

A First Report of the spinel-quartz assemblage in Achankovil Shear Zone, South India

Rajesh Jagadambal[1], Makoto Arima[2]

[1] Geological inst., Yokohama Natl. Univ., [2] Geolo. Instit. Yokohama Natl. Univ.

Based on the significant mineral assemblages and their chemistry, and the recent advances in the field of geothermometry turned many earlier high temperature metamorphic terrains into ultra high temperature (UHT) metamorphic terrains. Some of the characteristic features of the UHT terrains are a stable coexistence of spinel and quartz, and high Al₂O₃ content in orthopyroxenes. The Achankovil Shear Zone, South India is a prominent transcrustal ductile shear zone, and is characterized by highly deformed and sheared granulite facies supracrustal rocks and orthogneisses that are variously intruded by felsic plutons, mafic dykes and ultramafic bodies. This reports for the first time the existence of ultra high temperature metamorphic rocks in the Achankovil Shear Zone, one of the mega-shear zones related to the amalgamation of Gondwana continent during Pan-African era.

The high aluminous orthopyroxene bearing granulites within the shear zone are characterized by the mineral assemblage orthopyroxene-plagioclase-potash feldspar-garnet-spinel-biotite-quartz-ironoxides with minor accessories and opaques. Orthopyroxenes form elongated porphyroblasts. Two generations of garnets are noticed, one porphyroblasts and the other as coronal garnets with rims of other minerals such as plagioclase, K-feldspar and at places spinel. Spinel is hercynitic and two modes of occurrence are common, one as small granular grains and other as intergrowths with Fe-oxides and are at places shows sharp contacts with quartz. This is common in most of the analyzed sections and the later replacement of these anhydrous phases by biotite +quartz symplectites are also observed. Orthopyroxenes show XMg variation from 0.62 to 0.55, and the cores of the orthopyroxenes consist of higher Al₂O₃ contents (7.90-8.74 wt.%). Garnet compositions are dominated by almandine content. The earlier formed biotites are having higher Ti content up to 0.75 p.f.u. Spinels are having lower Zn content ranging from 0.04 to 0.06 p.f.u. Various thermometers were applied for the Spinel-Quartz rock unit and among them the Al in Orthopyroxene thermometer and Orthopyroxene-garnet thermometer give temperature conditions ~950 degree celsius. Based on various geobarometers we conclude that the pressure conditions might vary between 6.0-7.0 kbar. Features including the direct contact of spinel and quartz grains, lower Zn content in spinel, higher Al₂O₃ content in orthopyroxene and higher Ti content in earlier formed biotites are all suggestive of the prevalence of ultrahigh temperature conditions during the formation of peak metamorphic assemblage, and then the later retrogressive phase is marked by the formation of biotite-quartz symplectites. Development of ultra high temperature metamorphic rocks within and proximal to ACSZ mega-shear zone was probably manifestation of the higher temperature input from the mantle into lower crust during the amalgamation of Gondwana continent.