Paper Number: 1575

Evidence for mid oceanic ridge basaltic (MORB) setting of mafic rocks in Archaean Amgaon greenstone belt of western Bastar craton, central India

Malpe, D.B.[1], Hazarika, B. [1], Meshram, D.C.[2] and Dongre, A.[3]

[1]Department of Geology, RTM Nagpur University, Nagpur-440001, India, e-mail: dbmalpe@yahoo.com
[2]Department of Geology, University of Pune, Pune-411007, India
[3]Department of Geology, University of Johannesburg, Auckland Park 2006, South Africa

---

The Bastar craton is one of the major Archean nuclei in Peninsular India. The craton is composed mainly of tonalite–trondjhemite gneisses (TTG), supracrustal rocks including greenstone belts and intrusive granitic plutons. Amgaon greenstone belt is situated in the western part of Bastar craton and mainly comprises of orthoamphibolites (metabasics) [1] engulfed in gneissic complex. The gneissic complex is dominated by TTG assemblages dated between 2500 and 2600 Ma that are interpreted to reflect a major interval of crustal accretion [2]. The tonalites yielded a U–Pb upper intercept age of 3561±11 Ma thought to reflect the oldest age of the gneissic protolith.

The metabasics are metamorphosed under closed system and rules out the possibility of mobilisation of elements during metamorphism. The metabasics are classified as subalkaline, low-K tholeiites having high Fe and Ti concentration. Low-K tholeiites are the dominant counterparts of the Archean greenstone belts as well as of modern volcanism. High Ti concentration with Al_2O_3/TiO_2 and CaO/TiO_2 ratios less than chondritic (20 and 17 respectively) values are significant for mid oceanic ridge basalts (MORB). These tholeiites have Fe enrich trend than modern MORB [3] which may be the result of combination of higher degree partial melting and different composition of source mantle. All the rocks are distinctly showing flat high field strength elements (HFSE) pattern and variable abundance of large ion lithophile elements (LILE) in their primitive mantle normalised spidergrams. Both the abundances are slightly lower than modern MORB whereas variable abundance of LILE's may also be related to sea water alteration. Depleted Zr concentration ranging from 9.73 to 24.41 is reflected in MORB normalised spidergrams in the form of strong negative anomaly. The distinct Zr/Y value less than 3 due to Zr depletion and La/Nb ratio < 1.4 discriminant metabasics from those erupted on arc environment. Whereas the average Nb/Th=18.02, Nb/La=1.11 and Ti/Sm= 2991 ratios are much similar to that observed in normal MORB (19, 0.9 and 2890 respectively). The undifferentiated nature of metabasics and their genesis from depleted mantle source is characterised by the short range (1.12 to 1.36) of La/Lu ratio and relatively flat REE pattern (La_N/Sm_N ~ 1) with absence of Eu anomaly (Eu/Eu*=0.89) in chondrite normalized diagram. HREE abundance is lower than those of modern MORB but abundance of LREE is comparable. It should be noted that there is no REE depletion in the samples, which may be related to the results of higher degree of partial melting in Archean mantle or highly fertile Archean mantle. Present study suggests that the metabasics are resulted from higher degree of partial melting of the Fe rich Archean mantle evolved under oceanic environment close to mid oceanic ridge (MOR) setting.

References:

[1] Malpe et al. (1997) Gond Geol Mag 12(1):25-39
[2] Ramakrishnan M and Vaidyanadhan R (2008) In: *Geology of India- Vol 1*: Geol Soc India, 594
[3] Hazarika B et al. (2015) Jour Appl Geochem 17(2):182-189