

Participation of Titanium Influencing the Petrological Assemblage of Mafic Dyke: Salem, South India

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Abstract : The study of metamorphic reaction textures is important in contributing to our understanding of the evolution of metamorphic terranes. Where preserved, they provide information on changes in the P-T conditions during the metamorphic history of the rock, and thus allow us to speculate on the P-T-t evolution of the terrane. Mafic dykes have attracted the attention of petrologists because they act as window to mantle. This rock represents a mafic dyke of doleritic composition. It is fine to medium grained in which clinopyroxene are enclosed by the lath shaped plagioclase grains to form spectacular ophitic texture. At places, sub ophitic texture was also observed. Grains of pyroxene and plagioclase show very less deformation typically plagioclase showing deformed lamella along with plagioclase-clinopyroxene-phyrlic granoblastic fabric within a groundmass of feldspar microphenocrysts and Fe-Ti oxides. Both normal and reverse zoning were noted in the plagioclase laths. The clinopyroxene grains contain exsolved phases such as orthopyroxene, plagioclase, magnetite, ilmenite along the cleavage traces and the orthopyroxene lamella form granules in the periphery of the clinopyroxene grains. Garnet corona also develops preferentially around plagioclase at the contact of clinopyroxene, ilmenite or magnetite. Tiny quartz and K-fs grains showed symplectic intergrowth with garnet at a few places. The product quartz formed along with garnet rims the coronal garnet and the reacting clinopyroxene. Thin amphibole corona formed along the periphery of deformed plagioclase and clinopyroxene occur as patches over the magmatic minerals. The amphibole coronas cannot be assigned to a late magmatic stage and are interpreted as reactive being restricted to the contact between clinopyroxene and plagioclase, thus postdating the crystallization of both. The amphibole and garnet do not share grain boundary in the entire rock and is thus pointing towards simultaneous crystallization. Olivine is absent. Spectacular myrmekitic growth of orthoclase and quartz rimming the plagioclase is consistent with the potash metasomatic effects that is also found in other rocks of this region. These textural features are consistent with a phase of fluid induced metamorphism (retrogression). But the appearance of coronal garnet and amphibole exclusive of each other reflects the participation of Ti as the prime reason. Presence of Ti as a reactant phase is a must for amphibole forming reactions whereas it is not so in case of garnet forming reactions although the reactants are the same plagioclase and clinopyroxene in both cases. These findings are well validated by petrographical and textural analysis. In order to obtain balanced chemical reactions that explain formation of amphibole and garnet in the mafic dyke rocks a matrix operation technique called Singular Value Decomposition (SVD) was adopted utilizing the measured chemical compositions of the minerals. The computer program C-Space was used for this purpose and the required compositional matrix. Data fed to C-Space was after doing cation-calculation of the oxide percentages obtained from EPMA analysis. The Garnet-Clinopyroxene geothermometer yielded a temperature of 650 degrees Celsius. The Garnet-Clinopyroxene-Plagioclase geobarometer and Al-in amphibole yielded roughly 7.5 kbar pressure.

Keywords : corona, dolerite, geothermometer, metasomatism, metamorphic reaction texture, retrogression

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