

**Crystal Data:** Triclinic. *Point Group:* 1. As poorly formed prismatic to blocky crystals or irregular grains to 0.3 mm and in open-work aggregates to 1.2 mm.

**Physical Properties:** *Cleavage:* None. *Fracture:* Uneven. *Tenacity:* Brittle. *Hardness* = 3 D(meas.) = n.d. D(calc.) = 3.411 Water soluble and hygroscopic. Visually not distinguishable from cesiodymite.

**Optical Properties:** Transparent to translucent. *Color:* Light green to green, occasionally with a yellowish hue. *Streak:* Pale green. *Luster:* Vitreous.

*Optical Class:* Biaxial (-).  $\alpha = 1.610(3)$   $\beta = 1.632(4)$   $\gamma = 1.643(4)$   $2V(\text{meas.}) = 65(5)^\circ$   $2V(\text{calc.}) = 70^\circ$  *Pleochroism:* Distinct, *Z* = bright green, *Y* = green with a weak yellowish hue, *X* = pale green to almost colorless. *Absorption:*  $Z > Y > X$ .

**Cell Data:** Space Group: *P1*.  $a = 10.0045(3)$   $b = 12.6663(4)$   $c = 14.4397(5)$   $\alpha = 102.194(3)^\circ$   $\beta = 101.372(3)^\circ$   $\gamma = 90.008(3)^\circ$   $Z = 4$

**X-ray Powder Pattern:** Yadovitaya fumarole, Tolbachik volcano, Kamchatka Peninsula, Russia. 6.95 (100), 3.93 (65), 6.22 (45), 3.19 (35), 13.9 (30), 3.76 (30), 3.39 (30)

<b>Chemistry:</b>	(1)
Na <sub>2</sub> O	0.30
K <sub>2</sub> O	9.55
Rb <sub>2</sub> O	0.89
Cs <sub>2</sub> O	0.90
MgO	0.83
CuO	33.95
ZnO	9.14
<u>SO<sub>3</sub></u>	<u>44.06</u>
Total	99.62

(1) Yadovitaya fumarole, Second scoria cone, Tolbachik volcano, Kamchatka Peninsula, Russia; average of 4 electron microprobe analyses supplemented by Raman spectroscopy; corresponds to (K<sub>1.83</sub>Na<sub>0.09</sub>Rb<sub>0.09</sub>Cs<sub>0.06</sub>) $\Sigma=2.07$ (Cu<sub>3.86</sub>Zn<sub>1.02</sub>Mg<sub>0.19</sub>) $\Sigma=5.07$ S<sub>4.97</sub>O<sub>21</sub>.

**Polymorphism & Series:** Forms a solid-solution series with cesiodymite.

**Occurrence:** As sublimates on basaltic scoria near a volcanic fumarole (>350-400 °C.).

**Association:** Cesiodymite, euchlorine, chalcocyanite, dolerophanite, alumoklyuchevskite, anglesite, fedotovite, wulfite, langbeinite, apthitalite, piypite, klyuchevskite, eleomelanite, anhydrite, dravertite, krashennikovite, calciolangbeinite, steklite, hematite, tenorite, pseudobrookite, As-bearing orthoclase, sylvite, halite, lammerite, lammerite- $\beta$ , urusovite, gold (Arsenatnaya fumarole); euchlorine, alumoklyuchevskite, langbeinite, steklite, fedotovite, hematite, lyonsite (Yadovitaya fumarole).

**Distribution:** From the Yadovitaya and Arsenatnaya fumaroles, Second scoria cone, Tolbachik volcano, Kamchatka Peninsula, Russia.

**Name:** From the Greek κρυπτός, which means “concealed”, and χαλκός, which means “copper” in allusion to the natural association concealed among other green copper oxysulfate minerals.

**Type Material:** A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (95002).

**References:** (1) Pekov, I.V., N.V. Zubkova, A.A. Agakhanov, D.Y. Pushcharovsky, V.O. Yapaskurt, D.I. Belakovskiy, M.F. Vigasina, E.G. Sidorov, and S.N. Britvin (2018) Cryptochalcite, K<sub>2</sub>Cu<sub>5</sub>O(SO<sub>4</sub>)<sub>5</sub>, and cesiodymite, CsKCu<sub>5</sub>O(SO<sub>4</sub>)<sub>5</sub>, two new isotypic minerals and the K-Cs isomorphism in this solid-solution series. *Eur. J. Mineral.*, 30(3), 593-607. (2) (2019) *Amer. Mineral.*, 104(12), 1866-1867 (abs. ref. 1).