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## Magmatic evolution of Girnar volcano-plutonic complex of Deccan Traps, India: Sr-Nd-Pb-Hf isotopic evidence of multiple sources

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Close spatial association of plutonic and volcanic rocks in Large Igneous Provinces is very rare. Occurrence of various mafic rocks (syeno-diorite, gabbro, basalt and mafic dyke) and silicic rocks in the Girnar volcano-plutonic complex of Deccan Traps provides a unique opportunity to understand complex petrogenetic processes. Alkaline rocks (syeno-diorite and mafic dyke) display an enriched LREE pattern ( $La/Sm_N \sim 5.0$  to  $7.8$ ), whereas the tholeiitic gabbro and basalt show a relatively flat LREE pattern ( $La/Sm_N \sim 0.8$  to  $1.8$ ) with a positive Eu anomaly ( $1.1$  to  $1.3$ ). Trace elements modelling of alkaline rock compositions are consistent with their origin by 5–9% partial melting of a spinel lherzolite source, with the melt experiencing 74–88% fractional crystallization. Tholeiitic gabbro and basalt could be generated from 20% and ~5% melting of a depleted MORB source, respectively. Distinct isotopic composition of silicic rocks ( $^{87}Sr/^{86}Sr_i = 0.7204$ – $0.7275$ ,  $\epsilon_{Nd(i)} = -6.8$  to  $-7.3$ ,  $^{206}Pb/^{204}Pb_i = 18.74$ – $19.02$ ,  $^{207}Pb/^{204}Pb_i = 15.76$ – $15.79$ ,  $^{208}Pb/^{204}Pb_i = 39.63$ – $40.03$ ,  $\epsilon_{Hf(i)} = -6.0$  to  $-7.3$ ) indicate an origin from melting of a crustal source contaminated with ( $\leq 5\%$ ) mantle-derived mafic melts. The presence of shattered clinopyroxene crystals in silicic rocks and variation in Ti content of quartz are attributed to a sudden release of pressure during magma ascent. The Girnar Complex is emplaced in a reactivated fault lineament where mafic rocks (both alkaline and tholeiitic) were uplifted by several kilometers after its formation in a shallow magma chamber. Silicic rocks were emplaced along the concentric marginal fault of the Girnar Complex, synchronously or just after this uplift event.