



# Spatial variations in the geochemical characteristics of basalts from the Deccan Volcanic Province, India: Role of mixing and assimilation fractional crystallisation

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In the present study, we have demarcated five zones within the Deccan Volcanic Province (DVP): (1) Kutch, (2) Western Ghats, (3) Central Son–Narmada, (4) Eastern Son–Narmada and (5) South-Eastern Deccan (SE DVP) to evaluate spatial geochemical variations within the DVP possibly controlled by different eruption loci. True OIB-type unmixed trace element and isotopic signatures are demonstrated by both alkali and tholeiitic basalts from Kutch and a small proportion from Western Ghats. However, large number of tholeiitic basaltic samples from both the zones and Central Son–Narmada zone illustrate sub-continental lithosphere mantle (SCLM) signatures. The Eastern Son–Narmada and SE DVP zones of the DVP show evolved compositions, but are dominantly derived from sub-lithospheric sources. The plume–lithosphere interaction is represented by mixing and/or assimilation and fractional crystallisation (AFC) of plume-derived melts with the sub-continental lithospheric mantle (SCLM)-derived melts, sediments preserved in the SCLM, lower crustal (TTG-type) and upper crustal (granitic) components. We argue that melts from the Archaean sediments preserved in the SCLM, represented by calc-alkaline lamprophyres, are the most suited components that interacted with the plume-derived as well as SCLM peridotite-derived melts. Few Kutch zone basalts require granitic components, while some proportion of Western Ghats zone basalts require TTG-type assimilate to explain their isotopic characteristics. Mixing and/or AFC between the plume-derived and sediment-derived melts and SCLM peridotite-derived and sediment-derived melts played fundamental roles in the observed geochemical heterogeneity of the Deccan basalts. We demonstrate that original sub-lithosphere melts may display apparent SCLM signatures by ~10% mixing and/or ~20% AFC of lamprophyre source melts and entire Deccan data considered in the present study can be explained by 20% mixing and/or 50% AFC of plume-derived melts with calc-alkaline lamprophyre as an assimilate.

**Keywords.** Deccan Volcanic Province; basalt; mixing; assimilation fractional crystallisation; plume; SCLM.