**Kummerite**

**Mn$_{2+}$Fe$_{3+}$Al(PO$_4$)$_2$(OH)$_2$$\cdot$8H$_2$O**

**Crystal Data:** Triclinic.  **Point Group:** $\overline{1}$.  Typically as deformed laths in sprays or rounded aggregates, to 500 $\mu$m.

**Physical Properties:**  **Cleavage:** Good on {010}.  **Fracture:** Uneven.  **Tenacity:** Brittle.  
Hardness = n.d.  
D(meas.) = n.d.  
D(calc.) = 2.34

**Optical Properties:** Translucent.  **Color:** Amber-yellow.  **Streak:** White.  **Luster:** Vitreous.  
**Optical Class:** Biaxial (-).  
$\alpha = 1.565(5)$  
$\beta = 1.600(5)$  
$\gamma = 1.630(5)$  
**Dispersion:** Weak.  
2V(meas.) = n.d.  
2V(calc.) = 84(?)°  
**Pleochroism:** Weak, tones of amber yellow.  Displays fine-scale undulose extinction.

**Cell Data:**  
Space Group: $P\overline{1}$.  
$a = 5.316(1)$  
b = 10.620(3)  
c = 7.118(1)  
$\alpha = 107.33(3)^\circ$  
$\beta = 111.22(3)^\circ$  
$\gamma = 72.22(2)^\circ$  
Z = 1

**X-ray Powder Pattern:** Cornelia Mine Open Cut, Hagendorf, Oberpfalz, Bavaria, Germany.  

**Chemistry:**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe$_5$O$_3$</td>
<td>[19.1]</td>
<td>17.2</td>
</tr>
<tr>
<td>FeO</td>
<td>[5.3]</td>
<td>5.3</td>
</tr>
<tr>
<td>MnO</td>
<td>5.9</td>
<td>5.4</td>
</tr>
<tr>
<td>MgO</td>
<td>2.2</td>
<td>2.4</td>
</tr>
<tr>
<td>ZnO</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Al$_2$O$_3$</td>
<td>10.7</td>
<td>10.7</td>
</tr>
<tr>
<td>P$_2$O$_5$</td>
<td>30.2</td>
<td>30.2</td>
</tr>
<tr>
<td>H$_2$O</td>
<td>[32.5]</td>
<td>32.5</td>
</tr>
<tr>
<td>Total</td>
<td>106.6</td>
<td>100.0</td>
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</tbody>
</table>

(1) Cornelia Mine Open Cut, Hagendorf, Oberpfalz, Bavaria, Germany; average of 13 electron microprobe analyses supplemented by IR spectroscopy, H$_2$O and Fe$_2$O$_3$:FeO calculated.

(2) Analysis 1 normalized; corresponds to (Mn$_{2+0.37}$Mg$_{0.27}$Zn$_{0.03}$Fe$_{3+0.33}$)$_{2-1.00}$/Fe$_{3+1.06}$Al$_{0.94}$)$_{2-2.00}$(PO$_4$)$_{1.91}$(OH)$_{2.27}$(H$_2$O)$_{7.73}$.

**Mineral Group:** Laueite group.

**Occurrence:** A secondary mineral in pegmatite formed by the reaction of laueite with Al-bearing hydrothermal fluids.

**Association:** Zwieselite, Zn- and Al-bearing beraunite, Al-bearing frondelite, jahnsite-(CaMnMn).

**Distribution:** From the 57 ± 2 m level, Cornelia Mine Open Cut, Hagendorf, Oberpfalz, Bavaria, Germany.

**Name:** Honors Rudolf Kummer (1924-1982), mining director of the Cornelia mine at Hagendorf Süd from 1964-1982 for his appreciation of and familiarity with the mineral occurrences at the mine and support for researchers and collectors who studied and collected samples from the mine.

**Type Material:** Museum Victoria, Melbourne, Victoria, Australia (M53448).

**References:** (1) Grey, I.E., E. Keck, W.G. Mumme, A. Pring, C.M. MacRae, A.M. Glenn, C.J. Davidson, F.L. Shanks, and S.J. Mills (2016) Kummerite, Mn$^{2+}$Fe$^{3+}$Al(PO$_4$)$_2$(OH)$_2$$\cdot$8H$_2$O, a new laueite-group mineral from the Hagendorf Süd pegmatite, Bavaria, with ordering of Al and Fe$^{3+}$.  
Mineral. Mag., 80(7), 1243-1254.  