Kinoite

\[
\text{Ca}_2\text{Cu}_2\text{Si}_3\text{O}_8(\text{OH})_4
\]

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**Crystal Data:** Monoclinic. *Point Group:* 2/m. As well-formed crystals, to 1.5 mm, tabular on [100], somewhat elongated along [001]; also in veinlets, massive.

**Physical Properties:** *Cleavage:* Excellent on {100}; distinct on {100} and {001}. Hardness = 4–5  D(meas.) = 3.16(3)  D(calc.) = [3.20]

**Optical Properties:** Transparent to translucent. *Color:* Deep azurite-blue. *Optical Class:* Biaxial (−). *Pleochroism:* Strong; X = pale greenish blue; Y = blue; Z = deep blue. *Orientation:* X = b; Z ∧ c ≈ 0°. *Dispersion:* r < v, distinct. *Absorption:* Z > Y > X. \(\alpha = 1.638–1.640\)  \(\beta = 1.663–1.665\)  \(\gamma = 1.676–1.680\)  \(2V(\text{meas.}) = 68°\)  \(2V(\text{calc.}) = 64°–80°\)

**Cell Data:** *Space Group:* P2₁/m. \(a = 6.991(2)\)  \(b = 12.884(3)\)  \(c = 5.655(2)\)  \(\beta = 96°11'2''\)  \(Z = 2\)

**X-ray Powder Pattern:** Santa Rita Mountains, Arizona, USA. 4.72 (100), 3.052 (81), 6.44 (74), 2.116 (41), 3.138 (30), 2.315 (30), 3.951 (26)

**Chemistry:**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO₂</td>
<td>35.90</td>
<td>36.97</td>
</tr>
<tr>
<td>CuO</td>
<td>31.10</td>
<td>32.63</td>
</tr>
<tr>
<td>MgO</td>
<td>0.15</td>
<td></td>
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<tr>
<td>CaO</td>
<td>23.55</td>
<td>23.01</td>
</tr>
<tr>
<td>H₂O</td>
<td>8.16</td>
<td>7.39</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>98.86</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

(1) Santa Rita Mountains, Arizona, USA. (2) \(\text{Ca}_2\text{Cu}_2\text{Si}_3\text{O}_8(\text{OH})_4\).

**Occurrence:** In vugs and veinlets in skarn (Santa Rita Mountains, Arizona, USA); in amygdules in basaltic lava flows (Calumet, Michigan, USA).

**Association:** Apophyllite, copper (Santa Rita Mountains, Arizona, USA); quartz, calcite, copper, silver, epidote, pumpellyite, chlorite (Calumet, Michigan, USA).

**Distribution:** In the USA, in Arizona, between Helvetia and Rosemont, Santa Rita Mountains, Pima Co., and in the Christmas copper mine, Gila Co.; in the Bawana mine, about six km northwest of Milford, Beaver Co., Utah; and in Michigan, in the Laurium and La Salle mines, Calumet, Houghton Co. and at the Northwestern mine, Keweenaw Co.

**Name:** For Fr. Eusebio Francisco Kino (1645–1711), Jesuit pioneer of the Sonora-Arizona-California frontier.

**Type Material:** Harvard University, Cambridge, Massachusetts, 109439; National Museum of Natural History, Washington, D.C., USA, 122395.


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