Putnisite

\[ \text{SrCaCr}_8^{3+}(\text{CO}_3)_8\text{SO}_4(\text{OH})_{16} \cdot 25\text{H}_2\text{O} \]

**Crystal Data:** Orthorhombic.  
**Point Group:** 2/m 2/m 2/m.  
As pseudocubic crystals to 0.5 mm.

**Physical Properties:**  
**Cleavage:** One excellent and two good parallel to \{100\}, \{010\}, and \{001\}.  
**Fracture:** Uneven.  
**Tenacity:** Brittle.  
**Hardness:** 1.5-2  
\( D(\text{meas.}) = 2.20(3) \)  
\( D(\text{calc.}) = 2.23 \)

**Optical Properties:**  
**Translucent.**  
**Color:** Pale to dark purple.  
**Streak:** Pink.  
**Luster:** Vitreous.  
**Optical Class:** Biaxial (-).  
\( \alpha = 1.552(3) \)  
\( \beta = 1.583(3) \)  
\( \gamma = 1.599(3) \)  
**Orientation:** Uncertain.

**Pleochroism:** Distinct,  
\( X = \) pale bluish gray,  
\( Y = \) pale purple,  
\( Z = \) pale purple.

**Cell Data:**  
**Space Group:** Pnma.  
\( a = 15.351(3) \)  
\( b = 20.421(4) \)  
\( c = 18.270(4) \)  
\( Z = 4 \)

**X-ray Powder Pattern:** Halls Knoll gossan, Western Australia, Australia.  
13.58 (100), 7.66 (80), 6.67 (43), 5.084 (19), 3.689 (16), 4.901 (13), 7.09 (10)

**Chemistry:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Formula</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na₂O</td>
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<tr>
<td>MgO</td>
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<td>0.08</td>
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<tr>
<td>CaO</td>
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<td>10.81</td>
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<tr>
<td>SrO</td>
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<tr>
<td>BaO</td>
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<tr>
<td>CuO</td>
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<td>Cr₂O₃</td>
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<td>SO₃</td>
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<td>SiO₂</td>
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<td>Cl⁻</td>
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<td>H₂O</td>
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<tr>
<td>-O=Cl</td>
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<tr>
<td>Total</td>
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<td>100.81</td>
</tr>
</tbody>
</table>

(1) Halls Knoll gossan, Western Australia, Australia; average of 11 electron microprobe analyses,  
\( \text{CO}_2 \) and \( \text{H}_2\text{O} \) calculated from crystal structure analysis and confirmed by infrared spectroscopy,  
\( \text{OH}^- \) calculated for charge balance; corresponding to  
\( \text{Cr}^{3+} \cdot \text{0.02Ca} \cdot \text{0.01Sr} \cdot \text{0.01Cu} \cdot \text{0.07Mg} \cdot \text{0.04Ba} \cdot \text{0.02[SiO}_4 \cdot \text{0.09(SiO}_2 \cdot 0.03]Z=0.99(\text{CO}_3) \cdot 0.98(\text{OH}) \cdot 16.19\text{Cl} \cdot 0.15^2 \cdot \text{24.84H}_2\text{O} \).

**Occurrence:** A product of the oxidation of a massive nickel sulfide deposit in komatiitic/dioritic rocks.

**Association:** Quartz, a near-amorphous dark green mineral.

**Distribution:** From the Halls Knoll gossan, Polar Bear peninsula, Southern Lake Cowan, 40 km north of Norseman, Western Australia, Australia.

**Name:** Honors Australian mineralogists Christine and Andrew Putnis of the Institut für Mineralogie,  
Universität Münster, Germany, in recognition of their outstanding contributions to mineralogy.

**Type Material:** South Australian Museum, Adelaide, South Australia, (registration number G33429) and at the Canadian Museum of Nature, Ottawa, Canada (CMNMC 86133).

**References:**  
(1) Elliott, P., G. Giester, R. Rowe, and A. Pring (2014) Putnisite,  
\( \text{SrCaCr}_8^{3+}(\text{CO}_3)_8\text{SO}_4(\text{OH})_{16} \cdot 25\text{H}_2\text{O} \), a new mineral from Western Australia: description and crystal structure. Mineral. Mag., 78(1), 131-144.  