Timing and Tempo of Deccan volcanism relative to the KPg extinction revealed by Mercury and Tellurium anomalies

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Abstract

Mercury (Hg) and more recently tellurium (Te) are indicator of large-scale volcanism in marine sediments and provide new insights into relative timing between biological and environmental changes, mass extinctions and delayed recovery. Several studies evaluated the relationship between Hg anomalies in sediments and LIP activity across mass extinction horizons. The bulk (80%) of Deccan Trap eruptions occurred over a relatively short time interval in magnetic polarity C29r. U-Pb zircon geochronology reveals the onset of this main eruption phase 350 ky before the Cretaceous-Tertiary (KT) mass extinction. Maximum eruption rates occurred before and after the K-Pg extinction, with one such pulse initiating tens of thousands of years prior to both the bolide impact and extinction, suggesting a cause-and-effect relationship.We present a comprehensive high-resolution analysis of Deccan Traps Hg-Te loading, climate change and end-Cretaceous (KPB) mass extinction from a transect, which includes 30 sections deposited in both shallow and deep environments. In all sections, results show that Hg concentrations are more than 2 orders of magnitude greater during the last 100ky of the Maastrichtian up to the early Danian P1a zone (first 380 Ky of the Paleocene). Hg anomalies generally show no correlation with clay or total organic carbon contents, suggesting that the mercury enrichments resulted from higher input of atmospheric Hg species into the marine realm, rather than organic matter scavenging and/or increased run-off. Significant and coeval Hg enrichments are observed in multiples basins characterized by proximal and distal, as well as shallow and deep-water settings, supporting a direct direct fallout from volcanic aerosols. Hg isotope data from Bidart confirm a direct Hg fallout from volcanic aerosols. Te/Th ratios measured in the Goniuk (Turkey), Elles (Tunisia), Gubbio (Italy) Beida and Wadi Nukhul (Egypt) sections show the same trend as Hg/TOC and are consistent with a volcanic origin, albeit a minor extraterrestrial contribution of Hg to the boundary cannot be excluded. Te and Hg are however not correlated with iridium contents in the KPg interval and are consequently not related with impact and maximum eruption rates occurred before and after the K-Pg extinction, with one such pulse initiating tens of

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thousands of years prior to both the bolide impact and extinction. The most intense phase of Deccan volcanism (Wai Formations) began shortly before the K-Pg boundary, and was therefore not triggered by the Chicxulub impact.

Keywords: KPG mass extinction, Deccan Volcanism, Mercury, Tellurium