

Sapphirine granulite to metasomatic sapphirine rock

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Sapphirine is a mineral usually formed during high-ultrahigh temperature metamorphism. The association of sapphirine with quartz is the robust mineral association representing ultrahigh-temperature (UHT) metamorphism. These rocks are generally restite in nature with Mg-Al rich bulk chemical composition. Such rocks are prominent in high-temperature orthopyroxene (high-Al) and Mg-rich garnet-bearing mineralogy. Many of these UHT samples are silica undersaturated with minor relicts of sapphirine-quartz or orthopyroxene-sillimanite-quartz assemblages. Sapphirine associations in meta-troctolite and ultramafic rocks are rare but reported from few localities across the world. Such sapphirine bearing rocks are distinct and usually associated with clinopyroxene.

Sapphirine-bearing rocks rich in hydrous minerals such as gedrite, staurolite, cordierite with or without garnet are another category reported from various localities around the world. These rocks are also Mg-Al rich in bulk composition and often misled to interpret as UHT occurrence. This study reports petrologic investigations of hydrous sapphirine rocks from the Palghat-Cauvery Shear Zone, India. The (Ca-(Fe+Mg)-garnet [Alm_{54.9-53.3}, Prp_{34.8-35.6} Grs_{11.7-9.8}]-aluminosilicate rock preserves inclusions of gedrite, spinel and quartz within garnet. In some domains, inclusions of sapphirine with spinel occur within the garnet, marking the prograde evolution of garnet. The formation of garnet-rim around gedrite with gedrite matrix further supports the garnet forming reaction after gedrite. The garnet-corundum-staurolite-kyanite/sillimanite assemblage formed as porphyroblasts. Most of the staurolite in the studied samples shows moderate to high Mg content. However, the staurolite composition varies in each microdomain. Various garnet breakdown symplectite textures in these rocks involved gedrite, cordierite sapphirine and spinel. Most of the textures are reported as evidence for very high pressure and/or temperature in the previous publication. However, present results demonstrated that the geology of the region and association of marble and amphibolite in the same locality indicate the possibly chemical-potential gradient and Ca-Si mobility induced metasomatic process. This process can form sapphirine rock with high Mg-Al-OH bearing mineral assemblages at relatively lower PT conditions.

Keywords: metasomatism, UHT metamorphism, sapphirine rock