

Whelanite**Cu₂Ca₆[Si₆O₁₇(OH)](CO₃)(OH)₃(H₂O)₂**

Crystal Data: Orthorhombic. *Point Group:* *mm2*. As irregular clusters and radial aggregates of terminated, platy to lath-like crystals to 1 mm, flattened on {001} and elongated along [100].

Physical Properties: *Cleavage:* Perfect on {001}; good on {010}. *Tenacity:* Flexible, nonelastic. *Fracture:* Splintery. *Hardness* = ~ 2.5 *D(meas.)* = 2.74(3) *D(calc.)* = 2.738

Optical Properties: Translucent. *Color:* Pale blue. *Streak:* Pale blue. *Luster:* Vitreous. *Optical Class:* Biaxial (-). $\alpha = 1.612(2)$ $\beta(\text{calc}) = 1.622$ $\gamma = 1.626(2)$ $2V(\text{meas.}) = 64(1)^\circ$ *Pleochroism:* Weak: $X = Y =$ pale blue, $Z =$ light blue. *Absorption:* $X = Y < Z$. *Orientation:* $X = a$, $Y = c$, $Z = b$.

Cell Data: *Space Group:* *Pn2n*. $a = 5.6551(4)$ $b = 3.683(3)$ $c = 27.1372(7)$ $Z = 1$

X-ray Powder Pattern: Bawana mine, Rocky mining district, Beaver County, Utah, USA. 3.013 (100), 6.79 (52), 2.802 (45), 2.522 (44), 3.072 (43), 2.921 (39), 1.839 (37)

Chemistry:	(1)	(2)
CaO	34.46	34.61
CuO	12.09	16.36
FeO	1.52	
SiO ₂	37.96	37.08
CO ₂	5.93	4.53
H ₂ O	8.86	7.41
Total	100.82	100.00

(1) Bawana mine, Rocky mining district, Beaver County, Utah, USA; electron microprobe analysis supplemented by TGA and Raman spectroscopy; corresponds to Cu_{1.41}Fe_{0.20}Ca_{5.68}Si_{5.84}C_{1.25}O₂₆H_{9.09}.
 (2) Cu₂Ca₆[Si₆O₁₇(OH)](CO₃)(OH)₃(H₂O)₂.

Occurrence: In a copper-rich, diopside-garnet-magnetite contact metamorphic rock (skarn).

Association: Thauasite, stringhamite, kionoite, diopside, garnet (grossular-andradite), goethite, magnetite, tenorite, chrysocolla (Bawana mine); gilalite, ruizite, stringhamite, tobermorite, andradite, bornite, calcite, chalcoppyrite, quartz, wollastonite (Christmans mine); apophyllite, lepidocrocite, stringhamite, thauasite, bornite, calcite, diopside, grossular, tenorite (Sunrise prospect); wayneburnhamite, vesuvianite, wollastonite, grossular, cerussite, nasonite (Crestmore).

Distribution: From the Bawana mine, Rocky mining district, 5 miles NW of Milford, Beaver County, Utah, USA. Also from the Christmas mine, Pinal County, Arizona; the Sunrise copper prospect near Bird Springs in the Nelson Range, Inyo County, California; and the Commercial quarry, Crestmore, Sky Blue Hill, Riverside County, California, USA.

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Type Material: National Museum of Natural History, Washington, D.C., USA; Natural History Museum of Los Angeles County, Los Angeles, California, USA (15507-15516).

References: (1) Kampf, A.R., S.J. Mills, S. Merlino, M. Pasero, A.M. McDonald, W.B. Wray, and J.R. Hindman (2012) Whelanite, Cu₂Ca₆[Si₆O₁₇(OH)](CO₃)(OH)₃(H₂O)₂, an (old) new mineral from the Bawana mine, Milford, Utah. *Amer. Mineral.*, 97, 2007-2015.