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Letter

First evidence of dmisteinbergite ($CaAl_2Si_2O_8$ polymorph) in high-grade metamorphic rocks

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Abstract

We identified dmisteinbergite, the rare trigonal polymorph of $CaAl_2Si_2O_8$, for the first time in high-grade metamorphic rocks. Dmisteinbergite occurs as a crystallization product of silicate melt inclusions (nanogranitoids) in garnet from three host rocks with different protoliths and re-equilibration conditions, i.e., from 1.0 to 4.5 GPa. Raman spectra and compositions of the dmisteinbergite here investigated are overall identical to those of previously characterized artificial and natural dmisteinbergite. In nanogranitoids, this phase coexists with other metastable polymorphs of feldspar (kumdykolite, kokchetavite) and SiO_2 (quartz, cristobalite), recently interpreted as the result of undercooling, supersaturation and rapid crystallization of a silicate melt confined in a micrometric pore. Dmisteinbergite formation likely results from a similar process, and thus it should be regarded as a kinetically controlled phase. Moreover, the investigation of dmisteinbergite as well as of other metastable feldspar polymorphs offers new insights into the behavior of natural materials under non-equilibrium conditions.

Keywords: Dmisteinbergite, anorthite polymorph, partial melting, nanogranitoids, metastable phases, garnet, high-grade metamorphism