

# Helmutwinklerite

# PbZn<sub>2</sub>(AsO<sub>4</sub>)<sub>2</sub>•2H<sub>2</sub>O

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**Crystal Data:** Triclinic, pseudomonoclinic. *Point Group:*  $\bar{1}$ . As crystals, tabular on {001}, to 5 mm, modified by {100}, {010}, {011}, {101}, {111}, {112}.

**Physical Properties:** *Fracture:* Conchoidal. Hardness = 4.5 D(meas.) = 5.3(1)  
D(calc.) = 5.21–5.29

**Optical Properties:** Translucent to transparent. *Color:* Colorless, light blue, sea-green.

*Streak:* White. *Luster:* Vitreous, resinous on fracture surfaces.

*Optical Class:* Biaxial (–). *Orientation:* X (11°, -145°); Y (82°, -35°); Z (82°, 56°) [with a (90°, 90°) and b (90°, 0°) using ( $\phi, \rho$ )]. *Dispersion:*  $r < v$ , distinct.  $\alpha = 1.83(2)$   $\beta = [1.87]$   $\gamma = 1.89(2)$   
2V(meas.) = 70(5)° 2V(calc.) = 73°

**Cell Data:** *Space Group:*  $P\bar{1}$ .  $a = 5.606(2)$   $b = 5.610(2)$   $c = 7.617(1)$   $\alpha = 70.19(2)^\circ$   
 $\beta = 69.91(2)^\circ$   $\gamma = 69.18(2)^\circ$   $Z = 1$

**X-ray Powder Pattern:** Tsumeb, Namibia.

2.579 (100), 4.697 (80), 3.075 (75), 3.269 (70), 2.768 (50), 1.735 (50), 6.953 (40)

## Chemistry:

|                                | (1)    | (2)      | (3)    |
|--------------------------------|--------|----------|--------|
| As <sub>2</sub> O <sub>5</sub> | 34.35  | 36.42    | 35.26  |
| CuO                            | 1.48   | 1.62     |        |
| ZnO                            | 27.50  | 23.54    | 24.97  |
| PbO                            | 31.28  | 34.20    | 34.24  |
| H <sub>2</sub> O               | 6.14   | [5.53]   | 5.53   |
| Total                          | 100.75 | [101.31] | 100.00 |

(1) Tsumeb, Namibia; by electron microprobe, average of 10 analyses on two crystals, H<sub>2</sub>O by the Karl Fischer method; corresponding to Pb<sub>0.90</sub>(Zn<sub>2.17</sub>Cu<sub>0.12</sub>)<sub>Σ=2.29</sub>(As<sub>0.96</sub>O<sub>4</sub>)<sub>2</sub>•2.19H<sub>2</sub>O. (2) Do.; by electron microprobe, average of 39 analyses, H<sub>2</sub>O calculated from theory; corresponds to Pb<sub>0.98</sub>(Zn<sub>1.85</sub>Cu<sub>0.13</sub>)<sub>Σ=1.98</sub>(AsO<sub>4</sub>)<sub>2.03</sub>•2.00H<sub>2</sub>O. (3) PbZn<sub>2</sub>(AsO<sub>4</sub>)<sub>2</sub>•2H<sub>2</sub>O.

**Mineral Group:** Tsumcorite group.

**Occurrence:** A very rare secondary mineral in corroded tennantite ore from a dolostone-hosted hydrothermal polymetallic ore deposit.

**Association:** Tennantite, willemite, quartz.

**Distribution:** Found at Tsumeb, Namibia.

**Name:** Honors Professor Helmut G.F. Winkler (1915–1980), University of Göttingen, Göttingen, Germany, for his contributions to petrology, mineralogy, and crystallography.

**Type Material:** Göttingen University, Göttingen, Germany.

**References:** (1) Schnorrer-Köhler, G. (1980) Koritnigit and Helmutwinklerit – zwei neue Minerale von Tsumeb (SW-Afrika). Aufschluss, 31, 43–49 (in German). (2) (1980) Amer. Mineral., 65, 1067 (abs. ref. 1). (3) Süsse, P. and G. Schnorrer (1980) Helmutwinklerite, a new arsenate mineral from Tsumeb, S.W. Africa. Neues Jahrb. Mineral., Monatsh., 118–124. (4) Schmetzer, K., B. Nuber, and O. Medenbach (1985) Thometzekite, a new mineral from Tsumeb, Namibia, and symmetry relations in the tsumcorite-helmutwinklerite family. Neues Jahrb. Mineral., Monatsh., 446–452. (5) Krause, W., K. Belendorff, H.-J. Bernhardt, C. McCammon, H. Effenberger, and W. Mikenda (1998) Crystal chemistry of the tsumcorite-group minerals. New data on ferriotharmeyerite, tsumcorite, thometzekite, mounanaite, helmutwinklerite, and a redefinition of gartrellite. Eur. J. Mineral., 10, 179–206.

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