

Hogbomite-bearing ultrahigh temperature metapelites in southern Madagascar

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We report hogbomite occurrences in ultrahigh temperature (UHT) metamorphic rocks from the Betroka Belt, south Madagascar. This mineral is identified over a length of 35 km along the Ranotsara shear zone of Pan-African age. It occurs as fine-grained euhedral to subhedral crystal along fractures and grain boundaries of magnetite, ilmenite and hematite grains. It is commonly associated with Mt, Spl, Ti-Hem, Ilm, Crn, Rt and/or pseudorutile. XRD analyses indicate that the hogbomite is the 2N2S polysome type. The hogbomite is characterized by relatively high ZnO (up to 7.78 wt%). The petrography and mineral chemistry allow identification of two stages of hogbomite crystallization: (1) Hogbomite crystallization during the prograde metamorphic stage. This mineral was encapsulated within porphyroblastic cordierite and garnet. (2) The second generation of hogbomite crystallized after peak metamorphic condition, which was prior to the cordierite-forming reaction from spinel+quartz. The textural relationships suggest that the both hogbomite-forming reactions involved melt together with spinel, Ti-hematite, corundum, ilmenite, and/or rutile. The hogbomite chemical composition varies even in the same thin section, suggesting microdomain equilibrium during its crystallization.

The peak metamorphic assemblages in the studied granulite is Spl + Grt + Crd + Crn + Sill + Kf + Pl + Qtz. Combining the TWEEQU program and the conventional geothermobarometers with the petrogenetic grid in the KFMASH system (Dasgupta et al., 1995), we suggest that the Betroka metapelites experienced ultrahigh temperature metamorphism under the peak condition of ~950 degree C and about 6.5kbar, which was followed retrogressive nearly isobaric cooling to about 735 degree C and 4.5-6 kbar. Phlogopite, sillimanite and quartz grains included in porphyroblastic cordierite and garnet suggest the prograde condition of about 900 degree C and about 7.5kbar. The occurrence of spinel-quartz and corundum-quartz assemblages in the granulite studied is also an additional strong evidence of UHT metamorphism. The present study suggests that a crustal portion the southern Madagascar was suffered an ultrahigh metamorphism condition, probably associated with intense magmatic activity at a middle level.