



Timing, tempo and paleoenvironmental influence of Deccan volcanism relative to the KT extinction

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Deccan Traps erupted in three main phases with 6% total Deccan volume in phase-1 (base C30n), 80% in phase-2 (C29r) and 14% in phase-3 (C29n). Recent studies indicate that the bulk (80%) of Deccan trap eruptions (Phase-2) occurred over a relatively short time interval in magnetic polarity C29r (Chenet et al., 2008). Moreover, U-Pb zircon geochronology shows that the main Phase 2 began 250 ka before the Cretaceous-Tertiary (KT) mass extinction, suggesting a cause-and-effect relationship (Blair et al., 2015).

In India a strong floral response is observed as a direct consequence of volcanic phase-2. In Lameta (infratrappean) sediments preceding the volcanic eruptions, palynoflora are dominated by gymnosperms and angiosperms (Samant and Mohabey, 2005). Shortly after the onset of Deccan phase-2, this floral association was decimated as indicated by a sharp decrease in pollen and spores coupled with the appearance of fungi, which mark increasing stress conditions apparently as a direct result of volcanic activity. The inter-trappean sediments corresponding to the Phases 2 and 3 are characterized by the highest alteration CIA index values suggesting increased acid rains due to SO₂ emissions.

Closer to the eruption center, the lava flows are generally separated by red weathered horizons known as red boles, marking a quiescent period between two basalt flows. Red boles consist mainly of red silty clays characterized by concentrations of immobile elements such as Al and Fe³⁺ ions, which provide indirect evidence of a primitive form of paleo-laterite that probably developed during the short periods of weathering between eruptions. There are at least 15 thick red bole layers in C29r below the KT boundary, and all were deposited in phase-2 volcanic eruptions that occurred over a time span of about 250 ky. These short duration exposures are reflected in the mineralogical and geochemical data that indicate rapid weathering (high CIA) but arid conditions. The arid conditions can be explained by acid rain, which accelerated the weathering process. These observations indicate that Deccan volcanism played a key role in increasing atmospheric CO₂ and SO₂ levels that resulted in global warming and acidified oceans, thus increasing biotic stress that predisposed faunas to eventual extinction at the KTB.