Catastrophism—is it scientific?

Most of us were shocked by the disastrous earthquake that shook Mexico City on September 19, 1985, killing an estimated 8,000 people. We were equally shocked two months later when a mudflow resulting from a volcanic eruption destroyed the major part of the town of Armero, Colombia, burying at least 20,000 people. Why were we surprised by these disasters? In both cases there had been warnings. Our reactions raise some interesting academic questions, but also, and more significantly, they raise questions indirectly related to belief or disbelief in the Genesis account of a worldwide flood.

A brief historical review will help elucidate the issues involved. Around the end of the eighteenth century a number of geological controversies—some of them acrimonious—were in ferment.[1] Among them was the highly controversial proposal by the famous Scottish geologist James Hutton that the earth's crust had developed as a result of slow changes over long ages. His suggestion countered the then prevailing concept that major catastrophes were the important agents of geologic change. (The number and type of catastrophes suggested varied with the theorist. Some considered the worldwide flood described in Genesis to be the prime catastrophe.) While Hutton's writings have had a reputation for obscurity, it is clear that he wanted to explain geologic change on the basis of slow, normal processes: "What more can we require? Nothing but time." In his most famous statement (first published in 1788), he pushed his emphasis on the normal to the limits of the past and future: "The result, therefore, of our present inquiry is that we find no vestige of a beginning—no prospect of an end."

Several other scientists entered into the controversy over what rate of geologic change should be considered normative. Sir Charles Lyell, the most important among these, stressed even more strongly than his predecessor Hutton the importance of small, slow changes. In a letter to his fellow geologist Roderick Murchison he stated that "no causes whatever have from the earliest time to which we can look back, to the present, ever acted but those now acting and . . . they never acted with different degrees of energy from that which they now exert."

Lyell published a major treatise, *Principles of Geology* (1830-1833), that he called a polemic "to sink the diluvialists" (those who believed in a worldwide flood as described in Genesis). He was more successful than Hutton in gaining acceptance for the concept of slow changes. He was also more clever in his mode of argumentation. A letter he wrote to an active supporter reveals some of his methodology: "If you . . . compliment the liberality and candor of the present age, the bishops and enlightened saints will join us in despising both the ancient and modern physio-theologians."

Lyell's methods apparently worked, for soon thereafter the majority of geologists and other scholars adopted strict concepts of slow changes over eons. This new interpretation stood in stark contrast to the Bible's historical record, which proposes a recent creation and a worldwide flood that could have produced many of the geologic features under discussion.

During that time the words *uniformitarianism* and *catastrophism* came into use to describe the two contrasting modes of thought. Catastrophism refers to the concept that major catastrophes, usually of worldwide consequence, were the primary agents in shaping the crust of the earth. Uniformitarianism refers to the concept that the changes took place as a result of normal processes operating over long periods of time. The terms have recently undergone some confusing changes in meaning from their classical use, but the contrast between the two modes of thought still remains.

Catastrophism loses out

1. Catastrophism was sometimes associated with supernatural intervention, and during the time of the debate science was emancipating itself from extraneous concepts, trying to explain everything within its own naturalistic framework. The theory of evolution, which was developing at that time, is a prime example. A little earlier Hutton himself expressed this tendency: "Therefore, there is no occasion for having recourse to any unnatural supposition of evil, to any destructive accident in nature, or to the agency of any preternatural [supernatural] cause, in explaining that which actually appears."

2. Catastrophic events are unusual, and we do not readily take them into our thinking.

3. In order to establish scientific principles, it is highly desirable to test the hypotheses, to gain assurance that the conclusions are correct. It is much easier to test for normal processes than for unusual, catastrophic events, and the results of research are thus biased toward the more easily accessible, normal event. All these factors, and doubtless others as well, contributed to the rigorous application of uniformitarian interpretations in geology.

Recently the picture has changed

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dramatically. The data from the rocks themselves have demanded a reinterpretation. The concept of the slow, constant rate of change is being challenged at many levels of geological interpretation, and catastrophes are again being considered as important geologic agents. Note the following authoritative statements, which highlight this recent shift in thought:

W. Bahngrell Brown, *Geology:* "Of late there has been a serious rejuvenation of catastrophism in geological thought." [3]

Derek V. Ager, *The Nature of the Stratigraphical Record:* "The hurricane, the flood, or the tsunami may do more in an hour or a day than the ordinary processes of nature have achieved in a thousand years." [4]

Dag Nummendal, *Geotimes:* "The profound role of major storms throughout geologic history is becoming increasingly recognized." [5]

Erle Kauffman, in Roger Lewin, *Science:* "It is a great philosophical breakthrough for geologists to accept catastrophe as a normal part of Earth history." [6]

In the past, catastrophism may have been considered completely unscientific, but now geologists are finding similar concepts acceptable. At geological conventions discussions of major catastrophic events are now common. Some scientists have been particularly concerned that the new trend not be associated with the supernatural, as it often was in the eighteenth and nineteenth centuries. They have proposed terms other than *catastrophism* to distinguish the new approach—candidates include *neocatastrophism, episodism,* and *convulsive events*—but the terminology and definitions remain in a state of flux.

But while uniformitarianism is no longer dogma, there appears to be no trend toward shortening the billions of years assumed for the history of the crust of the earth. The theorists preserve the long ages by putting long periods of time between the catastrophic events. The new catastrophism does *not* posit one major event, such as the Genesis flood; nevertheless, current thinking often seriously considers events of worldwide significance.

The missing time gaps

The proposed time gaps between catastrophic events provide one more argument in favor of the authenticity of the biblical account of origins. The geologic record at these gaps offers no evidence similar to what the earth's surface now shows of the effects of long exposure to weathering agents. Usually evidence of erosion and soil development, and fossil evidence for the development of plant life is missing at these hypothetical major breaks. If long periods of time had intervened, this evidence should be apparent. Norman D. Newell, a leading evolutionary paleontologist, has admitted: "A puzzling characteristic of the erathem [one of the major fossil boundaries in the layers of the earth's crust] and of many other major biostratigraphic boundaries is the general lack of physical evidence of subaerial exposure. Traces of deep leaching, scour, channeling, and residual gravels tend to be lacking, even where the underlying rocks are cherty limestones. . . . These boundaries are paraconformities that are usually identifiable only by paleontological [fossil] evidence." [8]

Since these boundaries do not show the physical evidence of the long time gaps evolutionary scientists believe the fossil patterns suggest, it does not appear that there ever were long periods between the depositions of these layers. The paucity of such time-dependent features at the so-called time gaps between many of the sedimentary layers of the earth poses a striking contrast with the irregular erosion on the earth's present surface. These layers appear to have been laid down in rapid succession with little or no time between the events that precipitated their deposition. This is what we would expect of a single catastrophic event like the Genesis flood.

A few examples of catastrophic activities will illustrate how rapid their action can be. In 1976 the great Teton Dam in Idaho gave way, and in less than two hours the waters eroded down through 300 feet of the earthen dam. In 1959 an earthquake in the Madison River canyon in southern Montana loosened material from as high as 1,000 feet above the canyon floor, forming a huge landslide that traveled so fast across the canyon that it rode 400 feet up the opposite side. Scientists estimated that the slide was traveling about 100 miles per hour and that the whole process occurred in less than three minutes. Unfortunately 19 campers were buried beneath the slide.

In 1929 the Grand Banks earthquake near Newfoundland loosened some mud on the edge of the continental shelf. Within 14 hours that mud had traveled 500 miles into the North Atlantic and deposited a new, two-to three-foot-thick layer of sediment over 40,000 square miles of ocean bottom. It is estimated that the mudflow traveled at speeds up to 55 miles per hour [9] and, interestingly, ran into the hull of the famous ship S.S. *Titanic,* which had sunk in this region on its maiden voyage in 1912.

More significant than the simple recognition that changes can occur very rapidly, the new trend toward catastrophism has engendered the reinterpretation of several processes that once were thought to be slow. Tens of thousands of layers of sediment that scientists originally considered to have been deposited very slowly in shallow seas, they now interpret as having been deposited very rapidly in special underwater mudflows called turbidites.[10] A number of so-called reefs, composed of the skeletons of marine organisms, that were thought to require many hundreds to thousands of years to form are now considered the

result of rapid debris flows.[9] The Goosenecks area of the San Juan River in southeastern Utah has dramatic, deep meanders originally interpreted to have been eroded very slowly. New evidence indicates that they were cut by rapid current activity.[10]

The southeastern portion of the state of Washington contains huge erosion channels, some of them scores of miles long. These were first thought to represent slow erosion, but after many years of controversy it is now agreed that they were formed by flood activity. Some geologists have postulated that one or more ice dams located upstream broke suddenly, releasing water over the area at the rate of 9.5 cubic miles per hour, which is 10 times the combined flow of the rivers of the world.[11] Geology has moved a long way from the strict uniformitarianism of a few decades ago, and major catastrophes are again an acceptable part of scientific interpretation.

Paradigms influence science

We can learn from the pattern of thought illustrated by the controversies over catastrophism. In *The Structure of Scientific Revolutions* [12] Thomas Kuhn has pointed out that certain broad ideas, which he calls paradigms, dominate scientific interpretations. As long as these paradigms are normative, they are not questioned. One way or another, most data are interpreted to fit the accepted views.

Classical uniformitarianism provides an outstanding example of how thinking can be influenced in this way. Hutton and Lyell so thoroughly established the concept of constant geologic change over long periods of time that major catastrophes were completely ignored for more than a century. The effect that this strict uniformitarian conditioning has had on the thought matrix of geology as a whole cannot easily be evaluated, but it is unquestionably considerable. The pattern of strict adherence to accepted ideas raises sobering questions regarding the validity of other dominant ideas in science (to say nothing of human intellectual activity as a whole—not only science is subject to these episodic thought patterns).

Because catastrophes are rare, we tend to ignore them and base our conclusions on the usual calm. The disasters caused by the Mexican earthquake and the Colombian volcano might not have seemed so devastating if we were more attuned to the reality of catastrophes, but the normal dominates our thinking. Likewise, because such an event is so unusual, we find it difficult to conceive of a worldwide flood as described in Genesis. But we must not fall into the trap of drawing our conclusions solely on the basis of the normal. In the case of geologic changes the unusual catastrophe is much more important than the usual calm. Fortunately the possibility of catastrophes is no longer being ignored.

The new trend toward catastrophism has important implications for anyone searching for truth regarding the history of this world. Since both the Bible and the book of nature have the same Author, they should agree if correctly interpreted. Much of the evidence of catastrophism found in the rocks does agree closely with what we would expect as a consequence of the worldwide flood described in Genesis. The present trend toward catastrophism in geological interpretation lends support to the authenticity of the Bible.

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[1] For a more comprehensive discussion, see Chapter 2 of A. Hallam, *Great Geological Controversies* (New York: Oxford University Press, 1983). The quotations of Hutton and Lyell presented herein are from this text.

[2] W. Bahngrell Brown, "Induction, Deduction, and Irrationality in Geologic Reasoning," *Geology* 2 (1974): 456.

[3] Derek V. Ager, *The Nature of the Stratigraphical Record*, 2nd ed. (New York: John Wiley & Sons, 1981), p. 54.

[4] Dag Nummendal, "Clastics," *Geotimes* 27, No. 2 (1982): 23.

[5] Erle Kauffman, quoted in Roger Lewin, "Extinctions and the History of Life," *Science* 221 (1983): 935-937.

[6] Norman D. Newell, "Mass Extinction: Unique or Recurrent Causes?" in W. A. Berggren and John A. Van Couvering, eds., *Catastrophes and Earth History: The New Uniformitarianism* (Princeton, N.J.: Princeton University Press, 1984), pp. 115-127.

[7] B. C. Heezen and M. Ewing, "Turbidity Currents and Submarine Slumps, and the 1929 Grand Banks Earthquake," *American Journal of Science* 250 (1952): 849-873.

[8] R. G. Walker, "Mopping Up the Turbidite Mess," in R. N. Ginsburg, ed., *Evolving Concepts in Sedimentology* (Baltimore: Johns Hopkins University Press, 1973), pp. 1-37.

[9] E. W. Mountjoy, H. E. Cook, L. C. Prav, and P. N. McDaniel, "Allochthonous Carbonate Debris Flows—Worldwide Indicators of Reef Complexes, Banks or Shelf Margins," *Reports of the Twenty-Fourth International Geological Congress, Montreal, 1972*, section 6 (1972), pp. 172-189.

[10] R. G. Shepherd, "Incised River Meanders: Evolution in Simulated Bedrock," *Science* 178 (1972): 409-411.

[11] *The Channeled Scablands of Eastern Washington: The Geologic Story of the Spokane Flood* (Washington, D.C.: U.S. Government Printing Office, 1973).

[12] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: The University of Chicago Press, 1970).