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Granitoid melt inclusions in orogenic peridotites and origin of garnet clinopyroxenites

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Former melt inclusions have been identified for the first time in orogenic peridotites from two different locations in the Granulitgebirge, Bohemian Massif. The inclusions are between 5 and 20 μm in diameter, and can be either polycrystalline, i.e. nanogranitoids, or glassy. When crystallized, they contain a fine grained assemblage of kumdykolite/albite, phlogopite, osumilite, kokchetavite and quartz identified via Micro Raman Spectroscopy and EDS mapping. Both the presence of glass and the mineral assemblage are consistent with the interpretation of these inclusions as former droplets of melt. The inclusions are distributed in clusters in garnet, thus confirming that the trapped melt was present during garnet growth. Nanogranitoids have been re-homogenized in a piston cylinder apparatus to a hydrous glass. The re-homogenization conditions - 1000°C, 22 kbar - correspond to those calculated for garnet1 formation and thus for melt entrapment. The host rock of the investigated inclusions is a garnet clinopyroxenite with granoblastic texture. In both localities the host rocks occur as single layers in larger bodies of garnet-bearing peridotites, hosted in turn in high pressure felsic granulites. The composition of the melt varies from granitic to trondhjemitic.
The occurrence of nanogranitoids in clusters, their negative crystalline shape and the presence of glassy inclusions were also observed in low and high pressure migmatites2 where they are interpreted as evidence of localized partial melting. In the garnet clinopyroxenites this process would have been responsible for the formation at the same time of melt, garnet and maybe also clinopyroxene. Microstructures, the mineral assemblage and the REE partitioning between melt and garnet are consistent with localized partial melting rather than melt infiltration. However, the lack of obvious mineralogical relicts so far, makes the identification of the protolith problematic. The melt is enriched in Cs, Rb and Pb and depleted in Ba, Nb and Sr. Such a pattern suggests the involvement of white mica (possibly phengite) in the melt-producing reaction.

References:
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