Calcioandyrobertsite  

\[ \text{KCaCu(AsO}_4\text{)}_4\text{[As(OH)]}_2\text{O}_2\cdot 2\text{H}_2\text{O} \]

**Crystal Data:** Monoclinic. *Point Group:* 2/m. Crystals have \{100\} dominant, with \{210\}, \{102\}, \{001\}, and \{011\}. As a crystallographically continuous, lamellar intergrowth with andyrobertsite as plates, to 10 mm, that radiate from the center of an aggregate 1.4 cm long and 1 cm at the base.

**Physical Properties:** *Cleavage:* Good on \{100\}. *Fracture:* Conchoidal. *Tenacity:* Brittle.  
Hardness = 3  
\( D\text{(meas.)} \approx \text{n.d.} \  \ D\text{(calc.)} = 4.011 \)

**Optical Properties:**  
*Streak:* Pale blue.  
*Luster:* Electric blue; greenish blue in transmitted light.  
*Optical Class:* Biaxial (-).  
\[ \alpha = 1.713(3) \  \beta = 1.743(1) \  \gamma = 1.749(1) \  \text{2V(meas.)} = 50(5)^\circ \]  
\( \text{2V(calc.)} = 48^\circ \)  
*Orientation:* \( X^\| a = 12^\circ \) (in \( \beta \) obtuse), \( Y = b, Z = c \).  
Nonpleochroic.  
*Dispersion:* Moderate, \( r < v \), asymmetric.

**Cell Data:**  
*Space Group:* \( P2_1/m \).  
\( a = 9.8102(9) \  \ b = 10.0424(6) \  \ c = 9.9788(7) \  \beta = 101.686(7)^\circ \)  
\( Z = 2 \)

**X-ray Powder Pattern:** Tsumeb mine, Namibia.  
9.64 (100), 3.145 (50), 4.46 (40), 3.048 (40), 2.698 (40), 7.00 (30), 4.81 (30)

**Chemistry**

<table>
<thead>
<tr>
<th>Material</th>
<th>(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K\text{2O}</td>
<td>4.05</td>
</tr>
<tr>
<td>CaO</td>
<td>3.52</td>
</tr>
<tr>
<td>MnO</td>
<td>0.86</td>
</tr>
<tr>
<td>CdO</td>
<td>1.26</td>
</tr>
<tr>
<td>ZnO</td>
<td>0.04</td>
</tr>
<tr>
<td>CuO</td>
<td>32.86</td>
</tr>
<tr>
<td>As\text{2O}_3</td>
<td>49.56</td>
</tr>
<tr>
<td>H\text{2O}</td>
<td>[4.61]</td>
</tr>
<tr>
<td>Total</td>
<td>96.75</td>
</tr>
</tbody>
</table>

(1) Tsumeb mine, Namibia; electron microprobe analysis supplemented by IR spectroscopy, \( \text{H}_2\text{O} \) calculated from structure analysis; corresponds to  
\( \text{K}_{1.01}\text{(Ca}_{0.74}\text{Cd}_{0.12}\text{Mn}_{0.11})\text{Cu}_{1.06}\text{(Zn}_{0.01}\text{As}_{0.95}\text{O}_4)\text{[As(OH)]}_2\text{[H}_2\text{O}_2]}. \)

**Occurrence:** On a single specimen from a weathered polymetallic mineral deposit.

**Association:** Cuprian adamite, zincian olivenite, andyrobertsite, tennantite.

**Distribution:** From the Tsumeb mine, Namibia.

**Name:** The prefix, *calcio*, designates the calcium analog of *androbertsite*.

**Type Material:** Royal Ontario Museum, Toronto, Canada (M47022 and M47110) and the Natural Museum of Natural History, Washington, D.C., USA (171487).

(3) Cooper, M.A. and F.C. Hawthorne (2000) Highly undersaturated anions in the crystal structure of andyrobertsite – calcio-andyrobertsite, a doubly acid arsenate of the form  
\( \text{K(Cd}_{0.08}\text{Ca}_{0.92}\text{Cu}^{2+}\text{AsO}_4)\text{[As(OH)]}_2\text{[H}_2\text{O}_2]}. \)  