

**Chrysothallite**

**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:* I4/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 <sub>2</sub> O | [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<sub>2</sub>O from structure analysis; corresponding to  $\text{K}_{6.09}(\text{Cu}_{5.78}\text{Zn}_{0.32})_{\Sigma=6.10}\text{Tl}_{0.97}\text{Cl}_{17}(\text{OH})_{3.80}\text{O}_{0.20}\cdot\text{H}_2\text{O}$ . (2)  $\text{K}_6\text{Cu}_6\text{Tl}^{3+}\text{Cl}_{17}(\text{OH})_4\cdot\text{H}_2\text{O}$ .

**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 *thallium* 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. Viganina, I.S. Lykova, E.G. Sidorov, and D.Yu. Pushcharovskiy (2015) Chrysothallite  $\text{K}_6\text{Cu}_6\text{Tl}^{3+}\text{Cl}_{17}(\text{OH})_4\cdot\text{H}_2\text{O}$ , 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).