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TEM investigation of potassium-calcium feldspar inclusions in Bøggild plagioclase

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ABSTRACT

Potassium-calcium feldspar inclusions in a Bøggild plagioclase were investigated by analytical high-resolution transmission electron microscopy (HRTEM), and the formation process of these inclusions is considered based on the Al-Si ordering scheme in ternary feldspar system. Nanometer-scale chemical analyses and selected-area electron diffraction (SAED) patterns show that the rims of the inclusions consist of lamellar intergrowths of potassium feldspar ($C\bar{1}$ symmetry) and anorthite ($P\bar{1}$ symmetry), whereas the core is unexsolved potassium feldspar ($C\bar{1}$ symmetry). Potassium feldspar and anorthite in the inclusions share the crystallographic orientation of the host Bøggild plagioclase. High-resolution lattice images indicate coherent interfaces between the inclusions and the host Bøggild plagioclase and the phases in the inclusions. The results indicate a unique formation process of potassium-calcium feldspar inclusions in a ternary feldspar: crystallization of host labradorite → precipitation of potassium feldspar → decomposition of Bøggild exsolution lamellae → growth of anorthite on the rims of potassium feldspar inclusions. Potassium-calcium feldspar inclusions may be found in Bøggild and other plagioclase, and they have the potential to give constraints on thermal histories of K-rich plagioclase.