

Experimental incorporation of Th into xenotime at middle to lower crustal *P-T* utilizing alkali-bearing fluids

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ABSTRACT

In this study, a natural Th-absent xenotime [(Y+HREE)PO₄], is enriched in specific areas with respect to Th + Si utilizing a series of alkali-bearing fluids that included 2 *N* NaOH, 2 *N* KOH, Na₂Si₂O₅ + H₂O, and NaF + H₂O, in addition to ThO₂ and SiO₂. Charge and fluid were sealed in Au capsules and placed in the piston-cylinder apparatus (CaF₂ assemblies) at 1000 MPa and 900 °C (8 to 25 days) or in cold-seal autoclaves on a hydrothermal line at 500 MPa and 600 °C (23 days). BSE imaging, EMP analysis, and TEM indicate that a fraction of the xenotime grains in the 2 *N* KOH, Na₂Si₂O₅ + H₂O, and NaF + H₂O experiments have altered areas enriched in Th + Si. No reaction was observed in the 2 *N* NaOH experiments. The altered areas occur as a series of curvilinear intergrowths with sharp compositional boundaries that extend from the edge of the xenotime grain into the interior. Formation of these Th + Si enriched areas is interpreted as a consequence of fluid-mediated coupled dissolution-precipitation.

Keywords: Xenotime, thorite, coupled dissolution-precipitation, alkali-bearing fluids