



High-pressure and ultrahigh-temperature metamorphism along the Gondwana suture zone in Southern India

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The southern granulite terrane in India comprises several crustal blocks (e.g., Madurai and Trivandrum Blocks) which were welded together during the Late Neoproterozoic to Early Cambrian collisional orogeny related to the final amalgamation of Gondwana supercontinent. The northern margin of the Proterozoic collage is defined by the EW-trending Palghat-Cauvery Suture Zone (PCSZ), which corresponds to the trace of the Gondwana suture zone dissecting the Archean Dharwar Craton to the north and the granulite terrane to the south. Previous petrological studies on the granulite blocks and the PCSZ presented evidence for extreme crustal metamorphism at ultrahigh temperature (UHT; $T > 900^\circ\text{C}$), which are characterized by several diagnostic assemblages such as sapphirine + quartz, spinel + quartz, orthopyroxene + sillimanite + quartz, and Al-rich-orthopyroxene. Although the peak metamorphic pressure of the granulites blocks are probably ~ 10 kbar, evidences of high-pressure ($P > 14$ kbar) metamorphism have been reported from the PCSZ. For example, relict Mg-rich ($\text{XMg} > 0.5$) staurolite and kyanite inclusions in garnet have been found from several localities (e.g., Sevitturangampatti, Panangad, Komateri) from the PCSZ. The inclusion staurolite is rarely surrounded by sapphirine or sapphirine + quartz corona, suggesting the formation of sapphirine + quartz after staurolite through the progress of the reaction: garnet + staurolite \Rightarrow sapphirine + quartz + H_2O . The textures suggest prograde high-pressure metamorphism at $P > 14$ kbar prior to the peak UHT event. Such a prograde high-pressure event is also supported by the occurrence of clinopyroxene with high Ca-Eskola (up to 8.6 %) and moderate jadeite (up to 4.3 %) end member moles in mafic granulite, which are common features of clinopyroxene in high-pressure metamorphic rocks. Our petrological data from the PCSZ identified several localities that preserve trace of prograde high-pressure granulite-facies (or even near eclogite-facies) metamorphism. We regard that the PCSZ underwent regional high-pressure metamorphism, which might be related to subduction of crustal materials to the mantle depth during the assembly of Gondwana Supercontinent.