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 infer-red *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 corundumleuco-some-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 recrystal-lized weakly foliated fabric made up of plagioclase ($An_{21}Ab_{77}Or_2$) and biotite (4.9 wt% TiO_2, 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.: $An_2Ab_{35}Or_{63}$), minor relict biotite (4.25.1 wt% TiO_2, X_{Mg} = 0.48-0.46) and plagioclase ($An_{21}Ab_{78}Or_1$). 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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