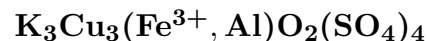


Klyuchevskite



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Crystal Data: Monoclinic. *Point Group:* 2. Crystals are acicular, elongated along [010], to 0.5 mm; in random aggregates.

Physical Properties: *Cleavage:* On {h0l}, perfect. Hardness = n.d. VHN = 167 (3 g load). D(meas.) = 3.00–3.15 D(calc.) = 2.98 Soluble in H₂O.

Optical Properties: Transparent. *Color:* Dark green to olive-green. *Streak:* Pale green. *Luster:* Submetallic.

Optical Class: Biaxial (+). *Pleochroism:* Strong; X = olive-green; Y = green; Z = dark olive-green. *Orientation:* Y = b. $\alpha = 1.549(1)$ $\beta = 1.550(1)$ $\gamma = 1.680(1)$ 2V(meas.) = n.d. 2V(calc.) = 11°

Cell Data: *Space Group:* I2. $a = 18.667(7)$ $b = 4.94(2)$ $c = 18.405(7)$ $\beta = 101.5(2)^\circ$ Z = 4

X-ray Powder Pattern: Tolbachik volcano, Russia; similar to alumoklyuchevskite. 9.03 (100), 9.17 (95), 3.762 (55), 7.20 (35), 3.409 (28), 4.502 (25), 3.678 (23)

Chemistry:	(1)	(2)
SO ₃	40.98	41.06
Al ₂ O ₃	1.38	
Fe ₂ O ₃	7.86	10.24
CuO	31.15	30.59
ZnO	0.04	
PbO	0.71	
Na ₂ O	0.00	
K ₂ O	18.17	18.11
Cl	0.13	
–O = Cl ₂	0.03	
Total	100.39	100.00

(1) Tolbachik volcano, Russia; by electron microprobe, average of 25 grains; corresponds to $\text{K}_{3.00}(\text{Cu}_{3.05}\text{Pb}_{0.02})_{\Sigma=3.07}(\text{Fe}_{0.77}\text{Al}_{0.21})_{\Sigma=0.98}\text{O}_2(\text{S}_{1.00}\text{O}_4)_{4.00}$. (2) $\text{K}_3\text{Cu}_3\text{FeO}_2(\text{SO}_4)_4$.

Occurrence: In cavities in volcanic fumaroles.

Association: Alarsite, fedotovite, lammerite, nabokoite, atlasovite, langbeinite, ponomarevite, tolbachite, kamchatkite, hematite, tenorite.

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

Name: For the locality, as one of the Klyuchevskaya group of volcanoes.

Type Material: Mining Institute, St. Petersburg, Russia, 979/1.

References: (1) Vergasova, L.P., S.K. Filatov, M.G. Goskaya, V.V. Ananov, and A.S. Sharov (1989) Klyuchevskite $\text{K}_3\text{Cu}_3\text{Fe}^{3+}\text{O}_2(\text{SO}_4)_4$ – a new mineral from volcanic sublimates. Zap. Vses. Mineral. Obshch., 118, 65–69 (in Russian). (2) (1990) Amer. Mineral., 75, 1210–1211 (abs. ref. 1). (3) Gorskaya, M.G., S.K. Filatov, I.V. Rozhdestvenskaya, and L.P. Vergasova (1992) The crystal structure of klyuchevskite, $\text{K}_3\text{Cu}_3(\text{Fe}, \text{Al})\text{O}_2(\text{SO}_4)_4$, new mineral from volcanic sublimates. Mineral. Mag., 56, 411–416.