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Sr-Nd-Pb-Hf isotopic signatures in the rocks from the Rajmahal Traps Large Igneous Province, India

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The Rajmahal Traps Large Igneous Province, located in Eastern India, are among the earliest volcanic epicenters of the Greater Kerguelen igneous province, dating back 118-120 million years. We present major oxides, trace elements, and Sr-Nd-Pb-Hf isotopic compositions of basalt and basaltic andesite from the Rajmahal Traps, demonstrating significant geochemical variations than that reported earlier. Chondrite normalized rare earth element (REE) patterns display a light REE (LREE) enrichment with a flat to depleted heavy REE (HREE) pattern for basalt and basaltic andesite. All mafic rocks show a weak negative Eu anomaly [Eu/Eu* = 0.65-0.89]. These mafic and intermediate rocks show relatively large variations in $^{87}Sr/^{86}Sr_i$ (0.7053-0.7227), $\varepsilon_{Nd(i)}$ (-1.3 to -7.4), $\varepsilon_{Hf(i)}$ (+7.8 to -10.6), $^{206}Pb/^{204}Pb_i$ (16.91-20.66), $^{207}Pb/^{204}Pb_i$ (15.51-15.88), and $^{208}Pb/^{204}Pb_i$ (36.53-41.31) isotopic ratios, indicating involvement of more than one source. Our results suggest significant differences between the geochemical signature of the Rajmahal Traps with that of the recent Kerguelen hotspot eruptions. Thermodynamic-based geochemical modeling suggests melts from a dominantly lithospheric mantle source underwent assimilation of continental crust and simultaneous fractional crystallization to form the Rajmahal Traps rocks.