

## The Decline and Fall of the Non-avian Dinosaurs

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Despite claims to the contrary, the cause or causes of the non-avian dinosaur extinction at the end of the Cretaceous remain as controversial as ever. The reason little progress has been, and perhaps will never be made, has to do with (1) the nature of the end-Cretaceous dinosaur record and (2) the nature of cause-effect tests involving historical data. Two recent proposals have appeared recently that purport to account for this extinction. Both assume a bolide impact was the sole cause. The first suggests that following collision, impact ejecta re-entering the atmosphere would create a 'thermal pulse' that would kill any land-dwelling organism that could not find shelter quickly. While this scenario may account for the general pattern of dinosaur extinction, it falters when its predictions are referenced to other terrestrial (e.g., birds, evidence for wildfires, evidence from terrestrial invertebrates) and marine groups. The second proposal addresses the data used to support the long-standing observation that non-avian dinosaur species richness values declined from a Late Campanian high through the Maastrichtian. This proposal uses a questionable interpretation of rarefaction results to suggest that Late Maastrichtian values were the equal of—if not greater than—Late Campanian values. A reanalysis of the data on which these conclusions are based not only fails to reproduce these results, it confirms the magnitude of the Maastrichtian dinosaur richness decline and offers further detail into that decline's taxonomic structure. Other proposals involving combined analyses of turtles, mammals, and plants and another analysis of plants do offer sufficient temporal resolution to rule out a long-term richness decline in these groups, but not to the point where differences between extinction patterns played out over 50-500,000 years could be recognized. Given the certain knowledge that several potential extinction mechanisms were active in the Earth's environment over this interval, the singling out of any one as the only cause of non-avian dinosaur extinction is more a matter of speculation than science.

***Journal of Vertebrate Paleontology* 25(supplement. to no. 3):87A.**