

## **Determination of the $\text{H}_3\text{BO}_3$ concentration in fluid and melt inclusions in granite pegmatites by laser Raman microprobe spectroscopy**

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### **ABSTRACT**

A method of determining the boric acid ( $\text{H}_3\text{BO}_3$ ) concentration in fluid inclusions and volatile-rich glasses using laser Raman microprobe spectroscopy is described. The  $\text{H}_3\text{BO}_3$  content of melt and fluid inclusions is determined with good accuracy and precision in the concentration range of 0 to 20 wt%, and with a minimum detection limit (mdl) of 0.05 wt%  $\text{H}_3\text{BO}_3$ . The method is applicable to complex solutions that contain components such as NaCl, KCl, RbCl, or CsCl, which do not form stable hydrated borates with boric acid at room temperature.

This Raman study demonstrates that boric acid is an abundant component in volatile-rich melt inclusions and in genetically linked primary and pseudosecondary fluid inclusions, particularly in tourmaline-bearing granites and boron-rich pegmatites. In quenched pegmatite melt boron occurs predominantly as a trigonal coordinated  $\text{B}(\text{OH})_3$  complex. The analytical method is applied to a series of melt and fluid inclusions from different localities and geological environments; namely hydrothermal tin and tungsten deposits, granite pegmatites, and rhyolites. Special emphasis is given to the analysis of fluorine-, phosphorus-, and boron-rich pegmatites of the Variscan Ehrenfriedersdorf complex (Central Erzgebirge, Germany). In this pegmatite system, boron in combination with water, fluorine, and phosphorous is responsible for immiscibility of two coexisting silicate melts, a silicate-rich  $\text{H}_2\text{O}$ -poor melt and a silicate-poor  $\text{H}_2\text{O}$ -rich melt accompanied by strong element fractionation between the two. Boron fractionates into the water-rich silicate melt by factors between 1.8 at 500 °C and 1.0 at 712 °C. If, at low pressure, a vapor phase is additionally formed, boron is partitioned into the vapor phase. The utility of the developed method was also quantitatively tested by experiments with a hydrothermal diamond anvil cell.