Oxy-schorl, Na(Fe\textsuperscript{3+}Al)\textsubscript{6}Si\textsubscript{6}O\textsubscript{18}(BO\textsubscript{3})\textsubscript{3}(OH)\textsubscript{3}O, a new mineral from Zlatá Idka, Slovak Republic and Přibyslavice, Czech Republic

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ABSTRACT

Oxy-schorl (IMA 2011-011), ideally Na(Fe\textsuperscript{3+}Al)\textsubscript{6}Si\textsubscript{6}O\textsubscript{18}(BO\textsubscript{3})\textsubscript{3}(OH)\textsubscript{3}O, 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+Bi+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\textsuperscript{3} (Zlatá Idka) and 3.19(1) and 3.198 g/cm\textsuperscript{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 R3\textit{m}, Z = 3, a = 15.916(3) Å, c = 7.107(1) Å, V = 1559.1(4) Å\textsuperscript{3} (Zlatá Idka) and a = 15.985(1) Å, c = 7.154(1) Å, V = 1583.1(2) Å\textsuperscript{3} (Přibyslavice). The composition (average of 5 electron microprobe analyses from Zlatá Idka and 5 from Přibyslavice) is (in wt%): SiO\textsubscript{2} 33.85 (34.57), TiO\textsubscript{2} <0.02 (0.03), F 0.26 (0.56), Cl 0.01 (<0.01), B 0.190 (0.305), Ca 0.078 (0.115), Mg 0.006 (0.009), Na 1.67 (1.76), K\textsubscript{2}O <0.02 (0.03), F 0.26 (0.56), Cl 0.01 (<0.01), B\textsubscript{2}O\textsubscript{3} (calc.) 0.50 (0.55), H\textsubscript{2}O (from the crystal-structure refinement) 2.92 (2.72), sum 99.29 (98.41) for Zlatá Idka and 3.19(1) and 3.198 g/cm\textsuperscript{3} (Přibyslavice), respectively. A combination of EMPA, Mössbauer spectroscopy, and crystal-structure refinement yields empirical formulas (Na\textsubscript{0.95}Ca\textsubscript{0.10}Al\textsubscript{0.30}Si\textsubscript{0.62}O\textsubscript{1.15}F\textsubscript{0.30}OH\textsubscript{0.03} for Zlatá Idka and Na\textsubscript{0.96}Ca\textsubscript{0.04}Si\textsubscript{0.30}O\textsubscript{1.30}F\textsubscript{0.30}OH\textsubscript{0.03} for Přibyslavice). Oxy-schorl is derived from schorl end-member by the AlOFe\textsubscript{2}+(BO\textsubscript{3})\textsubscript{3}OH\textsubscript{3}O substitution. The studied crystals of oxy-schorl represent two distinct ordering mechanisms: disorder of R\textsuperscript{2+} and R\textsuperscript{3+} cations in octahedral sites and all O ordered in the W site (Zlatá Idka), and R\textsuperscript{2+} and R\textsuperscript{3+} cations ordered in the Y and Z sites and O disordered in the Y and W sites (Přibyslavice).

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

INTRODUCTION

Minerals of the tourmaline-supergroup are common in many geological environments. The complexity of their structure, including a variability of structural sites and chemical composition are manifested in a relatively large number of mineral species (Henry et al. 2011). Oxy-schorl, ideally Na(Fe\textsuperscript{3+}Al)\textsubscript{6}Si\textsubscript{6}O\textsubscript{18}(BO\textsubscript{3})\textsubscript{3}(OH)\textsubscript{3}O, is a new member of the alkali group and oxy-series of the tourmaline supergroup (sensu nomenclature of Henry et al. 2011). The coupled general substitution $\text{R}^{2+}+\text{OH}^{-}\leftrightarrow\text{Al}^{3+}+\text{O}^{-}$ derived from ideal schorl NaFe\textsuperscript{2+}Al\textsubscript{6}Si\textsubscript{6}O\textsubscript{18}(BO\textsubscript{3})\textsubscript{3}OH\textsubscript{3}O and leading to the ideal oxy-schorl was discussed already by Foit and Rosenberg (1977). Povondra (1981), Povondra et al. (1985, 1987), and Foit (1989) published several chemical analyses of tourmalines corresponding to oxy-schorl including samples from the co-type locality Přibyslavice (Povondra et al. 1987). However, the term oxy-schorl was first introduced by Hawthorne and Henry (1999).