EDITORIAL

THE MEXICO EARTHQUAKE — SOME AFTERTHOUGHTS

It happened suddenly, and the results were devastating. A major earthquake (Richter 8.1) shook Mexico City on September 19, 1985. The tremor which lasted about four minutes caused the collapse of over 250 buildings and the deaths of thousands. Ironically, many died in two large hospitals that had collapsed. Thirty-six hours later, a second tremor (Richter 7.5) caused further damage of upright and toppled buildings. The total number of badly damaged or destroyed buildings from the two quakes was estimated at 2500, and the number of deaths was expected to exceed 8000.

Such catastrophes surprise us. If we knew they were coming, we would be more prepared — or would we? In a way we know that they are coming; seismologists had warned about potential problems in Mexico City long ago, but Mexico City remained unprepared. Part of the reason for our surprise is that it is difficult to take the extraordinary very seriously when the ordinary is so dominant.

Usually life is relatively placid. The normal routine of daily activities is not exciting. Things do not change all that much. The geologist returning to his outcrop finds it very much the same as it was the day before. The laboratory scientist repeating his experiments over and over again to make sure they are valid is not attuned to the possibility of the unusual. Commonality can almost hypnotize us into thinking only of the ordinary. Then, once in a while, something unusual like an earthquake jars us out of our coma and makes us realize that life is not an even continuum, but is definitely episodic. However, we soon become retrapped into the dull, normal calm, and we are again unprepared for the shakeup of the unusual.

The dissimilarity between the normal and the unusual illustrates two contrasting modes of geological thought: *uniformitarianism*, which proposes that geologic changes occur by normal processes, and *catastrophism*, which proposes changes during unusual catastrophic events, often of worldwide proportions. Recent changes in geological thought about these concepts have made their definition imprecise; nevertheless, the general contrast between the two terms remains.

The Scottish geologist James Hutton (1726-1797) was primarily influential in promoting uniformitarianism (normal processes) to explain geologic changes. One of his more famous quotations illustrates his emphasis on slow, normal changes over long periods of time: “What more can we require? Nothing but time.” This mode of thinking is in sharp contrast to catastrophic explanations (unusual events) prevalent at that time. These explanations often included concepts of a worldwide flood as

described in Genesis. A little later (1830-1833) the English geologist Sir Charles Lyell published his *Principles of Geology* which has been called a polemic to destroy catastrophism and "to sink," as he worded it, "the diluvialists."

For more than a century, uniformitarianism was dogma in geological interpretation. It is only natural that this should occur, because one usually observes only slow, normal geologic changes, while catastrophic events are rare. Likewise in research, the replication which is highly desirable for the establishment of firm conclusions is much less accessible for the rare event; hence, investigation tends to concentrate on the readily available, normal data, and the matrix of results is biased in this direction. This in turn influences our concept of truth towards the normal which can be further reinforced by our intuition which tells us that the normal is reliable. The problem of bias due to the unavailability of information is not easily evaluated, and our concepts of truth are insidiously influenced by this. Hence, concepts such as uniformitarianism, which favor the normal, easily gain acceptance, even if they misrepresent the total picture.

Fortunately for geological thinking, the past two decades have witnessed a retrenchment away from strict uniformitarianism. A modified form of catastrophism has become acceptable. This is not a return to the classical catastrophism of events such as the Genesis flood but is a trend in that direction. The billions of years conceived for the development of the crust of the earth are still preserved by putting long periods of time between significant catastrophic events. The comments of several scientists in authoritative publications witness to the present trend.

> *It is a great philosophical breakthrough for geologists to accept catastrophe as a normal part of Earth history* (Erle Kauffman, quoted by Lewin 1983, in Science).
>
> *Of late there has been a serious rejuvenation of catastrophism in geological thought* (Brown 1974, in Geology).
>
> *The profound role of major storms throughout geologic history is becoming increasingly recognized* (Nummendal 1982, in Geotimes).
>
> *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* (Ager 1981, p 54, in his book on stratigraphy).

The trend towards catastrophism has been generated by evidence found in the surface of the earth that witnesses to catastrophic activity in the past. It is a credit to geologists that among the dominant changes in geological thought that have occurred over the past quarter of a century, the unusual catastrophic event is gaining significant recognition.

Have we become sufficiently removed from the possibility of being trapped by the commonality of the normal? Obviously not, or the tragedy of Mexico City would not haunt us. Because of the plasticity of thought

induced by our frail memories and the ease of noting the normal, the normal will continue to bias our thinking. We tend to forget the unusual. Unique events such as worldwide floods conceived by classical catastrophism are even more difficult to envision and incorporate in our framework of reality, because such events are so remote — in time, magnitude, and complexity — from the normal that dominates our reference field. While such catastrophes may leave evidence of their occurrence, it is natural that we should have doubts about such unusual events; nevertheless, Mexico City reminds us that the exceptional may be very real. In our search for truth we must not fall into the trap of limiting our concepts to the normal; if we do, we may suddenly find that we are on shaky ground.

Ariel A. Roth

REFERENCES

Ager DV. 1981. The nature of the stratigraphical record. 2nd ed. NY: John Wiley.

Brown BW. 1974. Induction, deduction, and irrationality in geologic reasoning. Geology 2:456.

Lewin R. 1983. Extinctions and the history of life. Science 221:935-937.

Nummendal D. 1982. Clastics. Geotimes 27(2):23.