Corundum-leucosome-bearing aluminous gneiss from Ayyarmalai, Southern Granulite Terrain, India: a textbook example of vapour-phase-absent muscovite melting in silica-undersaturated pelitic rocks

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The Palghat-Cauvery high-pressure granulite belt (PCSZ) marks an important Neoproterozoic crustal suture which separates Archaean cratonic blocks (north) from Palaeo- to Neoproterozoic granulite terrains (south) in southern India. Assemblages and reaction textures of Mg-Al granulites indicate the supracrustal rocks experienced extreme metamorphic conditions. Published P-T estimates and inferred P-T paths are, however, equivocal: [1] 950-1000 °C, 15 kbar, steep anticlockwise P-T loop; [2] 900 °C, 10-12 kbar, clockwise P-T loop.

In this contribution we describe a corundum-leucosome-bearing biotite-plagioclase paragneiss from a newly discovered locality near Ayyarmalai in the eastern extension of the PCSZ, which provides a superb example of muscovite melting in silica-deficient aluminous rocks. The migmatitic structure is defined by closely spaced centimetre-decimetre scale leucosomes that host large euhedral corundum crystals. Mesosome domains show a well recrystallized weakly foliated fabric made up of plagioclase (An21Ab77Or2) and biotite (4.9 wt% TiO2, X_Mg = 0.51-0.47). The contacts with the leucosomes are sharp, and no melanosome selvages are developed. The corundum crystals are located in the centre of the leucosomes, in a matrix of coarse-grained perthitic alkalifeldspar (integr. comp.: An2 Ab35Or63), minor relict biotite (4.25-5.1 wt% TiO2, X_Mg = 0.48-0.46) and plagioclase (An21Ab79Or1). Accessory apatite and zircon occur in both mesosome and leucosome, while opaque phases are absent. The mineralogical, textural and chemical characteristics of the migmatite indicate leucosome formation through vapour phase-absent muscovite melting, focussed around the sites of nucleation and growth of peritectic corundum. The contrasting chemistry of leucosome and mesosome domains points to significant bi-directional element transfer. The P-T pseudosection for the paragneiss suggests onset and completion of muscovite-melting along a steep narrow reaction band which extends from c. 6 kbar/700 °C to c. 12 kbar/800 °C. As biotite remained stable and was not involved in melting reactions, peak-temperatures of metamorphism did not exceed 900 °C, consistent with the results of feldspar thermometry. When combined with the P-T data for garnetiferous basic granulite in the area, these P-T constraints are consistent with a clockwise P-T evolution of supra-crustal granulites in the eastern PCSZ that did not exceed 900°C and 10-12 kbar.

References
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