

Fluid-rock interaction and formation of high-grade metamorphic rocks in the Trivandrum Block, southern India

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Infiltration of supercritical fluids from external sources into lower crustal rocks probably plays an important role on the formation and the stability of various high-grade metamorphic rocks. Generally, introduction of high-H₂O activity fluids (such as pure H₂O fluid) in the lower crust will enhance hydration or partial melting, whereas low-H₂O activity fluids (such as CO₂-rich fluid) will give rise to dehydration reactions to form anhydrous mineral assemblages (such as orthopyroxene-bearing granulite-facies assemblages). As a case study in southern India, this study evaluates the petrogenesis of a white-colored (bleached) hydration vein and a dark-colored dehydration vein associated with granulites from Parakkani and Marthandam in the Trivandrum Block, southern India. The Trivandrum Block is a granulite block formed by a Neoproterozoic to Cambrian (ca. 600-510 Ma) high-grade metamorphism probably related to a series of collisional events during the assembly of Gondwana supercontinent. The bleached vein occurring parallel to the foliation of the matrix anhydrous charnockite body (orthopyroxene + quartz + plagioclase + K-feldspar + biotite) is characterized by a hydrous mineral assemblage of garnet + biotite + quartz + plagioclase + K-feldspar. In contrast, the dark-colored vein occurring perpendicular to the foliation of the matrix garnet-biotite gneiss (garnet + biotite + quartz + plagioclase + K-feldspar) has an anhydrous mineral assemblage of orthopyroxene + quartz + plagioclase + K-feldspar + biotite. The field occurrences and the mineral assemblages in the host-vein rocks indicate possible effects of fluid migration in the lower crust for the formation of the two types of vein. It is important to note that the two veins occur in the same area around Marthandam. The preliminary results of this study thus suggest complex fluid migration history during the formation of granulites in the Trivandrum Block.

Keywords: charnockite, garnet-biotite gneiss, fluid-rock interaction, Trivandrum Block, Southern India, vein