Joteite

$\text{Ca}_2\text{CuAl}[\text{AsO}_4][\text{AsO}_3(\text{OH})]_2(\text{OH})_2\cdot5\text{H}_2\text{O}$

**Crystal Data:** Triclinic.  
*Point Group:* $\bar{1}$.  
As thin blades up to $\sim$300 $\mu$m, flattened on {001} and exhibiting {001}, {010}, {110}, {210}, and {111}, also in sheaf-like bundles, less commonly in divergent sprays, and sometimes as dense crusts and cavity linings.  
*Twinning:* Ubiquitous by reflection on {001}.

**Physical Properties:**  
*Cleavage:* Perfect on {001}.  
*Fracture:* Curved.  
*Tenacity:* Brittle.  
*Hardness* = 2-3  
*D(meas.)* = n.d.  
*D(calc.)* = 3.084

**Optical Properties:**  
*Color:* Sky-blue to greenish blue.  
*Streak:* Very pale blue.  
*Luster:* Vitreous.  
*Optical Class:* Biaxial (-).  
$\alpha = 1.634$  
$\beta = 1.644$  
$\gamma = 1.651$  
$2V(\text{meas.}) = 78(2)^\circ$  
$2V(\text{calc.}) = 79.4^\circ$  
*Orientation:* $X \approx c$;  
$Y \approx b$.  
*Dispersion:* Weak, $r < v$.  
*Pleochroism:* $Z$ = greenish blue, $Y$ = pale greenish blue, $X$ = colorless.  
*Absorption:* $Z > Y > X$.

**Cell Data:**  
*Space Group:* $P\bar{1}$.  
$a = 6.0530(2)$  
b = 10.2329(3)  
c = 12.9112(4)  
$\alpha = 87.413(19)^\circ$  
$\beta = 78.480(2)^\circ$  
$\gamma = 78.697(2)^\circ$  
$Z = 2$

**X-ray Powder Pattern:** Jote mine, Tierra Amarilla, Copiapó Province, Atacama, Chile.  
12.76 (100), 4.206 (26), 3.40 (25), 3.92 (24), 5.009 (23), 2.97 (20), 3.233 (19)

**Chemistry:**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaO</td>
<td>17.12</td>
<td>15.70</td>
<td>15.72</td>
</tr>
<tr>
<td>CuO</td>
<td>12.23</td>
<td>11.22</td>
<td>11.15</td>
</tr>
<tr>
<td>Al$_2$O$_3$</td>
<td>9.07</td>
<td>8.32</td>
<td>7.14</td>
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<tr>
<td>As$_2$O$_5$</td>
<td>50.83</td>
<td>46.62</td>
<td>48.32</td>
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<tr>
<td>H$_2$O</td>
<td>[19.78]</td>
<td>18.14</td>
<td>17.67</td>
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<tr>
<td><strong>Total</strong></td>
<td>109.03</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

(1) Jote mine, Tierra Amarilla, Copiapó Province, Atacama, Chile; average of 5 electron microprobe analyses, H$_2$O calculated from structure analysis, OH and H$_2$O confirmed by Raman spectroscopy; corresponds to $\text{Ca}_{1.98}\text{Cu}_{1.00}\text{Al}_{1.15}\text{As}_{2.87}\text{H}_{1.24}\text{O}_{18}$.

(2) Analysis 1 normalized.

(3) $\text{Ca}_2\text{CuAl}[\text{AsO}_4][\text{AsO}_3(\text{OH})]_2(\text{OH})_2\cdot5\text{H}_2\text{O}$.

**Occurrence:** In narrow seams and vugs in the oxidized upper portion of a hydrothermal sulfide vein hosted by volcanoclastic rocks.

**Association:** Conichalcite, mansfieldite, pharmacolamite, pharmacosiderite, scorodite.

**Distribution:** From the Jote mine, Pampa Larga district, Tierra Amarilla, Copiapó Province, Atacama, Chile.

**Name:** For the mine from which the first specimens were collected.

**Type Material:** Natural History Museum of Los Angeles County, Los Angeles, California, USA. (63592–63594).

**References:**

(1) Kampf, A.R., S.J. Mills, R.M. Housley, G.R. Rossman, B.P. Nash, M. Dini, and R.A. Jenkins (2013) Joteite, $\text{Ca}_2\text{CuAl}[\text{AsO}_4][\text{AsO}_3(\text{OH})]_2(\text{OH})_2\cdot5\text{H}_2\text{O}$, a new arsenate with a sheet structure and unconnected acid arsenate groups. Mineral. Mag., 77(6), 2811-2823.  