Geochemical signatures of subduction setting for a gabbro pluton at the craton-mobile belt interface

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The tectonic setting for the thrusted shear zone between Proterozoic Eastern Ghats Mobile Belt and Arcahean East Dharwar craton, south India is much debated since it is the locus of several alkaline, mafic-ultramafic and granitic plutons ranging in age from ~1450-800 Ma and sporadic occurences of dismembered ophiolitic assemblages [1]. Pasupugallu gabbro-anorthosite pluton is one of such intrusives that displays rhythmic magmatic layering and cumulate textures.

The plutonic units are normative quartz-free and show high Fe_2O_3 (7.11 to 14.2 wt%) and Al_2O_3 (10.97 to 26.51 wt%), but variations can be seen in MgO content (3.42 to 10.91 wt%). These are also enriched in CaO content (8.48 to 13.28 wt%), which has promoted the increased proportion of clinopyroxene and plagioclase. These are moderate in alkalies (Na_2O: 2.02-2.96 wt% and K_2O: 0.31 to 2.51 wt%). High values (>0.4) of Fe*/(Fe*+Mg), which vary between 0.5 to 0.69 for most members indicate crystallization from fractionated melts and CaO/ ($CaO+Na_2O+K_2O$) remains within a range between 0.73 and 0.82. The silica vs alkali diagram suggests sub-alkaline nature, and the AFM plot shows the tholeiitic, while the Al_2O_3-MgO- (FeO^*+TiO_2) relationship suggests high Fe-tholeiitic basaltic nature of the intrusive.

The gabbroic rocks of the pluton are also characterised by enriched LREE and depleted HREE patterns with a positive Eu anomaly. The high enrichment of Sr content may reflect the partial melting in the upper mantle related to slab melting process. The geochemical characteristics of lithological assemblages of the pluton suggest that the rocks belong to low potassium island arc tholeiites. The overall field, petrographic and geochemical signatures support the possible subduction or collision related magmatic origin for the Pasupugallu pluton. The intial rifting environment inferred from the older nepheline syenites [2] and other alkaline complexes and the subsequent transpressional regime between the mobile belt and the craton with the present geochemical signatures suggest the tectonic setting akin to Wilson cycle.

References

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