

Coexisting clinopyroxene/spinel and amphibole/spinel symplectites in metatroctolites from the Buck Creek ultramafic body, North Carolina Blue Ridge

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ABSTRACT

Buck Creek metatroctolites preserve evidence of three stages in the geologic history of the region: a relict igneous stage; a high-pressure, granulite-facies metamorphic stage; and a hydrous alteration stage. During high-pressure granulite-facies metamorphism, adjacent olivine and plagioclase reacted to produce complex coronitic textures. Relict olivine is surrounded by radial, columnar orthopyroxene, and plagioclase is rimmed by fine-grained symplectite composed of separate grains of clinopyroxene/spinel, tschermakitic amphibole/spinel symplectite and minor clinopyroxene/sapphirine symplectite. Examination of textural relationships in back-scattered electron images and X-ray element maps of the symplectites demonstrates that amphibole/spinel and clinopyroxene/spinel symplectites grew simultaneously at high temperature to replace plagioclase in these rocks. Clinopyroxene/sapphirine symplectite grew in the latest stages of plagioclase replacement in some samples.

A successful model for the main corona-forming reaction in sample BC7, $1.00 \text{ Pl} + 1.72 \text{ Ol} + 0.17 \text{ H}_2\text{O} = 0.59 \text{ Di} + 0.17 \text{ Amp} + 0.68 \text{ Spl} + 0.79 \text{ Opx}$, results only if amphibole is included. The model predicts relative volumes of product clinopyroxene, amphibole and spinel that are generally consistent with the proportions in imaged symplectites. Proportions of clinopyroxene- and amphibole-hosted symplectite appear to have been governed by local mass-balance of Na and Al in plagioclase and/or availability of H₂O. The most successful model for formation of the inner clinopyroxene/sapphirine corona, $1.00 \text{ Pl} + 1.47 \text{ Ol} + 0.17 \text{ H}_2\text{O} = 0.59 \text{ Di} + 0.17 \text{ Amp} + 0.30 \text{ Spr} (10 \text{ ox.}) + 0.57 \text{ Opx}$, also includes amphibole, which is present in association with clinopyroxene/sapphirine symplectite. Sufficient H₂O for formation of symplectitic amphibole must have been present in the intergranular fluid of relict igneous troctolites or have infiltrated during metamorphism at high *P-T* conditions.