Journal of Sedimentary Research

An International Journal of SEPM

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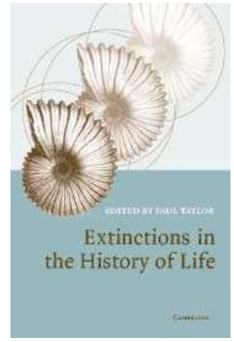
Review accepted 26 October 2006

Extinctions in the History of Life, edited by Paul D. Taylor, 2004. Cambridge University Press, The Edinburgh Building, Cambridge, CB2 2RU, United Kingdom. Hardback, x + 191 pages. Price GBP 40.00; USD 70.00. ISBN 0-521-84224-7.



When one has to deal with a complex subject, it is of great value if a concise and clear reference work is at hand, which explains general terms and concepts. The volume edited by Paul Taylor may serve as such a reference work (or textbook) for those who study fossil diversity, mass extinctions, or any other paleobiology-related topic. The best experts in these fields provide simply presented information about ordinary extinctions, mass extinctions, their causes, and evolutionary consequences. The book consists of six chapters, which are preceded by brief biographies of the authors (and the reader is thus informed about the achievements of these "living classics").

The first chapter (by P.D. Taylor) explains the difference between ordinary extinctions (so-called "background extinctions") and mass extinctions. An incomplete fossil record, including the Signor-Lipps and Lazarus effects, prevents the proof of true extinctions of taxa. Pseudoextinctions of paraclades pose another interesting problem: if birds were closely related to dinosaurs, it could be concluded that this complex group of fossils have survived the K–T boundary without problems! Then, Taylor mentions the possible approaches to measure the extinction. It is an important note: the scientists should avoid to extrapolate the changes in extinction rates at the level of species to the level of genera or families. The Phanerozoic fossil diversity is briefly discussed, and three general patterns in its dynamics are outlined, i.e., the evident decline in background extinction (it is discussed whether this is an artefact), the presence of at least five mass extinctions (but, in my opinion, a larger number of events might well be proclaimed as "mass extinctions"), and the appearance of a cyclic character in the extinctions (following Taylor, I greatly doubt its actual occurrence). Selectivity, i.e. which taxa became extinct and which not, is discussed later. An important question might have been discussed here, i.e., whether mass extinctions should be established only on the basis of the extinction patterns, or whether the changes in the total diversity need be considered. Next, Taylor states that the interpretation of extinction patterns depends largely on uniform stratigraphical timescales and on the quality of the sampling techniques. Competition, predation, and disease are among the main biotic factors of extinction, but it is difficult to evaluate their importance in this process. An evaluation of the influence of abiotic factors requires precise correlation techniques.

The second chapter (by J.W. Schopf) is devoted to extinctions in the Precambrian. It rather explains, however, why there were no events of such a kind then. And this is right, as 'status quo evolution' (in Schopf's terms) was a characteristic feature of the earliest organisms. Extinction becomes only a common pattern in the evolution of eukaryotes with sexual reproduction. Additionally, this chapter presents a very good description of Precambiran life.

The third chapter (by S.L. Wing) deals in detail with an extinction-related subject about which still very incomplete data are available, i.e., the extinctions among plants. Wing examines floristic changes and extinctions at four boundaries: Westphalian–Stephanian, Permian–Triassic, Cretaceous–Tertiary, and Paleocene/Eocene. In the cases of the Permian/Triassic and Cretaceous–Tertiary boundaries, the plants were stressed by the same environmental conditions as the animals. Choosing between the possible options that Wing mentions as possible explanations for the absence of clear evidence of these plant mass extinctions in the global record, I prefer the huge lack of data in the various paleobotanical databases compiled thus far. Wing suggests that the plant extinctions were selective, but that major clades survived these times of environmental stress. Finally, abrupt climatic changes, as those at the Paleocene–Eocene transition, might have or have not provoked significant extinctions among plants. Two appendices to this chapter containing paleobotanic information are of special interest.

The fourth chapter (by D.J. Bottjer) starts with a note on the absence of reefs (the ecosystems with the highest biodiversity) in the Early Triassic, and in the early and late Early Jurassic. These may be related to the aftermath of mass extinctions. Various authors explain the latter by the occurrence of giant-scale volcanic eruptions in the large igneous provinces, which would have given rise to killing mechanisms. An interesting conclusion is that, if even any of the mentioned mass-extinction events occurred thanks to extraterrestrial impacts, the paleoenvironments must already have been stressed by the volcanic eruptions. I wonder whether such a situation simply makes a biotic effect of an impact possible, or that mass extinctions thus become more pronounced in comparison to those induced by eruptions only.

The fifth chapter (by P.B. Wignall) overviews the possible causes and effects of mass extinctions, which have been induced (or, at least, become more developed) by impacts, massive volcanism, sea-level changes, marine anoxia, global climatic changes, and strangelove oceans. All these factors seem capable (completely or partly), but it is not yet possible to attribute each of the known mass extinctions to any of these potential causes specifically; this will need much more further study. Perhaps some extinctions were provoked by a combination of causes, i.e., by the co-occurrence of an impact and volcanism (in which case the volcanism might have been triggered by the impact ...). Figure 5.8 presents a possible “chain of events,” triggered by an eruption in a giant volcanic province. Such a variety of possible mechanisms of mass extinctions leads me to hypothesize that there was never a single cause for all these events, but we are still far from the understanding how the Earth's biota became stressed, and why did this occur. It is easy to agree with Wignall that we know the correlation between events fairly well, but not their true interrelations.

The sixth and last chapter (by D. Jablonski) discusses the evolutionary consequences of biotic catastrophes, and lessons from their studies. Mass extinctions provided the possibility for new groups of fossils to radiate, thus changing the structure of the Earth’s ecosystems. Jablonski mentions an intriguing problem, i.e. the incomparable characters of the rise of biota after the great mass extinctions on one hand, and this rise during the Cambrian explosion on the other hand (but I should also mention here that my own studies on foraminifers demonstrated that the taxonomic structure of this group after the Permian–Triassic event was somewhat similar to that in the Early Paleozoic). In summary, Jablonski come to five important conclusions: (1) extinctions were not occasional events; (2) survival may not be linked directly with “biological success,” as demonstrated well by “dead clade walking” (but the question arises: how could one know that a clade is dead, if it does not go to be extinct yet?); (3) mass extinctions are able to homogenize the global biota; (4) recovery is a relatively slow process; (5) recovery is an unpredictable process. These conclusions are also important in the light of protecting present-day ecosystems.

This volume ends with a highly informative glossary, which gives a brief, but clear explanation of the many terms used.

Is this book perfect? Fortunately not (such a book would destroy all dreams of authors and publishers to be the first the write or publish the perfect book!). One thing that I dearly miss in this book is a chart or a table that summarizes the present knowledge on mass extinctions. I would like to find out easily in this way which biotic crises that have been discovered during two past decades might, in addition to the Big Five, be considered as true mass extinctions. Were the end-

Jurassic, Cenomanian/Turonian or any Cenozoic crises true mass extinctions? Were there extinctions before the end-Ordovician? Finally, if any of these and other crises occurred and if they were true mass extinctions, was their effect really less than that of Big Five? At least to me, it seems that the early Toarcian event, considered in this volume by Bottjer, was at least partly comparable with the Cretaceous–Tertiary mass extinction (as I may deduce from foraminifer studies). Another question that should have been considered in a book like this, is whether there is any possibility that our further studies will lead us to the finding of new mass extinctions! These shortcomings are, however, certainly not detrimental to this book, which is, almost in all respects, of excellent quality.

I therefore recommend this book to both those specialists who are already specialized in fossil diversity and young scientists. The former may use this book as a help not to forget about the basic paleobiological principles when carrying out research, whereas the latter will be stimulated by this book to initiate new investigations of the fossil record. Geology amateurs and other non-specialists will also find this book very interesting. In my opinion, this volume is among the best syntheses of paleobiological knowledge, and everybody will read it with pleasure.

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