance.[72]

Radioactive Moon Rocks. *Why were radioactive rocks found on the Moon's surface?*

56. *HP:* From the Moon's surface, astronauts brought back loose rocks containing hard, durable zircons. They contained 3.8-billion-years' worth of radioactive decay products, *based on today's decay rates*. The hydroplate theory postulates the rapid production of radioisotopes only on the earth, not the Moon (or Mars). So why are radioactive rocks on the Moon?

As the flood began, the fountains of the great deep launched rocky debris containing those newly formed, but radiometrically "old," zircons. Much of that debris came from the crushed subterranean pillars in which many radioisotopes quickly formed. The Moon's craters, lava flows, and some loose surface rocks are a result of bombardment by material ejected from earth at high velocities.

PREDICTION 43: Corings into basement rock on the Moon, Mars, or other rocky planets will find little radioactivity and considerably fewer distinct isotopes than are on Earth.

Inconsistent Dates. *Why are so many radiometric dates inconsistent with each other and with fossil correlations?*

57. *CE:* Radiometric dating is unfortunately subject to contamination and millions of years of unknown conditions. However, even if our dates are off by a factor of ten, the earth is not less than 10,000 years old.

[Response: The public has been greatly misled concerning the consistency and trustworthiness of radiometric dating techniques (such as the potassium-argon method, the rubidium-strontium method, and the uranium-thorium-lead method). For example, geologists hardly ever subject their radiometric age measurements to "blind tests."[124] In science, such tests are a standard procedure for overcoming experimenter bias. Many published radiometric dates can be checked by comparisons with the evolution-based ages for fossils that sometimes lie above or below radiometrically dated rock. In more than 400 of these published checks (about half of those sampled), the radiometrically determined ages were at least one geologic age in error—indicating major errors in methodology and understanding.[125] One wonders how many other dating checks were not even published because they, too, were in error.]

Baffin Island Rocks. *Are some Baffin Island rocks as old as the earth?*

58. *CE:* According to various evolutionary dating techniques, the oldest rocks in the world have been recently found on Canada's Baffin Island. And yet, those rocks contain embarrassing contradictions.[126] They have the highest ratios ever found (on earth or in space) of $^3He/^4He$, long considered a measure of age, because most evolutionists believe that the ^3He remains from the material that originally formed earth. However, ^3He in surface rocks should have escaped into the atmosphere long ago or have been subducted into the mantle, where mantle convection would have largely mixed all helium isotopes.

Also, Baffin Island rocks have been dated by uranium-to-lead and other evolutionary dating techniques that give ages as old as the earth itself! If they had been at the earth's surface for long, they would have been severely altered by erosion and weathering, but if they came from the mantle or below, they should have melted and been uniformly mixed.

An explanation, consistent with all the evidence, is that during the flood, nuclear reactions resulting from electrical discharges in the vicinity of Baffin Island were extremely large. Therefore, that region should contain large amounts of radioactive daughter products and ^3He. (^3He is only produced by nuclear reactions.)

Chemistry in the Sun. *Is the Sun a third-generation star?*

- ***59. CE:*** To account for the heavy chemical elements seen in the Sun, evolutionists believe the Sun is a third-generation star; that is, the relative abundances of its heavy chemical elements require that it formed from material spewed out by a supernova that was from an exploded star which formed from earlier stars that exploded. This is ad hoc—a hypothesis, without independent support, created to explain away facts.

Chemistry in Stars. *Why are stars so chemically different?*

- ***60. CE:*** If all the heavier chemical elements came from debris made in stars and by supernovas, stars that formed from that debris should have fairly similar ratios of these heavier elements. For example, a star named HE0107–5240, which has 1/200,000 of the iron concentration as the Sun, should have a similar concentration of the other heavier chemical elements relative to the Sun. Instead, HE0107–5240 has 10,000 times more carbon and 200 times more nitrogen than expected.[127] Such problems can be solved only by making new assumptions for which there is no supporting evidence.

Star and Galaxy Formation. *How did stars and galaxies form? According to the chemical evolution theory, their formation is a prerequisite for producing radioactivity and 98% of the chemical elements.*

- ***61. CE:*** Let's assume the big bang happened and all the heavier chemical elements and radioisotopes were made in stars and supernovas. A huge problem remains: mechanisms to form galaxies, stars (including our Sun), and the earth are unknown or are contradicted by undisputed observations. [See pages 27–36.]

Big Bang: Foundation for Chemical Evolution. *How sound is the big bang—the foundation for the chemical evolution theory?*

- ***62. CE:*** The big bang theory is extremely flawed. [See **"Big Bang?"** and **"Dark Thoughts"** beginning on page 30.] A better explanation for the expansion of the universe is found on pages 383–388, **"Why Does the Universe Appear to Be Expanding?"** Cosmic microwave background radiation, discovered in 1965 and a main argument used to support the big bang, is better explained on pages 389–391.

  Also, the high concentrations of deuterium found on earth—and especially in comets—resulted not from the big bang, but from neutron capture by water during the early weeks of the flood. [See **"How Much Energy?"** on page 343.] In fact, the widely taught beliefs concerning deuterium (as given from the chemical evolution perspective in the sidebar on page 346) may be wrong. A big bang would have probably consumed all the deuterium it ever produced, because deuterium is "burned" faster than it is produced. As advocates of chemical evolution and the big bang have admitted:

  > *The net result of attempts to synthesize deuterium in the Big Bang remains distressingly inconclusive.*[128]

  > *The abundance of deuterium, in particular, is too high to be explained by stellar or cosmic ray processes. Deuterium is consumed more easily than it is produced, and, if cosmic rays were the source of deuterium, they would have also produced much more than the observed amount of ^7Li.*[129]

Final Thoughts

Notice the many disciplines involved in understanding the origin of earth's radioactivity: chemistry, physics, nuclear physics, meteorology, astronomy, cosmology, mineralogy, geology, and engineering (mechanical, nuclear, and electrical). The hydroplate theory draws on evidence from even more fields in solving the 26 major mysteries it addresses. [See page 109.]

Nature is not divided into academic disciplines. If we stay within our comfort zones and consider only topics in our favored disciplines (or, worse yet, only a few topics within a single discipline), we will miss the big picture and not be able to "connect the dots." We would be like the proverbial blind men trying to describe an elephant; disagreements would abound. This may partially explain why the global flood and its profound consequences have been overlooked for so long, and why so few of us fully examine the complete subject scientifically.

No doubt, the almost unimaginable size and power of the flood are other reasons for our failure to understand the flood and its many consequences—such as earth's radioactivity. We all tend to constrain our thinking to familiar events, so it is a challenge to grasp the magnitude of the events that were unleashed when all the fountains of the great deep erupted and to recognize that the entire earth's crust was once a gigantic nuclear reactor. Reprocessing all available evidence and various proposed explanations will take time, but we should attempt to follow the evidence.

Earth's Age. If you ask a hundred adults "How old is the earth?" you will probably hear ninety-nine *scientifically* shallow answers. On the old-earth side, some will say, "Scientists say it is billions of years old," "Radiometric dating shows that it is billions of years old," or "I learned in school (or hear every week in the media) that it is millions of years old." Only opinions of others are given. This is how science was practiced for thousands of years before Newton, Galileo, Kepler and the era of modern science; one simply quoted the opinions of supposedly "learned men," such as Aristotle. If science still worked that way, technological advancements during the last 500 years would have been much slower. All of us might still believe the earth is flat, because at one time the "learned men" said the earth was flat.

On the young earth side, you will sometimes see a listing of the many dating techniques that support a young earth, such as those on pages 39–43, or hear criticisms (accurate and inaccurate) of radiometric dating. Criticisms are not explanations. Some who think that the earth is young base their belief on the Bible, but if their view is stated publicly, it usually draws scoffing and a sense of scientific superiority by those of the old-earth school of thought. Many become intimidated and avoid the subject. In academic communities or in groups where political correctness is valued, such views usually produce embarrassed silence.

A Scientific Revolution. Widespread belief systems seldom change when frequently reinforced by influential institutions, such as the universities, media, religious institutions, and the scientific and intellectual elite. But when vast numbers of people realize that they have been misled, an intellectual revolution takes place. Such a revolution in thinking occurred when Copernicus and Galileo showed that the earth and other planets orbited the Sun. An equally significant transformation is occurring as more and more people realize that a global flood occurred and profoundly altered the earth. Again, entrenched interests and fixed opinions will resist this shift in thinking. Observers of this revolution should note which side avoids a rational, scientific debate.

So how can this subject be discussed scientifically?

1. We must focus on scientific evidence—*that which has been measured with instruments or detected with our senses, is verifiable, and bears on the issue.*
2. Possible explanations cannot be ruled out ahead of time. For example, the flood and all its consequences should not be dismissed unless one is prepared to first address the scientific case. [See Part II of this book, including all twenty-six topics listed on page 109.]
3. "The age of the earth" and "the origin of earth's radioactivity" need to be discussed openly, in front of all who are interested and understand the science. (Feeling strongly about the subject is not sufficient.) This chapter and the hydroplate theory provide starting points for that discussion.

Page 476 is my offer to those who reject a global flood, believe in an old earth, and wish to participate in that open discussion. See if you, the reader, can flush out someone who will present scientific evidence opposing the global flood.

The assistance of Jon Schoenfield in writing this chapter has been invaluable and is greatly appreciated.

References and Notes

1. *"Immediately after lightning crackled through the atmosphere, the detectors would register a burst of gamma rays, followed about 15 minutes later by an extended shower of gamma rays that peaked after 70 minutes and then tapered off with a distinctive 50-minute half-life."* Kim Krieger, "Lightning Strikes and Gammas Follow?" *Science*, Vol. 304, 2 April 2004, p. 43.

◆ *"It will be shown that the observations of near-ground AGR* [atmospheric gamma radiation] *following lightning are consistent with the production and subsequent decay of a combination of atmospheric radioisotopes with 10–100 minute half-lives produced via nuclear reactions on the more abundant elements in the atmosphere."* Mark B. Greenfield et al., "Near-Ground Detection of Atmospheric Rays Associated with Lightning," *Journal of Applied Physics*, Vol. 93, 1 February 2003, p. 1840.

2. In just 70 billionths of a second, 80 times more electrical current passes through the Z-pinch machine than is consumed in all the world during that same brief time interval. However, that energy is only enough to provide electricity to about five or six houses for an hour. What is important for the reader to note is (a) the *shortness* and (b) *intensity* of a (c) *linear discharge of electrical current.*

   Similar experiments have been successfully conducted at Texas A & M University.

3. While the physics of the process is well understood, several decades of engineering challenges must be solved before fusion reactors can become an economic reality.

4. Briefer, but more intense, compressive stresses and electrical discharges also occurred as the hydroplates crashed near the end of the flood. Because this compression event may be harder to visualize, we will focus primarily on the broader and lengthier events at the beginning of the flood.

5. *"No complete theory exists which fully describes the structure and behavior of complex nuclei based solely on a knowledge of the force acting between nucleons* [protons and neutrons]*."* J. S. Lilley, *Nuclear Physics* (New York: John Wiley & Sons, Ltd, 2001), p. 35.

   Various models of the atom are debated. Each explains some things, but each has problems. For example, the

popular planetary model visualizes electrons orbiting a nucleus, much as planets orbit the Sun. However, a consequence of Ampere's Law and Faraday's Law is that a charged particle, such as an electron, moving in an orbit should radiate energy as electromagnetic waves. Electrons should lose energy and quickly fall into the nucleus. Stated another way:

> *The "planetary" model assumed that light, negatively charged electrons orbit a heavy, positively charged nucleus. The problem with this model was that the electrons would be constantly accelerating and should radiate energy as electromagnetic waves, causing the atom to collapse.* Ibid., p. 4.

Because this does not happen, either electrons do not orbit nuclei, or the above laws must be modified.

Contrary to popular belief, atoms and their components (protons, neutrons, electrons, etc.) are not spheres or mathematical points. This is another example of how we sometimes unknowingly distort reality in order to simplify.

6. Six of the 94 naturally occurring chemical elements have no stable isotopes. Four of the six—Technetium (***43***), Promethium (***61***), Astatine (***85***), and Francium (***87***)—are formed by cosmic rays and nuclear tests, but soon disappear. Two—Neptunium (***93***) and Plutonium (***94***)—are produced by the absorption of neutrons released by the fission of other isotopes. (***Atomic numbers***—the number of protons in the element's nucleus—are in blue italics above.) All elements above bismuth (***83***) are unstable and undergo radioactive decay. As of 2010, 118 elements have been observed, some very briefly in experiments.

7. A few will raise some respectable objections. They say that stars, including our sun, derive their energy by electrical and magnetic phenomena, not by fusing hydrogen into helium. [See Donald E. Scott, *The Electric Sky* (Portland, Oregon: Mikamar Publishing, 2006).] We will bypass this fascinating possibility, because the electrical explanation does not address the origin of earth's radioactivity.

8. What must happen for fusion or fission to produce nuclei that have *less* binding energy? Energy must be put into the process, as is being demonstrated at the Proton-21 Electrodynamics Research Laboratory in the Ukraine. [See page 333.] Fluttering hydroplates at the beginning of the flood and the piezoelectric effect were a similar trigger. This origin of earth's radioactivity also accounts for other effects, including accelerated radioactive decay and the false belief that the earth is billions of years old.

9. In decay, a nucleus is changed *spontaneously*, usually because a tiny subatomic particle leaves (as in alpha, beta, or gamma decay) or enters (as in electron capture). In fission, a very large nucleus splits into two large nuclei of similar size. Fissions occur in two ways. Either the large nucleus splits after being bombarded by another particle, such as a neutron, or the nucleus splits spontaneously, without bombardment. (Spontaneous fissions are considered decays. Decays are not nuclear reactions. Nuclear reactions occur when nuclei are bombarded by subatomic particles that change the nuclei.)

   Some isotopes, such as ^{238}U, can change in multiple ways: by alpha decay or by fissioning (spontaneously or by bombardment). When ^{238}U fissions spontaneously, it releases four times more energy than when it decays all the way to lead by emitting eight alpha particles and six beta particles. For ^{238}U, alpha decays are 1.8 million times more frequent than spontaneous fissions.

10. The instability index is a purely arbitrary number that I used to map half-lives of $0-\infty$ years into an easily visualized 100–0 scale. The arbitrary formula was:

$$\left[\begin{array}{c}\text{instability}\\ \text{index}\end{array}\right] = \frac{100}{\pi/2}\tan^{-1}\left[\frac{C}{\text{half-life (yrs)}}\right]$$

   where $C = 10^{-7}$ years. For example, a radioisotope with a half-life of 10^{-7} years (or 3 seconds) would have an instability index of 50. That isotope would be represented by a tall, thin bar that rose halfway up the side of the valley of stability. The data used in constructing this figure were taken from *Nuclides and Isotopes: Chart of the Nuclides*, 16th edition (Schenectady, NY: Knolls Atomic Power Laboratory, 2002) by Edward M. Baum et al.

11. Why does the valley of stability curve? It is a direct result of "the strong force," described briefly on page 332. For details, consult a good textbook on nuclear physics.

12. *"... ^{223}Ra nuclei occasionally, but significantly, decay with the loss not of an α-particle but of a carbon-14 (^{14}C) fragment."* John Maddox, "Exotic Nuclear Decay Discovered," *Nature*, Vol. 307, 19 January 1984, p. 207.

   - H. J. Rose and G. A. Jones, "A New Kind of Natural Radioactivity," *Nature*, Vol. 307, 19 January 1984, p. 245–247.
   - *"In addition to α particle decay, certain heavy mass nuclei have been observed to decay by emitting ^{12}C, ^{14}C, ^{20}O, ^{24}Ne, ^{28}Mg, or ^{32}Si at extremely low rates. This form of decay has been designated 'Cluster Radioactivity,' and was first observed in the emission of ^{14}C from ^{223}Ra. Since 1984, Cluster Radioactivity has been observed in 22 nuclides."* Baum et al., p. 31.
   - The isotopes that are now known to decay by emitting a carbon-14 nucleus (plus other particles) include: francium-221, radium-221, radium-222, radium-223, actinium-223, radium-224, actinium-225, and radium-226.

13. For example, hydrogen-6 has a half-life of 3×10^{-22} seconds, and tellurium-128 has the longest known half-life: 2.2×10^{24} years. Other isotopes may have more extreme decay rates, but their half-lives are more difficult to measure.

14. H. P. Hahn et al., "Survey on the Rate Perturbation of Nuclear Decay," *Radiochimica Acta*, Vol. 23, 1976, pp. 23–37.

   A few decay rates increase by 0.2% at a *static* pressure of about 2,000 atmospheres, the pressure existing 4.3 miles below the earth's surface. [See G. T. Emery, "Perturbation of Nuclear Decay Rates," *Annual Review of Nuclear Science*, Vol. 22, 1972, pp. 165–202.]

In another static experiment, decay rates increased by 1.0% at pressures corresponding to depths inside the earth of 930 miles. [See Lin-gun Liu and Chih-An Huh, "Effect of Pressure on the Decay Rate of ^{7}Be," *Earth and Planetary Science Letters*, Vol. 180, 2000, pp. 163–167.] Obviously, *static* pressures do not significantly accelerate radioactive decay.

15. K. Makariunas et al., "Effect of Chemical Structure on the Radioactive Decay Rate of ^{71}Ge," *Hyperfine Interactions*, Vol. 7, March 1979, pp. 201–205.

- T. Ohtsuki et al., "Enhanced Electron-Capture Decay Rate of ^{7}Be Encapsulated in C_{60} Cages," *Physical Review Letters*, Vol. 93, 10 September 2004, pp. 112501-1 – 112501-4.

16. Richard A. Kerr, "Tweaking the Clock of Radioactive Decay," *Science*, Vol. 286, 29 October 1999, p. 882.

17. *"The rhenium-187 aeon* [billion-year] *clock is an example which brings to light—in a rather spectacular manner—the influence of the atomic charge state* [electrical charge] *on nuclear and astrophysical properties. It has long been recognized that the number and configuration of electrons bound in the atom can significantly alter beta decay lifetimes. However, none of these effects could be investigated until very recently, while only* [electrically] *neutral atoms were available in the laboratories."* Fritz Bosch, "Setting a Cosmic Clock with Highly Charged Ions," *Physica Scripta*, Vol. T80, 1999, p. 34.

- *"... a half-life of 32.9 ± 2.0 yr for bare ^{187}Re nuclei could be determined, to be compared with 42 Gyr for neutral ^{187}Re atoms."* Fritz Bosch et al., "Observation of Bound-State β^{-} Decay of Fully Ionized ^{187}Re," *Physical Review Letters*, Vol. 77, 23 December 1996, p. 5190.

18. *"Unexplained periodic fluctuations in the decay rates of ^{32}Si and ^{226}Ra have been reported by groups at Brookhaven National Laboratory (^{32}Si) and at the Physikalisch-Technische-Bundesandstalt in Germany (^{226}Ra). We show from an analysis of the raw data in these experiments that the observed fluctuations are strongly correlated in time, not only with each other, but also with the distance between the Earth and the Sun."* Jere H. Jenkins et al., "Evidence for Correlations Between Nuclear Decay Rates and Earth-Sun Distance," arXiv:0808.3283v1 [astro-ph], 25 August 2008, pp. 1–4.

- Davide Castelvecchi, "Half-life (More or Less)," *Science News*, Vol. 174, 22 November 2008, pp. 20-22.

19. See United States Patent 5076971, "Method for Enhancing Alpha Decay in Radioactive Materials," awarded on 28 August 1989 to William A. Barker. Assignee: Altran Corporation (Sunnyvale, California).

20. Stanislav Adamenko et al., *Controlled Nucleosynthesis: Breakthroughs in Experiment and Theory* (Dordrecht, The Netherlands, Springer Verlag, 2007), pp. 1–773.

Those who wish to critically study the claims of Adamenko and his laboratory should carefully examine the evidence detailed in his book. One review of the book can be found at www.newenergytimes.com/v2/books/Reviews/AdamenkoByDolan.pdf

21. *"The products released from the central area of the target* [that was] *destroyed by an extremely powerful explosion from inside in every case of the successful operation of the coherent beam driver created in the Electrodynamics Laboratory 'Proton-21,' with the total energy reserve of 100 to 300 J,* ***contain significant quantities (the integral quantity being up to 10^{-4} g and more) of all known chemical elements, including the rarest ones.****"* [emphasis in original] Adamenko et al., p. 49.

In other words, an extremely powerful, but tiny, explosion occurred inside various targets, each consisting of a single chemical element. All experiments combined have produced at least ***10^{-4} gram of every common chemical element.***

- In these revolutionary experiments, the isotope ratios for a particular chemical element resembled those found today for natural isotopes. However, those ratios were different enough to show that they were not natural isotopes that somehow contaminated the electrode or experiment.

22. Stanislav Adamenko, "The New Fusion," *ExtraOrdinary Technology*, Vol. 4, October-December, 2006, p. 6.

23. Stanislav Adamenko, "Results of Experiments on Collective Nuclear Reactions in Superdense Substance," *Proton-21 Electrodynamics Laboratory,* 2004, pp. 1–26. For details see www.proton21.com.ua/articles/Booklet_en.pdf.

- "Frequently Asked Questions," *Proton-21 Electrodynamics Laboratory*. See: www.proton21.com.ua/faq_en.html.

- Stanislav Adamenko, Personal communication, 13 April 2010.

24. *"... the nuclei of elements Li, Be, and B are easily destroyed in thermonuclear reactions due to the insufficiently high binding energy."* Adamenko et al., p. 458.

- *"Specifically, the rare and fragile light nuclei Lithium, Beryllium and Boron are not generated in the normal course of stellar nucleosynthesis (except ^{7}Li) and are, in fact, destroyed in stellar interiors."* E. Vangioni-Flam and M. Cassé, "Cosmic Lithium-Beryllium-Boron Story," *Astrophysics and Space Science*, Vol. 265, 1999, p. 77.

- *"Thus the net result is always to convert these elements* [deuterium, Li, Be, and B] *into helium through proton bombardment, and the rates of the reactions are such that in all conditions before a star evolves off the main sequence all of the deuterium, lithium, beryllium, and boron in the volume which contains the vast majority of the mass will be destroyed."* E. Margaret Burbidge et al., "Synthesis of the Elements in Stars," *Reviews of Modern Physics*, Vol. 29, October 1957, p. 618.

25. One might wonder how a star composed of only neutrons could exist if neutrons must be surrounded by protons and electrons in order to be stable. Yes, neutrons at the surface of a neutron star will tend to decay into a proton, electron, and an antineutrino, but the extreme gravity of a neutron star would probably prevent electrons from permanently escaping from neutrons. [See Lloyd Earnest Busch, "The

Paradox of Neutron Decay in Neutron Stars," *Journal of Theoretics*, Vol. 5, No. 2, 2003, pp. 10–11.]

26. Paul Giem, "Carbon-14 Content of Fossil Carbon," *Origins*, Vol. 51, 2001, pp. 6–30.

- John R. Baumgardner et al., "Measurable ^{14}C in Fossilized Organic Materials," *Proceedings of the Fifth International Conference on Creationism* (Pittsburgh, Pennsylvania: Creation Science Fellowship, Inc., 2003), pp. 127–142.

27. Melvin A. Cook, *Prehistory and Earth Models* (London: Max Parrish, 1966), pp. 66–67.

28. *"The K-Ar method, which is based on the decay of ^{40}K to ^{40}Ar, is probably the most commonly used radiometric dating technique available to geologists."* G. Brent Dalrymple, *The Age of the Earth* (Stanford, California: Stanford University Press, 1991), p. 90.

29. Cook, pp. 66–67.

- *"... almost all of the ^{40}Ar and ^{4}He were produced in the earth."* Frank D. Stacey, *Physics of the Earth,* 3rd edition (Brisbane, Australia: Brookfield Press, 1992), p. 63.

30. *"The textbook view that the earth spent its first half a billion years drenched in magma could be wrong."* John W. Valley, "A Cool Early Earth?" *Scientific American*, Vol. 294, October 2005, p. 59.

- *"The first 700 million years of Earth's 4.5-billion-year existence are known as the Hadean period, after Hades, or, to shed the ancient Greek name, Hell. That name seemed to fit with the common perception that the young Earth was a hot, dry, desolate landscape interspersed with seas of magma and inhospitable for life."* Kenneth Chang, *The New York Times*, 2 December 2008, p. D1.

- *"The Hadean is the geologic eon before the Archean. It started at Earth's formation about 4.6 billion years ago (4,600 Ma), and ended roughly 3.8 billion years ago, though the latter date varies according to different sources. The name 'Hadean' derives from Hades, Greek for 'Underworld', referring to the conditions on Earth at ... the period before the earliest-known rocks. ... Recent (September 2008) studies of zircons found in Australian Hadean rock hold minerals that point to the existence of plate tectonics as early as 4 billion years ago. If this holds true, the previous beliefs about the Hadean period are far from correct. That is, rather than a hot, molten surface and atmosphere full of carbon dioxide, the earth's surface would be very much like it is today."* http://en.wikipedia.org/wiki/Hadean.

31. Michelle Hopkins et al., "Low Heat Flow Inferred from >4 Gyr Zircons Suggest Hadean Plate Boundary Interactions," *Nature*, Vol. 456, 27 November 2008, pp. 493–496.

32. *"The origin of the carbon and the nature of the carbon reservoir, as well as the process by which microdiamonds can be incorporated in zircon together with 'granitic' inclusions, present problems fundamental to understanding processes active in the early history of the Earth. ... The observed large variations in* [carbon isotope ratios] *inclusions hosted in the same zircon grain suggest that the carbon inclusions formed from different material and/or under different geological conditions before they were eventually included in the zircon. ... Therefore, the simplest explanation, and the one which is supported by most observations, is that the diamond formation must pre-date zircon crystallization and, most probably, is not related to zircon formation."* Alexander A. Nemchin et al., "A Light Carbon Reservoir Recorded in Zircon-Hosted Diamond from the Jack Hills," *Nature*, Vol. 454, 3 July 2008, pp. 92–93.

33. *"In fact, considering the Precambrian age of the granite cores* [containing zircons], *our results show an almost phenomenal amount of He has been retained at higher temperatures, and the reason for this certainly needs further investigation ..."* Robert V. Gentry et al., "Differential Helium Retention in Zircons," *Geophysical Research Letters*, Vol. 9, October 1982, p. 1130.

- D. Russell Humphreys, "Young Helium Diffusion Age of Zircons Supports Accelerated Nuclear Decay," *Radioisotopes and the Age of the Earth*, editors Larry Vardiman et al., (El Cajon, California: Institute for Creation Research, 2005), pp. 25–100.

34. Nuclear reactions first produce ^{3}H (tritium), often as a rare fission product, or in one of the following ways:

$$^{6}Li + n \rightarrow \alpha + {}^{3}H$$

$$^{14}N + n \rightarrow {}^{12}C + {}^{3}H$$

$$^{14}N + n \rightarrow 3\alpha + {}^{3}H$$

Then a beta decay (with a half-life, today, of 12.32 years) converts ^{3}H into ^{3}He. [See L. T. Aldrich and Alfred O. Nier, "The Occurrence of He^{3} in Natural Sources of Helium," *Physical Review*, Vol. 74, 1 December 1948, pp. 1590–1594.]

35. *"They found* [in Siberian flood basalts] *that the ratio of helium 3 to helium 4 was not just 8 times greater than the atmospheric ratio, as it is at midocean ridges, but 13 times greater."* Marc Zabludoff, "Breakthroughs, Geology," *Discover*, Vol. 16, December 1995, p. 122.

- The ratio of ^{3}He to ^{4}He varies widely in rocks near oceanic trenches, among deposits of natural gas, and within the Hawaiian Islands.

36. R. J. Strutt (son of the famous Lord Rayleigh who made many scientific discoveries, including the discovery of argon) first explained this in 1906, ten years after Henri Becquerel discovered radioactivity. Strutt measured radioactivity in various rocks and found that granite contained *more than enough radioactivity* to explain all geothermal heat. Of course, Strutt assumed the earth is very old.

- *"The distribution of radioactive material with depth is unknown, but amounts of the order of those observed at the surface must be confined to a relatively thin layer below the Earth's surface of the order of a few tens of kilometers in thickness, otherwise more heat would be generated than can be accounted for by the observed loss from the surface."* H. S. Carslaw and J. C. Jaeger, *Conduction of Heat in Solids*, 2nd edition (Oxford: At the Clarendon Press, 1959), p. 87.

37. William R. Corliss has cataloged many books and reports of electrical activity associated with earthquakes. My brief extracts, slightly edited, are taken from his *Strange Phenomena* (Glen Arm, Maryland: The Sourcebook Project, 1974), Vol. G1, pp. 183–204 and Vol. G2, pp. 135–151.

38. Myron L. Fuller, *The New Madrid Earthquake* (Washington, D.C.: USGS Bulletin 494, 1912), p. 46.

39. *"... the molten rock oozing from midocean ridges lacks much of the uranium, thorium, and other trace elements that spew from some aboveground volcanoes."* Sid Perkins, "New Mantle Model Gets the Water Out," *Science News*, Vol. 164, 13 September 2003, p. 174.

40. *"... 90% of uranium and thorium are concentrated in the continents. In general, the heat production rate must decrease with depth. Otherwise, surface values would imply zero or negative mantle heat flow."* Dan F. C. Pribnow, "Radiogenic Heat Production in the Upper Third of Continental Crust from KTB," *Geophysical Research Letters*, Vol. 24, 1 February 1997, p. 349.

41. *"The measured temperature gradient of 27.5 K km^{-1} in the upper 9.1 km* [5.7 miles] *cannot continue to the Moho, otherwise a boundary condition derived from seismic interpretations is violated."* Ibid., pp. 351–352.

    In other words, the rocks directly below the Moho would have melted—an easily detected condition. Decades ago, students were taught that the mantle was a liquid. Even today, some textbooks make this erroneous claim. If the mantle had only a thin, *continuous* shell of liquid at any depth, certain seismic waves (shear waves) could not pass through that shell. However, seismometers all over the world measure those waves daily.

42. Robert F. Roy et al., "Heat Generation of Plutonic Rocks and Continental Heat Flow Provinces," *Earth and Planetary Science Letters*, Vol. 5, 1968, pp. 1–12.

43. For example, did you know that a person's foot size correlates with writing ability? Does this mean that the bigger your feet, the better you write? No. It means that babies don't write well.

    Although correlations may suggest a cause and effect relationship, they do not demonstrate cause and effect. For that, mechanisms and experimental results are needed.

44. So far, 16 zones have been discovered, but some are now known to be connected.

45. If 100 neutrons were somehow produced in the first generation, and x neutrons were produced in the second generation, the reactor's efficiency would be x percent. If

$$k = \frac{x}{100}$$

    the total number of neutrons produced would be

$$100\,(1 + k^1 + k^2 + k^3 + \cdots) = \frac{100}{1 - k} \qquad \text{where } k < 1$$

    If $k = 0.6$, a total of 250 neutrons would be produced. With an efficiency of 99%, 10,000 neutrons would be produced. If a trillion neutrons were produced in the first generation, and the efficiency were 99%, 100 trillion neutrons would be produced.

46. *"Reactors 7 to 9* [discovered in 1978] *... appear as small uranium-rich pockets where the core of the reactor is always very thin (a few centimeters) ... ."* F. Gauthier-Lafaye et al., "Natural Fission Reactors in the Franceville Basin, Gabon: A Review of the Conditions and Results of a 'Critical Event' in a Geologic System," *Geochimica et Cosmochimica Acta*, Vol. 60, No. 23, 1996, p. 4838.

47. *"The anomalous behavior at the reactor zone borders should be further investigated to determine if it is a general phenomenon capable of a common explanation such as the 'reflux' hypothesis presented in this paper."* G. A. Cowan et al., "Some United States Studies of the Oklo Phenomenon," *The Oklo Phenomenon* (Vienna: Vienne International Atomic Energy Agency, 1975), p. 355.

    In a later paper, Cowan acknowledged that the "reflux hypothesis" did not explain the problem and that "puzzling anomalies" remained at the borders. [See George A. Cowan, "A Natural Fission Reactor," *Scientific American*, Vol. 235, July 1976, p. 44.]

48. S. Hishita and A. Masuda, "Thousandfold Variation in ^{235}U/^{238}U Ratios Observed in a Uranium Sample from Oklo," *Naturwissenschaften*, Vol. 74, May 1987, pp. 241–242.

49. A. A. Harms, "Reaction Dynamics and ^{235}U/^{238}U Ratios for the Oklo Phenomenon," *Naturwissenschaften*, Vol. 75, January 1988, pp. 47–49.

50. G. H. Henderson and F. W. Sparks, "A Quantitative Study of Pleochroic Halos, IV," *Proceedings of the Royal Society of London*, Series A, Vol. 173, 1939, pp. 238–249.

    ◆ G. H. Henderson, "A Quantitative Study of Pleochroic Halos, V," *Proceedings of the Royal Society of London*, Series A, Vol. 173, 1939, pp. 250–263.

51. Radiohalos have been found in more than 40 minerals. [See Robert V. Gentry, "Radioactive Halos," *Annual Review of Nuclear Science*, Vol. 23, 1973, p. 350.]

52. Actually, almost all (9,998 out of 10,000) ^{218}Po isotopes decay by emitting an alpha particle. A few emit a beta particle.

53. Robert V. Gentry, *Creation's Tiny Mystery*, 2nd edition (Knoxville, Tennessee: Earth Sciences Associates, 1988).

    Robert Gentry, in several dozen papers in leading scientific journals, has reported important discoveries concerning these mysteries. He is probably the one person most responsible for showing that the earth's crust was never molten and, therefore, did not evolve. The importance of Gentry's work is shown by the intensity of the opposition he has received; yet, many of his opponents admit in published writings that they cannot explain isolated polonium halos. To minimize that admission, opponents often refer to this major problem as "a tiny mystery." No, only the halos are tiny; the mystery to evolutionists is great. Moreover, the dilemma this presents to those who believe in a 4.6-billion-year-old earth is even greater.

54. *"*[Polonium halos] *will result from the initial presence of about 10^9 atoms of either Po-218, Bi-218, or Pb-218 in the central inclusion."* Robert V. Gentry, "Cosmological Implications of Extinct Radioactivity from Pleochroic Halos," *Creation Research Society Quarterly*, Vol. 3, July 1966, p. 18. [This article was reprinted in *Why Not Creation?* editor Walter E. Lammerts (Phillipsburg, New Jersey: Presbyterian and Reformed Publishing Co., 1970), pp. 106–113.]

55. If a billion polonium-218 (^{218}Po) atoms had ever been concentrated in a tiny inclusion in dry rock, the heat generated within one half-life (3.1 minutes) would melt an isolated sphere of radius 0.0033 cm. This is 40% larger than the final ^{218}Po halo radius of 0.0023 cm. Since polonium halos never melted, as explained in Endnote 56, we can conclude that a billion ^{218}Po atoms were never concentrated at any tiny inclusion in dry rock at the same time. *This includes the time of the rock's creation.* The actual melting would begin at the instant of creation (t=0) and rapidly advance outward from the center to a distance of 0.0033 cm in 3.1 minutes.

    Assume that a billion ^{218}Po atoms are concentrated in a tiny inclusion. Half would eject an alpha particle within 3.1 minutes—each alpha particle releasing 6.0 MeV of energy. (1 MeV $= 3.83 \times 10^{-14}$ cal) Of those 500,000,000 alpha particles, 375,000,000 would raise the sphere's temperature up to the rock's melting point. The remaining 125,000,000 alpha particles would melt the entire sphere.

    To verify the above statements, the following properties of the rock will be used:

$$\text{density} = 2.7\,\frac{\text{gm}}{\text{cm}^3} \qquad \text{heat of fusion} = 71\,\frac{\text{cal}}{\text{gm}}$$

$$\text{specific heat} = 0.21\,\frac{\text{cal}}{\text{gm}\,^\circ\text{C}}$$

$$\left\{\begin{matrix}\text{melting}\\ \text{temperature}\end{matrix}\right\} - \left\{\begin{matrix}\text{ambient}\\ \text{temperature}\end{matrix}\right\} = 1000\,^\circ\text{C}$$

    mass of a sphere with a radius of 0.0033 cm

$$= 2.7\left[\frac{4\,\pi}{3}(0.0033)^3\right] = 4.03 \times 10^{-7}\ \text{gm}$$

    and the following two heat-balance equations can be easily and quickly checked. First, raising the sphere's temperature to its melting point:

$$(3.75\times 10^8)\ (6.0 \times 3.83\times 10^{-14}) = 4.03\times 10^{-7} \times 0.21 \times 1000$$

    Then, melting the rock:

$$(1.25\times 10^8)\ (6.0 \times 3.83\times 10^{-14}) = 4.03\times 10^{-7} \times 71$$

    So why do we see *unmelted* polonium halos?

    i. The billion ^{218}Po atoms were electrically attracted to each tiny inclusion over a period of time, perhaps many weeks. This allowed time for the heat to transfer away as the halo slowly formed.

    ii. The halos were cooled by considerable subsurface water and by the "evaporation" of the volatile OH^-.

    For details, see pages 351–352.

56. Had melting occurred, the ionization damage produced by all the alpha decays would have been erased. Furthermore, Gentry conducted tests that confirmed that melting did not occur. [See Robert V. Gentry, "Radiohalos in a Radiochronological and Cosmological Perspective," *Science*, Vol. 184, 5 April 1974, pp. 62–66.]

57. Gentry never observed this concentration of halo centers in specific sheets. Personal communication, 7 August 2009.

58. Henderson and Sparks, p. 243.

59. More specifically, the mine's intrusions were *"calcite vein dikes (rocks containing mostly the mineral calcite and other minerals, such as mica) that are small in length and width and cut metasedimentary rocks which still retain bedding planes."* [See J. Richard Wakefield, "Gentry's Tiny Mystery," *Creation/Evolution*, Vol. 22, Winter 1987–1988, p. 17.]

    ◆ Gentry discusses this trip on pages 325–327 of *Creation's Tiny Mystery*. Wakefield discusses it in the reference above.

60. *"... the existence of polonium halos in the biotite at the Fission and Silver Crater Mines* [near Bancroft, Ontario] *serves to identify the host 'vein dikes' as also being created rocks, ..."* Robert V. Gentry, "Response to Wise," *Creation Research Society Quarterly*, Vol. 25, March 1989, p. 177.

    ◆ *"...* [Wakefield] *implies that certain 'intrusive,' crystalline rocks discount a creation origin for those rocks, but the fact is, my creation model includes these among the rock types that were created* [as solids]*."* Robert V. Gentry, "Response to Wakefield's Remarks," *Creation's Tiny Mystery*, p. 325.

61. Kurt P. Wise, "Radioactive Halos: Geologic Concerns," *Creation Research Society Quarterly*, Vol. 25, March 1989, pp. 171–176.

62. Lorence G. Collins, "Polonium Halos and Myrmekite in Pegmatite and Granite," *Expanding Geospheres, Energy and Mass Transfers from Earth's Interior*, editor C. Warren Hunt (Calgary: Polar Publishing Company, 1992), p. 132.

    Obviously, Collins overstates his case, because he could not have checked *"all of the granites in which Gentry found polonium halos."* Nevertheless, myrmekites were found in many of those granites.

63. Feldspars are a class of minerals that constitute almost 60% of the earth's crust. The subgroup, plagioclase feldspars, comes in two varieties: calcium-rich and sodium-rich. Myrmekite contains the sodium variety. Sodium feldspars form when sodium (Na^{1+}) and silicon (Si^{4+}) replace calcium (Ca^{2+}) and aluminum (Al^{3+}) in calcium feldspars.

    An alert reader may wonder (1) where all the calcium went, and (2) what provided the silicon for the replacement. The chapter **"The Origin of Limestone"** on pages 229–235 answers the first question. Pages 124–125, which explain the extreme solubility of quartz (SiO_2) in supercritical water (SCW), answer the second.

What accounts for the replacement of aluminum (Al) with sodium (Na) in the sodium feldspars? Answer: SCW readily dissolves aluminum (which opened up slots in calcium feldspars). Salt (NaCl) was dissolved in SCW as Na^+ and Cl^-. The Na^+ then entered those slots.

64. *"... several 'puzzles' that still challenge the geologic profession: ... Why are Po halos in biotite and fluorite associated with myrmekite-bearing granites?"* Lorence G. Collins, *Hydrothermal Differentiation and Myrmekite—A Clue to Many Geologic Puzzles* (Athens, Greece: Theophrastus Publications, S.A., 1988), p. 5.

65. *"The Po halos are observed to occur primarily in biotite and fluorite in pegmatites and in biotite in granite in terranes where the granite is myrmekitic."* Ibid., p. 232.

66. *"Thus, polonium was deposited in new crystals that grew from voluminous hydrothermal flushing of sheared and fractured, formerly-solid, mafic rock. ... Rapid entry of radon and precipitation of polonium could occur if a gabbro or diorite site were made porous and depressurized by tectonism."* Collins, "Polonium Halos and Myrmekite in Pegmatite and Granite," pp. 135, 136.

67. Collins' explanation is a more detailed refinement of the explanation by Canadian physicist G. H. Henderson in 1939, one of the earliest radiohalo researchers. [See Endnote 50.] Others have proposed less successful variations of Henderson's basic insight or have repackaged Collins' explanation without proper credit.

68. Collins' vague explanation lacks specifics and a mechanism.

    > *The creeping rock-movements associated with seismically-active terranes open avenues for radon-bearing water to move into lower-pressured pore space, and to the surface.* Collins, "Polonium Halos and Myrmekite in Pegmatite and Granite," p. 134.

    "Creeping"? Why "seismically-active"? What "opened 'avenues' inside rock for radon-bearing water" and when? What provided the necessary energy and forces?

69. Photographs of these elliptical halos can be seen in Plate 5 of Gentry's Radiohalo Catalogue in *Creation's Tiny Mystery*.

70. Bryan C. Chakoumakos et al., "Alpha-Decay Induced Fracturing in Zircon: The Transition from the Crystalline to the Metamict State," *Science*, Vol. 236, 19 June 1987, pp. 1556–1559.

71. *"Fractures pay not the least attention to the cohesion minimums and not even to grain boundaries, where slip would take place so easily under stresses, but evidently occur quite suddenly in the form of an explosive fracture and not a slow expansion. The evidently simultaneous effect on various other constituents including those of rather different hardness and tenacity are proof of the above. The sudden released energy must be enormous in individual cases. The author observed fracture circles about orthite in quartz of about 1 meter diameter in the Iveland district in southern Norway!"* Paul A. Ramdohr, "New Observations on Radioactive Halos and Radioactive Fracturing," *Oak Ridge National Laboratory Translation* (ORNL-tr-755), 26 August 1965, p. 19.

72. *"One of the major problems in determining the origin of batholiths of granite composition is to explain what happened to the country rock* [the older rock] *that was displaced by the invading magma."* [See Arthur N. Strahler, *Physical Geology* (New York: Harper & Row, Publishers, 1981), p. 912.]

    - *"A second problem involves the great volume* [hundreds of cubic miles in some cases] *of pre-existing country rock which must be removed to provide space for an invading batholith—the eliminated country rock must be accounted for somehow."* [See W. G. Ernst, *Earth Materials* (Los Angeles: Prentice-Hall, Inc., 1969), p. 108.]

73. Quartz will generate about 0.0625 volt (V) per meter for each N/m^2 (newton per square meter) of compression. [See http://en.wikipedia.org/wiki/Piezoelectric.] Granite's compressive strength is about 2×10^8 N/m^2. The crushing seen within the granite crust tells us that such compressive stresses have been exceeded in the past, and the observed electrical activity during modern earthquakes shows us that these stress thresholds are being reached today. [See **"Earthquakes and Electricity"** on page 335.] Certainly the impacts (as the pillars were pounded and during the compression event) briefly exceeded this compression. Therefore, electric fields of at least 12.5×10^6 V/m have been reached. Notice how this slightly exceeds—as it should—the breakdown voltage of dry granite: 9×10^6 V/m. [See *Smithsonian Physical Tables*, 9th revised edition (Norwich, N.Y., Knovel, 2003), p. 423.]

    Temperature is another important variable. The above properties were measured at room temperatures. As temperatures increase up to the limit of 1,063°F (573°C) mentioned in Endnote 74, the piezoelectric coefficient increases and breakdown voltages decrease—both contributing to more extensive and powerful plasma production.

74. A cyclic load on granite will produce a cyclic voltage. However, a static load on granite would not produce a sustainable voltage, because the minerals adjacent to each quartz crystal would slowly realign and neutralize the voltage. Also, once the temperature of quartz exceeds about 1,063°F (573°C), its atoms become mobile enough to neutralize any voltage.

75. *"In some parts of the world, earthquakes are often accompanied by ball lighting, stroke lightning and sheet lightning. ... We propose that the piezoelectric effect in the Earth's crust causes the electrical field. ... In rock with a mean piezoelectric coefficient several percent that of x cut single crystal quartz, and with typical seismic stress changes* [of only] *30–300 bars, an earthquake makes an average electrical field of 500–5,000 V cm^{-1}. For distances of the order of half the seismic wavelength, the generated voltage is 5×10^7 to 5×10^8 V, which is comparable with the voltage responsible*

for lightning in storms." David Finkelstein and James Powell, "Earthquake Lightning," *Nature*, Vol. 228, 21 November 1970, p. 759.

76. N. E. Ipe, "Radiological Considerations in the Design of Synchrotron Radiation Facilities," Stanford Linear Accelerator Center, *SLAC-PUB-7916*, January 1999, p. 6.

This report briefly describes the three mechanisms by which bremsstrahlung radiation releases neutrons from nuclei.

- Electrons accelerated in a plasma by high-energy lasers will produce neutrons, positrons, and fission fragments by bremsstrahlung radiation. [See P. L. Shkolnikov and A. E. Kaplan, "Laser-Induced Particle Production and Nuclear Reactions," J*ournal of Nonlinear Optical Physics and Materials*, Vol. 6, No. 2, 1997, pp. 161–167.]

77. The piezoelectric effect would generate an oscillating electric field with a peak amplitude of 12.5×10^6 V/m. [See Endnote 73 above.] At each latitude-longitude combination, peak voltages—*of the same sign*—would be reached simultaneously on the top and bottom of the fluttering crust. The midplane (called the *neutral surface*) of a 10-mile-thick crust, 5 miles (8,000 meters) below the earth's surface, is unstressed, so the midplane voltage was always zero. Free electrons in this field would have up to 100,000 MeV of potential energy,

$$12.5 \times 10^6 \ \frac{\text{volts}}{\text{meter}} \times 8{,}000 \text{ meters} =$$

$$100{,}000 \times 10^6 \text{ volts} = 100{,}000 \text{ MeV}$$

four orders of magnitude greater than is needed to release free neutrons. With each flutter cycle, electrons would surge from the top and bottom of the crust toward the neutral surface, and then from the neutral surface back toward the top and bottom of the crust.

Z-pinch (or a self-focusing plasma flow) only occurs if the current exceeds a critical threshold.

> *Streams of fast electrons which can accumulate positive ions in sufficient quantity to have a linear density of positives about equal to the linear density of electrons, along the stream, become magnetically self-focussing when the current exceeds a value which can be calculated from the initial stream conditions.* [Bennett, p. 890.]

That current, according to Bennett [p. 896], turns out to be very small when the voltage is extremely large, as it is in the case of fluttering hydroplates. That current is

$$i = \frac{2.5 \ T}{10^3 \ \sqrt{V}}$$

where T is in kelvins and V is in volts. If the plasma's temperature, T, is 10,000 K and the voltage, V, is 100,000 MeV (as shown above), then the current required for a Z-pinch is 0.000079 amps—a trivial amount.

78. *"The spatial variation in $\delta^{18}O$ (Fig. 1) can most easily be explained by the upward migration along the flank of the* [salt] *dome of diagenetically altered waters enriched in heavy oxygen ... ."* Jeffrey S. Hanor, "Kilometre-Scale Thermohaline Overturn of Pore Waters in the Louisiana Gulf Coast," *Nature*, Vol. 327, 11 June 1987, p. 501.

- *"Sulfate ions in saline lakes and brines have oxygen-18 enrichment of from 7 to 23 per mille relative to mean ocean water;"* A. Longinelle and H. Craig, "Oxygen-18 Variations in Sulfate Ions in Sea Water and Saline Lakes," *Science*, Vol. 156, 7 April 1967, p. 56.

- *"Results indicate both higher enrichments of heavier isotopes* [of ^{2}H and ^{18}O] *and higher chloride concentrations in water samples from salt pans than in water samples from other sources."* H. Chandrasekharan et al., "Deuterium and Oxygen-18 Isotopes on Groundwater Salinization of Adjoining Salt Pans in Porbandar Coast, Gujarat, India," *Hydrochemistry*, IAHS Publication No. 244, April 1997, p. 207.

79. The photo of this lightning rod can be seen at:
   http://en.wikipedia.org/wiki/Plasma_pinch.

After the owner of this photograph gave permission to use his image of the lightning rod, he withdrew permission, because he did not want his photo "used for such non-scientific purposes" as this book. (No one should think that all scientists are unbiased and freely exchange data and information. Some even suppress information.) In two other instances involving different topics, evolutionists denied permission to use photographs for this book, even though copyright fees were offered.

80. Willard H. Bennett, "Magnetically Self-Focussing Streams," *Physical Review*, Vol. 45, June 1934, pp. 890–897.

81. *"Elevated emanations of hydrogen, radon, helium, and other gases were detected over some of the lineaments, thus indicating anomalous permeability of these zones in comparison with adjacent areas."* O. V. Anisimova and N. V. Koronovsky, "Lineaments in the Central Part of the Moscow Syneclise and Their Relations to Faults in the Basement," *Geotectonics*, Vol. 41, No. 4, 2007, p. 315.

82. "*... many lineaments are zones of seismic activity ... .*" Ibid.

- *"... the main seismic activity is concentrated on the first and second rank lineaments, and some of* [the] *important epicenters are located near the lineament intersections. Stich et al., (2001) obtained from the analysis of 721 earthquakes with magnitude between 1.5 and 5.0 mb* [body-wave magnitude] *that the epicenters draw* [lie along] *well-defined lineaments and show two dominant strike directions N120–130°E and N60–70°E, which are coincident with known fault systems in the area and with the source parameters of three of the largest events."* A. Arellano Baeza et al., "Changes in Geological Faults Associated with Earthquakes Detected by the Lineament Analysis of the Aster (TERRA) Satellite Data," *Pagina Web De Geofisica*, December 2004, p. 1.

83. J. R. Rygg et al., "Dual Nuclear Product Observations of Shock Collapse in Inertial Confinement Fusion," *LLE Review*, Vol. 111, pp. 148–153.

84. Josh Dean, "This Machine Might Save the World," *Popular Science*, January 2009, pp. 64–71.

85. This huge energy release (1.5×10^{15} hydrogen bombs' worth of energy, or 7.72×10^{37} ergs) must first be seen from the perspectives of two calculations. From the first, this energy will appear small, but from the second, it will seem too large. ***Then, to help resolve both in your mind, you will need to consider carefully the remarkable properties of supercritical water.*** [See, for example, page 343.]

- If 7.72×10^{37} ergs of energy were released uniformly in the earth's crust over 40 days, how many watts of power would be emitted in every cubic centimeter?

  Earth has a surface area of 5.1×10^{18} cm^2. Assuming that the crust is 16×10^5 cm thick (about 10 miles), the average cubic centimeter of rock would generate only 0.27 watts.

$$\frac{7.72 \times 10^{37}\ \text{ergs}}{5.1 \times 10^{18}\ \text{cm}^2 \times 16 \times 10^5\ \text{cm} \times 40\ \text{days}} \times \frac{1\ \text{watt} - \text{day}}{8.64 \times 10^{11}\ \text{ergs}}$$

$$= 0.27\ \frac{\text{watts}}{\text{cm}^3}$$

  where a watt-day = 8.64×10^{11} ergs. (A 100-watt light bulb releases energy 370 times faster. Also, some 20-watt light bulbs are less than a cubic centimeter.)

- If 7.72×10^{37} ergs of *thermal energy* were evenly distributed throughout the earth *at one time*, the entire earth would melt! The earth's mass is 5.976×10^{27} grams. Let's assume that a rise in earth's temperature of 1,784 K throughout would melt the earth. Using the outer core's specific heat and heat of fusion given in Table 31 on page 496, and neglecting the variation of these properties with pressure and temperature, the energy needed to melt the entire earth is

$$5.976 \times 10^{27}\ \text{gm} \left(5 \times 10^6\ \frac{\text{ergs}}{\text{gm K}} \times 1784\ \text{K} + 4 \times 10^9\ \frac{\text{ergs}}{\text{gm}} \right)$$

$$= 7.72 \times 10^{37}\ \text{ergs}$$

86. The following definitions pertain to the sidebar **"How Much Energy?"** on page 343:

- ***Avogadro's number***: the number (6.022×10^{23}) of atoms or molecules in one mole. For example, 12 grams of carbon contain 6.022×10^{23} carbon atoms.

- ***erg***: a unit of energy or work done by a force of 1 dyne acting through a distance of 1 centimeter. For example, a 1-pound brick falling through 1 foot releases 13,600,000 ergs of energy.

- ***fast neutron***: a free neutron with a kinetic energy of at least 1MeV (14,000 km/sec). Nuclear reactions (fission or fusion) produce fast neutrons.

- ***MeV***: a unit of energy—a million electron volts. It is the energy gained by an electron accelerated through one million volts. A snowflake striking the concrete pavement releases about 4 MeV.

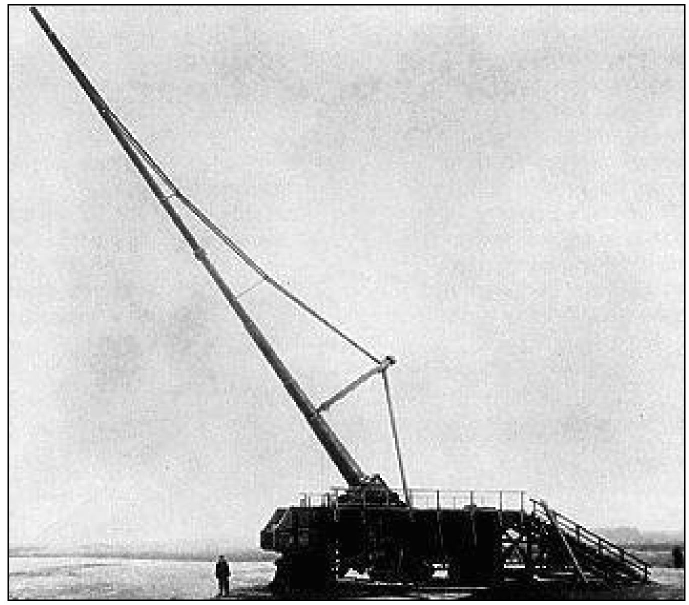


Figure 183: Paris Gun. German engineers in World War I recognized that longer gun tubes would, with enough propellant (energy), accelerate artillery rounds for a longer duration and fire them farther—and even strike Paris from Germany. In 1918, this 92-foot-long gun, launching 210-pound rounds at a mile per second, could strike a target 81 miles away in 3 minutes. Parisians thought they were being bombed by quiet, high altitude zeppelins (dirigibles).

If a 92-foot-long gun could launch material at a mile per second, how fast might a 10-mile-long gun tube launch material? In principle, if a gun tube is long enough and enough energy is available, a projectile could escape earth's gravity and enter cometlike orbits. (Nuclear reactions provided more than enough energy to launch water and rocks into space.)

Would the tremendous velocities in the fountains of the great deep harm or remove the atmosphere? Not by much if the launch velocity were great enough. As children, we all have had a bandage that we were afraid to rip off, because it would hurt. Even though our parents told us that a quick jerk would rip the bandage off with less pain, most of us didn't believe them. It was counterintuitive, because we didn't understand the role that inertia played in tending to keep our skin stationary. The same applies to the friction the fountains applied to the atmosphere. The greater the fountain's velocity, the less kinetic energy the fountains could transfer to the atmosphere *per pound of jetting water*. Also, seconds after the rupture, the fountains (and rupture) were many miles wide,[88] and then they grew even wider. Therefore, relatively little water made contact with the atmosphere. Furthermore, the fountains pulsated, so the jetting slowed at regular intervals, allowing most of the entrained air to fall back toward the earth.

- ***mole***: the amount of a pure substance whose mass, in grams, equals the number of nucleons in each atom or molecule. For example, a mole of carbon-12 is 12 grams of carbon. A mole of the molecule water (H_2O or $^1H + ^1H + ^{16}O$) is 18 grams of water.

- ***thermalize***: to slow the effective speed of a subatomic particle (usually a neutron) until it corresponds to the speeds of like particles at the local temperature.

87. While all the crust was not obliterated, at least two large areas were. You will recall the discussion on pages 119 (and Endnote 27 on page 138) of the vast "mother salt layer" about 20,000 feet below sea level under the Gulf of Mexico

and under the Mediterranean Sea. As explained earlier, salt precipitated out of the SCW and formed a thick salt layer on the chamber floor before the flood. (This phenomenon in supercritical fluids, first reported in 1879, is called *out-salting*.) During the flood, so much nuclear energy was released that the resulting high pressures pulverized and blew away that portion of the crust, allowing the floor below to rise. Much less of the escaping subterranean waters could sweep over those salt layers to transport them up to the earth's surface.

Even without this understanding, doesn't it appear, if one looks at a globe, that a circular region of the Americas' plate was removed to form the Gulf of Mexico and part of the Europe/Africa/Asia plate was removed to form the Mediterranean Sea? What about the Caribbean Sea and the Black Sea?

88. Granite typically has a tensile strength of 1,850 psi and a modulus of elasticity of 7,300,000 psi. The earth's crust has a mean circumference of 24,875 miles. Therefore, the strain just before the rupture (which would equal the initial rupture width) was about

$$\frac{1{,}850 \text{ psi}}{7{,}300{,}000 \text{ psi}} \times 24{,}875 \text{ miles} = 6.3 \text{ miles}$$

89. Other examples are more physically meaningful, at least to me. As a boy, I would buy bags of dried peas and put a dozen or so in my mouth. Then I would place one end of a plastic straw in my mouth, insert a pea in the straw with my tongue, and sneak around the corner of a house where I could blow peas out the other end and zap my friends who were trying to shoot me. (Fortunately, no one lost his eyesight.) With a longer straw and a bigger breath, I could shoot farther. Cannons, guns, rifles, mortars, and howitzers use the same principle. [See Figure 183.]

90. George Gamow, "Expanding Universe and the Origin of Elements," *Physical Review*, Vol. 70, October 1946, pp. 572–573.

91. *"However, it was soon realized that the building up of heavy nuclei during the Big Bang could not have continued very far, because collisions between nuclei became less frequent as the universe cooled* [and expanded]*, and the thermal energy of the nuclei became too low to overcome the electrostatic repulsion of their positive charges."* Edward M. Baum et al., *Nuclides and Isotopes: Chart of the Nuclides*, 16th edition (Schenectady, NY: Knolls Atomic Power Laboratory, 2002), p. 34.

92. Ralph A. Alpher, Hans Bethe, and George Gamow, "The Origin of Chemical Elements," *Physical Review*, Vol. 73, April 1948, pp. 803–804.

93. *"As already mentioned, there is no stable nucleus with five or eight nuclear particles* [nucleons]*, so it is not possible to build nuclei heavier than helium by adding neutrons or protons to helium (^{4}He) nuclei, or by fusing pairs of helium nuclei. (This obstacle was first noted by Enrico Fermi and Anthony Tukevich.)"* Steven Weinberg, *The First Three Minutes* (New York: Bantam Books, Inc., 1977), p. 119.

- The barrier at 5 nucleons causes almost instantaneous decays, with half-lives of less than 7.6×10^{-22} seconds.

94. *"But the stellar theory of nucleosynthesis also had its problems. It is difficult to see how stars could build up anything like a 25–30 percent helium abundance—indeed, the energy that would be released in this fusion would be much greater than stars seem to emit over their whole lifetime."* Weinberg, p. 120.

95. *"It seems probable that the elements all evolved from hydrogen, since the proton is stable while the neutron is not. Moreover, hydrogen is the most abundant element, and helium, which is the immediate product of hydrogen burning by the pp chain and the CN cycle, is the next most abundant element."* Burbidge et al., p. 549.

96. Joseph Silk, *The Big Bang* (San Francisco: W. H. Freeman and Co., 1980), p. 79.

97. See Endnote on page 138.

98. Charles Seife, "Accelerator Aims to Find the Source of All Elements," *Science*, Vol. 298, 22 November 2002, p. 1544.

99. *"... the temperatures in the interior of stars are measured in tens of millions of degrees, whereas several billion degrees are needed to 'cook' radioactive nuclei from the nuclei of lighter elements."* George Gamow, *One Two Three ... Infinity*, Bantam Science and Mathematics edition (New York: The Viking Press, Inc., 1961), p. 329.

Notice that researchers at the Proton-21 Electrodynamics Research Laboratory in the Ukraine, using a Z-pinch, are overcoming Coulomb forces and producing heavy elements by fusion at close to these billion degree temperatures. [See page 333.] However, it happens briefly (in 10^{-8} second) in a "hot dot" that is less than 10^{-7} millimeter in diameter. Supernovas are not needed, only a focused and concentrated plasma.

100. *"... frequently in quartzite, the quartz occurs as grains with isometric form but shows a preferential orientation in terms of internal crystal structure, that is, in terms of the axes of crystallization."* E. I. Parkhomenko, *Electrical Properties of Rocks* (New York: Plenum Press, 1967), p. 6.

101. *"The simplest interpretation of this linear relation is that the radioactivity measured at the surface is constant from the surface to depth b."* Roy et al., p. 1.

Throughout the eastern United States, b = 4.68 miles, but increases slightly for other regions, such as the western United States and parts of Australia.

102. If the base of a semi-infinite, 4.68-mile-thick slab of rock is heated from below by a steady heat source, half that heat flux will pass through the top of the slab in 1.5 million years. After 40 million years, 90% of the heat flux entering from below would reach the surface. For each doubling of the slab's thickness, the time required for a given fraction of the heat flux to reach the surface increases by a factor of four.

103. Arthur H. Lachenbruch, "Crustal Temperature and Heat Production: Implications of the Linear Heat-Flow Relation," *Journal of Geophysical Research*, Vol. 75, No. 17, 10 June 1970, pp. 3291–3300.

104. *"Heat production rate is well correlated to lithology; no significant variation with depth, neither strictly linear nor exponential, is observed over the entire depths of the* [two German holes]." Christoph Clauser et al., "The Thermal Regime of the Crystalline Continental Crust: Implications from the KTB," *Journal of Geophysical Research*, Vol. 102, No. B8, 10 August 1997, p. 18,418.

105. Frank D. Stacey, *Physics of the Earth* (New York: John Wiley & Sons, 1969), p. 244.

106. Frank D. Stacey, *Physics of the Earth,* 3rd edition (Brisbane, Australia: Brookfield Press, 1992), pp. 62–65.

107. *"Even larger amounts of neutrons can be generated* [by bremsstrahlung radiation in heavy chemical elements]*, in particular in natural uranium."* Shkolnikov and Kaplan, p. 165.

108. "[At the Oklo reactor] *most of the fission-product elements and the neutron capture products have remained partially or wholly in place."* George A. Cowan et al., "The Oklo Phenomenon," p. 342.

109. Frank D. Stacey, *Physics of the Earth* (New York: John Wiley & Sons, 1969), p. 240.

110. "Dehydroxylation" is the removal of hydroxide ions (OH^-) from a mineral's crystalline structure by the application of heat at specific, but high, temperature-pressure combinations. Usually the heat and pressure are applied to a large mass of the mineral. However, in the case at hand, a ^{218}Po atom impacting a mineral containing hydroxide would concentrate tremendous heat and pressure near the impact point, release thousands of OH^- ions from their crystalline structure, form water (HOH), and result in dehydroxylation. The reaction is of the type

$$2\,OH^- \rightleftarrows H_2O + O^{2-}$$

[See Douglas Yeskis et al., "The Dehydroxylation of Kaolinite," *American Mineralogist*, Vol. 70, 1985, pp. 159–164.] Flowing water then dissolves and removes the O^{2-} ion.

To get a feel for the large number of particles that might be removed by the impact of just one ^{218}Po atom—or the decay of an embedded ^{218}Po atom—consider the following. At 100°C and atmospheric pressure, 539 calories of heat will evaporate 1 gram of liquid water. (1 MeV = 3.83×10^{-14} cal) Eighteen grams of water (1 mole) contains 6.022×10^{23} molecules. Therefore, the kinetic energy of one recoiling ^{218}Po (2% of the 5.49 MeV of energy released by the decay of ^{222}Rn) could, if concentrated, evaporate up to

$$\frac{0.02 \times 5.49 \times 3.83{\times}10^{-14} \times 6.022{\times}10^{23}}{539 \times 18} = 2.6 \times 10^{5} \text{ molecules}$$

111. After etching mica sheets with acid, Robert Gentry could see tiny pits where heavy, recoiling atoms had impacted after ejecting an alpha particle. He assumed those pits were made by recoiling polonium. Pit densities near isolated polonium halos were no greater than the pit densities far from halos. Therefore, he concluded that *diffusion or slow movement did not* transport polonium (an alpha emitter) into the halo centers. If that had happened, some polonium would have decayed as the polonium converged on those centers, so pit densities would have been greater near polonium halos. [See Robert V. Gentry, "Fossil Alpha-Recoil Analysis of Certain Variant Radioactive Halos," *Science*, Vol. 160, 14 June 1968, pp. 1228–1230.] This led to his eventual conclusion that the hundreds of millions of polonium isotopes must have been clustered at specific points *since the instant of creation.*

However, Gentry overlooked the powerful positive electrical charges at certain impact points and the rapid transport of ^{222}Rn in flowing water along channels between growing sheets of mica. A flowing ^{222}Rn atom that emitted an alpha particle instantly became ^{218}Po with a -2 electrical charge. That new polonium was pulled into the nearest point of positive charge in seconds. Then when the anchored polonium decayed minutes later, heat from its recoil evaporated more negatively charged hydroxide particles, so those points became more positive and attracted more polonium even faster from greater distances. Almost all the uniformly distributed recoil pits Gentry saw were produced by decaying ^{222}Rn, not decaying polonium.

112. Ejaz ur Rehman et al., "Mass Spectrometric Determination of $^{234}U/^{238}U$ Ratio with Improved Precision," *Analytical Chemistry*, Vol. 77, 1 November 2005, pp. 7098–7099.

113. *"Clear evidence of* [former] *^{60}Fe in chondrites was first found in troilite (FeS) and magnetite (Fe_3O_4)."* Shogo Tachibana et al., "^{60}Fe in Chondrites: Debris from a Nearby Supernova in the Early Solar System?" *The Astrophysical Journal*, Vol. 639, 10 March 2006, pp. L87–L90.

- "[Researchers] *analyzed two primitive meteorites that are thought to be almost pristine leftovers of solar system formation. They detected nickel 60, the product of the radioactive decay of iron 60, in chemical compounds where, by rights iron should be found."* Simon F. Portegies Zwart, "The Long-Lost Siblings of the Sun," *Scientific American*, Vol. 301, November 2009, p. 42.
- *"Recent studies of meteorites confirm the presence of live ^{60}Fe in the early solar system."* J. Jeff Hester et al., "The Cradle of the Solar System," *Science*, Vol. 304, 21 May 2004, p. 1116.

114. What is meant by "quickly"? Supernovas are the hottest and most violent explosions observed in the universe. If mineral grains are somehow to form from a supernova, the gas/plasma debris from the supernova must first merge into microscopic particles. That is quite a trick, because the expanding gas/plasma moves radially outward, steadily increasing the distances between most of its atomic and subatomic particles. Martin Harwit calculates that to grow a grain to only 10^{-5} centimeter would require 3 billion years—*assuming no expansion and that every particle that*

strikes a growing grain would stick. Sir Fred Hoyle put it more bluntly; *"… there is no reasonable astronomical scenario in which mineral grains can condense."* [See **"Interstellar Gas"** on page 93.]

Second, these tiny grains (drifting weightlessly in space) must gravitationally collect into small bodies. Then those bodies must somehow merge into asteroid-size bodies, massive enough to compress and heat (in a supercold, nearly absolute zero, environment) the grains into uniform crystals. At that point, enough ^{60}Fe atoms might be concentrated to form minerals such as troilite (FeS) and magnetite (Fe_3O_4). How long would this second step take? No one can say for sure, but probably most astronomers have an opinion. If they were candid, I suspect many would say that this second step couldn't happen in 10,000,000 years. But almost all the ^{60}Fe (half-life 1,500,000 years) would have decayed before then. In other words, neither the first nor the second step could happen quickly enough to form detectable crystals containing ^{60}Fe.

115. *"The supernova was stunningly close; much closer to the sun than any star is today."* Brian D. Fields as quoted by the University of Illinois News Bureau, 10 April 2006. http://news.illinois.edu/NEWS/06/1004solar.html

- Leslie W. Looney, John J. Tobin, and Brian D. Fields, "Radioactive Probes of the Supernova-Contaminated Solar Nebula," *The Astrophysical Journal*, Vol. 652, 1 December 2006, pp. 1755–1762.

116. George Cooper et al., "Carbonaceous Meteorites As a Source of Sugar-Related Organic Compounds for the Early Earth," *Nature*, Vol. 414, 20/27 December 2001, pp. 879–883.

117. Peter R. Briere and Kathryn M. Scanlon, "Lineaments and Lithology Derived from a Side-Looking Airborne Radar Image of Puerto Rico," U. S. Geological Survey Open-File Report 00-006, 2000, pp. 1–5.

118. John W. Harbaugh et al., "Reconstructing Late Cenozoic Stream Gradients from High-Level Chert Gravels in Central Eastern Kansas," *Current Research in Earth Sciences*, Bulletin 253, 2007, p. 14.

119. *"The observation that Mars' northern polar cap barely deforms* [from season to season] *implies that its planetary interior is colder than expected."* Matthias Grott, "Is Mars Geodynamically Dead?" *Science*, Vol. 320, 30 May 2008, p. 1171.

   "This result is surprising. First, the temperatures in the interior of terrestrial planets should be proportional to their radius if they started with the same amount and distribution of radioactive, heat-producing elements and then cooled through surface losses. In this case, [the surface heat loss from] *Mars would be expected to plot between Earth and the Moon. However, the new estimates imply that the martian heat flow, a measure for the temperatures in the planetary interior, is below that of the Moon, even though Mars is about twice the diameter."* Ibid.

- *"Mars probably has subchondritic heat sources"* [that is, less heat-generating radioactive material than is contained in the meteoritic material from which it supposedly formed]. Roger J. Phillips et al., "Mars North Polar Deposits: Stratigraphy, Age, and Geodynamical Response," *Science*, Vol. 320, 30 May 2008, p. 118585.

120. Burbidge et al., pp. 547–650.

121. *"Optical measurements of the beryllium and boron abundances in halo stars have been achieved by the 10 meter KECK telescope and the Hubble Space Telescope. These observations indicate a quasi linear correlation between Be and B vs. Fe, at least at low metallicity, which, at first sight, is contrary to a dominating GCR* [Galactic Cosmic Ray] *origin of the light elements which predicts a quadratic relationship. As a consequence, the theory of the origin and evolution of LiBeB nuclei has to be refined."* E. Vangioni-Flam and M. Cassé, p. 77.

122. Paul M. Myrow et al., "Extraordinary Transport and Mixing of Sediment across Himalayan Central Gondwana during the Cambrian-Ordovician," *Geological Society of America Bulletin*, Vol. 122, September/October 2010, p. 1660.

123. Myrow et al., p. 1660.

124. A blind test requires that the people making the measurements not know (be "blind" to) which of several specimens is the one of interest. For example, to measure a rock's age by some radiometric technique, similar rocks—of different, but known, ages—must accompany the rock of interest. Only after the measurements are announced are the technicians making the measurements told the history of any specimen. Subtle biases can enter the experimental procedure if individuals with vested interests in the test's outcome make the measurement or influence those who do. Blind tests ensure objectivity.

   A special type of blind test commonly used in medicine is a "double-blind test." Neither doctors nor patients know who receives the special treatment being tested. A random selection determines which patients receive the special treatment and which receive a placebo—something obviously ineffective, such as a sugar pill. Experienced medical researchers give little credibility to any medicine or treatment that has not demonstrated its effectiveness in a well-designed and rigorously executed double-blind test.

   The Shroud of Turin, claimed to be the burial cloth of Christ, was supposedly dated by a blind test. Actually, the technicians at all three laboratories making the measurements could tell which specimen was from the Shroud. [Personal communication on 19 July 1989 with Dr. Austin Long who participated in the measurements.] The test would have been blind if the specimens had been reduced to unidentified carbon powder before they were given to the testing laboratories.

   Radiometric dates that do not fit a desired theory are often thrown out by alleging contamination. Few ever hear about such tests. If those who object to a blind radiometric date have not identified the contamination before the test, their claims of contamination should carry little weight. Therefore, careful researchers should first objectively evaluate the possibility of contamination.

Humans are naturally biased. We tend to see what we want to see and explain away unwanted data. This applies especially to those proposing theories, myself included. Scientists are not immune to this human shortcoming. Many popular ideas within geology would probably never have survived had a critical age measurement been subjected to a blind test.

125. John Woodmorappe, "Radiometric Geochronology Reappraised," *Creation Research Society Quarterly*, Vol. 16, September 1979, pp. 102–129.

- Robert H. Brown, "Graveyard Clocks: Do They Tell Real Time?" *Signs of the Times*, June 1982, pp. 8–9.
- *"It is obvious that radiometric techniques may not be the absolute dating methods that they are claimed to be. Age estimates on a given geological stratum by different radiometric methods are often quite different (sometimes by hundreds of millions of years). There is no absolutely reliable long-term radiological 'clock.'"* William D. Stansfield, *Science of Evolution* (New York: Macmillan Publishing Co., 1977), p. 84.

126. *"Chemical and physical processes such as mantle convection, tectonic-plate recycling and magma generation through partial melting should have scrambled, if not obliterated, any coherent geochemical signature of the primordial material. Even if a vestige of such material remained, it seems unlikely that it would be found in any samples from Earth's surface or the shallow subsurface that are available to geologists. Yet that is what* [this] *new evidence suggests."* David Graham, "Relict Mantle from Earth's Birth," *Nature*, Vol. 466, 12 August 2010, p. 822.

- *"Cenozoic-Era Baffin Island and West Greenland lavas, previously found to host the highest terrestrial-mantle ^{3}He/^{4}He ratios, exhibit primitive lead-isotope ratios that are consistent with an ancient mantle source age of 4.55–4.45 Gyr* [billion years]. *The Baffin Island and West Greenland lavas also exhibit ^{143}Nd/^{144}Nd ratios similar to values recently proposed for an early-formed (roughly 4.5 Gyr ago) terrestrial mantle reservoir."* Matthew G. Jackson et al., "Evidence for the Survival of the Oldest Terrestrial Mantle Reservoir," *Nature*, Vol. 466, 12 August 2010, p. 853.

127. *"Beyond its Fe deficiency, the singular feature of HE0107–5240 is that its measured abundance of C, relative to Fe, is about 10,000 times the observed ratio of these elements in the Sun, the largest such 'over-abundance' ratio ever seen. The N abundance ratio is also greatly enhanced, though only by a factor of 200."* Timothy C. Beers, "Telling the Tale of the First Stars," *Nature*, Vol. 422, 24 April 2003, p. 825.

128. Silk, p. 124.

129. Baum et al., p. 34.

WHY ARE CREATION AND THE FLOOD IMPORTANT?

How Can the Study of Creation Be Scientific?

What Triggered the Flood?

Is Evolution Compatible with the Bible?

Why Did the Flood Water Drain So Slowly?

Have Scientific Tools Detected Adam and Eve within Us?

Is There Life in Outer Space?

HOW OLD DO EVOLUTIONISTS SAY THE UNIVERSE IS?

Is There a Large Gap of Time between Genesis 1:1 and 1:2?

Galaxies Are Billions of Light-Years Away, So Isn't the Universe Billions of Years Old?

Why Does the Universe Seem to Be Expanding?

WHAT PREDICTIONS OF THE HYDROPLATE THEORY HAVE BEEN CONFIRMED?

DOES THE NEW TESTAMENT SUPPORT GENESIS 1–11?

How Can Origins Be Taught in High School or College?

How Could Saltwater and Freshwater Fish Survive the Flood?

HOW CAN I BECOME INVOLVED IN THIS ISSUE?

What Are the Social Consequences of Belief in Evolution?

What Is the Written Debate Offer?

Is Global Warming Occurring? If So, What Causes It?

Did a Water Canopy Surround the Earth and Contribute to the Flood?

How Do You Respond to Common Claims of Evolutionists?

What Questions Could I Ask Evolutionists?

Did the Flood Last 40 Days and 40 Nights?

Why Don't Creationists Publish in Leading Science Journals?

If God Made Everything, Who Made God?

Have Planets Been Discovered Outside the Solar System?

What about the Dinosaurs?

How Was the Earth Divided in Peleg's Day?

How Accurate Is Radiocarbon Dating?

What Is the Taped and Transcribed Telephone Debate Offer?

If the Sun and Stars Were Made on Day 4, What Was the Light of Day 1?

DID IT RAIN BEFORE THE FLOOD?

Is the Hydroplate Theory Consistent with the Bible?

How Did Human "Races" Develop?

How Do Evolutionists Respond to What You Say?

What Was Archaeopteryx?

According to the Bible, When Was Adam Created?

Why Did People Live for about 900 Years before the Flood?

Figure 184: Frequently Asked Questions.

Part III:

Frequently Asked Questions

Most questions concerning origins are answered in Parts I and II. Of the questions that remain, the following are some of the most frequently asked in my seminars and public presentations. These topics can be read in any order.

Why Are Creation and the Flood Important?

First, let's acknowledge why some people reject Genesis and are not willing to carefully consider
- how the universe, earth, and life began, and
- the flood, earth's defining geological event.

The following reflects attitudes I once held.

In our scientifically "enlightened" age, don't educated people accept that evolution happened? Most of my teachers and professors, people I greatly respected, accepted evolution. It appeared to me that those who believed in the biblical version of creation did not grasp the immense age of the earth and universe. Don't we sense great age when we see the Grand Canyon or galaxies that are billions of light-years away? Given billions of years, vast changes will occur. To believe that a worldwide flood occurred seemed ridiculous. Just look at a globe. Where could so much water come from to cover, as the Bible clearly states, all the mountains of the earth? Mount Everest rises almost 6 miles above sea level. If that much water once covered the earth, where did all that water go? Obviously, the Bible was written in an age when people were relatively uneducated and little was known about the earth—or so I thought.

Was I curious enough to study origins? No. I thought it was a complex, time-consuming subject. Besides, I felt the case was closed a century ago—certainly after the famous Scopes Trial in 1925. Those who accepted the biblical version of creation and a global flood were a little embarrassing to be around. I became a Christian in high school, but held the above attitudes until my early 30s. I was at Position 1, shown in Figure 185.

Others reject the theory of evolution, believe that God created everything relatively recently, and accept a global flood. Although their beliefs, usually based on a literal interpretation of the Bible, clash with evolution (taught in almost all schools and universities), they tend to ignore the conflict. The reasons are many: they may feel too busy, they may not recognize all the contradictions between evolution and the Bible or may feel powerless to resolve them. They may wish to avoid controversy or involvement in unfamiliar scientific topics. They may have only a vague understanding of the flood. (Major consequences of the flood have been incorrectly interpreted as supporting evolution.) They may not realize that evolution (1) is scientifically bankrupt, (2) is a major stumbling block for countless nonbelievers, and (3) has caused many children raised in Christian homes to later reject their faith or view church as irrelevant. This is Position 3.

Other people know how foundational Genesis 1–11 is to the entire Bible. (Genesis 1–11 tells of the creation, fall, and flood—three of the most significant events of all time.) Every New Testament writer and many Old Testament writers refer to those chapters. [See **"Does the New Testament Support Genesis 1–11?"** on pages 457–459.] If those writers were wrong about ancient history, why should we believe them when they say that a man rose from the dead? Jesus Christ also spoke of events described in each of the first seven chapters of Genesis. If Christ was mistaken about ancient history, why should we believe Him when He speaks of eternity? If Genesis 1–11 is in error, then many other portions of the Bible that refer to those chapters are equally wrong, opening the door to differing interpretations of the entire Bible and a comfortable, pick-and-choose view of Scripture. *If evolution happened, then death existed for a billion years before man evolved. Death would not be a consequence of Adam's sin; Adam's sin would simply be a fiction, believed only by "literalists." And if sin is a fiction, we don't need a Savior! (Also, if there is no such thing as sin—or a Creator—there are no moral absolutes.* See **"What Are the Social Consequences of Belief in Evolution?"** on pages 463–465.)

These are scary thoughts for countless Christians. Some search for ways to reinterpret the Bible to harmonize it with evolution. They are called "theistic evolutionists." Others who have great confidence in and a broad understanding of the Bible know that these reinterpretations produce more contradictions than they resolve. [See **"Is Evolution Compatible with the Bible?"** on pages 451–457.] However, the last thing they want to do is argue with scientists. For some—including myself at one time—image and intellectual respectability must be preserved. Scientific answers often seem more credible and objective than various theological positions. Also, churches strive for internal harmony; raising this issue could bring disharmony. For any or all of these reasons, some Christians prefer to avoid the origins issue, even if evangelism suffers. They hold Position 4.

Finally, those holding Positions 2 and 5 are examining the evidence. Most are surprised and excited by what they are learning. In fact, after seeing the evidence, the frequent reaction is, "Why haven't I been told this before?" Rather than being intimidated by science, a subject they may have disliked in school, they are amazed at the simple, compelling evidence for creation and a global flood. Hundreds of topics and scientific discoveries supporting creation and the flood fascinate most people and are easy to discuss, even with strangers. In effect, this becomes a powerful pre-evangelistic tool. While no one has all the answers concerning our origins, be assured that the scientific evidence is overwhelmingly consistent with

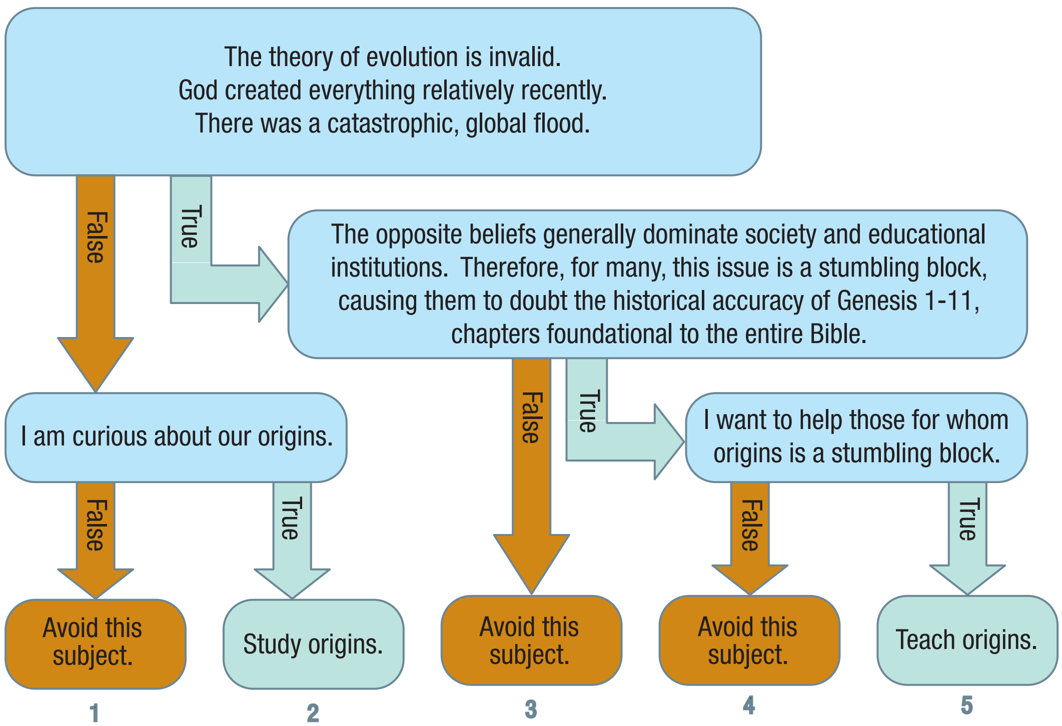


Figure 185: Five Views on Origins. People generally fall into five categories when it comes to the question of origins. Individuals of all ages and academic, scientific, and theological backgrounds occupy each category.

Genesis 1–11 and opposes evolution. In fact, it is extremely difficult to find any knowledgeable evolutionist willing to debate the issue—orally or in writing—with someone who understands this evidence.

Most Christians feel a burden to evangelize—to take seriously the great commission. What are the major obstacles to evangelism? People give many reasons for rejecting Christ:

- Christians are hypocrites, judgmental, dogmatic, legalistic, and out of touch with reality.
- My past misdeeds could never be forgiven.
- I prefer to live without biblical constraints.
- I am too busy to consider the matter.
- I prefer another religion.
- Evolution proves that the Bible is wrong.
- God is unnecessary.
- A loving God would not allow the suffering and evil we see in the world.
- The Bible is outdated; it contains myths and errors.

A correct understanding of origins overcomes several of these objections directly. Other objections result, to a large extent, from a nonbeliever's diminished understanding of the Bible. For those who do not believe the Bible is accurate, it does little good to assert, "The Bible says so!" What better way to establish the remarkable accuracy and authority of Scripture than by showing that Genesis 1–11 (the most discredited portion of the Bible to the secular world) is scientifically accurate? Understanding Genesis helps the Bible come alive. Ignoring the origins issue leaves evolution, a major obstacle to many, unopposed. For the church, evolution is like an elephant that has occupied the church's living room for over a century. Instead of accommodating the beast, why not remove it?

When speaking to the Jews, all of whom knew there was a Creator, the Apostle Paul could begin with Jesus Christ and the gospel. However, when speaking to Greek pagans, Paul first had to explain that there is a Creator (Acts 14:15, 17:24–28). Because we live in an increasingly pagan society that is bombarded daily by claims of evolution, helping others recognize the Creator seems to be a logical first step in bringing them to Christ.

But Christ was more direct. When confronting some of the religious leaders, Jesus said in John 5:46–47,

> *For if you believed Moses, you would believe Me; for he wrote of Me. But if you do not believe his writings, how will you believe my words?*

What did Moses compile that has been so widely rejected for the last 150 years? Genesis 1–11, the most ridiculed—and to many Christians—embarrassing portion of the Bible. Elsewhere (John 1:3, Colossians 1:16) we are told that Christ was there in the beginning and "*all things have been created through Him and for Him.*" Also, Genesis 3:15 gave us the first hint of Christ and His work of salvation.

For the first half of my life, I held Position 1. During the next few years, I shifted from Position 2 to 3 to 4. Since then, I have been at Position 5. Christians are in all five positions. Where are you?

How Can the Study of Creation Be Scientific?

Let me define science.

> ***science:*** *A field of study seeking to better understand natural phenomena through the use of observations and experiments.*

Broad, but increasingly precise and concise, relationships are sought between causes and effects. These relationships, called *scientific laws*, help predict future phenomena and explain past events.

Notice, this does not mean that *the first cause* must be naturalistic. It is poor logic to say that because science deals with natural, cause-and-effect *relationships*, the first cause must be a natural event. Furthermore, if the first cause were a natural consequence of something else, it would not be the first cause. Scientific laws can give great insight on ultimate origins even though the first cause cannot, by definition, be duplicated. Yes, there was a beginning. [See Items 53 and 55 on page 31.]

Scientific conclusions, while never final, must be based on evidence.

> ***scientific evidence:*** *Something that has been measured with instruments or detected with our senses, is verifiable, and helps support or refute possible physical explanations.*

All evidence in Parts I and II of this book is based on observable, natural phenomena that others can check. (Part II contains 43 testable and potentially falsifiable predictions.) To most people, this evidence implies a creation and a global flood. This does not mean that the Creator (The First Cause) can be studied scientifically or that the Bible should be read in public-school science classes. (I have always opposed that.) Those who want evolution taught without the clear evidence opposing it, in effect, wish to censor a large body of scientific evidence from schools. That is wrong. Also, the consequences of a global flood have been misinterpreted as evidence for evolution, not as evidence for a flood. That misinterpretation, unfortunately, is taught as science. [See Part II.]

Explanations other than creation or a global flood may someday be proposed that are (1) consistent with all that evidence and (2) demonstrable by repeatable, cause-and-effect relationships. Until that happens, those who ignore known evidence are being quite unscientific. Evolutionists' refusal to debate this subject (see pages 473–476) and their speculations on cause-and-effect phenomena that cannot be demonstrated also show poor science, especially when so much evidence opposes those speculations.

Evolutionists raise several objections. Some say, "Even though evidence may imply a sudden beginning, creation is supernatural (not natural) and cannot be entertained as a scientific explanation." Of course, no one understands *scientifically* how the universe came into existence—how space, time, matter, and the laws of physics began. [See Figure 205 on page 461 and the paragraph preceding that figure.] Others, not disputing that the flood best explains many features on earth, object to a global flood, because the Bible—a document they wish to discredit—speaks of such a flood. Still others object to the starting point for the flood (given on page 122), but in science, all starting points are possibilities. The key question must always be, "What best explains all the evidence?"

Also, the source of a scientific idea does not need to be scientifically derived. For example, Friedrich Kekulé discovered the ring structure of benzene in a dream in which a snake grabbed its tail. Kekulé's discovery laid the basis for structural chemistry. Again, what is important is not the source of an idea, but whether all evidence supports it better than any other explanation. Science, after all, is a search for truth about how the physical universe behaves. Therefore, let's teach all the science.

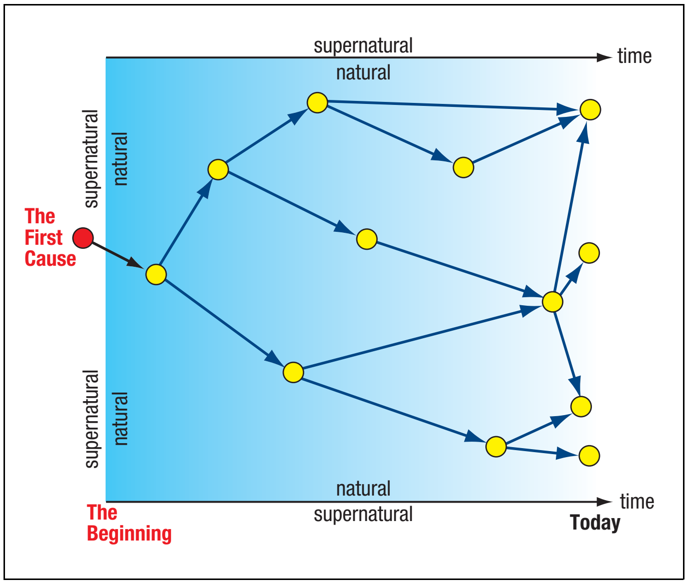


Figure 186: Causes and Effects. Each arrow's tail represents a cause, and each yellow circle represents an effect. The arrow itself is the cause-to-effect relationship. Yellow circles also represent scientific evidence that to most people suggests a creation and a global flood. All of us, including students, should be free to reach our own conclusions about origins after learning the evidence and all reasonable explanations. Withholding that information in schools or misrepresenting it in the media is inexcusable.

The first cause appears to be supernatural, or beyond the natural (blue area). Evolutionists often say that the yellow circles and their scientific implications cannot be presented in science classrooms, because the first cause (red circle) is supernatural. Subjects outside the natural (including biblical descriptions of creation and the flood that are so consistent with the physical evidence) are inappropriate for publicly financed science education. However, excluding what is observable and verifiable in nature, along with possible causes, is bad science, misleading, and censorship. Creation science, then, is the study of this scientific evidence.

Galaxies Are Billions of Light-Years Away, So Isn't the Universe Billions of Years Old?

The logic behind this common question has several hidden assumptions, two of which are addressed by the following italicized questions:

a. *Was space, along with light emitted by stars, rapidly stretched out soon after creation began?* If so, energy would have been added to the universe and starlight during that stretching. Pages 383–388 show that the scientific evidence clearly favors this stretching explanation over the big bang theory, which also claims that space expanded rapidly. (Yet, the big bang theory says all this expansion energy, plus all the matter in the universe, was, at the beginning of time, inside a volume much smaller than a pinhead.
b. *Has starlight always traveled at its present speed—about 186,000 miles per second or, more precisely, 299,792.458 kilometers per second?*

If either (a) space and its starlight were stretched out, or (b) the speed of light was much faster in the past, then distant stars should be visible in a young universe. Here we will address possibility (b) by examining the historical measurements of the speed of light.

Historical Measurements. During the past 300 years, at least 164 separate measurements of the speed of light have been published. Sixteen different measurement techniques were used. Astronomer Barry Setterfield of Australia has studied these measurements, especially their precision and experimental errors.[1] His results show that ***the speed of light has apparently decreased so rapidly that experimental error cannot explain it!*** In the seven instances where the same scientists remeasured the speed of light with the same equipment years later, a decrease was always reported. The decreases were often several times greater than the reported experimental errors. I have conducted other analyses that weight (or give significance to) each measurement according to its accuracy. Even after considering the wide range of accuracies, it is hard to see how one can claim, with any statistical rigor, that the speed of light has remained constant.[2]

M. E. J. Gheury de Bray, in 1927, was probably the first to propose a decreasing speed of light.[3] He based his conclusion on measurements spanning 75 years. Later, he became more convinced and twice published his results in *Nature*,[4] possibly the most prestigious scientific journal in the world. He emphasized, "If the velocity of light is constant, how is it that, ***invariably***, new determinations give values which are lower than the last one obtained … There are twenty-two coincidences in favour of a decrease of the velocity of light, while there is not a single one against it."[5] [emphasis in original]

Although the measured speed of light has decreased only about 1% during the past three centuries, the decrease is statistically significant, because measurement techniques can detect changes thousands of times smaller. While the older measurements have greater errors, the trend of the data is startling. The farther back one looks in time, the more rapidly the speed of light seems to have been decreasing. Various mathematical curves fit these three centuries of data. When some of those curves are projected back in time, the speed of light becomes so fast that light from distant galaxies conceivably could have reached Earth in several thousand years.

No scientific law requires the speed of light to be constant.[6] Many simply assume that it is constant, and of course, changing old ways of thinking is sometimes difficult. Russian cosmologist, V. S. Troitskii, at the Radiophysical Research Institute in Gorky, is also questioning some old beliefs. He concluded, independently of Setterfield, that ***the speed of light was 10 billion times faster at time zero!***[7] Furthermore, he attributed the cosmic microwave background radiation and most redshifts to this rapidly decreasing speed of light. Setterfield reached the same conclusion concerning redshifts by a different method. If either Setterfield or Troitskii is correct, the big bang theory will fall (with a big bang).

Other cosmologists are proposing an enormous decay in the speed of light.[8] Several of their theoretical problems with the big bang theory are solved if light once traveled millions of times faster.[9]

Atomic vs. Orbital Time. Why would the speed of light decrease? T. C. Van Flandern, working at the U.S. Naval Observatory, showed that atomic clocks are probably slowing relative to orbital clocks.[10] Orbital clocks are based on orbiting astronomical bodies, especially Earth's one-year period about the Sun. Before 1967, one second of time was defined by international agreement as 1/31,556,925.9747 of the average time it takes Earth to orbit the Sun. On the other hand, atomic clocks are based on the vibrational period of the cesium-133 atom. In 1967, a second was redefined as 9,192,631,770 oscillations of the cesium-133 atom. Van Flandern showed that if atomic clocks are "correct," the orbital speeds of Mercury, Venus, and Mars are increasing. Consequently, the gravitational "constant" should be changing. However, he noted that if orbital clocks are "correct," then the gravitational

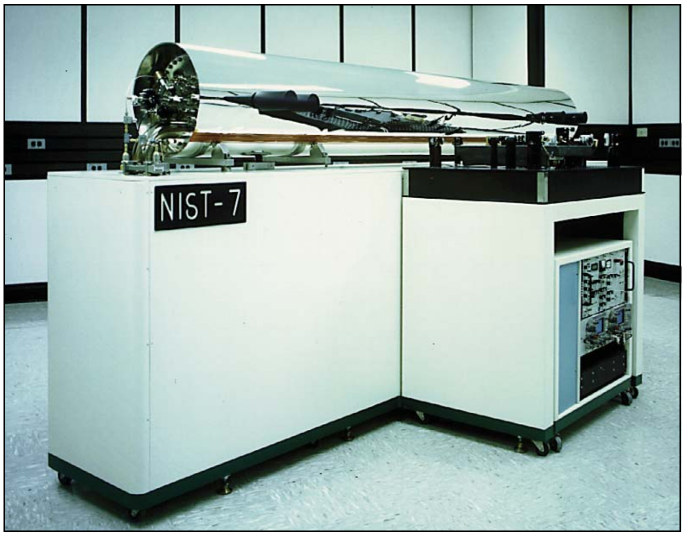


Figure 187: Atomic Clock. This atomic clock at the United States National Institute of Standards and Technology is named NIST-7. If its time were compared with a similar clock 6 million years from now, they might differ by only one second! A newer development, called NIST F-1, will achieve three times greater precision by cooling the vibrating atoms to nearly absolute zero. Despite the extreme precision of atomic clocks, we have no assurance that they are not all drifting relative to "true" time. In other words, we can marvel at the *precision* of atomic clocks, but we cannot be certain of their *accuracy*.

constant is truly constant, but atomic vibrations *and* the speed of light are decreasing. The drift between the two types of clocks was only several parts per billion per year. But again, the precision of the measurements is so good that the discrepancy is probably real.

For the following four reasons, orbital clocks seem to be correct and atomic frequencies are probably slowing very slightly.

- If atomic clocks and Van Flandern's study are correct, the gravitational "constant" should be changing. Other studies have not detected variations in the gravitational constant.
- If a planet's orbital speed increased (and all other orbital parameters remained the same), the planet's energy would increase. That would violate the law of conservation of mass-energy.
- If atomic time is slowing, then clocks based on the radioactive decay of atoms should also be slowing. Radiometric dating techniques would give ages that are too old. This would bring radiometric clocks more in line with most dating clocks. [See pages 39–43.] It would also explain why no primordial isotopes have half-lives of less than 50 million years. Such isotopes simply decayed away when radioactive decay rates were much greater.[11]
- If atomic frequencies are decreasing, then five "properties" of the atom, such as Planck's constant, should also be changing. Statistical studies of past measurements show that four of the five "constants" are changing—and in the right direction.[12]

So, orbital clocks seem to be more ***accurate*** than the extremely ***precise*** atomic clocks.[13]

I initially doubted Setterfield's claim, because the decrease in the speed-of-light measurements ceased in 1960. Large, one-time changes seldom occur in nature. The measurement techniques were precise enough to detect any decrease in the speed of light after 1960, if the trend of the prior three centuries had continued. Later, Setterfield realized that beginning in the 1960s, atomic clocks were used to measure the speed of light. If atomic frequencies are decreasing, then both the measured quantity (the speed of light) and the newly adopted measuring tool (atomic clocks) are changing at the same rate. Naturally, no relative change would be detected, and the speed of light would be constant in atomic time—but not orbital time.

Misconceptions. Does the decrease in the speed of light conflict with the statement frequently attributed to Albert Einstein that the speed of light is constant? Not really. Einstein said that the speed of light was not altered by the velocity of the light's source. Setterfield says that the speed of light decreases over time.

Einstein's statement that *the speed of light is independent of the velocity of the light source,* is called Einstein's Second Postulate. (Many have misinterpreted it to mean that "Einstein said the speed of light is constant over time.") Einstein's Second Postulate is surprising, but probably true. Wouldn't we expect a ball thrown from a fast train in the forward direction to travel faster than one thrown in the opposite direction, at least to an observer on the ground? While that is true for a thrown ball, some experimental evidence indicates it is not true for light.[14] Light, launched from a fast-moving train, will travel at the same speed in all directions. This strange property of light led to the more extensive theory of special relativity.[15]

Some people give another explanation for why we see distant stars in a young universe. They believe that God created a beam of light between Earth and each star. Of course, a creation would immediately produce completed things. Instantly, they would look much older than they really were. This is called "creation with the appearance of age." The concept is sound. However, for starlight, this presents two difficulties:

- Bright, exploding stars are called *supernovas.* If starlight, seemingly from a supernova, had been created en route to Earth and did not originate at the surface of an exploding star, then what exploded? Only a relatively short beam would have

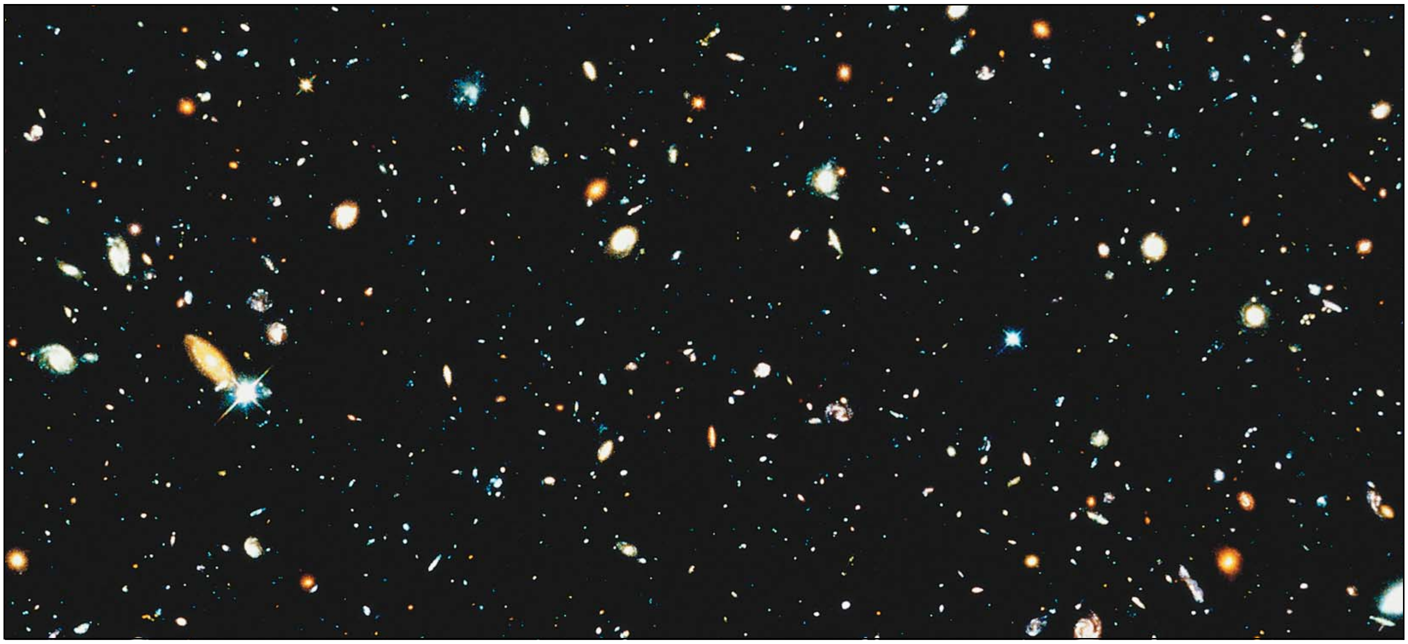


Figure 188: Hubble Deep Field North. The Hubble Space Telescope, searching for evolving galaxies in December 1995, focused for 10 continuous days on a tiny patch of sky, so small when viewed from Earth that *a grain of sand held at arm's length would cover that area.* This picture of that tiny patch of sky is called Hubble Deep Field North. Most objects in it are not isolated stars, but galaxies, each containing billions of stars. Of the 3,000 galaxies photographed that emitted enough light to measure their redshifts, which presumably measure distance, all seemed surprisingly mature. As stated in *Scientific American*, "the formation of 'ordinary' spiral and elliptical galaxies is apparently still out of reach of most redshift surveys."[16] Moreover, fully formed *clusters of galaxies*, not just galaxies, are seen at the greatest distances visible to the Hubble Space Telescope.[17] In 1998 and 2004, similar pictures—with similar results—were taken.

Think about this. There is not enough time in the age of the universe (even as evolutionists imagine it, *times a billion*) for gravity to pull together all the particles comprising clusters of galaxies.[18] (As explained under **"Galaxies"** on page 36, clusters of galaxies cannot form, even granting all this time.) Because the most current studies show fully-formed galaxies even farther away than those shown above,[19] creation becomes the logical and obvious alternative. We may be seeing galaxies as they looked months after they were created. Vast amounts of time are no longer needed. [See page 392.]

been created near Earth. If the image of an explosion was created on that short beam of light, then the star never existed and the explosion never happened. One finds this hard to accept.

- Every hot gas radiates a unique set of precise colors, called its ***emission spectrum***. The gaseous envelope around each star also emits specific colors that identify the chemical composition of the gas. Because all starlight has emission spectra, this strongly suggests that a star's light originated at the star—not in cold, empty space. Each beam of starlight also carries other information, such as the star's spin rate, magnetic field, surface temperature, and the chemical composition of the cold gases between the star and Earth. Of course, God could have created this beam of light with all this information in it. However, the real question is not "Could God have done it?" but "Did He?"

Therefore, starlight seems to have originated at stellar surfaces, not in empty space.

Surprising Observations. Starlight from distant stars and galaxies is redshifted—meaning that their light is redder than one might expect. Although other interpretations are possible, most astronomers have interpreted redshifted light to be a wave effect, similar to that of the lower pitch of a train's whistle when the train is going away from an observer. As the wave emitter (train or star) moves away from an observer, the waves are stretched, making them lower in pitch (for the train) or redder in color (for the star or galaxy). The greater a star's or galaxy's redshift, the faster it is supposedly moving away from us.

Since 1976, William Tifft, a University of Arizona astronomer, has found that the redshifts of distant stars and galaxies typically differ from each other by only a few fixed amounts.[20] This is very strange if stars are actually moving away from us. It would be as if galaxies could travel only at specific speeds, jumping abruptly from one speed to another, without passing through intermediate speeds. If stars are not moving away from us at high speeds, the big bang theory is wrong, along with many other related beliefs in the field of cosmology. Other astronomers, not initially believing Tifft's results, did similar work and reached the same conclusion.

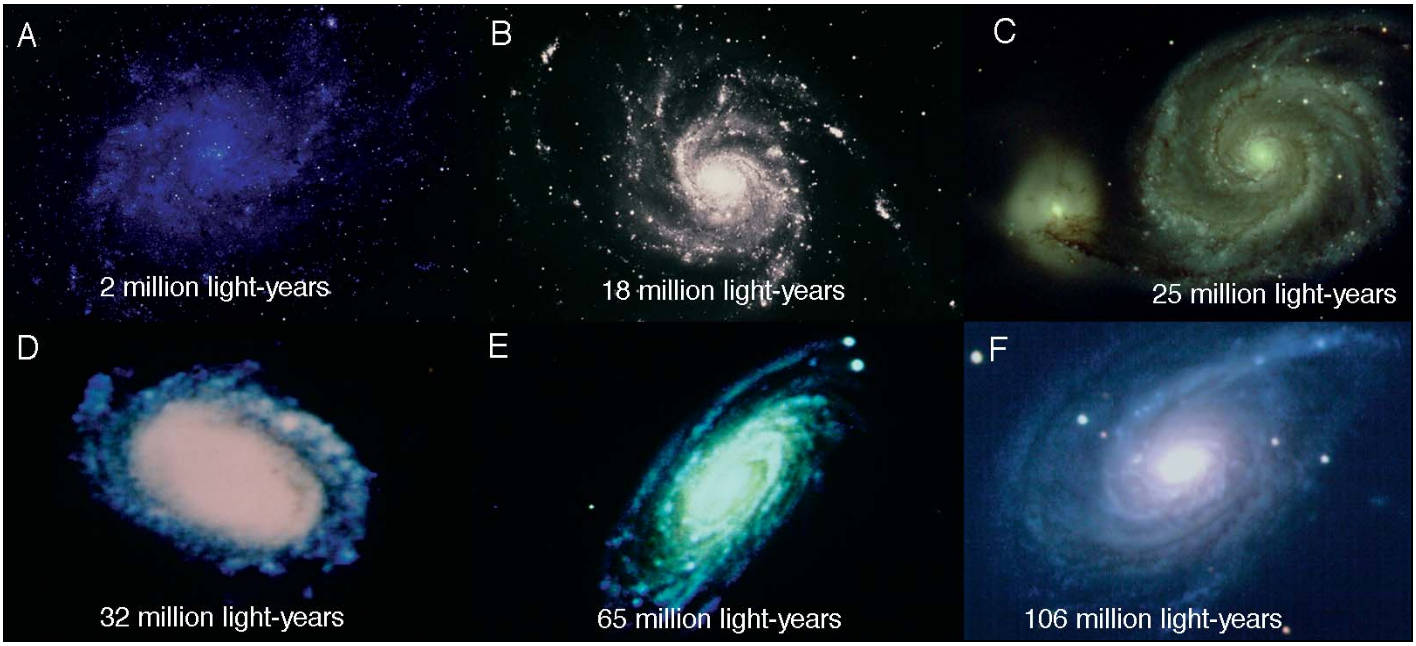


Figure 189: Spiral Galaxies. The arms in these six representative spiral galaxies have about the same amount of twist. Their distances from Earth are shown in light-years. (One light-year, the distance light travels in one year, equals about 5,879,000,000,000 miles.) For the light from all galaxies to arrive at Earth tonight, the more distant galaxies, which had to release their light long before the closer galaxies, did not have as much time to rotate and twist their arms. Therefore, farther galaxies should have less twist. Of course, if light traveled millions of times faster in the past, the farthest galaxies did not have to send their light long before the nearest galaxies. Spiral galaxies should have similar twists. This turns out to be the case.[21] The galaxies are: A) M33 or NGC 598; B) M101 or NGC 5457; C) M51 or NGC 5194; D) NGC 4559; E) M88 or NGC 4501; and F) NGC 772. All distances are taken from R. Brent Tully, *Nearby Galaxies Catalog* (New York: Cambridge University Press, 1988).

All atoms give off tiny bundles of energy (called *quanta*) of fixed amounts—and nothing in between. So, Setterfield believes that the "quantization of redshifts," as many describe it, is an atomic effect, not a strange recessional-velocity effect. If space slowly absorbs energy from all emitted light, it would do so in fixed increments, which would redshift starlight, with the farthest star's light red-shifting the most. Setterfield is working on a theory to tie this and the decay in the speed of light together. If he is correct, we should soon see the redshifts of a few distant galaxies suddenly decrease. This may explain why two distinct redshifts are seen in each of several well-studied galaxies;[22] they are obviously not flying apart!

Another surprising observation is that most distant galaxies look remarkably similar to nearer galaxies. For example, galaxies are fully developed and show no signs of evolving. This puzzles astronomers.[23] If the speed of light has decreased drastically, these distant, yet mature, galaxies no longer need explaining. Also, the light from a distant galaxy would have reached Earth not too long after the light from nearby galaxies. This may be why spiral galaxies, both near and far, have similar twists. [See Figure 189.]

A Critical Test. If the speed of light has decreased a millionfold, *we should observe events in outer space in extreme slow motion.* Here is why.

Imagine a time in the distant past when the speed of light was a million times faster than it is today. On a hypothetical planet, billions of light-years from Earth, a light started flashing toward Earth every second. Each flash then began a very long trip to Earth. Because the speed of light was a million times greater than it is today, those initial flashes were spaced a million times farther apart than they would have been at today's slower speed of light.

Now, thousands of years later, imagine that throughout the universe, the speed of light has slowed to today's speed. The first of those light flashes—strung out like beads sliding down a long string—are approaching Earth. The large distances separating adjacent flashes have remained constant during those thousands of years, so the moving flashes slowed in unison. Because the first flashes to strike Earth are spaced so far apart, they will strike Earth every million seconds. In other words, we are seeing past events on that planet (the flashing of a light) in slow motion. If the speed of light has been decreasing since the creation, then the farther out in space we look, the more extreme this slow motion becomes.

About half the stars in our galaxy are binary. That is, they and a companion star are in a tight orbit around their common center of mass. If there is a "slow-motion effect," the apparent orbital periods of binary stars should tend to increase with increasing distance from Earth. *If the speed* *of light has been decreasing, the Hubble Space Telescope may eventually find that binary stars at great distances have very long orbital periods, showing that we are observing them in slow motion.*

References and Notes

1. Trevor Norman and Barry Setterfield, *The Atomic Constants, Light, and Time* (Box 318, Blackwood, South Australia, 5051: self-published, 1987).

2. Two creationist physicists have claimed that the data shows no statistically significant change in the speed of light. See, for example:

- Gerald E. Aardsma, "Has the Speed of Light Decayed?" *Impact*, No. 179 (El Cajon, California: The Institute for Creation Research), May 1988.

- Gerald E. Aardsma, "Has the Speed of Light Decayed Recently?" *Creation Research Society Quarterly*, Vol. 25, June 1988, pp. 36–40.

- Robert H. Brown, "Statistical Analysis of the Atomic Constants, Light and Time," *Creation Research Society Quarterly*, Vol. 25, September 1988, pp. 91–95.

  Their calculations contain mathematical errors which, if corrected, would support the hypothesis that the speed of light has decreased. I have discussed these matters with each author. The following professional statisticians have verified my conclusions or have reached similar conclusions independently:

  Michael Hasofer, University of New South Wales, Sidney 2033, Australia.

  David J. Merkel, 11 Sunnybank Road, Aston, Pennsylvania 19014, U.S.A.

  Alan Montgomery, 218 McCurdy Drive, Kanata, Ontario K2L 2L6, Canada.

3. "The Velocity of Light," *Science*, Vol. 66, Supplement x, 30 September 1927.

4. M. E. J. Gheury de Bray, "The Velocity of Light," *Nature*, 24 March 1934, p. 464.

- M. E. J. Gheury de Bray, "The Velocity of Light," *Nature*, 4 April 1931, p. 522.

5. Ibid.

6. Light beams are considered to be traveling in a vacuum. Light traveling through any substance—such as air, water, or glass—travels at slightly slower speeds.

- In two published experiments, the speed of light was exceeded by as much as a factor of 100! The first experiment involved radio signals which, of course, are a type of light. [See P. T. Pappas and Alexis Guy Obolensky, "Thirty Six Nanoseconds Faster Than Light," *Electronics and Wireless World*, December 1988, pp. 1162–1165.] The second report referred to a theoretical derivation and a simple experiment that allowed electrical signals to greatly exceed the speed of light. This derivation follows directly from Maxwell's equations. The special conditions involved extremely thin electrical conductors with very low capacitance and inductance. [See Harold W. Milnes, "Faster Than Light?" *Radio-Electronics*, Vol. 54, January 1983, pp. 55–58.]

  Another phenomenon allows light to slightly exceed its normal speed. [See Julian Brown, "Faster Than the Speed of Light," *New Scientist*, 1 April 1995, pp. 26–29. Also see Jon Marangos, "Faster than a Speeding Photon," *Nature*, Vol. 406, 20 July 2000, pp. 243–244.] However, this effect does not explain distant light in a young universe.

7. V. S. Troitskii, "Physical Constants and the Evolution of the Universe," *Astrophysics and Space Science*, Vol. 139, December 1987, pp. 389–411.

8. *"We have shown how a time varying speed of light could provide a resolution to the well-known cosmological puzzles."* Andreas Albrecht and João Magueijo, "A Time Varying Speed of Light as a Solution to Cosmological Puzzles," *Physical Review D*, 15 February 1999, p. 043516-9. [The authors state that light may have traveled thirty orders of magnitude faster than it does today!]

- *"It is remarkable when you can find one simple idea* [a decaying speed of light] *that has so many appealing consequences."* John D. Barrow, Professor of Astronomy and Director of the Astronomy Centre at the University of Sussex, as quoted by Steve Farrar, "Speed of Light Slowing Down," *London Sunday Times*, 15 November 1998.

- *"If light initially moved much faster than it does today and then decelerated sufficiently rapidly early in the history of the Universe, then all three cosmological problems—the horizon, flatness and lambda problems—can be solved at once."* John D. Barrow, "Is Nothing Sacred?" *New Scientist*, Vol. 163, 24 July 1999, p. 28.

  Two comments. First, each problem Barrow mentions is actually a reason for concluding the big bang theory is wrong. Second, no scientific law says that the speed of light is a constant. It has only been assumed to be such. In fact, today it is arbitrarily *defined* as a constant.

9. For example, "the horizon problem" recognizes that opposite extremes of the universe have the same temperature. Why should this be? The universe isn't old enough for such vastly separated regions ever to have had contact with each other. Light doesn't travel fast enough—at least not today.

10. T. C. Van Flandern, "Is the Gravitational Constant Changing?" *The Astrophysical Journal*, Vol. 248, 1 September 1981, pp. 813–816.

- T. C. Van Flandern, "Is the Gravitational Constant Changing?" *Precision Measurement and Fundamental Constants II*, editors B. N. Taylor and W. D. Phillips,

National Bureau of Standards (U.S.A.), Special Publication 617, 1984, pp. 625–627.

11. Some who believe in an old universe have a different explanation. Those isotopes are extinct because so much time has passed. However, this explanation raises a counterbalancing question: How did those isotopes, and 97% of all elements, form? The standard answer is that these elements appeared during 13.7 billion years' worth of supernova explosions. This is speculation, because no supporting evidence has been found. Besides, in our galaxy, we see the remnants of only 7,000 years' worth of supernovas. [See **"Supernova Remnants"** on page 43.]

12. Alan Montgomery and Lambert Dolphin, "Is the Velocity of Light Constant in Time?" *Galilean Electrodynamics*, Vol. 4, September–October 1993, pp. 93–97.

13. "Precision" should not be confused with "accuracy." Atomic clocks are very precise, but not necessarily accurate. They keep very consistent time with each other, and each atomic clock can subdivide a second into 9 billion parts. This is remarkable ***precision***. But what if this entire global network of atomic clocks is drifting—speeding up or slowing down? Precision, while impressive, is a necessary but not sufficient requirement for accuracy.

14. Kenneth Brecher, "Is the Speed of Light Independent of the Velocity of the Source?" *Physical Review Letters*, Vol. 39, 24 October 1977, pp. 1051–1054.

15. Another question concerns Einstein's well-known formula, $E=mc^2$, which gives the energy (E) released when a nuclear reaction annihilates a mass (m). If the speed of light (c) decreases, then one might think that either E must decrease or m must increase. Not necessarily.

    In the universe, time could flow according to either atomic time or orbital time. Under which standard would $E=mc^2$ be a true statement? Mass-energy would be conserved under both; in other words, the energy or mass of an isolated system would not depend on how fast time passed. Obviously, $E=mc^2$ would be true in atomic time where c is constant, but not in orbital time where c appears to decrease. Today, $E=mc^2$ will be approximately correct even in orbital time.

    Nuclear reactions convert mass to energy. Unfortunately, the extremely small mass lost and large energy produced cannot be measured precisely enough to test whether $E=mc^2$ is absolutely true in orbital time. Even if mass and energy were precisely measured, this formula has embedded in it *an experimentally-derived, unit-conversion factor* that requires a time measurement by some clock. Which type of clock should be used: an orbital clock or an atomic clock? Again, we can see that $E=mc^2$ is "clock dependent."

    If c has decreased (using the orbital time standard), neither length, electrical charge, nor temperature standards would change. Therefore, chemical and nuclear reactions would not change. However, the *speed* of chemical and nuclear reactions would change, because the vibrational frequencies of atoms and nuclei would change. Also, radioactive decay rates, which depend on the vibrational frequency of the nucleus, would decrease if c decreased.

16. F. Duccio Macchetto and Mark Dickerson, "Galaxies in the Young Universe," *Scientific American*, Vol. 276, May 1997, p. 95.

17. Govert Schilling, "Early Start for Lumpy Universe," *Science*, Vol. 281, 11 September 1998, p. 1593. [See also E. J. Ostrander et al., "The Hubble Space Telescope Medium Deep Survey Cluster Sample: Methodology and Data," *The Astronomical Journal*, Vol. 116, December 1998, pp. 2644–2658.]

18. This problem for conventional astronomy has been quietly recognized for several decades.

- See Endnote 7 on page 387.

19. J. A. Stevens et al., "The Formation of Cluster Elliptical Galaxies as Revealed by Extensive Star Formation," *Nature*, Vol. 425, 18 September 2003, pp. 264–267.

- See Endnote 15 on page 387.

20. William G. Tifft, "Properties of the Redshift. III. Temporal Variation," *The Astrophysical Journal*, Vol. 382, 1 December 1991, pp. 396–415.

21. *"The biggest challenge to the standard model of galaxy formation could be the number of large galaxies showing the spiral structure in the early universe."* Ivo Labbé, as quoted by Ron Cowen, "Mature Before Their Time," *Science News*, Vol. 163, 1 March 2003, p. 139.

22. William G. Tifft and W. John Cocke, "Quantized Galaxy Redshifts," *Sky & Telescope*, January 1987, p. 19.

23. "Most Distant Galaxies: Surprisingly Mature," *Science News*, Vol. 119, 7 March 1981, p. 148.

Why Does the Universe Seem to Be Expanding?

At least eleven times, the Bible says that God "stretched out" or "stretches out" the heavens. [See Table 19.] For emphasis, important ideas are often repeated in the Bible. While we may have difficulty visualizing this stretching, we can be confident of its significance.

Table 19. Bible References to Stretching Out of the Heavens

Job 9:8	"[God] stretches out the heavens"
Ps 104:2	"stretching out heaven like a tent curtain"[1]
Is 40:22	"He … stretches out the heavens like a curtain and spreads them out like a tent"[1]
Is 42:5	"… God the Lord, who created the heavens and stretched them out"
Is 44:24	"I, the Lord, am the maker of all things, stretching out the heavens by Myself"
Is 45:12	"It is I who made the earth and created man upon it. I stretched out the heavens with My hands"
Is 48:13	"Surely My hand founded the earth and My right hand spread out the heavens."
Is 51:13	"the Lord your Maker, Who stretched out the heavens and laid the foundations of the earth"
Jer 10:12	"He has stretched out the heavens"
Jer 51:15	"He stretched out the heavens"
Zech 12:1	"the Lord who stretches out the heavens"

The context of each of the above verses deals with creation. Although past and present tenses (stretched and stretches) are expressed in these English translations, Hebrew verbs do not generally convey past, present, or future. Translators must rely on context and other clues to determine verb tense.

Even if we knew the intended Hebrew tense, is the stretching from God's perspective or man's? The creation was completed in six days (Exodus 20:11), suggesting that in God's time the heavens were stretched out during the creation week, perhaps on Day 4. However, in our time, some redshifted light from extreme distances—a consequence of this past stretching—is reaching us now.

The Hebrew word for stretched is *natah*. It does not mean an explosion, a flinging out, or the type of stretching that encounters increasing resistance, as with a spring or rubber band. *Natah* is more like the effortless reaching out of one's hand.

Expansion: Big Bang or Stretching?

The stretching explanation, proposed here, has similarities and differences with the big bang theory. Both the big bang and stretching explanations describe a very rapid expansion of the universe, beginning soon after time began, before all the laws of physics were in place. As one big bang authority stated:

> *In its standard form, the big bang theory maintains that the universe was born about 15 billion years ago from a cosmological singularity—a state in which the temperature and density are infinitely high. Of course, one cannot really speak in physical terms about these quantities as being infinite.* ***One usually assumes that the current laws of physics did not apply*** [during the big bang's rapid expansion]. … *One may wonder, What came before? If space-time did not exist then, how could everything appear* ***from nothing****? What arose first: the universe or the laws determining its evolution? Explaining this initial singularity—where and when it all began—still remains the most intractable problem of modern cosmology.*[2] [emphasis added]

Table 20. Comparison of Two Explanations for Expansion of the Universe

	Big Bang	Stretching
The universe was once much smaller. It began soon after time began and before all the laws of physics came into operation.[2] Energy and matter appeared out of nothing.	Yes	Yes
When did the expansion occur?	Expansion has been going on ever since the big bang.	Expansion occurred during the creation week.
Why is distant light redshifted?	The more distant the light source, the greater the expansion rate and redshift.	The light we see today from very distant objects shows the amount of stretching the light experienced.
Expansion began at almost a mathematical point.	Yes[3]	No
Expansion energy came from within the universe.	Yes	No
The initial temperature and density of matter was	nearly infinite	finite
All expansion energy was expended	within a tiny fraction (10^{-34}) of a second	as the expansion proceeded
Stars, galaxies, and black holes began forming	after 500,000,000 years, in an expanded universe	before the expansion

The stretching explanation, in contrast to the standard big bang theory, does not begin with a singularity—an infinitesimal point.[3] Nor does the energy expended in stretching out the heavens come from within the universe or during its first trillionth of a trillionth of a ten-billionth of a second (10^{-34} second) or less, as with the big bang theory. Energy flowed *into* the universe as stretching progressed. According to the big bang theory, stars, galaxies, and black holes began forming after hundreds of millions of years. According to the stretching explanation, *these bodies were formed (or began) near the beginning of time—during the creation week. Because matter and starlight occupy space,* *they were also stretched*. You can decide which explanation the following surprising evidence supports.

The Evidence

Accelerating Expansion. The redshift of distant starlight suggests an expansion. However, a big bang should produce only a decelerating expansion, not the accelerating expansion observed. [See **"Dark Thoughts"** on page 33.] Stretching, completed during the creation week, could have produced the accelerated expansion which is shown by the light that has finally reached earth from the edge of the visible universe.

Star Formation. Astronomers recognize that the densest gas cloud seen in the universe today could not form stars by any known means, including gravitational collapse, unless that gas was once thousands of times more compact.[4] Apparently, stars were formed before or as the heavens were stretched out.

Intergalactic Medium (IGM). Outer space is nearly a perfect vacuum. The IGM (the vast space between galaxies) contains about 10–100 hydrogen atoms per cubic meter. However, almost every hydrogen atom in the IGM, out to the farthest galaxies the best telescopes can see (13 billion light-years away), has been *ionized*—has lost its electron.

According to the big bang theory, for the first 400,000 years after the big bang, the expanding universe was so hot that all matter was ionized. Only after the universe had expanded (and cooled) enough could protons acquire an electron and produce neutral hydrogen. Then, after matter in the universe was no longer ionized, stars and galaxies, according to the theory, began evolving. (Note: reasons why stars and galaxies could not evolve are given on pages 32–36.)

This presents a major problem. What reionized the hydrogen that today pervades the IGM? No explanation has been found. Most big bang theorists had guessed that the radiation from the earliest stars and galaxies—after the universe had already expanded for hundreds of millions of years—was powerful enough to reionize the IGM. This now appears to not be the case.[5]

According to the stretching explanation, when the universe was initially created, it was extremely compact, so the intense light of DAY 1 and/or the light of stars and galaxies (created on DAY 4) ionized the surrounding gases. Then, the heavens were stretched out. Therefore, hydrogen in the IGM has always been ionized, just as we see it today.

Black Holes. A black hole is at the center of at least every nearby galaxy. (Black holes are so massive that nothing can escape their gravity—even light.) Astronomers admit that black holes must have existed very soon after the universe began,[6] but the big bang theory says that all matter was spread out uniformly after 300,000 years, before stars formed. That uniformity would prevent gravity from forming galaxies and black holes even over the supposed age of the universe.[7] However, stars and black holes could easily have formed or existed soon after the creation of matter and the universe, when the universe was much more compact[8]—before the heavens were stretched out. Had this stretching not occurred, all the matter in the universe would have collapsed into a black hole. Life would not exist.

Even though nothing should escape black holes, some black holes are expelling powerful jets at "up to 99.98 percent of the speed of light. These amazing outflows traverse distances larger than galaxies."[9] Stars sometimes expel jets, so this paradox could be resolved if space was stretched out as stellar jets and black holes formed.

Likewise, much of the expansion of supernova remnants over great distances may be due to the stretching, rather than the passage of millions of years.

Galaxies and Their Black Holes. The masses of black holes—one at the center of each galaxy—and the size of each galaxy are positively correlated. (The larger the galaxy, the larger its black hole.) According to the standard explanations for galaxy formation, this should not be,[10] because black holes are so small in volume compared to galaxies. If a massive black hole formed first, it would not be able to form a large galaxy, because black holes cannot affect something as large as a galaxy. Nor would a large galaxy necessarily produce a large black hole. What the positive correlation means is that *each galaxy and its central black hole formed simultaneously*,[11] something standard astronomy has been unable to explain.

But this is precisely what should happen based on the stretching explanation. Before the universe was stretched out, some regions contained more mass than other regions. The denser concentrations collapsed rapidly, forming massive black holes, but the stretching that quickly followed prevented all that concentration of mass from ending up in the black hole. Instead, a large galaxy was formed around the massive black hole. Less dense concentrations formed less massive black holes and the stretching that quickly followed produced a smaller galaxy.

Central Stars. About forty stars orbit within a few dozen light-hours of the black hole at the center of our Milky Way Galaxy. Those stars could never have evolved that close to a black hole, which has the mass of 4,300,000 suns, because the black hole's gravity would have prevented gas from collapsing to become a star.[12] However, those stars could have formed in a much denser environment,[13] before space was stretched out during the creation week.

Some astronomers say that these stars evolved far from the black hole and then migrated great distances toward the black hole. Such a migration, which seemingly violates the laws of physics,[14] must have been fast because the stars are so massive that their lifetimes are very short in astronomical terms. Also, matter (or stars) migrating toward black holes must radiate vast amounts of energy, but that energy is not observed in any wavelength.

Spiral Galaxies. If spiral galaxies formed billions of years ago, their arms should be wrapped more tightly around their centers than they are. Also, nearer galaxies should show much more "wrap" than more distant spiral galaxies. [See Figure 189 on page 380.] However, if space was recently stretched out, spiral galaxies could appear as they do.

Heavy Elements in Stars. According to the big bang theory, there are three generations of stars, each with increasing amounts of heavy elements. The first generation would have contained only hydrogen and helium. After hundreds of millions of years, second-generation stars would begin forming with heavier elements made inside first-generation stars that later exploded. Although some first-generation stars should still be visible, not one has ever been found. [See Endnote 56n on page 90.]

According to the stretching explanation, stars have always had some heavier chemical elements. The most distant stars, galaxies, and quasars that can be analyzed contain some of these heavier chemical elements.

Stellar Velocities. Stars in the outer parts of spiral galaxies travel much faster than they should based on physical laws. However, if those stars were nearer the centers of their galaxies only thousands of years ago—before the heavens were stretched out—they could have had the higher speeds we see. Those speeds would remain even after the heavens were stretched out. (So-called dark matter, which has not been directly measured or detected, would not need to be imagined to explain these velocities.)

Speeding Galaxies. A similar observation can be made about tight clusters of galaxies. Galaxies in clusters are traveling much faster than they should, based on their distances from their clusters' centers of mass.

Distant Galaxies. Massive galaxies and galaxy clusters are now found at such great distances that they must have formed soon after the universe began. The big bang theory cannot explain how such galaxy concentrations could have formed so quickly and so far away.[15] The stretching explanation says that galaxies and galaxy clusters began before the heavens were stretched out, when all matter was relatively confined.

Strings of Galaxies. It is widely recognized that gravity would not pull matter into long strings of hundreds or thousands of galaxies—even if the universe were unbelievably old. Instead, gravity, if acting over enormous time and distances, would form more spherical globs of matter. Yet, long, massive filaments of galaxies have been discovered.[16]

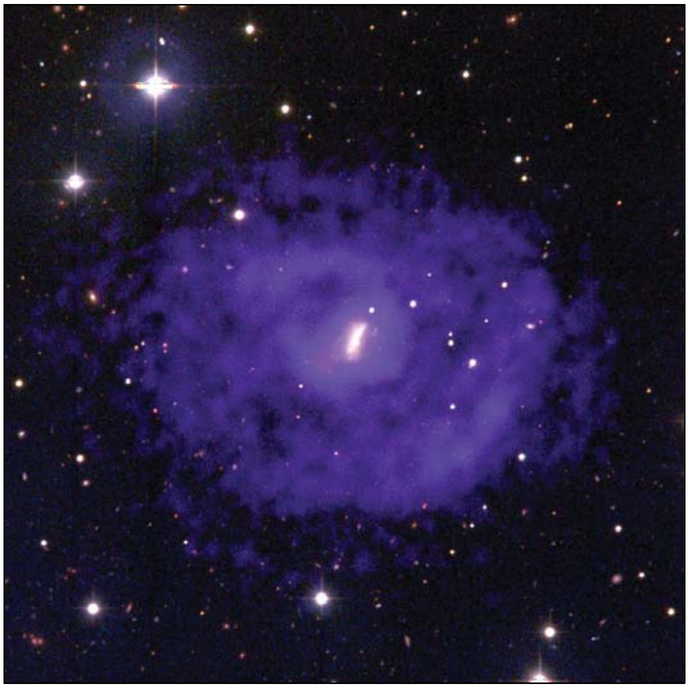


Figure 190: Dwarf Galaxy. An enormous hydrogen disk (blue) surrounds the dwarf galaxy UGC 5288 (bright white). This isolated galaxy, 16 million light-years from earth, contains about 100,000 stars and is 1/25 the diameter of our Milky Way Galaxy, which has at least 100,000,000,000 stars. The dwarf's mass is about 30 times too small to gravitationally hold onto the most distant hydrogen gas, so gravity could not have pulled the distant hydrogen gas into its disk. Because the gas is too evenly distributed and rotates so smoothly, it was not expelled from the galaxy or pulled out by a close encounter with another galaxy.

Hydrogen gas would have assumed this shape if space was once more compact and later was stretched out. Before the stretching, gravitational forces would have been much more powerful, thereby producing this smooth rotational pattern. This would have occurred recently, because the gaseous disk has not dispersed into the vacuum of space. (The galaxy is seen in visible light; the hydrogen disk is seen by a fleet of 27 radio telescopes.)

These strings of galaxies can be understood if galaxies were formed when all matter in the universe was initially confined to a much smaller volume. (In that small space, stars and galaxies formed either by the direct acts of a Creator or by the powerful gravitational forces resulting from so much extremely confined mass.) Then, the heavens were rapidly stretched out. Just as one might pull taffy into long strings, the stretched out heavens might contain long, massive strings of thousands of galaxies. A surprising number appear connected or aligned with other galaxies or quasars, as prominent astronomers have noted. [See **"Connected Galaxies"** on page 43.]

Dwarf Galaxies. Dwarf galaxies are sometimes embedded in a smoothly rotating disk of hydrogen gas that is much larger than the galaxy itself. The mass (hidden or otherwise) of each dwarf galaxy is insufficient to pull the gas into its disk shape,[17] but if this matter was once highly concentrated and then the space it occupied was recently stretched out, all observed characteristics would be explained. [See Figure 190.]

Colliding Galaxies. Some galaxies contain two distinct rotating systems, as if a galaxy rotating one way collided with another rotating the opposite way. Based on the speeds of galaxies we see and their vast separation distances today, such mergers would take billions of years.

Does this mean that the universe must be billions of years old? No. Before the heavens were stretched out, galaxies would have been closer to each other, resulting in much greater speeds and frequent collisions. Today, galaxies are so far apart that, according to astronomers' calculations, collisions should rarely happen. However, past galactic mergings are surprisingly common.[18]

If some galaxies merged over billions of years, why haven't the different rotations within a merged galaxy homogenized by now? Obviously, the mergings did not happen billions of years ago.[19]

Helium-2 Nebulas. Clouds of glowing, blue gas, called *helium-2 nebulas*, have been set aglow by something hot enough to strip two electrons from each helium atom. No known star—young or old—is hot enough to do so,[20] but compressed conditions before the heavens were stretched out would do this.

Dark "Science." The big bang theory must invoke unscientific concepts, such as "dark matter" and "dark energy," to try to explain the "stretched out heavens." What is dark matter and dark energy? Even believers in those ideas don't know.[21] [Dark matter, dark energy, and many other scientific problems with the big bang theory are discussed, beginning on page 32.]

Cosmic Microwave Background (CMB). The CMB is often given as evidence for the big bang theory. Actually, that radiation, when studied closely, is a strong argument against the big bang and evidence for the sudden creation of matter within an immense universe. [For details, see pages 389–391.]

Summary

With both the big bang and stretching explanations, it is difficult to imagine time beginning, the sudden presence of matter and energy in a small universe, space expanding, and a brief period when all the laws of physics did not operate. The big bang theory says that space expanded for a fraction of a second from a mathematical point—t*rillions of billions of times faster than the speed of light today.* The stretching theory says that a much smaller universe than we have today was rapidly stretched out, along with the matter and light in that space. Although no *scientific* explanation can be given for either form of expansion, we can see which explanation fits the observable evidence.

We also can appreciate why at least eleven Bible passages, involving five different writers, mention the "stretched out heavens." Another verse, Psalm 19:1, takes on a new depth of meaning: "*The heavens are telling of the glory of God, and their expanse is declaring the work of His hands.*"

References and Notes

1. The analogy of "stretching out heaven like a tent curtain" (Ps 104:2 and Is 40:22) suggests that the heavens existed in a smaller, denser, finite form before the stretching began. Also, the evidence cited in this section titled "Stellar Velocities," "Intergalactic Medium," "Speeding Galaxies," "Dwarf Galaxies," "Strings of Galaxies," "Colliding Galaxies," and "Helium-2 Nebulas" implies a finite universe before stretching began.
2. Andrei Linde, "The Self-Reproducing Inflationary Universe," *Scientific American*, Vol. 271, November 1994, p. 48.
3. *"According to inflationary cosmology, the universe* [began] *growing from a patch as small as* 10^{-26} *m, one hundred billion times smaller than a proton, ..."* Alan H. Guth and David I. Kaiser, "Inflationary Cosmology: Exploring the Universe from the Smallest to the Largest Scales," *Science*, Vol. 307, 11 February 2005, p. 885.
4. See **"Interstellar Gas"** on page 93.
5. *"*[Astronomer Richard S.] *Ellis notes that the new findings also hint at a puzzle. His team estimates that the distant galaxies, which are too tiny to be clearly resolved by Hubble, are making stars at a puny rate. In some cases, that rate is as low as the mass equivalent of 0.0025 suns per year. According to current models, that rate couldn't have generated enough ultraviolet starlight for a critical milestone in the evolution of the universe—the wrenching apart of neutral hydrogen into their subatomic constituents."* Ron Cowen, "Hubble's New Finds Go the Distance," *Science News*, Vol 176, 10 October 2009, p. 8.

◆ Andrew J. Bunker, Richard S. Ellis, et al., "The Contribution of High Redshift Galaxies to Cosmic Reionization: New Results from Deep WFC3 [Wide Field Camera 3] Imaging of the *Hubble* Ultra Deep Field," *arXiv:0909.2255*, 22 September 2009, pp. 1–13.

6. *"The masses of these early black holes are inferred from their* [quasar] *luminosities to be >10⁹ solar masses, which is a difficult theoretical challenge* [for the big bang theory] *to explain."* Rennan Barkana and Abraham Loeb, "Spectral Signature of Cosmological Infall of Gas Around the First Quasars," *Nature*, Vol. 421, 23 January 2003, p. 341.

- *"The daunting problem for theories of structure formation in the Universe is to understand how such huge black holes* [3 billion solar masses] *and the vast reservoirs of gaseous fuel were assembled so soon after the Big Bang …"* Edwin L. Turner, "Through a Lens Brightly," *Nature*, 27 June 2002, p. 905.

- *"… such black holes indeed formed early in the history of the universe and were already devouring matter voraciously a mere billion years after the Big Bang."* Ron Cowen, "Mature Before Their Time," *Science News*, Vol. 163, 1 March 2003, p. 139.

7. *"But the standard model* [the big bang theory] *still can't easily account for a large number of mature or massive galaxies in the early universe."* Ibid.

- *"But this uniformity* [in the cosmic microwave background (CMB) radiation] *is difficult to reconcile with the obvious clumping of matter into galaxies, clusters of galaxies and even larger features extending across vast regions of the universe, such as 'walls' and 'bubbles'."* Ivars Peterson, "Seeding the Universe," *Science News*, Vol. 137, 24 March 1990, p. 184.

- *"Gravity can't, over the age of the universe, amplify these irregularities enough* [to form huge clusters of galaxies]." Margaret Geller, as quoted by John Travis, "Cosmic Structures Fill Southern Sky," *Science*, Vol. 263, 25 March 1994, p. 1684.

- *"Yet how could the universe have gone from homogeneous plasma to pancakes to galaxies so quickly? Gravity alone was simply not strong enough to do it."* M. Mitchell Waldrop, "The Large-Scale Structure of the Universe," *Science*, Vol. 219, 4 March 1983, p. 1051.

- Robert Irion, "Early Galaxies Baffle Observers, but Theorists Shrug," *Science*, Vol. 303, 23 January 2004, p. 460.

8. *"Standard cosmological models implied that matter in the universe was not concentrated tightly enough to have formed black holes so early on. Clearly the models were wrong."* Michael Lemonick, "The Great Cosmic Census," *Discover*, March 2009, p. 64.

9. *"More embarrassing to astrophysicists is our lack of understanding of black hole jets—phenomena in which the forces near a supermassive black hole somehow conspire to spew out material at ultrarelativistic speeds (up to 99.98 percent of light speed). These amazing outflows traverse distances larger than galaxies, …"* Avery E. Broderick and Abraham Loeb, "Portrait of a Black Hole," *Scientific American*, Vol. 301, December 2009, p. 44.

10. *"For reasons not fully understood, it appears that the sizes of central black holes and the masses of their galaxies, especially the central bulges, are almost perfectly in step."* Charles Petit, "Ultra Massive: As Big As It Gets," *Science News*, Vol. 174, 25 October 2008, p. 20.

11. *"These black holes at the centers of galaxies are big (as black holes go). But compared with a galaxy, they're really small. So they don't have that much of an effect; we have nothing to fear. They only affect the very closest stars to them. But recently it was observed that the mass of a central black hole correlates with the mass of the galaxy around it! Before that observation, we didn't know if the black hole formed first and then the galaxy formed around it, or if the galaxy formed first and then the black hole formed from the galaxy. The correlation means that the black hole and galaxy had to form together. They couldn't be separate events because a black hole can't affect an object as big as a galaxy. Whatever gave rise to that galaxy had to give rise to the black hole."* Andrea Ghez, "Frontiers of Astronomy," *Discover*, May 2009, p. 44.

12. *"The black hole's inactivity* [today] *suggests that the central few light years doesn't contain enough raw material to make stars. And the enormous gravitational tidal forces around the black hole would seem to prohibit stars from forming even if the material were there: it's hard for a cloud of gas to contract into a star under its own gravity when something that weighs as much as four million stars is sitting next door."* Jeff Kanipe, "A Long Time Ago, in a Galaxy Not So Far Away," *Nature*, Vol. 446, 5 April 2007, p. 601.

- *"… the stars we studied to prove that there was a black hole turned out to be very young. Young stars have absolutely no right to be next to a black hole because a black hole should shear them apart* [if they evolved]. *We have no idea how these stars formed."* Ghez, p. 43.

13. *"In principle, this could have occurred if the density of the gases in the centre of the Galaxy was much higher in the past. Higher density would allow clumps in the clouds to collapse to form stars, even in the presence of a strong gravitational field* [of a black hole]." Ibid., p. 602.

14. *"Astrophysicists can model the accreting material to some extent, but it is unclear how gas in the accretion flow migrates from an orbit at a large radius to one near the horizon …"* Avery E. Broderick and Abraham Loeb, p. 44.

15. *"The discovery of massive, evolved galaxies at much greater distances than expected—and hence at earlier times in the history of the Universe—is a challenge to our understanding of how galaxies form."* Gregory D. Wirth, "Old Before Their Time," *Nature*, Vol. 430, 8 July 2004, p. 149.

- A. Cimatti et al., "Old Galaxies in the Young Universe," *Nature*, Vol. 430, 8 July 2004, p. 184.

- David Shiga, "Nursery Pictures," *Science News*, Vol. 167, 5 March 2005, pp. 148–149.

- *"Until now, we wouldn't think that you could make galaxies emerge that early in the universe."* George Helou, as quoted by Alex Hutchinson, "New and Old Galaxies Show Up in All the Wrong Places," *Discover*, January 2006, p. 61.

16. *"Thirty-seven of the brightest galaxies were detected, including a quasar, but thousands of galaxies were probably in the string, according to astronomer Dr. Paul Francis who heads the team. But none of the existing computer simulation models were able to reproduce galaxy strings as large as the one the team found. 'We are looking back four-fifths of the way to the beginning of the universe and the existence of this galaxy string will send astrophysicists around the world back to the drawing board to re-examine* [big bang] *theories of the formation of the universe,' Francis said. The simulations tell us that you cannot take the matter in the early universe and line it up in strings this large. There simply hasn't been enough time since the Big Bang for it to form structures this colossal."* Science & Space, "Galaxy Find Stirs Big Bang Debate" on 8 January 2004 at www.cnn.com/2004/TECH/space/01/08/galaxies.find.

- Paul J. Francis et al., "An 80 Mpc Filament of Galaxies at Redshift Z=2.38," presented to the American Astronomical Society (Atlanta, Georgia), 7 January 2004.

  [80 Mpc = 1,500,000,000,000,000,000,000 miles
  = 2,400,000,000,000,000,000,000 kilometers
  = 261,000,000 light-years]

- M. Mitchell Waldrop, "The Large-Scale Structure of the Universe Gets Larger—Maybe," *Science*, Vol. 238, 13 November 1987, p. 894.

- M. Mitchell Waldrop, "Astronomers Go Up Against the Great Wall," *Science*, Vol. 246, 17 November 1989, p. 885.

17. Robert Irion, "The Hunt for Stealth Galaxies," *Science*, Vol. 308, 20 May 2005, pp. 1104–1106.

- *"The existence of quiescent, extended gaseous disks around a handful of dwarf irregular galaxies is puzzling."* Liese van Zee, "A Large Gas Disk Around a Small Galaxy," *National Radio Astronomy Observatory Newsletter*, Issue 103, April 2005, p. 13.

18. *"Violent encounters between galaxies appear surprisingly common."* Joshua Barnes et al., "Colliding Galaxies," *Scientific American*, Vol. 265, August 1991, p. 40.

- *"… merging two spiral galaxies to make an elliptical* [galaxy] *is statistically improbable."* James E. Gunn, as quoted by Karen Hartley, "Mixing It Up in Space," *Science News*, Vol. 135, 8 April 1989, p. 219.

19. *"Other studies of elliptical galaxies have found additional signs of* ***recent*** *merging. In some ellipticals, for example, the central region rotates in one direction, while the outer parts spin the other way. Such a countervailing rotation pattern would be difficult to explain if these galaxies formed all of one piece but could come about quite naturally from a merger."* [emphasis added] Barnes et al., p. 41.

20. *"Hotter stars 'are not predicted by normal stellar evolution, so the presence of the He II nebulas is a bit of a mystery' comments Garnett …"* Donald R. Garnett, as quoted by Ron Cowen, "Gorgeous Gas," *Science News*, Vol. 163, 24 May 2003, p. 328.

21. *"No one knows what dark matter is, but they know what it is not. It's not part of the 'standard model' of physics that weaves together everything that is known about ordinary matter and its interactions."* Jenny Hogan, "Welcome to the Dark Side," *Nature*, Vol. 448, 19 July 2007, p. 241.

- *"We know little about that sea. The terms we use to describe its components, 'dark matter' and 'dark energy,' serve mainly as expressions of our ignorance."* David B. Cline, "The Search for Dark Matter," *Scientific American,* Vol. 288, March 2003, p. 52.

If the Sun and Stars Were Made on *Day 4*, What Was the Light of *Day 1*?

Light from the Sun and other stars is not the only way to illuminate the earth and produce day-night cycles. The light of *Day 1* may have been a consequence of the instantaneous creation of matter. To understand why, some basics must first be explained.

Before planets, plants, and people could be created, fundamental forces had to be created including the gravitational force and the electrical force. All things on earth—rocks, the chair you are sitting in, and your body—are pulled toward the center of the earth by the gravitational force. The atoms in each object are held together by powerful electrical forces.

Gravity. The Bible seems to mention the beginning of gravitational forces. In describing earth's earliest state, Genesis 1:2 says, "*And the earth was formless and void, … .*" The second half of that verse then states, "*… the Spirit of God was moving over the surface of the waters.*" Could the earth be formless but soon afterwards have a surface? Yes, if gravitational forces suddenly began acting to make a "*formless*" earth spherical.

The earth's particles, when created, would have been located at various distances from where they would finally rest after gravitational forces came into existence and pulled the particles together. Likewise, if atomic particles (electrons, protons, etc.) were not created in their equilibrium resting positions within atoms, the newly created electrical forces would have pulled electrons and protons—negatively and positively charged particles—toward each other to form atoms.

Electrons. Suppose electrons were created at various (even tiny) distances from what would become their first atoms. Negatively charged electrons would accelerate, or "fall," by electrical attraction toward positively charged nuclei. In doing so, they would emit light. Genesis 1:3 may be describing this: "*Then God said, 'Let there be light', and there was light.*"

Whenever electrical charges accelerate, electromagnetic radiation—which can include visible light—is given off. That is how an antenna works. Electrons surge up and down the antenna at a particular frequency, causing radio, television, or other electromagnetic waves to radiate out at that frequency.

If "a universe" of newly created electrons accelerated (or "fell") toward atomic nuclei, light with various frequencies would radiate. When light reflects enough times off surrounding matter, everything reaches a common temperature and the space between that matter becomes filled with ***blackbody radiation***.[1] If that space later expands, that radiation's temperature will drop.

Two Perspectives

A Creation Perspective. The instant matter was created, a burst of light emanated from every particle of matter in the universe. Light from one point on earth would reach other points in a tiny fraction of a second. The farther matter was from earth, the longer it would have taken for that light to reach earth. Just how long would depend on the velocity of light and how far matter extended from earth.

Visualize an observer sitting in a rowboat on a very large, glassy-smooth lake. At one instant, pebbles fall uniformly onto the entire lake. Assume that only one wave ripples out from each pebble's splash. Waves that began nearest the rowboat strike the boat first. As time passes, waves that began farther and farther out strike the boat. For the observer in the boat, the waves hitting the boat at any instant appear to have started from an imaginary ring centered on the boat and expanding at "wave velocity."

Now imagine a similar situation, but in three dimensions. An observer in the vacuum of outer space sees a constant stream of light coming from all directions—all emitted at the instant matter was created. It will appear to the observer that the light originated from an imaginary spherical shell with the observer at its center. The sphere's radius increases at the speed of light, but the observer receives the same amount of radiation—from all directions and at all times. This is because the expanding sphere's increasing area exactly balances the reduction in the radiation's intensity due to the increasing distance the light has traveled.

If, before space was stretched out, matter was created with positive and negative charges accelerating toward each other, we would see almost identical blackbody radiation coming from all directions. Such radiation was discovered in 1965 and is called the ***cosmic microwave background (CMB) radiation***. Its temperature today corresponds to a very cold 2.73 kelvins (-454.76°F). [Stretched out space is discussed on page 383: ***"Why Does the Universe Seem To Be Expanding?"***]

What would this light have looked like before the Sun, Moon, and stars were made on *Day 4* and before the heavens were stretched out? The initial burst of light from matter comprising the "*formless*" earth would disappear in less than a second. However, light would then reach earth from the surrounding sphere that expanded from earth at the velocity of light. Seconds or minutes later, light would arrive from the newly created matter from which the Sun would be made on *Day 4*. Hours later—and before the heavens were stretched out—light would begin arriving from matter that would form the bulk of the stars in our Milky Way Galaxy.

This bright, temporary source of light, from matter that would become our galaxy, would be concentrated in a particular portion of the sky. Earth, rotating since its creation on *Day 1,* would experience day-night cycles even before the Sun was created on *Day 4*. Today, thousands of years after that first day when matter was created throughout the universe, the CMB reaching earth is uniformly spread out over the entire sky. This is because blackbody radiation uniformly filled otherwise empty space on *Days 1–3,* before the heavens were stretched out. Since *Day 4*, the Sun has been earth's dominant light source.

The Big Bang Perspective. The big bang theory, whose popularity is largely due to its explanation for the CMB, gives another explanation. Within a tiny fraction of a second after the big bang, the universe was about the size of a basketball and was expanding *trillions of billions of times faster than the speed of light today*. Minutes later, matter and energy came together to form hydrogen nuclei.

Matter, during that time, was so compressed and temperatures were so hot that most nuclei would have merged to form heavier nuclei such as carbon, iron, and uranium. However, because hydrogen is by far the most abundant element in the universe today, something must have prevented this nuclear fusion. Intense background radiation would do the job, as Nobel prize winner Steven Weinberg explains:

> [Before CMB was discovered, James Peebles, an early big bang researcher] *noted that if there had not been an intense background of radiation present during the first few minutes of the universe, nuclear reactions would have proceeded so rapidly that a large fraction of the hydrogen present would have been "cooked" into heavier elements, in contradiction with the fact that about three-quarters of the present universe is hydrogen. This rapid nuclear cooking could have been prevented only if the universe was filled with radiation having an enormous equivalent temperature at very short wavelengths, which could blast nuclei apart as fast as they could be formed.*[2]

Notice: CMB was needed to make the big bang theory work—as were "dark matter" and "dark energy." [See **"Dark Thoughts"** on page 33.]

Smoothness of the CMB

The CMB is remarkably smooth, so smooth that for 25 years after its discovery, no variations could be detected. Increasingly precise instruments were designed and launched into space to look for variations in the CMB's intensity, because the big bang theory said they had to be there. Without billions of large concentrations of matter (from which most CMB radiated), other matter could not gravitationally contract around those concentrations to form the untold billions of galaxies. If galaxies did not form, we would not be here!

Finally, after 25 years of searching, variations amounting to only one part in 100,000 were found. However, experts recognized that such weak concentrations, even after hundreds of billions of years, could not have pulled in enough matter to form galaxies.

> *But this uniformity* [in the CMB] *is difficult to reconcile with the obvious clumping of matter into galaxies, clusters of galaxies and even larger features extending across vast regions of the universe, such as "walls" and "bubbles."*[3]

> *Why was* [the CMB in] *the early universe asymmetric by such a small amount? This is one of the outstanding puzzles of the Big Bang theory.*[4]

> *The theorists know of no way such a monster* [a massive accumulation of galaxies, called *the Great Wall*] *could have condensed in the time available since the Big Bang, especially considering that the 2.7 K background radiation reveals a universe that was very homogeneous in the beginning.*[5]

> *Gravity can't, over the age of the universe, amplify these* [tiny] *irregularities enough* [to form huge clusters of galaxies].[6]

Furthermore, the Hubble Space Telescope has photographed the extreme edges of the visible universe. Most experts expected to see diffuse matter slowly gravitating together to form galaxies. This is what one would expect if the extremely smooth CMB was left over from the big bang. Instead, galaxies were already "bunched together"—having formed very early in the history of the universe.

> *... tremendously distant galaxies are just as clustered as today and are arranged in the same filamentary, bubbly structures that nearby galaxies are.*[7]

> *In each of the five patches of sky surveyed by the team, the distant galaxies bunch together instead of being distributed randomly in space. "The work is ongoing, but what we're able to say now is that galaxies we are seeing at great distances are as strongly clustered in the early universe as they are today," says* [Charles C.] *Steidel, who is at the California Institute of Technology in Pasadena.*[8]

Conclusion

Is the CMB (1) left over from the big bang, (2) radiation emitted for a brief instant from all created matter, or (3) something else? Both (1) and (2) place the CMB at the beginning of time and attribute the radiation's current low effective temperature (2.73 kelvins, or -454.76°F) to an expansion of space.

The big bang's explanation for the CMB has several widely recognized problems.

- The CMB, when viewed over the entire sky, is thousands of times too smooth to have produced the galaxies we see today, even after billions of years.
- The most distant galaxies seen are tightly clustered, much more than gravity could accomplish over the big bang's age of the universe.
- According to the big bang theory, there is no reason why radiation from opposite sides of the universe should be identical, because radiating matter that far apart could not have reached thermal equilibrium. However, if the CMB is a natural consequence of the creation of matter within a very compact universe that was later stretched out, identical radiation would be expected.

All of this does not necessarily mean that the explanation proposed here for the light of *Day 1* is correct. However, if one considers the many other problems with the big bang theory—a discussion that begins on page 32—the two choices described here are reduced to one. (Other possibilities, usually of a nonquantitative, nontestable nature and having nothing to do with the CMB, have been proposed for the "light of *Day 1*.")

Yes, there is much we do not know about light and the beginning hours and days of the universe. However, faulty ideas should be exposed and superior ideas presented, even if they are not the final answer. Otherwise, incorrect ideas are accepted by default—reinforcing the reigning paradigm.

The subject is not unimportant. God asked Job (Job 38:19–20), "*Where is the way to the dwelling of light? And darkness, where is its place, that you may take it to its territory, and that you may discern the paths to its home?*" Just as Job could not answer those questions and others related to creation (Job 38), we also fall short—even though we better understand light and just how immense the universe is today.

One thing is clear: on *Day 1*, three days before the Sun and all stars were made—or before the creation of all stars was completed[9]—a temporary light source illuminated the spinning earth and provided day-night cycles.

References and Notes

1. A blackbody radiates at all wavelengths, but the intensity at each wavelength depends on only the body's temperature. Perfect blackbodies do not exist, because all matter (solids, liquids, gases, and plasmas) radiates at preferred wavelengths. However, blackbodies can be approximated in the laboratory.

   If the positive and negative electrical charges in all atoms were created in their resting positions, charges would not accelerate toward each other, so no light would be emitted. The light of Genesis 1:3 would not be *a consequence of the creation of matter*. Instead, light would have been created *independently of matter*. Even so, blackbody radiation would still be produced by the multiple reflections of light off matter in the much smaller universe that was stretched out later during the creation week.

   Genesis 1:3 clearly states that light was created. Was it created as a consequence of accelerating matter (electrons) or independently of matter? Either way, blackbody radiation would be produced before the heavens were stretched out.

2. Steven Weinberg, *The First Three Minutes: A Modern View of the Origin of the Universe* (New York: Basic Books, Inc., 1977), pp. 44–45.
3. Ivars Peterson, "Seeding the Universe," *Science News*, Vol. 137, 24 March 1990, p. 184.
4. Joseph Silk, *The Big Bang* (San Francisco: W. H. Freeman and Co., 1980), p. 117.
5. M. Mitchell Waldrop, "The Large-Scale Structure of the Universe Gets Larger—Maybe," *Science*, Vol. 238, 13 November 1987, p. 894.
6. Margaret Geller, as quoted by John Travis, "Cosmic Structures Fill Southern Sky," *Science*, Vol. 263, 25 March 1994, p. 1684.
7. Michael A. Straus, "Reading the Blueprints of Creation," *Scientific American*, Vol. 290, February 2004, p. 61.
8. Ron Cowen, "Light from the Early Universe," *Science News*, Vol. 153, 7 February 1998, p. 92.

9. Stars and other heavenly bodies may not have all been made on a single day (Day 4); instead, they may have been *completed* on Day 4. Keil and Delitzsch, in analyzing the Hebrew words in Genesis 1, feel strongly that Day 4 marks the *completion* of the heavenly bodies: "the words can have no other meaning than that their creation was completed on the fourth day." [See C. F. Keil and F. Delitzsch, *Commentary on the Old Testament in Ten Volumes*, Vol. 1 (reprint, Grand Rapids: Eerdmans Publishing Co., 1981), p. 59.]

   This is consistent with the Bible verses and scientific evidence discussed in **"Why Does the Universe Seem to Be Expanding?"** on page 383. Before the heavens were stretched out on Day 4, gravity acted in a much more compact universe and, therefore, was much more powerful. Stars and black holes would form. Galaxies would collide, be stretched out in a "string," and achieve velocities that, today, appear to contradict laws of physics.

How Old Do Evolutionists Say the Universe Is?

In the late 1920s, evolutionists believed that the universe was 2 billion years (b.y.) old. Later, radiometric dating techniques gave much older ages for certain rocks on Earth.[1] Obviously, a part of the universe cannot be older than the universe itself. This contradiction was soon removed by devising a rationale for increasing the age of the universe.

Similar problems are now widely acknowledged. [See **"Big Bang?"** on page 32.] If a big bang occurred, it happened 13.7 b.y. ago. If stars evolved, some stars are 16 b.y. old, such as the stars in the globular cluster below.[2] Obviously, stars cannot be older than the universe. Also, the Hubble Space Telescope has found distant galaxies whose age, based on big bang assumptions, exceeds the age of the universe.[3]

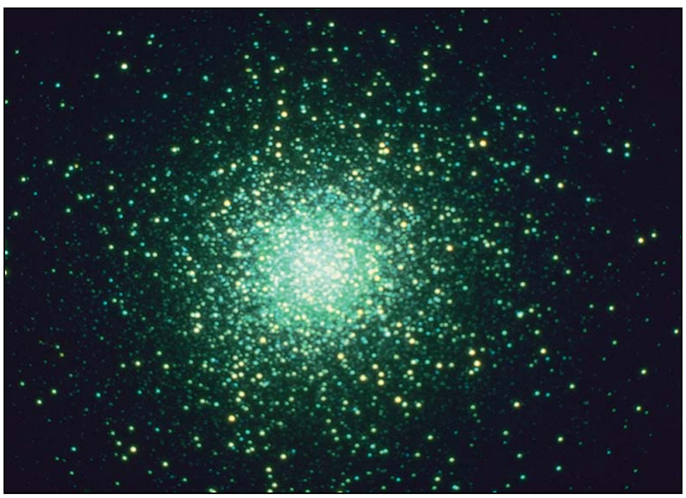


Figure 191: Globular Cluster. Globular clusters are tight, spherical concentrations of 10,000–1,000,000 stars. This globular cluster, called M13, is about 22,000 light-years away. To see why stars in a globular cluster did not evolve but came into existence at about the same time, see **"Star Births? Stellar Evolution?"** on page 34.

Here is a similar, but less widely known, problem. Let's suppose that the universe is 13.7 b.y. old. That is not enough time for stars *containing heavy chemical elements* to form and then transmit their light to Earth. A big bang would have produced only hydrogen, helium, and lithium—the three lightest chemical elements. Light from the most distant stars and galaxies shows that they contain much heavier chemical elements such as carbon, iron, and lead—elements that could not have been in the first generation of stars to form after the big bang. Evolutionists, therefore, believe that the hundred or so heavier chemical elements (97% of all chemical elements) were produced either deep inside stars or when some stars exploded as supernovas. Much later, a second generation of stars supposedly formed with the heavy elements from that exploded debris.

In other words, a big bang would produce only the three lightest chemical elements. Therefore, big bang advocates have struggled to explain the origin of the heavier chemical elements (carbon, oxygen, iron, lead etc.). To squeeze enough hydrogen nuclei together to form some heavier elements would require the high temperatures inside stars. To form elements heavier than iron requires special conditions or something much hotter—maybe a supernova.

So, if a big bang happened, there would not be enough time afterward to complete all four of the following:

a. Form the first generation of stars out of hydrogen, helium, and lithium.
b. Have many of those stars quickly[4] pass through their complete life cycles then finally explode as supernovas to produce the heavier chemical elements.
c. Recollect, somehow, enough of that exploded debris to form the second generation of stars. (Some were quasars thought to be powered by black holes, *billions of times more massive than our Sun*! See Endnote 6 on page 387.)
d. Transmit the light from these heavy elements to Earth, immense distances away.

New and sophisticated light-gathering instruments have allowed astronomers to discover heavy elements in many extremely distant galaxies[5] and quasars.[6] One such galaxy has a quasar at its center.[7] If the speed of light has been constant, its light has taken 94% of the age of the universe to reach us. This means that only the first 6% of the age of the universe would have been available for events a–c above. (Only 0.8 b.y. would be available in a 13.7-b.y.-old universe.) Few astronomers believe that such slow processes as a–c above, if they happened at all, could happen in 0.8 b.y.[8]

Evolutionists can undoubtedly resolve these time contradictions—but at the cost of rejecting some cherished belief. Perhaps they will accept the possibility that light traveled much faster in the past. Measurements exist which support this revolutionary idea. [See page 377.] Maybe they will conclude that the big bang never occurred, or that heavy elements were somehow in the first and only generation of stars, or that stars degrade, but new stars don't evolve. Much evidence supports each of these ideas, and all are consistent with a recent creation.

Few evolutionists are aware of these contradictions. However, as more powerful telescopes begin peering even farther into space, these problems will worsen and more attention will be focused on them. If scientists find, as one might expect, even more distant stars and galaxies with heavy elements, problems with the claimed age of the universe will no longer be the secret of a few evolutionists.[9]

References and Notes

1. Arthur N. Strahler, *Science and Earth History* (Buffalo, New York: Prometheus Books, 1987), pp. 102, 129.

2. Ivan R. King, "Globular Clusters," *Scientific American*, Vol. 252, June 1985, pp. 79–88.

3. Robert C. Kennicutt Jr., "An Old Galaxy in a Young Universe," *Nature*, Vol. 381, 13 June 1996, pp. 555–556.

◆ James Dunlop, "A 3.5-Gyr-Old Galaxy at Redshift 1.55," *Nature*, Vol. 381, 13 June 1996, pp. 581–584.

4. For this to happen quickly, evolutionists must assume that the first stars were giants, more than a hundred times larger than the Sun. (Theoretically, more massive stars would burn faster.) Thus, textbooks confidently say that the first stars were giants.

   No one *knows* that the first stars were giants. It's a required assumption if stars evolved. In fact, characteristics of the light we should see from the first generation of evolved stars is missing. [See Piero Madau, "Trouble at First Light," *Nature*, Vol. 440, 20 April 2006, pp. 1002–1003.]

5. James Glanz, "CO in the Early Universe Clouds Cosmologists' Views," *Science*, Vol. 273, 2 August 1996, p. 581.

◆ *"The presence of these* [25] *elements, particularly those heavier than iron, in such a young* [distant] *galaxy is striking. Fundamentally, it seems to indicate that in the galaxies (or at least in this galaxy) that formed relatively shortly after the Big Bang, the onset of star formation and related element production was very rapid."* John Cowan, "Elements of Surprise," *Nature*, Vol. 423, 1 May 2003, p. 29.

◆ Jason X. Prochaska et al., "The Elemental Abundance Pattern in a Galaxy at z=2.626," *Nature*, Vol. 423, 1 May 2003, pp. 57–59.

6. *"According to standard models* [all based on the big bang theory]*, the first stars needed at least 500 million years to begin lighting up and another 700 million to 1 billion years to manufacture heavy elements such as iron and spread them through space.* [Wolfram] *Freudling therefore expected that gas around the quasars, which were shining when the universe was just 900 million years old, would be metal-free.* [Astronomers call the hundred or so heavier chemical elements "metals."] *Instead, he and his colleagues found the quasars are surrounded by copious amounts of iron."* Kathy A. Svitil, "Signs of Primordial Star Ignition Detected," *Discover*, January 2004, p. 66.

◆ *"… quasar environments are metal rich at all red shifts."* F. Hamann et al., "Quasar Elemental Abundances and Host Galaxy Evolution," *Origin and Evolution of the Elements*, Vol. 4, editors A. McWilliam and M. Rauch (Cambridge, England: Cambridge University Press, 2003), p. 12.

◆ Ohta et al., "Detection of Molecular Gas in the Quasar BR 1202-0725 at Redshift z = 4.69," *Nature*, Vol. 382, 1 August 1996, pp. 426–431.

◆ *"First, the chemical composition of quasars hints at early enrichments, indicative of star formation. Emission lines in the quasar spectrum can be used to measure their abundance of heavy elements, or 'metallicity.' Luminous, high-redshift quasars have roughly solar or higher metallicity, even at redshifts > 6, indicating that they existed in a metal-rich environment similar to that found in the centers of massive galaxies."* Xiaohui Fan, "Black Holes at the Cosmic Dawn," *Science*, Vol. 300, 2 May 2003, p. 752.

7. Fabian Walter et al., "Molecular Gas in the Host Galaxy of a Quasar at Redshift z=6.42," *Nature*, Vol. 424, 24 July 2003, pp. 406–408.

8. Jeff Kanipe, "Galaxies at the Confusion Limit," *Astronomy*, December 1988, pp. 56–58.

◆ R. F. Carswell, "Distant Galaxy Observed," *Nature*, Vol. 335, 8 September 1988, p. 119.

9. Dietrick E. Thomsen, "Farthest Galaxy Is Cosmic Question," *Science News*, Vol. 133, 23 April 1988, pp. 262–263.

◆ M. Mitchell Waldrop, "Pushing Back the Redshift Limit," *Science*, Vol. 239, 12 February 1988, pp. 727–728.

◆ M. Mitchell Waldrop, "The Farthest Galaxies: A New Champion," *Science*, Vol. 241, 19 August 1988, p. 905.

◆ Dietrick E. Thomsen, "Galaxies in a Primitive State," *Science News*, Vol. 133, 23 January 1988, p. 52.

What Was *Archaeopteryx*?

If dinosaurs (or, as other evolutionists assert, reptiles) evolved into birds, thousands of types of animals should have been more birdlike than dinosaurs and yet more dinosaur-like than birds. Evolutionists claim that *Archaeopteryx* (ark-ee-OP-ta-riks) is a feathered dinosaur, a transition between dinosaurs (or reptiles) and birds. Of the relatively few claimed intermediate fossils, *Archaeopteryx* is the one most frequently cited by evolutionists and shown in most biology textbooks. Some say the six *Archaeopteryx* fossils are the most famous fossils in the world.

Archaeopteryx means ancient (*archae*) wing (*pteryx*). But the story behind this alleged half-dinosaur, half-bird is much more interesting than its fancy, scientific-sounding name or the details of its bones. If *Archaeopteryx* were shown to be a fraud, the result would be devastating for the evolution theory.

Since the early 1980s, several prominent scientists have charged that the two *Archaeopteryx* fossils with clearly visible feathers are forgeries.[1] Allegedly, thin layers of cement were spread on two fossils of a chicken-size dinosaur, called *Compsognathus* (komp sog NAY thus). Bird feathers were then imprinted into the wet cement.

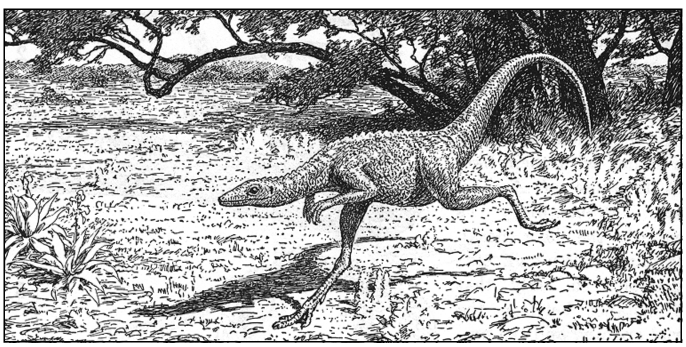


Figure 192: *Compsognathus*. While most dinosaurs were large, this one, *Compsognathus longipes*, was small—about the size of a domestic cat. The German scientist who discovered *Compsognathus*, Andreas Wagner, "recognized from the description [of *Archaeopteryx*] what seemed to be his *Compsognathus* but with feathers! He was extremely suspicious …"[2] *Compsognathus* and *Archaeopteryx* have many similarities. *Compsognathus* fossils are also found at the same site in Germany where *Archaeopteryx* was found.

If *Archaeopteryx* did not have a few perfectly formed, modern feathers, clearly visible on two of the six known specimens,[3] *Archaeopteryx* would be considered *Compsognathus*.[4] The skeletal features of *Archaeopteryx* are certainly not suitable for flight, because no specimen shows a sternum (breast bone), which all birds and bats must have to anchor their large flight muscles. But why would *Archaeopteryx* have modern, aerodynamically perfect feathers if it could not fly?[5] Finally, *Archaeopteryx* should not be classified as a bird.[6]

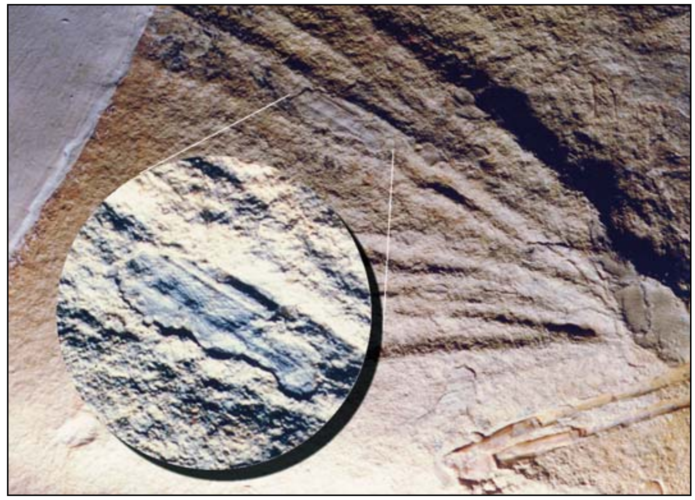


Figure 193: "Chewing Gum Blob." These raised spots have the appearance of pieces of chewing gum. They have no corresponding indentation on the mating face of the fossil. Possibly some small drops of wet cement fell on the surface and were never detected or cleaned off by the forger.

The two fossils with feathers were "found" and sold for high prices by Karl Häberlein (in 1861 for 700 pounds) and his son, Ernst (in 1877 for 20,000 gold marks), just as Darwin's theory and book, *The Origin of Species* (1859), were gaining popularity. While some German experts thought that the new (1861) fossil was a forgery, the British Museum (Natural History) bought it sight unseen. (In the preceding century, fossil forgeries from limestone quarries were common in that region of Germany.[7])

Evidence of an *Archaeopteryx* forgery includes instances where the supposedly mating faces of the fossil (the main slab and counterslab) do not mate. The feather impressions are primarily on the main slab, while the counterslab in several places has raised areas with no corresponding indentation on the main slab. These raised areas, nicknamed "chewing gum blobs," are made of the same fine-grained material that is found only under the feather impressions. The rest of the fossil is composed of a coarse-grained limestone. [See Figure 193.]

Some might claim that *Archaeopteryx* has a wishbone, or furcula—a unique feature of birds. It would be more accurate to say that only the British Museum specimen has a visible furcula. It is a strange furcula, "relatively the largest known in any bird."[8] Furthermore, it is upside down, a point acknowledged by two giants of the evolutionist movement—T. H. Huxley (Darwin's so-called bulldog) and Gavin deBeer. As Fred Hoyle and N. Chandra Wickramasinghe stated,

> *It was somewhat unwise for the forgers to endow Compsognathus with a furcula, because a cavity had to be cut in the counterslab, with at least some*

Frequently Asked Questions

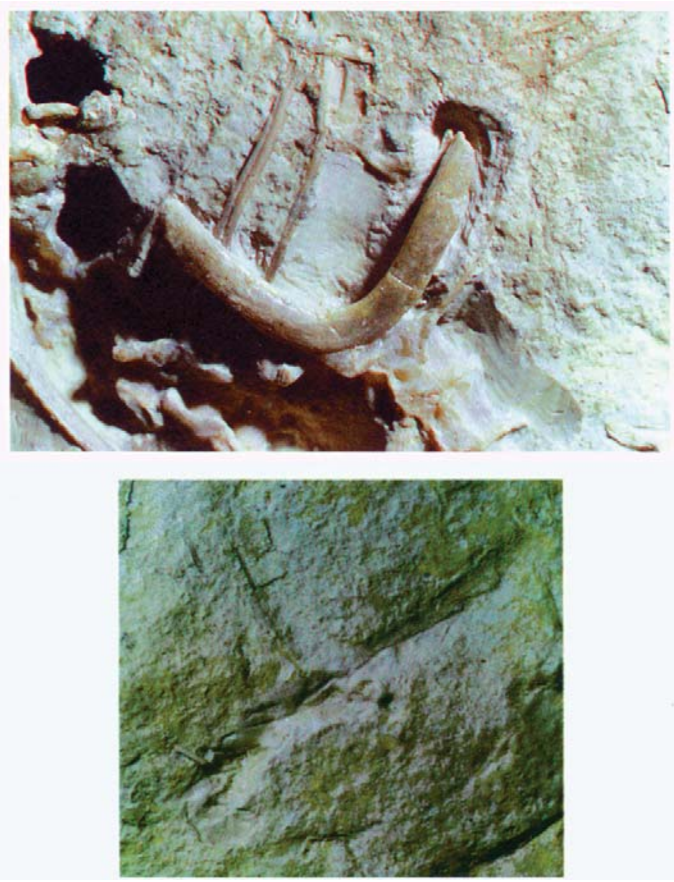


Figure 194: Furcula of *Archaeopteryx*? This V-shaped bone is claimed to be the wishbone, or furcula, of *Archaeopteryx*. It is shaped more like a boomerang than the familiar wishbone in a chicken. A furcula acts as a spring—storing and releasing energy with each up and down wing flap. Notice the crack in the right arm of the furcula and the broken right tip—strange for a bird's flexible bone buried in soft sediments. Perhaps it broke when a forger chipped it out of another fossil. One must ask why only this Berlin specimen shows a clear furcula. Notice how the counter-slab (bottom picture) does not have a correspondingly smooth depression into which the raised furcula will fit.

> *semblance to providing a fit to the added bone. This would have to be done crudely with a chisel, which could not produce a degree of smoothness in cutting the rock similar to a true sedimentation cavity.*[9] [See Figure 194.]

Feather imprints show what have been called "double strike" impressions. Evidently, feather impressions were made twice in a slightly displaced position as the slab and counterslab were pressed together. [See Figure 195.]

Honest disagreement as to whether *Archaeopteryx* was or was not a forgery was possible until 1986, when a definitive test was performed. An x-ray resonance spectrograph of the British Museum fossil showed that the finer-grained material containing the feather impressions differed significantly from the rest of the coarser-grained fossil slab. The chemistry of this "amorphous paste" also differed from the crystalline rock in the famous fossil quarry in Bavaria, Germany, where *Archaeopteryx* supposedly was found.[10] Few responses have been made to this latest, and probably conclusive, evidence.[11]

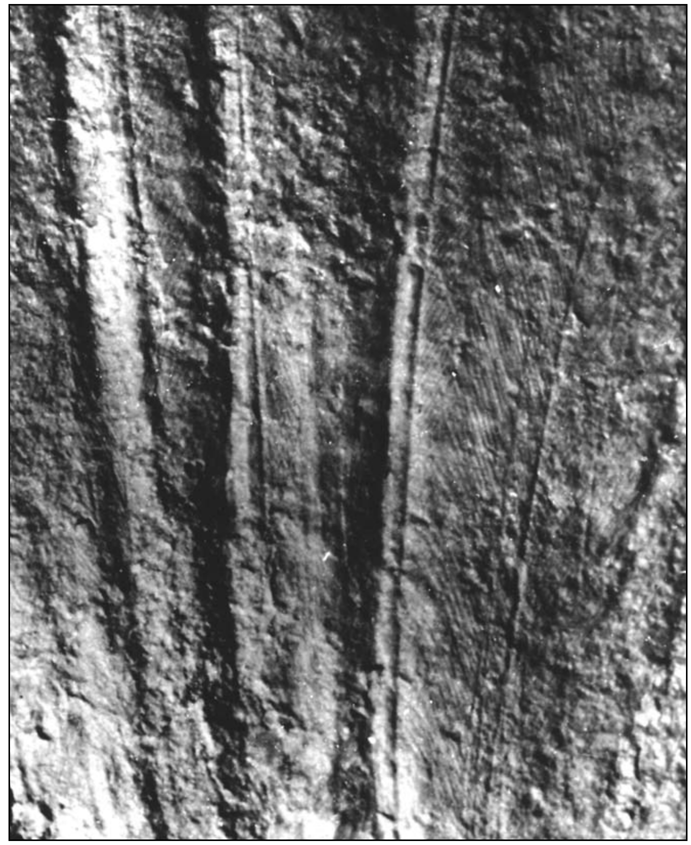


Figure 195: Double Strike. A forger would have a delicate task positioning the counterslab on top of the slab with a cement paste between the two slabs. The two halves of the fossil must mate perfectly. A last-minute adjustment or slip would create a double strike.

Fossilized feathers are almost unknown,[12] and several complete, flat feathers that just happened to be at the slab/counterslab interface are even more remarkable. Had a feathered *Archaeopteryx* been buried in mud or a limestone paste, its feathers would have had a three-dimensional shape, typical of the curved feathers we have all held. Indeed, the only way to flatten a feather is to press it between two flat slabs. Flattened feathers, alone, raise suspicions.

Also, there has been no convincing explanation for how to fossilize (actually encase) a bird in the 80% pure, Solnhofen limestone. One difficulty, which will be appreciated after reading about liquefaction on pages 175–187, is the low density of bird carcasses. Another is that limestone is primarily precipitated from seawater, as explained on pages 229–235. Therefore, to be buried in limestone, the animal must lie on the seafloor—unusual for a dead bird. Other problems with evolving birds are described in Endnote i on page 67.

Significantly, two modern birds have been discovered in rock strata dated by evolutionists as much older than *Archaeopteryx*.[13] In Argentina, many birdlike footprints have been found which evolutionists say preceded *Archaeopteryx* by at least 55 million years.[14] Therefore, according to evolutionary dating methods, *Archaeopteryx* could not be ancestral to modern birds. True fossilized birds have been found that evolutionists believe lived shortly after *Archaeopteryx*.[15] This has forced some to conclude that the distinctly different *Archaeopteryx* was not ancestral to modern birds.[16]

When the media popularize an evolutionist claim that is later shown to be false, retractions are seldom made. One refreshing exception is provided by *National Geographic*, which originally, and incorrectly, reported the discovery in China of "a true missing link in the complex chain that connects dinosaurs to birds." (Actually, the fossil was a composite of a bird's body and a dinosaur's tail, faked for financial gain.)[17] Details were explained on a few back pages of *National Geographic* by an independent investigator at the request of *National Geographic*'s editor. The report was summarized as follows:

> *It's a tale of misguided secrecy and misplaced confidence, of rampant egos clashing, self-aggrandizement, wishful thinking, naive assumptions, human error, stubbornness, manipulation, backbiting, lying, corruption, and, most of all, abysmal communication.*[18]

Such fiascoes are common among those seeking rewards and prestige for finding fossils of missing links. The media that popularize these stories mislead the public.

Archaeopteryx's fame seems assured, not as a transitional fossil between dinosaurs (or reptiles) and birds, but as a forgery. Unlike the Piltdown hoax, which fooled leading scientists for more than 40 years, the *Archaeopteryx* hoax has lasted for 125 years. [See **"Ape-Men?"** on page 13.] Because the apparent motive for the *Archaeopteryx* deception was money, *Archaeopteryx* should be labeled as *a fraud*. The British Museum (Natural History) gave life to both deceptions and must assume much of the blame. Those scientists who were too willing to fit *Archaeopteryx* into their evolutionary framework also helped spread the deception. Piltdown man may soon be replaced as the most famous hoax in all of science.

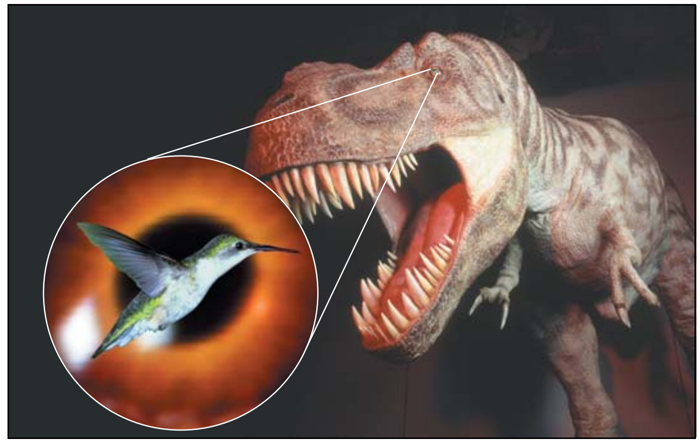


Figure 196: Birds from Dinosaurs? Birds have many marvelous and unique features: flight, feathers, energy efficiency, navigational abilities, brittle eggs, amazing eyesight, and lightweight construction. If birds evolved, from where did they come? Evolutionists try to solve this recognized dilemma[19] by claiming that birds evolved from dinosaurs[20] or that they are "cousins." *Archaeopteryx* is a prime exhibit for both views. Yes, dinosaurs have some features in common with birds, especially aspects of their bone structure, but birds have many characteristics that dinosaurs do not have. No doubt, more will be discovered.

Another possibility is that a designer gave both birds and dinosaurs some common features, because each had similar needs. For example, gears are common to cars, bicycles, windmills, and watches. Everyone knows they were designed. No one teaches, advocates, or even considers that windmills turned into cars or watches. Efficiency dictates design similarities. How could anyone think dinosaurs evolved into hummingbirds? Time, mutations, and natural selection?

References and Notes

1. Dr. Lee Spetner first made this allegation in a meeting of orthodox Jewish scientists held in Jerusalem in July 1980. Spetner studied the British Museum specimen in June 1978 and explained the discrepancies to Dr. Alan Charig, the museum's Chief Curator of Fossil Amphibians, Reptiles, and Birds. [See "Is the *Archaeopteryx* a Fake?" *Creation Research Society Quarterly*, Vol. 20, September 1983, pp. 121–122.] Charig has consistently denied a forgery.

   For the most complete description and photographs of this evidence, see Fred Hoyle and N. Chandra Wickramasinghe, *Archaeopteryx, the Primordial Bird: A Case of Fossil Forgery* (Swansea, England: Christopher Davies, Ltd., 1986). This book also responds to counterclaims that *Archaeopteryx* was not a forgery.

2. Ian Taylor, "The Ultimate Hoax: *Archaeopteryx* Lithographica," *Proceedings of the Second International Conference on Creationism*, Vol. 2 (Pittsburgh, Pennsylvania: Creation Science Fellowship, 1990), p. 280.

3. Some defenders of *Archaeopteryx* will claim that three of the other four specimens also have feathers—the Teyler Museum specimen, the Eichstätt specimen, and the poorly preserved Maxberg specimen. Hoyle, Wickramasinghe, and Watkins put it bluntly. *"Only people in an exceptional condition of mind can see them."* [F. Hoyle, N. C. Wickramasinghe, and R. S. Watkins, "*Archaeopteryx*," *The British Journal of Photography*, 21 June 1985, p. 694.]

4. *"… these specimens* [of *Archaeopteryx*] *are not particularly like modern birds at all. If feather impressions had not been preserved in the London and Berlin specimens, they* [the other specimens] *never would have been identified as birds. Instead, they would unquestionably have been labeled as coelurosaurian dinosaurs* [such as *Compsognathus*]. *Notice that the last three specimens to be recognized* [as *Archaeopteryx*] *were all misidentified at first, and the Eichstätt specimen for 20 years was thought to be a small specimen of the dinosaur Compsognathus."* John H. Ostrom, "The Origin of Birds," *Annual Review of Earth and Planetary Sciences*, Vol. 3, 1975, p. 61.

◆ *"Apart from the proportions of its wings, the skeleton of Archaeopteryx is strikingly similar to that of a small, lightly built, running dinosaur, such as the coelurosaur Compsognathus."* Dougal Dixon et al., *The Macmillan Illustrated Encyclopedia of Dinosaurs and Prehistoric Animals* (New York: Macmillan Publishing Co., 1988), p. 172.

5. Some evolutionists say that the modern, aerodynamically perfect feathers allowed *Archaeopteryx,* after climbing a tree, to glide down, maybe catching food on the way. Reply: Simple hang-gliding-like equipment, as in a bat's wing, would have worked better and been much easier to evolve.

6. *"Phylogenetic analysis of stem-group birds reveals that Archaeopteryx is no more closely related to modern birds than are several types of theropod dinosaurs, including tyrannosaurids and ornithomimids. Archaeopteryx is not an ancestral bird, nor is it an 'ideal intermediate' between reptiles and birds. There are no derived characters uniquely shared by Archaeopteryx and modern birds alone; consequently there is little justification for continuing to classify Archaeopteryx as a bird."* R. A. Thulborn, "The Avian Relationships of *Archaeopteryx* and the Origin of Birds," *Zoological Journal of the Linnean Society*, Vol. 82, 1984, p. 119.

7. Herbert Wendt, *Before the Deluge* (Garden City, New York: Doubleday & Co., Inc., 1968), pp. 40–57.

8. Larry D. Martin, "The Relationship of *Archaeopteryx* to Other Birds," *The Beginnings of Birds: Proceedings of the International Archaeopteryx Conference of 1984* (Eichstätt, Germany: Jura Museum, 1985), p. 182.

9. Hoyle and Wickramasinghe, *Archaeopteryx, the Primordial Bird: A Case of Fossil Forgery*, p. 93.

10. N. Wickramasinghe and F. Hoyle, "*Archaeopteryx*, the Primordial Bird?" *Nature*, Vol. 324, 18/25 December 1986, p. 622.

11. Two milligram-size samples of the fossil material were tested, one from a "feather" region and a control sample from a nonfeathered region. The British Museum *"contends that the amorphous nature of the feathered material is an artifact explainable by preservatives that they have put on the fossil."* [Lee M. Spetner, "Discussion," *Proceedings of the Second International Conference on Creationism* (Pittsburgh, Pennsylvania: Creation Science Fellowship, 1990), p. 289.] If this excuse were correct, why were no "preservatives" found on the control specimen? Control specimens are tested for precisely this purpose—to dispel unique, last-minute excuses. The British Museum has refused further testing, a shocking position for a scientific organization, and one which raises suspicions to the breaking point.

12. *"Exactly 1 year ago, paleontologists were abuzz about photos of a so-called "feathered dinosaur," … But at this year's vertebrate paleontology meeting in Chicago late last month, the verdict was a bit different: The structures are not modern feathers, say the roughly half-dozen Western paleontologists who have seen the specimens.* [Instead, they are 'bristlelike fibers.'] *"* Ann Gibbons, "Plucking the Feathered Dinosaur," *Science*, Vol. 278, 14 November 1997, p. 1229.

13. Tim Beardsley, "Fossil Bird Shakes Evolutionary Hypotheses," *Nature*, Vol. 322, 21 August 1986, p. 677.

◆ Alun Anderson, "Early Bird Threatens *Archaeopteryx's* Perch," *Science*, Vol. 253, 5 July 1991, p. 35.

◆ Sankar Chatterjee, "Cranial Anatomy and Relationship of a New Triassic Bird from Texas," *Philosophical Transactions of the Royal Society of London*, B, Vol. 332, 1991, pp. 277–342.

14. *"Here we describe well-preserved and abundant footprints with clearly avian characters from a Late Triassic redbed sequence of Argentina, at least 55 Myr before the first known skeletal record of birds."* Ricardo N. Melchor et al., "Bird-Like Fossil Footprints from the Late Triassic," *Nature*, Vol. 417, 27 June 2002, p. 936.

15. Lianhai Hou et al., "Early Adaptive Radiation of Birds: Evidence from Fossils from Northeastern China," *Science*, Vol. 274, 15 November 1996, pp. 1164–1167.

16. Ann Gibbons, "Early Birds Rise from China Fossil Beds," *Science*, Vol. 274, 15 November 1996, p. 1083.

17. *"The 'Archaeoraptor' fossil, once proclaimed as a key intermediate between carnivorous dinosaurs and birds but now known to be a forgery, is a chimaera formed of bird and dromaeosaur parts."* Zhonghe Zhou et al., "*Archaeoraptor*'s Better Half," *Nature*, Vol. 420, 21 November 2002, p. 285.

◆ Xu Xing, "Feathers for *T. Rex*?" *National Geographic*, Vol. 197, March 2000, Forum Section.

18. Lewis M. Simons, "Archaeoraptor Fossil Trail," *National Geographic*, Vol. 198, October 2000, p. 128.

19. *"The issue of bird origins continues to occupy center stage among scientists because these animals differ in so many ways from their flightless antecedents, making avian evolution a critical problem to solve."* Richard Monastersky, "A Fowl Flight," *Science News*, Vol. 152, 23 August 1997, p. 120.

20. *"And let us squarely face the dinosaurness of birds and the birdness of the Dinosauria. When the Canada geese honk their way northward, we can say: 'The dinosaurs are migrating, it must be spring!'"* Robert T. Bakker, *The Dinosaur Heresies* (New York: William Morrow and Co., Inc., 1986), p. 462.

How Could Saltwater and Freshwater Fish Survive the Flood?

Related Questions: Why didn't the hot, salty, subterranean water kill all freshwater fish during the flood? How did saltwater fish survive before the flood? Were preflood fish adapted to salt water or fresh water?

Chemistry of Body Fluids in Fish. Blood and other body fluids of almost all fish, freshwater and saltwater, have surprisingly similar chemistry. Their blood's salinity, for example, is somewhere between that of fresh water and salt water. Actually, its concentration is about one-third that of normal seawater, not just for salt (NaCl) but for many other substances.[1] For reasons that will soon be apparent, a typical preflood sea probably had a small salt content, as if you mixed two parts of fresh water with one part of seawater. However, just as oceans and seas today have variations in salt content, variations probably existed in and among preflood seas—perhaps large variations.

Living things have many marvelous, semipermeable membranes that allow some liquids or gases to pass through, but not others. For example, capillary walls are semipermeable membranes. Oxygen in our lungs can pass through capillary walls and mix with our blood, but blood does not normally pass through those walls. S*ubstances that can pass through the membrane (such as oxygen) will, on balance, go from the higher concentration (in the lungs) to the lower concentration (in the blood). This is called* ***osmosis***.

Fish have a water problem. Freshwater fish have greater salinity in their blood (less concentration of water) than is in the water they swim in, so water seeps into their blood by osmosis. To correct this problem, freshwater fish seldom drink, and their kidneys secrete a watery urine. Conversely, saltwater fish have less salinity in their blood than is in their saline environment, so osmosis forces water from their bodies. Their kidneys pump out so little water that saltwater fish seldom urinate.

Mixing. During the flood, fish would have tried to stay in the most comfortable regions of the volume of water that was their preflood habitat. Salty, subterranean water, erupting onto the earth's surface, would not have rapidly mixed with the less salty preflood seas. In fact, the larger a preflood sea, the slower it mixed and diffused, and the better it insulated its fish from muddy, hot, salty currents during the flood.[2] Besides, preflood seas would have tended to "float" on the denser, muddier, saltier water.

In one 55-gallon experiment, a layer of freshwater floated on a typical layer of seawater. Several freshwater fish, salt-water fish, and other organisms placed in the tank lived in their respective environments for 30 days. The fish even made brief excursions into the more hostile environment.[3] No doubt fresh water and salt water would mix at increasingly slower rates *per unit volume* if the experiment were scaled up to the size of a global flood.

Natural Selection. After 150 days (according to Genesis 8:3), flood waters began to drain into newly formed ocean basins. Fish trapped in continental basins were the potential ancestors of our freshwater fish. Rainfall over the next several decades diluted the salt concentration in most postflood lakes.[4] Natural selection eliminated fish in each generation that could not tolerate the declining salinity. Those that could, had less competition for resources and could reproduce their tolerance for lower salinities. Because fish reproduce frequently and profusely, *limited* variations in each generation allowed rapid adaptation in their ability to control the water in their bodies. This is microevolution, not macroevolution. No new organs were needed.

Meanwhile, fish that ended up in the new oceans either had to tolerate slowly increasing salinity or face extinction. Survivors became our saltwater fish. Those unable to adapt are now extinct. (This largely explains why marine animals have experienced the most extinctions.) Some fish, the best-known being salmon, are adapted to both fresh water and salt water. Wider salinity tolerances, such as those of salmon, may have existed before the flood.

Design. The ability over many generations to adapt to changing environments is a wonderful feature designed into all life. Without this capability, extinctions would be more common, and life would eventually cease—beginning, perhaps, near the bottom of the food chain. But adaptation has never produced macroevolution.

References and Notes

1. Sylvia S. Mader, *Biology*, 3rd edition (Dubuque, Iowa: Wm. C. Brown, Publishers, 1985), pp. 580–581.
2. Suggestive of the time required for mixing a large body of water is the following:

If we think of the oceans as big interconnected basins, we can ask our question about circulation rates in terms of the average length of time that a water molecule spends in each basin. The results of such calculations indicate that water molecules spend from 200 to 500 years in the deep Atlantic *before being transferred to another reservoir …* Karl K. Turekian, *Oceans*, 2nd edition (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1976), p. 38.

3. E. Norbert Smith and Stephen C. Hagberg, "Survival of Freshwater and Saltwater Organisms in a Heterogeneous Flood Model Experiment," *Creation Research Society Quarterly*, Vol. 21, June 1984, pp. 33–37.

4. Dilution rates depend on many things, including drainage rates into and out of a lake, evaporation, and rainfall.

What Predictions of the Hydroplate Theory Have Been Confirmed?

All the predictions of the hydroplate theory are summarized below. Confirmed predictions are in bold, and a partially missed prediction is in italics. Page numbers, where more information can be found, are in parentheses.

1. **pooled water under mountains** (130)
2. salty water in very deep granite cracks (130)
3. **deep channels under Bosporus and Gibraltar** (134)
4. fracture zones mark high magnetic intensity (143)
5. magnetic strength grows at hydrothermal vents (143)
6. granite layer deep under Pacific floor (161)
7. shallow-water fossils in and near trenches (161)
8. inner core's spin is decelerating (170)
9. age sequences wrong for Hawaiian islands (171)
10. thin, parallel, extensive varves not under lakes (180)
11. sand dunes from Canyon (206)
12. unique chemistry of Grand and Hopi basins (209)
13. slot canyons have cracks up to 10 miles deep (211)
14. Grand Canyon's inner gorge is a tension crack (212)
15. fault under East Kaibab monocline (224)
16. loess at bottom of ice cores (252)
17. muck on Siberian plateaus (252)
18. rock ice is salty (253)
19. carbon dioxide bubbles in rock ice (253)
20. muck particles in rock ice (253)
21. no fossils below mammoths (254)
22. radiocarbon dating mammoths (254)
23. ice age can be demonstrated (268)
24. **salt on Mars** (284)
25. moons around some comets (284)
26. mass of solar system heavier than expected (285)
27. a few comets reappear unexpectedly (285)
28. excess heavy hydrogen in 5^{+}-mile-deep water (287)
29. salt and bacteria in comets (287)
30. Oort cloud does not exist (296)
31. no incoming hyperbolic comets (296)
32. argon only in comet crust (297)
33. **asteroids are flying rock piles** (306)
34. asteroid rocks are magnetized (310)
35. deuterium on Themis (310)
36. water is inside large asteroids (311)
37. mining asteroids too costly (311)
38. Deimos has a very low density (314)
39. Mars' sediments deposited through air (317)
40. heavy hydrogen in space ice (319)
41. comets are rich in oxygen-18(354)
42. lineaments correlate with earthquakes(354)
43. little radioactivity on Moon, Mars(357)
44. **carbon-14 in "old" bones** (418)
45. bacteria on Mars (444)
46. *spin rate and direction of Ceres* (322)

Is Global Warming Occurring? If So, What Causes It?

Global warming—an emotionally charged social, political, economic, and ecological issue—is occurring.[1] As a result, world economies will be altered, and poorer countries may be less able to advance. Thousands of researchers with conflicting solutions to the problem are competing for funds. However, before billions of dollars are spent, global warming's cause should be clearly understood.

All can agree that the Sun's output varies and historical records show wide swings in temperature over the centuries. Nevertheless, the net trend toward global warming will probably continue, but for a surprising reason. We should first understand why the earth has so much ice—7 million cubic miles, mainly in Antarctica and Greenland. If all that ice melts, sea level will rise at least 200 feet.[2]

The global flood produced the special conditions that caused the Ice Age: *temporarily cold continents and warm oceans*. [See pages 109–147.] Crashing hydroplates at the end of the flood crushed and thickened continents and buckled up the earth's major mountains, making the continents higher than they are today and, consequently, colder. Also, after the flood, oceans were warmer than today, primarily because so much magma spilled onto the floor of the Pacific Ocean. Warm oceans produced extensive evaporation and precipitation, which on the cold continents resulted in extreme snowfall rates that built up glaciers. Heavy cloud cover and volcanic dust further cooled the continents.

Large temperature differences between cold continents and warm oceans generated strong wind systems that quickly carried the moist air up and over the continents where much of the water vapor cooled, condensed, and fell as snow. Each winter's glacial advances were followed by summer's glacial retreats; these yearly cycles left marks on earth that some mistakenly associate with multiple, but differing, numbers of ice ages (4–30, depending upon location).

For a few centuries after the flood, the warm oceans cooled and the thickened continents sank into the mantle. Both changes steadily reduced the heavy snowfall toward today's rates. Eventually, ice depths peaked. Then, as snow and ice decreased on earth, less of the sun's radiation was reflected off ice sheets and back into space.[3] More of the sun's heat warmed the earth, so even more ice melted, and the warming continued. This cycle will repeat and accelerate—unless cost-effective ways are found to reduce the warming.

Does mankind's burning of fossil fuels and production of greenhouse gases contribute to global warming? Of course, but no one really knows to what extent.[4] *Those who claim that man is the sole cause of global warming have not addressed the key question: Why did the earth once have so much ice?* Apart from the worldwide flood, explanations for the Ice Age run into scientific problems. Scientists who have studied the Ice Age in great detail know these problems, although few others do.

Since the peak of the Ice Age, melting ice has raised sea level about 300 feet;[5] man did not cause *that* rise. (Man began increasing CO_2 emissions thousands of years later, in about 1800, at the start of the industrial revolution.) Without some unexpected development, sea level will rise 200 feet more in the next few thousand years.[6] This steady rise will be apparent to all in a few decades. If increasing greenhouse gases turn out to be a major factor, the rise will be even faster.

Yes, atmospheric CO_2 (carbon dioxide) is increasing, but most of the increase is due to the warming of oceans, which then release some of the CO_2 they contain. (Oceans contain 50 times more CO_2 than the atmosphere.) In other words, CO_2 increases did not produce much global warming; warming produced most CO_2 increases.

Those who express opinions on the cause of global warming usually look at its effects today and, using a few relatively recent clues, try to determine its cause. The hydroplate explanation takes a much broader, relatively long-range look, not just from effect back to cause, but also from cause directly to effect. We can have much greater confidence in our conclusion when, after considering all the data, including the Ice Age and its causes, the issue is seen identically in both directions. The flood also explains many other features on the earth.

References and Notes

1. Most who jump to the conclusion that man is the primary cause of global warming also believe that the earth is billions of years old. They are alarmed that man is ruining a billion-year-old earth in just a few decades. No, global warming began at the peak of the Ice Age, only a few thousands of years ago.
2. This estimate involves many complex factors. Water levels do not change if *floating* ice melts. About 7% of earth's grounded ice is below sea level. Its melting will *lower* sea level slightly. Even if no ice melts, sea level rises to a large extent as the oceans warm and thermally expand.

Antarctic Lakes

Historical evidence, described in Figure 197, also shows that snow depths on Antarctica increased recently and rapidly. As they did, lakes were quickly covered and insulated from the cold antarctic air. The result today is more than 155 unfrozen lakes, 1–280 kilometers long, in Antarctica. One, Lake Vostok, the sixth largest lake in the world, has the volume of Lake Michigan.[7]

How could Antarctica have one or, more surprisingly, at least 155 unfrozen lakes buried under snow and ice—a "preposterous"[8] discovery made in the 1990s? To answer this requires answering two basic questions:

- How could a lake form on Antarctica?
- After all these years, why would even one Antarctic lake still be unfrozen?

The flood provides an obvious answer to the first question. *When the flood waters drained into the newly formed ocean basins, every continental basin, including those on Antarctica, were left full of water—some with warm and salty water. Therefore, Antarctica had lakes immediately after the flood.* Those who deny a global flood must find a way to warm Antarctica enough to create lakes. According to the plate tectonic theory, Antarctica has always been at the South Pole, so proponents of that theory cannot claim that Antarctica drifted in from warm latitudes. Nor did volcanic activity provide the necessary heat, because Antarctica has few volcanoes and most are not near those 155 lakes.

Once a thin sheet of ice forms on a lake in Antarctica, a "race" begins between (1) ice growing downward and (2) snow building upward. Either the lake will become a solid block of ice, or the insulating snow on top of the lake will become thick enough to prevent the lake from freezing. Each year, the ice will grow downward and thicken, at a steady but diminishing rate. Simultaneously, snow will build up above the lake. If the snow's thickness reaches about 2,000 feet before the downward growing ice touches the lake bottom, the lake will be insulated enough to retain its heat and not completely freeze; the slight amount of geothermal heat coming up through the floor of the lake will then prevent it from freezing solid.

Of course, the annual snowfall, the average air temperature, and the lake's initial depth and salt content will determine the winner. Today, Antarctica has less than 2 inches of precipitation each year, and the average air temperature is 20°F (-6.7°C) in the summer and -30°F (-34.4°C) in the winter. Under today's conditions, the ice should win that race on Antarctica, especially if the initial lake is shallow. If the lake is deep or salty, snow has a better chance of winning. However, those who do not think there was a global flood have difficulty explaining how deep or salty lakes developed on Antarctica.

If one accepts a global flood, the first bulleted question has the italicized answer above. The second question is answered when one realizes that for centuries after the flood, snowfall rates would be orders of magnitude greater than today, and many postflood lakes would be salty *and* deep. The more a lake freezes, the greater the salt's concentration becomes in the remaining liquid, so its freezing temperature drops. Ice growth rates would quickly approach zero. Snow would win. One extensively studied subsurface lake in Antarctica, Lake Vida, has seven times the salt concentration of our oceans! [9]

Because Antarctica has so many subsurface lakes, conditions must have been favorable for Antarctic lakes to form. This, by itself, suggests that there was a global flood followed by extreme rates of snowfall—the Ice Age.

- A 10-meter (33-foot) rise in sea level would displace 10% of the world's population and submerge New Orleans, New York City, London, much of Florida, and small islands. Major parts of North America's east coast, northern Europe, Bangladesh, Siberia, and China, would also be flooded. [See Gordon McGranahan et al., "The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones," *Environment & Urbanization*, Vol. 19, April 2007.] A 200-foot rise in sea level would displace 20% of the world's population.

3. Dry snow reflects 70–90% of the sun's radiation; open water reflects only 7–10%.

4. Current increases in the amount of atmospheric carbon dioxide are trivial compared to the amount spilled out during the flood. [See **"The Origin of Limestone"** on pages 229–235.] *Carbon dioxide is food for plants, and provides almost every carbon atom in every living thing.* The release of CO_2 during the flood helped reestablish earth's forests that were destroyed by the flood.

   Experiments conducted by the U.S. Department of Agriculture have shown that if the atmosphere's CO_2 is increased by a given percent, plant growth increases by a much greater percent. [See Sherwood B. Idso, *CO_2-Climate Dialogue* (Tempe, Arizona: Laboratory of Climatology, 1987).] Certainly, increases in atmospheric CO_2 have negative consequences, but the above experiments show positive aspects as well. (A related fact: *The main, heat-producing, greenhouse gas in our atmosphere is water vapor, not carbon dioxide or other gases produced by man.*)

Figure 197. Ancient Map Shows Recent Antarctic Snow Accumulation. In 1929, this amazing map was discovered in an old palace in Constantinople (Istanbul), Turkey. The map, drawn on gazelle skin, was signed in 1513 by Turkish admiral Piri Re'is (Pear-ee-RYE-us). The Admiral wrote on the map that it was based on 20 older maps, some dating back to the 4th Century B.C. and one used by Christopher Columbus. The Piri Re'is map shows, with amazing accuracy for the 16th Century, parts of Africa, Europe, the Americas, and Antarctica. Surprisingly, details show that Piri Re'is must have had a source map that was drawn *before snow was deep enough to cover the rugged Antarctic coastline.* Forgery can be ruled out, because we would learn the shapes of those ice-covered coastlines only after the development of seismic techniques for penetrating deep ice.

The Atlantic Ocean runs down the center of the map. (Disregard the symbols and focus on coastlines.) Notice at the upper right of the map the bulge of Africa and the Iberian Peninsula (today's Spain and Portugal). Next, locate a "skinny" South America. While some scales on the map are distorted and some marginal notes are incorrect, the shapes of the above continents are unmistakable. Finally, in the extreme south is part of the Antarctic coast called Queen Maud Land. Today, glaciers extend far beyond, and hide, that irregular coastline.

Copies of the Piri Re'is map are held by the U.S.Library of Congress and other leading libraries. Charles Hapgood[10] gives many details of Piri Re'is and other old maps that show a relatively ice-free Antarctica: Oronteus Finaeus, 1531; Hadju Ahmed, 1559; and Mercator, 1569. These medieval maps, copied 2–3 centuries before 1819 (when textbooks say Antarctica was discovered) were probably based on much earlier source maps. These and other[11] medieval maps also suggest much lower sea levels before the Ice Age. (The hydroplate theory explains why lowered sea levels were followed by the Ice Age.) The maps provide additional information on Antarctica's mountain ranges, plateaus, bays, coastal islands, and former rivers—under about a mile of ice today. Obviously, the Antarctic ice cap grew rapidly and recently[12] as humans were exploring the earth.[13] The ice cap did not grow, as taught for the last century, over millions of years or before man allegedly evolved.

◆ *"While CO_2 has increased substantially* [in recent decades], *its* [direct] *effect on temperature has been so slight that it has not been experimentally detected."* Arthur B. Robinson et al. "Environmental Effects of Increased Atmospheric Carbon Dioxide," *Journal of American Physicians and Surgeons*," Vol. 12, Fall 2007, p. 85.

Indirect effects would be larger. A slight warming of earth's surface (by CO_2, or any other means) raises ocean temperatures. Warmer oceans then release some of their immense amounts of dissolved CO_2—and, more importantly, increase the amount of water vapor in the atmosphere. Water vapor is a much more potent greenhouse gas.

5. Since 1841, increasingly accurate estimates have been made of the volume of ice on the earth at the peak of the Ice Age. Knowing that volume, one can approximate how far sea level was lowered. [For details, see Richard Foster Flint, *Glacial and Quaternary Geology* (New York: John Wiley and Sons, Inc., 1971), pp. 84, 315–342.]

6. Some experts are predicting sea level rises of 4–17 inches by 2100 and about 1 foot each century thereafter.

7. Robin E. Bell et al., "Tectonically Controlled Subglacial Lakes on the Flanks of the Gamburtsev Subglacial Mountains, East Antarctica," *Geophysical Research Letters*, Vol. 33, 28 January 2006, pp. L02504–L02507.

◆ Sid Perkins, "Cold and Deep," *Science News*, Vol. 169, 4 February 2006, pp. 69–70.

8. *"The idea that there was water underneath either of Antarctica's ice sheets (there is an eastern and western one) seemed preposterous."* Mariana Gosnell, "The Last Hidden Place on Earth," *Discover*, November 2007, p. 46.

9. Peter T. Doran et al., "Formation and Character of an Ancient 19-Meter Ice Cover and Underlying Trapped Brine in an 'Ice-Sealed' East Antarctic Lake," *Proceedings of the National Academy of Sciences*, Vol. 100, 7 January 2003, pp. 26–31.

10. Charles H. Hapgood, *Maps of the Ancient Sea Kings* (New York: Chilton Books, 1966; reprint, Kempton, Illinois: Adventures Unlimited Press, 1996).

    On 6 July 1960, the commander of the 8th Reconnaissance Technical Squadron, U.S. Air Force, wrote the following letter to Charles Hapgood. [Ibid., p. 243.]

    > Dear Professor Hapgood:
    >
    > Your request for evaluation of certain unusual features of the Piri Reis World Map of 1513 by this organization has been reviewed.
    >
    > The claim that the lower part of the map portrays the Princess Martha Coast of Queen Maud Land Antarctica, and the Palmer Peninsula is reasonable. We find this is the most logical and in all probability the correct interpretation of the map.
    >
    > The geographical detail shown in the lower part of the map agrees very remarkably with the results of the seismic profile made across the top of the ice cap by the Swedish-British-Norwegian Antarctic Expedition of 1949. This indicates the coastline had been mapped before it was covered by the ice cap.
    >
    > The ice cap in the region is now about a mile thick. We have no idea how the data on this map can be reconciled with the supposed state of geographical knowledge in 1513.
    >
    > Lt. Colonel Harold Z. Ohlmeyer

11. Other maps of this period show continents joined. [See Gregory C. McIntosh, *The Piri Reis Map of 1513* (Athens, Georgia: University of Georgia Press, 2000), p. 52.] If today's sea level were lowered by only 300 feet, all continents would be joined, except for narrow channels between Australia and Asia and between Europe and North America.

12. Using dubious assumptions, evolutionists claim that the ice sheets began building up at least a million years ago. Why then have scientists, using corings down through 12,000 feet of antarctic ice, discovered frozen bacteria—with their cell walls intact—directly above Lake Vostok? Obviously, those bacteria were frozen relatively recently.

    "Both [scientists] *detected hundreds, in some cases thousands, of bacterial cells per milliliter of* [12,000-foot-deep] *ice. Some of the bacteria had intact membranes, so 'they were alive fairly recently.'"* Gosnell, p. 48.

13. Researcher Bill Cooper discovered, in a few European libraries, ancient genealogies and histories that go back to Noah and his descendants mentioned in Genesis 10. Those records, written before Europe was introduced to Christianity, were often a basis for ancient rulers establishing their authority. Some of these scrupulously preserved genealogies can be "cross verified." They show remarkably rapid migrations and explorations after the flood by our rugged, resourceful ancestors. These histories also describe an ice age. [See Bill Cooper, *After the Flood: The Early Post-Flood History of Europe Traced Back to Noah* (West Sussex, England: New Wine Press, 1995). See also Endnote 6 on page 415.]

    Genesis 10, called the "Table of Nations," names the lands that Noah's early descendants (including Noah's great-great-great grandsons) colonized. Some of these individuals appear to match names in Cooper's historical genealogies and many of these distant lands are identifiable today. All of this shows travel across continental distances within a few generations of the flood. This implies navigational abilities similar to the abilities of those who made the source maps used by Piri Re'is and other medieval map makers.

Have Planets Been Discovered Outside the Solar System?

Yes. However, what has been learned from these discoveries does not imply that planets evolve or that life exists on such planets. Quite the opposite.[1]

The media and a few astronomers usually fail to explain important aspects of these discoveries. From 1963–2000, claims were made that planets had been found outside the solar system. Few details accompanied each report, so the general impression that planets evolve was reinforced and became textbook orthodoxy. Today, hundreds of planets have been discovered, but their characteristics contradict all theories (proposed during the past 275 years) for how planets evolved,[2] and almost all of their orbits create temperatures too extreme for life.[3] Besides, many other requirements must be met for life to exist, and most importantly, life is too complex to have evolved. [See pages 5–24 and **"Is There Life in Outer Space?"** on page 444.]

What were these false claims that planets had been discovered? In 1963, Peter van de Kamp announced that Barnard's star wobbled, as if a planet orbited the star. Ten years later, other astronomers showed that the telescope wobbled, not the star. In 1984, major radio and television networks reported that astronomers at Kitt Peak National Observatory had discovered the first planet outside the solar system. Other astronomers, after months of searching, could not verify the claim. Two years later, the astronomers who made that "discovery" acknowledged that atmospheric turbulence probably fooled them, because even they could not find their "planet." In 1991, British astronomers reported that a star, named Scutum, wobbled with a six-month cycle. They claimed, and the excited media announced, the discovery of the first planet outside our solar system. Later, these astronomers admitted their error. The Earth wobbled slightly, not the star.

On 19 May 1998, NASA announced, amid much fanfare, that the Hubble Space Telescope had made the first *direct* observation of a planet outside the solar system. An editorial in *Nature* criticized NASA's premature announcement. *"One does not need to read between the lines to perceive a deep need within NASA for publicity."*[4] Two years later, the astronomer making the "discovery" retracted her claim.[5.] What she thought was a planet was a star dimmed by interstellar dust. Other false alarms involved astronomers, eager for publicity, who joined with media hungry for an audience. Misinformation resulted. Unfortunately, the media rarely retracts reports that are later disproven, and textbooks, which change slowly, have yet to catch up.

Several stars are surrounded by disks of gas and dust, which a few astronomers thought might be merging to form planets. Some of these astronomers also believe that finding such disks confirms the theory that planets evolve from gas and dust orbiting a star. However, it is now known that on rare occasions the outer envelope of a sunlike star can be ejected into a disk-shaped cloud within a few years.[6.]

Since 2000, much more sophisticated techniques have identified hundreds of planets outside our solar system. One technique accurately measures a star's wobble, indicating that a possible planet orbits that star. A second technique measures the slight but periodic dimming of a star, suggesting that a planet is passing between the star and Earth. A few planets have been detected based on the way their gravity bends light rays we see from a light source behind the planet. A few telescopes have directly spotted extremely large planets that are far from the glare of the stars they orbit.

What has been learned? As one astronomer wrote, these newly discovered planets "spell the end for established theories of planet formation."[7] How do these extrasolar planets contradict evolution theories? One planet has been found in a tight cluster of tens of thousands of stars that would disrupt the evolution of any planet. That cluster is also devoid of the heavy chemical elements thought necessary to evolve a planet.[8] At least 30 planets have two suns; one sun of each pair would tend to disrupt any slow evolution of a planet.[9] A Jupiter-size planet has been found with three suns! Its orbit is so close to one star (0.05 AU) that it would have been pulled apart and overheated before it could have evolved. Worse yet, two other stars orbit the first star at a distance of 12.3 AU. Their presence would also prevent the planet from evolving.[10]

Some planets are so near their star that they are losing mass too rapidly to have been planets for very long.[11] Besides, their rocky cores would have melted before the planet's evolution could begin.[12] Others are too far from their star and the dust near the star needed to grow a planet. Also, their slow motion at those great distances would "scoop up" little dust. If planets evolved, friction from the gas and dust around a young star would have circularized each planet's orbit. Many extrasolar planets have very elongated and/or highly inclined orbits as opposed to the orbits of the planets in our solar system. A few planets orbit their star in directions opposite to the direction the star rotates.[13] Neither elongated, nor tilted, nor retrograde orbits would evolve from swirling dust clouds.

Some relatively cool, "rogue" planets (not associated with any star) are being discovered wandering alone in deep space. Experts admit that, *"The formation of young, free-floating, planetary-mass objects like these is difficult to explain by our current models of how planets form."*[14.]

What is clear is that for both our solar system's planets and for the extrasolar planets, evolutionary explanations are completely inadequate. Unfortunately, hundreds of millions of people have been misled by claims that planets evolved. Even the "experts" who have been telling us these stories will now admit that they were wrong.[15]

So what accounts for planets (solar and extrasolar)? They could have been created directly. A second possibility, explained on pages 383–388, is that planets formed from densely packed matter just before the heavens were stretched out.

References and Notes

1. *"We've learned that we really don't know what we're talking about with respect to exoplanets: how they form, what their distributions are, anything!"* Gibor Basri, "Is Anybody Out There?" *Discover*, November 2010, p. 49.

2. These theories include: the nebular hypothesis by Emanuel Swedenborg (1734) and later refined by Immanuel Kant (1755) and Pierre-Simon Marquis de Laplace (1796), the planetesimal theory by Thomas Crowder Chamberlin and Forest Noulton (1901), the tidal theory by James H. Jeans (1917), the accretion theory by Otto Schmidt (1944), the protoplanet theory by William Hunter McCrea (1960), the capture theory by Michael Woolfson (1964), and the solar nebular disk theory by Viktor Safronov (1972).

3. *"Most of the worlds we have found seem unlikely to support life* [because of temperatures]." Adam Frank, "How Nature Builds a Planet," *Discover*, Vol. 26, July 2005, p. 30.

4. "Dangers of Publication by Press Conference," *Nature*, Vol. 393, 4 June 1998, p. 397.

5. Ron Cowen, "The Planet That Isn't," *Science News*, Vol. 157, 22 April 2000, p. 271.

- Susan Terebey et al., "The Spectrum of TMR-1C Is Consistent with a Background Star," *The Astronomical Journal*, Vol. 19, May 2000, pp. 2341–2348.

6. L. F. Miranda et al., "Water-Maser Emission from a Planetary Nebula with a Magnetic Torus," *Nature*, Vol. 414, 15 November 2001, pp. 284–286.

7. *"With so little in common with the familiar Solar System planets, these newcomers spell the end for established theories of planet formation."* Dan Falk, "Planet Formation," *Nature*, Vol. 422, 17 April 2003, p. ix.

8. *"Finally, it is possible that regardless of how many and where planets form, the dynamical perturbations experienced over the history of the cluster would be too disruptive to allow the survival of any planets ..."* Steinn Sigurdsson et al., "A Young White Dwarf Companion to Pulsar B1620-26: Evidence for Early Planet Formation," *Science*, Vol. 301, 11 July 2003, p. 195.

- *"The discovery of a giant planet amid a cluster of primitive stars is challenging one of astronomers' pet notions. ...* [The planet would have to have been] *born billions of years before most astrophysicists thought the universe had spawned the raw materials needed to make them."* Robert Irion, "Ancient Planet Turns Back the Clock," *Science*, Vol. 301, 11 July 2003, p. 151.

9. Ron Cowen, "One Star Better Than Two?" *Science News*, Vol. 169, 21 January 2006, p. 46.

10. Maciej Konacki, "An Extrasolar Giant Planet in a Close Triple-Star System," *Nature*, Vol. 436, 14 July 2005, pp. 230–233.

- *"The discovery by Maciej Konacki of a giant planet in a system where the gravitational pull of a second star would disturb the planet's putative nursery will now place severe constraints on such* [evolutionary] *theories."* Artie P. Hatzes and Günther Wuchterl, "Giant Planet Seeks Nursery Place," *Nature*, Vol. 436, 14 July 2005, p. 182.

- *"In July* [2005] *Caltech planetary scientist Maciej Konacki turned up a world with three suns in the constellation Cygnus. Finding that a planet could exist in a multiple-star system counter to theoretical expectations, 'will put our theories of planet formation to a strict test,' says Konacki."* Jack Kelley, "Hunt for Another Earth Broadens," *Discover*, Vol. 27, January 2006, p. 26.

11. Instead of gaining mass, as any evolving planet must do, one extrasolar planet is so close to its star that it is losing at least 10,000 metric tons of hydrogen a second. (The rate of loss may be several orders of magnitude greater.) See A. Vidal-Madjar et al., "An Extended Upper Atmosphere Around the Extrasolar Planet HD209458b," *Nature*, Vol. 422, 13 March 2003, pp. 143–146.

12. *"More of these 'hot Jupiters' (orbiting within a tenth of the Earth-Sun distance) were soon found, making it clear that the principles underlying the formation of planetary systems needed some revision."* Gibor Basri, "Too Close for Comfort," *Nature*, Vol. 430, 1 July 2004, p. 24.

13. *"Cameron and colleagues recently studied 27 exoplanets and found that one-third had highly tilted orbits, including at least four that orbited backward."* Stephen Ornes, "Wrong-Way Worlds" *Discover*, November 2010, p. 17.

14. M. R. Zapatero Osorio et al., "Discovery of Young, Isolated Planetary Mass Objects in the σ Orionis Star Cluster," *Science*, Vol. 290, 6 October 2000, pp. 103–107.

15. *"Extrasolar planets have peculiar properties, and our understanding of how planets form, which was incomplete even before the new data became available, now looks even shakier."* Dan Falk, "Worlds Apart," *Nature*, Vol. 422, 17 April 2003, p. 659.

- "[Planets] *form through processes that do not clearly fit into any of the standard theoretical models."* Frank, p. 30.

- Ron Cowen, "What Is a Planet: New Riddles beyond the Solar System?" *Science News*, Vol. 170, 2 December 2006, pp. 360–361.

  "The astonishing close orbits and incredibly high planetary temperatures for the so-called hot Jupiters shattered the Solar System paradigm of planet formation and was the first surprising discovery of many in exoplanetary science." Drake Deming and Sara Seager, "Light and Shadow from Distant Worlds," *Nature*, Vol. 462, 19 November 2009, p. 301.

What about the Dinosaurs?

This frequent question, asked in just this way, implies many questions related to dinosaurs—a word meaning "terrible lizards." When did they live? What killed the dinosaurs? What were they like? What does the Bible say about them? Could so many large animals have fit on the Ark? There were about 500 different types of dinosaurs. Most were large; some even gigantic. One adult dinosaur was as tall as a five-story building. However, some adults were small, about the size of a chicken. [See page 394.] Most evolutionists now say that birds are dinosaurs.

Many questions will be answered if we focus on one question, "When did they live?" Two quite different answers are usually given. Evolutionists say that dinosaurs lived, died, and became extinct at least 60 million years before man evolved. Others believe God created all living things during the creation week, so man and dinosaurs lived at the same time. If we look at the evidence, sorting out these two very different answers should be easy.

Did dinosaurs become extinct at least 60 million years before man evolved? Almost all textbooks that address the subject say they did. Movies and television vividly portray this. One hears it even at Disney World and other amusement parks. Some will say that every educated person believes this. We frequently hear stories that begin with impressive-sounding phrases such as, "Two hundred million years ago, when dinosaurs ruled the earth, ..." But none of this is evidence; some of it is an appeal to authority. Evidence must be observable and verifiable.

Did man and dinosaurs live at the same time? Scientists in the former Soviet Union have reported a layer of rock containing more than 2,000 dinosaur footprints alongside tracks "resembling human footprints."[1] Obviously, both types of footprints were made in mud or sand that later hardened into rock. If some are human footprints, then man and dinosaurs lived at the same time. Similar discoveries have been made in Arizona.[2] Were it not for the theory of evolution, few would doubt that these were human footprints.

Soft dinosaur tissue has now been recovered from several dinosaurs: three tyrannosaurs (*T. Rex*) and one hadrosaur. It is ridiculous to believe that soft tissue can be preserved for more than 60,000,000 years, but it could be preserved for 5,000 years. [For details see **"Old DNA, Bacteria, Proteins, and Soft Tissue?"** on page 37.]

The Book of Job is one of the oldest books ever written. In it, God tells of His greatness as Creator and describes an animal, called Behemoth, as follows:

> *Behold now, Behemoth, which I made as well as you; He eats grass like an ox. Behold now, his strength in his loins, And his power in the muscles of his belly. He bends his tail like a cedar; The sinews of his thighs are knit together. His bones are tubes of bronze; His limbs are like bars of iron.* (Job 40:15–18)

Marginal notes in most Bibles speculate that Behemoth was probably an elephant or a hippopotamus, but those animals have tails like ropes. Behemoth had a *"tail like a cedar."* Any animal with a tail as huge and strong as a cedar tree is probably a dinosaur. Also, Job 40:19–24 says this giant, difficult-to-capture animal was not alarmed by a raging river. If the writer of Job knew of a dinosaur, then the evolution position is wrong, and man saw dinosaurs.

The next chapter of Job describes another huge, fierce animal, a sea monster named Leviathan.[3] It was not a whale or crocodile, because the Hebrew language had other words to describe such animals. Leviathan may be a plesiosaur (PLEE-see-uh-sore), a large seagoing reptile that evolutionists say became extinct 60 million years before man evolved.

Figure 198: Probably Not a Plesiosaur. This 32-foot-long "monster," caught by a Japanese fishing ship off the coast of New Zealand in 1977, was unfortunately thrown overboard shortly after this picture was taken. The animal made front-page news for weeks in Japan. Several Japanese scientists felt that it was a plesiosaur, and a Japanese postage stamp seemed to commemorate the discovery of the first modern plesiosaur. In the 6th edition (1995) of this book, this animal was incorrectly labeled as a "possible plesiosaur." Later, after reading English translations of opinions of other Japanese scientists and seeing similar pictures of decaying basking sharks, it seems more likely that this was a large basking shark.[4] Decay patterns near the shark's head give the appearance of a neck. My apologies for the error.

For the past three centuries, reports have come from the Congo in western Africa that dinosaurs exist in remote swamps. Eyewitness stories are often from educated people who can quickly describe dinosaurs. Two expeditions to the Congo, led by biologist Dr. Roy Mackal of the University of Chicago, never saw dinosaurs, but interviewed many of these witnesses and concluded that their reports were about dinosaurs and were apparently true.[5] If any of these accounts are correct, man and dinosaurs were contemporaries.

Consider the many dragon legends. Most ancient cultures have stories or artwork of dragons that strongly resemble dinosaurs.[6] *The World Book Encyclopedia* states that:

> *The dragons of legend are strangely like actual creatures that have lived in the past. They are much like the great reptiles* [dinosaurs] *which inhabited the earth long before man is supposed to have appeared on earth. Dragons were generally evil and destructive. Every country had them in its mythology.*[7]

The simplest and most obvious explanation for so many common descriptions of dragons from around the world is that man once knew the dinosaurs.

What caused the extinction of dinosaurs? Primarily, the flood. Because dinosaur bones are found among other fossils, dinosaurs must have been living when the flood began. Dozens of other dinosaur extinction theories exist, but all have recognized problems. [See pages 121–122.] Most of the food chain was buried in the flood. Therefore, many large dinosaurs that survived the flood probably had difficulty feeding themselves and became extinct.

Were dinosaurs on the Ark? Yes. God told Noah to put representatives of every kind of land animal on the Ark. (Some dinosaurs were semiaquatic and could have survived outside the Ark.) But why put adult dinosaurs on the Ark? Young dinosaurs would take up less room, eat less, and be easier to manage. Animals were on board so they could reproduce after the flood and repopulate the earth. Young dinosaurs would have more potential for reproduction than old dinosaurs.

Certain bones in dinosaur bodies show annual growth rings, as trees do. Dinosaurs, early in life and late in life, grew at very slow rates. During mid-life, they went through huge growth spurts.[8] Therefore, during the year dinosaurs were on the Ark, juveniles probably weighed less than 60 pounds. (A 2-year-old *T. Rex* weighed 66 pounds. The largest known *T. Rex* lived to the age of 28 years.[9] Dinosaurs did not become large because they lived long lives.)

References and Notes

1. Alexander Romashko, “Tracking Dinosaurs,” *Moscow News*, No. 24, 1983, p. 10.
2. Paul O. Rosnau et al., “Are Human and Mammal Tracks Found Together with the Tracks of Dinosaurs in the Kayenta of Arizona?” Parts I and II, *Creation Research Society Quarterly*; Vol. 26, September 1989, pp. 41–48 and December 1989, pp. 77–98.

◆ Before 1986, many thought that dinosaur tracks and human tracks were together along the banks of the Paluxy River, near Glen Rose, Texas. Some, but not necessarily all, of the humanlike tracks were made by part of a dinosaur’s foot. The film, *Footprints in Stone*, and John Morris’ book, *Tracking Those Incredible Dinosaurs*, which popularized the man-track idea, have been withdrawn. A few creationists still claim that some of these manlike tracks were made by humans. I believe that the Paluxy tracks should be studied more and many questions satisfactorily answered before claiming human tracks are along the Paluxy River.

◆ In Uzbekistan, 86 consecutive horse hoofprints were found beside supposedly 90–100-million-year-old dinosaur tracks. Evolutionists have almost as much difficulty believing that horses and dinosaurs lived together as they do man and dinosaurs. Horses allegedly did not evolve until many millions of years after the dinosaurs became extinct. [See Y. Kruzhilin and V. Ovcharov, “A Horse from the Dinosaur Epoch?” *Moskovskaya Pravda* (*Moscow Truth*), 5 February 1984.]

3. Leviathan is also mentioned in Psalms 74:14 and 104:26 and in Isaiah 27:1. Both Leviathan and Behemoth are described in the apocryphal book II Esdras. Verses 6:49–53 say that these beasts were created on the fifth day and given separate territories because of their large size.
4. Glen J. Kuban, “Sea-Monster or Shark? An Analysis of a Supposed Plesiosaur Carcass Netted in 1977,” *Reports of the National Center for Science Education*, Vol. 17, May/June 1997, pp. 16–19, 22–28.

◆ Pierre G. Jerlström, “Live Plesiosaurs: Weighing the Evidence,” *Creation Ex Nihilo Technical Journal*, Vol. 12, No. 3, 1998, pp. 339–346.

◆ Pierre G. Jerlström and Bev Elliott, “Letting Rotting Sharks Lie,” *Creation Ex Nihilo Technical Journal*, Vol. 13, No. 2, 1999, pp. 83–87.

5. Roy P. Mackal, *A Living Dinosaur?* (New York: E. J. Brill, 1987).

◆ “Living Dinosaurs?” *Science 80*, November 1980, pp. 6–7.

◆ Jamie James, “Bigfoot or Bust,” *Discover*, March 1988, pp. 44–53.

6. Lorella Rouster, “The Footprints of Dragons,” *Creation Social Science and Humanities Quarterly*, Fall 1978, pp. 23–28.
7. Knox Wilson, “Dragon,” *The World Book Encyclopedia*, Vol. 5, 1973, p. 265.
8. Gregory M. Erickson et al., “Gigantism and Comparative Life-History Parameters of Tyrannosaurid Dinosaurs,” *Nature*, Vol. 430, 12 August 2004, pp. 772-775.
9. Ibid., p. 773.

Did It Rain before the Flood?

Genesis 2:5–6 suggests that it did not rain before the flood:

> *Now no shrub of the field was yet in the earth, and no plant of the field had yet sprouted, for the Lord God had not sent rain upon the earth; and there was no man to cultivate the ground. But a mist used to rise from the earth and water the whole surface of the ground.*[1]

But notice, these verses only say that *shortly after the earth was created*, it had not rained. How long did this condition last? Some believe that this mist began the evaporation-rain cycle. If so, the period of no rain was brief, and it rained before the flood. Let's look for other clues.

Rainbows. God promised never again to flood the entire earth (Genesis 9:12–17), a promise marked by a *"bow in the cloud"*—a rainbow. Rainbows form when raindrops refract sunlight. This suggests that rainbows began after the flood, which would mean there was no preflood rain.

Others disagree, saying rainbows may have been visible before the flood, but afterward God simply associated His promise with rainbows. This would be similar to the symbolism of a wedding ring. Rings existed before a wedding, but afterward the ring recalls a solemn vow. However, if rainbows suddenly began after the flood, the rainbow's symbolic effect would have been more unforgettable and reassuring to the frightened survivors of the flood.

Some argue that rainbows would have formed before the flood every time water splashed and sunlight passed through the droplets. This argument overlooks that God's promise concerned rainbows "*in the cloud*," not a relatively few drops of water several feet above the ground.

A Terrarium. The Hebrew word translated "mist," *ed* (אד), in Genesis 2:6 is used in only one other place in the Bible—Job 36:27. There it clearly means water vapor. So, did the preflood earth act as a humid terrarium in which water vapor evaporated, condensed without rainfall, and watered the earth? Could an earth-size terrarium produce enough water to supply major rivers, such as described in Genesis 2:10–14? Two preflood rivers, the Tigris and Euphrates, were evidently the basis for naming the mighty postflood rivers that today bear the same names. [See Endnote 4. on page 449.]

The preflood earth was quite different from today's earth. If the hydroplate theory is reasonably correct, earth's preflood topography was smoother, so rivers flowed more slowly and required less water to keep them filled. No volcanoes, major mountains, glaciers, or polar ice existed before the flood. Approximately half the earth's water was under the earth's crust, so the earth's surface had about half the water it has today. With 360-day years, days were slightly longer. [See pages 109–147 and Endnotes 23–18 on page 169.] The preflood earth had greater land area, because the flood produced today's ocean basins. [See pages 149–173.] Preflood forests were vast and lush, enough to form today's coal, oil, and methane deposits. This left little room for deserts. Could these preflood conditions have prevented rain, yet adequately watered a thirsty earth?

Condensation Nuclei. Water droplets almost always begin with water vapor condensing on *a solid surface*. A common example is early-morning dew that collects on grass. Raindrops, snowflakes, and fog particles begin growing on microscopic particles carried in the air. These particles, called ***condensation nuclei***, are typically 0.001–0.0001 millimeters in diameter—less than one hundredth the diameter of a human hair. Each cubic inch of air we breathe contains at least 1,000 such particles. Water vapor molecules rarely collide and stick together; instead, a water droplet forms when trillions of water molecules collect on one of these microscopic particles.

Wind. Most wind is produced by atmospheric temperature differences; wind then mixes air that has different temperatures and moisture contents. The various "mixtures" give us weather: rain, snow, hail, hurricanes, tornadoes, droughts, fair weather, etc. Without today's major mountains, ice sheets, volcanoes, and vast oceans,[2] the preflood earth had more uniform temperatures. Also, abundant vegetation moderated temperatures by evaporative cooling during the day and condensation and heating at night. More uniform temperatures meant less wind[3] and weather extremes.

If a water molecule were the size of a ping-pong ball, a condensation nucleus would be a house-size "rock" and a raindrop would be 100 miles in diameter. When a gaseous water molecule strikes that "rock," much of the molecule's energy is transferred to the "rock" as heat. If a somewhat "absorbent rock" is cold enough and the humidity is high enough, the molecule will stick; condensation will begin, and a raindrop will start to grow. The "rock," slightly warmer because of the added energy from colliding water molecules, will warm the surrounding air, causing slight updrafts. Moist breezes plus updrafts would bring enough moisture to "the rock" for it to grow into a water droplet.

That "rock" and its attached water cannot "float" in calm air for long, just as a grain of sand cannot float in still water. Only wind can suspend condensation nuclei, just as only a swift stream can suspend a sand particle. With less preflood wind, condensation nuclei would receive less lift and stay closer to the ground. With more uniform temperatures globally, less air would rise over warmer areas—again, keeping nuclei and moisture closer to the ground. High clouds may not have existed.

Once water began collecting on nuclei near the ground, the heat of condensation warmed adjacent air, causing it to rise. A microscopic droplet has a large cross-sectional area relative to its volume, so rising, moist air carried the tiny droplet upward. As it rapidly grew, its weight increased faster than its cross-sectional area, so it quickly settled to the earth and often collected other droplets in its path. We could describe this as fog rising from the earth and then settling back to water the ground before rain could form. (This sounds like Genesis 2:5–6, doesn't it?)

It would be similar to morning fog rising on a still lake, but with two differences. First, without polar ice and snow-capped mountains before the flood, less solar radiation reflected back into space, so more of the Sun's rays heated the earth during the day. With more forests, few (if any) clouds, and slightly longer days, the earth absorbed even more solar energy. Consequently, more water evaporated each day. At night, fewer clouds and longer nights allowed more heat to escape into space, causing more water to condense. (Today, clouds reflect back into space 20–25% of the incoming radiation and hold in much of the earth's outgoing radiation.) Therefore, ***the preflood earth was watered more abundantly and uniformly by daily condensation than by rain today.*** Furthermore, watering occurred at daily intervals. Unlike today, there were no long dry spells or wet spells, droughts or local floods.

Heavy condensation before each sunrise kept moisture closer to the ground and restricted high-cloud formation. Today, morning fog evaporates soon after sunrise, before the moisture can settle to the ground. With fewer, if any, high clouds before the flood, temperatures dropped more rapidly at night. This, coupled with more moisture in the daytime air, allowed water droplets to grow larger, settle to the ground faster, and soak into the soil before morning evaporation could begin.

The second difference caused preflood fog droplets to grow even faster and larger. Without today's main sources of condensation nuclei (volcanic debris, sulfur compounds from volcanoes, man-made pollutants, lightning-produced fires, sea salt from ocean spray, or dust kicked up by high winds) there were fewer condensation nuclei. Condensing more moisture on fewer nuclei meant fog droplets grew larger and settled faster.

First Rain. If it did not rain before the flood, how did the first rain form *at the very beginning* of the flood? As explained on pages 109–147, the drops of water falling at the beginning of the flood were not formed by condensing water. Instead, they formed by fragmenting the upward-jetting subterranean water into a spray.

Any credible explanation of the flood should explain why rain probably did not fall before the flood, how the fertile earth was watered, what supplied the rivers, how violent rain[4] fell so rapidly at the beginning of the flood, and why the rain ended after 40 days, even though the flood waters rose until the 150th day when all the preflood mountains were covered. Also, if the flood's 40 days of rain formed by condensation, why didn't that rain stop after a few days, because falling rain would have removed the condensation nuclei? The hydroplate theory answers these questions.

References and Notes

1. Translations of these verses have raised frequent questions. Many believe that Genesis 2:5–6 contradicts Genesis 1. They dismiss Genesis as inaccurate or conclude that there are two creation accounts, Genesis 1 and Genesis 2. (Item 3 on page 451 refutes those opinions.)

   Other objections include the following: The creation of vegetation was described in Genesis 1:11–12, but later, Genesis 2:5 says there was no vegetation. Man was created in Genesis 1:27, yet Genesis 2:5 says there was *"no man."* Furthermore, it says man must be present before plants could grow, but in Genesis 1, plants came before man.

   These misunderstandings disappear when one realizes that "vegetation" in Genesis 1:11–12 is the Hebrew word *deshe*, meaning the plant kingdom. In Genesis 2:5, "shrub" (*siach*) and "plant" (*eseb*) are special kinds of cultivated plants. Following the latter two words with *"of the field"* implies cultivation or farming of specific plants—not vegetation in general. Likewise, *"beasts of the field"* (Genesis 2:19–20, II Samuel 21:10, Psalm 8:7) are domestic animals, while *"beasts of the earth"* (Genesis 1:24–25) are wild animals. *"Plants of the field"* (cultivated plants) were probably not eaten until after the fall (Genesis 3:18). My understanding of Genesis 2:5–6, although not a translation, is:

   > *Crops were not yet growing on the newly created earth. The Lord God had not sent rain, and man did not yet toil for food.* [Hard labor came after the fall.] *Heavy fog watered the earth.*

2. Oceans and other large bodies of water change temperature more slowly than land. Today, large temperature contrasts between the two generate strong wind systems high into the atmosphere. With less ocean water before the flood, these temperature contrasts, and the wind they generated, would have been weaker.

3. Another factor that retarded preflood winds was aerodynamic drag from the extensive preflood forests.

4. See Endnote 6. on page 412.

Did the Flood Last 40 Days and 40 Nights?

No. This is a common misunderstanding. Violent *geshem* rain lasted for 40 days and 40 nights, but the flood waters covered all preflood mountains 150 days after the flood began. *People and animals were in the Ark for more than a year—7 months after the Ark landed.* Why? Wouldn't you have wanted to leave that boat? No doubt, conditions outside the Ark were hostile. Figure 70 on page 136 lists the destructive events following the continental drift phase.]

This is the most precisely recorded year in the Bible. Here are some flood-year events. ("D-day" marks the start of the flood. D-7 represents one week before the flood began.)

Table 21. Log of the Flood Year[1]

Day (Duration)	Reference in Genesis	Event	Comments
D - 7	7:1, 4, 10	Loading the Ark begins: Noah, his wife, their three sons, their sons' wives, and representatives of all air-breathing land animals enter the Ark.	
D	7:11, 13	Humans enter the Ark for the last time. Then, on this single day, all the fountains of the great deep burst open[2] and rain begins. [See Figures 41, 56, and 57.]	This occurred on the 17th day of the 2nd month. Noah was 600 years old.
(40 days)	7:12, 17	Rain[3] falls upon the earth. The Ark is *lifted up above the earth*. The waters increase greatly[4] upon the earth.	Evidently, the Ark was loaded on dry land.
(150 days)	7:19, 24	Waters prevail [rise with mighty power] upon the earth. They eventually cover all the earth's preflood mountains.	Notice that the waters rose for 110 days after 40 days of *"geshem"* rain.
D + 150 days	8:1–4	A wind passes over the earth. The waters begin to subside; the fountains of the deep and the floodgates of the sky close, and the rain is restrained. The Ark rests upon the mountains of Ararat, and the water continues to steadily recede.	Months were probably 30 days long. Compare 8:3 and 8:4, and note that 8:4 begins with "And." After the flood, rapid rising of mountains and thickening of the crust displaced air and probably caused the wind.[5]
D + 224 days	8:5	The tops of the mountains become visible.	Noah saw at least two peaks.
D + 264 days	8:7	Noah sends out a raven. It does not return.	The birds were released at seven-day intervals. (Study Genesis 8:10.) This hints at a seven-day week and a sabbath—a commemoration of the creation week. [See Genesis 7:4.]
D + 271 days	8:8–9	Noah sends out a dove. It returns to Noah.	
D + 278 days	8:10–11	Again, Noah releases a dove. It returns with an olive leaf.	
D + 285 days	8:12	Noah releases a dove for the third time. It does not return.	
D + 314 days	8:13–14	Noah removes the covering of the Ark and sees the dry ground.	Noah stayed in Ark 57 more days. Conditions outside were unsafe. [See **"Recovery Phase"** on page 131.]
D + 371 days	8:15–19	God tells Noah to off-load the Ark.	

References and Notes

1. Durations are based on the Masoretic text. The Septuagint text has Noah in the Ark exactly one year. Other manuscripts of Genesis give slightly different times.
2. "Burst open" is a loose translation of בָּקַע, which means a violent cleavage. Isaiah 34:15 and 59:5 uses it to describe the hatching or breaking forth from inside an egg, i.e., the breaking of a thin shell or crust. Numbers 16:31 uses it to describe the splitting open of the earth. [See also Psalm 78:15.]
3. גֶּשֶׁם transliterates as *geshem*. It is the most violent rain. In Ezekiel 13:11–13, *geshem* rain destroyed mortared walls.
4. "Greatly" is an understatement. "Greatly, greatly" would be a more accurate (although rougher) translation, because Hebrew uses the double superlative construction. This construction is used in only one other place in the Old Testament—in Genesis 17:2 where God makes a covenant with Abraham.
5. Noah and the Ark certainly experienced high winds during the preceding five months. So, the wind that began on the 150th day must have been unusual and extreme.

   Noah released a bird (a raven) from the Ark 114 days after the wind began. He probably did this to learn how far the waters had receded. Noah would not have done this if the extreme wind were still blowing, because it would have blown the raven from the Ark, and the raven would have had difficulty returning. Therefore, the wind was temporary.

Is the Hydroplate Theory Consistent with the Bible?

Without hearing from eyewitnesses, police can usually reconstruct the general outlines of an automobile accident by carefully studying skid marks and wreckage. So also, some details of the flood can be pieced together by studying its wreckage. However, good witnesses provide details consistent with the physical evidence as well as information we could never learn otherwise.

For example, the flood was initiated by God as a consequence of man's sin. We may never understand the precise event that God used (or allowed) to physically trigger the flood; however, once started, other events must have occurred whose consequences, or "wreckage," we can still see. Examples include earthquakes, volcanic eruptions, rapid burial and preservation of trillions of fossils in layered rocks; crumpled mountains; marine fossils on every major mountain range; the jigsaw fit of the continents; strange features on the ocean floor; gouged out canyons; comets, asteroids, and meteorites; earth's radioactivity; and hundreds of other features. One can place many of these consequences in a cause-and-effect sequence that (1) conforms to scientific laws, (2) best explains details of these observations, and (3) provides a greater understanding of this global cataclysm. That is the purpose of the hydroplate theory.

Table 22 shows the close correspondence between the biblical description of the flood and the hydroplate theory.

Table 22. Comparison of Biblical Chronology with Major Events of the Hydroplate Theory

Biblical Chronology	Hydroplate Theory
Day 2 of Creation Week: The earth was covered by water. (Gen 1:2) Then "a *raqia*" separated liquid water above from liquid water below. (Gen 1:6–7)	The Initial Condition: A layer of water was below the earth's crust (a *raqia*, or pressed-out solid). [See **"What Does 'Raqia' Mean?"** on page 429 for further details.]
Day 3 of Creation Week: The waters below the heavens are gathered into one place, and the dry land appears. (Gen 1:9)	Water above the crust drains into depressions and dry land appears. (A rock crust, resting on a layer of water, will automatically deform. Portions will sink to the subterranean chamber floor and resemble tapered pillars; the displaced water will lift other portions of the crust.) [See pages 433–437.]
The flood begins suddenly with all the fountains of the great deep[1] bursting open on one day. *"Geshem* rain" begins. (Gen 7:11)	**Rupture Phase:** A crack propagates around the earth in about 2 hours, releasing subterranean water. Fountains of muddy, pulsating water and rocks jet high above the earth. Mammoths are frozen in supercold, muddy hail falling from above the atmosphere. Comets, asteroids, and meteoroids form from some of the high velocity water and rocks that escape earth. [See pages 237–327.]
40 days and 40 nights of *"geshem* rain" ends. (Gen 7:4,12)	**Flood Phase:** Rising flood waters blanket and suppress the jetting of the fountains of the great deep. Animals and plants are buried in sediments from the muddy water.
Flood waters rose until the 150th day, when they covered all preflood mountains. (Gen 7:19–24)	High-pressure water continues to gush up into the flood waters. Liquefaction sorts sediments and dead plants and animals. Salt domes, coal, and oil begin forming.
150th Day: A wind passes over the earth. Waters begin to slowly subside.[2] Ark lands on the mountains of Ararat. (Gen 8:1–4)	**Continental-Drift Phase:** Mid-Atlantic Ridge buckles up; Atlantic floor rises and western Pacific subsides, so the hydroplates accelerate downhill, sliding on a layer of lubricating water. When the massive hydroplates decelerate, they are crushed, thickened, buckled, and heated in a gigantic *compression event*. Overthrusting occurs in some places. Continents take on present shape. As major mountains form, air is displaced, causing a great wind. The earth begins a slow 35°–45° roll, so the poles shift.
150th — 371st Day: Passengers stay on Ark.	**Recovery Phase:** Hostile environment: earthquakes begin; inner earth melts; ocean trenches, ring of fire, and methane hydrates form; flood basalts and volcanoes erupt; water drains; continents shift; vegetation reestablished; and Ice Age begins. Lowered sea level facilitates land migration and allows the formation of tablemounts and submarine canyons. Plateaus form. Large continental canyons form by the breaching of natural dams.
371st Day: Ark off-loaded. (Gen 8:15–19)	
371st Day to the present. [See Endnote 13 on page 403.]	

The following verses speak of subterranean water. Taken collectively, they appear to provide support for the statements in bold below. Some passages may be metaphors referring to ancient demonstrations of God's power.

1. Large quantities of subterranean water existed in the ancient past.

- Psalm 24:2. ... *He has founded it* [the earth] *upon the seas ...*
- Psalm 33:7. ... *He gathers the waters of the sea together as a heap; He lays up the deeps in storehouses ...* (A storehouse is a closed container that preserves something you may use later. God used that water when He brought it forth as a flood. Many storehouses, or interconnected chambers, held the subterranean water.)
- Psalm 104:3. *He lays the beams of His upper chambers in the waters ...*[3] [Pillars were formed.]

- Psalm 136:6. … [He] *spread out the earth above the waters …*
- II Peter 3:5. … *the earth was formed out of water and by water …*[4]

2. These subterranean waters burst forth bringing on the flood.

- Genesis 7:11–12. … *the fountains of the great deep burst open,*[5] *and the floodgates*[6] *of the sky were opened. And rain fell …*[7]
- Job 38:8–11. *who enclosed the sea with doors, when bursting forth, it went out from the womb; when I made a cloud its garment …*
- Psalm 18:15. … *the channels of water appeared, and the foundations of the world were laid bare …*
- Proverbs 3:20. … *the deeps were broken up and the skies dripped dew …*

3. A massive hailstorm occurred.

- Exodus 9:18, 24. … *I will send a very heavy hail, such as has not been seen in Egypt from the day it was founded until now. … So there was hail, and fire flashing continually in the midst of the hail, very severe, such as had not been in all the land of Egypt since it became a nation.* [Both verses may suggest that an even larger hailstorm than the one God inflicted on Pharaoh occurred *before* Egypt became a nation. If so, that earlier hailstorm was presumably during the flood.][8.]

4. After the 40-day avalanche of rain ended, the waters continued to rise until the 150th day.

- Genesis 7:12. *And the* [geshem (see Endnote 6)] *rain fell upon the earth for forty days and forty nights.*[9]
- Genesis 7:18–19, 24. … *the water prevailed*[10] *and increased greatly … so all the high mountains everywhere under the heavens were covered. … and the waters prevailed for one hundred and fifty days.*

5. During the compression event, the continents crushed and thickened and mountains dramatically rose, each in minutes. Then the flood waters receded.

- Psalm 104:6b–9. … *the waters were standing above the mountains. At Thy rebuke they fled; at the sound of Thy thunder they hurried away. The mountains rose; the valleys sank down to the place which Thou didst establish for them. Thou didst set a boundary that they* [the water] *may not pass over; that they may not return to cover the earth.*[11]
- A possible description of some events in earth's early history may be found in Proverbs 8:22–29.

6. Before the flood, the Earth probably had a 360-day year and may have had a 30-day lunar month. As Genesis 1:14–16a states, the Sun and Moon were created as "very good" time keepers. The 150th day of the flood was exactly 5 months after the fountains of the great deep broke loose. [See Genesis 7:11, 7:24, and 8:4.] Five 30-day months would be 150 days; twelve 30-day months would be 360 days. The flood very likely altered a 30-day lunar orbit. [See Endnote 23 on page 169, Figure 147 on page 273, and **"Did the Preflood Earth Have a 30-Day Lunar Month?"** on page 485.]

References and Notes

1. This Hebrew word for "deep" is *tehom*, which according to the 1973 *Strong's Concordance*, means "a surging mass of water, especially from the main sea or the subterranean water supply." [See *Strong's Exhaustive Concordance of the Bible* (New York: Abingdon Press, 1973), Hebrew Word 8415.]
2. See **"Why Did the Flood Water Drain So Slowly?"** on page 442.
3. Psalm 104:1–4 is a celebration of the first and second creation days. [See C. F. Keil and F. Delitzsch, *Commentary on the Old Testament in Ten Volumes*, Vol. 5 (reprint, Grand Rapids: Eerdmans Publishing Co., 1980), p. 128.]
4. See page 433.
5. The same Hebrew word, *baqa* (בָּקַע), is used for "burst open" and "broken up" in Genesis 7:11 and Proverbs 3:20, respectively. *Baqa* describes a violent and complete splitting, sometimes of the earth's crust (Numbers 16:31, Micah 1:4, Zechariah 14:4). Isaiah 34:15 and 59:5 use *baqa* to describe the breaking of an egg shell by internal pressure as a baby bird exits. This aptly describes events of the hydroplate theory—the globe encircling rupture (splitting) of the earth's crust by internal pressure. [See Figures 41 and 57 on pages 106 and 126.]
6. The "floodgate terminology" shows that water fell in a violent and concentrated manner. Imagine the overwhelming force you would feel if you stood under floodgates that suddenly opened—floodgates that had 40 days' worth of water behind them. The word for violent rain, גֶּשֶׁם (transliterated *geshem*), was used instead of the word for normal rain. *Geshem* rain is sometimes accompanied by high winds and huge hailstones that can destroy mortared walls (Ezekiel 13:11–13). Normal rain (*matar* rain) is formed by condensation, a relatively slow process, because heat must be transferred away from condensing droplets. Rain formed by condensation does not correspond to the

dramatic release of power suggested by the "floodgate terminology" and the bursting forth of water in Genesis 7:11.

The Hebrew word for "floodgates" is *arubbah* (אֲרֻבָּה). In Isaiah 24:18, its opening was associated with the shaking of the foundations of the earth (as in the hydroplate theory). In Malachi 3:10, II Kings 7:2, and 7:19, *arubbah* describes an almost miraculous opening of the sky. In Hosea 13:3, it means chimney and describes smoke pouring from a chimney, much like muddy water jetted into the sky in the hydroplate theory.

7. These events—the bursting open of the fountains of the great deep, opening of the floodgates of the sky, and falling rain—are in the cause-and-effect order of the hydroplate theory. This is also true in Genesis 8:2 and Proverbs 3:20.

8. This insight was brought to my attention by Don J. McIlrath on 23 January 2002.

9. After 40 days and 40 nights, "*geshem* rain" stopped. However, the flood water rose until the 150th day when it covered all preflood mountains, and the floodgates were closed (Genesis 8:2). The hydroplate theory helps us understand this. After 40 days, the layer of water rising on the earth blanketed and suppressed the high jetting of *the fountains of the great deep*. Nevertheless, high-pressure subterranean water continued to gush out and add to the rising flood water until the 150th day. On that day, the fountains were closed (Genesis 8:2) by the settling hydroplates pinching shut the outward flowing water.

10. The Hebrew word *gabar* is usually translated in this verse as "prevailed." It carries the idea of a mighty opposition of forces, in which one force overwhelms (or prevails over) another. It is as if the flood waters were fighting to overcome forces that would have drained the water from the earth. On the 150th day, after the compression event, that "prevailing" ceased. The flood waters then began to drain into deep basins, such as the newly opened Atlantic.

11. God promised never to send another global flood (Genesis 9:15). Psalm 104:6b–9 tells why water would *"not return to cover the earth."* The mountains rose, and the valleys sank down, so a boundary was set for the water.

The hydroplate theory provides further understanding. During the compression event, continents were crushed and thickened; mountains buckled up. Water drained into the low spots as the land rose out of the water. Imagine the violent sounds—*"the sound of Thy thunder"*—during the compression event. After the hydroplates settled onto the floor of the subterranean chamber, water could no longer be forced up onto the continents. In this way, surface water was contained in basins—*"a boundary that they may not pass over; that they may not return to cover the earth."* It is now clear why there will never be another global flood.

After the flood, some water remained (1) between the irregularities in the chamber floor and the settling hydroplates, and (2) in cracks in the crushed hydroplates. This trapped water seems to explain mysteries associated with shallow earthquakes, salt water under the Tibetan Plateau, and why deep drilling has intersected "hot flowing water" that is too deep to have seeped down from the earth's surface. [See pages 116 and 131.] Exodus 20:4 may refer to this water.

How Was the Earth Divided in Peleg's Day?

Genesis 10:25 states, and I Chronicles 1:19 repeats, "*And two sons were born to Eber; the name of the one was Peleg, for in his days the earth was divided.*" Peleg lived a few centuries after the flood. Little else is known about him.

In what way was the earth divided? Here are three possibilities. Bible commentators mention only the first two.

a. Languages suddenly multiplied at Babel and produced divisions among the people of the world. [See Genesis 11:1–9.]
b. The continents were divided by continental drift, which began in Peleg's day.
c. Greatly lowered sea levels soon after the flood (as explained by the hydroplate theory) connected all continents.[1] Sea level rose in Peleg's day, ***dividing the earth by water***.

Languages Divided in Peleg's Day? Scripture says, "*the earth was divided.*" The Hebrew word for earth, *erets*, can also be translated as "countries," "land," or "ground." In other words, the land was divided, not people or languages. Besides, Peleg probably lived two generations after languages were multiplied at Babel.[2]

Continents Broke and Began Drifting in Peleg's Day? If this happened, *what broke them apart?* Worse yet, *what moved them?* It takes earthshaking forces to break and move continents. Those who accept the plate tectonic theory believe that continents have broken frequently—geologically speaking. To stretch and break a thick slab of rock requires, among other things,[3] sliding it horizontally on its foundation against enormous frictional force. [See the Technical Note on page 487.] Simultaneously, an additional force must stretch the slab, like a rubber band, until it breaks. Plate tectonics can't provide either gigantic force. Therefore, you can safely offer to move a continent (provide one force) if someone will break a continent (provide both forces).

Those who claim that continents broke and moved have not fully considered the forces and energy required. To open up the entire Atlantic in a few thousand years *by rock-on-rock sliding* would produce indescribable global violence and volcanic activity that left no geological or historical record. (Among almost all cultures, ancient and modern, the only global catastrophe with a clear historical record is the flood.)

If the continents broke apart, they should fit together better than they do. (Figures 52–53 on page 118, show this.) The public has been misled for decades into believing that the continents fit against each other. Actually, four great map distortions were deliberately made, as Figure 51 explains. Continents bordering the Atlantic fit much better next to the base of the Mid-Atlantic Ridge. The hydroplate theory explains why.

Rising Water Divided Continents in Peleg's Day? The Bible uses the Hebrew word *peleg* as a verb three times. Two usages, mentioned above, are translated simply as divided (Genesis 10:25 and I Chronicles 1:19). The third use is a division by water (Job 38:25). In the ten instances where *peleg* is a common noun, it always involves water. The *New American Standard Bible* translates it eight times as "streams," once as "stream," and once as "channels." Therefore, *peleg* may imply a division by water.

In English, we have the words *archipelago* (a sea having, or dividing, many islands) and *pelagic* (relating to or living in the sea). Pelagic sediments or deposits are sediments on the ocean floor. Pelagic frequently refers to life forms found in the sea. *Bathypelagic* means relating to or living in the deep sea. Also, the prefix *pelag* means sea.

Dr. Bernard Northrup, a Hebrew professor, has shown that *peleg* originally meant division by water.[4] That meaning is embedded in all three language families of Noah's offspring. Consequently, its meaning probably preceded the multiplication of languages at Babel. Northrup states:

> [Peleg, palag, or PLG] *often contains within it a reference to water. It is used to refer to a stream of water in Hebrew, Coptic, Ethiopic and in Greek. The root is used to refer to irrigation canals which carried the water throughout the farming land of Mesopotamia. However, an examination of the Greek usage (of the family of Japeth* [one of Noah's three sons]*) of the root letters PL and PLG clearly shows that in the majority of the instances this root was used of the ocean. … It is used to mean: "to form a sea or lake," "of places that are flooded and under water," "of crossing the sea," of "the broad sea" itself, of "being out at sea," "on the open sea." It is used of seamen and ships. The noun with the result suffix is used of "an inundation." I continue: it is used of "a being at sea," of "a creature of or on the sea," of "one who walks on the sea," of "running or sailing on the open sea," of "a harbor that is formed in the open sea by means of sandbags," and in many ways of "the open sea itself," of "going to, into or toward the sea," of "roving through the sea," of "being sea-nourished," of "turning something into the sea," or "of flooding." It is quite apparent that every Greek usage here involves the sea in some way.*

Therefore, the earth was probably ***divided by water*** in Peleg's day. The hydroplate theory explains how and why. Soon after the flood, sea level was several miles lower than today,[5] because the floor of the subterranean chambers was about 10 miles below the earth's surface. As the crushed, thickened, buckled, and sediment-laden continents sank into the mantle in the centuries after the flood, sea level had to rise in compensation. Eventually, sea level approached today's level. [See pages 109–147 for details and evidence.]

With sea level much lower for a few centuries after the flood, imagine how many migration paths existed for animals and man to populate today's continents and islands.[6] God's commands (Genesis 9:1, 11:4–9) for humans and animals to populate the "whole earth" after the flood must have been doable. If, after the flood, sea level was where it is today, repopulating the "whole earth" would have been difficult, if not impossible, for those first receiving God's command. The wisdom and urgency of God's command are apparent when we realize that sea level was steadily rising. The "window of opportunity" for global migration was disappearing in Peleg's day.

From the genealogies listed on page 420, we see that Peleg lived from 100 to 339 years after the flood, five generations after Noah. Therefore, Peleg, or those who named him, may have been world travelers or explorers who discovered that the earth was being divided by rising water. Certainly, Noah's early descendants knew how to construct ships, because Noah and his three sons built the Ark. They would have had an explorer's curiosity when they realized how drastically the flood had changed the earth. Their long life spans allowed them to pursue that curiosity and accumulate knowledge. This would help explain a remarkably accurate, authentic, and ancient map that shows islands now covered with water and the outlines of Antarctica—as it would look with no ice. [See Figure 197 on page 402.]

The Ice Age would have lowered sea level about 300 feet—almost enough to join all continents. But at the height of the Ice Age, Antarctica and all its coastlines would have been covered with ice. Therefore, the Ice Age cannot explain both the visible coastlines shown on the ancient map and interconnected continents. The flood accounts for both. (The hydroplate theory also shows how the flood produced the Ice Age.)

Conclusion. Strong linguistic and scientific arguments oppose the two interpretations of Genesis 10:25 commonly taught: (1) a division of people by multiplication of languages, and (2) the beginning of continental drift. Instead, these studies point to an earth being divided by rising water in the days of Peleg. They also paint a picture o our ancestors migrating and exploring soon after the flood.

References and Notes

1. North America would join Asia at the Bering Strait. Except for very narrow bodies of water, Australia would connect to Asia along a 1,000-mile-wide land bridge, Europe would join North America via Greenland, and Antarctica would touch South America.
2. Nimrod, who ruled at Babel, lived three generations after Noah (Genesis 10:8–10), while Peleg lived five generations after Noah.
3. The slab must first separate from its foundation before sliding and stretching can begin. At the extreme pressures pressing a continent onto its foundation, "fusing" would occur. Atoms on one side of the slab-foundation interface would bond with atoms on the other side in a crystalline, minimum-energy structure. Breaking that bond by some shearing action along a nearly horizontal plane would require *precise*, herculean forces.

   Some speculate that large asteroid impacts or volcanic eruptions broke the continents. If such global disasters occurred, consider the vast collateral damage. Had today's fragile life forms been anywhere on earth during such a catastrophe, they would not be here today. Also, deep rock is under extreme compression, which prevents spreading or breaking. These proposals have many other problems.
4. Bernard Northrup, "Continental Drift and the Fossil Record," *Repossess the Land* (Minneapolis: Bible Science Association, 1979), pp. 165–166.
5. Three lines of evidence also support the conclusion that sea level was several miles lower than today: submarine canyons, tablemounts, and coral formations almost one mile below Eniwetok Atoll. For details, see pages 109–147.

   A drastically lowered sea level after the flood surprises most people, because it has always been difficult to see how water covering all the earth's mountains could go anywhere, let alone miles below today's sea level. However, once one realizes where the flood waters came from, one can understand where they went.

   Following the Ice Age, a few land bridges would have been divided by a relatively small rise in sea level (about 300 feet). However, this probably occurred long after the flood, and would not be the division spoken of in Peleg's lifetime.
6. Legends of the Hopi Indians tell how their ancestors came to the Americas. *After a gigantic flood, their ancestors used many family-size rafts made from hollow reeds* [bamboo] *and "island hopped" for many years north and east to the Americas. The steep coastline* [today's continental slope] *forced them along the coast until they could land. Rising water later drowned the chain of islands along their path.* [See Frank Waters, *Book of the Hopi* (New York: Penguin Books, 1963), pp. ix–27.] The Hopi legend and its significance were brought to my attention by Kevin P. Kluetz on 4 June 1996.

This seems to describe the Mid-Oceanic Ridge in the Pacific as a major corridor to the northeast. It would explain many things, including why the earliest known settlers in the Western Hemisphere lived in Central and South America and came from southern Asia. [See Tom D. Dillehay, "Tracking the First Americans," *Nature*, Vol. 425, 4 September 2003, pp. 23–24.] Today, bamboo, sometimes 12 inches in diameter, grows abundantly in southeast Asia and is used in building large, seagoing rafts. [See Bruce Bower, "Erectus Ahoy: Prehistoric Seafaring Floats into View," *Science News*, Vol. 164, 18 October 2003, pp. 248–250.]

- Lowered sea levels in the centuries after the flood also contributed to rapid migration in other parts of the world. The Austronesian family of languages include those spoken by the peoples of Taiwan, Indonesia, Madagascar, New Zealand, Easter Island, the Philippines, Hawaii, and other Polynesian Islands—1,200 languages in all. Linguists, tracing the "ancestry" of each language, can see that the mother tongues originated in Taiwan and then radiated southwest, south, and east to the lands mentioned above—a span of 16,000 miles. [See R. D. Gray et al., "Language Phylogenies Reveal Expansion Pulses and Pauses in Pacific Settlement," *Science*, Vol. 323, 23 January 2009, pp. 479–483.] For example, words associated with canoes are common among those languages outside Taiwan, but not on Taiwan. [For linguistic details, see Jared M. Diamond, "Taiwan's Gift to the World," *Nature*, Vol. 403, 17 February 2000, pp. 709–710.] Similar conclusions were reached in a study that traced mutations in a common bacterium in human intestines. [See Yoshan Moodley et al., "The Peopling of the Pacific from a Bacterial Perspective," *Science*, Vol. 323, 23 January 2009, pp. 527–530.]

  Also, pots, tools, bones, and farming methods show that the outward expansion happened in several surges a few thousand years ago. Some experts feel improved boating technology allowed explorations to distant islands. Early sea migrations used bamboo sailing rafts. Later, canoes were used, and still later, outriggers. Lowered sea levels after the flood would have reduced the distances vessels had to travel, because most of these lands, which are today islands, would have been connected or nearly connected.

  Commerce and travel would have continued between many of these once larger, nearly-connected lands as sea levels rose, the lands shrunk to become islands, and the waterways separating the islands expanded. Without this understanding, we might think that ancient peoples survived long, dangerous voyages and just happened to land on distant islands.

How Accurate Is Radiocarbon Dating?

Radiocarbon ages that are less than 3,500 years old are probably accurate. However, before accepting any radiocarbon date, one should know how the technique works, its limitations, and its assumptions. One limitation is that the radiocarbon technique dates only material that was once part of an animal or plant, such as bones, flesh, or wood. It cannot date rocks directly. To understand the other capabilities and limitations of radiocarbon dating, we must understand how it works and consider the flood.

Most carbon atoms weigh 12 atomic mass units. However, roughly one in a trillion carbon atoms weighs 14 atomic mass units. This carbon is called *carbon-14*—or ***radio***carbon, because it is ***radio***active. Half will decay in about 5,730 years to form nitrogen. Half of the remaining half will decay in another 5,730 years, and so on.

Carbon-14 comes from two sources: (1) the upper atmosphere where cosmic rays convert nitrogen-14 to about 21 pounds of carbon-14 per year, and (2) the earth's crust where some neutron-heavy radioisotopes decay by emitting small amounts of carbon-14 nuclei.[1] The first source is widely known; relatively few have heard of the second, which was discovered in 1984.

As explained in **"The Origin of Earth's Radioactivity"** on pages 329–371, neutron-heavy and superheavy radioisotopes were produced in abundance during the flood, so some unknown but significant quantity of carbon-14 escaped into the atmosphere when those heavy isotopes quickly fissioned and decayed. Smaller, but also unknown, amounts of carbon-14 are still escaping from the crust.[2]

Most carbon-14 in the atmosphere quickly combines with oxygen to form radioactive carbon dioxide. Plants take in carbon dioxide, incorporating in their tissues both carbon-14 (unstable) and normal carbon-12 (stable) ***in the same proportion as was in the atmosphere at that time***. Carbon-14 then moves up the various food chains to enter animal tissue—again, in about the same ratio as carbon-14 had with carbon-12 in the atmosphere.

When a living thing dies, its radiocarbon loss (decay) is no longer replenished by intake, so its radiocarbon steadily decreases with a half-life of 5,730 years. If we knew the ratio of carbon-12 to carbon-14 in an organism when it died, we could date its death. The assumption usually made is that the atmospheric ratio of carbon-14 to carbon-12 has always been about what it is today—about one in a trillion—so every living thing died with that ratio of carbon-14 to carbon-12 in its tissues.[3] However, that assumption will be shown (in a few pages) to be terribly wrong for organic material living before or soon after the flood.

The worldwide flood invalidated this standard assumption in a second way by uprooting and burying preflood forests. Less carbon was then available in the biosphere to dilute the carbon-14 continually entering the atmosphere from both sources, so the ratio of carbon-14 to carbon-12 in the atmosphere steadily increased. If that ratio has doubled since the flood and we did not know it, radiocarbon ages of things that lived soon after the flood would appear to be one half-life (or 5,730 years) older than their true ages. If that ratio quadrupled, organic remains would appear 11,460 (2 × 5,730) years older, etc. Therefore, a "radiocarbon year" would not correspond to an ***actual*** year.

As explained in Figure 199, recent measurements show that the ratio of carbon-14 to carbon-12 has been building up in the atmosphere.[4] However, for the last 3,500 years, the increase in the ratio has been slight but measurable.

Radiocarbon dating of vertical sequences of organic-rich layers at 714 locations worldwide has consistently shown a surprising result.[5] For radiocarbon ages that are a few thousand years old, ages do not increase *steadily* with depth, as one might expect. Instead, they increase at an accelerating rate. In other words, the concentration of carbon-14 is unexpectedly low in the lower organic layers and becomes more so the deeper the layer.

Tree-ring dating allows us to infer how the atmospheric concentration of carbon-14 changed in the past. Some types of trees growing at high elevations with a steady supply of moisture will reliably add only one ring each year. In other environments, multiple rings can be added in a year.[6] A tree ring's thickness depends on the tree's growing conditions, which vary from year to year. Some rings may show frost or fire damage. By comparing sequences of ring thicknesses and ring damage in two different trees, a correspondence can sometimes be shown. Trees of the same species that simultaneously grew within a few hundred miles of each other may have similar patterns. Trees of different species or trees growing in different environments have less similar patterns.

Claims are frequently made that tree-ring thickness patterns of wood growing today can be matched up with those of some scattered pieces of dead wood, so that tree-ring counts can be extended back more than 8,600 years. This is incorrect. These claimed "long chronologies" begin with either living trees or dead wood that can be accurately dated by historical methods.[7] This carries the chronology back perhaps 3,500 years. Then, the more questionable links are made based *on the judgment of a tree-ring specialist.* Sometimes "missing" rings are added.[8] Each tree ring's width varies greatly around the tree's circumference. Standard statistical techniques could show how well the dozen supposedly overlapping tree-ring thickness patterns fit. However, in at least two instances tree-ring specialists have refused to subject their judgments to these statistical tests and would not release their data, so others could do these statistical tests.[9]

Several laboratories in the world are now equipped to perform a much improved radiocarbon dating procedure. Using atomic accelerators, a specimen's carbon-14 atoms

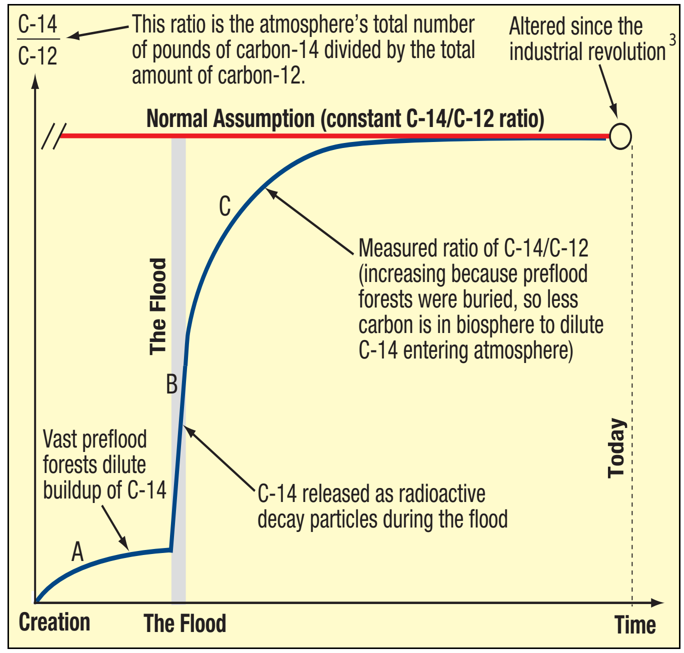


Figure 199: Increasing Amounts of Carbon-14. *If one thought that the C-14/C-12 ratio had always been what it is today, one would incorrectly conclude that small amounts of carbon-14 in fossils meant that much time had passed. Instead, those organisms had less carbon-14 when they died.*

Radiocarbon dating requires knowing the ratio of carbon-14 to carbon-12 in the atmosphere when the organic matter being dated was part of a living organism. The assumption (shown in red), which few realize is being made, is that this ratio has always been what it was before the industrial revolution—about one carbon-14 atom for every trillion carbon-12 atoms. Willard Libby, who received a Nobel Prize for developing this technique, conducted tests in 1950 that showed more carbon-14 forming than decaying. Therefore, the amount of carbon-14 and the ratio must be increasing. He ignored his test results, because he believed that the earth must be more than 20,000–30,000 years old, in which case the amount of carbon-14 must have had time to reach equilibrium and be constant.[4] In 1977, Melvin Cook did similar, but more precise, tests which showed that the ratio was definitely increasing, even faster than Libby's test indicated.

Before the flood, about half of today's water was under the earth's crust, so the preflood earth had less sea area and more land and forest area. The small amount of carbon-14 that accumulates in the upper atmosphere (about 21 pounds per year) was, therefore, diluted before the flood by the vast amounts of carbon-12 in the lush vegetation growing on the earth. Much of that vegetation was buried during the flood and became our coal, oil, and methane deposits. Beginning at the creation, the blue curve [line A] gradually rose from zero. During the flood [line B], carbon-14 rapidly entered the atmosphere as radioactive decay products. (A smaller amount still is entering the atmosphere.[1,2]) Therefore, the ratio of carbon-14 to carbon-12 has steadily increased [line C] since the flood.

can now actually be counted, giving a more precise radiocarbon date with even smaller samples. The standard, but less accurate, radiocarbon dating technique counts only the rare disintegrations of carbon-14 atoms, which are sometimes confused with other types of disintegrations.

This new atomic accelerator technique has consistently detected at least small amounts of carbon-14 in every organic specimen—even materials that evolutionists claim are millions of years old, such as coal. This small amount is found so often among various specimens that contamination can probably be ruled out. Ancient human skeletons, when dated by this new "accelerator mass spectrometer" technique, give surprisingly recent dates. In one study of eleven sets of ancient human bones, all were dated at about 5,000 radiocarbon years or less![10]

Radiocarbon dating of supposedly very ancient bones should provide valuable information. Why are such tests rarely performed? Researchers naturally do not waste money on a technique that destroys their specimen and provides no specific age. In an organic specimen thought to be older than 100,000 *radiocarbon* years, all carbon-14 would have decayed, so an age could not be determined. Therefore, researchers will not radiocarbon date specimens if they think are older than 100,000 years. Conversely, if carbon-14 is in any specimen, it must be less than 100,000 years old, even if the researcher believes the specimen is millions of years old.

PREDICTION 44: Bones or other organic remains that contain enough carbon and are believed to be older than 100,000 years will be shown to be relatively young in blind radiocarbon tests. This prediction, first published in the 6th edition (1995), p. 157, has now been confirmed.[11] (Blind tests are explained on page 95.)

Very precise measurements now show that most fossils—regardless of presumed "geologic age"—have roughly the same ratio of carbon-14 to carbon-12. (This includes fossil fuels: coal, oil, and methane.) Therefore, those organisms must have been living at about the same time—and less than 100,000 years ago. Because almost all fossils are preserved in water deposited sediments, all this former life was probably buried in a recent, global flood.[12]

Radiocarbon dating is becoming increasingly important in interpreting the past. However, one must understand how it works and especially how a flood affected radiocarbon dating. Radiocarbon ages less than 3,500 years are probably accurate. Ages around 40,000 *radiocarbon* years, which are typical of coal, have much younger *true* dates—near the time of the flood, roughly 5,000 years ago.

References and Notes

1. *"... ^{223}Ra nuclei occasionally, but significantly, decay with the loss not of an α-particle but of a carbon-14 (^{14}C) fragment."* John Maddox, "Exotic Nuclear Decay Discovered," *Nature*, Vol. 307, 19 January 1984, p. 207.

◆ H. J. Rose and G. A. Jones, "A New Kind of Natural Radioactivity," *Nature*, Vol. 307, 19 January 1984, pp. 245–247.

2. The isotopes that are now known to decay by emitting a carbon-14 nucleus (plus other particles) include: francium-221, radium-221, radium-222, radium-223, actinium-223, radium-224, actinium-225, and radium-226. During the flood, the abundant superheavy isotopes, which briefly formed, would have produced much more carbon-14.

3. Actually, several minor corrections are made. For example, since the industrial revolution began, human activity, *especially the burning of fossil fuels*, has altered the ratio of carbon-14 to carbon-12 in the atmosphere. Also, nuclear explosions in the atmosphere temporarily tripled the ratio.

4. In 1952, when Willard Libby proposed the radiocarbon dating technique, he called attention to the critical assumption that the ratio of carbon-14 to carbon-12 has been constant. He tested that assumption by making various measurements and calculating how rapidly carbon-14 was forming and decaying. Surprisingly, he saw that *carbon-14 was entering the atmosphere faster than it was decaying*. That meant there was much less atmospheric carbon-14 in the past. If we did not know that, we would incorrectly conclude that the lack of carbon-14 in dead animals and plants was because much time had passed and the carbon-14 had decayed.

   Libby believed that his measurements were in error, because he thought that the earth was so old that a balance between formation and decay must exist. (Of course, he did not know that carbon-14 is a decay product from inside the crust and is steadily leaking into the atmosphere.) He wrote:

   > *If the cosmic radiation has remained at its present intensity for 20,000 or 30,000 years, and if the carbon reservoir has not changed appreciably in this time, then there exists at the present time a complete balance between the rate of disintegration of radiocarbon atoms and the rate of assimilation of new radiocarbon atoms for all material in the life-cycle.* Willard F. Libby, *Radiocarbon Dating* (Chicago: University of Chicago Press, 1952), pp. 4–9.

   In 1986, Libby's measurements were repeated with even greater accuracy. These results show that the out-of-balance condition is much more than Libby believed. ***Radiocarbon is forming 28–37% faster than it is decaying.*** This means that *the farther one looks back in time, the greater the out-of-balance condition would have been—until the time of the flood*. Changes in the atmosphere's carbon-14 to carbon-12 ratio, from 3,500 years ago to the industrial

revolution, have been very small, because the biosphere has so much carbon-12. [See Melvin A. Cook, "Nonequilibrium Radiocarbon Dating Substantiated," *Proceedings of the First International Conference on Creationism*, Vol. 2 (Pittsburgh, Pennsylvania: Creation Science Fellowship, 1986), pp. 59–68.] This is what we would expect as a result of the flood.

- *"It now appears that the C14 decay rate in living organisms is about 30 per cent less than its production rate in the upper atmosphere."* William D. Stansfield, *Science of Evolution* (New York: Macmillan Publishing Co., 1977), p. 83.

5. Robert H. Brown, "Implications of C-14 Age vs. Depth Profile Characteristics," *Origins*, Vol. 15, No. 1, 1988, pp. 19–29.

- Radiocarbon ages of seeds in ancient caves often span unreasonably long time periods, such as 2,000 years. [See, for example, Bruce D. Smith, "The Initial Domestication of *Cucurbita pepo* in the Americas 10,000 Years Ago," *Science*, Vol. 276, 9 May 1997, pp. 932–934. Also see, Wade Roush, "Squash Seeds Yield New View of Early American Farming," *Science*, Vol. 276, 9 May 1997, pp. 894–895.]

6. W. S. Glock and S. Agerter, "Anomalous Patterns in Tree Rings," *Endeavor*, Vol. 22, January 1963, pp. 9–13.

7. The oldest living tree known (called the *Methuselah Tree*) is a bristlecone pine in the White Mountains of California. The American Forestry Association estimates that it is 4,600 years old. Amazingly, it is not part of any "long chronology." Its age, however, is remarkably close to the probable time of the flood, about 5,000 years ago. It should not be surprising that some trees alive today started growing soon after the flood.

8. Harold S. Gladwin, "Dendrochronology, Radiocarbon and Bristlecones," *Anthropological Journal of Canada*, Vol. 14, No. 4, 1976, pp. 2–7.

9. *"The entire chronology is the work of one laboratory, the director of which* [C. W. Ferguson] *has refused to allow critical study of the raw data."* For details, see Herbert C. Sorensen, "Bristlecone Pines and Tree-Ring Dating: A Critique," *Creation Research Society Quarterly*, Vol. 13, June 1976, p. 5.

- Leading tree-ring specialists do not subject their judgments to statistical tests. In a private three-hour meeting (19 July 1989) I had with the director (Dr. Malcolm Hughes) and lead scientist (Dr. Austin Long) of the world's largest tree-ring laboratory (University of Arizona's Laboratory of Tree-Ring Research), both expressed no interest in doing so.

- A year before, a worker in this laboratory reported that circular reasoning was used in tree-ring chronologies. Wood specimens considered for "long chronologies" are first radiocarbon dated. If a date is old enough (perhaps by an erroneous reading), tree-ring specialists then look at the "old" specimen's ring thicknesses for a way to extend the "long chronology." This chronology is used to assure the public that radiocarbon dating has been calibrated by a continuous sequence of tree rings. [This unsound practice is also described by Henry N. Michael and Elizabeth K. Ralph, "'Quickee' ^{14}C Dates," *Radiocarbon*, Vol. 23, No. 1, 1981, pp. 165–166.]

10. R. E. Taylor et al., "Major Revisions in the Pleistocene Age Assignments for North American Human Skeletons by C-14 Accelerator Mass Spectrometry," *American Antiquity*, Vol. 50, No. 1, 1985, pp. 136–140.

11. *"There is measurable carbon-14 in* [75 samples of] *material that should be 'dead' according to standard evolutionary theory;"* Paul Giem, "Carbon-14 Content of Fossil Carbon," *Origins*, Vol. 51, 2001, p. 6.

    Giem addressed (on pages 6–30) possible sources of error, including contamination. He either eliminated them or determined that they were highly unlikely.

- Personal communication: Walt Brown to Paul Giem, 4 April 2000; Paul Giem to Walt Brown, 10 September 2000.

- John R. Baumgardner et al., "Measurable ^{14}C in Fossilized Organic Materials," *Proceedings of the Fifth International Conference on Creationism* (Pittsburgh, Pennsylvania: Creation Science Fellowship, Inc., 2003), pp. 127–142.

12. *"Since it is believable that most fossil carbon has roughly the same $^{14}C/C$ ratio, it is reasonable to conclude that all this carbon was in the biosphere at approximately the same time. In that case, since most, if not all, fossil carbon was deposited by water, the data suggest a flood of massive proportions, and that the biblical account has to be taken seriously."* Giem, pp. 26–27.

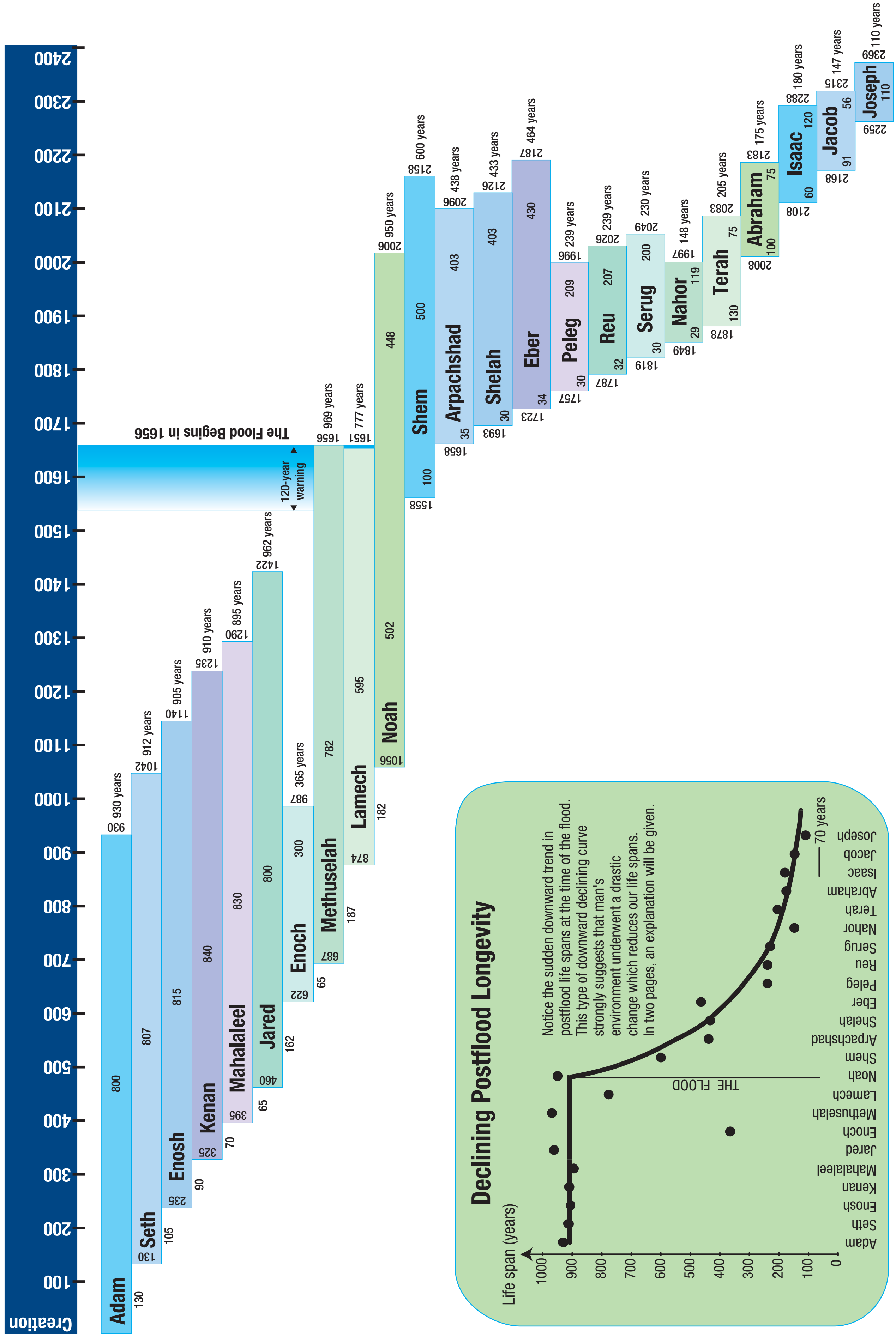


Figure 200: Genealogy Chart.

According to the Bible, When Was Adam Created?

The ages and relationships of the patriarchs, given in Genesis and shown Figure 200, allow one to estimate the time of Adam's creation at slightly more than 6,000 years ago. What uncertainties are involved?

a. These ages are based on the Hebrew (Masoretic) text, used in almost all English translations. The corresponding numbers in the Samaritan and Greek (Septuagint) texts place Adam's creation about 6,200 and 7,300 years ago, respectively. Which text is closest to the original is uncertain. If one uses the Septuagint, then Methuselah died 14 years after the flood—a logical impossibility, since he was not on the Ark. (Some sources say that the name Methuselah means, "When he is dead, it shall be sent." According to the numbers in Figure 200, the flood began in the year Methuselah died.)
b. Fractions of a year should be added or subtracted, because each patriarch was probably not born on his father's birthday. Also "became the father of" or "begot" may have referred to the time of conception rather than the time of birth.
c. Some ages in all three texts have evidently been rounded, because too many numbers end in zero or five. Rounding 15 or so ages in Genesis probably would not inject more than 20 years of total error, but this rounding might have been intended to absorb the fractions of the year mentioned in b above.
d. Disagreements exist concerning Terah's age when Abraham was born. Some argue that Terah was 70 years, not the favored 130 years shown in this chart.[1]
e. Luke 3:36 lists Cainan as the son of Arpachshad and the father of Shelah. In Genesis, Cainan's name occurs only in recent copies of the Septuagint—not the oldest. Nor is Cainan in the oldest known copy of Luke. Therefore, a copyist probably added Cainan's name inadvertently, perhaps taking it from Luke 3:37.
f. Most students of the subject place the death of Joseph (Jacob's son) between 1606 B.C. and 1690 B.C. An error in this date will add a corresponding error to the year of Adam's creation.

Theistic evolutionists often raise two objections to the chronological information in Genesis.

a. Some say, pointing to Cainan, that the genealogies contain gaps. However, the possibility of gaps is irrelevant to the year of Adam's creation. Let us assume that many generations existed between two consecutive patriarchs on this chart. The time between their births is fixed by Genesis, no matter how many generations might be missing. (For example, Enosh was born 105 years after Seth's birth.) The writer or compiler of this information had a careful, systematic, and mathematical way of linking the chronology into one continuous family record—in contrast to other genealogies in the Bible.
b. Some have said that the long ages of the preflood patriarchs resulted from lunar months being incorrectly counted as years. If so, Mahalaleel and Enoch were 5 years old when they had children.

This chart contains other interesting details.

a. Noah's son Shem, born before the flood, nearly outlived Abraham. Surprisingly, many people think of Noah and Shem as relatively ancient (or imaginary) but accept Abraham as historically recent. Noah died only two years before Abraham was born.
b. Notice the continuous chain of overlapping life spans of Adam, Methuselah, Shem, and Abraham or Isaac.
c. Enoch's time on earth was cut short, but not by death. [See Hebrews 11:5.]
d. Notice the systematic change in life spans after the flood, as shown in the inset on page 420.

Genesis 5 says that each of the first 9 patriarchs had *"other sons and daughters"* besides the son in the patriarchal line. In other words, each family had *at least* 5 children: 3 sons and 2 daughters. Statistically, all 9 families would probably have at least 3 sons and 2 daughters if each family had 10 or more children. (Conversely, all 9 families would probably not have had 3 sons and 2 daughters if each family had 9 children or less.) If 10 or more children per family were typical before the flood, and plagues, famines, and wars were no more common than in the last several thousand years, then the world's population at the time of the flood would have exceeded today's population of almost 7 billion people.

References and Notes

1. Genesis 11:26 says that *"Terah lived 70 years, and became the father of Abram* [Abraham]*, Nahor and Haran."* This does not mean that Terah was 70 years old when Abram was born. Children are not always listed in birth order. Noah's three sons were not. [See Genesis 5:32, 9:24, and 10:21.] The son mentioned first may simply be the most prominent, as was Abraham. So, we must look deeper.

   Genesis 11:32, Genesis 12:4, and Acts 7:4 tell us that Terah lived 205 years, and when Abram was 75 years old, Terah died. So, Terah was 130 years old when Abram was born.

Why Did People Live for about 900 Years before the Flood?

Life spans suddenly began decreasing after the flood, at least for the patriarchs listed in Figure 201 (also shown in Figure 200 on page 420). This "ski slope" type of decline (called an *exponential decay*) is one that every engineer and scientist sees frequently. It occurs when a system moves from a balanced, equilibrium situation toward a suddenly produced, lower equilibrium state.

Many people have speculated on the cause of this decrease, but few proposals fit all the following facts. The decline:

- began at the flood
- fits an exponential decay[1]
- affected Shem, who carried *preflood* genetics[2]
- affected the entire postflood population, regardless of latitude, elevation,[3] diet, nationality, or customs

Unfortunately, proposals that do fit these facts cannot be tested experimentally. Nor can my proposal. However, the flood events I have already described fit all of these facts *and would automatically reduce longevity—greatly.*

A previous frequently-asked question (pages 416–419) concerns radiocarbon dating and the rapid buildup of carbon-14 beginning at the flood. As explained in **"The Origin of Earth's Radioactivity"** (pages 329–371), during the flood powerful electrical (piezoelectric) currents inside the fluttering crust released small but significant amounts of carbon-14. Also produced were a few thousand other *new isotopes*—chemical elements that were unusually light or (heavy) because they had fewer (or more) than the normal number of neutrons.

To illustrate what contributed to some extent to decreased life spans after the flood, let's first consider carbon-14—just one of these few thousand new isotopes. (Slightly different, but related, examples will then be given for the other isotopes produced during the flood.)

Imagine a man weighing 160 pounds (72,575 grams). About 30% of his body (by mass) is carbon. Every 12 grams of carbon contains 6.022×10^{23} carbon atoms. One carbon atom out of a trillion (10^{12}) is carbon-14. Carbon-14 has a half-life of 5,730 years. When carbon-14 decays, it becomes nitrogen-14. Therefore, *a 160-pound body experiences 4,200 carbon-14 disintegrations every second!*

$$\frac{72{,}575 \times 0.30 \times 6.022 \times 10^{23} \times 0.693}{12 \times 10^{12} \times 5{,}730 \times 31{,}556{,}736} = 4{,}200\ \frac{\text{disintegrations}}{\text{second}}$$

Note: There are 31,556,736 seconds in a year, and the number 0.693 (-ln ½) converts half-lives to rates of decay.

What happens when carbon-14 atoms in your body suddenly decay and become nitrogen? *It's not good.* Those atoms bond differently with other tissues, producing distortion (or wrinkling) at the atomic level. Also, if any carbon in your DNA or RNA suddenly becomes nitrogen, the affected genes may not work properly. Both effects age you every second, with clocklike precision, but which organs finally break down or become diseased will be somewhat random and will depend partially on the genetics you inherited. The *negative exponential curve* in Figure 201 is a mirror image of the *positive exponential curve* (line C) in Figure 199 on page 417. Did that postflood carbon-14 *increase* cause *decreased* longevity? Maybe.

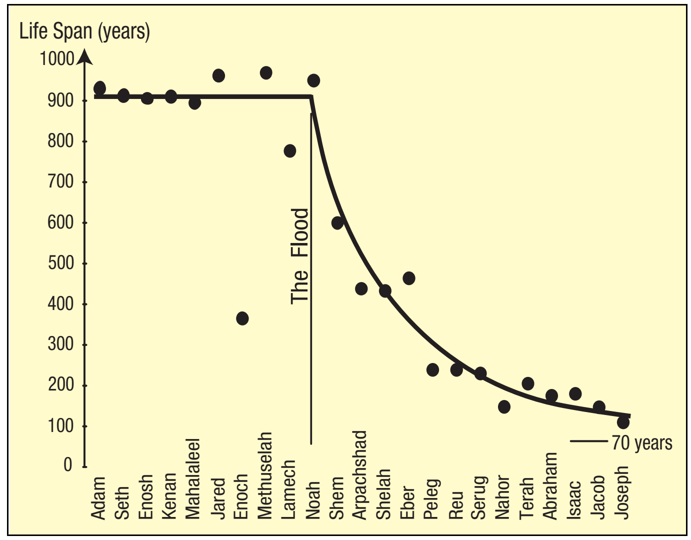


Figure 201: Declining Postflood Longevity. Notice the sudden downward trend in postflood life spans at the time of the flood. This type of downward declining curve (an exponential decay) strongly suggests that man's environment underwent a drastic change which reduced human life spans.

What about the few thousand other new isotopes produced during the flood that slowly worked their way into the biosphere over the centuries?[1] Those isotopes sometimes produce defective proteins in trillions of your cells. Here's why. Most cells in your body contain tens of thousands of *ribosomes*—absolutely amazing and complex manufacturing plants that produce your body's proteins. The new isotopes you eat, drink, and inhale are sometimes incorporated into amino acids which are brought into your ribosomes and hooked together (according to the instructions in your DNA) into long chains. When an amino-acid chain exits a ribosome, the electrical charges on the chain fold it in multiple directions simultaneously. That tight, very specific, three-dimensional shape determines what the protein will do in your body. If the protein misfolds—due to light (or heavy) isotopes that either speed up (or slow down) a particular fold—the protein will be defective and an organ in your body might suffer. These defects build up over time, so your proteins steadily, but imperceptibly, degrade. An animation of this complex folding process in a bacterium can be seen at:

www.mrc-lmb.cam.ac.uk/ribo/homepage/movies/translation_bacterial.mov

Every second, isotopes produced during the flood are slowly aging us at the atomic scale; therefore, our organs deteriorate. Which of the thousands of new isotopes are the chief culprits (mild poisons) and what other factors and repair systems play a role are open questions.

Scientists are starting to recognize some of this. For example, Dr. Thomas Kirkwood, Director of Aging and Health at Newcastle University in England, writes:

> *Many scientists believe that the aging process is caused by the gradual buildup of a huge number of individually tiny faults—some damage to a DNA strand here, a deranged protein molecule there, and so on. This degenerative buildup means that the length of our lives is regulated by the balance between how fast new damage strikes our cells and how effectively this damage is corrected. The body's mechanisms to maintain and repair our cells are wonderfully effective—which is why we live as long as we do—but these mechanisms are not perfect. Some of the damage passes unrepaired and accumulates as the days, months and years pass by. We age because our bodies keep making mistakes.*
>
> *We might well ask why our bodies do not repair themselves better. Actually we probably could fix damage better than we do already. In theory at least, we might even do it well enough to live forever.*[4]

In addition to asking "why our bodies do not repair themselves better," we should ask why our cellular machinery started malfunctioning.

- The new, unusually heavy or light isotopes produced during the flood interfere continually with our extremely complex cellular machinery.
- The damage begins below the atomic level—in the nuclei of atoms that become incorporated in our proteins and DNA. Those nuclei sometimes have different numbers of neutrons than the same chemical elements did before the flood. These "strange isotopes" are mixed in with all that we eat, drink, and breathe.
- The damage accumulates in a somewhat random manner, even among identical twins,[5] because the "strange isotopes" that we take into our bodies become "bullets" in tiny but rapid versions of "Russian roulette." The potential damage during each "Russian roulette" game is extremely small; however, we each play thousands of games a second. We, and all living things, are slowly aging.[6] *But aging is qualitatively different from radiation damage, which produces ever-increasing, inheritable deformities and lack of fitness.*

References and Notes

1. If the life spans of the postflood patriarchs had been mistranslated, randomly selected, or made up by someone with no knowledge of higher mathematics, it is highly unlikely that an exponential decay would have resulted. A linear fit would be much more likely.

   However, the thousands of isotopes produced in the fluttering crust during the flood would exit the crust and enter the biosphere—and living organisms—at a rate proportional to their concentration in the crust. So, the concentration of these "strange isotopes" in the biosphere and within organisms would rapidly increase initially, but would level off after some period of time. In other words, life spans would experience an exponential decay.

   Why was Noah's life span apparently unaffected by the post-flood environment? Answer: Many years were required for the harmful isotopes produced in the fluttering crust to work their way into the biosphere and the food, water, and air we take into our bodies. Then more years were required for sufficient damage to build up in Noah's already mature organs.

2. Some say that the decline in life spans was caused by a "genetic bottleneck." Yes, a genetic bottleneck occurred at the flood. However, Shem avoided that bottleneck, because his genetics were fixed a century earlier. Yet, his drop in longevity was the greatest of all the patriarchs listed in Figure 201. We also see genetic bottlenecks (a) in pioneering families or other small groups that live in isolation for generations, and (b) in hundreds of breeding experiments with different animals. But to my knowledge, nothing similar to an exponential decay in their life spans has been observed. Likewise, the greatest genetic bottleneck in humans occurred with Adam and Eve, but no exponential decay in lifespans followed that first generation.

3. Advocates of the various canopy theories claim, without providing mechanisms or details, that a preflood canopy would account for the preflood longevity and the collapse of that canopy caused the rapid drop in postflood life spans. The originator of canopy theories, atheist Isaac Newton Vail (1840–1912), made a similar claim as early at 1874. See **"Did a Water Canopy Surround the Earth and Contribute to the Flood?"** on page 424 for a refutation of this idea.

4. Thomas Kirkwood, "Why Women Live Longer," *Scientific American*, Vol. 303, November 2010, p. 35.

5. Identical twins who die of "natural" causes typically die more than 10 years apart.

6. This aging is not related to our 20 years or so of growth from conception to maturity, so the time required to become a mature adult has probably not changed too much. Therefore, people living before the flood spent a much greater percentage of their lives as productive, mature adults than we who live after the flood. Indeed, Noah had children after he was 500 years old. [See Genesis 5:32.]

Did a Water Canopy Surround the Earth and Contribute to the Flood?

Isaac Vail (1840–1912) first proposed the canopy theory in 1874.[1] He believed that a canopy formed millions of years ago as the earth evolved from a molten state. Vail supported his case primarily by ancient mythology. In his opinion, this included Genesis 1:6–8a, which states:

> *Then God said, "Let there be an expanse in the midst of the waters, and let it separate waters from waters." And God made the expanse, and separated the waters which were below the expanse from the waters which were above the expanse; and it was so. And God called the expanse heaven.*

Notice that these verses do not explicitly say that a canopy surrounded the earth.

Vail's canopy was a vapor cylinder surrounding the earth but open at the poles. Since then, many people have recognized problems with Vail's canopy and proposed variations. These usually involved a thin, spherical shell of water—as either a liquid, gas (a vapor), or solid (ice particles or an ice shell). As we will see, each variation has serious biblical and scientific problems. In fact, canopy theories "do not hold water." Consequently, canopy theories have delayed our understanding of Genesis 1:6–8a, the structure of the preflood earth, the flood, and earth's geological features. But first, what are the standard arguments for a canopy?

Arguments for a Canopy—and Brief Responses

The Source of the Flood Water. *"If all the water in the earth's atmosphere were to condense, only an average of one inch of rain would fall. Therefore, the Genesis flood raises two common questions: Where did so much flood water come from, and where did it go? A canopy partially answers the first question."*

Response: No canopy theory claims to provide all the water for a global flood. Nor does any canopy theory explain where the water went after the flood. Somehow transporting this water back into outer space or suddenly forming deep ocean basins after the flood is hard to imagine or explain. However, the phrase *"the fountains of the great deep"* (Genesis 7:11) implies that the flood water came from subterranean sources. To learn where the water went after the flood, see pages 109–147.

Many have rejected the Genesis flood account because they could not imagine where the flood water, which covered all mountains, went. Canopy theories have contributed to this rejection of the flood account.

Drop in Longevity. *"Radiation from outer space may cause people to age. If so, a preflood canopy might have shielded people from this aging process. Perhaps this is why life spans before the flood were about 900 years."*

Response: If radiation from space reduced life spans, we would expect an immediate drop in longevities after the flood. Life spans did drop, but for 12 generations after the flood, human longevity remained much higher than today. [See Figure 200 on page 420.] Even Noah lived 349 years *after* the flood. Some argue that perhaps radiation damage accumulated genetically over many generations. Few, if any, canopy proponents have proposed specifically what type of harmful radiation it was, how it reduced longevity so much without causing massive deformities and genetic diseases, why longevity leveled off at about 70 years rather than continuing to deteriorate, or how to test the proposed mechanism.

Most proposals for this drop in longevity are testable, but seldom tested. One test, which might have shown that cosmic or solar radiation reduce longevity, failed. Mice were raised in deep caves, shielded from both types of radiation. Neither those mice nor their offspring lived longer than other mice.[2] Furthermore, if radiation from outer space accelerated aging, then living at a lower elevation, where one is protected by a thicker blanket of atmosphere, should increase longevity. No such effect is known.[3]

Joseph Dillow's book, *The Waters Above*, is probably the most complete, accurate, and up-to-date defense of any canopy theory. After explaining other problems with the "longevity claim," Dillow concludes, "So it appears that canopy theorists have been in error when they appealed to the shielding effect of the canopy as a direct explanation for antediluvian longevity."[4] Dillow also states, "We readily admit that Genesis ***does not*** teach the existence of a pre-Flood vapor canopy."[5] [emphasis in original]

A Uniformly Warm Climate. *"A canopy may have given the earth a uniformly warm climate. This might explain why fossils of temperate animals and plants (such as dinosaurs and large trees) are found in Antarctica and on islands inside the Arctic Circle."*

Response: After the flood, mountains were suddenly pushed up. This shifted the poles and brought temperate regions to today's polar regions. [For details see page 133 and Endnote 69 on page 144.] Also, during the global flood, some plants and animals may have floated to today's polar latitudes where they were later fossilized.

Even if a canopy produced a warm polar climate, it would not satisfy another requirement for lush vegetation—sunlight in the winter. Polar nights are six months long, and when the Sun does shine, it is always low in the sky. How could large trees and dinosaurs (requiring long food chains) survive, let alone thrive, during the long polar night?

Despite much speculation, no one knows what temperatures would exist under a canopy. Today, even experts disagree on the extent to which carbon dioxide warms the earth. Think how much more difficult it is to determine the warming, thousands of years ago, under a canopy of unknown thickness, reflectivity, content, and height above the earth.

Venus. *"We see canopies on other planets, such as Venus."*

Response: Some planets have atmospheres, but none has a canopy. An atmosphere has contact with its planet, but a canopy is a distinct shell above the planet's atmosphere. Venus is shrouded by a thick, opaque atmosphere, consisting primarily of carbon dioxide (96.5%), nitrogen (3.4%), and traces of other gases. Venus does not have a layer of water, or any other relatively heavy substance, above its atmosphere.

Genesis 7:11–12. *"Genesis 1:6–8a seems to speak of a water canopy that contributed to the flood. After all, Genesis 7:11–12 states that* ***'the floodgates of the sky were opened. And the rain fell …'*** *A lot of rain fell from somewhere."*

Response: If this were true, similar canopy interpretations should predate Vail's in 1874. Where are they? Quite often it is hard to see alternatives once we have learned "the accepted explanation."

Actually, Genesis 7:11–12 says that *"all the fountains of the great deep burst open, and the floodgates of the sky were opened. And the rain fell …"* Later, Genesis 8:2 states *"the fountains of the deep and the floodgates of the sky were closed, and the rain from the sky was restrained."* These events were probably in cause-and-effect order. That is, the fountains of the great deep caused extreme, torrential rain. Once the fountains stopped, this violent rain ended. Then milder, more normal, rain fell. In other words, *"the rain from the sky was restrained."*

A cause and effect sequence is also given in Proverbs 3:19–20: *"The Lord by wisdom founded the earth; by understanding He established the heavens. By His knowledge the deeps were broken up, and the skies dripped with dew."* The same Hebrew word, *baqa* (בָּקַע), is used for "broken up" and "burst open" in Proverbs 3:20 and Genesis 7:11. *Baqa* describes a violent and complete splitting, sometimes of the earth's crust (Numbers 16:31, Micah 1:4, Zechariah 14:4). Isaiah 34:15 and 59:5 use *baqa* to describe the breaking of an egg shell by internal pressure as a baby bird exits. This aptly describes events of the hydroplate theory—the globe encircling rupture splitting the earth's crust by internal pressure and releasing fountains of water.

The Hebrew word, *matar,* means normal rain. Violent rain is *geshem* (used in Genesis 7:11 and 8:2). It is sometimes accompanied by high winds and huge hailstones that can destroy mortared walls (Ezekiel 13:11–13). The hydroplate theory (pages 109–147) explains this sequence in more detailed, physical terms. We have failed to appreciate the explosiveness, magnitude, and power of *"the fountains of the great deep."* [See **"The Origin of Earth's Radioactivity"** on pages 329–371.]

Scientific Arguments Opposing a Canopy

The Pressure Problem. A canopy holding only 40 feet of liquid water, or its equivalent weight of vapor (steam) or ice, would double the earth's atmospheric pressure—making oxygen and nitrogen toxic to many animals, including humans.[6] This is why most vapor canopy theories limit the thickness of water in their canopy to less than 40 feet.

For a vapor canopy holding this amount of water, the high pressure at the canopy's base would require that the temperature at the base exceed a scorching 220°F. Otherwise, the vapor would condense into a liquid. A vapor canopy whose base had that temperature would radiate large amounts of heat to the earth's solid surface. People, plants, and animals would absorb so much heat from all directions above that life might not survive.[7] Those who believe that a vapor canopy would produce a globally mild climate have overlooked this detail.

Maintaining a canopy's 220°F temperature at night, or worse yet, at the poles during the coolest season, adds a further difficulty. Yes, there were seasons before the flood. [See Genesis 1:14.][8]

The Heat Problem. All canopy theories[9] have another major heat problem. The larger the canopy, the greater the heat problem.

A Vapor Canopy. Each gram of water vapor (steam) that condenses to a liquid releases about 539 calories of heat. If 6.22×10^{21} grams of water fell from a vapor canopy (enough to form a layer of water only 40 feet thick around the world), the temperature of the water *and* atmosphere would, as a first approximation, rise 810°F (or 450°C).

$$\frac{539\,\frac{\text{cal}}{\text{gm}} \times 6.22\times10^{21}\ \text{gm}}{\left(5.1\times10^{21}\ \text{gm}\times 0.242\,\frac{\text{cal}}{\text{gm}\,^{\circ}\text{C}}\right)+\left(6.22\times10^{21}\ \text{gm}\times 1.0\,\frac{\text{cal}}{\text{gm}\,^{\circ}\text{C}}\right)} = 450^{\circ}\text{C} = 810^{\circ}\text{F}$$

where 5.1×10^{21} grams is the mass of the atmosphere, and 0.242 and 1.0 are the calories needed to raise one gram of air and one gram of liquid water (respectively) 1°C. Unbearable temperatures remain even after we expand this analysis to include every scientifically conceivable way to remove this heat.[10] Also, ***40 feet of rain would not produce a global flood.***

A Liquid or Ice Canopy. For liquid or ice particles to remain in space above the earth's atmosphere, they must orbit the earth. Anything in a near-earth orbit must travel about 17,000 miles per hour (760,000 cm/sec). (As stated earlier, a layer of water only 40 feet thick contains 6.22×10^{21} grams of water.) Just as a spacecraft generates great heat as it reenters the atmosphere, orbiting liquid or ice particles would release all their kinetic energy as heat as they reenter the atmosphere. That amount of heat is

$$\frac{1}{2}\times 6.22\times10^{21}\left(760{,}000\right)^{2}\times 2.39\times10^{-8} = 4.29\times10^{25}\ \text{cal}$$

where 2.39×10^{-8} converts the units to calories. This heat would raise the atmosphere's temperature

$$\frac{4.29\times10^{25}\ cal}{\left(5.1\times10^{21}\ gm\times0.242\,\frac{cal}{gm\,°C}\right)+\left(6.22\times10^{21}\ gm\times1.0\right.}$$

$$= 5{,}700°C = 10{,}000°F$$

Even if a canopy began with the coldest ice possible (absolute zero) or if some heat were transferred elsewhere, insufferable heat would remain.[11]

A similar problem exists if this ice were part of a spinning shell surrounding the earth. A rapidly-spinning shell, providing enough centrifugal force to balance the gravitational force as much as possible, would still have too much kinetic energy. Once the shell collapsed, that energy would become scalding heat, enough to "roast" all life on earth.

The Light Problem. A canopy having only 40 feet of water—in any form—would reflect, refract, absorb, or scatter most light trying to pass through it.

Starlight. People living under a 40-foot-thick canopy could see stars only if they were directly overhead, so their light would have the shortest path through a canopy. Before the flood, people presumably could see stars, because stars were created for a purpose: *"for signs, and for seasons, for days and years"* (Genesis 1:14). Stars would achieve their purpose only if enough stars could be seen to identify seasonal variations. Therefore, one needs to see large star patterns, such as constellations—not just a few stars directly overhead. By looking through a "keyhole" into the night sky, it is questionable whether one could have seen, recalled, and distinguished seasonally shifting star patterns through the filter of a 40-foot-thick canopy, even on a moonless night.

Sunlight. A canopy would also reflect and absorb considerable sunlight. How then could many tropical plants that require much sunlight today, have survived for centuries under a preflood canopy?

The Nucleation Problem. To form raindrops, microscopic particles, called *condensation nuclei*, must be present to begin condensation. However, falling rain sweeps away these nuclei and cleans the atmosphere. This reduces further condensation. Rain from a vapor canopy would actually "choke off" further rain production.

Some claim that volcanic eruptions, beginning suddenly at the time of the flood, continually ejected condensation nuclei into the upper atmosphere. Never explained is why volcanic eruptions suddenly began globally, then quickly and continually distributed nuclei through the atmosphere for about 40 days. Volcanic eruptions, rather than contributing to the flood, require special conditions that seem to be a consequence of the flood. [For an explanation, see pages 115 and 130.]

The nucleation and heat problems limit the rain formed by condensation to that of a local flood. It seems more likely that *"geshem rain"* was produced by the powerful jetting of the *"fountains of the great deep,"* which caused torrential rain for *"40 days and 40 nights."*[12]

The Greenhouse Problem. While sunlight can pass through glass into a greenhouse, heat in a greenhouse has more difficulty radiating back out through the glass. This greenhouse effect traps heat inside the greenhouse, raising its temperature. All canopy theories have a greenhouse problem.

Also, as temperatures under a canopy rose, more water would evaporate from the earth's surface, especially its oceans. More water vapor in the air means a greater greenhouse effect, a warmer atmosphere, and even more evaporation. This cycle would feed on itself, producing what is called "a runaway greenhouse effect." For example, Venus' atmosphere has experienced a runaway greenhouse effect. Venus is about 700°F hotter than one would expect based on its distance from the Sun. The greenhouse effect increases earth's temperature by about 60°F.

During the last 36 years, the Institute for Creation Research (ICR) has been the best-known advocate of a vapor canopy. In 1998, ICR wrote that a strong greenhouse effect would exist under a vapor canopy, raising *"surface temperatures as high as 400°F."* However, if many variables were chosen in the most favorable way for a vapor canopy, *"the water content of a canopy could be as much as* [no more than] *three feet of liquid water without* *the surface temperature reaching temperatures which would destroy life on the earth.*"[13] Actually, their study shows that surface temperatures would be unbearable if a canopy were only 4 inches thick.

The Support Problem. What supported the canopy?

> ***A Vapor or Liquid Canopy.*** A *vapor* canopy would rapidly mix with the atmosphere, just as steam above a kitchen stove quickly mixes with air. Once the vapor contacted the earth's surface, it would condense. A *liquid* canopy would quickly evaporate and then diffuse through the atmosphere. Neither type of canopy could have survived for the many centuries before the flood.

> ***An Ice Canopy.*** A pure ice canopy would vaporize into the vacuum of space, just as dry ice vaporizes at atmospheric temperature and pressure. Furthermore, ice is structurally weak. An ice shell could not withstand tidal stresses or meteoritic, cometary, or asteroidal impacts. A spinning ice shell could not withstand the powerful centrifugal forces at its equator and the crushing gravitational forces along its spin axis.

The Ultraviolet Problem. Ozone in the earth's upper atmosphere blocks the Sun's destructive ultraviolet light, but a canopy surrounding the atmosphere would be exposed to ultraviolet light. Therefore, water in a canopy would dissociate into hydrogen and oxygen, effectively destroying the canopy.

Final Thoughts. Could there have been a canopy? Perhaps, in one of two ways. First, one could minimize most of these scientific problems by assuming that the canopy was thin, maybe inches thick. The thinner the canopy, the less severe most problems become. (Notice, the support and ultraviolet problems remain.) But what function would the canopy perform, and what hard, scientific evidence—not speculation—is there for claiming that a thin canopy could perform that function? Certainly, a thin canopy would not contribute to a global flood—the reason most people accepted the canopy in the first place.

Second, one could also dismiss each of these scientific problems by saying that God performed a miracle. That may be true. Certainly, He can; He has; and He sometimes does. However, miracles should not be proposed to "prop up" a scientific theory. (Some evolutionists mistakenly believe that this is how creation science works.) As one sees more and more "miracles" required by canopy theories, their plausibility decreases, and the need for an alternate explanation increases.

An Alternate Interpretation

Let us now consider another interpretation of Genesis 1:6–8a and related verses:

The word expanse (raqia) is used nine times in Genesis, all in the creation account, chapter 1. The first four uses are distinguished from the last four, to minimize confusion. Following each of the last four uses (in Genesis 1:14–20) is the phrase "of the heavens." Clearly, from the context, "expanse of the heavens" means sky, atmosphere, outer space, or heaven. However, the first four uses of "expanse," in Genesis 1:6–7, do not use the phrase "of the heavens." That expanse was the earth's crust. Surface waters (oceans, seas, lakes, and rivers) were above this crust, and subterranean waters were below. The subterranean waters burst forth, producing the "fountains of the great deep" and the global flood.

Repetition of the phrase, "of the heavens" further helps us distinguish between the last four uses and the first four uses. The middle, or fifth, usage of the word "expanse" will be discussed on page 428.

Pages 411–413 and 433–437 contain other support for this interpretation of *raqia*. Psalm 136:5–9, a song of thanks to God, deserves a special comment as well. It describes three sequential events: (1) the heavens are made, (2) ***the earth is spread out above the waters***, and (3) the Sun, Moon, and stars were made. This sequence is similar to the creation events of *Day 1*, *Day 2*, and *Day 4*. If the proposed interpretation is correct, then Psalm 136:5–9 precisely parallels the creation events of *Days 1, 2*, and *4*.

Several ancient extrabiblical writings also state that the earth's crust, when first created, divided liquid waters above from liquid waters below.[14]

If this picture of the newly created earth is correct, then it seems worthy of inclusion in the brief creation chapter of Genesis 1. However, if *"the waters above"* refers to a canopy containing less than one-half of 1% of the earth's water, then why would one creation day and almost 10% of the creation chapter be devoted to it?

Key Hebrew Words

To understand Genesis 1:6–8a better, we will study the key words in bold below.

> *Then God said, "Let there be an* ***expanse in the midst of*** *the* ***waters****, and let it* ***separate waters*** *from* ***waters****." And God made the* ***expanse****, and* ***separated*** *the* ***waters*** *which were below the* ***expanse*** *from the* ***waters*** *which were above the* ***expanse****; and it was so. And God called the* ***expanse heaven****.*

Waters (mayim). This word means a liquid water, not a vapor or solid.[15] Had the water in Genesis 1:6-8 been a vapor, cloud, mist, or ice, other Hebrew words would have been more appropriate. For example, ancient Hebrew had six words for "cloud."

II Peter 3:5–6 also implies that this is liquid water. Peter used the same Greek word (ὕδωρ) to describe both the ***liquid*** water that flooded the earth and the water out of which the earth formed, an obvious reference to Genesis 1:6-7. ***Liquid*** water was both above and below the expanse, which contradicts the vapor or ice canopy ideas but is consistent with the "expanse = crust" interpretation.

Separate (badal). This word implies a sharp division. Furthermore, the generally untranslated preposition "*ben*," associated with "*badal*," means "between." It suggests an ordering (water, expanse, water) with no overlapping or gaps. Interfaces are also implied on each side of the expanse.[16] These meanings oppose a vapor, liquid, or ice particle canopy lying above the atmosphere, because atmospheric gases would mix with the canopy.

In the Midst of (tavek). This word means between, within, among, inside, etc. Sometimes it means "to bisect" or "in the center of." The respected Jewish scholar, Cassuto, in commenting on Genesis 1:6–7, stated, "It is true that in the Pentateuch, too, reference is made to the division of the primeval world-ocean into two halves, situated one above the other, ..."[17] [See also Genesis 15:10.] Rabbi Solomon Yitzchaki, in his famous eleventh century *Rashi Commentary*, stated that the expanse was "in the exact center of the waters."[18] As we have seen, canopy theories place less than one-half of 1% of the earth's water above the expanse and the rest below. (This is necessary to reduce the problems associated with heat, light, and pressure mentioned earlier.) Would it not seem strange to say that your scalp is "in the midst of" your body? According to the hydroplate theory, the crust of the preflood earth approximately bisects the earth's liquid waters.

Heaven (shamayim). *"Heaven"* had a variety of meanings in ancient Hebrew, as it does in modern languages. Moses used *shamayim* to describe outer space (Genesis 26:4), the atmosphere (Genesis 27:28), where God dwells (Deuteronomy 26:15), where angels dwell (Genesis 28:12), and the source of blessings (Genesis 49:25). The context in which *shamayim* is used is important to understanding its specific meaning.

Expanse or Firmament (raqia). The key Hebrew word in Genesis 1:6–8a is *raqia* (רָקִיעַ). It is translated "firmament" in the King James Version and "expanse" in most Hebrew dictionaries and modern translations. While its original meaning is uncertain, its root, *raqa* (רָקַע), means to spread out, beat out, or hammer as one would a malleable metal. It can also mean "*plate*." This may explain why the Greek Septuagint translated *raqia* 16 out of 17 times with the Greek word *stereoma* (στερέωμα), which means "a firm or solid structure." The Latin Vulgate (A.D. 382) used the Latin term "firmamentum," which also denotes solidness and firmness. So, the King James translators in A.D. 1611 coined the word "***firm***ament." Today, "firmament" is usually used poetically to mean sky, atmosphere, or heavens. In *modern* Hebrew, *raqia* means sky or heavens. However, originally it probably meant something solid or firm that was spread out. Indeed, Isaiah 42:5 says the earth was "*spread out*."

Finally, if *raqia* were related to a canopy, it seems strange that other Hebrew words, often translated as "canopy," were not used in Genesis: *sukkah* (Psalms 18:11 and II Samuel 22:12), *chuppah* (Isaiah 4:5), and *shaphrur* (Jeremiah 43:10).

Genesis 1:8a — Two Interpretations

Why then, does Genesis 1:8a state, *"And God called the expanse heaven"*? Here are two interpretations:

1. "The expanse" meant the atmosphere or outer space.
2. "The expanse" meant "heaven"—where God dwelt—the original paradise. Recall that God "walked" and "talked" with Adam (Genesis 3:8–9), so heaven was originally on the earth—or the earth's crust.

If "heaven" meant atmosphere or outer space, then the Septuagint and Vulgate translators incorrectly associated solidness with it. Notice also that the similarities of *raqia* (רָקִיעַ) with *baqia* (בָּקִיעַ) and *raqa* (רָקַע) support second interpretation. [See page 429.] If *raqia* (expanse or firmament) always means atmosphere or outer space, five questions, or apparent textual contradictions, arise.

Question 1: Why was the word *raqia* followed by the phrase *"of the heavens"* in Genesis 1:14, 15, 17, and 20? That would be redundant.

Question 2: If *raqia* implies a canopy, why wasn't one of the three Hebrew words that clearly means "canopy" used?

Question 3: Genesis 1:1 says that the heavens were created on the first day.[19] However, if *raqia* always means "heaven" (atmosphere or outer space), then Genesis 1:8a says heaven was created on the second day. Also, Genesis 1:8a defines heaven ***after*** the word "heavens" was first used in Genesis 1:1. Normally a word's meaning is understood from the context of its first usage.

Question 4: Genesis 1:9 states, *"Let the waters below the heavens be gathered into one place, and let the dry land appear."* Obviously, these are earth's surface waters. If "heaven" meant atmosphere or outer space and "expanse" had the identical meaning (as canopy theorists believe), why did Genesis 1:9 not read, "Let the waters ***below*** be

What Does *"Raqia"* Mean?

The Hebrew word *raqia* is usually translated "expanse" or "firmament." When it is directly followed by "of the heavens" it means atmosphere, sky, outer space, or heaven. However, what does *raqia* standing alone mean? The Hebrew words most similar to *raqia* (רָקִיעַ) are *raqa* (רָקַע) its root, *baqia* (בְּקִיעַ), and *baqa* (בָּקַע). Each describes a deformed solid.

Table 23. All Biblical Meanings of Words Related to *Raqia*

SUFFIX	PREFIX (STEM)	
	baq	**raq**
a	***baqa*** (Strong's #1234): breached (3), break forth (1), break into (1), break open (1), break out (3), break through (1), breaks forth (1), broke through (2), broken into (2), breaks open (1), broken up (1), burst (2), burst open (1), cleave (1), dashed to pieces (1), divide (2), divided (3), hatch (2), hews (1), invaded (1), make a breach (1), rip up (1), ripped open (2), ripped up (1), shook (1), split (7), split open (1), splits (1), tear (1), tore (2), torn (2)	***raqa*** (Strong's #7554): beaten (1), hammered out (2), plates (1), spread out (3), spreading out (1), stamp (1), stamped (2) For usage and context see Ex 39:3; Num 16:39; II Sam 22:43; Job 37:18; Ps 136:6; Is 40:19, 42:5, 44:24; Jer 10:9; and Ezek 6:11, 25:6.
ia	***baqia*** (Strong's #1233): breaches (1), fragments (1) For usage and context see Is 22:9 and Amos 6:11.	***raqia*** (when not followed by "*of the heavens*"): Traditional Interpretation: atmosphere, outer space, sky, heaven Proposed Interpretation: a hammered-out solid, such as pillars

In 1890, James Strong published a catalogue of all usages of every word in the Old and New Testaments. He counted the frequency of each Hebrew and Greek word's specific English translation. For example, the Hebrew word *raqa,* the 7554th word in Strong's Hebrew dictionary, is translated in the *New American Standard Bible* as "hammered out" twice, "spread out" three times, etc. By studying all usages and contexts of a word and similar words, a difficult-to-translate word can be better understood.

The King James translators translated *raqia* as ***firm***ament, because they thought that it involved something firm. However, its specific meaning when Genesis was written is unknown. *Raqia* is obviously important, because the second creation day centered around it, just as the third day dealt with plants, and the fourth day with heavenly bodies. What was the *raqia*? Certainly, *raqia* is one of the most mysterious words in the Bible.

By studying English meanings of *raqa, baqa*, and *baqia* in Table 23, one can see that atmosphere, sky, outer space, and heaven do not relate to what we might guess *raqia* means. Instead, we get a picture of ***a breakable, hammered out, or pressed-out solid***. How can a solid be breakable but malleable? Answer: extreme compression.

Few realize that all rock 5 miles or more below the earth's surface is "pressed out." Imagine a perfectly vertical column of a typical rock 5 miles high. If the rock were "somewhat confined," as explained in the next paragraph, the pressure at the column's base would be so great that it would slowly flow—like tar. Stacking more rock on top would cause even more flow at the bottom. If the column were 10 miles high, all the rock in the bottom half would try to flow. The rock at the bottom—especially the pillars—would be squeezed like a tall stick of butter trying to support a 10-ton truck. [To understand why, how, and when pillars formed, see pages 433–437.]

If our column were pressed in from all sides by similar columns, the flow in the central column could go nowhere. The central column would have lateral support. Furthermore, if all columns were given lateral support by other columns, we would have the situation that actually exists in the top 10 miles of the earth's crust. At depths of 5 miles or greater, the rock wants to flow but can't, because the forces on all particles are balanced in all directions. So, below 5 miles, the rock is sealed like highly compressed putty. Cracks could not normally open up directly above the subterranean water chamber, which I estimate was almost 10 miles below the earth's surface.

This 10-mile-thick crust above the subterranean chamber, *and especially the pillars in the subterranean water,* were a hammered-out, stamped-out, pressed-out solid—a ***raqia***. [For important details, see Figure 211 on page 488.] How could the crust break? A crack could not begin in the sealed, extremely compressed lower half. However, if a vertical crack formed at the earth's surface, steadily increasing pressure in the subterranean water would cause the crack to grow downward. Once the crack penetrated halfway down, it would then become unstable and, in a few seconds, rip catastrophically to the bottom of the crust. What would follow is the subject of Part II of this book, pages 107–327.

gathered into one place"? That would have been sufficient, clear, and consistent with the phrasing of Genesis 1:7, which relates the water's two locations to the expanse. It would also make clear that the expanse (*raqia*) is above—not below—the surface waters. Instead, the text reads, "Let the waters below ***the heavens*** be gathered into one place." The words "the heavens" apparently were added to make clear that ***surface*** waters were gathered into one place.

Question 5: Genesis 1:14 says the Sun, Moon, and stars (which fill the universe) were placed ***in*** the *raqia of the* *heavens,* and Genesis 1:7 says liquid water was placed ***above*** the *raqia* (as opposed to the *raqia of the heavens*). Does this mean that the *raqia* is the universe, and liquid water surrounded the universe.[20]

After struggling to understand Genesis 1:8a for 30 years, I described several possible interpretations of Genesis 1:8a in the 7th edition (2001) of this book. In 2005, I received independent letters from two pastors proposing an explanation.[21] Before Adam's fall, the earth was a paradise; in a sense, it was "heaven on earth." Therefore, God called the firmament (earth's crust) heaven. Each pastor provided different biblical reasons for his view, but both maintain that our difficulty in understanding Genesis 1:8a results largely from our inability to imagine the original paradise. If man had not fallen, no one would have difficulty with the fact that God called the earth, "heaven."

Confirmation of this is in Randy Alcorn's outstanding book, *Heaven* (2004).[22] His case is so detailed, voluminous, and strong that any attempt to summarize it here would not do justice to his work. As Alcorn points out, nonbiblical stereotypes of heaven have crept into our Christian culture. I believe this accounts for much of our confusion over Genesis 1:8a. (Every Christian should study what the Bible actually says.) The earth was created with the intention that it would be heaven. The fall temporarily delayed that plan, and the earth was cursed. Alcorn also discusses the future "new earth."

Those who reject this proposed understanding of *expanse* and Genesis 1:8a should carefully weigh the two alternatives shown in Table 24.

Table 24. Two Interpretations

Interpre-tation	Translation	Problems
Traditional	expanse = atmosphere, outer space, heavens	Questions 1–5 Seven Scientific Issues Key Hebrew Words
Proposed	expanse *of the heavens* = space, etc. expanse [only] = earth's crust	Visualizing earth before the fall

Mythology and Canopies

Vail's case for a canopy rested largely on the mythology of the Greeks, Romans, Egyptians, and other ancient cultures. He argued that a real canopy, millions of years ago, produced these myths. Vail wrote,

> *I have been told again and again that the canopy idea is weak because it is founded on mythology. I can only protest that it is not founded on mythology. On the contrary mythology is largely founded on the canopy, fossilized in human thot* [thought]. *The canopy as a watery heaven close to the earth existed for untold millions of years before a myth ever germinated.*[23]

We can all agree with Vail that ancient mythology and today's canopy theories are linked. But which came first: myth or canopy? If the best canopy theory cannot overcome the scientific problems mentioned earlier, then a canopy did not produce or precede the ancient myths. Myths probably produced canopy theories.

Conclusion

Arguments for canopy theories do not stand up when examined closely. These theories also contain many biblical and scientific problems, such as those associated with pressure, heat, sunlight, support, condensation nuclei, the greenhouse effect, and ultraviolet light. Even leading canopy advocates privately acknowledge these problems. Also, canopy theories do not even begin to explain the flood's global destruction and geological activity. [Page 109 lists 26 examples.]

Canopy theories have misled many, delaying understanding of the flood, geology, and, therefore, earth's true age. The flood water came from below, not above. Failure to understand this has caused many to doubt the historical accuracy of the flood account, and, therefore, the Bible itself. Without the flood to explain the fossils buried in the earth's sedimentary layers, the theory of organic evolution fills the vacuum—an explanation that also removes or minimizes need for the Creator.

References and Notes

1. Isaac Newton Vail published many pamphlets on his canopy theory, starting with *Waters Above the Firmament* in 1874. Other titles included *The Misread Record* (also published under the title *The Deluge and Its Cause*), *Eden's Flaming Sword, Ring of Truth, The Heavens and Earth of Prehistoric Man, Canopy Skies of Ancient Man, A Glance at Comparative Mythology, Annular World Evolution*, and others. Most of these titles have been republished by Donald L. Cyr, *Waters above the Firmament* (Santa Barbara, California: Stonehenge Viewpoint, 1988). In 1902, Vail also published a 400-page book titled *The Earth's Annular System*. However, it was John C. Whitcomb Jr. and Henry M. Morris who popularized the canopy theory in *The Genesis Flood* (Philadelphia, Pennsylvania: Presbyterian and Reformed Publishing Co., 1961).
2. Joseph C. Dillow, *The Waters Above* (Chicago: Moody Press, 1981), p. 170.

3. Vail claimed that after the canopy collapsed, the earth was no longer shielded from the Sun's radiation, so life spans decreased. If so, someone, even after the time of Abraham, should have noticed that people living indoors or farther from the equator lived longer.

4. Dillow, p. 170.

◆ *"It is commonly held that the pre-flood vapor canopy shielded the earth from cosmic radiation and also reduced surface ozone levels. These effects supposedly contributed to the longevity of the antediluvian patriarchs. However, radiation studies and research in molecular biology seems to rule this out. Even if the earth were 100 percent shielded from radiation and if ozone levels in the pre-flood world were zero, no appreciable improvement would have resulted."* Joseph C. Dillow, "The Canopy and Ancient Longevity," *Creation Research Society Quarterly*, Vol. 15, June 1978, p. 27.

5. Dillow, *The Waters Above*, p. 222.

6. Doubling atmospheric pressure doubles the blood's oxygen content. Doubling the blood's oxygen content, by any means, can produce a disease called *retrolental fibroplasia* in unborn or premature children. An opaque membrane forms behind the lens of the eye, resulting in blindness. This also occurs in mice and other species.

   Increased ambient pressure also results in excess carbon dioxide in the blood. Oxygen and nitrogen toxicities increase significantly. The problem is aggravated at high work levels and for the elderly and ill. [Personal communication with Daniel J. O'Rourke, M.D., 11 December 1994.]

7. The Sun's surface radiates at an effective temperature of 10,000°F, but occupies only one 10,000th of the daytime sky. A 220°F canopy, while not as hot, would radiate from the entire sky—day and night. Taking only these factors into consideration, a vapor canopy would radiate more heat than the Sun. Other complex factors might remove some of this heat.

8. Genesis 1:14 says that the heavenly bodies were created *"... for seasons, and for days and years."* Therefore, the earth's axis was tipped relative to the earth's orbital plane, because only by being tipped can seasonal shifts in star patterns occur.

9. Not addressed are canopy theories that provide no scientific details or data to support speculative claims.

10. For example, two other ways to remove this heat might be to radiate it into outer space or to conduct it into the earth. Both processes are slow, removing relatively little heat in the short time available.

11. Some have proposed that a huge, icy comet struck earth, causing a global flood and an ice age. Those proposals ignore this same heat problem. Actually, such a comet would have more kinetic energy than an ice or water canopy of equal mass. Therefore, the temperature increase would be greater.

12. After 40 days and 40 nights, the "*geshem* rain" stopped (Genesis 7:12). However, the flood water rose until the 150th day, when it covered all preflood mountains (Genesis 7:19–24). After 40 days, the layer of water rising on earth blanketed and suppressed the jetting of the fountains of the great deep. Nevertheless, high-pressure subterranean water continued to gush out and add to the rising flood waters until the 150th day. On that day, the fountains were closed (Genesis 8:2) by the hydroplates settling onto the floor of the subterranean water chamber, pinching shut the outward-flowing water. [See pages 109–147 for the scientific details supporting this explanation.]

13. "Numerical Climate Modeling at ICR," *Acts & Facts*, April 1998, p. 2.

◆ Larry Vardiman and Karen Bousselot, "Sensitivity Studies on Vapor Canopy Temperature Profiles," *Proceedings of the Fourth International Conference on Creationism* (Pittsburgh, Pennsylvania: Creation Science Fellowship, Inc., 1998), pp. 607–618.

14. Ancient extrabiblical writings, although not having the authority of biblical passages, also support the idea that earth was created with water under the crust.

    The First Book of Adam and Eve states in verse 70:15 that *"God ... established the earth upon the waters." The Secrets of Enoch*, another apocryphal book, also known as *II Enoch*, says in verse 47:5, *"The Lord ... fixed the earth upon the waters."* [Rutherford H. Platt Jr., editor, *The Forgotten Books of Eden* (New York: World Publishing Co., 1927), pp. 50, 98.]

    II Esdras, which was part of most Christians' Old Testaments until the Reformation, retells the same creation story found in Genesis 1. However, in II Esdras 6:41–42 the second and third days are described differently by Ezra.

    > *On the second day you created the angel of the firmament, and commanded him to make a dividing* ***barrier*** *between the waters, one part withdrawing upwards and the other remaining below. On the third day you ordered the waters to collect in a seventh part of the earth; the other six parts you made into dry land, ...* [emphasis added]

    In other words, the earth's waters immediately after the creation were divided into two parts, perhaps equal parts. One part was below a barrier, and the other part was above. After the third creation day but before the flood, the earth's seas covered only 1/7 of the earth's surface. Therefore, the volume of surface water was probably much less than the volume of today's surface water, which covers 70% of the earth. So, considerable water would have been on the other side of the barrier—much more than any canopy could have held. However, subterranean chambers could have held that amount.

    Most definitive is the word "barrier." It hardly seems to describe the atmosphere, sky, heaven, or outer space. It aptly describes the earth's crust that vertically divided the earth's liquid water. II Esdras 16:58 reinforces this: *"He has shut up the sea in the midst of the waters, and by His command He has hung the earth upon the water."*

A final, but intriguing, extrabiblical writing, *The Book of the Cave of Treasures*, is explained on page 435.

15. Stanley V. Udd, "The Canopy and Genesis 1:6–8," *Creation Research Society Quarterly*, Vol. 12, September 1975, pp. 90–93.

◆ Dillow, p. 58.

16. Udd, p. 91.

17. Umberto Cassuto, *A Commentary on the Book of Genesis, From Adam to Noah*, translated by Israel Abrahams (Jerusalem: The Hebrew University, 1961), p. 32.

18. M. Rosenbaum and A. Silberman, *Rashi Commentary on the Pentateuch*, Vol. 1 (Jerusalem: Silberman Family, 1930), p. 4.

19. Genesis 1:1 describes the first acts of creation on *Day 1*, and is not, as some have proposed, a topic sentence summarizing the entire creation week. The Hebrew conjunction—translated "and"—joining verses 1 and 2, shows a sequential action. (Similar connections—"and" and "then"—join all verses in chapter 1, tightly linking them all in time.) Obviously, the creation of time ("In the beginning") and space ("the heavens") must precede the creation of *things* such as earth, waters, and light.

20. A few people claim that *raqia* is the universe, and the waters above the expanse (*raqia*) surround the universe. This places all the heavenly bodies *in* the expanse of the heavens, which is consistent with Genesis 1:14–17. [This was first proposed by Harold L. Armstrong, "The Expanding Universe and Creation," *Repossess the Land* (Minneapolis: Bible Science Association, 1979), pp. 22–27. More recently, D. Russell Humphreys adopted this interpretation in his book *Starlight and Time* (Colorado Springs: Master Books, 1994), pp. 34–36, 58–77.]

    Surrounding the universe with water assumes that the universe is finite, when its size may be infinite, or it may have an even more exotic geometry. Let us assume that the edge of the universe is only 10 billion light-years away, and absolutely nothing is outside it, even empty space. Surrounding the universe with as much water as the earth contains (1.43×10^{24} grams), as just one example, would spread one gram over every 3×10^{22} square miles—or place adjacent water molecules one mile apart!

    Pure water in the near vacuum of space would clearly be water vapor, not the ***liquid*** water the Bible describes above the expanse. What purpose would that water fulfill? Certainly, it would have played no role in the flood and could not be detected today. Why then mention it in the brief first chapter of Genesis?

21. Pastor Diego Rodriguez first suggested this in a letter on 10 January 2005. Pastor Bob Enyart's independent proposal was sent on 23 February 2005. In 2008, Pastor Rodriguez published a small book laying out his very biblically sound case. [See *Paradise: Past, Present, and Future* (Fresno, California: Sound Alive Publishing, 2008).]

22. Randy Alcorn, *Heaven* (Wheaton, Illinois: Tyndale House Publishers, 2004).

23. Isaac Newton Vail, *The Misread Record* (Seattle: The Simplex Publishing Co., 1921), pp. 36, 37.

What Triggered the Flood?

Man's sin caused the flood.[1] At the end of the creation week, all that God created was *"very good"* (Genesis 1:31), so the flood was *not inevitable* at that time. In other words, the earth was not created with a "ticking time bomb." Nor was the universe created with killer comets, asteroids, or meteoroids aimed at earth. Their presence at the end of the creation week would not have been *"very good."*

Indeed, all natural disasters are a consequence of the flood: earthquakes, volcanic eruptions, tsunamis, storms (tornadoes, hurricanes, blizzards, etc.), lightning strikes, local floods, droughts, landslides, global impacts by comets, asteroids, and meteorites, and mutations and other cellular damage caused by radioactive decay. [Pages 271–326 explain how the flood produced comets, asteroids, and meteorites. Pages 329–371 address the origin of earth's radioactivity. The index will help you locate other explanations showing the connection of these natural disasters to the flood.]

Because of the depth of man's sin (Genesis 6:5–6), God destroyed the earth with a flood. We may never know with certainty what physical chain of events initiated the flood, but the Bible gives some intriguing clues.

The hydroplate theory, summarized on pages 109–147, shows how a global flood, corresponding in every detail to the Genesis flood, easily explains 26 otherwise mysterious features of the earth and solar system. This theory requires (1) a large volume of water under the earth's crust, and (2) pillars that partially supported the crust. The Bible speaks in several places of considerable subterranean water (see page 411), but *how and when did the pillars form?*

Rock Movement. First, visualize an important feature of the newly created, preflood earth. Imagine the entire earth's surface covered by a sandwich arrangement in which a horizontal layer of rock (which will become the earth's crust) has a layer of water above and below it. The rock layer is almost 10 miles thick; each water layer is about ¾ mile thick.[2] The water above this rock layer is surface water; the confined water below is subterranean water. If the rock layer were perfectly uniform in thickness and density, everything would be in balance. Equilibrium would exist.

No doubt variations existed in the rock's thickness and density. The heavier parts would sag (bend) downward, like an overloaded floor, causing additional surface water to flow into each depression. That added weight would increase each sag. More surface water would flow into the growing depressions, driving each sag even deeper.[3]

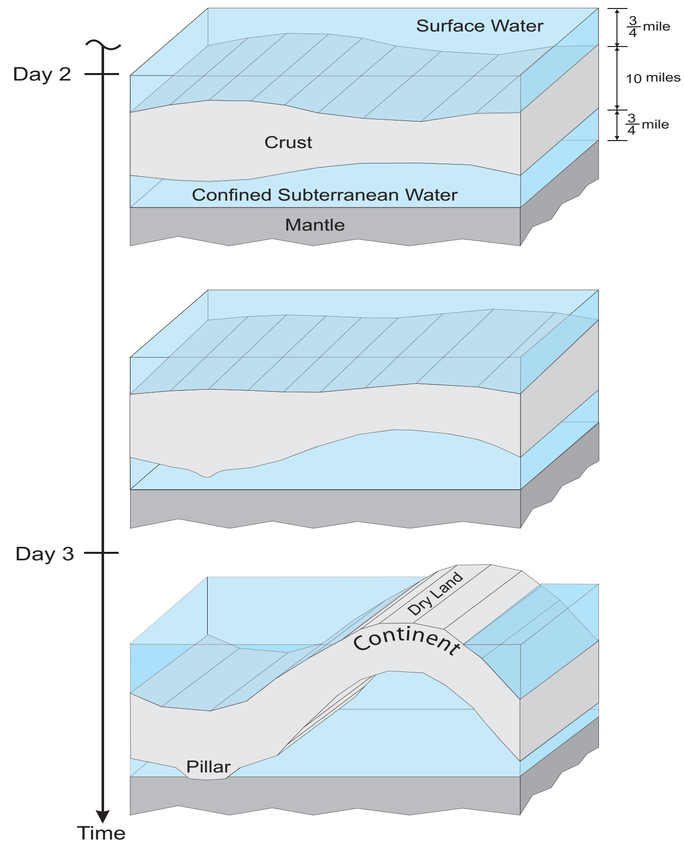


Figure 202: Dry Land Appears. At the end of the first creation day, *Day 1*, water covered the entire earth. On *Day 2*, God made a "*raqia*" that sharply separated ("*badal*") the liquid water ("*mayim*") above from the liquid water below. On *Day 3*, land rose out of the surface water, in preparation for the creation of plants, animals, and humans. (Water thicknesses are exaggerated to illustrate events of *Days 2* and *3*. Dimensions are estimates.)

Sequence is important. If the Sun and Moon, created on *Day 4*, had existed before pillars formed, the Sun's and Moon's powerful gravity would have greatly deformed the temporarily unstable crust. Pillars, the foundations of the earth, maintained stability.

Recognizing that a large amount of water was under the preflood crust, as the Bible states, is essential to understanding the flood. Our failure to understand basic physical aspects of the flood opened the door to evolution and a belief, by some, in a multibillion-year-old earth.

Some sagging rock would also be *squeezed* downward through the subterranean water, forming protrusions—or "pillars"—pressed against the chamber floor. This is because the pressure within the rock at the base of the rock layer's thicker, denser portions would exceed the subterranean water's pressure pushing upward. If that pressure difference exceeded the rock's shear strength at any point, rock would "flow" downward, deforming like putty. (Compression tests on cylinders of rock subjected to high confining pressures, but larger axial loads, show that the rock cylinders deform like putty.)

Downward protrusions (pillars) would grow like the downward flow in a lava lamp, except that the rock, being a solid instead of a liquid, had internal strength due to atomic bonding. The deeper the pillars went, the greater this pressure difference would become, so rock would "flow" even deeper until all pillars pressed against the chamber floor. Pillars carrying an excessive load would thicken and penetrate slightly into the chamber floor.

Because the confined subterranean water had essentially a fixed volume, the thinner, less-dense portions of the crust would have risen out of the water, forming continents. Therefore, as rock sagged *downward* and as pillars were squeezed *downward*, this fixed volume of subterranean water forced the thinner parts of the crust *upward*.

If, on *Day 2* of the creation week, our "sandwich" encircled the earth like the outer three rings of an onion, water would cover the entire earth. In the following hours, the thinner portions of the crust would rise out of the surface water and become dry land. Water would drain into depressions. This seems to be what happened on *Day 3* (Genesis 1:9–10). Water covered the entire earth, then *"God said, 'Let the waters below the heavens be gathered into one place, and let the dry land appear'; and it was so. And God called the dry land earth, and the gathering of the waters He called seas;"* [Pages 424–432 further support this interpretation of *Day 2*.]

Genesis 1:9 says that the waters *below the heavens* were gathered into *one* place (i.e., one big ocean). Why, then, in the next verse did God call the collected waters "seas"—plural? Answer: Multiple seas were honeycombed *below* the crust. *The Interpreter's Bible* explains:

> *"Seas" embraces more than the waters upon the face of the earth; it includes also the (supposed) subterranean waters upon which the earth was believed to rest … and the circumfluent ocean, upon which the pillars of the firmament stood.*[4]

Psalm 24:2a specifically states that God "*founded it* [the earth] *upon the seas*."

Interestingly, *Day 2* was the only creation day in which the Bible does not expressly say God saw that day's work was *"good."* Certainly, nothing bad was done on the second day, because at the end of the creation week, God saw that all He had made was *"very good."* Apparently, the second day's activity was not completed until *Day 3*.

Now we can see why. On *Day 2*, immediately after the crust was created with liquid water above and below it, the crust began to deform. Heavier portions sagged and squeezed down pillars, while lighter portions rose out of the water. On *Day 3*, after the pillar structure had been established (the foundations of the earth were laid), God stated in Genesis 1:10 that "it was good." Later on *Day 3*, after vegetation was created, God made a similar statement. Thus, *Day 3* was the only creation day in which two "it was good" pronouncements were made.

Psalm 104:3, in describing *Day 2*,[5] states (with my interpretations in brackets), *"He lays the beams* [pillars] *of His upper chambers* [the crust] *in the* [subterranean] *waters."* By *Day 3*, surface water had drained into depressions, forming dry land—a *"good"* condition (Genesis 1:10) necessary for the life God would create next.

Peter also seems to describe these events in II Peter 3:3–6. He states that in the latter days mockers will not understand that, *"the earth was formed out of water and by water, through which the world at that time was destroyed, being flooded with water."*

This is consistent with the following interpretation: On *Day 2*, a nearly horizontal crust, or "expanse," was formed in the midst of the liquid water covering the earth (Genesis 1:2,6,7,9). On *Day 3*, lighter portions of the crust rose out of the water, causing water above the rising crust to flow into depressions (Genesis 1:10). In other words, the earth (its crust) was formed ***out of*** (rose out of) surface water and was formed ***by*** pressure from subterranean water. Some might incorrectly think "forming the earth out of water" implies alchemy—water (H_2O) was changed into SiO_2, $(Mg,Fe)_2SiO_4$, and a host of other minerals that comprise rock. (Even if alchemy occurred, one would not say rock formed ***by*** water.) Actually, "out of" is used in a spatial sense. The King James Version clearly conveys this idea of the land rising out of water: "… *the earth standing out of the water … .*"

An ancient writing, ascribed to Rabbi Eliezer ben Hyrcanus (A.D. 80–118), vividly described these events as follows:

> *Until the third day of creation, the earth was level as a plain and water covered the whole earth. When God said* [Genesis 1:9]*, "Let the waters below the heavens be gathered," the mountains and hills arose and other parts became depressions. The waters filled these depressions and they were called seas.*

With remarkable insight a few lines later, he states that "*the earth is spread upon the water just like a ship which floats in the midst of the sea.*"[6]

About 2,000 years later,[7] the water below the crust burst forth as "*the fountains of the great deep*," combined with the surface water, and, as Peter wrote, flooded and destroyed earth in a global cataclysm. The Greek word *katakluzo*, from which we get our word "cataclysm," is translated as "flooded" in II Peter 3:6. In describing Noah's flood, the Bible never uses the normal Greek or Hebrew words for flood. Noah's flood was much more; it was an unparalleled, global cataclysm—earth's defining geological event.

The complex Hebrew word *raqia* is usually translated in modern times as "expanse" or "firmament." Pages 424–432 explain why *raqia* is sometimes identified with "heavens" but in other contexts refers to earth's preflood crust.

Rock Pillars. Pressure from the compressed subterranean water supported most of the crust's weight; pillars supported the rest. Every 12 hours, tidal effects, caused primarily by the Moon's gravity, lifted the subsurface water (and, therefore, the earth's crust), just as tides lift ocean surfaces today. At low tides, the crust settled. The pressure each pillar exerted on the chamber floor increased and decreased twice daily. These loose, or flexible, contacts could be described as "***sockets***." Smaller tides also occur in the solid earth. [See Endnote 5 on page 481.]

The Bible says the earth was founded on pillars. Psalm 75:3b says, *"It is I* [God] *Who have firmly set its* [the earth's] *pillars."* In Job 38, God demonstrates His authority by giving Job the most difficult science examination of all time. In verses 4–6, God asks Job, *"Where were you when I laid the foundation of the earth? Tell Me, if you have understanding, ... On what were its bases sunk?"* This word, "bases," is translated in all 54 other places in the Bible as "pedestals" or "***sockets***" ***which held pillars***.

Two verses later, in Job 38:8–11, God seems to speak of a confined sea of water that burst forth. Then a dark cloud of water vapor apparently enveloped the exploding sea.

> *Or who enclosed the sea with doors, when, bursting forth, it went out from the womb, when I made a cloud its garment, and thick darkness its swaddling band, and I placed boundaries on it, and set a bolt and doors, and I said, "Thus far you shall come, but no farther; and here shall your proud waves stop.*

Ancient extrabiblical writings, although not having the authority of biblical passages, also describe this pillar structure within the subterranean water. As one example, the British Museum's *The Book of the Cave of Treasures*, dated at about A.D. 300–599, states:

> *And on the Third Day God commanded the waters that were below the firmament to be gathered together in one place, and the dry land to appear. And when the covering of water had been rolled up from the face of the earth, the earth showed itself to be in an* ***unsettled and unstable state****, that is to say, it was of a damp or moist and* ***yielding nature. And the waters were gathered together into seas that were under the earth and within it****, and upon it.* ***And God made the earth from below, corridors and shafts, and channels for the passage of the waters****; ... Now, as for the earth,* ***the lower part of it is like unto a thick sponge, for it resteth on the waters.***[8] [emphasis added]

The Bible often speaks of "*the foundation(s) of the earth*." On *Day 3*, the earth's crust was literally established, or set (using pillars), on its foundation. Had this not happened, the crust would have continually tottered (or undulated, like the surface of an earth-size water bed). Perhaps this is why the psalmist wrote, "*He established the earth upon its foundations, so that it will not totter forever and ever"* (Psalm 104:5). Only by understanding some basic physics and the role of subterranean water, will these matters—and the global flood—be clear.

"On the same day all the fountains of the great deep burst open." (Genesis 7:11) On one day, the crust ruptured and the flood began. Water from the fountains fell as rain. Subterranean water flowed with unimaginable force horizontally through the subterranean chambers and up through the globe-encircling rupture. Pillars were crushed by the increasing crustal loads they carried. Each pillar's collapse produced huge waves in the surface water and pressure pulses in the subterranean water. Rock fragments from the crushed pillars, accelerated into space by astounding energy sources in the fountains of the great deep, became meteoroids.[9] Thus, the pillars, or foundations of the world, collapsed. This may be what Psalm 18:15 refers to when it says, *"Then the channels of water appeared, and the foundations of the world were laid bare."*

Rupture Mechanism: Tidal Pumping. But why did the pressure in the subterranean water increase enough to rupture the crust? Tides and heat. Each tidal cycle, driven by the Sun's and Moon's gravity, stretched and compressed the pillars.[10] This cyclic compression—tidal pumping—twice a day for almost 2,000 years, heated and expanded the pillars and subterranean water, steadily increasing the pressure in the chamber. [See page 124 and pages 488–489.]

As temperatures rose throughout the chamber, the water became ***supercritical water*** (see page 124), and the pillars and the crust weakened. Failure of the first few pillars increased the load on the remaining pillars, so all pillars soon collapsed, much like a falling house of cards. Consequently, pressures within the chamber fluctuated wildly.

How hot might the high-pressure water have become? Question 5 on page 308 explains why some meteorites reached temperatures of at least 1,300°F. Some minerals in other meteorites were even hotter,[11] a fact that perplexes meteorite experts, because meteorites came from supercold outer space, where temperatures are almost absolute zero (-460°F). This heating was not due to impacts or falling through earth's atmosphere, because the heating occurred not just on meteorite surfaces, but *throughout* meteorites. Because meteorites came from pillars, as explained on pages 305–327, pillars and the subterranean water exceeded 1,300°F.

Something to Think About: "Fire in Waters"

So much heat was generated within the pillars that they would have glowed, as incandescent filaments in lamps do today. Even some burning may have occurred in the subterranean water. [See **"Energy in the Subterranean Water"** on page 490, especially Figure 212.] With hot, glowing pillars (part of the *raqia*), the sight within the otherwise pitch-black subterranean chamber would have been eerie. An apt description of this might be "fire in waters."

One of the most famous and revered Hebrew scholars of all time, Rabbi Solomon Yitzchaki (A.D. 1040–1105) of France, proposed that the correct translation for Genesis 1:8a is *"And God called the expanse fire in waters,"* instead of the normal *"And God called the expanse heaven."* The reason may surprise you.

Before A.D. 700, written Hebrew contained only consonants. Vowel points were then inserted to standardize pronunciations. For example, the meaning of

n th bgnng Gd crtd th hvns nd th rth

may be clear, but the phrase is difficult to pronounce (and, therefore, to remember). If other vowels had been inserted in "hvns," the word would have a different meaning today. Rabbi Yitzchaki, in his eleventh century *Rashi Commentary*, pointed out that with different vowel points the original Hebrew word we now think of as meaning "heaven" *in Genesis 1:8a* would mean "fire in waters."

While in Jerusalem on 28 June 1990, I met for two hours with Michael Klein, Dean of Hebrew Union College. My question was, "What did *raqia* (expanse) and *shamayim* (heaven) mean in Genesis 1:8a when Moses wrote Genesis?" To my surprise, he suggested Rabbi Yitzchaki's translation, which I had previously studied. *Shamayim* is a compound of the words fire (*esh)* and liquid water (*mayim)*. After I briefly explained the hydroplate theory, Dean Kline said that *raqia* (as opposed to "*raqia of the heavens*") might well have been the earth's crust—appropriately called "fire in waters." You decide.

Sinking Continents. Since the lighter (and higher) portions of the crust were supported entirely by subterranean water, primarily the continents and preflood mountains sank as the supercritical water escaped during the flood phase. Therefore, *the flooded earth resulted as much from sinking continents as from rising water.*

Genesis 7:20 says that the flood waters covered all preflood mountains by 15 cubits (about 22½ feet). Today, mountain heights vary by thousands of feet, so why did many, if not all, preflood mountains have about the same elevation? (Some commentators, adding words not in the Bible, say that "at least" 15 cubits of water were above *all* the earth's mountains. Others say that the text means the Ark, whose height was 30 cubits, must have been only half submerged and did not run into mountain peaks.) The explanation becomes clear if we recognize that: (a) today's mountains were formed by completely different mechanisms than those on the preflood earth, and (b) the earth was founded on and spread out above liquid water (Psalms 24:2, 104:3, and 136:6). Here's why the flood waters covered the preflood mountains by 15 cubits:

On *Day 3* of the creation week, the higher a continent rose out of the surface water, the more pressure it exerted on the subterranean water directly below. To demonstrate this buoyancy effect, support a large rock under water with one hand. Notice how the pressure on your hand increases as you slowly lift the rock out of the water. Therefore, as the land rose higher, it would have risen more slowly, giving preflood mountains similar heights.

About 2,000 years later, as the flood waters rose and continents sank, this same buoyancy effect caused preflood mountains not yet covered by water to exert greater pressure on the water still under the crust. This reduced their height and lifted lower mountains, further equalizing mountain heights above the rising water—just as Genesis 7:20 states.

As the flood progressed, pillars were increasingly crushed, so more and more of the crust rested on the subterranean chamber floor, slowing the water's escape. The vertical walls on each side of the rupture were almost 10 miles high. Because the rock's pressure in the bottom half of each wall exceeded its crushing strength, the unsupported, unconfined walls continually crumbled—for 150 days (Genesis 7:24). During that time, the high-velocity fountains of the great deep removed that rubble, widening the rupture hundreds of miles.

Mass deep in the mantle shifted slowly toward these relatively unloaded portions of the chamber floor. Suddenly, the chamber floor buckled upward beneath the widened rupture, first forming the Mid-Atlantic portion of the Mid-Oceanic Ridge. The crust slid downhill on lubricating water, away from the rising Mid-Atlantic Ridge. Sliding continental plates—hydroplates—eventually crashed and compressed in the "*compression event*."

Weaker portions of the hydroplates crushed, thickened, and buckled. In doing so, the new, postflood continents rose out of the flood waters, allowing water to drain into newly opened—and temporarily very deep—ocean basins. Buckled mountains also formed, as shown in Figure 49 on page 116. For each cubic mile of land that rose out of the flood waters, one cubic mile of flood water could drain.

(Note: Today, the volume of all land above sea level is only one-tenth of the volume of all water on earth.) Other dramatic consequences in the Pacific, including formation of huge ocean trenches, are discussed on pages 149–173.

Sliding rock-on-rock contacts quickly became molten rock-water mixtures. This is why magma contains a surprising amount of dissolved water, why a thin saltwater layer appears to be under portions of all continents at the depth predicted by the hydroplate theory,[12] and why a thick, water-laden layer appears to be under the Tibetan Plateau.[13]

Conclusions. Sometime after the Fall but before the flood, a chain of physical events began that produced a global flood.[1] Although we cannot be sure exactly how it began, that cataclysm had many consequences: layered fossils; coal, oil, and methane deposits; major mountain ranges; the Ice Age; and dozens of other global features. Our challenge is to explain their details in the simplest, most internally consistent way that adheres to the laws of physics. If that explanation happens to conform to the biblical account, that is no reason to reject the explanation. Recognizing that a large volume of water was trapped under earth's crust and understanding the second creation day clarify the flood considerably and explain many major issues that befuddle evolutionists.

For centuries, hundreds of sincere questions about the flood have been asked; they deserve thoughtful, accurate answers. Without clear explanations, a "vacuum" has existed into which evolutionists have placed faulty theories. If we simply tell others (especially nonbelievers) to believe the Bible, we create unnecessary resentment because the questions remain, faulty explanations continue to be universally taught, and we unnecessarily appear somewhat self-righteous.

Day 2—a key to explaining the flood—has been poorly understood. As Peter wrote, people would not understand that earth's crust was formed out of water and by water that later flooded the earth. This proposed interpretation of *Day 2* helps us appreciate the presence of so much subterranean water, the power of "*the fountains of the great deep*," why they all erupted so quickly (on one day), and where the flood waters came from and where they went. Had the flood been better understood before Charles Darwin popularized evolution, that "idea vacuum" would never have formed, and many more people would have recognized that evolutionary explanations are ridiculous. Evolution would not have flourished. Our task, then, is to fill this "vacuum" by explaining to others what we now know about the flood.

References and Notes

1. Was the flood inevitible—"programmed" from the beginning? In my opinion, the answer is no. In other words, if sin had not entered the world, I believe that the earth would still have its preflood subterranean water and pillars.

   One admittedly speculative idea is that if mankind had not sinned and had learned to extract and use the abundant geothermal energy generated by tidal pumping, that energy could have been used for people's benefit, not their destruction. After all, humanity needed an energy source if it was to exercise dominion over the earth (Genesis 1:28). Today's primary energy source, fossil fuels, did not exist before the flood.

   Sin has physical consequences (Genesis 3). What might they be when every intent of all humans (except Noah) was evil continually (Genesis 6:5, 7:1)? Could sinful man's activities have caused physical changes that further weakened the crust or a few pillars? After all, "*the earth* [at that time] *was filled with violence*." (Genesis 6: 11) A sufficiently large man-made explosion could have disrupted the weakening crust and pillar system, initiating the rupture and, therefore, triggered the flood. While this is speculation, dozens of similar scenarios could be proposed.

   As a second possibility, God could simply have commanded the earth's crust to crack or a pillar to collapse. God spoke the universe into existence, so commanding such a small thing at the right place, which is all it would take, is not difficult to imagine.

   Would this second possibility inject a miracle into the physical world, thereby departing from science? The hydroplate theory does not assume that a miracle happened. The theory has one main assumption: the presence of subterranean water before the flood. (Starting assumptions, often unstated, are part of every scientific theory that tries to explain the past.) The hydroplate theory has only one main assumption.

   As explained on pages 411–413, the Bible states that subterranean water was supernaturally created along with the rest of the universe. Later, either sinful man's actions (or inactions) or a direct act by God weakened the crust or pillars, thereby increasing the subterranean water's pressure. Thus, the crust ruptured. Yes, God's acts or man's possible activity are not scientific ideas, but they bring us to the same starting point as the strictly scientific hydroplate theory. Regardless of how one reaches that point, everything that follows is within the scientific realm.

   The role of creation science, as I see it, is to explain what we see in the universe with the fewest assumptions and without never-ending appeals to miracles. (It was this practice of invoking miracles to solve scientific problems that irritated so many and led to the rigid insistence on uniformitarianism.) Creation science avoids the narrow-minded assumption that "the physical universe is all there is and all there ever will be"—a belief called materialism and scientism. These views (materialism, uniformitarianism, and scientism), common in most schools and much of society, produce scientific contradictions. Creation science, on the other hand, (a) does not endlessly invoke miracles, (b) is more consistent with the evidence and the laws of physics, and (c) recognizes the obvious: there is a Creator (Romans 1:20). [See **"How Can the Study of Creation Be Scientific?"** on page 376.]

2. This thickness for the subterranean water assumes than no water escaped earth's gravity. However, an unknown amount of water did escape into outer space, so the average thickness would have been somewhat greater than ¾ of a mile.

3. The rock layer would have had some stiffness, because it was almost 10 miles thick. However, the crust's large area (basically the earth's surface) would have given it great flexibility. If the crust's thickness, density, or strength varied (as a sine wave, for example) with an amplitude of only 1% and a wavelength of 110 miles, the crust would have sagged downward to the chamber floor at more than 18,000 locations.

   The effects of the rock sagging downward through water at one location on earth would spread laterally, but only at the speed of sound in water. Outside that expanding "ring of influence," other sags could occur simultaneously.

4. Walter Russell Bowie, "The Book of Genesis," *The Interpreter's Bible*, Vol. 1 (New York: Abingdon Press, 1952), p. 473.

5. See Endnote 3 on page 412.

6. This writing and translation was brought to my attention by Ari Haviv on 13 September 2010. See also Pirkê De Rabbi Eliezer, translation by Gerald Friedlander (New York: The Bloch Publishing Company, 1916), pp. 27–28.

   The original Hebrew can be found in chapter 5 at www.daat.ac.il/daat/vl/pirkeyeliezer/pirkeyeliezer02.pdf

7. According to the Masoretic text of the Old Testament, this time period was 1,656 years. [See page 420.] According to the Septuagint text, it was 2,242 years.

8. *The Book of the Cave of Treasures,* translated from the Syriac Text of the British Museum (MS. Add. 25875) by Sir E. A. Wallis Budge (London: The Religious Tract Society, 1927).

9. For details and supporting evidence, see pages 271–326.

10. Before the flood, the energy added to the pillars every 12 hours by the gravitational pull of the Moon, and to a lesser extent the Sun, was huge. That energy was proportional to the crust's massive weight times the average lift distance. [For details see **"Tidal Pumping: Two Types"** on pages 488–489.]

11. Besides iron meteorites, which were once at least 1,300°F, chondrules were once about 3,000°F. [See Figure 159 on page 308 and **"Chondrules"** on page 309.] Also, the matrix material encasing chondrules shows thermal metamorphism requiring temperatures of at least 750°F. [See O. Richard Norton, *The Cambridge Encyclopedia of Meteorites* (Cambridge, England: Cambridge University Press, 2002), p. 92.] While the heat-generating mechanisms for each are different, all three result from the release of gravitational potential energy.

12. *"Magnetotelluric measurements show the lower continental crust to be electrically conductive globally ... The most probable candidates for the conduction mechanisms are small amounts of interconnected saline pore fluids and interconnected thin films of graphite. ... We favor the supercritical saline fluid model ..."* R. D. Hyndman et al., "The Origin of Electrically Conductive Lower Continental Crust: Saline Water or Graphite?" *Physics of the Earth and Planetary Interiors*, Vol. 81, 1993, pp. 325, 341.

    While these authors favor the *supercritical* saltwater explanation for this electrical conductivity, they assume that the salt water is in innumerable microscopic pockets that are electrically and horizontally connected. The authors are puzzled, because so much horizontal connectivity should be accompanied by vertical connectivity. Over long geological ages, this water should have leaked up to the earth's surface.

    The hydroplate theory solves the problem. The subterranean water layer had worldwide connectivity. Before the flood, the supercritical, slowly circulating subterranean water dissolved many minerals, such as salt. As water escaped during the flood, this saltwater layer simply became thinner.

    ◆ *"Nevertheless, the simplest explanation of increased conductivity in the deep crust is the presence of a continuous, lithostatically pressured, water-rich fluid."* Bruce W. D. Yardley and John W. Valley, "How Wet Is the Earth's Crust?" *Nature*, Vol. 371, 15 September 1994, p. 206.

    After presenting a strong case for the presence of water trapped deep under the earth's surface, Yardley and Valley point out a problem. Over hundreds of millions of years, that water would leak up to the earth's surface. It apparently never occurred to these authors that the earth is not hundreds of millions of years old—and most of the subterranean water did escape upward during the global flood.

13. See the quote by Wenbo Wei et al. in Endnote 68 on page 144.

    The hydroplate theory makes 45 explicit predictions. Prediction 1, published in 1980, says that large volumes of pooled salt water are beneath major mountains. The above study by Wie et al. explains why salt water appears to be about 10 miles below the Tibetan Plateau (the world's highest and largest plateau), which is bounded on the south by the most massive mountain range on earth.

How Did Human "Races" Develop?

In this context, there is only one race, *the human race*. Today, the word "race" has come to mean a group of people with distinguishing physical characteristics such as skin color, shape of eyes, and type of hair. This new meaning arose with the growing acceptance of evolutionism in the late 1800s. The word "race," referring to physical characteristics, hardly ever occurs in the Bible.[1] Instead, the word "nation" is used more than 200 times.

Race is a social idea, not a scientific concept. It is recognized that genetic and molecular variations among the so-called "races" are trivial, although a few traits may vary widely. Human variations are relatively minor when compared with many other kinds of life. For example, consider the many traits in the dog family. [See Figure 3 on page 4.] Most varieties of domestic dogs have been produced during the past 300 years. Dogs may be white, black, red, yellow, spotted, tiny, huge, hairy, almost hairless, cute, or not-so-cute. Temperaments and abilities also vary widely. Because domestic dogs can interbreed with the wolf, coyote, dingo, and jackal, all are part of the dog kind. The vast number of genes in every kind of life permits these variations, allowing successive generations to adjust to environmental changes. Without this design feature, extinctions would be much more common. Besides, wouldn't life be much less interesting without variations within each kind?

The following three mechanisms[2] probably account for most "racial" characteristics, all of which developed since the flood, approximately 5,000 years ago.

1. Natural Selection. This well-established phenomenon is not a mechanism for macroevolution, as a century of experimentation has shown, although it is an important mechanism for microevolution. Natural selection filters out certain parental genes in successive generations, producing offspring with slightly different characteristics *but less genetic variability*. For example, fair-skinned people living near the equator are more susceptible to several health risks, such as skin cancer. Consequently, they have slightly less chance of living to reproductive age and passing on genes for light skin color to their children. Likewise, darker-skinned people absorb less sunlight, depriving them of vitamin D_3, which forms in skin exposed to sunlight. In polar latitudes, this could cause rickets. Therefore, over many generations, dark-skinned people tend to live near the equator and light-skinned people tend to live at higher latitudes.

There are exceptions. Eskimos (Inuits) have dark skin, yet live in Arctic latitudes. However, their traditional diet, which includes fish-liver oils containing large amounts of vitamin D_3, prevents rickets.

2. Cultural Preference. This takes the form of likes (as in mate selection) or dislikes (as in prejudices).

> ***Likes.*** The saying, "beauty is in the eye of the beholder," illustrates how a person's culture may influence mate selection along "racial" lines. This has been demonstrated in geese. Blue snow geese live in one region of the Arctic, and white snow geese live in another. In an experiment, eggs from each colony were hatched in an incubator. The goslings were then raised by "foster parents" of the opposite color. The young geese later showed a mating preference for geese having the color of their foster parents. In another experiment, the foster parents were painted pink. Again, there was a mating preference for the color the young geese saw as they were growing up, even though that color was artificial. The old song "I Want a Girl Just Like the Girl That Married Dear Old Dad" makes the point.

> ***Dislikes.*** Humans also have prejudices—some people more than others. Prejudices based on physical appearances have caused wars, genocide, forced segregation, and voluntary isolation. Adolf Hitler had a fanatical hostility toward Jews and many others and a strong preference for the supposedly Aryan characteristics of tall, blond, blue-eyed people. This led to Hitler's extreme, repugnant steps to exterminate the former and increase the latter. An example of voluntary isolation occurs in Africa. Pygmies, typically 4½ feet tall, live separately from the Watusi, who are sometimes 7 feet tall. Yet, both may live within several hundred miles of each other. These and hundreds of other prejudicial actions, operating over several thousand years, segregated many people based on physical appearances.

3. Small, Isolated Populations. A population of people, or any other form of life, has a large set of genetic characteristics. If a few members of this population move to an isolated region, such as an island, the new group will have a different and smaller set of genetic characteristics (or a smaller range of genetic potential) than the entire population. As a result, later generations on that island will have traits that differ from the original population.

Imagine a barrel filled with marbles—half white and half black. Let's say that each marble represents a person, and the marble's color represents a gene for that person's skin color. If pairs of marbles, representing a husband and wife, are drawn at random and placed on separate islands, about half the islands will have marbles of just one color—white or black. This would be somewhat analogous to the

Figure 203: Faces. A few members of the human race from the following places: top row, left to right: Japan, Tibet, Borneo, Holland; second row: Ireland, China, Rwanda, Korea; third row: New Zealand, Bali, Okinawa, Israel; fourth row: United States of America, Australia, India, Egypt; bottom row: Molucca Islands, Canada, Greece, Guatemala. Visualize all without variations in dress, hair style, age, and skin color. How different are we? People continents apart laugh alike and cry alike. Yes, our personalities, experiences, and talents are individually unique, but our physical differences are small; our similarities are great.

dispersion and isolation of peoples after the flood and after Babel. If a husband and wife had the same genes for skin color (dark or light), then their descendants would tend to have the same skin color. The color of the marbles could just as well represent other genetic characteristics.

Actually, the genetics of this process are more complicated than this simple illustration. For example, at least three genes determine skin color, not one. Also, there are thousands of traits, each of which might cluster in an isolated geographic region if small groups broke off from the larger population. So, specific characteristics can easily arise, as they did when the eight survivors of the flood and their descendants eventually obeyed God's command to spread out and repopulate the earth. From the listing of Noah's descendants given in Genesis 10–11, we can see how early migration patterns began. Shem's immediate descendants stayed generally near Ararat (what is now eastern Turkey) or migrated eastward. Ham's descendants migrated southward, while Japheth's descendants migrated northward. Undoubtedly, many other small groups colonized isolated regions, allowing their unique genetic characteristics to be expressed in later generations.

Understanding these three mechanisms—natural selection, cultural preferences, and isolated populations—we can now ask some interesting questions. What did Adam and Eve look like? Obviously, their genes, modified by degenerative mutations, carried all traits humans have today—and probably other traits that have since disappeared. Many of their genes, of course, were not visible (or expressed) because other genes dominated. We usually imagine Adam and Eve as looking like ourselves. However, for genetic reasons, Adam and Eve were not "white" or "black" but something in between. The Hebrew word for Adam suggests redness, because an almost identical Hebrew word means "red" or "to show blood." Adam's skin coloring may have been similar to that of Native Americans.

For the past 150 years, evolutionists have painted a very different picture. Man supposedly ascended from some apelike ancestor. According to the theory, because some early humans branched off sooner than others, they had different physical, mental, and behavioral characteristics. This is ***racism***, a highly prejudicial school of thought that dehumanizes fellow human beings. One cannot say that evolutionists today are racists, although Charles Darwin and many of his followers were. Racism is unpopular today, at least openly, so public acknowledgment of it is rare. However, the theory of evolution provides a rationale to justify racism.[3]

Genesis provides quite a different historical perspective. We are all descended from Adam and Eve and from Noah and his wife. Consequently, we are all cousins. Think what the world would be like if everyone realized that and acted accordingly!

References and Notes

1. The word "race," as applied to groups of people, is never used in the King James Version and is seldom used in modern translations. The two or three uses in these modern translations come from Hebrew and Greek words that mean "family" or "offspring," not a variety or subspecies.
2. A fourth mechanism may play a role. Experiments with a few plants and animals have shown that a hostile environment can switch on *preexisting* genetic machinery in a parent, so offspring are better protected. [See Item 2 on page 5.] This may partially explain skin color variations in humans.
3. *"Biological arguments for racism may have been common before 1859* [when Darwin wrote *The Origin of Species*], *but they increased by orders of magnitude following the acceptance of evolutionary theory."* Stephen Jay Gould, *Ontogeny and Phylogeny* (Cambridge, Massachusetts: Harvard University Press, 1977), p. 127.

- Roger Lewin, *Bones of Contention* (New York: Simon & Schuster, Inc., 1987), pp. 266–267.

Why Did the Flood Water Drain So Slowly?

After the Ark landed on the mountains of Ararat, 74 days passed before the tops of surrounding mountains were visible (Genesis 8: 3–5). Shouldn't most of the flood water have quickly drained off the high, thickened continents and into the new, deep ocean basins? And why did all passengers (except a few birds) stay on the Ark for 222 days after the Ark landed? Surely, the humans on board wanted to leave that noisy, smelly boat, breathe fresh air, stretch, stand on solid ground, cease caring for the animals, and explore the new earth.

First of all, the earth was still a hostile place. Secondly, powerful forces were being slowly unleashed deep inside the earth. A brief review of pages 109–173 is needed.

Review. During the flood phase, the escaping subterranean water widened the rupture, so the chamber floor directly below steadily bulged upward—similar to what is shown in the quarry sketch on page 127. This upward arching increased stresses and melting below that bulging floor. Deep fractures resulted in slippage, friction and instantaneous melting along vertical faults. This, in turn, triggered deeper stresses, plastic deformations, melting, and uplift.

As a result, the hydroplates eventually began sliding downhill, away from the rising bulge that would become the Mid-Atlantic Ridge. This removal of weight provided orders of magnitude more lift and slippage—and, near the center of the earth, melting. Within hours, the entire Atlantic floor was rapidly rising; that, in turn, pulled down the Pacific plate and moved surface water toward the Pacific side of the earth. The subsiding Pacific plate and the rising Atlantic floor steepened the slopes on which the hydroplates slid away from the Mid-Atlantic Ridge.

Gravitational settling within the melted rock (magma) deep in the earth released more heat than did frictional sliding along faults. [See **"Melting the Inner Earth"** on pages 496–498.] The more the melting, the greater the heat released by gravitational settling, so even more melting occurred. Runaway melting near the center of the earth began, and the earth's liquid outer core started to form.

Drainage. For years after the flood, this melting of the inner earth continued and the liquid outer core grew. For two reasons, this made the earth's terrain increasingly irregular and allowed the flood waters to slowly drain. First, when rock below the crossover depth melts, its volume decreases. [See **"Magma Production and Movement"** on page 152.] Therefore, as the inner-earth shrank, the solid mantle and crust were slowly compressed and crushed. As a result, elevations at the earth's surface became increasingly varied in the years after the flood—much like the wrinkling skin of a drying apple.

Second, imagine a unique water bed. Rather than its water being a liquid, it is a uniform layer of ice. On top of the bed are two types of areas; in one are blocks of wood (representing continents) and in the other are bricks (representing magma from the upper mantle that had spilled onto the new Pacific basin in the months and years after the flood). As the ice (representing the deep inner earth) melts, the bricks slowly settle into the mattress, and the wood rises. Increasingly, the denser ocean basins (density ~3.0 gm/cm^3) and the mantle below them sank into this growing liquid foundation—the outer core. As they did, the lighter crust (density ~2.7 gm/cm^3) and the mantle below rose in compensation. This also allowed the flood waters to drain into the new, deepening ocean basins. So it took a few months before the tops of mountains surrounding the Ark could be seen—just as Genesis 8: 3–5 states.

Summary and Perspective. On the 150th day of the flood, the accelerating hydroplates, sliding away from the rising Mid-Atlantic Ridge on a layer of water, crashed, crushed, and buckled. Seashells were then on every major mountain range on earth. [See page 48.] Within hours, the Ark landed on the thickened crust. [See page 411.] For a few years, internal melting enlarged earth's liquid outer core, so elevations on earth became more irregular, the lighter continents rose, the denser ocean basins slowly sank, and most of the flood waters drained into those new ocean basins. As ocean basins sank below today's levels, submarine canyons were carved, and tablemounts formed. [See **"The Origin of Tablemounts"** on page 159.]

Also, immediately after the flood, the new continents were not at their equilibrium levels *relative to the mantle*. During the compression event, the hydroplates had been crushed, buckled, and thickened, so each hydroplate's mass was concentrated on a smaller base. [See Figure 49 on page 116.] Therefore, continents settled very slowly into the solid, but deformable, mantle. In compensation, the ocean basins gradually rose to almost today's levels. Also, magma spilling up onto the Pacific floor raised sea level. Pages 408–416 explain why all but the last several hundred feet of the rise took a few centuries. While sea levels were lower, animals and humans migrated between the temporarily interconnected continents.

Years were required to approach equilibrium levels in the newly formed *liquid* outer core, but centuries-to-millennia were needed for the continents to sink into the *solid* mantle. Earthquakes, tsunamis, volcanic eruptions, and very slow shifts of blocks of crust toward the Pacific still occur [Figure 87 on page 161], demonstrating that perfect equilibrium has not been reached. Consequences of the flood, at times catastrophic, are still with us.

If God Made Everything, Who Made God?

We live in, among other things, a time dimension where one event follows another. Time passes. Everything ages. Throughout our lives, we learn that effects always have causes. We would be confused if they didn't. Therefore, it is hard to imagine the first cause, and even harder to imagine what, if anything, preceded "The First Cause."

Just as God created the universe and everything in it, God also created time. There was a beginning of everything, including space and time. Consequently, God is outside of space and time. This means that God is unchanging (I Sam 15:29, Mal 3:6, Heb 6:17, James 1:17). He had no beginning and has no ending.

Also, and more pertinent to the question, from God's perspective an effect does not follow a cause. He sees the beginning and the end (Rev 1:8, 21:6, 22:13). Asking who made God before time began reflects a lack of understanding—even though most of us at one time have pondered the question. *No one made God; He is infinite and outside of time, and He existed before time began.*

Many years ago, one of my children asked me this question as I tucked him into bed. While I can't remember my answer, I am sure it was inadequate. Having years to think about his question has helped me reconcile the logic of the preceding two paragraphs with what is hard to imagine.

Seeing things from God's infinite perspective is probably as hard for us as it is for a dog or cat to understand what is on this printed page. If God is infinite and we are His finite creations, our limited understanding and perspective should not surprise us.

How else do we know that time began? The Bible is the most widely read book of all time. Within it, the most read page is probably the first page of Genesis. The first three words on that page

In the beginning ...

are probably the best-known group of three words of all time—the single, most widely proclaimed idea. By reading the fourth word, one sees that God was there at the beginning.

Another key insight comes from John 1:1.

In the beginning was the Word, and the Word was with God, and the Word was God.

Again, there was a beginning; we are also told Who was there when time began. Verses 1:2, 3, and 14 clarify these profound events even more.

For *scientifically* compelling reasons, there was a beginning. [See Items 53 and 55 on page 31.] Alternatively, you can save time and effort by reading again the first four words of the Bible—and believing them.

In the beginning, God ...

Is There Life in Outer Space?

Those who believe that life exists on distant planets usually base their belief on the following reasoning:

> *Life evolved on Earth. Because the universe is so immense and contains so many heavenly bodies, life probably began and evolved on other planets as well.*

This reasoning is flawed. First, it assumes that life evolved on Earth. Overwhelming evidence shows that life is so complex it could not have evolved—anywhere! [See pages 5–24.] Over the last 150 years, our culture has been so saturated with evolution that many uncritically believe it. As a result, they conclude that life must also have evolved on at least a few of the multitude of extraterrestrial bodies.

Yes, there are many stars, and a small fraction are known to have planets. [See **"Have Planets Been Discovered Outside the Solar System"** on page 403.] However, the probability of just one living cell forming by natural processes is so infinitesimal, *even considering the vast number of stars,* that the likelihood of life spontaneously occurring anywhere in the universe is virtually zero!

Despite popular and influential science fiction books and films, such as *Star Wars, E.T., Star Trek, 2001, A Space Odyssey,* and *Close Encounters of the Third Kind,* there really is no scientific evidence for intelligent extraterrestrial life. Hundreds of millions of tax dollars have been spent trying to find life in outer space. Conditions outside Earth are more destructive than almost anyone suspected before space exploration began: deadly radiation, poisonous gases, extreme gravitational forces, gigantic explosions, and the absence of the proper atmospheres and chemical elements. Just the temperature extremes in outer space would make almost any form of life either so hot it would vaporize or so cold it would be completely rigid, brittle, and dead. Unfortunately, these physical realities do not excite public imagination as much as science fiction and evolutionary stories.

A few people are searching for signals from outer space that would imply an intelligent source. Radio telescopes, linked with computers, simultaneously search millions of radio frequencies for a nonrandom, nonnatural, extraterrestrial signal—any short sequence of information. Yet the long sequence of information in the DNA of every living thing is a signal from an intelligence—a vast intelligence—a Creator. Almost all of those searching for extraterrestrial life believe it evolved naturally in outer space. If they ever accepted the DNA evidence for a Creator, the evolutionary basis for their search would disappear. [See **"Codes, Programs, and Information"** on page 9.]

If life evolved in outer space as easily as some people believe, many extraterrestrial "civilizations" should exist, especially on planets around stars that evolutionists claim are older than our Sun. Some civilizations should even be technologically superior to ours, would have recognized that earth has abundant life, and would have tried to reach us. Any superior civilization within our galaxy would probably have already explored our solar system, at least with robots. Because we have no verifiable evidence of any of this, intelligent extraterrestrial life probably does not exist, certainly within our Milky Way Galaxy.

Almost all stories of unidentified flying objects (UFOs) have since been traced to natural or manmade causes. Even if technically advanced flying objects exist, they may have a terrestrial, not extraterrestrial, origin. The United States, for example, developed and flew the superfast SR-71 aircraft and its prototype several years before most senior military officers in the United States knew such technology was possible. Evidence that UFOs are from extraterrestrial civilizations, although not disproved, has not been verified and usually relies on the truthfulness, rationality, and accuracy of a few alleged witnesses.

Could God have created life elsewhere? Certainly, but the Bible is largely silent on this subject. However, the Bible does say, *"For in six days the Lord made the heavens and the earth, the sea, and all that is in them."* (Exodus 20:11a). So, if life were created in outer space, it would have happened during the six creation days.

Three other Bible verses suggest that conscious, rational life is unique to Earth.

- Romans 8:22 states, *"the whole creation groans and suffers"* because of Adam's sin. This would be a strange statement if humanlike beings existed in outer space, because it would mean that although not descended from Adam, they suffer because of his sin.
- Romans 5:12 tells us, *"through one man* [Adam] *sin entered the world."* The Greek word we translate as "world" is *kosmos*, which generally means the entire universe. Again, if intelligent beings exist beyond Earth, they would be suffering for Adam's sin.
- Genesis 1:14 states that the heavenly bodies were made *"for signs, and for seasons, and for days and years."* It does not say that they were created as habitats for other creatures.

Is there life in outer space? Except as noted on page 445, probably not. Many people enjoy speculating on this subject, and some want to believe that life is in outer space, usually life that is superior to ours. While they may be right, little rational basis exists for this belief—either scientific or biblical.

Is There Life on Mars?

Probably, but only microbes, such as bacteria. Life did not *evolve* on Mars. Instead, Mars' soil at certain locations seems to contain living bacteria launched from Earth by the fountains of the great deep and delivered by comets and asteroids. Here's why.

Three independent groups of scientists have discovered methane (CH_4) in Mars' atmosphere. The quantities are small but significant, averaging about 10 parts per billion by volume. Sunlight slowly destroys methane, so something, somewhere, must be replenishing that methane. Also, methane in Mars' atmosphere should mix uniformly in only a few months, but methane's concentration varies around the planet and appears to be concentrated where water once flowed.[1] Volcanoes on Mars are dormant, and today comets and asteroids rarely hit Mars, so *today* they are probably not the source of much methane. By elimination, this leaves isolated locations in Mars' soil as the likely source for Mars' methane.

How is methane produced? On Earth, it almost always comes from anaerobic bacteria (bacteria that do not require oxygen).[2] For example, bacteria in the digestive tacks of ruminant animals (cattle, buffalo, sheep, goats, and camels) produce at least 20% of the methane in Earth's atmosphere. (Bacteria in other animals and humans produce much less methane.)[3]

Most methane on Earth is trapped in molecule-size, crystalline cages formed by frozen water called *hydrates*. Each cage holds at least one methane molecule. These methane hydrates, first discovered in 1970, lie on the cold ocean floor off the coasts of all continents. [See **"Methane Hydrates"** on page 114 and the picture of "flaming ice."] Methane hydrates contain more fossil fuel than is in all Earth's coal and oil deposits combined. Why is so much methane there?

As the hydroplates suddenly crushed and thickened at the end of the flood, draining flood waters swept vegetation off the edge of continents. Each leaf fragment, blade of grass, and giant log was loaded, as today, with bacteria. If food is present, some bacteria can survive and multiply exponentially in the cold, wet sediments on the ocean floors. Preflood vegetation deposited around all continents was that food, so its carbon became the main part of methane, a by-product of decay. At the temperatures and pressures on the ocean floor, most methane becomes methane hydrates.

The fountains of the great deep also launched vegetation fragments containing bacteria, so bacteria and their food were in comets, asteroids, and meteorites. Living, but dormant, bacteria have been discovered in meteorites, and it has long been known that comets contain methane. [See page 278.] Therefore, besides providing water that flowed on Mars, comet and asteroid impacts also delivered methane-producing bacteria and their food.[4]

PREDICTION 45: Bacteria will be found on Mars. Their DNA will be similar to Earth's bacteria. Furthermore, isotopes of the carbon in Mars' methane will show the carbon's biological origin.

References and Notes

1. Vittorio Formisano et al., "Detection of Methane in the Atmosphere of Mars," *Science*, Vol. 306, 3 December 2004, pp. 1758–1761.

◆ Sushil K. Atreya, "The Mystery of Methane on Mars and Titan," *Scientific American*, Vol. 296, May 2007, pp. 42–51.

2. If considerable oxygen and few anaerobic bacteria are present, water and carbon dioxide will be produced, instead of methane.

3. Microbial cells, such as bacteria, are extremely small. Our bodies contain 10 times more microbes than human cells.

4. *"A little over 100 metric tons of methane would have to be produced* [on Mars] *each year to maintain a constant global average of 10 ppbv* [parts per billion by volume]*."* Atreya, p. 46.

About 45% of organic matter and 75% of methane is carbon by weight. Anaerobic bacteria convert about 76% of the available carbon to methane. Assume that eleven comets (or asteroids) weighing 10^{16} grams each struck Mars and only one hundred thousandth of each impactor consisted of organic matter. That would allow 100 metric tons of methane to slowly escape into Mars' atmosphere for each of 5,000 years. (1 metric ton = 10^6 grams.)

$$\frac{11 \times 10^{16} \times 0.45 \times 0.76}{100{,}000 \times 5{,}000 \times 10^{6} \times 0.75} = 100 \ \text{metric tons of methane per year}$$

Other reasonable combinations of numbers produce similar results. Certainly, more carbon is still trapped in Mars' soil.

Is There a Large Gap of Time between Genesis 1:1 and 1:2?

The idea that a vast period of time elapsed between the first two verses of Genesis is known as the gap theory. Most variations of this theory interpret Genesis 1:1 as the first creation, which included the creation of the heavens, the earth, plants and animals, and even a race of humans preceding Adam! Perhaps billions of years then elapsed, during which time Satan and his angels fell and corrupted earth's inhabitants. God then judged and destroyed the earth and all its inhabitants. Thus, the earth became "formless and void" (Genesis 1:2) and remained that way for eons. Genesis 1:3, according to the gap theory, describes the beginning of the second creation with the first day of the (re)creation week—the familiar six-day creation. This series of events is also called the "ruin-reconstruction theory," "the pre-Adamic cataclysm theory," or the "restitution interpretation."

The modern gap theory was proposed in 1814 by Thomas Chalmers, a leading Scottish theologian. Some geologists of his day argued that the earth was much older than Genesis implied. Chalmers, therefore, proposed the gap theory to harmonize Genesis with those demands. No clear record shows anyone before 1814 interpreting Genesis 1:1–2 in this way.[1] This is especially significant, because Hebrew scholars 2,000 years ago certainly understood Hebrew writing better than we do today. The gap theory simply accommodated the growing demand for long periods of time.[2] Unfortunately, the adherents to the theory are usually unaware of all the scientific evidence supporting a young earth.

What are the problems with the gap theory? Gap theorists generally believe that the fossil record was formed, not in a global flood, but when God destroyed the earth in "the gap" between Genesis 1:1 and 1:2. Gappists have not understood how the flood rapidly formed fossils and deposited sedimentary layers with a total average thickness of one mile. For that reason, they believe that Noah's flood was less destructive than the judgment they claim preceded the creation week. No clear biblical passage supports the worldwide destruction they imagine, and they mishandle references to Noah's flood by many biblical writers and Christ Himself (Matthew 24:37–39, Luke 17:26–27). The gap theory resulted, to a large extent, from a failure to comprehend the flood. [See pages 109–147.]

Gap theorists also ignore this clear biblical statement that no great time gap preceded the completed creation:

> *For in six days the Lord made the heavens and the earth, the sea and all that is in them …* (Exodus 20:11)

The gap theory states that the heavens were created long before the six creation days—perhaps billions of years earlier. Exodus 20:11 says the heavens (and everything else) were made in six days. If the gap theory is correct, the Sun must have shone on earth to support the life that existed before the "gap." But Genesis 1:14–18 says the Sun was made on the fourth day of the creation week.

Gap theorists miss the importance of Christ's words in Mark 10:6, *"But from the beginning of creation, God made them* [Adam and Eve] *male and female."* Christ knew that Adam and Eve were created at the beginning, not after a vast gap of time.

According to most versions of the gap theory, the death and destruction shown by the fossil record, including the death of supposedly pre-Adamic man, ***preceded*** Adam's creation. But the Bible clearly states that death came ***because of*** Adam's sin (therefore, after Adam's creation).

If Satan fell before the creation week, as most gap theorists maintain, it is strange that at the end of the creation week, God pronounced that all He had made was "very good" (Genesis 1:31). Also, the fossil record gives evidence of death and violent burial on a global scale. How could such destruction be described as "very good" if it preceded God's pronouncement?

Why then do some believe in the gap theory? As mentioned earlier, they have accepted, perhaps unknowingly, claims that the earth is billions of years old. Therefore, they try to find where a vast period of time might fit into the Bible. They know that long periods of time cannot be inserted after Adam's creation because the various genealogies are tightly linked.[3] Consequently, the only place billions of years can be inserted is before Adam. Because time flowed smoothly and continually during the creation week, a week that for various reasons is composed of normal 24-hour days, the time gap must be inserted before the first creation day. Rather than start the creation week at Genesis 1:1 as most Bible scholars do, gappists start that week at Genesis 1:3. Therefore, they believe that before Genesis 1:3, a vast length of time existed—as they state, "whatever geologists demand."

To justify this, they propose nontraditional translations of several verses. They believe that Genesis 1:2a should be translated "the earth *became* formless and void," instead of the more widely accepted translation "the earth *was* formless and void." I know of no record, before 1800, of anyone translating this verse as gap theorists do. While it is true that the Hebrew word "*hayah*" can be translated "became," it is usually translated "was." In fact, in the 4,900 times "*hayah*" occurs in the Old Testament, almost 98% are translated as "was." Hebrew grammarians and linguists have almost uniformly rejected the translation "became" or "had become."

Gap theorists rely heavily on Isaiah 45:18, which states:

> *For thus says the Lord, who created the heavens (He is the God who formed the earth and made it, He established it and did not create it a waste place, but formed it to be inhabited),*

They correctly say that God did not create the earth a waste place. Genesis 1:2, using the same Hebrew word as in Isaiah 45:18 for "waste place," describes the earth as "formless and void." Gap theorists unfortunately conclude that after the earth's first creation, it must have become a waste place that was "formless and void." A more straightforward and internally consistent interpretation is that the earth was *temporarily* "formless and void" during the first day of its creation. At the end of the sixth creation day, the earth was completed, inhabited, and "very good"—not "formless and void." In other words, God "did not create it [to be] a waste place, but formed it to be inhabited."

Another verse used to support the gap theory is Genesis 1:28, which in the King James Version states "... Be fruitful and multiply, and replenish the earth, and subdue it ..." Today, the meaning of the English word "replenish" has shifted away from its early meaning, which was "fill." ("Replenish" came from the French word "remplir," which means "to fill"; it does not mean "to refill" or "to fill again.") Almost all modern translations translate this word "fill."

Most people who accept the gap theory have great confidence in the Bible and oppose evolution. However, they accept many evolutionary interpretations of such things as dinosaurs, ice ages, and coal-producing peat bogs. They avoid controversy by placing dinosaurs, ice ages, and coal formation in the "gap," and thus fail to see their connection with the flood. So, gappists generally take a position of noninvolvement in the origins issue other than saying that they accept creation and oppose evolution. This attitude helped the evolutionary viewpoint go largely unopposed in our schools and media for decades.

The gap theory has declined in popularity in recent years.[4] It was one of many attempts to reinterpret Scripture to conform to a belief that was becoming popular among some scientists in the 1800s—a belief in an old earth. Unfortunately, the gap theory is inconsistent with the Bible in many ways.

References and Notes

1. *"It cannot be denied, in spite of frequent interpretations of Genesis 1 that departed from the rigidly literal, that the almost universal view of the Christian world until the eighteenth century was that the Earth was only a few thousand years old."* Davis A. Young, *Christianity and the Age of the Earth* (Grand Rapids: Zondervan Publishing House, 1982), p. 25.

◆ *"... given that virtually everyone in the Western world until well into the eighteenth century still believed in a cosmos that was only a few thousand years old, almost no one was prepared to suggest that the work described in the first two verses of Genesis 1 lasted tens of thousands of years or even more prior to the work of the six days."* Davis A. Young and Ralph F. Stearley, *The Bible, Rocks and Time* (Downers Grove, Illinois: InterVarsity Press, 2008), p. 120.

2. The best defense of the gap theory is *Without Form and Void* by Arthur C. Custance. His stated motivation for supporting the gap theory was to satisfy those demanding an old earth. In a later book, he wrote:

   > *Furthermore, if a vast antiquity far beyond the 4000 BC traditional date is demanded* [for the date of creation]*, there are other ways in which a great antiquity for the world prior to the creation of man can be allowed for. For example, the days of Genesis might be viewed as days on which revelation was given to Moses; or they might be taken to mean ages; or we may introduce a hiatus between Genesis 1:1 and 1:2, and so on.* Arthur C. Custance, *Two Men Called Adam* (Brockville, Ontario: Doorway Publications, 1983), p. 246.

   While Custance wavered on the question of the earth's age, he favored a young earth.

   > *And I do not think that the biblical account can ever be made to accommodate the antiquity that is still being demanded. Personally, I am convinced that the arguments for this vast antiquity will in due course be modified by fresh evidence and the Bible vindicated, as it always has been.* Ibid., p. 249.

3. Some believe that names are omitted in the genealogies of Genesis. This would not alter the stated lengths of time between generations. [See **"According to the Bible, When Was Adam Created?"** on page 421.]

4. For the most thorough discussion and critique of the gap theory, see Weston W. Fields, *Unformed and Unfilled: The Gap Theory* (Grand Rapids: Baker Book House, 1976).

Have Scientific Tools Detected Adam and Eve within Us?

Virtually all cells of every living thing (plants, animals, and humans) contain tiny strands of coded information called *DNA*. DNA directs the cell, telling it what to produce and when. Therefore, much of your appearance and personality is determined by the DNA you inherited from your parents.

In human cells, the nucleus contains 99.5% of the DNA. Half of it came from the individual's mother and half from the father. Because both halves are shuffled together, it is difficult to identify which parent contributed any tiny segment. In other words, half of this DNA changes with each generation. However, outside the nucleus of each cell are thousands of little energy-producing components called *mitochondria*, each containing a circular strand of DNA. This mitochondrial DNA (mtDNA) comes only from the mother. Where did she get hers? From her mother—and so on. Unless there is a rare mutation, mtDNA does not change from generation to generation.

DNA is written with an alphabet of four letters: A, G, T, and C. One copy of a person's mtDNA is 16,559 letters long. Sometimes a mutation changes one of the letters in the mtDNA that a mother passes on to her child. These rare and somewhat random changes allow geneticists to identify families. For example, if your grandmother experienced an early mutation in her mtDNA, her children and any daughters' children would carry the same changed mtDNA. It would differ, in general, from that in the rest of the world's population.[1]

In 1987, a team at the University of California at Berkeley published a study comparing the mtDNA of 147 people from five of the world's geographic locations.[2] They concluded that all 147 had the same female ancestor. She is now called "the ***mitochondrial Eve***."

Where did mitochondrial Eve live? Initial research concluded it was probably Africa. Later, after much debate, it was realized that Asia and Europe were also possible origins for the mitochondrial Eve.[3]

From a biblical perspective, do we know where Eve lived? Because the flood was so destructive, no one knows where the Garden of Eden was.[4] However, Noah's three daughters-in-law, who lived only a dozen or so generations after Eve, began raising their families near Mount Ararat in eastern Turkey—very near the common boundary of Asia, Africa, and Europe. (Each of us can claim one of Noah's daughters-in-law as our ever-so-great grandmother.) So, it is not surprising that Asia, Africa, and Europe are candidate homes for mitochondrial Eve.

Likewise, when similar words, sounds, and grammar of the world's most widely spoken languages are traced back in time, they also seem to originate near Ararat.[5] Another convergence near eastern Turkey is found when one traces agriculture back in time.[6]

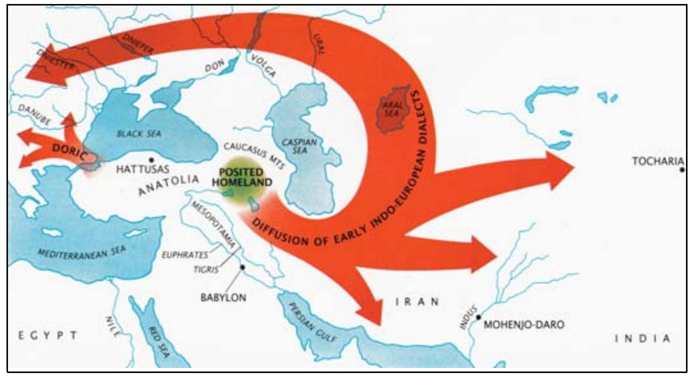


Figure 204: Language Divergence. Languages are related, as are genes. One of thousands of examples is the word for "from, of." It exists in French (*de*), Italian (*di*), Spanish (*de*), Portuguese (*de*), and Romanian (*de*). So, these languages, now spoken generally in southwestern Europe, are twigs on a tree branch called the *Romance languages* (Romance referring to Rome). This branch joins a larger branch that includes all languages derived primarily from Latin. They merge with other large branches, such as the Germanic branch that includes English, into a family called the *Indo-European languages*. When these and other languages are traced back in time, they appear to converge near Mount Ararat, a likely landing site of Noah's Ark. [See pages 45–48.] Linguists admit that they do not understand *the origin* of languages, only how languages spread.[7]

When did mitochondrial Eve live? To answer this, one must know how frequently mutations occur in mtDNA. Initial estimates were based on the following *faulty* reasoning: "Humans and chimpanzees had a common ancestor about 5 million years ago. Because the mtDNA in humans and chimpanzees differ in 1,000 places, one mutation occurs about every 10,000 years." Another incorrect approach began by assuming that Australia was first populated 40,000 years ago. The average number of mitochondrial mutations among Australian aborigines divided by 40,000 years gave another extremely slow mutation rate for mtDNA. These estimated rates, based on evolution, led to the mistaken belief that mitochondrial Eve lived 100,000–200,000 years ago.[8] This surprised evolutionists who believe that our common ancestor was an apelike creature that lived 3½ million years ago.

A greater surprise, even disbelief, occurred in 1997, when it was announced that mutations in mtDNA occur 20 times faster than had been estimated. Without assuming that humans and chimpanzees had a common ancestor 5 million years ago or that Australia was populated 40,000 years ago, mutation rates can now be determined directly by comparing the mtDNA of many mother-child pairs. Using the new, more accurate rate, ***mitochondrial Eve lived only about 6,500 years ago***.[9]

Is there a "genetic Adam"? A man receives from his father a segment of DNA which lies on the Y chromosome; this makes him a male. Where did your father receive his segment? From his father. If we all descended from one man, all males should have the same Y chromosome segment—except for rare mutations.

A 1995 study of a worldwide sample of 38 men showed no changes in this segment of the Y chromosome that is always inherited from fathers. Had humans evolved and all men descended from one male who lived 500,000 years ago, each should carry about 19 mutations. Had he lived 150,000 years ago, 5.5 mutations would be expected.[10] Because no changes were found, our common father probably lived only thousands of years ago. While Adam was father of all, our most recent common male ancestor was Noah.

In 2010, a comprehensive comparison was made between the DNA on the male Y chromosome of humans and chimpanzees. The differences were more than 30 percent![11]

For completeness, we must also consider another possibility. Even if we all descended from the same female, other women may have been living at the same time. Their chains of continuous female descendants may have ended; their mtDNA died out. This happens with family names. If Mary and John XYZ have no sons, their unusual last name dies out. Likewise, many other men may have lived at the same time as our "genetic Adam (or Noah)." They might have no male descendants living today. How likely is it that other men lived a few thousand years ago but left no continuous male descendants, *and* other women lived 6,000 years ago but left no continuous female descendants, *and* we end up today with a world population of almost 7 billion people? Extremely remote![12]

Yes, new discoveries show that we carry traces of Adam and Eve in our cells. Furthermore, our common "parents" are probably removed from us by only 200–300 generations. All humans have a common and recent bond—a family bond. We are all cousins.

References and Notes

1. This simplified explanation is complicated by *heteroplasmy*, a newly discovered form of inheritance for mtDNA. Heteroplasmy introduces slight statistical uncertainty in normal inheritance patterns.

2. Rebecca L. Cann et al., "Mitochondrial DNA and Human Evolution," *Nature*, Vol. 325, 1 January 1987, pp. 31–36.

3. Marcia Barinaga, "'African Eve' Backers Beat a Retreat," *Science*, Vol. 255, 7 February 1992, pp. 686–687.

◆ Alan R. Templeton et al., "Human Origins and Analysis of Mitochondrial DNA Sequences," *Science*, Vol. 255, 7 February 1992, pp. 737–739.

◆ "African Eve Gets Lost in the 'Trees'," *Science News*, Vol. 141, 22 February 1992, p. 123.

4. Some believe that the Garden of Eden was near today's Tigris and Euphrates Rivers, because Genesis 2:14 says rivers having those names were near Eden. However, the flood's destructiveness probably buried the Garden of Eden and preflood rivers under thousands of feet of sediment. (Indeed, today's Tigris and Euphrates Rivers flow over thick sedimentary layers deposited during the flood. Those layers contain some of the world's richest oil fields.) Continental movement and changes in continent thicknesses and topography would also have altered Eden's location and the flow of rivers. [For details, see pages 109–147.]

   It seems more likely that the survivors of the flood gave the two powerful rivers near Mount Ararat (today's Tigris and Euphrates Rivers) the same names as rivers those people knew before the flood. (Settlers in a new land often name geographical features after familiar landmarks in their "old world." Noah and his descendants probably did not know where they were, so they may well have attached preflood names to postflood geography.) This would also explain why the other rivers mentioned in Genesis 2 are not known today and why the preflood rivers described in Genesis 2:10–14 had characteristics that differed from today's rivers:
   - ❖ The river flowing out of Eden divided into four rivers. Today, rivers rarely divide; they merge.
   - ❖ Two of the Genesis rivers flowed *around* a land. Today, because rivers flow downhill, rarely would a river flow around (or nearly around) a land.
   - ❖ Without preflood rain, what was the source of each river's water? [See page 408.]

5. *"Our work indicates that the protolanguage originated more than 6,000 years ago in eastern Anatolia* [eastern Turkey] *..."* Thomas V. Gamkrelidze and V. V. Ivanov, "The Early History of Indo-European Languages," *Scientific American*, Vol. 262, March 1990, p. 110.

6. Colin Renfrew, "The Origins of Indo-European Languages," *Scientific American*, Vol. 261, October 1989, p. 114.

◆ *"The wild ancestors of the seven 'founder crops' harvested by the world's first farmers have all been traced to the region of southeastern Turkey and northern Syria."* Michael Balter, "Search for the Indo-Europeans," *Science*, Vol. 303,

27 February 2004, p. 1324. [See also Simcha Lev-Yadun et al., "The Cradle of Agriculture," *Science*, Vol. 288, 2 June 2000, pp. 1602–1603.]

7. Several generations after the flood, languages multiplied at Babel (Genesis 11:1–9). The name Babel gives us our word "to babble," meaning "to utter meaningless sounds." Most scholars place Babel's location somewhere between today's Tigris and Euphrates Rivers, near the site of ancient Babylon and Mount Ararat.

8. This widespread (and, I believe, incorrect) belief that the mitochondrial Eve lived 100,000–200,000 years ago should be contrasted with the mathematical conclusion that all humans alive today had a very recent common female (and male) ancestor. [See Douglas L. T. Rohde et al., "Modelling the Recent Common Ancestry of All Living Humans," *Nature*, Vol. 431, 30 September 2004, pp. 562–566.]

   These authors believe that our most recent common male and female ancestor lived only a few thousand years ago, but the authors recognize that the many assumptions in their model—especially migration rates and realistic mating patterns—could alter that number by a few thousand years.

   Therefore, it seems very unlikely that the mitochondrial Eve could have lived 100,000–200,000 years ago. A similar conclusion can be reached for the genetic Adam.

9. *"Regardless of the cause, evolutionists are most concerned about the effect of a faster mutation rate. For example, researchers have calculated* [previously] *that 'mitochondrial Eve'—the woman whose mtDNA was ancestral to that in all living people—lived 100,000 to 200,000 years ago in Africa. Using the new clock, she would be a mere 6000 years old."* Ann Gibbons, "Calibrating the Mitochondrial Clock," *Science*, Vol. 279, 2 January 1998, p. 29.

- *"If molecular evolution is really neutral at these sites* [occurs at a constant rate at all sites]*, such a high mutation rate would indicate that Eve lived about 6500 years ago—a figure clearly incompatible with current theories on human origins."* Laurence Loewe and Siegfried Scherer, "Mitochondrial Eve: The Plot Thickens," *Trends in Ecology & Evolution*, Vol. 12, 11 November 1997, p. 422.

- *"Thus, our observation of the substitution rate, 2.5/site/Myr* [million years]*, is roughly 20-fold higher than would be predicted from phylogenetic analyses* [evolution studies]*. Using our empirical rate to calibrate the mtDNA molecular clock would result in an average age of the mtDNA MRCA* [most recent common ancestor] *of only ~6,500 y.a.* [years ago]*, clearly incompatible with the known age of modern humans."* Thomas J. Parsons et al., "A High Observed Substitution Rate in the Human Mitochondrial DNA Control Region," *Nature Genetics*, Vol. 15 April 1997, p. 365.

  Evolutionists who understand this new discovery are shocked. They are now trying to explain why measured mutation rates of mtDNA are so fast, but their inferred mutation rates (based on fossil dating and the evolution of man from apelike creatures) are so slow. Perhaps, they say, mutations occur rapidly at only a few points on the mtDNA molecule, but later correct themselves. Therefore, many mutations are counted, but the net change is small. This "hot spot" hypothesis, is basically a "special pleading"—something imagined to solve a problem. Tests have shown the "hot spot" hypothesis to be invalid.

  > *Thus, the "hot spot" hypothesis, in the absence of additional elements, does not seem a sufficient explanation for the high observed substitution rate.* Parsons et al., p. 365.

10. Robert L. Dorit et al., "Absence of Polymorphism at the ZFY Locus on the Human Y Chromosome," *Science*, Vol. 268, 26 May 1995, pp. 1183–1185.

- A similar study was done with this same DNA segment in three types of apes: a chimpanzee, two orangutans, and three gorillas. Among the three types of apes, this DNA segment differed; for the three gorillas it was identical, as it was for the two orangutans. [See Wes Burrows and Oliver A. Ryder, "Y-Chromosome Variation in Great Apes," *Nature*, Vol. 385, 9 January 1997, pp. 125–126.]

  Statisticians recognize that when variations exist between groups but not within groups, it implies that the groups are distinct, unrelated populations. In other words, gorillas, orangutans, and chimpanzees probably did not evolve from some common ancestor. Of course, this DNA segment in humans was unrelated to an even greater degree.

11. "More than 30% of the DNA differs between the two species." Constance Holden, "Surprise in the Y," *Science*, Vol. 327, 22 January 2010, p. 397.

12. Assume that many women lived 6,000 years ago, and their descendants now number almost 7 billion people. *On average, each female must have had many children.* Whenever the average number of children per female exceeds two, the chance of *only one* of these many females having continuous female descendants today becomes highly improbable. A similar unlikely event must also happen for males. Having both improbable events happen concurrently, and having agriculture and linguistic origins trace back to the Ararat region a few thousand years ago is ridiculously improbable.

Is Evolution Compatible with the Bible?

Many people, although they may not know the term, are ***theistic evolutionists***; that is, they believe *God used evolution to create the universe and everything in it.* For some, this is an acceptable compromise—belief in at least some aspects of evolution and belief in God. The first provides scientific respectability, while the second satisfies an inward conviction that there must be a Creator. For these people, evolution is compatible with the Bible.

But is it? Since Darwin's time (mid-late 1800s), many who knew what the Bible said have tried to reinterpret Scripture to make it compatible with the theory of evolution. The fact that there are about twenty theistic evolution theories indicates the general dissatisfaction with each. It also suggests that reconciling evolution with the Bible is not as easy as some claim. You will soon see why.

Better-known efforts to reinterpret the early chapters of Genesis include the day-age theory,[1] the gap theory (pages 446–447), the framework theory,[2] the revelation theory,[3] and progressive creation.[4] Each theory uncritically accepts some aspects of evolution and then reinterprets Genesis to force it to accommodate those aspects. These reinterpretations contradict obvious meanings in Scripture, interpretations of the text made by ancient and modern Hebrew scholars,[5] clear statements of many Old Testament writers, all New Testament writers, and Jesus Christ Himself.

Many who accept these theories sincerely reject evolution. Unfortunately, they fail to realize the evolutionary assumptions on which these theories, and their personal beliefs, are built. Those assumptions may appear "scientific," unless the evidence is closely examined.

No single theistic evolution theory incorporates all 74 beliefs listed below.[6] However, each is compatible with one or more of the primary theistic evolution theories. Actually, no compelling scientific evidence supports any of these evolutionary positions, and much scientific evidence refutes them. [See **"The Scientific Case for Creation,"** pages 5–105.]

Notice how many ideas in the left-hand column below are uncritically accepted by mainstream society. Notice also how these ideas have subtly alienated many from the Bible—which both contradicts theistic evolution and lays the foundation for some of our most basic beliefs and institutions. Undermining this foundation has obviously contributed to many societal problems. [See **"What Are the Social Consequences of Belief in Evolution?"** on page 463.]

Table 25. Theistic Evolution vs. The Biblical Account

Theistic Evolution	The Biblical Account
1. Creation required few, if any, miracles. Science can now explain how everything evolved.	1. Creation was a miracle. Evolution, if true, would require many miracles. [See pages 5–105.] A miracle is a departure from physical laws.
2. Genesis 1–11 is either allegory, poetry, or myth. It is not literally true.	2. Genesis 1–11 is accurate history involving real people and major events. Jesus Christ and every New Testament writer cited these foundational events that shaped human culture. [See the 68 references beginning on page 457.]
3. Genesis contains two conflicting creation accounts, Genesis 1:1–2:3 and Genesis 2:4–2:25. Obviously, both cannot be correct—or taken literally.	3. Genesis contains two descriptions of creation. The first is chronological, while the second is from man's perspective. A close study of the Hebrew words shows no conflict. Christ, who in a single sentence mentioned both descriptions, knew they referred to the same creation event. (Mt 19:4–5) [Endnote 1 on page 409 contains additional information.]
4. Natural processes (or "Mother Nature") can explain the formation of the heavenly bodies, earth, and life. Matter preceded mind.	4. The Creator, with supernatural power, brought forth the heavenly bodies, earth, and life. Mind preceded matter. (Gen 1–2, Ps 33:6)
5. Space, time, and matter are eternal. Time existed before things were created.	5. God who is eternal, created space, time, and matter. The creation came out of nothing. There was a beginning.[7] Time began at the creation. (Gen 1:1, Mt 24:21, Mk 13:19, Jn 1:1, Col 1:16, Heb 11:3)
6. The universe began as a burst of light with the big bang. Ten billion years later, the earth slowly formed in the presence of sunlight.	6. On the first day, the earth was formed in darkness. (Gen 1:2) Soon afterward, but before the Sun and stars were made, light was created. (Gen 1:3) [See page 389.]
7. The big bang was the basic creation event. It occurred during a fraction of a second.	7. A series of creative acts occurred during the creation week. (Gen 1)
8. Hydrogen, helium, and some lithium formed millions of years before all the other 100^+ chemical elements.	8. All chemical elements came into existence during the creation week. (Gen 2:2, Ex 20:11)

Theistic Evolution	The Biblical Account
9. Since the big bang, the average temperature of the universe has continually decreased. Eventually, the Sun will exhaust its fuel and the earth will lose its heat and freeze solid.	9. The earth began in a relatively cool state (see #12 below). Eventually, intense heat will destroy the heavens and the earth. (II Peter 3:7,10,12)
10. The Sun and most stars formed billions of years before earth. Stars are still forming.	10. Earth was created three days before the Sun and stars. Today, stars are dying, not being created. (Gen 1:2, 1:16; Ex 20:11) [See page 35.]
11. During the fourth creation period (not the fourth day), the Sun, Moon, and stars were "made to appear"[8] on a previously cloud-covered earth.	11. On the fourth creation day, the Sun, Moon, and stars were made. (Gen 1:14–19) If the word "day" in Genesis 1:14 means a long period, what do the words "year" or "night" mean in that verse?
12. The earth initially had a hot, molten surface. Millions of years later, water—chemically locked in the earth's interior—oozed out.	12. On the first day, the earth had a liquid water surface.[9] Therefore, the earth was relatively cool at the beginning. (Gen 1:2)
13. The earth slowly coalesced from meteoritic impacts that melted the earth's surface and vaporized all surface water.	13. The earth formed quickly. After the second day, its surface was spread out above the liquid subterranean waters. (Ps 24:2, 104:3, 136:6)
14. Land formed before oceans.	14. A global ocean existed before land. Dry land appeared when the surface waters were gathered into one place. (Gen 1:2, 1:9)
15. Evolution took place over billions of years, not in six literal days. The word "day" in the Bible can, in rare cases, mean an indefinite period of time. The six creation "days" may have been six ages, so each creation age had millions of evenings and mornings. Another possibility is that God created in six literal days, but each day was separated by millions of years.	15. Creation took place in six literal, consecutive days. (Gen 1, Ex 20:11) The Hebrew word for day, *yom*, always means literal, consecutive days when modified by a plural number. *Yom* was defined as a literal day when it was first used. (Gen 1:4,5) Each creation day had only one "evening and morning." To survive, plants need the Sun and animals—especially insects. All were created within three literal days of each other. (Gen 1:11–23) Had it taken much longer, plants could not have survived.[10] (Gen 1:5, 8, 13, 19, 23, 31)
16. In the Bible, a day can be a long time. For example, Psalm 90:4 and II Peter 3:8 say that "a day is like a thousand years."	16. Those verses do not refer specifically to the six creation days. Instead, they say that God is outside of time; He can see the intimate details and the big picture. Besides, no evolutionist believes creation took 6,000 years.
17. Since the earth began, natural disasters have occurred: earthquakes, floods, hurricanes, tornadoes, volcanic eruptions, lightning strikes, tsunamis, droughts, and impacts by meteorites, asteroids, and comets. Even radiation damage is a consequence of the flood.	17. These calamities were not part of God's "*very good*" creation. Later, man's sin destroyed that tranquility. Man's wickedness became so bad that God chose to destroy almost all men and air breathing animals in a global flood. (Gen 1:31, 6:5–7) Part II of this book explains why each type of natural disaster was a different consequence of the global flood. [See pages 107–371.]
18. The present is the key to the past; that is, presently observable natural processes explain all past events. (This principle, called *uniformitarianism*, underlies much of geology.)	18. The present is not always the key to the past. God sometimes works suddenly, as He did during the creation, the fall, and the flood. (Gen 1–3, 6–8) No natural process on earth approaches the flood in its power, destructiveness, or extent. (II Peter 3:3–6) [See pages 107–371.]
19. Once the atmosphere began to evolve, rains occurred on the earth.	19. Before the flood, man apparently had not seen a rainbow in the sky. (Gen 9:11–17) The hydrodynamic cycle must have been quite different. It probably did not rain before the flood. [See pages 408–409.]
20. There have been no worldwide floods—only brief, local floods. "Noah's flood," if it happened, was only a local, or regional, flood. God's promise, in Genesis 9:11, not to again flood the earth cannot be taken literally.	20. A catastrophic, worldwide flood covered *all*[11] the earth's preflood mountains after 150 days. (Gen 7:19–20, 7:24; Ps 104:6–9) This year-long flood (Gen 7:11, 8:14) destroyed almost all humans and air-breathing land animals. (Gen 6:13, 6:17, 7:4, 7:21–23, 8:21, 9:11; Lk 17:27; I Pet 3:20; II Pet 2:5, 3:6)
21. The first animals were microscopic, single-celled creatures.	21. The first animals included great sea monsters, such as whales, and other complex creatures. (Gen 1:20–21)
22. The first sea life was a small blob of complex chemicals. It took a billion years for other sea life to form.	22. On the fifth day, sea life was created, and the waters swarmed with all the various kinds of sea creatures. (Gen 1:20–22)
23. The original atmosphere consisted of methane, ammonia, and other poisonous gases. Over billions of years, the atmosphere became what it is today.	23. The atmosphere was created quickly and has since supported all living things. (Gen 1:6–8)
24. Plant life helped produce our atmosphere.	24. The atmosphere was created before plant life. (Gen 1:6–12)
25. Plants evolved over a long period of time. Flowering plants evolved 220 million years after all other plants.	25. All major categories of plants, including their seeds and fruit, were created on the third day. (Gen 1:11–12)

Theistic Evolution	The Biblical Account
26. The Sun evolved several billion years before plant life.	26. The Sun was made one day after plant life. (Gen 1:12–16)
27. Various forms of plant life and animal life evolved during each of four sequential, geological eras: Precambrian, Paleozoic, Mesozoic, and Cenozoic. These eras were of unequal length.	27. Life was created during only three of the six creation days—3rd day: plant life, 5th day: sea life and birds, and the 6th day: other land animals and man. (Gen 1)
28. Since the earth began, new forms of life have continued to arise within each of the major categories: plants, sea creatures, birds, and land animals.	28. All plants were created first, then all sea creatures and birds, then all land animals. Finally, man was created. (Gen 1)
29. There is continuity among all forms of life. All organisms have a common ancestor. Therefore, there were continuous transitions among all plants and among all animals. The millions of species are not fixed and not distinct.	29. There are permanent discontinuities between the many different *"kinds"* of life. In fact, the Bible states *10 times* that each *"kind"* will reproduce after itself. (Gen 1) The kinds are fixed and distinct. (I Cor 15:39)
30. Sea life preceded land life by hundreds of millions of years.	30. Sea life did not precede land life. (Gen 1:11–13, 1:20–23)
31. Adam could not have named all the animals in one day, because there were too many. Besides, most animals and plants became extinct before man evolved.	31. The Bible does not say that Adam named all the animals. On *Day 6*, he named "all the cattle," "the birds of the sky," and "every beast of the field" (domesticated animal). Adam did not name, for example, sea creatures, creeping things (insects), and the beasts of the earth (wild animals). (Gen 2:20) All animal kinds have lived contemporaneously with man. (Gen 1:20–30)
32. Insects evolved millions of years before birds and flowering plants.	32. All birds and plants were created before *"creeping things."* (Gen 1:20–24)
33. Either reptiles or dinosaurs evolved into birds. More than 100 million years later, 60 million years after the dinosaurs became extinct, man evolved.	33. Birds were created before dinosaurs, reptiles, and other beasts of the earth. (Gen 1:20–25) Man saw and wrote about dinosaurs and giant seagoing reptiles. (Job 40:15–41:34)
34. Fish evolved hundreds of millions of years before birds and fruit trees. The first fish and birds came from eggs.	34. Fruit trees were created before fish. Fish and birds were created on the same day. Fish were created swimming, and birds were created flying. (Gen 1:11, 21–22)
35. It is uncertain which came first, the chicken or the egg.	35. Eggs were within the first chickens, so both came together. All animals were created fully formed and functional.[12]
36. The first animals were simple sea creatures. Much later, fish evolved, then amphibians, and finally mammals. The last mammals to evolve included whales.	36. The first animals created included highly developed mammals such as the great whales. The next day, many so-called "lower forms" were created. (Gen 1:21, 1:24)
37. For hundreds of millions of years before man evolved, many animals were carnivores (meat eaters).	37. Early animals were herbivores (plant eaters). After either the fall or the flood, some became carnivores. (Gen 1:30)
38. Females evolved before males.	38. Males and females within a *"kind"* were created on the same day. (Gen 1:20–25) The first human male came before the first human female. (Gen 2:22)
39. Macroevolution continues today, so creation is a long process.	39. Creation was a distinct event. (Ps 148:5) God finished *"all His work"* in six days. (Gen 2:1–3; Ex 20:11, 31:17; Heb 4:1–11)
40. Everything in nature, from protons to people, evolved by slow, continuous processes.	40. Everything in nature was created in discrete steps. (Ps 33:6–9) Five times Genesis states that *"God said … and it was so."* (Gen 1:6–7, 1:9, 1:11, 1:14–15, 1:24) All the Bible's miracles occurred quickly, including the biggest and first miracle—creation itself.
41. Evolution works, in part, through a process called "survival of the fittest." Violence, pain, and death were necessary for animals to become more complex. Suffering, cruelty, and death are natural results of the evolutionary process. In this sense, death produced man.	41. God is all-powerful and does not need to use violence, pain, or death to create. God did not author evil, suffering, disease, or calamity. Several attributes of our Creator are love, peace, and joy. Right after the creation, everything was *"very good."* (Gen 1:31) Suffering and cruelty entered the world when Adam sinned. (Gen 3) In this sense, man produced death. (Gen 2:17, Rom 5:12, I Cor 15:21)
42. Man is a product of nature. Man is controlled and shaped by his environment. In fact, the environment largely determined how man evolved.	42. Man was given dominion over nature. God told man to control his environment—to subdue the earth and rule over every living thing that moves on the earth. (Gen 1:26, 1:28–30)

Theistic Evolution	The Biblical Account
43. Man is an animal that has evolved a little higher than the apes.	43. Man, who was given dominion over all animals, was created in the image of God. (Gen 1:26–27, 1:30, 5:1) Man was made *"a little lower than the angels."* (Ps 8:5)
44. Man evolved from a lower animal.	44. Adam was formed from the dust. (Gen 2:7)
45. Man has existed during only the past 1,000th of the earth's history—10,000,000,000 years after the universe began and 4,000,000,000 years after the earth formed.	45. Man has existed since the creation. (Mt 19:4; Mk 10:6, 13:19; Lk 11:50–51a; Jn 8:44; Rom 1:20)
46. There really was no one individual we can call "Adam"; the term refers to "mankind" or a race of primitive men. Adam and Eve may be mythical characters in a saga explaining how evil originated—or characters in a timeless myth representing the sinful choices we all make.	46. Inspired writers of both Testaments spoke of Adam as an individual, not as a race of people. (Gen 5:3; I Chron 1:1; Lk 3:38; Acts 17:26; Rom 5:12; I Cor 15:21–22, 15:45–47) Eve was also a unique person. (I Cor 11:8–9, I Tim 2:13–14) Regardless of skin color or where we live on this planet, we are all descended from Adam and Eve. (Gen 3:20)
47. Almost all fossils formed before man appeared on earth.	47. Man was created before any fossils formed.
48. Man's genealogy includes many apelike animals. It spans more than a hundred thousand generations. Adam had millions of years' worth of ancestors.	48. Man's genealogy begins with Adam and Eve. It involves only a few hundred generations. The Bible gives the line of descent from Adam to Noah and even up to historical times. (Gen 5, I Chron 1, Lk 3:23–38) Christ never mentioned any ancestors of Adam; Adam had none. (Mt 19:4)
49. Although apes, man's closest relatives, have no difficulty or pain in giving birth, human childbirth is painful and can be dangerous for mother and child. Natural selection should have eliminated women with narrow birth canals.[13]	49. Humans are a special creation; they did not descend from apes or any ancestor of apes. Pain in human birth greatly increased as a result of the fall. (Gen 3:16)
50. God breathed a spirit into an apelike creature. This became man.	50. God breathed the breath of life into a lifeless human body. This became man. (Gen 2:7)
51. The earliest people were meat eaters. The first animals that could be considered human were hunters. Hundreds of thousands of years later, man began farming.	51. The earliest people were vegetarians. (Gen 1:29) The first man, Adam, was a gardener. (Gen 2:15) Later, Adam became a farmer; his son Abel was a herdsman. (Gen 4:2) Less than 10 generations later, man began hunting. (Gen 9:3)
52. Because man evolved from the animals, there is very little difference in the psychological makeup and behavior of animals and man. (This premise underlies much of modern psychology.)	52. Man was created distinct from the animals and in the image of God. (Gen 1:26–27, 5:1) Adam did not find any animal that was physically and emotionally compatible with him. Only another human, Eve, could be his counterpart. (Gen 2:20)
53. The first man came from a woman. Woman, like man, evolved from animals. The story of Eve being formed by "divine surgery" from Adam's side is nonsense. Eve had a mother.	53. The first woman came from a man. (Acts 17:26, I Cor 11:8) Eve was specially created—taken from the side of Adam. (Gen 2:21–23) Eve had no mother.
54. Marriage, a cultural convention, evolved from human experience. Marriage therefore changes as culture evolves.	54. Marriage is a permanent bond instituted by God. (Gen 2:24)
55. Man slowly developed our basic units of time: a day, a week, a month, and a year.	55. Genesis 1, which did not originate with man, defines our basic units of time.
56. No one established the seven-day week. It was culturally derived. Surprisingly, almost all known cultures throughout history have had a seven-day week.	56. God established the seven-day week for man's benefit. (Mk 2:27) It reminds us of His activity and rest during the creation week. (Gen 1, Ex 20:8–11)
57. The Garden of Eden is a myth.	57. Eden was a literal place. (Is 51:3; Ezek 28:13, 36:35; Joel 2:3)
58. People have rarely lived beyond 100 years, especially in the primitive past.	58. Before the flood, conditions were such that at least the people listed in chapter 5 of Genesis lived to be about 900 years old. [See page 420.]
59. Lunar months may have been mistakenly called "years" by the early Hebrews. Thus, the patriarchal ages (typically 900 "years") in Genesis 5 could be much younger in true years.	59. Two patriarchs were 65 years old when their sons were born. (Gen 5:15, 5:21) If those "years" were lunar months, then they had children when they were 5 years old!
60. Early man was quite primitive and technologically immature.	60. Within only a few hundred years after the creation, man built musical instruments and refined alloys. (Gen 4:21–22) Early man also had the technology to build Noah's Ark (Gen 6:14–16) and the Tower of Babel. (Gen 11:3–6)
61. The genealogies listed from Adam to Joseph contain many gaps. Each gap may span centuries.	61. The genealogies from Adam to Joseph are tightly linked, because each patriarch's age is given when the next named patriarch was born. [See page 420.] Therefore, more time cannot be inserted between patriarchs.

Theistic Evolution	The Biblical Account
62. Cain, Adam and Eve's first son, was banished to a distant land and would not have had a wife, unless he married a subhuman primate or another evolved human.	62. Adam and Eve had many sons and daughters. (Gen 5:4) Cain probably married a sister, or perhaps a niece.[14]
63. Language evolved slowly; it began with grunts and signs of emotion. (Most linguists admit they do not know how languages multiplied. Today, languages are rapidly becoming extinct.)	63. Adam, who was created with a large vocabulary, conducted intelligent conversations from the beginning. He named many, but not all, land animals on the day he was created. (Gen 2:18–24) Languages multiplied suddenly at Babel. (Gen 11:1–9) [See **"Language"** and **"Speech"** beginning on page 8.]
64. For a billion years, millions of species have slowly improved and become more complex. This is still happening. New forms of life are always evolving.	64. God did not need a billion years or a bloody, cruel, inefficient process like evolution (consisting primarily of mistakes) to create. Right after the creation, God saw all that He had made, and it was *"very good."* (Gen 1:31) After the fall, things deteriorated (Gen 3:16–19, Rom 8:18–22) and diversified. We have never seen a new kind of life evolve. (Ex 20:11)
65. Death entered the world just after the simplest form of life evolved—a billion years before man evolved.	65. Death entered the world after Adam was created and sinned. (Rom 5:12)
66. Death preceded the activities that some people call sin.[15]	66. Sin preceded death. (Gen 2:17, 3:1–24; Rom 5:12, 6:23, I Cor 15:21)
67. The fall of Adam had only spiritual consequences.	67. The fall of Adam had both spiritual and physical consequences. (Gen 2:17, 3:14–24; Rom 8:18–22; I Cor 15:21–22)
68. Ever since plants evolved, some have been poisonous. This enhanced their survivability.	68. Before the fall, every green plant was edible. (Gen 1:29–30)
69. Thorns and thistles evolved along with plants.	69. Adam's sin caused thorns and thistles. (Gen 3:17–18)
70. Man's wickedness is a result of his animal nature.	70. Since the fall, man's wickedness is a result of his fallen nature.
71. God gave Adam a spirit, so Adam was the first primate who could be called human. He died physically as did his primate ancestors, but not as a penalty for disobedience. Adam's penalty for disobedience was only spiritual death—separation from God.	71. The first Adam brought physical and spiritual death into the world for humans. The last Adam (Jesus Christ) brings physical resurrection from the dead and spiritual life. If Adam's body evolved from an animal, this profound theological correspondence is broken, along with the "plan of redemption."[16] Both "Adams" had miraculously created bodies, but both could die as a penalty for human disobedience. (Rom 5:14–15, I Cor 15:45)
72. Struggle and death preceded man's arrival on earth. This struggle has continued ever since.	72. The completed creation, which included man, was *"very good."* (Gen 1:31) There was no struggle and death. Later, man (by his willful disobedience) fell from this universal paradise, causing struggle and death to enter the world. Someday, this paradise will be restored as a *"new heaven and a new earth."* (Is 11:6–9, Rev 22:2–3)
73. Man is continually improving—physically, mentally, socially, morally, and spiritually.	73. Since early times, man has advanced technologically. (Gen 4:21–22) This was largely inevitable. (Gen 11:6) However, man has regressed physically and spiritually. (Gen 3, 5, 11)
74. Because man culminates billions of years of upward progress, his well-being and continued improvement must be our greatest concern.[17]	74. Because God created man (and everything else), God should be our greatest concern. Man, who was made in the image of God, was given dominion over all other creatures. (Gen 1:26) Man must exercise great care and concern for the creation, especially for his fellow man. However, men are special creatures who have sinned and, therefore, need a Savior. (Jn 3:16)

Having examined the many contradictions between theistic evolution and the biblical view of life and history, one should consider the following question:

> *If God is not limited in power and could have created the world, if He has given man a record of what He did, and if the scientific evidence does not contradict it, then what prevents you from believing that it actually happened?* [18]

If evolution happened, then death was widespread before man was on earth. But if death preceded man and was not a result of Adam's sin, then sin is not the cause of death—so we do not need a Savior.

References and Notes

1. The day-age theory claims that *each of the six creation days was a long age.*

2. The framework theory claims that *the six creation days are a literary device—a **framework** in which similar creation events that happened over long ages are categorized.* The creation days are not chronological. The parallel nature of the some events of Days 1 and 4, Days 2 and 5, and Days 3 and 6 supposedly show that Genesis 1 is not literal history.

3. The revelation theory maintains that *in six days, God **revealed** to Adam what He created over vast ages.* For details see P. J. Wiseman, *Creation Revealed in Six Days* (London: Marshall, Morgan & Scott, Ltd., 1948).

4. Progressive creation maintains that God created, but He did so *over billions of years, in many short, miraculous, **progressive** steps.*

5. In a letter dated 23 April 1984 to David C. C. Watson, Hebrew Professor James Barr at the University of Oxford wrote:

   > *... probably, so far as I know, there is no professor of Hebrew or Old Testament at any world-class university who does not believe that the writer(s) of Gen. 1–11 intended to convey to their readers the ideas that (a) creation took place in a series of six days which were the same as the days of 24 hours we now experience (b) the figures contained in the Genesis genealogies provided by simple addition a chronology from the beginning of the world up to later stages in the biblical story (c) Noah's flood was understood to be world-wide and extinguished all human and animal life except for those in the ark. Or, to put it negatively, the apologetic arguments which suppose the "days" of creation to be long eras of time, the figures of years not to be chronological, and the flood to be a merely local Mesopotamian flood, are not taken seriously by any such professors, as far as I know. The only thing I would say to qualify this is that most such professors may avoid much involvement in that sort of argument and so may not say much explicitly about it one way or the other.*

6. This format and some of the ideas were suggested by Richard Niessen's article "Several Significant Discrepancies between Theistic Evolution and the Biblical Account," in *The Creation Research Society Quarterly*, Vol. 16, March 1980, pp. 220–221.

7. If each effect had a cause that also had a cause, an infinite chain of events would stretch back in time—with no beginning. Philosophically, one must accept either (a) this infinite regression or (b) an infinite God. Scientifically, one can conclude that there was a beginning; that is, no infinite regression. [See **"A Beginning"** on page 31 and **"Second Law of Thermodynamics"** on page 32.] Biblically, one needs to read and believe only the first three words of the Bible (the title of this book)—a far simpler task.

8. Those holding this widespread belief never explain to whom the Sun appeared. Humans, according to these theistic evolutionists, arrived several billion years later.

   Claiming that the word "made" (Hebrew: *asah*) in Genesis 1:16 really means "made to appear" is a deceptive play on words and is not supported by the Hebrew. Every major Bible translation says the Sun, Moon, and stars were ***made*** on day four. Had "made to appear" been intended, as when *"God said, ... let the dry land **appear**"* (Gen 1:9), the Hebrew *raah* would presumably have been used.

9. The Hebrew word for "waters" (*mayim*) in Genesis 1:2 is used 574 times in the Bible. It always means *liquid* water, not ice, steam, or a cloud.

10. Some advocates of the day-age theory say that the light of Genesis 1:3 sustained plants until the Sun appeared an age later. While sunlight produces photosynthesis, light in general does not. For example, light from an ordinary light bulb will not grow plants shielded from all sunlight. Special light bulbs, designed to grow plants, must closely match the Sun's spectrum across all colors and into the infrared and ultraviolet wavelengths. Some plants, such as tomatoes and strawberries, even have difficulty growing under such bulbs. For most plants, the light must have a day-night cycle. Some plants also need light with annual cycles to cause the plant to change from one stage of growth to another, such as budding to blooming. If the light source's distance from the plant varies too much, the changing light intensity will harm the plant. The most obvious way for a light source to satisfy all these requirements is for it to correspond to the Sun's location, brightness, and spectrum—in other words, for the light to come from the Sun.

    To understand better the light of Genesis 1:3, see **"If the Sun and Stars Were Made on Day 4, What Was the Light of Day 1?"** on page 389. Theistic evolutionists do not say what the light of Genesis 1:3 was, what its characteristics were, or where it originated. Therefore, they do not know if it could have sustained all plant life and kept the earth at just the right daily and seasonal temperatures for "three ages" (hundreds of millions of years) until the Sun "took over." Did the light of Genesis 1:3 just "switch off " when the Sun was made during "the fourth age"? Remember, to most theistic evolutionists the "six ages" lasted 4,600,000,000 years.

    Even if the absence of sunlight for "an age" were not a problem for the day-age theory, the absence of animals for two "ages" is a fatal problem. Animals produce the carbon dioxide plants require, and insects are important for reproductive fertilization, especially for flowering plants. Insects, other animals, and the Sun must have existed within days or weeks of the first plants.

11. The literal Hebrew actually says that "*all* the high mountains under *all* the heavens" were covered with water. This double use of "all" (Hebrew: *kaal*), while redundant in our language, emphasized the universality of the flood in Hebrew.

12. Even if one never knew that the phrase, "[they will reproduce] *after their kind,"* is repeated 10 times in

Genesis 1, common sense affirms it. Obviously, only chickens come out of chicken eggs, and only chickens lay chicken eggs. This raises the classic paradox: Which came first, the chicken or the egg? The answer may surprise you.

Most of us have heard that baby girls are born with hundreds of eggs. (Recent research shows that mammal ovaries regulate the production of even more precursor egg cells in the mammals' bone marrow.) So, female vertebrates—animals with backbones such as birds, mammals, fish, reptiles, and amphibians—are born with many potential eggs. (Some fish may be exceptions. Researchers are working to clarify this.) Therefore, with the first chicken came the first eggs. Neither came first; both arrived together. Paradox solved.

Only evolutionists have this paradox. It disappears when one understands life's amazing complexity that only an infinitely powerful and intelligent Creator could produce.

13. Joshua Fischman, "Putting a New Spin on the Birth of Human Birth," *Science*, Vol. 264, 20 May 1994, pp. 1082–1083.

14. Was it improper for brothers and sisters to marry? In many countries today, close intermarriages are discouraged or prohibited by law, because they often produce genetic defects in children. For example, children have a 4.4% greater chance of dying before age ten if their parents are first cousins. This includes late miscarriages, six months or more after conception. [See Kevin Davies, "Cost of Consanguinity," *Nature*, Vol. 371, 13 October 1994, p. 630.]

    Damaged genes, which are usually caused by radiation and other adverse environmental factors, have steadily accumulated in humans since the time of Adam and Eve. Most defective genes are not immediately harmful, because each person usually has a good corresponding gene from the other parent. However, if the parents are closely related, both have a much greater chance of having inherited the same damaged gene from their common ancestor. If their child then receives this defective gene from both parents, abnormalities usually result.

    Because damaged genes accumulate with time, Adam and Eve's children and grandchildren probably had few genetic defects. (Genesis 1:31) Therefore, close intermarriages would not have had the medical consequences they have today. The biblical prohibition forbidding incest was introduced when Moses was inspired to write Leviticus 18:6–18.

15. Many atheists—better than most theists—understand just how important this is. G. Richard Bozarth, writing in *The American Atheist*, stated:

    > *Christianity has fought, still fights, and will fight science to the desperate end over evolution, because evolution destroys utterly and finally the very reason Jesus' earthly life was supposedly made necessary. Destroy Adam and Eve and the original sin, and in the rubble you will find the sorry remains of the son of god* [sic]. *Take away the meaning of his death. If Jesus was not the redeemer who died for our sins, and this is what evolution means, then Christianity is nothing!*
    > G. Richard Bozarth, "The Meaning of Evolution," *The American Atheist*, Vol. 20, February 1978, p. 30.

16. For a fuller discussion of this profound subject, see Arthur C. Custance, *Two Men Called Adam* (Brockville, Ontario: Doorway Publications, 1983). At one point (p. 250), Custance summarized the issue as follows:

    > *The bond between ...* [Adam and Christ] *is entirely predicated on a miraculous origin in both cases: the creation of the first man Adam, which was clearly a supernatural event; and the virgin conception of the Last Adam, which was also clearly a supernatural event.*
    >
    > *A body of animal origin acquired by evolutionary processes is an entirely different thing from a body of divine origin acquired by direct creation. As to the former, it is clear that such a body must by nature be subject to death, the ancestral line being through some primate channel where death is natural. As to the latter, such a body becomes subject to death not by nature but only as a penalty.*
    >
    > *The whole Plan of Redemption hinges upon this difference because the Last Adam cannot by nature be subject to death and still make a truly vicarious sacrifice of Himself. He would merely be paying a debt to nature before the expected time.*

17. This is the basic tenet of secular humanism—a belief system that generally dominates our media and tax-supported schools. Most subscribers to this atheistic philosophy are unaware of its evolutionary roots, its definition, or its implications. The U.S. Supreme Court declared that secular humanism is a religion. (Tercaso v. Watkins, 367 U.S. 488, 1961, note 11.)

18. Malcolm Bowden, *The Rise of the Evolution Fraud* (San Diego: Creation-Life Publishers, 1982), p. 167.

Does the New Testament Support Genesis 1–11?

Over the past century, claims that evolution is a scientific fact have become more entrenched in our schools. As a result, the first eleven chapters of Genesis have slowly become an embarrassment within many Christian churches and seminaries. Few people in these churches and seminaries have stopped to consider just how foundational these chapters are to the New Testament. The early chapters of Genesis were frequently referred to by every New Testament writer and Jesus Christ Himself. What happens to their credibility if these early chapters are incorrect? Listed below are 68 direct references in the New Testament that refer back to these foundational chapters of Genesis. [Based in part on Dr. Henry M. Morris' book, *The Remarkable Birth of Planet Earth* (San Diego: Institute for Creation Research, 1972), pp. 101–103.] There are many more indirect references.

All New Testament writers believed that Genesis 1–11 was historically accurate. Note:

a. Every New Testament writer refers to the early chapters of Genesis (Genesis 1–11).
b. Jesus Christ referred to each of the first seven chapters of Genesis.
c. All New Testament books except Galatians, Philippians, I and II Thessalonians, II Timothy, Titus, Philemon, and II and III John refer to Genesis 1–11.
d. Each of the first eleven chapters of Genesis is directly referred to somewhere in the New Testament.

Table 26. New Testament References to Genesis 1–11 (*The words of Jesus Christ during His earthly ministry.)

Reference	Topic	Genesis Reference
*1. Matthew 19:4	Created male and female	1:27, 5:2
*2. Matthew 19:5–6	Cleave to his wife; become one flesh	2:24
*3. Matthew 23:35	Righteous Abel	4:4
*4. Matthew 24:37–39	Noah and the Flood	6:1–22, 7:1–24, 8:1–22
*5. Mark 10:6	Created male and female	1:27, 5:2
*6. Mark 10:7–9	Cleave to his wife, become one flesh	2:24
*7. Mark 13:19	Since the beginning of the creation which God created	1:1, 2:4
8. Luke 3:34–36	Genealogies: Abraham to Shem	10:22–25, 11:10–26
9. Luke 3:36–38	Genealogies: Noah to Adam to God	5:3–29
*10. Luke 11:51	Blood of Abel	4:8–11
*11. Luke 17:27	The flood came and destroyed them all	7:10–23
12. John 1:1–3	In the beginning God	1:1
*13. John 8:44	Father of lies	3:4–5
14. Acts 14:15	Who made the heaven and the earth	2:1
15. Acts 17:24	God made all things	1:1–31
16. Romans 1:20	The creation of the world	1:1–31, 2:4
17. Romans 4:17	God can create out of nothing	1:1–31
18. Romans 5:12	Death entered the world by sin	2:16–17, 3:19
19. Romans 5:14–19	Death reigned from Adam	2:17
20. Romans 8:20–22	Creation corrupted	3:17–18
21. I Corinthians 6:16	Two will become one flesh	2:24
22. I Corinthians 11:3	Head of the woman	3:16
23. I Corinthians 11:7	In the image of God	1:27, 5:1
24. I Corinthians 11:8	Woman from man	2:22–23
25. I Corinthians 11:9	Woman for the man	2:18
26. I Corinthians 15:21–22	By a man came death	2:16–17, 3:19
27. I Corinthians 15:38–39	To each … seeds of its own (kind)	1:11, 1:21, 1:24
28. I Corinthians 15:45	Adam became a living being	2:7
29. I Corinthians 15:47	Man from the earth	3:23
30. II Corinthians 4:6	Light out of darkness	1:3–5
31. II Corinthians 11:3	Serpent deceived Eve	3:1–6, 3:13
32. Ephesians 3:9	Created all things	1:1–31, 2:1–3
33. Ephesians 5:30–31	Cleave to his wife, become one flesh	2:24
34. Colossians 1:16	All things created by Him	1:1–31, 2:1–3
35. Colossians 3:10	Created in His image	1:27
36. I Timothy 2:13–14	Adam created first	2:18–23
37. I Timothy 2:14	Woman deceived	3:1–6, 3:13
38. I Timothy 4:4	Everything created by God is good	1:10–31
39. Hebrews 1:10	In the beginning God made heavens and earth	1:1
40. Hebrews 2:7–8	All things in subjection under man	1:26–30, 9:2–3
41. Hebrews 4:3	Works were finished	2:1
42. Hebrews 4:4	Rest on the seventh day	2:2–3
43. Hebrews 4:10	Rest from His works	2:2–3
44. Hebrews 11:3	Creation of the universe	1:1
45. Hebrews 11:4	Abel offered a better sacrifice	4:3–5
46. Hebrews 11:5	Enoch taken up	5:21–24
47. Hebrews 11:7	Noah's household saved	7:1
48. Hebrews 12:24	Blood of Abel	4:10

Reference	Topic	Genesis Reference
49. James 3:9	Men in the likeness of God	1:27, 5:1
50. I Peter 3:20	Construction of the Ark, eight saved	6:14–16, 7:13–24, 8:1–19
51. II Peter 2:5	A flood upon the ungodly, eight saved	6:8–12, 7:1–24
52. II Peter 3:4–5	Earth formed out of water and by water	1:6–7
53. II Peter 3:6	The world destroyed by water	7:17–24
54. I John 3:8	Devil sinned from the beginning	3:14
55. I John 3:12	Cain slew his brother	4:8, 4:25
56. Jude 11	The way of Cain	4:8, 4:16, 4:25
57. Jude 14	Enoch, the seventh generation from Adam	5:3–24
58. Revelation 2:7	Tree of life	2:9
59. Revelation 3:14	Beginning of the creation of God	1:1–31, 2:1–4
60. Revelation 4:11	Created all things	1:1–31, 2:1–3
61. Revelation 10:6	Who created heaven … and the earth	1:1, 2:1
62. Revelation 14:7	Who made the heaven and the earth	1:1, 2:1, 2:4
63. Revelation 20:2	The serpent of old, who is the devil	3:1, 3:14
64. Revelation 21:1	First heaven and first earth	2:1
65. Revelation 21:4	No more death, sorrow, crying or pain	3:17–19
66. Revelation 22:2	Fruit of the tree of life	3:22
67. Revelation 22:3	No more curse	3:14–19
68. Revelation 22:14	The tree of life	2:9

An interesting parallel between Genesis and the New Testament involves the flood and water baptism. What was the *original* significance of water baptism? Of course, John baptized as a symbol of repentance for the forgiveness of sins, but where did he get the idea? The practice was a very ancient Jewish ritual called *mikveh*. As you look at the following table, consider whether water baptism, in addition to its Christian meaning and Christ's command to baptize (Matthew 28:19–20), *should also remind us of the flood*. I Peter 3:20–21 also makes the connection.

Table 27. Comparison of the Flood with Water Baptism

The Flood	Water Baptism
The flood waters came from under the earth's crust.	Water for Jewish baptism (*mikveh*) had to be from an underground spring, in a container built into the ground, or in a building attached to the ground.[1]
A sin-corrupted world was covered with water.	A sinful person who has trusted Christ for salvation is covered by water.
The Ark lifted the followers of God out of the water.	The believer rises out of the water.
After the flood began, it rained 40 days and 40 nights.	After Jesus was baptized, he fasted 40 days and 40 nights.
The earth experienced a "new birth" as the flood waters retreated.[2]	By accepting Christ, a person is born again. Christ tells His followers to baptize, although baptism does not produce salvation.
After the flood, a dove returned to Noah indicating that it was safe to go out into the world that had been destroyed.	After John baptized Jesus Christ, the spirit of God descended to Christ as a dove. Then Christ went into the wilderness.

Another remarkable parallel exists between the Ark and Jesus Christ. Both provided the only refuge from a horrible judgment. Both were perfect provisions, designed by God and freely available to sinful people. Conventional "wisdom" has doubted, even mocked, the sufficiency of each. To save others, both took a unique and terrible beating. People scoffed at the thought of water falling from the sky and needing to be saved; today, many scoff at the cross and the need to be saved. The Ark had many rooms; Christ has prepared a place with many rooms (John 14:2–3). The Ark had one door, which God closed; Christ said, "I am the door" (John 10:9); God will close it as well. Genesis 8:4 says the Ark landed on the 17th day of the 7th month (in the *ancient* Hebrew calendar)—today's 17th day of Nisan. Christ rose from the dead on the 17th day of Nisan—3 days after the Passover, which begins on the 14th day of Nisan. The Ark was made leak-proof by pitch (Hebrew: *kopher*); Christ's blood is a "watertight" ransom (Hebrew: *kopher*) that perfectly shields us. (*Kopher* is closely related to the Hebrew word, *kaphar*, which means "to atone" or "to cover.")

References and Notes

1. In rabbinic literature, baptismal water (*mikveh*) was referred to as "the womb of the world."
2. The concept of water immersion in rabbinic literature is called "a new birth."

How Can Origins Be Taught in High School or College?

Teaching *scientific evidence* for creation has always been legal in public schools.[1] Nevertheless, many teachers wonder how to do this. Schools should be places of inquiry, where students are taught to analyze all sides of an issue. Few academic subjects have greater inherent interest for high school or college students than the origins question. The fact that it is controversial is, therefore, not a liability but an asset.[2] The origins question, then, is an ideal vehicle for developing analytical skills.[3] An excellent way to develop these skills is "The Origins Research Project."

The Origins Research Project

Introduction. The Origins Research Project may be one of the most interesting and exciting projects students ever experience. It will demonstrate how scientific inquiry works while building upon one of the most basic and natural questions a person ever asks: "How did everything begin?" Each student is (1) to decide which theory of origins best fits the scientific evidence, and (2) to write a paper explaining why. Religious beliefs, while possibly important to the student's overall conclusion, are not to be a part of this paper. There are no right or wrong answers. Instead, the student's work should be evaluated on its breadth of research, critical thinking, sound logic, and detailed comparisons of the data with the various theories.

The following description of the Origins Research Project is written in a generalized form, so it can be used at the high school or college level in either secular or religious schools. Teachers can tailor this project to the time available, the students' needs, and the teacher's objectives.

Purpose. This project will (1) help each student develop analytical skills in science, (2) integrate many seemingly diverse topics and fields of science into a meaningful, maturing, and exciting investigation, and (3) allow academic study in an important area of science without infringing on diverse religious views that are the prerogative of the individual and the home. Because strongly held views will be presented on both sides of this question of origins, the student will develop, probably for the first time, strong, reasoned, and confident disagreement with some scientific authorities and textbook authors. This experience, which even most scientists and engineers do not have until they are well into their first major research effort, is one of the most maturing that an education can provide. Unfortunately, the typical classroom experience, especially in the sciences, involves learning or absorbing information, not evaluating the evidence and deciding which of several scientific explanations is most plausible.

The Project. Each student will write a paper stating which theory of origins he or she thinks is best supported by the scientific evidence and why. The first sentence of the paper will be, "I believe that the scientific evidence best supports ______________________." The blank space, for example, might contain one of the following:

- the theory of evolution
- the theory of creation
- a modified theory of evolution
- a modified theory of creation

(Possible definitions of "evolution" and "creation" are on page 461. Any student who feels the evidence supports a theory other than evolution or creation should define that theory.) Students should understand that their conclusions, based upon an examination of only some scientific evidence, may differ from their religious views (theism, atheism, or their many variants).

The scope of this project is not to resolve such differences but to learn to examine scientific evidence. Limitations and uncertainties in science, especially when dealing with ancient, unrepeatable events having no observers, will become apparent before the project is completed.

The Role of the Teacher. The teacher's role is (1) to help develop students' analytical skills in science, (2) to prevent religious aspects from entering classroom discussions, (3) to prevent censorship of any scientific evidence, (4) to facilitate discussion, and (5) to challenge and stimulate students' thinking. Teachers should frequently ask thought-provoking questions such as:

- What assumptions are being made?
- Can those assumptions be tested?
- Why do other scientists disagree?
- What are other explanations?
- What evidence is there for other conclusions?

The teacher's role is not to compel belief in any theory of origins; nor is it to teach the material. The subject matter is so broad that it would be unreasonable to expect teachers to master it quickly enough to teach it. Furthermore, most teachers probably have presuppositions that could easily bias a student's decision-making process. Students will frequently ask, sometimes subtly, what the teacher believes. A suggested response is:

> *Don't be concerned with what I believe. What matters in this class is how thoroughly you examine the scientific evidence on both sides of this issue. I am not interested in your specific conclusion; I am interested only in the thoroughness and logic you use to reach your conclusion. You are on your own.*

Teacher Options.

1. Decide the length of the written paper. This decision should be based upon the student's academic level, the scientific fields the student should explore, and the teacher's objectives. For a high school physics, biology, or general science course, 1,000 words might be a minimum. For a college student majoring in science education or geology, 40 typewritten pages might not be sufficient.
2. Determine the beginning and ending dates for the Origins Research Project. The project should be long enough to allow the student to reflect on the subject, to do the depth of reading and library research the teacher desires, and to write the paper. It is suggested that the Origins Research Project span 1–4 months and be finished in time to allow one week for grading. This project can be completed using a minimum of three classroom periods.
3. Specify the writing and grading standards. The required quality of the written paper and its adherence to the school's style manual should be established. Schools that have a well-integrated curriculum may want English teachers to grade the papers from a writing standpoint and science teachers to grade the papers from a scientific standpoint. If, among the teachers available for grading, at least one is an evolutionist and one is a creationist, students could have their papers graded by a teacher who holds their basic view of origins (creation or evolution or both).
4. Establish the weight that will be assigned to this graded project. It should be commensurate with the research effort the teacher desires and the student motivation that will be needed, possibly one-third to one-sixth of the course grade. Some students have been allowed to complete the Origins Research Project instead of taking the final exam.

Resource Materials

Teachers should make available books, videos, and DVDs that will balance the broad range of perspectives concerning origins. If outside speakers are brought into the classroom, students who favor evolution should question the creationist speakers, and students who favor creation should question evolutionist speakers. Short student debates create great interest.

Questions and Answers

Q: *Can creation be dealt with scientifically?* [See also **"How Can the Study of Creation Be Scientific?"** on page 376.]

A: Scientists employ a common but special type of reasoning when they try to explain past, unrepeatable events that had no observers. They first develop a model—or what scientists call a "working hypothesis." This simply describes what they think happened. Alternate explanations must also be defined. Then, evidence is shown that will raise or lower the plausibility of the various possible explanations. There are many possible models of origins. However, the two basic models, creation and evolution, can be defined as follows:

The Creation Model of Origins:

- Everything in the universe, including the stars, the solar system, the earth, life, and man, came into existence suddenly and recently, with essentially the complexity we see today.
- Genetic variations are limited.
- The earth has experienced a worldwide flood.

The Evolution Model of Origins:

- Over billions of years, the universe, the solar system, the earth, and finally life developed from disordered matter through natural processes.
- Random mutations and natural selection brought about all life from single-celled life.
- All life has a common ancestor.

Neither creation nor evolution can explain scientifically what happened at the ultimate beginning (represented by the region in red in Figure 205). The evolution model is completely silent about the origin of matter, space, energy, time, and the laws of chemistry and physics. The farthest back in time most evolutionists claim to go is to a hypothetical "big bang." They admit that they have no scientific understanding of what preceded such an event. Creationists likewise have no *scientific* understanding of what happened during the creation event. Nevertheless, to the right of the red region, both models can be tested against the evidence. For any assumed starting condition in the past, scientists frequently ask if the laws of physics and chemistry would produce what we see today. These are certainly scientific questions that give us insight into our beginnings.

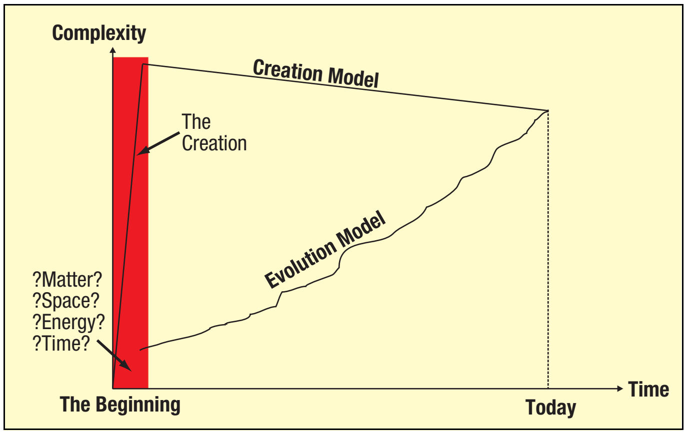


Figure 205: Two Models. Comparison of Creation and Evolution on the Complexity Scale.

Frequently Asked Questions

Q: *How can those high school students who are underachievers or poorly motivated carry out this project?*

A: Teachers who see students having difficulty may choose to limit them to a narrower topic, such as the fossil record. Students could be asked such questions as:

- How do evolutionists and creationists explain the fossil record?
- How are fossils formed?
- Where are fossils formed today?
- What details are found in the fossil record?
- Which explanation best fits these observations?

Answers to these questions could form an outline for a student's paper. If the student requires more guidance, references and page numbers could be included with each question.

Students are often surprised that their conclusions differ from those of some scientists—either creationists or evolutionists. The confidence these students have that their answers are more credible than those of certain scientists produces self-confidence and increased interest in science. Students frequently want to explore other aspects of the origins controversy on their own. Generating this sense of excitement and discovery should be an objective of every science curriculum.

Q: *What would the minimum project involve at the high school level?*

A: The following would require only three class periods; they should be spread out over at least three weeks.

Day 1:
- Pass out the assignment sheets that (1) state the length, format, grading criteria, and due dates for the outline and final 1,000-word paper; (2) define "creation" and "evolution"; and (3) list the resources available in the school library.
- Describe selected resources.
- Explain science methodology when dealing with past events that were not observed and cannot be repeated. [See Figure 205.]

Day 2:
- Students conduct one or two debates.
- Lead an informal discussion of the issue. Emphasize the importance in science of basing conclusions on evidence.
- Remind the students when their outlines are due.

Day 3:
- Comment on the quality of students' outlines.
- Discuss articles posted on the bulletin board.
- Remind students when their final papers are due.

References and Notes

1. In 1987, the Supreme Court of the United States held:

   Moreover, requiring the teaching of creation science with evolution does not give schoolteachers a flexibility that they did not already possess to supplant the present science curriculum with the presentation of theories, besides evolution, about the origin of life. "*Edwards, Governor of Louisiana et al. v. Aguillard et al.,*" *Supreme Court of the United States*, No. 85–1513, argued 10 December 1986, decided 19 June 1987, p. 1. Also see the first paragraph of page 8.

- On 13 June 2001, the United States Senate passed the following resolution by a vote of 91 to 8.

  It is the sense of the Senate that—
  (1) good science education should prepare students to distinguish the data or testable theories of science from philosophical or religious claims that are made in the name of science; and
  (2) where biological evolution is taught, the curriculum should help students to understand why this subject generates so much continuing controversy, and should prepare the students to be informed participants in public discussions regarding the subject. Senator Rick Santorum, *Congressional Record*, Vol. 147, No. 82, 13 June 2001, pp. 1–2. See also Constance Holden, "Senate Gives Nod to Creationists," *Science*, Vol. 292, 29 June 2001, p. 2429.

- *"Several benefits will accrue from a more open discussion of biological origins in the science classroom. First, this approach will do a better job of teaching the issue itself, both because it presents more accurate information about the state of scientific thinking and evidence, and because it presents the subject in a more lively and less dogmatic way. Second, this approach gives students greater appreciation for how science is actually practiced. Science necessarily involves the interpretation of data; yet scientists often disagree about how to interpret their data. By presenting this scientific controversy realistically, students will learn how to evaluate competing interpretations in light of evidence—a skill they will need as citizens, whether they choose careers in science or other fields. Third, this approach will model for students how to address differences of opinion through reasoned discussion within the context of a pluralistic society."* David DeWolf, as quoted by Senator Rick Santorum, *Congressional Record*, 13 June 2001. p. 2.

- *"I think, too often, we limit the best of our educators by directing them to avoid controversy and to try to remain politically correct. If students cannot learn to debate different viewpoints and to explore a range of theories in the classroom, what hope have we for civil discourse beyond the schoolhouse doors? Scientists today have numerous theories* *about our world and its beginnings. I, personally, have been greatly impressed by the many scientists who have probed and dissected scientific theory and concluded that some Divine force had to have played a role in the birth of our magnificent universe. These ideas align with my way of thinking. But I understand that they might not align with someone else's. That is the very point of this amendment—to support an airing of varying opinions, ideas, concepts, and theories. If education is truly a vehicle to broaden horizons and enhance thinking, varying viewpoints should be welcome as part of the school experience."* Senator Robert Byrd, *Congressional Record*, 13 June 2001, p. 6.

2. Richard Alexander, evolutionist and professor of zoology and curator of insects at the University of Michigan, proposed a similar idea.

   No teacher should be dismayed at efforts to present creation as an alternative to evolution in biology courses; indeed, at this moment creation is the only alternative to evolution. Not only is this worth mentioning, but a comparison of the two alternatives can be an excellent exercise in logic and reason. Our primary goal as educators should be to teach students to think and such a comparison, particularly because it concerns an issue in which many have special interests or are even emotionally involved, may accomplish that purpose better than most others. Richard D. Alexander, "Evolution, Creation, and Biology Teaching," *American Biology Teacher*, Vol. 40, February 1978, p. 92.

- *"We who teach introductory physics have to acknowledge, if we are honest with ourselves, that our teaching methods are primarily those of propaganda. We appeal—without demonstration—to evidence that supports our position. We only introduce arguments or evidence that support the currently accepted theories, and omit or gloss over any evidence to the contrary. We give short shrift to alternative theories, introducing them only in order to promptly demolish them—again by appealing to undemonstrated counter-evidence. We drop the names of famous scientists and Nobel prizewinners to show that we are solidly on the side of the scientific establishment. ... Of course, we do all this with the best of intentions and complete sincerity."* Mano Singham, "Teaching and Propaganda," *Physics Today*, June 2000, p. 54.

3. Analytical skills in science include observing; classifying; measuring; explaining; predicting; applying mathematics; designing investigations and experiments; collecting and analyzing data; drawing conclusions; identifying assumptions; contrasting alternative explanations; formulating definitions, questions, hypotheses, and models; and retracting prior conclusions when the evidence warrants it.

What Are the Social Consequences of Belief in Evolution?

Opinions about origins have profound social consequences and even affect the way we think. Consider the following italicized perspectives and some responses. Notice that all these perspectives presume evolution occurred, despite the scientific evidence. We recognize that some people believe that God used evolution to create and that evolution is compatible with the Bible; however, a careful reading shows, in dozens of ways, that it is not. [See **"Is Evolution Compatible with the Bible?"** on pages 451–457.]

1. ***Animal-like Behavior.*** *If humans descended from animals, why shouldn't humans behave like animals?*

2. ***Meaninglessness.*** *If evolution happened, why believe that life has any purpose other than to reproduce and pass on your genes?* [1]

   Response: Evolution did not happen. Your life has purpose and hope. God does not make mistakes. You are not an accident.

3. ***Good vs. Evil.*** *If nature is all there is, why believe there is good and evil?* [2]

   Response: Distinguishing good and evil requires broad, even absolute, standards—and Someone competent to set those standards. Humans instinctively know there is good and evil, right and wrong. Someone implanted that understanding in us; the laws of physics can't.

4. ***Survival of the Fittest.*** *If we evolved by "survival of the fittest," then getting rid of the unfit is desirable. To conquer and exploit weaker people, businesses, or countries is just the law of the jungle from which we evolved. Mercy killings, forced sterilization, and selective breeding of humans, while unpopular with some, would be beneficial, in the long run, and very logical—if we evolved.*

5. ***Communism.*** Friederich Engels, one of the founders of communism, wrote Karl Marx, another founder, and strongly recommended Charles Darwin's book, *The Origin of Species*. In response, Marx wrote Engels that Darwin's book *"contains the basis in natural history for our view* [communism]."[3] Marx offered to dedicate his book, *Das Capital*, to Darwin, but Darwin declined.

Joseph Stalin, ruthless dictator of the Soviet Union from 1929 to 1953, killed millions of his people. Stalin read Darwin's book as a student at a church-based school and urged others to read it. During that time, he became an atheist.

6. ***Personal Responsibility.*** *If everything came into existence by chance and natural processes, then we have no responsibility to some supernatural being. Religions would be a crutch for the weak-minded and superstitious. Churches would be monuments to human ignorance.*

   Furthermore, if evolution happened, then we and our actions are consequences of billions of years' worth of natural events—over which we had no control. Our responsibility for our situation is relatively small. If bad things happen to us, we are primarily victims.

   Response: We were created for a purpose, so we have great responsibility, and our Creator will hold us accountable. More will be expected from those who have been given more.

7. ***Relativism.*** *There are no absolutes, moral or otherwise (except the fact that there are absolutely no absolutes). Your belief is just as good as mine; your truth is just as good as my truth.*

   Response: Obviously, the One who created the universe, life, and humans has the authority and ability to establish timeless moral absolutes—and He has.

8. ***Social Darwinism.*** *If life evolved, then the human mind evolved. So did products of the human mind and all social institutions: law, government, science, education, religion, language, economics, industry—civilization itself.*

   Response: Technology progresses, information accumulates, and civilization often improves, but humans remain humans—with all our frailties and shortcomings.

9. ***Secular Humanism.*** *If the "molecules-to-monkeys-to-man" idea is correct, then man is the highest form of being. Man should be the object of greatest concern, not some fictitious Creator that man actually created.*

   Response: That philosophy is called *secular humanism* (a humane, intellectual-sounding term) that claims God is irrelevant and the Bible is fiction. Secular humanism will decline as people increasingly learn the scientific flaws of evolution.

10. ***New Age Movement.*** *If people slowly evolved up from bacteria, then aren't we evolving toward God? Aren't we evolving a new consciousness? Aren't we evolving into a glorious New Age?*

    Response: These beliefs, built on evolution, continue to spread like a cancer, even in many churches in the world. New age beliefs also will decline as the scientific errors of evolution become known.

11. ***Marriage.*** *If marriage is a cultural development, begun by ignorant tribes thousands of years ago, then why not change that custom, as we do other out-of-date customs? Animals don't marry; why should people? After all, we're just animals. If people are a product of natural processes, then why not do what comes naturally? What's wrong with sexual activity outside of marriage as long as no one is hurt?*

    Response: God instituted marriage when He created a man and a woman (Adam and Eve) and said they should become one.

12. ***Racism.*** *If humans evolved up from some apelike creature, then some people must have advanced higher on the evolutionary ladder than others. Some classes of people should be inherently superior to others.*

    Response: But that's racism. That's the twisted logic Hitler used to try to establish his Aryan master race and to justify killing six million Jews in the Holocaust. This does not mean that evolutionists are racists, although Charles Darwin and many of his followers of a century ago were extreme racists. However, evolution has provided the main rationale for racism. Stephen Jay Gould wrote that "Biological arguments for racism ... increased by orders of magnitude following the acceptance of evolutionary theory." [See Endnote 3. on page 441.] People with darker skin have suffered greatly from evolutionary racism. Belief in evolution has also caused others to suffer even more. They are victims of a greater holocaust going on all around us—abortion.

13. ***Abortion.*** *We dispose of unwanted animals such as cats and dogs. If humans are evolved animals, why not terminate an unwanted pregnancy? Isn't it the mother's right? Shouldn't she have a "choice" in such a personal matter? After all, a fetus has no name or personality. During its first three months, it's just a tiny glob of tissue—no more important than a little pig or rabbit. Why shouldn't a fetus, having less value than an adult, be "terminated" if adults or society*

would benefit? This will help solve our population problem. We must guide our destiny.

Response: Abortion is the premeditated killing of an innocent, defenseless, developing (but completely human) baby. Calling an unborn child merely a "fetus" is dehumanizing. Nor should we speak of "terminating a pregnancy." That is simply a euphemism for killing a very young human.

Nine years after Darwin published his theory of evolution, Professor Ernst Haeckel announced that animal embryos, including unborn humans, pass through stages that mimic their evolutionary ancestors. Human embryos begin as microscopic spheres, because, Haeckel said, humans evolved from bacteria, which are sometimes microscopic spheres. Later, unborn babies look like fish, because humans evolved from fish. Still later, human embryos look like chimpanzees, because humans evolved from some apelike ancestor. So, human embryos are not yet human. Can you see the errors in this logic? *Similarity does not imply a genetic relationship.*

Haeckel faked his drawings to fit his theory. In the following 140 years, hundreds of textbook writers copied these drawings, popularizing the theory. It has since been taught as fact worldwide, even in medical schools. Today the theory is completely discredited, although it is still taught. [See **"Embryology"** on page 11 and page 63.]

Unborn children *are* human. Each adult's body has about 100 trillion cells. When you were just one cell inside your mother, all the marvelous, complex information that physically defines you and every organ in your body was there. Although you were tiny and immature, you were completely human when you were one cell. While you were in your mother's womb, she was your support system, just as medical support systems are needed by some sick or elderly people. Needing a support system does not remove a person from the human race or justify killing that person.

Although these matters have nothing to do with whether evolution is true or false, they have much to do with the importance of the issue and the adverse consequences of teaching that evolution is a fact. These social problems did not originate with evolution, but *they follow logically from evolution.* No doubt most evolutionists are as opposed as creationists to many of these social problems, but from an evolutionist perspective these behaviors are easily justified, rationalized, or tolerated. Evolution, while not the cause of evil, can usually defend or justify such behavior—with seeming scientific credibility.[4]

Obviously, the creator of a complex machine can best provide its operating instructions. Likewise, only our Creator has the authority and ability to establish timeless moral absolutes. By what logic could anyone oppose these thirteen italicized viewpoints if there were no moral absolutes? Without moral absolutes, "right" and "wrong" will be decided by whoever is in control, but that will change from time to time. A false understanding of origins has subtle and far-reaching consequences.

References and Notes

1. *"Perhaps most importantly, if the world and its creatures developed purely by material, physical forces, it could not have been designed and has no purpose or goal. … this seems to be the message of evolution."* Douglas J. Futuyma, *Science on Trial* (New York: Pantheon Books, 1983), pp. 12–13

◆ *"The more the universe seems comprehensible, the more it also seems pointless."* Steven Weinberg, *The First Three Minutes* (New York: Bantam Books, Inc., 1977), p. 144.

2. *"The universe we observe has precisely the properties we should expect if there is, at bottom, no design, no purpose, no evil and no good, nothing but blind, pitiless indifference."* Richard Dawkins, *River out of Eden* (New York: Basic Books, Inc., 1995), p. 133.

3. Conway Zirkle, *Evolution, Marxian Biology, and the Social Scene* (Philadelphia: University of Pennsylvania Press, 1959), p. 86.

4. Some evolutionists even say that rape is a consequence of evolution. Professors Randy Thornhill and Craig T. Palmer, in their book, *A Natural History of Rape: Biological Basis of Sexual Coercion* (Cambridge, Massachusetts: The MIT Press, 2000), say that rapists, on average, have more children than other men; that is, they have greater "reproductive success." Therefore, after millions of years, rapist tendencies have spread within the human population. "Good," according to evolution theory, is whatever enhances "reproductive success"; "good" has nothing to do with morality. The fields of evolutionary psychology and sociobiology, taught in many universities, popularize and legitimize such ideas.

How Can I Become Involved in This Issue?

People who learn about the case for creation and the adverse and far-reaching consequences of evolution frequently ask, “What can I do?” Others incorrectly feel this is merely a scientific issue that must be left to scientists. Actually, each of you, with your unique circumstances, interests, and abilities, can help expose these evolutionary myths. Here are eight possibilities.

1. Understand the Problem. Evolutionary theories and interpretations are usually taught as facts. Teachers, textbooks, and the media frequently convey the attitude that evolution is the only scientific and intellectually respectable view of origins. Students are implicitly presented with a choice, a false dichotomy: “Are you going to hold a narrow-minded religious belief, or are you going to accept a scientific explanation?” Evolution is thus protected from competent criticism, and students are kept ignorant of its many shortcomings. Scientific data are ignored (see pages 5–105), while the accuracy and authority of the Bible are undermined. Students who were taught this way are now teachers, professors, publishers, and textbook writers. The creation movement threatens their position, prestige, and income, so they tend to ignore the scientific evidence opposing evolution and supporting creation.

2. Words to Avoid.

- ***Creationism***. Popular and frequent use of the word “creationism,” even by creationists, is unfortunate; the preferred term is “creation.” Why? Words have power. To most people, “isms” are usually bad. For example: terrorism, communism, racism, sexism, socialism, antisemitism, humanism, scientism, etc. The term “creationism,” therefore, is prejudicial. Furthermore, “isms” are belief systems or ideologies. Although creation has important belief aspects, creation is not just a belief, as evolutionists maintain, but is supported by much scientific evidence. The term “creationism” de-emphasizes this scientific evidence and carries the negative connotation of most “isms.”
- ***Prove***. Science doesn’t *prove* anything. Proofs occur only in mathematics. Furthermore, mathematical proofs are not absolutely true, since one begins with assumptions called *axioms* and *postulates*. If they change, your “proofs” change. In science, nothing is ever absolute, and not all the evidence and possible explanations have been considered. Those who use the word “prove” in a scientific context usually are overstating something. Hardly ever will you hear an experienced scientist say that something in science has been proved. Better terms include *indicates*, *suggests*, *confirms*, and *supports*. In science, explanations (hypotheses and theories) are made increasingly plausible or implausible by evidence.

3. Learn More and Teach Others. Tell your friends what you have learned. Encourage them to learn more about the creation-evolution issue. Excellent books and periodicals are available—some at your local libraries and bookstores. Learn more yourself, and explain it to others in formal and informal settings. Conduct tours to nearby museums, and identify the errors in their displays. You will be surprised at how excited and grateful people become after learning this information. A growing number of people work full time giving presentations on creation. If you are an effective speaker, you may wish to consider such work. Demand for speakers greatly exceeds the supply.

Those interested in forming a group to study this book may request a *Study Guide*. [See page 518.]

4. Talk to Educators. Write or talk to teachers, school officials, and school-board members in your community. Ask them such questions as the following: Are you aware of the many fallacies concerning the theory of evolution that we have all been taught? Are you teaching all the scientific evidence? Are you aware that the great majority of the American public wants both evolution and creation taught? Are you aware that more than 85% of the public do not want only evolution taught?[1] Our message to educators should be:

- Teach the scientific evidence for ***and against*** evolution. [See pages 471–472 for responses to standard objections to doing this.]
- Teach students to think critically: to examine evidence, to test alternative hypotheses, to question, to identify hidden assumptions, to think accurately, and to reach their own conclusions.
- Teachers should become technically up-to-date and learn the evidence concerning origins.
- Teachers have a responsibility for the accuracy of what they say in their classrooms, especially about the subject of origins.

Many educators mistakenly believe that most scientific creationists want to legislate their views into the classroom. ***Assure teachers and professors that few, if any, scientists who are creationists advocate legislation that would force certain views to be taught.*** Even if every legislature required teachers to present both creation and evolution, unproductive hostility and ridicule would result. The scientific evidence for creation is so strong that education and persuasion are much more effective and lasting.

Explain to friends and educators that most creationists advocate the following:

- ***No religious doctrines or writings should be taught—or ridiculed—in science classes in public schools.***
- ***All the major scientific evidence dealing with origins should be taught at the appropriate grade levels.***
- ***When a theory of origins is presented, any reasonable opposing evidence should also be presented.***

5. Propose the Origins Research Project. Encourage science teachers and professors, as well as members of boards of education and boards of trustees, to add an Origins Research Project to their curriculum. [See **"The Origins Research Project"** on pages 460–463.] Such a project, in which each student decides which theory of origins is best supported by the scientific evidence, could be one of the most interesting, maturing, and valuable projects the students ever experience. The project is appropriate at the high school or college level, can be tailored to fit many school or classroom situations, requires no special teacher training, favors no theory of origins, is not restricted to just two models (creation and evolution), focuses on only scientific evidence, removes any concern about bringing religion into public schools, and involves only a moderate amount of classroom time and expense.

6. Challenge Evolutionists. Encourage knowledgeable evolutionists to enter either the simple oral/phone debate or the written debate. [See pages 473–476.] If they decline, make a point of asking, "Why won't evolutionists debate the scientific evidence?" Do not argue with such evolutionists until you are familiar with the evidence. If you are not, refer these evolutionists to those who are.

7. Expose Theistic Evolution. Speak with pastors, ministers, priests, or rabbis. Show them that the scientific evidence is consistent with the biblical account of creation and the worldwide flood of Noah's day. If they are not already aware of it, explain that evolutionists are reluctant to debate this issue on a scientific basis. Then point out the many problems with theistic evolution and the subtle means by which the Bible has been falsely discredited because of evolution. [See **"Is Evolution Compatible with the Bible?"** on pages 451–457.] Encourage church leaders to add creation books and audiovisual materials to your church library and invite speakers to address this subject. Consider speaking on the subject yourself.

8. Inform the Media. Write letters to television stations and newspaper and magazine editors. Compliment them whenever they give accurate and balanced coverage of the creation-evolution issue. Provide polite and reasoned criticisms when they assume that evolution is a fact or when they avoid the scientific evidence. In the case of television, send a copy of your letter to the program's advertisers. Inform the advertisers and media officials of the public's positions on the issue of origins.[2]

References and Notes

1. Many organizations have surveyed public attitudes on the teaching of origins. Results are remarkably consistent, regardless of whether creationist, evolutionist, or another organization conducted the survey. Typically, responses are as follows:

   5% I would like only evolution taught.

   15% I would like only creation taught.

   70% I would like both creation and evolution taught.

   10% No opinion, or teach neither.

2Six Gallup polls have surveyed beliefs in the United States concerning origins. People were given four choices:

- The Creation Position: God created man in his present form at one time within the last 10,000 years.
- The Theistic Evolution Position: Man has developed over millions of years from less advanced forms of life, but God guided this process, including man's creation.
- The Atheistic Evolution Position: Man has developed over millions of years from less advanced forms of life. No God participated in this process.
- No Opinion

Table 28. Gallup Poll Results

	1982	1991	1993	1997	1999	2001
Creation	44%	47%	47%	44%	47%	45%
Theistic Evolution	38%	40%	35%	39%	40%	37%
Atheistic Evolution	9%	9%	11%	10%	9%	12%
No Opinion	9%	4%	7%	7%	4%	6%

Sampling errors: ±3%. Data taken from George Gallup Jr., The Gallup Poll (Wilmington, Delaware: Scholarly Resources Inc.),1982, 1991, 1993, 1997, 1999, and 2001.

Notice how few people are atheistic evolutionists, and yet this position dominates the media and most schools. Surprisingly, despite a century of monopolistic teaching of evolution, so many are creationists.

Some incorrectly claim that almost all scientists believe in evolution. The only survey of scientists of which I am aware involved chemists. Fewer than half (48.3%) said that "it was possible that humans evolved in a continuous chain of development from simple elements in a primordial soup." A slight majority (51.7%) said that "supernatural intervention played a role." [Murray Saffran, "Why Scientists Shouldn't Cast Stones," *The Scientist*, 5 September 1988, p. 11.]

What Questions Could I Ask Evolutionists?

Here are categories of questions that you could ask. The page numbers below will show why evolutionists avoid these questions. If you find evolutionists who feel they or others can answer them, then ask one more question: "Why won't evolutionists enter a strictly scientific debate on the creation-evolution issue?" For details on two debate offers, see pages 473-476.

1. Where has macroevolution ever been observed? [See page 5.] What is the mechanism for getting new complexity, such as new vital organs? [See pages 5–7.] If any of the thousands of vital organs evolved, how could the organism have lived before getting the vital organ? (Without a *vital* organ, the organism is dead—by definition.) If a reptile's leg evolved into a bird's wing, as evolutionists claim, wouldn't the leg become a bad leg long before it became a good wing? How could metamorphosis evolve? [See page 18.]

2. Living things are incredibly complex, so how could organs as complex as the eye, ear, or brain of even a tiny bird ever come about by chance or natural processes? [See **"Complex Molecules and Organs"** on page 7. Also see pages 14–24.]

3. Motors do not work until each radically different component is completely developed and in its precise place, so how could a bacterial motor evolve? [See page 20.]

4. If macroevolution happened, where are the billions of transitional fossils that should be there? Billions! Not a handful of questionable transitions. Why don't we see a smooth continuum among all living creatures, or in the fossil record, or both? [See page 11.]

5. Textbooks show an evolutionary tree, but where is its trunk and where are its branches? For example, what are the evolutionary ancestors of the insects? [See page 12.]

6. How could the first living cell begin? That is a greater miracle than for bacteria to evolve into man. How could that first cell reproduce? [See page 15.] Speaking of reproduction, how could sexual reproduction evolve? [See page 18.] Just before life appeared, did the atmosphere have oxygen or did it not have oxygen? Whichever choice you make creates a terrible problem for evolution. Both must come into existence at about the same time. [See page 14.]

7. Can you describe one natural process that creates information? What evidence is there that information, such as that in DNA, could ever assemble itself? What about the 4,000 books' worth of coded information that are in a tiny part of each of your 100 trillion cells? If astronomers received an intelligent signal from some distant galaxy, most people would conclude that it came from an intelligent source. Why then doesn't the vast information sequence in the DNA molecule of just a bacterium also imply an intelligent source? [See pages 9 and 16.]

8. Which came first, DNA or the proteins needed by DNA, which can only be produced by DNA? [See page 16.]

9. How could immune systems evolve? [See page 20.]

10. If it takes intelligence to make an arrowhead, why doesn't it take vastly more intelligence to create a human? Do you really believe that hydrogen will turn into people if you wait long enough?

11. If the solar system evolved, why do three planets spin backwards? Why do at least 30 moons revolve backwards? [See page 27.]

12. Can you name one reasonable hypothesis for the Moon's origin—any hypothesis that is consistent with all the data? Why isn't the public told the scientific reasons for rejecting all the evolutionary theories for the Moon's origin? What about the almost 200 other moons in the solar system? [See page 29.]

13. Where did matter, space, time, energy, or even the laws of physics come from? [See page 31.] What about water? [See page 27.]

14. The gravity of a black hole is so strong that nothing, not even light, can escape it. How then did all the matter in the universe escape the singularity of the big bang—an infinitesimal point? [See pages 383–388.]

15. What is dark matter and dark energy? [See page 33.]

16. How could stars evolve? [See pages 32–34.]

17. Why are dormant, but living, bacteria found inside rocks that you say are hundreds of millions of years old and in meteorites that you say are billions of years old? Clean-room techniques and great care were used to rule out contamination. [See page 37.]

The DNA in those bacteria also rules out contamination. [See Endnote 88 on page 325.]

18. Do you know that most scientific dating techniques support a young earth, solar system, and universe? [See pages 36–43.] Are you aware of all the assumptions and contradictory evidence used by those who say the earth is billions of years old? [See pages 39–43 and 377–382.]

19. Why do so many ancient cultures have flood legends? [See page 49.] How do you explain seashells that have been found on top of every major mountain range on earth? [See page 48.]

20. Have you heard about the mitochondrial Eve and the genetic Adam? Scientists know that mitochondrial Eve was the common female ancestor of every living person, and she appears to have lived only about 6,000–7,000 years ago. [See pages 448–450.]

21. Careful researchers have found the following inside meteorites: living bacteria, salt crystals, limestone, water, sugars, terrestrial-like brines, and earthlike isotopic patterns. Doesn't this implicate earth as their source? [See page 316.]

22. What successful predictions have been made by the theory of evolution? [See **"predictions of evolution"** in the index. Haven't they all failed?] What successful predictions have been made by the hydroplate theory? [See the 46 **"predictions of the hydroplate theory"** on page 399 and in the index.] The bolded entries have been recently confirmed. Pages 278 and 287 explain the predicted discoveries made by the *Deep Impact* and *Stardust* space missions to comets in 2005.]

23. Why are more than 155 lakes, 1–280 kilometers long, unfrozen today in Antarctica? (One lake, Lake Vostok, is the sixth largest lake in the world and has the volume of Lake Michigan.) How could a lake even begin in Antarctica? Why would it stay unfrozen for so long? [See **"Antarctic Lakes"** on page 401.]

24. How did the earth develop its inner and outer core? [See pages 496–498.] Why is earth's magnetic field so large—2,000 times larger than the combined magnetic fields of planets Mercury, Venus, and Mars? [See page 155.]

25. Tablemounts are flat-topped volcanic cones that lie 3,000–6,000 feet below sea level. How were their tops planed off? If sea level was lower by that amount, where did the water go? If the seafloor was higher by that amount, where did the rock below the floor go so the floor could subside? [See page 159.]

26. What produced the ring of fire around the Pacific, and why is that ocean so large? [See pages 152–153.]

27. How can a continental size, crustal plate that is 30–60 miles thick dive into the mantle? What would initiate the dive? Why doesn't friction or the blunt end of the plate prevent subduction? [See page 165.]

28. To form the Grand Canyon required the removal of almost 3,000 cubic miles of dirt. *Where did all that dirt go?* If the Colorado River carved the Grand Canyon as almost every book on the subject claims, the largest river delta in the world should be where the Colorado River enters the Gulf of California. Why isn't it there? [See pages 189–227.]

29. Textbooks often show the Americas as having a jigsaw fit with Europe and Africa. Is this true, or have artists drastically altered the continents' size, shape, and orientation to make the fit look good? If these continents were once joined as one continent, what broke them apart, and how did they move to their present locations? [See pages 109–147.]

30. Can you explain the origin of the following 26 features of the earth and solar system? (Page numbers below refer to entire chapters devoted to that subject. Use the index of this book to locate other pages.)
    - The Grand Canyon (pages 189–227)
    - Mid-Oceanic Ridge
    - Earth's Major Components
    - Ocean Trenches (pages 149–173)
    - Earthquakes
    - Magnetic Variations on the Ocean Floor
    - Submarine Canyons
    - Coal and Oil
    - Methane Hydrates
    - Ice Age
    - Frozen Mammoths (pages 237–269)
    - Major Mountain Ranges
    - Overthrusts
    - Volcanoes and Lava
    - Geothermal Heat
    - Strata and Layered Fossils (pages 175–187)
    - Limestone (pages 229–235)
    - Metamorphic Rock
    - Plateaus
    - The Moho and Black Smokers
    - Salt Domes
    - Jigsaw Fit of the Continents
    - Changing Axis Tilt
    - Comets (pages 271–302)
    - Asteroids and Meteoroids (pages 305–327)
    - Earth's Radioactivity (pages 329–371)

How Do Evolutionists Respond to What You Say?

They generally ignore it. A few will criticize the evidence in forums where I cannot respond. Once every year or two, a knowledgeable evolutionist will agree to an oral, strictly scientific debate. These debates are usually lively, but always cordial. Unfortunately, little can be covered in a 2½-hour debate, and the substance of the debate cannot be widely distributed, studied, and recalled by others as it could if it were in writing.

The best way, I believe, to clarify the creation-evolution controversy is to have a thorough, written, publishable, strictly scientific debate. Both sides would lay out their case, much as I have in *The Scientific Case for Creation* on pages 5–105. Then each side would respond, point-by-point, to the case for the other side. Both sides would have the right to publish the finished exchange. I have sought such an exchange since 1980, but have not had a serious, qualified taker. Many leading evolutionists know of the offer. When I speak at universities and colleges, I offer students a $200 finder's fee if they can find an evolutionist professor who will complete such a debate. I am repeating that offer here to the first student who can find such a science professor.

Several excuses are given by evolutionists.

1. ***"I don't have time."***

   Response: Many do not have time, and of course, they need not participate. However, others have the time to write books attacking and misrepresenting creationist positions. Many are teaching what I feel are outdated evolutionary ideas and refuse to place themselves in a forum where they must defend what they are teaching. *If you are going to teach something, you should be willing to defend it*, especially if taxpayers are paying your salary.

2. ***"Creation is a religious idea. It is not science."***

   Response: Creation certainly has religious implications, but much scientific evidence bears on the subject. Only the scientific aspects would be permitted in this written debate. An editor would remove any religious, or antireligious, comments from the exchange. If my comments were only religious, the editor would strike them from the debate. I would have nothing left to present, so the evolutionist would win by default. (Incidentally, evolution also has religious implications.)

3. ***"I don't want to give creationists a forum."***

   Response: Of the thousands of scientific controversies, the creation-evolution controversy may be the one in which scientists most often refuse to exchange and discuss the evidence. That is an unscientific, closed-minded position.

4. ***"I don't know enough about evolution"*** [Carl Sagan's answer]***, or "I am qualified in only one aspect of evolution."***

   Response: A team of evolutionists could participate in the debate.

5. ***"Any debate should be in refereed science journals."***

   Response: No journal would allocate the number of pages needed for such a debate. Besides, the journals you refer to are controlled by evolutionists, so why would they provide a platform to have their beliefs criticized? Nor do they publish any research questioning evolution and supporting creation. Publishers of these journals would be severely criticized by their subscribers and advertisers if they did. (The few evolutionists who participate in oral debates often admit how much they are criticized by other evolutionists for participating in a debate.) In a well-publicized case, one journal, *Scientific American*, withdrew a contract to hire a highly qualified assistant editor when the journal's executives learned he was a creationist.

If anyone wishes to explore the written-debate idea further, see pages 473–475. But if you are going to ask a qualified evolutionist to participate, watch for excuses.

How do evolutionists respond to the scientific case for creation? Most try to ignore it. As you can see from the above excuses, even qualified evolutionists usually avoid a direct exchange dealing with the scientific evidence.

How Do You Respond to Common Claims of Evolutionists?

1. "The evidence against evolution is bad science."

Response: Have you studied the evidence? [See Parts I and II of this book.] Both sides of this issue tend to think the other is defending "bad science," but "good" evidence may exist on both sides. Why not teach all the major scientific evidence? Evolutionists avoid a thorough, publishable, head-to-head comparison of the evidence for and against evolution. [See pages 473–475.] In fact, evolutionist leaders advise others never to participate in even an oral scientific debate on the evidence for and against evolution. In what other major science controversy has one side refused to allow all the evidence on the table?

2. "If you are going to teach an alternate view to evolution, why not teach chemistry AND alchemy, heliocentrism AND geocentrism, gynecology AND the stork 'theory,' or astronomy AND astrology?"

Response: If anyone has scientific evidence for these fringe beliefs, I would be happy to lay out the counterevidence. (Remember, evidence must be observable and verifiable.) Millions of people know evidence that opposes evolution. Even polls conducted by evolutionist organizations have shown that about 80% of the American public want such evidence taught in the schools their taxes finance.

3. "National science standards call for the exclusive teaching of evolution."

Response: There are no "national science standards." Three private, *nongovernmental*, national organizations (The National Science Teachers Association, The American Association for the Advancement of Science, and The National Research Council) have a long record of promoting evolution. Each has proposed a different science curriculum, all with a common theme—evolution.

Some may think the National Research Council is part of the federal government. No. The National Research Council is a private organization set up to advise elements of the federal government *when invited* on matters of science and technology. None of these self-appointed groups has any charter for establishing national standards in any academic discipline. ***There are no "national science standards."***

4. "Almost all scientists accept evolution."

Response: No, they don't. The only study that I am aware of that addressed this question was a survey of chemists. A slight majority rejected evolution. [See the last paragraph of Endnote 2 on page 467.] Most professors in the basic sciences favor evolution, in part, because that is what they were taught and those who openly reject evolution are not hired or are fired.

In the applied sciences (engineering, computer science, medicine, etc.) and among scientists in industry, those accepting and rejecting evolution may be nearly balanced. This mix of views comes from two opposing forces: the dominance of evolution in everyone's schooling, and the tendency of those in the applied sciences (as opposed to the basic sciences) to be inherently practical. Consequently, in the applied sciences, evolution is not universally accepted. Engineers, for example, learn to design things and appreciate complexity when they see it. They know that matter and energy, left to themselves, do not produce complexity; in general, the more time that passes, the more things degrade.

Gallup polls have shown that more Americans reject evolution than accept it. [See page 467.] Of course, scientific conclusions should be based on evidence, not a vote. The founders of modern science (Kepler, Bacon, Pascal, Boyle, Galileo, Hooke, and Newton—who, by the way, were creationists and opposed the evolutionary views of their day) based decisions on evidence. In contrast, the science of even earlier ages was based on philosophical deductions or authoritative opinions. Those who try to establish scientific truth by "counting noses" regress into dark-age thinking. By that criterion, you would believe in a flat earth, because once most scientists believed in a flat earth.

5. "People who oppose evolution do so for religious reasons."

Response: In some cases. In other cases, some people who want to suppress the evidence against evolution do so for *their* religious reasons. Let's just agree to stick to the scientific evidence on both sides of the origins issue.

In the first half of my life, I was an evolutionist. My basic Christian beliefs have not changed, but after learning some convincing evidence, I had to reject evolution. Of course, the origins issue has religious implications for everyone—even those who claim to hold no religious views. But the issue can be addressed from a purely scientific standpoint. The special edition of this book (1996) demonstrated that. In it, religious matters were excluded, as I believe they should be in public schools.

6. "Speaking of a creator or a global flood is religious, because those ideas are drawn directly from the Bible."

Response: Speaking of Noah's flood would be religious, but explaining geological features caused by a global flood would not be. [See pages 107–371.] Speaking of Adam or

Eve would be religious, but describing the evidence related to the "mitochondrial Eve" or the "genetic Adam," from whom many scientists have concluded all humans recently descended, is not. [See pages 448–450.] Referring to the God of the Bible or the Allah of the Qur'an as the Creator would be religious, but speaking of a creator is not. As Supreme Court Justice Scalia wrote: *"to posit a past creator is not to posit the eternal and personal God who is the object of religious veneration."* Scalia also wrote, *"We will not presume that a law's purpose is to advance religion merely because it happens to coincide or harmonize with the tenets of some or all religions."* [1]

For example, scientists (even some evolutionists) who understand the amazing complexity inside a living cell know it could never have evolved; it had to be created. [See **"The Elephant in the Living Room"** on page 19.] But science cannot say who the creator was. It might have been several creators or even "little green men" from Mars. Nevertheless, when one understands the evidence, it is clear that this amazing complexity could not have evolved. It is hard to imagine an unbiased person who understands the evidence reaching any other conclusion. Unfortunately, few educators and scientists have heard this evidence. (Unintended ignorance is excusable. Unwillingness to learn is not. Preventing students from learning is reprehensible.)

Because much scientific evidence is being censored from our schools, a small but growing number of individuals, such as myself, spend our time teaching others this evidence. People, including scientists, are excited about what they are learning. Demand for speakers and information exceeds what we can give. If the schools did their job, this rapidly-growing endeavor would shrink. But today, parental dissatisfaction with public schools in general, and science education in particular, has never been higher—in large part because of the one-sided way origins has been taught.

7. "The courts have stated that teaching evidence for creation would violate the separation of church and state."

Response: Wrong. The U.S. Supreme Court has said just the opposite. A few evolutionist organizations, the ACLU, and many media outlets have propagated that myth. The Supreme Court actually said that the scientific evidence for any theory of origins, including creation, has always been legal in the classroom. *"Moreover, requiring the teaching of creation science with evolution does not give schoolteachers a flexibility that they did not already possess to supplant the present science curriculum with the presentation of theories, besides evolution, about the origin of life."* [2]

Of course, our issue is whether the evidence ***against*** evolution will be taught along with that ***for*** evolution. Besides, the U.S. Constitution only states that *"Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof."* Our founding fathers, who acknowledged the Creator in many places, including the *Declaration of Independence,* did not want a national religion such as the Church of England. (The phrase *"separation of church and state"* is not in the Constitution. Nor is the word "separation" or the word "church.")

8. "Evolution may have some problems, but they will be solved as science advances."

Response: Maybe. However, the opposite has been increasingly true for many decades. That is, as more has been learned, evolution appears even weaker. It is a theory in crisis, a theory without a mechanism. Let's not withhold information. Suppressing evidence is not the way to advance science. Let's just teach the scientific evidence that is known and undisputed. Insisting that only evolution be taught amounts to indoctrination—*telling students what to think, not teaching them how to think*. That deprives them of the opportunity to evaluate and think critically.

References and Notes

1. *"Edwards, Governor of Louisiana et al. v. Aguillard et al.," Supreme Court of the United States*, No. 85–1513, argued 10 December 1986, decided 19 June 1987, pp. 6, 20.
2. See Endnote 1 on page 462.

Why Don't Creationists Publish in Leading Science Journals?

Scientists should want their conclusions critiqued, or refereed, by their peers (peer review). Researchers who believe their work is important should try to publish that work. However, leading science journals will not accept papers published elsewhere. (That stipulation alone eliminates any portion of this book from consideration.) Seldom would a science journal publish a paper more than 6 pages in length. (That also prevents the hydroplate theory, pages 107–371, from being published in a journal.)

I certainly want my ideas tested and have frequently initiated and appreciated cordial, factual exchanges with scientists who are not creationists. But in a journal, who does the evaluation, and is there an unbiased process where a writer who advances creation or the flood can challenge an evolutionist reviewer's disagreement? Leading science journals have a solid history of hostility toward creationists, so evolutionists are both judge and jury. Who would want to make his case in a court run by an opponent? Why would that opponent publish your case?

To level the playing field, I have had on the table, since 1980, a written-debate offer for any qualified evolutionist or team of evolutionists who disagree with what I have written. A neutral editor, acting as judge, would ensure the debate rules were followed; the jury would be all readers. Both sides would have the right to publish the complete debate if a large publisher chose not to.

Evolutionists have known of this offer for many years. It was published in the well-known anticreation journal, *Creation/Evolution*, in 1990. The offer was even placed on the worldwide web in 1995. So far, no evolutionist has accepted. (A few initially agreed but soon dropped out, because they were unwilling to limit the exchange to science; they wanted to include religious views.) Another debate offer is a telephone debate that could be heard (or read from a transcript) by the public over the Internet; it is explained on page 476. Can you find a taker for either debate? Until someone accepts the written debate and as long as my good health continues, both offers will remain.

What Is the Written Debate Offer?

The following offer is for a written, scientific debate on the creation-evolution issue. It addresses a longstanding desire by the public for a comprehensive and understandable comparison of the two main explanations for how everything began—a heated issue in which little constructive dialogue has occurred. Scientific disagreements can and should be discussed without acrimony.

Notice several things about this sincere and fair offer on pages 474–475. Evolutionists who disagree with these proposed debate procedures but wish to participate can propose their own suggestions for a written, strictly scientific debate. They must sign a statement, as I will, that they will abide by the editor's decisions resolving disagreements about procedures.

*However, **the debate must be restricted to science and avoid religion**, a broader, more complex, and less-structured subject. (Because I am not a theologian, I will not debate those topics. My focus is on the scientific evidence relating to origins.) Scientific methodology is also better understood by more people. Indeed, methods for reaching religious conclusions are diverse, subjective, and cultural. Religious disagreements have been with us for thousands of years. A purely scientific debate will be broad enough.*

Many can participate on the evolutionist side. Only the lead evolutionist must hold a doctorate in either applied or basic sciences. Anyone who wishes to participate may recruit a lead evolutionist with a doctorate and offer to assist the evolutionist team. (A lack of recognized qualifications does not mean that a person has nothing to contribute. However, without them, many readers might dismiss that side's case or blame a poor performance, not on a weak case, but on a lack of scientific qualifications.)

Once a lead evolutionist agrees to participate, we will search for and select an editor associated with a large, neutral publisher. I am confident that many publishers will be interested. Those invited may conclude that one or both sides have not demonstrated the ability to produce a credible, unemotional, and thorough case, understandable to most readers. If so, sales of the final, book-length debate would suffer. Sales, after all, are a publisher's main concern. Editors and publishers may also conclude that one side is unprepared to address all relevant disciplines in the creation-evolution issue: life sciences, astronomical sciences, earth sciences, physical sciences, and their many subdisciplines. If so, the editor and publisher might ask one side to add qualified people to its side or withdraw.

The editor/publisher may require both sides of the debate to sign a contract to complete the manuscript as described in this offer. Because the publisher has "first right of refusal" and makes no commitment to publish the completed debate, the publisher has much to gain with little risk.

Written Debate Offer

The purpose of this debate is:

a. To provide a vehicle for a dispassionate and comprehensive exchange of scientific data on both sides of a heated issue in which little constructive dialogue has occurred.
b. To make available to interested readers a clear explanation (in English) of the major scientific evidence on both sides of the creation-evolution issue. Alternate interpretations and counterevidence will be contrasted. The disciplines will include the life sciences, astronomical sciences, earth sciences, and physical sciences (physics and chemistry).

The debate question is: ***Does the scientific evidence favor creation or evolution?*** Each side will present the evidence it feels supports its view of origins and refutes the opposing explanation. Each side will summarize its position in 100 words or less and submit it with this signed paper. (Possible examples are given below.)

a. The Creation Position:
   - Everything in the universe, including the stars, the solar system, the earth, life, and man, came into existence suddenly and recently, in essentially the complexity we see today.
   - Genetic variations are limited.
   - The earth has experienced a worldwide flood.
b. The Evolution Position:
   - Over billions of years, the universe, the solar system, the earth, and finally life developed from disordered matter through natural processes.
   - All life has a common, single-celled ancestor.
   - Random mutations and natural selection produced today's many forms of life.

The debate will consist only of scientific evidence and the logical inferences from that evidence. Religious ideas and beliefs, while possibly correct, will not be allowed. The editor will strike such ideas from the record. The "no religion" rule would be violated by

a. referring to religious writings, such as the Bible or the Qur'an,
b. ridiculing a deity or religious belief, or
c. using a religious writing to support a scientific claim. However, using scientific evidence to reach a conclusion that happens to correspond to a religious writing would not be a violation.

The credibility of creation and the flood, as a scientific matter, should rise or fall based on evidence, not the religious beliefs of either side of this debate. If the debaters scrupulously avoid religion, the debate's content can be used in the public schools. Each side will define its terms, organize its evidence, and submit its arguments in whatever way will add clarity to its case.

Debate Procedures

1. One side, selected at random, will begin by nominating a willing editor who is associated with a large publisher. (A large publisher is defined as one with annual sales of more than 10 million U.S. dollars.) The other side can either accept that nomination or propose a different editor-publisher combination. This nomination process will continue until a side has received three nominations. Then it must accept one, including the royalties and other contractual details offered by the publisher. (Royalties will be divided equally between the two sides.) The editor must have no strong opinions on the creation/evolution issue.

2. Companies specializing in book design will be asked to bid on all computer aspects of assembling a full-color book with an index. The editor and each side of the debate will vote to select the book's designer. Before the book is published, the publisher will pay the editor and the book's designer. If the book is never published, neither the editor nor book's designer will be paid.

3. Each side of the debate will make four submissions of up to 100,000 words each. Submissions may included additional evidence and arguments, rebuttals, and corrections. Each picture, figure, graph, or sequence of equations will be considered the equivalent of 200 words. Submissions, in a computer-readable form, will be sent to the editor by email at four-month intervals. The first submission will be due four months after the editor is selected. The editor will delete from all submissions any religious ideas, unprofessional remarks, or comments that do not contribute to the debate's intent. Within one month of receiving both submissions, the editor will simultaneously transmit both edited submissions to each side.

4. The editor will:
   a. Make whatever rulings will help accomplish the debate's purpose.
   b. Resolve all procedural disagreements.
   c. After consulting with each side, select the style manual to be followed and provide formatting and layout guidance to the book designer.
   d. Collect a color photograph of each participant and a biographical sketch of 100–200 words.
   e. Direct each side, if needed, to address the more important unanswered points made by the other side, to include new issues raised during the last submission.
   f. Terminate the debate if, in his or her opinion, one side is not participating adequately.
   g. Organize and edit the final written product.

h. Write the book's preface, including a description of these agreements and whether or not both sides followed them.
i. List for the publisher all of the book's intended artwork, along with costs and copyright owners. The authors, operating within a budget established by the editor, are responsible for obtaining this information. The eventual publisher will purchase all artwork that is used, design the cover, and obtain an ISBN number and a Library of Congress number.

5. Outside parties who contribute significant ideas, data, or logic to the written product must be cited. Those who contribute substantially to the debate may become joint participants. However, the lead debater for each side, whose signature appears below, is responsible for integrating all viewpoints for his or her side into one coherent case.

6. One side may feel that the other has not adequately documented a claim. If, after consulting with each side, the editor agrees, either the documentation must be provided or the claim withdrawn.

7. One side may feel that the other has quoted an authority out of context. If the editor concurs and the quotation is not qualified or removed, the editor may add a comment.

8. If both sides have difficulty finding certain references cited by the other side, the editor will direct that each side provide specific documents to the other. The editor, after considering the number and costs involved, will balance the burden placed on each side.

9. Each side will be allowed four extensions of one month each. The side requesting the extension must notify the editor and the other side as soon as possible but at least seven days before the submission is due.

10. If one side withdraws from the debate, as confirmed and explained in writing by the editor, the other side will have exclusive rights to publish any or all of the partially completed debate. The remaining side can include in the final published document the 100,000-word submission it was working on at the time of the withdrawal.

11. Within one month after receiving the fourth submission, each side can notify the editor if it feels new issues were raised in that submission. If the editor agrees, he or she may permit responses to those new issues.

12. Each side is encouraged to correct errors in its case. Corrections or deletions of previous arguments are allowed if they do not exceed that submission's word limit. If, however, a correction is suggested by an opponent's rebuttal, that error can be changed only as described in paragraph 13 below.

13. One month after the fourth submission has been made and all new issues have been answered, each side can propose that certain of its arguments be deleted or modified. This "bartering process" between debaters is intended to aid the reader by eliminating, in balanced fashion, earlier statements that are superfluous or inaccurate, or have been effectively rebutted. The editor will try to facilitate the bartering process.

14. The final form of the written debate should be as clear and readable as possible. Therefore, after the fourth submission, the editor will direct each side to gather into one coherent argument any scattered arguments dealing with a narrow topic. No new ideas can be added in this revision. In this way, readers can easily study and contrast opposing arguments. The completed written debate will be in the format directed by the editor and will include, as far as possible, the evidence and arguments placed side by side and point by point. It will consist of two main parts: (a) the evolution case with the creation rebuttals placed directly below each argument, and (b) the creation case with the evolution rebuttals placed directly below each argument. The book will begin with the shorter of the two cases.

15. One month after revisions are submitted, the editor will send a complete manuscript to each side along with a reasonable deadline for submitting final comments. After the editor finalizes the book, the publisher associated with the editor will have the "first right of refusal" to publish the written debate. If the publisher declines, each side may publish the debate or sell the publishing rights. Printed copies of the debate must contain the entire debate in final form, including the editor's preface.

16. The two debaters, by mutual consent, can modify this agreement.

[INITIAL IF APPROPRIATE] I wish to propose a change to the above procedures (1-16). However, I am willing to have the editor decide the matter after my opponent and I have presented our positions. I will abide by this ruling and participate in the written debate. My proposals are attached.

[Signed and dated by the principal debater for each side. List name, address, phone and FAX numbers, and email address.]

What Is the Recorded and Transcribed Oral/Phone Debate Offer?

The hydroplate theory, explained in this book, shows how a catastrophic, global flood rapidly produced 26 otherwise mysterious features of the earth and solar system. The theory also explains where all the flood water came from and where it went. Failure to understand the flood led to the mistaken belief in evolution over billions of years.

If you know any credible individuals who disagree with the hydroplate theory, but will not enter a written, publishable debate as explained on pages 473–475, here is their opportunity to show, before a potentially large audience, that they have a scientific case. This is also your opportunity to see if their criticisms have merit. Critics—with your urging, if necessary—should send an email to

phonedebate@creationscience.com

(1) requesting a recorded telephone debate with Dr. Walt Brown, followed with written exchanges as necessary, and (2) stating that they have read the hydroplate theory (Part II of *In the Beginning* and pertinent cross references and technical notes). Please include full name, address, phone and FAX numbers, present job, and academic background. (No particular academic credentials are required.)

Walt Brown is able to participate in a 60-minute conference-call debate once a month. This debate will be recorded by goconferencecall.com and will be available to anyone immediately afterward. The recording, in MP3 and WAV format (and its transcription), can be distributed—or broadcast—anywhere by anyone if done in its entirety. Participants may also record the call.

If more than one person wishes to debate Dr. Brown in a given month, the individual with the strongest scientific credentials will be selected. Participants will be notified at least one month before each conference call, and a mutually agreeable time for the call will be arranged. CSC will post a transcript and an audio version of each month's oral/phone debate at

www.creationscience.com/podcasts/csc_phonedebate_podcasts.rss

Others can do the same at their websites. (*As of this writing, no one has accepted this balanced offer.*)

A neutral debate moderator, jointly selected by both debaters, will be a debate instructor/coach from a randomly selected university or college in the United States. The conference call will begin with the moderator introducing both participants to the listening audience and summarizing the debate rules—namely, that all of the hydroplate theory has been read, and that no religion (only science) will be discussed. The "no religion" rule would be violated in this telephone exchange by:

- referring to religious writings, such as the Bible,
- ridiculing a deity or religious belief, or
- using a religious writing to support a scientific claim. However, using scientific evidence to reach a conclusion that happens to correspond to a religious writing would not be a violation.

After introducing the two debaters, the moderator will ask the hydroplate critic two questions:

- Is it correct that you have read the hydroplate theory?
- What is your first criticism of the theory?

Then Dr. Brown will respond and the discussion will focus on the critic's topics and related issues. The moderator's role is not to interview participants, but to listen to the exchange, enforce the rules, and ensure that both sides have about the same speaking time and questioning opportunities. If necessary, the moderator will intervene or edit out statements about religion or unprofessional comments (yelling, repeated interruptions, etc.).

If, in the moderator's opinion, the hydroplate critic has not carefully read the theory, as previously claimed, the moderator will end the conference call. Obviously, a debater's credibility falls apart if it becomes clear that he has not read what he is criticizing. Dr. Brown can question the critic on the portions of the theory that are relevant to the criticisms, but he cannot raise unrelated issues. He will not be expected to take his limited debate time to explain relevant portions that the critic has not read.

Also, the breadth of the hydroplate theory—purportedly explaining the origin of mountains, volcanoes, coal, oil, earthquakes, the Grand Canyon, ocean basins, the ice age, the frozen mammoths, fossil sorting, layered strata, rapid continental drift, earth's inner and outer core, earth's magnetic field, comets, meteorites, asteroids, earth's radioactivity, and dozens of otherwise strange features on earth—makes a thorough reading even more imperative. *The events that formed each feature often relate to and support those that formed all other features—and a global flood.* Dr. Brown will be happy to read before the debate any of the critic's specific, written objections to the hydroplate theory. If complex issues are raised, the debate could be continued a following month with calculations and writings exchanged during the interim.

Part II of this book, pages 107–371 and associated cross references (including technical notes), explain the hydroplate theory. A 170-word summary of the hydroplate theory is on page 48, and a one-chapter summary of the theory begins on page 109. Almost all critics of the hydroplate theory have not read it, choose to be anonymous, will not put their science to the test before Dr. Brown (as he will before them), or are scientifically uninformed.

Technical Notes

How Long Would It Take the Moon to Recede from Earth to Its Present Position?

Evolutionists believe that (1) the Earth and Moon are 4.5 billion years old, and (2) with enough time bacteria will change into people. We have all heard some evolutionists say, "Given enough time, anything can happen." This simplistic attitude overlooks two things. First, most conceivable events will not happen, because they would violate well-established laws of science.[1] Second, if 4.5 billion years have elapsed, many things should have occurred that obviously have not. Rather than time being "the hero of the plot," as one prominent evolutionist stated,[2] immense amounts of time cause problems for evolution, as you will now see.

Most dating techniques, including the majority that indicate young ages, make the three basic assumptions given on page 36. The following dating technique has few, if any, major assumptions. It relies basically on only the law of gravity and one undisputed and frequently repeated measurement. *We will look at the forces causing the Moon to spiral farther and farther away from Earth. Then we will see that this spiraling action could not have been happening for the length of time evolutionists say that the Earth and Moon have been around.*

It will be shown that if the Moon began orbiting very near the Earth, it would move to its present position in only 1.2 billion years. Stated another way, if we could run time backwards, in 1.2 billion years the Moon would be so close to Earth that ocean tides would sweep over all mountains. Astronomers who are aware of this problem call it "the lunar crisis."[3] Notice that this conclusion does not say that the Earth-Moon system is 1.2 billion years old; it only says that the Earth-Moon system must be *less than* 1.2 billion years old. If the Moon began orbiting Earth slightly inside the Moon's present orbit, its age would be much less. Obviously, something is wrong with either the law of gravity or evolutionists' belief that the Earth-Moon system is 4.5 billion years old. Most astute people would place their confidence in the law of gravity, which has been verified by countless experiments.

What causes tides? If the Moon's gravity attracted equally every particle in and on Earth, there would be no tides. Tides are caused by slight differences in the Moon's gravitational forces throughout Earth.[4] As shown in Figure 206, the Moon pulls more on ocean particle A, directly under the Moon, than it does the center of Earth, C, because A is closer to the Moon. Therefore, A, pulled with slightly more force, moves proportionally farther toward the Moon than C, creating a tidal bulge. Likewise, water particle B, on the far side of Earth, is pulled with slightly less force than C. This difference pulls Earth away from B, creating the far tidal bulge.

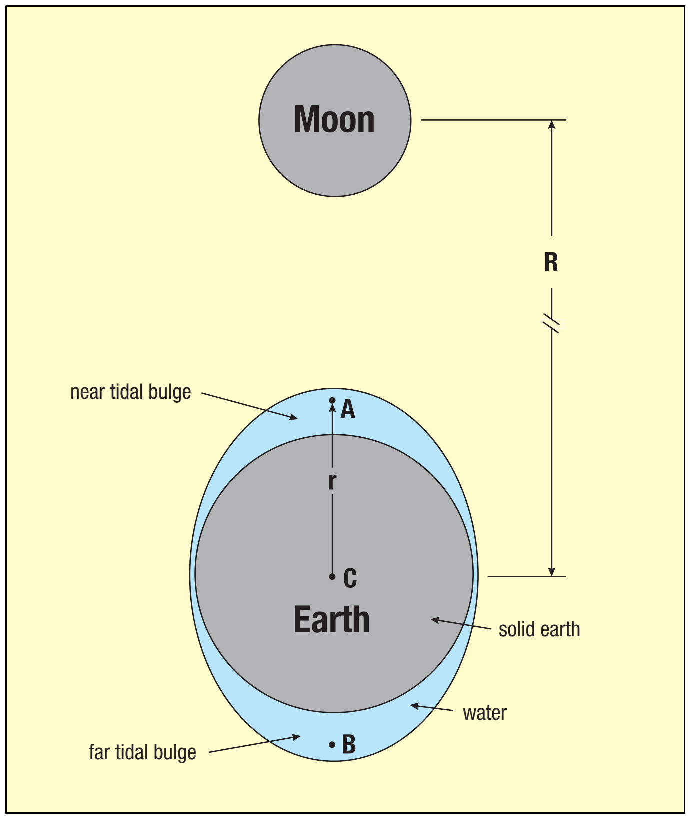


Figure 206: Why the Moon Produces Tides on Earth.

How does the height of ocean tides relate to the Earth-Moon separation distance (R)? According to Newton's law of gravitation, the Moon's gravitational force pulls on Earth's center of mass (C) with a force proportional to $1/R^2$. Water particle A directly under the Moon is one Earth radius (r) closer, so it is pulled by a force proportional to $1/(R-r)^2$. The difference between these forces is proportional to

$$\frac{1}{(R-r)^2}-\frac{1}{R^2}=\frac{R^2-(R-r)^2}{(R^2)(R-r)^2}=\frac{2rR-r^2}{(R^2)(R-r)^2} \qquad (1a)$$

Because r is much less than R, the numerator on the right is almost 2rR and its denominator is almost R^4. Therefore, the force difference producing tides and tide heights is approximately proportional to

$$\frac{2rR}{R^4}=\frac{2r}{R^3} \qquad (1b)$$

Because Earth's radius (r) is constant, we can conclude that the height of the tides is proportional to $1/R^3$. For example, if the Earth-Moon distance suddenly doubled, tides caused by the Moon would be only 1/8 as high.[5]

How do tides affect the Moon's orbit and the Earth's spin rate? Surprisingly, the tidal bulges do not line up directly under the Moon as shown in Figure 206. This is because the spinning Earth carries the bulges out of alignment as shown in Figure 207. If Earth spun faster in the past, as we will see, the misalignment would have been even greater.

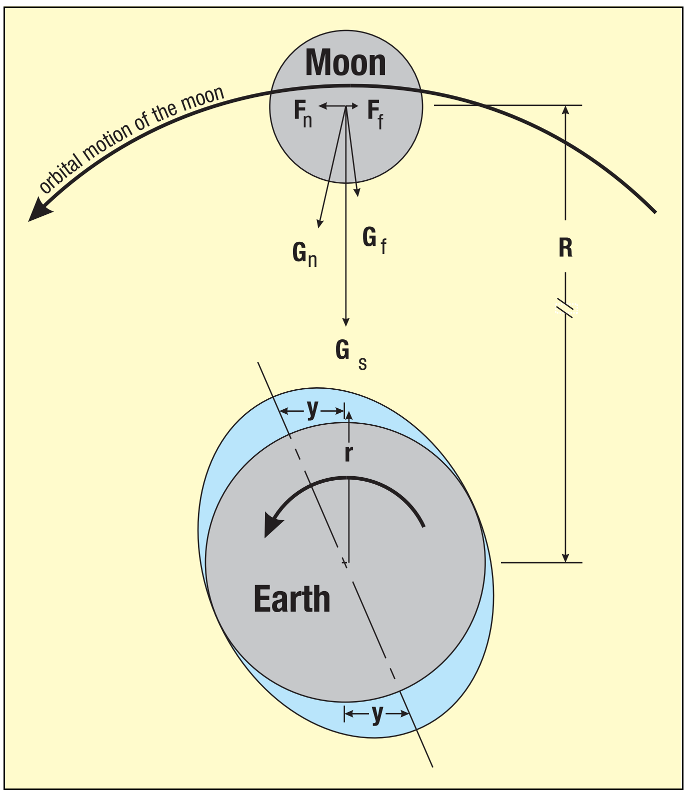


Figure 207: Rotated Tidal Bulges.

Let's think of Earth as composed of two parts: a spherical portion (gray in Figure 207) and the tidal bulges—both water and solid tides.[6] G_s is the gravitational force the Moon feels from the *spherical* portion of Earth. Because G_s is aligned with the centers of Earth and Moon, it does not alter the Moon's orbit. However, the near tidal bulge, because it is offset, pulls the Moon in a direction shown by G_n, with a tangential component, F_n, in the direction of the Moon's orbital motion. F_n accelerates the Moon in the direction it is moving, flinging it into an increasingly larger orbit. The far tidal bulge has an opposite but slightly weaker effect—weaker because it is farther from the Moon. The *far* bulge produces a gravitational force, G_f, and a retarding force on the Moon, F_f. The net strength of this accelerating force is $(F_n - F_f)$. It can also be thought of as a thrust pushing the Moon tangential to its orbit, moving the Moon farther from Earth. This accelerating force allows us to calculate an *upper limit* on the age of the Moon. Today's recession rate has been precisely measured at 3.82 cm/yr,[7] but as you will see, it was faster in the past.

Conversely, the Moon's net gravitational pull applies an equal and opposite force on Earth's tidal bulges, slowing Earth's spin. In other words, the Earth spun slightly faster in the past.

How does $(F_n - F_f)$ relate to the Earth-Moon separation distance (R)? Using similar triangles,

$$\frac{F_n}{G_n}=\frac{y}{\sqrt{(R-r)^2+y^2}}\approx\frac{y}{R-r} \qquad \frac{F_f}{G_f}=\frac{y}{\sqrt{(R+r)^2+y^2}}\approx\frac{y}{R+r}$$

$$G_n=\frac{Gmm_b}{(R-r)^2} \qquad G_f=\frac{Gmm_b}{(R+r)^2}$$

where y is the misalignment distance of each tidal bulge, m is the Moon's mass, m_b is the mass of each tidal bulge, and G is the gravitational constant. Solving for $(F_n - F_f)$

$$(F_n-F_f)\approx 6rGmy\left(\frac{m_b}{R^4}\right)$$

Equation 1b showed that the mass of a tidal bulge, m_b, is approximately proportional to $1/R^3$, that is

$$m_b=\frac{C_1}{R^3}$$

where C_1 is the constant of proportionality. Therefore

$$(F_n-F_f)\approx 6rGmy\left(\frac{C_1}{R^7}\right) \qquad (2)$$

The velocity of the Moon (or any body in a circular orbit) is

$$V=\sqrt{\frac{G(M+m)}{R}}$$

where M is Earth's mass (or the mass of the central body).

Differentiating both sides with respect to time (t) and solving for $\frac{dR}{dt}$ gives

$$\frac{dR}{dt} = (-2)\left(\frac{dV}{dt}\right)\frac{R^{\frac{3}{2}}}{\sqrt{G(M+m)}}$$

Because the Moon's tangential acceleration, $\frac{dV}{dt}$, is equal to $\frac{(F_n - F_f)}{m}$, which is known from equation (2)

$$\frac{dR}{dt} = (-2)\left(6rGy\frac{C_1}{R^7}\right)\frac{R^{\frac{3}{2}}}{\sqrt{G(M+m)}} \qquad (3)$$

The slight displacement of the tidal bulge (y), as mentioned earlier, is proportional to the difference in the Earth's spin rate (ω) and the Moon's angular velocity (ω_L). In other words,

$$y = C_2\,(\omega - \omega_L) \qquad (4)$$

Substituting (4) into (3) and replacing the product of all constants by C gives

$$\frac{dR}{dt} = \frac{C(\omega - \omega_L)}{R^{\frac{11}{2}}} \qquad (5)$$

C is found by using today's values (subscript t)

$$C = \left(\frac{dR}{dt}\right)_t \frac{R_t^{\frac{11}{2}}}{(\omega - \omega_L)_t} \qquad (6)$$

Kepler's third law shows how $(\omega - \omega_L)$ varies with R:

$$\omega_L = \sqrt{\frac{G(M+m)}{R^3}} \qquad (7)$$

Applying the law of conservation of angular momentum gives

$$P\omega + \frac{Mm}{M+m}R^2\,\omega_L = L \qquad (8)$$

where the constant L is the angular momentum of the Earth-Moon system, and P is Earth's polar moment of inertia. Combining (7) and (8) gives

$$\omega = \frac{L}{P} - \frac{Mm}{P}\sqrt{\frac{GR}{M+m}} \qquad (9)$$

Substituting (6), (7), and (9) into (5) gives us the final equation. Because it has no closed-form solution, it will be solved by numerical iteration. The steps begin by setting the clock to zero and R to its present value of 384,400 km. Then time is stepped backwards in small increments (dt) until the centers of the Moon and Earth are only 15,000 km apart. Had this happened, ocean tides would have steadily grown to a ridiculous 12.8 km (8 miles) high and left marks on Earth that would be—but obviously are not—visible.[8]

$$R_{i+1} = R_i - \left[\frac{C}{R^{\frac{11}{2}}}(\omega - \omega_L)_i\right]dt \qquad \text{from (5)}$$

$$t_{i+1} = t_i + dt$$

$$\omega_{i+1} = \frac{L}{P} - \frac{Mm}{P}\sqrt{\frac{GR_i}{M+m}} = \frac{L}{P} - bR_i^{\frac{1}{2}} \qquad \text{from (9)}$$

$$(\omega_L)_{i+1} = \sqrt{G(M+m)}\,R_i^{-\frac{3}{2}} = a\,R^{-\frac{3}{2}} \qquad \text{from (7)}$$

The QuickBasic program that solves this system of equations (shown on page 480) gives *1.2 billion years as the upper limit for the age of the Moon.* (If the Moon began moving away from Earth 1.2 billion years ago, the Earth would have rotated once every 4.9 hours.)

Two complicated effects were neglected that would further reduce this upper limit for the Moon's age.[9]

1. Evolutionists believe that the Earth formed by gravitational accretion of smaller bodies. If so, the impacts would have left a molten Earth. The Earth, throughout its history, would have been less rigid than it is today. Therefore, tidal bulges would have been larger, causing the Moon to spiral away from the Earth even faster than we calculated here.

2. Internal friction from tidal stretching of the solid Earth reduces Earth's spin velocity. A greater value for ω in the past would have increased the tidal misalignment and the Moon's recession over what we assumed above. This would have been especially severe if the Earth had been less rigid in the past.

Incorporating these effects into the above analysis would make the *upper limit* on the Moon's age even less than 1.2 billion years.

One might argue that 1.2 billion years ago the Moon was captured by the Earth or blasted from the Earth by an extraterrestrial collision.[10] These events would have placed the Moon in a very elongated orbit. Today, Earth's Moon and most of the almost 200 other known moons in the solar system are in nearly circular orbits.[11] So many circular, or nearly circular, orbits are difficult for evolutionists to explain with any rigor.[12] Therefore, it is highly unlikely that the Moon (1) was captured, (2) was blasted from Earth by an extraterrestrial collision, or (3) somehow began orbiting Earth 1.2 billion years ago. Its orbit is too circular. (Other problems with evolutionary theories on the Moon's origin are discussed under **"Origin of the Moon"** on page 29.)

Besides mountain-eroding tides, what other implications would a 1.2-billion-year-old Moon have for organic evolution and the age of Earth? Evolutionists claim that certain fossils are 2.8–3.5 billion years old. Had the Moon begun orbiting Earth 1.2 billion years ago, such fossils would have been pulverized by the havoc of gigantic tides. Evidently, the Moon did not originate near Earth. This further reduces the maximum age of the Moon.

All other dating techniques must assume how fast the dating clock has always ticked and the clock's initial setting. For example, radiometric techniques assume, with much less certainty, that each radioactive isotope has a constant half-life. This analysis on the Moon's recession assumes that only the law of gravity has been constant. Neither assumption can be proven, but there is no doubt which assumptions scientists would favor. If Newton's law of gravitation did not hold in the past, our scientific foundations would crumble. However, if the Moon is less than 1.2 billion years old, a few evolutionary preconceptions must be discarded. But that's progress.

```
PROGRAM
   DEFDBL A-Z          'DOUBLE PRECISION
   dt = 1              'TIME INCREMENT (yr)
   G = 6.64E-08        'THE GRAVITATIONAL CONSTANT (km^3 gm^-1 yr^-2)
   LOP = 13486.23      'ANGULAR MOMENTUM OF EARTH-MOON SYSTEM / P (1/yr)
   ME = 5.97E+27       'MASS OF THE EARTH (gm)
   mm = 7.35E+25       'MASS OF THE MOON (gm)
   P = 8.068E+34       'EARTH'S POLAR MOMENT OF INERTIA (gm km^2)
   R = 384400          'TODAY'S EARTH-MOON SEPARATION DISTANCE (km)
   Rdot = 0.0000382    'TODAY'S RATE OF CHANGE OF R (km/yr)
   w = 2301.22         'TODAY'S ANGULAR VELOCITY OF THE EARTH'S SPIN (rad/yr)
   wL = 83.993         'TODAY'S ANGULAR VELOCITY OF THE MOON'S ROTATION (rad/yr)
   t = 0               'TIME, THE NUMBER OF YEARS AGO (yr)

   a = SQR(G * (ME + mm))
   b = ME * mm * SQR(G / (ME + mm)) / P
   C = Rdot * R ^ 5.5 / (w - wL) 'FROM (6)

'marching solution begins

DO
   R = R - (C * (w - wL) / R^5.5) * dt 'FROM (5)
   IF R < 15000 THEN LPRINT "The upper limit on the Moon's age is"; t; "years.": END
   w = LOP - b * SQR(R)          'FROM (9)
   wL= a * R ^ -1.5              'FROM (7)
   t = t + dt
LOOP

OUTPUT

The upper limit on the Moon's age is 1,198,032,532 years.
```

References and Notes

1. If you disagree, hold a rubber ball at arm's length and release it. Of the many possible paths the ball could conceivably take (actually an infinite number), it will follow only one. As another example, compress the ball between two surfaces. Of the many possible ways the ball might deform, it will deform in a way that minimizes its stored energy. These are consequences of physical laws. Most things will not happen, even with an infinite amount of time. Protons will not turn into planets, plants, or people.

2. George Wald, "The Origin of Life," *Scientific American*, Vol. 191, August 1954, p. 48.

3. Two international conferences have tried to address this problem. [See P. Brosche and J. Sündermann, editors, *Tidal Friction and the Earth's Rotation* (New York: Springer-Verlag, 1978) and P. Brosche and J. Sündermann, editors, *Tidal Friction and the Earth's Rotation II* (New York: Springer-Verlag, 1982).] The studies presented were of mixed quality; none considered the effect described in

equations 4–9, and all left this recognized problem somewhat "out of focus."

4. We will consider only the Earth-Moon interaction. The Sun's tidal effect is about half that of the Moon.

5. If a force (or a change in force) is small, the displacement it produces is proportional to the force if all states passed through are equilibrium states. For example, a small displacement of an extension spring is proportional to the force causing the displacement. This doesn't hold if the spring breaks or stretches beyond its elastic limit. Tidal forces and displacements at a particular location are quite small.

◆ Once R is fixed, the tide's height at a specific location depends on many other factors, especially the shape of the coastline and seafloor. When high tides arrive at a coastline with a narrow, funnel-shaped bay, tide heights increase. At the Bay of Fundy in eastern Canada, tides rise and fall up to 48 feet twice daily. The average tidal amplitude on the open ocean is about 30 inches. Inland lakes have small tides. Lake Superior, for example, has 2-inch tides.

Tides also occur in the atmosphere and solid Earth. Relative to the center of the Earth, the foundation of your home (and everything around it) may rise and fall as much as 12 inches (relative to the center of the earth), depending on your latitude. Ocean tides are the primary cause of the Moon's recession.

6. Earth's mountain ranges and equatorial bulge can be disregarded in this analysis, because their effects on the Moon's recession cancel over many orbits.

7. Laser beams have been bounced off arrays of corner reflectors left on the Moon by three teams of Apollo astronauts and the Russian Lunakhod 2 vehicle. Knowing today's speed of light and the length of time for the beam to travel to the Moon and back gives the Moon's distance. This has been successfully done more than 8,300 times since August 1986. Adjusting for many other parameters that affect the Moon's orbit gives its recession rate: 3.82 ± 0.07 cm/yr. [See J. O. Dickey et al., "Lunar Laser Ranging: A Continuing Legacy of the Apollo Program," *Science*, Vol. 265, 22 July 1994, p. 486.] This recession was first recognized in 1754 by observing the Moon's increasing orbital period. [For details see Walter H. Munk and Gordon J. F. MacDonald, *The Rotation of the Earth* (Cambridge, England: Cambridge University Press, 1975), p. 198.]

8. How high would tides be if the Earth-Moon distance (R) were 15,000 km? (Whether or not the Moon would be pulled apart if it were ever that near Earth will be bypassed. It depends on many factors, including the Moon's tensile strength, its rotation rate, and a subject called *Roche's limit*.)

From equation 1b, the tidal height varies as $1/R^3$. The average height of tides on the open ocean today (with R = 384,400 km) is 30 inches or 0.76 meter. [See Endnote 5, above.] Therefore, if R were ever 15,000 km, the tidal height would be

$$0.76 \times 10^{-3} \left(\frac{384,400}{15,000} \right)^3 = 12.8\,\text{km} = 8\,\text{miles}$$

Tides more than a mile high would occur if R < 30,000 km = 18,606 miles.

9. In a much more detailed study that incorporated many more variables than I have, Touma and Wisdom arrived at a similar answer.

> *The evolution of the lunar semimajor axis presents the well-known time scale problem; the lunar orbit collapses only a little over a billion years ago.* Jihad Touma and Jack Wisdom, "Evolution of the Earth-Moon System," *The Astronomical Journal*, Vol. 108, November 1994, p. 1954.

They then disregarded the consequences of their work by saying, *"Presumably, the tidal constants have changed as the continents have drifted."*

Another problem they uncovered, but also chose to ignore, is that as the Moon approaches the Earth, its orbit becomes highly inclined to Earth's equator. All evolution theories for the Moon have it beginning in the plane of Earth's equator.

> *We are presented with an unresolved mystery. All theories of lunar formation require that formation take place in the equator plane, yet models of tidal evolution do not place the Moon there.* Touma and Wisdom, p. 1955.

The answer to both these mysteries is that the Moon did not evolve.

10. The other evolutionary theories on the Moon's origin require it to have an age of 4.5 billion years. Because we have seen that the Moon cannot be older than 1.2 billion years, and it may be much younger, these other theories can be rejected.

11. Today, the Moon's orbital eccentricity is 0.0549. A perfect circle has zero eccentricity. An extremely elongated elliptical orbit has an eccentricity of slightly less than 1.000. The ellipse in Figure 151 on page 276 has an eccentricity of about 0.65.

12. Most people, even scientists, do not appreciate the difficulty of placing a satellite in a nearly circular orbit. For an artificial satellite to achieve such an orbit, several "burns" are required at just the right time, in just the right direction, and with just the right thrust. Most planets and many moons have nearly circular orbits. How could this have happened?

How Much Dust and Meteoritic Debris Should the Moon Have If It Is 4,600,000,000 Years Old?

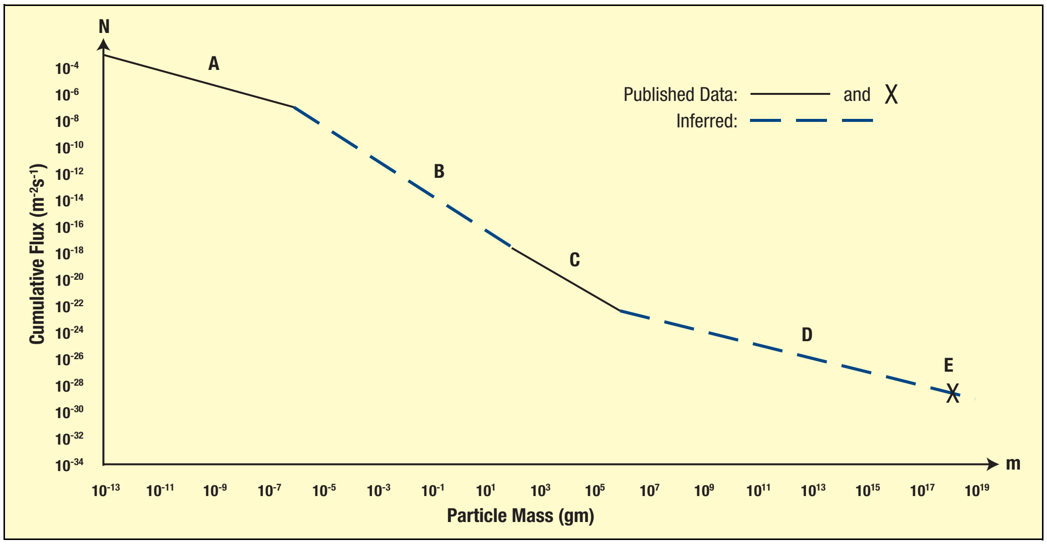


Figure 208: Cumulative Meteoritic Flux vs. Particle Mass.

In 1981, I had a conversation with Dr. Herbert A. Zook of the U.S. National Aeronautics and Space Administration (NASA). He had been intimately involved in estimating the thickness of the dust layer on the Moon before the first Apollo Moon landing. He also helped analyze the lunar material brought back from the Moon. Of the many interesting things he told me and gave me, one is critical in answering the above question.

NASA did not realize until the Moon dust and rocks were analyzed that only one part in 67 (or 1.5%) of the debris on the Moon came from outer space. The rest was pulverized Moon rock. In hindsight, this makes perfect sense. Meteorites that strike the Moon travel about 10 times faster than a bullet—averaging 20 km/sec. When they strike the Moon, they are not slowed down by an atmosphere (as on Earth), because the Moon has no atmosphere. Suddenly decelerating a meteorite traveling 20 km/sec to a "dead stop" would compress every atom in it and raise each particle's temperature to many hundreds of thousands of degrees Celsius. Therefore, each projectile, regardless of size, instantly fragments and vaporizes upon impact, kicking up a cloud of pulverized Moon rocks. Vaporized portions of the meteorite then condense on the pulverized Moon rocks. This was discovered by slicing Moon rocks and finding them coated by meteoritic material—material rich in nickel. Pure Moon rocks have little nickel. In this way, NASA arrived at the factor of 67.[1]

The Data

How much meteoritic material is striking the Moon? More specifically, how many particles (N) *greater than* a certain mass (m) pass through a square meter on the Moon's surface each second? This is called the cumulative flux. The data are usually reported on a coordinate system as shown in Figure 208. Logarithmic scales are used, because so many more smaller particles strike the Moon than larger particles.

Particle sizes vary widely. Solar wind blows most particles smaller than 10^{-13} gram out of the solar system. At the other extreme are large crater-forming meteorites. Measurements exist for the influx of meteoritic material in three regions across this broad range. The first will be called Region A; the second will be called Region C; and the last will be called Point E. Regions B and D are interpolated between these known regions and are shown as the blue dashed lines in Figure 208.

Region A is based on impacts registered on a satellite 0.98–1.02 astronomical units from the Sun.[2] The curve for Region A is

$$\log N_A = -10.08 - 0.55 \log m \qquad (10^{-13} < m < 10^{-6} \text{ gm})$$

Seismometers placed on the Moon provided the data for Region C.[3] The results, again where N_C is the number of particles per square meter per second that are greater than mass m, were

$$\log N_C = -15.12 - 1.16 \log m \qquad (10^{2} < m < 10^{6} \text{ gm})$$

The equation for Region B is obtained by finding the line that joins the far right point in Region A with the far left point in Region C. That equation is

$$\log N_B = -14.77 - 1.33 \log m \qquad (10^{-6} < m < 10^{2} \text{ gm})$$

Point E is based on the fact that "there are 125 structures [craters] on the Moon with diameters greater than 100 km."[4] The diameter of a large meteorite, impacting at typical velocities, is about 12% of its crater's diameter. If the density of meteorites is 3 gm/cm^3, then the mass of a meteorite that could form a crater 100 km in diameter would be

$$\frac{4}{3}\pi\left(\frac{0.12\times 100\,\mathrm{km}}{2}\right)^3\left(\frac{10^5\,\mathrm{cm}}{\mathrm{km}}\right)^3 \times 3\frac{\mathrm{gm}}{\mathrm{cm}^3} = 2.71\times 10^{18}\,\mathrm{gm}$$

The Moon's surface area is 3.8 × 10^{13} m^2. If the largest 125 meteorites struck the Moon during the last 4.6 × 10^9 years, then the average cumulative flux at Point E is

$$N_E = \frac{125}{4.6\times 10^9 \times 365.24 \times 24 \times 3600\,\mathrm{sec}} \times \frac{1}{3.8\times 10^{13}\,\mathrm{m}^2}$$
$$= 2.266\times 10^{-29}\,\frac{1}{\mathrm{m}^2\,\mathrm{sec}}$$

Point E connects to Region C by the curve

$\log N_D = -18.91 - 0.53 \log m \qquad (10^6 < m < 2.7 \times 10^{18}\ \mathrm{gm})$

The task now is to integrate the total mass of meteoritic material in Regions A, B, C, and D. To do this, we must convert these cumulative flux curves to the thickness of meteoritic material.

Integration

The general form of the cumulative flux curves is

$$\log N = a + b \log m$$

which is equivalent to

$$N = 10^a m^b = \int_m^\infty n\,dm$$

where n(m) is the distribution function of the number of particles of size m.

Differentiating both sides of the right equation above with respect to m gives

$$10^a\,(b)\,m^{b-1} = -n$$

Multiplying the number of particles (n) in a narrow mass range (dm) by the mass m and then integrating between m_1 and m_2 gives the total mass within that size range [m_1–m_2] that accumulates per square meter per second.

$$\int_{m_1}^{m_2} n\times m\,dm = 10^a\left(\frac{b}{b+1}\right)\left(m_1^{b+1} - m_2^{b+1}\right)$$

Within this mass range, the thickness (t) of pulverized meteoritic material that will accumulate on the Moon's surface in 4.6 × 10^9 years, *if the influx has always been at today's rate*, is

$$t_{1-2} = 10^a\left(\frac{b}{b+1}\right)\left(m_1^{b+1} - m_2^{b+1}\right)k$$

where

$$k = \frac{4.6\times 10^9 \times 365.24 \times 24 \times 3600\,\mathrm{sec}}{2\,\dfrac{\mathrm{gm}}{\mathrm{cm}^3}}\left(\frac{\mathrm{m}}{100\,\mathrm{cm}}\right)^3$$

and the density of the pulverized lunar crust is 2 gm/cm^3.

The total thickness of meteoritic material *and pulverized Moon rock* during 4.6 × 10^9 years is

$$(t_A + t_B + t_C + t_D)\,67$$

where 67 is the ratio of the pulverized Moon rocks to meteoritic material. Table 29 gives the calculated values for the various thicknesses.

Table 29. Computed Thickness of Lunar Dust

Region	a	b	Mass Range (gm)	67 × t_{A-D} (meters)
A	-10.08	-0.55	10^{-13} to 10^{-6}	0.98
B	-14.77	-1.33	10^{-6} to 10^2	3.17
C	-15.12	-1.16	10^2 to 10^6	0.01
D	-18.91	-0.53	10^6 to 2.71×10^{18}	310.86
			Total Thickness =	***315.02 m***

We will disregard debris contributed by the region to the right of Point E.

Discussion

The lunar surface is composed of a powdery soil, an inch or so thick, below which are 4–10 meters of regolith.[5] The Moon's regolith consists of a range of particle sizes from fine dust up to blocks several meters wide. Meteoritic impacts overturn and mix this soil-regolith, each time coating the outer surfaces with very thin layers of condensed meteoritic material.

The expected thickness of the soil-regolith, as shown in Table 29, exceeds by about 50 times its actual thickness. (That table assumes that the Moon has been bombarded for 4.5 billion years *at only today's rate.)* ***Most of this calculated thickness comes from Region D***—meteorites larger than 10^6 grams but smaller than meteorites that can form craters 100 km in diameter. Why are the contributions from Regions A, B, and C so much smaller?

We made two faulty assumptions. First, we assumed that the influx of meteoritic material, for Regions A, B, and C, has always been what it is today. Obviously, as time has passed, the influx has decreased enormously because moons and planets sweep meteoritic material up or expel it beyond the Earth-Moon neighborhood. In other words, the influx of smaller dust particles in the past was much greater than satellite and moon-based seismometers have detected recently. Only Point E, which strongly influenced Region D, did not have that assumption. Point E is based on rocks that we know struck the Moon sometime in the past. Removing this assumption *increases the expected thickness even more in all regions*[6] and would partly explain why Region D contributes so much to our total expected thickness.

Second, Table 29 assumes that the impactors fell steadily from outer space as they do today. However, Figure 147's description on page 273 explains why most large lunar impactors probably originated from Earth and struck the Moon within a few years after the flood began. Heat flow measurements on the Moon are also consistent with a recent cratering event. [See **"Hot Moon"** on page 41 and the corresponding endnote on page 102.]

What if all lunar impactors were of two types: primary and secondary? The primary impactors were large, extremely *high-velocity* rocks launched from Earth by the fountains of the great deep. Those impacts, perhaps after a few years of orbiting the Sun, formed the Moon's giant, multiringed basins. The resulting debris and other space debris were secondary impactors. Consequently, primary impactors account for Point E, and secondary impactors account for much smaller and slower impactors. Therefore, Region D received less impactor mass than our interpolation assumed.

Conclusion

The relative small amount of debris on the Moon is inconsistent with what we would expect if the solar system and Moon evolved over 4.6×10^9 years. It appears that two types of impacts have occurred:

a. a brief and recent interval of very high-velocity impacts by rocks launched from Earth, many of which were large, and
b. a diminishing number of smaller impacts, distributed today as shown in Regions A–C.

Several individuals have published attempts to answer the question of this technical note. Those efforts have usually (1) neglected the factor of 67, (2) ignored the large impacts shown by Point E, (3) assumed that the influx rate has always been what it is today, and (4) overlooked the relatively recent event that produced meteorites, pummeled the Moon, and provided secondary impactors.

References and Notes

1. This number has also been published.
   The content of meteoritic material in mature lunar soils is about 1.5 percent. Stuart Ross Taylor, *Lunar Science: A Post-Apollo View* (New York: Pergamon Press, Inc., 1975), p. 92.
2. David W. Hughes, "Cosmic Dust Influx to the Earth," *Space Research XV*, 1975, pp. 531–539.

◆ More recent work has confirmed the cumulative mass flux in the 10^{-9} to 10^{-4} gram size range. [See S. G. Love and D. E. Brownlee, "A Direct Measurement of the Terrestrial Mass Accretion Rate of Cosmic Dust," *Science*, Vol. 262, 22 October 1993, pp. 550–553.]

3. Taylor, p. 92.
4. Ibid., p. 84.
5. Ibid., p. 58.
6. Evolutionists admit that the flux rate has decreased, at least in Region C, by about a factor of 10.
   This flux is about one order of magnitude less than the average integrated flux over the past three aeons, calculated on the basis of crater counts on young lunar maria surfaces. Ibid., p. 92.

Did the Preflood Earth Have a 30-Day Lunar Month?

> *Then God said, "Let there be lights in the expanse of the heavens to separate the day from the night, and let them be for signs, and for seasons, and for days and years and let them be for lights in the expanse of the heavens to give light on the earth"; and it was so. And God made the two great lights, the greater light* [the Sun] *to govern the day, and the lesser light* [the Moon] *to govern the night;*
>
> Genesis 1:14–16a

Genesis 7:11, 7:24, and 8:3–4 tell us that exactly 5 months elapsed during the first 150 days of the flood. Could the preflood Earth have had 30-day months? Page 155 and Endnote 23 on page 169 explain why the preflood Earth probably had a 360-day year. This would make 30-day lunar months an ideal way to divide a year. The changing phases of the Moon would clearly show each month's progression to everyone on Earth.

The problem with this idea is that today the average time between successive full Moons is 29.531 days—not 30 days. If preflood months were 30 days long, but today are 29.531 days long, then the Moon's orbit was probably "pulled" closer to Earth as a consequence of the flood. (Satellites travel faster the closer they are to the body they orbit. A satellite orbiting very close to Earth completes one orbit in about 90 minutes.)

The energy (E) of a body of mass m (such as the Moon) orbiting a much larger body of mass M (such as the Earth) is

$$E = \frac{-GmM}{2a}$$

where G is the gravitational constant and a is the semimajor axis of the orbiting body. The orbiting body's period (P) is

$$P = 2\pi\sqrt{\frac{a^3}{GM}} \qquad \text{so} \qquad a = \left[\frac{P^2(GM)}{4\pi^2}\right]^{\frac{1}{3}}$$

Solving for E in terms of P gives

$$E = K\,P^{-\frac{2}{3}} \qquad \text{where } K = -m\left[\frac{(\pi GM)^2}{2}\right]^{\frac{1}{3}}$$

As explained on page 155, before the flood (bf), a day was probably 365.256/360 times longer than a day is after the flood (af). If the Moon had a 30-day period before the flood, it would have lost 2.0% of its orbital energy as a result of the flood.

$$\frac{E_{bf} - E_{af}}{E_{bf}} = \frac{P_{bf}^{-\frac{2}{3}} - P_{af}^{-\frac{2}{3}}}{P_{bf}^{-\frac{2}{3}}} = \frac{\left(30\times\frac{365.256}{360}\right)^{-\frac{2}{3}} - (29.531)^{-\frac{2}{3}}}{\left(30\times\frac{365.256}{360}\right)^{-\frac{2}{3}}} = -0.020$$

The cratered Moon has been severely bombarded. [See Figure 147 on page 273 and Item 12 on page 288.] Did the debris (rocks, ice, and water molecules), launched into space during the flood, remove 2% of the Moon's energy? While these particles would have a wide range of orbits, the greatest concentration of debris would initially travel near to and roughly parallel with Earth's orbit. Half the time, the Moon would have traveled generally in the same direction as this dense debris, so collisions would have been few and of low velocity. During the other half of the Moon's orbit, orbiting debris would have opposed the Moon's motion; many high-velocity collisions would have removed energy from the Moon's orbit.

The Moon would have been analogous to a massive truck that every 15 days traveled in the proper lane (with the flow of traffic). On alternate 15-day periods, this "truck" traveled in the wrong lane (facing oncoming traffic), experienced many collisions, and lost some of its energy.

Ice and water vapor hitting the Moon would contribute to a thin lunar atmosphere. That atmosphere, especially on the side of the Moon facing the Sun where temperatures reach 260°F, would steadily escape the Moon's gravity. Escaping water molecules would then be available for additional collisions with the Moon on future orbits. Therefore, water particles in the inner solar system would have been used multiple times in removing energy from the Moon's orbit. (Although a water particle's mass was small, the water's total mass and momentum were large.) Eventually, these particles would have been scattered, and most would have been absorbed by the Sun and planets.

The Apollo 17 crew discovered that the Moon has an extremely thin atmosphere, about 10^{-14} that of Earth. These gases come from several sources, but the relatively large amount of oxygen present probably comes from dissociated water vapor that collided with the Moon. Today's lunar atmosphere may be a remnant of what existed on the Moon soon after the flood. Water recently discovered on the Moon falsifies theories on the Moon's evolution, but is consistent with the hydroplate theory. [See Endnote 48f on page 87 and Endnote 17 on page 294.]

If the preflood Earth had a 30-day lunar month, as appears likely, people living then would have had a marvelous system for telling calendar time—one that was simple, free, visible to all, standardized worldwide, and fixed with respect to the seasons.

At the end of the creation week, "*God saw all that He had made, and behold, it was very good.*" (Genesis 1:31) Seldom are we able to understand how much better things were then. However, with regard to measuring time, we now can better imagine how "very good" things once were.

Does Subduction Really Occur?

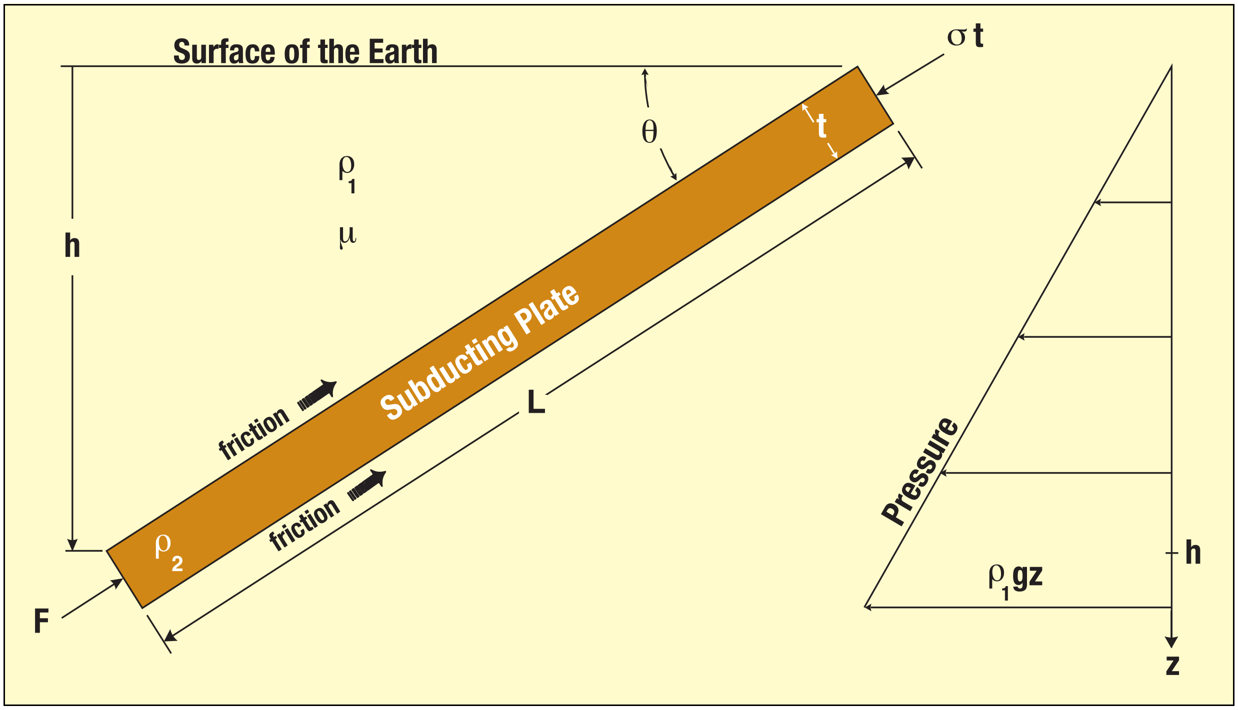


Figure 209: A Plate Trying to Subduct.

A plate, which may or may not be subducting, has a length L, thickness t, a unit depth, and density ρ_2. It is inclined at an angle θ below the horizontal and is pushed by a compressive stress σ through rock whose density is ρ_1. Solid-to-solid friction, with a coefficient of μ, acts to a depth h. The lithostatic pressure at a depth z is the mean density ρ_1 times z times the acceleration due to gravity g. A drag force F opposes movement at the leading edge of the plate.

To make subduction as likely as possible, assume that:

- The thrusting force, σ t, is perfectly aligned with the subduction angle θ.
- The thrusting force is the maximum possible, but does not exceed the crushing strength of the subducting plate.
- The plate is denser than the mantle surrounding it. (*This assumption is necessary or else the plate would not sink. Actually, the mantle, through which the plate must push, is much denser than the plate.*)

For the plate to subduct, the sum of the forces down and to the left must exceed the sum of the forces up and to the right. That is:

{Net Thrust} + {Body Forces} > {Friction on Top and Bottom Surfaces}

$$(\sigma\,t - F) + g(\rho_2 - \rho_1)Lt\sin\theta > \left(\rho_1 g\frac{h}{2}L\mu\right) + \left(\rho_1 g\frac{h}{2} + \rho_2 g\,t\cos\theta\right)L\mu$$

In dimensionless form, this simplifies to

$$\frac{\left(\sigma - \frac{F}{t}\right)}{\rho_1 g L\sin\theta} + \left(\frac{\rho_2}{\rho_1} - 1\right) > \left(\frac{L}{t} + \frac{\rho_2}{\rho_1}\operatorname{ctn}\theta\right)\mu$$

The coefficient of static friction for rock against rock is about 0.6, and it is largely independent of the mineralogical composition and temperature up to about 350°C. Typical values for the above inequality are shown below.

$$\sigma = 2\times10^9\ \frac{\text{dynes}}{\text{cm}^2} \qquad g = 980\ \frac{\text{cm}}{\text{sec}^2}$$

$$\rho_1 = 3.2\ \frac{\text{gm}}{\text{cm}^3} \qquad \rho_2 = 3.5\ \frac{\text{gm}}{\text{cm}^3}$$

$$L = 160\text{ km} \qquad t = 80\text{ km}$$

$$\theta = 30^\circ \qquad \mu = 0.6$$

To make subduction much more likely, let's assume that F = 0. Substituting these values in the above inequality gives the *false* statement that

$$0.04 \;+\; 0.09 \;>\; (2.000 \;+\; 1.894) \times 0.6$$

Because *the inequality cannot be satisfied, a pushing force will not cause subduction.* Remember, we made the very generous assumption that F=0. In other words, the blunt end of a plate 30–60 miles thick, and hundreds of miles wide, experiences no resistance as it is pushed through the Earth's rock crust. (Even if the coefficient of friction were only 0.031, one-nineteenth of the above value and F=0, subduction could still not occur!)

Some believe that a pulling force causes subduction. They say, for example: "at a given depth, the subducting plate is colder, and therefore denser, than the mantle. The plate sinks through the mantle, like a dense rock falling through mud. As it falls, it pulls the rest of the plate."

This proposal overlooks the weak tensile strength of rock. If the pushing force, described above, cannot cause subduction, a pulling force certainly will not. ***Therefore, subduction will not occur.***

Can Overthrusts Occur? Can Mountains Buckle?

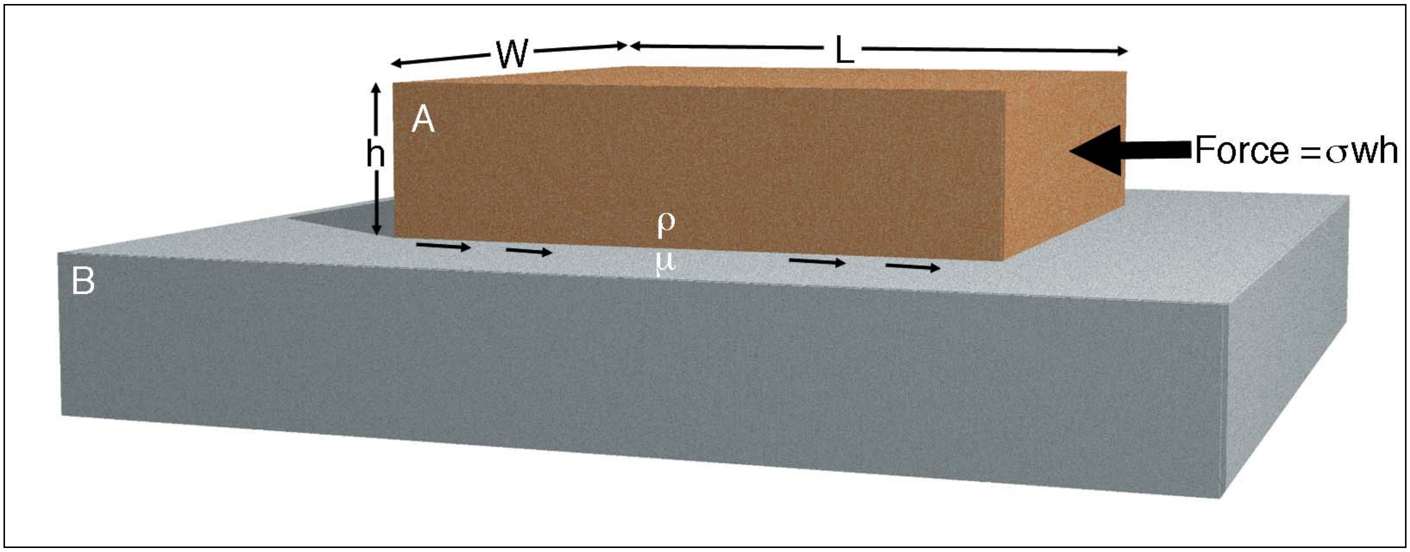


Figure 210: Frictional Locking of Two Slabs.

Slab A has a length, height, width, and density of L, h, w, and ρ, respectively. It rests on horizontal surface B and is pushed from the right. The pressure or force trying to move slab A over surface B exerts the maximum compressive stress, σ, throughout the right end of slab A.

Let us make the very generous assumption that slab A is not bonded to slab B. Resisting the movement is the static friction at their interface having a coefficient of μ. For motion to occur, the pushing force must exceed the resisting force, that is:

$$\sigma \; w \; h \;>\; \rho \; g \left(L \; w \; h \right) \mu$$

Using the density of granite $\left(\rho = 2.7 \dfrac{\text{gm}}{\text{cm}^3} \right)$ and the values for g, μ, and σ from page 486, Slab A will move only if

$$L < \frac{\sigma}{\rho \; g \; \mu} = \frac{2 \times 10^9}{2.7 \times 980 \times 0.6} = 12.6 \times 10^5 \text{ cm} = 12.6 \text{ km}$$

In other words, if a slab of rock is longer than 12.6 km (8 miles), the compressive stress would exceed the rock's maximum strength, so before movement could begin, crushing would occur, but only near the end being pushed. This result holds regardless of the slab's other dimensions.

Conclusion: A rock slab longer than 8 miles cannot be pushed over unlubricated rock, so overthrusts would not occur in this fashion, and mountains would not buckle. Because both happened (for example, see Figure 49 on page 116), something lubricated the movement.

Unlike the "applied force" above, gravity applies a "body force" that acts on every atom in the rock. If gravity sliding accelerated a lubricated slab, crushing and buckling could occur (1) where the slab was relatively weak or thin or (2) near the points where the lubricant was first depleted. Therefore, mountains could form *within* a continental-size plate, and overthrusting could occur.

Tidal Pumping: Two Types

The water layer under earth's preflood crust largely *decoupled* it from the mantle. That gave the crust (a spherical shell), much greater flexibility than if it had been anchored and bonded over the entire mantle's surface as it is today. In other words, few shearing stresses acted on the base of the crust, allowing it to flex more easily from a sphere to a prolate ellipsoid during each tidal cycle. Also, as the Moon's gravity lifted the crust at 12 o'clock, the crust was depressed (pinched in) at 9 o'clock and 3 o'clock. Consequently, the confined subterranean water was always pumped *by increasing pressure* from low to high tide. (Today, the crust is tightly anchored to the mantle, so only small ocean tides are produced by a very slight gravity gradient. Before the flood, this gravity flow in the subterranean chamber also lifted the crust at 12 o'clock.)

The pillars were compressed and stretched twice a day—a second form of tidal pumping. What force compressed the pillars, and how much strain occurred? The pillars were compressed by a sizeable fraction of the gigantic weight of the crust. Today, even without a decoupling layer of subterranean water, the Global Positioning System can measure solid tides on Earth up to 0.4 meters (1.31 feet).[1] At midlatitudes solid tides are about a foot,[2] but with a decoupling layer of water, the crust's preflood deflections would have been greater. If the average pillar's strain were only a foot, repeatedly compressed and hammered pillars would have produced enormous amounts of heat.[3]

Of course, some energy expended in compressing pillars was recovered elastically during the expansion half-cycle. However, a fraction of that energy was dissipated as heat and would have steadily raised the water's temperature, although some of the water's heat would have been lost by conduction into the chamber's floor and ceiling. (Later, we will combine these fractions into an "efficiency factor," e.)

How rapidly did the subterranean water become supercritical? Let Q be the heat generated in pillars that raised the subterranean water's temperature. Two tidal cycles occur for each of N days. The subterranean water's mass, volume, and density are m, V_w, and ρ_w, respectively, and the granite crust's volume and density are V_g and ρ_g. Let the specific heat of water at the pressure in the subterranean chamber be c_p and the temperature rise needed for that water to become supercritical be ΔT. The pillars are compressed by an average of δ centimeters and e is the efficiency factor mentioned above. Therefore,

$$Q = c_p \, \Delta T \, m$$

$$(V_g \, \rho_g \, g) \times \delta \times 2N \times e = c_p \, \Delta T \, (V_w \, \rho_w)$$

$$N = \frac{c_p \, \Delta T}{2 \times \delta \times e \times g} \times \frac{V_w \, \rho_w}{V_g \, \rho_g} \text{ days}$$

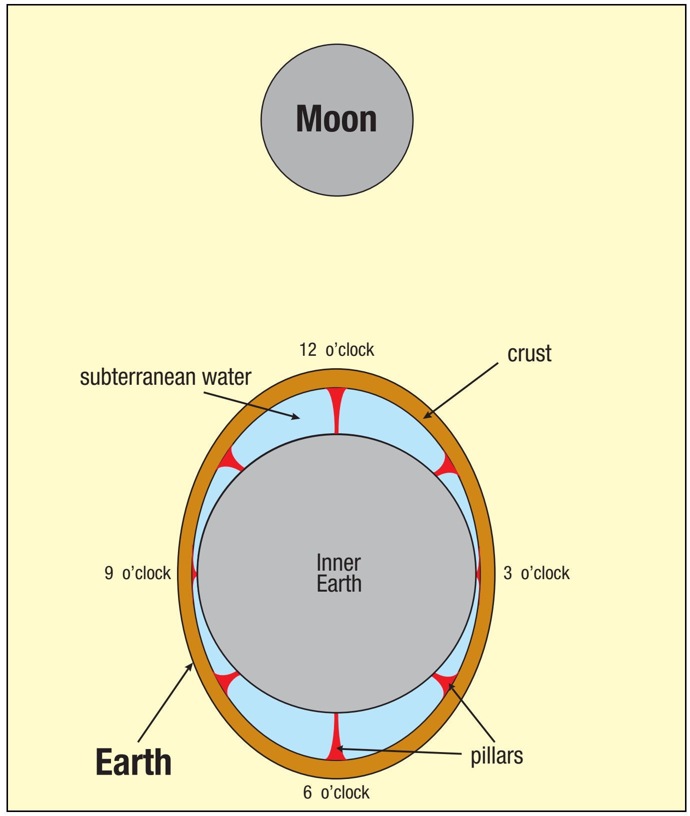


Figure 211: Tidal Pinch. (Not to scale.) Before the flood, the Moon's gravity not only lifted the largely decoupled (and, therefore, relatively flexible) crust at 12 o'clock and 6 o'clock, it pinched the crust inward at 9 o'clock and 3 o'clock. Both actions pumped the confined subterranean water toward high tide. Twice a day for centuries, tidal pumping also generated immense amounts of heat as the massive crust compressed the pillars near 9 o'clock and 3 o'clock and stretched those near 12 o'clock and 6 o'clock. (Pillars were portions of the sagging crust that touched the chamber floor. See pages 433–437.)

On page 429, the Hebrew word *raqia*, which means a hammered-out or pressed-out solid, was identified as the earth's crust. As one visualizes centuries of tidal pumping—and pillars compressing (being hammered or pressed out) twice a day—*raqia* seems an apt, descriptive word.

If

$$V_g / V_w = 12.33, \quad \rho_g / \rho_w = 2.7 / 1.14 = 2.37,$$

$$c_p = 0.9 \text{ cal/gm K}, \quad \delta = 30.48 \text{ cm (1 foot)},$$

$$\Delta T < 374 \text{ K}, \quad g = 980 \text{ cm/sec}^2, \quad e = 0.25,$$

and because 1 cal = 41,868,000 gm cm^2/sec^2, the water became supercritical in less than

$$N < \frac{0.9 \times 374}{2 \times 30.48 \times 0.25 \times 980} \times \frac{41{,}868{,}000}{12.33 \times 2.37}$$

$$= 32{,}290 \text{ days} = 88 \text{ years}$$

The greatest uncertainty in these numbers is the variable e.[4] However, even if e were an order of magnitude smaller, the subterranean water would become supercritical long before the flood began.

Two moons in the solar system, Saturn's Enceladus and Jupiter's Europa, are unusual, because they emit so much heat—far more heat than can be explained by radioactive decay.[5] Enceladus' heat produces a jet of water plasma that the orbiting Cassini spacecraft passed through and measured several times. A layer of water under the crusts of both moons explains the great heat produced.[6,7] Other evidence also supports the presence of those layers of liquid water.[8] [See page 312.]

Heat on Enceladus and Europa is generated by the flexing of their floating ice crusts. Because Earth's preflood crust was composed not of floating ice, but granite, pillars would have been present. [For details on why, how, and when pillars formed, see pages 433–437.] Therefore, the second form of tidal pumping would have acted continuously on pillars before the flood and produced much more heat than that produced in the deflecting crust.

By understanding how tidal pumping produced supercritical water (SCW), perplexing questions can now be answered, including:

- the source of the SCW that has been discovered still jetting up in black smokers on the ocean floor,
- the origin and nature of the Moho,
- the origin of vast salt, limestone, and dolomite deposits,
- the source of the cementing agents that hold sedimentary rocks together, and
- the origin of most ore bodies.

For a few details, see pages 119–127.

Without knowing that SCW was present before the flood or how SCW was produced, these rarely addressed topics would continue to seldom be discussed, and the gigantic energy released by all the fountains of the great deep would not be understood.

References and Notes

1. *"... the solid Earth tide can account for displacements up to ~0.4 m* [1.31 feet]*"* C. Watson et al., "The Impact of Solid Earth Tide Models on GPS Coordinate and Tropospheric Time Series," *Geophysical Research Letters*, Vol. 33, 22 April 2006, p. L08306-1.

2. *"Tidal effects could reach up to 30 cm* [0.98 feet] *in Denmark and Greenland ..."* Guochang Xu and Per Knudsen, "Earth Tide Effects on Kinematic/Static GPS Positioning in Denmark and Greenland," *Physics and Chemistry of the Earth (Part A: Solid Earth and Geodesy)*, Vol. 25, 2000, p. 409.

3. An additional amount of heat would have been generated in each pillar's expansion half-cycle. For simplicity, and to be conservative, this heat will be neglected.

   Alternatively, the heat generated during *a complete compression-expansion cycle* would equal the mechanical hysteresis losses, sometimes called *the tidal dissipation*. If the pillars were purely elastic (or could be considered as a perfect spring), the hysteresis losses would be zero. Because granite is partially elastic, the hysteresis losses must be experimentally determined for the particular (but unfortunately unknown) geometry of the granite pillars. For rocks at tidal frequencies, tidal dissipations of 50% are often used.

4. If half the thermodynamic work expended in compressing (hammering-out or pressing-out) pillars twice a day was dissipated as heat, and half of the water's heat was lost by conduction into the subterranean chamber's floor and ceiling, the "efficiency factor," e, would be 0.25.

5. *"The question arises as to the present state of the H_2O mantle* [on Europa]*—is it primarily water or ice? Calculations of the transport of heat by subsolidus convection in ice indicate that it would be completely frozen if normal solar system abundances of radioactive elements were the only heat sources present."* P. Cassen et al., "Is There Liquid Water on Europa?" *Geophysical Research Letters*, Vol. 6, September 1979, p. 731.

   ◆ *"... radiogenic heating alone cannot explain the huge heat power observed at the south pole* [of Enceladus]*."* G. Tobie et al., "Solid Tidal Friction above a Liquid Water Reservoir as the Origin of the South Pole Hotspot on Enceladus," *Icarus*, Vol. 196, August 2008, p. 642.

6. *"The heating rate in the ice crust is greater than in a completely solid body because the unsupported crust is subject to greater deformation."* P. Cassen et al., p. 731.

   ◆ *"...only interior models with a liquid water layer at depth can explain the observed magnitude of dissipation rate and its particular location at the south pole."* G. Tobie et al., p. 642.

   ◆ *"... when a globally decoupling liquid layer is included, the total dissipation power is strongly enhanced and it reproduces the observed* [heat flow]*."* Ibid., p. 644.

   ◆ *"... models with no internal liquid layer cannot generate a hotspot at the south pole."* Ibid., pp. 644-645.

7. Jupiter's moon, Io, has many volcanoes, some ejecting material 500 kilometers into space—farther than from any other volcanoes in the solar system. Tidal pumping also generates Io's heat, but the ejected material is sulfur dioxide, not water.

8. For example, see Steven W. Squyres et. al., "Liquid Water and Active Resurfacing on Europa," *Nature*, Vol. 301, 20 January 1983, pp. 225–226.

Energy in the Subterranean Water

Extremely large explosions are often the result of a chain reaction—a rapid sequence of stages, each stage triggering the next and releasing greater magnitudes of energy. For example, a gun is fired by first applying energy to pull a trigger. That, in turn, releases the greater energy stored in a compressed spring that accelerates a firing pin into a percussion cap. Its explosion ignites the propellent that rapidly burns and generates gases that accelerate a bullet down a gun barrel.

A second but tragic example would be a large aircraft crashing into a tall building and releasing 5×10^{16} ergs of kinetic energy. The impact ignites the plane's fuel. Within an hour, 5×10^{18} ergs of chemical energy are released. That heat weakens the building's structure, causing it to collapse, releasing 10^{19} ergs of potential energy (about 25% of a small atomic bomb).

Likewise, the explosion of a hydrogen bomb is the end result of a rapid series of smaller explosions. First, a relatively tiny chemical explosion compresses nuclear fuel into a supercritical mass. This produces an atomic explosion, a fission reaction. That heat initiates a thermonuclear, or fusion, reaction—a thousand times the energy of an atomic bomb.

An astounding, literally earth-shaking amount of energy accumulated in stages in the subterranean water before the flood. All that energy was finally released when the powerful fountains of the great deep launched water and rocks into space. Most of the rocks and water later merged and became comets and asteroids.[1] The four sources were:

- tidal energy from Earth's spin and the gravitational attraction of the Sun and Moon
- chemical energy from combustion in the supercritical water (SCW)
- potential energy residing in the dense preflood crust that lay above water
- nuclear energy as explained in the chapter **"The Origin of Earth's Radioactivity"** on pages 329–371.

These four energy sources will be briefly described. But first, we will estimate the total energy that had to be in the subterranean water to launch all the matter that escaped Earth's gravity.

Energy Required

The launched material includes what later became comets, asteroids, and the irregular moons[2] of the giant planets—moons that I maintain are captured asteroids. Table 30 estimates the magnitude of this energy. Some factors were derived in the comet and asteroid chapters (pages 271–327).

Table 30. Three Energy Requirements

	Total Mass M (gm)	Average Launch Velocity v (km/sec)	Kinetic Energy $E = \frac{1}{2} M v^2$ (ergs)
Comets	5.8×10^{21}	32.0	3.0×10^{34}
Asteroids	2.6×10^{24}	11.2	1.6×10^{36}
Irregular Moons	1.3×10^{23}	11.2	8.2×10^{34}
Note: Earth's escape velocity is 11.2 km/sec or 7.0 mi/sec.		TOTAL :	1.7×10^{36}

Perhaps 10 times more energy than 1.7×10^{36} ergs was needed (1) because other mass was launched besides that in comets, asteroids, and irregular moons, (2) because of the inefficiency of the launch mechanism, and (3) because some heat was lost by conduction into the chamber's ceiling and floor.[3] Let's assume that the total energy required was $\mathbf{1.7 \times 10^{37}}$ **ergs**.[4] Since this energy was released over many weeks, it is more accurately described as coming from an "engine"—an "*Earth-size nuclear engine*" (as you will see)—rather than an explosion.

Because the energy needed to launch the fragments that later merged to become asteroids is so much greater than the energy needed to launch the fragments that became comets or irregular moons, the methods for calculating the mass of all asteroids deserves special comment. In the early 1990s, much to the dismay of evolutionist astronomers, moons were discovered around some asteroids. Before then, asteroid mass could be estimated only by multiplying an asteroid's volume by its assumed density. Such assumptions produced considerable error, because from Earth each asteroid looked like a big, solid rock, not a flying rock pile containing ice and voids. Now that moons can be observed orbiting many asteroids, their masses and *extremely low* densities[5] can be directly calculated. Using their average density, the total mass of all asteroids can be more accurately estimated. While not all asteroids have been identified, the volumes of the largest thousand or so have been measured. Statistically, their size distribution shows that the smallest asteroids, although numerous, contribute relatively little to the total mass of all asteroids.

Energy Available

What provided the needed 1.7×10^{37} ergs of energy? Notice that the energy released by each of the first three sources described below is huge, but each is small compared to 1.7×10^{37} ergs. Nevertheless, each of these three sources would trigger the next source. Finally, the size of the fourth source (nuclear energy) was clearly sufficient. As explained on page 343, it generated *at least* 7×10^{37} *ergs of energy*!

Before proceeding further, carefully consider:

- the dozens of evidences presented on pages 271–327 showing that meteorites and the particles that merged to become comets and asteroids came from Earth and that the standard explanations for those bodies are, in so many ways, unworkable.
- the many evidences in **"The Origin of Earth's Radioactivity"** chapter (pages 329–371) showing that *powerful pressure cycles from the fluttering crust* [see **"What Is Flutter?"** on page 286] *generated, via the piezoelectric effect, extreme voltages that exceeded electrical breakdown voltages within rock. The resulting electrical surges (akin to bolts of lightning passing through rock and highly conductive salt water) rapidly produced Earth's radioactivity and what would, at today's rates, be billions of years' worth of daughter products.* As this chapter explains and calculations and experiments show, this is much more realistic than and far superior to the standard, vague explanation for the origin of Earth's radioactivity—an explanation without experimental support.

What were the four sources of energy?

Tidal Pumping. Twice a day, tides in the subterranean chamber compressed and stretched the pillars. As pillars were heated, the water's temperature rose.[6] Quartz, which occupies about 27% of granite by volume, readily dissolves in hot water. Consequently, more and more quartz dissolved as temperatures rose, so the pillars and lower crust increasingly *looked like sponges and weakened*. Hot, salty—and, therefore, *electrically conducting—supercritical water (SCW) filled these interconnected pockets that once held quartz crystals*. That SCW would later remove staggering amounts of nuclear energy that would be generated in the lower crust over a period of weeks. [See page 124 and pages 488–489.]

Burning.[7] There may also have been fire in the subterranean water. SCW at high pressures and temperatures will release oxygen and, *if a fuel is present*, spontaneously burn (oxidize), releasing CO_2 (carbon dioxide), CH_4 (methane), and heat.[8] We cannot say what fuels were present, although the great dissolving ability of SCW and the large volume of spongelike rock in contact with SCW open up many possibilities.[9] Any heat added to the SCW by burning would have hastened the final rupture.

The products of combustion in the SCW may have produced *Earth's ores, such as iron ore*. Those ores would have been swept up to the Earth's surface with the escaping flood water.

Potential Energy. The preflood granite crust had an average thickness, t, and a density, ρ_g. It lay above a water layer of density, ρ_w, and volume, V. This gave the crust a potential energy, E_p, of

$$E_p = t\,V\,g\,(\rho_g - \rho_w)$$

where g is the acceleration due to gravity. During the flood, that huge energy was released as the hydroplates sank and the subterranean waters violently escaped upward. If

$t = 1.6 \times 10^6$ cm $V = 7.15 \times 10^{23}$ cm^3
$\rho_g = 2.8$ grams/cm^3 $g = 980$ cm/sec^2
$\rho_w = 1.14$ grams/cm^3, then

$$E_p = 1.6 \times 10^6 \times 7.15 \times 10^{23} \times 980\,(2.8-1.14) = 1.86 \times 10^{33} \text{ ergs}$$

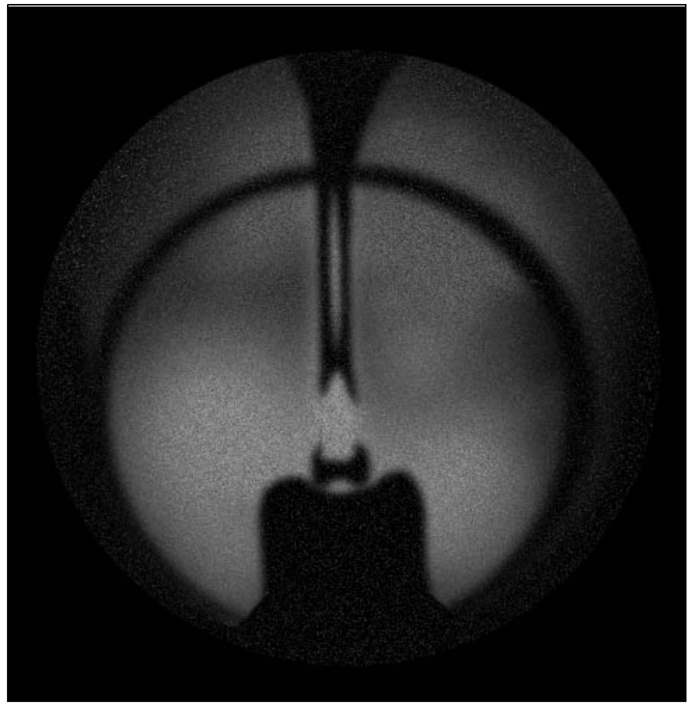


Figure 212: Burning in Supercritical Water. You are looking through a thick, sapphire window at combustion in supercritical water (SCW) at 450°C (842°F) and 1,000 bars (14,500 psi). The tube at 6 o'clock is injecting oxygen into the SCW at 3 mm^3/sec. Oxygen unites with methane (CH_4) that is dissolved in the SCW and releases heat which, in turn, releases more oxygen in the water ($H_2O \rightarrow H + OH \rightarrow 2H + O$). The resulting spontaneous combustion produces CO_2 and excess heat as long as fuel (in this case, carbon) is available.[10]

At slightly higher temperatures, Russian scientists have duplicated the above *without injecting oxygen* and have shown how SCW, in the presence of fuel, readily explodes from the chamber.[11] Sudden jumps of 670°C (1,238°F) in temperature and 210 bars (3,000 psi) in pressure were measured.

After the Earth's crust ruptured, a similar, but vastly larger, *long-duration* explosion occurred for weeks in the subterranean chamber as the fluttering crust settled to the chamber floor. Most of the energy came not from chemical energy (as described above) but from nuclear energy—atomic nuclei that quickly decayed and released their binding energy. Those who ignore the flood will falsely conclude that all Earth's products of radioactive decay must have accumulated at the very slow rate they do today, so the Earth must be billions of years old.

(At the high pressures in the subterranean chamber, liquid water has a density of 1.14 grams/cm^3.)

Nuclear Energy. Thermal energy from tidal pumping and burning (if fuel was present) increased the pressure in the subterranean chamber and weakened the pillars and crust. Once the crust ruptured, the potential energy was released, the subterranean water erupted, and dramatic *electrical* events occurred that are described in **"The Origin of Earth's Radioactivity."** For reasons explained in that chapter and as demonstrated by experiment, new, superheavy radioisotopes rapidly formed and quickly fissioned and decayed. In the process, gigantic amounts of heat were released in the SCW.

Various nuclear reactions produced fast neutrons. How much of that nuclear energy was absorbed by the subterranean water? Our oceans have 1.43×10^{24} grams of water. For every 18 grams of water (1 mole) there are 6.022×10^{23} (Avogadro's number) water molecules—each with 2 hydrogen atoms. One out of every 6,400 hydrogen atoms in our oceans is heavy hydrogen. Each fast neutron that was thermalized by the water delivered about 1 MeV of energy. (1 MeV = 1.602×10^{-6} ergs) A hydrogen atom (^{1}H) that absorbed a fast neutron released 2.225 MeV of binding energy and became heavy hydrogen (^{2}H), also called *deuterium*. The comet chapter (pages 271–302) explains why earth's heavy hydrogen was concentrated in the subterranean chamber as the flood began. Therefore, the amount of nuclear energy that was added to the subterranean water over several weeks was:

$$\frac{1.43\times10^{24}}{18}\times\frac{6.022\times10^{23}}{6,400}\times2\times(1+2.225)\times1.602\times10^{-6}$$
$$= 7.72\times10^{37}\text{ ergs}$$

Other products of nuclear decay would have added additional energy to the subterranean water, and much water was expelled from earth, so the above is a conservative estimate of the nuclear energy that was added to the subterranean water in weeks.

Those who try to estimate the total energy that has been released by radioactive decay on Earth often make two errors. Some assume that most geothermal energy flowing up to the Earth's surface is from nuclear decay over billions of years. As the radioactivity chapter explains, relatively little geothermal heat is from slow nuclear decay. Most geothermal heat is due to electrical surges and rapid nuclear decay at the beginning of the flood and tectonics at the end of the flood. [The tectonic events are explained on pages 149–173.] A second error is assuming that the total heat released by accelerated decay equaled the annual radioactive heat generated in the Earth's crust today multiplied by hundreds of millions of years.

Of course, many uncertainties exist that make exact calculations impossible. What were the initial and final temperatures in the subterranean chamber? What was its actual volume and depth below the Earth's surface? What were the sizes, shapes, and numbers of the pillars? How much combustion occurred in the SCW? How much energy was supplied to the escaping subterranean water by all nuclear reactions, including fissions, captures, and gamma, alpha, and beta decay? Further research should narrow these uncertainties. Nevertheless, the energy released was clearly sufficient.

Evidence

While it is shocking at first to consider—and try to grasp—the vast amount of energy in the subterranean chamber, one should also reflect on the answers it provides.

1. ***Comets and Asteroids.*** Pages 271–327 cite dozens of evidences showing that the material that merged in the years after the flood to become comets and asteroids was launched from Earth. The energy in the chamber was sufficient for that task.

2. ***Hot Origin for Cold Comets.*** Tiny rocks and dust recovered from comet Wild 2 (pronounced "Vilt 2") in 2004 were found to have been forged in white-hot heat. This contradicts the standard story, taught since 1950, that comets formed in the coldest portion of the solar system.[12] (In 2005, the Deep Impact space mission made similar discoveries in comet Tempel 1.) These rocks should not have been crystalline, and yet they were crystalline and earthlike, as I explained they would be in the 7th edition (2001, page 201). The subterranean chamber provided not only the white-hot heat and launch energy, but also the crystalline material for comets, asteroids, and meteoroids. [See **"Deep Impact Mission"** and **"Stardust Mission"** on page 278 and Item 7 on page 287.]

3. ***Heavy Hydrogen.*** Normal hydrogen (^{1}H) has a nucleus containing only one proton. Hydrogen that has absorbed one neutron is deuterium (^{2}H); hydrogen that has absorbed two neutrons is tritium (^{3}H).

   Comets contain 20–100 times the concentration of heavy hydrogen as interstellar space and the solar system in general. Why are comets so rich in heavy hydrogen? Comets also contain water twice as rich in heavy hydrogen as Earth's surface waters. Therefore, comets did not provide the Earth with its water. [See **"Heavy Hydrogen"** on page 279.]

Only nuclear reactions produce heavy hydrogen.[13] Therefore, earth's water (as opposed to water or hydrogen in the rest of the universe) must have been exposed to extreme nuclear reactions. Furthermore, the water that ended up in comets must have been especially exposed to nuclear reactions. What provided the neutron flux to form all this heavy hydrogen?

Actually, all the water in comets and about half the water in our oceans came from the subterranean chamber—a chamber that absorbed a high flux of neutrons from nuclear reactions as the flood began. Therefore, our oceans contain considerable heavy hydrogen, and comets have twice that concentration.

4. ***Irregular Moons.*** Most astronomers recognize that irregular moons are captured asteroids. But, how were so many captured? (Invoking long periods of time will not work, because those moons are being destroyed or stripped from their planets too rapidly.) The same energy that launched the particles that later merged to become comets and asteroids also scattered an "ocean" of water vapor into the solar system. That gas provided the aerobraking that allowed planets, large asteroids, and perhaps comets to capture moons. Today, that water vapor is no longer in interplanetary space, so aerobraking is not possible. This is why astronomers are baffled, but the hydroplate theory explains why there are so many irregular moons.

5. ***Ore Deposits.*** Conventional geologists have difficulty explaining the origin of Earth's ore deposits. "Ores of sufficient richness to be extracted have required very special geologic processes to come into existence."[14] What were those special conditions and processes that *concentrated* large ore deposits?[15] Beyond vague references to "hydrothermal solutions," evolutionists can only say that ores must have formed slowly in the distant past. However, diverse ore deposits are not forming today—even slowly. Spontaneous combustion in the SCW under the crust may have produced Earth's ores. If so, escaping flood waters swept those ores up to the Earth's surface.

6. ***Gold Deposits.*** Why are gold veins at the Earth's surface? If extremely hot water (932°F or 500°C) circulated under the crust, gold in high concentrations could go into solution. If the solution then came up to the Earth's surface fast enough, little gold would precipitate as the water's pressure dropped. About 250 cubic miles of water must have burst forth to account for the gold found in just one gold mining region in Canada.[16] With less extreme pressure-temperature conditions, even more water must come up faster to account for the Earth's gold deposits. These are hardly the slow, uniformitarian processes that evolutionists visualize. When the hydroplates crashed, vast amounts of hot water still under the crust burst up through faults and deposited concentrated minerals, including gold.

   About 40% of all gold mined in the world is from the Witwatersrand Basin in South Africa. This gold, deposited in compressional fractures (gold veins) within the basin, precipitated from water whose temperature exceeded 300°C.[17]

7. ***The Quartz Problem.*** Geologists acknowledge their inability to explain where enough silica could come from to cement most of the Earth's sediments into rocks. This is called "the quartz problem." [See page 229.] SCW dissolved much of the quartz in the rocks bordering the subterranean chamber. That dissolved silica, cooling at the Earth's surface soon after the flood, cemented rocks—and petrified wood.

8. ***Salt Deposits.*** Thick salt deposits on the floor of the Atlantic Ocean were not formed by evaporation but by hot brines deep in the Earth. Among the many reasons for this conclusion are the absence of organic remains in those deposits and the presence of ore minerals that are not found in evaporating basins today.[18] Again, hot, erupting, mineral-rich subterranean water explains what we see.

9. ***Geothermal Heat.*** As one descends deeper into the Earth, temperatures increase. Many scientists and laymen believe that Earth's geothermal heat is left over from the formation of the Earth by meteoritic bombardment. A few simple calculations show that if Earth formed that way, too much heat would have been released; the entire Earth would have melted several times over. [See Endnote 45a on page 85 and **"Melting the Inner Earth"** beginning on page 496.] Others believe that billions of years of radioactive decay produced the temperature patterns we see inside the Earth. The flaws in this thinking are explained in **"The Origin of Earth's Radioactivity."**

10. ***Understanding Accelerated Decay.*** For more than 20 years, I, along with a few other creationists, have cited evidence that rates of radioactive decay were much faster sometime in the past. In 2005, some creationists, citing several additional evidences, correctly reached the same conclusion. However, they

did not know what produced earth's radioactivity, what caused accelerated decay or when either happened (during the creation,[19] the fall, or the flood). They realized that the decay, whenever it happened, would have produced a vast amount of heat—enough, they thought, to melt much of the Earth and evaporate all the oceans. Because this did not happen, they reasoned that a miracle occurred or some strange, new physics removed the heat. (Miracles should not be proposed to solve a scientific problem.)

In fact, normal physics was involved. These researchers never addressed the larger question: *What was the origin of Earth's radioactivity?* They were also unaware of all the preflood subterranean water and why it became electrically conductive SCW and increasingly permeated the lower crust. ***That SCW absorbed most of the nuclear energy and converted it primarily to kinetic energy, without a huge rise in temperature.*** Furthermore, the extremely powerful fountains of the great deep expelled most of that energy into outer space. Some of these researchers completely missed the cataclysmic nature of the flood's beginning—saying that when, "*on the same day all the fountains of the great deep burst open*" (Genesis 7:11), the fountains were simply like geysers. These individuals also did not realize that the hydroplate theory explains the accelerated decay and energy removal, and places that decay at the beginning of the flood.[20]

Final Thoughts

The origin and consequences of so much energy in the subterranean water is admittedly a startling new idea. Grasping and interrelating the many evidences that show this will require a period of thoughtful reevaluation and reflection by each reader.

References and Notes

1. Large rocks ejected from Earth had correspondingly large spheres of influence that expanded as other matter—aided by water vapor and aerobraking—gently merged around those "rock seeds." This allowed the capture of even more matter, eventually forming "fluffy" comets and very low density asteroids. [Spheres of influence are explained on page 274.]

2. Irregular moons have high eccentricity and inclination and very low mass. Most astronomers recognize that irregular moons are captured asteroids, but admit that captures are too improbable. So, how did they occur?

   Pages 305–327 explain how, for years after the flood, the radiometer effect and aerobraking, via the abundant water vapor in the solar system, produced those captures. At least 43 moons in the solar system are irregular; one of the largest is Saturn's Enceladus, whose "strange behavior" is explained on page 312. Mars' two moons, Phobos and Deimos, are probably captured asteroids.

3. Some heat would have been conducted into the ceiling and floor of the subterranean chamber. However, the rate of heat loss from the chamber would have steadily diminished with time, because the deeper the heat penetrated into the rock, the more resistance (or insulation) the rock provided.

   More specifically, the heat flux from a hot, constant-temperature fluid in contact with a cold, semi-infinite solid will diminish as the inverse square root of time. To see why, consult a basic textbook on heat transfer.

4. A 1-megaton hydrogen bomb releases almost 5×10^{22} ergs of energy. Therefore, the release of 1.7×10^{37} ergs is the equivalent of exploding 300 trillion hydrogen bombs! However, most of the energy in the subterranean water was generated continually over many weeks (not one big explosion) and was focused up through the rupture and expelled into space. Comets, asteroids, irregular moons, and meteoroids have great kinetic and potential energy.

5. The Cassini mission to Saturn flew near enough to Saturn's irregular moon, Hyperion, to measure its low density. (Hyperion, with a density of 0.544 gm/cm^3, would float high in water if it were placed in a very large bathtub.) Hyperion also contains organic matter. What do you suppose was the origin of this organic matter? Earth would be a good guess. [See P. C. Thomas et al., "Hyperion's Sponge-Like Appearance," *Nature*, Vol. 448, 5 July 2007, pp. 50–53.]

   The low densities of comets and asteroids are not surprising when one understands how they formed. Consider that:
   - "[Comet Tempel 1 is] *the size of a mountain held together with the strength of the meringue in a lemon meringue pie."* Carey M. Lisse as quoted by Ron Cowen, "Deep Impact," *Science News*, Vol. 168, 10 September 2005, p. 169.
   - "[The comet's] *structure is more fragile than that of a soufflé ...."* Jay Melosh as quoted by Ron Cowen, Ibid., p. 168.

6. Earth's polar moment of inertia is 8.068×10^{44} gm cm^2. Of course, we do not know how much Earth's spin slowed during this period of tidal pumping. However, if the Earth slowed from a period of 23 hours per day to today's 24 hours per day, the energy lost from Earth's rotational kinetic energy and gained as heat in the subterranean water would have been

$$\frac{1}{2} \times 8.068 \times 10^{44} \left[\frac{2\,\pi}{24 \times 3600}\right]^2 \left[\left(\frac{24}{23}\right)^2 - 1\right] = 1.9 \times 10^{35} \text{ ergs}$$

7. "Burning," in this context, is defined as the rapid chemical reaction of oxygen with a fuel, releasing heat and light.

8. A. A. Vostrikov et al., "The Effect of Thermal Explosion in a Supercritical Water," *Technical Physics Letters,* Vol. 27, 2001, pp. 847–849.

9. Burning hydrogen (H) to produce water (H_2O) did not result in a net increase in energy, because the energy gained (57.8 kcal/mole) equaled the energy spent in dissociating the oxygen in the first place.

10. E. U. Franck, "Experimental Studies of Compressed Fluids," *High Pressure Chemistry and Biochemistry*, editors R. van Eldik and J. Jonas (Dordrecht, Holland: D. Reidel Publishing Company, 1987), pp. 93–116.

◆ E. U. Franck, "Fluids at High Pressures and Temperatures," *Pure & Applied Chemistry*, Vol. 59, No. 1, 1987, pp. 25–34.

11. *"It was established that water participates in the conversion process on a chemical level: in particular, oxygen from water molecules is involved in the formation of carbon oxides. Even in the absence of added molecular oxygen, the process of naphthalene* [$C_{10}H_8$] *and bitumen in a certain temperature interval exhibited an exothermal character. Upon adding* O_2 *into SCW, the oxidation reaction may proceed in a burning regime with self-heating* [spontaneous combustion] *of the mixture. Under certain conditions, the self-heating process may lead to the thermal explosion effect accompanied by ejection of the substance from the reactor, which is explained by the high rate of hydrocarbon burning in SCW."* A. A. Vostrikov et al., "The Effect of Thermal Explosion in a Supercritical Water," *Technical Physics Letters*, Vol. 27, No. 10, 2001, p. 847.

12. *"Scientists analyzing the first samples returned from a comet announced startling news this week. They are finding not the unprocessed* [noncrystalline] *'stardust' thought to have glommed together in the frigid fringes of the early solar system, but bits of* [crystalline] *rock forged in white-hot heat."* Richard A. Kerr, "Minerals Point to a Hot Origin for Icy Comets," *Science*, Vol. 311, 17 March 2006, p. 1536.

13. *"Because stars consume large amounts of* [deuterium] *and no process creates it in significant amounts, the amount of deuterium in the universe declines steadily."* Ron Cowen, "Too Much Deuterium?: A Chemical Mystery in the Milky Way," *Science News*, Vol. 170, 9 September 2006, p. 172.

14. Arthur N. Strahler, *Physical Geology* (New York: Harper & Row, Publishers, 1981), p. 551.

15. Before the flood, some men learned how to forge implements of bronze (about 88% copper and 12% tin) and iron. This noteworthy achievement (Genesis 4:22) involved more than just isolating copper, tin, and iron from rocks; it also involved combining them in solid solutions to achieve superior chemical, mechanical, and physical properties. Today, we have very large, already concentrated ore deposits of many other metals besides copper, tin, and iron.

16. Robert Kerrich, "Nature's Gold Factory," *Science*, Vol. 284, 25 June 1999, pp. 2101–2102.

17. A. C. Barnicoat et al., "Hydrothermal Gold Mineralization in the Witwatersrand Basin," *Nature*, Vol. 386, 24 April 1997, pp. 820–824.

◆ Robert R. Loucks and John A. Mavrogenes, "Gold Solubility in Supercritical Hydrothermal Brines Measured in Synthetic Fluid Inclusions," *Science*, Vol. 284, 25 June 1999, pp. 2159–2163.

18. *"Salt deposits in deep oceanic areas are considered to be deposits from hot brine originating at great depths in the earth during tectonic movements."* V. I. Sozansky, "Origin of Salt Deposits in Deep-Water Basins of Atlantic Ocean," *The American Association of Petroleum Geologists Bulletin*, Vol. 57, March 1973, p. 589.

◆ *"Salt is not an evaporitic formation or a derivative from volcanic rock; it is a product of degasification of the earth's interior. The salt precipitated from juvenile hot water which emerged along deep faults into a basin as a result of change in thermodynamic conditions. … the water-salt composition of the ocean and atmosphere is the product of degassing of the earth's interior."* V. B. Porfir'ev, "Geology and Genesis of Salt Formations," *The American Association of Petroleum Geologists Bulletin*, Vol. 58, December 1974, p. 2544.

19. From a biblical perspective, harmful radioactive decay did not exist at the end of creation, because all God made was "very good" (Genesis 1:31).

20. Larry Vardiman, Steven A. Austin, John R. Baumgardner, Steven W. Boyd, Eugene F. Chaffin, Donald B. DeYoung, D. Russell Humphreys, and Andrew A. Snelling, "Summary of Evidence for a Young Earth from the RATE Project," *Radioisotopes and the Age of the Earth*, editors Larry Vardiman, Andrew A. Snelling, and Eugene F. Chaffin (El Cajon, California: Institute for Creation Research, 2005), pp. 735–772. [This was a highly publicized, $1,000,000+, 8-year research project. Because these researchers mistakenly say there is a heat problem, some people believe that the Earth required millions of years to cool.]

◆ Two coauthors of the above study apparently were unaware of the hydroplate explanation for heat removal.
   ❖ *"I also pointed out that heat is not merely a problem for accelerated decay, but also for all Creation or Flood models I know of."* D. Russell Humphreys, "Young Helium Diffusion Age of Zircons Supports Accelerated Nuclear Decay," Ibid., p. 68.
   ❖ *"All creationist models of young earth history have serious problems with heat disposal."* Andrew A. Snelling, "Radiohalos in Granites," Ibid., p. 184.

Melting the Inner Earth

Today, the Earth's density at any depth, z, is well known. Some values are given in column G of Table 32.[1] Based on those values, the mass, acceleration due to gravity, polar moment of inertia, and gravitational potential energy are calculated in columns H–K for successive spherical shells. The potential energy of a shell of mass m and radius r is

$$GM_i m \int_r^{\infty} \frac{dr}{r^2} = -\frac{GM_i m}{r} = -mgr$$

where G is the gravitational constant, g is the acceleration due to gravity at r, and M_i is the mass *inside* the shell.

Preflood values of density (column B) can be estimated by the formula

$$\text{density} = a + bz + cz^2 + dz^3$$

where $a = 2.840$, $b = 1.6362 \times 10^{-3}$, $c = 5.4000 \times 10^{-8}$, and $d = -1.1587 \times 10^{-11}$. These coefficients were selected to satisfy the following constraints: the flood did not appreciably change the mass of the Earth,[2] the preflood density at the Earth's surface and center was what it is today (2.840 and 12.460 gm/cm^3, respectively), pressure and, therefore, density increased smoothly with depth, and the polar moment of inertia allowed the Earth to rotate 360 times per year. (Endnotes 18–23, beginning on page 169, justify a 360-day year before the flood.) Other functional relationships between preflood density and depth that satisfied these same constraints would not greatly alter the following conclusions.

As explained on pages 149–173, during the flood, mass shifts within the Earth generated internal friction, heating, and melting. Melting, especially toward the center of the Earth where pressures (and thus frictional heating) were greatest, was followed by gravitational settling of the denser minerals and chemical elements. Rock that melted below the crossover depth contracted. [See **"Magma Production and Movement"** on page 152.] This produced further mass shifts (faulting), frictional heating, melting, and gravitational settling. Most of the potential energy lost by the Earth—the difference in the sums of columns F and K—was converted to heat by gravitational settling.[3]

$$(2.489 \times 10^{39} - 2.460 \times 10^{39}) = \mathbf{29.0 \times 10^{36}\ ergs}$$

Once slippage began inside the earth, the potential energy lost by frictional melting eventually generated about 5 times more heat energy in the Earth's core through gravitational settling.[4] This created a runaway situation: more slippage and melting produced more heating by gravitational settling, which then produced even more slippage, etc. Within months, most of the inner earth melted. *That melting, gravitational settling, and compression of magma in the outer core is shown by the sharp density discontinuity highlighted in yellow in Table 32 (column G) and by Earth's extremely strong magnetic field.* [See **"The Origin of Earth's Powerful Magnetic Field"** on page 155 for an explanation.]

All this heat, released within months inside Earth, could provide almost 3 billion years' worth of the present heat flux at the Earth's surface (1.0×10^{28} ergs/year).

How does the heat released by gravitational settling (almost 29.0×10^{36} ergs) compare with the heat needed to form Earth's present-day core? It partly depends on the initial temperatures of the denser particles inside the Earth before they fell toward the Earth's center to become the inner and outer core. However, before gravitational settling could begin, those temperatures would have been raised to near the local melting temperatures. Particles that melted after they fell added to the liquid outer core; denser particles that did not melt or that solidified under the great pressure near the Earth's center formed the solid inner core.

Anderson gives the following estimates for the thermal properties of the inner and outer core. (The masses for inner and outer core are derived from Table 32.)

Table 31. Some Properties of the Earth's Core[5]

Property	Inner Core	Outer Core
Mass (gm)	0.132×10^{27}	1.831×10^{27}
Mean Melting Temperature (K)	6,575	3,800
Specific Heat (erg/gm/K)	5×10^6	5×10^6
Heat of Fusion (erg/gm)		4×10^9

To form today's inner core requires approximately

$$[5 \times 10^6 \times (6{,}575 - 3{,}800)] \times 0.132 \times 10^{27} = 1.832 \times 10^{36} \text{ ergs}$$

To form today's outer core requires approximately

$$(4 \times 10^9) \times (1.831 \times 10^{27}) = 7.324 \times 10^{36} \text{ ergs}$$

Therefore, the heat released by gravitational settling (almost 29.0×10^{36} ergs) exceeded that needed to form the Earth's inner and outer core (9.156×10^{36} ergs). Temperatures quickly rose near the center of the Earth. Notice that the heat released by gravitational settling, *if evenly distributed throughout the Earth*, might melt the entire Earth, whose mass is 5.976×10^{27} grams.

$$29.0 \times 10^{36} \text{ ergs} > (\sim 4 \times 10^9) \times (5.976 \times 10^{27}) \text{ ergs}$$

Table 32 allows two other important conclusions. Evolutionists claim that the Earth formed by meteoritic bombardment, sometimes called *gravitational accretion*. If so, the 2.489×10^{39} ergs of potential energy lost by these meteoroids (sum of column K) would become heat after

Technical Notes

Table 32. Energy Released by Gravitational Settling

		BEFORE FLOOD					AFTER FLOOD				
	A	B	C	D	E	F	G	H	I	J	K
	depth z (km)	density (gm/cm^3)	mass (gm)	gravity (cm/sec^2)	inertia (gm cm^2)	potential (ergs)	density (gm/cm^3)	mass (gm)	gravity (cm/sec^2)	inertia (gm cm^2)	potential (ergs)
Crust	0	2.840		982.2			2.840		982.2		
			2.18E+25		5.88E+42	-1.36E+37		2.17E+25		5.85E+42	-1.36E+37
	15	2.865		983.2			2.840		983.2		
			6.58E+25		1.76E+43	-4.10E+37		7.54E+25		2.02E+43	-4.70E+37
	60	2.938		986.2			3.332		984.7		
			5.91E+25		1.56E+43	-3.67E+37		6.64E+25		1.75E+43	-4.12E+37
	100	3.004		988.8			3.348		986.1		
			1.50E+26		3.87E+43	-9.26E+37		1.64E+26		4.23E+43	-1.01E+38
	200	3.169		994.9			3.387		989.6		
			1.53E+26		3.83E+43	-9.35E+37		1.60E+26		4.01E+43	-9.73E+37
	300	3.335		1,000.2			3.424		993.4		
			7.76E+25		1.89E+43	-4.70E+37		7.88E+25		1.92E+43	-4.74E+37
	350	3.419		1,002.6			3.441		995.5		
			7.82E+25		1.87E+43	-4.70E+37		8.44E+25		2.02E+43	-5.04E+37
	400	3.502		1,004.8			3.775		996.4		
			2.04E+25		4.84E+42	-1.22E+37		2.20E+25		5.22E+42	-1.31E+37
	413	3.524		1,005.4			3.795		996.6		
			1.38E+26		3.21E+43	-8.19E+37		1.48E+26		3.44E+43	-8.71E+37
	500	3.670		1,008.8			3.925		997.5		
			1.60E+26		3.61E+43	-9.40E+37		1.70E+26		3.85E+43	-9.90E+37
	600	3.839		1,012.0			4.075		998.6		
			8.05E+25		1.77E+43	-4.68E+37		8.53E+25		1.88E+43	-4.90E+37
	650	3.923		1,013.4			4.150		998.7		
			2.43E+26		5.17E+43	-1.39E+38		2.58E+26		5.48E+43	-1.45E+38
Mantle	800	4.178		1,016.4			4.380		997.8		
			3.01E+26		6.02E+43	-1.68E+38		3.09E+26		6.19E+43	-1.69E+38
	984	4.491		1,017.9			4.529		996.0		
			2.62E+25		5.06E+42	-1.43E+37		2.64E+25		5.09E+42	-1.41E+37
	1,000	4.519		1,017.9			4.538		995.8		
			3.28E+26		6.07E+43	-1.76E+38		3.21E+26		5.95E+43	-1.68E+38
	1,200	4.861		1,016.4			4.655		994.3		
			3.25E+26		5.58E+43	-1.67E+38		3.05E+26		5.22E+43	-1.54E+38
	1,400	5.205		1,012.1			4.768		993.7		
			3.21E+26		5.08E+43	-1.58E+38		2.88E+26		4.55E+43	-1.39E+38
	1,600	5.549		1,004.7			4.877		994.5		
			3.14E+26		4.57E+43	-1.46E+38		2.70E+26		3.94E+43	-1.26E+38
	1,800	5.893		994.4			4.983		997.1		
			3.05E+26		4.06E+43	-1.35E+38		2.53E+26		3.37E+43	-1.13E+38
	2,000	6.236		981.1			5.087		1,002.1		
			2.94E+26		3.58E+43	-1.22E+38		2.36E+26		2.87E+43	-1.01E+38
	2,200	6.578		964.8			5.188		1,010.2		
			2.81E+26		3.11E+43	-1.09E+38		2.18E+26		2.41E+43	-9.03E+37
	2,400	6.918		945.5			5.288		1,022.3		
			2.67E+26		2.67E+43	-9.66E+37		2.01E+26		2.01E+43	-8.02E+37
	2,600	7.256		923.3			5.387		1,039.3		
			2.51E+26		2.26E+43	-8.41E+37		1.84E+26		1.66E+43	-7.11E+37
	2,800	7.590		898.1			5.487		1,062.6		
			9.36E+25		7.79E+42	-2.95E+37		6.73E+25		5.60E+42	-2.54E+37
	2,878	7.720		887.5			5.527		1,073.8		
			1.41E+26		1.11E+43	-4.26E+37		1.81E+26		1.42E+43	-6.59E+37
	3,000	7.922		869.9			10.121		1,046.7		
			2.17E+26		1.55E+43	-6.08E+37		2.76E+26		1.97E+43	-9.25E+37
	3,200	8.249		838.9			10.421		999.6		
			1.99E+26		1.26E+43	-5.03E+37		2.50E+26		1.58E+43	-7.49E+37
	3,400	8.572		804.9			10.697		949.5		
			1.81E+26		9.96E+42	-4.09E+37		2.24E+26		1.23E+43	-5.94E+37
	3,600	8.890		768.1			10.948		896.7		
			1.62E+26		7.74E+42	-3.24E+37		1.98E+26		9.46E+42	-4.61E+37
	3,800	9.202		728.5			11.176		841.4		
			1.44E+26		5.86E+42	-2.51E+37		1.73E+26		7.07E+42	-3.48E+37
Outer	4,000	9.507		686.2			11.383		783.9		
			1.25E+26		4.32E+42	-1.89E+37		1.49E+26		5.13E+42	-2.55E+37
Core	4,200	9.806		641.2			11.570		724.4		
			1.07E+26		3.08E+42	-1.37E+37		1.26E+26		3.61E+42	-1.81E+37
	4,400	10.098		593.6			11.737		663.0		
			9.02E+25		2.11E+42	-9.59E+36		1.04E+26		2.44E+42	-1.23E+37
	4,600	10.382		543.5			11.887		600.0		
			7.39E+25		1.38E+42	-6.39E+36		8.40E+25		1.57E+42	-7.97E+36
	4,800	10.657		491.0			12.017		535.6		
			5.41E+25		7.94E+41	-3.73E+36		6.05E+25		8.90E+41	-4.53E+36
	4,982	10.899		441.1			12.121		475.9		
			4.70E+24		5.97E+40	-2.85E+35		5.22E+24		6.63E+40	-3.41E+35
	5,000	10.923		436.1			12.130		469.9		
			2.87E+25		3.30E+41	-1.58E+36		3.18E+25		3.65E+41	-1.87E+36
	5,121	11.079		401.9			12.197		429.6		
			1.62E+25		1.58E+41	-7.66E+35		1.78E+25		1.74E+41	-8.96E+35
	5,200	11.179		379.2			12.229		403.1		
			3.27E+25		2.54E+41	-1.22E+36		3.55E+25		2.75E+41	-1.40E+36
	5,400	11.426		320.3			12.301		335.4		
			2.21E+25		1.14E+41	-5.59E+35		2.36E+25		1.22E+41	-6.20E+35
Inner	5,600	11.662		260.0			12.360		267.1		
			1.34E+25		4.18E+40	-2.07E+35		1.41E+25		4.39E+40	-2.20E+35
Core	5,800	11.886		199.5			12.405		198.2		
			6.79E+24		1.08E+40	-5.49E+34		7.03E+24		1.12E+40	-5.42E+34
	6,000	12.099		143.7			12.437		129.0		
			2.35E+24		1.41E+39	-9.03E+33		2.40E+24		1.44E+39	-6.13E+33
	6,200	12.299		139.6			12.455		59.5		
			2.59E+23		3.03E+37	-1.55E+32		2.61E+23		3.05E+37	-6.64E+31
	6,371	12.460		0.0			12.460		0.0		
	SUM		5.976E+27		8.14E+44	-2.460E+39		5.976E+27		8.03E+44	-2.489E+39

Technical Notes

impact with the growing Earth. This is 86 times greater than the heat released by gravitational settling.

$$\frac{2.489 \times 10^{39}}{29.0 \times 10^{36}} = 86$$

In other words, heat released by meteoritic bombardment would melt the Earth many times over, even if the bombardment was spread over millions of years. [See Endnote 45a on page 85.] Had this happened, we would not find heavy, nonreactive chemical elements, such as gold, at the Earth's surface, nor would granite exist. [See **"Molten Earth?"** on page 85 and Endnote 18 on page 168.]

Conclusion

By assuming a uniform density distribution throughout the preflood Earth (altered only by the compressive stress that increases with depth), the hydroplate theory and gravitational settling answer the many questions raised in **"Volcanoes and Lava"** on page 115 and **"Geothermal Heat"** on page 116. This also explains why the inner core spins faster than the rest of the Earth (page 155), and why George Dodwell found that the tilt of the Earth's spin axis has steadily changed during the last 4,000 years. [See page 120 and Endnote 69 on page 144.] Finally, the hydroplate theory and gravitational settling explain the following unusual characteristics of today's Earth:

- the huge density discontinuity at the core-mantle boundary (highlighted in yellow on page 497),
- Earth's liquid outer core and solid inner core,
- "oceans" of flood basalts found worldwide, especially in and surrounding the Pacific and Indian Oceans,
- oceanic trenches and the ring of fire (explained on (pages 149–173),
- the 40,000 volcanoes (all taller than 1 kilometer) on the floor of the Pacific Ocean,
- the great variability of the temperature gradient under the Earth's surface (discussed on page 117), and
- Earth's powerful magnetic field—2,000 times greater than the combined magnetic fields of all the rocky planets. [See **"The Origin of Earth's Powerful Magnetic Field"** on page 155.]

References and Notes

1. See, for example, Frank D. Stacey, *Physics of the Earth* (New York: John Wiley & Sons, Inc., 1969), pp. 281–282.

2. The mass expelled from Earth during the flood was probably less than 2.8×10^{24} grams, less than 1/2,000 the mass of the Earth. [See Table 30 on page 490.] Therefore, that lost mass can be neglected. Even if it could not be neglected, it would have only a secondary effect, because the loss of that mass would not alter Earth's spin rate.

3. Only a very small fraction of the preflood Earth's potential energy was expended in increasing the Earth's rotational kinetic energy. The Earth's angular velocity today is

$$\omega = 7.29211 \times 10^{-5}\ \frac{\text{radians}}{\text{sec}}$$

so the rotational kinetic energy gained by Earth as a result of its faster spin rate (but lower polar moment of inertia) after the flood is relatively trivial and can be neglected.

$$\frac{1}{2}\left[8.03 \times 10^{44}\ \omega^2 - 8.14 \times 10^{44}\left(\frac{360}{365.25}\ \omega\right)^2\right] = 3.25 \times 10^{34} \text{ ergs}$$

Endnotes 2 and 3 above may seem contradictory to some people. The ice skater shown in Figure 81 on page 150 will spin faster as she pulls her arms in toward her spin axis. However, even if something as heavy as her arms (while extended) suddenly flew off her spinning body, her spin rate would stay about the same.

4. This factor of 5 can be estimated by calculating the ratio of the energy released by gravitational settling just within the outer core ($\Delta\rho\ g\ V\ h$) to the energy expended in melting ($L\ V\ \rho_{av}$), where

$\Delta\rho$ = the average density *difference* between particles that sink to the particles that float,
g = the average acceleration of gravity in the core,
V = the volume of melted rock in the outer core,
h = the average "fall distance" (about half the radius of the outer core),
L = the heat of fusion in the outer core, and
ρ_{av} = average density of the melted particles.

If $g \approx 500$ cm/sec^2 $\quad h \approx 1{,}750 \times 10^5$ cm

$L \approx 4 \times 10^9$ ergs/gm $\quad \frac{\Delta\rho}{\rho_{av}} \approx 0.23$

then this dimensionless ratio is about 5.

$$\frac{g\ h}{L} \times \frac{\Delta\rho}{\rho_{av}} \approx \frac{500 \times 1{,}750 \times 10^5}{4 \times 10^9} \times 0.23 \approx 5 \gg 1$$

Any ratio that is much greater than 1.0 will produce runaway heating near the center of the Earth. (Other minor effects are being omitted.) From this analysis, it becomes clear that this factor is large because h (the "fall distance") is so large. With about 5 times more heat in the core than it takes to melt the outer core, heat from the outer core should be conducting today into and melting the base of the mantle and the top of the inner core.

5. Don L. Anderson, *Theory of the Earth* (Boston: Blackwell Scientific Publications, 1989), p. 68.

Rapid Attraction

Two electrical charges (Q_1 and Q_2 statcoulombs, one positive and the other negative) are attracted toward each other by a force of F dynes when they are separated by a distance of x centimeters in a medium with permittivity k.

$$F = k\frac{Q_1\ Q_2}{x^2}$$

For a vacuum, $k = 1$. One statcoulomb is the charge of 2.08×10^9 electrons.

Stokes' law gives the terminal velocity of a sphere of mass m and radius r which is acted upon by a force F in a fluid whose viscosity is μ. That velocity is

$$v = \frac{dx}{dt} = \frac{2\ \rho\left(\frac{F}{m}\right)\ r^2}{9\ \mu}$$

The sphere's density, ρ, is

$$\frac{m}{\frac{4}{3}\ \pi\ r^3}$$

These equations simplify to

$$x^2\ \frac{dx}{dt} = \frac{k\ Q_1\ Q_2}{6\ \pi\ \mu\ r}$$

Integrating this from an initial separation distance of x_0 until the charged particles collide ($x = 0$) at time t gives:

$$\int_{x_0}^{0} x^2\ dx = \frac{k\ Q_1\ Q_2}{6\ \pi\ \mu\ r}\int_0^t dt$$

$$-\frac{x_0^3}{3} = \frac{k\ Q_1\ Q_2}{6\ \pi\ \mu\ r}\ t$$

What does this mean? Consider trillions of radon-222 (^{222}Rn) atoms flowing for weeks between sheets of mica that are growing because the mineral-rich water's temperature and pressure are dropping. If ^{222}Rn (half-life = 3.8 days) ejects an alpha particle (charge = +2), the radon instantly becomes ^{218}Po with a charge of $Q_1 = -2$ and a radius $r = 5 \times 10^{-8}$ centimeters. That polonium ion will recoil with enough energy to remove hundreds of hydroxide ions (OH^-)—each with a negative charge—from near the impact point in the mica. [For an explanation of dehydroxylation, see Endnote 110 on page 369.] While the water might absorb some recoil energy, or the polonium might be deflected off of a mica sheet, some recoiling ^{218}Po will crash into and become embedded in the mica, removing hundreds of hydroxide ions. This will give the impact point a large positive charge—both from the impact and the greater heating minutes later when the embedded ^{218}Po decays by emitting an alpha particle.

Let's conservatively say that the first impact in the mica produces a charge of $Q_2 = +100$. For water,

$$k = 0.0123\ \frac{\text{dynes cm}^2}{(\text{statcoulombs})^2} \quad \text{and} \quad \mu = 0.003\ \frac{\text{dynes sec}}{\text{cm}^2}$$

Other flowing ^{222}Rn atoms that decay near that +100 point charge will be pulled into it within one ^{218}Po half-life (3.1 minutes) if

$$x_0 \le \left[\frac{-k\ Q_1\ Q_2\ t}{2\ \pi\ \mu\ r}\right]^{\frac{1}{3}} = \left[\frac{-0.0123\ (-2)\ (+100)\ (3.1\times 60)}{2\pi\ (0.003)\ \ 5\times 10^{-8}\ \ (2.08\times 10^9)^2}\right]^{\frac{1}{3}}$$

$$= 0.0048\ \text{cm}$$

This is more than twice the radius of a ^{218}Po halo. As more radon decays near the impact point and as more ^{218}Po, ^{214}Po, and ^{210}Po are drawn into the impact point and then decay, the heating and recoil pressure remove more hydroxide ions, increasing Q_2. The distance, x_0, and the rate at which the polonium is pulled in increase.

The formula for biotite is $K(Mg,Fe)_3(Al,Fe)Si_3O_{10}(\mathbf{OH},F)_2$. Approximately 17/400 of its mass is OH^- (highlighted in bold above). A typical inclusion at the center of a polonium halo has a radius of about 0.00005 cm. Therefore, that tiny volume of biotite, whose density is 3.1 gm/cm^3, initially had about

$$\frac{17}{400} \times \frac{4}{3}\ \pi\left(5 \times 10^{-5}\right)^3 \times\ 3.1\ \left(6.022 \times 10^{23}\right) = 4.15 \times 10^{10}$$

OH^- ions.

If dehydroxylation removed only 1/20th of these ions, about a billion polonium ions could be attracted and concentrated, enough to form a sharp halo.

PREDICTION 46: A sensitive mass spectrometer will show about a 5% deficiency in hydrogen within the inclusions at the center of isolated polonium halos.

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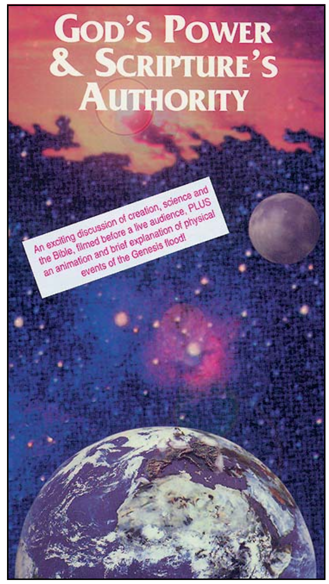

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About the Author

Walt Brown received a Ph.D. in mechanical engineering from the Massachusetts Institute of Technology (MIT), where he was a National Science Foundation Fellow. He has taught college courses in physics, mathematics, and computer science. Brown is a retired Air Force full colonel, West Point graduate, and former Army Ranger and paratrooper. Assignments during his 21 years of military service included: Director of Benét Laboratories (a major research, development, and engineering facility); tenured associate professor at the U.S. Air Force Academy; and Chief of Science and Technology Studies at the Air War College. For much of his life Walt Brown was an evolutionist, but after years of study, he became convinced of the scientific validity of creation and a global flood. Since retiring from the military, Dr. Brown has been the Director of the Center for Scientific Creation and has worked full time in research, writing, and teaching on creation and the flood.

For those who wish to know more about Walt Brown, a new book (Christian Men of Science: Eleven Men Who Changed the World by George Mulfinger and Julia Mulfinger Orozco) devotes a chapter to Brown. It may be read by clicking here.

Written Debate

The issue is: Does the scientific evidence favor creation or evolution? Dr. Brown's standing offer for a strictly scientific, written, and publishable debate is on page 512. Note that a few initially agreed to a strictly scientific debate, but later changed their minds, insisting they would only take part if the exchange included religion. One evolutionist is so upset that a written debate will not include religion that he now misleads by saying that Walt Brown has refused to debate him. (Correspondence in our files shows how he no longer wanted a strictly scientific debate after reading the 6th edition of this book.) Dr. Brown has consistently maintained his position for 31 years: the debate should be limited to scientific evidence. If someone says, "Walt Brown has refused to debate," we suggest you ask to see that person's signed debate agreement.

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For anyone who disagrees with the ***hydroplate theory*** (explained in Part II of this book), the refereed exchange is appropriate. Anyone, regardless of their scientific credentials, can engage Dr. Brown, provided they have read the theory. For details, see page 515.

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