Isothermal compression of an eclogite from the Western Gneiss Region (Norway)

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Résumé

In the Western Gneiss Region in Norway, mafic eclogites form lenses within granitoid orthogneiss and contain the best record of the pressure and temperature evolution of this ultrahigh-pressure (UHP) terrane. Their exhumation from the UHP conditions has been extensively studied, but their prograde evolution has been rarely quantified although it represents a key constraint for the tectonic history of this area. A well-preserved phengite-bearing eclogite sample from the Nordfjord region was investigated using phase-equilibrium modelling, trace-element analyses of garnet, trace- and major-element thermo-barometry and quartz-in-garnet barometry by Raman spectroscopy. Inclusions in garnet core point to crystallisation conditions in the amphibolite facies at 510–600 ∘C and 11–16 kbar, while chemical zoning in garnet suggests growth during isothermal compression up to the peak pressure of 28 kbar at 600 ∘C, followed by near-isobaric heating to 660–680 ∘C. Near-isothermal decompression to 10–14 kbar is recorded in fine-grained clinopyroxene-amphibole-plagioclase symplectites. The absence of a temperature increase during compression seems incompatible with the classic view of crystallization along a geothermal gradient in a subduction zone and may question the tectonic significance of eclogite-facies metamorphism. Two end-member tectonic scenarios are proposed to explain such an isothermal compression: (1) either the mafic rocks were originally at depth within the lower crust and were consecutively buried along the isothermal portion of the subducting slab, or (2) the mafic rocks recorded up to 14 kbar of tectonic overpressure at constant depth and temperature during the collisional stage of the orogeny.

Mots-Clés: isothermal compression, Western Gneiss Region, UHP eclogite, Raman spectroscopy, pseudosections, non–lithostatic pressure

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