

AIO(OH) mineral with sapphirine + quartz assemblage in an ultrahigh-temperature granulite

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Unknown AIO(OH) mineral has been found with equilibrium sapphirine + quartz assemblage in pelitic gneiss from Rajapalayam area in the southern Madurai Granulite Block, southern India. The Madurai Block is dominantly composed of hornblende-biotite gneiss and massive charnockite with minor supracrustal rocks such as pelitic and mafic granulites, calc-silicate rocks, and quartzite. The Rajapalayam area is a key location in southern India for ultrahigh-temperature (UHT) metamorphism, from where we recently reported the occurrence of equilibrium sapphirine + quartz assemblage enclosed in porphyroblastic garnet in quartzo-feldspathic and pelitic granulites for the first time from southern India, providing evidence for T more than 1000 degree peak UHT metamorphism. The occurrence of orthopyroxene + sillimanite + garnet + quartz and spinel + quartz assemblages as well as high Al₂O₃ content of orthopyroxene (more than 9 wt.%) further support extreme crustal metamorphism in this area.

The examined psammitic granulite (sample MD6-2L) is composed mainly of quartz (40-50 %), mesoperthite (20-30 %), garnet (10-20 %), biotite (2-5 %), sillimanite (2-5 %), and sapphirine (less than 1 %). The rock contains sapphirine + quartz assemblage enclosed in poikiloblastic garnet. The AIO(OH) mineral is very fine-grained (40 microns in length) and occurs between the grain boundary of sapphirine and quartz. Its composition was confirmed to be AIO(OH) by electron microprobe, although hydrogen could not be analyzed. It also contains small amount of Fe₂O₃ up to 1.7 wt. %. Laser Raman spectroscopy analysis of the mineral indicates a sharp peak at about 360 wavenumber (cm⁻¹), which is almost equivalent to that of boehmite. Although boehmite is a common AIO(OH) mineral occasionally formed by hydrothermal alteration, it is not a mineral stable at UHT. However, no evidence of later hydrothermal event has been observed in the sample. The unknown AIO(OH) mineral in the examined sapphirine + quartz granulite might be therefore a new polymorph phase of AIO(OH) at high-temperature.