

Chapter 5

What a Catastrophe!— Science Abandons Uniformitarianism?

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Introduction: the Uniformitarian Accusation

Over the last century it has been frequently claimed by defenders of a traditional reading of Genesis that one of the main reasons why scientists are blind to data supporting a world-wide Noachian Flood is because geology is philosophically uniformitarian. By this it is implied that geologists regard the present as the only reliable key to the past and in order to explain geological history will invoke only those very slow, gradual processes which can be observed in operation today. While this accusation was voiced in the late nineteenth century it was not until 1902 that the young George McCready Price levelled this charge in recognisably scientific form.¹ The argument changed very little over the next 70 years. Clearly these claims have been made in order to discredit the methodology and hence the reliability of geological science.

However, the last four decades have seen change. From the early 1970s some conservative evangelicals, while still criticising uniformitarianism, have correctly reported movement by the geological establishment in the opposite direction. They have pointed out, sometimes with glee, that recent data have dragged geologists, kicking and screaming, back to some degree of catastrophism! Some have gone further, implying that this reversal suggests growing

scientific support for a traditional, world-wide Noachian flood. In contrast to the first claim, any assertion of this latter kind clearly recognises some validity and value in geological science.

My purpose in this chapter is to investigate both of these claims. Although now less frequently expressed in the literature, the first requires attention since it is still occasionally heard and I believe it continues to inform the traditional perspective for some. The second requires evaluation for different reasons. Have recent shifts away from uniformitarian paradigms and towards the recognition of violent episodic events as agents of major geological change, that is, the emergence of what has been called “neo-catastrophism”, reflected scientific support for a universal Flood? A number of subsidiary questions emerge along the way. What are the meanings of the terms “catastrophism” and “uniformitarianism” (uniformity)? How and when did these ideas originate and with whom? What evidence challenged the reign of unconditional uniformitarianism within geology? Some attempt is made to provide brief answers to these questions as well.

The relevance of these points to the contemporary dialogue concerning Noah’s Flood needs no pointing out. Whitcombe and Morris stated the obvious, “... the Biblical doctrine of the Flood cannot be harmonised with the uniformitarian theories of geology”.²

Origin and Meaning of the Terms “Catastrophism” and “Uniformitarianism”

It could be said that the concept of a major disruption to the natural order, if not the term “catastrophism” itself, has always been a part of western collective thought because of the Judeo-Christian tradition of the Flood. Although geographic and geological data from about the seventeenth century gradually eroded the traditional understanding of the Flood for mainstream scientific thought, the concept proved remarkably resilient, being reincarnated a number of times as the explanation for various types and extents of geological formations, including those now deeply buried and, later, just topographical phenomena. Most of these Flood models involved violence and disruption on a massive scale, i.e. catastrophe. The diluvial catastrophism of Georges Cuvier, first published in 1812, was perhaps the last of these expressions.³

According to Cuvier's view, many sedimentary deposits, or the "secondary" and "tertiary" strata, as they were known at that time, had been laid down as a result of successive, transient and often violent catastrophes which had occurred over a long period of time. He asserted that these catastrophes had resulted in the extinction of a number of species. Speaking of the last of these he wrote, "If there is any circumstance thoroughly established in geology, it is that the crust of our globe has been subjected to a great and sudden revolution, ..." ⁴

The other great diluvialist of the period, William Buckland, speaking of what he understood to be incontrovertible evidences for Noah's flood, wrote:

Geology of itself must have called in the assistance of some such catastrophe, to explain the phenomena of diluvian action which are universally presented to us, and which are unintelligible without recourse to a deluge exerting its ravages at a period not more ancient than that announced in the Book of Genesis. ⁵

It was particularly the diluvial catastrophism of these two figures which became the focus of sustained and vigorous attack by those who felt that past geological processes had been smooth and gradual, no more violent than those they could observe in action around them. The fact that catastrophic processes had long been associated with models that involved miraculous, theistic interventions provided the larger context for these criticisms. As a result of the growing secularist influence, by the early 1800s such interventions were becoming increasingly unpalatable for science.

Although the geological term "uniformitarianism" would not be employed until 1832, as noted later in this section, it is generally acknowledged that the concept is much older and may be dated to the times of Frenchmen Benoit de Maillet and Georges-Louis Leclerc, the Comte de Buffon. De Maillet, one of the early advocates of what would later be called neptunism, took the view that rock formations had precipitated out of sea water in a slow and gradual manner as the ocean level gradually dropped over vast periods of time. While these ideas were committed to paper between 1692 and 1718 he chose to publish them much later, in 1748, and anonymously, under the pseudonym *Telliamed* (his name spelt backwards). Thirty years later the Comte de Buffon, in *Les époques de la nature* (1778), incorporated de Maillet's views of a gradually drying ocean into a comprehensive

cosmogony purporting to describe first the formation of the solar system and then the subsequent slow cooling of the Earth and the development of many of its surface features.⁶

A firmer footing for uniformitarian ideas was provided by the Scottish Enlightenment philosopher and geologist, James Hutton, who is often credited with formalising many of the foundations of modern geology. Certainly, he presented the most forthright uniformitarian claims made up to the year 1830. In his *Theory of the Earth*, published in final form in 1795, he assumed a long time-scale for the geological processes by which Earth's surface had been formed. Although not referring to his work, Hutton followed the Comte de Buffon and others in suggesting that such features should be explained in terms of those gradual, natural processes which could be observed currently in operation. He developed these ideas into a "steady-state", even cyclic, view of nature. It should be noted that such steady-state ideas, as found for example in the perpetual hydrological cycle, also proposed about that time and to which Hutton was a contributor, "were much in vogue". Hutton's view of endless cycling is probably best expressed in the famous words with which he concluded *Theory of the Earth*: "The result, therefore, of our present enquiry is, that we find no vestige of a beginning,—no prospect of an end."⁷

Hutton's philosophy was further enunciated after his death by his Edinburgh friend and self-appointed populariser, John Playfair, in the following terms:

Amid all the revolutions of the globe, the economy of Nature has been uniform, in this respect, as well as in so many others, and her laws are the only things that have resisted the general movement. The rivers and the rocks, the seas and the continents, have been changed in all their parts; but the laws which direct those changes, and the rates to which they are subject, have remained invariably the same.⁸

However, as far as long-term influence is concerned, by far the most significant promotor of uniformitarian ideas was Charles Lyell, whose *Principles of Geology* was initially subtitled: *Being an Inquiry How Far the Former Changes of the Earth's Surface Are Referable To Causes Now in Operation*. This work was first published in three volumes from 1830–1833. The quote from Playfair cited above was used on the frontispiece of some later editions.⁹

It is interesting to note that Lyell's *Principles* went through nine editions in the 23 years between 1830 and 1853, with considerable re-working and updating of material being done between editions. Furthermore, the number of volumes varied from three (early editions), to four (3rd and 4th editions) to one (7th, 8th and 9th editions). Between the 5th and 6th editions some of the material was split off into another work, *The Elements of Geology*, first published in 1838.¹⁰ The 10th edition appeared in 1866 and the entirely revised 11th edition, in 2 volumes, in 1872. All were initially published by John Murray, London, but were quickly taken up by other publishers, such as Hilliard, Gray & Co, in Boston. While the same point may have been made in many editions, the wording used was often different. Such a large number of disparate editions clearly makes the sourcing, referencing and comparison of Lyell's statements somewhat difficult. The earliest version which I could physically examine was the 9th edition (1853), held by the State Library of New South Wales. Some earlier editions were also accessed on the internet.

Lyell borrowed much from Hutton. He stated that the latter's treatise:

... was the first in which geology was declared to be in no way concerned about 'questions as to the origins of things;' the first in which an attempt was made to dispense entirely with all hypothetical causes, and to explain the former changes to the earth's crust, by reference exclusively to natural agents. Hutton laboured to give fixed principles to geology, as Newton had succeeded in doing for astronomy...

The characteristic feature of the Huttonian theory was, as before hinted, the exclusion of all causes not supposed to belong to the present order of nature¹¹

In this context Lyell eulogised Hutton's "fearless spirit", his "unwearied" application and the manner in which he was "constantly arriving at grand and comprehensive views of geology."¹² Gould comments that, picking up on these sentiments, Lyell also wished to "transfer the timeless majesty of Newton's cosmos to an earth that most of his colleagues viewed as progressing in definite and limited directions powered by occasional, devastating paroxysms."¹³ He wished to formulate geology in the same dynamic, steady-state terms

as those in which the timeless cosmos rolled on. It is not hard to see how such a wish could translate into uniformitarianism.

Although generally positive to the point of hyperbole concerning the work of Hutton, Lyell took him to task for proposing the sudden elevation of large land-masses, since such an idea was incompatible with the general thesis of uniformity:

Already therefore, we may regard the doctrine of the sudden elevation of whole continents by paroxysmal eruptions as invalidated; and there was the greatest inconsistency in the adoption of such a tenet by the Huttonians, who were anxious to reconcile former changes to the present economy of the world. It was contrary to analogy to suppose, that Nature had been at any former epoch parsimonious of time and prodigal of violence...¹⁴

In Volume 3 of the 1st edition of *Principles* Lyell speaks scathingly of the catastrophists of his time:

We are ... told of general catastrophes and a succession of deluges, of the alternation of periods of repose and disorder, of the refrigeration of the globe, of the sudden annihilation of whole races of animals and plants, and other hypotheses, in which we see the ancient spirit of speculation revived, and a desire manifested to cut, rather than patiently to untie, the Gordian knot.¹⁵

In the 9th edition Lyell describes his method of argument in the following words:

The readiest way, perhaps, of persuading the reader that we may dispense with great and sudden revolutions in the geological order of events, is by showing him how a regular and uninterrupted series of changes in the animate and inanimate world, may give rise to such breaks in the sequence, and such unconformability of stratified rock, as are usually thought to imply convulsions and catastrophes.¹⁶

In fact Lyell's views of what became known as uniformitarianism consisted of hybridised but separable strands. These were independently recognised as such in the 1960s by Gould, Hooykass, and Simpson.¹⁷ Gould has differentiated four distinct meanings of uniformitarianism.¹⁸ The first of these is *uniformity of law*, by which it is meant that natural laws are invariant in space and time. This is really a fundamental methodological assumption throughout science and represents nothing new. The second is *the uniformity of process* (actualism), whereby past results are, where at all possible, to be explained as the outcome of processes which are currently

observed to operate on Earth. This does not deny the possibility of anything new but does preclude a hasty retreat to such. Again, this is a generally accepted principle of science. The third is ***uniformity of rate*** (gradualism). By this principle Lyell meant that all geological end-products, no matter how apparently spectacular, were produced by the slow regular action of known forces and factors. In 1829 Lyell, writing to Murchison, described Earth as having been shaped by causes which “never acted with different degrees of energy from that which they now exert.” Unlike the first two constancies, this is not a standard scientific methodological presupposition, but requires testing. The fourth meaning of uniformitarianism is ***uniformity of conditions*** (non-directionalism, dynamic steady-state). Lyell’s Earth was one of constant small changes, one which cycled endlessly with no impetus in any particular direction. He saw the permanent extinctions of large groups of species to be in violation of this principle and confidently expected that, for example, the “huge iguanodon might reappear in the woods and the ichthyosaur in the sea, while the pterodactyl might flit again through the umbrageous groves of tree ferns”¹⁹. Clearly this fourth point was, and remains, highly conjectural.

Although he spoke much of “uniformity”, Lyell did not invent or use the term “uniformitarianism.” It was coined by the Scottish philosopher William Whewell, then at Cambridge, in his 1832 review of the second volume of *Principles of Geology*. The latter used the term specifically for “gradualism” the third of Gould’s uniformities discussed above. Soon after, the term was more generally applied by those succeeding him to cover all four meanings as distinguished by Gould.²⁰ Another famous phrase from this period used to express uniformitarian ideas was “the present is the key to the past”, coined by the Scottish geologist, Sir Archibald Geikie (1835–1924). It should be pointed out, though, that he regarded this as more a working methodology than an expression of absolute terms.²¹ These geological ideas of uniform and regular processes were extended from geology into biology by the work of Darwin.

An authoritative perspective on continental European terminology is offered by Hooykaas. He notes that in countries such as Germany and the Netherlands the term “actualism”, which is introduced above, is generally employed in geological literature as a synonym for the “anglosaxon” term “uniformitarianism.” He also points out, however,

that this equivalence erodes conceptual clarity since subtly different nuances lie behind the two terms.

Uniformitarianism implies that ancient changes in the earth's crust were effectuated by causes of the same *kind* as those working at present and that these causes had about the same *intensity* as their modern equivalents ...

That is to say, that uniformitarianism is antagonistic to catastrophism, which holds that causes now in operation (ice, water, winds, vulcanism), if active with the now prevalent intensity, are not sufficient to explain the geologic event of the past ...

In continental European languages, however, though the term actualism is considered as synonymous with the anglosaxon "uniformitarianism," it often has wider implications. For this term *in itself* implies only that the present (modern or actual) causes are sufficient to explain the events of the past; it does not necessarily include the idea that they operate with the same energy in the present as they did in the past. One could imagine that the geological causes of the past were the same kind as the actual causes, but that they were much more powerful, so that they sometimes led to cataclysmic effects. In such a case they would be in the literal sense of the word "catastrophic", as well as "actualistic" ...

In order to provide a tighter nomenclature, Hooykaas also differentiates between what he calls the *system* (the historical result) and the *method*, the actual mechanism by which a change is brought about. He notes that the scenario described immediately above can be said to involve an actualistic method, while the resultant system would be catastrophist.

Hooykaas then revisits geological thought of the eighteenth century noting that principal figures such as Burnet, Woodward and Whiston often incorporated elements of both actualism and catastrophism into their schema, and that in a sense "uniformitarianism and catastrophism already existed alongside each other in the 18th century".²² This point is also made by Rudwick.²³

From Lyell to Mid-Twentieth Century

Lyell's pervasive influence and authority ensured that uniformitarian ideas dominated geology for more than a century. Montgomery notes that "After European geologists dismissed a central role for a catastrophic flood in earth history the idea became biological heresy." For the remainder of the nineteenth century and well into the twentieth,

uniformitarian sentiments seem to have consolidated into hard rock, forming in a sense the crystal matrix of geology!

Geikie's *The Founders of Geology* (first edition 1897) states that Lyell became "the great high priest of uniformitarianism" and that "Catastrophists had it all their way until the Uniformitarians got the upper hand."²⁴ A prominent geological textbook published in 1920 stated that:

It is the triumph of Geology as a science, to have demonstrated that we do not need to refer to vast unknown, and terrible causes the relief features of the earth, but that the known agencies at work today are competent to produce them, provided they have time enough.²⁵

Speaking of this period Benton notes that:

The proponents of catastrophe and mass extinctions were consistently regarded as lunatics. To link a mass extinction to cosmic rays, sunspots, or meteorite impact was to class yourself with pseudoscientists and astrologers. The extinction deniers were the level-headed, careful scientists. Far better to call for more evidence, to argue that an extinction happened gradually, perhaps over 5 or 10 million years, to seek explanation in slow-acting earth-bound processes, such as sea-level change or climatic deterioration, than to fly off wildly into the arms of the soothsayers, doom-mongers and apocalypse merchants.²⁶

It seems that this was particularly true in English-speaking countries. Despite all of this, however, there were some voices expressing mild to more strident dissent. Writing in 1939, Lobeck stated that:

Some students of geology have perhaps become too enthusiastic over this principle of uniformitarianism for it is possible that some events take place on the earth's surface with cataclysmic suddenness ... Nevertheless, it is fairly certain that, looking back over all of geological time, we should see the same quiet, orderly processes of erosion, glaciation, wave action and wind movement, as well as the slight shifting of land masses due to earthquakes and the very slight and virtually imperceptible changes in the relation between land and sea which we observe going on from year to year.²⁷

The admission here of very limited "cataclysmic suddenness" indicates at least a residual sense of balance on the part some geologists. A very prominent advocate of catastrophism emerged in Germany during the early 1900s. Otto Schindewolf published

his first scientific paper in 1916 and continued to publish his ideas on palaeontology and stratigraphy until 1970, some 54 years later. Very influential within Germany, he was professor of palaeontology at the University of Tübingen for a period following WWII. He was completely out of step with English and American thought, not only in denying Darwinian evolution but in advocating mass extinctions. His *Grundfragen der Paläontologie* (1950) mounts the first significant argument for a mass extinction at the end of the Permian era. Schindewolf later suggested that such mass extinctions could have been caused by cosmic radiation bursts resulting from supernovae. In 1963 he published a paper entitled “Neokatastrophismus,” in which he claimed that catastrophism had a legitimate place in geology.²⁸

However, Davis Young may be going a little too far with his claim that as far back as the nineteenth century,

Geologists were also learning to recognize deposits and land forms that were probably produced by large regional catastrophic floods, a fact frequently overlooked by those who claim that uniformitarian geology has no room for great cataclysms.²⁹

Although there is seldom a single story line to any such history, it is certain that uniformitarian ideas were pervasive until the second half of the twentieth century.

The Geological Journey: From Uniformitarianism to Catastrophism

Certainly by the 1970s and ‘80s data were beginning to emerge that pointed in force to massive and violent geologic episodes. Major changes were sweeping geology at this time. For example, the discovery of mirror-imaged palaeo-magnetic field reversals recorded in the basaltic ocean floor on each side of the mid-Atlantic ridge resulted in a paradigm shift as geology finally embraced the theory of plate tectonics and continental drift *en masse*, after decades of resistance. Some of the geological stories which broke during this period and which ended the domination of the uniformitarian view are reviewed below.

Mega-floods in North West America

One very influential and famous chapter in this journey back towards catastrophism concerns the progressive explanation during the twentieth century of a number of geological features found in the

high deserts of eastern Washington State, such as large, exotic granite boulders perched on high basalt cliffs, giant potholes, extensive gravel bars in what are now dry valleys, and the apparently water-scoured cliffs of high, dry waterfalls.³⁰

Fresh out of graduate school and already displaying the interpretive skills of a field geologist, J Harlen Bretz was one of the few in the early 1920s who took the trouble to examine the region in person. He came to the heretical view that it was all best explained by a large water flow, which he called the Spokane flood. This conclusion flew in the face of established geological wisdom, which by that stage had long repudiated the idea of Noah's flood and, in accord with uniformitarian dogma, generally denied the existence of any floods of the magnitude proposed by Bretz. The latter's story of a raging expanse of water, hundreds of meters deep, scouring its way across what is now bone-dry desert quickly attracted the opprobrium of the geological establishment, which regarded him as an eccentric outsider. He went on to complete a PhD in geology at the University of Chicago in 1913 and taught at various universities, including Chicago and Washington, until his retirement in 1947.

He continued with his field studies within Washington State, quite prepared to encounter evidence which would prove him wrong. After all, the peak discharge rates he calculated at those locations at which the flow must have been constricted—rates of more than sixty million cubic feet per second (approximately two million cubic metres per second)—were surely impossible. Instead, he amassed even more evidence of a huge water-flow. Along the way he demonstrated that glacial activity could not have transported large stones to the positions at which they are found and, in any case, it had already been reasonably established that glaciers had never had any significant affect in these regions. He found no evidence at all of marine fossils or ancient beaches, thus effectively scuttling the idea, commonly accepted by his geological peers, that the huge granite boulders had been carried by floating ice during a time when these regions had been covered by the Pacific Ocean.

On a number of occasions he presented his work to the geological associations but it seemed that the more evidence he uncovered the more eager was the establishment to explain it away. After all, even Bretz could propose no realistic source for this huge amount of water.

In hindsight it emerged that at least one person present at some of these meetings, Joe Pardee, a Geological Survey geologist, suspected that Bretz may have been right. Pardee possessed information which suggested that this massive flood may have been caused by the sudden drainage of a large, ice-dammed lake, later called Lake Missoula. However, fear of the establishment gagged him and others from giving public support, although Pardee did privately communicate his idea to Bretz. Eventually Bretz accepted Pardee's suggestion.

Resistance to the idea of a mega-flood began to weaken in 1940 when Pardee showed the Seattle meeting of the American Association for the Advancement of Science evidence for ripples 50 feet high (approximately 15 metres) on the ancient bed of Lake Missoula, which could only be explained by the sudden movement of an enormous volume of water, most likely caused by the sudden collapse of an ice-dam. The many sceptics present were "rocked."

In 1952 Bretz, then aged 69, concluded his last summer of fieldwork at recent excavations in the scablands, hundreds of kilometres downstream from Lake Missoula. He was able to confirm that they were massive gravel bars. The picture was completed by aerial photography of the region which revealed to his practised eye that beneath the sage-brush the rugged topography had the appearance of giant ripples on a massive scale. Decades of work had finally provided enough evidence to swing the reluctant establishment. In 1965 an international group of geologists inspected extensively the region so well known to Bretz. Soon after he received a cable, now famous: "Greetings and salutations. We are now all catastrophists"! In 1979, at the age of 97, Bretz was belatedly awarded the highest honour of the Geological Society of America, the Penrose Medal. Following this presentation he is alleged to have jokingly remarked to his son that he had no one left over whom to gloat, most of his contemporaries having understandably predeceased him! Later work has established that there may have been as many as 100 mega-floods as Lake Missoula was blocked by huge ice dams which collapsed in turn.³¹

Victor Baker notes Bretz's claim, made in 1959, that "'Nowhere in the world is there known or suspected a story at all comparable to what we read from the scabland forms'", but goes on to point out that "cataclysmic flood landscapes with many similarities to the

Channelled Scabland have increasingly been documented in many parts of the world.” He identifies examples in Central North America, Central Asia and the floor of the English Channel and suggests that Bretz might have been particularly surprised and gratified by evidence of the same phenomena on the Martian surface.³²

The Cretaceous-Tertiary (K-T) event

While the palaeontological evidence had long been interpreted as implying that dinosaurs had become extinct millions of years ago it was only towards the end of the nineteenth century that scientists began to realise that all the non-avian dinosaurs appeared to have become extinct within quite a short time (geologically speaking). It also became apparent that more than 50% of other life-forms had disappeared during this same period. This dramatic extinction, understood by most scientists to have taken place some 65.5 million years ago, was so massive that it came to mark the boundary between the Cretaceous Period and the Tertiary Era which followed it, becoming known as the K-T event. Various explanations for this widespread extinction were suggested during the last decades of the 20th century.

In the late 1970s geologist Walter Alvarez and his father, Nobel Prize-winning physicist Luis Alvarez from Berkeley Labs, identified an unusual clay layer at the 1-cm-thick K-T boundary in Gubbio, Italy. This clay contained concentrations of the rare-earth element iridium that were 30 times higher than those normally found within Earth’s crust. The fact that iridium is abundant in many meteorites and asteroids suggested to the team that a massive meteorite may have struck Earth, initiating the K-T event. A second such investigation in Stevns Klint, Denmark, confirmed their suspicions to the point where they felt prepared to risk publication in *Science*; certainly a fraught venture, given the audacity of their claim and the paucity of evidence in hand.³³ After all, they had no impact site and what they were proposing was catastrophic in the extreme. Their paper appeared on June 6, 1980. Not surprisingly, it was one of the most controversial of the period but they have been substantially vindicated. Subsequent studies of over 100 sites around the world revealed widespread iridium enrichment at the K-T boundary, strongly supporting their hypothesis. Additional discoveries of impact-shocked quartz and beads of impact glass found within the clay associated with the K-T boundary, similar

to those found at nuclear bomb-sites, supported the idea that there had been a massive, high-energy impact.

The discovery in 1991 of evidence for a 180 km-diameter crater at Chicxulub on the Yucatan Peninsula in Mexico, independently dated to 65 mya, provided further verification of the impact theory. The impact of the asteroid that formed this crater would have released energy equivalent to *one hundred thousand million* 1-megaton nuclear explosions! The impact would have caused global devastation: a huge earthquake, winds of over 400 km/hr and a giant tsunami. Some of the 90,000 cubic km of debris blasted into the atmosphere would have returned as a fiery hail of devastating missiles. Small dust particles would have remained in atmospheric suspension, blocking sunlight and causing an “impact winter”. The resulting plummet in temperatures might have caused reduced photosynthesis and the collapse of food chains globally.³⁴ Benton notes that the general acceptance of this scenario

... marks one of the biggest shifts in scientific opinion of recent decades. From being regarded as pariahs, the *catastrophists*, geologists who point to larger-than-normal crises in the geological past, have won the argument, in terms of extinctions of life in the past at least. In retrospect now, it is extraordinary to see how mainstream geologists denied the reality of catastrophes for so long.³⁵

The Permian Extinction

Benton goes on to document evidence that an extinction far more significant, if lesser-known, than the KT event occurred at the end of the Permian period, some 250 million years ago. Whereas the K-T event is thought to have resulted in the loss of some 50% of species, the Permian extinction is thought to have left as few as 10% of the species and only about half the families. Plants and animal species were similarly affected.³⁶ Initially, and particularly because of difficulties in dating the rocks of the period, many scientists thought that the Permian extinction occurred over some 10 million years. Indeed, in an unusual analogy Teichert suggested:

The way in which many of the Palaeozoic life forms disappeared towards the end of the Permian Period brings to mind Joseph Hayden’s Farewell Symphony where, during

the last movement, one musician after another takes his instruments and leaves the stage until, at the end, none is left.³⁷

However, improvements in dating precision narrowed this period to less than one million years, and by 2000, less than half of that. However, scientific opinion seems still to be divided over the mechanism of this event, with the two major contenders being another huge meteor impact and massive volcanic eruptions that produced huge quantities of lava some of which, blown skyward, poisoned the atmosphere.³⁸

Other Catastrophes

In addition to the K-T event and the massive Permian extinction it is understood that at least three other major extinction events have occurred: in the late Ordovician (approximately 440 mya), in the late Devonian (approximately 370 mya) and at the end of the Triassic (approximately 200 mya).³⁹

Although not related to extinctions evidence suggests that there have been many other mega-flood events. The ice-dams holding back Lake Agassiz, a huge glacially dammed lake filling a large depression in northern North America, are also thought to have created a series of huge flood events in the Hudson Bay and St. Laurence River area. Some of these apparently extended down to the Mississippi. The final emptying of this lake, thought to involve a body of water one hundred times larger than Lake Missoula, was big enough to shut down the Gulf Stream in the Atlantic Ocean.⁴⁰

Another event of catastrophic proportions and suddenness which has been proposed is the formation of the Black Sea by the collapse of the low ridge of the Bosphorus. It is understood that the melting of the ice sheet, some 8,200 years ago, about the time of the last huge flood from Lake Agassiz, resulted in a rise in sea level of 1.5 metres. It is conjectured that this rise may have caused the sudden collapse of a ridge in what is now the Bosphorus Strait, spilling Mediterranean seawater into a low-lying basin, submerging some 70,000 square kilometres and producing what is now the Black Sea. In 1969 the research vessel *Atlantis* had found evidence that the floor of the Black Sea had been initially salty, had then changed to well-oxygenated freshwater, and had then experienced a rapid influx of seawater which had created stagnant, poorly oxygenated conditions.

In 1993, Ryan and Pitman scanned the bed of the black Sea with sonar and found strong evidence for submerged shorelines, streambeds and canyons. Collecting more samples from the sea bed they found remains of freshwater mussels underneath the expected remains of saltwater species. To their surprise they found that, irrespective of the place from which their samples were taken, the first marine species which had displaced the freshwater ecology gave the same carbon date of approximately 7,000 years. This seemed to indicate a sudden, rather than a gradual, inundation of salt water. Later studies indicated that it had taken about 1000 years for sufficient sea water to flow into the basin to allow the bottom of the new sea to begin supporting marine life.⁴¹ Particularly in view of the timing and the location, it is understandable that these discoveries have suggested to some that this is the site of the biblical Flood.

It has also been suggested that the Mediterranean Sea itself resulted from the collapse of a ridge at what is now the Strait of Gibraltar.

Re-evaluation by Science

Not surprisingly, as science has opened its doors once again to catastrophism, the annals of geology have been re-evaluated and re-written. While many aspects of Lyell's work continue to be venerated, his emphasis on uniform process has come under increasing criticism. Gould wrote:

Lyell, the Cardboard Hero, the white knight of science against lingering supernaturalism, is being replaced by Lyell the Passionate Believer, who pits his system of a balanced and stately earth against equally passionate (and equally scientific) beliefs in definite directions and catastrophic changes. A much more interesting man, and one much truer to the original.

Gould also notes that *Principles of Geology*

... was written by a lawyer, for Lyell trained and qualified in the profession banned from Utopia by Saint Thomas More (1516): 'They have no lawyers among them, for they consider them as a sort of people whose profession it is to disguise matters.'⁴²

In an attempt to divorce uniformitarianism from other more worthy facets of early geology, Rupke has stated that, "the common notion that modern geology originated with uniformitarianism is a hindrance to unencumbered study of the origin of the new geology"⁴³ In his introduction to *Catastrophes and Earth History: The New Uniformitarianism* (1984), John Van Couvering wrote, "The papers

in this volume are intended to involve the reader in the current reappraisal of uniformitarianism that is radicalizing Geology.”⁴⁴

It is now generally accepted by geologists that long periods of slow, gradual change have been punctuated by episodic violent and catastrophic phenomena. Indeed it has been said that Earth’s history very much resembles the life of a soldier: long periods of boredom punctuated by short moments of terror!⁴⁵ It seems fair to say that today geological science combines uniformitarian and catastrophist views but in a manner which, as noted by Dott, is neither “catastrophist” nor “uniformitarian” in the nineteenth-century sense.⁴⁶ This modern synthesis is also described by Huggett.⁴⁷

So much for the geological story. We now examine what has been made of it by Christian apologists.

Uniformitarian Charges Laid Against Science

Uniformitarian Charges Made before 1980

According to Ronald Numbers, Adventist pioneers homed in on the uniformity principle, which they saw as one of the platforms undergirding “the dreamy, incoherent utterances of geologists” at least as far back as 1870.⁴⁸ In that year the *Advent Review and Sabbath Herald* (hereafter called the *Review*) reprinted an article by the Rev R. Patterson which stated:

to judge of the formative period of our earth by its observed rate of present progress, is much as if one should measure a youth of six feet high, and finding that he grew half an inch last year, should conclude thence that he was a hundred and forty four years old.

This article went on to claim:

the rapidity of many geological formations, formerly assumed to have been very slow, is now demonstrated ... In thirty-six hours a green tree is converted into a fossil in California; and into lignite within a week; while before your eyes you behold the hardest porphyry converted into potter’s clay ...⁴⁹

The authors of these statements clearly question notions of uniformity, although the latter term is not used. In 1877 Charles W. Stone stated:

Physical changes are wrought so rapidly under certain conditions, and so slowly under others, that it is simply impossible to tell how

long a rock, a stratum of earth, or a deposit in the bottom of the Gulf of Mexico, has been in forming, unless the precise conditions are known.⁵⁰

Again, this certainly sounds like a criticism of the principle of uniformity, although that principle is not explicitly identified. Stone concluded his article by warning that the “guesswork of geologists is a very unsafe foundation on which to build theories that go back of the record of Moses.” Later Uriah Smith, the editor of the *Review*, quoted Lyell directly: “the forces formerly employed to remodel the crust of the earth, were the same in kind and energy as those now acting” and later asserted, “That this principle is true, who has ever proven or tried to prove? Nobody.”⁵¹

However, the early twentieth century saw this attack on uniformitarianism broaden. Those defending a literal reading of Genesis against emerging and increasingly unfriendly geological data continued to accuse geology of being rigidly and unfairly constrained by uniformitarian views. Some of those who have made these explicit uniformitarian accusations, particularly those of significance for modern Seventh-day Adventism, are reviewed below. While many of the quotations given do not refer directly to the Flood, it is generally this event which provides the larger context for each author’s concerns.

The first was George McCready Price. As noted by Numbers, he identified the scoffers predicted in 2 Peter 3:3, 4, who would walk after their own lusts and affirm that “all things continue as they were from the beginning of the creation” as uniformitarians!⁵² (Interestingly, this exegesis has continued to find currency among some leading flood geologists to the present day.⁵³) Reviewing some of the geological conclusions of his day, Price had much to say in disdain of uniformitarianism.

For nearly a century, or ever since the publication of Lyell’s “Principles of Geology” (1830–1833), geologists have assumed that all the rock deposits of the past were made much as rocks are being made today, by common-place causes. This is called the doctrine of *uniformity*, or *uniformitarian-ism*; and this doctrine has so long and so completely dominated scientific investigation that in effect it has become an iron dogma which rules out of consideration all evidence not agreeable to its teachings. .

But it is hardly necessary to point out that this is based on the assumption of uniformity in its most extreme type, a doctrine which

not only denies that these living forms are merely the *lucky survivors* of tremendous changes in which their contemporaries perished, but which, in essence, is taking for granted beforehand the very point which ought to be the chief aim of all geological enquiry; namely, HOW DID THE GEOLOGICAL CHANGES TAKE PLACE?

One class of modern scientists [i.e. geologists, *supplied*] argue that we ought to explain the past wholly in terms of the present—an obvious truth, but depending upon how we interpret the processes of our modern world. However, these persons declare that the geological processes of the past took place in much the same ways as the various physical changes in the ocean and on the lands are now taking place. This view is termed the theory of *Uniformity* or *Uniformitarianism*.

The theory of Uniformity has been fully represented in current geological writings and is widely understood.⁵⁴

Price may have become aware of the dominant role of uniformitarian thought from the earlier-mentioned textbooks of Geikie and von Zittel, since he gained much of his geological information from these two authors.⁵⁵ In so doing he was widely exposed to Lyell's biased perspectives on the history of early 19th century geology, since both Geikie and von Zittel borrowed Lyell's ideas extensively.

Harold W. Clark, a student of Price, who wrote on the faith/science interface for over 50 years between 1929 and 1980, also identified uniformitarianism as a predominant factor in modern geology which, in his view, prevented its reception of data supporting the Flood. Speaking of the initial reception of Lyell's view and its later fruitage he wrote:

In spite of criticisms, the uniformitarian hypothesis gradually came into favour, until at present it is universally accepted as the basis of modern geology.

Clark went on to support his statement by using the two quotations from popular science textbooks mentioned earlier: Pirsson's *Textbook of Geology* (1920) and Lobeck's *Geomorphology* (1939). He also noted:

All uniformitarian geology, all long-age geology, rests entirely upon assumption, not on proof ... Where did Lyell get his proofs for uniformitarianism? He never gave any. He took uniformity for granted. So did all the others. The whole geological world stands indicted for "begging the question" ... As has been said repeatedly, it

should be said again: Uniformitarianism is a worn-out hypothesis for which there is not one iota of proof, either in science or philosophy.⁵⁶

Frank Lewis Marsh, who wrote between 1941 and 1976, also followed Price's lead in identifying uniformitarian principles as a constraint within modern geology. Briefly tracing the development of these ideas from Leonardo da Vinci through to Charles Lyell, he stated:

Lyell is recognised as the founder of modern geology, which in its historical aspect, lamentably is built entirely upon the assumption of uniformity.⁵⁷

Whitcomb and Morris, authors of the very influential creationist text, *The Genesis Flood* (1961), clearly regarded entrenched uniformitarianism on the part of geology as one of the villains of the piece.

The fact that Lyellian uniformitarianism has been accepted as the true philosophy of geology in all major centers of scientific learning in the world today may be attributed partially to the fact that Charles Darwin, a disciple of Lyell, built his theory of organic evolution upon the uniformitarian foundation which Lyell had laid.

We feel that the orthodox geologist's adherence to the uniformity principle is only rarely attributable to an anti-Christian bias. Rather, he is the product of a particular background, conditioned by education and group pressure to think only in terms of evolution and uniformity.⁵⁸

Interestingly, although Whitcombe and Morris rejected the idea of a "tranquil" Flood, according to which the biblical Flood narrative was seen as describing the quiet and nonviolent rise and fall of the flood waters, they pointed out that Lyell drew some support for uniformitarianism from such theories, which were not uncommon in his time. Whitcombe's and Morris' views would be reflected by many other creationist authors over the next few decades.

In *Creation: Accident or Design?* (1969), Harold G. Coffin incidentally decries the dominance of uniformitarian thinking, attributing it to Hutton and Lyell, but develops no in-depth discussion. In his discussion of the flood he does, however, list evidences from the sedimentary and fossil record for which, "The most reasonable explanation ... is one based on catastrophism," and claims that, "the interpretation of this evidence is not a whit less 'scientific' than that to

which most geologists point in support of the theory of uniformity.” Perhaps the most direct reference to uniformitarianism is found in the chapter on evolution contributed by Edward E. White, who noted that Lyell’s “plausible writings attracted the general public, as well as men of science, and his theory of uniformitarianism became the fundamental philosophy of the newly emerging science of geology.”⁵⁹

In the 8th edition of *Why We believe in Creation not in Evolution* (1974), Fred Meldau defines “uniformitarianism in geology” as “‘the doctrine that all things and all forces continue as they were from the beginning’—and this of course rules out sudden catastrophic changes in the earth’s surface due to the tremendous upheavals of such cataclysmic events as implied in Gen1:2 and described in Genesis 6–8, the Flood.”⁶⁰

Flood Geologists Diversify

As has been noted in Section 3, by 1980, the scientific establishment was somewhat in retreat from overt uniformitarian ideology and this awareness was beginning to filter down from the heights. Accordingly, flood geologists’ comments about uniformitarianism began to diversify. Some continued their traditional criticisms of uniformitarianism as if nothing had happened within the scientific community. A sample of such authors is presented immediately below. However, other exponents of the Noachian Flood began to give science credit for softening its opposition to catastrophism. Some of these authors are mentioned at the end of this section.

Uniformitarian Accusations After 1980

At the time of writing the website of the Texas-based *Institute for Creation Research* (ICR) carries a message on uniformitarianism that is predominantly outmoded, mainly because it still features a number of older articles by Henry Morris, such as “Biblical Uniformitarianism,” earlier cited. This article alleges that Peter’s statement, “All things continue as they were from the beginning of creation”

. . . is as succinct a definition of the dogma of uniformitarianism as one could find. Not only the basic “laws of nature,” but also all natural processes are assumed to always be essentially equivalent to those operating today—similar rates of erosion and deposition, similar rates of salt influx to the sea, similar rates of radioactive decay, similar rates of biological variation, similar rates even of

local flooding and vulcanism, etc. No sudden global change in earth processes, and certainly no divine intervention in these processes is allowed. This has been the accepted scientific worldview for the past two centuries.⁶¹

This statement clearly conveys some truth, particularly where it makes the point that modern science has no place for divine intervention. However, there is no mention at all of the movement towards catastrophism on the part of science and to that extent modern science is misrepresented. To imply that modern scientific views are essentially those of the 1800s and to state that according to science there can be “no sudden change in earth processes” is misleading. In another (shorter) article which again refers to 2 Peter 3:3, 4, Morris, somewhat loosely, equates uniformitarianism with naturalism, materialism and evolutionism. There is no statement relating uniformitarianism to the current science context. Even an article entitled “The Failed History of Uniformitarianism,” again by Morris, conveys nothing of the modern geological story which has given rise to neocatastrophism.⁶² These articles clearly convey the sense that science remains obdurately uniformitarian. They are obviously older articles but they are still on the website. The problem introduced by the retention of old material is illustrated by the following anecdote.

In 1988 I attended a much publicised debate at the University of NSW between Dr Duane Gish and Dr Ian Plimer. During the course of this highly invidious altercation Plimer read from a particular creationist book. Gish later responded by asserting that the book was an old one. Surely, he said, Plimer, as a scientist, should know the perils of quoting from an outdated text. Plimer (who, it must be said, did not shine that night or carry all his points by any means) later responded along the lines of, “Would you like to know where I bought this book? I bought it from the creationist stand outside this auditorium as I entered this evening!”

However, in contrast to the ICR articles cited above, that by David Coppedge entitled “Venus vs. Uniformitarianism,” does give some credence to change within science. The author argues that, in the light of recent discoveries, the planet Venus “poses a serious challenge to uniformitarian views”, although it is difficult to establish what is being argued here. The author refers to “the geologic rule of uniformitarianism—the present is the key to the past” ..., but goes

on to recognise that “the twentieth century has seen the revival of catastrophism in Earth geology...”⁶³

Uniformitarian accusations also emerged tacitly during the “Celebration of Creation” at Avondale College on May 14, 2011. A palaeontologist at the Geoscience Research Institute reported on his extensive research on the sedimentary Pisco Formation in Peru, some of which has been published in the Geological Society of America’s journal, *Geology*. This Formation contains some of the most extensive sea mammal deposits known. Many species are represented, some of them quite modern. The fossil whales occur in many layers, many showing good preservation and skeletal articulation, even including teeth in position. Most surprisingly, for some specimens of baleen whales the baleen is still attached or at least still evident. He gave two presentations.

During the first address the data were interpreted as representing a conflict between catastrophism and uniformitarianism. It was stated that for uniformitarians the present is the key to the past, implying that, even today, scientists do not accept any processes they cannot actually observe in action. According to this uniformitarian philosophy, rates of sedimentary deposition are expected to be very low. Low rates also appear to be suggested by the radiometric dating methods (K-Ar mentioned) employed by modern science, according to which there are apparently some 12 million years between the top and bottom layers, separated by some 600 metres.

It was pointed out that, in contrast to this paradigm, the burial features noted above provide strong, perhaps incontrovertible evidence for rapid burial. Preserved baleen, for example, is very rare indeed. Recent studies have shown that it typically disappears within a few days of exposure. Even skeletal remains are usually degraded over just a few years. The presenter went on to describe a recent study of whale skeletons on the sea floor in which a remote submarine device equipped with cameras was used. It was found that crabs, worms, and other organisms rapidly degrade the remains of whales so that after three years little is left. It was urged that the retention of such quickly degraded materials would be impossible under the slow sedimentation conditions associated with uniformitarianism. This address was somewhat misleading in that it did not recognise that modern geology/biology readily admits to violent, episodic phenomena such

as rapid burial. As we shall see, the presenter's second address went a considerable way to redress this omission, in the process significantly weakening the point made in the first presentation. However, not all who heard the first address also heard the second.⁶⁴

Uniformitarian Accusations Dropped

One of the earliest to drop uniformitarian charges was Francis Schaeffer. In 1972 he denounced the long dominance of uniformitarianism but pointed out that, "Today, interestingly enough, geologists are finding it necessary to bring catastrophe (though they usually do not use this term) back into the story ..."⁶⁵ Clearly Schaeffer was well informed and reasonably current with his geological information.

The first Adventist author to qualify the standard uniformitarian accusation appears to have been Harold Coffin, in *Origin by Design* (1983), a substantial re-working of the earlier-mentioned 1969 book, *Creation: Accident or Design?* In a chapter entitled "Uniformity and Catastrophe," after noting the long dominance of uniformitarian ideas following the publications of Lyell, Coffin goes on to note that "geologists have begun to relax the role of uniformity in geological research and interpretations."⁶⁶ In this connection he refers to new speculations relating to the proposed formation of the Moon by capture, noting that in all probability this would have involved vast catastrophic tides. He also references the widespread acceptance of Wegener's continental drift theory, although this theory hardly speaks of rapid, catastrophic processes. In fact, had Lyell been aware of continental drift he may well have embodied it within the compass of his uniformitarianism! Coffin then presents a most informative account of the Harlen Bretz episode, quoting the famous 1965 telegram that announced a mass conversion to catastrophism. This story had essentially played out before the publication of his earlier book but it would seem that Coffin was unaware of it at that time.

A comprehensive and honest discussion of uniformitarianism is provided by Leonard Brand in *Faith, Reason and Earth's History* (1997). Brand includes a discussion of Gould's four constituent strands of uniformitarianism, as outlined earlier and, with reference to Gould and others, notes that "various authors have stated that Lyell's strictly gradualistic version of uniformitarianism is not needed—that it has been bad for geology because it has prevented geologists from

considering any hypothesis involving catastrophic interpretations of the data”. He considers that “modern geological theory is a modification of Lyell’s uniformitarian views and recognizes that Lyell was partly wrong”.⁶⁷

In his *Origins: Linking Science and Scripture* (1998), Ariel Roth also notes the declining fortunes of uniformitarianism, recounting the Bretz incident and mentioning a number of more recent catastrophism triumphs such as the K-T boundary extinction.⁶⁸ In his later *Science Discovers God* (2008), Roth again refers to the re-emergence of catastrophism, in the form of neocatastrophism, noting that, “some have characterized the change as a ‘great philosophical breakthrough’,” allowing “the possibility of catastrophes all through the rock record”.⁶⁹ Roth makes a similar point in *In the Beginning* (2012), also, to his credit, taking care to add:

In fairness it should be pointed out that in returning to catastrophism, the majority of geologists do not accept the biblical Flood as the major cause for depositing most of the sediments on earth.⁷⁰

Two contributors to *Creation, Catastrophe and Calvary* (2000) also note the emergence of neo-catastrophism. Richard Davidson states that, “numerous recent scientific studies provide a growing body of evidence for diluvial catastrophism instead of uniformitarianism.” John T. Baldwin gives a more detailed discussion, referring to Derek Ager’s classic text, *The New Catastrophism: The Importance of the Rare Event in Geological History* (1983), and offers some examples.⁷¹

In *Refuting Evolution* (2002), Jonathan Sarfati, recalls that uniformitarianism was defined very much as “the present is the key to the past” in his geology class of 1983. However, he states that, while historical geology has been shaped by this paradigm, geologists have “long allowed for the occasional (localised) catastrophic event.” He points out that “overwhelming” evidence for catastrophic formation has given rise to “a growing body of neo-catastrophists.”⁷²

Sarfati’s *Refuting Evolution* is also available on the *Creation Ministries International* (CMI) website. Laudably, when older articles are published on this site they are frequently accompanied by the warning, “... readers are advised to supplement these historic articles with more up-to-date ones available by searching (their website).” Other articles on the same website, such as Michael Oard’s “Controversy over the uniformitarian age of Grand Canyon,” cite current scientific work

and, aided by quotations from authors such as Gould, clearly convey the idea that science has come to question much of uniformitarian dogma. (This commendation of Oard is qualified, however, by pointing out that when replying in another article on the CMI website to an objection by Kathleen Benison, Oard states: “I will continue to refer to secular scientists as uniformitarian scientists for sake of simplicity, realizing that the situation is more complicated today.” The conflation of naturalism with uniformitarianism is not helpful. Such confused sentiments may underlie some of the criticisms directed towards diluvialists, such as those mentioned below.)⁷³ Oard’s *Flood by Design* (2008) further weakens any grounds for commendation in this respect due to its confused utterance on uniformitarianism. Speaking of the problems experienced by geomorphologists seeking to explain landforms he proposes that “the main problem is their key assumption, uniformitarianism.” However, on the same page (p 20) he cites, but does not reference, British geographer, C. P. Green: “The most far-reaching implication arises from the recognition that almost all landforms are relics and have not been shaped only, or even largely, by present-day processes.”⁷⁴ This seems somewhat confusing!

The *Answers in Genesis* (AIG) organisation also appears to have done its best to provide a fair appraisal of uniformitarianism for its readers. The lead article carried by its website on this topic notes that “there has been a recent revolution in geology that has rejected traditional uniformitarianism in favour of neocatastrophism” and which discusses nine terms associated with uniformitarianism. It attempts to refute the accusation that diluvialists do not understand this concept. In another article John Morris asserts that, “today, that view (uniformitarianism) is being seriously questioned and rightfully so” and goes on to quote James H. Shea:

‘Furthermore, much of Lyell’s uniformitarianism, specifically his ideas on identity of ancient and modern causes, gradualism, and constancy of rate, has been explicitly refuted by the definitive modern sources, as well as by an overwhelming preponderance of evidence that, as substantive theories, his ideas on these matters were simply wrong.’⁷⁵

Author John Ashton, during a recent presentation series, claimed that long ages, including long radiometric ages had been “based on what was called the uniformitarian principle: that the processes we observe today have been fairly consistent for millions of years.”

Inasmuch as science accepts such dates more confidently now than ever before this is most easily understood as a claim that science is still uniformitarian. However, Ashton went on to reference Derek Ager's *Earth's Catastrophic Past*, thereby acknowledging that geology now accepts a significant role for catastrophes in shaping the Earth's surface. The inference appeared to be that science is now suffering internal contradiction.⁷⁶

Evaluation of the Uniformitarian Charges

There is little doubt that uniformitarian premises characterised geology from the time of Lyell to the mid-twentieth century. The reluctance with which conventional geologists accepted Bretz's evidence would seem to bear this out. This being so, the uniformitarian charges pressed home by such writers as Price were clearly not without foundation. Moreover, Price's objections to the assumptions made by Lyell are now increasingly recognised by geologists as valid.

Lyell's heavily biased views are even seen by some recent authors as being in some sense responsible for the rise of what is perceived as anti-science sentiment, for which, to say the least, he is not thanked. Victor Baker recently noted: "How interesting that Lyell, who many consider to be the greatest of the 19th- century geologists, actually provided (through Price's seminal work) the inspiration through his logically flawed formulation of uniformitarianism for what eventually became creation science!"⁷⁷ This is almost to say that, if seeking a scapegoat for modern diluvialist excesses, don't blame George McCready Price, who was only doing his job. Sheet the blame home to where it really belongs, namely to Sir Charles Lyell himself! This is surely a most fascinating twist of fortune in what is already an interesting story. It might be concluded, then, that the uniformitarian charges levelled by Price and those mentioned above were essentially valid.

Similarly, those Flood geologists who followed Price in speaking out against the uniformitarian bias rampant within geology also had a point. However, the validity of this point clearly began to diminish as the decades of the twentieth century rolled on and geological science redefined its position. Certainly by the 1980s it was out of date and the failure to point this out has been held against the conservative movement. Dott notes that "modern creationists pretend that his (Lyell's) restrictive uniformitarianism is still geology's basis for

rejecting biblical catastrophism.”⁷⁸ As we have seen, Dott is only partly correct but we must lament the degree to which his point is valid. Young goes much further, claiming that:

Many (modern) proponents of a universal flood have dismissed the findings of mainstream geology by claiming that they are based on a fallacious philosophical system called uniformitarianism. They understand uniformitarianism as a dogmatic *a priori* insistence that all past geological processes were analogous to those of the present and occurred only slowly and gradually. They contend that uniformitarians refuse to believe in the occurrence of geologically catastrophic events solely on the basis of anti-theistic prejudice. They are simply working with a definition of uniformitarianism that doesn’t apply to the professional scientific community. Mainstream geologists have always acknowledged the role of catastrophe as well as more gradual processes in the production of geological phenomena.⁷⁹

Unfortunately Young’s picture of science seems rather rose-tinted and ignores much of the testimony of history. Also, he fails to give credit to those conservatives, such as those we have noted above, who have done their best to be honest.

Claims that the “Neo catastrophism” of 20thC Geology Supports the Noachian Flood

The Claim

It has been claimed that the revival of catastrophism in the last half of the twentieth century has provided increased scientific evidence for a world-wide Flood. In fairness it must be pointed out that this claim is often muted, and sometimes implied rather than explicitly stated. Nevertheless, it is made. In a second address at the “Celebration of Creation” at Avondale College on May 14, 2011, the speaker who had presented on the buried whales weakened his earlier argument by this time correctly pointing out that modern geology has seen a significant swing back to catastrophism. Mention was made of the recognition by science of rapid sediment layering due to tempestites, tsunamiites and turbidites. Although the Noachian Flood was not explicitly mentioned this was clearly the intended context of the address and that understood by most of the audience. The implied point of this second lecture was that the strong, almost incontrovertible evidence for rapid processes, which is now admitted by science, argues for a world-wide Flood.⁸⁰

Another example of this type of argument form is found in Ariel Roth's essay in *Understanding Creation: Answers to Questions on Faith and Science* (2011). Roth writes that

Geologists in general reject the Genesis flood interpretation; however, during the last half century a new trend has allowed catastrophes such as major floods into geologic interpretations. These new interpretations often include conclusions that coincide to a great degree with the results that would be expected from a worldwide flood. If such a flood were responsible for much of the fossil and accompanying sediment record, it would be expected that significant evidence of this should be found, which is, in fact, the case. Several lines of geological evidence favouring the Flood follow.⁸¹

These lines of evidence are: ocean sediments on the continents, abundant rapid underwater activity on the continents, evidence of continental-scale currents, widespread sedimentary deposits, flat gaps in the sedimentary layers, incomplete ecological systems and unusual coal deposits. Roth presents a similar array of evidence in *In the Beginning* (2012)⁸².

As noted earlier, John Morris points out that the uniformitarian dogma is now being "seriously questioned" by science. Although not initially pressing the connection between this circumstance and the Flood he does then argue that evidence which *could have* been provided by the Flood *must* have come from this source. Under the heading, "What Would a Major, Catastrophic, Global Flood Do?", he writes:

A global Flood would have done what major floods do. Such a Flood would have eroded and dissolved both soil and rock. Fragments would have been transported and deposited elsewhere as sediments full of dead plants and animals ... Now we observe those sediments hardened into sedimentary rock layers, while the dead things have hardened into fossils. We can be certain the great majority of earth's sedimentary rock layers and their contained fossils are the result of that great Flood (*italics supplied*).⁸³

Recent work on the manner in which Gower Gulch has been carved through the sandy hills and sedimentary rock of Death Valley by comparatively small amounts of water is cited in another article in support of a world-wide Flood published by AIG:

...water's ability to re-shape the earth is not due to "the steady flow of a routinely fed creek or river,' but is instead the result of periodic

storms ... The connection to Noah's flood and the young-earth model of geology should, by this point, be pretty obvious... Geologists repeatedly discover the catastrophic effects of local flooding on the earth's surface, resulting in the same conclusion each time: that substantial amounts of water can have the same geological effect in a short period of time (even laying down rock layers) that hypothesized millions of years would have.⁸⁴

In another article, published in 2010 and entitled "Scientists Coming to Grips with Catastrophic Geology", reference is made to a scientific study of Canyon Lake Gorge in Texas, which formed in just three days during 2002, and the following conclusion is reached:

If a single overflowing spillway in Texas can carve a mile-and-half-long, 80-foot-deep gorge in three days, imagine the geological havoc that a worldwide Flood—and its retreat—would cause over the span of more than a year!⁸⁵

Once again, although not explicitly stating that the investigations behind science's new interest in catastrophism constitute evidence for a world-wide Flood, this is strongly implied.

Similar claims are made on the CMI website. Froede refers to the Bretz story and the Alvarez controversy, noting their significance to the twentieth-century triumph of "Cuvier's catastrophism" over "Lyell's gradualism.

The rise to dominance of secular catastrophism has greatly helped the young-earth Creation Flood framework ... In many instances, secular catastrophism provides a significant first step towards defining a Flood interpretation of the rock record made possible following the widespread acceptance of the K-T extraterrestrial extinction hypothesis.⁸⁶

In a reply to David Montgomery Tas Walker contends that "in recent decades geologists have realised that Lyell's philosophy does not work." He quotes palaeontologist Warren D. Allmon as saying "Lyell also sold geology some snake oil," and also geologist Derek Ager: "... we have allowed ourselves to be brainwashed into avoiding any interpretation of the past that involves extreme and what might be called 'catastrophic' processes". Although he does not explicitly claim that this scientific shift in thought equates to Flood evidence, like Froede, Walker does imply it: "Once you know what to look for the geological evidence is everywhere. It matches what would be expected as a consequence of Noah's Flood." He goes on to list

evidences such as well-preserved marine fossils found on mountain tops, sedimentary deposits blanketing continents, huge volcanic eruptions and evidence for vast erosive processes.⁸⁷

Most recently Biaggi, in a popular article, after relating the Bretz story and noting the increasing acceptance of rapid processes by science, urges the consideration of a global flood. Although the context could hardly be spelled out to any length in such a short article the argument would appear to be similar to those of the authors quoted above, namely that the recent acceptance of rapid processes should make it easier to believe in a global Flood.⁸⁸

Evaluation of this Claim: A Question of Logic

It is not surprising that some have seen the restoration of catastrophic fortunes within geology as a hopeful sign of increasing scientific support of a worldwide Flood. Certainly, the constraint imposed by the *a priori* disallowance of violent episodes as a major shaper of Earth's crustal features appears to have now been removed. But does this circumstance, in and of itself, constitute support for a worldwide Flood? We need to be aware of some risks here.

This warning may be articulated in terms of one of the most common forms of scientific deduction, known by the Greeks as *modus tollens*.⁸⁹ If a given proposition P implies result Q , then the failure of Q implies the falsehood of P . This is sometimes written as a logical sentence in the form:

$$\text{If } P \rightarrow Q \text{ then } \bar{Q} \rightarrow \bar{P}.$$

Such decision-making might be illustrated by the process of identifying an unknown aircraft. Observed at a distance, a large jetliner might be thought to be an Airbus A380. One might reasonably say that if **the aircraft is an A380** (P) then it is implied that **it has four underwing engines** (Q) and thus that **engine configurations other than four underwing pods** ($\bar{Q}$) imply **it is not an A380** ($\bar{P}$). So if, when observed closely through a telescope, the aircraft is found not to have four underwing engines but two, or for that matter, tail-mounted engines instead, then according to the logical sentence above it cannot be an A380. Even for non-philosophers this carries conviction as a valid form of reasoning.

Now this is all well and good but more instructive for our purpose is the consideration of a logical statement which may appear to be similar to the foregoing but is clearly different:

$$\text{If } P \rightarrow Q \text{ then } Q \rightarrow P.$$

We may investigate the validity of this statement by beginning with the same proposition employed above and its implication, i.e. that if **the aircraft is an A380** then it is implied that **it has four underwing engines**. However, this time the statement goes on to assert that in this case **four underwing engines** implies **the aircraft is an A380**. Suppose that telescopic observations reveal that this time the aircraft does, indeed, have four underwing engines. According to the logical sentence immediately above we must then conclude that the aircraft is an A380. But this is clearly not a valid conclusion. The aircraft could, for example, be a Boeing 747 (or even an old Boeing 707) since both of these aircraft have four underwing engines. In other words, to reason according to this second schema is not valid. This logic argument is false. It is false because there are propositions other than (P) according to which (Q) is true. Sometimes this is called *the fallacy of affirming the consequent*.

Considering only the A380 and 747 options, we may investigate more stringently what may be legitimately inferred, first from the establishment of Q false, and second from the establishment of Q true, by considering the following (obviously correct *modus tollens*) logical sentences:

1. If **the aircraft is an A380** implies **it has four underwing engines** then **engine configurations other than four underwing pods** imply **it is not an A380**
2. If **the aircraft is a Boeing 747** implies **it has four underwing engines** then **engine configurations other than four underwing pods** imply **it is not a Boeing 747**.

It is clear from these two sentences that once it is established that the aircraft does not have four underwing engines, it can be neither an A380 nor a 747.

However, as in the earlier case, the point of greater interest for this paper concerns the circumstance of Q true, i.e. when it is established that the aircraft does, indeed, have four underwing engines. It is

important to note that in this instance the propositions, “the aircraft is an A380” and “the aircraft is a 747” are mutually exclusive. They cannot be both true. The aircraft can only be of one type. Furthermore, it is obvious that because both propositions imply the same result, i.e. four underwing engines, then this result is not useful in deciding whether the aircraft is an A380 or a 747. The strongest statement we can make in the event of four underwing engines being observed is that the plane might be an A380, but this is no more strongly inferred than that it might be a 747.

It must be remembered of course that, despite the shift towards catastrophism we have noted earlier in this chapter, most geologists still affirm that many, if not most, of Earth’s geological features assumed their present form over long periods of time under the slow action of common and regular processes. However, the line of argument developed above may be followed irrespective of the extent to which catastrophic causes are invoked. There are two main options for explaining those geological features which are thought to speak of catastrophe: a single, universal Flood, with its associated upheavals, or a series of more local but equally violent episodic phenomena spread over a period of time. These two options are referred to by Brand as “catastrophism” and “neocatastrophism”.⁹⁰ They may each be represented by a valid *modus tollens* sentence, as shown below.

1. If a **universal Flood catastrophe** implies **massive and extensive evidences of catastrophic processes** then **an absence of such evidence** implies (that) **no universal Flood occurred**.
2. If a **series of more local but violent episodic catastrophes** implies **massive and extensive evidences of catastrophic processes** then **an absence of such evidence** implies **no such series of local but violent catastrophes occurred**.

Clearly, if no evidence of massive and extensive catastrophic processes could be found, both propositions fail. However, all now substantially agree that such evidence does exist and, furthermore, that it is unmistakable. It is also clear that only one of these propositions can be true. Either the geological features under study were substantially caused by a universal Flood or else by a series of more local catastrophes over a long time period. This circumstance suggests that the flood dilemma closely resembles that of identifying the aircraft. It is clear then that the observation of extensive evidence

for catastrophic processes does not help in deciding between these propositions. Even if it is admitted that smaller flood events augmented the major, universal event, as advanced by Brand⁹¹, this argument remains substantially intact.

Data that indicate violent, even widespread catastrophic events are certainly of interest. They deserve mention and need further study. But even if they are perfectly consistent with what could reasonably be expected from a worldwide Flood they do not uniquely, or even strongly, imply it as the favoured option among other widespread, perhaps violent depositional events.

More useful for this purpose would be consistent evidence from around the globe, drawn from a range of erosional or depositional phenomena, a very substantial portion of which demonstrated consistencies which suggested a single, recent event. Today, such an assemblage would need to include, for example, ice-core data from both hemispheres, seafloor and lake sediment studies as well as evidence of a significant water-borne sediment excursion in palaeosoils. If these data appear to indicate scenarios other than a single, world-wide Flood event an adequate and believable explanation is required on the part of those asserting such a Flood. Creationist authors have, in my view very correctly, pointed out features of the distribution of fossils in the world's sedimentary rocks which argue against the evolutionary story so frequently told. What is required is a Flood model which explains the fossil distribution better than conventional geological explanations. However, it will have to invoke better explanations of fossil distributions than those proposed earlier, such as ecological zonation, hydrological sorting or relative mobility.

How Science Makes Up its Mind

In 1543 Copernicus wrote:

Therefore in this ordering we find that the world has a wonderful commensurability and that there is a sure bond of harmony for the movement and magnitude of the orbital circles such as cannot be found in any other way.⁹²

This statement might well have caused some surprise among his initial readers. Up until this time scientific questions had been largely decided, following Greek thought, on the basis of deductive argument, but this was to change. Within a few decades, Copernicus' bulldog, Galileo, having become convinced by heliostatic cosmology,

had embarked on his vigorous campaign to convert intellectual Europe. However, he realised it was hard to establish watertight deductive arguments in support of his position. There was so much about the cosmos which was inaccessible, far away and hard to observe. Furthermore, Pope Urban VIII had challenged one of the few deductive arguments he had put up, namely that based on the movement of tidal waters over the Earth. Perhaps growing out of an incipient fear that the Pope may have been correct and perceiving the need for a broader base for his argument, Galileo, in his *Dialogo*, picked up on Copernicus' idea of judging competing scientific models on the basis of their coherence, cohesiveness and consistency. For example, he pointed out that according to the Copernican theory the planetary order imposed by distance from the Sun also matched the order of increasing orbital period about the Sun, which was mathematically elegant. Gingerich notes that in this sense Galileo permanently changed the rules of science.⁹³ This idea is often known as "hypothetico-deductive thinking" although Alistair McGrath refers to it as "inference to the best explanation".⁹⁴ This strategy worked for Galileo. Even when it emerged later that the Pope was right, namely that there was another explanation for tidal movement, the edifice of Galileo's argument survived. Since then it has become even more clear that nature is subtle and that it is seldom possible to establish the veracity of natural laws, particularly those pertaining to the very large or the very small, or historical details from the deep past through the precise deductive methods of classical reasoning. Accordingly, science judges as best and takes most seriously those ideas/theories which are the most comprehensive in their scope; the most internally coherent, cohesive and consistent; those involving the least amount of special pleading.

It is interesting to note that, by the mid-1800s, two deductively valid bodies of evidence had emerged which strongly buttressed the idea that Earth orbited the Sun while spinning on its own axis. These were the observation of stellar parallax and the observation of the changing plane of Foucault's pendulum in Notre-Dame Cathedral. However, these discoveries caused no particular excitement within the scientific community. By then all had already been well and truly persuaded of the truth of Copernicanism on the basis of Galileo's mode of argument.

It appears that this is not always understood by those who seek to buttress their position by presenting apparent exceptions to the accepted scientific paradigms or by stressing the assumptions made by scientists, while ignoring the enormously persuasive mass of concordant data on which the particular paradigm is based. Yes, there will generally be such exceptions and assumptions, but this strategy is nonetheless flawed. The only means of challenging a scientific view successfully is to demonstrate that an alternative model gives a better and clearer explanation of the factual base and is even more powerful, elegant, cohesive and consistent. We must catch up with Galileo!

Conclusion

Since its inception in the early nineteenth century as a late starter in the serious science enterprise geology has achieved phenomenal advances in understanding the processes that have shaped our Earth. It has unlocked the wealth of mineral and fuel reserves which power the world's economies. At the same time, there have been advances and retreats, as with all other science disciplines. As Christians it is important for us to keep current with scientific research, to represent it correctly at all times and to work at integrating it in a way which best accords with our strongly Christian world view.

As Numbers states, George McCready Price, although largely an armchair geologist and somewhat fanatical in his cause, was "no fool."⁹⁵ He was smart enough to find the uniformitarian chink in the geological armour and is now grudgingly being recognised as having played a valid critical role in this respect. However, science has changed significantly in this regard and Christians can no longer repeat Price's accusations credibly. We need to be fair and honest in our discourse. This requires us to avoid representing science as standing for a principle that it has now substantially abandoned. Furthermore, if we are going to enter the scientific fray we must understand not only the current language of science but the rules by which it operates. This is particularly so of the manner in which scientists draw conclusions. Lastly, we should press our argument only so far as it can be sustained by the evidence.

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1st ed. vol 1,	Jan, 1830
vol 2,	Jan, 1832
2nd ed. vol 1,	1832

- 2nd ed. vol 2, Jan, 1833
 1st ed. vol 3, May, 1833
 3rd edition of whole work in four volumes, May, 1834
 4th edition of whole work, in four volumes, June 1835
 5th edition of whole work, March, 1837
 Some of the work was then split off into the *Elements of Geology*, first published in July, 1838
 6th edition in three volumes, June 1840
 7th edition in one volume, Feb, 1847
 8th edition in one volume, May, 1850
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