Lahnsteinite \( \text{Zn}_4(\text{SO}_4)(\text{OH})_6 \cdot 3\text{H}_2\text{O} \)

**Crystal Data:** Triclinic (pseudo-orthorhombic). \( \text{Point Group}: 1 \). As hexagonal tabular crystals, to 0.7 mm, displaying \( \{001\}, \{00 \overline{1}\}, \{110\}, \{130\}, \{010\}, \{1 \overline{1} 0\}, \{ \overline{1} 3 0\}, \) and \{0\( \overline{1} 0\)\}.

**Physical Properties:** \( \text{Cleavage}: \) Perfect on \( \{001\} \), 2 more less-perfect sets perpendicular to \( \{001\} \). \( \text{Fracture:} \) n.d. \( \text{Tenacity:} \) Sectle. \( \text{Hardness} = 1.5 \). \( \text{D(meas.} = 2.98(2) \quad \text{D(calc.)} = 2.995 \)

**Optical Properties:** \( \text{Translucent.} \) \( \text{Color:} \) Colorless. \( \text{Streak:} \) n.d. \( \text{Luster:} \) n.d.

**Optical Class:** Biaxial (–). \( \alpha = 1.568(2) \quad \beta = 1.612(2) \quad \gamma = 1.613(2) \quad 2V(\text{meas.)} = 18(3)^\circ \quad 2V(\text{calc.)} = 17^\circ \quad \text{Orientation:} \) X ~ c, Y ~ b, Z ~ a. \( \text{Dispersion:} \) None.

**Cell Data:** \( \text{Space Group:} \) \( P1 \). \( a = 8.312(1) \quad b = 14.545(1) \quad c = 18.504(2) \quad \alpha = 89.71(1)^\circ \quad \beta = 90.05(1)^\circ \quad \gamma = 90.13(1)^\circ \quad Z = 8 \)

**X-ray Powder Pattern:** Friedrichssegen mine, near Lahnstein, Rhineland-Palatinate, Germany. 9.30 (100), 2.723 (57), 2.624 (36), 2.503 (35), 1.574 (23), 3.476 (19), 3.290 (19)

**Chemistry:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Formula</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>FeO</td>
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<tr>
<td>CuO</td>
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<tr>
<td>ZnO</td>
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<tr>
<td>SO(_3)</td>
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<tr>
<td>H(_2)O</td>
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<tr>
<td><strong>Total</strong></td>
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<td></td>
</tr>
</tbody>
</table>

(1) Friedrichssegen mine, near Lahnstein, Rhineland-Palatinate, Germany; average of 6 electron microprobe analyses, H\(_2\)O by gas chromatography; corresponding to \( (\text{Zn}_{3.53}\text{Fe}_{0.27}\text{Cu}_{0.11})_e \text{Li}=3.91 \text{(S}_0\text{.98O}_4\text{)(OH)}_6 \cdot 3\text{H}_2\text{O} \).

**Occurrence:** In the oxidized zone of a hydrothermal polymetallic sulfide deposit.

**Association:** Hydrozincite, pyromorphite, native copper, goethite.

**Distribution:** From dumps at the Friedrichssegen mine, near Lahnstein, Ems District, Rhineland-Palatinate (Rheinland-Pfalz), Germany.

**Name:** For the city nearby the locality from which the first specimens were collected.

**Type Material:** A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia (4352/1).

**References:**

