Geophysical Research Abstracts
Vol. 17, EGU2015-6774, 2015
EGU General Assembly 2015

Deccan Volcanism, Chicxulub Impact, Climate Change and the end-Cretaceous Mass Extinction

Gerta Keller (1), Jahnavi Punekar (), Paula Mateo (), Thierry Adatte (), and Jorge Spangenberg ()

(1) Princeton University, Department of Geosciences, Princeton, United States (gkeller@princeton.edu), (2) ISTE, Université de Lausanne, Unil-Mouline, Géopolis, 1015 Lausanne, Switzerland

Age control for Deccan volcanism, associated global climate changes, high-stress conditions and the KTB mass extinction is excellent based on biostratigraphy and corroborated by new U-Pb dating providing new evidence for a complex mass extinction scenario. The massive Deccan eruptions of phase-2 began in the latest Maastrichtian C29r and ended at or near the Cretaceous-Tertiary boundary (KTB) depositing ∼3000 m of stacked lava flows or 80% of the total Deccan eruptions over a period of just 250 ky. The onset of phase-2 eruptions coincided with rapid global warming on land (8°C) and oceans (4°C) and increasingly high-stress environments evident by dwarfed species and decreased diversity preceding the mass extinction in planktic foraminiferal zones CF2-CF1. Deep cores in the Krishna-Godavari Basin, SE India, document the rapid mass extinction of planktic foraminifera in intertrappean sediments between four major volcanic eruptions known as the longest lava flows on Earth. Maximum stress is observed globally approaching the end of the Maastrichtian with faunal assemblages dominated (∼90%) by the disaster opportunist Guembelitria cretacea. This interval correlates with the massive eruptions of the world's longest lava flows, renewed rapid global warming and ocean acidification during the last ∼50 ky of the Maastrichtian.

The Chicxulub impact occurred during the global warming near the base of zone CF1 preceding the mass extinction by <100 ky (depending on the time scale used). This age estimate is based on the stratigraphically oldest impact spherule layer in NE Mexico, Texas, and Yucatan crater core Yaxcopoil-1. In all other regions (e.g., North Atlantic, Caribbean, Belize, Guatemala, southern Mexico) impact spherules are reworked in early Danian sediments (zone P1a) at least 100 ky after the KTB due to Gulf Stream erosion and increased tectonic activity in the region. No species extinctions are associated with the Chicxulub impact.

Any KTB mass extinction scenario must take into account both Deccan volcanism and the Chicxulub impact. The age of this impact is controversial though generally assumed to be precisely at the KTB and the sole cause of the mass extinction. This assumption is no longer valid given the short duration of massive Deccan eruptions, and the dramatic climatic and environmental effects over just 250 ky ending with the mass extinction. The pre-KTB age of the Chicxulub impact rules out a direct role in the mass extinction, although the additional CO_2 and SO_2 emissions likely exacerbated the ongoing Deccan climate warming. The KTB kill mechanism was likely ocean acidification resulting in the carbonate crisis commonly considered the primary cause for four of the five Phanerozoic mass extinctions.