

CREATION RESEARCH SOCIETY



QUARTERLY

Volume 46 Spring 2010 Number 4

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- A close-up photograph of a giant panda's face as it eats a green bamboo stalk. The panda's black and white fur is clearly visible, and its mouth is open, showing its teeth and pink tongue as it chews on the bamboo. The background is a blurred natural setting.
- THE PLEIOTROPY PROBLEM
 - HOLOBARAMINIC STATUS IN BEARS
 - THE ORIGIN OF GRAND CANYON—PART II
 - SEDIMENTATION AND THE EVOLUTIONARY HYPOTHESIS
 - NOVARUPTA AND THE VALLEY OF 10,000 SMOKES

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Haec Credimus

For in six days the Lord made heaven and earth, the sea, and all that in them is, and rested on the seventh. —Exodus 20:11

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Editorial

It's Time for Atheists to Get Real

I. Pascal's Wager

"It has been said that when human beings stop believing in God they believe in nothing. The truth is much worse: they believe in anything."

—Malcolm Muggeridge

Seventeenth-century French mathematician and philosopher Blaise Pascal provided a series of writings on reasoning and Christian faith. As part of these writings, he offered a type of mathematical probability that it is more reasonable to assume God exists than to assume that He does not exist (e.g., see DeYoung, 2007). This claim (or "wager," as Pascal called it) has become known as *Pascal's Wager*.

My paraphrased and expanded version of Pascal's reasoning is: belief in God offers the best probability of outcomes. It provides a moral foundation and stability to both individuals and societies. It provides a higher calling and results in people being more loving and benevolent toward others. Ultimately, if God does not exist, then death brings no different consequence than for disbelief. Thus, nothing is lost. On the other hand, disbelief in God fails to provide a moral foundation and gives little incentive to love others. But, by contrast, should God ultimately prove to exist, the consequence of disbelief is far different than for belief. Thus, nothing is gained. Pascal reasoned that by assum-

ing the existence of God, a person risks little and gains much, but by assuming there is no God, a person gains little and risks much.

Some have criticized Pascal for not specifying which "god" his wager involved. However, much of his earlier theological writings had been an analysis of the Christian God compared to other "gods." He had concluded the Christian God to be the only true God. So, it can easily be assumed that Pascal's Wager refers strictly to the God of the Bible, as he did not consider any other "god" to be real or relevant.

Atheists have attempted to refute Pascal's argument by suggesting that "religion" does not lead to better and more benevolent living. In fact, some have recently claimed that religious belief actually causes more wars, distress, and human suffering. Thus, little is gained from Christianity, and much is lost.

While there have always been critical exchanges between Christians and atheists, in the last few years the tone has taken a decidedly negative turn. Led by vocal "god-haters" Richard Dawkins and Sam Harris, atheists have begun to aggressively accuse religion (with a major focus on Christianity) as being the primary cause of every form of human plight and physiological malfunction.

For example, as part of his argument, Harris (2006, p. 55) identifies specific geographical regions where he claims

"religion has been the explicit cause of literally millions of deaths in the last ten years." Of course, Harris makes no attempt to distinguish between the world's various religions, enabling him to castigate Christianity as part of his broad-brush accusation. Also, Harris (2006) provides little documentation of his claim, and a quick statistical search finds that all conflict-related deaths in his specified regions between the years 1996 and 2006 are probably less than one million (with no distinction of religion vs. non-religion motivations). Of particular interest is one country on Harris's list: Ethiopia. This single, tiny country suffered over one million government-sanctioned murders by the atheistic, communistic Derg regime between 1974 and 1987. Perhaps Mr. Harris's history book does not go back that far.

In one of his recent diatribes, Dawkins (2006) attempts to draw a strong connection between war and religion. Among his claims is the notion that religion causes divisions among people, and these divisions directly contribute to the prejudice that leads to war. Of course, politics, race, culture, and geography also divide people and have always served as a strong contributor to regional conflicts and tribal quarrels. Humans have rarely needed much justification for their greed, prejudice, and hatred. Yet, Jesus sought to break down social

divisions and commanded His followers to love everyone (regardless of race, politics, culture, etc.) (Matt. 5:43–44; Luke 10:27–37; John 13:34–35). That is not the type of teaching that motivates nations toward war.

While some wars admittedly have been motivated by the religious differences between nations and people groups, the ultimate cause of most wars is far more complicated, and religious connections are generally tenuous at best. In American history, the Revolutionary War, War of 1812, and Civil War were fought by combatants with the same religious convictions. Many of the medieval European wars were fought for land, power, and wealth. Any religious connection was merely a “lip-service” attempt to justify human greed. In fact, the two largest wars in history hardly could be viewed as religious wars. Not surprisingly, Dawkins’s history is as bad as his science.

Nineteenth-century German philosopher Friedrich Nietzsche stated that industrialization and science had eliminated the human need for the emotional crutch called “god.” Thus, he gleefully declared, “God is dead ... and we have killed him” (Nietzsche, 1974, p. 181). Interestingly, though, with no belief in God to influence people, even Nietzsche prophetically said that the twentieth century would experience “wars such as there have never yet been on earth” (Nietzsche, 1979, p. 97). Why? According to Dawkins, wars are caused by people who foolishly worship God, not by those who do not.

Atheists also have attacked the Wager by claiming that religion does not intrinsically result in higher morals or greater respect and benevolence. Sadly, there is some truth in this claim, as some religions openly promote violence upon their “unbelieving brothers.” Even many calling themselves “Christian” fail to become the “new creation” that is to be the Christian life (2 Cor. 5:17). For a Christian, though, there is an intrinsic

foundation that calls us to greater love and a higher moral ground (e.g., 1 John 2:5; 4:7–21).

In contrast, Dawkins (2006) vainly attempts to give some moral foundation to atheism. Ultimately, the best he can achieve is to declare that there is no reason to suggest that an atheistic worldview causes people to steal, kill, etc. However, the more relevant question is, how does atheism cause people *not* to steal, kill, etc? *When Joseph Stalin’s Russian government murdered over 20 million of its own citizens, was he violating some moral code or ethical constraint of atheism? Was he being inconsistent with some basic principle within the atheistic worldview? No, since atheism is actually*

**When we become accountable
only to ourselves, then we
have made ourselves God.
And humans are terrible
at being God.**

(and must be!) nonmoral, it has no basis to make a moral judgment about what is or is not moral behavior. After all, without a lawgiver, where would such moral laws come from? Thus, while atheism does not require immoral or criminal behavior, it lacks any guiding means of teaching against it.

Some atheists argue that humans possess an innate sense of morality. Abraham Maslow claimed that if we allow our “inner nature ... to guide our life, we [will] grow healthy, fruitful, and happy” (Maslow, 1968, p. 5). He added, “There is no place else to turn but inward, to the self, as the locus of values” (Maslow, 1968, p. 14). Maslow (1970) also proposed that human behavior is linked to a “hierarchy of needs.” As these needs are met, it will “open the

way to the expression of a ‘higher human nature’” (Maslow, 1968, p. 29). Because Maslow viewed the inner self as the only true source of human values, he placed “self-actualization” at the top of human needs (Maslow, 1970). In other words, our most important need is to follow our own desires, and somehow this will make us better people. Of course, I am inclined to suspect that such an “all-about-me” philosophy might be more likely to make people selfish and narcissistic rather than loving and moral. In fact, Pascal referred to such philosophy of self-gratification as “licking the earth.”

More to the point, where would an inner moral code originate? Based upon his atheistic worldview, Dawkins (1995, p. 85) admits that the universe has “no design, no purpose, no evil and no good, nothing but pitiless indifference.” How can an indifferent universe impart a human moral code or a healthy life? What aspect of contemporary evolutionary “theory” can account for the origin of an innate sense of good and evil? Do mutations have morals? Do chemical reactions make ethical decisions?

Bertrand Russell (1986) suggested ethical behavior is linked to human happiness. Apparently, when a person is happy he or she will be good. However, what makes a person happy? I doubt if even Russell really had any idea. A pedophile may claim that his acts of sexual perversion give him happiness. Could Russell have disagreed? In fact, what is human happiness? Attempts to answer this would likely result in lengthy and rather nonproductive philosophical debates. Yet, without answers to these questions, Russell’s suggestion has little value to the atheistic worldview and has little meaning to how people actually live their lives.

Some also argue that a moral code can arise from social norms. But how does a society establish these norms? Simply because some behavior is acceptable within a specific society does not even

make it acceptable to another society. Does nineteenth-century America's acceptance of slavery or 1940s Germany's acceptance of racial eugenics make these morally appropriate? By what standard does a society determine moral conduct? In fact, even today slavery and racial eugenics can be found in many societies. Does this make it morally acceptable? Is morality merely a consequence of an ever-changing popular opinion?

It is also important to remember that Hitler and his National Socialist Party (Nazis) did not take control of the German government by force. They were voted into office. By a huge landslide, I would add. Their legacy needs no retelling. The atrocities they committed are almost incomprehensible. (No wonder Eisenhower requested that a vast amount of pictures, movies, and documents be obtained to counter any doubts by future generations.) What led to the Nazis' acquisition of power? Voter apathy? Church complacency? What motivated their evil actions? No consciousness of moral accountability? Is it coincidental that this was the society so strongly influenced by Nietzsche?

Some have begun suggesting that Hitler was actually a Christian and a creationist, attempting to link his barbarity to his claims of Christian faith. However, Christianity is far more than simply claiming to be a Christian. Jesus taught that only those who love (John 13:35) and do the will of the Father (Matt. 7:21) are His followers. At what point was Hitler showing love and doing the Father's will? In the same vein, atheists have argued that prisons are full of people calling themselves Christian. However, for many, the conversion is after their imprisonment. For the remainder, as with Hitler, how were their criminal actions founded in Christ's teachings? Instead, their behavior was inconsistent with any claims they made of being a Christian.

It is also "historical revisionism" to claim that Hitler was a creationist. Any

comments that Hitler made regarding separation or purity of life-forms were clearly not challenges to evolutionary common descent. Rather, they were justifications for his policies of racial purity and genocide. The very title of his book, *Mein Kampf*, means "my struggle"—a clear reference to his understanding of "survival of the fittest." It is a reference that echoes throughout the book. For example, he comments that "our planet has been moving ... for millions and millions of years, uninhabited by men, and ... may easily do so again—if men should forget that they [owe] their superior level of existence [to] acknowledging and rigorously observing the iron laws of nature (Hitler, 2010, p. 261). This is not a creationist perspective, let alone a Christian position. It is clearly a philosophy founded on the basic principles of naturalism and Darwinian evolution.

As a type of final desperation, attempts also have been made to apply "evolution game theory" to explain human behavior (Skyrms, 2004; Sober and Wilson, 1999). In its purest form, game theory is a mathematical model to predict outcomes based upon probability of options or choices. Evolutionists have attempted to adapt it to predict evolutionary change. Applying evolution game theory to human ethics requires many assumptions, including an evolutionary connection of human attitudes with animal behavior. Also, "game theory ethics" typically involves some form of self-gratification as a primary human motive. In some ways, the application of game theory to human behavior is almost too silly to even seriously consider, let alone offer as an explanation for the origin of some form of moral code. Yet, humans, driven by their need to replace God, will desperately consider almost anything. Remember what Muggeridge said.

A number of vocal atheists also have made the claim that a "god" that allows evil and suffering must, himself, be evil, and belief in such a "god" is also evil (or at least extremely foolish). Harris (2004,

p. 173) refers to evil as an "insurmountable" problem for believers. In his mind, there is no wager to even consider. Evil means that God cannot possibly exist.

In his book, *Why I Became an Atheist*, John Loftus (2008) rages about how suffering and evil betray the believer. Thus, he could no longer pretend God existed. He questions how anyone could possibly follow a "god" who is either powerless or apathetic about the human condition. Why would someone even want to follow such a god?

Yet, who are we humans to make such arrogant accusations? We have kicked God out of our schools and then demand to know why He allows school shootings. We have kicked God out of our homes and then demand to know why He allows child abuse. We have kicked God out of our families and then demand to know why He allows our children to become addicts and emotionally troubled. We have banned God from our governments and then demand to know why He allows our governments to be corrupt and repressive. We have ignored God in our society and then cannot understand why He allows our society to be so decadent—filled with adultery, drug addiction, child pornography, embezzlement, fraud, broken homes, and even corruption of those who are supposed to defend and protect us. We have killed millions of innocent unborn children and call it "choice"; yet we demand to know why God allows our societies to be filled with murder and violence. We have filled our bodies with various drugs and wonder why God allows newborn infants to suffer from afflictions such as fetal alcohol syndrome or heroin addiction. We have filled our minds with evil and violence and then demand to know why God does not stop us from our evil and violent actions.

We have kicked God out of this world and have crowned a new prince (John 12:30–32; 14:29–30). We have flouted God's laws and then blame Him for the consequences of our lawlessness. We

have told God to not be part of our lives, our community, and our world and in so doing have caused Him to remove His presence and protection from our societies. Yet, we then become angry when He does not protect us from natural disasters or the consequences of our own sin. We fail to give God glory, yet we are anxious to give Him the blame.

What is more, the presence of evil and disease in the world is not an “insurmountable” problem for Christianity. Many strong theological answers have been provided. (Although some theologians struggle with an answer since their evolution-based answers are weak and inconsistent.) Undoubtedly, for critics such as Harris and Loftus, no answer will be acceptable. Not only because they are poor philosophers (their books are a series of philosophical inconsistencies), but also they do not really seek an answer. They are easily pacified with the thought that if there is evil there cannot be a loving God. They have little interest in any deeper understanding.

It is also sadly amusing that many so-called “Christians-turned-atheists” claim that in becoming atheists they felt some form of liberation. Liberation from what? God’s love? Grace? Forgiveness? I suspect their “god” probably never offered these. Actually, it would seem to be more a liberation from any sense of responsibility and accountability. And, this somehow enables the expression of a “higher human nature”?

It has been my observation that when accountability is removed, we humans are magnificent at fabricating a “truth” that fits our own purposes. In so doing, we are merely seeking to justify our sin. Also, if a situation or event does not suit our needs, we rationalize a substitute. History, for example, is being rewritten to offer a more “nonreligious” verdict: a historical verdict that can be used to rationalize that God does not move in the lives of His people; that man, without God, can achieve his own greatness and goodness; that man, without God, is

not lost in an abyss of moral decay and destruction. Yet, the nightly news tells a far different story. *When we become accountable only to ourselves, then we have made ourselves God. And humans are terrible at being God.*

In the early 1960s, Stanley Milgram began conducting a series of controversial experiments (Milgram, 1974). Milgram tested people’s compliancy to a perceived “authority” who instructed them to inflict pain on others. He found that only a small minority of people defied the “authority” and stopped inflicting the pain. Sadly, such experiments reveal how easily humans can be coerced into negative behavior. What happened to the innate moral code? It also illustrates how susceptible we can be to negative social pressures. (Nazi soldiers typically argued they were “just following orders.”) It took less than 3 days for hurricane-damaged New Orleans (USA) to break down into social anarchy. Where was the social constraint? All too easily, a new wave of Nazi-type brutality could sweep the world.

When Christ said to love your neighbor as yourself (Matt. 19:19) and to love and pray for your enemies (Matt. 5:44), he was not simply confirming how humans naturally act and think. Contrary to Maslow and others, this is not human nature. Jesus was not telling us to “do what comes naturally.” Instead, He was telling us to deny our own natural, selfish desires and rise to a higher calling: a calling that cannot be based upon our own desires of self-gratification, which produce the opposite; a calling that cannot result from social opinion, which is never consistent or selfless; a calling that cannot result from “being happy,” as that is merely a subjective state of mind, subject to change every day.

It is a calling that is beyond a “wager” of best probable outcomes. It is a calling that places Christianity above all human, earthly teachings. It is a calling from the Creator, who knows what brings peace and fulfillment into our lives. It is a call-

ing from Jesus, who has all authority over His creation (Matt 28:18).

Kevin Anderson, Ph.D.
Editor

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Novarupta and the Valley of 10,000 Smokes: Begging for a Biblical Interpretation

David E. Shormann*

Abstract

On June 6, 1912, the biggest eruption in over 100 years occurred in what is now Katmai National Park, Alaska. Ejecting over 30 times more material than Mount St. Helen's, the Novarupta Volcano exploded for 60 hours. Novarupta contains a treasure trove of information just waiting to be interpreted within a Biblical framework. This article seeks to encourage further exploration of Novarupta and The Valley of Ten Thousand Smokes by creation scientists. Details of the eruption are discussed, together with first encounters of the eruption zone by Robert F. Griggs shortly after the 1912 eruption. Comparisons are made between Novarupta and other eruptions, and the local geology is discussed. Rates of glacial advance and retreat in the area may have implications for both global climate change and the causes of the Ice Age. Present-day bedrock incision rates are used to speculate about geologic timescales. The geologic history of Novarupta and The Valley of Ten Thousand Smokes appears congruent with Biblical history.

Introduction

Imagine if there was a place on Earth where astronauts trained for walking on the moon. Where one of the three largest volcanic eruptions in recorded history occurred and created a "great incandescent sand flow" (Griggs, 1922, p. 253), along with a rare form of rock known as "banded pumice." Where gla-

ciers are growing. Where a canyon was gouged out following the breaching of a massive rockslide dam. Where rocks not only float but also fly! Where an eruption, 30 times larger than St. Helens, dropped temperatures worldwide 2° F, caused mountains to disappear, and caused the head of the National Geographic Society in 1922 to consider

the earth as a "young and active planet" (Griggs, 1922, p. xv).

This place is The Valley of Ten Thousand Smokes (TVTTS), created by the June 6–8, 1912 eruption of Novarupta volcano. Novarupta, Latin for "new eruption," is the biggest volcanic eruption in over 100 years and one of the top three in recorded history. Located in Katmai National Park (Figure 1), TVTTS is one of the most researched areas in Alaska. This volcanic region lies atop 15,000 feet of sedimentary rock and presents an opportunity for interpreting earth history within a Biblical framework.

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Figure 1. Map of The Valley of 10,000 Smokes, modified from Griggs (1922).

The 1912 Eruption and Subsequent Exploration

On June 9, 1912, Ivan Orloff wrote to his wife:

My dear wife Tania:

A mountain has burst near here, so that we are covered in ashes, in some places 10 feet and 6 feet deep.... The earth is trembling; it lightens every minute. It is terrible ... Perhaps we will see each other again ... We are praying. (Griggs, 1922, p. 19)

God spared Orloff's life, and in fact not a single soul died during the massive eruption. Like Mount St. Helens, Novarupta was a plinian eruption, and the low density and high silica content of its rhyolitic magma made it even more explosive (Eichelberger and Izbekov,

2000). In three massive eruptions beginning on June 6, 1912, Novarupta spewed forth its volatile mixture of ash, rock, and corrosive gases, cloaking Kodiak Island (60 miles away) and its approximately 500 inhabitants in complete darkness for two days and three nights (Bodeau, 1996).

The volcanic plume rose 25 miles, and the eruption flooded the adjacent valley with a "great hot sand flow" (Griggs, 1922, p. 285), forming tuff. It was also one of few historic eruptions to form "welded tuff" (Hildreth, 1983), where high temperatures fuse tuff together into a pyroclastic rock. Mt. St. Helens and Yellowstone's Caldera also contain welded tuff (Christiansen and Blank, 1972). Ejecta from Novarupta

buried the valley under nearly 700 ft of ash (Brantley, 1994; Glore, 2007). The ash flow stopped near the upper Ukak River, over 15 miles away (Griggs, 1922).

It is difficult to describe the spectacle of a massive volcanic eruption. Griggs, leader of the first expedition into the eruption zone, described Novarupta this way:

If such an eruption should occur on Manhattan Island, the column of steam would be conspicuous as far as Albany. The sounds of the explosions would be plainly audible in Chicago. The fumes would sweep over all the states east of the Rocky Mountains.... There would be no occasion for rescue work [on Manhattan Island], for there would be no survivors. The whole of Manhattan Island, and an equal area besides, would open in great yawning chasms, and fiery fountains of magma would issue from every crack. (Griggs, 1922, p. 1)

Sponsored by the National Geographic Society, Griggs, a botanist by degree, made several expeditions to the area from 1913 to 1919. Initially sent to study the effects of ash fall on Kodiak Island plants, the expeditions expanded to include "a thorough investigation of the immediate environs of the volcano" (Griggs, 1922, p. 71). The expeditions included chemists, geologists, topographers, photographers, students, and even a one-handed bear hunter from Kodiak (Griggs, 1922, p. 73).

Griggs and his group thoroughly scoured the area for details and named many of the mountains and rivers in the area. One of his most appropriate names was the River Lethe, named after the river flowing through Hades in Greek mythology. The river has lived up to its name, as entries in the USGS Baked Mountain Cabin logbooks reveal.

After spending careful hours of contemplation I chose a narrow gorge in



Figure 2. Novarupta then (left, from Griggs, 1922, p. 280) and July 2009 (right).

which to jump the River Lethe ... After the tragic loss of our Swiss camper this summer, I was confronted with a respect, perhaps fear, of this river (Fisher, 1989).

The most memorable name that Griggs gave to the area was The Valley of Ten Thousand Smokes. When he first saw it in July of 1916, he had this to say:

The sight that flashed into view as we surmounted the hillock was one of the most amazing visions ever beheld by mortal eye. The whole valley as far as the eye could reach was full of hundreds, no thousands—literally,

tens of thousands—of smokes curling up from its fissured floor. (Griggs, 1922, p. 191)

Novarupta and TVTTS Today

Almost 100 years have passed since Novarupta exploded. Although Novarupta no longer steams as profusely as it did in 1917, the general shape of the lava plug remains the same (Figure 2).

TVTTS no longer emits “ten thousand smokes” (Figure 3), as the ash flow sheet has cooled and the sources are depleted. The ash flow sheet has not lost all its heat, though, as mid-val-

ley thermal springs still emit water at 30°–60° C (Hogeweg et al., 2005), down from the 95° C temperatures Griggs’s team measured from the same area in 1918 (Griggs, 1922).

The weather has not changed much since 1912. On multiple occasions, Griggs’s expeditions were faced with a curious phenomenon known as a pumice storm (Figure 4). When the winds gust upwards of 50 mph, the lightweight pumice stones get whisked away, forming miniature tornadic slurries of rock and wind. In a particularly nasty storm that destroyed their campsite, he had this to say about the storms:



Figure 3. TVTTS then (left, from Griggs, 1922, p. 188) and July 2009.



Figure 4. A pumice storm. Imagine how rain stings when it hits your face at a high speed. Magnify that feeling many times over, and you can get a feel for a pumice storm!

The hail of pumice that greeted us as we crawled out to see if anything could be done cannot be imagined. It could not be endured on face or hands for an instant. It hurt clear through our clothing. It drove in around our 'dust proof' goggles, a constant menace to our eyes. Many

of the pieces were as large as hickory nuts and all were armed with sharp corners that made them terrible missiles. (Griggs, 1922, p. 229)

While the weather has not changed much in 100 years, our understanding of the processes that formed the area has. Griggs concluded that Mount Katmai

was the source of the eruption. Before the eruption, it towered over the landscape, ascending from the waters of Cook Inlet to a height of over 7,500 ft. Afterwards, it looked like its top had blown off, leaving a massive hole in the top of the mountain over 2 miles wide in places (Figure 5). Griggs thought Mt. Katmai had exploded, although he also thought Novarupta contributed a significant portion of the eruption (Griggs, 1922, p. 261).

One clue that Katmai did not explode was the banded pumice that formed (Figure 6). As flour is to baked goods, silica is to rocks (Bodeau, 1996), and different densities of silica from different magma chambers usually have different colors. The banded pumice was a clue that more than one magma chamber was involved. Scientists now believe that an andesitic/dacitic magma chamber underneath Mt. Katmai emptied during the Novarupta eruption, while mixing with a lower-density rhyolitic magma source that had risen up and formed the dike that triggered the event (Eichelberger and Izbekov, 2000), 6.2 miles to the west. Once the magma chamber underneath Mt. Katmai emptied, the mountain collapsed, forming a caldera. However, volcanism is ongoing. The new Novarupta Dome is about 1,300 ft in diameter and 215 ft tall (Figure 2 and Brantley, 1994).



Figure 5. Portion of Mount Katmai that collapsed (left) after the magma chamber underneath emptied out Novarupta (right). Photographs from the Three Forks Visitor Contact Station, Katmai National Park.

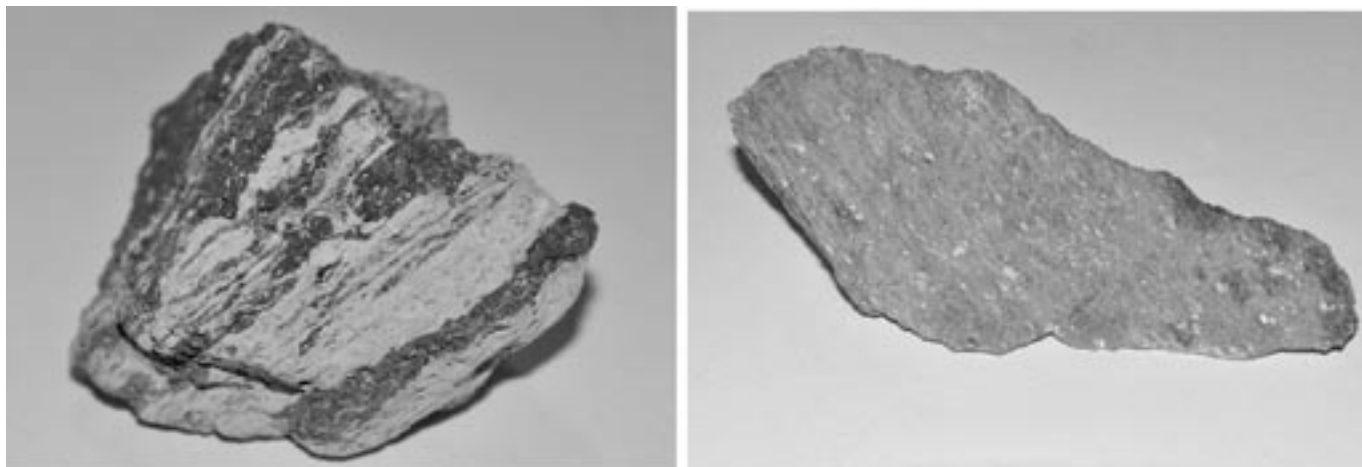


Figure 6. Banded pumice (left) from the floor of TVTTS and rhyolite (right) from the top of Novarupta.

What Can Novarupta Teach Us About Biblical Earth History?

Catastrophism

Traditional geology was built on the gradualism of Lyell and the evolutionary directionalism of Darwin. However, these views are changing because the empirical evidence of the rock record shows that both catastrophism and stasis are elements of natural history. This is consistent with the common-sense understanding that science can only draw inferences about past events based on incomplete evidence and a forensic approach, since observation is not possible.

Overconfidence in historical interpretations arose because uniformitar-

ians required scientific certainty to rid history of the Genesis Flood (Froede, 2007). Thus, many modern scientists have ignored evidence pointing to a worldwide flood, although many now style themselves as secular catastrophists. This view predates Lyell; his continental opponent, Georges Cuvier, published a number of works advocating past “revolutions” (e.g., Cuvier, 1825).

Novarupta and TVTTS can readily be interpreted within the framework of Biblical history. Eichelberger and Izbekov (2000) compared the Novarupta Volcano/Katmai Caldera complex with Russia’s Karymsky Volcano/Academy Nauk Caldera complex. They found that the lower silica content of the Russian magma resulted in an effusive eruption,

while the high silica magma of Novarupta resulted in an eruption they simply described as “catastrophic.”

There really is no better word to describe Novarupta than “catastrophic,” an eruption that was 10 times more powerful than the Mt. St. Helens 1980 blast (Glore, 2007). However, it was still small compared to ancient eruptions like the Yellowstone Caldera (Table 1). Novarupta dwarfs Mt. St. Helens, but the Yellowstone eruption ejected over 75 times more magma than Novarupta. The welded tuff and rhyolite formations left behind by the Yellowstone Caldera eruption suggest that it too was extremely explosive like Novarupta. Still larger eruptions have occurred in the past (Austin, 1998; Froede, 2007). This is consistent with the Biblical Flood and associated phenomena.

Canyon Formation

While most would agree that canyons form by water eroding through rock, disagreements come primarily when rates and initial conditions are discussed due to the lack of direct observation. However, canyons near Novarupta help illustrate the forces involved in canyon formation.

When an eruption as large as Novarupta occurs, highly unstable geologic

Table 1. Comparison of magma ejected from several volcanoes.

Eruption	Year	Volume of Magma Ejected (cubic miles)
Yellowstone Caldera	unknown	240*
Krakatoa	1883	4.3*
Novarupta	1912	3**
Mount Saint Helens	1980	0.1 ^T

*Austin (1998); **Eichelberger and Izbekov (2000); ^T Brantley (1994).



Figure 7. Gorge formed (dashed borders) by the Great Flood of 1916 (from Griggs, 1922, p. 116). White lines show the source of the landslide that had dammed the Katmai River, holding back 8 billion cubic feet of water.

conditions may exist for years afterwards. Griggs's 1916 expedition experienced this in what he called the "Great Flood" (Griggs, 1922, pp. 103–122). The flood was caused by the escape of water impounded by a landslide (Figure 7). The landslide, formed during the eruption when a portion of Mt. Katmai fell away, impounded about 8 billion cubic feet of water. The landslide dam burst, and the water's erosive actions formed a "trench as straight and clean-cut as though excavated by man to carry some great engineering work, like the Panama Canal" (Griggs, 1922 p. 117; Figure 7). Comparing it to other great floods, Griggs calculated the Katmai flood to be 35 times as great as the 1889 Johnstown, Pennsylvania flood (Griggs, 1922, p. 119). With speeds calculated at over 60 mph, the Katmai flood had a destructive power over a million times greater than the average Mississippi River flood (Griggs, 1922, p. 121). It excavated about 33 million cubic yards of material, about half the amount moved in excavating the

Culebra Cut (aka Gaillard Cut) of the Panama Canal (Griggs, 1922).

Griggs did not reach the landslide dam until the year following the breach, and the photograph taken that year (Figure 7) clearly shows the large channel excavated by the flood, and the smaller channel formed from the more normal flow levels of the Katmai River. Griggs felt very fortunate that their arrival in 1916 was behind schedule, for if they had landed a week earlier, they "would almost inevitably have been overwhelmed, for our work kept us on the flats [of the lower Katmai River] and there would have been no chance for escape" (Griggs, 1922, p. 115). The photograph is excellent testimony of how catastrophic events form larger canyons, similar to evidence found in the Upper Toutle River near Mt. St. Helens (Austin, 1984; 1998) and at Red Rock Pass (Austin, 1998).

TVTTS provides excellent evidence for subsequent canyon erosion. Scientists commonly use the stream power

erosion law for modeling stasis bedrock channel incision (Goudie, 2004; Ritz, 2008; Stock and Montgomery, 1999; Whipple et al., 2000a; Whipple and Tucker, 2002). In TVTTS, stream flow incision models have been used to pattern incision rates into bedrock of the Ukak River (Whipple et al, 2000b). The Ukak River provided an excellent setting for applying the stream power erosion law, because scientists knew the exact year (1912) when incision began in a diverted section of the Ukak River.

The most visibly striking feature of the bedrock incision in TVTTS is the width of the canyons. In Figure 8, the Ukak River cuts through sedimentary rock of the Naknek formation. A few miles upstream from this, the River Lethe incises into welded tuff from Novarupta (Figure 8). The canyons in Figure 8, formed under normal flow conditions, are narrow enough to jump across in places. Although many variables, including lithology, effect canyon width (Wil-



Figure 8. Ukak River cutting through sedimentary rock (left) and the River Lethe cutting through welded tuff. The catastrophic canyon formation of Griggs' "Great Flood" was far greater than modern fluvial action.

liams, 1998), evidence from TVTTS shows that under stasis conditions, rivers flowing over two different types of bed-rock cut extremely narrow, steep-walled canyons. This is the opposite of what a uniformitarian model might predict (Froede and Williams, 2003).

Glaciers, Timescales, and Climate Change

Almost all the volcanoes in TVTTS are covered by multiple glaciers (Figure 9). Glaciers at the base of Mount Mageik

retreated about 2,424 ft between 1912 and 1987 (Hildreth et al., 1998).

Although global temperatures, on average, are rising, it appears to be a cyclical trend (Singer and Avery, 2008). That view is supported by the Katmai National Park glaciers, which retreated an average of 56.8 ft per year from 1951–1987, accelerated that retreat from 1974 to 1987 to 112.5 ft per year, and then decreased from 1987 to 2000 down to 44.0 ft per year (Giffen et al., 2007), suggesting a cyclical pattern of temperature change.

After the 1912 eruption and collapse of Mt. Katmai, a new glacier formed inside the Katmai caldera. It may be the only glacier in the world whose exact age is known (Bodeau, 1996). In addition, the Knife Creek Glaciers on the north face of Mt. Katmai actually have advanced from 1951–2000 (Giffen et al., 2007; Figure 9). One reason for this advance may be the insulating effects of the pumice covering over the Knife Creek Glaciers (Hildreth et al., 1998).

After the eruption, scientists calculated that if the Novarupta ash had

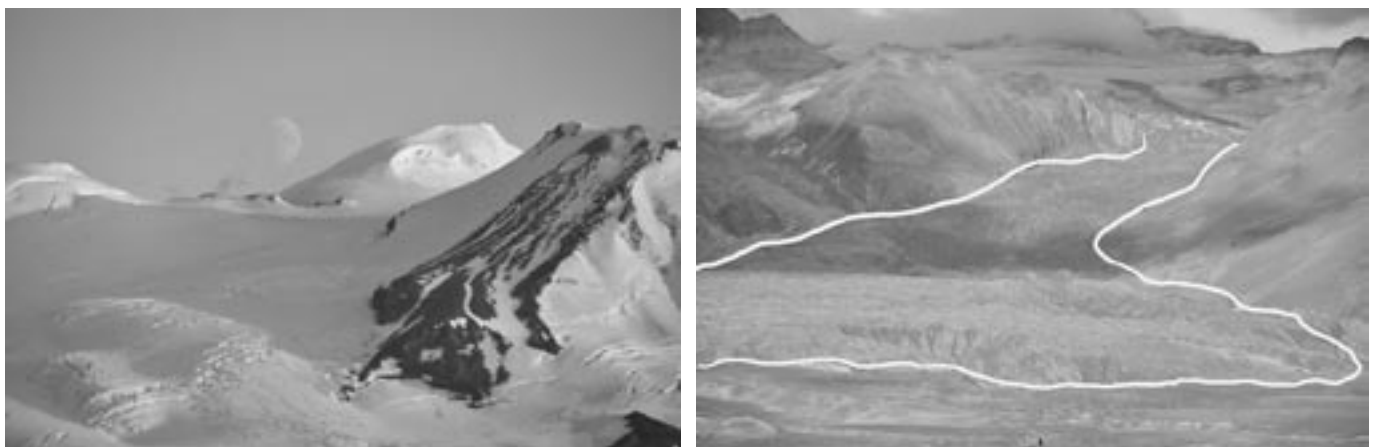


Figure 9. The top of glacier-coated Mt. Mageik (left), with steam rising and the moon setting over its volcanic peak. On the right, ash-covered Knife Creek Glaciers (inside white borders) have been advancing.

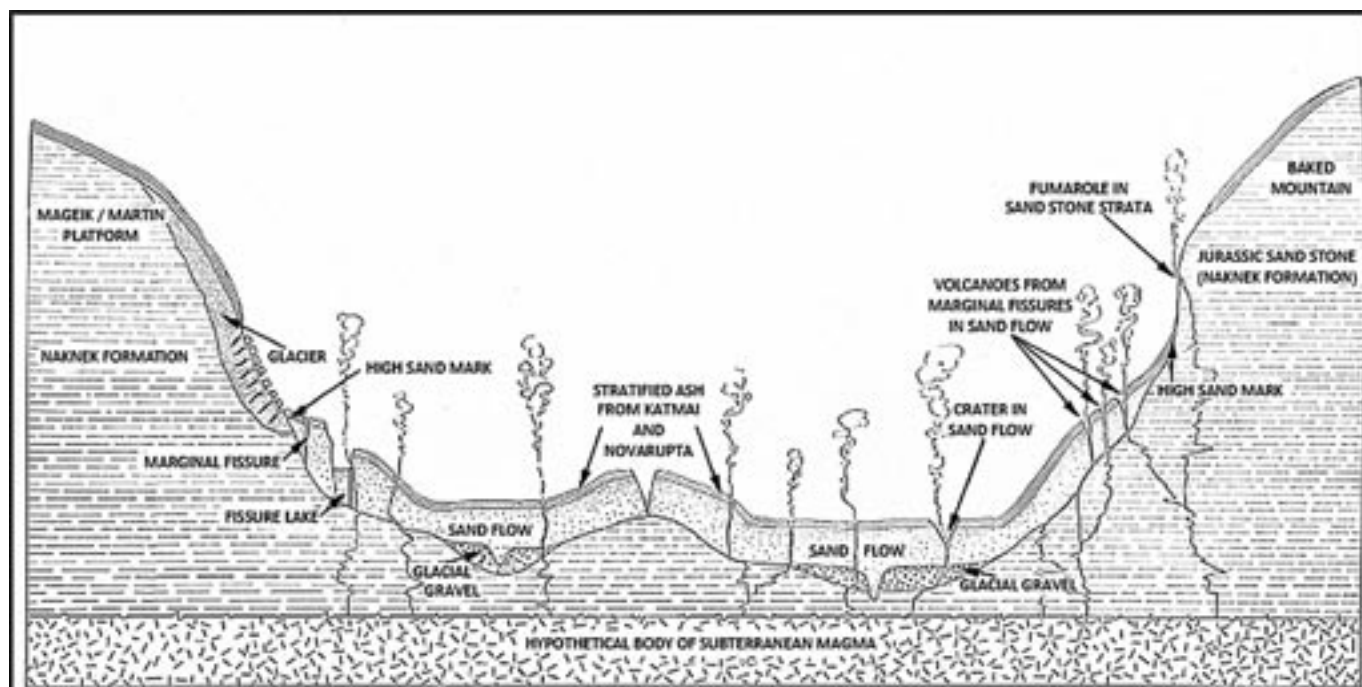


Figure 10. Cross section of TVTTS from Griggs, p. 263. The dashed lines represent sedimentary rock of the Naknek formation.

stayed in the atmosphere a little longer, the temperature decrease would have been enough to initiate another Ice Age (Griggs, 1922). Given that impact, larger volcanic eruptions in the past, like Yellowstone, might have generated significant climate change. Cuvier believed that the volcanic upheavals surrounding the Genesis Flood were responsible for the Ice Age (Cuvier, 1825), and the hypothesis still is popular today (Froede, 2007; Oard, 1990).

The Naknek Formation and the Genesis Flood

Beneath the volcanics produced by the Novarupta eruption, lie up to 15,000 ft of sedimentary rock. This suggests a massive, water-related event (Figure 10). Hundreds of square miles of Alaska are covered by the sedimentary Naknek Formation. The Naknek and underlying Shelikof formations in Katmai National Park are said to be composed of rapidly

eroded coastal sediments mixed with a “considerable volume” of volcanic debris (Harris et al., 2003).

In places, the Naknek Formation is described as having been formed by “continuous sedimentary deposition” (Church et al., 1994). In the Talkeetna Mountains northeast of TVTTS, studies describe the Naknek Formation forming when “gravelly mass flows transformed downslope into sandy turbidity currents on a muddy pro-delta slope” (Trop et al., 2005). In places, the Naknek Formation contains a considerable number of marine fossils, and fossil-containing rocks litter many mountaintops in the park (Figure 11).

Summary

The Valley of Ten Thousand Smokes sits atop one of the most volcanically active regions in the world, where the Pacific Plate dips underneath the North American Plate. In an old-earth framework,

one would expect this area to consist of layer upon layer of volcanic strata, with steep-walled canyons incising thousands of feet down. Instead, we find evidence of a relatively recent, yet massive geologic upheaval that mixed marine sediments and volcanic ash into a uniform slurry in places. Glacial action then sculpted the terrain, and this is capped by a volcanic layer from an eruption less than 100 years old.

Grosvenor (Griggs, 1922, p. xv, emphasis added) described Griggs’s work as an “important addition to our knowledge of the *young and active planet* upon which we live.” This is a description that would receive great ridicule from many scientists today, but why should it? Great effort has been expended over the past 200 years to rid geologic history of any connections to Biblical history (Froede, 2007), but many scientists are now finding this was a foolish idea. One thing is certain: man’s interpretations of past events will always be speculative,



Figure 11. Fossil-bearing sedimentary rock of the Naknek Formation.

because we cannot go back in time and verify the results. Nevertheless, evidence that supports Biblical history should not be ignored.

Acknowledgments. Special thanks to Carl Froede, Jr. for assistance and excellent advice with the manuscript. Thanks to Kenny, John, Mike, Joel, and Tommy for the incredible adventure we had in TVTTS! Let us hope they repair the outhouse that blew down while we were out there. Thank you, God, for making your creative acts so obvious. We are indeed without excuse for knowing Him (Romans 1:20).

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Book Review

The Immense Journey

by Loren Eiseley

Random House, New York,
1957, 210 pages, \$10.00.

Classic books deserve rereading, including this gem by naturalist Loren Eiseley (1907–1977).

Eiseley's family homesteaded in Nebraska. Against economic odds, including some time as a railroad hobo, the author gained his education through a Ph.D. in anthropology from the University of Pennsylvania. The naturalist spent 30 years on the faculty there, while also hiking the open country of America.

This volume is one of several books produced by Loren Eiseley. It has sold well over a million copies with translation into 20 languages. Eiseley wrote as a poet and described nature in refreshing ways. Not a religious man, he assumed the truth of evolution, while realizing that it fell far short of explaining what he saw in the wild. Many of his nature descriptions, now five decades old, deserve a close look. Ten of them follow.

First, regarding the deep sea and the creatures that live in it, he wrote, "Through it drift luminous jack-o-lantern faces with wolf-trap mouths and meager bodies, as though a head floating in that enormous darkness were more important than a body" (p. 31). Second, Eiseley describes a continuous, unstructured sheet of living matter girdling the entire ocean floor, as proposed by Ernst Haeckel and Thomas Huxley. "The structureless protoplasmic 'Urschleim'

was a projective dream of scientists striving to build an evolutionary tree upon existing organisms. ... It did not exist" (pp. 36–37).

Third, Eiseley called himself a bone hunter as he wandered the land. "I have stared so much at death that I recognize the lingering personalities in the faces and skulls and feel accompanying affinities and repulsions" (p. 127). Fourth, Eiseley was amazed at the endless design in nature. Regarding the multiple life-giving properties of water, he wrote, "If there is magic on this planet, it is contained in water" (p. 15).

Fifth, Eiseley describes levels of complexity on the smallest scale of cells and atoms. He lists authors from a century ago who suggested that the atoms themselves were inhabited by micro-beings. David Brewster wrote, "God has all along been attentive to forms of life of which we have no knowledge" (p. 156). Sixth, there is an intriguing experience related from the Australian outback: "We were pushing a dugout up one of the tidal creeks in northern Australia ... we jam this mangrove bush and things [fish] come tumbling down. What were they doing up there in bunches? I ask you. It's no place for a fish. Besides that they had a way of sidling off with those popeyes trained on you ... Somebody ought to keep an eye on them" (pp. 48–49). A

witness of bush-climbing fish — just what bizarre creatures was Eiseley describing a half-century ago?

Seventh, regarding the mysterious workings of his brain, Eiseley writes, "There are times when I sit quietly in my chair and try to hear the little purr of the cogs in my head and the tubes flaring and dying as the messages go through them and the circuits snap shut or open" (p. 180). Eighth, Eiseley gives wonderful descriptions of bird behavior observed during countless hours. He concludes this book portion, writing, "I can never bear to see a bird imprisoned" (p. 185).

Ninth, Eiseley, concludes that fall is the best season for studying nature. "I shall be found puzzling over the saw teeth on a desiccated leg of a dead grasshopper or standing bemused in a brown sea of rusty stems" (p. 197). Finally, regarding the origin of life, Eiseley quotes British biologist Joseph Woodger: "Unstable organic compounds and chlorophyll corpuscles do not persist or come into existence in nature on their own account at the present day, and consequently it is necessary to postulate that conditions were once such that this did happen although and in spite of the fact that our knowledge of nature does not give us any warrant for making such a supposition ... it is simple dogmatism—asserting that what you want to

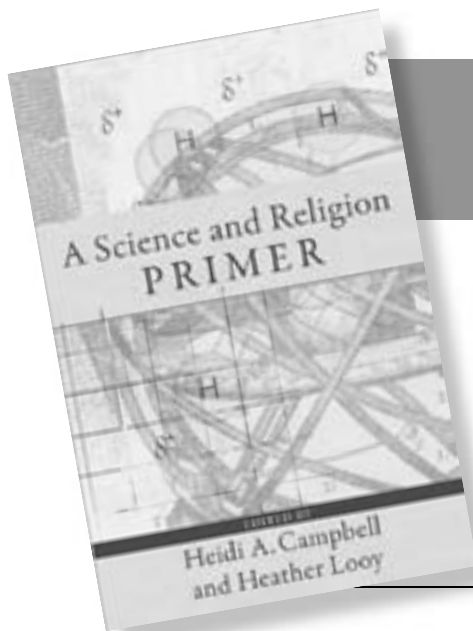
believe did in fact happen” (p. 200).

Eisley appears to have given up on understanding the meaning of life: “I shall wonder what strange forces at the heart of the matter regulate the tiny beat

of a rabbit’s heart or the dim dream that builds a milkweed pod” (p. 209). Only God knows a person’s heart, but this book lacks any evidence of spiritual awareness. How sad to inspect nature

as a lifelong pursuit, more deeply than most of us, and yet to miss the purpose of it all.

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Book Review

A Science and Religion Primer

edited by Heidi Campbell
and Heather Looy

Baker Publishing Group, Grand Rapids, 2009, 230 pages, \$20.00.

The authors are professors; Campbell in communications at Texas A & M, and Looy in psychology at the King’s University College, Ontario. Their goal is a “respectful, intelligent conversation between science and religion” (back cover), and they have succeeded. Four introductory essays make clear the Biblical roots of modern science and also challenge the “warfare metaphor” between science and religion. The heart of the book is a compact encyclopedia of terms from history, philosophy, science, and theology. Seventy guest writers define and evaluate the terms, which range from altruism to the verification principle. The contributors are from such schools as Asbury, Azusa Pacific, Bethel (Indiana), Calvin, Grove City,

Fuller Seminary, Messiah, Notre Dame, and Westmont. Authors Campbell and Looy are to be complimented for bringing together the writing talents of so many colleagues.

The book treats young-earth creation with respect; however, the hundreds of references do not include a single creationist writer. Regarding limited creationist research, it is correctly stated that “the number of people doing the research is small, and it is difficult to find funding or journals willing to publish the results” (p. 72). Later, the book correctly challenges the myth that Galileo’s heliocentrism was a victim of religion: “A mythology grew up: Galileo was tortured (he wasn’t); he was imprisoned in the ‘dungeons of the Holy Office’ (he

was never placed in a dungeon); he muttered after abjuring, ‘And yet it moves!’ (a later invention); he was condemned ‘for demonstrating the earth’s motion’ (he wasn’t and he didn’t)” (p. 111).

This book is attractively printed; the writing and editing is crystal clear. The encyclopedia is a valuable reference with topics including chaos theory, ecofeminism, intelligent design, Kepler, miracles, Newton, William Paley, process theology, quantum theory, and the scientific method.

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Time Required for Sedimentation Contradicts the Evolutionary Hypothesis

Guy Berthault*

Abstract

Stratigraphy, the basis of geological dating, was founded in the seventeenth century on three principles proposed by Nicolas Steno: superposition, continuity, and original horizontality. Successive observations and experiments show that his stratigraphic model was not in line with experimental data, because it overlooked the major variable factor of sedimentation: *the current and its chronological effects*. Experiments simulating the formation of sedimentary layers at variable current velocities using different-sized particles show that Steno's principles apply only to the case of deposition at zero current velocity. Since sedimentary processes affect stratigraphy and geological dating, paleohydraulic conditions must be considered in any stratigraphic analysis. The estimated time of deposition is often the crucial factor in developing a local timescale, and the paleohydraulic approach links deposition to the critical transport velocity of current as determined by particle size. From this velocity, the corresponding transport capacity in units of volume and time is calculated. The time of sedimentation is the quotient obtained from dividing the volume of sedimentary rocks by the transport capacity. A team of Russian sedimentologists have applied this method to geological formations of the Crimean Peninsula and of the Northwest Russian Plateau in the St. Petersburg region. They discovered that the time required for sedimentation was only 0.01% of the corresponding period of the geological timescale. This is at variance with the time required for species to evolve.

Introduction

This review of my research goes to the heart of the subject of evolution. My research has focused on empirical experiments showing how strata form,

a topic about which little work has been done. While it is true that sediments had been examined and flume experiments performed in connection with building and other projects, none

of these attempted to explain the mechanics of stratification. In fact, my early literature research found very little to guide my practical research. With regard to sedimentation, the basic principles of superposition, continuity, and initial horizontality laid down in the seventeenth century had been accepted, albeit with elaboration, virtually without question. There seemed to

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have been few subsequent attempts to examine the actual mechanics of how strata form.

Yet that question has far-reaching implications for both the geological timescale and the fossil record. Since the late eighteenth and early nineteenth centuries, stratigraphy has tacitly assumed slow, gradual sedimentation, accepting the premises of Nicolaus Steno (1638–1686) as congenial to deep time, in-situ fossil preservation, and the globally correlative geologic timescale. As Professor Gabriel Gohau of the French Geological Society wrote in his book *A History of Geology* (1990, p. 192), “Time is measured by the interval required for sediments to deposit, a fact upon which everybody is more or less agreed, and not by orogenesis or ‘biological revolutions.’”

Gohau (1990) mentioned in his work how Charles Lyell was influenced in the construction of the geological timescale by his belief in “biological revolutions” occurring over 240 million years. It was the geological timescale, giving the impression that there was a succession and change in fossilized species, which led Darwin to formulate his theory of evolution. In the twentieth century, Lyell’s age was replaced by a radiometric date of 542 million years for the base of the Cambrian Era. What Professor Gohau wrote is perfectly correct, because fossils are buried in sediments. Therefore, it is the time of sedimentation that determines the age of fossils and not a chronology based on “biological revolutions,” interpreted now as “biological evolution.” Biostratigraphy has proven no more successful than other modern stratigraphic methods, because they all are heavily weighted by assumptions that cannot be demonstrated. Thus, the stratigraphic approach has now reached the extreme of proposing to define age boundaries by fiat through the use of global stratotype sections and points (Gradstein et al., 2004).

As regards radiometric dating, Professor Aubouin stated in his *Précis de Géologie* (1967, Tome 1, p.193):

Each radioactive element disintegrates in a characteristic and constant manner, which depends neither on the physical state (no variation with pressure or temperature or any other external constraint) nor on the chemical state (identical for an oxide or a phosphate).

Rocks form when magma crystallizes. Crystallization depends on pressure and temperature, from which radioactivity is independent. So, there is no relationship between radioactivity and crystallization, absent assumptions that the “clocks” are set at zero time upon crystallization. Consequently, radioactivity does not date the formation of rocks. Moreover, daughter elements contained in rocks result mainly from radioactivity in magma, where gravity separates the heavier parent element from the lighter daughter element. Thus radiometric dating has no chronological significance. It seemed to me, therefore, necessary to study the basis of the stratigraphic scale that depended upon the stratification of sedimentary rocks.

Steno was the founder of stratigraphy. It was in 1667 that he introduced in his work *Canis Calchariae* the postulate; “layers of sub-soil are ‘strata’ of ancient successive ‘sediments’” (Steno, 1667, p. 27 C.II). From this partial interpretation, he drew three initial principles of stratigraphy, formulated in his work *Prodromus* (1669).

(1) Principle of superposition

At the time when one of the high stratum formed, the stratum underneath it had already acquired a solid consistency. At the time when any stratum formed, the superincumbent material was entirely fluid, and, due to this fact at the time when the lowest stratum formed, none of the superior strata existed (Steno, 1667, p. 30, C.II. 3.d).

(2) Principle of continuity

Strata owe their existence to sediments in a fluid. At the time when any stratum formed, either it was circumscribed on its sides by another solid body, or else it ran around the globe of the earth (Steno, 1667, p. 30, C.II.3c).

(3) Principle of original horizontality

At the time when any stratum formed, its lower surface, as also the surfaces of its sides, corresponded with the surfaces of the subjacent body and lateral bodies, but its upper surface was (then) parallel to the horizon, as far as it was possible (Steno, 1667, p. 30. C.II. 3.4.).

The sedimentological model corresponding to these three principles is, therefore, the following. In a fluid covering the earth, except for exposed land, a precipitate deposits strata after strata, covering all of the submerged earth. After the deposition of each stratum, the sedimentation is interrupted for the time it takes for the stratum to acquire a solid consistency. The stratum being contained between two parallel planes indicates that the sedimentation rate of the precipitate is uniform around the submerged earth.

Deficiencies of Steno’s Stratigraphy

The first part of the definition of the principle of superposition is, “At the time when one of the highest stratum formed, the stratum underneath it had already acquired a solid consistency” (Steno, 1667, p. 30, C.II. 3.d). A stratum between 50 cm and 1 m is considered thick. Consequently, submarine drillings should encounter solid strata in the stratified oceanic sediments after a few meters. However, the results of sea-bottom drilling have shown that the first semi-consolidated sediments occur between 400 and 800 m. Iso-

lated, hardened chert beds have been found under 135 m of unconsolidated sediment near oceanic transform faults (Logvinenko, 1980). Steno's definition, therefore, which would significantly extend the total time of deposition by his concept of successive hardening, is not supported by these sedimentological observations.

As regards the principle of continuity, clearly no sedimentary layer extends globally. As concerns the principle of original horizontality, seismic readings and submarine coring demonstrate that strata in oceanic sediments are not always horizontal and that the rate of sedimentation is not uniform on a global scale in Earth's oceans.

Steno (1667, p. 30, CII.3c) said, "Strata owe their existence to sediments in a fluid," but he said nothing about the action of the fluid on the sediments, so that the relative stratigraphic chronology resulting from his principles did not take flow velocity into account (the subsequent principles of paleontological identity and uniformitarianism changed nothing in this respect). Currents exist in present-day oceans, which erode, transport, and deposit sediments, as shown by Strakhov in 1957.

Charles Lyell adapted Steno's principles to his theory of uniformitarianism, giving as an example layers deposited in fresh water in Auvergne. Observing that the layers were less than 1 mm thick, he considered that each one had been laid down annually. At this rate, the 230-m thick deposit would have taken hundreds of thousands of years to form. In the next section (and also Figure 1), I show that these layers, which are laminae, do not always correspond to annual deposits and may be generated in a time interval much less than that which is indicated by the modern geological timescale.

Geologists have now recognized sequences of facies (conglomerate, sandstone, shale, limestone, evaporate) that correspond to marine transgres-

sions and regressions. This is the object of study in sequence stratigraphy today. Diagrams in this discipline, however, give no indication of the current velocity during these transgressions and regressions. However, this information can be derived from the size of particles of sediment in a sequence, which corresponds to a minimum current velocity needed to erode and transport particles.

Major Stages of the Laboratory Research

The two principal stages of program investigated the following two lines of research: lamination and stratification.

Lamination

Berthault (1986) described the deposition of heterogranular sediments in water. These sedimentation experiments were conducted in still water with a continuous supply of heterogranular material. A deposit was obtained, giving the illusion of successive beds or laminae (Figure 1). These laminae are the result of a spontaneous periodic and continu-



Figure 1. Lamination resulting from sediment flowing into water.

ous grading process, which takes place immediately following the deposition of the heterogranular mixture.

The thickness of the laminae appears to be independent of the sedimentation *rate* but increases with extreme differences in the particle size in the mixture. Where a horizontal current is involved, thin laminated layers developing laterally in the direction of the current are observed.

Further experiments demonstrated that in still water, continuous deposition of heterogranular sediments gives rise to laminae, which disappear as the height of the fall of particles into water increases and apparently their size. Laminae follow the slope of the upper part of the deposit. In running water, many closely related types of lamination appear in the deposit, even superposed (Berthault, 1988).

Stratification

Experiments in stratification were conducted at Colorado State University with professor of hydraulics and sedimentology Pierre Julien (Figure 2). A flume with recirculating water was used to track the progress of a sediment-laden current. Current velocity was varied, as Hjølstrom (1935) and his successors had defined the critical sedimentation rate for each particle size. It was discovered that varying the current velocity resulted in the superposed stratification based on the segregation of particles by size, not on the time of deposition. Thus, Steno's principle of superposition as an indication of relative time did not apply in this case.

Instead, the flume experiment showed that in the presence of a variable current, stratified superposed beds form *simultaneously* in the direction of the current. This mirrors conditions observed in the field, on the scale of facies, to Golovkinskii, Inostrantzev and Walther's law (Walther, 1894; Middleton, 1973; Romanovskii, 1988). According to this law, the progression of

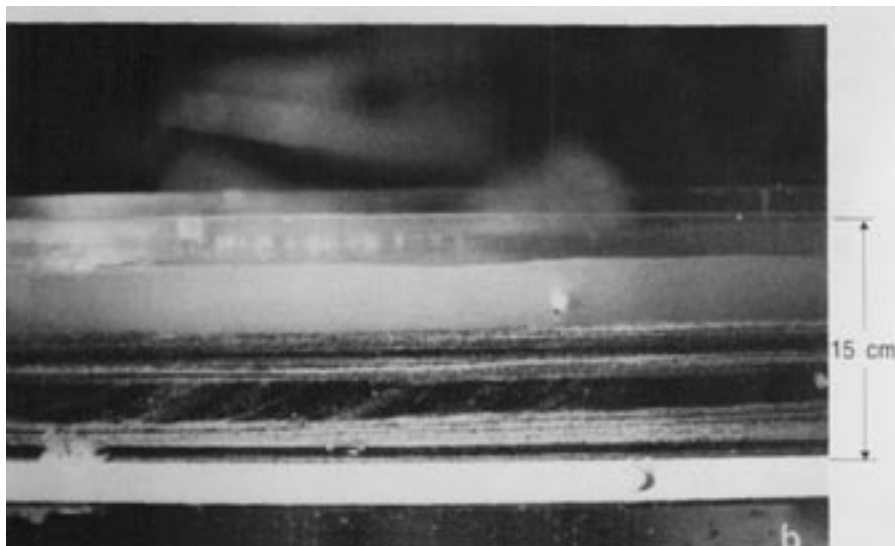


Figure 2. Typical longitudinal view of deposition (flow from right to left).

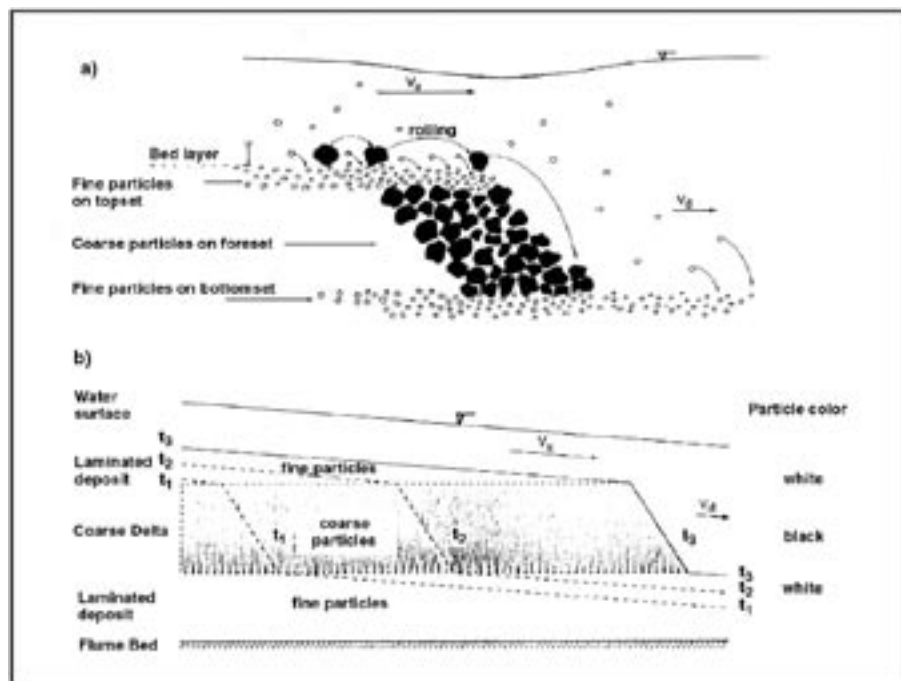


Figure 3. Results of experiments. (A) schematic formation of graded beds. (B) time sequence for deposit formation for $t_1 < t_2 < t_3$.

facies of a specific sequence is the same in both a lateral and vertical direction (Figure 3).

Laboratory experiments on the desiccation of natural sands also show the preferential fracturing (or joints) at

the interface of layers of coarse and fine particles. This shows that what is often interpreted as sedimentary bedding in the field can form merely as a result of dewatering in beds formed by the segregation of varying grain sizes. So,

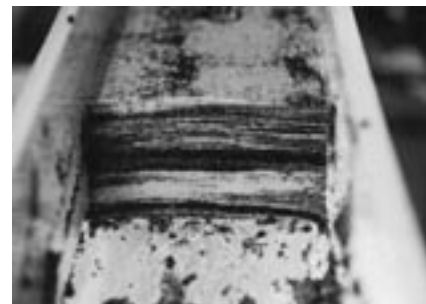


Figure 4. Typical cross-sectional view of deposit.

in the experiment, apparent successive sedimentary layers are, in fact, joint planes that form based on the mechanics of the deposition. Therefore, given a continuous supply of heterogeneous sandy mixtures in a current of varying velocity, laminae are created by the natural segregation of the particles according to their size, graded beds are created by nonuniform flow (Figure 4), and apparent parallel bedding boundaries are formed by desiccation at the interface between layers of different particle size (Figure 5). Superposed strata are not, therefore, necessarily identical to successive sedimentary layers, as was thought by Steno.

The report of the flume experiments was published in the Bulletin of the Geological Society of France (Julien et al., 1993). The results of both sets of experiments (lamination and stratification) were presented to several sedimentological congresses and recorded in the video *Fundamental Experiments on Stratification* (Julien and Berthault, 1993). These results contradicted the principles of Steno by showing that up to the limit of the angle of repose (30° to 40° for the sands), the lamination of a given deposit is parallel to the slope (Figure 6). Thus, the principle of original horizontality does not apply universally, as has often been assumed by geologists. Field examples that were thought to show tectonism after deposition tilting the originally horizontal sediments may

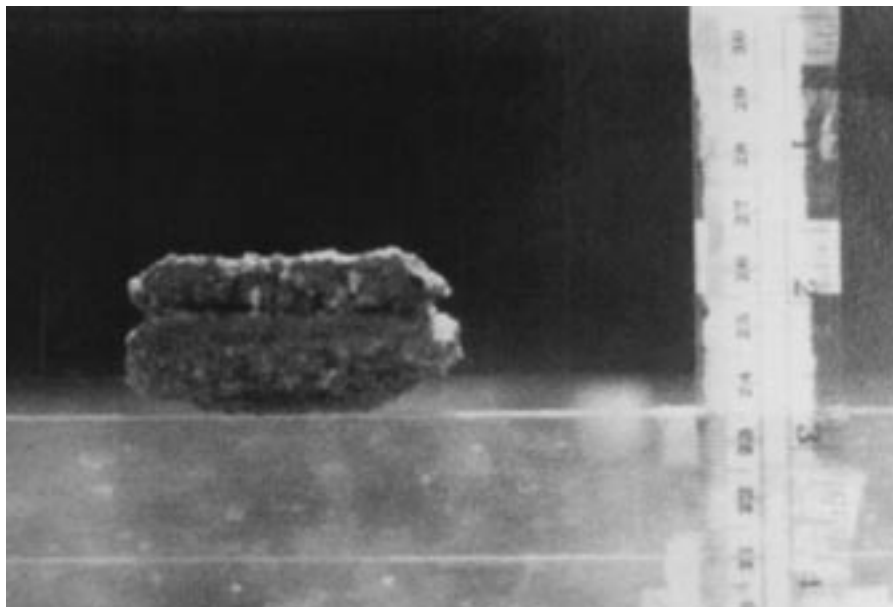


Figure 5. Horizontal fracturing of the Bijou Creek sand.

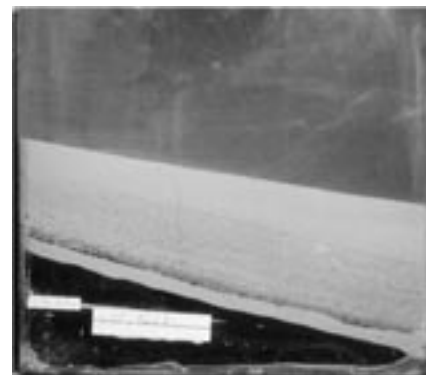


Figure 6. Lamination parallel to slope of 15°.

actually instead simply show deposition along an original slope.

Paleohydraulic conditions

Application of Steno's principles has led to the development of stratigraphy absent a careful evaluation of paleohydraulic factors. However, during the twentieth century, sedimentologists began to investigate these factors. The relationship between hydraulic conditions and the configuration of deposits (submarine ripples and dunes and horizontal beds) in contemporary deposits has been the object, especially recently, of well-known observations and experimentation. Rubin and McCulloch (1980) investigated bed forms in San Francisco Bay (Figure 7) and Southard and Boguchwal (1990) in flume experiments.

Following the pioneering work of Hjulstrom (1935), Lebedev (1959), Neill (1968), Levi (1981), Maizels (1983), Van Rijn (1984a, 1984b), and Maza and Flores (1997) determined minimum current velocities needed for the erosion and sedimentation of different size particles at varying water depths (Table I).

Geologists attribute the large-scale deposition of sediments to marine transgressions and regressions. The relationships shown in Table I can be applied particularly to detrital rocks, such as sandstone, during the first stage of a

Table I. Maximum permissible velocities for nonerosive or noncohesive grounds, in m/s (according to Lebediev, 1959).

Avg. particle diameter (mm)	Average flow depth (m)					
	0.40	1.0	2.0	3.0	5.0	>10
0.005	0	0	0	0	0	0
0.05	0	0	0	0	1	1
0.25	0	0	1	1	1	1
1.0	1	1	1	1	1	1
2.5	1	1	1	1	1	1
5	1	1	1	1	1	2
10	1	1	1	1	1	2
15	1	1	1	2	2	2
25	1	1	2	2	2	2
40	2	2	2	2	2	3
75	2	2	3	3	3	4
100	2	3	3	4	4	4
150	3	3	4	4	4	5
200	4	4	4	5	5	5
300	4	4	5	5	6	6
400		5	5	5	6	6
>500			5	6	6	6

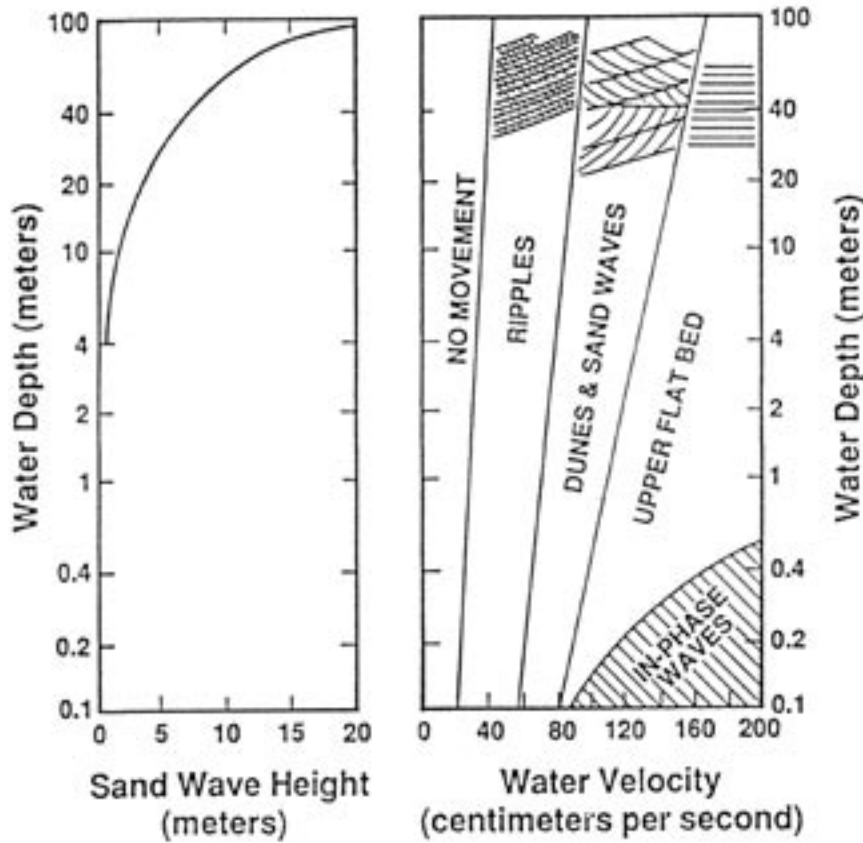


Figure 7. Graphs of (a) water depth versus sand-wave height and (b) water depth versus water velocity, showing bedforms in fine sand expected under different water conditions. The thickness of cross beds observed in fine-grained sandstone is used to estimate sand-wave height. Then, sand-wave height is entered into the graph (a) to estimate the water depth where the sand wave formed. After a water depth is estimated on graph (a), the depth is transferred to graph (b), where the minimum and maximum velocities of water are indicated for the specific water depth.

transgressive marine sequence. As rocks are eroded, transported, and deposited by powerful currents in relatively shallow water, the resulting grain sizes can supply information about those hydraulic factors. The paleovelocity of a current below which particles of a given size are deposited and the corresponding *capacity* of that current to transport sediments can be determined based upon these data. Current speed and carrying capacity can then help determine the time needed to create a particular deposit.

Similar relationships between current velocity, water depth, and sedimen-

tary processes have been determined for different types of rock and sediment (Tables II and III). These are described in more detail in Berthault (2002).

The next step was to arrange a new series of experiments (Table IV) to measure the erosion of different types of rocks (sandstone, limestone) at higher current velocities (up to 27 m/s). This was especially important in understanding the paleohydraulic properties of conglomerates, which are typically the basal sedimentary unit of a clastic transgressive sequence. This work was done with the St. Petersburg Institute of Hydrology.

Initially, a water current moving at a velocity of around 25 m/s was run parallel across the surface plane of the sedimentary sample. At this velocity and orientation, there was no observed erosion during periods of less than 10 hours. However, when the period reached 18 hours, approximately 2 grams of material was eroded. In Experiment 25, the sedimentary rock was oriented so that the flow was at an angle of 2.5° to the direction of the current. Changing this parameter caused the erosion of 6.6 grams of material in 18 hours. These experiments are being continued, particularly in regard to flow that is not strictly parallel to the sedimentary sample.

Paleohydraulic analyses are not restricted to the laboratory. A team of Russian sedimentologists directed by Alexander Lalomov (Russian Academy of Sciences, Institute of Ore Deposits) has applied paleohydraulic analyses in conformity with Newtonian mechanics to geological formations in Russia. An investigation of sedimentary formation on the Crimean Peninsula (Lalomov, 2007) concluded that the current velocities derived from sedimentary particle analysis would have resulted in the deposition of the entire sedimentary sequence in a very short period of time, rather than the millions of years implied by a stratigraphic analysis using the geological timescale. Additional research of sandstones on the Northwest Russian Plateau in the St. Petersburg region shows that the time of sedimentation was only 0.01% of that attributed to it by the stratigraphic timescale. Results of the research are awaiting publication in *Lithological and Mineral Resources* under the auspices of the Russian Academy of Sciences.

Finally, in concert with the Institute of Geology of Kazan, the same team undertook an investigation into the time of sedimentation of the local transgression sequence in the Kama region studied in 1868 by Golovkinskii, founder of sequence stratigraphy (Berthault et al., 2008). The result is similar to the time of

Table II. Maximum permissible velocities (V , m/s) for rock soils (from Central Administrative Board on Hydraulic Energetic Building).

Lithology	Average Depth (m)							
	Rough Bottom Surface				Smooth Bottom Surface			
	0.4	1.0	2.0	>3.0	0.4	1.0	2.0	>3.0
A. Sedimentary Rocks	V (m/s)							
marl, shale, clay	2.1	2.5	2.9	3.1				
porous limestone, stratified								
limestone, sandstone with lime	2.5	3.0	3.4	3.7	4.2	5.0	5.7	6.2
massive limestone, dolomite								
sandstone, siliceous limestone	3.7	4.5	5.2	5.6	5.8	7.0	8.0	8.7
B. Crystalline Rocks	V (m/s)							
marble, granite, gabbro	16	20	23	25	25	25	25	25
porphyry, andesite, basalt								
diabase, quartzite	21	25	25	25	25	25	25	25

Note: Velocities calculated for unweathered massive rocks. Velocities decrease proportionately with weathering and fragmentation down to those of unconsolidated soils.

Table III. Maximum permissible velocities (V , m/s) for rock soils.

Lithology	Average Depth (m)					
	1	3	5	10	15	20
Loose siltstone	1	1	1	1	1	1
Siltstone, moderately hard	1	1	1	2	2	2
Hard siltstone	2	2	2	2	3	3
Marl	3	3	3	4	4	5
Porous, stratified, dolomitic limestone	4	4	5	6	6	6
Solid, massive, siliceous limestone	5	6	7	8	9	9
Sandstone with lime cement	4	4	5	6	6	6
Dolomitic sandstone	5	6	7	8	9	9
Granite and other intrusive rocks	>15	>15	>15	>15	>15	>15

sedimentation of rocks in the St. Petersburg region. The report was presented to the Thirty-third International Congress of Geology, held in Oslo in August 2008, and to the Fifth Conference on Lithology in Ekaterinburg (Russia) in October 2008.

Conclusion

The geological chronology has been established on two pillars: stratigraphy and radiometric dating. Stratigraphy was built on the principles of Steno, and early geologists interpreted Steno to imply vast lengths of time for the creation

of rock strata. However, Steno's crucial failure was in not accounting for the effects of moving water on sedimentary particles. When the principles of hydraulics are applied to the mechanics of sedimentation, several interesting conclusions demonstrate the gaps in Steno's approach. These include: (1) the natural segregation by grain size of heterogeneous particles in a moving current, (2) the lateral, not vertical, development of sedimentary bedding in a variable current, and (3) the creation of apparent bedding planes by desiccation. Thus, a major pillar of deep time—stratigraphy—needs to be reevaluated from a sedimentological and hydraulic perspective. Radioactivity is independent from the physical or chemical state of the sample and thus is not influenced when a sample changes from magma to rock. Consequently, as the radiometric dating process is not linked to the solidification of the magma, it cannot date the

Table IV. Erosion of different types of rocks at higher current velocities.

Experiment	Sample & Side	Dry Initial Mass (g)	Mass of the container and with water sample (g)		Mass (dry sample post-experiment, pre-stabilization, g)	Flow vel. (m/s)	Duration (hours)	Loss of dry mass of sample (t = 18° C)	
			Before experiment	After experiment				Visual	By weight ΔG , (g)
1	2;A	6759.8	8576.0	8652.1	-	25.9	13.2	No	-
2			8652.1	8657.0	6760.0	25.9	9.3		0.0
3	5;A	6571.3	8349.9	8374.9	-	25.8	8.2	No	-
4			8374.9	8375.9	6570.8	25.6	7.3		0.0
5	3;A	6631.2	8482.9	8559.5	-	26.0	8.0	No	-
6			8559.5	8585.5	6631.2	25.9	10.0		0.0
7	1;A	6322.9	8159.0	8217.9	-	25.8	13.5	Yes	4.7
8	1;B	-	8217.9	8227.9	6318.2	25.8	21.7	No	-
9			6979.9	7068.2	-	22.5	10.5		-
10	4;A	4802.8	7068.2	7049.2	-	17.3	15.0	Yes	-
11			7049.2	7028.0	-	10.9	16.0		-
12			7028.0	7022.9	4650.0	7.8	17.5		152.8
13	3;B	6613.6	8471.7	8543.9	6613.8	25.7	9.0	No	0.0
14	3c;A	6589.6	8475.3	8523.1	6589.5	25.9	5.7	No	-
15	3c;A	6589.6	8519.5	8548.3	6589.5	26.0	17.3		0.0
16	4k;B	4692.5	6951.5	7036.0	4674.5	4.4	7.0	Yes	<18.0>
17	3c;B	<i>Demonstration Experiment</i>							
18	4k;A	4674.5	-	-	4673.0	5.5	18.0	No	1.7
19	1;B	6317.2	-	-	6315.1	25.9	18.0	No	2.1
20	4k;A	4673.0	-	-	4671.5	13.2	18.0	No	1.3
21	1;A	6315.1	-	-	6313.1	25.9	16.0	No	2
22	4k;A	4671.5	-	-	4669.0	19.6	18.0	Yes	2.5
23	1;A	6313.1	-	-	6311.2	23.8	18.0	Yes	1.9
24	4k;A	4669.0	-	-	4668.0	8.4	18.0	Yes	1.0
25	1;A	6311.2	-	-	6309.9	19.2	18.0	Yes	0.8–1.3
26	3c;B	5897.8	-	-	5891.2	20.1–25.8	18.0	Yes	6.6

formation of metamorphic or volcanic rocks (Pontcharra, 2009).

Paleohydraulic analysis can approximate the time required for the sedimentation of a sequence much more accurately than conventional stratigraphy, which tends to grossly overestimate the time required. Since evolution depends in part on a sufficient quantity of time for

life to develop from nonlife and for present life-forms to develop from a common ancestor through innumerable genetic mutations over hundreds of millions of years, then the paleohydraulic approach to sedimentary strata not only invalidates conventional stratigraphy but also eliminates the time required for biological evolution (cf. www.sedimentology.fr).

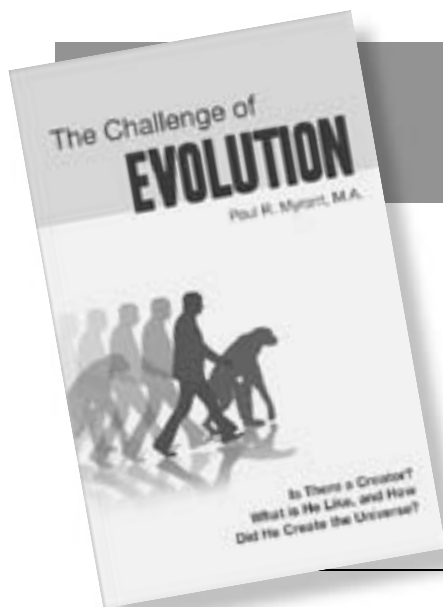
Paleontologists may object based on their ability to “show” evolutionary sequences in stratigraphic intervals. However, as present marine species live in different ecological zones, according to sea depth, latitude, and longitude, this interpretive evolutionary sequence of different fossils that appear to support stratigraphic superposition may

correspond instead to paleoecological distribution in depth and to migration patterns.

By calling into question the principles and methods upon which geological dates are founded, and in proposing the new approach of paleohydrology, I hope to open a dialogue with specialists in the disciplines concerned who are able to appreciate the implications and propose a geological chronology in conformity with experimental observation based upon time of sedimentation—time that is insufficient for the evolution of species, as conceived by the proponents of the evolutionary hypothesis.

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Book Review

The Challenge of Evolution

by Paul R. Myrant

Tate Publishing & Enterprises,
Mustang, OK, 2009, 238 pages,
\$30.00.

Many creationist writers have put forth challenges to evolution, but few have published responses to those challenges. Now, we have an author taunting (in his book title at least) believers in Darwinism to prove their case. Does he provide scientific facts to show that evolution is neither a fact nor even a theory? No, but Myrant has accumulated an extensive array of facts concerning the creation/evolution controversy. In the introduction he writes, "This book is a discussion about creationism, evolution, and the apparent division between religion and science." Thus he acknowledges that he is not challenging evolutionists to prove their case but is presenting a case for creationism.

Paul Myrant, a graduate of Talbot Seminary, received his Master of Arts degree in Biblical studies and has served as a senior pastor and teacher for over three decades. As such he is well qualified to defend Biblical creation. His book is divided into three primary

sections: (1) The Existence of a Creator, (2) The Nature of the Creator, and (3) The Creator and Evolution. The author writes, "My premise is that the existence of a Creator is an axiom, a self-evident or universally recognized truth or innate belief" (p. 22). He states that "globally, only 8 percent of all people are atheists" and "17 percent are agnostic." Myrant believes that disbelief in the existence of a Creator is often due to three fallacies: that belief in a Creator is an act of blind faith, that it is the result of religious indoctrination, and that it is a subjective, unknowable "truth." His book is an attempt to show the inaccuracy of these fallacies and persuade the reader that the Creator exists and that such belief is more rational and reasonable than a belief that life and all matter exist without a cause.

A major problem is a lack of a review by a professional editor. Such a person probably would have suggested a different title. In addition, mistakes in spelling

such as *religion's* for *religions*; *affect* for *effect*; and *umbilical chord* for *umbilical cord* need correction. Myrant writes in his book: "Sir Fred Hoyle calculated the odds that just the proteins of an amoebae arising by chance as one chance in 1040,000 (ten to the forty thousandth power)" (p. 64). Most readers of this book will instantly recognize the errors. The professional editor would have corrected the spelling of "an amoebae" to "an amoeba" and changed "one chance in 1040,000" to "one chance in 10^{40,000}." There are several other cases of such errors as well.

I suggest that the author plan a second edition immediately and take advantage of the services provided by the publisher's professional editors. Myrant's research is too valuable to lose by not having the errors corrected. If this is done, I would recommend wide distribution.

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The Case for Holobaraminic Status in Bears (Family Ursidae) and the Implications within a Creation Model of Ecology

Tom Hennigan*

Abstract

Extant bears (Family Ursidae) are currently classified into three subfamilies, three genera, eight species, and numerous subspecies. They inhabit the continents of Eurasia, North America, and South America. Previous research has identified all eight species as sharing biologically meaningful similarity among its members, making them a monobaramin. A literature search was initiated to determine the extent of unique suites of ursid traits that significantly distinguish them from other taxa, making them an apobaramin. In current baraminological thought, if a taxon is both monobaraminic and apobaraminic, it becomes a holobaramin, or the best determination of the created bear kind. Creation research should focus on revealing how genetic mechanisms may be influenced by environmental factors that trigger them. It is predicted that an understanding of these processes will reveal insights into how the Creator ensured creature persistence in the face of changing environments and the mechanisms involved with rapid ursid diversification in less than 4500 years.

Introduction

“Better to meet a bear robbed of her cubs than a fool in his folly” (Proverbs 17:12 NIV).

For many who enjoy wilderness wanderings, the mere thought of startling a grizzly bear slumbering in the thick bramble or getting between a mama bear and her cubs invokes fear and awe. Though such creatures have been

worshipped and elevated as status symbols for their strength and courage, the knowledgeable hiker also is aware of their unpredictability and sometimes deadly demeanor. For these reasons they have been extensively eradicated throughout their range. Conversely, I have had experiences with both black and grizzly bears, and with proper understanding of

their behavior they can be enjoyed and respected. They are formidable creatures designed by God to operate in a cursed world. In general, they also fear man (Gen. 9:2), and it is out of this fear that unpredictable attacks may occur. Bears are the most studied wild carnivores because the survival of many species is now a concern (Krause et al., 2008).

Common traits include less developed carnassial teeth, production of hybrid offspring in seven of the eight species, specific chromosome banding patterns, biomolecular data, trophic flexibility, unique bile salt metabolism,

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non-obligate hibernative metabolism, plantigrade feet, and premature birth with the smallest young compared to the size of the mother than any other placental mammal (Weissengruber et al., 2001; Lindburg and Baragona, 2004; Breiter, 2005; North American Bear Center, 2009). These traits demonstrate that ursids possess biologically meaningful similarity and therefore are classified as a *monobaramin* (Tyler, 1997; Weston and Wieland, 1998; Wood, 2003; Lamb, 2006; Tyler, 2006; Wood, 2006).

In contrast, an *apobaramin* is identified if the extant and extinct bears are bound by biologically meaningful differences, when compared with other taxa, but without regard to similarities between them (Wood, 2003). If biologically meaningful suites of characters indicate that the ursids are both a monobaramin and an apobaramin, they are designated a *holobaramin*, or the closest approximation of the created bear “kind.” A few dissimilar traits in the giant panda and the difficulty in delineating suites of biologically meaningful traits make an ursid apobaramin and holobaramin hard to demonstrate.

Turner (2009, pp. 56–57) stressed the importance for creation scientists to be careful with the identification of “kind” (Heb. *mîn*), emphasizing the following conclusions.

- *Mîn* is often related thematically and theologically in the main contexts of its use.
- It is unclear if the word is used in a technical or nontechnical sense and, therefore, to demand a precise technical definition is inappropriate and dogmatism, for its use in modern biological taxonomy is unwarranted.
- *Mîn* does assume certain discontinuities, but it is impossible to determine how many “kinds” there were. Consequently, the “kinds” determined by creationists may not be equal to Biblical kinds.

He warns that creation researchers “could fall into the same modernist trap of spending more time on getting behind the text and wrestling with scientific reconstructions rather than sitting under the text’s authority, being informed and transformed by its message and theology” (Turner, 2009, p. 58).

With the above in mind, one researcher, using fossil data, has proposed placing Ursidae as sub-baraminic, using a post-Flood fossil continuity criterion (Wise, 2008; Wise, 2009a). Under this criterion, taxa that are sub-baraminic are defined as having diversified well after the Flood, as evidenced by their first appearance in the fossil record. Figure 1 depicts the extant fossil evidence for bears. The dark grey box illustrates a time interval of massive global changes around the Miocene-Pliocene boundary. Before that boundary, older fossils tend to be incomplete and their relationships to living bears are unknown and subject to the interpretation of the investigator. Many evolutionists tend to hypothesize that bears evolved from the canids, while many creationists see canids and ursids as separate baramins and discontinuous. The early fossil evidence is lacking for either interpretation.

Genetic research on bears is greatly expanding, and new insights continue to be discovered. For example, recently it has been shown that the geographic ranges of cave bears extend as far east as Transbaikalia, Eastern Siberia. Knapp et al. (2009) compared mitochondrial DNA and morphology of Asian and European cave bear fossils. The data suggest that these bears are morphologically different from one another, and their diversity was greater than assumed. This is consistent with ursid heterotrophic flexibility as it relates to their morphology, discussed later in this paper.

Many evolutionists and creationists believe that ursid diversification happened rapidly, but the time frames vary due to differing presuppositions. For example, according to evolutionary

assumptions, mtDNA evidence favors rapid diversification of both extant and extinct bears starting around the Miocene-Pliocene boundary, about five million years ago (Figure 1) (Krause et al., 2008). Creationary presuppositions posit a more rapid radiation from the original bear kind that survived the Flood. Assuming the general completeness of the fossil record, and a Flood/post-Flood delineation around the K/T boundary (Figure 1), which not all creation researchers would agree with, the fossil record of bears begins well after the Flood, less than 4500 years ago (Wise, 2008).

Because older fossils are questionable due to their fragmentary nature and a whole paper can be dedicated to bear genetics alone, this paper focuses on the current metabolic, behavioral, and anatomical suites of traits that may indicate their apobaraminic status. The ecological implications of the data also will be explored within a young earth paradigm.

The Extant Bears

Bears are diverse in some ways and similar in many others. The giant panda (*Ailuropoda melanoleuca*) has been historically problematic because it has several traits that are inconsistent with other bear species. To have an appreciation for Ursidae unity and diversity in light of how much they have changed since the Flood, it is important to briefly distinguish each species. Tables 1 and 2 summarize the descriptions, range, chromosome numbers, subspecies, general behavior, and conservation status for the extant bears (American Zoo and Aquarium’s Bear Taxon Group, 2009; North American Bear Center, 2009; Lindburg and Baragona, 2004). Table III is the most current and complete summary of hybridization data (Hennigan, 2009a; Hennigan, 2009b). Taxonomically, bears comprise three subfamilies: Ailurinae, Tremarctinae, and Ursinae.

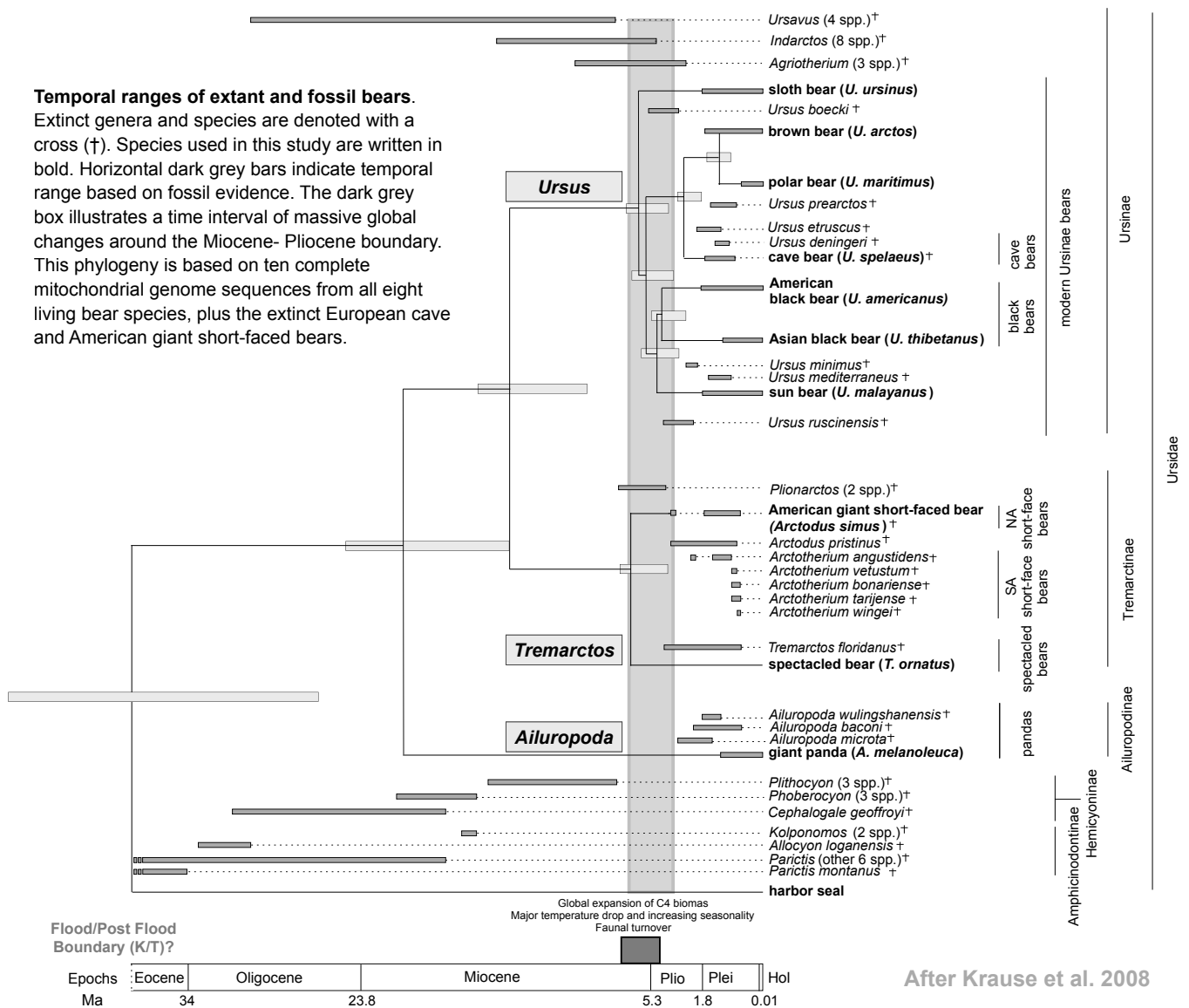


Figure 1. The extant fossil evidence for bears. Genera and species are denoted with a cross (†). (Used by permission from BioMed Central.)

The Giant Panda

Subfamily Ailurinae contains the giant panda (*Ailuropoda melanoleuca*), which is its only living member. The giant panda is known as an umbrella species for conservation because it is endangered and declining. As an umbrella species, it represents an animal that people can connect with and care for. The hope is that a caring public may enhance the chances of survival for both the panda community and its habitat. The giant panda has a distinctive white face and

black eye patches. It probably has the smallest home range and is sometimes sympatric with the Asiatic black bear (*U. thibetanus*).

Fossil evidence of *Ailuropoda* usually consists of scattered teeth and a few rare skulls. Two of the extinct species discovered in China (Figure 1) include *A. baconii*, which is a larger version of today's panda. *A. microta* is a fairly recent discovery of a much smaller version and is interpreted as the oldest fossil of the giant panda genus (Jin et al., 2007).

In some ways the giant panda is similar to the lesser (red) panda (*Ailurus fulgens*—44 chromosomes) in that about 99% of their diet is bamboo, but both will eat meat on occasion. Both have backward-facing male genitalia (Lindburg and Baragona, 2004, p. 45), unlike other bears, where male genitalia point forward. The giant and lesser pandas have a radial sesamoid, which is a sixth, "toe-like" structure produced by an enlarged carpal bone. The lesser panda's radial sesamoid is not as prominent

Table I. Ursidae descriptions, ranges, chromosomes, and subspecies.

Descriptor	Sun <i>Ursus malayanus</i>	Sloth <i>Ursus ursinus</i>	Brown <i>Ursus arctos</i>	Polar <i>Ursus maritimus</i>	American Black <i>Ursus americanus</i>	Asiatic Black <i>Ursus thibetanus</i>	Andean (Spectacled) <i>Tremarctos ornatus</i>	Giant Panda <i>Ailuropoda melanoleuca</i>
Physical Description	Smallest bear , short, black fur, light colored crescent on chest, large paws, long claws	Very shaggy black coat with mixed gray/brown hair, light colored "Y" or "U" shape on chest, light colored muzzle, can close nostrils	Dark brown to cream to black, if guard hairs have white tips gives "grizzled" appearance, shoulder hump, box-shaped nose, dish shaped profile, longer claws on front than back feet	Largest bear , long neck, white fur, triangular profile, no shoulder hump, black skin, very wide paws for paddling, considered a marine mammal	Medium size, found in many different color phases including; black, chocolate, cinnamon, pale blue, and white	Medium sized bear, mostly black but also has a brown phase, muzzles are light colored and all have a cream-colored "V" shaped marking on chest	Small bear with cream colored facial markings around eyes that give it the name "spectacled" bear	Small black and white bear, shortened muzzle, large black eye patches, most of torso and head are white, black "saddle" and fore and hind limbs
Range	Eastern Himalayas, China, Malayan Peninsula	Mostly India, Nepal, Sri Lanka, Bangladesh	Widest distribution of all bears and includes Eurasia & Western NA, 2nd largest home range	Circumpolar Arctic Regions, multi-continental largest home range	USA, Canada, & Northern Mexico	Southern & Eastern Asia Including Pakistan, Korea, Afghanistan	Forested Mountains of South America	Six small regions of southwest China, may have smallest home range
Number of Subspecies	2	2	Variable 5 - 90	0	16	1	0	0
Chromosome Number	74	74	74	74	74	74	52	42

Table II. Ursidae comparative behaviors and conservation status.

Descriptor	Sun Bear	Sloth Bear	Brown Bear	Polar Bear	American Black Bear	Asiatic Black Bear	Andean Bear	Giant Panda
Winter Dormancy Not Obligate	Yes	No	Yes	Yes Pregnant Females	Yes, body temps. may drop to 31-34 degrees C	Sometimes, body temps. may drop 3-7 degrees C	No	No
Feeding Behavior # of Teeth	Omnivore, mostly frugivorous 42	Omnivore Insect Specialist 40	Omnivore Mostly Plants Variable 42	95% Carnivore Fruits Kelp 42	Omnivore Mostly Plants Eats A Variety of foods 42	Omnivore Mostly Plants Bamboo 42	Omnivore Mostly Plants Bromeliaceae 42	Omnivore 99% Bamboo Eats some meat 42
Delayed Implantation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unique Behaviors & Daytime Activity	Makes nests in trees and sleeps in them Much unknown Variable mostly diurnal & crepuscular	Slow walking, no upper incisors so they can make a tube out of mouth and "vacuum" insects mostly nocturnal & crepuscular	Observed far north riding ice flows, wild hybrids with polar bears, may be heavily carnivorous. Variable, mostly crepuscular	Except for pregnant and nursing mothers, don't hibernate, fasts during summer months Mostly diurnal	Excellent tree climbers, "bear nests" Mostly diurnal but varies with season and life history	50% time may be spent in trees, may migrate rather than hibernate "bear nests" Mostly nocturnal but varies by region	Best tree climbers, will make feeding and sleeping platforms in trees Generally nocturnal & crepuscular	Not very active, sleeps most of day, radial sesamoid for eating bamboo, smallest of cubs Generally crepuscular but varies
Conservation Status	Vulnerable Declining	Vulnerable CITES: Appendix I	Threatened CITES Appendix I	<u>U.N</u> Vulnerable USA Threatened Russia/Canada Species of Concern	Estimated 450,000 in North America Game Species	Vulnerable CITES Appendix I Sub- species is Critically Endangered	Vulnerable CITES Appendix I	Endangered CITES Appendix I Declining

Table III. Discontinuity matrix for Ursidae.

Does the Bible claim Discontinuity for bears?		No
Does the Bible infer Discontinuity for bears?	Yes	
Do most of the members of the group exhibit a novel metabolic pathway not found in other groups or only in groups known to be discontinuous? (Bile Salt Metabolism? , Hibernation Metabolism?)	Yes	
Is the similarity of ingroup comparisons significantly greater than ingroup vs. outgroup comparisons?	Yes	
Do most members of the group possess novel cell types or structures not possessed by other groups or only in groups known to be discontinuous?		No
Do most members of the group possess novel organs or anatomical structures not possessed by other groups or only in groups known to be discontinuous? (Dentition , Epipharyngeal pouches)	Yes	
Is the overall morphological similarity within the group significantly greater than the similarity of the group with other groups?	Yes	
Does the group occupy an environment notably different from other organisms?		No
Are stratomorphic intermediates that would connect the group with other groups mostly absent?	?	?
Is the lowest member of the proposed ancestral group found in a higher layer than the lowest member of the group of interest?		No

Compiled from Wood and Murray, 2003, p. 95

as that of the giant panda. Most bears have the muscles in place for a radial sesamoid, but the carpal extension tends to be small and insignificant. Only in the giant panda is there a sufficient extension to use it as an opposable thumb for holding bamboo while eating.

Biochemically, the giant panda is more like other bears than the red panda (Nash et al., 1998; Lindburg and Baragona, 2004; Yu et al., 2007; Krause et al., 2008). Chromosome banding patterns, serological, immunological, and sequence data classify the giant panda as an ursid and not a procyonid (raccoon) (Lindburg and Baragona, 2004). The morphological, behavioral, and molecular data show that giant pandas are a highly specialized bear that has adapted to an herbivorous diet (Lindburg and Baragona, 2004). This suggests that they diverged very early and are the most basal offshoot of the Ursidae family (Figueirido, 2009; Yu et al., 2007). This conclusion also fits the observation that all ursids, including the giant panda, have carnivore intestines, though longer than the typical meat-eater and contain-

ing no known digestive microbes (e.g., Breiter, 2005, pp. 100, 165). Compared to other bears, the panda has the shortest digestive system and can absorb only about 20% of the food it eats. In contrast, typical non-ursid herbivores contain intestinal microbes that allow them to digest about 60% of plant matter (DeBruyn, 1999). The giant panda must eat 12–15% of its body weight daily, for 15 hours per day, and for this reason does not produce the fat reserves required for hibernation. There is no evidence that the giant panda has hybridized with any other bear species.

The Spectacled (Andean) Bear

Subfamily Tremarctinae consists of the only extant member of the *short-faced* bears, the spectacled, or Andean, bear, *Tremarctos ornatus*. The extinct, giant short-faced bear (*Arctodus simus*; Figure 1) is the largest bear that ever lived. It stood 1.2–2 m at the shoulder and could weigh up to a ton or more. Unlike extant bears, which are “pigeon-toed,” the giant short-faced bear had long, straight toes. Some have interpreted their long, gangly

legs and straight toes as evidence that they were fast runners. They inhabited the land west of the Mississippi River to Alaska (North American Bear Center, 2009), and, until recently, high skeletal $N^{14}:N^{15}$ ratios have suggested that they were mostly carnivorous. Recent data show that this conclusion was premature, an issue discussed later.

Spectacled bears favor forested habitats at elevations between 1800 and 2500 meters, and their diet consists mostly of bromeliads (pineapple family Bromeliaceae) and other fruits (Breiter, 2005). The only bear species inhabiting South America, they are the most arboreal of bears. Much of their time is spent in trees making platforms for eating and sleeping.

The Sun (Malayan) Bear

Subfamily Ursinae comprise the rest of the six species. The smallest of the six is the sun bear (*Ursus malayanus*). A highly arboreal species, it inhabits lowland rainforests of Southeast Asia and, for its size, has one of the largest canine teeth of all known bears (Breiter, 2005). They have a variable birthing season, and cubs tend to be female biased. The sun bear is declining worldwide, now occupying an estimated half of its historical range (Smithsonian National Zoological Park, 2009).

The Sloth Bear

The shaggy sloth bear (*U. ursinus*) is an unusual bear of the grasslands and lower woodlands of Southern Asia. With its upper incisors absent, naked lips, and ability to close its nostrils, it is an insectivore. Their “vacuum cleaning” feeding behavior can be heard 90 meters away “vacuuming” termites and ants out of their nests. Also, mother bears often let the cubs ride on their backs.

The Asiatic Black Bear

In southern and eastern Asia, the Asiatic black bear (*U. thibetanus*) is also known as the “moon” bear. The Asiatic black

bear is considered the American black bear's closest cousin and can be sympatric with the giant panda and brown bear. *U. thibetanus* is found in temperate mountain forests at elevations as high as 3000 m, and it is estimated that they spend about half their time in trees. Like the spectacled bear, they also make tree platforms for feeding and resting. There is one small area in India where the sun, sloth, and Asiatic black bears are sympatric with one another.

The Brown Bear

The variable brown bears (*U. arctos*), along with polar bears, are the only bears ranging over more than one continent. They are believed to be endemic to Eurasia, later dispersing to North America and becoming sympatric with American black bears in the west. The largest numbers of brown bears are found in Russia. A female brown bear had her last litter at 42 years of age and lived to a record age of 47 years in captivity before she had to be euthanized (Breiter 2005, p. 140). Habitat and phenological events allow the brown bear a high degree of flexibility in their trophic ecology, which is true for most bears. Grizzlies have been observed on sea ice hunting seals 60 miles from land (Doupé et al, 2007; Breiter, 2005).

Depending on the source, subspecies range from five to ninety and include the grizzly bear (*U. a. horribilis*), Eurasia's brown bear (*U. a. arctos*), and the Kodiak brown bear (*U. a. middendorffi*). The Bible has 14 references to bears and refers to the smallest brown bear subspecies, the Syrian brown bear (*U. a. syriacus*). It no longer inhabits the wilds of Israel because it was extirpated in the early twentieth century. Some wild populations may still be found in western Asia, but the numbers are declining.

The Polar Bear

The carnivorous polar bears (*U. maritimus*), on average, are the biggest extant bears, reaching weights of 450 kg or

more (American Zoo and Aquarium's Bear Taxon Advisory Group, 2009). Compared with most other bears, they occupy a habitat of low food diversity and are the most restricted carnivorous bear. Having the largest canine teeth, their diet consists of about 95% meat, but they also eat fruit and kelp. Polar bear hair is not white but made of transparent hollow tubes that reflect and scatter light to produce the white effect (Polar Bears International, 2009). These hollow hairs also provide the conditions for algal growth in zoo bears, turning them green. When photographed with ultraviolet sensitive film, the bear looks black. This led researchers to hypothesize that the hollow hairs functioned as optical fibers that conduct light to their black skin. It was assumed that the black skin absorbed the light, producing increased warmth in their bitterly cold environment. Beside the fact that polar bears are most active during the time of year when there is little or no light, this theory was disproven in 1988. Physicist Daniel W. Koon realized that the keratin makeup of hair, not the skin, was probably absorbing the light (Koon, 2009). In fact, the polar bear is so well insulated with guard hairs, thick fur, and about 12cm of blubber that infrared photography reveals no detectable heat loss on a healthy bear (Breiter, 2005 p. 97; Polar Bears International, 2009).

In 2006, a wild grizzly/polar hybrid was shot in northern Canada. DNA results determined that the father was a grizzly and the mother was a polar bear (Lamb, 2006; Doupé et al., 2007; Hennigan, 2009b). Captive polar bears have produced fertile hybrid offspring with brown bears (Table III), and hybrid traits between the two species tend to be intermediate with exceptions (Table V).

The American Black Bear

The variably colored American black bear (*U. americanus*) is considered the only endemic North American bear species. The American black bear is actually

found in a range of colors, usually based on region, including black, blue-gray, cinnamon, and white. The white allele expressed in the "Spirit" or "Kermode" bear is rare. Normally it occurs along the British Columbia coast and the southeast panhandle of Alaska (Breiter, 2005, p. 95).

Favored foods of the American black bear include jack-in-the-pulpit (*Arisaema sp.*), wild calla (*Calla palustris*), and skunk cabbage (*Symplocarpus foetidus*), which contain calcium oxalate, a compound harmful to humans when ingested but not deleterious to black bears (DeBruyn, 1999, p. 110). If humans were to ingest these plants, calcium oxalate would cause potassium and phosphate to diffuse out of the blood, resulting in tissue shrinkage, throat constriction, and possible death.

Excellent tree climbers, black bears often climb a tree, find a fixed position, and pull fruit and mast-laden branches toward them, consuming the mast and fruit as they go. When they are finished, the bent branches look like giant nests; hence they are locally referred to as "bear nests."

Conservation Status

Humanity has been entrusted with the stewardship of God's creation (Genesis 1 and 2). As His ambassadors and stewards, our task is to represent the Creator to our fellow man and the created order. This stewardship involves managing ecosystems and creatures by exercising a benevolent dominion that balances the use of land for the well-being of people, while maintaining optimum wildlife habitat and long-term ecological sustainability (Hennigan, 2009c). Therefore, it is important to understand the current status of bear conservation to better steward these creatures. Their response to anthropogenic and environmental changes also will lead to questions concerning how God designed genetic mechanisms that enable them to re-

spond to ecosystem instability and allow both their persistence and seemingly rapid diversification after the Flood.

Bears are probably the most studied carnivore because of international conservation concerns (Table I) outlined by the International Union for Conservation of Nature and Natural Resources (IUCN, 2009). The IUCN publishes the Red List, which is a comprehensive inventory of threatened plants and animals. An international agreement called the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and signed by the United States in 1973 purposed to ensure that international trade did not affect the survival of threatened plants and animals around the world. That same year the United States passed the Endangered Species Act and implemented CITES under Section 8 (Abhat, 2008). Different magnitudes of extinction threat exist, for example, both the giant panda and the Baluchistan subspecies of the Asiatic black bear (*U. thibetanus gedrosianus*) are red listed as *Endangered* and *Critically Endangered* because their numbers suggest that, unless action is taken, they will go extinct (IUCN, 2009). The sun, sloth, Asiatic black, Andean, polar, and brown bears are red listed *Vulnerable* because there is great concern that they are likely to become endangered. Except for the American black bear, all the rest are listed in CITES and cannot be commercially traded.

Russia and Canada classify polar bears as a *Species of Concern* because both countries view the data as insufficient to warrant listing them as endangered or vulnerable (Polar Bears International, 2009). Those who believe in anthropogenic climate change have stressed possible polar bear extinction due to melting ice. The ice is important for breeding, hunting, and sometimes denning. At the most recent IUCN meeting (2009), in Copenhagen, the polar bear specialist group determined that out of the 19 subpopulations, eight

are declining, three are stable, one is increasing, and there is not enough data to draw conclusions about the other seven (Polar Bears International, 2009). These issues are important to clarify within a Biblical worldview because the question becomes whether it is more important to focus on the stewardship of the individual species or the created "kind." It has been argued, consistent with God's desire for the persistence of His creatures, that to finance extraordinary measures in order to protect species and subspecies is unjustified because if the baramin persists, the potential for continued speciation also exists (Wood, 2005).

The Case For Apobaraminic Status in Ursidae

The key for determining an apobaraminic relationship is to look for holistic character sets that bind taxa together, making them discontinuous with other taxa, without taking into account their continuity. If ursids are an apobaramin, holistic suites of morphological, bio-

chemical, and behavioral traits would be evident and unique only to them. In order to guide this research, a discontinuity matrix (Table IV) was prepared to highlight the organization of criteria that may shed light on an ursid apobaramin (Wood and Murray, 2003). The case for these criteria is discussed below and will be analyzed for their value in using them as evidence for apobaraminic status in family Ursidae.

Gross Morphology, Dentition, and Heterotrophic Flexibility

Common traits in bears that represent gross morphology include size, brain morphology, auditory region with ossicles, ridges on hard palate, and hair structure (Lindburg and Baragona, 2004). Though the dentition varies between species, specific dental traits set bears apart from other carnivores, including more elongated M2 molars and premolars with broad enamel platforms and underdeveloped carnassials (NHC, 2009; Lindburg and Baragona, 2004). Carnassial teeth consist of the last upper premolar and the first lower

Table IV. Ursid hybrids.

Hybrid Pairing	Wild or Captive	Fertility	References
<i>U. malayanus</i> (♀) x <i>U. ursinus</i> (♂) Sun Bear x Sloth Bear	Captive	Unknown	Asakura, 1969 Scherren, 1907
<i>Tremarctos ornatus</i> ♂ x <i>U. thibetanus</i> ♀	Captive	Fertile	McLellan & Reiner, 1994 Torres, D.E., 2009
<i>U. malayanus</i> x <i>U. thibetanus</i> Sun Bear x Asiatic Black Bear	Wild	Probable	Galbreath et al. 2008
<i>U. thibetanus</i> (♀) x <i>U. arctos</i> (♂) Asiatic Black Bear x Brown Bear	Captive	Unknown	Gray, 1972
<i>U. americanus</i> x <i>U. thibetanus</i> American Black Bear x Asiatic Black ?	Wild ?	Unknown	Hybrid Bears, 2009
<i>U. americanus</i> (♀) x <i>U. arctos</i> (♂) American Black Bear x Brown Bear	Captive	Unknown 3 cubs	Gray, 1972
<i>U. arctos</i> (♀) x <i>U. maritimus</i> (♂) Brown Bear x Polar Bear	Captive	Fertile	Kowalska, 1962, 1965, 1969 Martin, 1876, 1882
<i>U. maritimus</i> (♀) x <i>U. arctos</i> (♂) Polar Bear x Brown Bear	Captive	Fertile	Gray, 1972
<i>U. maritimus</i> (♀) x <i>U. arctos</i> (♂) Polar Bear x Brown Bear	Wild	Fertile	Hybrid Bears, 2009 Doupé et al., 2007

Table V. Example trait comparisons between brown/polar hybrid offspring and parents.

Traits	Brown Bear	Polar Bear	Hybrid Offspring
Overall Size	Slightly smaller than polar bear	Largest bear	Intermediate
Neck	Short	Long	Long
Shoulder Hump	Large	No Shoulder Hump	Small
Head Size/Shape	Thick set	Slender	Intermediate
Tail	Barely visible	Visible	Visible
Soles of Feet	Hairless	Covered with hair to insulate against ice	Partially covered with hair
Body Hair Structure in Cross Section	Solid or full of small hollow regions, depending on location	Almost completely hollow	A blend of both
Behavior	Do not pounce with two front feet and do not pick up bags and hurl them. Neither behavior has been observed in wild like it has with polar bears.	Pounce on toys with both feet like they do when breaking into seal dens. Use teeth to pick up and throw bags from left to right like they hurl prey in the wild.	Pounce on toys with both feet. Pick up bags with teeth and throw them from left to right.

Source: Walker, 2009

molar used in cutting. They are the classic dental trait of carnivores but are not as developed in bears. This character is consistent with their general hypocarnivorous behavior and is a key trait used when classifying fossil specimens within Ursidae (Lindburg and Baragona, 2004).

Figueirido et al. (2009) suggest reasons for the variable dentition and skull morphology in bears. They compared and contrasted 157 skull morphologies of herbivorous, faunivorous, and omnivorous extant bears with fossil specimens of the giant short-faced bear (*Arctodus simus*) and the European cave bear (*Ursus spelaeus*). Through statistical analysis they concluded that, rather than trying

to determine skull morphology as a function of ancestor-descendent relations, the data suggests that these differences are due to trophic ecology.

For example, herbivorous bears tend to have skull morphologies that include long cheek teeth, short, vault-shaped skulls with well-developed zygomatic arches, and small canines. Faunivorous bears tend to have shorter cheek teeth, long skulls, small zygomatic arches, and well-developed canines. Omnivorous bears share morphological traits intermediate between the two. The giant short-faced bear was assumed to be hyper-carnivorous (North American Bear Center, 2009), and the European cave bear more herbivorous. However, upon

closer examination, skull morphology in the extinct specimens was not statistically different from skulls of extant bears, and both extinct specimens were probably more omnivorous than once thought. These findings, along with the ability for seven of the eight extant species to hybridize, have implications for designed genetic mechanisms that respond to environmental disturbances affecting both morphological traits and the flexibility to alternate between carnivory and herbivory. These flexible traits are unique to bears and not observed in other carnivores.

It is evident that God wants His creatures to persist. Rather than recreating adaptations to withstand changing

environments, God designed genetic mechanisms that respond to environmental cues. Mechanisms, such as transposons (altruistic genetic elements) and epigenetics, should be areas of fruitful research to determine how bears might rapidly adapt in response to changing environments (Lightner, 2009; Wood, 2003; Wood, 2002) and has potential for shedding light on the origin of bear carnivory.

Hibernation Metabolism

Historically, *hibernation* has been a slippery term and has caused confusion. Some researchers did not believe bears hibernated because they did not undergo large body temperature reductions, such as observed in ground squirrels and bats. Therefore, they used terms such as *winter torpor*, *carnivorean lethargy*, and *winter sleep*. The confusion was a definitional problem. Today, the leading physiologists simply use the word “hibernate” when discussing the physiological processes that occur when bears retire to dens when food is no longer available (North American Bear Center, 2009).

The fact that bear hibernation metabolism is very different from other creatures makes them unique. Other taxa that hibernate, such as the eastern chipmunk (*Tamias striatus*) and the little brown bat (*Myotis lucifugus*), have the genetic capability of reducing their body temperature very near an ambient temperature of 0°C, resulting in nearly no detectable heart rate or respiration (Heinrich, 2003; Boyles et al., 2007). However, these creatures periodically raise their body temperatures, wake up, and proceed to eat, drink, urinate, and defecate.

Hibernating bears periodically wake, but generally do not eat, urinate, drink, and defecate except under unique conditions such as prolonged dormant periods (North American Bear Center, 2009). Some bears are not just hibernators but super hibernators (Rogers, 1999).

Five of the eight extant bear species (sun, brown, American black, Asiatic black, and polar bears) are non-obligate hibernators and only hibernate under specific environmental or reproductive conditions. Evidence exists that extinct species such as *A. simus* and *U. spelaeus* also hibernated. The giant panda, sloth, and spectacled bears do not hibernate. The giant panda's poor diet and inability to accumulate needed fat reserves are reasons why. The sloth bear may enter a period of lethargy late in the year. When it is cold, both pandas and spectacled bears may migrate to warmer climes. The question remains as to whether these bears have the latent ability to express metabolic, hibernative processes if food availability and/or climate changed drastically.

By mid to late summer, hibernating bears start the process of hyperphagia (Nelson et al., 1983). They put hundreds of pounds of body fat on their frames, a designed feat that causes no deleterious cholesterol effects. Pregnant bears give birth during hibernation, and births are well timed because of delayed implantation. All eight bear species, along with many other mammal taxa from mustelids to roe deer, have delayed implantation. Mating generally takes place in spring and early summer, and gestation occurs in two stages. The fertilized ovum divides for about a week into a 1–2 mm blastula and then stops when the material in the ovum is depleted. In stage two the blastocyst implants in the uterine wall, and it is thought that implantation is triggered when the bears go into hibernation (see Breiter, 2005 p. 39). It takes two months or less from the time of hibernation to birth.

The data suggests that as winter approaches, the lack of food causes bears to den (Breiter, 2005). The environment also seems to be involved with another phenomenon known as “walking hibernation” (Nelson et al., 1983), caused when bears lower their metabolism to conserve energy in the absence of

available food. In summer polar bears are landlocked and food is scarce. They may revert to walking hibernation and fast for several months (Breiter, 2005). Bears have control over this metabolism, so as various foods become available they will raise their metabolism and resume normal feeding activity until the food is gone.

Denning time depends on environment and stage of life. Pregnant females tend to be the first to den, then the subadults and nonpregnant females, followed by dominant males (Breiter, 2005). If food is plentiful, males and nonpregnant females may not hibernate at all. However, pregnant females, including polar bears, will hibernate. Once retired to a den consisting of an enlarged hole, the cavity under tree roots or below a brush pile, metabolic rate slows by half and their normal body temperature (38°C) drops with decreasing ambient temperatures. The body temperature continues to decrease to within 12° of normal but no farther (Rogers, 1999). The heart rate may decrease from 50 to 10 beats per minute, and pregnant females may burn 4000 cal/day (Breiter, 2005). In pregnant bears, unlike other hibernators, the minimal body temperature decrease is critical because high body temperatures are needed for fetal development.

These metabolic processes are unique to bears. A unique metabolic system is required to keep bears healthy during long bouts of inactivity, and many of these metabolic processes remain a mystery. The longest documented hibernative period was a female grizzly on the North Slope of Alaska who averaged eight months in hibernation per year (Breiter, 2005). The huge amounts of fat the bears accumulate sustain them. Cholesterol levels are more than twice the summer levels, yet they experience no cholesterol gallstones or hardening of the arteries (Rogers, 1999). All bears but the giant panda produce a unique bile acid called ursodeoxycholic acid, which

is thought to prevent gallstones during hibernation (Rogers, 1999). Kidney function is reduced, and the bears do not need to drink because water is recycled in their bodies. Toxins, like urea, do not build up because urea is hydrolyzed. The nitrogen released combines with glycerol, which is used to synthesize amino acids, and these enter into protein synthesis pathways (Nelson, 1980). The protein is used to rebuild and maintain muscle and organ tissue.

Further reduction in protein loss for pregnant mothers is accomplished through premature birth of babies. Fatty acids are too large to get through the placenta, so the baby is fed by the breakdown of the mother's muscle proteins (Breiter, 2005). If the babies were to go full-term, the mother's muscle mass would dissipate, and she would not be able to move in the spring. This unique hibernation metabolism explains, in part, why the bear cub-to-adult ratio is the largest of any other eutherian and monotreme mammals and is another exclusive bear character. The results of this unique hibernation metabolism include the ability to respond to danger, minimal muscle loss, and strong bone density. Other evidence suggests that unique hormones regulate hibernation physiology, and when injected into other species (hibernators and non-hibernators), these hormones produce hibernation-like effects (Rogers, 1999).

Because food resources seem to be the hibernation trigger, it is unknown whether the sloth bear, spectacled bear, and giant panda have this latent capability. Research into safe ways of triggering hibernation metabolism has potentially fruitful implications for resolving their baraminological status and unlocking latent, directed genetic mechanisms predicted by the creation model. Understanding these metabolic mechanisms also may help us to prevent bedsores, loss of muscle mass, osteoporosis, and heart disease in human patients (Heinrich, 2003).

Unique Bile Acid— Tauroursodeoxycholic Acid

Bile is a complex chemical mixture containing water and large amounts of organic molecules critical for digestion, absorption of vitamins and fats, and waste product elimination. Bile is produced by the liver, stored in the gallbladder, and enters the small intestine through the bile duct. Since as early as A.D. 659, bile from bear gallbladders has been used in oriental medicine for ailments such as digestive problems, inflammation, pain, and blood purification (Nette, 2000).

The key ingredient is ursodeoxycholic acid (UDCA), and in recent years this bile chemistry has been clinically shown to have analgesic and anti-inflammatory properties, along with the ability to treat both cirrhosis of the liver and to dissolve gallstones (Li et al., 1995; Nette, 2000). Today, the bile industry is causing a problem for bear populations, as many are poached solely for their gallbladders. It is estimated that China has 7000 captive bears kept in confined conditions and tortured through the "milking" of their bile acids, even though Japanese scientists synthesized the compound in 1955 (Nette, 2000). Some compare the industry to the drug trade. Various laws often are broken, and some estimates of the street value may range from \$1 to \$9 per gram (Nette, 2000).

UDCA is a unique bile acid produced only by bears. The function of this acid includes dissolving gallstones, making it possible for long-term hibernation. If the bile contains high concentrations of cholesterol and other specific substances, it can harden and block normal bile flow. The effects are possible infection or damage to the gallbladder, liver, and pancreas, which may lead to death. However, the giant panda is the only bear that does not synthesize the compound. This may be another reason, other than available food sources, why they do not, or cannot, hibernate. Some researchers have concluded that the giant panda

does not have the enzymes necessary to synthesize UDCA (e.g., Lindburg and Baragona, 2004, pp. 40–41).

The Bear Roundworm (*Baylisascaris transfuga*)

The question of whether or not obligate host/parasite relations may be used as additive or subtractive evidence in determining baraminological relationships may be a worthwhile pursuit. For example *Baylisascaris transfuga*, the bear roundworm can only complete its development in bears and has been identified in all eight species (Schaul, 2006). It is possible that the parasite develops only in bears due to the unique biochemical traits that bears possess. *Baylisascaris* sp. are roundworms that affect a number of mammals, the most important of which is *B. procyonis*, which affects raccoons and causes sickness and even death in humans (Sorvillo et al., 2002; Medpedia, 2009). Other roundworm species of *Baylisascaris* complete their development in other mammals, including the skunk and badger.

Bear roundworm larvae have various intermediate hosts, usually rodents, and bears usually are infected when the cubs ingest eggs, though other infection mechanisms exist. This parasite can be a particular problem in captive bears, and the data suggest that it has potential for causing serious zoonoses with humans and should be monitored (Schaul, 2006). However, before this relationship can conclusively be included in a suite of characteristics that determine an ursid apobaramin, more data are needed to resolve these relationships because *B. transfuga* also has been identified in the red panda, which has now been classified in its own family Ailuridae (Heath and Platnick, 2008).

Epipharyngeal Pouches

Weissengruber et al. (2001) noted unique morphological structures in bears known as caudodorsal epipharyngeal pouches. These elongated and tubular blind ending

structures are located at the dorsal end of the trachea. The openings of these structures begin in the pharyngeal cavity. The pouch linings have ciliated respiratory epithelia that are involved in moistening and protecting airways to provide a barrier against pathogens, and because of their musculature, are thought to be involved with bear phonation. Structures in similar locations exist in other mammal taxa, but the caudodorsal epipharyngeal pouches on bears (though variable within Ursidae) have large morphological differences and do not suggest phylogenetic relationships between other taxa (Weissengruber et al., 2001). Although identified in all bears, it has not been confidently confirmed in the Asiatic black bear, nor has it been identified in the raccoon and lesser panda. The pouches are currently thought to be unique to ursids.

Conclusions and Further Research

There is much we do not understand, and the role of the seemingly infinite complexity of biomolecular cellular systems is the most important to understanding life and life patterns. As one examines these systems in detail, it appears that a language has been imputed into the system by an Intelligence far beyond our comprehension. For creation biologists this understanding may lead to discoveries that materialists would never consider.

It seems evident that bears have diversified rapidly in less than 4500 years. For this to happen, they must have been designed with biochemical mechanisms that responded to the ecological upheaval produced by the Flood. Genetic drift occurring in small populations immediately after the Flood may explain this. However, biological observations make it clear that it cannot be explained by random mutation and natural selections (Wise, 2009b).

Evidence suggests that bears, including the giant panda, may have

come from one “kind,” depending on how one defines the term. By human baraminological standards, they are monobaraminic, but the jury is out on their apobaraminic status. The suite of traits that favor an ursid baramin include chromosome banding patterns, serology, immunology, DNA sequence data, hibernation metabolism, gross morphology, bile salts, variation in skull morphology due to diverse trophic ecology, wide-ranging environmental adaptations, largest cub-to-adult ratio of mammals except marsupials, underdeveloped carnassials, roundworm development, and epipharyngeal pouches. However, because of various exceptions, these traits cannot be declared holistically unique within Ursidae, and therefore their apobaraminic status and classification as a holobaramin cannot be determined.

Future research into latent and directed mutations, expressed by specific environmental triggers, may elucidate the origins of carnivory and other latent characters as hibernation and bile metabolisms. Knowledge from this research has potential in the understanding of rapid ursid diversity, discovering God’s methods for preserving His creatures, and illuminating relationships that may differentiate God’s idea of “kind” with our ideas. Finally, holistic data sets with hundreds of characters analyzed through statistical baraminological methods may produce quantitative measures that shed light on their relationships both within and without the family (Cavanaugh and Wood, 2002).

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Glossary of Baraminological Terms

Apobaramin – A group of known organisms bounded by biologically meaningful differences (discontinuity) without taking into account the

biologically meaningful similarities (continuity) within the group

Baramin – From the Hebrew *bara* (create) and *mîn* (“kind”), it refers to the “created kind” and was coined by Frank Marsh in 1941. The word *mîn* is poorly understood, and many Hebrew scholars disagree on its meaning (see Turner, 2009). It may be defined as a region of biological attributes within which any combination of these attributes could produce healthy offspring, at any point or period of history (Wood and Murray, 2003).

Baraminology – a uniquely creationist method of studying the organization of biological diversity.

Continuity – Biologically meaningful similarity between organisms that embrace all types of biological characteristics.

Discontinuity – Biologically meaningful differences between organisms.

Holobaramin – Organisms that share significant biological similarity with at least one other in the group (monobaramin) and are also bounded by biologically meaningful differences with all other taxa (apobaramin). The complete set of known organisms that belong to a single *baramin*.

Hybrid – The offspring produced from the hybridization of different taxa.

Hybridization – The mating of two different taxa. Baraminologists recommend that this be treated as a separate category of meaningful biological similarity. The production of hybrids reveals biologically meaningful similarity at the genetic, developmental, and anatomical levels that would not normally be revealed by biological research (Wood et al., 2003).

Monobaramin – A group of known organisms that share biologically meaningful similarity without considering biologically meaningful differences with other taxa.

Sub-baraminic – Based on a new criterion called the Flood fossil continuity criterion (Wise, 2008; Wise, 2009a), “sub-baraminic” refers to taxa that have diversified well after the Flood, as evidenced by first appearance in the fossil record.

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The Pleiotropy Problem for Evolution

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Abstract

Pleiotropy is the effect resulting from an interconnected genetic system in which a single gene influences many different biological systems in positive or negative ways. Pleiotropy occurs because multiple phenotypic effects usually arise from each expressed gene. The adverse effects of pleiotropy on the effectiveness of natural selection is reviewed in this paper. It is concluded that pleiotropy creates a major problem for evolutionary theory because the accumulation of mutations, even beneficial mutations, often has unintended negative effects.

Introduction

Pleiotropy—from *pleio*, meaning “many,” and *tropo*, meaning “changes”—is defined as the situation in which a single genetic variant is responsible for a number of distinct and often unrelated phenotypic effects (King and Stansfield, 1997, p. 264). Genes never operate alone, but are part of a highly interrelated biological system (Wagner et al., 2008). Therefore, even if a mutation is positive for one trait, negative effects frequently result as well, creating what is termed a “fitness cost.” In humans the result is obvious when a single mutation causes a disease that produces many unrelated symptoms (Dudley et al., 2005).

The best-known example of pleiotropy is the multiple effects resulting from the damage to one gene in sickle-cell anemia, a disease that results from a single mutation in the hemoglobin

gene. Besides anemia, other physical complications include leg ulcers, bone problems, blood clots, anoxia caused by the abnormal blood cells that lack the ability to flow properly, spleen damage, strokes, and hemolysis. Bacteria also frequently utilize a type of pleiotropy as part of their adaptive capabilities (Anderson and Purdom, 2008).

Pleiotropy, Mutations, and Evolution

The pleiotropy pitfall must be thoroughly addressed because mutations are considered the major source of genetic variety selected to achieve evolutionary change. Pleiotropy is “frequently observed” in the natural world and poses clear “evolutionary disadvantages for an organism, including limiting the rate of

adaptation for some traits in response to selection for others” (Dudley et al., 2005, p. E8). The disadvantage for evolution by mutations is: If a particular phenotype is the result of a mutation that produces the loss or alteration of a single function, it may also cause the loss of other functions that are required by disrupting part of a branching pathway.

This impediment to evolutionary progress is called “the cost of complexity” (Orr, 2000, p. 13). Another obstruction is that loss of function for one gene may affect several phenotypic traits adversely, and difficulties may result if a protein that is encoded by one gene serves several functions (see Dudley et al., 2005).

Pleiotropy is a consequence of the fact that most genes in eukaryotic cells are controlled by ten or more regulatory proteins, and each gene is in turn regulated by a dozen or more sites where the regulatory proteins bind. These gene regulation sites are usually upstream in close proximity to the gene being regulated, but they may be located some distance away, even on another chromo-

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some. For this reason one mutation can have multiple phenotypic effects, often on different organs and even different organ systems (Hodgkin, 1998).

An entire class of genes called *homeotic genes* all contain a sequence called a *homeobox* that produces Hox proteins. Hox proteins are master regulators of developmental programs involved in the coordinated construction of entire structures, such as wings or limbs. Mutations in Hox genes can cause a whole series of major phenotypic changes, such as development of an extra set of nonfunctional wings. Often mutations in Hox genes produce a cascade of ultimately lethal changes.

Just as construction of a modern office complex requires the coordination of hundreds or thousands of workers, by analogy, so does the construction of cells, wings, and organs such as lungs, hearts, and kidneys. A building will not function properly if the mechanical, electrical, or structural aspects are not properly designed or are improperly assembled and/or not integrated correctly. So too, if the parts of an organ or structure are not assembled correctly or have design flaws, the living organism will be unfit for life.

Types of Pleiotropy

Genes are classified into two basic gene types relative to their pleiotropic effects: the highly pleiotropic genes called *major pleiotropic genes*, those that have a large effect; and the non- or limited pleiotropic genes called the *minor pleiotropic genes*, those that have a small effect because they apparently act independently (Albert *et al.*, 2007). This classification is limited because even though some genes are major and others are minor, many manifest a pleiotropic effect on the phenotype for other reasons.

Hodgkin (1998) proposed a classification system that divides the pleiotropic effect into seven distinct types according to its cause. This classification system

documents how extensively interconnected genes are at the phenotypic level and, also, the many ways that genes can be interconnected. His classification system is as follows.

1. *Artefactual pleiotropy*, in which adjacent but functionally unrelated genes are affected by a single mutation, such as when two genes are located next to each other on a chromosome and a mutation in one affects the other. Hodgkin claimed that organisms with “compact, gene-dense genomes will be especially susceptible to artefactual pleiotropies” (1998, p. 502). This observation indicates that pleiotropy may be more of an impediment in simpler and more primitive organisms. An example is the *Drosophila* claret-nondisjunction mutation that causes both eye color abnormalities and meiosis nondisjunction.
2. *Secondary pleiotropy*, or “relational pleiotropy,” involves a single mutation causing biochemical alterations that produce changes affecting many structural changes. An example is a mutation causing phenylketonuria, a defect in a liver enzyme (phenylalanine hydroxylase) that causes a deficiency in axon myelination. It leads to numerous health defects, including mental retardation (Hodgkin, 1998, p. 502). Secondary pleiotropy is especially common in complex, long-lived organisms, and consequently presents a major problem for the evolution of “higher” creatures.
3. *Adoptive*, or *exaptational pleiotropy*, is the situation whereby one gene product is used for very different biochemical reactions in different tissues. An example Hodgkin gave is crystalline

protein that is not only the most abundant protein in the eye lens but also is used for structural roles in other tissues such as smooth muscle.

4. *Parsimonious pleiotropy* is the case in which one enzyme is used to catalyze the same chemical reaction in many different tissues and organ systems or is used in different biochemical pathways. An example is that the same enzymes are used in very different branches of a biochemical pathway that synthesizes isoleucine and valine.
5. *Opportunistic pleiotropy* is an event whereby one regulatory protein serves an important role with other cell or tissue types in addition to its main functions. The example Hodgkin used is the control elements *sisB* and *runt* on the x chromosome that cause problems early in development and which genes are also used in later stages of growth, such as during secondary sexual development.
6. *Combinatorial pleiotropy* is a case of one gene product interacting with different proteins in different cell types and being used in several different ways that result in distinct variations. A large number of examples exist, including most transcription factors, which cause a very different biochemical activity, depending on where they interact with the genome. As a result, mutations affecting this protein “have multiple and often very diverse effects on a wide variety of tissues” (Hodgkin, 1998, p. 503).
7. *Unifying pleiotropy* is a phenomenon whereby one gene or cluster of adjacent genes encodes multiple proteins that have common or related biologi-

cal functions. Examples include various structural components, binding domains and enzymes. As a result, mutations in genes in this category “have complex physiological consequences, which may be hard to explain if the underlying biology is not understood” (Hodgkin, 1998, p. 503).

In all seven of these types of pleiotropy, the mutations (even if beneficial) can cause negative or even lethal effects elsewhere. This list illustrates the many ways in which all systems are interconnected. It also illustrates how one genetic change can cause adverse modifications in the system directly affected, and in very different systems or even in later developmental stages. This fact causes a critical difficulty for evolution, because any mutation, even if beneficial, will likely have some or many negative effects.

Antagonistic Pleiotropy

Antagonistic pleiotropy occurs when a single gene produces multiple *competing* effects so that its beneficial effects are offset by deleterious consequences produced by the same gene. Some genes, for example, can increase fitness when a person is young but decrease fitness later in life. A case in point is the testosterone hormone gene, which increases reproductive fitness in an adolescent but can contribute to prostate cancer in an older adult.

Functions of Pleiotropy in Biology

Pleiotropy is necessary in order to coordinate body growth and development. For example, a normal healthy small woman has close to the same proportion of body parts, such as limbs, heart, lungs, and other internal organs, as does a normal healthy large man. A tall man has longer limbs than a short

woman, but each leg is normally close to the same proportion in each person. Pleiotropy is likewise a major means of coordinating a variety of body functions such as metabolism.

One reason genetics influences phenotypic correlations is because genes control the quantity of hormones secreted, and hormones often influence many separate functions. An example is the growth hormone secreted by the pituitary gland, which increases not only height and size of hand and foot, but also controls the entire body size. Many genes have well-known pleiotropic effects, including one important gene called p53 and all heat-shock genes that are part of the genetic systems responding to temperature fluctuations (e.g., Meyers, 1995, p. 281–285). The heat-shock response activates a number of genes that protect the cell from thermal damage. This complex response to heat damage is both rapid and reversible.

Another example of the results of pleiotropy is cytokine networks. The cytokines are hormone-like polypeptides produced transiently by a wide variety of cells. They usually act locally to alter cellular physiology by binding to cell surface receptors in order to activate certain genes. The effects of cytokines are *redundant* (meaning different cytokines may have the same effect) and yet can have multiple effects on the same cell in different circumstances.

This fact again illustrates that single mutations, although beneficial, often have a wide variety of results, some quite negative, on other systems. A single cytokine can have different effects on different cells and different cytokines also may interact either synergistically or antagonistically, or even in an additive way (Meyers, 1995). Since the origin of new genetic information upon which evolution selects is mutations, pleiotropy demonstrates that positive mutations usually also add to the “cost of complexity,” by bringing more harm than benefit.

Examples of Pleiotropy from Medicine

All drugs affect the body’s biochemistry, and all medicines have side effects due to pleiotropy. The reason is that all medicine attenuates or activates certain aspects of the body’s biochemistry, medically impacting the entire interconnected biochemical system it affects. Common side effects of many drugs include tiredness, nausea, dry mouth, reduced alertness, stomach problems, and allergies. Aspirin interferes with the prostaglandin biochemical pathway that not only blocks pain, but also interferes with the body’s ability to protect the stomach from the corrosive effects of HCl stomach acid.

A disease-causing mutation that damages one gene often can result in many different, and at times unrelated, symptoms. A mutation that damages the phenylalanine hydroxylase gene, which makes an enzyme that converts the amino acid phenylalanine into the amino acid tyrosine, can increase phenylalanine concentrations to toxic levels. This metabolic disease known as phenylketonuria (PKU) if not treated causes a variety of symptoms including mental retardation, hair growth reduction, blue eyes, and light skin color from skin pigmentation reductions (Hodgkin, 1998).

These examples all illustrate the extent of biochemical connectedness of human physiology and how attempts to alter it to benefit the patient often result in undesirable effects. Likewise, a beneficial mutation, even if very helpful, also can cause numerous undesirable side effects. The cost of complexity can be great, and for this reason evolution by the accumulation of mutations is seriously problematic. Instead, these examples of pleiotropy argue for creation *ex nihilo*.

Examples of Pleiotropy from Animal Breeding

Pleiotropy is a significant obstacle to successful animal breeding. The negative

effects that result from animal breeding illustrate why evolution by the accumulation of mutations is not a realistic mechanism. When breeding for a single desired trait, undesirable consequences almost always result (Grandin and Johnson, 2005). Chicken breeders select hens and roosters that are fast growing, bulky, and well muscled. Grandin and Johnson (2005) claimed that a gain in one of these traits *invariably* results in a loss in other traits. For example, fast-growing hens and roosters usually end up with fertility problems, a side effect also found with Belgian Blue cattle and certain other animals.

When a trait that allows faster growth in chickens was selected, the resultant chickens had weak hearts. Death from heart failure then became more common. Attempts to breed chickens with larger breasts resulted in chickens with deformed, bent, and swollen legs. Attempting to solve these problems, breeders worked on creating chickens with both larger breasts and stronger hearts. They eventually produced what appeared to be a dream chicken—a strong chicken with larger breasts, heavy legs, and strong hearts—but they soon discovered severe behavioral problems, such as a tendency for the roosters to kill the hens in part because the breeding led to the inadvertent elimination of the rooster's courtship dance. In the absence of the courtship dance, the hens would not cooperate sexually with roosters. The problem of breeding for one trait and losing others is universal. Grandin and Johnson (2005, p. 72) concluded this adversity happens “all the time when breeders over-select for a single trait. You get warped evolution.”

Yet, Grandin and Johnson (2005, p. 72-73) claimed that what artificial selection cannot achieve, natural selection can. In their section heading titled “Selection Pressure,” they discussed the evolution of color vision in primates, which they claimed natural selection produced in primates without intelli-

gence. The implication is that artificial breeders usually create genetic problems when they try to select for single traits, but the blind forces of nature can do the job just fine. However, they provide no support for that claim.

Negative selection repercussions can typically be avoided by selecting only for minor improvement; i.e., instead of the largest chicken possible, select for larger chickens that, although they compromise the other traits, do not compromise them to the degree that the problems that result are insurmountable or even serious. As is well known, breeding always carries limits, and, as we reach these limits, complications always eventually arise because of pleiotropy. Likewise, this illustrates why macroevolution by the accumulation of mutations is very unlikely—one step forward invariably results in several steps backward due to the effects of pleiotropy.

Epistasis

The concept of pleiotropy is related to the concept of epistasis. Both refer to interactions that influence phenotypic traits. Epistasis refers to the complex interactions that exist between different genes, often when one gene is modified by other genes, called **modifier genes**. *Synergistic* epistasis is a positive interaction resulting in a higher expression of a trait; *antagonistic* epistasis is a negative interaction resulting in lower expression of the trait.

Epistasis often refers to normal gene control and regulation, while pleiotropy refers to both normal and abnormal gene interaction. But both systems can create major difficulties for Darwinian evolution by the accumulation of mutations. If one gene in an epistatic system is altered, it can effect other genes. Evolutionists argue that synergistic epistasis gives natural selection a powerful means to remove deleterious mutations, preventing their accumulation. They reason that if a mutation in one gene effects the proper

operation of other genes, a non-lethal mutation can become lethal or adversely affect the survival of the organism. Thus, the organism possessing the mutation is more likely to be negatively selected by natural selection, reducing the overall mutation load of the organism.

While this effect may work, at least in theory, it can also cause many normally non-lethal neutral mutations (including those that are potentially beneficial mutations) to become lethal or be negatively selected as a result of the epistatic interactions. Consequently, the synergistic effect removes not only many deleterious mutations, but also most of the potentially beneficial ones. The net effect is mutations, both negative and positive, are removed, producing a conserving effect that resists genetic change. As a consequence, for beneficial mutations to increase and become fixed within the population there is an increased cost of selection (ReMine, 2006). It is unlikely that most populations could accommodate this increased cost.

Molecular Mechanisms for Pleiotropy

One important reason for pleiotropy is that molecules must constantly interact with one another in a living organism, and to function they must bind to some and not bind with others. Most often a molecule interacts with many other molecules in the cell within what is referred to as a “noisy biochemical environment” (Savir and Tlusty, 2007, p. e468). Mutations often change the conformation (shape) and even the binding properties of molecules, which can affect their interaction with other molecules.

This result is important because “practically all biological systems rely on the ability of biomolecules to specifically recognize each other,” and a change may mean that they do not recognize the molecules that are required and, consequently, react with some they should not, both conditions causing problems

(Savir and Tlusty, 2007, p. e468). Some common examples include antibody-antigen recognition, binding of regulatory proteins to DNA, and enzyme-substrate interactions required in body chemistry.

Overlapping Genes

Overlapping genes occur where one or more genes actually exist within another gene, or two genes overlap so that one gene is part of another gene next to it. Evidence now exists that there can be up to 12 or more overlapping codes in one gene. Changing one nucleotide can thus affect multiple information systems, indicating that almost all mutations will have pleiotropic effects (Trifonov, 1989; 1997). The recent ENCODE project has documented that a typical nucleotide is part of multiple overlapping messages, and this shows that most mutations should have pleiotropic effects (Kapranov et al., 2007). Sanford introduced the concept of “poly-functional DNA,” which means many functional units of DNA are “poly-constrained” such that a mutation improving one message will often damage the overlapping messages (Sanford, 2008).

How Common Is Pleiotropy?

The study of many life-forms, including yeasts, demonstrates that “a large number of pleiotropic genes” exist (Dudley et al., 2005). Much research indicates that most, and possibly all, genes have a pleiotropic effect. It is at least clear that a majority of genes have pleiotropic effects. For instance, promoter regions alone are regulated by nearly a dozen to several dozen transcription-factor binding sites (Stone and Wray, 2001). One study of the number of traits affected by each mutation using quantitative trait loci (QTL) analysis of skeletal traits in mice found half of QTLs affected up to six traits and one set of QTLs affected as many as 25 to 30 different traits (Wagner et al., 2008, p. 471).

Another QLT study looked at the number of major and minor pleiotropic effect genes for the body shape of two stickleback species. Their findings indicate that about half were minor pleiotropic effect genes and several had “large and possibly widespread effects” (Albert et al., 2007, p. 76). More studies are needed to determine the level of pleiotropic effects of other genes. The effect likely is probably much greater than this study indicates.

Hox genes and other transcription factors are known to influence and regulate the development of body morphology (Coyne, 2005). Hodgkin (1998, p. 501) argued that pleiotropy “may well be the rule rather than the exception in higher organisms.” He showed that recent evidence supports this conclusion, demonstrating its importance in higher organisms. Jaroslav Flegr has proposed that pleiotropy limits the plasticity of a species (Hall, 2009). High plasticity life-forms, such as dogs, are able to produce many morphological variations, and plastic species have a greater proportion of their traits coded by a single gene. Thus they show fewer gene-gene interactions, while frozen species have a greater proportion of their traits coded by a larger number of genes and show enhanced genetic interactions (Hall, 2009).

Summary

Pleiotropy not only creates a major genetic barrier to both micro- and macroevolution, but it also even sets limits on animal and plant breeding because of the biochemical interconnectivity existing in cells, tissues, organs, and organ systems. This fact is well known among plant and animal breeders, as well as those persons who fancy purebred dogs, horses, and other animals. As Hodgkin (1998, p. 501) admitted, “In complex eukaryotes, pleiotropy may lead to major constraints on possible mutational avenues” that might allow evolution to

occur. As stated earlier, the evidence of pleiotropy favors special creation (Tinkle, 1975).

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Book Review

The Ultimate Proof of Creation: Resolving the Origins Debate

by Jason Lisle

Master Books, Green Forest, AZ, 2009, 254 pages, \$14.00.

This book by Jason Lisle is devoted to apologetics and the defense of the Biblical worldview. It focuses on defending the Biblical understanding of creation and the creation account in Genesis. Dr. Lisle explains the importance our worldview plays in determining how we both understand and interpret scientific evidence (as well as life in general). His main argument, the “ultimate proof” of the title, is that only the Biblical worldview embracing the accuracy of the entire Bible provides a consistent

basis for knowledge. This is so because, though we rely on our sense to perceive the world around us, we have no guarantee that our senses are reliable unless the Bible is true in declaring that there is a Creator. Dr. Lisle also discusses logic, both formal and informal, and the role of evidence in our understanding of the world. He gives many examples of emails and letters he has received and guides the reader through analyzing them and applying what has been learned. The book is an excellent introduction to

logic and apologetics for the layperson, and is helpful for learning to spot errors in logic.

One drawback to the book is the lack of an index and glossary, both of which would be helpful resources for the reader. Overall the book is an excellent apologetics resource and is a great addition to any Christian library.

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The Origin of Grand Canyon

Part II: Fatal Problems with the Dam-Breach Hypothesis

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Abstract

Uniformitarian explanations of the origin of Grand Canyon all appear improbable. Thus, we turn to published catastrophic options. The most popular of these today is the dam-breach hypothesis. There are three versions of this general hypothesis, but all face major problems, of which two appear especially critical: (1) the lack of evidence for the existence of the breached lakes, and (2) the presence of the long Kanab and Havasu tributary canyons that enter Grand Canyon at the level of the Colorado River. There are no diagnostic bottom sediments, shorelines, raised deltas, or other geomorphological features at the proposed sites of the breached lakes, despite their common occurrence at the sites of other Ice Age lakes. Also, the erosion of the Kanab and Havasu canyons, a mile deep and a quarter mile wide at their mouths, would require vast quantities of rushing water over a wide area to erode these tributaries along with Grand Canyon, since the heads of the tributaries lie about 50 miles from Grand Canyon and over 100 miles from each other. This area seems too large for a breached lake to have flooded with sufficient energy to erode the canyons. Another catastrophic alternative is needed.

Introduction

Part I of this series (Oard, 2010) demonstrated that despite nearly 150 years of research, the origin of Grand Canyon remains opaque to uniformitarian geologists. All of their hypotheses depend on the slow erosion of the canyon by the

Colorado River over varying lengths of time, with different mechanisms to explain this process. However, none of them—the antecedent stream theory, the stream piracy theory, or the lake spillover hypotheses—can explain the relevant field evidence.

Since the hypotheses all share a bias toward uniformitarianism, it seems logical to see that connection as a possible point of failure of all their ideas. Thus, exploring a catastrophic origin for the canyon seems imminently reasonable. We will examine the four hypotheses proposed by creationists. Three of these are remarkably similar, and center on the abrupt failure of the dams of post-Flood, Ice-Age lakes. The other creationist hypothesis suggests the erosion

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Figure 1. Picture of the three lakes from display of the dam-breach hypothesis at the AiG museum.

of the canyon by the channelized flow of retreating Floodwater.

This paper will explain and assess the three dam-breach models. Since they face many of the same problems, these can be summarized as applicable to all three. Of these common problems, two major issues seem to invalidate *any* dam-breach idea.

The Three Dam-Breach Hypotheses

The dam-breach hypothesis is recent compared to uniformitarian ideas. It was developed in the mid 1980s, and proposes the formation of several post-Flood lakes northeast and southeast of

the Kaibab Plateau in basins of the Colorado Plateau (Figure 1). “Lake Hopi,” occupied the Little Colorado River Valley southeast of the eastern Grand Canyon. The name for this lake was borrowed from uniformitarian scientists, who think that a Miocene/Pliocene lake existed there based on their interpretation of the Bidahochi Formation found on the northern and eastern sides of the basin (Scarborough, 1989).

“Canyonlands Lake” is thought to have been located northeast of Grand Canyon (Austin, 1994b). It is also called “Grand Lake” by Brown (2001; 2008). Both authors suggest that the waters of this lake were dammed by the Vermillion-Echo Cliffs northeast of the Marble

Platform, rather than the Kaibab Plateau. This location is farther northeast than shown in Figure 1, and seems a point of contention between Austin, Brown, and other advocates of the dam-breach hypothesis. The Vermillion-Echo Cliffs were assumed to have once been connected on a northwest-southeast line. A reconstruction of the area with a lake surface level of 5,700 ft (1,737 m) would flood the Marble Platform (Austin, 1994a; Holroyd, 1990a; 1994), as seen in Figure 1. However, if the two cliffs were once connected and were eroded during the dam-breach event, then it is reasonable that the southwest edge of the lake was blocked by the Vermillion-Echo Cliffs.

The total area of the two proposed lakes depends on their depth (Austin, 1994a, p. 110, note 62). Canyonlands Lake supposedly had an elevation of about 5,800 ft (1,768 m), while Hopi Lake was slightly higher, at a little above 6,000 ft (1,829 m). At those elevations, the lakes would have covered some 30,000 mi² (77,700 km²) and contained 3,000 mi³ (12,505 km³) of water, 2.5 times the volume of Lake Michigan. These proposed elevations are just under the spillover points on the north and south edge of the Kaibab Plateau.

Austin (1994a) proposed a third lake just north of Grand Lake in northeast Utah. He named it “Lake Vernal” or “Lake Uinta.” It was separated from “Grand Lake” by the Book and Roan Cliffs. He suggested that Lake Vernal was one of a series of lakes that deposited the Green River Formation (and its equivalents) in northeast Utah, southwest Wyoming, and northwest Colorado (Oard and Whitmore, 2006). Of course this implies that these formations were deposited after the Flood. However, if the Green River Formation was deposited *during* the Flood, then it is doubtful that there ever was a “Lake Vernal.” If not, then some of the water needed to erode Grand Canyon must be found elsewhere (Oard and Klevberg, 2008).

In all three dam-breach models, the lakes emptied catastrophically, like the Lake Missoula flood in the Pacific Northwest (Oard, 2004b). The authors suggest this occurred within a few centuries after the Flood. The escaping lake water eroded a notch in the Vermilion-Echo Cliffs, continuing southwest to break through the Kaibab Plateau and the other plateaus of the southwest Colorado Plateau. This vast flood then turned west, eroding Grand Canyon.

There are significant differences between the ideas of Austin (1994a) and those of Brown (2001; 2008). These must be taken into account in a general critique of the dam-breach hypothesis. To further complicate the picture, other creationists have informally suggested yet another dam-breach model. Instead of lakes existing for centuries, it posits the ponding of Floodwater in the same area. These waters broke through the Kaibab Plateau, eroding Grand Canyon within weeks or months of the end of the Flood. It can be called the *ephemeral lake version*. But since this idea has not yet been published, this article will concentrate on the Austin and Brown models.

Austin's Dam-Breach Model

Austin's (1994a) mechanism can be broken down into three stages.

- (1) Within a few centuries of the Flood, sediments damming Lake Hopi were breached by piping. "Piping" is an engineering term that describes the forcing of water through weak areas in a dam because of the water pressure behind the dam. Austin proposed that a tunnel formed initially by piping, and was rapidly enlarged by high-pressure flow before the roof collapsed, forming a channel.

Erosion would have been aided by cavitation (Holroyd, 1990b; 1990c; 1990d). Cavitation is caused by the implosion

of "bubbles" or vacuum cavities formed by irregularities in a channel during extremely high flows. It multiplies the erosive strength of the water, plucking large sections of rock from the channel floor. However, once the tunnel collapsed, cavitation would cease, since it exists only in shallow, very fast currents. This dam failure led to the catastrophic emptying of the lake, cutting the drainage of the Little Colorado River.

- (2) Immediately after the draining of "Lake Hopi," "Canyonlands Lake" suffered a similar fate, cutting through the Vermilion-Echo Cliffs, probably also by piping. This event cut Marble Canyon and extended the Grand Canyon north and northeast from the Kaibab Plateau.
- (3) Like toppling dominoes, "Vernal Lake" emptied too, cutting through the Roan and Book Cliffs. The combined water from these three lakes flowed west, eroding Grand Canyon and probably the Canyonlands area of southeast Utah, Black Canyon on the Gunnison River in western Colorado, and Flaming Gorge in Utah and Wyoming. The volume of water needed to erode Grand Canyon demands the simultaneous emptying of all three lakes.

Brown's Dam-Breach Model

Brown's (2001; 2008) hypothesis is more complex, involving seven key steps. It flows from his larger "Hydroplate" hypothesis and is thus dependent on its veracity.

- (1) The initial elevation of the southwest Colorado Plateau was lower, at about 5,000 ft (1,524 m) msl. The top of the Kaibab Limestone was at 4,000 ft (1,219 m) msl, capped by

another 1,000 ft (305 m) of soft Mesozoic strata. In other words, the Kaibab Limestone that today forms the surface of the Kaibab Plateau was 5,000 ft (1,524 m) lower than its present elevation of about 9,000 ft (2,743 m) just before the dam-breach event.

- (2) During the Genesis Flood, continent-sized blocks of crust composed of large crustal plates moved west and downward off the rapidly rising ocean floor of the Mid-Atlantic Ridge, which rose 10 miles (16 km), initiating the lateral sliding of large crustal plates. Lubricated by subcrustal water, North America slid west at a relatively high speed and then came to an abrupt halt, as the western end was halted by friction. The rest of the "hydroplate" buckled and compressed within hours during the "compression event." Weaker portions were crushed, thickened, and forced upward, creating the new continents, which were then about twice today's elevation, which triggered the Ice Age. The Rocky Mountains would then have been roughly double their current elevation—similar to the Himalayas of today.
- (3) The unstable mountains began to sink, forcing the mantle up on either side, causing the adjacent plateaus to rise—thousands of feet over several centuries following the Flood. The Colorado Plateau, and the remaining water ponded there, rose as much as a mile (1.6 km). This post-Flood isostatic adjustment caused extensive frictional melting and the volcanism around the perimeter of the Colorado Plateau. Brown suggests that block faulting during uplift caused most of the high east-west cliffs on the Colorado Plateau:

Large blocks, when lifted and tilted, became cliffs and mountains—called *block-faulted mountains*. North of the Grand Canyon are many examples: Utah's Book Cliffs, Roan Cliffs, the Grand Staircase (Vermilion Cliffs, White Cliffs, Grey Cliffs, Pink Cliffs), and others (Brown, 2008, p. 191).

Figure 3 shows the Grand Staircase from Le Fevre Overlook, northwest of the North Rim of the Grand Canyon half-way up the northwest Kaibab Plateau (see Figure 3 in Part I for a diagram of the Grand Staircase). The scarps of the Grand Staircase in Brown's model were caused by faulting. But field data indicates that all of these cliffs are *erosional*; there is no evidence for significant block faulting. It is possible that minor faulting could have occurred along the Vermilion Cliffs north of Grand Canyon, but they are normal faults, down to the north—the opposite of the direction suggested by Brown. At any rate, Brown has "Grand Lake" rising to an elevation of about 5,700 feet (1,737 m) msl while Lake Hopi ended up at 5,950 feet (1,814 m) msl.

- (4) The climate after the Flood produced more rain than is seen today, which caused the lake levels to rise, until "Grand Lake" cut through its southwest bank, spilled over the Vermilion-Echo cliffs, and catastrophically eroded 2,000 ft (610 m) of soft Mesozoic strata, forming an 18-mile (29 km)-long and up to 12-mile (19 km)-wide spillway, called the "funnel," between the Vermilion and Echo Cliffs (Figure 4). Lee's Ferry, where many rafting enthusiasts start their journey down the Colo-

rado River (Figure 5), is located at the northeast end of the funnel. During catastrophic erosion of "the funnel," horizontal strata beneath its floor began to arch upward as the weight of overlying sedimentary rock was removed. Since the rock was not malleable, the arching caused the strata to split under tension, forming Marble Canyon parallel to the funnel axis.

- (5) Southward flowing water from "Grand Lake" undercut the northwest corner of "Lake Hopi," triggering its catastrophic emptying. This flow formed a waterfall about thirteen times higher and possibly a hundred times the volume of Niagara Falls (Brown, 2008, p. 192). Catastrophically released water from both lakes swept west as a sheet, eroding at least 1,000 ft (300 m) of soft Mesozoic strata above the Kaibab Limestone over a wide area. This sheet erosion event stripped strata from northwestern Arizona, an area of 10,000 mi² (25,900 km²). Brown points to the approximately 1,000-foot (305 m)-high erosional remnants of this Mesozoic sedimentary rock, such as Red Butte, which is capped by lava, as evidence for this sheet erosion event.
- (6) The westward flowing wall of water converged at the lowest point of the "rising" Kaibab Plateau, cutting Grand Canyon. The removal of a 1,000-ft (305 m) sheet of strata from Kaibab Plateau supposedly helped generate the rapid 5,000-ft (1,524 m) rise in its elevation. The course of Grand Canyon was due to an anticlinal uplift along its path caused by the earlier sheet erosion. As the canyon was eroded downwards, the process was aided by the continu-

ous creation of tension cracks and the anticlinal uplift of the strata, until Grand Canyon was excavated into the igneous and metamorphic rocks that mark its present bottom.

- (7) Brown attributes some of the erosion of Grand Canyon to groundwater, which existed at that time in greater quantity than today. He thinks that up to 20% of the Flood's waters became groundwater. During the formation of Marble Canyon and Grand Canyon, this groundwater began to flow rapidly towards the newly eroding Grand Canyon, multiplying the erosional effects of the surface waters, and opening underground channels, which in turn collapsed and formed side canyons.

The Kaibab Plateau Uplifted Before Grand Canyon Formed

Austin's (1994a) version is the best developed of the two models. He begins with today's topography, with the Kaibab Plateau already at its current elevation. Brown's model (2001; 2008) proposes that the Kaibab Plateau uplifted during and after the breaching of the lakes.

Austin is better supported by two pieces of field evidence. First, the Butte Fault (related to the East Kaibab Monocline) and the Colorado River between Nankoweap Creek and the Little Colorado River are parallel to each other (Figure 2). This is best explained by the uplift of the Kaibab Plateau *before* the Colorado River developed (see Figure 5 of Part I for the location of the East Kaibab Monocline). Ranney (2005, p. 71, emphasis and brackets mine) stated:

In his [Walcott's] report he noted how the Colorado River in Marble Canyon exactly parallels the trace of the Butte Fault for ten miles from Nankoweap Creek to the Little Colo-

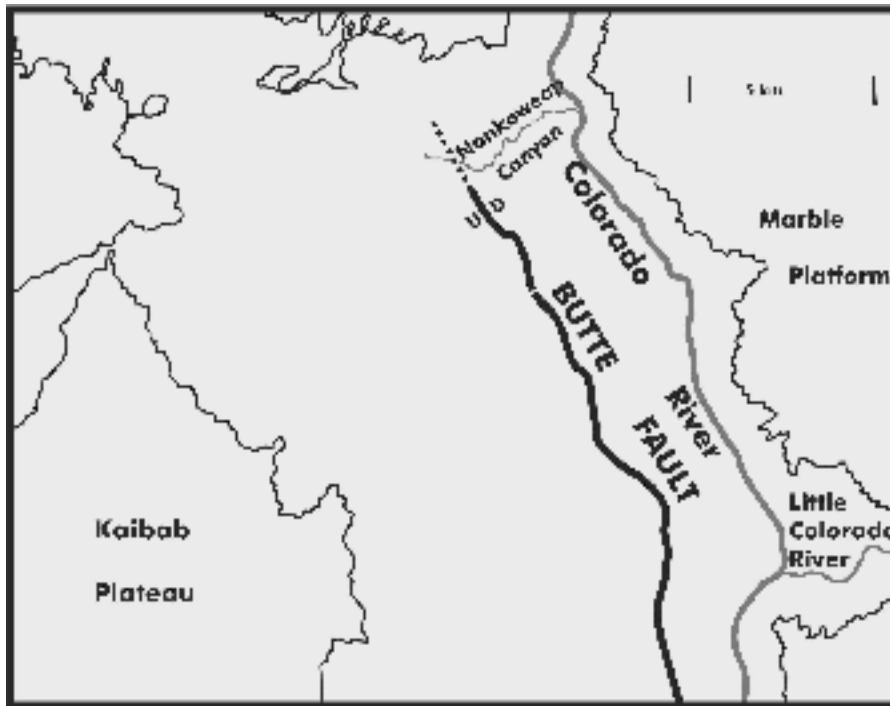


Figure 2. The Butte Fault parallel to Colorado River between Nankoweap Canyon and the mouth of the Little Colorado River Canyon, showing that the Kaibab Plateau was already uplifted before the Colorado River formed. Drawing by Peter Klevberg.



Figure 3. The Grand Staircase from Le Fevre Overlook. These cliffs represent about 10,000 feet (3,048 m) of erosion.

rado. This showed unequivocally that the river must have become positioned *after* that structure was formed.

Second, the northern part of the East Kaibab Monocline just east of Bryce Canyon National Park, Utah, is erosionally beveled. This surface is overlain by

flat-lying strata believed at one time to be the Wasatch Formation (Austin, 1994a; Babenroth and Strahler, 1945). This formation has since been renamed the Claron Formation (Harris et al., 1997), because it is much different than the typical Wasatch Formation found farther north, being composed mostly of limestone with very few fossils and conglomerate lenses. In any case, the presence of these flat-lying strata, extensively eroded along the Grand Staircase (see Figure 3, Part I), suggests that the Kaibab Plateau was uplifted *before* the Claron Formation was deposited. And since this formation once covered over 2,000 mi² (5,100 km²) north of Grand Canyon, it seems reasonable to attribute it to the Flood. Therefore, widespread Flood sedimentation was happening *after* the Kaibab Plateau uplifted (Oard et al., 2009), which would be hard for Brown's dam-breach hypothesis to explain.

My Journey Away from the Dam-Breach Hypothesis

Originally, I accepted Austin's dam-breach model. It seemed plausible, supported by published evidence. At the time, I was pursuing other projects and did not evaluate the model closely. In my first (generally favorable) examination of the dam-breach hypothesis (Oard, 1993), I noticed five geological problems and estimated Ice Age precipitation for the southwest United States. Precipitation then would have been about four times today's and evaporation less, due to cooler temperatures during the Ice Age. Higher precipitation and lower evaporation could have led to rapidly rising lake levels in the American Southwest. My climatological focus diverted attention from geological problems. I mentioned several as a means to spur Austin and others to answer them. Brown attempted to do so, but his explanations were not convincing. Over time, other research not directly connected to Grand Canyon began to raise other questions and

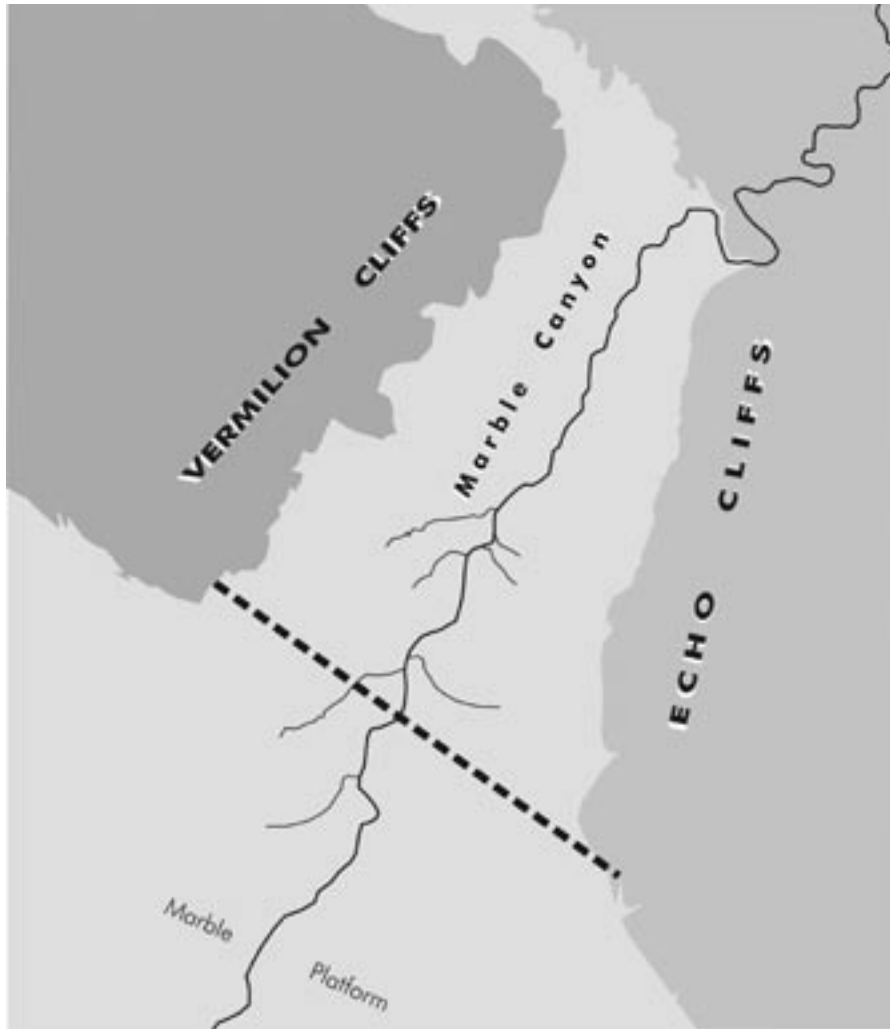


Figure 4. The “funnel” between Echo and Vermilion Cliffs. Note the tributaries entering Grand Canyon at an obtuse angle. Drawing by Peter Klevberg.



Figure 5. The start of a raft trip down the Colorado River beginning at Lee's Ferry, northeast of Marble Canyon.



Figure 6. Pluvial lakes in the Basin and Range Province during the Ice Age.

uncover even more problems (Oard, 2004a; 2004b).

At this time, I was researching the Lake Missoula flood at the peak of the Ice Age and the resulting Channeled Scabland of eastern Washington. Years of field and literature research led to the conclusion that only one large Lake Missoula flood occurred (with some minor flooding possible later) (Oard, 2000; 2003; 2004b). That research spurred my interest in features of other post-Flood lakes of the Southwest United States (Figure 6). These *pluvial lakes* existed during the wetter part of the Ice Age, later shrinking or disappearing. They would have been located just west of the two “dam-breach” lakes, and so should share a generally common history. The pluvial lakes commonly exhibit well-developed shorelines and other features such as raised deltas at the mouth of tributary streams.

Glacial Lake Missoula and the pluvial lakes of the southwest United States are suitable analogs for Ice Age lakes on the Colorado Plateau. All of them existed during the early post-Flood period—many for several centuries, though glacial Lake Missoula probably existed for less than a century. All of these post-Flood lakes would have been

growing and filling up until the peak of the Ice Age, experiencing rising water levels following the Flood due to heavy precipitation and melting ice.

Flooding occurred, as field evidence clearly shows. In addition to Lake Missoula, Lake Bonneville in western Utah broke through a rock barrier causing the Bonneville flood in the upper Snake River Valley of southern Idaho (O'Connor, 1993). There is well-documented evidence for the Lake Missoula and Bonneville floods. Austin (1994a) even referred to glacial Lake Missoula and the Channeled Scabland as an example for his dam-breach model, noting that Grand Coulee, carved during the Lake Missoula flood, was a small-scale example of Grand Canyon. Given these similarities, the Lake Missoula and Lake Bonneville dam-breaches should be good analogies of the dam-breach models for Grand Canyon. Therefore, the field evidence of this process should not be subtle, but obvious and overwhelming.

All dam-breach models fail at this point. Instead of the evidence being obvious and overwhelming, it is typically vague and inconclusive.

Numerous Problems

Exploring the problems of the dam-breach hypotheses requires more room than available here. However, they can be summarized as:

- (1) Lack of evidence for the proposed lakes.
- (2) Unexpected long, deep, narrow tributary canyons.
- (3) Rapidly rising water after the Flood would most likely have eroded outlet(s) at low elevations of the Kaibab Plateau, precluding a later catastrophic release.
- (4) Piping would have had to operate over nearly 100 miles (161 km). Thus, piping in man-made dams is a poor analogy. The Redwall Limestone has been

suggested as the suspect formation, having a number of small caves. However, it would have been in the wrong position, several thousand feet deeper than the bottom of the lakes. Movement along the East Kaibab Monocline could potentially have broken up overlying strata, allowing the water to reach the Redwall, but the lakes were not banked against the monocline.

- (5) Austin's model requires an improbable simultaneous release of lake volumes to provide sufficient water to erode the 1,000 mi³ (4,169 km³) of rock from Grand Canyon. The timing would have had to be perfect.
- (6) Brown's model includes both sheet erosion and later channelized flow. He is hard-pressed to explain that volume of water.
- (7) Large crustal movements and block faulting (Brown, 2008) are not supported by field evidence.
- (8) The plethora of features such as gravel bars and slackwater deposits readily observed for the Lake Missoula and Bonneville floods are not present on the southwest Colorado Plateau.
- (9) Widespread erosion, such as that on the southeast edge of the Kaibab Plateau (often higher than the proposed lakes) cannot be explained by Austin's theory.
- (10) There is no massive gravel bar at the mouth of Grand Canyon, similar to the 200 mi² (518 km²), 300-ft (91 m)-thick Portland Delta at the mouth of the Columbia Gorge. There are of course gravel bars downstream from the Grand Canyon and gravel on pediments, as found in many locations in southeast California and southwest Arizona far from the Colorado River. These features cannot dif-

ferentiate between catastrophic models. Given the volume of water needed to erode Grand Canyon, the expected gravel bar at its mouth should be at least an order of magnitude larger than the Portland Delta.

Since the first two objections seem fatal to either dam-breach model, we will evaluate them in more detail.

No Evidence for the Lakes

Obviously, there needs to be upstream lakes if there was any breach. Is there any evidence for their existence?

No Lake-Bottom Sediments

Of the three proposed lakes, Lake Vernal is a special situation, as previously discussed. Thick sediments, both extant and eroded, are attributed to this supposed lake, which was one of several "lakes" that occupied 30,000 mi² (77,700 km²) of northeast Utah, southwest Wyoming, and northwest Colorado after the Flood. However, sediments commonly attributed to this lake were very likely deposited by the Flood (Oard and Klevberg, 2008), not by a post-Flood lake.

The debatable sedimentary evidence for "Lake Vernal" is the best evidence for the proposed lakes. But, no sedimentary evidence exists for "Grand Lake." Even its proponents, as well as uniformitarian scientists who believe in the spillover hypothesis (see Part I), admit the absence of "Grand Lake" sediments.

Austin (1994a) claimed that the Bidahochi Formation contained sedimentary remains of "Lake Hopi" in the Little Colorado River Valley. But geologists think that only a small part of the formation was deposited by a lake and that this lake was only a small desert lake (Dallegge et al., 2001; White, 1990). Most of the formation is volcanic or laid down in moving water. Unless the Bidahochi Formation can be reinterpreted, there does not seem

to be enough sediment to justify a lake as large as “Lake Hopi.”

Furthermore, these lake deposits are near to or higher than the proposed elevation of the lake. While the Bidahochi lake sediments are located near the northern and eastern “shoreline,” there are no deposits in what would have been the deepest part of the lake—exactly where they would be most expected. There should be thick sediments at the bottom of the Little Colorado River Valley. Since the sediments of the watershed surrounding “Lake Hopi” are easily eroded, another explanation for their absence needs to be developed.

Some might argue that the missing sediments were scoured away during the breach of Lake Hopi’s dam. But the outlet of “Lake Hopi” is the Little Colorado River Canyon—a narrow canyon about half a mile (0.8 km) high and a quarter mile (0.4 km) wide where it enters the Colorado River (Figure 7). Figures 8, 9, and 10 show this narrow canyon at three locations above its junction with the Colorado River. Although water would be rushing through the constricted canyon of the Little Colorado River, this quarter-mile-wide outlet would allow only a small volume of water to pass through compared to the large volume of Lake Hopi. Thus, in the lake away from the outlet, the currents would be sluggish until they neared the outlet, minimizing scour of the lake bottom. It does not seem likely that the dam breach would have caused the complete scouring of the lake-bottom sediments. The same argument applies to “Grand Lake” and Marble Canyon. With restricted outlets, there is no reason not to expect thick deposits of lake-bottom sediments.

In contrast, Lake Missoula left abundant sediments in the broad basin of northwestern Montana. These are located at the lowest elevations northwest of Missoula, as expected (Figure 11). Although the lake sediments were eroded from the narrow valleys of west-



Figure 7. The mouth of the Little Colorado River from a raft on the Colorado River (view southeast).



Figure 8. The Little Colorado River valley west of Cameron as it enters the beginning of the canyon.

ern Montana, that is expected, given the current velocities of up to 60 mph (97 kph). Figure 12 shows a schematic of expected currents at various points within Lake Hopi and its outlet.

No Shorelines or Raised Deltas

In addition to the missing sediments, the proposed lakes left no geomorphological

markers either. All lakes have shorelines, and when rivers flow into lakes they form deltas. If a lake empties, those shorelines and deltas will remain, carved or deposited on the surround hills. The Flood ended around 4,500 years ago. The lakes breached several hundred years later. That leaves slightly more than four millennia, which is not enough time to



Figure 9. The narrow valley of the Little Colorado River Valley at a scenic overlook at milepost 285.7 on highway 64. The canyon at this point is a slot-like canyon about 1,200 feet.



Figure 10. Top of the slot-like canyon of the Little Colorado River Valley at milepost 277.7 on highway 64.



Figure 11. Extensive, flat lake-bottom sediments (rhythmites) from glacial Lake Missoula in the Little Bitterroot Valley, about 75 miles (120 km) northwest of Missoula, Montana. These sediments were laid in the bottom of glacial Lake Missoula, over 1,000 feet (300 m) below maximum lake level. The catastrophic emptying of the lake failed to erode these sediments.



Figure 12. Schematic of theoretical currents in “Lake Hopi” and the Little Colorado River Canyon. The current would have been strong through the Little Colorado River Canyon because of its slot-like shape but much weaker away from the drainage point. Hence, little erosion of lake bottom sediments should have occurred. Thick arrows show high velocity, and thin arrows show relatively low current velocities. Drawing by Peter Klevberg.

erase all traces of these lakes, as is clearly seen in the remains of other pluvial lakes in the same region.

(1) Shorelines and Raised Deltas around Glacial Lake Missoula

How do we know that the shorelines and high deltas should still exist today? Simply by analogy; shorelines, raised deltas, and other shoreline features are abundant around *other* past Ice Age lakes. Even if

the hypothetical dam-breach occurred before the Ice Age (a very unlikely idea), the same evidence should still be seen.

For instance, glacial Lake Missoula was most likely a very short-lived lake that rose each year during the peak of the Ice Age (Oard, 2004b). Although it burst and emptied in a few days, relict shorelines are abundant. A few examples are the shorelines found around the city of Missoula (Figures 13 and 14), in the

Missoula Valley west of Missoula (Figure 15), and on the north slope of the National Bison Range (Figure 16). There are also raised deltas at the entrance of tributary valleys to the Bitterroot Valley (Weber, 1972).

Moreover, the host lithology makes no difference. The shorelines are etched equally clearly in hard rocks and in soft clay slopes—e.g., the north slope of the Missoula Valley. Alt (2001, p. 48) stated, “But the shorelines seem just as numerous on the weak clay slopes north of the Missoula Valley as on extremely stable slopes of Belt rocks.” The shorelines on clay slopes are very similar in appearance to those shorelines cut on harder rocks. Thus, any appeal to absence from erosion seems unlikely.

If distinct shorelines for ephemeral glacial Lake Missoula are so abundant and obvious—even in soft rocks—surely we should see many obvious shorelines associated with the lakes proposed by Austin and Brown.

(2) Shorelines and Raised Deltas around Ice Age Lakes in the Great Basin

The Basin and Range Province lies west of the Colorado Plateau. It is composed of high mountain ranges separated by deep valleys or basins, with no external drainage. Today, the climate is hot in the summer and annual precipitation is



Figures 13. Shorelines from glacial Lake Missoula on Mount Sentinel, east of Missoula, Montana.



Figure 14. Shorelines from glacial Lake Missoula on Mount Jumbo, northeast of Missoula, Montana.



Figure 15. Shorelines from glacial Lake Missoula on the northern slope of Missoula Valley, just north of Frenchtown.



Figure 16. Shorelines along the northern National Bison Range, about 35 miles (55 km) north of Missoula, Montana.



Figure 17. Lake Bonneville shoreline at base of mountains north of Salt Lake City.

generally light. But during the Ice Age, enclosed basins within the Great Basin (as well as areas of southeast California) contained many deep lakes (see Figure 6). These lakes would have been partially filled during the final retreat of the Genesis Flood, as should have any lakes on the Colorado Plateau. Lake Bonneville was the largest, about 800 feet (244 m) deeper than Great Salt Lake; a mere remnant of Lake Bonneville, and only about 12 feet (3.7 m) deep on average.

All these lakes would have continued to grow during the Ice Age (Oard, 1990; 2004a). Heavy Ice Age precipitation caused Lake Bonneville to eventually overtop an outlet at Red Rock Pass (southeast Idaho) causing the Bonneville flood (O'Connor, 1993; Oard, 2004a; 2004b). Ice Age lakes in the Great Basin should have been similar to those on the Colorado Plateau, if the latter existed.

The existence of these pluvial lakes is shown by their abundant shorelines. Some are huge. The most impressive are those around Lake Bonneville (Figure 17), just west of “Grand Lake.” Shorelines from other pluvial lakes of the Great Basin—such as Ice Age Mono Lake in Owens Valley, California; Ice Age Lake Lahonton in western Nevada; Ice Age Lake Manly in Death Valley (Figure 18); and Ice Age lakes in southeast Oregon (Figure 19)—are less distinct but still visible. Ice Age lakes in western Nevada and southeast Oregon also exhibit beach barrier bars, spits, back-barrier lagoons, rounded gravel and other shoreline geomorphological features (Adams and Wesnousky, 1998; Carter et al., 2006). The most prominent shoreline in Death Valley is located at 300 ft (91 m) above the basin floor, with possible shorelines much higher (Hooke, 1999). There is abundant and obvious evidence for their post-Flood existence.

(3) No Shorelines and Raised Deltas for Proposed Colorado Plateau Lakes

When we turn to the two lakes east and northeast of the Kaibab Plateau,



Figure 18. Lake Manly shorelines in Death Valley on lower slope to left.



Figure 19. Shorelines on the lower slope from a pluvial lake in southeast Oregon.

there are *no* shorelines, raised deltas, or other beach geomorphological features (Holroyd, 1994). The ephemeral lake version is the only one of the three dam-breach hypotheses that can account for the observed evidence. But for other reasons, such as Grand Canyon carved at an intermediate altitude through the Kaibab Plateau and the long tributary canyons (described below), that version is unlikely. At best it depends on the absence of evidence.

(4) Are There Any Reasons Not to Expect Shorelines?

Brown (2008, pp. 201-202) responded to this lack of evidence. He first stated that after the Flood, the Colorado Plateau rose more than a mile (1.6 km), while the Rocky Mountains sank. Such uplift altered the shapes of the basins and caused

the shorelines to shift so that the water level would not be at one location long enough to etch a shoreline. Pluvial Lake Bonneville and glacial Lake Missoula were supposedly not affected by these great vertical movements, though Lake Missoula technically lies in the Rocky Mountains and Lake Bonneville just to the west of Grand Lake and Lake Hopi.

But these movements are contrary to field evidence. Furthermore, if there had been such widespread tectonic instability, it seems unlikely that lakes would have formed at all. Brown (2008) countered by suggesting that oscillations in the lake waters would have eroded any shoreline features, but these same movements would have caused the lakes to overflow their natural barriers well before any dam breach. And if he is right, the same problems would have been faced at nearby Lake Bonneville. But that lake shows excellently preserved features and no evidence of large-scale vertical motions.

In another attempt to deal with these difficulties, Brown (2008) also suggested that Lakes Bonneville and Missoula probably breached centuries after Lakes Grand and Hopi. He suggests that thunderstorms would then have had more time to erode the shorelines of the dam-breach lakes. But do the numbers add up? Grand Lake and Lake Hopi likely lasted 200 to 500 years. On the other hand, glacial Lake Missoula probably lasted only 80 years with each year's stillstand forming a shoreline (Oard, 2004b). It then obviously took less than a year to etch each still-visible shoreline of glacial Lake Missoula.

Glacial Lake Missoula was emptied at the peak of the Ice Age, about 500 years after the Flood. Pluvial lake Bonneville broke through Red Rock Pass a little earlier (O'Conner, 1993), since the deposits of the Bonneville flood are below those of the Lake Missoula flood around Lewiston, Idaho. Lake Bonneville dropped over 330 feet (100 m) during the Bonneville flood. The

highest shoreline, as well as the next to the highest shoreline, is still very distinct. So, the highest shoreline of Lake Bonneville must have been carved within a very short time. It does not take long to make a shoreline. The many levels of shorelines from Grand and Hopi Lakes should be clearly preserved.

Furthermore, the same thunderstorms should have affected other preserved features across the western United States. And ironically, shorelines cut into slopes would be immune from the worst erosion from thunderstorms, which comes from water accumulating in lower areas and flooding down gradient. Most geologists would recognize that climatic conditions in Montana are much more conducive to erosion, yet the remnants of glacial Lake Missoula are still there.

Brown (2008) also appealed to elevated groundwater flow after the dam breach to erode the shorelines. With a sudden drop in base level, the

surrounding groundwater would have destroyed shorelines and formed cliffs as the groundwater shot high into the air. But groundwater flow is usually very slow compared to surficial flow, and it is more likely that a rapid adjustment to the water table surface near the drained lake would slowly accommodate the change in base level. Even so, some shorelines would have certainly existed at high altitudes once the lake emptied and probably above the water table. Most groundwater discharge, especially in any volume, would occur at lower elevations.

Although Brown (2008) did not make the argument, someone may claim that shorelines would more easily erode on the Colorado Plateau because of the friable nature of the sedimentary rocks. But if glacial Lake Missoula's shorelines were preserved in both hard rock and soft clay (Alt, 2001), why should not Lake Hopi's and Grand Lake's? Furthermore, many of the rocks beneath the proposed

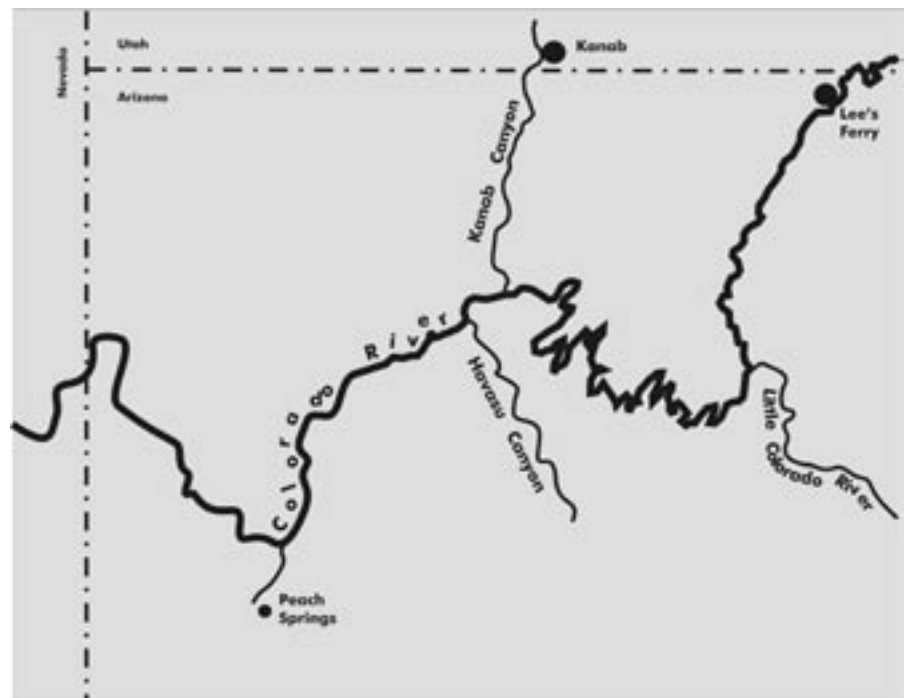


Figure 20. The four long tributary canyons of the Colorado River through Grand Canyon that gradually descend to the level of the Colorado River. Drawing by Peter Klevberg.



Figure 21. The mouth of Kanab Canyon from the Colorado River in Grand Canyon.



Figure 22. Havasu Canyon with Cataract Creek.

lakes on the Colorado Plateau are consolidated, and certainly hard enough to preserve shorelines from minimal erosion over 4,000 years.

(5) Summary

If Grand Canyon was carved by a flood from the catastrophic emptying of post-Flood lakes, then a primary test of that

hypothesis would be indisputable evidence of these lakes at the right time and in the right place. That evidence would include the presence of lake sediments, shorelines, and other geomorphological features commonly associated with numerous dry lakebeds in the western United States. Analogies like glacial Lake Missoula and Lake Bonneville demonstrate the types of features we should expect, as well as their preservation potential. Their absence, especially given the quality of the analogies is a powerful argument against the hypothetical lakes on the Colorado Plateau.

Long Tributary Canyons: Another Major Hurdle for the Dam-breach Hypothesis

We will now look at another powerful argument against the dam-breach hypothesis—the presence of long tributary canyons (Figure 20). There are four long tributary canyons to Grand Canyon:

- (1) Kanab Canyon, running about 50 miles (80 km) from Kanab in south central Utah
- (2) Havasu Canyon, which starts about 60 miles (97 km) south of Grand Canyon near Williams, Arizona
- (3) Peach Springs Canyon, about 20 miles (32 km) long
- (4) Little Colorado River Canyon

Peach Springs Canyon is likely related to the Hurricane Fault. Since there is a structural component to its existence, and it was not formed completely by erosion, it will not be discussed in depth. But it is interesting to note that north of its intersection with the Colorado River, the path of Grand Canyon is unrelated to this fault, one of the most significant in the Grand Canyon area (Austin, 1994c). Furthermore, when Grand Canyon did intersect the trace of the Hurricane Fault, it did not continue along the fault, but turned west.



Figure 23. Tributary canyon to Havasu Creek. The headwaters of this canyon are in a fairly dry location with a very little drainage basin on the west side of Havasu Creek. It does not seem likely that such a deep canyon, tributary to Havasu Creek could form during the dam-breach or in the post-Flood climate.

The other three long tributary canyons are not related to any known fault. Practically all the significant faults trend perpendicular to the Grand Canyon, in a north-south direction (Huntoon, 1990; Shoemaker et al., 1974; Warner, 1978). There are some minor northwest trending faults detected in the upper Havasu Canyon drainage and west of Havasu Creek (Shoemaker et al., 1974), but they do not seem to have affected the path of Havasu Creek.

The Little Colorado River Valley is not included in this analysis since, as one of the dam-breach outlets, it presents no problem to the hypothesis.

Kanab and Havasu Canyons

That leaves Kanab and Havasu canyons. They are erosional, not fault related. The simplest explanation is that they formed during the same erosional event that

carved Grand Canyon. Kanab Canyon enters Grand Canyon (Figure 21) as a narrow gorge about one mile (1.6 km) deep and a quarter mile (0.4 km) wide (Powell, 2005). Havasu Canyon is of similar dimensions (Figure 22). Both require significant erosion of hard rock. Cataract Creek runs down Havasu Canyon year-round, but Kanab Creek is dry most of the year and presents a problem to even uniformitarian geologists: "To make the question even more difficult, Kanab Creek, like most of the side canyons, and in contrast to the perennial Colorado, is usually dry" (Powell, 2005, pp. 63–64). Ranney (2005, pp. 50, 51) puzzled over the origin of these tributaries:

How is it that much smaller tributaries, which have no water in their channels most of the time, can carve canyons just as deep as the Colo-

rado River has carved the Grand Canyon?

Thus, the uniformitarian solution for this problem is "deep time" and flash floods (Powell, 2005; Ranney, 2005).

If Kanab and Havasu Canyon did not form during the dam breach, could they have formed after the dam breach? That would require their erosion by present-day processes operating over about 4,000 years. Early on, precipitation would have been higher but with very few summer thunderstorms that cause the erosive flash floods we see today. Toward the end of the Ice Age, the climate would dry and then the summer thunderstorm regime would set up about 4,000 years ago. But even with flash floods, erosion observed today in these canyons is modest at best. It does not seem possible that summer thunderstorms and flash floods could carve a mile-deep canyon, not to



Figure 24. Hanging valleys west of Banks Lake, upper Grand Coulee

mention the deep canyons tributary to Kanab and Havasu Canyons (Figure 23). We must conclude that it is highly unlikely that these tributary canyons formed by modern processes after Grand Canyon.

The Canyons Eroded at the Same Time as Grand Canyon

Since the tributaries reach the same depth as Grand Canyon, the most logical explanation is that they were eroded at the same time. Because they gradually descend to the exact depth of Grand Canyon from their upper drainage basins, they could not have formed before Grand Canyon. They had to form simultaneously with Grand Canyon.

The erosion of Grand Canyon required massive volumes of water. Apart from the Flood, that volume is difficult to explain. The presence of the tributary canyons exacerbates that problem, not

least because the water would have had to be present at the upper ends of the drainage basins of the tributary canyons, and at the upper end of Grand Canyon at the same time—areas separated by over a hundred miles. In other words, water flowing at sufficient velocity for a sufficient time to erode a mile into indurated rock would have had to have been spread over a hundred miles (161 km) of the southwest Colorado Plateau or to have been derived simultaneously from three widely spread sources.

The relationship between Grand Canyon and its tributaries is mirrored in the erosional remnants of the Lake Missoula flood. Had the tributary canyons not been eroded at the same time as Grand Canyon, they would probably have created hanging valleys, such as those seen in the Pacific Northwest. During the flood that formed the Channeled Scabland, Grand Coulee, and Moses

Coulee, about 10 miles west of Grand Coulee, formed rapidly (Oard, 2004b). Preexisting valleys were left as hanging valleys in the walls of the coulees (Baker, 1978; Hanson, 1970) (Figure 24). Those tributary valleys that slope to the floor of Grand Coulee do so because they were formed at the same time. For example, Northrup Canyon, along the northeast edge of Upper Grand Coulee, is not a hanging valley because it formed at the same time as Grand Coulee.

The necessity for multiple sources of flooding or for one extremely widespread source militates against the dam-breach hypothesis.

What about the Tributary Canyons on Marble Platform?

Brown (2008, p. 190) noted that the tributary canyons to the Colorado River through Marble Canyon are at an obtuse angle (see Figure 4), while in a

normal drainage they should be acute. He interprets this angle to suggest that Marble Canyon tributaries were formed by a northeast flowing current. But how would such a river fit into Brown's hypothesis? This is the opposite direction to which the water of the dam-breach flowed. His objection is easily answered. The unusual obtuse tributaries could simply be a result of late Flood and post-Flood drainage flowing *downslope*, which is toward the northeast on the Marble Platform. The Colorado River flows south to southwest, but the top of the Marble Platform slopes the opposite way, quite different from a normal drainage network.

Summary

Uniformitarian models fail to explain to origin of Grand Canyon. Catastrophist alternatives have focused on the abrupt emptying of upstream lakes by a dam breach. But these models face many problems, too. Two especially severe objections to any dam-breach theory are the absence of evidence for the antecedent lakes and the inability of lake sources to account for the simultaneous erosion of tributary canyons. Counter arguments to the absence of lake features fall apart when met with the analogies of other nearby lakes existing at about the same time. Lake Bonneville and Lake Missoula left abundant evidence of their presence; proposed "Lake Hopi" and "Grand Lake" should do no less.

An unpublished hypothesis, the ephemeral lake version, offers a possible explanation of the absence of lake features but cannot explain the synchronous erosion of multiple canyons many miles apart. Nor can it explain the location of Grand Canyon at an intermediate altitude on the Kaibab Plateau or the fact that Grand Canyon was carved just west of the Kaibab Plateau perpendicular to the topographic slope. Furthermore, until it is published, it has not earned a place in the literature discussion.

The existence of such long, deep tributaries to the Grand Canyon is similar to (though at a greatly expanded scale) the formation of drainage channels on bare fields during runoff (Thornes, 1990). There is always a main channel with tributaries that cut down to the level of the main channel. Thus erosion by running water seems capable of explaining the canyon system, yet the scale of such an event seems well beyond a local release of water from a few lakes. Logic therefore pushes us toward a different explanation—that the canyon and its tributaries were all eroded during the closing stages of the Genesis Flood. This hypothesis will be fleshed out in Parts III, IV, and V of this series. As will be shown, it answers many of the problems that have baffled both uniformitarians and proponents of a catastrophic dam-breach event.

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Notes from the Panorama of Science

The Blue Lagoon

The Blue Lagoon is one of the most famous tourist sites in Iceland (Figures 1 and 2). A lagoon it is not. The blue comes from the color of the sky reflected in the shallow water from the white, sand-sized sediment on the bottom. It makes a dramatic contrast with the dark, angular basalt of the lava flow that surrounds this artificial body of water. When I went for a dip in the Blue Lagoon in 2002, I was told it is actually a thermal wastewater pond from the nearby geothermal power station (Figure 3), which injects seawater into hot tholeiite basalt bedrock and extracts the heat for use in nearby Reykjavík. After passing through the plant, the hot, circulated seawater, laden with dissolved minerals, is dumped (“wasted”) into this depression in the lava flow, forming a large pond. Of course calling a thermal pond in a dramatic setting a “wastewater pond” would do nothing to attract tourists!

Basalt is the most common lithology (rock type) on earth, making up the bulk of oceanic crust and significant areas on the continents also. Rocks are combinations of minerals. Of the approximately 2,400 known minerals, roughly 60 are common rock-forming minerals, of which nearly all are silicates (see Dietrich and Skinner, 1979, p. 8). The most common single mineral is quartz, which is pure silica, and the most common mineral group is the feldspars, which are silicates. Approximately 72% of the earth’s continental crust is composed of silicon and oxygen. Basalt is composed principally of plagioclase feldspar ($\text{NaAlSi}_3\text{O}_8$ to $\text{CaAl}_2\text{Si}_2\text{O}_8$) and pyroxenes ($\text{Ca}(\text{Mg,Fe})\text{Si}_2\text{O}_6$ to $(\text{Mg,Fe})_2\text{Si}_2\text{O}_6$),



Figure 1. The “Blue Lagoon” from the visitor center.



Figure 2. Map of Iceland showing location of Blue Lagoon and other features.



Figure 3. The geothermal power plant responsible for the Blue Lagoon. It is located in a field of tholeiite flows on the Reykjanes Peninsula.



Figure 4. Dacite column near Kalmanstunga.

with olivine ($(\text{Fe,Mg})_2\text{SiO}_4$) and other accessory minerals, including quartz (SiO_2). Basalts range from silica deficient (alkaline basalts) to slightly enriched in silica (some alumina basalts and quartz tholeiites). If, as many believe, the silica-undersaturated basalt and its plutonic equivalent gabbro dominate oceanic crust and are derived from pyroxenite, peridotite or eclogite (Klevberg, 2007; McBirney, 1993) or other basic rocks in the mantle, what is the source of sialic and silicic rocks, rocks that are relatively rich in silica?

One potential source for the higher silica content of many of the rocks in continental crust and in isolated locations within large igneous provinces (such as in Iceland) is previously-existing silica-rich rocks. Another potential

source is fractional melting of basalt (Klevberg, 2007), as observed in eruptions from Hekla volcano in Iceland (Figure 2). Even though relatively low in silica, basalt still commonly contains about 46 to 52% silica (McBirney, 1993). The silica content is high enough that basalt can exhibit alkali-silica reaction when used as concrete aggregate (Korkanç and Tuğrul, 2005); this seems largely related to the glass content of the lava and also occurs in dacites (Figure 4), andesites, and other volcanic rocks.

A potential source of silica not commonly considered (it is not a common present process) is hydrothermal extraction from basalt. The silica forming the sandy bottom of the Blue Lagoon was extracted from seawater pumped through hot basalt. Silica from similar natural

processes during the Deluge could have been a source for silicic rocks such as bedded cherts (e.g., in California's famous Franciscan Formation). The "fountains of the great deep" (Genesis 7:11) could have been responsible for similar concentration of silica in solution. Even today, hydrothermal vents on the sea floor produce "black smokers" and "white smokers" that precipitate sulfide and other minerals, and siliceous sinter is produced in hot springs. Extraction of silica from common rocks by the hydrothermal activity of "the fountains of the great deep" could have resulted in precipitation of silicic rocks on a much wider scale during the Deluge of Genesis than the comparatively tiny examples we witness today.

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Earth-Sourced Impact Events on Day 2 of the Creation Week?

Recent decades have witnessed a growing recognition of impact events in Earth's history. Impact craters, tektites, and shocked minerals attributed to many large impactors have been discovered around the world (Figure 1). In an effort to construct a viable Biblical geological history, young-earth creationists must address these same data. One key issue to resolve is the timing of bombardment episodes.

Certainly the assumption of the validity of the uniformitarian geologic timescale is not acceptable, but some creationists believe that its general framework, as well as "relative" radiometric age-dating can help reconstruct a Biblical chronology of impact events (e.g., Dickens and Snelling, 2008a). They advocate interpreting the history of the Creation Week by direct reference to the various Precambrian Eras/Eons (sans deep time) and adapt this history to the

Biblical framework. As part of this proposal, they accept the use of radiometric age-dates within the framework of the uniformitarian geologic column—but in a "relative" manner (Dickens and Snelling, 2008a).

Interpreting some of the Paleoproterozoic impact structures, Dickens and Snelling (2008a, p. 67) state:

The Vredefort Impact Structure in South Africa is believed to be the oldest (2 Ga) and largest impact structure (estimated 250–300 km diameter original crater) in the world. The Sudbury Impact Structure in Canada is similar in size (estimated 200 km diameter original crater) and age (1.85 Ga). The Shoemaker Impact Structure, the oldest Australian impact structure to date (1.63 Ga), is located on the southern margin of the Paleoproterozoic Eeraheedy Basin, Western

Australia and is approximately 30 km in diameter.

Shifting perspectives to the young-earth Creation/Flood framework, Dickens and Snelling (2008a, p. 70) define these Paleoproterozoic impact structures as having formed on Day 2 of the Creation Week when the earth was undergoing tremendous upheaval; "Paleoproterozoic impact structures are inferred to have formed when material ejected from the earth fell back to earth."

Why are these impact craters (Figure 2) assigned to Day 2? It appears to be based solely on the radiometric age-dates of the surrounding rocks (Froede, 2008). Unfortunately, this approach relies on the uniformitarian geologic timescale to provide a historical chronology, rather than the Bible alone. It also concedes a relative accuracy to radiometric dating that has not been empirically demon-



Figure 1. Manicouagan Lake and impact structure, Quebec. This feature is approximately 41 miles wide and is located on the Canadian Shield in Precambrian rocks (CCRS, 1976). Many such structures of varying sizes have been discovered in the past 50 years as geologists continue to examine Earth. Do we need “relative” radiometric age dating coupled with the geologic timescale to assign a Biblical age to these structures? At this location the Precambrian rocks are covered by Mesozoic volcanic sediments at the lower elevations (CCRS, 1976). What happened to the Paleozoic strata? It is probable that impact features like this formed during the Flood. Modified from NASA image No. 1636-14584, April 20, 1974 (Short et al., 1976).

strated, largely because reported dates are skewed by expectations generated by the timescale.

A better explanation of the impact events in the rock record is the cataclysmic nature of the Flood. An extraterrestrial bombardment occurring during this same period of time provides a better explanation for the formation of these impact craters (Froede and DeYoung, 1996; Froede, 2002; Froede 2009, and references therein) (Appendix).

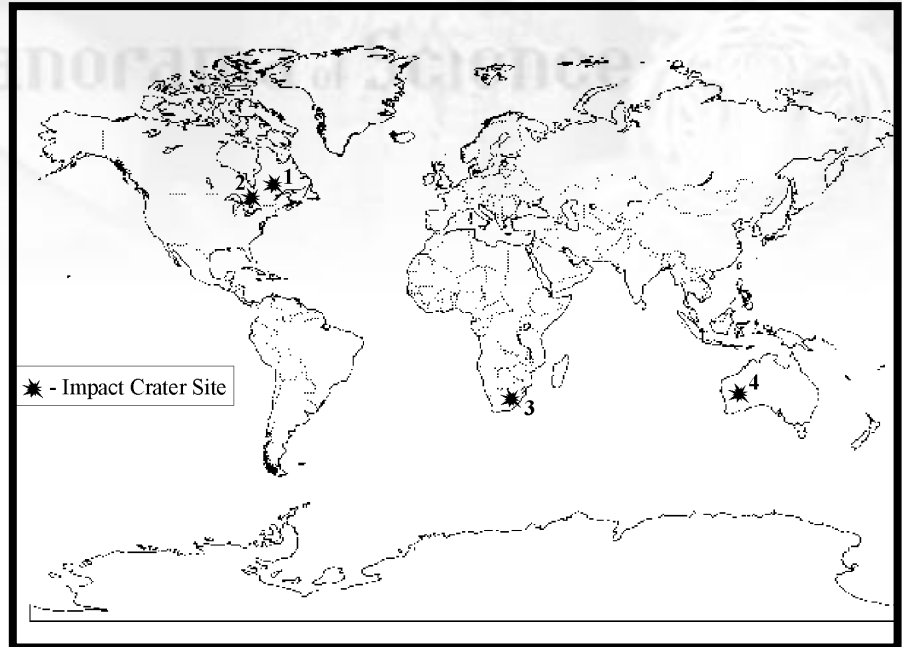


Figure 2. Location of impact craters mentioned in this article. Found in metamorphic and granitic rock thought by secular geologists to be the oldest on Earth, these structures are radiometrically age-dated to the Precambrian. Currently, there are 23 impact craters (of a total of 176) on Earth dated to the Precambrian (Earth Impact Database, 2009). However, without assuming the validity of radiometric dating, these rocks could be interpreted as either from the Creation Week or the Flood. So, determining the age of an impact crater becomes a matter of interpretation. If the only period of bombardment (extraterrestrial or otherwise) occurred during the Flood, then Earth’s impact structures would “date” to that global event. To invoke Earth-ejected materials returning to the surface as impactors during a “Day Two” bombardment is unnecessary, and may diminish the true magnitude of the Flood. Map key: 1. Manicouagan impact crater; 2. Sudbury impact crater; 3. Vredefort impact crater; 4. Shoemaker impact crater (formerly Teague Ring) (Hodge, 1994; Earth Impact Database, 2009).

Creationists should carefully consider whether the “Precambrian” as defined by uniformitarian geologists has any historical significance in the Creation/Flood framework. Many think that some portion of these rocks formed during the Flood, and some were original to Creation. Most of these rocks are problematic, possessing no inherent stratigraphic markers such as fossils or large-scale unconformities, and for that reason the international stratigraphic

community relies on radiometric dates to define and correlate the various eras and eons (Reed, 2008). It is entirely possible that “Precambrian” basement rocks could have formed both during the Creation Week and also during the Flood (Froede and Oard, 2007; Oard and Froede, 2008).

Therefore, there seems to be no compelling reason to force impact events into the Creation Week, other than the perceived need to use a condensed ver-

sion of the uniformitarian framework of Earth history. Young-earth creationists already have credible geological timescales to guide their interpretations of natural history (Walker, 1994; Froede, 1995; Froede, 2007). Utilizing the uniformitarian geological timescale by applying “relative” radiometric age-dates to rocks is unnecessary in reconstructing a geological history dominated by the global Flood of Genesis, as illustrated by the need to force impact events into Day 2 of Creation Week without considering their occurrence during the Flood.

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Appendix

The Sudbury impact structure contains one of the largest nickel deposits in the world. If this precious metal was derived from the Earth's interior (as proposed by Dickens/Snelling), then its origin in the lower mantle or even the iron-nickel core would represent a cataclysm that seems out of place in the events recorded by Genesis 1. However, many geologists believe that the nickel found within the crater was derived from a nickel-iron meteor (Naldrett, 2003). Consistent with that interpretation, I believe that a very large nickel-iron meteor, derived from the asteroid belt, struck this location during the Flood, eliminating the need to assign this crater to a Day Two event (Froede, 2009).

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Letters to the Editor

The policy of the editorial staff of CRSQ is to allow letters to the editor to express a variety of views. As such, the content of all letters is solely the opinion of the author, and does not necessarily reflect the opinion of the CRSQ editorial staff or the Creation Research Society.

C-14 in Dinosaur Bones

I read with great interest Bergman's article (Bergman, 2009). Dinosaurs have always been of great fascination to me. Although creationists don't often think about it, dinosaurs have incredible potential for the creation model. If it could be proved beyond any doubt that their bones are only thousands, not millions, of years old, a 65-million year slice of time would be taken from the evolutionist's pie. If a dinosaur bone is shown to be only thousands of years old, then obviously the geological strata it came from is that same age also. At least 65 million years of the geologic column would have to be condensed by a factor of a thousand. Such a large amount of time would likely call the entire geologic column into question. If the column is unreliable, then so is the theory of evolution. The reason is because the geologic column is the Bible to the evolutionist. If it is unreliable, then one must ask, Can we believe a theory whose foundation is destroyed?

My proposal is that creationists should simply try to radiocarbon date a dinosaur fossil. Since carbon-14 can only be detected at up to 100,000 years, to find any measurable radiocarbon would certainly prove they existed only thousands of years ago.

Although there have been several reports about possible C-14 in dinosaur bones (Fields et al., 1990; Dahmer et al., 1990; see also omniology.com/C-14Verification.html), to my knowledge there is no recent, in-depth, and widely

known paper on confirmed carbon-14 in a dinosaur fossil.

Although radiocarbon has been found in fossilized wood and ammonites from the Cretaceous period (Snelling, 2008), this will not be as devastating to the geologic column as C-14 in dinosaur bones simply because dinosaurs are much more popular and are often used to promote evolution. Would it not be ironic if the very thing used to "push" the theory on the public would be the thing that destroyed it?

Dinosaurs are obviously used to popularize Darwin's tale. The devil loves using them for his godless philosophy because everyone, especially children, are fascinated by them.

If the creation model is correct, then radiocarbon should be found in dinosaur fossils. This is a logical way to test both the evolutionary and creation models. As a creationist, it would not be a surprise to me if C-14 is found in their bones. It is my proposal that creationists start looking for it.

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Infinite Time?

I frequently fly out of the country and enjoy reading recent issues of the *CRS Quarterly* while in flight. I enjoyed reading the recent editorial [CRSQ 46:77].

While reading the article, I noted an important factor was not mentioned but should be brought to the reader's attention, namely, the time factor. While the monkeys (or whatever) and their typewriters could perhaps generate readable literature over a truly infinite period of time, the allotted time "scientists" believe our planet has existed ranges from 8 to 13 billion years only. Certainly this is FAR from an infinite time.

Donald E. Adler

Tetrapod Footprints Stop Evolution in Its Tracks

Over the years I have written a number of papers pushing back the history of four-footed creatures, collectively known as tetrapods, thus removing any possibility of their evolution from lobe-finned fish (Brown, 1996, 1997, 1999, 2001, 2006a, 2006b).

My present argument shows the tetrapods to be so old that they came before the main lines of the lobe-finned fish, making it *impossible* for evolution to have ever occurred!

The fossils are footprints of four-footed land creatures with clear toe impressions, which have been found in a quarry in Poland and dated at 397 million years, giving them a history going back a further 400 million years or more, placing them at the start of the Devonian period or even further back into the Silurian (Amos, 2010). This would put these four-footed creatures well before the main lines of lobe-finned fish and

with four functional limbs would put them well beyond the possibility of their having evolved from anything!

This renders the theory of evolution stone dead and creation spot on, with any features that life-forms may share being the result of the shared-features model spoken of in a number of papers I have written (Brown, 1996), showing that life-forms will remain within their respective kinds thanks to the principle of symmetric variation (Brown, 1999, 2000, 2009).

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Colin Brown
Warrington, UK

Time Travel: One Man's Quest To Make It A Reality

This is a human story that in some respects touches us all. We have all lost a loved one and know how this feels.

Professor Ronal Mallett was ten years old when his father died at the age of 33. A short time after this, he came across the book *The Time Machine* by H. G. Wells, which gave Ron hope of going back in time to see his father and, hopefully, warning him to slow down.

Over the years he has worked non-stop to find a way of attaining this goal. He now feels he has made an important find and in due course hopes to send particles back in time. He now has Professor Chandra Roychoudhuri working

with him; both are at the University of Connecticut.

The main argument against time travel being possible is one most people never seem to address. Let me use an example. Isaac Newton is buried in Westminster Abbey. In order to go back and meet Newton, he and everything in his world would have to have left copies, duplications of everything animate and inanimate, both here on Earth and throughout the entire universe, which, of course, would need an enormous amount of energy to achieve. The next question would be, do these copies also leave copies? This begs the question of whether the universe has the nature to

accomplish this.

On account of this alone, I believe doubts must be raised! The mere idea of taking particles back in time does *not* answer just how we come to get an extant past in the first place. So, whilst I feel for Professor Mallett, I question the feasibility of the subject of time travel.

References

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Colin Brown
Warrington, UK

Instructions to Authors

Submission

Electronic submissions of all manuscripts and graphics are preferred and should be sent to the editor of the *Creation Research Society Quarterly* in Word, WordPerfect, or Rich Text Format (see the inside front cover for address). Printed copies also are accepted. If submitting a printed copy, an original plus two copies of each manuscript should be sent to the editor. The manuscript and copies will not be returned to authors unless a stamped, self-addressed envelope accompanies submission. If submitting a manuscript electronically, a printed copy is not necessary unless specifically requested by the *Quarterly* editor. Manuscripts containing more than 35 pages (double-spaced and including references, tables, and figure legends) are discouraged. An author who determines that the topic cannot be adequately covered within this number of pages is encouraged to submit separate papers that can be serialized.

All submitted manuscripts will be reviewed by two or more technical referees. However, each section editor of the *Quarterly* has final authority regarding the acceptance of a manuscript for publication. While some manuscripts may be accepted with little or no modification, typically editors will seek specific revisions of the manuscript before acceptance. Authors will then be asked to submit revisions based upon comments made by the referees. In these instances, authors are encouraged to submit a detailed letter explaining changes made in the revision, and, if necessary, give reasons for not incorporating specific changes suggested by the editor or reviewer. If an author believes the rejection of a manuscript was not justified, an appeal may be made to the *Quarterly* editor (details of appeal process at the Society's web site, www.creationresearch.org).

Authors who are unsure of proper English usage should have their manuscripts checked by someone proficient in the English language. Also, authors should endeavor to make certain the manuscript (particularly the references) conforms to the style and format of the *Quarterly*. Manuscripts may be rejected on the basis of poor English or lack of conformity to the proper format.

The *Quarterly* is a journal of original writings, and only under unusual circumstances will previously published material be reprinted. Questions regarding this should be submitted to the Editor (CRSQeditor@creationresearch.org) prior to submitting any previously published material. In addition, manuscripts submitted to the *Quarterly* should not be concurrently submitted to another journal. Violation of this will result in immediate rejection of the submitted manuscript. Also, if an author uses copyrighted photographs or other material, a release from the copyright holder should be submitted.

Appearance

Manuscripts shall be computer-printed or neatly typed. Lines should be double-spaced, including figure legends, table footnotes, and references. All pages should be sequentially numbered. Upon acceptance of the manuscript for publication, an electronic version is requested (Word, WordPerfect, or Rich Text Format), with the graphics in separate electronic files. However, if submission of an electronic final version is not possible for the author, then a cleanly printed or typed copy is acceptable.

Submitted manuscripts should have the following organizational format:

1. Title page. This page should contain the title of the manuscript, the author's name, and all relevant contact information (including mailing address, telephone number, fax number, and e-mail address). If the manuscript is submitted by multiple authors, one author should serve as the corresponding author, and this should be noted on the title page.

2. Abstract page. This is page 1 of the manuscript, and should contain the article title at the top, followed by the abstract for the article. Abstracts should be between 75 and 200 words in length and present an overview of the material discussed in the article, including all major conclusions. Use of abbreviations and references in the abstract should be avoided. This page should also contain at least five key words appropriate for identifying this article via a computer search.

3. Introduction. The introduction should provide sufficient background information to allow the reader to understand the relevance and significance of the article for creation science.

4. Body of the text. Two types of headings are typically used by the CRSQ. A major heading consists of a large font bold print that is centered in column, and is used for each major change of focus or topic. A minor heading consists of a regular font bold print that is flush to the left margin, and is used following a major heading and helps to organize points within each major topic. Do not split words with hyphens, or use all capital letters for any words. Also, do not use bold type, except for headings (italics can be occasionally used to draw distinction to specific words). Italics should not be used for foreign words in common usage, e.g., "et al.", "ibid.", "ca." and "ad infinitum." Previously published literature should be cited using the author's last name(s) and the year of publication (ex. Smith, 2003; Smith and Jones, 2003). If the citation has more than two authors, only the first author's name should appear (ex. Smith et al., 2003). Contributing authors should examine this issue of the CRSQ or consult the Society's web site for specific examples as well as a more detailed explanation of

manuscript preparation. Frequently-used terms can be abbreviated by placing abbreviations in parentheses following the first usage of the term in the text, for example, polyacrylamide gel electrophoresis (PAGE) or catastrophic plate tectonics (CPT). Only the abbreviation need be used afterward. If numerous abbreviations are used, authors should consider providing a list of abbreviations. Also, because of the variable usage of the terms “microevolution” and “macroevolution,” authors should clearly define how they are specifically using these terms. Use of the term “creationism” should be avoided. All figures and tables should be cited in the body of the text, and be numbered in the sequential order that they appear in the text (figures and tables are numbered separately with Arabic and Roman numerals, respectively).

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6. References. Authors should take extra measures to be certain that all references cited within the text are documented in the reference section. These references should be formatted in the current CRSQ style. (When the *Quarterly* appears in the references multiple times, then an abbreviation to CRSQ is acceptable.) The examples below cover the most common types of references:

Robinson, D.A., and D.P. Cavanaugh. 1998. A quantitative approach to baraminology with examples from the catarrhine primates. *CRSQ* 34:196–208.

Lipman, E.A., B. Schuler, O. Bakajin, and W.A. Eaton. 2003. Single-molecule measurement of protein folding kinetics. *Science* 301:1233–1235.

Margulis, L. 1971a. The origin of plant and animal cells. *American Scientific* 59:230–235.

Margulis, L. 1971b. *Origin of Eukaryotic Cells*. Yale University Press, New Haven, CT.

Hitchcock, A.S. 1971. *Manual of Grasses of the United States*. Dover Publications, New York, NY.

Walker, T.B. 1994. A Biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.

7. Tables. All tables cited in the text should be individually placed in numerical order following the reference section, and not embedded in the text. Each table should have a header statement that serves as a title for that table (see a current issue of the *Quarterly* for specific examples). Use tabs, rather than multiple spaces, in aligning columns within a table. Tables should be composed with 14-point type to insure proper appearance in the columns of the CRSQ.

8. Figures. All figures cited in the text should be individually placed in numerical order, and placed after the tables. Do

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Submission of letters regarding topics relevant to the Society or creation science is encouraged. Submission of letters commenting upon articles published in the *Quarterly* will be published two issues after the article's original publication date. Authors will be given an opportunity for a concurrent response. No further letters referring to a specific *Quarterly* article will be published. Following this period, individuals who desire to write additional responses/comments (particularly critical comments) regarding a specific *Quarterly* article are encouraged to submit their own articles to the *Quarterly* for review and publication.

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Occasionally, the editor will invite individuals to submit differing opinions on specific topics relevant to the *Quarterly*. Each author will have opportunity to present a position paper (2000 words), and one response (1000 words) to the differing position paper. In all matters, the editor will have final and complete editorial control. Topics for these forums will be solely at the editor's discretion, but suggestions of topics are welcome.

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All book reviews should be submitted to the book review editor, who will determine the acceptability of each submitted review. Book reviews should be limited to 1000 words. Following the style of reviews printed in this issue, all book reviews should contain the following information: book title, author, publisher, publication date, number of pages, and retail cost. Reviews should endeavor to present the salient points of the book that are relevant to the issues of creation/evolution. Typically, such points are accompanied by the reviewer's analysis of the book's content, clarity, and relevance to the creation issue.

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Creation Research Society

History—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (graduate degrees in science) and about 1000 non-voting members. The *Creation Research Society Quarterly* is a peer-reviewed technical journal. It has been gradually enlarged and modified, and is currently recognized as one of the outstanding publications in the field. In 1996 the CRSQ was joined by the newsletter *Creation Matters* as a source of information of interest to creationists.

Activities—The Society is a research and publication society, and also engages in various meetings and promotional activities. There is no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund and research center are maintained to assist in such projects. Contributions to the research

fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates The Van Andel Creation Research Center in Chino Valley, Arizona.

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1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.

3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.

4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation can come only through accepting Jesus Christ as our Savior.

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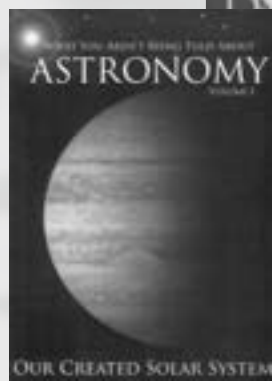


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