

The chemistry and crystal structure of okanoganite-(Y) and comparison with vicanite-(Ce)

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ABSTRACT

The structure of okanoganite-(Y), a rare REE-rich borofluorosilicate, was refined in space group $R\bar{3}m$, starting from the atomic coordinates of vicanite-(Ce), to a final R -factor of 0.032 for 1857 observed reflections. Okanoganite-(Y) is trigonal with $a = 10.7108(5)$, $c = 27.0398(11)$ Å, $Z = 3$. SIMS procedures were used for the analysis of H, F, Li, Be, B, REE, Y, actinides (U, Th, Pb), and other trace elements (Sr, Ba, Cs). An excellent agreement was obtained by comparing EMPA + SIMS with SREF data. On the basis of 38 O atoms, the resulting unit formula is $(Y_{4.52}REE_{6.82}Ca_{2.65}Na_{1.63}Th_{0.19}Sr_{0.02}Ba_{0.01}U_{0.01})_{\Sigma 15.85}(Fe_{0.74}^{3+}Ti_{0.19}Li_{0.04})_{\Sigma 0.97}(Si_{6.71}P_{0.32}B_{2.94}Be_{0.01})_{\Sigma 9.98}(O_{34.02}OH_{3.98})_{\Sigma 38}F_{10.04}$. The chemical data are compared to those in the literature and discrepancies are discussed.

The structure of okanoganite-(Y) resembles that of vicanite-(Ce). They are the only two borosilicates showing a structural unit of threefold rings of BO_4 tetrahedra. The main differences between the two minerals lie in the different chemical composition [absence of As and low amount of Ca and Th in okanoganite-(Y); absence of Y and low amount of Na in vicanite-(Ce)] and in the lack, in okanoganite-(Y), of a B atom that is at the center of a triangular BO_3 coordination in vicanite-(Ce). Additional analogies and differences between the two structures are shown.