

Paper Number: 3340

Late Archaean Granitoid Magmatism: an insight to SW Bundelkhand Craton

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Bundelkhand Craton, an Archaean-Proterozoic basement complex in the central Indian Shield, opens a window to elucidate the distribution of its various lithounits and their possible role in the formation of an early continental crust in northern India. It mainly comprises of TTG gneisses and Granitoids, which are diversified throughout the area. TTGs show signs of gradual younging towards the west, whereas the more voluminous group (80%) of younger granitoid magmatism of ~2.57-2.53 Ga spreads throughout the area and show no structural or significant age difference.

Microscopic studies show typical granitic assemblages, depicting compositional range from Granite to quartz monzodiorite. They are peraluminous (A/CNK avg. = 1.5), following calc-alkaline trend with S-type characteristics ranging from magnesian to ferroan. The SiO_2 content in these rocks have a broad range with lower Na_2O content and higher K_2O/Na_2O ratio ranging from (0.94-2.03). Negative trend for most of the major elements except for K_2O , which exhibits a positive trend, probably indicate igneous trend. Bundelkhand granitoids are enriched with light rare earth elements as compared to the heavy ones and some of their rare earth patterns are similar to Closepet granites and High K granitoids. On the basis of the Chondrite normalized Rare Earth Element (REE) plots, the samples have been grouped into 3 categories viz., Closepet Type, High and Low HREE Monzogranites and A-Type Rapakivi Granites. These samples show significant difference in their petrography and geochemistry along with marked negative anomalies for Ba, P, Nb and Ti and positive anomalies for Pb, U and Th indicating imprints of crustal signature. Hence, the appreciation of their evolution can play an important role in revealing the mysteries of crustal evolution during the late Archaean.

After the formation TTG gneisses, late-Archean magma evolution was marked by the diversification of granitoids and crustal growth processes in Bundelkhand. This sudden occurrence of compositionally varied granitoids marks a characteristic change in the geodynamics of the craton. While typical Archean TTGs were derived from meta-basaltic material, the magmas emplaced at the Archean-Proterozoic transition must have involved a variety of sources based of differing geochemical composition.

To conclude, our preliminary geochemical data suggests three different granitoid types with differing chemical affinity, probably suggesting tapping of different sources and/or more than one phase of magmatic activity in the region during the Archaean-Proterozoic (~2.5 Ga). Apart from that the processes that occurred in a quick succession (2.57-2.53 Ga) surfacing diversified rock types within such a short time span, need thinking and a theory to relate it to the crustal evolution pattern that happened during the Archaean-Proterozoic transition.

