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Mass extinctions, recovery and resilience

Changes in dinosaur ecosystems leading up to the Cretaceous-Paleogene boundary in North America

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The Cretaceous-Paleogene (K-Pg) boundary is associated with Earth's third largest mass extinction. Despite being one of the best-studied intervals of time, there is considerable debate regarding the drivers and tempo of the extinction. The Deccan Traps flood basalt province and the Chicxulub bolide impact have both been suggested as drivers of the K-Pg mass extinction. With these drivers in mind, we provide a detailed and temporally constrained terrestrial fossil record that documents relative abundance of Hell Creek Formation dinosaur skeletons from the latest Cretaceous of North America.

The dataset consists of ceratopsians (65%), Edmontosaurus (23%), Thescelosaurus (5%), tyrannosaurs (4%), pachycephalosaurs (2%), and other taxa (1%). The relative abundance of skeletons is not distributed evenly through time or depositional environment. The lower third has a relatively even distribution of ceratopsians (31%), Edmontosaurus (38%), and Thescelosaurus (31%), while the relative abundance of ceratopsian dinosaurs increases to 58% and 73% in the middle third and upper third, respectively. In addition, ceratopsians are preferentially found in mudstone overbank deposits by a 2:1 margin, Edmontosaurus and Thescelosaurus in sandstone riverine deposits by a 16:1 and 8:1 margin, respectively. The preferential occurrence of taxa with lithology, combined with a general lithologic change from a sandstone-dominated base to a mudstone-dominated top suggests depositional environment changes, likely a result of marine transgression, is a primary driver for observed changes in Hell Creek dinosaur ecosystems. The occurrence of all large, common dinosaurs within the uppermost Hell Creek suggests a rapid demise as a result of the bolide impact.