Cesiodymite $CsKCu_5O(SO_4)_5$

Crystal Data: Triclinic. *Point Group*: 1. As crude prismatic to thick tabular crystals or irregular grains to 0.3 mm and in open-work aggregates to 0.5 mm.

Physical Properties: *Cleavage*: None. *Fracture*: Uneven. *Tenacity*: Brittle. Hardness = ~3
D(meas.) = n.d. D(calc.) = 3.593 Water soluble and hydroscopic.
Visually not distinguishable from cryptochalcite.

Optical Properties: Transparent to translucent. *Color*: Light green to green, occasionally with a yellowish hue. *Streak*: Pale green. *Luster*: Vitreous.
Optical Class: Biaxial (-). α = 1.61(1) β = 1.627(4) γ = 1.635(4) 2V(meas.) = 70(10)°
2V(calc.) = 68° *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: *P*1. *a* = 10.0682(4) *b* = 12.7860(7) *c* = 14.5486(8) α = 102.038(5)° β = 100.847(4)° γ = 89.956(4)° Z = 4

X-ray Powder Pattern: Arsenatnaya fumarole, Tolbachik volcano, Kamchatka Peninsula, Russia.
3.946 (100), 6.95 (54), 3.188 (50), 3.404 (39), 3.765 (37), 2.681 (31), 3.104 (28)

Chemistry:

	(1)
Na_2O	-
K_2O	5.47
Rb_2O	1.55
Cs_2O	10.48
MgO	-
CuO	29.91
ZnO	11.05
SO_3	40.74
Total	99.20

(1) Arsenatnaya fumarole, Second scoria cone, Tolbachik volcano, Kamchatka Peninsula, Russia; average of 5 electron microprobe analyses supplemented by Raman spectroscopy; corresponds to $(K_{1.14}Cs_{0.73}Rb_{0.16})_{\Sigma=2.03}(Cu_{3.69}Zn_{1.33})_{\Sigma=5.02}S_{4.99}O_{21}$.

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

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

Association: Cryptochalcite, euchlorine, chalcocyanite, dolerophanite, alumoklyuchevskite, anglesite, fedotovite, wulffite, langbeinite, aphthitalite, piypite, klyuchevskite, eleomelanite, anhydrite, dravertite, krasheninnikovite, calciolangbeinite, steklite, hematite, tenorite, pseudobrookite, As-bearing orthoclase, sylvite, halite, lammerite, lammerite-β, urusovite, gold (Arsenatnaya fumarole).

Distribution: From the Arsenatnaya fumarole, Second scoria cone, Tolbachik volcano, Kamchatka Peninsula, Russia.

Name: *Cesi* for the essential cesium content and the Greek δίδυμοζ, which means “a twin brother” in recognition that the mineral is the Cs-K-ordered analogue of cryptochalcite.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (95349).

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, $K_2Cu_5O(SO_4)_5$, and cesiodymite, $CsKCu_5O(SO_4)_5$, 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).