Centennialite $CaCu_3(OH)_6Cl_2 \cdot nH_2O$, $n \approx 0.7$

Crystal Data: Hexagonal. *Point Group*: $\bar{3}\,2/m$. As encrustations, often as botryoidal chalky aggregates.

Physical Properties: *Cleavage*: n.d. *Tenacity*: n.d. *Fracture*: n.d. Hardness = n.d. D(meas.) = n.d. D(calc.) = 3.100

Optical Properties: Translucent. *Color*: Pale to azure blue. *Streak*: n.d. *Luster*: n.d. *Optical Class*: n.d. Microscopic optical properties could not be determined.

Cell Data: *Space Group*: $P\bar{3}\,m1$. a = 6.6606(9) c = 5.8004(8) Z = 1

X-ray Powder Pattern: Centennial mine, Calumet, Houghton County, Michigan, USA. 5.799 (100), 2.583 (75), 2.886 (51), 2.045 (32), 1.665 (20), 1.605 (17), 1.600 (15)

Chemistry:

	(1)	(2)
Ca	10.1	9.6
Cu	44.3	45.8
Cl	16.9	17.0
O	24.2	25.8
H	1.91	1.8
Total	97.41	100.0

(1) Centennial mine, Calumet, Houghton County, Michigan, USA; average of combustion, ion chromatography, inductively coupled plasma mass spectrometry and inductively coupled plasma atomic emission spectroscopy analyses, normalized to 2 Cl, with OH and H_2O partitioned for H content and charge balance; corresponds to $Ca_{1.05}Cu_{2.92}(OH)_{5.94}Cl_2 \cdot H_{1.98}O$.
(2) $CaCu_3(OH)_6Cl_2 \cdot nH_2O$, $n \approx 0.7$.

Occurrence: A secondary low-temperature mineral formed by the reaction of acidic water with other copper mineralization and essentially physically indivisible from other copper-containing secondary minerals.

Association: Calumetite, atacamite family minerals (paratacamite, clinoatacamite).

Distribution: Likely widespread. Analytically confirmed from the Lake Superior native copper district, Michigan, USA, specifically the Ahmeek, Quincy, White Pine, Mohawk, and Franklin Jr. mines.

Name: For the *Centennial* mine, Calumet, Houghton County, Michigan, USA.

Type Material: Mineralogical Museum, University of Arizona, Tucson, USA (8789) and the Mineralogy Museum, School of Mines, Paris, France (14073 and 19588).

References: (1) Crichton, W.A. and H. Müller (2017) Centennialite, $CaCu_3(OH)_6Cl_2 \cdot nH_2O$, $n \approx 0.7$, a new kapellasite-like species, and a reassessment of calumetite. Mineral. Mag., 81(5), 1105-1124. (2) (2018) Amer. Mineral., 103, 2038 (abs. ref. 1).