Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.33514

Using chalcophile elements to understand the degassing history of the Deccan Volcanic Province

TANVI CHOPRA[1], JOSUA J PAKULLA[2], FRANCES E JENNER[1], SARAH C SHERLOCK[1], SIMON R PASSEY[3], SAM J HAMMOND[1], JONAS TUSCH[2], MIKE W JANSEN[2], RAYMOND A DURAISWAMI[4], CARSTEN MÜNKER[2] AND ANNE E JAY[1]

[1]The Open University
[2]University of Cologne
[3]CASP
[4]Savitribai Phule Pune University

The ~66.3–65.5 Ma flood basalt eruptions of the Deccan Volcanic Province coincided with the Cretaceous–Palaeogene (K–Pg) boundary[1], which is associated with the extinction of the dinosaurs. Previous studies have used correlations between radiogenic isotopes and trace-element proxies (e.g. Nb/Th) to define three main source components: melting of La Réunion plume-type mantle, assimilation of continental crust, and melting of sub-continental lithospheric mantle (SCLM)[2]. While these proxies effectively classify Deccan magmas into chemically distinct groups, it is unknown whether similar variability is exhibited by toxic chalcophile elements, such as Se and As. Given that the Deccan lava flows are associated with significant S release to the atmosphere, such variability may have implications for the timing and magnitude of volatile-driven environmental change at the K–Pg boundary.

Here we present new whole-rock data for Deccan and La Réunion basalts to evaluate whether the established geochemical groupings (e.g., for Nb/Th) correspond to systematic differences in S, Se and other potentially toxic chalcophile elements (e.g., As, Tl, Pb). We also examine samples of Giant Plagioclase Basalts (GPB) containing unusually large (≥1–2 cm) plagioclase crystals, commonly linked to mush-zone processes and interpreted as formation-boundary markers.

The compositions of many melt inclusions from the Deccan basalts are depleted in S compared to Mid-ocean ridge basalts, consistent with S degassing. Our whole-rock data also indicate substantial S and Se loss during eruption and cooling, whereas As, Tl and Pb show no evidence for degassing and instead behave comparably to refractory lithophile elements during fractionation, eruption and cooling. La Réunion samples contain lower Tl abundances than the most radiogenic, lowest-Nb/Th Deccan samples which exhibit the highest Tl concentrations. Despite the potential for prolonged crustal storage, the GPBs do not show evidence for higher proportions of crust assimilation than the non-GPB samples. Some Tl concentrations in both GPBs and non-GPBs approach those of the continental crust, which cannot be explained exclusively by crust assimilation. These systematics are likely characteristics associated with melting of SCLM.

[1] Schoene et al. (2021), Geochronology 3, 181–198.
[2] Pakulla et al. (2023), Chemical Geology 640, 121749.