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Sm-Nd isotope systematics of Indian shales constrain the growth of Indian continental crust

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Shales may represent the average composition of the upper continental crust (UCC) and thus indicate its evolution. This study uses Sm-Nd isotopic composition of Indian shales (n = 54) collected and compiled from different litho-units of Archean cratons and Proterozoic basins of India to calculate the depleted-mantle Nd model ages, which were then used to constrain the growth of the Indian continental crust. The present-day average $\varepsilon_{Nd(0)}$ = (-18.8±5.4, 1 S.D) and $^{147}Sm/^{144}Nd$ (0.111±0.009) isotopic ratios of Indian shales are comparable to the average global clastic sediments, and other UCC-derived erosional products like North American shales and Ganga River sediments. We used a two-stage box model approach (dividing the crust into juvenile and older shield areas) to model the growth of the Indian continental crust from Hadean to Recent. A dimensionless erosional parameter K has been used to model the growth of the Indian continental crust accounting the effect of preferential erosion. The model considers more contribution from the younger juvenile blocks than the older shields. Our two-stage model assumes K = 1 for the Archean (no erosion), K = 6 for the post-Archean. The results suggest that ~80% of the present-day crust was formed by the end of Archean marking a sharp change in terms of continental growth at the Archean-proterozoic boundary (with a mean age of the continent of 2.42 Ga) estimated for the first time in this study. The model result for Indian continental crustal growth is different from the continental crustal growth of the Australian shield despite both being part of the Gondwana supercontinent. Results indicate a rapid growth of the Indian continental crust in the Archean period, followed by a long-term slow-progressive growth in the post-Archean. The crustal growth pattern of the Indian shield was controlled by the supercontinent-superplume cycles which in turn affected the pulses of juvenile crust formation at different stages.