



Chicxulub Impact's Real Age & Mass Extinction's Real Cause

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After 42 years, the debate over the end-Cretaceous mass extinction still rages with arguments made for Chicxulub impact and Deccan volcanism as the real cause of this catastrophe. We briefly review the evidence for the pre-KPB age of the Chicxulub impact based on the primary impact spherule layer, which we link to Deccan volcanism based on the global mercury (Hg) fallout from Deccan eruptions. Mercury from volcanic eruptions is distributed around the world during its atmospheric residence time of 6 months to one year, after which it rains out over land and oceans. Major pulsed volcanic eruptions yield high Hg concentrations during fallout, which we termed Extreme Events (EE). We identified 20 of these Hg extreme events during the last 550 ky of the late Maastrichtian in sequences from Tunisia, Israel, Egypt and Mexico. At Elles, Tunisia, we dated these events (EE1 to EE20) based on orbital cyclicity and biostratigraphy with precision of one cycle (20 ky) with an error margin of 10-20 ky (Keller et al., 2020). We linked these dates to U-Pb zircon ages of the Deccan Traps with similarly high precision (Schoene et al., 2019). The resulting mercury stratigraphy yielded excellent age control linking Deccan eruption pulses across the globe. Results from two localities in NE Mexico revealed the Chicxulub impact crashed into Yucatan above the base of the *Plummerita hantkeninoides* zone CF1 and EE6 at about 200 ky prior to the KPB mass extinction. This deposit is unlike any other of the over 100 reworked spherule layers mixed with abundant shallow water debris. This oldest and primary impact spherule layer consists of compressed pure melt rock glass and glass spherules that settled rapidly to the deep seafloor. The environmental effects of this large impact were short-lived and caused no species extinctions. The effects of this 10 km-sized bolide impact had been vastly overrated.

The KPB mass extinction was identified between the longest lava flows across India to the Krishna-Godavari Basin and into the Bay of Bengal. Based on peak Hg fallout, we identified these volcanic eruptions as the largest most rapid sequence of pulsed events in Tunisia, Israel, Egypt and Mexico, all coinciding with the rapid mass extinction observed in India. The mass extinction began with the onset and ramp-up of pulsed Deccan eruptions resulting in toxic and acidic waters that caused 50% species extinctions. Extremely rapid large pulsed eruptions followed and resulted in the longest lava flows and hyperthermal warming that caused the rapid demise of all but one species,

the disaster opportunist *Guembeltria cretacea*. Deccan eruptions quickly diminished after the mass extinction and climate cooled rapidly giving rise to the first new species. Volcanic eruptions remained low and cool temperatures persisted through the early Paleocene interrupted by a smaller eruption phase about 100 ky after the mass extinction. These data reveal that Deccan volcanism caused the KPB mass extinction without any extraterrestrial aid.

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