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Linking the Deccan lava stratigraphy with the end-Cretaceous extinction and impact – new insights from Rajahmundry

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The Deccan flood basalt province in India was erupted within < 1 Myr and overlaps in age with the Cretaceous-Paleogene boundary (KPB) extinction event, and the Chicxulub impact in Mexico. Consequently, the role of Deccan volcanism in the KPB extinction is debated, and it has also been proposed that the Chicxulub impact triggered the largest Deccan lava formations (Poladpur, Ambenali and Mahabaleshwar (PAM)), which represent approximately 70% by volume of the total Deccan and may have been erupted within 500,000 years. Recent geochronological data studies debate whether the onset of the PAM eruptions began at the KPB as consequence of the Chicxulub impact, or whether the PAM lavas were erupted in several pulses, beginning several tens of thousands of years before the KPB (e.g., Sprain et al. 2019, Schoene et al., 2019).

The Rajahmundry Traps on the eastern side of India are believed to represent either the distal ends of voluminous Ambenali and Mahabaleshwar lava flows (e.g., Baksi et al. 1994), or lavas which were erupted locally through fault-controlled fissures unrelated to Deccan volcanism (Manikyamba et al. 2015). In contrast to lavas of the Main Deccan Province, the three separate lava flow units at Rajahmundry are interbedded with sediments, which constrain their age relative to the KPB (Keller et al. 2008; Fendley et al. 2020).

Here we present new major and trace element data for lavas from Rajahmundry and from the Main Deccan Province, and correlate the lavas from Rajahmundry with the younger formations of the Deccan Traps using machine learning algorithms. We find that flows of the Poladpur (lower flow), Ambenali (middle flow) and Mahabaleshwar (upper flow) formations are all present at Rajahmundry, confirming these as an eastward extension of the Deccan Traps. The geochemical classification is consistent with published paleomagnetic and geochronological data for these lavas. Our study shows that some Poladpur lava flows were of sufficient volume and were erupted rapidly enough to flow approximately 1000 km across the Indian subcontinent. The ages of sediments at Rajahmundry imply that eruption of the Poladpur Formation and thus the onset of voluminous PAM volcanic activity began close to the KPB (and Chicxulub impact), and at least the youngest Poladpur flows were emplaced in the Danian.