

TAXONOMIC DIVERSITY AND FAUNAL TURNOVER IN THE EARLY CAMBRIAN: DID THE MOST SEVERE MASS EXTINCTION OF THE PHANEROZOIC OCCUR IN THE BOTOMIAN STAGE?

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A handful of mass extinctions, scattered through the Phanerozoic, forever changed the course of life on Earth, eliminating large numbers of clades from the evolutionary race and allowing the survivors to diversify following the extinction. These ecological-evolutionary upheavals extirpated whole communities and eliminated otherwise successful clades from the evolutionary race. While the mechanism(s) responsible for most mass extinctions remain to be identified, their impact on the biosphere is self-evident. Thus, recognition of a previously overlooked, severe extinction early in the Phanerozoic provides important new insights and perspectives on the history of life

In the course of research on the biogeographic distribution of Early Cambrian metazoan taxa, I compiled a database on the geographic and stratigraphic distribution of metazoan genera. The data are derived from the primary literature on the paleogeographic and stratigraphic distributions and systematics of Early Cambrian fossils. The Russian zonation scheme for the Siberian Platform (incorporating four stages, in ascending order: Tommotian, Atabanian, Botomian, and Toyonian) was employed for biostratigraphic correlations. Correlations of other regions to the Siberian stages were based upon work by F. Debrenne and her colleagues on archaeocyathans and upon M. D. Brasier's correlations from small shelly fossils. While there is no accepted global correlation scheme for Lower Cambrian strata, this approach yields results that are useful at the four-stage level of resolution. The data base currently includes more than 850 genera.

Examination of the aggregate data reveals a substantial reduction (> 60%) in the global total of genera extant in the Toyonian, in comparison to the Botomian stage. The extinction rate of genera at the end of the Botomian exceeds 80 percent. By comparison, the end-Permian extinction eliminated slightly more than 60 percent of the extant genera.

In addition to the general reduction in generic diversity, Brasier (1982) has documented a fall in sea level and reduction in the shelf area. Associated with this regression was a loss of reef-forming archaeocyathan genera. While a small number of archaeocyathan genera persisted into the Toyonian (and a few genera have been reported from Late Cambrian strata in Antarctica), the bulk of archaeocyath diversity was lost in the Botomian. The losses in diversity, extermination of reef-forming organisms, and high turnover in conjunction with a marine regression matches the pattern observed at most other mass extinctions.

It is remarkable that this relatively severe extinction has gone mostly unnoticed by paleobiologists. Much of the data is relatively new, a product of intense international study of early metazoan faunas. Most likely, the mass of data produced by Lower Cambrian specialists over the past ten years has yet to reach the treatises and monographs where it can be easily summarized. Also, resolution of patterns within the Early Cambrian has waited on the development of correlations and a satisfactory zonation. Indeed, detailed study of the Botomian extinction will await more accurate correlations.

Brasier, M. D. 1982. Sea-level changes, facies changes, and the late Precambrian-Early Cambrian evolutionary explosion. *Precambrian Research* 17: 105-123.