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Peralkalinity in peraluminous granitic pegmatites. I. Evidence from whewellite and hydrogen carbonate in fluid inclusions

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Abstract

Fluid inclusions in pegmatite minerals were studied using Raman spectroscopy to determine the carbon species. Carbon dioxide is very abundant in the aqueous liquid and vapor phases. Occasionally, CH_4 was found in the vapor. In the aqueous liquid, HCO_3^- was detected in fluid inclusions in tantalite-(Mn) from the Morrua Mine and in late-stage quartz from the Muiâne pegmatite and the Naipa Mine, all in the Alto Ligonha District, Mozambique. Moreover, we observed a carbonate (calcite group) in fluid inclusions in garnet from the Naipa Mine and in beryl from the Morrua Mine, both in the Alto Ligonha District, Mozambique, and a calcite-group carbonate and whewellite [$CaC_2O_4 \cdot H_2O$] in fluid inclusions in topaz from Khoroshiv, Ukraine. The occurrence of oxalate is interpreted to be due to a reaction of some form of carbon (possibly CO or bitumen) with a peralkaline fluid. Our results support the hypothesis that, although counterintuitive, hydrogen carbonate-rich peralkaline fluids may locally be involved in the evolution of peraluminous granitic pegmatites, in which peralkaline minerals are normally absent or very rare.

Keywords: Whewellite, carbonate, hydrogen carbonate, oxalate, CO_2, fluid inclusion, pegmatite