

LETTER

Corundum + orthopyroxene ± spinel intergrowths in an ultrahigh-temperature Al-Mg granulite from the Southern Marginal Zone, Limpopo Belt, South Africa

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ABSTRACT

We report the occurrence of unusual lamellar (random and regular subparallel) intergrowths of corundum and symplectic intergrowth of spinel with orthopyroxene in an ultrahigh-temperature Al-Mg granulite from the Southern Marginal Zone of the Limpopo Belt, South Africa. Separate compositions are suggested for the homogenous phase that might have existed prior to the formation of the two types of lamellar intergrowths of corundum with orthopyroxene. In the case of random lamellar corundum + orthopyroxene intergrowth, the estimated garnet precursor composition is similar to Fe-Mg garnet, while, although speculative, an ultrahigh-Al orthopyroxene precursor is suggested to account for the exsolution nature of the unique regular subparallel corundum lamellae in orthopyroxene. Considering that the stability field of Fe-Mg-rich garnet relative to orthopyroxene + corundum extends to lower pressures, the estimated garnet composition ($X_{\text{Mg}} = \sim 0.65$) is most likely stable at low pressures of ~ 5 kbar. Such low pressures are further supported by the Fe-Mg-rich garnet compositional nature of the pre-spinel-intergrowth orthopyroxene. Given the rare preservation of the mineral assemblages typical of prograde metamorphism in granulite facies rocks, our discovery of corundum lamellar intergrowth with orthopyroxene from an ultrahigh-temperature Al-Mg granulite is unique.

Keywords: Corundum + orthopyroxene intergrowth, ultrahigh-temperature Al-Mg granulite, Fe-Mg-rich garnet, Limpopo Belt