Tsumebite $Pb_2Cu(PO_4)(SO_4)(OH)$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Typically well crystallized, platy, with large {110}, {101}, narrow {100}, many minor forms, to 3 mm. *Twinning:* Always twinned on $\{\bar{1}22\}$, may be multiple, with serrated re-entrants oscillatory between {011} and $\{\bar{1}04\}$.

Physical Properties: *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 3.5
D(meas.) = 6.01–6.13 D(calc.) = 6.22

Optical Properties: Transparent. *Color:* Emerald-green, bluish green; green in transmitted light. *Luster:* Vitreous, brilliant.
Optical Class: Biaxial (+). *Pleochroism:* Faint; $X = Y$ = very pale blue to colorless; Z = robin's-egg-blue. *Dispersion:* $r < v$, strong. *Absorption:* $Z > X$. $\alpha = 1.885$–1.900 $\beta = 1.920$ $\gamma = 1.943$–1.956 2V(meas.) = ∼90°

Cell Data: *Space Group:* $P2_1/m$. a = 8.70 b = 5.80 c = 7.85 $\alpha = 111.5°$ Z = 2

X-ray Powder Pattern: Otavi mine, Southwest Africa [=Tsumeb, Namibia]; close to arsentsumebite. (ICDD 29-568).
3.24 (100), 2.897 (65), 2.936 (35), 2.718 (35), 2.267 (35), 4.70 (30), 2.619 (25)

Chemistry:

	(1)	(2)
SO_3	n.d.	11.67
P_2O_5	10.26	10.35
CuO	11.97	11.60
PbO	65.09	65.07
H_2O	n.d.	1.31
Total		100.00

(1) Tsumeb, Namibia. (2) $Pb_2Cu(PO_4)(SO_4)(OH)$.

Mineral Group: Brackebuschite group.

Occurrence: A rare secondary mineral in the oxidized zone of some arsenic-bearing Pb–Cu deposits.

Association: Azurite, smithsonite, malachite, cerussite, mimetite, wulfenite, olivenite.

Distribution: From Tsumeb, Namibia. At Kipushi, 28 km southwest of Lubumbashi, Katanga Province, Congo (Shaba Province, Zaire). In the USA, in Arizona, at Morenci, Greenlee Co.; from the Mammoth-St. Anthony mine, Tiger, Pinal Co.; from the Mex-Tex mine, near Bingham, Hansonburg district, Socorro Co., New Mexico; on the Blue Bell claims, near Baker, San Bernardino Co., California; in the Black Pine mine, near Philipsburg, Granite Co., Montana. From Roughton Gill, Carrock Fell, Cumbria, England. At Altenmittlau, Hesse, and in the Clara mine, near Oberwolfach, Black Forest, Germany. From Broken Hill, New South Wales, Australia.

Name: For its first-noted occurrence at Tsumeb, Namibia.

Type Material: Destroyed by bombing.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 918–919. (2) Bideaux, R.A., M.C. Nichols, and S.A. Williams (1966) The arsenate analog of tsumebite, a new mineral. Mineral. Soc. Amer. Annual Meeting. Amer. Mineral., 51, 258–259 (abs.). (3) Nichols, M.C. (1966) The structure of tsumebite. Mineral. Soc. Amer. Annual Meeting. Amer. Mineral., 51, 267 (abs.). (4) Fanfani, L. and P.F. Zanazzi (1967) Structural similarities of some secondary lead minerals. Mineral. Mag., 36, 522–529. (5) Schlüter, J., G. Gebhard, and G. Wappler (1994) Tsumebit oder Arsentsumebit aus Tsumeb? Lapis, 19(10), 31–34, 86 (in German).