Chrysothallite $K_6Cu_6Tl^{3+}Cl_{17}(OH)_4 \cdot H_2O$

Crystal Data: Tetragonal. *Point Group*: 4/*m* 2/*m* 2/*m*. As equant to thick tabular crystals, to 0.05 mm, displaying {001}, {100}, {110}, {101} and {102}. Also in aggregates to 0.2 mm or in crusts to 1 mm thick.

Physical Properties: *Cleavage*: None. *Fracture*: Uneven. *Tenacity*: Brittle.
Hardness = ~ 3 D(meas.) = 2.95(2) D(calc.) = 2.97

Optical Properties: Transparent. *Color*: Bright golden-yellow to light yellow; yellow in transmitted light. *Streak*: Yellow. *Luster*: Vitreous.
Optical Class: Uniaxial (+). $\omega = 1.720(5)$ $\varepsilon = 1.732(5)$ *Pleochroism*: Weak, in yellow tones.
Absorption: *O* > *E*.

Cell Data: *Space Group*: *I*4/*mmm*. $a = 11.3689(7)$ $c = 26.207(2)$ Z = 4

X-ray Powder Pattern: Second scoria cone, Tolbachik volcano, Kamchatka, Russia.
6.88 (100), 3.075 (47), 13.20 (44), 2.771 (38), 5.16 (30), 3.153 (30), 3.471 (28)

Chemistry:	(1)	(2)
K	15.92	15.88
Cu	24.56	25.82
Zn	1.38	
Tl	13.28	13.84
Cl	40.32	50.88
H_2O	[3.49]	3.66
Total	98.95	100.00

(1) Second scoria cone, Tolbachik volcano, Kamchatka, Russia; average of 4 electron microprobe analyses supplemented by Raman spectroscopy, H_2O from structure analysis; corresponding to $K_{6.09}(Cu_{5.78}Zn_{0.32})_{\Sigma=6.10}Tl_{0.97}Cl_{17}[(OH)_{3.80}O_{0.20}] \cdot H_2O$. (2) $K_6Cu_6Tl^{3+}Cl_{17}(OH)_4 \cdot H_2O$.

Occurrence: Formed by the interactions among high-temperature sublimate minerals, fumarolic gas and atmospheric water vapor at temperatures not higher than 150 °C.

Association: Belloite, avdoninite, chlorothionite, sanguite, eriochalcite, mitscherlichite, sylvite, carnallite, kainite (Glavnaya Tenoritovaya fumarole); belloite, avdoninite, chlorothionite, eriochalcite, atacamite, halite, kröhnkite, natrochalcite, gypsum, antlerite (Pyatno fumarole).

Distribution: From the Glavnaya Tenoritovaya and Pyatno fumaroles, Second scoria cone, Northern Breakthrough of the Great Tolbachik Fissure Eruption, Tolbachik volcano, Kamchatka, Russia.

Name: For its bright golden-yellow color (from the Greek χρυσός for *gold*) and the presence of *thall*ium as a species-defining constituent.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (94129).

References: (1) Pekov, I.V., N.V. Zubkova, D.I. Belakovskiy, V.O. Yapaskurt, M.F. Vigasina, I.S. Lykova, E.G. Sidorov, and D.Yu. Pushcharovsky (2015) Chrysothallite $K_6Cu_6Tl^{3+}Cl_{17}(OH)_4 \cdot H_2O$, a new mineral species from the Tolbachik volcano, Kamchatka, Russia. Mineral. Mag., 79(2), 365-376. (2) (2016) Amer. Mineral., 101, 1490-1491 (abs. ref. 1).