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SUBDUCTION RELATED METABASALTS FROM THE WESTERN SINGHBHUM CRATON, EASTERN INDIA - A REVIEW

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Abstract

The Singhbhum Craton (SC) has significant mafic magmatism records spanning from Paleo-Mesoarchean to Neoproterozoic age. The present study compares the mineralogy and geochemistry of metabasalts from the Older Metamorphic Group (OMG ~3.5 Ga), Iron Ore Group (IOG ~3.4 Ga) and the Malangtoli Lavas (~2.25 Ga) of SC to understand the role of mantle wedge and the subducting slab during their genesis. They show similar mineralogical assemblages represented by plagioclase + actinolite-tremolite + chlorite + opaques + clinopyroxene ± epidote ± biotite ± quartz representing basalt-basaltic andesite with tholeiitic to cal-alkaline geochemical affinity. These metabasalts are characterised by OMG (Nb < 1, Nb/La < 0.2,), IOG (Nb ~16, Nb/La <0.5), Malangtoli (Nb~2, Nb/La ~0.4) and similar Nb, Ta, Zr, Hf, Ti negative anomalies on Primitive Mantle Normalized multielement diagrams, suggesting typical subduction zone signatures. Variable values of REE and HFSE ratios suggest a relatively low to medium degree (~20-30%) of partial melting at shallower depths consistent with a spinel peridotite mantle source for the OMG and Malangtoli metabasalts, whereas the IOG metabasalts appear to have been generated by lower degree (~5-10%) of partial melting of a mantle source extending from shallower to greater depth corresponding to the compositional domain of spinel and garnet peridotite. The OMG and Malangtoli tholeiitic metabasalts show affinity towards back-arc and fore-arc tholeiites whereas IOG calk-alkaline metabasalts correspond to continental margin volcanic arc with polygenetic crustal signatures. The comprehensive geochemical data suggest that these volcanic rocks originated in a subduction zone environment which controlled their parent magma generation and petrogenesis. The occurrence of these arc basalts provides evidence for mantle heterogeneity and across arc variation during the Archaean and Proterozoic timespan in western Singhbhum Craton.

Keywords: Singhbhum Craton, arc signatures, Slab Melting, subduction zone, crustal growth