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Indian Deccan volcanism a plume head generated CFBP?

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The widely accepted plume head model of continental flood basalt (CFB) genesis predicts pre-volcanic regional domal uplift and associated erosion immediately prior to, and during the onset of main eruption. However, once initiated, rapid lava effusion generates a swiftly-growing volcanic edifice that may effectively bury any evidence of these early uplift and erosion stages. By contrast, non-plume, edgedriven convection (EDC) models do not predict pre-volcanic uplift, and so an absence of regional uplift or erosional indicators in the pre-volcanic geological record has been used to substantiate such models.

The current work uses two lines of evidence in an effort to resolve whether or not the current plume head model satisfies Deccan geological observation and data. The first line of evidence explores the nature of the basement-basalt contact at key localities around the periphery of the Deccan Volcanic Province (DVP), India. Each locality offers a different geological setting and, when considered together, elucidate the nature of the pre-, syn-, and early stage volcanic environments. The second line of evidence uses new $^{187}Os/^{188}Os$ data to explore whether a mantle deep melting signature is preserved in the earliest lavas.

High precision $^{40}Ar/^{39}Ar$ data confirms that the lavas comprising the DVP become younger both southward and south-eastward, thus supporting models invoking a southward migrating locus of volcanism as India passed over a fixed mantle melting anomaly. In the north, early lavas include K-rich picrites which lie with angular unconformity upon Late Cretaceous successions. The presence of thick conglomerate sheets containing both basement and basalt clasts provide evidence of significant erosion during the earliest phases of DVP eruption. Only at a much later stage did the lava fields arrive at the eastern and southern periphery of the DVP. Such basement-basalt contacts are more consistent with greater India having passed over a plume-like melting anomaly during the latest Cretaceous.

Age corrected Os isotopic data from picrites, erupted during earliest stages of DVP activity, are similar to estimates of putative primitive mantle material, and are similar to Os isotopic data for melts erupted in during the initial stages of the West Greenland CFBP. Both the Greenland examples, and those from the Deccan, are consistent with deep melting of entrained lower mantle material within a mantle plume.