

# **Young Earth vs Old Earth**

## **(Some Relevant Research Materials)**

**This packet contains a variety of information that will illustrate some of the arguments and familiarize you with a few central points of difference YEC's have with modern Science.**

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## YOUNG EARTH vs OLD EARTH Introduction

The Young Earth teaching advances the idea that the Earth is only approximately 6 to 12 thousand years old as opposed to the present modern day secular science view of 3.5-15 billion years old. This opposing view has *rebuilt* a rather strong modern day movement over the last few decades and has invested millions of dollars in a few museums across the United States promoting this idea. Much of it has grown out of a passion to combat the encroachment of the evolution teachings in our public schools. However, it has caused an “extreme” difference of approach with other *Christian Creationists* who happen to believe that these are excessive and inordinate debates, not required to battle the dispute of evolution.

Much of the disagreement revolves around the theory of *uniformitarianism*—the teaching that time has gone uninterrupted for billions of years to accommodate the need evolution has for the development of the many different species. This is a commonality that Young Earth Creationists (YEC) have with old Earth Creationist (OEC)—both believe and are in agreement with the idea, *uniformitarianism* is erroneous and did not happen.

However, the main difference is YEC’s take the approach of attempting to advance the Earth could not facilitate this idea because it’s only 6-12 thousand years old—and this *includes the whole universe!* Conversely, the OEC’S simply believe, there was an unknown amount of years that is *prehistoric* to the creation of Adam and Eve and therefore the Earth’s creation described in Genesis 1 is a renewal and/or restoration of the Earth and *not the original creation* of the Earth and universe. This is *central to the controversy* between these two points of view.

Obviously, accommodating a 6-12 thousand year old earth requires an enormous amount of restructuring and redefining modern scientific data. This *change of data* affects many fields of science, forcing *archeological* artifacts, like dinosaurs, to be reclassified along with many *geological* modifications to explain a brief Ice Age, plant life, or rock strata. Also, *physics* requires reconstituting certain data regarding *chemical compositions/gases*, and in *Astronomy*, theories about the speed of light are advanced, etc. Many of these restructures and/or reclassifications are based on disproving the premise that *uniformitarianism has occurred—when in fact both camps of creationists are agreed it didn’t.*

The positions of OEC’s simply question the logic of these explanations and the forcing of such extraordinary, and what appear to be, unreasonable and irrational positions of belief. And though the amount of scientific data and the advancement of so many varieties of different hypotheses generated by the YEC’s to justify and explain this information is commendable; frankly, the information remains highly suspect when compared to the present scientific arguments that exist from the knowledge of so many fields of modern science.

Actually, modern science is in conflict with *uniformitarianism* also, because it has proved through many of its own findings that *catastrophism* is an "event force" with historical record embedded in the evidence of the dinosaurs, rocks, and physics, of the Earth and moon. And though YEC's question the credibility of the variety of dating methods and different experiment techniques modern scientific data is based on and taken from; there is just as much evidence to consider these *multiple methods* are very creditable and quite accurate.

This packet contains a variety of information that will illustrate some of the arguments and familiarize you with a few central points of difference YEC's have with modern Science. This information is provided to give you a *small introduction* to an enormous amount of facts the scientific community has available to prove the Earth is indeed, 3.5 -15 billion years old. As you will come to find, it's quite complex, and if one is not familiar with the many terms specific to the scientific community, it may be hard to understand. But, in all due respect, it should illustrate that the Young Earth Movement within the *Christian Evangelical Community* has been addressing a "straw man issue" premised on the principle of *uniformitarianism*, which neither camp of creationists believes exists, and of which, even modern science proves to have a contrarian point-of-view.

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**NOTE: This website has not been updated since early in this decade. I do not have the time or inclination to maintain it, but I have decided to keep it available as a product of its time. So please read with discernment and check sources. -MST (10 September 2009)**

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## Is There Really Scientific Evidence for a Young Earth?

For the past several decades, the question of the age of the Earth has been a very divisive one among Christians. Many people (known as "Young-Earth Creationists") believe that the only valid interpretation of the Bible indicates that the Earth is 10,000 years old or less, and they also claim to have scientific evidence that supports this view of the Earth. At the same time, there are many others who believe that scientific evidence overwhelmingly supports the claim that the Earth is about 4.6 billion years old, while the Universe as a whole is 10 to 20 billion years old. Many people in this latter category affirm the intimate involvement of God in this process of creation.

It is not the purpose of this paper to discuss theology, but this author firmly believes that a literal interpretation of Genesis allows for an Old-Earth view that is consistent with mainstream science. I say this only to emphasize that this paper is not intended to oppose any Christian beliefs, or to tear down anyone's faith. Rather, the purpose of this paper is to ensure that our Faith is based firmly on *Truth*, and not merely wishful thinking.

Through the ages, many people have denied certain facts of nature because those facts did not fit into the belief system that they desired to hold to. Both Christians and atheists are commonly guilty of this error. It should be obvious that any Christian who believes that God is the ordainer and framer of this world, and that God is the initiator of all logic and scientific thought, should never take such a position. The purpose of this paper is to show that Young-Earth Creationists, however unintentionally, have in fact done this. Regardless of what we may think the Bible says, the facts of nature are also ordained by God, and it is not right deny them or to misrepresent them in order to support any particular belief system. The purpose of this paper is to set forth the facts of nature in light of the claims made by Young-Earth Creationist leaders in hope that, by better understanding the facts of nature, we will also come to a better understanding of God's greater source of revelation - the words of the Bible.

**Concerning References:** A large number of articles from scientific journals are referenced in this fact sheet, and I strongly encourage interested readers to look at this source material. In general, these journals should be available at your local university library, and in some cases the public library. If not, you can ask your librarian about an inter-library loan, which is generally available for a nominal fee. Many journal articles are also available online, one good source for finding them is the

Astrophysical Data System Abstract Service ([http://adsabs.harvard.edu/abstract\\_service.html](http://adsabs.harvard.edu/abstract_service.html)). All of the young-Earth claims addressed in this fact sheet can be found in books published by Young-Earth organizations. In brackets, after the title of each claim, are references indicating where the claim can be found, in case the reader would like to look at the source to better understand the Young-Earth arguments. Most references are from the 1995 version of *The Defender's Bible* (DB), an official ICR publication, or the 1992 version of *The Illustrated Origins Answer Book* (OAB) by Paul S. Taylor. Both of these are Young-Earth publications that include extensive lists of "young-Earth evidences," and both of them are still distributed by the Institute for Creation Research (the most prominent young-Earth organization), and so can be assumed to receive their approval. The references to the *Defender's Bible* give the page number followed by the number that the claim receives on that page. All of the arguments from the *Origins Answer Book* are found on pages 18-20, and are numbered from 1 to 107. I also included a few claims from the *ICR Creation Online* course (<http://www.creationonline.org/frame.htm>).

**Acknowledgements:** Thanks to all those that have offered comments and advice for this fact sheet, including Hill Roberts, Tim Swindle, William Keel, Mike Tice, George Bendo, Adam Crowl, Kyle Witten, Marj Harmon, and Bob Stuart. Additionally, some useful lines of reasoning were suggested to me by writings of Hugh Ross, Don Stoner, and Hill Roberts, which are referenced below.

**Note to Reader:** The most important element of this fact sheet to me is its scientific accuracy. My purpose is to investigate "young-Earth evidences" honestly and responsibly, confident that God will be glorified by the Truth regardless of its theological implications. Therefore, if you have any comments or suggestions regarding anything in this fact sheet, please contact me. My goal of clarity and accuracy can only be fully reached with the help of others who are also familiar with the material. Although I would love comments on any part of the fact sheet, I would particularly appreciate any help on the few remaining sections that are printed in italics, indicating places where the fact sheet is not yet finished. My email address is *matthewt at lpl dot arizona dot edu* Thanks and God bless you.

Matthew Tiscareno  
October 7, 1999

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## Common Fallacies

Before I begin addressing one-by-one the arguments for a young Earth, I think it is important to explain some errors that are repeatedly committed in these arguments. The first fallacy is claiming that an unexplained mystery supports the creationist view simply because science is not currently able to explain it, and the second fallacy is looking at only one side of a natural equilibrium and claiming that an unlimited build-up would occur, posing a challenge to mainstream science.

**The Unexplained Mystery** Even in this age of scientific and technical achievement, there are many natural phenomena that do not have a satisfactory scientific explanation. If this were not so, then Science would cease to exist. We do not fully understand how charges get separated in rainclouds to produce lightning, or how river valleys were carved on the now-bone-dry planet of Mars. Yet, these mysteries do not support one viewpoint over another, they are simply areas in which more needs to be learned. The lack of a known scientific explanation does not prove that no natural explanation exists. In fact, scientists are constantly finding explanations for previously unexplained phenomena, as Science continues to work towards a greater understanding of God's Creation. Therefore, it is a fallacy to assume that a phenomenon has a supernatural cause, simply because no adequate natural explanation has yet been discovered. To demonstrate this fallacy, consider the manufacture of organic molecules. Two hundred years ago, it was thought by many that only living cells, endowed with a God-given "life force," could produce organic molecules. This idea was bolstered by the failure of all attempts to produce organic molecules synthetically, and it was eventually laid to rest when chemists



finally did succeed in synthesizing organic molecules. In this case, a supernatural explanation or organic molecule formation had been advanced due to the lack of satisfactory natural explanations, and was abandoned when the natural explanation was discovered. Please note that I am not saying that all supernatural explanations are un-scientific by definition. That would be a *philosophical* statement of "naturalism," not a statement that can be backed up with scientific evidence. Rather, I am saying that any such claim would have to be based upon positive evidence; it is not enough simply to argue from the lack of any known natural explanation. The existence of an Unexplained Mystery is not, on its own, evidence for a supernatural explanation.

Many arguments that are advanced in favor of "recent creation" are in fact based simply upon phenomena that currently lack an adequate explanation, and it is important to recognize this fallacy. For example, we may not currently understand exactly how Dr. Gentry's polonium halos were formed, but that does not support the claim that "God created them that way" any more than the former inability to synthesize organic molecules meant that only cells with a God-given "life force" could do it. In both cases, a natural explanation exists, even if we do not yet know what it is. Examples of the Unexplained Mystery Fallacy include Parentless Polonium-218 Halos, Escape of Methane from Titan, and The "Red Sirius" Mystery.

**The One-Sided Equation** A large class of "evidences" presented by young-Earth advocates involve measuring rates of various Earth processes, then attempting to extrapolate them backwards for millions of years. Generally, the purpose is to show that the process in question would build up to absurdity if it were allowed to continue through "evolutionary timescales." The fallacy of most claims of this type is a failure to recognize the importance of equilibrium. Most processes on Earth are in a state of balance, in which one process (such as erosion of the continents) is counteracted by others (such as emplacement of new continental material by volcanoes and tectonic uplift). Generally, processes on Earth do not build up without limit, because there is always another process that opposes the build-up, leading to the establishment of equilibrium. The method for dealing with young-Earth claims of this type is to look for the limiting process that imposes equilibrium. In some cases the balancing process has simply been overlooked, and the young-Earth claim is laid to rest by pointing it out. Other times the balancing process is not well understood or even unknown, which may seem to lend credence to young-Earth claims. However, in these cases we simply revert to the Unexplained Mystery. Unless we can prove that no balancing process exists (and in most cases that cannot be done), we should adopt the working hypothesis that there is a yet-to-be-discovered process that provides the equilibrium, rather than jumping to the assumption of a supernatural explanation. Examples of the One-Sided Equation Fallacy include Influx of Magma from Mantle to Form Crust, and Erosion of Sediment from Continents, Maximum Life of Comets, and Helium-4 in the Atmosphere

## Geophysics

**Decay of Earth's Magnetic Field** [DB 1506 (1); OAB 50] Since devices for measuring the Earth's magnetic field were invented a few hundred years ago, measurements have shown that the Earth's magnetic field has been steadily decreasing over those few hundred years. It is claimed that these measurements indicate that the Earth's magnetic field has been steadily losing energy ever since it formed. By extrapolating the decay backwards in time, it is then claimed that an age greater than 10,000 years is impossible. However, it is easily shown that such a simple extrapolation is not

justified. Scientific instruments are not the only mechanisms that have ever existed for measuring the Earth's magnetic field. Ovens used by ancient civilizations and the igneous rocks making up the ocean floor are two of the more obvious examples. Both record the direction and strength of the magnetic field as it was at the time they were last heated, and both prove conclusively that the hypothetical exponential decay of Earth's magnetic field has not occurred (according to the young-Earth theories, the magnetic field was many times greater only a few thousand years ago, a hypothesis that is clearly at odds with the above-mentioned evidence). Instead, the evidence shows that the magnetic field has fluctuated back and forth in strength as well as direction. These fluctuations are clearly observed in places where the stratigraphy (i.e. which rocks are older than which rocks) is obvious due to either layering or distance from a sea-floor spreading ridge. The decrease measured in the past few hundred years, therefore, is nothing more than a downward trend as part of an overall fluctuation, and has no implication for the age of the Earth (for a more detailed discussion of this issue, see Thompson (1997), <http://www.talkorigins.org/faqs/magfields.html>).

It has been proposed by Young-Earth scientists that all of the magnetic reversals recorded in the sea floor were created during Noah's Flood. There are several problems with this theory that make it physically implausible, but regardless of whether or not this theory is valid, the fact remains that a coherent Old-Earth theory exists to explain the recent decline in Earth's magnetic field strength. Therefore, that decline should not be used to argue against an ancient Earth.

**Cooling of the Earth** [DB 1507 (40); OAB 25] This claim is known as "Kelvin's age of the Earth", and it is taught in introductory physics and geology classes as a classic example of a great calculation that *didn't take everything into account*. A hundred years ago, the eminent scientist Lord Kelvin assumed that the heat now escaping from the Earth must have come from gravitational contraction, the most powerful energy source known at the time. Calculating the gravitational energy available, and the cooling time, he derived a maximum age of the Earth: 24 million years. However, the powerful energy that could be released by radioactivity was not known until late in Kelvin's career. Calculations using the amount of radioactive materials known to exist in the Earth's crust show that the energy available is in good agreement with a cooling time of 4.6 billion years. Although Kelvin was in fact one of the great scientists of his time, he simply did not have all of the relevant information available to him in the late nineteenth century. Kelvin's calculation was shown one hundred years ago to be incomplete, giving a misleading answer, and it is rather disingenuous for young-Earth proponents to include it in their publications (as recently as 1995) as if it were still a valid argument.

## Planetary Science

**Shrinking Sun** [OAB 94] This claim was made in 1979 by J.A. Eddy and A.A. Boornazian (*Science News*, v.32, no.9, pp.17-19 (Sept 1979)), who analyzed 120 years of Sun measurements from the Greenwich Observatory in London. Eddy and Boornazian claimed that these measurements indicated that the Sun is shrinking at a rate of about 2 arcseconds per century (an arcsecond is a measure of angles, equal to 1/3600 of a degree). At such a rate, the Sun would shrink down to nothing in only 200,000 years, so this shrinking obviously could not be going on steadily for several billion years. However, even if these measurements were accurate, it would not be much of a problem for scientists because it could easily be explained by a shift in the Sun's fusion process which would cause a temporary change in size. In fact, Eddy and Boornazian's research was motivated by a desire to

investigate the possibility of such a shift, which is an important point, because it shows that the shrinking Sun claim was *not* discredited in order to "preserve evolutionary timescales." However, these measurements were in fact shown to be incorrect only a year after they were first published. I.I. Shapiro (*Science*, v.208, pp.51-53 (4 April 1980)) analyzed measurements of transits of the planet Mercury across the solar disk from 1736 to 1973, and showed that the size of the Sun has remained constant during that time within 0.3 arcseconds. Parkinson, Morrison, and Stephenson (*Nature*, v.288, pp.548-551 (11 Dec 1980)) re-analyzed the Greenwich data from 1715 onward, taking into account the changes in instrumentation over that period, changes in the transparency of the atmosphere, and differences in the person making the measurements. They showed that the uncertainty in Eddy and Boornazian's data is much too large to support their claim. Even J.A. Eddy himself was so convinced by these refutations that he never again referred in print to his research on this subject. In summary, the claim of a shrinking Sun was refuted less than a year after it was published, and should not be used as evidence for the age of the Solar System.

**Fusion in the Sun** [OAB 95] It is claimed that the Sun might not be operating by thermonuclear fusion at all, in which case the Sun would not have an energy source powerful enough to last for 4.5 billion years. The main reason for thinking this was that the amount of neutrinos (a sub-atomic particle) coming out of the Sun was only about a quarter of what was theoretically expected. Firstly, the existence of a significant flow of neutrinos cannot be explained by any method other than nuclear processes; so even though the theory needed refining, it was extremely over-zealous to claim that the difficulty disproves fusion in the Sun (to be fair, some people merely claimed that the lack of neutrinos showed that fusion could not account for all of the Sun's energy). But secondly, the necessary adjustments have now been made to the theory due to the recent experimental proof that the neutrino is not a massless particle like a photon, but instead it has a tiny mass like an electron does. With this adjustment, nuclear theory now correctly accounts for the Sun's neutrino flow, and there is no reason to doubt that nuclear fusion is the source of all the Sun's energy.

**Accumulation of Dust on the Moon** [DB 1507 (38); OAB pp.17-18] This was formerly a widely-used young-Earth claim, but it has now been discredited. Nonetheless, it is still sometimes repeated in young-Earth circles. One of the first estimates of dust expected on the Moon was made in 1960 by Hans Pettersson. Pettersson estimated the influx of space dust by standing on top of a mountain with a device used to measure smog levels. By assuming (incorrectly) that all of the nickel dust he detected came directly from outer space, Pettersson arrived at a very large estimate of the amount of space dust falling on the Earth (and the Moon). When the Apollo landers found that the amount of dust on the Moon was much less than suggested by Pettersson's measurements, some young-Earth advocates claimed this proved that the Moon was young. Not long after Pettersson, however, the influx of space dust was measured by satellites. It has been measured several different ways now, and is known to be almost 1,000 times smaller than Pettersson thought. In fact, there is no discrepancy whatsoever between the influx of space dust and the amount of dust found on the Moon's surface. Nowadays, most of the more responsible young-Earth advocates have ceased to use this claim. For example, Snelling and Rush (*Creation Ex Nihilo Technical Journal*, v.7, pp.2-42 (1993)) not only explain why the moon-dust argument is untenable, they also refute the commonly-repeated myth that Apollo scientists were afraid that their landers would sink into a deep dust layer.

**Moon Rock Viscosity** [OAB 56] In a paper published in a young-Earth journal (*Creation Research Society Quarterly*, v.20, pp.105-108 (Sept 1983)), former young-Earth advocate Glenn R. Morton

attempted to calculate the time it would take for lunar craters to be erased by the slow flow of rock. The central parameter in the calculation is the viscosity of the rock (its resistance to flow). As a rock's temperature approaches its melting point, its viscosity becomes low enough (although still a trillion trillion times higher than that of honey) for some flow to be observed over long time periods. This phenomenon allows, for example, convection in the Earth's mantle, which is crucial to Plate Tectonics, and in turn to many geophysical processes. Viscous flow can also be observed in many other solids, from glass to Silly Putty, but always at temperatures that are rather close to the melting point of the solid. Morton attempted to apply this process to rocks on the surface of the Moon. However, by failing to understand viscosity's extreme dependence on temperature, he grossly underestimated the viscosities of lunar rocks. Morton assumed that the viscosity of the Moon's surface rocks would be comparable to the highest measured rock viscosities (those of Earth's mantle). However, since a rock's viscosity increases exponentially as its temperature falls (and the Earth's mantle is very hot while the Moon is very cold), the viscosities of moon rocks are exponentially higher than the viscosities in Earth's mantle. In fact, moon rock viscosities are so high that they are practically infinite, meaning that no flow will occur (i.e., rocks are more likely to break or fracture than to flow). Since the flow of rock is basically impossible at the temperatures that exist on the Moon's surface, there will be no relaxation of lunar craters, and thus no problem with the age of the Moon.

**Deceleration of Earth by Tidal Friction** [DB 1507 (39); OAB 60] It is claimed that tidal interactions between the Earth and the Moon are causing the Moon to move away from the Earth, and the Earth to rotate more slowly. This much is true, and in fact paleontological studies of ancient corals and stromatolites has confirmed that the Earth did rotate faster in the past, resulting in more than 365 days in a year. It is also true that such a faster rotation would have caused a much greater equatorial bulge in the past than currently exists. The fallacy is the assumption that such a bulge would have remained for us to observe today. The Earth's mantle, made up of rock subjected to high temperatures and pressures, acts like a fluid over long time periods -- it does not hold its shape over billions of years. The current equatorial bulge is very close to what you would expect to be produced by the current rotation rate, although it is slightly larger because the Earth has not completely relaxed from previous times when it rotated faster.

A related question concerns the *rate* at which the Moon is receding from the Earth. If you simply extrapolate the Moon's orbit backwards in time, assuming that the rate at which it is currently receding has not changed, you find that the Moon would have been close enough for the Earth's gravity to pull it apart only 2 billion years ago. However, K.S. Hansen described a very plausible answer to this question (*Reviews of Geophysics and Space Physics*, v.20, no.3, pp.457-480 (1982)). He pointed out that the current Earth-Moon configuration contains a resonance which increases the efficiency of the tidal interactions that are causing the Moon to recede, and that therefore the Moon is currently receding faster than usual. In his computer models, by carefully keeping track of the changing tidal parameters as the Moon spirals away from the Earth, Hansen determined that the Moon would have been at an acceptable distance from the Earth 4.5 billion years ago (for a more detailed discussion, including more recent research based on Hansen's breakthrough, see Thompson (1999), <http://www.talkorigins.org/faqs/moonrec.html>).

Incidentally, a misunderstanding of how "leap seconds" work has led some people to grossly overestimate the rate of change of Earth's rotation. The U.S. Naval Observatory, along with other

international agencies, adds a "leap second" to the calendar whenever they determine that Earth's rotation is out-of-sync with their atomic clocks. Properly understood, the rate of about one "leap second" every two years *does not mean* that Earth's rotation is slowing by a half-second every year. Rather, it means that Earth's rotation is consistently a tiny fraction slower than it was when the length of the second was rigorously defined, a discrepancy that builds up over a year to a difference of half a second. If Earth's rotation were really declining measurably, we would expect to see "leap seconds" become more and more frequent, since every year the discrepancy in year-length would be greater than it was the previous year. In fact, we do not see this. "Leap seconds" are due, not to a consistent decline, but to fluctuations in Earth's rotation rate about a mean value, which are caused by entirely different processes and have little long-term effect. On the other hand, the consistent deceleration of Earth by the Moon is so slow that it cannot be directly measured (physical calculations put it at about one second every 70,000 years), although it is corroborated by fossil corals that show more days per year in the past.

**Planetary Diversity** [ICR Creation Online] Our Solar System is quite diverse, with its planets and satellites and other bodies having extremely different compositions and histories. It is claimed that, if our Solar System was formed from a single cloud of dust, then all planets should have the same composition. This is akin to saying that gasoline and plastic should be similar because they both come from crude oil. Even though the bodies of the Solar System came from the same source, they have had radically different histories, due to their different locations and the conditions to which they have been subjected. For example, the higher temperatures at the locations of the inner planets caused them to lose their hydrogen and helium, while the lower temperatures of the outer Solar System allow for the possibility of icy and gaseous bodies. For another example, tidal forces can cause satellites that are closer to their planets (such as Io, Europa, and Enceladus) to be geologically active, while nearby satellites (such as Callisto and Rhea) have been relatively quiet. On the other hand, many similarities also exist in the Solar System, such as the similar heavily cratered surfaces of the Moon, Mercury, Callisto, and many other bodies. The diversities and similarities in our Solar System do make Planetary Science an interesting and exciting field, but they do not present an overall problem for scientists.

**Hydrogen and Helium in Terrestrial Planets** [ICR Creation Online] It is claimed that prevailing theories of Solar System formation cannot account for the lack of hydrogen and helium in the planets Mercury, Venus, Earth, and Mars. The simple answer is that these light gases were in fact present when the terrestrial planets were formed, but they escaped into space for two reasons. The first reason is that the terrestrial planets are closer to the Sun, and the higher temperatures made the light gases more energetic, and therefore more likely to escape. The second reason is that these four planets are smaller than the outer gas giants, and therefore they did not have enough gravity to hold on to these energetic light gases.

**Rotation States in the Solar System** [ICR Creation Online] Almost all bodies in the Solar System orbit and rotate in the same direction, although several exceptions exist. This predominant direction is called *prograde* (if you were to look down on the Solar System from the Sun's North Pole, it would be counter-clockwise), and the opposite direction is called *retrograde*. Some young-Earth advocates claim that, if the Solar System really condensed from a dust cloud as is generally accepted, then all rotations should be prograde. These people claim that the *exceptions to the predominant direction* show that the prevailing theories of Solar System formation are invalid. Others assert that, since

rotation states are thought to be largely influenced by impacts, rotation states should be randomly distributed (approximately half prograde and half retrograde). This second group claims that the *existence of a predominant direction* of rotation argues against the prevailing theories. Obviously, these two groups are making similar claims, but their justifications for saying so oppose each other.

It is most likely that the second group is at least partly correct: rotation states are greatly influenced by impacts, and we would expect them to be close to random. However, this is not known for certain. It is also important not to be misled by planets which have definitely *not* had their rotations affected by impacts. Two planets (Jupiter and Saturn) are almost entirely gas, and thus impacts would have very little effect on their rotation. Therefore it is no surprise that Jupiter and Saturn have prograde rotation. A third planet, Pluto, has a rotation state that is the result of tidal resonance with its moon Charon. Whatever Pluto's original rotation state may have been, it would have been inevitably dragged by Charon into its present state, in which it always keeps the same face towards Charon (similarly, almost all moons in the Solar System have had their rotation states defined by tidal forces, not by impacts, which explains why they are predominantly prograde). Discounting these three, we are left with 6 planets, two of which (Venus and Uranus) have retrograde rotation. Therefore, the claims of the second above-mentioned group (that rotations should be random) are most likely true, while their objections (that there is a predominant direction) is easily explained by statistical fluctuation and the influence of tides. Also, the objections of the first group (that all rotations should be in the same direction) are answered by considering the influence of large impacts and tides during the early history of the Solar System.

**Orbits in the Solar System** [ICR Creation Online] Almost all bodies in the Solar System orbit and rotate in the same direction, although several exceptions exist. This predominant direction is called *prograde* (if you were to look down on the Solar System from the Sun's North Pole, it would be counter-clockwise), and the opposite direction is called *retrograde*. It is sometimes claimed that, if the Solar System really condensed from a dust cloud as is generally accepted, then all orbits should be prograde without exception. A closer look shows those bodies that do have retrograde orbits (such as comets and Neptune's moon Triton) show other signs that they are not in their original orbits. These signs include high inclinations and eccentricities (other indicators of irregularity in an orbit), compositions that are different from other nearby bodies, and in some cases (such as Triton), indications of extreme tidal heating due to the body's being forced into a new orbit. The conclusion from these observations is that these objects were formed elsewhere in the Solar System (presumably with prograde orbits), and then were thrown into their present orbits by later events (See Maximum Life of Comets, below). So the theory that all Solar System bodies were formed with prograde orbits remains intact.

**Maximum Life of Comets** [DB 1507 (32,33); OAB 17,18] The claim is that comets that pass close to the Sun (the comets we see) cannot have survived for 4.6 billion years in their present orbits. This is not necessarily true for some comets with very long orbital periods, but generally the point is a valid one. However, this claim is a One-Sided Equation that considers the rate at which comets are destroyed without considering how the comet population is replenished. The population of comets is kept in equilibrium by new comets which are continuously introduced into our solar system from beyond Pluto's orbit. When they are far away from the Sun's deteriorating effects, comets can last indefinitely. Comets that are in orbits which bring them close to the sun have not been in those orbits since the formation of the solar system, rather they were perturbed into a close-encounter trajectory by

some larger body (e.g. a planet or star or even another comet). Based upon observed comet orbits, scientists have concluded that they come from two major comet sources: the Kuiper belt, a disk-shaped cloud just beyond the orbit of Neptune; and the Oort cloud, a spherically-shaped cloud that may stretch for as far as 1 light-year from the Sun. One piece of evidence favoring this theory is the fact that comets, unlike everything else in the Solar System, have retrograde orbits just as commonly as they have prograde orbits (See [Orbits in the Solar System](#), above). This is strong evidence that comets are not in their original orbits, that rather their orbital directions were picked up randomly when they were thrown into their present orbits, in keeping with the Oort/Kuiper theory. However, due to their small size, low reflectivity, and great distance from the Sun, these objects are nearly impossible to detect. But since the Oort/Kuiper theory is coherent and explains all of the evidence amply, it alone should be sufficient to dispense with the young-Earth objection concerning comet lifetimes. Recently, however, our telescope technology has improved to the point where we no longer need to rely on theory alone to deal with this objection. Since 1995, over 50 Kuiper belt objects have been discovered, dramatically confirming the Oort/Kuiper theory of comet origins. Kuiper belt observations continue to be an ongoing frontier of Planetary Science.

**Influx of Small Particles to the Sun** [DB 1507 (34); OAB 23] The claim is that Poynting-Robertson drag, an effect which causes interplanetary dust to fall into the Sun, should have swept the solar system clear of debris if it were old. In reality, the debris is constantly replenished by pieces of comets stripped off by solar wind, as well as other sources. This replenishing source is summarily dismissed by the authors of this claim however, who reason that comets cannot have existed for billions of years. See previous claim ([Maximum Life of Comets](#)).

**Maximum Life of Meteor Showers** [DB 1507 (35); OAB 54] It is true that the particles now causing meteor showers on Earth could not have been there 4.6 billion years ago and survived to the present day. However, meteor showers are known to be caused by large clusters of debris shed by comets, and are replenished by periodic comet flybys. For example, the well-known Perseid meteor shower, occurring every August, is known to be caused by debris from the comet Swift-Tuttle, and occurs every time the Earth passes through Swift-Tuttle's orbit. The shower is even observed to be more dense if the comet has passed by recently. This claim thus shifts to the survival of comets to the present day (See [Maximum Life of Comets](#)).

**Lack of Sorting in Meteoroids** [OAB 53] It is claimed that the Poynting-Robertson effect (see [Influx of Small Particles to the Sun](#), above) should have had sufficient time to sort meteoroids by size, if the Solar System were old. But of course, meteoroids (which are interplanetary particles that can fall into Earth's atmosphere and become meteors) are being constantly replenished by comets (see [Maximum Life of Meteor Showers](#), above), thus maintaining a random distribution.

**Interstellar Comets** [OAB 19] The claim is that no comets have ever been detected to pass through the solar system on an interstellar trajectory (that is, on a trajectory to escape the Sun's gravity, which would indicate that they came from interstellar space). Although this is true, and scientists do not understand the reason, the claim that this supports the young-Earth position falls victim to the [Unexplained Mystery Fallacy](#).

**Heat of Jupiter and Saturn** [OAB 40,76] Jupiter and Saturn give off a good deal more heat than they absorb from the Sun, therefore there must be some additional source of heat within these two planets.

The primary solution to this problem is that, unlike the Earth (see [Cooling of the Earth](#), above), Jupiter and Saturn are so large that they have not had time to completely get rid of the heat produced by gravitational formation. Gravitational heat and radioactive decay together account for very nearly all of the heat given off by Jupiter, and most of the heat given off by Saturn. It is thought that any remaining discrepancy is explained by helium rainout. Saturn's lower temperatures, along with the relative lack of helium in its atmosphere, support the theory that helium rainout has been more important in Saturn than Jupiter. Furthermore, even if the aforementioned explanations are not sufficient to account for Jupiter and Saturn's heat, we are simply left with the harmless [Unexplained Mystery Fallacy](#).

**Volcanoes on Io** [OAB 58] The claim is that the existence of volcanoes on Io, Jupiter's closest large moon, demonstrates that the moon has not cooled off from the creation event, and that it therefore must be young. The fact is, however, that we know exactly what the heat source is which supplies Io. Because Io is so close to Jupiter, there are tremendous tidal forces which heat Io's interior by friction. That is why Io is the most volcanically active body in the solar system. In fact, calculations based on tidal heating predicted Io's volcanism *before* the Voyager spacecraft arrived at Jupiter and discovered it (see Peale, Casson, and Reynolds, *Science*, v.203, pp.892-894 (1979)).

**Escape of Methane from Titan** [DB 1507 (37); OAB 59] The methane in the atmosphere of Saturn's moon Titan is constantly being converted into other organic molecules. Since the hydrogen gas produced by these reactions is lost into space, these processes are not reversible and the methane is permanently lost. *If* there were nothing replacing the methane, and *if* the rate of loss were constant, then all of Titan's present methane supply would disappear in about 10 million years. However, this does not indicate that Titan is less than 10 million years old. Using exactly the same reasoning, one could measure the amount of water vapor in the Earth's atmosphere, and the rate at which the water is lost as rain, and thus derive a maximum age of the Earth. But of course such a calculation would be silly because the Earth's atmospheric water vapor is resupplied by the oceans. It is very likely that the Titan question has a similar explanation -- surface lakes or underground reservoirs of liquid hydrocarbons (including methane) are very likely to exist on Titan, given its cryogenic temperatures and the abundance of such compounds in its atmosphere. Such reservoirs at the surface would easily explain the continuing presence of methane in Titan's atmosphere. However, Titan's opaque atmosphere has kept our knowledge of its surface quite minimal, so no one can say for sure whether such reservoirs exist. The Cassini spacecraft, due to arrive at Saturn in 2004, should shed a great deal of light on this [Unexplained Mystery](#). The problem of Titan's methane is a simple case of insufficient data, not an indication that the Solar System is young.

**Instability of Saturn's Rings** [DB 1507 (36); OAB 77] Like the question of Titan's methane, the question of the instability of Saturn's rings is an [Unexplained Mystery](#) that arises primarily as a result of insufficient data. Saturn's ring system is extremely complex, and we have had very few opportunities to study it up close (Pioneer 11 and the two Voyager spacecraft were all brief flybys with limited instrumentation). At our present state of knowledge, it is true that we do not know how Saturn's rings could have remained stable for longer than 10 to 100 million years. There are two main possible solutions to this problem: either the secret of the rings' stability is yet to be discovered, or the ring system is in fact much younger than Saturn itself. The second possibility is intriguing: the rings of giant planets may be cyclical, being regenerated by material that strays to near and is pulled apart by the planet's gravity, and then dissipating again over time. In fact, if Saturn's rings are due to a



relatively recent such event, it would explain why Saturn is the only one of the four giant planets to have such a large ring system. Whatever the solution to this problem may be, we should learn a great deal about it from the Cassini spacecraft, due to arrive at Saturn in 2004. And in any case, even if it does turn out that Saturn's rings are relatively young, there is no reason why such a discovery should have any implication for the age of Saturn itself, much less the age of the Solar System or the Universe.

**Clean Surfaces of Saturn Ring Particles** [OAB 77] It is claimed that the fresh-looking surfaces of particles in Saturn's rings demonstrate a young age. This may be due to the dislodging of older material from the particle surfaces by the constant jostling and colliding in Saturn's densely-populated ring system. Or this may be another indication that Saturn's rings are in fact much younger than Saturn itself, having been created by relatively recent destruction of an icy body by Saturn (see [Instability of Saturn's Rings](#)). In either case, this observation has no implications for the age of the Solar System.

## **Astronomy**

**Supernova Remnants** [ICR Creation Online] This argument comes from an article by Canadian young-Earth advocate Keith Davies (<http://www.creation.on.ca/cdp/snrtart.html>), who claims that astronomers do not observe enough supernova remnants (SNRs) in our Galaxy to justify an age greater than 7,000 years. Davies assumes that SNRs will remain visible for 1 to 6 million years after the supernova event. In fact, although they may in fact continue to *exist* for that length of time, they become rapidly more difficult to *detect* as time passes. In the years following a supernova event, the remaining gases spread out, becoming thinner and thinner. They also become distorted by the interstellar medium (ISM), and become difficult to observationally distinguish from the ISM. So, even though SNRs can continue to exist for a few million years, most only remain *detectable* for 20,000 to 120,000 years, depending on the size of the supernova event and other factors. D.A. Leahy and Wu X. (*Publications of the Astronomical Society of the Pacific*, v.101, pp.607-613 (June 1989)) discuss the various effects limiting the detectability of SNRs. The remaining discrepancy between observation and Davies' predictions is accounted for by various minor errors in Davies' paper. For a more detailed discussion of Davies' claims, see Moore (2000), <http://www.valinor.freemove.co.uk/supernova.html>. Incidentally, Davies also notes that no third-stage SNRs (SNRs that have been expanding for more than 120,000 years) have been detected in the Galaxy. As stated above, this is because most SNRs are too spread out by that time to be detectable. However, some third-stage SNRs in other galaxies come from supernova events that were so large that the SNRs are still detectable. One known as SNR 0450-709, in the Large Magellanic Cloud, is 340 light-years across, and has been expanding for several hundred thousand years (see T.W. Jones et al, *Publications of the Astronomical Society of the Pacific*, v.110, pp.125-151 (Feb 1998)). The existence of such third-stage SNRs is inconsistent with the young-Universe hypothesis.

**Galaxy Spirals** [OAB 32] The claim is made that galaxies would not have coherent spirals if they were not young. However, more recent research has shown that the concentration of mass formed by a galaxy's spiral arm forms a "density wave," whose gravity causes stars to continue to congregate in the wave and thus to perpetuate the spiral arm. Stars move into and out of the density wave, in the same way that water molecules move into and out of an ocean wave at the beach, yet the wave itself maintains its shape. Detailed calculations have shown that density waves can be stable over extremely

long periods of time, so the continuing existence of spiral galaxies does not place any limit on the age of the Universe.

**Large Stars [OAB 86]** It is well-known to astronomers that larger stars have much shorter lifespans than smaller stars, in some cases less than a billion years. The claim seems to be that large stars, which are characteristically short-lived, should not exist in an old Universe. Of course, the explanation for this is simple if one recognizes the ongoing formation of new stars, and the real issue here is simply whether or not new stars are formed. Young-Earth advocates complain that star formation has not been observed, but this is not really true. Although the complete process of star formation cannot be observed on a single star because the process is so slow, the physics of star formation are well understood (in fact, they are simpler than the physics of raindrop formation), and stars are observed in every stage that is predicted by theory. In fact, in the past few years, the Hubble Space Telescope and other advanced telescopes have observed stars in stages of formation that had previously been known only as theoretical predictions. Notwithstanding complaints about the lack of certain observations which are impossible anyway, a robust and coherent theory exists for star formation, and therefore the existence of new stars should not be cited as if it were a challenge to the age of the Universe.

**Hydrogen in the Universe [OAB 38]** Hydrogen throughout the universe is being converted into helium without a proven generator of hydrogen to replace it, yet great amounts of hydrogen exist throughout the universe. This claim is true, but proves nothing more than that even more hydrogen existed in the past than exists now. There is no discrepancy.

**Mass of Star Clusters and Galaxy Clusters [OAB 29-31,87]** It is claimed that many galaxy clusters do not have enough mass to hold themselves together, so that many of them should have drifted apart by now if the Universe is old. Also, it is claimed that "field galaxies" (galaxies that are not part of a galaxy cluster) should exist in an old Universe but do not. The first objection is easily answered by noting that not all stars or galaxies that appear to be in close proximity are actually gravitationally bound. A star or galaxy could simply be passing through a neighboring cluster, and thus it would be no surprise to observe that it is moving too fast to be gravitationally bound to the cluster. Also, the existence of dark matter (for which even further observational evidence was announced as of 30 April 2001) causes clusters to be more massive than they appear, and thus to have enough gravity to hold stars or galaxies at higher velocities. For example, similarly too-fast velocities are observed in spiral galaxies, where the stars show every sign of being in stable orbits. This is almost certainly due to extra mass in the galaxy comprised of dark matter. An excellent discussion of dark matter was written recently by V. Rubin (*Scientific American Presents*, v.9, no.1 (Spring 1998), or <http://www.sciam.com/specialissues/0398cosmos/0398rubin.html>). The second part of the objection (the lack of field galaxies) is simply incorrect. Field galaxies are well-known to astronomers, and are an object of ongoing study.

**An Expanding Cloud of Interstellar Gas [DB 1507 (31); OAB 33]** This claim focuses on a paper by V.A. Hughes and D. Routledge (*Astronomical Journal*, v.77, pp.210-214 (April 1972)) announcing the discovery of a ring of gas expanding from a center near the Sun. According to the observations of Hughes and Routledge, the gas cloud is most likely the result of a type-III supernova occurring about 65 million years ago. The authors make no mention of, or claim regarding, the age of the Earth or the Universe, although they do speculate that radiation from this supernova may have had something to

do with the mass extinctions, including that of the dinosaurs, that occurred about 65 Myr ago (more recently, however, convincing evidence has been discovered showing that an impact, not radiation, was responsible for that extinction). Despite the absence of any such claim by its authors, both DB and OAB cite this paper, without comment, as limiting the age of the Earth to 60 million years. However, there is absolutely no reason to believe that the Earth must be younger than the supernova that created this cloud of gas. The supernova would have been several hundred light-years from the Earth, and despite Hughes and Routledge's speculation that it may have had some effect on terrestrial life, it would not necessarily have had any effect on the Earth at all.

**Decay of Thorium-232 in Stars** [OAB 97] A conundrum was proposed in 1987 by H.R. Butcher (*Nature*, v.328, pp.127-131 (9 July 1987)), who announced that there were inconsistencies between his observations of the amount of Thorium-232 in certain stars, and the accepted ages of those stars. Although some young-Earth advocates cite Butcher's work as casting doubt on standard astronomical chronologies, what was really occurring was simply working the bugs out of a new dating method. Butcher's 1987 paper was part of his pioneering work in nucleocosmochronology, the science of determining the age of stars by measuring the amounts of heavy elements produced in their cores, but his anomalous results were simply due to the fact that he had not yet perfected the method. As is pointed out in a paper by J. Westin et al (see page 784 of *Astrophysical Journal*, v.530, pp.783-799 (20 Feb 2000)), the spectroscopic signature of Thorium-232 is difficult to isolate from that of certain other metallic species, and therefore Butcher's method can only be accurately performed on stars that are severely depleted in metals, so that the Thorium dominates the spectral signature. There are also other important factors in perfecting the method of nucleocosmochronology, and more technical discussions of Butcher's paper can be found in papers by Morell, Kallander, and Butcher (*Astronomy and Astrophysics*, v.259, pp.543-548 (1992)), and by Francois, Spite, and Spite (*Astronomy and Astrophysics*, v.274, pp.821-824 (1993)). Also, there is a less technical brief review of nucleocosmochronology by C. Sneden (*Nature*, v.409, pp.673-675 (8 Feb 2001)). In conclusion, the new dating method announced in Butcher's 1987 paper is a good one, and has sparked a great deal of profitable research since that time. The anomalous ages given in the 1987 paper are simply due to bugs in the method that Butcher had yet to work out. Since those difficulties have now been overcome, the original 1987 paper should not be cited as evidence against standard astronomical chronologies.

**The "Red Sirius" Mystery** [OAB 83] Sirius, the brightest star in the night sky, is known from modern observation to be white in color. However, many texts from ancient astronomers (although not all) indicate that they saw Sirius as red. The "red Sirius" mystery has puzzled scientists for decades, and no completely satisfactory answer has yet been formulated. One answer that has been proposed is that Sirius' small companion star (known as Sirius-B), which is currently a white dwarf, may have been a red giant star when the ancients were observing 2,000 years ago. The main problem with this hypothesis is that the transition from red giant to white dwarf is thought to take about 10 million years. Some young-Earth advocates have latched onto the red-giant explanation of the "red Sirius" mystery as the correct one, and have then gone on to claim that it is evidence against established "evolutionary" theories of astronomy. The first problem with this claim is that it is not simply "evolutionary theories" but the laws of physics themselves that challenge the transition from red giant to white dwarf in only 2,000 years. The laws of thermal physics make it unlikely that the rapid change in temperature required could have taken place in such a large body in such a short period of time. Also, red giants, being much more massive than white dwarfs, would have to lose most of their mass

in such a transition, and would have left behind large clouds of gas (known as "nebula") surrounding Sirius. No such clouds of gas exist. Recognizing the physical evidence against this claim, many young-Earth advocates no longer use it. In reality, the "red Sirius" mystery is just that: It is an Unexplained Mystery that continues to puzzle scientists, but it is not evidence for a young Universe. Incidentally, a good discussion of the various proposed explanations of the "red Sirius" mystery was recently published by D.C.B. Whittet (*Monthly Notices of the Royal Astronomical Society*, v.310, pp.355-359 (1999)).

## Earth's Atmosphere and Oceans

**Helium-4 in the Atmosphere** [DB 1506 (8); OAB 35] It is claimed that the atmosphere's level of Helium-4 (which is created by radioactive decay) should be much higher if radioactive decay has been going on in the Earth's crust for 4.6 Gyr. The calculation behind this claim assumes that helium escapes by a simple thermal-gravitational process, as it does from planets without large atmospheres. In reality, the Earth's magnetic field causes it to give off a stream of particles from the poles, in a process identical to the formation of the solar wind. This "polar wind" carries atmospheric particles away from the Earth, and is primarily responsible for removing Helium-4 from the atmosphere at a faster rate than gravitational escape alone would do (see page 8 of D.M. Hunten, *Icarus*, v.85, pp.1-20 (1990)). Furthermore, if one truly wanted to use noble gas abundances to determine a date for Earth's atmosphere, a much better method would be to use Argon-40 rather than Helium-4. Argon-40 is also created by radioactive decay, but because it is much heavier than Helium-4, it does not escape from the atmosphere at any appreciable rate. H.A. Shillibeer and R.D. Russell attempted to date the atmosphere precisely this way (*Geochimica et Cosmochimica Acta*, v.8, pp.16-21 (1955)). Although this is not the most accurate dating method, due to uncertainties in the rate at which Argon-40 enters the atmosphere and other outstanding questions, Shillibeer and Russell did arrive at a date in generally good agreement with the accepted age of the Earth. In conclusion, the polar wind emanating from Earth's upper atmosphere is the main reason that there is less Helium-4 in the atmosphere than would otherwise be expected, but from looking at heavier radiogenic gases that do not escape gravitationally, it is clear that there is no discrepancy between atmospheric abundances and the age of the Earth.

**Abundance of Oxygen in the Atmosphere** [OAB 67] It is pointed out that the present quantity of oxygen in Earth's atmosphere could be generated by plants in 5,000 years. That may be true, but this One-Sided Equation fails to account for processes that remove oxygen from the atmosphere, most notably the breathing of animals. The balance between plant photosynthesis (which turns carbon dioxide into oxygen) and animal breathing (which turns oxygen into carbon dioxide) has kept the amount of Earth's oxygen in equilibrium for a long time.

**Submarine Oil Seepage into the Ocean** [DB 1507 (28); OAB 66] This claim focuses on a paper by R.D. Wilson et al (*Science*, v.184, pp.857-865 (24 May 1974)). Wilson summarizes what was then known about the rate of natural petroleum seepage from underground deposits into the ocean, then makes a very approximate estimate of the worldwide rate of seepage. After comparing his seepage rate to estimates made by others of the amount of oil available for seepage, Wilson concludes that the present rate of seepage could be maintained for at least 50 million years. The young-Earth publications, such as DB and OAB, therefore claim that this 50 million years is a limit on the age of the Earth. However, in his very next sentence, Wilson points out that the reservoir of oil available for

seepage is actually greater than what his colleagues had estimated, due to deposits at greater ocean depths that the previous estimates had not included, and thus there is no difficulty in sustaining the present rate of seepage back into the Mesozoic era (the time at which most of the oil was formed). Wilson also emphasizes that his estimate is an extremely rough one, and that there is no evidence that past rates of seepage are the same as at present. To summarize, 1) The estimate of 50 million years, quoted by young-Earth advocates, is not Wilson's final estimate but a much younger one. 2) Wilson himself cautions that his estimates are extremely rough. 3) Nothing in the paper mentions or deals with the age of the Earth in this first place; Wilson's estimate is of the age of the oil deposits, which everyone agrees are much younger than the Earth as a whole, and his estimates are consistent with the standard age of the deposits.

**Influx of Calcareous Ooze into the Ocean** [DB 1507 (41); OAB 64] During a detailed study of sediment distribution in the Atlantic Ocean, M. Ewing, J.I. Ewing, and M. Talwani (*Geological Society of America Bulletin*, v.75, no.1, pp.17-36 (1964)) mentioned that their measurements of carbonate sediments indicated ocean-floor ages of about 2 to 5 million years, with some areas near the Mid-Atlantic Ridge appearing to be even younger. Since these ages were much younger than what Ewing considered to be realistic, he suggested that the rate of deposition of these sediments may have been much smaller in the past. Young-Earth advocates, on the other hand, have cited this paper as claiming that the Earth cannot in fact be older than 2 to 5 million years. The key to understanding this puzzle is to note the date of Ewing's paper. In 1964, the current theory of Plate Tectonics was undeveloped and unpopular. Ewing assumed that the age of the ocean floor was close to the age of the Earth as a whole, and thus he was not equipped to understand the implications of his measurements. In the 40 years since that time, modern Plate Tectonics has been confirmed countless times, and we understand that the ocean floor is in fact much younger than most continental areas, with the mid-ocean ridges being the youngest of all. Modern understanding of the ocean floor is perfectly in agreement with Ewing's measurements.

**Influx of Sediment into the Ocean** [DB 1506 (10); OAB 78] This claim is based on observations of the thickness of sediments on the ocean floor. ICR author Stuart Nevins, in ICR Impact #8 (<http://www.icr.org/pubs/imp/imp-008.htm>), roughly estimates the amount of sediment on the ocean floor and the amount of sediment being delivered to the oceans by rivers. He arrives at the conclusion that it would only take about 30 million years for the observed sediment to accumulate. This estimate is probably roughly correct, but Nevins' conclusion that this number represents a limitation for the Earth's age fails to recognize the periodic recycling of the ocean floor (the other side of the One-Sided Equation). Due to Plate Tectonics, ocean floor is continuously created at mid-ocean ridges and subducted into the Earth's mantle at ocean trenches. This process moves at about an inch or two per year, so the average age of the ocean floor is in fact a few tens of millions of years, as Nevins estimated, and thus his result is completely consistent with old-Earth science.

It is sometimes claimed that subduction only gets rid of 10 percent of the sediment being added to the oceans (D.R. Humphreys, *Creation: Ex Nihilo*, v.13, no.1, p.31 (1991)). This claim is made by comparing one researcher's estimate of the sediment being added to the oceans (V.V. Gordeyev et al, *Doklady Akademii Nauk SSSR*, v.238, p.150 (1980)), to another researcher's estimate of the amount of sediment being subducted (W.W. Hay et al, *Journal of Geophysical Research*, v.93, no.B12, pp.14933-14940 (1988)). Humphreys claims that, since Gordeyev's estimate is 25 times larger than Hay's, sediment must be added to the ocean much faster than subduction can get rid of it, and thus the

lack of observed accumulated sediments remains a problem for old-Earth scientists. The fallacy in that statement is that Hay based his estimate entirely on the assumption that ocean sediment is in a steady state. Hay used his own calculation of the amount of sediment in the ocean, which is much less than Gordeyev's, to calculate the amount being subducted. If Hay had instead used Gordeyev's estimate of the sediment in the ocean, his estimate of the amount of sediment being subducted would have been correspondingly larger. In short, Hay's estimate was based on an assumption of steady state, and it does not make sense to compare his estimate with an alternate rate of accumulation in an attempt to prove that a steady state does not exist.

**Influx of Juvenile Water into the Ocean** [DB 1506 (4); OAB 106] The claim is that the rate at which subterranean water comes to the surface from volcanoes, hot springs, and other vents could fill the ocean in 340 million years. This calculation seems to assume that all subterranean water originates inside the Earth and is coming out onto the surface for the first time. In reality, hot springs are largely fed by a recycling process. Water seeps from the surface into underground aquifers, where it sometimes comes into contact with a heat source and returns to the surface as a hot spring. Most volcanic water comes from ocean water that is dragged into the mantle with oceanic plates that are subducted under continents by plate tectonics. Once again, the young-Earth advocates have forgotten the other side of the balance: They assume that the amount of water coming out of the ground remains at the surface and builds up endlessly, neglecting to consider the large amounts of water going back into the ground.

**Influx of Salts and Metals into the Ocean via Rivers** [DB 1506-1508 (15-19,42-68); OAB<sup>2</sup>] By citing measurements of the amounts of various chemical compounds<sup>3</sup> in the oceans, and measurements of the rate at which rivers are adding those compounds to the oceans, it is claimed that a maximum age for the oceans can be derived. The answer here is twofold. Firstly, processes that *remove* these compounds from the oceans generally are not adequately accounted for. Secondly, because these measurements are difficult to carry out, their accuracy is not terribly high, so that, when removal processes are considered, a state of equilibrium is either within the margin of error or very close to it (Some recent young-Earth studies attempt to show that the claim is still valid even when removal processes are accounted for; however, overly optimistic assumptions about groundwater addition and statistical precision account for the remaining discrepancy). Therefore, this claim is both a One-Sided Equation and an Unexplained Mystery. There are many processes that take salt out of seawater, including sea spray, high-temperature alteration of brine into albite at undersea hydrothermal vents, and deposition to the ocean floor. Precipitates on the sea floor will be swept clear periodically by plate tectonic subduction. It is also important to realize that there is a great deal that we do not understand about the deep ocean floor, due to the obvious difficulties in studying it, and it is likely that there are other important processes going on there that have yet to be discovered. For that reason, it is not very responsible to speak as if we knew for sure that there is no other process removing these compounds from seawater. D.R. Humphreys states that "as far as we know, the remainder [of these chemicals] simply accumulates in the ocean" (*Creation: Ex Nihilo*, v.13, no.1, p.31 (1991)). However, it is just as true (and much more responsible) to say that, as far as we know, the processes exist on the ocean floor that are keeping the concentrations of these chemicals in equilibrium, but we have not yet rigorously measured them.

Another important point is that several of these "dating methods" published in young-Earth references give ages that are impossibly *young* from any perspective. For example, if this line of reasoning were

valid, the amount of aluminum in the ocean would prove that the Earth was only 100 years old! In fact, if you look closely, the claims concerning Al, Pb, Ti, Cr, Mn, Fe, Th, and W all "prove" Earth ages less of than 2,000 years! Are we to conclude that the death and resurrection of Christ occurred before the Earth was created? Obviously this is not true. The failure to give "Earth-age limits" that are reasonable even from a young-Earth perspective demonstrates that this line of reasoning cannot be valid: processes which remove salts from the ocean have not been adequately taken into account.

**Note regarding oceanic abundances claim:** One point of concern is the number of times that this claim is repeated in many young-Earth references. The claim that "the ocean has fewer chemicals in it than we'd expect if it were old" is really only one single piece of "evidence for a young-Earth". However, in both DB and OAB, this claim is repeated dozens of times, each time using a different chemical substance ("There's not enough Al...", "There's not enough Pb...", etc.). The resulting effect of this is that the total number of claims on a list of "evidences" is inflated. For example, since this claim is repeated 32 times in *The Defender's Bible*, it almost doubles the total number of claims in that reference. A few other pieces of "young-Earth evidence" are also repeated multiple times (each time with slight variation), with the effect of increasing the total number of claims, but none on as large a scale as the oceanic abundances. Of course, this would not be a topic of any concern whatsoever, except for the fact that many young-Earth publications do make a big deal about the *number* of pieces of evidence that they claim support a young Earth. The argument is often made that "The *number* of pieces of evidence supporting a young Earth is greater than the number supporting an old Earth." There are other responses to that argument, but it is very important to realize that, if nothing else, the artificial inflation of the numbers by repeating the oceanic abundances claim renders this argument invalid.

## The Earth's Surface

**Over-Pressurized Oil Traps** [DB 1506 (20); OAB 65; ICR Creation Online] Underground oil deposits are always under a great amount of pressure, due to the weight of the material overlying them. The pressure does not leak away from these deposits, because the surrounding rock is also buried under the same pressure, and thus it is not at all surprising that pressurized oil deposits are found. Some versions of this claim point to certain oil deposits that are found to be under greater pressure than would be expected from the weight of the overlying material. One paper reporting these observations (P.A. Dickey et al, *Science*, v.160, pp.609-615 (10 May 1968)) was written before it was fully realized how extremely impermeable some rocks (such as certain forms of shale) can be to water. It is now known that these over-pressurized deposits are completely surrounded and sealed by impermeable layers, due to underground faulting. The formation and retention of these over-pressurized deposits is no longer a mystery.

**Parentless Polonium-218 Halos** [DB 1507 (24); OAB 70] Radiohalos are a well-known geological phenomenon. They are small disruptions of a mineral's crystal structure caused by the radioactive decay of an element in the crystal. The identity of the decaying element can often be determined because the energy released by the decay depends on what the element is. The claims of Dr. Robert Gentry, detailed in his book *Creation's Tiny Mystery* (Knoxville, TN, 37912-0067: Earth-Science Associates, 1986), concern certain isotopes of the element polonium, which are short-lived decay products of uranium-238. Gentry claims that certain rock samples contain polonium radiohalos but are missing any radiohalos from the "parent" element, uranium. Gentry's conclusion from his observation

is that the rocks in question were created instantaneously, with the polonium already in place, thus explaining why no evidence of the "parent" uranium is present. Because of the short half-lives of the polonium isotopes (Po-218 has a half-life of 3 minutes), Gentry claims that this is the only way to bring the polonium into the crystal, while the crystal is solidified enough to preserve the radiohalo, before the polonium decays away. While it is true that these radiohalos are not fully understood by scientists, this does not mean that Gentry's hypothesis should automatically be accepted. Other scientists have contended that there are other possible explanations for the radiohalos, including a process called hole diffusion (see A.L. Odom and W.J. Rink, *Science*, v.246, pp.107-109 (Oct 1989)). A summary of evidence against Gentry's hypothesis was written by Kurt Wise, who doubts the validity of Gentry's methods even though Wise is himself a young-Earth advocate (K.P. Wise, *Creation Research Society Quarterly*, v.25, pp.171-176 (1989)). The death blow to Gentry's hypothesis is given by the geological setting in which his samples were found. A geologist named Jeffrey Wakefield, while investigating Gentry's claims, determined that some of his samples were not from primordial rocks at all, but from younger dikes (infusions of igneous rock into pre-existing rock) that crosscut older formations (see J.R. Wakefield, *Journal of Geological Education*, v.36, pp.161-175 (1988), or <http://www.csun.edu/~vcgeo005/gentry/tiny.htm>). A recent article defending Gentry (ICR Impact #326, <http://www.icr.org/pubs/imp/imp-326.htm>) conceded that some of the radiohalos are indeed found in younger rocks, feebly countering that not all of his samples are in that situation. However, that is beside the point, because if *any* of Gentry's radiohalos occur in samples that everyone agrees (even young-Earth advocates) were formed by natural chemical processes, then there must exist a natural chemical process by which the halos are formed. Polonium-218 halos are simply an Unexplained Mystery. It is true that we do not fully understand the chemical process that formed them, but we can safely adopt the working hypothesis that that process was natural rather than supernatural.

**"Squashed" Polonium-210 Halos [OAB 69]** Dr. Gentry also found radiohalos in coalified wood in the Colorado Plateau (R.V. Gentry et al, *Science*, v.194, pp.315-318 (15 Oct 1976)). This time the halos are due to polonium-210, which is the same element (and thus has the same chemical properties) as the polonium-218 discussed above (see Parentless polonium halos), but a different isotope and thus has different nuclear properties. For example, polonium-210 has a half-life of 138 days, much longer than polonium-218's half-life of 3 minutes. Many of the halos found by Gentry are elliptical rather than spherical, which, according to Gentry, indicates that they were formed while the wood was still relatively soft, and then were "squashed" into an elliptical shape when the wood was compressed. In some cases, there is an elliptical and a spherical halo centered at the same point. Gentry claims that the second halo was formed by polonium-210 derived from the decay of lead-210, a process that takes 50 to 100 years. Since the second halo is not "squashed" but spherical, Gentry claims that the compression of the wood must have been completed before the second halo formed, implying that the compression and coalification of wood occurs in less than 50 years. Gentry also claims that, since coalified wood containing these halos occurs in strata of various geological ages, all geological ages are suspect. *Need rebuttal from knowledgeable source. This claim is not present in the Defender's Bible, indicating that it has been abandoned by ICR as weak.*<sup>1</sup>

**Lead in Zircons [OAB 42] and Helium in Hot Rocks [OAB 36]** Dr. Gentry (see Parentless polonium halos, above) also measured the amounts of helium and lead (both products of radioactive decay) in zircon crystals from a single granite formation. The present temperature at each depth sampled was recorded. The depths ranged from the surface to 4310 meters, while the temperatures ranged from 20



to 313 degrees centigrade. Using standard methods to determine the amount of lead produced by radioactive decay in the samples, Gentry found that practically all of the expected lead was present in the samples, even though the lead would be expected to have diffused away from the samples due to the high temperatures (R.V. Gentry et al, *Science*, v.216, pp.296-298 (16 April 1982)). In his book *Creation's Tiny Mystery*, Gentry proposes an age limit of 300,000 years based on his lead findings. Similarly, judging the amount of helium produced from the amount of lead present, he found a significant amount of helium (from 17% to 58% of his calculated limit) in samples down to 2900 meters of depth. Again he argued that the helium should have diffused away due to the high temperatures if the sample were really hundreds of millions of years old. On the other hand, and this may be of great importance, Gentry reported that practically all of the helium had diffused away in the samples from deeper than 2900 meters (R.V. Gentry et al, *Geophysical Research Letters*, v.9, no.10, pp.1129-1130 (1982)). *The likely explanation for Gentry's findings seems to be that the formation from which he drew his samples has only recently been subjected to temperatures high enough to cause diffusion. If so, the lack of diffusion then would not date the rock formation itself, but rather the onset of high temperatures. This is especially indicated by the complete diffusion of helium in his deeper samples, since helium diffuses more easily than lead, and the deeper parts of the formation would be expected to experience higher temperatures earlier than the shallower parts. In fact, Gentry acknowledges in the above-cited Science article that temperatures in the formation are indeed thought to be rising. Need confirmed rebuttal from knowledgable source. These claims are not present in the Defender's Bible, indicating that they have been abandoned by ICR as weak.*<sup>1</sup>

**Natural Plutonium** [DB 1507 (29); OAB 68] The reference given for this claim is literally a single paragraph, without cited references, in the "news digest" section of *Chemical and Engineering News* (v.49, no.39, p.29 (20 Sept 1971)). The paragraph reports the detection of plutonium-244 in a natural ore sample by a group of American researchers. Noting the relatively short half-life of plutonium-244 (80 million years), the *C&EN* report wonders about production of plutonium by nuclear processes early in the history of the Solar System. The claim by young-Earth advocates that this report places an 80-million-year limit on the age of the Solar System is flawed in several ways. Firstly, a *half-life* of 80 Myr is very different from an *age limit* of 80 Myr. Since radioactive decay is not linear but exponential, small remnants of an element remain even after the half-life has expired many times over. In this case, the amount of plutonium left after 4.5 billion years (4500 Myr) would be about  $10^{-17}$  of the original sample [to be precise, the calculation is  $(1/2)^{4500/80} = 10^{-17}$ ]. This is an exceedingly small amount, but not too small to detect in a sample that was initially very enriched. Secondly, the young-Earth advocates completely ignored the actual scientific paper referred to in the *C&EN* news item, which is by D.C. Hoffman et al (*Nature*, v.234, pp.132-134 (19 Nov 1971)). The very first paragraph of Hoffman's paper makes it clear that the detection of natural plutonium is not a challenge to mainstream cosmology. Calculations based on the abundance of thorium-232, a long-lived radioisotope with similar origins to plutonium-244, indicate that the global abundance of natural plutonium should be extremely low, but just high enough to still be detected in enriched ores. The final section of the paper also discusses at length the plutonium's origin. Indeed, it has become clear in the 30 years since Hoffman's article that natural plutonium is exceedingly rare, if it actually does exist at all. No one has ever duplicated Hoffman's measurement, and no one has ever reported another detection of natural plutonium. Not only does the existence of natural plutonium pose no challenge to an old Earth, it also brings up the question of why, if the young-Earth paradigm is correct, are there no genuine examples of this argument? Plutonium-244 is in the extreme with its

short half-life among elements found in nature, and indeed its natural abundance is extremely low. No elements with half-lives *shorter* than plutonium-244's are found in nature at all, although many are observed in young stars and in man-made particle accelerators. On the other hand, every single known element with a half-life *longer* than plutonium-244's is found in nature. The obvious explanation for this phenomenon is that the Earth has been around long enough for the shorter-lived isotopes to decay away, leaving only the longer-lived ones. However, if the young-Earth hypothesis is correct, then this phenomenon is nothing more than a bizarre coincidence.

**Influx of Magma from Mantle to Form Crust [DB 1506 (5); OAB 47] and Erosion of Sediment from Continents [DB 1506 (11); OAB 26]** In a seminal young-Earth reference book (*Scientific Creationism*, Santee, CA: Master Books, 1974), H.M. Morris claims that the current rate of volcanic activity would cause the continents to cover a far larger fraction of Earth's surface than we now observe, if it had been continuing for billions of years. Yet, a few pages later, he claim that erosion would wear down all the continents to sea level in much less than 4 billion years. The fallacy here is obvious: These two processes (assisted by others such as mountain uplift) counterbalance each other. You cannot cite each process separately as if it would build up without end. In fact, they are in equilibrium, and each process keeps the other from running amok.

**Leaching of Salts from Continents [DB 1506 (12-14); OAB 7,13,84]** This is yet another One-Sided Equation. It looks at the processes taking certain elements (namely sodium, chlorine, and calcium) out of the continents, but ignores other processes (such as volcanism and hydrothermal activity) that replenish them.

**Mountain Uplift Rate [OAB 61]** The claim is that Earth's mountains should be taller if the current rate of tectonic uplift has been maintained over long time periods. Of course, it is erosion that balances the process.

**River Deltas [DB 1507 (27); OAB 22]** The claim is that the size and growth rate of river deltas proves that they cannot be very old. The error here seems to lie in thinking that the delta consists only of what are actually the very youngest delta deposits (the parts that still *look* like delta deposits). In fact, the Mississippi Delta, which is used by young-Earth advocates as an example, actually consists of a seven-mile-thick layer of sediment covering much of the south-central U.S. (by contrast, sedimentary rocks in most places on Earth are only one mile thick). The same is generally true at the Earth's other great river deltas. River deltas are actually a potent argument *against* the young-Earth hypothesis. Not only are the 7 miles of Mississippi delta sediments far more than could accumulate in 10,000 years (especially since delta deposits cannot accumulate underwater, and thus could not have been accelerated by Noah's Flood), but the observed sinking of the crust under the weight of the delta, which keeps the surface at sea level and allows the delta to continue forming, could only happen very slowly.

**River Canyons [OAB 74]** It is pointed out that "the meandering serpentine course of many rivers and canyons cut through many layers of strata." However, it is not completely clear what conclusion is intended to be drawn from this observation, so I will cover two different possibilities. One argument that I have heard is that meandering riverbeds will not maintain the same channel long enough to dig deep serpentine canyons, such as the San Juan River in Utah, because periodic flooding will break through to a straighter course, creating oxbow lakes, as happens with the lower Mississippi River. In

fact there are two reasons why the riverbed of the lower Mississippi is not stable, and these two reasons are not necessarily present for all meandering riverbeds. The first is that the Mississippi floods rather frequently, and the second is that the lower Mississippi riverbanks are made of relatively soft material (soil and shale). In Utah, flooding is not as frequent, so the river will have time to cut a deeper canyon. Also, the riverbanks in Utah are made of hard sandstone, not soft shale. Both of these factors will make it much harder for floods to break through to a straighter course.

Not only are serpentine canyons easy to explain from an Old-Earth standpoint, they are virtually impossible within the Young-Earth model. A canyon formed in a short period of time by a huge torrent of water could not possibly be serpentine, because the flood would overflow the shallow meandering channel and form a more straight canyon. The only way for a river to be serpentine is for it to be flowing *slowly* (like the lower Mississippi River today), therefore a serpentine *canyon* can only be formed by a slow-flowing river. Since a slow-flowing river would take at least many tens of thousands of years to dig a deep canyon, these canyons cannot possibly be any younger than that.

Another possible argument simply notes that many present rivers are cutting into sedimentary strata (A.W. Mehlert, *Creation Research Society Quarterly*, v.25, no.3, pp.121-123 (Dec 1988), as cited in OAB). Of course, since rivers change their course relatively frequently, especially near their deltas, I see nothing implausible in the theory that a river flowed through a certain area, laying down sedimentary deposits, then changed course to a different area, and finally returned sometime later to erode its own sediment.

**Tightly Folded Strata** [OAB 89] It is well-known to geologists that, when temperatures and pressures are high, rocks will behave like an extremely high-viscosity fluid (kind of like Silly Putty, but even much thicker than that). You may know that, if you hit a piece of Silly Putty with a hammer, it will shatter just as a rock would do. However, you can bend Silly Putty around into shapes if you do it slowly enough, and rocks can do the same thing (although they require the bending to be as slow as many thousands of years, rather than a few seconds as it is for Silly Putty). If sedimentary rocks were buried, so that they were subjected to high temperature and pressure, and then folded by forces of plate tectonics, it is easily shown that folded strata could occur. By the way, the young-Earth claim (which supposes that these were sand layers that were folded before they hardened) cannot explain what force could have folded the layers in such a short time.

**Rapid Accumulation and Lithification of Sediment** [OAB 79,80] The article referred to by OAB (from a 1975 issue of *Creation Research Society Quarterly*) claims that sediments are allegedly accumulating and lithifying so fast that 20,000 years will account for all the rocks we see. However, the only justification given for this claim are "unpublished calculations" by the author (ICR founder Henry Morris). After writing to ICR for more information, I was told that the calculations "refer to the amount of time that it takes cement to cure because this is analogous to sedimentary rock formation." This, in fact, is not a good analogy because cement contains components that cause it to harden much faster than any sedimentary rock. A simple excursion to your nearest riverbed, observing that the sediment is still sandy years after being deposited, will make it obvious that sediments do not harden into rock as quickly as cement.

**Continuous Rapid Deposition of the Geologic Column** [DB 1506 (3)] Although it is true that many geological deposits can be laid down quickly, there are many which cannot. The majority of deposits

still require long ages of deposition. Sand dune deposits, evaporites, and varved sediments are just a few examples. Furthermore, the common occurrence of "angular unconformities" demonstrates that the deposition of the geologic column could not have been continuous. Angular unconformities occur when strata are tilted with respect to each other, rather than lying horizontally one on top of the other. This is generally caused by tectonic processes tilting the lower layers before the higher layers were deposited, and a sharp angular unconformity proves that no deposition was going on while the tilting occurred; thus the deposition has not been continuous.

**"The Geologic Column Does Not Exist"** The claim has often been made that "the geologic column is an idea, not an actual series of rock layers. Nowhere do we find the complete sequence" (Henry Morris and Gary Parker, *What Is Creation Science?* San Diego: Creation-Life Publ., 1987). This statement does have an element of truth, because nowhere in the world is there an unbroken record of all time from the creation of the Earth to the present. However, no such record is expected by anyone, for many reasons. Deposited layers can be later eroded away or destroyed in other ways, and drought can prevent layers from being deposited at all for long periods of time. However, the above statement is very misleading in that it insinuates that the geologic column is somehow a "figment of the evolutionist's imagination." The truth is that the geologic records all over the world are very well correlated with each other, not only with stratigraphy (i.e., which layer overlies which layer) and fossils, but with paleomagnetism, radiometric dating, and many other important factors, all of which fit together remarkably well. This does not mean that everything is completely understood (otherwise science would cease to exist), but it does mean that we have a very good handle on the stratigraphic record. Furthermore, using the criterion that Morris and Parker set for themselves, their statement is not technically true at all. They claimed the non-existence of any location where all 11 of the Phanerozoic periods of the geologic column are represented, while in fact there are now 23 such locations known, including the Williston Basin in North Dakota.

**Carbon-14 in Precambrian Wood** [OAB 10] The reference for this claim is a book by Melvin A. Cook entitled *Prehistory and Earth Models* (London: Max Parrish, 1966). I wrote to the Institute for Creation Research regarding this claim, and their response was as follows: "As you can see, this is a 30-year-old source, and it is out of print. We do not think this is good evidence anymore for a young earth. We do not think that there are any Precambrian wood samples. More recent publications, like the Defender's Study Bible, do not include this as a young earth indicator anymore."

**Carbon-14 in Meteorites** [OAB 11] The paper cited here by young-Earth advocates (R.S. Boeckl, *Journal of Geophysical Research*, v.77, no.2, pp.367-368 (1972)) deals with the age of a certain class of meteorites known as tektites. One of the parameters mentioned by Boeckl while discussing this subject is the "terrestrial age" of the tektites, by which he means the amount of time that has elapsed since the tektite fell to Earth. Boeckl discusses "terrestrial ages" ranging from 10,000 to 500,000 years. Apparently, some young-Earth advocates misunderstood the "terrestrial age" in Boeckl's paper to be the age of the Earth, and cited his paper as limiting the age of the Earth to 100,000 years. Therefore, this claim seems to be based on nothing more than a misunderstanding. Although most young-Earth advocates have abandoned this unfounded claim, it has not yet ceased circulating in lists of "young-Earth evidences."

**Absence of Meteorites in the Geological Record** [DB 1517 (94); OAB 52] It is claimed that more meteorites should be found in the geologic record if the Earth is billions of years old. The problem with this claim is that it overestimates the number of buried meteorites that should exist as well as the

likelihood of finding them. Some young-Earth advocates calculate the "expected" number of buried meteorites by simply multiplying 4.5 billion years by the rate at which meteorites fall to Earth. However, this is a One-Sided Equation that fails to account for the destruction of meteorites by erosion. A very large percentage of the sediment that has been laid down during Earth's history has since been destroyed by erosion, and the meteorites embedded in those sediments have also been destroyed. In truth, the frequency of buried meteorites in Earth's sediments should be comparable to the frequency of meteorites on Earth's surface. Since meteorites are in fact very rare on the surface of the Earth, we expect them to be correspondingly rare in buried sediments. Furthermore, even those buried meteorites that do exist would be very hard to recognize as such, due to chemical weathering that turns them into rusty lumps, making them very hard to distinguish from rusty lumps that didn't come from outer space at all. Although a few buried meteorites have in fact been found, the process of recognizing them is far too tedious, and their value too low, to make any systematic search worthwhile (Incidentally, some versions of this claim may also suffer from Pettersson's gross overestimate of meteoritic influx, discussed in Accumulation of Dust on the Moon.)

**Amino Acid Racemization** Amino acids, the building blocks of proteins, are asymmetrical molecules and can be either "right-handed" or "left-handed". If left to itself, a pool of amino acids will naturally assume the most disorderly (highest entropy) state, which is half right-handed and half left-handed. This process is called racemization. All living organisms, however, artificially maintain themselves in a state of pure left-handed amino acids. When an organism dies, therefore, its amino acids slowly begin to change (racemize) from their pure left-handed state back to their natural state of half right-handed and half left-handed. Some scientists have proposed that, by measuring the rate of racemization, and the relative percentages of right-handed and left-handed amino acids, the death of the organism can be dated. Most scientists, however, reject Amino Acid Racemization Dating (AAR) as unreliable because the rate of racemization can be highly dependent on temperature and pressure, and can also be subject to contamination. Indeed, AAR has yielded some highly anomalous dates, such as assigning an age of tens of thousands of years to a fossil found in sediment hundreds of millions of years old, and some young-Earth advocates have seized upon these inconsistencies to cast aspersions on dating methods in general. Such claims, however, place a great deal more faith in the AAR method than is warranted. AAR differs from most other dating methods on one very important point: The process of racemization, which is a chemical process, does not proceed at a constant rate, but is highly affected by changes in temperature and pressure. Radioactive decay, on the other hand, is a nuclear process that proceeds with such extreme constancy that no relevant process is known to man to alter it. In fact, one of the main proponents of AAR (a group at the U of Massachusetts that performs the technique, <http://www.geo.umass.edu/amino/aalintro.html>) cautions that it is important to precisely ascertain the thermal environment of the sample over its entire lifetime before attempting AAR. Even Duane Gish of the Institute for Creation Research wrote about the extreme uncertainty of the rate of racemization (ICR Impact #23, <http://www.icr.org/pubs/imp/imp-023.htm>). Although some young-Earth advocates claim that the anomalously young dates given by AAR falsify the scientific old-Earth position. However, the truth is that Gish was right in the first place. Amino Acid Racemization Dating is a highly unreliable method that should not be used to support either a young-Earth or old-Earth position.

## Life on Earth

**Age of the Oldest Living Part of the Biosphere** [DB 1506 (6); OAB 45] The fact that the oldest known living organism is about 5,000 years old does not prove anything about the age of the Earth. It only proves that we don't know of any organisms that are able to live longer than 5,000 years.

**Age of Human Civilizations** [DB 1506 (7); OAB 3] It is true that human civilization is recent, although its age is closer to 10,000-15,000 years than to 4,000. Everyone, except the young-Earth proponents themselves, agrees that human civilization is much younger than the Earth itself, thus the age of human civilization does not affect the age of the Earth unless you assume a young-Earth view in the first place. That, of course, would be circular reasoning.

**Growth of Human Population** [DB 1506 (9); OAB 37] It is claimed that the case for a young Earth is strengthened by the calculation that the current world population could be produced from only two people in 4,000 years, using the appropriate exponential arithmetic (Henry Morris, *Scientific Creationism*, 1987 edition, pp.167-169). The fallacy in this claim, of course, is that the human population has not been growing at a steady rate. This is a classic One-Sided Equation, failing to consider factors that limit the population. Human population is limited mainly by its ability to feed itself, and until the past few hundred years, that limitation (combined with humanity's lower ability in the past to cope with natural catastrophes) has kept the population steady and fairly low. Only recently have we had the technology to remove these environmental limitations, resulting in a population explosion. Therefore, it is not valid to extrapolate the current rate of growth, which is much less affected by its past limitations, back in time.

## Claims of "Flood Geology"

It is beyond the scope of this fact sheet to comment on the nature of the Great Flood described in chapters 6 through 8 of the Book of Genesis. However, it is appropriate from a scientific point of view to address the common young-Earth paradigm of "Flood Geology," which makes the single event of the Flood into the cause of practically all geological activity observed today. The Bible does not, in fact, require that all Phanerozoic rocks were formed by the single cataclysm of the Genesis Flood, and "Flood Geology" is not tenable from a scientific perspective either. Following are some claims made by the *Defender's Bible* in support of "Flood Geology":

**Marine Fossils on Mountaintops** [DB 1515 (71)] Due to the uplift of mountains through Plate Tectonics, many surfaces that are currently several thousand feet in altitude were once near sea level. Tectonic forces are easily powerful enough to accomplish this over millions of years. Therefore, the detection of marine fossils at such high altitudes is no great surprise, and does not necessarily provide evidence for global flood.

**Raised Shorelines and River Terraces** [DB 1516 (82)] The weight of a glacier, or sometimes a deep lake, can form a depression in the Earth after only a few thousand years (the Earth's mantle has a viscosity much greater than "Silly Putty" but exhibits similar properties over timescales of several thousand years or more). Raised shorelines in Canada, Scandinavia, and Utah came about when such a depression was followed by removal of the weight because the glacier melted (or, in Utah's case, Lake Bonneville was drained). The depression then slowly rebounds, much like a depression made in a bowl of Jell-O will rebound after several hours. The rate of uplift, and thus the viscosity of the mantle, can be calculated by using various methods to date the shorelines, and the results are

consistent around the world (adding to their credibility). Furthermore, shorelines near the center of the formerly depressed areas are now raised much higher than shorelines near the edges. This is expected from the isostatic rebound model, but it is inexplicable to the "Flood Geology" hypothesis, which assumes that all of the shorelines are vestiges of a single high water level.

**Evidence of Former Worldwide Warm Climate** [DB 1515 (72)] We know from paleomagnetism (which is able to determine a rock's latitude at the time it solidified) and from plate tectonics that landmasses which are now at high latitudes (including Antarctica) were all much closer to the Equator at one time or another. Therefore, warm-climate fossils found in these places are not surprising, and do not necessarily provide evidence for a global pre-Flood tropical climate. Furthermore, fossil evidence of cold climates are found in areas that are now warm, also contradicting this claim.

**Polystrate Fossils** [DB 1516 (87); OAB 71] Most so-called "polystrate fossils" are tree trunks that were buried as they grew by several layers of mud in relatively quick succession. That they were buried in place is attested to by the way in which their root systems often extend into the surrounding sediment. Far from supporting "Flood Geology," these buried forests (which often grew with many meters of supposedly Flood-deposited sediment *below* them) were recognized in the 19th century as strong evidence against it. Although some fossilized tree trunks may have been transported by water, rather than buried as they grew, this does not support "Flood Geology" either, since local floods could easily have accomplished the same task.

Another well-known reported "polystrate fossil" was a whale skeleton that was supposedly oriented vertically on its tail, cutting perpendicularly through hundreds of feet of strata. It turns out that this story was much distorted through re-telling, and that in fact the whale and the strata both dipped at the same angle of 50 degrees from the horizontal. So the "whale on its tail" was not even a "polystrate fossil" at all.

**Human Footprints in Cretaceous Sediments** [DB 1517 (96)] Although there are several claims of fossilized human footprints in "old" sediments, none is as credible (relatively speaking) or has received as serious consideration as the prints in the Paluxy Riverbed near Glen Rose, Texas. At this location, supposedly human footprints are interspersed with undisputed dinosaur footprints. Yet upon closer consideration, even the Paluxy footprints are highly disappointing for young-Earth advocates. The "human" footprints are too far apart to fit the stride of humans, and the footprint size is also too large. Many of the "human" prints show dinosaur features like claw marks, and most damaging of all, some trails of "human" prints continue as a path of near-perfect dinosaur prints. Recognizing the overwhelming evidence, ICR president John Morris admitted in 1986 that the Paluxy footprints are probably not human but are eroded dinosaur footprints (ICR Impact #151, <http://www.icr.org/pubs/imp/imp-151.htm>). However, many young-Earth advocates, including many at ICR, unfortunately are still reluctant to give up on this now-discredited claim.

**Absence of Evidence of Drainage Systems in "Old" Sediments** [DB 1517 (98)] Ancient riverbeds are very difficult to find and identify for two reasons. The first is that they are often eroded beyond recognition before they are buried, and the second is that they are relatively small compared to the vast size of the geologic strata burying them. For these reasons, we would not expect for very many ancient riverbeds to be discovered. On the other hand, the claim stated here, that no ancient riverbeds exist, is false -- some have been found. One example is a riverbed that was found by researchers using

seismic "sonar" to search for oil (*AAPG Explorer*, June 1993, p.14). Within a layer of limestone, 1670 feet below the Texas prairie, the researchers found a meandering channel in which the limestone had been eroded away. In summary, although we do not expect to find many of them due to the difficulties involved, buried ancient riverbeds are known to exist, contrary to this claim.

**Modern Sightings of Noah's Ark on Mount Ararat** [DB 1517 (100)] No confirmed piece of evidence has ever come to light supporting the existence of remains of Noah's Ark on Mt. Ararat in Turkey (the Sun Pictures documentary that aired on CBS in 1993 was later found to be a hoax). In fact, the Bible doesn't even say that Noah's Ark landed on Mount Ararat, rather it says that it was in "the mountains of Ararat" (Genesis 8:4), which is a much larger region containing many lower-elevation hilly areas. Since the Ark would have been made of very high-quality wood in order to be able to withstand the stresses it was subjected to (given the dimensions described in Genesis), it is hard to imagine that it wasn't dismantled for building materials. In conclusion, no hard evidence has ever been given that Noah's Ark is in fact in Turkey, and reasoning from the Genesis account, it shouldn't be expected to be there anyway.

## Positive Evidence for the Age of the Earth and Universe

This fact sheet is mainly concerned with exposing false lines of reasoning that are used to support the young-Earth hypothesis. Whatever one's view of the Genesis account may be, as Christians who have renounced all dishonesty and craftiness (II Corinthians 4:2), we must face up to the fact that the young-Earth hypothesis has no basis in the scientific evidence. Before closing, I will briefly mention many of the lines of evidence that indicate that the Earth and Universe are ancient. However, since this is not the focus of this fact sheet, I cannot cover the subject in detail. Further information can be found in many sources, including the books *Creation and Time* by Hugh Ross (<http://www.reasons.org>) and *A New Look at an Old Earth* by Don Stoner (<http://www.answers.org/newlook>). An excellent discussion, dealing specifically with the evidence for an old Earth, is a set of notes by Hill Roberts entitled *Evidences That Have Led Many Scientists to Accept an Ancient Date for Creation of the Earth and Universe* (<http://lordibelieve.org/page15.html>).

For many people, the idea of an ancient Earth is inextricably linked with an Evolutionary Origin of the Species. In fact, the charge is often repeated that the only reason people take old-Earth positions is because of a commitment to Evolution. On the contrary, it is important to recognize the historical fact that the evidence for an ancient Earth was recognized by geologists as early as the late 18th century, more than 50 years before Darwin published his theory. Most of these geologists were Christians who struggled with the implications of their discoveries on their faith, yet could not deny the evidence that they saw before them. Today, many Christians are similarly driven by evidence to an old-Earth view.

I will now briefly outline some important lines of evidence for an ancient age for the Earth and Universe. For more detail, please see the references cited above, especially Roberts' notes.

- **Observed large formations that could not have formed quickly** *River delta deposits* cannot form underwater, and thus could not have been accelerated by Noah's Flood. The rate of *coral reef growth* is inherent in the organisms that build the reef, and also would not be affected by Noah's Flood. Both are observed in volumes that would take at least hundreds of thousands of years to accumulate. The formation of *stalactites* in caves requires small amounts of water,



increasing the flow of water will stop the carbonate precipitation rather than increase it (quick-forming stalactites under artificial concrete structures are due to an entirely different chemical process). A 3-meter stalactite would take 30,000 years to form. In addition, the cooling of large underground *granite batholiths*, as well as the formation of *metamorphic rocks*, requires much more than 10,000 years.

- **Continuous records of various Earth processes** Annual layers in *ice deposits* in Greenland, and especially in Antarctica, are observed which give records of the climate in the year each layer was deposited. The upper layers of these deposits correlate with other methods of measuring recent climate, but from there the layers continue to give a continuous record of the yearly climate for the past 160,000 years (see C. Lorius et al, *Nature*, v.316, pp.591-596 (15 Aug 1985); J. Jouzel et al, *Nature*, v.329, pp.403-408 (1 Oct 1987); J.M. Barnola et al, *Nature*, v.329, pp.408-414 (1 Oct 1987)). Among the many discernable patterns, the 26,000-year climate cycle due to the precession of the Earth's rotation axis (that is, the Earth "wobbles" like a top, and the rate of its 26,000-year cycle can be calculated from physics alone) is clearly visible throughout the 160,000-year record. This refutes the young-Earth claim that perhaps the lower layers of the ice cores were built up quickly due to large precipitation rates from Noah's Flood. A young-Earth attempt to explain away this evidence (ICR Impact #226, <http://www.icr.org/pubs/imp/imp-226.htm>) talks mostly about issues that are irrelevant to the Antarctic data, and its only attempt to challenge the above-cited data is to quote a statement from 1972 that deeper annual layers are more difficult to measure, a difficulty that was solved by superior technology by 1985. It is important to note that, if this is a case of "apparent age", God would have not only created these layers for no apparent reason, but would have "written" into the ice a climate record that cannot be trusted. Such a theory results in serious difficulties with the truthfulness of God. A similar situation applies to *sedimentary varves* (annual layers from lake sediments). Varves in Utah's Green River Formation give several million years of unbroken history. *Evaporite deposits*, in which one layer is formed each time a shallow body of water is evaporated dry, also contain records at least hundreds of thousands of years long. Finally, *paleomagnetism*, the science that studies the reversals of Earth's magnetic field as recorded in rocks, has worked out a consistent history of Earth's magnetic field stretching back hundreds of millions of years, correlated across the entire globe.
- **Formations that could not form underwater** According to the prevailing young-Earth hypothesis, all sedimentary rocks are the result of Noah's Flood. Yet several kinds of deposits are found inter-bedded with sedimentary rocks that could not possibly form underwater. These include *sedimentary varves*, *glacial deposits*, *evaporite deposits*, and *sand dune deposits*.
- **Record of shorter days in the past** One species of rugose coral forms both daily and yearly layers. Specimens of this coral from Devonian strata (360 to 410 million years old) show that the Earth's year was 400 days long when the coral was alive! This is a dramatic confirmation of both Planetary Science and Geology (see [Deceleration of the Earth by tidal friction](#), above), but inexplicable for the young-Earth hypothesis.
- **Radioisotope Abundances** All radioactive isotopes with half-lives greater than 75 million years are found on Earth, while not a single radioactive isotope with a smaller half-life is found in nature (except for a few which are found as decay products). This supports the claim that the Earth is old enough for the shorter-lived isotopes to have decayed away (which takes many times the half-life), but it would be a strange coincidence indeed if the young-Earth hypothesis were correct. Furthermore, we have very clear evidence that several of these short-lived

radioisotopes did in fact exist early in the Solar System's history (aluminum-26 being the most abundant and well-known). Since Al-26 is known to have existed in the past (due to detected excesses of its decay product, Mg-26, in ancient meteorites), and has completely decayed away since the beginning of the Solar System, the age of the Solar System is demonstrated to be at least many times the half-life of Al-26 (which is 26,000 years). Among the radioisotopes for which the same argument applies are hafnium-182 and palladium-107, with half-lives greater than 10 million years.

- **Radiometric Dating** Problems with radiometric dating techniques are greatly overstated by most young-Earth advocates. They often cite isolated instances of implausible dates, but these are generally caused by obsolete dating methods, contamination that a good scientist would detect (and which does not affect the large majority of dates), or by attempting to date materials that are younger than the dating method's margin of error (using radiometric methods to date recent Hawaiian lavas or living sea creatures, for example, is akin to using an unmarked yard-long stick to measure the thickness of a human hair). Most modern radiometric dating uses the isochron method, which measures several different samples (and sometimes different decay paths) and correlates them. The isochron method basically cross-checks itself constantly, and results that do not represent real ages will fail the isochron tests. Consequently, the isochron method does not require any assumption about initial amounts of parent and daughter elements (a common young-Earth objection to radiometric dating). An important consideration with the isochron method, however, is to know what it is that you're dating. Plotting several samples on an isochron will tell you *how long ago the samples were separated from one another*. For samples from the same lava flow, this will give you the age of the lava flow. But for samples from different flows, there can be a residual isochron giving the age of the melting event in the Earth's mantle from which the flows were derived. This is exactly what ICR geologist Steve Austin measured in the Grand Canyon. He claims that Rb/Sr isochron dating of lavas at the top of the Grand Canyon gives ages older than Grand Canyon basement rocks (ICR Impact #224, <http://www.icr.org/pubs/imp/imp-224.htm>). However, since Austin's samples came from several different flows, he could not have been dating the age of a single flow, rather he was dating the magma chamber beneath the Grand Canyon, from which all of the flows came. Although Austin claims that his "anomalous ages" cast doubt on radiometric dating in general, the fact is that geochemists often use the same method Austin used to date melting events much earlier than the formation of the flows themselves. For a more detailed discussion of ICR's "Grand Canyon Dating Project," see Stassen (1999), <http://www.talkorigins.org/faqs/icr-science.html>. Another common objection to radiometric dating is that addition or removal of parent or daughter elements may have occurred. However, in most cases this would leave tell-tale chemical clues that scientists could detect (and indeed this frequently happens), and furthermore such contamination could not possibly account for all of the world's radiometric measurements, which are in good agreement. Finally, radioactive decay rates are known to be constant under all relevant physical conditions. The fact is that, although radiometric dating is imperfect like any other science, there is tremendous overall agreement among radiometric ages, as well as with stratigraphic (relative) ages, giving very strong circumstantial evidence for the reliability of radiometric dating methods. For a general overview of radiometric dating, see *Radiometric Dating: A Christian Perspective* by Christian geologist Roger Wiens (<http://asa.calvin.edu/ASA/resources/Wiens.html>).
- **Star Distances** It is extremely evident from astronomy that our Universe is billions of

light-years across, and thus that light from distant stars has taken billions of years to reach us. One method of accurately determining star distances uses *Cepheid variable stars*, which have a known relationship between brightness and pulse rate. This relationship is explained by physics, and verified (calibrated) by measuring all Cepheid variable stars whose distances are close enough to confirm by parallax. Therefore, the actual brightness of a Cepheid variable star can be determined by its pulse rate, regardless of how far away it is. And, of course, if a star's actual brightness and measured (apparent) brightness are known, its distance can be calculated from a simple equation (apparent brightness decreases as one over the distance squared). This and many other methods verify Hubble's law describing the expansion of the Universe, with the beginning (Genesis 1:1) between 10 and 20 billion years ago. Attempts by young-Earth proponents to explain these facts have been unavailing. Norman and Setterfield's proposal of decay in the speed of light is easily shown to be invalid (Roberts, Ross, and Stoner all deal with this), as is Humphreys' attempt at a young-Earth cosmology (see Conner and Ross (1999) <http://www.reasons.org/resources/apologetics/unravelling.html>). Another explanation, that the Universe was created with "appearance of age" is both un-scientific at its core (if all the evidence that we see for age is fabricated, then why even have this debate?), as well as having theological problems with the truthfulness of God, since in that case we are constantly observing events in the cosmos which in fact never occurred (see *Brain Teaser: SN1987a*, <http://lordibelieve.org/page16.html>, for an illustrative example of this point).

## Footnotes

<sup>1</sup>In response to a question that I asked, an ICR apologist wrote the following to me: "I talked to Dr. Morris about the differences in the charts [of young-Earth evidences], and he said that in general, the ones that were not published in the more recent lists (like the Defender's Bible) were not as strong as they once were. New evidence has either put the interpretation into question or has changed the amount of time it would take or has shown that there is not a uniform process that can be extrapolated back in time."

<sup>2</sup>The points in OAB comprising this argument are numbers 1-2, 4-6, 8, 12, 14-16, 20, 34, 39, 43-44, 46, 48, 51, 55, 63, 73, 75, 81-82, 85, 92-93, 98-100, 102-103, and 107.

<sup>3</sup>DB cites the following compounds: carbonate, sulfate, chlorine, calcium, uranium, sodium, nickel, magnesium, silicon, potassium, copper, gold, silver, mercury, lead, tin, aluminum, lithium, titanium, chromium, manganese, iron, cobalt, zinc, rubidium, strontium, bismuth, thorium, antimony, tungsten, barium, molybdenum. In addition to those just mentioned, OAB includes bicarbonate.

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[Two Books of God](#)

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[Evaluation of Evolution](#)  
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[ORIGINS EDUCATION](#)

[Public School Education](#)  
[Christian Education \(in church, school, home\)](#)  
[Informal Education](#)

## **Age of the Earth and Universe**

( Part 2 — Scientific Evidence & Perspectives )

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A brief overview of this page is in the homepage for [Origins Evidence](#).

Sections in this page:

[\*Historical Science — Can we reach reliable conclusions?\*](#)

[\*Overviews of Young-Earth Science & Old-Earth Science\*](#)

[\*Selected Topics with Age-Science Claims and Responses\*](#)

[\*Learn more about Noah's Flood, Geology, Radiometry, and Astronomy\*](#)

We should use all of the information provided for us by God, so usually the reasons for adopting an "age of the universe" view are both **scientific** (the focus in this page) and **theological** (the focus in [AGE OF THE EARTH & UNIVERSE - THEOLOGICAL PERSPECTIVES](#)).

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This page describes high-quality educational resources on the web — with views from a variety of perspectives — that we think you'll find interesting and useful, that will stimulate your thinking and help you explore a wide range of ideas. *{information & disclaimer}*

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### **Historical Science — Can it be reliable?**

We cannot directly observe ancient history, but can we — by a logical analysis of historical evidence (in fields like astronomy, geology, paleontology, evolutionary biology, and archaeology) — reach reliable conclusions about what happened in the past, on the earth and in other parts of the universe? Young-earth creationists ask "Were you there? Did you see it?", and imply that "NO" means "then you can't know much about it." What can we know, and how?

This section is now in its own page — [HISTORICAL SCIENCE](#) — which looks at criticisms and responses, and says that "officially, ASA does not have a position on historical science" but "unofficially, most members of ASA think the essential foundation of historical science — the logical evaluation of evidence about the past — provides a reliable way to learn about the history of nature."

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## How old are the earth and universe?

Most scientists think there is overwhelming scientific evidence, from a wide variety of fields, proving (beyond any reasonable doubt) that the earth and universe are very old, with ages of approximately 4.55 and 13.7 billion years, respectively. But proponents of young-earth theories challenge the evaluations that lead to old-earth conclusions.

The rest of this page looks at *scientific evidence and logic* that can help us answer questions about age. Our goal is to help you get an accurate understanding, so we've tried to find "the best information and arguments that all sides of an issue can claim as support." And even though the overall result won't be NEUTRAL, "we will try to be FAIR by letting representatives of each perspective clearly express their own views and criticize other views, and by treating their views with respect." (quotes from [Accurate Understanding and Respectful Attitudes](#))

Typically, advocates of a young earth claim there are only two basic views of origins: young-earth creation (Christian) and old-earth evolution (atheistic). They define all old-earth views as "evolutionary" and imply that an old-earth view cannot be authentically Christian. They ignore the important differences between three questions (when, how, who) and use "when" to define the answer to all three. But the actual situation is not this simple, as you can see in [THREE VIEWS OF CREATION](#).

For all age-questions, we encourage you to carefully examine the scientific evidence-and-logic. But it's more important to ask, "**Is young-earth belief an essential part of Christian theology?**" and ask yourself whether it seems wise to insist that "if the earth is not young, the Bible is not true."

You can jump to [Selected Topics](#) or begin with these **Overviews & Responses**:

### Old-Earth Science Overviews (geology & more)

- Craig Rusbult explains the logical principle of [Multiple Independent Confirmations](#) — regarding what we can conclude from the fact that "abundant evidence from a wide range of fields... indicates that the earth and universe are billions of years old" — and summarizes [Scientific Evidence for an Old Earth](#) from a wide range of fields.
- Deborah Haarsma & Loren Haarsma briefly summarize [Geological Evidence \[before 1840\] for an Old Earth](#).
- Hill Roberts — [Evidences \(\\*\) That Have Led Many Scientists to Accept An Ancient Date for Creation of the Earth and Universe](#). (\* from geology, radiometric dating, plate tectonics, astronomy, and the Bible)
- David Leveson explains how scientists determine the [relative ages](#) and [absolute ages](#) of rock formations.
- Mark Isaak asks 20 tough questions about [Producing the Geological Record in a Global Flood](#).
- Answers In Creation offers a free [Online Geology Curriculum](#) for homeschoolers, or anyone who wants to learn.

- Greg Neyman, from Answers in Creation, examines stratigraphy (science of geological layers) in the western United States, especially the Grand Canyon, and EarthHistory evaluates young-earth theories in the conclusion of a 5-part series about the Grand Canyon.

- Dan Wonderly — The Date of Creation: Bible-Compatible Evidences for Great Age and other resources from Wonderly.

### **Young-Earth Science Overviews (geology & more)**

- John Morris proposes major geological changes during Creation Week and Noah's Flood.
- Tas Walker offers a 12-page series about Biblical Geology.
- Arthur Chadwick outlines a Creation/Flood Model.
- claims for young-earth evidence (from geology, radiometric dating, astronomy,...) by Russell Humphreys and Carl Wieland and Jonathan Sarfati.
- a summary (by Ashby Camp) of ideas in Faith, Form and Time (a book by Kurt Wise, a prominent young-earth scientist).
- and within the community of young-earth creation scientists, debates about theories and approaches.

### **Old-Earth Responses (geology & more)**

Advocates of young-earth *flood geology* often point to a geological feature caused by a fast-acting catastrophic event (a flood, volcano,...) and imply that this proves old-earth geology is wrong because it insists that ALL geological features were produced by slow-acting uniformitarian processes. But modern conventional geological science, which is accepted by almost all geologists, is a "hybrid combination" proposing that slow *uniformitarian processes* produced most features, but fast *catastrophic events* produced some features, as explained by Mark Isaak and Greg Neyman.

Two young-earth models (for plate tectonics & radiometric dating) are evaluated by Deborah Haarsma & Loren Haarsma and Greg Neyman examines catastrophic plate tectonics and provides links (1 at start, 7 at end) where you can learn more. Twenty young-earth books are reviewed by Greg Neyman & others who explain why "the scientific arguments [for a young earth & young universe] are completely void of any credible evidence."

Hundreds of questions — about the when and how of origins, in areas of geology, physics, astronomy, biology, and beyond — were examined by Mark Isaak (for Talk Origins) and then Greg Neyman (for Answers in Creation), who give brief responses (\*) that are labeled "TO" and "AiC" in the topics-table below. In a similar way, except in one big page instead of many small ones, Matthew Tiscareno and Brent Dalrymple present old-earth evidence while responding to a variety of young-earth claims; and, for a smaller range of questions, Chris Stassen; and a collection of small pages assembled, by Craig Rusbult, from the topics-pages below.

### **Young-Earth Responses (geology & more)**

One response is to acknowledge the weakness of current young-earth science, but hope it will improve in the future and will become more satisfactory. { But most scientists think this optimism is not justified, since the abundant evidence for an old earth (and old universe) occurs in so many different areas, covering a wide range of phenomena, and is strong in each area. } Another response is to claim that their own logical analysis of the evidence is better than the conventional analysis:

Tas Walker responds to old-earth arguments and there is a 3-part series (OE YE OE) about *The Problems of Flood Geology* by Mark Isaak (OE) & Jonathan Sarfati (YE) & Brad Henke (OE), and a comprehensive page about *The Fossil Record* by Sean Pitman. \* For counter-responses to the responses from TalkOrigins, CreationWiki summarizes many young-earth claims.

## Radiometric Dating — Overviews & Responses

- Principles and applications are explained by the [Haarsmas](#) and Roger Wiens ([briefly](#) & [in detail](#)) and [Jonathon Woolf](#) & [Brent Dalrymple](#) & [Hill Roberts](#). The reliability of radiometric dating is challenged in [AIG's Answer Book](#) (Ham, Sarfati & Wieland) and by [Clyde Webster](#) and in Arthur Chadwick's [56-part FAQ](#) but [Brent Dalrymple responds to these criticisms](#).

- The results of [RATE](#) (Radioactivity and the Age of The Earth), a young-earth research project by ICR, are described in book-outlines of [Thousands not Billions](#) (popular level) and [Radioisotopes and the Age of the Earth](#) (technical level); *a dialogue in ASA's journal* begins with [Assessing the RATE Project](#) by Randy Isaac (June 2007) followed (in March 2008) by response & replies from [RATE plus Randy Isaac and Kirk Bertsche](#); expanded responses from RATE authors, Isaac, and Bertsche, plus Gary Loechelt and others, are in [RATE AND RADIOMETRIC DATING](#). / The claims of RATE are also criticized by [Stephen Meyers](#) & [Greg Neyman](#) and others.

## Astronomy — Overviews & Responses

To help you learn quickly and well, here are some carefully selected resources:

- explanations of the Big Bang Expansion: a [brief overview](#) and [Cosmology 101](#) (a series from NASA) and [Three Evidences](#) (by Perry Phillips) and [news + FAQ + tutorial](#) (from Ned Wright).

- old-universe claims* by [TO](#) and [Hill Roberts](#); a good overview of [current young-universe astronomy](#) by Danny Faulkner; young-universe claims by [Don DeYoung](#) and [Jonathan Sarfati](#) (with science plus Galileo). The overviews & responses above also include some astronomy, especially in [Humphreys \(topics 1-3\)](#), and [TO's Topic-List & Tiscareno](#) (astronomy plus the final topic in page, Star Distances).

There is plenty of evidence for the Big Bang, as described in the above (in the overview, Cosmo 101, Phillips, Wright) and by [Hugh Ross & TO](#) (brief) & [TalkOrigins](#) (in depth), plus responses to [10 Problems for the Big Bang](#) (Richard Deem) and [Complexity & The Second Law](#) (Craig Rusbult). David Berlinski (OE) wonders [what happened before the beginning](#) and Apologetics Press (YE, [A B](#)) describes science history and science. [John Hartnett](#) and [Carl Wieland](#) think disagreements among OE-scientists shows the Big Bang theory is in trouble, but Greg Neyman ([A B](#)) explains that this is just how science works. Astronomy (about Distant Starlight, Big Bang, and Solar System) is in Chapters 1-3 of an excellent book ([available online](#)) by Robert Newman & Perry Phillips, *Genesis One and the Origin of the Earth* (2nd Edition, 2007).

You can also learn about Distant Starlight (plus Light Speed Slowdown & White Hole Cosmology) and more in [ASTRONOMY — AGE OF THE UNIVERSE](#).

## Scientific Methods and Logical Evaluations

This page begins by asking, *[Can we use historical science to get reliable information about the history of nature?](#)*

Usually, advocates of a young earth say NO. Frank Sherwin, a young-earth scientist, seems to disagree when he explains why scientists should [Follow the Evidence](#) but John Morris thinks [scientists cannot study the past with confidence](#) so [Biblical interpretation \(not historical science\)](#) is the most reliable way to know the history of nature. Ken Ham agrees; he thinks the old-earth conclusions of conventional science are not due to scientific evidence-and-logic, they are caused by scientists looking through a sinful [secular lens](#) (not a [Biblical lens](#)) with [old-earth presuppositions](#); he thinks we should [return to Biblical authority](#) and should not "start outside the Bible to (re)interpret the Words of Scripture" but (as explained by Craig Rusbult) he doesn't follow his own advice when he asks, [does the earth rotate and orbit?](#)

To gather information about their young-earth (YE) views of science, ask a YE believer, "Is there any scientific evidence that would convince you the earth is old?" If they answer **yes**, ask "then why do you harshly criticize the theology (and sometimes the faith and character) of the many Christians (your brothers and sisters in Christ) who have logically and prayerfully examined the evidence, and it has convinced them that the scientific support for an old earth is extremely strong?" If they say **no**, ask "should a scientist reach a conclusion before examining the evidence?"

Greg Neyman describes the conclusion first approach of YE "scientists" and the tendency of young-earth believers to avoid old-earth evidence, and the fact that YE websites don't link to pages with OE evidence-and-logic so it won't be seen by their YE followers; and Glenn Morton explains how, when he was a YE believer, his Morton's [YE] Demon prevented him from seeing any non-YE evidence.

How can we wisely use information from THE TWO BOOKS OF GOD in Scripture and Nature?

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## Selected Topics

The table below shows **age-claims** (•) and **responses** from two perspectives, young earth (YE) and old earth (OE). If you want to study these topics (and many others) in more depth, you can explore four pages — for **NOAH'S FLOOD, GEOLOGY, RADIOMETRIC DATING, and ASTRONOMY** — that contain plenty of educational resources.

For a variety of reasons — personal and interpersonal, spiritual and scientific — it's important to ask, "Is young-earth belief an essential part of Christian theology?"

note: Information about size (such as "8 k") is for the main part of a page, not including end-references; the "AiC" and "TO" pages are brief, usually about 1 k, as explained above.

### YOUNG-EARTH PERSPECTIVES

#### **Coral Reefs** — a YE solution?

Paula Weston describes coral biology, with appendix (not by her?) claiming Barrier Reef is 3700 years old (10 k) [OE: but reefs grow only when they're under water] (3 k); Tas Walker claims that fossil reefs aren't reefs (2 k).

AIG claims a fast growth rate (3 k) but EarthHistory says it's not that fast (8 k for Part 1 in 2-part page). Roth-1979 is often cited, re: fast rates, but Ariel Roth (in 1995) barely mentions his own paper when he asks, are fossil reefs really reefs? (29 k); and EarthHistory explains why yes, they are reefs (40 k).

#### **Varve Layers** — a YE solution?

In some rock formations we observe millions of thin layers that, according to conventional geology, were produced in millions of years.

An overview of young-earth responses, from

### OLD-EARTH PERSPECTIVES

#### • **Coral Reefs** — a problem for YE?

Why do scientists think reefs required a long time to grow? Perry Phillips describes principles (8 k) and timing-details (5 k) that are summarized by Don Lindsay (2 k), and Dan Wonderly provides in-depth analysis of reefs (50 k).

#### • **Varve Layers** — a problem for YE?

Explanations of what varves are (and what they tell us about time) from Don Lindsay (1 k), Perry Phillips (4 k), and Glenn Morton describes the uniformity & details (1 k & 2 k).



John Morris (3 k) and, in more detail, Kurt Howard (10 k).

How do layers form? Andrew Snelling's overview of layering (5 k) introduces the sedimentation experiments of Guy Berthault.

*Varves and Fossils in the Green River Formation* are examined by Paul Garner (YE, 6 k) and — with careful attention to important details — Glenn Morton (OE, 41 k); also Michael Oard (YE, 17 k) and Greg Neyman (OE, 9 k); and focusing on fossils, John Whitmore (YE, 6 k) and Daniel Woolley (YE, 23 k) and Don Lindsay (OE, 3 k). ==[find OE w fish]

#### **Patterns of Small Fossils — a YE solution?**

Tammy Tosk looks at relationships between microfossil patterns and flood geology principles (22 k) and — without trying to explain the patterns — Frank Sherwin discusses microfossil evolution (3 k).

Can varves form in less than a year? AiC TO *The Truth about Varves* by Greg Neyman (11 k) plus varve-ideas (19 k) from Jonathan Sarfati (YE), and Kevin Henke.

#### **• Patterns of Small Fossils — a problem for YE?**

In a very tough question for YE theories, Glenn Morton asks whether young-earth flood geology can explain fossil patterns in foraminifer microfossils (21 k) and we see similar patterns for pollen (4 k) and isotopic changes (5 k+).

note: The problem for flood geology is *the patterns*, because the "evolution" in the patterns requires only minor macro-evolution (with small differences between successive species) which is accepted by most young-earth creationists. If you have any doubts about the overwhelming scientific evidence for an old earth, study these pages carefully; and you can also think about the many other Multiple Independent Confirmations above and below.

#### **The Geological Column — an explanation?**

John Morris and Steven Austin describe a young-earth theory about layered strata (3 k) and ten misconceptions about the geological column. (10 k)

#### **The Geological Column — an explanation?**

Does the entire geological column exist (TO) in proper sequence (AiC TO) with meteor craters (TO) and meteorites (TO), and could it be deposited by a global flood? (AiC TO)

#### **Grand Canyon — an explanation?**

You can buy ICR's *Grand Canyon* book but it's not available on the web, and I haven't found a "GC series" like those on the right. But there are small pages — such as John Morris (4 k) & William Hoesch (3 k) & AIG (2 k) — plus Gary Parker (30 k).

#### **Grand Canyon — an explanation?**

Greg Neyman reviews ICR's book about the Grand Canyon (intro - 71 k for Chapters 3 & 4 & 5), Jon Woolf (4 pages for 83 k), GC Explorer (description + explanation for 28 k), EarthHistory (5 pages for 172 k, including an excellent conclusion).

Two YE pages about the GC (Tas Walker & Tom Vail) claim that rocks/layers cannot bend without breaking but TO and Greg Neyman disagree.

The origin of sandstones (Coconino & Navajo) in the GC are debated by Snelling & Austin versus AiC & TO & Neyman (A B).

#### **How were fossils formed, and what can they tell us about age of the earth?**

Each view should be criticized for what it is, not what it isn't. A central educational goal of this website is to describe all views accurately, and not allow any distorted "strawman" caricatures built by opponents of a view. In the pages below, it's clear that OEs propose a combination of *slow-acting uniform process* and *fast-acting catastrophic events*, as explained earlier. But YEs often imply that OEs think ALL features were formed slowly by an accumulation of small events,

with NO features formed quickly by relatively large events. When you read, think carefully with alert awareness, and don't allow any inaccurate strawmen in your thinking.

Basic Fossil Principles are explained by Don Lindsay (OE, [A](#) [B](#) [C](#) [D](#)) and John Morris (YE, [A](#) [B](#)).

Rapid Rocks: Does OE claim that ALL rocks and fossils are formed slowly? Consider some YE claims (by John Morris, AIG, and Tas Walker) and OE responses (by Greg Neyman): [YE OE](#) - [YE - YE OE](#). When you're evaluating the relevance of analogies, think about similarities and also differences between the analogy-situation and actual-situation. For example, don't just ask "Can a rock form quickly?", also ask "Could *this* rock form quickly?" And the problem for YE is not speed, it's geological context.

YEs claim their position is supported by mass burials ([YE OE](#)) and *polystrate (upright, in situ)* fossils: [YE OE](#). YEs claim that SOME fossils formed quickly, and OEs agree but they disagree with a YE implication that ALL formed quickly ([A B](#)) and they wonder about numbers ([OE YE](#)). Here are pairs about moulting ([YE OE](#)) and birth ([YE OE](#)), a dino ([YE OE](#)) and whales ([YE OE](#)), plus contorted fossils [OE] and a "how fast" overview [YE].

**Fossil Patterns in Geology — YE solutions?**  
Tas Walker introduces basic principles (7 k)  
and Jim Gibson analyzes fossil patterns (48 k).

**• Fossil Patterns in Geology — a problem for YE?**

Do fossil patterns exist, and are they explained by ecological zonation or hydrology or ability to escape or a combination of these factors? (TO) Glenn Morton describes some fossil patterns. (plus *Patterns of Small Fossils*)

Although fossil patterns provide information about both age and evolution, WHEN and HOW are different questions about creation. Evidence for basic fossil evolution strongly supports an old earth, but it doesn't clearly distinguish between old-earth *evolutionary* creation and old-earth *progressive* creation.

Does the claim for a "geological column" assume evolution ([AiC TO](#)) and does it use circular reasoning by dating strata with fossils, and fossils with strata? ([YE OE](#))

An "expansion of fossil ranges" is criticized by [John Woodmorappe](#) (22 k) but [TO](#) and [Greg Neyman](#) (6 k) explain why it's a normal part of open-minded science. Views of fossil patterns by [Ken Ham](#) and Greg Neyman.

**• Dinosaur Blood in Old Layers — a problem for OE?**

A "sensational dinosaur blood report" from [Carl Wieland](#) plus a followup.

Is dino tissue a "devastating issue" for OE? [Frank Sherwin](#) & [Carl Wieland](#)

**Dinosaur Blood in Old Layers — an OE solution?**

dino-fossils with blood cells? [TO](#) & [Greg Neyman](#) & [Gary Hurd](#)

and soft tissues? [TO](#) & [Rich Deem](#) & [Gary Hurd](#)

a tissue claim ([AIG](#)) & response ([Greg Neyman](#)), plus blood and tissue with Greg Moore & Carl Wieland: [GM](#) [GM](#) [CW](#) [GM](#)

**Details within Layers — YE solutions?**

Have YEs tried to explain these details? Here are two responses:

mudcracks in drought or flood? [Glenn Morton](#) & [William Hoesch](#)

burrows (vertical and horizontal) - Glenn

**• Details within Layers — problems for YE?**

Interesting "flood activities" (of animals,...) are described by EarthHistory (dinosaur eggs) and Glen Morton: termites & dino tracks & raindrops fossilized dung bio-varnish river channels salt deposits. {and more}

Morton ([A](#) [B](#) [C](#)) & [Sean Pitman](#)

**Volcano Pollution during Flood** — YE solution?

[so far, I haven't found any YE responses for this]

• **Volcano Pollution during Flood** — problem for YE?

Glenn Morton describes the resulting [sulfuric acid](#) (9 k) and [carbon dioxide](#) (4 k) and you can read a [pollution paper](#) (11 k) rejected by a young-earth journal.

If all of the volcanic rocks in flood layers were produced by volcanoes during Noah's Flood, as proposed in flood geology, what would happen to the water and air? and if all meteors in flood-layers fell to earth during the flood, what would happen to Noah's Ark?

### Extrapolation of Rates

Matthew Tiscareno explains why many young-earth claims — based on "measuring rates of various Earth processes, then attempting to extrapolate them backwards for millions of years... to show that the process in question would [with an old earth] build up to absurdity" — are not scientifically valid because [they ignore or underestimate opposing processes](#) (that lead to long-term balance) or *changes in rate*. The following young-earth claims are from the overviews above.

• **Salt in the Sea** — problem for OE?

In their overviews above, [Sarfati & Humphreys & Wieland](#) all claim that the oceans of an old earth would have more salt than we observe, so the earth cannot be old, and in another page Sarfati provides [details](#).

**Salt in the Sea** — OE solution?

But do young-earth calculations include all of the ways that salts can be removed from the oceans? Neyman and Isaak say "no" for salts in general ([AiC TO](#)) and specifically for sodium ([TO](#)), and so do [the Haarsmas](#).

• **Helium in Air and Rocks** — problem for OE?

Jonathan Sarfati outlines [two helium-arguments](#) by explaining why, if the earth is old, we should observe more helium in the atmosphere (from which it escapes slowly) and less helium in zircon-rocks (from which it escapes quickly). Russell Humphreys explains the details of his rock-argument that is based on [the diffusion of helium out of zircons](#). {and you can explore [more YE and OE zircon-arguments](#)}

**Helium in Air and Rocks** — OE solution?

[TO](#) and [Dave Matson](#) explain why the air-argument is "an oversimplification of a complex problem." And critiques of the rock-argument by [AiC](#) and [TO](#) show why [Randy Isaac](#) (in ASA's journal, *PSCF*, June 2007) reports that the zircon system is "so complex both theoretically and experimentally that helium concentrations are not considered by geochronologists to be reliable for any dating implications."

• **Erosion of Continents** — problem for OE?

Due to rapid erosion, after a few million years [the continents would disappear](#).

**Erosion of Continents** — OE solution?

This doesn't occur because erosion is balanced by the uplifting of mountains. ([AiC TO](#))

• **Decrease of Magnetic Field** — problem for OE?

Is an old earth impossible because its magnetic field is decreasing too quickly? This claim, now revised (including a recognition of magnetic reversals), is summarized by Russell

**Decrease of Magnetic Field** — OE solution?

Based on conventional views of magnetism ([Deem & NASA](#)) there are responses by [TO](#) (brief overview) and [Joe Meert](#) (thorough examination of revised YE claims) and [Tim Thompson](#) (including "Current Creationist

Humphreys ([in claim #6](#)) & [Jonathan Sarfati](#) & Andrew Snelling ([A](#) [B](#)); Humphreys (1993 & 2002) claims that reversals — mostly during Noah's Flood — contributed to a decrease in total magnetic energy that is still occurring.

• **Speed of Moon Recession** — problem for OE?

If the moon had moved away for 4.5 billion years at the current rate, it would be much further away.

• **Number of Supernova Remnants** — problem for OE?

In an old universe, we would see more second- and third-generation supernova remnants.

Status" near end) plus sections (re: basics & unrevised Barnes) in [Chris Stassen](#) & [Brent Dalrymple](#).

**Speed of Moon Recession** — OE solution? The arrangement of continents has changed, and this changed the rate of recession, so the "if" isn't correct and neither is the calculation. (TO)

**Number of Supernova Remnants** — OE solution?

The YE math is based on wrong premises, and supernovas support OE in several ways. (TO [Neyman](#))

We hope you'll carefully examine the questions above by clicking the links and reading the pages, and (if you want) you can expand your studies of these age-questions, and others, by using the abundant educational resources above and area-pages below.

**If you want to learn more about age-science questions, you can explore these areas:**

[Noah's Flood](#)    [Geology](#)    [Radiometric Dating](#)    [Astronomy](#)

( currently only Astronomy has significant content )

The pages below contain large numbers of *candidates for resource-pages* in each area, as explained in the [project-overview page](#).

[flood-pages](#)    [geology-pages](#)    [radiometric-pages](#)    [astronomy-pages](#)

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• **INFORMATION** for readers is in a [brief page](#) about our **Goal** (a quick education for you), **Quality** (because we've made choices) and **Variety** (you'll see multiple positions, hence the disclaimer below), **Exploring with Freedom** (you can use sections and page-links in any order), **Size** (what does "20 k + 5k" mean?), and **Links** (that open in a new window)

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**A DISCLAIMER:**

In this page you'll find links to resource-pages expressing a wide range of views, which don't necessarily represent the views of the American Scientific Affiliation. Therefore, **linking to a page does not imply an endorsement by the ASA**. We encourage you to use your own critical thinking to evaluate everything you read.

This website for Whole-Person Education has TWO KINDS OF LINKS: an *ITALICIZED LINK* keeps you inside a page, moving you to another part of it, and a NON-ITALICIZED LINK opens another page. Both keep everything inside this window, so your browser's **BACK-button** will always take you back to where you were.

this page, written by Craig Rusbult (editor of ASA's website for Whole-Person Education), is <http://www.asa3.org/ASA/education/origins/agescience2.htm> and was revised June 4, 2010

all links were checked-and-fixed on July 3, 2006

other links-pages about Origins Questions are at the [top of this page](#), or you can [Search the Website](#)

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## Old Earth Creation Science Dinosaur Evidence for an Old Earth

by [Greg Neyman](#)

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Old Earth Ministries Website

Young earth creation science models for the Flood of Noah claim that the sedimentary layers of the world were created during the Flood. The reason for this is their belief that there was no physical death before Adam's sin. As a result, they must account for all the fossils in the rock record.

According to the young earth model, the flood created these rock layers, and killed the animals that we see in the rocks. However, the young earth creation science model has a problem...the distribution of animals in the rock layers does not lend itself to an easy fit with the Flood model. To demonstrate this, let's look at young earth creationist Steven Austin, and the Institute for Creation Research book [Grand Canyon: Monument to Catastrophe](#). He explains that all the Mesozoic rocks (Triassic, Jurassic, and Cretaceous, or 248 to 65 million years ago on the geologic time scale) were late-flood rocks, i.e., the rock layers were formed when the Flood waters were receding from the earth.<sup>1</sup> However, the Mesozoic rock layers is where ALL the dinosaur fossils are found...none appear earlier or later. This presents

insurmountable obstacles for the young-earth model, as we will see below.

Other young earth creationists, recognizing this flaw, oppose using the Mesozoic as "receding water" sediments. They simply identify the possible boundary of the Flood/Post-Flood sediments. Even doing it this way, they still have dinosaurs during the middle to late portion of the Flood, because they too must lay down the same rock layers.

Some young earth creation scientists explain away the fossil distribution problem, by stating the bodies floated around the globe, and eventually sank. To counter this possibility, we only have to look at the study done by young earth creationists Baumgardner and Barnette. In their study of the ocean currents for a globe completely covered by water, they showed that ocean currents would have been around 150 miles per hour, in cyclonic patterns above the continental land masses (where the dinosaur fossils would be). At this speed, no large objects, such as dinosaurs, would float, but would instead be battered by the current, and by other objects caught in the current. We would end up with small fragments, not entire bones. The bones would not fall out of suspension until they left the cyclonic area, and would be deposited in the ocean basins...never again to be found.

Even if any of the three above young earth creation science ideas were correct, there are several major, insurmountable problems this presents for the young-earth scientist, for which they have no answer.

Before we proceed, lets lay a little groundwork first. God made it rain upon the earth for 40 days. At the end of the forty days, the water would be at it's highest. Therefore, it stands to reason that all land animals are killed before the end of this forty day period of rain. We see this in Genesis 7:20-23, which states,

"Fifteen cubits upward did the waters prevail; and the mountains were covered. 21And all flesh died that moved upon the earth, both of fowl, and of cattle, and of beast, and of every creeping thing that creepeth upon the earth, and every man; 22All in whose nostrils was the breath of life, of all that was in the dry land, died. 23And every living substance was destroyed which was upon the face of the ground, both man, and cattle, and the creeping things, and the fowl of the heaven; and they were destroyed from the earth; and Noah only remained alive, and they that were with him in the ark."

It is obvious that all animals were dead at the end of this forty day period of rain.

However, the evidence we have of the dinosaurs indicates that they were alive and well when the Mesozoic rocks were being deposited, which, according to young earth creation science theory, is the receding phase of the flood, when the waters are decreasing. The time period for this receding phase can be deduced from Genesis. Genesis 7:24 states,

"And the waters prevailed upon the earth an hundred and fifty days."

Couple this with the 40 days of rain, and we have 190 days until the waters started to recede from the earth. This is the point that the young earth model claims that the dinosaur-bearing Mesozoic rocks were deposited...a full 150 days after all the dinosaurs were supposedly killed. To answer this, they turn to the floating body theory mentioned above. However, as you will see below, the evidence does not support this theory.

Now that we have laid the groundwork, let's look at the evidences from the Mesozoic rocks which completely shatter the young earth flood model.

## Poop

Fossilized excrement in the rock record is called a coprolite. Many studies have been done on coprolites. You can examine them for evidences of what the animal was eating. As I write this, I have a piece of dinosaur poop on my desk as a paperweight. It's a great conversation item...I have visitors pick it up and guess what it is first, before telling them it's a 140 million year old piece of dinosaur poop. Coprolites appear throughout the dinosaur fossil record during the Mesozoic.

It is important to note that all of the fossilized dinosaur poop is found in Mesozoic rocks. According to Steven Austin and the young-earth proponents, these rocks were deposited in the receding phase of the flood, therefore to have dinosaurs pooping in these rocks, when they were clearly dead by the end of the 40 days of rain, is not possible.

The only possible young earth creation science model to explain fossil distribution (including coprolites) is the floating body model. As the bodies floated around, they gradually sank, giving us the fossil record we see today. However, let's consider the poop. Even if the dinosaurs floated until the same time and then sank, how is it that their poop sank at exactly the same time as the bodies? No, this explanation is not feasible.

For the person considering old-versus-young earth creation, they must consider...why do we have dinosaurs laying down all this poop, right in the middle of sediments deposited by the receding waters of Noah's Flood? By the young earth Flood model, all the animals died within the first forty days of the Flood, so why do we have massive amounts of coprolites in late-Flood sediments? The facts don't add up to the young earth model for the flood. And, if we had dinosaurs living just before the flood, it stands to reason that dinosaur poop would be found in the earliest rocks of the flood as well. However, looking at the Grand Canyon alone, we have at least a mile of sediments laid down by the flood, with no dinosaur poop at all! (All Grand Canyon sediments are stratigraphically underneath the dinosaur fossil-bearing rock layers of the Mesozoic period.)

There is only one logical conclusion. This is direct evidence of a living, breathing animal, alive on earth in the latter part of the Flood, which is a direct contradiction of the young earth model. Therefore, the young earth creation science model must be incorrect.

## **Trackways**

With poop, we have indirect evidence of dinosaurs which were eating and eliminating food in the middle of the flood. Let's move on to more direct evidence of living dinosaurs. To further complicate the issue for the young-earth model, the fossil record is full of the footprints of animals. Locations that have many of these prints are called trackways.

For example, let's look at the Morrison Formation in Wyoming, which has yielded hundreds of skeletons of Apatosaurus. The Morrison contains many footprints of these magnificent beasts. However, if you believe the young-earth Flood model, these could not exist! How can animals that are dead be making footprints in rocks which are hundreds of feet underwater? It's not possible.

To re-emphasize again, the dinosaur layers, including the Morrison, are Mesozoic in age, and, if you believe the young earth flood model, they were deposited after the animals on earth were killed, during the receding water phase of the Flood. It is not possible to have walking dinosaurs when the entire planet is under water! How could we have footprints from animals that should already be dead from the first 40 days of the flood?

Again, it is clear that the young earth model for Noah's flood cannot explain why there are signs of living dinosaurs during the latter stages of the flood. However, there is more evidence awaiting us.



## Breeding

The Maiasaura is a beautiful dinosaur. The name means "good mother lizard." It was so named because of the way it protected its nest, as can be seen in the fossil record. Fossils of this dinosaur are found, still sitting on top of their nests full of eggs.

Other dinosaurs are also found with their eggs, such as Oviraptor.<sup>2</sup> It is important to note that these egg sites are at different stratigraphic layers. In other words, fossil eggs/nests are found in one site, and then several hundred feet of sediment below that site, more eggs/nests are found.

Young earth proponents look at the Maiasaura's nesting sites and see this as evidence of the flood burying them rapidly as they nested. However, this does not fit the evidence. First, because they are at different stratigraphic layers, separated by hundreds, or thousands of feet of sediment, they cannot be from the same flood event.

Second, and more importantly, why do we have nests with eggs, in sediments that were supposedly deposited in the receding water phase of Noah's Flood? Technically, the dinosaurs would have to survive the first 40 days of the Flood, then swim around until the water subsided, and then lay their eggs on dry land, only to be immediately buried again by the waters of the Flood. However, Genesis 7:20-23 makes it clear that all animals died during the first forty days of the flood...therefore who is laying these eggs? Obviously, there is mating going on between dinosaurs, right in the middle of Noah's Flood!

Once again, the evidence directly contradicts the young earth creation science model for Noah's flood. There is direct evidence of mating dinosaurs during the middle of the flood.

## Mass Graves

Many young earth theorists point to the mass dinosaur graves as evidence of catastrophic death and burial during the Flood. There is one critical piece of information that the young earth creationism overlooks in using these as evidence of a young earth.

Young earth proponents are eager to point to mass graves as proving that a great flood killed these dinosaurs, however, they fail to consider that there are other dinosaur fossils above and below the rock layers at these gravesites. If the flood killed them, then they would all be located in the same rock layer. In fact, we should see fossils of Tyrannosaurus Rex right alongside the fossils of Apatosaurus.

However, we don't see this jumbled mix of species in these graves. The mass graves that have been found contain one type of dinosaur, such as the graves of hadrosaurs found in the western United States. If the young earth model were true, we would have one layer of dinosaur fossils, with all the species mixed together.

The fact that these graves contain single species supports the old-earth theory. Why? Think for a minute about the T-Rex and Apatosaurus. According to young-earth theory, they should be found together as a result of the flood...but they are not. Why not? Because they didn't live at the same time! The Apatosaurus lived in the late Jurassic period, about 150 million years ago. The T-rex is a more recent dinosaur species, all living around 67 million years ago. The two species never interacted, never shared the same piece of real estate.

As you can see, the mass graveyards offer no evidence to support a young earth, and no support for the dinosaur's end by the flood of Noah.

## Feeding

Finally, one piece of evidence often overlooked at mass gravesites is the teeth marks. Many of these bones show chew marks from carnivorous dinosaurs, as they fed on the carcasses of the dead animals. In several cases, right alongside the large teeth marks are small ones from the juvenile dinosaurs of the same species.

Dinosaur teeth are continually reproduced. As they break off during feeding, a new one is grown right underneath the older tooth. At these feeding sites, we have both adult and juvenile teeth that have been shed during the eating of these carcasses.

The young earth model fails to explain the existence of these teeth marks, and the shed teeth at these sites. It is obvious that carnivorous dinosaurs, both adult and juvenile, were feeding on the carcasses in these graveyards. So one must ask...why did the meat-eaters not die also during the initial flood event? How could they be alive, and eating at these all-you-can-eat dinosaur buffets, when according to the young-earth model they were dead also?

Clearly, the young-earth model cannot account for this evidence of feeding dinosaurs during the receding portion of the flood of Noah. The only way to explain it from a young earth creation science model is the following proposal...

...the plant eaters were killed by the flood. However, the carnivorous dinosaurs, who were adept at swimming in great currents of water, survived much longer. As they swam around, they dived down, persevering through the 150 mile per hour water currents, and reached bottom, where the bodies of the plant eaters were. They feasted, old and young alike, until their breath could not hold out, and then surfaced for air.

You can see how ridiculous this proposal is. However, if you want a young earth, this is what you have to believe.

## Conclusion

The young earth creation science Flood model cannot explain all the evidences for dinosaurs that were living, pooping, walking, breeding, and eating, right in the middle of Noah's Flood. By their model, they should have died in the first 40 days of the Flood, as God says in Genesis 7:20-23, but instead we have direct evidence that they survived the first 40 days of the Flood. The young earth model is in direct contradiction to the Bible in this matter.

The only plausible explanation is that the earth is billions of years old. These dinosaur rock layers were laid down millions of years ago, just like the geologist has said all along. The standard geologic explanation is the best one, and there is no need to try and squeeze all the fossil bearing rock layers into a year-long flood event.

God created the dinosaurs millions of years ago. There is no plausible evidence to suggest otherwise.

Comment on this article on its [Blog Page](#)

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<sup>1</sup> Grand Canyon: Monument to Catastrophe, Figure 4.1

<sup>2</sup> Rocks, Fossils and Dinosaurs, page 312. Fog City Press, 2002

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If you are not a Christian, and you have been holding out on making a decision for Christ because the Church always preached a message that was contrary to what you saw in the

scientific world, then rest assured that the Bible is the inerrant Word of God, and you can believe in Christ and receive salvation, while still believing in an old earth. Click here for more.

Are you a Christian who believes in young earth creationism? Now that we have shown the many difficulties of the young earth creation science model in this and many other articles, how does this impact your Christian life? If you are a young earth creationism believer, click here.

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Poop

Trackways

Breeding

Mass Graves

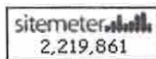
Feeding

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# How Old Is the Earth?

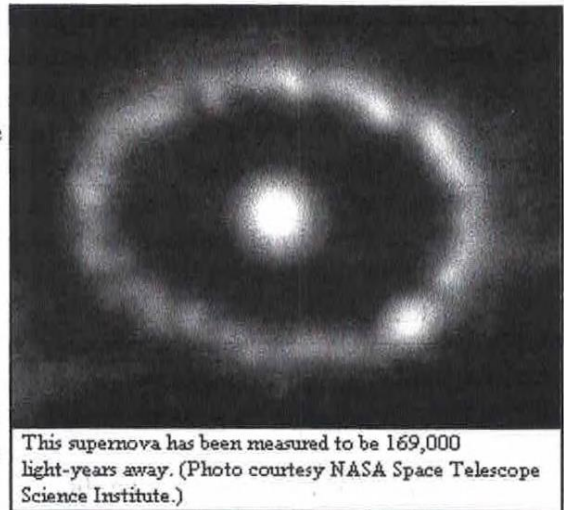
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By Merle Hertzler

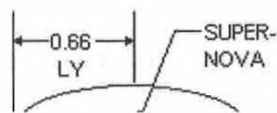
Last night, light arrived at your house from the distant stars. It must have taken a long time for that light to reach your house, for the stars are very far away, and light travels at only 186,000 miles per second. Scientists tell us it would have taken billions of years for the light to have made that journey from the distant stars. If the light did indeed come from those stars, then the light left those stars billions of years ago. And if the light was traveling for billions of years, then the stars must be very old, and the universe is very old.

Some people will object to this conclusion, and will tell me the universe is only 6000 years old, based on a literal interpretation of the Bible. But if the universe and the stars are only 6000 years old, and light appears to have taken billions of years to make that journey, how did that light manage to reach the earth?

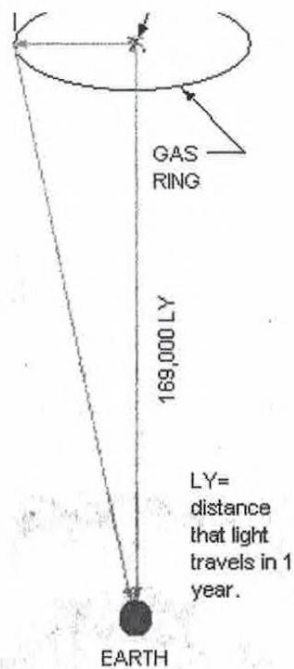
Creationists have made several attempts to explain this problem. Some have questioned that the universe is really that big. If the stars are closer to us than scientists claim, then the light would have had time to reach earth in 6000 years.



So how can scientists be so sure the stars are far away? Good question. Let's look at one measurement that was made. On February 23, 1987, a supernova, which is a vast star explosion, was observed. It was known as SN 1987A. About eight months after the explosion was observed, reflections from the explosion were seen in a distant gas cloud ring that circled the supernova. The ring can be seen as an orange circle in the photo above. The reason the reflected light was delayed eight months was that it took time for the light to travel from the supernova to the distant gas clouds and then to reflect from there back to earth. (See illustration below.) And so we can conclude that it took about eight months--or 0.66 years-- to journey from the supernova to the gas ring. Knowing the time it took to reach the ring, and knowing the speed of light, we can calculate the distance to the ring. Knowing this distance, and measuring the angle between the supernova and the reflection as seen from the earth, we can use simple trigonometry to calculate the distance of the supernova from the earth. Astronomers have calculated that the distance is so large that it took light 169,000 years to make that journey.



So if you think the universe is 6000 years old, how is it that we can see this supernova and the reflected light? The light



had to travel for 169,000 years to reach earth. It must have left the supernova long before the traditional date of Creation, 4000 BC. Can you see how most of us conclude the universe is more than 6000 years old?

Some will suggest that God made the universe complete with a beam of light from the stars to the earth. The actual light that arrives here would have never left the stars, but would have been created midway. It would be like a truckload of Florida oranges that made it to Vermont in 1 hour because the truck and the oranges aboard had been created out of nothing 20 miles away from Vermont. But if this had happened, then the truck does not have oranges from Florida onboard. It would be carrying oranges that had been created enroute. Similarly, if the light was created enroute, the light would not have actually come from the stars.

There is a big problem with this view. We are not merely seeing a simple beam of light. We see events such as this supernova explosion in the light that arrives. Did these explosions really occur? If the light was created part way between the star and the earth in such a way that it looked like an explosion, then it seems that the creator was deceptive. For to create light that looks like an elaborate explosion, when no such explosion really happened, would be deceitful. If the creator was deceptive, would he blame us for being fooled by the deception he made?

If we were to assume that the Bible was God's perfect revelation, but that the light from the stars was deceiving us, how could we trust such a God's written revelation? For if God's physical evidence is deceptive, could not the written evidence also be deceptive?

#### SN 1987A Links

Additional photos can be found at [Space Telescope Science Institute](#) . (offsite)

For more information on the distance calculation, see [SN 1987A and the Antiquity of the Universe](#) by Todd Greene. (offsite)

Suppose that God had deliberately faked the light of an explosion that had never happened. If he did this, how would we know anything about the universe? Once we postulate that an all-powerful, deceptive God is manipulating the data, we could know nothing. Such a God could be fooling us in everything we observe. We may think lightning is made of electricity, but if a deceitful God is in charge, maybe his is only fooling us. We may think the laws of physics apply, but a deceitful God could be manipulating the data. So if God is all-powerful, and is deceitfully manipulating the data, we would know nothing.

If we rule out a deceitful God, than it seems that the distant star light has been traveling

for millions of years.

Did light manage to get here in less than 6000 years because it used to travel faster? This is an old Creationist claim, which has been thoroughly refuted [1]. In this case, however, even a faster speed of light would not help. Light from the supernova took 8 months to reach the outer ring. Suppose light was traveling ten times as fast when it started its journey. Then the light would have gone ten times further during that 8 months it took to reach the cloud ring, and the ring would be ten times bigger than we have calculated. This would mean that the triangle in the illustration above is ten times as big, and the distance to earth is ten times as far. This only makes the problem worse! Now the light would need to travel much further to get to earth. So even if the light had started out faster, it would not resolve the problem for believers in a 6000-year-old earth.

So the light we see in the photo above simply could not have made it to earth if the universe is less than 169,000 years old. Something is wrong with the 6000-year time frame.

I use SN 1987A as an example because it was in a galaxy that was close enough that we could photograph it. We can see that other supernovas are occurring much further away. The light that arrives from the most distant stars would have taken billions of years to reach earth. And yet we see it. Can you reach any other conclusion but that the universe is billions of years old?

Let us pause for a minute to address a concern that may be on your heart at this point. The conclusion of an old earth will not be easy for many Christians to reach. You have a high regard for the findings of true scientific observation and reason, but you also trust the Bible. And your Bible seems to indicate that the universe is thousands of years old, not billions. And so you are faced with a conflict. One solution would be to just ignore the physical observations of the universe. Another solution would be to just ignore the Bible. Neither of those is satisfactory to you. There are some other options. Either you could modify your observations of starlight so that it is compatible with your interpretation of the Bible, or you could modify your interpretation of the Bible so that it is compatible with the physical observations. We have tried to modify our observations of the universe to match a 6000-year-old earth, and failed. So the natural question for many Christians to ask next is, "Can the Bible be interpreted to be compatible with an old universe."

Many Christians have found that the Bible can indeed be interpreted that way. For instance, Norman Geisler, one of the foremost Evangelical apologists, writes:

One of the biggest problems for the young earth view is in astronomy. We can see light from stars that took 15 billion years to get here. To say that God created them with the appearance of age does not satisfy the question of how their light reached us. We have watched star explosions that happened billions of years ago, but if the universe is not billions of years old, then we are seeing light from stars that never existed because they would have died before Creation. Why would God deceive us with the evidence? The old earth view

seems to fit the evidence better and causes no problem with the Bible. [2]

Notice that this quote does not come from a godless, atheist infidel. No, it comes from a leading Evangelical authority. He finds that an old earth causes no problem with the Bible. And many leading Evangelical scholars have been publicly open to an old-earth view, including Lee Strobel, John Ankerberg, Pat Robertson, William Lane Craig, Hugh Ross, Hank Hannegraff, and Francis Schaeffer.

#### **Evangelical Old-Earthers**

Notable Christians Open to an Old Earth Interpretation, at Reasons to Believe by Hugh Ross.

Affiliation of Christian Geologists Christian geologists who believe in an old earth.

Old Earth Ministries by Greg Nayman. "Dedicated to sharing the Gospel, supporting Christians who believe in an old earth, and ending the false teaching of young earth creationism."

Not 'Apparent Age': God is not deceptive A Christian perspective making many of the same points found on this page.

There are several ways in which the Bible can be interpreted to be compatible with an old universe. One of the most popular is to assume that each "day" in Genesis actually represents a long period of time. Other options have been proposed. If your interpretation of the Bible is making it difficult to accept the obvious conclusion from nature, you may want to look at some of the links above before you proceed.

#### **The Fossil Record**

I will move on. Not only do we find that the stars are old, but we can see that the earth is old.

All around the world we find many layers of underground fossils and sediments. Where did all of these fossils come from? Glenn Morton, a former young-earth Creationist writer, has written a description of the fossil record as it appears in North Dakota. He describes the 3-mile-thick fossil record, which includes animal fossils, burrows, shark teeth, coal, and fecal pellets (click here to see it offsite).

Where did all of these layers come from? How is it that we find animal fossils, teeth, and fecal pellets spread throughout the record? It is difficult to escape the conclusion that all of these are the remains of real animals that were buried. But if animals have been buried 3 miles deep, and other animals have been buried on top of them, and still others on top of them up through all 3 miles of sediment, one must surely conclude that it took a long time for all those layers to accumulate.

Let's look at another example of the details found in the fossil record. Specimen Ridge in Yellowstone Park is a 2000-foot-high wall of rock that includes the petrified remains of 18 forests, each one growing on sediments that were deposited on the forest layer below it. [3]

Now think about that. A forest grew and was covered up by a catastrophic volcano and landslide. The soil weathered until it became fit for plant life to grow again. Another forest grew. Many years later it too was wiped out in another catastrophe. The process repeated until at least 18 forests grew and were wiped out. Surely it takes a long time for one forest to be covered, for the soil to weather, and for another forest to grow above it, only to be covered again. Do you not agree that the bottom of this ridge—down below those 18 fossilized forests—is very old?

How can young-earth believers explain the fossil record? Some have tried to say that God created all of these layers at the beginning of the world. But is that logical? Are we really to believe that the fossil bones of dinosaurs and buried forests were put into the rocks at the creation of the world? That would mean that those

dinosaur fossils did not come from real animals. Is it possible that God just buried all of those fake fossils down there? That doesn't seem likely. Could God be so deceptive? I think we have agreed to rule out a deceptive God.

So, we must conclude that the fossils are real, and that the rocks in which dinosaur fossils were found were formed after those dinosaurs had lived and died. Therefore, many of the rocks down there could not have been formed during a one-week creation. They had to be formed later, sometime after the dinosaurs that they cover had died.

Now the same reasoning that makes me think that the dinosaurs were real, also convinces me that the fish and trilobite fossils found far below the dinosaur fossils are also the real remains of real animals that once lived. And so, these rocks must also have been formed long after the origin of the earth. These fossils simply could not have existed in the earth from the beginning. They must have been made later, and there must have been a long period of time involved.

### **Flood Geology**

Some young-earth creationists have tried to argue that the bulk of the fossil record was formed during Noah's flood, a view known as flood-geology. I had read such books as a teenager and was convinced that they described the way the fossil record was formed. Years later, I would find that the problems with this view are insurmountable.

For instance, in the middle of the Grand Canyon we find a buried sand dune, which was made of wind-blown sand. Now flood geologists claim that the rock layers in the Grand Canyon were created during Noah's flood. But if those rock layers were formed during the flood, why do we see buried sand dunes amid the deposits? Something is wrong here. Surely there were no winds blowing sand around under the flood waters. How then is this dune in the middle of the deposits? If this dune occurred before the flood, how can you explain all the fossil-bearing layers below it? And if the dune occurred after the flood, how can you explain all the layers above it? Where did they come from? So, a global flood does not explain the fossil record.

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#### **Flood Links**

[Problems with a Global Flood](#). By Mark Isaak. Learn why scientists do not take flood-geology seriously.

[The Geologic Column and its Implications for the Flood](#) by Glenn Morton. Find out what is below the surface of the earth.

[The Impossible Voyage of Noah's Ark](#) at National Center for Science Education.

[Noah's Flood and Creation Science](#) at Old Earth Ministries.

[Flood Geology and Scientific Creationism](#) by Merle Hertzler

[Billions of Angels Did It!](#) by Merle Hertzler

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And what about the cave systems, footprints, and animal burrows that we find throughout the fossil record? How can these things be created during a raging flood? Animals would not be walking around leaving footprints if a flood was going on above them, would they? And how can a cave possibly get formed in the middle of a flood? So, it seems to me that the flood cannot explain the fossil record. The layers of rock must have been formed over a very long period of time.

### **Isochrons**

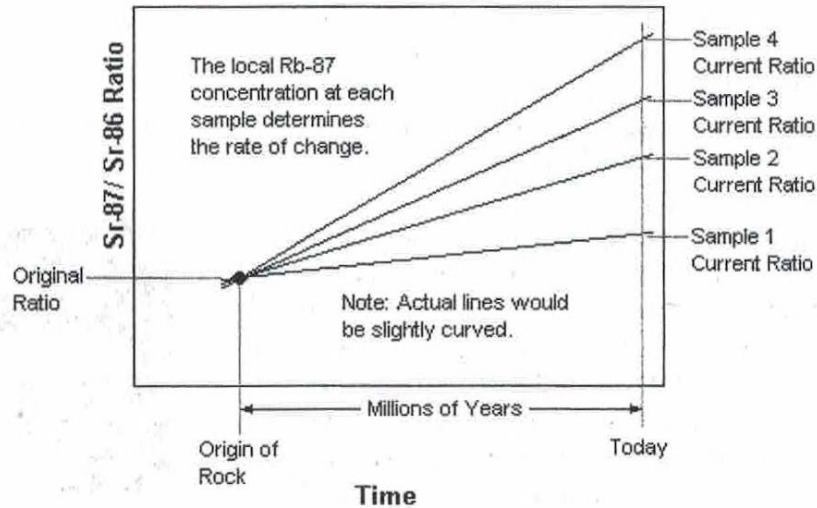
How old is the earth? Surprisingly, modern science has been able to answer that question to a high degree of accuracy. A technique known as radiometric dating is used to find the



age of the rock layers. These dates are based on the knowledge that some elements in rocks decay to form other elements. We know how fast they decay. Thus, if we know what the original concentrations of the elements in a rock were, and know what the concentrations are today, and if we can establish that there were no outside disturbances that interfered with the process, we can calculate the age of a rock. That sounds like a lot of unknowns. Young-earth Creationists love to point them out as if scientists had never thought about them. They are wrong. Scientists have dealt with these problems, and have found solutions.

This gets a little technical here--skip this paragraph if I lose you-- but I think we should take a brief look at Rb-Sr isochrons. This was the clincher for me. I had once argued that the earth is young, but when I learned about isochrons, I soon changed my mind. Scientists use isochrons to calculate the original composition of certain elements in a rock, and to show that contamination has not affected the result. Does that sound like magic? It isn't. It turns out that the element rubidium-87 (Rb-87) in rock decays to form strontium-87 (Sr-87) at a known rate. The more Rb-87 in a rock, the faster Sr-87 accumulates. So if we know the concentration of Rb-87 of any sample, we will know the rate at which the Sr-87 concentration increases with time. And knowing this rate of change, we can calculate back to any time in the past and determine what the Sr-87 concentration would have been. Rocks also have another form of strontium, Sr-86, which stays constant with time. Scientists measure the amount of Sr-87 in a rock by looking at the Sr-87/Sr-86 ratio. As Sr-87 accumulates, the Sr-87/Sr-86 ratio increases. What does this tell us? One sample doesn't tell us much. Let's look at another sample from a different location on the same formation where there is more Rb-87. This point will experience a faster change in its Sr-87/Sr-86 ratio because there is more Rb-87 to decay. Again, we can calculate this ratio back through time. In a valid sample, we will find that, at some point in the distant past, both samples had the same Sr-87/Sr-86 ratio. Scientists can repeat the process for a number of samples on a valid rock formation, and all will show that they had nearly the same Sr-87/Sr-86 ratio at that point in the past (see graph below). This is interesting. For, in rock formations that come from a single flow of lava, the strontium comes from one source, and would indeed have had the same Sr-87/Sr-86 ratio throughout when the rock layer was formed. The most obvious reason for the correlation of these ratios is that this is the point when the lava that created this formation was flowing, with strontium from one source spread throughout the lava. So this must be the date of the lava flow. This procedure yields ages of many millions of years. [4] What other explanation is there? Could God have scattered these elements in the rocks at different concentrations, using a different Sr-87/Sr-86 ratio at each point depending on the local Rb-87 content, so that it looks like the rocks existed through millions of years of decay? Wouldn't that be deceptive?

### Increase in Sr-87/ Sr-86 Ratio with Time



We have looked at only one method of dating rocks. There are more than 40 radiometric dating methods. Scientists usually do more than one test on a rock formation, and find excellent correlation between the dates found. With so many different methods--each based on different principles--and with each arriving at the same answer, isn't that strong evidence that the dates found are correct?

Even if you do not understand the concepts, there are thousands of scientists that do. And there is a scientific consensus that radiometric dating is valid, and that these rocks are many millions of years old.

It is important to understand that there are animal fossils under these rocks. Now you agree with me that these fossils were formed from the remains of animals, don't you? And you surely must agree that the rocks on top of those animal fossils must have been deposited after those animals had lived. So the rocks on top of the fossils--the rocks that we evaluate with radiometric dating--could not have been formed *when the earth was first formed*. They must have been formed later. If we were to suggest that God deliberately manipulated the elements to change the apparent date, it would mean that he did it when the volcano that formed those rocks erupted many years after the earth began. Did God manipulate the data hundreds of times throughout the ages as these various rocks solidified? I cannot imagine God doing that, can you? Surely he would not be bothered with deliberately manipulating the data every time a volcano erupts.

I can only come to one of two conclusions. Either those rocks are many millions of years old, or God used extremely elaborate means to make the rocks look old. The deception would be so subtle that

**The Age of the Earth**

nobody could have possibly been fooled by it until scientists had reached the modern understanding of radioactivity. Could God have deliberately faked all of these components of all of these rocks, just so we would arrive at the wrong answer when we tried to date them years later? That doesn't seem likely to me. If we rule out deliberate deception, I am left with believing that the rocks are old.

Some have proposed that these rocks are not the work of God, but of the devil. Okay, suppose that a volcano erupts in Hawaii. Do a host of demons swarm over the lava to manipulate the elements and make it look old? Science cannot seem to detect such demons. Besides, if demons are doing that, shouldn't the rocks from recent volcanoes date to millions of years old? Rocks from recent volcanoes do not yield old ages when tested. Have

the demons forgotten to manipulate the elements? Okay, we could postulate that these demons worked only in the distant past. But then I need to ask why there is so much volcanic rock down there if the earth is 6000 years old. Yes, we could postulate that another swarm of underground demons was down there causing volcanoes. Then I would ask why we find no mammals or people in the older layers. Again, we could postulate yet another host of demons, who chased all of the mammals away from the early volcanoes. We could continue to postulate yet another demon for every problem with this hypothesis. Do you see how throwing all of these demonic entities into the solution makes it all implausible? Every time we add yet another demon to fix a flaw in the theory, the whole theory becomes less likely. William of Occam discovered long ago that simple explanations are usually more likely to be true than explanations that require multiple ad hoc explanations. Once we start multiplying entities--once we add one demon after another to explain each detail--we could prove anything. We could state, for instance, that the earth was flat, and could propose a different demon for every evidence to the contrary. If that is acceptable, no idea could then be proven false. We would know nothing. So scientists look for the simplest explanations, the ones that do not need multiple ad hoc assumptions.

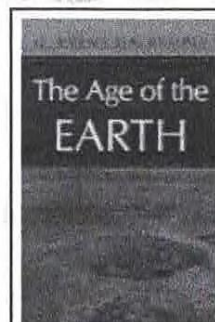
The simplest explanation is that the rocks look old because they are old.

How old is the earth? Rocks on the earth have been dated as old as 4 billion years. Many meteorites have been dated, and we consistently find an age of about 4.5 billion years. Evidence indicates that the meteorites and the earth were formed at about the same time, about 4.5 billion years ago.

Perhaps you are not into the study of radioactive elements and exponential decay. How about counting? You can certainly do that. If you were to cut down a tree and count 100 rings, you would know that this tree was 100 years old. We can do a very similar thing

For a good overview of radiometric dating, see [Radiometric Dating: A Christian Perspective](#) by Roger Wiens. (offsite)

See [Occam's Razor](#) by Francis Heylighen to learn about keeping it simple. (offsite)



How do scientists know that the earth is old?

(click on the book)

with the polar ice caps. The ice builds up another thin layer every year. People have drilled down through the ice and counted the layers. They find more than 50,000 distinct layers before they begin to fade together. Doesn't that prove that the earth is more than 6000 years old?

Years ago, organizations like the ICR had convinced me that the earth was young. They used arguments that sounded good when I heard only one side. They told me, for instance, that the earth's magnetic field was decreasing. They said that the magnetic field must have started out strong several thousand years ago, and decreased since then. That sounded convincing to me. Since I, who knew little about the earth's magnetic field, was convinced by their argument, did that prove that the argument was correct? Of course not. The real test of a scientific proposal is not the ability to convince the general public, but the ability to convince those that understand the relevant data. Those that understood recognized that the claim for a constantly decreasing magnetic field was false, for it did not account for all of the components of the earth's magnetic field, and did not recognize the evidence that the magnetic field has been fluctuating throughout earth history. Those who understood the earth's magnetic field were not convinced with this young-earth argument. You may hear arguments from the young-earth crowd that sound impressive. Please understand that scientific-sounding arguments that convince the general public do not prove a concept is true. An idea should be considered scientific only if it stands up when those who understand the science involved analyze it and accept it. That is the real test.

### Young Earth Claims

The [Institute for Creation Research](#) (ICR) is the granddaddy of the young-earth creation movement. (offsite)

Young-earth claims have been examined by science and found wanting. See [The Age of the Earth](#) by Chris Stassen and [Young-Earth Arguments: A Second Look](#) by Glenn Morton (both offsite).

I conclude that the universe is very old. We can see distant starlight. We can dig up old fossils and date rocks to billions of years. And a lot can happen in a billion years.

[Next Question](#)

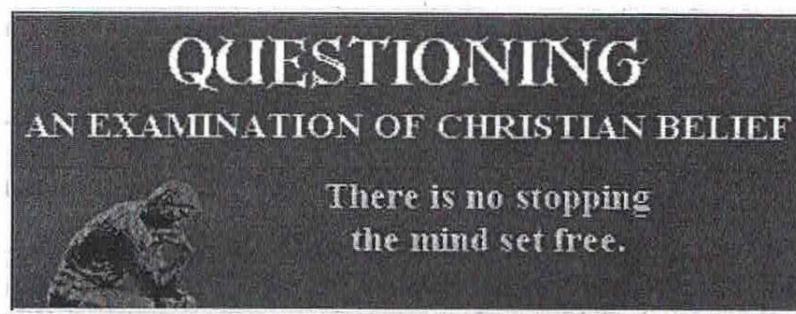
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[Links](#)

### Notes

1. Measurements throughout history have shown that the speed of light is constant (see [The Decay of c-Decay](#) by Robert P. J. Day). Observations of distant objects show that the speed of light was the same for billions of years (see [Dealing with Creationism in Astronomy](#) by W.T. Bridgman). The speed of light is so reliably constant, that the meter is officially defined as the distance that light travels through a vacuum in a specified fraction of a second. (see [Is the Speed of Light Constant?](#))
2. Geisler, Norman, *When Skeptics Ask: A Handbook of Christian Evidence* ( Baker Books, 1995 ), p. 229
3. Strahler, Arthur, *Science and Earth History* (Buffalo N.Y: Prometheus Books, 1994) p. 221.
4. The science of isochrons involves much more than what I discuss here. In practice, scientists plot the Sr-87/Sr-86 ratio against the Rb-87/ Sr-86 ratio on a graph and use the slope to determine the age based upon these principles. For more details, see [Isochron Dating](#) by Chris Stassen.

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# Light-Travel Time: Evidence for an Old Universe

One of the simplest arguments for an earth much older than a few thousand years comes from starlight. Light travels outward from its source at a large but finite rate - 186,000 miles per second, or about 6 trillion miles per year. In fact, astronomers define a distance unit, the light-year, as how far light travels in one year.

## THE ARGUMENT

If the universe were only a few thousand years old, we would expect to see no objects more distant than a few thousand light-years away. But, as a matter of fact, we do see objects much further away than this. Most of the stars in our Milky Way galaxy are further, up to nearly 100,000 light-years away. The nearest large galaxy beyond our Milky Way is the Andromeda Galaxy, about 2 million light-years distant. The furthest galaxies we see are several billion light-years from us. And the most distant objects which we can observe, called quasars, range up to 10 billion light-years away (Pasachoff, 1989, chs 5 & 15). Thus the universe is most naturally understood to be greater than 10 billion years old.

This argument depends on several assumptions which we need to consider in order to have some feeling for how compelling the argument is. There are three such assumptions we should consider. Each is a very natural assumption, but it is possible that one or more of these is mistaken. Let us look at each in turn.

## ASSUMPTION #1: CONSTANT SPEED OF LIGHT

The first assumption is that **the speed of light is constant (or nearly so) throughout space over the history of the universe.** If this is not so, then perhaps light travels faster in other places than it does

near us, or perhaps it travelled faster in the past than it does now. Notice that this assumption does not require that the speed of light be exactly constant, but only that it not be drastically different elsewhere or at another time. To be able to see objects 10 billion light-years away from us if the universe is only 10 thousand year old, the speed of light must average more than a million times faster elsewhere than it does here, or must have been similarly larger in the past than it is now. There is no observational evidence for anything of this sort.

It is true that Barry Setterfield and others have argued there is evidence for a decrease in the speed of light in the past couple hundred years. But this decrease (which is disputed in any case) amounts to only a few percent at most, so they must assume that the decrease was **much faster** early in earth's history than it is now in order to bring light here from the most distant objects in just a few thousand years (Norman & Setterfield, 1987).

But if the light speed was only thousands of times faster early in human history than it is now, then Einstein's equation  $E = mc^2$  means that masses must have been millions of times smaller at that time in order for energy to be conserved. If so, then neither humans nor air would have been heavy enough to keep from floating away from our planet and life would have been impossible. This obviously was not the case, so it does not appear that the speed of light has changed in such a way as to avoid an old universe (Newman, 1991).

## **ASSUMPTION #2: LARGE DISTANCES**

The second assumption is that **distance measurements to objects beyond a few thousand light-years are sufficiently accurate to guarantee that these are millions or billions of light-years away and not just thousands.**

Distances to relatively close astronomical objects are measured by a geometric technique similar to that used in camera range finders or on artillery range finders such as were used on battleships before the advent of radar. The object is looked at from two different locations, and the difference in apparent position is measured to calculate the distance. The effect can be illustrated by holding up your finger and looking at it against a wall as background first with your left eye and then with your right. Your finger will appear to jump back and forth against the wall. For stars, the two different locations are the position of the planet Earth six months apart (on opposite sides of its orbit), and the shifts even for close stars are very small, a few ten thousandths of a degree. Yet the distances of stars out to perhaps 100 light-years can be measured by this technique.

Distances to objects further away than this are estimated by using statistics derived from the stars within 100 light-years. It is observed that there is a simple relationship between star color and actual brightness, such that blue stars are brighter and red stars dimmer. This is because most stars belong to the grouping called the "main sequence," in which stars are burning their hydrogen into helium, and there is a simple relation between surface temperature (star color) and brightness or luminosity for such stars. This has been demonstrated with computer models for how stars burn. Once the actual brightness of a star is known, its apparent brightness as viewed from the earth is a measure of how far it is away from us. This technique of using main sequence stars not only works for stars closer than 100 light-years, it gives us distances to stars out to a few 100 thousand light-years. Thus there appear to be many stars in our own galaxy that are more than ten thousand light-years away, and the stars in nearby galaxies range up to several 100 thousand light-years away. Beyond this distance it is not possible for us to detect main sequence stars with our telescopes.

For greater distances, use is made of variable stars, one class of which varies with a regular period and has a longer time-span between dim and bright the brighter it actually is. These so-called Cepheid variables may be used to measure distances out to some 10 million light-years. It appears also that the brightest stars in galaxies and the brightest globular star-clusters in galaxies have a maximum brightness, which provides us with distance measurements out to some 100 million light-years. Beyond that distance, it appears that the brightest galaxies in galaxy-clusters has a maximum, and this gives us distance measurements beyond a billion light-years. Thus it appears that we are seeing objects which are more than one billion light-years away, and that the universe is more than one billion years old.

Some have tried to argue that we are not really seeing this far into space. Harold Camping, for instance, argues that only the first method described above for measuring distance is any good, and that all the stars we see are actually only a few light-years further away than the closest ones. But this requires that the very dim stars - which look like they are far away - are actually rather close, and therefore very small. However, Camping has no explanation for how such small stars could hold together (since their masses would produce too little gravity to hold such hot gas) nor how they could burn (since the nuclear reaction which makes stars shine requires a large mass to get hot enough inside). Is it really credible that all the stars, star clusters, galaxies and galaxy clusters we see are small objects only a few light-years away? Camping's argument is just an attempt to avoid the natural conclusion of an old universe without any supporting evidence (Newman, 1982).

Another proposal, using the work of Moon and Spencer, argues that light travels a different route



though space than does a meteor or spaceship - that light travels in curves with a radius of 5 light-years rather than in straight lines. Thus the most distant objects we see are really only about 10 light-years away, and that we see multiple images of these to account for all the objects we see. The work of Moon and Spencer in this regard is flawed; see Phillips (1988). Even if it were not, it would not solve the light travel-time problem, as the more distant objects would be images of nearby stars for which the light would have travelled millions of times around the circle and would have taken many millions of years to have done so. In any case, is it really credible that all the stars-clusters, galaxies, and galaxy-clusters we see are just multiple images of less than 100 stars within 10 light-years of us? Again, it looks like this scheme was concocted to avoid the scientific evidence.

### **ASSUMPTION #3: REAL SOURCES**

The third assumption is that **the light we observe when we look at the stars at night actually comes from the objects we observe**. This again is the natural assumption one would make, though we sometimes see images of people that only come from a drawing which an artist has made.

The commonest attempt to avoid an old universe argues that the light imaging objects more than 10,000 light-years away never left the objects it pictures. The light, they say, was created on the way, since God wanted us to know that these distant objects existed and it would otherwise take billions of years for some of these images to reach us.

This suggestion raises a serious theological problem involving the truthfulness of God. Consider: when we look at our sun, we see what was happening on the sun (movement, rotation rate, sunspots, flares, etc.) as it was about 8 minutes ago when the light we see left the sun. When we look at the next nearest star, we see what was happening about 4 years ago, when the light we see left that star. When we look at a star 8,000 light-years away, we see what it was doing 8,000 years ago. But when we look at a star (say) 12,000 light-years away, we do not see what it was doing 12,000 years ago, because (by this argument) the star didn't exist. Instead we see what it **would** have been doing if it had existed, but it didn't - fictitious history! Not just "appearance of age," but a full, complex history of events that never happened. And not just for a few isolated objects, but for the vast majority of stars and star-clusters, and for all the galaxies and galaxy-clusters in the universe. To such extremes are we led if we are determined that we must interpret the Bible to teach a young earth, in spite of the evidence God has provided us in nature.

In harmonizing the revelation God has provided us in his Word, the Bible, and in his world, the universe, it seems to me that it is much preferable to spend our efforts on models that do not require us to believe that God has given us fictitious history - either in Scripture or in nature.

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