

Nabokoite

$\text{Cu}_7(\text{Te}^{4+}\text{O}_4)(\text{SO}_4)_5 \cdot \text{KCl}$

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Crystal Data: Tetragonal. *Point Group:* $4/m\ 2/m\ 2/m$. Crystals are thin tabular on {001}, to 1 mm, showing {001}, {110}, {102}, {014}, in banded intergrowth with atlasovite.

Physical Properties: *Cleavage:* Perfect on {001}. *Hardness* = 2–2.5 *D*(meas.) = 4.18(5) *D*(calc.) = 3.974

Optical Properties: Transparent. *Color:* Pale yellow-brown, yellow-brown. *Streak:* Yellow-brown. *Luster:* Vitreous.

Optical Class: Uniaxial (-). $\omega = 1.778(3)$ $\epsilon = 1.773(3)$

Cell Data: *Space Group:* $P4/ncc$. $a = 9.833(1)$ $c = 20.591(2)$ $Z = 4$

X-ray Powder Pattern: Tolbachik volcano, Russia.
10.35 (10), 2.439 (7), 3.421 (6), 2.881 (5), 4.57 (4), 3.56 (4), 1.972 (4)

Chemistry:	(1)	(2)
SO_3	33.66	33.60
TeO_2	13.78	13.40
V_2O_3	0.07	
Bi_2O_3	0.49	
Fe_2O_3	0.09	
CuO	45.25	46.74
ZnO	1.26	
PbO	0.28	
K_2O	3.94	3.95
Cs_2O	0.11	
Cl	2.92	2.98
$-\text{O} = \text{Cl}_2$	0.66	0.67
Total	101.19	100.00

(1) Tolbachik volcano, Russia; by electron microprobe, corresponds to $(\text{Cu}_{6.74}\text{Zn}_{0.18})_{\Sigma=6.92}(\text{Te}_{1.02}\text{Bi}_{0.02}\text{Pb}_{0.01}\text{Fe}_{0.01}\text{V}_{0.01})_{\Sigma=1.07}\text{O}_{4.10}(\text{SO}_4)_{4.98}\text{Cl}_{0.98}$. (2) $\text{KCu}_7(\text{TeO}_4)(\text{SO}_4)_5\text{Cl}$.

Polymorphism & Series: Forms a series with atlasovite.

Occurrence: A rare sublimate formed in a volcanic fumarole.

Association: Atlasovite, chalcocyanite, dolerophanite, chloroxiphite, euchlorine, piypite, atacamite, alarsite, fedotovite, lammerite, klyuchevskite, anglesite, langbeinite, hematite, tenorite.

Distribution: From the Tolbachik fissure volcano, Kamchatka Peninsula, Russia.

Name: Honoring Sof'ya Ivanovna Naboko (1909–), Institute of Volcanology, Petropavlovsk-Kamchatskii, Russia, Russian volcanologist who first collected the mineral.

Type Material: A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 87577.

References: (1) Popova, V.I., V.A. Popov, N.S. Rudashevskiy, S.F. Glavatskikh, V.O. Polyakov, and A.F. Bushmakin (1987) Nabokoite $\text{Cu}_7\text{TeO}_4(\text{SO}_4)_5 \cdot \text{KCl}$ and atlasovite $\text{Cu}_6\text{Fe}^{3+}\text{Bi}^{3+}\text{O}_4(\text{SO}_4)_5 \cdot \text{KCl}$ – new minerals of volcanic exhalations. *Zap. Vses. Mineral. Obshch.*, 116, 358–367 (in Russian with English abs.). (2) (1988) *Amer. Mineral.*, 73, 929 (abs. ref. 1). (3) Pertlik, F. and J. Zemmann (1988) The crystal structure of nabokoite, $\text{Cu}_7\text{TeO}_4(\text{SO}_4)_5 \cdot \text{KCl}$: the first example of a $\text{Te}(\text{IV})\text{O}_4$ pyramid with exactly tetragonal symmetry. *Mineral. Petrol.*, 38, 291–298.

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