

## The Nature of the Stratigraphical Record

By Derek V. Ager. 1973. Halsted (Wiley), New York. 114 pp., illus. \$9.50.

The early observations made at the dawn of development of the science of geology already recognized the discontinuous nature of the geological record and led to what appeared as a logical conclusion—a series of catastrophic events. This explanation was clearly supported by the biblical Deluge idea and provided a simple answer to what we now know is a complex problem. Catastrophism and fatalism have always captured the imagination of the human mind and filled man with morbid curiosity about events that he observed but could not adequately explain. Events such as volcanic eruptions, earthquakes, floods, landslides, intense atmospheric storms, and other like events are recorded and remembered because they appear to be exceptional and can have a disruptive impact on human activities and mind—they are *newsworthy*. There is a vast difference between the meaning of the word *catastrophe* in the geological sense and in the sense of its usage by our current, or ancient, news media. Commonly man understands catastrophe to mean a sudden event of disastrous nature. Events that are “sudden” in a geological sense (certain mass extinctions of biota, glaciations, the presence of some very widespread deposits) may have taken, in fact, thousands or a few million years to occur and leave a recognizable “signature” in the geologic record.

Ager's book deals with some selected aspects of the stratigraphical record: the persistence of facies; the problems of the fossil record; gaps in the record; the catastrophic nature of stratigraphy, and uniformitarianism; the process of sedimentation; the “golden spike” principle; and the processes controlling the accumulation of the record.

*The Nature of the Stratigraphical Record* is a provocative book. It appears to challenge some of the very basic principles of geology and in doing so brings into clear focus the need in geology to examine and re-examine, and reinterpret the record in the light of new technological and theoretical advancements made in the geological sciences and related natural sciences. I interpret Ager's message to mean that we in geology should be never completely satisfied with our understanding of the stratigraphical record and that we should be always prepared to reconsider existing hypotheses in view of new evidence from all possible sources.

While discussing the abruptness of some of the major changes in the history of life Ager states

that, “It is both easy and tempting (and very much in line with the other ideas expressed in this book) to adopt a neocatastrophist attitude to the fossil record” (page 19). He hastens to explain, however, that “In case this book should be read by some fundamentalist searching for straws to prop up his prejudices, let me state categorically that all my experience (such as it is) has led me to an unqualified acceptance of evolution by natural selection as a sufficient explanation for what I have seen in the fossil record. I find divine creation, or several such creations, a completely unnecessary hypothesis.” What Ager is saying is that rates of geological processes have varied significantly through time and that “most evolution proceeds by sudden short steps or quanta.”

In his discussion of mass extinctions of biota, Ager considers a number of causes that have been proposed (including meteoritic impacts) and he seems to imply that we should keep an open mind in respect to a search for such causes and evaluate them on the basis of all available evidence. He states that “clearly we cannot blame a single organic agent for the simultaneous extinction of all the varied and unrelated groups of dinosaurs, the pterosaurs, the marine reptiles, the ammonites, the belemnites, the rudistids and many minor groups besides at the end of the Mesozoic.”

Ager's discussion of the fragmentary nature of both the sedimentary and fossil records confirms what has already been commonly accepted by stratigraphers and paleontologists. We know that many gaps exist in the stratigraphical record, and that these gaps are gradually being filled by new information obtained during further investigations.

Under the heading of “catastrophic uniformitarianism” Ager gives special attention to relatively rare geological events. He illustrates the point by saying that “given time, the rare event becomes a probability and given enough time, it becomes a certainty.” As one example, he refers to the frequency of tsunamis as known from historical records and concludes that “this would allow us more than 100 000 tsunamis in a million years.” On the basis of this reasoning Ager feels that, “given all the millennia we have to play with in the stratigraphical record, we can expect our periodic catastrophes to do all the work we want of them.” Although Ager challenges apparently some aspects of uniformitarianism, he claims that, “I do not deny uniformitarianism in its true sense, that is to say, of interpreting the past by means of the processes that we see going on at the present day, so long as we remember that the periodic catastrophe (including sudden events like the rush of a turbidity current) is one of those processes.”



Ager challenges some concepts relating to certain aspects of the process of sedimentation, and emphasizes the question of diachronism of stratigraphic units and boundaries. In this context he concludes, in part, that "most sedimentation in the continental areas is lateral rather than vertical."

In the final paragraphs of his book Ager observes that, "In our near-sighted way of looking at the stratigraphical column, we tend to forget that these recent events (Pleistocene glaciations), if considered on the normal geological time-scale, were virtually instantaneous and certainly catastrophic. The whole of the Pleistocene ice-age would fit within an ammonite zone or two." Obviously what may appear as a catastrophe on the geological time-scale can be a slow process on the human time-scale. In fact, the appearance of man

on earth would be very much a catastrophic event on the geological time-scale.

Although Ager's book tends to be provocative and challenging in respect to several basic geological principles, and the unfortunate over-emphasis of the word catastrophe, the main value of this book is in the forcing of geologists to scrutinize the stratigraphical record with an open mind and not to be constrained by traditional views to the point where these stifle progress. From this viewpoint the book can be recommended as stimulating reading to geologists and others interested in the history of the earth.

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### The Changing Flora and Fauna of Britain

Edited by D. L. Hawksworth. 1974. Academic Press, London & New York. (Systematics Association Special Volume 6). 461 pp. \$23.75.

Canada has a land area of 3 560 238 square miles and a population of around 22 million; it has, therefore, an average of about six persons per square mile. The corresponding figures for the British Isles, are 110 463 square miles, 60 million people, and an average population density about 90 times that of Canada. In Canada we are rightly concerned that an increasing population, making increasing demands on the environment, is threatening to impoverish our flora and fauna. Is it surprising, then, that Canadians sometimes wonder what plants and animals can, in fact, survive a population density of more than 500 persons per square mile, coupled with two centuries of industrialization, and many more of intensive agriculture? This attractive volume, representing the proceedings of a symposium held by the Systematics Association in April 1973, answers this question admirably. It does a great deal more, however, for it provides in separate chapters an informed appraisal of the present status and future prospects for survival of 20 different groups of organisms, ranging from birds and vascular plants to spiders and "arthropod ectoparasites of man"!

Inevitably there is some unevenness of treatment because, whereas the occurrence and distribution of vascular plants and vertebrates in the British Isles (despite its title the book covers

Ireland also) have been the subjects of detailed study for over two centuries, knowledge of groups such as the microfungi, freshwater algae, and some of the freshwater invertebrates is still rudimentary. In most other groups the situation is in between, with new records of species of bryophytes, macro-mycetes, and most terrestrial invertebrates being reported at a steady rate. This is well summarized by E. A. G. Duffey who comments with regard to the British spider fauna that "many species thought to be very rare have been shown to be more widely distributed as a result of work during the last 15-20 years."

It is interesting that elements of the fauna and flora of such small islands peopled with so many enthusiastic amateur and professional naturalists are still so incompletely known—when, if ever, can we hope to approach that level of knowledge in Canada?—but it is not very helpful in terms of monitoring changes due to man's increasing influence on the environment. For this we must look primarily to the vertebrates and vascular plants, and to a lesser extent to the lichens, through their sensitivity to atmospheric pollution, the terrestrial molluscs, through the long-standing interest in conchology, and the orthoptera, well-known because of the few British species.

From these the overall picture is one of remark-





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