Geophysical Research Abstracts
Vol. 21, EGU2019-7917, 2019
EGU General Assembly 2019

Mercury links Deccan Volcanism to Climate Change and the End-Cretaceous Mass Extinction

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Deccan volcanism in India and the Chicxulub impact in Mexico are both linked to the end-Cretaceous mass extinction but the relative timing of the impact and volcanic eruptions remains controversial, precluding a full assessment of their respective roles. Recent discovery of mercury (Hg) anomalies, from volcanic emissions and following atmospheric fallout, in stratigraphic records provides a potential tool to directly assess the cause-and-effect relationship between Large Igneous Provinces (LIPs) volcanism and climate change and mass extinctions. We report the first high-resolution Hg record across the Cretaceous-Paleogene boundary (KPB) in the astronomically tuned Elles section in Tunisia (auxiliary Global Stratotype Section and Point), correlated with U-Pb geochronology from the Deccan Traps in Western India. Results support Hg as a robust proxy for Deccan volcanism and reveal a direct link between the environmental changes that led to the end-Cretaceous mass extinction and Deccan volcanic activity: (1) onset of Hg loading near the base of C29r, 340 ky before the KPB, correlative with onset of global warming; (2) peak in Hg loading at the CF1/CF2 zone boundary correlative with a bottom water temperature increase of 3.2 ºC; (3) maximum Hg loading correlative with hyperthermal warming, which rapidly raised bottom water temperatures by 3.5 ºC within ~2 ky, and ocean acidification in the last 25 ky of the Maastrichtian ending with the mass extinction at the KPB. These volcanically-induced environmental changes led to increased stress on marine life evident by reduced species size (Lilliput effect), decreased species populations and a carbonate crisis that ultimately led to the end-Cretaceous mass extinction when threshold life conditions were reached during paroxysmal volcanic eruptions in the last 25 ky before the KPB. The timing of the Chicxulub impact and its environmental effects relative to Deccan volcanism remain enigmatic and still need to be investigated.