

## **Ramanite-(Cs) and ramanite-(Rb): New cesium and rubidium pentaborate tetrahydrate minerals identified with Raman spectroscopy**

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### **ABSTRACT**

This study of melt and fluid inclusions in graphic pegmatite quartz from the Island of Elba, Italy has identified silicate melts and coexisting aqueous fluid from the final stage of pegmatite formation, which contain extremely high concentrations of boron (up to 19.8 mass% B<sub>2</sub>O<sub>3</sub>), cesium (>5 mass% Cs<sub>2</sub>O), and rubidium (>0.5 mass% Rb<sub>2</sub>O). Several boron-bearing minerals have been identified in melt and fluid inclusions, including sassolite (H<sub>3</sub>BO<sub>3</sub>) and santite (KB<sub>5</sub>O<sub>8</sub>·4H<sub>2</sub>O). In addition, we have found two new minerals observed as daughter mineral phases, and these have been accepted by the IMA, Commission on New Minerals, Nomenclature and Classification (CNMNC) as ramanite-(Cs) (2007-007), monoclinic β-cesium pentaborate tetrahydrate (CsB<sub>5</sub>O<sub>8</sub>·4H<sub>2</sub>O) with space group *C2/c*, and ramanite-(Rb) (2007-006), orthorhombic rubidium pentaborate tetrahydrate (RbB<sub>5</sub>O<sub>8</sub>·4H<sub>2</sub>O) with space group *Aba2*.

At the moment, given sample constraints, we cannot directly determine some of the properties traditionally reported for new minerals; however, both phases have Raman spectra identical to spectra obtained on synthetic Cs and Rb pentaborates, which were studied for comparison. Although difficult to recognize optically, ramanite-(Cs) and ramanite-(Rb) have distinctive Raman spectra allowing simple and definitive identification from other translucent phases found in many hypersaline fluid inclusions. Although currently only identified from a limited number of occurrences, given the availability of a definitive means of identification, we suspect that ramanite-(Rb) and ramanite-(Cs) may in fact be common, at least in boron-rich pegmatites.

**Keywords:** Fluid and melt inclusions, strong enrichment of boron, rubidium, and cesium, Raman spectroscopy, new Cs and Rb minerals, ramanite-(Cs), ramanite-(Rb)