P-T evolution of eclogite-facies metapelitic migmatites with "nanogranitoids" from the Egéré domain (Egéré-Aleksod terrane, Central Hoggar, South Algeria)

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In the Egéré domain (Egéré-Aleksod terrane, Central Hoggar, South Algeria), mafic eclogite lenses are hosted in metapelitic rocks with high-pressure relicts. These metapelites show textural records of partial melting phenomena, mainly as primary melt inclusions shielded in garnet crystals and later crystallized as "nanogranitoids". Garnet porphyroblasts display inclusions of kyanite, phengite, quartz, biotite, staurolite and rutile, and show a strongly-smoothed prograde zoning with a Mn bell-shaped profile.

The high-grade metamorphic paragenesis is inferred to be garnet, kyanite, phengite (Si up to 6.36), quartz, rutile, ±ilmenite, ±feldspars and melt.

During exhumation, dehydration melting microstructures have been recognized and consists of phengite transformation into fine-grained aggregates of biotite, plagioclase and K-feldspar. Phengite breakdown, along with other retrograde reactions, produced a late paragenesis with biotite, plagioclase, K-feldspar, quartz, almandine-rich garnet, ±sillimanite, ±staurolite, ±muscovite and ilmenite.

The thermodynamic modelling, using P–T pseudosections, provided detailed constraints of the various steps of the metamorphic history from garnet growth at 4.0 kbar and ~600ºC along a prograde metamorphic path to pressure peak conditions of 14–20 kbar and temperature peak of 800–820ºC. A later retrograde trajectory down to 6.0–5.5 kbar and 725–685°C was responsible of the last assemblage formation.

Partial melting process likely started during the prograde path when crossing the H_2O-saturated solidus, at T ≥ 650–670°C and P ≥ 10 kbar, continued upon heating up to the peak conditions, as well as during decompression. This evolution is interpreted in terms of subduction of the continental crust to mantle depths, followed by an exhumation through a clockwise P–T path, during the Pan-African orogeny. The Egéré metapelites are relatively well-preserved eclogite-facies rocks, which represent an unusual trace of subduction within a Neoproterozoic orogen. In addition, they contain inclusions of "nanogranitoids", hitherto very little known in eclogite-facies metamorphic rocks.

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