Lammerite  
\( \text{Cu}_3(\text{AsO}_4, \text{PO}_4)_2 \)

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Crystal Data: Monoclinic.  Point Group: 2/m.  Crystals, to 2 mm, are prismatic along [001] to tabular on {100} and terminated by {011}; additional forms include {010} and striated {120}; in radial spheroidal aggregates.

Physical Properties:  Cleavage: Perfect on {010}; good on {100}; imperfect on {001}.  Hardness = 3.5–4 D(meas.) = 4.9–5.18 D(calc.) = 5.263


Optical Class: Biaxial (+).  Pleochroism: Strong; \( X = \) pale blue; \( Y = \) sky-blue; \( Z = \) pale bluish green.  Orientation: \( X = b; Z \wedge c \approx 40^\circ \).

Dispersion: \( r \gg v, \) very strong.  \( \alpha = \) ∼1.89
\( \beta = 1.90-2.06 \)
\( \gamma = 1.95-2.14 \)
\( 2V(\text{meas.}) = 54(5)^\circ \)
\( 2V(\text{calc.}) = 50^\circ \)

Cell Data:  Space Group: \( P2_1/a. \)
\( a = 5.079(1) \)
\( b = 11.611(2) \)
\( c = 5.394(1) \)
\( \beta = 111.72(2)^\circ \)
\( Z = 2 \)

X-ray Powder Pattern:  Laurani, Bolivia.
2.89 (10), 2.52 (9), 3.06 (8), 3.00 (8), 2.62 (8), 2.59 (8), 2.84 (7)

Chemistry:

<table>
<thead>
<tr>
<th>Element</th>
<th>Formula</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>As_2O_5</td>
<td></td>
<td>49.8</td>
<td>32.64</td>
</tr>
<tr>
<td>P_2O_5</td>
<td></td>
<td>12.40</td>
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</tr>
<tr>
<td>FeO</td>
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<td>0.2</td>
<td>0.06</td>
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<tr>
<td>CuO</td>
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<td>49.9</td>
<td>54.64</td>
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<tr>
<td>ZnO</td>
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<td>0.8</td>
<td>0.11</td>
</tr>
<tr>
<td>MgO</td>
<td></td>
<td>0.2</td>
<td></td>
</tr>
</tbody>
</table>

Total 100.9 99.85

(1) Laurani, Bolivia; by electron microprobe, absence of \((\text{OH})^-\) and \(\text{H}_2\text{O}\) confirmed by IR; corresponding to \((\text{Cu}_2\text{Zn}_0\text{Mg}_0\text{Fe}_0.01)_1\Sigma=2.98(\text{As}_1\text{O}_4)\).  (2) Tolbachik fissure volcano, Russia; by electron microprobe, corresponding to \((\text{Cu}_{2.96}\text{Zn}_{0.01})\Sigma=2.97(\text{As}_{0.62}\text{P}_{0.38})\).

Occurrence: On an old mineral specimen (Laurani, Bolivia); in an oxidized zone in a dolostone-hosted hydrothermal polymetallic ore deposit (Tsumeb, Namibia); in volcanic sublimates (Tolbachik fissure volcano, Russia).

Association: Olivenite (Laurani, Bolivia); chalcanthite, anhydrite, leightonite (Tsumeb, Namibia); euchlorine, melanothallite, dolerophanite, chalcocyanite, leningradite, hematite, tenorite (Tolbachik fissure volcano, Russia).

Distribution: From Laurani, Oruro, Bolivia. At Tsumeb, Namibia. From the Tolbachik fissure volcano, Kamchatka Peninsula, Russia.

Name: Honors Franz Lammer, mineral collector of Leoben, Austria, who provided the first specimen.


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