Centennialite  

\[ \text{CaCu}_3(\text{OH})_6\text{Cl}_2\cdot n\text{H}_2\text{O}, n \approx 0.7 \]

**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.

**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:**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td>10.1</td>
<td>9.6</td>
</tr>
<tr>
<td>Cu</td>
<td>44.3</td>
<td>45.8</td>
</tr>
<tr>
<td>Cl</td>
<td>16.9</td>
<td>17.0</td>
</tr>
<tr>
<td>O</td>
<td>24.2</td>
<td>25.8</td>
</tr>
<tr>
<td>H</td>
<td>1.91</td>
<td>1.8</td>
</tr>
<tr>
<td>Total</td>
<td>97.41</td>
<td>100.0</td>
</tr>
</tbody>
</table>

(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\(_2\)O partitioned for H content and charge balance; corresponds to Ca\(_{1.05}\)Cu\(_{2.92}\)(OH)\(_{5.94}\)Cl\(_2\)·H\(_{1.96}\)O.

(2) \( \text{CaCu}_3(\text{OH})_6\text{Cl}_2\cdot n\text{H}_2\text{O}, n \approx 0.7 \).

**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, \( \text{CaCu}_3(\text{OH})_6\text{Cl}_2\cdot n\text{H}_2\text{O}, n \approx 0.7 \), a new kapellasite-like species, and a reassessment of calumetite. Mineral. Mag., 81(5), 1105-1124.  