Carbon reservoir perturbations in the Indian subcontinent induced by the Deccan volcanism in marine and terrestrial realm

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The Deccan flood basalt eruption spans across the Cretaceous-Paleogene (K/Pg) Boundary and records the largest
and the longest lava flows in the world. While the volcanism has been linked to the infamous K/Pg extinction,
however, its implications on the regional carbon budget are still not well constrained. Carbon isotope records in marine carbonates ($\delta^{13}C_{carb}$) and bulk organic matter ($\delta^{13}C_{org}$), coupled with carbon and hydrogen isotope records
of *n*-alkane ($\delta^{13}C_{alk}$ and δD_{alk} respectively) have been measured along with *n*-alkanes characterization from two
inter-trappean and one infra-trappean sedimentary sequence exposed south of the city of Rajahmundry, SE India
in order to evaluate the climatic and environmental response exacerbated by the volcanism in the marine and terrestrial realm. Overall, our data demonstrate major perturbations in the terrestrial and marine carbon cycle induced by the Deccan volcanism, with considerable environmental stress predating the K/Pg Boundary. Strong covariance between $\delta^{13}C_{org}$ and $\delta^{13}C_{carb}$ (r=-0.71) suggest that the dissolved inorganic carbon (DIC) in the shallow
marine environment was largely controlled by organic matter (OM) flux. The occurrence of large unresolved complex mixtures (UCM/n-alkane>>4) and hopanes (m/z 191) and steranes (m/z 217) in the limestones OM suggest considerable input from petroleum into the biomass. The upper part of the infra-trappean and lower parts of inter-trappean show considerable decreases in the marine $\delta^{13}C_{carb}$ values and have been inferred to occur from hydrocarbon assimilation by heterotrophs and early diagenesis of OM. Steady temporal increase in $\delta^{13}C_{carb}$ values and total organic carbon (TOC) content throughout the sequence imply increases in primary productivity, with the upper inter-trappean limestone marking the recovery phase. The $\delta^{13}C_{alk}$ values, coupled with the chain-length distribution pattern of *n*-alkanes and spore-pollen records exhibit significant turnovers in the vegetation community structure. High δD_{alk} values (~-110‰) indicate arid conditions before the deposition of mega flow episodes in Rajahmundry. Depletion in δD_{alk} values (~-150‰) observed in the middle part of the inter-trappean signifies a change to a humid condition. The increased rainfall prompted an upsurge in weathering that led to increases in freshwater influx (depletion in $\delta^{18}O_{carb}$ values) and higher terrestrial OM input (increase in long-chain *n*-alkanes). Atmospheric CO_2 concentration reconstructed from two paleosol horizons in the infra- and inter-trappean units respectively indicate major drawdown in pCO_2 across the main flow episode in Rajahmundry. It is speculated that the volcanism induced changes in pCO_2 was one of the main drivers for exacerbating changes in the carbon cycle.

Keywords: Deccan volcanism, carbon reservoir, n-alkane, stable isotope, Rajahmundry

