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PETROLOGY AND GEOCHEMISTRY OF MAFIC DYKE AND SILLS IN CUMBUM FORMATION, OF THE PROTEROZOIC NALLAMALAI FOLD BELT RAJAMPET AREA, ANDHRA PRADESH, INDIA

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Nallamalai Fold Belt (NFB); a 400 km long arcuate fold and thrust belt falls in the eastern part of the Proterozoic Cuddapah basin in SE India [1]. NFB is comprised of a lower quartzite with intercalated argillites (Bairenkonda / NagariFormation), while the upper part (Cumbum / Pullampet Formation) is predominantly an argillaceous sequence (slate / phyllite) with interbedded dolomite and quartzite. The NFB shows a thrusted contact with the adjoining younger (Kurnool Group) in its western part and the older Nellore Schist belt (NSB) rocks in its eastern margin. Intrusive Igneous activity within NFB includes alkali syenite of Racherla, Giddalur and lamproite dykes in Chelima and Zangamrajupalle.

Present study reveals the presence of several mafic dyke and sills of doleritic composition within the sediments of Cumbum Formation in southern part of Pullampet sub basin. Sills are co-deformed with the sediments of Cumbum Formation showing development of S_1 schistosity, but the dykes cut across the S_1 schistosity of phyllite. Hence these sills are prior to the deformation and dykes are younger one. Microscopic study reveals that both dykes and sills are similar in composition and consist of clinopyroxene (augite), plagioclase and chlorite (chamosite), showing ophitic, sub-ophitic and intergranular textures. Under microscope C and C' types of shear bands are observed in sills showing dextral sense of shearing. Majority of the pyroxene grains are altered to chlorite, though some relict pyroxene grains are preserved. Laths of plagioclase feldspars are altered to epidote.

SiO_2 and MgO percentage of dykes and sills varies from 45%-52% and 6.5-9.28% respectively, Mg# values of the rocks ranges from 0.51-0.58, indicating non-primitive (highly fractionated) nature. Very low Ni content (37-110ppm) also shows their non- primitive nature. The rocks are subalkaline (molar $Na_2O+K_2O/Al_2O_3<1$) in nature. In $Nb/Y-Zr/TiO_2$ bivariate plot most of the samples fall in subalkaline basalt field AFM diagram shows tholeiitic nature and iron enrichment trend. Ni-Zr trace element modeling shows that the dykes and sills are formed by more than 10% of partial melting of the source and subsequent fractional crystallisation. Chondrite normalised REE diagram of sills and dykes show slight enrichment of LREE relative to HREE, which shows a flat pattern suggesting absence of garnet during partial melting of protolith. Plots in N-MORB normative multi-element diagram shows that LILE are strongly enriched with respect to HFSE with prominent trough in Nb and peak in Cs, Rb, Ba, Pb, Th and K, which are signatures of island arc basalt magmatism. The alkali syenites of Rachela and Giddalur and the lamproite dykes of Chelima are dated to be 1326±73 Ma and 1354±52 Ma in age respectively [2] and suggested a metasomatised mantle as the source for the lamproite dykes and syenite, which have been extremely depleted prior to metasomatism, but The magmatic event giving rise to mafic dyke and sills is a result of melting of subcontinental lithospheric mantle enriched by earlier subduction related

activity [3]. Tectonic discrimination diagram [4] exhibits that most of the samples fall in within plate basalt field, on the other hand discrimination diagram [5] shows that all the samples fall at the contact between MORB and IAT field. This paradox of subduction signatures in a within plate setting can be explained by the fact that the source region of the mafic magma generated by later rifting process still preserves the chemical characteristics of earlier subduction related activity[3]. The mode of occurrence in field and small volume suggests that the mafic magma is likely to have generated in a continental rift setting.

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