American Mineralogist, Volume 98, pages 485–492, 2013

Oxy-schorl, $Na(Fe^{2+}_2Al)Al_6Si_6O_{18}(BO_3)_3(OH)_3O$, a new mineral from Zlatá Idka, Slovak Republic and Přibyslavice, Czech Republic

Peter Bačík,[1,*] Jan Cempírek,[2,3] Pavel Uher,[1] Milan Novák,[4] Daniel Ozdín,[1] Jan Filip,[5] Radek Škoda,[4] Karel Breiter,[6] Mariana Klementová,[7] Rudolf Ďuďa,[8] and Lee A. Groat[3]

[1]Department of Mineralogy and Petrology, Comenius University, Mlynská dolina, 842 15 Bratislava, Slovakia
[2]Department of Mineralogy and Petrography, Moravian Museum, Zelný trh 6, 659 37 Brno, Czech Republic
[3]Department of Earth, Ocean, and Atmospheric Sciences, University of British Columbia, 6339 Stores Road, Vancouver, British Columbia V6T 164, Canada
[4]Department of Geological Sciences, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic
[5]Regional Centre of Advanced Technologies and Materials, Palacký University in Olomouc, 17. listopadu 12, 771 46 Olomouc, Czech Republic
[6]Geological Institute of the Academy of Science of Czech Republic, v.v.i., Rozvojová 269, 165 00 Praha 6, Czech Republic
[7]Institute of Physics of the AS CR, v.v.i., Na Slovance 2, 182 21 Praha 8, Czech Republic
[8]Bystrická 87, 040 11 Košice, Slovakia

Abstract

Oxy-schorl (IMA 2011-011), ideally $Na(Fe^{2+}_2Al)Al_6Si_6O_{18}(BO_3)_3(OH)_3O$, a new mineral species of the tourmaline supergroup, is described. In Zlatá Idka, Slovak Republic (type locality), fan-shaped aggregates of greenish black acicular crystals ranging up to 2 cm in size, forming aggregates up to 3.5 cm thick were found in extensively metasomatically altered metarhyolite pyroclastics with Qtz+Ab+Ms. In Přibyslavice, Czech Republic (co-type locality), abundant brownish black subhedral, columnar crystals of oxy-schorl, up to 1 cm in size, arranged in thin layers, or irregular clusters up to 5 cm in diameter, occur in a foliated muscovite-tourmaline orthogneiss associated with Kfs+Ab+Qtz+Ms+Bt+Grt. Oxy-schorl from both localities has a Mohs hardness of 7 with no observable cleavage and parting. The measured and calculated densities are 3.17(2) and 3.208 g/cm^3 (Zlatá Idka) and 3.19(1) and 3.198 g/cm^3 (Přibyslavice), respectively. In plane-polarized light, oxy-schorl is pleochroic; *O* = green to bluish-green, *E* = pale yellowish to nearly colorless (Zlatá Idka) and *O* = dark grayish-green, *E* = pale brown (Přibyslavice), uniaxial negative, ω = 1.663(2), ε = 1.641(2) (Zlatá Idka) and ω = 1.662(2), ε = 1.637(2) (Přibyslavice). Oxy-schorl is trigonal, space group *R*3*m*, *Z* = 3, *a* = 15.916(3) Å, *c* = 7.107(1) Å, *V* = 1559.1(4) Å^3 (Zlatá Idka) and *a* = 15.985(1) Å, *c* = 7.154(1) Å, *V* = 1583.1(2) Å^3 (Přibyslavice). The composition (average of 5 electron microprobe analyses from Zlatá Idka and 5 from Přibyslavice) is (in wt%): SiO_2 33.85 (34.57), TiO_2 <0.05 (0.72), Al_2O_3 39.08 (33.55), Fe_2O_3 not determined (0.61), FeO 11.59 (13.07), MnO <0.06 (0.10), MgO 0.04 (0.74), CaO 0.30 (0.09), Na_2O 1.67 (1.76), K_2O <0.02 (0.03), F 0.26 (0.56), Cl 0.01 (<0.01), B_2O_3 (calc.) 10.39 (10.11), H_2O (from the crystal-structure refinement) 2.92 (2.72), sum 99.29 (98.41) for Zlatá Idka and Přibyslavice (in parentheses). A combination of EMPA, Mössbauer spectroscopy, and crystal-structure refinement yields empirical formulas $(Na_{0.591}Ca_{0.103}\square_{0.306})_{\Sigma1.000}(Al_{1.885}Fe^{2+}_{1.108}Mn_{0.005}Ti_{0.002})_{\Sigma3.000}(Al_{5.428}Mg_{0.572})_{\Sigma6.000}(Si_{5.506}Al_{0.494})_{\Sigma6.000}O_{18}(BO_3)_3(OH)_3(O_{0.625}OH_{0.236}F_{0.136}Cl_{0.003})_{\Sigma1.000}$ for Zlatá Idka, and $(Na_{0.586}Ca_{0.017}K_{0.006}\square_{0.391})_{\Sigma1.000}(Fe^{2+}_{1.879}Mn_{0.015}Al_{1.013}Ti_{0.093})_{\Sigma3.00}(Al_{5.732}Mg_{0.190}Fe^{3+}_{0.078})_{\Sigma6.000}(Si_{5.944}Al_{0.056})_{\Sigma6.000}O_{18}(BO_3)_3(OH)_3(O_{0.579}F_{0.307}OH_{0.115})_{\Sigma1.000}$ for Přibyslavice. Oxy-schorl is derived from schorl end-member by the $AlOFe_{-1}(OH)_{-1}$ substitution. The studied crystals of oxy-schorl represent two distinct ordering mechanisms: disorder of R^{2+} and R^{3+} cations in octahedral sites and all O ordered in the *W* site (Zlatá Idka), and R^{2+} and R^{3+} cations ordered in the *Y* and *Z* sites and O disordered in the *V* and *W* sites (Přibyslavice).

Keywords: Oxy-schorl, tourmaline-supergroup minerals, new mineral, electron microanalysis, crystal-structure refinement, Přibyslavice, Zlatá Idka