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Petrology of garnet-clinopyroxene rocks from the Gondwana suture zone in southern India

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The Palghat-Cauvery Suture Zone (PCSZ) in the southern granulite terrane, India, which separates Pan-African granulite blocks (e.g., Madurai and Trivandrum Blocks) to the south and Archean terrane (e.g., Salem Block and Dharwar Craton) to the north is regarded as a major suture zone in the Gondwana collisional orogeny. It probably continues westwards to the Betsimisaraka suture in Madagascar, and eastwards into Sri Lanka and possibly into Antarctica. The available geochronological data including U-Pb zircon and EPMA monazite ages indicate that the rocks along the PCSZ underwent an episode of high-grade metamorphism at ca. 530 Ma that broadly coincides with the time of final assembly of the Gondwana supercontinent. Recent investigations on high-grade metamorphic rocks in this region have identified several new occurrences of garnet-clinopyroxene rocks and associated meta-gabbros from Perundurai, Paramati, Aniyapuram, Vadugappatti, and Mahadevi areas in Namakkal region within the central domain of the PCSZ. They occur as elongated boudins of 1 m to 1 km in length within hornblende-biotite orthogneiss. The garnet-clinopyroxene mafic granulites contain coarse-grained (up to several cm) garnet (Alm30-50 Pyr30-40 Grs10-20) and clinopyroxene (XMg = 0.70-0.85) with minor pargasite, plagioclase (An30-40), orthopyroxene (hypersthene), and rutile. Garnet and clinopyroxene are both subidioblastic and contain few inclusions of clinopyroxene (in garnet) and plagioclase. Orthopyroxene occur only as Opx + Pl symplectite between garnet and clinopyroxene in almost all the localities, suggesting the progress of decompressional reaction: Grt + Cpx + Qtz => Opx + Pl, which is a dominant texture in the PCSZ. The prograde mineral assemblage of the rocks is therefore inferred to be Grt + Cpx + Qtz, although quartz was probably totally consumed by the progress of the reaction. The metamorphic P-T calculations using Grt-Cpx-Pl-Qtz geothermobarometers yield T = 850-900C and P >13 kbar, which is consistent with the occurrence of high-pressure Mg-rich staurolite in Mg-Al-rich rocks from this region. Fluid inclusion study of some garnet-clinopyroxene rock samples identified CO2-rich fluid inclusions trapped as primary phases within garnet, suggesting that prograde high-pressure metamorphism was dominated by CO2-rich fluids. The results therefore confirmed that the PCSZ underwent regional dry high-pressure metamorphism followed by the peak ultrahigh-temperature event probably associated with the continent-continent collisional and suturing history along the PCSZ.