

Jeremejevite as a precursor for the formation of olenitic tourmaline: An experimental and B isotope study

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Time-dependent piston-cylinder synthesis experiments were performed in the system $\text{SiO}_2\text{-Al}_2\text{O}_3\text{-B}_2\text{O}_3\text{-NaCl-H}_2\text{O}$ at $700^\circ\text{C}/40$ kbar and run durations of 0.5 h, 2.5 h and 216 h, starting from quartz- $\text{Al}_2\text{O}_3\text{-H}_3\text{BO}_3$ mixtures and NaCl-solutions. Sharply zoned olenitic tourmaline ($^{11\text{V}}\text{B}$ -rich cores, $^{11\text{V}}\text{B}$ -poor rims) formed in all experiments, with its abundance increasing with increasing run duration. The amount of the additional solid product phases coesite and the hydroxyl end-member of jeremejevite $\text{Al}_6(\text{BO}_3)_5(\text{OH})_3$ decreases with time. Extensive porosity is recognized in jeremejevite and the cores of early grown acicular tourmaline. Textural relationships (Fig. 1) indicate that olenitic tourmaline grows at the expense of jeremejevite that acts as a crystalline precursor.



Figure 1: SEM image of olenitic tourmaline (Tur) that forms from jeremejevite (Jer) as a precursor phase after 0.5 h.

The transformation likely proceeds via a dissolution/re-precipitation mechanism, which triggers the sharp chemical zonation in olenite. B-isotope analyses of fluids and solids show that olenite growth concomitant with the decay of jeremejevite will produce scattered or inverse boron isotope patterns (heavy cores, light rims) in tourmaline, which can not result from simple Rayleigh fractionation. Similar precursor reactions involving jeremejevite or other precursor phases might explain chemical zonation and porous textures in tourmaline root zones reported in many experimental studies.