

## Prewittite, $\text{KPb}_{1.5}\text{Cu}_6\text{Zn}(\text{SeO}_3)_2\text{O}_2\text{Cl}_{10}$ , a new mineral from Tolbachik fumaroles, Kamchatka peninsula, Russia: Description and crystal structure

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### ABSTRACT

Prewittite, ideally  $\text{KPb}_{1.5}\text{Cu}_6\text{Zn}(\text{SeO}_3)_2\text{O}_2\text{Cl}_{10}$ , was found in the fumarole field of the second cinder cone of the North Breach of the Great fissure Tolbachik eruption (1975–1976, Kamchatka peninsula, Russia). It occurs as separate olive-green tabular crystals up to 0.2 mm in maximum dimension. It has vitreous luster and brownish-green streak. Prewittite is orthorhombic, space group  $Pn\bar{m}$ ,  $a = 9.132(2)$ ,  $b = 19.415(4)$ ,  $c = 13.213(3)$  Å,  $V = 2342.6(9)$  Å<sup>3</sup>,  $Z = 4$ ,  $D_{\text{calc}} = 3.89$  g/cm<sup>3</sup>,  $D_{\text{meas}} = 3.90(2)$  g/cm<sup>3</sup>. The eight strongest lines of the powder X-ray diffraction pattern are  $\{I [d(\text{Å})] hkl\}$ : 70 (8.26) 110; 60 (7.53) 101; 90 (4.111) 220, 132, 141; 100 (3.660) 212, 123; 40 (2.996) 223; 50 (2.887) 062; 40 (2.642) 322, 214; 40 (2.336) 073, 180, 244. Prewittite is biaxial (–). The optical orientation is  $X = a$ ,  $Y = c$ ,  $Z = b$ . The mineral has clear pleochroism:  $X$ ,  $Y$  – olive green,  $Z$  – red-brown. The mineral is very brittle with the perfect cleavage on (010) and (101). The most developed crystal forms are  $\{010\}$ ,  $\{001\}$ , and  $\{101\}$ . The chemical composition determined by the electron-microprobe is (wt%): K<sub>2</sub>O 1.76, PbO 21.18, CuO 33.24, ZnO 8.00, SeO<sub>2</sub> 15.74, Cl 26.06, O=Cl –5.88, total 100.10. The empirical formula derived on the basis of O+Cl = 18 and sum of positive charges of cations equal to 26 is  $\text{K}_{0.53}\text{Pb}_{1.33}\text{Cu}_{5.87}\text{Zn}_{1.38}\text{Se}_{1.99}\text{O}_{7.67}\text{Cl}_{10.33}$ . The crystal structure was solved by direct methods and refined to an agreement index  $R1 = 0.034$  on the basis of 1522 independent reflections with  $I \geq 2\sigma$ . It is based upon metal oxide selenite chloride layers parallel to (010) and linked through K-Cl and Pb-Cl bonds to the K and Pb atoms located in the interlayer. The mineral name honors Charles T. Prewitt (b. 1933) in recognition of his important contributions to crystal chemistry of minerals and planetary materials.

**Keywords:** Prewittite, new mineral, crystal structure, copper selenite chloride, fumaroles, Tolbachik volcano, Kamchatka peninsula, Russia