Whelanite $Cu_2Ca_6[Si_6O_{17}(OH)](CO_3)(OH)_3(H_2O)_2$

Crystal Data: Orthorhombic. *Point Group*: *mm*2. 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 (–). α = 1.612(2) β(calc) = 1.622 γ = 1.626(2) 2V(meas.) = 64(1)° *Pleochroism*: Weak: *X* = *Y* = pale blue, *Z* = light blue. *Absorption*: *X* = *Y* < Z. *Orientation*: *X* = *a*, *Y* = *c*, *Z* = *b*.

Cell Data: *Space Group: Pn*2*n*. *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_2O	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 $Cu_{1.41}Fe_{0.20}Ca_{5.68}Si_{5.84}C_{1.25}O_{26}H_{9.09}$. (2) $Cu_2Ca_6[Si_6O_{17}(OH)](CO_3)(OH)_3(H_2O)_2$.

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

Association: Thaumasite, stringhamite, kinoite, diopside, garnet (grossular-andradite), goethite, magnetite, tenorite, chrysocolla (Bawana mine); gilalite, ruizite, stringhamite, tobermorite, andradite, bornite, calcite, chalcopyrite, quartz, wollastonite (Christmans mine); apophyllite, lepidocrocite, stringhamite, thaumasite, 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.

Name: Honors James A. Whelan (1928- 2003), professor of mineralogy (1958 to 1992), University of Utah, Salt Lake City, Utah, USA.

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, $Cu_2Ca_6[Si_6O_{17}(OH)](CO_3)(OH)_3(H_2O)_2$, an (old) new mineral from the Bawana mine, Milford, Utah. Amer. Mineral., 97, 2007-2015.