

(Ca-Y)-phosphate inclusions in apatite crystals from Archean rocks from the Barberton Greenstone Belt and Pilbara Craton: First report of natural occurrence

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ABSTRACT

Here, we report the first occurrence of two (Ca-Y)-phosphate phases in apatite crystals from ancient rocks from both the Barberton greenstone belt and the Pilbara Craton. First, a cubic $\text{Ca}_3\text{Y}(\text{PO}_4)_3$ phase was observed in a sample of silicified tuff from the Mendon Formation from the Barberton greenstone belt. A second phase, corresponding to a synthetic compound with the formula $\text{CaYP}_7\text{O}_{20}$, was observed in a sample of black banded chert from the Hooggenoeg Formation of the Onverwacht Group and in a sample of chert from the Strelley Pool Chert Formation (East Pilbara Terrane). Based on the presence of these phosphates and specific textures revealed by transmission electron microscopy, we argue for the importance of dissolution-reprecipitation processes in the formation of these phosphate phases. Temperature was likely not the primary parameter controlling the crystallization of the $\text{Ca}_3\text{Y}(\text{PO}_4)_3$ and $\text{CaYP}_7\text{O}_{20}$ phases. Instead, the REE-F complexes in an H_2O solution and the specific budget of REEs and Y in apatite were likely responsible for the nucleation and formation of the (Ca-Y)-phosphate phases in the Archean rocks of the Barberton greenstone belt and Pilbara Craton.

Keywords: Barberton, apatite, TEM, (Ca-Y)-phosphate