This paper examines the five “big” mass extinction in earth history and assesses each one’s right to that claim. When studying extinction events, paleontologists must confront problems of poor rock preservation, vague age constraints and the fluctuations of actual plant, animal and microbial diversity over the interval in question. Some scientists have asserted that the “big five” are artifacts of gaps in the fossil record, or simply represent normal background extinction taken to extremes. Furthermore, the authors look into the claim that the five mass extinctions had some common underlying cause; they conclude that because the mass extinctions differ greatly both in their effects and greater diversity contexts. As a side note, the scientists also address the unusual diversity fluctuations in the Cambrian and Early Ordovician.

Central to the analysis is the relationship of origination rates to extinction rates; extinctions result from either origination rates dropping below extinction rates or extinction rates superceding origination rates. Based on these two modes, the researchers identified three of the five mass extinctions that resulted from increases in extinction rates. Only the end-Ordovician, end-Permian and end-Cretaceous saw significant losses of diversity, as opposed to the end-Devonian and end-Triassic saw mellower diversity losses in times of low origination. Because each extinction occurred in its own “stratigraphic neighborhood,” as well as in differing tectonic and climatic surroundings, the researchers conclude that each mass extinction had a unique cause (or convergence of causes).

By statistically manipulating Sepkoski’s raw diversity data, the researchers were able to place each extinction in a stratigraphic “neighborhood.”

This paper was quite thorough, which I always appreciate. Of course, briefer papers have a far more specific focus, but I often find that shorter papers leave me with more questions that when I started. The broader scope of this article allowed the authors to lay out multiple inquiries under their umbrella research question. The article was published in Paleobiology, but it could easily be understood by a layperson; the authors take pains to explain both the procedures and results for each section. I was especially fascinated by their discussion of the three “true” mass extinctions. Their method, comparing origination rates to extinction rates, could be a full paper on its own, and is an admirably simple and clear way to distinguish among the mass extinctions. I also liked their method of using changing origination/extinction rates to explore the idea that all the mass extinctions had an underlying common cause or set of causes.

I did, however, find some of their conclusions a little dense and perplexing, such as the nonlinear regressions; had I gotten more detail on their thought process, I might have made more of that. As it stood, I was unsure of what exactly it served for the paper as a whole. I also wish they had discussed qualitative theories on the five mass extinctions, as this would have helped me put their statistical findings in the larger geochemical/paleoclimate context. The authors did touch on qualitative evidence occasionally, especially in their examination of trilobite diversity in the Cambrian, and I would have found the paper even more accessible and readable had they set aside space to do so with each extinction.

The figures are integral to the paper, and the captions do a good job of explaining the graphs’ meanings and relevance. They consisted completely of linear graphs or dot graphs that almost amount to such. By various manipulations of the data and axes, they were able to graphically represent each of their findings. I found their graphs relating to the three “true” mass extinctions the most illuminating. By plotting origination rates and extinction rates as separate lines, it was easy to see how the two rates interacted to produce downswings in diversity. This as much as the actual writing illustrated to me the difference between extinction events that are produced by catastrophic loss of species and those that areaccentuated bytaking place in a time of low origination.