

A QUESTION OF TIME:

The Age of the Earth from the Perspective of Faith and Reason

Today, many Catholics believe that Genesis 1:11 should be understood metaphorically because it conflicts with the theories of evolution and an old age for the earth. However, in his 1893 encyclical, *Providentissimus Deus*, Pope Leo XIII laid the burden of proof upon those who argue against a literal interpretation of Genesis:

But he [the expositor of Scripture] must not on that account consider that it is forbidden, when just cause exists, to push inquiry and exposition beyond what the Fathers have done; provided he carefully observes the rule so wisely laid down by St. Augustine -- not to depart from the literal and obvious sense, except only where reason makes it untenable or necessity requires; a rule to which it is the more necessary to adhere strictly in these times, when the thirst for novelty and unrestrained freedom of thought make the danger of error most real and proximate.¹

Almost 60 years later, Pope Pius XII in *Humani Generis* cautiously allowed for investigation into the theory of evolution, with the stipulation that the evidences both for and against the theory be considered:

However, this must be done in such a way that the reasons for both opinions, that is, those favorable and those unfavorable to evolution, be weighed and judged with the necessary seriousness, moderation and measure, and provided that all are prepared to submit to the judgment of the Church, to whom Christ has given the mission of interpreting authentically the Sacred Scriptures and of defending the dogmas of faith.²

In 1991, Berkeley law professor Phillip Johnson added a new twist to the debate with the publication of *Darwin on Trial*, the landmark cross-examination of the evidence for evolution that helped to launch what is now known as the Intelligent Design movement. His distinctive approach was to consider not only the evidence, but also the parameters that scientists use to determine which evidence is admissible:

"But evidence never speaks for itself, it has meaning only in the context of rules of reasoning which determine what may be considered and what counts as evidence."³

Twenty years after *Darwin on Trial*, the time is ripe for Johnson's methodology to be extended to the field of geology, and in particular to the issue of the age of the earth. As Johnson pointed out, Darwinian evolution requires long ages of time because of its reliance upon random chance as the essential agent of change. So far, however, the presumed old age of the earth remains the only aspect of evolutionary theory that has not been publicly questioned by Intelligent Design proponents.

A complementary analysis to Johnson's for the earth sciences would look first at the parameters that geologists use to interpret evidence, and then at the reliability of the evidence itself. The point of this exercise is not to argue for any particular age of the earth, but to determine the certainty with age claims can be made. One test of certainty would be to determine whether or not the evidence for an old age of the earth meets the burden of proof of reasonable doubt, the highest standard of proof in criminal law.⁴ Failure to meet the reasonable doubt standard would remove the aura of irrefutability from the presumed old age of the earth, raising the possibility that other hypotheses merit consideration. It would also imply that the standard of proof required by Pope Leo XII has not been met, and the literal and obvious sense of the Book of Genesis—as understood by all of the Fathers and Doctors of the Church--should prevail.

Presumptions

Geology is distinguished from the life sciences by its claim to be able to quantify the unwitnessed past. However, whenever anyone speaks about unwitnessed events, they have moved from the realm of science into the realm of history, and must proceed on assumptions. The most basic assumption of geology as it is now practiced and taught is the Principle of Uniformity, often phrased as “the present is the key to the past.” As the late paleontologist and popular author Stephen Jay Gould showed in his book, “Time’s Arrow, Time’s Cycle,” the term actually has two meanings. The first is “uniformity of process,” which is really a restatement of William of Ockham’s principle of parsimony.⁵ Gould interprets it to mean, “Don’t invent extra, fancy, or unknown causes, however plausible in logic, if available processes suffice.”⁶ In other words, if an observed geological process appears to explain the formation of a rock in the field, then that explanation should be preferred. Uniformity of process as a forensic tool is used by geologists on both sides of the origins debate.

The second meaning, called “uniformity of law” by Gould, is philosophical in nature.⁷ It holds that natural laws are constant in space and time, and is articulated most clearly by geologist M. King Hubbert, the founder of the peak oil theory:

History, human or geological, represents our hypothesis, couched in terms of past events, devised to explain our present-day observations. What are our assumptions in such a procedure? Fundamentally, they are two:

- (1) We assume that natural laws are invariant with time
- (2) We exclude hypotheses of the violation of natural laws by Divine Providence, or other forms of supernaturalism.⁸

Such a statement however, is not derived from deduction, but is an a priori position, and a statement of faith in the idea that all that exists can be explained solely by natural causes. By definition, it excludes any possibility of miracles. Unless one is a strict materialist, however, there is no inherent reason to exclude supernatural causes or to presume that natural laws have been invariant throughout time. This does not mean that a miracle must be proposed for every unexplainable phenomenon, but it does mean that miraculous causes should not be automatically excluded. For one who accepts the possibility of the supernatural, the requirements of logic and reason are satisfied by the practice of preferring the natural explanation unless there is a theological reason to do otherwise. He or she is then free to examine the evidence unfettered by the constraints of naturalistic uniformitarianism.

The Evidence

Radiometric Dating. The only way geologists can quantify the unwitnessed past is by extrapolating rates of presently observed geological processes backward into time. Of the processes used by geologists to estimate elapsed time, the main contributor to the idea of billions of years of age is radiometric decay. The term refers to the process of measuring the concentration of nuclear decay products in a particular rock or mineral, particularly lead and potassium, and the principal evidence for old age is the large amount of decay products found in certain minerals. The old age assumption is that the rate of nuclear decay is constant, therefore much time must have passed to allow for the production of so much decay.

If age determinations based on the measurement of radioactive decay products are to satisfy the reasonable doubt standard, however, they must first be shown to be admissible scientific evidence. In the US, the use of scientific evidence in court cases is governed by a rule of evidence called the Daubert standard. The US Supreme Court has suggested that the following factors be considered by judges when deciding whether or not to allow scientific evidence in a case:⁹

1. Has the technique been tested in actual field conditions (and not just in a laboratory)? [e.g. fingerprinting has been extensively tested and verified not only in laboratory conditions, but even in actual criminal cases. So it is admissible. Polygraphy on the other hand has been well tested in laboratories but not so well tested in field conditions]

2. Has the technique been subject to peer review and publication?
3. What is the known or potential rate of error? Is it zero, or low enough to be close to zero?
4. Do standards exist for the control of the technique's operation?
5. Has the technique been generally accepted within the relevant scientific community

In the case of radiometric dating, the answer is “Yes” for questions 1, 2, 4 and 5. But for several reasons, the answer to question 3 is “No.”

First, other geological processes have been found to profoundly contradict the dates derived from radiometric decay. For example, Carbon 14 is an isotope formed by the radioactive decay of carbon atoms, which is not supposed to be detectable in organic material older than about 50,000 to 60,000 years because of its short half life. However, it is often found in materials dated by other methods to be millions of years old, including petroleum, coal, wood, and bone, and has even been detected in diamonds otherwise dated at billions of years of age.^{10,11,12}

Additionally, the surprising discovery of soft tissue in fossils presumed to be millions of years old brings radiometric dating into direct contradiction with currently observed decay rates of organic materials. In 2005 and 2007, evolutionary scientist Mary Schweitzer reported on the discovery of what appeared to be blood cells in 65 million years old tyrannosaur bones.^{13,14} This presented a quandary for scientists, because organic material is not supposed to last that long based upon present decay rates.¹⁵ When her work was called into question, Dr. Schweitzer obtained similar tissue in 80 million year old hadrosaur bones, went to extraordinary lengths to prevent contamination and perform rigorous tests on her samples, and defended her discovery in an article in *Science* that appears to have satisfied her detractors.¹⁶ But nobody, including Dr Schweitzer, has called into question the high improbability of blood surviving 65-80 million years.

More ancient organic matter has been unearthed since Schweitzer’s original discovery. Examples include:

- Exoskeleton remnants discovered in 417 million year old eurypterid and 310 million year old scorpion (February 2011)¹⁷
- Dark colored, soft tissue melanocytes found in 120 million year old dinosaurs¹⁸ (May 2010)
- Preserved ink sac from 150 million year old squid¹⁹ (August 2009)
- Original shell preserved from 189-199 million year old lobster²⁰ (September 2010)
- Organic molecules preserved in 66 million year old hadrosaur²¹ (July 2009)
- Preservation of scaly soft tissue in 36 million year old penguin²² (September 2010)
- Remains of 50 million year old insects found preserved in amber²³ (November 2010)
- Blood and eye tissues, skin and cartilage preserved in two 80 million year old mosasaurs^{24,25} (March, October 2010) and one 70 million year-old mosasaur²⁶(May 2011)
- Bone marrow found in 10 million year old frog²⁷ (July 2006)
- Muscle tissue found in 18 million year old salamander²⁸ (November 2009)
- Original feather material found in 150 million year old archaeopteryx²⁹ (May 2010)

In a very significant study published in April, 2011, researchers in Sweden subjected soft tissue from a presumably 70 million year old mosasaur to a battery of tests to determine if the material was original to the organism.³⁰ In addition to verifying that the tissue was indeed original, the scientists were able to perform C-14 dating, which produced a calculated age of 24,600 years BP (before present). Although the researchers attributed the C-14 to post-burial bacterial activity, they did not find any bacterial proteins or hopanoids (cholesterol-like compounds) that might have contributed the carbon. The most straightforward conclusion is that the C-14 is original to the soft tissue.



Mosasaur skeleton, Canadian Fossil Discovery Centre, Morden MB, Canada.
(<http://www.flickr.com/photos/loozrboy/4839417698/>)

The Swedish mosasaur study is a remarkable illustration of a C-14 date contradicting other radiometric dating methods. Combined with the increasing pace of discovery of soft tissues in fossils otherwise dated millions of years old, it argues for the conclusion that radiometric dating is not reliable enough to be considered probative evidence for old age.

Perhaps the most compelling demonstration of the unreliability of radiometric dating, however, is the fact that geologists themselves are reluctant to make it the basis of the Geologic Time Scale, the primary icon of old age. Of the 115 periods of geologic time, called stages, into which geologists have divided up the Time Scale, the only ones whose boundaries are marked by radiometric dates are the 14 oldest stages, from the period when life was not supposed to be abundant. The majority of the remaining stages are marked by the appearance or disappearance of distinctive assemblages of fossils called index fossils.

It would seem that the absolute dates provided by radiometric dating should be the preferred method for marking stage boundaries. However, geologists consider fossil assemblages, not radiometric dating, to be the basis for the time scale. As the International Commission on Stratigraphy, the official “keeper” of the Time Scale, states,

Geologic stages are recognized, not by their boundaries, but by their content. The rich fossil record remains the main method to distinguish and correlate strata among regions, because the morphology of each taxon is the most unambiguous way to assign a relative age.³¹

In practice, this means that if a radiometric date obtained from a rock sample conflicts with the presumed age of the fossils contained in the rock, the presumed fossil age will prevail. As an example, the Hell Creek formation, from which Mary Schweitzer’s tyrannosaur was dug, was dated by nine radiometric samples, but only the five which agreed with the presumed age range of the fossils found in the formation were considered to be valid measurements.³²

It may be argued that the assumption of old age is the best available explanation for the both the amount of radiometric decay found in rocks and the regional correlations of dating results around the world. However, the best theory is not ipso facto a good theory. For example, the ancient Greeks’ geocentric model explained the movement of heavenly bodies, even to the point of accounting for the details of planetary motion. The heliocentric model proposed by Copernicus in 1543, was no more accurate than the Ptolemaic system, and it took over a century of further scientific advances before heliocentrists could prove that their system had more explanatory power than geocentrism.

In a similar manner, while there may be a lack of substantive alternatives to the hypothesis that radiometric dates correspond to true age, significant anomalies exist that are not easily explained away. Carbon 14 dating is a proven technique that can be cross-checked by other historical methods, and the rapid decay of soft tissues is well verified. When alternate lines of reasoning contradict so profoundly, which should be preferred? I suggest the answer is not necessarily a dismissal of the hypothesis, but a reclassification of its certainty and a rejection of its factuality.

The Rock Record. There are other processes used to estimate elapsed time, but they either depend on radiometric dates for their baseline or are based on the assumption of gradualism, the idea that

profound change is the cumulative product of slow but continuous processes. The logical problem with gradualism is that there is no way of verifying that past rates were the same as those of the present. To use the analogy of a leaking faucet, just because water is observed to be dripping slowly from a faucet right now does not mean that it wasn't flowing faster in the past.

Some of the more common arguments for old age based on gradualistic assumptions include the formation of thin silt layers called varves, the accumulation of ice in the polar ice caps, and the identification of ancient soils in rock layers. However, many of these interpretations are controversial even among conventional geologists. For example, sequences of alternating dark and light layers of sediment called varves are used to argue for long age, on the basis that each pair of dark and light sediments took a year to form.³³ Varves can be found in an unlithified state in glacial lakes and in the rock record as laminated layers of hard rock. In regard to glacial lake varves, geologist Arthur Strahler admits, "In fairness to both parties, it would be wise to simply judge the debate a draw on the basis of glacial varve evidence presented on both sides."³⁴ And while he criticizes young earth explanations for lithified varves in the rock record, he also acknowledges the problems with uniformitarian explanations for the staggering quantity and preservation of varves in places like the Green River formation of Wyoming. The sheer numbers of varves there raise the question of how such uniform deposition could continue for the 5 to 8 million years that a straightforward counting of the couplets would suggest for the formation's age.³⁵



Photograph of an outcrop containing a thick section of Pleistocene age varves, Scarborough Cliffs, Toronto, Ontario, Canada (from Wikipedia)

Another example is the formation of layers of shale rock, or mudstone, which make up almost two thirds of the sedimentary rock on Earth.³⁶ Geologists have traditionally believed that shale was formed in quiet waters by sediment slowly settling out of suspension.³⁷ However, investigations by Indiana University geologist Juergen Scheiber and others have revealed that mud can also be deposited by currents, which could allow large volumes of shale to be deposited quickly. The "mudstone revolution" that has resulted is reshaping the way geologists explain the large thicknesses of shale found around the world, many of which are commercially valuable as sources of hydrocarbons.³⁸

Even after assuming an old age for the earth, there are many features in the rock record that geologists have problems explaining in a gradualistic scenario. These include layers of rock whose thickness, uniformity and areal extent greatly exceed that of any currently forming sedimentary layers, volcanism on a scale far greater than what we see now occurring, and millions of fossils entombed in the rocks, when the natural order of the present is for dead organisms to decay without fossilization.

For example, the Deccan basalts of India consist of over 6500 feet of lava, and cover nearly 200,000 square miles,³⁹ and the Columbia River basalt flows of the Pacific Northwest, consisting of over 6000 feet of lava spread over 63,000 square miles, are so thick that they have depressed the earth's crust.⁴⁰



Layers of Deccan basalt near Matheran, east of Mumbai, India (from Wikipedia)



Columbia flood basalts in the Palouse Canyon downstream of Palouse Falls on the Palouse River in southeastern Washington State, USA (from Wikipedia)

In addition, the mere fact that recognizable widespread rock layers exist at all is problematical. The earth's surface today is anything but flat, as any bicyclist can attest to, but there are many sequences of rock layers around the world that are flat, regular in thickness, and recognizable in outcrop for hundreds of square miles. For example, one coal bed in the dinosaur fossil-bearing Hell Creek formation is never more than half a meter thick, yet can be traced for at least 1000 square km.⁴¹ In cases like this, it is reasonable to assume that deposition in the past was operating at a different scale than in the present, since existing depositional processes do not form these types of uniform and widespread layers.



Badlands of the Hell Creek Formation, showing contrast between flat layers of rocks and current deeply eroded topography (from Wikipedia)

To help account for some of these features, old age proponents have admitted the occurrence of catastrophic events in the past, such as meteor impacts, megafloods and supervolcanoes, all set within the old age framework. This allowance for non-repeating catastrophes is called actualism. Any invocation of actualistic catastrophes, however, is usually accompanied by controversy. As Montana State geologist David Alt says in his book on one of those past controversies, the Lake Missoula megaflood, "To this day, most geologists consider it nothing less than heresy to invoke a catastrophic explanation for a geologic event."

Alt relates how geologist J Harlan Bretz noticed in the early part of the 20th century that features of the channeled scablands area of Washington could only have been produced by an enormous flood, far beyond the scope and magnitude of anything ever witnessed historically. In the face of immense scorn and criticism from his peers, who couldn't believe there could have been any event so catastrophic, he persevered in defending his theory, and lived to see his views accepted by the geologic community. Sadly, however, only a few of those who originally disbelieved him ever changed their opinions.

The Lake Missoula megaflood demonstrates that erosion can occur quickly, as do historically witnessed events of rapid canyon formation. For example, shortly after the 1980 eruption of Mt. St. Helens, a mudflow eroded a canyon system up to 140 feet deep in the headwaters of the North Fork of the Toutle River Valley.⁴² Other examples of deep canyons formed within historical time include:

- Burlingame Canyon near Walla Walla, Washington, up to 120' deep and 120' wide, formed in less than six days in 1926 from diversion of water flow⁴³
- Providence Canyon in Georgia, with gullies up to 150' formed since the 1800s by erosion from bad farming practices⁴⁴
- Canyon Lake Gorge in Texas, one and a half miles long and 80 feet deep, created in 2002 when a spillway overran, causing "70,000 cubic feet of water to gush downhill toward the Guadalupe River for three days, scraping off vegetation and topsoil and leaving only limestone walls"⁴⁵

These examples verify the prediction that large-scale erosional features such as the Grand Canyon could form in a short period of time, though the depth of the Grand Canyon suggests erosion on a much greater scale than the above examples.



Providence Canyon, GA, formed since the 1800s (from Wikipedia)

One particularly enigmatic set of landforms for geologists to account for are water gaps, notches in hills and mountains found all over the world that have been carved out by rivers in apparent conflict with the laws of physics. Young earth geologists interpret these gaps as relicts of channelized flow that occurred as waters receded from a worldwide inundation, and point to similar features known to be caused by the Lake Missoula megaflood in the scablands of eastern Washington. Conventional geologists have proposed various solutions to the problem such as antecedent streams or headward erosion, but none of these processes are currently observed, and most geologists admit that water gaps are difficult to explain.

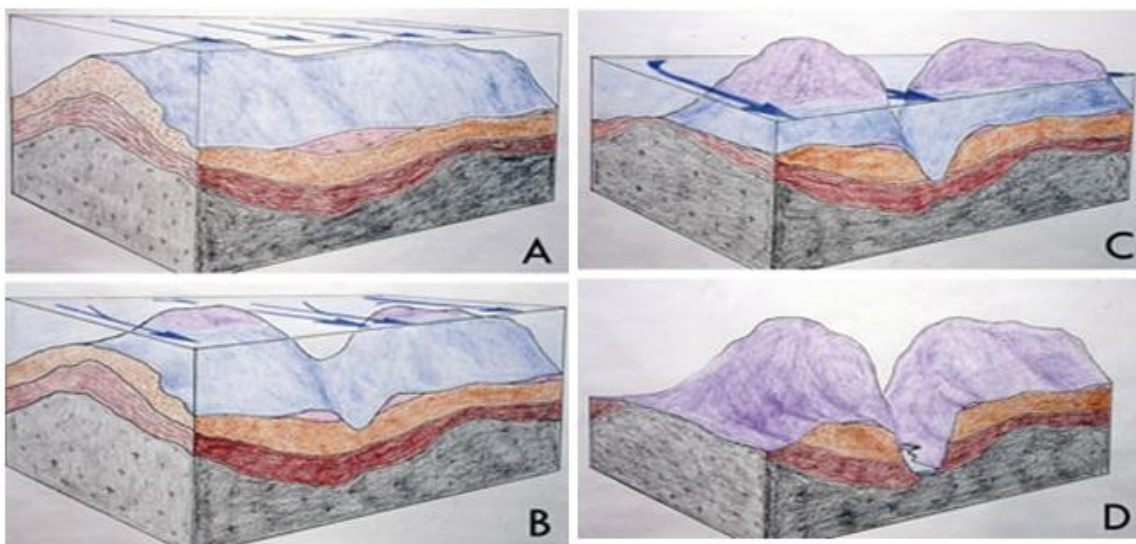
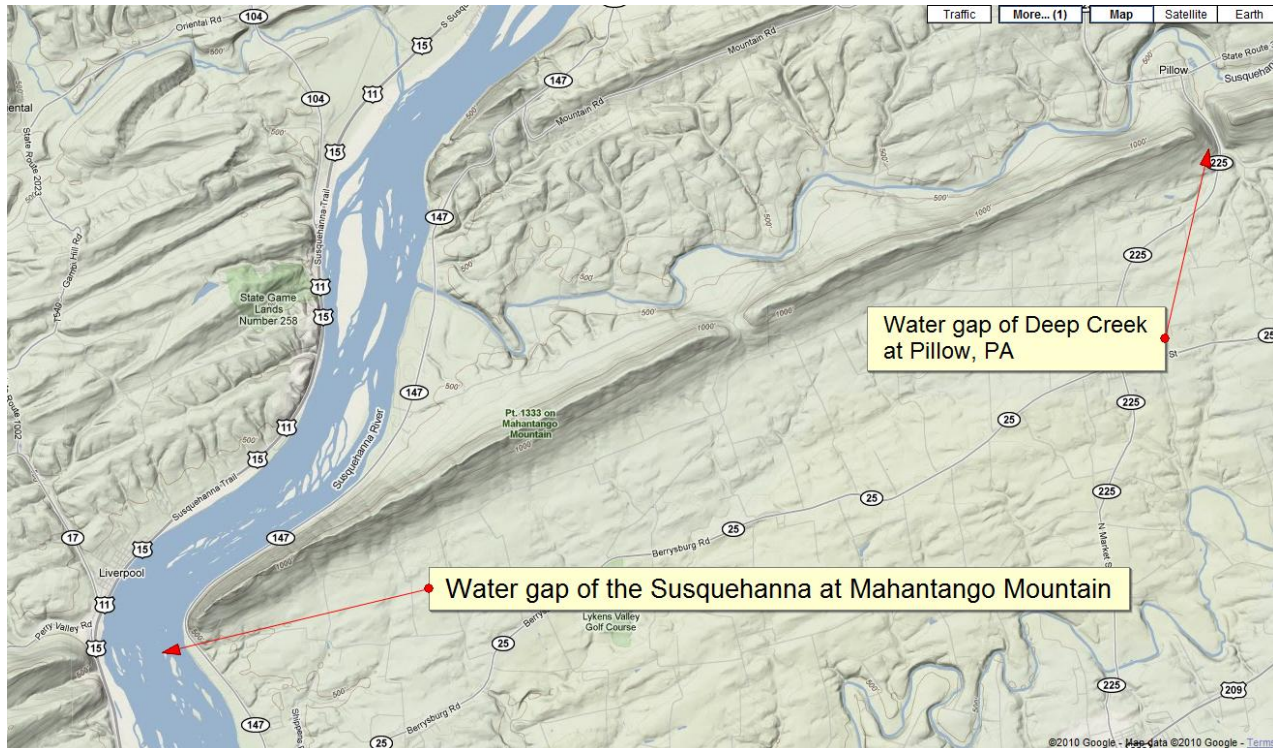


Diagram of possible mechanism of water gap formation as lowering water levels cause channelization in ridges (courtesy of

In the Susquehanna River basin of Pennsylvania, fine-scale terrain analysis has revealed hundreds of water gaps, often in linear arrays along ridges, through which flow streams of widely varying sizes. The conventional geological interpretation is that because the Susquehanna and its tributaries flow through ridges rather than around them, they are older than the ridges, and by extension, the collision between

two continents which is supposed to have created those ridges 300 million years ago. Yet it is not uncommon for the sides of gaps to have slopes ranging from 45 to 50 degrees, which raises the question of how those steep slopes could have been maintained without being eroded over the past 300 million years.

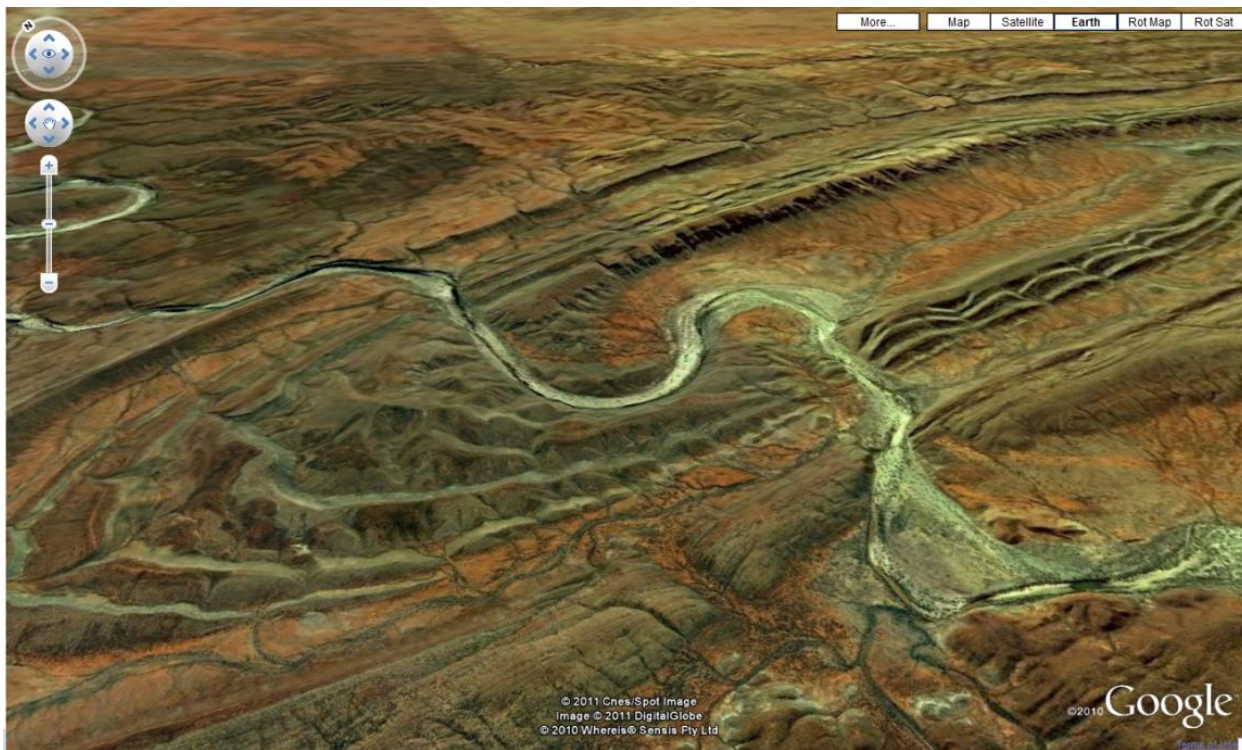
In addition, streams of many different sizes flow through similar-sized gaps. For example, the Susquehanna River, with a discharge of more than 500 cubic meters/second, flows through a gap 700 feet deep in a ridge called Mahantango Mountain. Six miles away in Pillow, PA, a small stream called Deep Creek, with a discharge of less than half a cubic meter/second, flows through the same ridge in a gap 600 feet deep. It seems unlikely that the erosional capabilities of Deep Creek and the Susquehanna River were similar enough to cut such similar gaps. The more reasonable explanation is that both gaps are remnants of a catastrophic erosional event, and the streams which currently flow through them are relicts of the channelized flow which originally cut the gaps.



Water gaps of Susquehanna River and Deep Creek through Mahantango Mountain, PA (image from Google Maps)

The Rocky Mountain west is filled with water gaps; in fact, the Grand Canyon is a giant water gap. It makes a 90 degree turn in its southward course about 30 miles west of Tuba City, AZ, and plunges through the 2900 foot thickness of the Kaibab plateau. Other gaps line the courses of the Green and Powder Rivers, and, like the Colorado, the Snake River of Wyoming makes a 90 degree turn south of Jackson, WY, and flows directly into the Teton mountain range. Other areas of extensive water gaps are found all over the world, often transecting mountains of presumed old age. For example, the Finke River of Australia is supposed to be the oldest river in the world, because, like the Susquehanna, it flows through ridges which are supposed to have formed in a mountain building event that peaked 300-400 million years ago.⁴⁶

However, instead of being remnants of ancient river systems that remained unchanged as continents collided around them and layers of rock folded beneath them, the frequency and distribution of water gaps worldwide are more easily explained as catastrophic channelization on a global scale as landscapes emerged from inundation.



Finke River, Australia, cross-cutting through ridges formed by folded layers of rock (image from Google Earth)

The Fossil Record. One of the reasons catastrophism is difficult for geologists to accept is that many standard principles of interpretation rely on gradualistic assumptions. For example, geologists reason that the order in which fossils are found represents the succession of life forms throughout time, deposited more or less continuously, under conditions similar to those in the present. The problem is that organic remains in nature are normally removed by scavengers and decay-producing microorganisms, yet there are rock layers all over the world so packed with fossils that they take on the nature of bone yards. To give an example from my home state of Florida, there is a rock layer in the central portion of the state called the Bone Valley Formation. This layer is so densely fossiliferous that there are people who make a living from taking tourists out on fossil-hunting expeditions to gather bones from the riverbanks where it crops out.

Dr. Robin Brown, in his book, "Florida Fossils," writes:

Known the world over, Bone Valley fossils are a mixture of marine (sea), estuarine (brackish water), freshwater, and terrestrial (land) vertebrates. Shark and manatee are found adjacent to rhinoceros, horse and extinct pond turtle. *These complex deposits originated in bays, rivers, and coastal plains, [emphasis mine] beginning about 15 million years ago in the Miocene and ending about three million years ago in the Pliocene.*⁴⁷

The problem from a gradualistic perspective is that nowhere in the bays, rivers and coastal plains of the present day is there found currently accumulating the amount of terrestrial, marine, and estuarine vertebrate bones that would have been necessary to create a layer similar to the Bone Valley Formation.

Other examples abound. At Agate Fossil Beds National Monument in Nebraska, a layer of bones was described by paleontologist Kirk Johnson as being so dense "that several museums showed up and chiseled out square chunks, just like cutting brownies out of a pan."⁴⁸ Johnson relates that at Como Bluff, Wyoming, one of the first major dinosaur bone excavation sites in the US, fossilized dinosaur bones were so numerous that a local shepherd inadvertently built a cabin out of them.⁴⁹



Reconstruction of fossil bone layer at Agate Fossil Beds National Monument Visitor Center

Besides being found in massive quantities, fossils are often discovered in incredible states of preservation. Fossils have been found of marine reptiles giving birth,⁵⁰ eggs with preserved embryos inside them,⁵¹ fish eating other fish,⁵² and even fossilized animal droppings.⁵³ This mass preservation is difficult for geologists to explain because it is not the natural order. They often postulate local floods as a mechanism of fossilization, but it is fair to say that no flood, tsunami, or hurricane in recorded history has preserved the remains of organisms in the quantities and state of preservation seen in the fossil record.

In addition, the lack of transitional fossils between species confirms the existence through time of biological discontinuities. Geologists assume that the fossil record represents the descent of all life through time from a common ancestor, through the processes of natural selection and genetic mutation. However, living things are persistent in reproducing after their own kind, with mutations more likely to reduce fitness than to improve it. As Randy Guliuzza of the Institute for Creation Research says,

Biological life is *fundamentally discontinuous*, meaning organisms fit *only one* phylum, class and order. Common descent explanations generally clash with these observations.⁵⁴

Stephen Jay Gould recognized this problem, and along with Niles Eldredge, came up with the theory of punctuated evolution, which essentially presumes that evolution must have occurred, but since it is not preserved in the fossil record, it must have happened in so short a time span compared to geologic time that the transitional organisms didn't have a chance to become fossilized.

Other scientists are voicing similar thoughts. In November 2010, geologist Michael Rampino suggested that the catastrophist evolutionary views of Patrick Matthew, a contemporary of Charles Darwin, should be reconsidered as a valid hypothesis.⁵⁵ Paleoecologist Keith Bennett, writing in *New Scientist* in October 2010, argued for a chaos theory of evolution, citing studies showing that "most species remain unchanged for hundreds of thousands of years, perhaps longer, and across several ice ages. Species undergo major changes in distribution and abundance, but show no evolution of morphological characteristics despite major environmental changes."⁵⁶

While the existence of biological discontinuities and the accumulation of deleterious mutations present a significant problem for unguided common descent, many Intelligent Design proponents appear to favor some form of directed evolution. For example, Michael Flannery wrote in the ID blog "Evolution News and Views":

The question isn't--and never was--evolution or no evolution. The real question is, is evolution directed, detectably designed, and purposeful common descent or is it, as Darwin himself

suggested, no more designed "than the course which the wind blows"? In short, is evolution intelligent?⁵⁷

Given the current state of genetic knowledge, however, the logical implication of directed evolution is that overcoming barriers to variation must have required the supernatural intervention of the Intelligent Designer, since biological discontinuities are the normal order of nature. If the preference is for the explanation which requires the least amount of supernatural interventions, then a single appearance of biologic kinds with built-in but limited potential for variation is preferable to the number of interventions that would have been necessary for a one-celled organism to develop into the multiplicity of life forms that now exist.

The Verdict

The evidence can be summarized as follows:

- Radiometric dating, while supportive of old age, is contradicted by other age evidences such as preservation of soft tissue and the presence of Carbon-14, and is regarded by its own proponents as subordinate to fossil assemblages for marking the divisions of the Geologic Time Scale.
- Evidence of geologic catastrophism rebuts gradualism and reduces the ability of geologists to extrapolate currently observed processes into the past.
- Water gaps rebut the chronologies provided by radiometric dating for river systems, and are more easily explained as relicts of the worldwide emergence of landscapes from inundation.
- The quantity and preservation of fossils are difficult to explain in a gradualistic scenario.
- The existence of biologic discontinuities and deleterious mutations are problematic for Darwinian hypotheses of descent through genetic mutation.

I conclude that the age claims of conventional geology do not pass the burden of proof of reasonable doubt. If it were a crime to be as old as geologists claim, then the earth should be declared, "Not guilty."

However, the failure of the old age hypothesis to meet the reasonable doubt standard does not automatically translate into proof that the earth is young. Both old age and young age proponents have marshaled many arguments for their positions using the evidences of geology, and those who wish to investigate the technical aspects of the issue are encouraged to consult the resources given at the end of this paper. What can be safely stated, however, is that that reason alone cannot give a conclusive age for the earth.

The Witness of Faith

The failure of old age evidences to meet the reasonable doubt standard does show that the standard of proof has not been met by those who would challenge the literal and obvious sense of Genesis 1-11 as interpreted by all of the Fathers and Doctors of the Church, and by the Popes and Councils in their authoritative teaching.¹

In addition, while geology cannot conclusively establish the earth's age, evidences of geologic catastrophism appear to corroborate the worldwide flood described in Genesis. Furthermore, the existence of genetic discontinuities between species and the lack of intermediate forms in the fossil record support the Genesis account of a one-time creation of biologic kinds, with built-in but limited potential for variation.

¹ For a detailed examination of magisterial teaching supportive of the literal historical interpretation of Genesis 1-11, see Fr. Victor Warkulwiz, *The Doctrines of Genesis 1-11*. For an exposition of the conciliar teaching on creation of Lateran IV and Vatican I, showing its incompatibility with evolutionary theory, see *Creation and Time*, by Dominique Tassot et al, with a foreword by Bishop Desmond Moore. Both works are available from the Kolbe Center for the Study of Creation, 952 Kelly Rd., Mt. Jackson, Virginia 22842, www.kolbecenter.org

Apart from any evidence from the natural sciences, there are sound theological reasons to uphold the traditional interpretation of Genesis as true history:

1. The historical character of Genesis testifies against an old age for the earth. The whole Genesis account from Adam to Abraham is a coherent historical narrative, which is taken up in the New Testament when Luke traces the genealogy of Jesus all the way back to Adam. If we reject the historicity of Genesis before Abraham, then we are put in the position of having real people be the descendants of metaphorical ones. Most importantly of all, the Lord Jesus Christ Himself always referred to the accounts of persons and events in Genesis 1-11 as true history.

2. A strictly metaphorical understanding of Genesis did not exist before the development of the theories of evolution over long geological ages. As Father Victor Warkulwiz documents in his book, *The Doctrines of Genesis 1-11*, the Magisterium of the Catholic Church interpreted Genesis as authentic history up until the 19th century, and it was not new theological insight that produced the modern allegorical interpretation, but rather the desire of theologians to accommodate Scripture to the emerging theories of old age and evolution.⁵⁸

3. Even taken strictly metaphorically, Genesis does not adapt well to theories of evolution over long ages of geological time. While Genesis does reflect the sophisticated concept that light existed before the sun and the moon, the rest of the order of creation does not match the uniformitarian scenario. Vegetation preceded the creation of the sun and moon, sea creatures and birds were created before animals and men, and all creatures were initially vegetarian, since animal death was the result of the fall.²

4. One cannot reject the supposedly unscientific events of the Old Testament without casting doubt upon the similarly unscientific events of the New Testament. Nothing could be less scientific than the idea that a man was born of a virgin and rose from the dead, yet that is what Christians are required to believe. If the supernatural events of the New Testament are true history, then it is not unreasonable to believe that the supernatural events of Genesis could be true history as well.

5. If the evolutionary interpretation of the geological column is correct, God allowed hundreds of millions of years of death, disease, genetic defects and deformities *before* the Original sin of Adam. But this is not the all-wise, all-loving and all-powerful God who is revealed in Jesus Christ and in the Bible, as understood by all of the Fathers and Doctors of the Church. The God of the Bible and Catholic Tradition created a perfectly harmonious universe for mankind, devoid of any kind of defect or deformity. In this account, animal and human death, disease, and genetic defects and deformities are the consequence of sin—and the fossil record of death, disease, and deformity is primarily a testament to Noah's Flood: God's merciful judgment, which preserved a faithful remnant from a world that had become almost totally corrupt.

By His very nature, God was able to create the world in any manner He desired, including that described literally in Genesis. In addition, it would be consistent with His nature as a loving and caring Father to reveal a true account of creation, so that His children would be able to reconcile the existence of physical and moral evils with faith in His perfect wisdom, goodness, and love.

I conclude that the revelation of faith and the witness of reason both provide powerful support for the view that Genesis 1-11 should be interpreted not as allegory, but as true history.

² Although the Magisterium has never ruled definitively on the question of animal death before the Fall, St. Augustine is the only Church Father whose writings on Genesis have been preserved who believed that animals practiced carnivory before the Fall. All of the other Fathers held that animal death did not begin until after the Original Sin.

RESOURCES

WEBSITES:

Young Age

<http://www.creationresearch.org/>

The Creation Research Society is a "professional organization of trained scientists and interested laypersons who are firmly committed to scientific special creation." (from website)

<http://www.icr.org/>

Institute for Creation Research

Education and research institution for "equipping believers with evidences of the Bible's accuracy and authority." (from website)

<http://creation.com/age-of-the-earth>

"101 evidences for a young age of the earth and the universe," from Creation Ministries International, an international organization dedicated to speaking & publishing on YEC issues.

<http://creation.com/a-christian-response-to-radiometric-dating>

Dr. Tas Walker's critique of article supporting absolute dating methods by Roger Wiens

Old Age

http://www.kolbecenter.org/mullan_fundamentalists.htm

Article by Catholic astronomer Dermott Mullan defending old age of universe.

http://www.talkorigins.org/faqs/dalrymple/scientific_age_earth.html

Article by geologist Brent Dalrymple, defending old age of earth.

http://noanswersingenesis.org.au/a_radiometric_dating_resource_list.htm

Website defending accuracy of radiometric dating

BOOKS:

Young Age

"Earth's Catastrophic Past." Andrew A. Snelling, Institute for Creation Research. 2009. Technical compilation of supportive evidence for young age.

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