American Mineralogist, Volume 100, pages 1434–1451, 2015

Sc- and REE-rich tourmaline replaced by Sc-rich REE-bearing epidote-group mineral from the mixed (NYF+LCT) Kracovice pegmatite (Moldanubian Zone, Czech Republic)

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Abstract

Primary black thick-prismatic Al-rich schorl to rare fluor-schorl (TurP1), locally overgrown by brownish-green Li-rich fluor-schorl to fluor-elbaite (TurP2) from the Kracovice pegmatite (mixed NYF+LCT signature), was partly replaced by secondary Li-rich fluor-schorl to fluor-elbaite (TurS) plus the assemblage REE-bearing epidote-group mineral + chamosite. Primary Al-rich schorl (TurP1) shows high and variable contents of Sc (33–364 ppm) and Y+REE (40–458 ppm) with steep, LREE-enriched REE pattern. Overgrowing (TurP2) and replacing (TurS) Li-rich fluor-schorl to fluor-elbaite is typically depleted in Sc (21–60 ppm) and Y+REE (3–47 ppm) with well-developed tetrad effect in the first (La-Nd) and the second (Sm-Gd) tetrads. Scandium- and REE-rich black tourmaline (TurP1) crystallized earlier from the melt, whereas crystallization of primary Li-rich fluor-schorl to fluor-elbaite (TurP2) most likely took place during late magmatic to early hydrothermal conditions. Both the secondary Li-rich fluor-schorl to fluor-elbaite (TurS) and the unusual assemblage of REE-bearing epidote-group mineral + chamosite are likely coeval products of subsolidus reactions of the magmatic Al-rich schorl (TurP1) with evolved REE-poor, Li,F-rich, alkaline pegmatite-derived fluids. Well-crystalline REE-bearing epidote-group mineral (Y+REE = 0.42–0.60 apfu) confirmed by Raman spectroscopy has a steep, LREE-rich chondrite-normalized REE pattern with significant negative Eu anomaly and shows variable and high contents of Sc (≤3.3 wt% Sc_2O_3) and Sn (≤1.0 wt% SnO_2). Substitution $ScAl_{-1}$ and minor vacancy in the octahedral sites are suggested in the REE-bearing epidote-group mineral.

Keywords: Schorl, fluor-elbaite, tourmaline replacement, Sc-rich REE-bearing epidote-group mineral, granitic pegmatite, Bohemian Massif