Seeking geological understanding: catastrophism to uniformitarianism and (partly) back to neocatastrophism

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Abstract: Until a few centuries ago scholars in the western, mostly Christian, world accepted the truth of the Bible and its account of creation and a global flood. This gradually began to change, especially during the 18th century Enlightenment. Eventually this was replaced by what became known as uniformitarianism – geological processes and events occurred slowly and gradually, over millennia. The shift was primarily a *choice*, without convincing evidence. Early geologists generally were convinced that the geological record was produced by catastrophic, rapid geological processes. For many of them this included the biblical flood. A new, uniformitarian understanding of geology was developed especially by two geologists between the late 1800's and mid 1900's, arguing that geological processes proceeded slow and gradually, over very long time periods, with only occasional, unusual catastrophes.

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Introduction

We will be discussing the history of when and why the field of geology moved from catastrophism to uniformitarianism; from believing in a biblically compatible understanding of geology, to commitment to a long-ages time scale without a global flood. It was a long and complex episode, but we will summarize the essential nature of this transformation. This topic is significant because modern intellectual culture portrays this shift as the necessary and inevitable result of new scientific evidence in biology and geology. Is this true? Was the change really the result of the new evidence that became available, or were there other important factors behind the change from confidence in the Bible to confidence in geological theory? What can we tell our students and church members?

The history of geological thought has been strongly influenced by the surrounding culture, and by personal choices made by prominent scientists and philosophers, as will be seen in the discussion to follow. Definitions of some terms used in this discussion are given below, before the references section.

Early History of Geological Thought

In the early centuries after Christ, geological thought was poorly developed. It took several centuries for fossils to even be seen as remains of actual organisms. Some were explained as “sports of nature”, or misinterpreted as mineral objects. They finally were increasingly recognized for what they are – the remains of animals or plants

buried and preserved. Until the 18th century the biblical flood was about the only known feasible explanation for these organic remains (Rudwick 1976). Understanding of the nature and the rate of geological change also had a long and complex history. In geology, as early as the 15th century there were some uniformitarian ideas, of slow, gradual geological changes, as well as more catastrophic interpretations. Among experienced geologists, catastrophist theories of geology became the prominent interpretation, and remained so into the 19th century (Huggett 1990).

Until a few centuries ago scholars in the western, mostly Christian, world accepted the truth of the Bible and its account of creation and a global flood. This gradually began to change, especially during the 18th century Enlightenment, with some scholars advocating philosophies that were not compatible with the Bible. I suggest that the Reformation, oddly enough, inadvertently supported this change. Before the reformation the Catholic church expected its followers to be constrained to follow what the church taught them. The reformers opened minds for people to do more thinking for themselves. This led many Christians to follow the Bible rather than church dogmas. For persons who did not wish to follow the Bible it likely led to more freedom to think in other ways as well. Whether or not that is correct, there began a gradual division of the population into faithful Bible believers and those who moved away from viewing the Bible as an authoritative book. This move resulted from factors that we will discuss below. It also involved a *choice*, without convincing evidence - a choice by some scholars to leave the Bible behind and develop and advocate a more liberal understanding of the Bible, or even a materialist philosophy. These trends also were evident in the understanding of geology – some professional geologists accepting the Genesis account of creation followed by a catastrophic, global flood, and another group moving away from accepting a literal creation and catastrophic flood, to a materialist, or naturalistic geological theory, not influenced at all by the Bible. In addition, the new Newtonian mechanics unintentionally enhanced secular thinking, even though Newton and others were strong believers in a biblical understanding of nature.

This resulted, among geologists in recent centuries, in the development of two schools of geological interpretation: (1) Rock formations were formed rapidly and

catastrophically (catastrophism). Some adjectives used at the time, to describe the understanding of these catastrophic events were momentous, violent, sudden, ruinous, unexpected, and widespread. 2) Rock formations were formed by natural agencies, smoothly, ceaselessly, locally, slowly and gradually (uniformitarianism or gradualism) (Huggett 1990, p. 3).

Catastrophist Geology

During the time when much of the western scholarly world still believed the Bible, scientists believed that geological layers formed through catastrophic processes. Before about 1830, most geologists were catastrophists, some influenced by belief in the Genesis account of a global flood, but others just saw evidence in the rocks for a catastrophic origin. These ideas developed especially in England, where the study of geology began. The early English catastrophists were generally deists, but were willing to invoke God to initiate a global flood.

Catastrophism was prominent among geologists into the last half of the 18th century and into the 19th century (Huggett 1990, p. 41-44). The early catastrophists saw Noah's flood as the only event since creation capable of making significant geological change in the earth. This group included Thomas Burnet, John Woodward, William Whiston, and Alexander Catcott. A group known as English diluvialists (Adam Sedgwick, Daniel Conybeare, and William Buckland later in his life) believed in a succession of catastrophes in earth history, with the last one probably being Noah's flood. Some, known as Scriptural geologists, in the early 19th century also rigidly followed the Bible, but allowed more variation in geological processes (Buckland in part, Sedgwick, Conybeare, Roderick Murchison). All were believers in the Bible, and they tried to harmonize events of geology in Genesis, with an understanding of scientific concepts. For many of these early geologists the catastrophes were usually global, or at least continental, and highly destructive.

The Choice to Shift Away from Catastrophism

Beginning in the 18th century there was more study of rock strata and familiar events like earthquakes and volcanoes. More evidence was seen to indicate that geological processes were more complex than had been realized before. From about 1750 to 1830 catastrophes, including Noah's flood began to be regarded as natural events, rather than supernatural. After about 1830 scriptural geology faded from the English scene, but remained popular in the United States. By 1830 the professional geological community did not believe that catastrophes had a supernatural cause.

Two geologists are especially recognized as leading the move away from biblical geology. The first was James Hutton, who published his book *Theory of the Earth* in 1788, with a uniformitarian view of geological history (Hutton 1795). The essence of his theory can be portrayed with his phrase "no vestige of a beginning and no prospect of an end." He still saw geological processes as God's agents to accomplish His will. Hutton presented a revolutionary understanding of geology, but he was not a good writer and he had relatively little influence.

In the early 1800's Charles Lyell was a more effective advocate of uniformitarianism. His *Principles of Geology* (Lyell 1830–1833), was the beginning of the end for catastrophist doctrines. His book can also be understood as the beginning of Geology as an organized science. Lyell's ideas did not result from pulling together and organizing the evidence and the geological understanding of the day. He did not like catastrophist ideas, and he *chose* to develop his own uniformitarian theory of geology (gradualism), which essentially banned catastrophic interpretations of geological evidence. He was a lawyer, skilled at arguing his case, and a good writer, and he consequently had much more influence than Hutton.

Harvard paleontologist Stephen J. Gould, in his review of Lyell's work suggested that Lyell took a culturally derived concept and imposed it on geology. Gould also concluded that the catastrophists were better observers than Lyell. Lyell chose to develop his personal thinking about geological interpretation, even though the evidence favored catastrophist interpretations. "Lyell won with rhetoric what he could not carry with data (Gould 1987)." He effectively succeeded in banning catastrophist interpretations from geology for a century. Gould was definitely not a believer in the

biblical account of origins, but he recognized weak points in Lyell's work. According to Gould, "Lyell's gradualism has acted as a set of blinders, channeling hypotheses in one direction among a wide range of plausible alternatives (Gould 1984)."

I wish to emphasize a point that is referred to above, because I believe it is central to the issues we are dealing with. The philosophical shift characteristic of the Enlightenment was the result of *choices* to move away from confidence in the Bible and a biblical worldview. However, this was not just a blind, stubborn denial of Scripture, but several developments in the Christian world weakened confidence in the Bible and in religious faith. These involved fragmentation among Christians in how they interpreted the Bible (Catholicism vs the growing number of protestant traditions and their doctrinal disagreements), and resultant serious religious wars (e.g. the 30 years' war and the English civil war). Conflicts such as this influenced many scholars to move to Deism, rationalism, or empiricism, or to reject the reliability of the Bible altogether, and replace it with confidence only in human reason and science. It was no doubt, at the time, difficult to find the right path through these controversies. In retrospect we can recognize that the resulting scholarly shift was not caused by actual evidence that claims in the Bible were not true. Rather, the problem arose from human errors such as inadequate study of the Bible and its claims, and using power (religious wars) instead of study and discussion to resolve religious differences (Brown 2014; Bray 1996). So, the rise of doctrinal controversies and religious wars was not from problems with the Bible; the problem was with people (Christians) who were behaving badly. Also, amid the growing conflict between science and biblical claims such as miracles and creation, the available scientific evidence at the time, in biology, geology, and cosmology was not adequate to bring solid understanding.

An example of this conflict was a misreading of the meaning of the Copernican revolution. The church accepted the Geocentric universe as true and biblical, although it really came from Greek philosophy, not from the Bible or from convincing science. The acceptance of the heliocentric universe was seen, at the time, to contradict the Bible, but it only contradicted dogmatic church doctrine that had its roots in Greek philosophy (Finocchiaro 1989; Milan 1999).

In retrospect once again, it is increasingly evident that the advance of science into the 21st century is revealing the inadequacies of the science available during the Enlightenment and in the succeeding century. Darwin's theory of evolution could seem convincing at the time, but the 19th century understanding of biology was in some ways primitive, and today Darwinism is encountering significant, unanswerable scientific challenges. Also, in geology the arguments against the biblical global flood are encountering growing difficulties (Meyer 2009, 2013; Shapiro 2011; Tour 2016; Brand and Chadwick 2016; Also see the vimeo https://vimeo.com/635821123).

To summarize this brief presentation of a very large subject, the movement away from confidence in the reliability of the Bible was ultimately the result of human errors and inadequate information, combined with a *choice* to develop perspectives on life and history based on human wisdom, that were different from the Bible. The same can be said of Lyell's uniformitarian philosophy. Lyell made a *choice* to think that way, even though the evidence was not in his favor. Since scholars in other disciplines were at that time choosing to abandon biblical thinking, it is not surprising that Lyell also chose to follow this same path. That way of thinking was "in the air" and it was probably inevitable that some geologists would find the same route attractive. These choices have hardened into a settled scholarly denial of biblical perspectives, and a preference to think that we know better. This is still because of *choices* by much of the human population to think that way, and not from evidence against the Bible's reliability. The more we choose skepticism of the Bible, the more likely that all evidence will be persistently *interpreted to fit* the assumptions of this prevailing mindset. I will not try to demonstrate that my interpretation is correct, but I wish to challenge readers to carefully evaluate it for themselves.

The Geological Evidence and the Choice

The difference between catastrophism and uniformitarianism can be illustrated by interpretations of the history of a gigantic canyon in Canyonlands National Park, in Utah, USA.

Figure 1

Figure 1*. A gigantic canyon in Canyonlands National Park, with the Green River flowing through it. The skyline in the distance (arrow) is the upper rim of the canyon, and the river is the bottom of the canyon. The prominent white rim near the bottom of the canyon is one of the more erosion-resistant, widespread rock units. Photo by Leonard Brand.*

We will discuss two stages in the history of the canyon – 1) the deposition of the rock layers that form the walls of the canyon, and 2) the erosion of the canyon. The table below summarizes these two, as interpreted by the contrasting philosophical positions of catastrophism and uniformitarianism.

History of the canyon in the photo above:

1. ***Deposition of the rock layers (strata)***

   Catastrophism – the strata were deposited by a vast catastrophic flood of water across this area and far beyond. This flood can be seen as at least part of the global flood.

   Uniformitarianism – the strata were deposited by rivers or other local processes, slowly accumulating the sediment over millions of years.

2. ***Erosion of the canyon***

   Catastrophism – the canyon was eroded rapidly and catastrophically by an immense flood across this part of Utah. The flood came from Wyoming and Colorado (and beyond), across this region on its way to California and the Gulf of California. During this process it removed an unimaginable number of cubic kilometers of sediment. As the water flow decreased, the much smaller river remained, following the drainage pattern established by the original flood, all the way to California.

   Uniformitarianism – the canyon was eroded over millions of years by this medium-sized river as it slowly meandered back and forth through this region on its way to California, cutting lower into the rock strata, until it removed all the rock

material originally filling what is now the canyon (see the comments below on the "piddling school" of geology).

The catastrophist interpretation requires that this entire process was part of a huge event – the biblical flood or something equivalent. This will not be acceptable within contemporary geological theory. On the other hand, the uniformitarian interpretation is consistent with the assumptions of modern geology, but it faces very significant scientific challenges. The geological processes active in the modern world produce smaller, more localized deposits such as river channel deposits. They do not deposit layer after layer of sedimentary rock that uniformly covers thousands to hundreds of thousands of square kilometers, as is seen in this part of Utah, and far beyond this area. Also, in a uniformitarian process, a river eroding a region with these extensive rock layers would slowly, over millennia, produce far more complex erosion patterns, not vast, cleanly cut canyons as seen here in Canyonlands. The decision to accept Lyell's uniformitarianism was led, not by the evidence, but by the *choice* to accept a particular philosophy with its set of assumptions.

Charles Darwin read Lyell's books while on his famous voyage on the Beagle. This was important for the development of his theory of evolution, because it helped to provide the immense time periods needed to make evolution appear feasible. Scientific advances, especially in recent decades, are making that time for evolution irrelevant. To ask how long it will take for random biochemical mutations to produce a living cell with its numerous and awesome molecular machines, is equivalent to asking how long it will take for my Toyota to swim across the Atlantic Ocean.

Lyell's uniformitarianism was not accepted enthusiastically by all geologists. In some cases it met with sarcasm and humor. The geologist Murchison was delighted by a cartoon lampooning the "piddling school" of geology. The cartoon depicted a child urinating in a broad valley, with the implication that this little stream of water produced the entire valley, as understood by uniformitarian theory (Haile 1997). But in spite of some opposition, uniformitarianism soon dominated geological thought.

Uniformitarianism Adjusts to New Evidence

After Lyell the opposition to catastrophic interpretations held sway for a century, but trouble appeared in the early 20th century, in the person of independent thinking geologist J Harlen Bretz (Baker 1978, 1995; Soennichsen 2008). Bretz began several decades of research, from 1922 to 1952, in the chaotic landscape of eastern Washington State, called the Channeled Scabland. Bretz was convinced the evidence could only be explained by a massive, catastrophic flood of water across this region. Others, including the leading geologists of the time, could not stomach his catastrophist ideas, which presumably had been eliminated from geology by Lyell. When Bretz published papers and gave presentations at geological meetings, those who disagreed did not go to eastern Washington to examine Bretz's evidence. They responded with their own theories of how the Scabland could have been carved by slow, more conventional, acceptable processes. On one occasion Bretz was invited to present his theory at a national geology meeting, dealing with the Scabland. Bretz carefully prepared, hoping to make progress in convincing the group of his theory. But the meetings were actually a deliberate setup, to ridicule Bretz. Bretz, however, was persistent, and in time his stubborn persistence and accumulating evidence turned the tide. At one set of geology meetings late in this process, U.S. Geological Survey geologist Joseph Pardee gave a talk with a noncommittal title, but he presented new evidence that just quietly "blew away the opposition" to Bretz's theory. Finally, for the first time, a geology field trip with prominent geologists went to look at the Scablands. After seeing the evidence for himself, one geologist who had vigorously opposed Bretz, said "How could I have been so wrong?"

The Bretz episode is recognized as finally showing that Bretz was right and Lyell was wrong. Catastrophic geological processes do occur. This, in time, has developed into a new era in geology referred to as neocatastrophism. However, geologists are not accepting flood geology – not at all (Rogers 2017). Catastrophist interpretations with lots of time between catastrophes are OK, if supported by adequate evidence. But questioning the standard geological (radiometric) timescale is not OK, and proposing a global flood catastrophe is not OK. We could refer to the result as a modern version of

uniformitarianism. The accepted viewpoint recognizes that catastrophes do occur, but they are understood as unusual events, and geological deposits are believed to normally form slowly and gradually over millions of years. Ancient geological deposits are understood as deposited and eroded only by processes active or feasible today. This would include rivers, streams, lakes, local flash floods, ocean currents, desert winds, and volcanoes (neocatastrophism). This uniformitarian explanation of modern geological processes is not convincingly supported by evidence, but is the result of philosophical *choices* during the last couple of centuries – deliberate choices to reject the biblical, catastrophist view of ancient history. This was a choice that was, and is being made, even by Catholic and mainline Protestant churches, and today we also must make our choice.

Recognition of rapid geological events characteristic of neocatastrophism has grown quickly, even in recent decades. The incidence of geological papers using terms in their titles or key words like catastrophe, tsunami, storm, hurricane, earthquake, hazard, has increased exponentially since about 1990 (Marriner et al. 2010). This is true, even among those who follow uniformitarianism. A prominent advocate of neocatastrophist interpretations was English geologist Derek Ager (Ager 1981). He did extensive global travel, getting acquainted with the geology of many countries. He concluded that much evidence was characteristic of catastrophic processes. He suggested that geological history can be compared with the life of a soldier – moments of terror separated by long periods of boredom. He also recognized that geological deposits characteristic of specific parts of the geological column were very similar in many places on earth, which implied a global process. He saw this and other evidence to be problematic for accepted geological theory, although he warned creationists not to try to give a biblical explanation to the evidence.

Recognizing Biblical Insights

For several decades some of us have been using a different approach, using the Bible account of the flood and a geological time frame of only a few thousand years to

open minds to recognize new explanations that are more compatible with the geological evidence than secular explanations are. This process is being quite successful, and certainly much more successful now than it was two centuries ago when geological understanding was less advanced.

A long-ago episode in understanding the relationship between geology and the Bible sheds light on this topic. In the 18th century it was known that extensive chaotic deposits of rock debris, including large erratic boulders, covered parts of England. Using the Bible to help understand geologic deposits, these were interpreted as deposited by Noah's flood. In the early 19th century there was a long debate over these deposits, and finally, led by Louis Agassiz, Buckland and others, it was recognized that they resulted from the movements of continental ice sheets during a Pleistocene ice age, rather than from the flood (Imbrie and Imbrie 1979). After much discussion this explanation was accepted by the geological community, and because of the failure of their flood interpretation of these deposits, prominent geologists became discouraged with the prospect of seeking biblical assistance in interpreting geology. By the time Lyell's geological theory became established biblical interpretation of geology was given up.

This episode could be taken as reason for not looking to the Bible today for help in understanding geology. However, that would be a misunderstanding of what happened in the early 1800's. Before the establishment of the ice age theory the only process known by anyone, likely to cause such widespread chaotic geological deposits was Noah's flood. But at that time some areas of geological theory were still in their infancy. This included explanations for evidence left behind by the continental ice sheets and how they fit into an overall geological theory. We can understand why the biblical geologists at that time became discouraged by this turn of events, but it was just too early in geological theory development for them to possibly understand the best interpretation of the available evidence. The possibility of reaching a correct understanding of the relationships between the flood, the ice age, and other geological episodes was still far in the future. Today, although we are still a long way from having a complete understanding of geological history, much has been discovered in the last

two centuries. This increase in knowledge of geological processes and events greatly reduces the likelihood of seriously misinterpreting the evidence, as the biblical geologists did in the early 19th century. We believe an approach that allows the Bible to open up better geological interpretations, used in the richer geological environment of the 21st century can in time result, and is already resulting, in significant improvements in geological understanding for those willing to take the Bible seriously. There are a number of specific examples of this work that have been presented in other places (Brand 2023; Brand and Chadwick 2016).

Conclusion

The cultural change from confidence in Scripture to supreme confidence in science was not the result of new and better scientific evidence. In large part it was a gradual philosophical shift – a growing wish by thought leaders to move away from a biblical, God-centered approach, and devise our own explanations. They thought the evidence was on their side, but in reality, their own thinking and choices were the important factors influencing how they interpreted the evidence. But now a realization of what that philosophical shift has done to us, has awakened many Bible-oriented scholars. Consequently, the dominating modern theories of evolution and long-ages geology are actually facing increasing scientific challenges. As the cultural commitment to contemporary evolution and long geological time deepens into something approaching dogma, many scholars are encouraged to think more deeply and reexamine the evidence.

We can encourage our students and church members to realize how these personal choices through the centuries have led to unrealistic confidence in what popular science tell us about biological and geological history, and ask deeper questions of science. This and other papers in this series can assist us to better understand the true nature of the evidence, and grasp the deep insights that the Bible provides for us.

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DEFINITIONS

Catastrophism: Geological processes have often been rapid and catastrophic in the past. Bible-based catastrophism, as discussed here, is understood to begin with miraculous creation of life, followed later by a catastrophic global flood.

Materialism (naturalism): The philosophy based on the assumption that the material universe is all there is. According to this philosophy, there are and have never been any miracles.

Uniformitarianism (gradualism): Geological processes in the past were slow and gradual, over millions of years. Ancient geological processes occurred by the same processes seen in the modern world, such as sedimentation and erosion by rivers, streams, local flash floods, volcanoes, etc.

Worldview: A set of explanations for where we came from, why we are here, where we are going, and how we understand our world. It also answers many other questions, such as, was the biblical story of origins correct.

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APPENDIX

FIGURE 1