

The contrasting Sr/Y ratios in fraternal granitoid twins of a TTG parent: An indicator of crustal remelting for granite genesis

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Granitoids, that build the upper and middle continental crusts are products of melt extraction from the mantle. However, these granitoids are too Si-rich and Mg-poor to derive directly from an ultramafic mantle. Therefore, the mechanism of continental extraction requires multiple stages, involving extraction of mafic magmas from the mantle and further differentiation through either fractional crystallization or remelting.

The intra-crustal derived, calc-alkaline granitoids of the Kerala Khondalite Belt (KKB) of southern India exhibit contrasting geochemical compositions, however, with common source-rock signatures. Previous studies [1,2] suggested these granitoids as mixtures of large-scale leucosomes (granites) and entrained melanosomes (tonalites), as seen in anatectic systems. As such, the granitoid twins of the KKB provide an opportunity to understand the process of formation of large-scale granitic systems through crustal anatexis and its significance on the differentiation of the continental crust. A prominent geochemical distinction among these granitoids is the high Sr/Y nature of the tonalites (avg. = 90), whereas, the ratios are low in granites (avg. = 3). The Sr/Y ratios in the calc-alkaline, arc-related magmas are primarily controlled by thickness of the crust during melting [2]. The high Sr/Y ratio and other geochemical features such as high $(La/Yb)_N$ (avg. 45) ratios and strongly positive and/or no europium ($Eu/Eu^* = 0.7–1.47$) anomalies suggests TTGs, derived through partial melting of a thickened lower arc-crust composed of mafic source rocks, as the precursors to the tonalites. On the contrary, the granites are ferroan, with moderate REE fractionation (avg. $(La/Yb)_N = 20$), with significant negative Eu anomalies (avg. $Eu/Eu^* = 0.25$). These geochemical features along with high ratios of Rb/Sr, Ba/Sr, and negative anomalies for HFS elements (*e.g.*, Nb and Ti), characterise the granites as crustal derivatives formed by remelting of TTG dominated arc-crust, leaving plagioclase enriched melanosomes (tonalites) as residue.

[1] Sreejith & Ravindra Kumar (2013), *J. Geodyn.* **63**, 69–82. [2] Ravindra Kumar & Sreejith (2016), *Lithos* **262**, 334–354. [3] Chiaradia (2015), *Nature Sci. Rep.* **5**, 8115.