

S8-5**Mass extinction events in the Phanerozoic**

Yukio Isozaki

Department of Earth Science and Astronomy, The University of Tokyo

Komaba, Meguro, Tokyo 153-8902, JAPAN

In the Phanerozoic (last one-ninth of the Earth's history, ca. 543 million years), five major mass extinction events were recognized. They are often called the Big-5 that includes Late Ordovician, end-Devonian, end-Permian, end-Triassic, and end-Cretaceous events. As each event has considerably driven the evolutionary course of Earth's life, missing of even one event among them may have not led the modern biota including human beings. The end-Cretaceous (K-T) boundary (ca. 65 m.y. ago) is known for the dinosaur/ammonite-massacre and for the sole example of proven extraterrestrial impact-related event. Similar impact-oriented interpretations have been applied also to other extinction cases, however, none of them were proved with hard evidence for a consequence of bolide impact. The end-Devonian and end-Triassic sedimentary rocks retain some possible but not yet convincing lines of evidence for impact. The biggest extinction of the Phanerozoic occurred at the end-Permian or the Paleozoic-Mesozoic boundary (ca. 253 m.y. ago). Despite several claims for impact-triggering cause, all were consequently refuted. Instead, terrestrial causes such as large-scale volcanism including continental flood basalt eruption, appear lately promising in the continuously active discussion. The latter mechanism was probably related to episodic convection of the Earth's mantle called superplume activity. Thus at present, we have at least two possible scenarios to explain large-scale mass extinction in the Phanerozoic. On the other hand concerning the Precambrian, scarce fossil data hinder detailed analysis on extinction pattern and possible causes. Although life were primitive and small in the Precambrian, similar processes should have occurred more than several times in such a long period over 4 billion years. Judging from the formation processes and later evolution of our planet, frequency of such events was much greater in the deep past. The Phanerozoic cases will provide useful guidelines for further studies on the Precambrian extinction/evolution history.

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