Pertsevite-(OH), a new mineral in the pertsevite series, Mg$_3$(BO$_3$)$_{1-x}$(SiO$_4$)$_x$(F,OH)$_{1-x}$ ($x < 0.5$), from the Snezhnoye deposit in Sakha-Yakutia Republic, Russia

IRINA O. GALUSKINA, LUISA OTTOLINI, MILEN KADIYSKI, THOMAS ARMBRUSTER, EVGENY V. GALUSKIN, PIOTR DZIERŻAŃOWSKI, AND ANTONI WINIARSKI

1Faculty of Earth Sciences, Department of Geochemistry, Mineralogy and Petrography, University of Silesia, Będzińska 60, 41-200 Sosnowiec, Poland
2CNR, Institute of Geosciences and Earth Resources (IGG), Unit of Pavia, Via A. Ferrata 1, I-27100 Pavia, Italy
3Mineralogical Crystallography, Institute of Geological Sciences, University of Bern, Freiestrasse 3, CH-3012 Bern, Switzerland
4Institute of Geochemistry, Mineralogy and Petrology, University of Warsaw, al. Żwirki i Wigury 93, 02-089 Warszawa, Poland
5August Chełkowski Institute of Physics, University of Silesia, Uniwersytecka 4, 40-007 Katowice, Poland

ABSTRACT

Pertsevite-(OH), end-member formula Mg$_3$(BO$_3$)$_{1-x}$(SiO$_4$)$_x$(OH)$_{1-x}$, where $x = 0.1–0.3$. Pertsevite-(OH) is biaxial: $2V_r = 55–65^\circ$ (meas), $2V_r = 75^\circ$ (calc); $\alpha = 1.611(1)$, $\beta = 1.623(1)$, $\gamma = 1.644(1)$; $X = b$, $Y = c$, $Z = a$. It is associated with kotoite, szabielyite, ludwigite-azoproite, clinohumite, hydroxyclinohumite, forsterite, chondrodite, calcite, REE-bearing sakhaite, sphalerite, and goethite. Ion microprobe analyses of pertsevite-(OH) using secondary ion mass spectrometry gave B, F, and H contents consistent with B and F contents determined by electron microprobe analyses (EMPA), and with OH contents calculated from EMPA data, confirming that OH/F ratio > 1 in pertsevite-(OH). Pertsevite-(OH) is orthorhombic, with space group $Pnma$. Cell dimensions refined from X-ray powder diffraction data are as follows: $a = 20.499(1)$, $b = 11.900(1)$, $c = 4.589(1)$ Å, and $V = 1119.4(3)$ Å$^3$. The strongest lines of the X-ray diffraction pattern are [(hk0), d-spacing in Å, (h)]: (331) 2.7480 (61), (141) 2.4788 (42), (711) 2.4197 (35), (441) 2.2455 (86), (801) 2.2408 (45), (442) 1.7124 (100), (802) 1.7074 (47), and (124) 1.4817 (51). The main bands in the FTIR spectrum of pertsevite-(OH) are 1354, 1261, 1178, 1022, 975, 929, 888, 745, 555 and OH-specific 3696, 3562, 3530 cm$^{-1}$.

Keywords: Pertsevite-(OH), pertsevite-(F), pertsevite series, SIMS, FTIR, Snezhnoye deposit, Sakha-Yakutia Republic, Russia

INTRODUCTION

Galuskina et al. (2008) reported data on the composition, structure, and genesis of an OH analog of pertsevite, Mg$_3$BO$_3$F (Schreyer et al. 2003), which was, up to this time, only known as a fluorine-dominant mineral. However, the species and name for an OH-dominant pertsevite had not been submitted to Commission on New Minerals, Nomenclature and Classification, International Mineralogical Association (CNMNC IMA) for approval. Additional investigations of OH-dominant pertsevite using secondary ion mass spectrometry (SIMS), including direct determination of hydrogen, gave an empirical ratio OH/F > 1, confirming previous data based on chemical compositions obtained by electron probe microanalysis (EPMA) (Galuskina et al. 2008) and establishing the existence of OH-dominant pertsevite. The species and name pertsevite-(OH) were approved by the CNMNC in February 2009 (IMA 2008-060). Moreover, the Chairman of the CNMNC agreed to renaming pertsevite (Schreyer et al. 2003) to pertsevite-(F). The new mineral was analyzed in the holotype sample number 3755/1 (Fersman Mineralogical Museum, Moscow, collection N.N. Pertsev, author’s number B-814), a kotoite rock containing pertsevite-(OH), collected in 1963 by Nikolai Pertsev at the Snezhnoye deposit, Sakha-Yakutia Republic, Russia.

The present paper has the twin goals of reporting new data on pertsevite-(OH), which led to its acceptance as a new mineral species, and discussing classification of the pertsevite series. The new data comprise direct measurement of H, F, and B; FTIR spectra, X-ray powder diffraction data, and optical properties.

EXPERIMENTAL METHODS

Electron microscopy and microprobe analyses (EPMA)

Scanning electron microscope Philips/FEI ESEM XL30 with EDS/EDAX (University of Silesia, Sosnowiec, Poland) under low vacuum was used during the preliminary selection of pertsevite grains for FTIR spectroscopy and SIMS analyses.