Rietveldite  \( \text{Fe(UO}_2\text{)}_{(\text{SO}_4)}_{2\cdot}5\text{H}_2\text{O} \)

**Crystal Data:** Orthorhombic.  \( \text{Point Group: mm2.} \) As subparallel intergrowths or random sprays of crystals elongated along \{001\} and flattened on \{010\} to 0.5 mm.

**Physical Properties:** Cleavage: Good on \{010\}, fair on \{100\} and \{001\}.  \( \text{Tenacity: Brittle.} \)

Fracture: Curved.  \( \text{Hardness} = -2 \) \( D(\text{meas.}) = 3.31 \) \( D(\text{calc.}) = 3.274 \)  Soluble in water.

**Optical Properties:** Transparent.  \( \text{Color: Brownish yellow; yellowish beige (aggregates).} \)

Streak: White.  \( \text{Luster: Vitreous.} \)

**Optical Class:** Biaxial (+).  \( \alpha = 1.570 \)  \( \beta = 1.577 \)  \( \gamma = 1.586 \)  \( 2V(\text{meas.}) = 82(1)^\circ \)

\( 2V(\text{calc.}) = 83.3^\circ \)  \( \text{Pleochroism: Very weak, shades of light brownish yellow.} \)

Absorption: \( Y < X = Z. \)

Orientation: \( X = b, Y = a, Z = c. \)

Dispersion: Very strong, \( r > v. \)

**Cell Data:** \( \text{Space Group: Pmn}_{21}. \)

\( a = 12.9577(9) \)  \( b = 8.3183(3) \)  \( c = 11.2971(5) \)

\( Z = 4 \)

**X-ray Powder Pattern:** Jáchymov, Czech Republic.

6.477 (100), 5.110 (58), 3.238 (49), 4.668 (48), 3.428 (41), 4.653 (36), 8.309 (34)

**Chemistry:**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
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<tbody>
<tr>
<td>( \text{FeO} )</td>
<td>9.56</td>
<td>9.02</td>
<td>10.34</td>
<td>26.99</td>
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<td>26.46</td>
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<tr>
<td>( \text{ZnO} )</td>
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<td>0.61</td>
<td>0.96</td>
<td>47.32</td>
<td>46.62</td>
<td>47.39</td>
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<tr>
<td>( \text{MgO} )</td>
<td>0.14</td>
<td>0.48</td>
<td>0.06</td>
<td>( \text{H}_2\text{O} )</td>
<td>15.39</td>
<td>14.75</td>
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<tr>
<td>( \text{MnO} )</td>
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<td>2.32</td>
<td>0.36</td>
<td>Total</td>
<td>100.56</td>
<td>99.63</td>
</tr>
</tbody>
</table>

(1) Giveaway-Simplot mine, Utah, USA; average of 4 electron microprobe analyses supplemented by Raman and IR spectroscopy, \( \text{H}_2\text{O} \) from structure analysis; corresponds to \( \text{Fe}_{0.76}\text{Zn}_{0.06}\text{Mg}_{0.02}\text{Mn}_{0.01}\text{O}_2\times9.90(\text{UO}_2)_{0.96}(\text{SO}_4)_{2.01}\text{·}5.10\text{H}_2\text{O}. \)  
(2) Willi Agatz mine, Saxony, Germany; average of 6 electron microprobe analyses supplemented by Raman and IR spectroscopy, \( \text{H}_2\text{O} \) from structure analysis; corresponds to \( \text{Fe}_{0.81}\text{Mn}_{0.22}\text{Mg}_{0.07}\text{O}_2\times1.03(\text{UO}_2)_{0.98}(\text{SO}_4)_{3.91}\text{·}5.29\text{H}_2\text{O}. \)
(3) Jáchymov, Czech Republic; average of 7 electron microprobe analyses supplemented by Raman and IR spectroscopy, \( \text{H}_2\text{O} \) from structure analysis; corresponds to \( \text{Fe}_{0.82}\text{Zn}_{0.05}\text{Mn}_{0.03}\text{Mg}_{0.01}\text{O}_2\times0.97(\text{UO}_2)_{1.01}(\text{SO}_4)_{2.01}\text{·}4.98\text{H}_2\text{O}. \)

**Occurrence:** A result of oxidation in a humid, postmining, underground environment, attacking disseminations of uraninite and pyrite originally deposited as replacements of wood and other organic material in permeable sandstone (Utah); weathering product of U-bearing pyritiferous coal (Germany); on a museum specimen of strongly altered gangue (Czech Republic).

**Association:** Asphaltum, ferriciopiapite, gypsum, römerite, shumwayite, halotrichite (Utah); halotrichite, krasite, melanterite, native sulfur, voltaite (Germany); rozenite, shumwayite, and an unnamed Al-uranyl sulfate (Czech Republic).

**Distribution:** Found at the Giveaway-Simplot mine, White Canyon mining district, San Juan Co., Utah, USA, at the Willi Agatz mine, Gittersee mining field, Dresden, Saxony, Germany, and at Jáchymov, Western Bohemia, Czech Republic.

**Name:** Honors Dutch crystallographer Hugo M. Rietveld (1932-2016) the author of the Rietveld method for the refinement of neutron and powder X-ray diffraction data. He was involved in the study of uranium compounds for much of his scientific career.

**Type Material:** Natural History Museum of Los Angeles County, Los Angeles, California, USA (66291, 66292); the TU Bergakademie, Freiberg, Germany (84140); and the National Museum, Prague, Czech Republic (PIN 45564).

**References:** (1) Kampf, A.R., J. Sejkora, T. Witzke, J. Pläšil, J. Čejka, B.P. Nash, and J. Marty (2017) Rietveldite, \( \text{Fe(UO}_2\text{)}(\text{SO}_4)_{2\cdot}(\text{H}_2\text{O})_5 \), a new uranyl sulfate mineral from Giveaway-Simplot mine (Utah, U.S.A.), Willi Agatz mine (Saxon, Germany) and Jáchymov (Czech Republic). Journal of Geosciences, 62(2), 107-120.  