Wernerkrauseite

\( \text{CaFe}^{3+2}\text{Mn}^{4+}\text{O}_6 \)

**Crystal Data:** Orthorhombic.  
**Point Group:** 2/m 2/m 2/m.  
As prismatic, acicular crystals striated along elongation, with rhombic cross-sections, up to 0.5 mm, and displaying \{210\}, \{110\}, \{010\}, \{011\}, and \{1\{1\}.

**Physical Properties:**  
*Cleavage:* None.  
*Fracture:* Uneven.  
*Tenacity:* n.d.  
*Hardness* = ~3  
\( \text{VHN} = 154(5) \) (25 g load).  
\( \text{D(meas.)} = \text{n.d.} \)  
\( \text{D(calc.)} = 4.66 \)

**Optical Properties:**  
*Opaque.*  
*Color:* Black, gray in reflected light.  
*Streak:* Black.  
*Luster:* Sub-metallic.

**Optical Class:**  
Weak pleochroism, birefringence and anisotropy.


**Cell Data:**  
**Space Group:** Pnma.  
\( a = 9.0548(2) \)
\( b = 2.8718(1) \)
\( c = 10.9908(2) \)
\( Z = 8/3 \)

**X-ray Powder Pattern:**  
Bellerberg volcano, Eifel, Rhineland-Palatinate, Germany.

\( 2.646 (100), 2.450 (77), 2.748 (62), 4.527 (54), 4.698 (44), 1.818 (43), 2.425 (37) \)

**Chemistry:**  
\begin{align*}
\text{Al}_2\text{O}_3 & \quad 0.27 \\
\text{Fe}_2\text{O}_3 & \quad 27.97 \\
\text{MnO}_2 & \quad 29.52 \\
\text{Mn}_2\text{O}_3 & \quad 22.97 \\
\text{MgO} & \quad 0.40 \\
\text{CaO} & \quad 18.48 \\
\text{Total} & \quad 99.61 
\end{align*}

(1) Bellerberg volcano, Eifel, Rhineland-Palatinate, Germany; average of 9 electron microprobe analyses supplemented by Raman spectroscopy, \( \text{Mn}^{4+}/\text{Mn}^{3+} \) calculated for charge balance; corresponds to \( \text{Ca}_{0.99}(\text{Fe}^{3+}_{1.06}\text{Mn}^{3+}_{1.03}\text{Mn}^{2+}_{0.88}\text{Mg}_{0.04}\text{Al}_{0.03})\text{O}_6 \).

**Polymorphism & Series:** Forms a solid solution series with harmunite.

**Occurrence:**  
A late-stage mineral formed during retrograde metamorphism of strongly altered xenoliths within alkaline basalt.

**Association:**  
Ettringite-thaumasite, hydrocalumite, jennite, katoite, portlandite, magnesioferrite, perovskite.

**Distribution:**  
From the Bellerberg volcano (Caspar quarry), Ettringen near Mayen, Eifel, Rhineland-Palatinate, Germany.

**Name:** Honors Dr. Werner Krause (b. 1949), a chemist with a special interest in the crystal chemistry and morphology of secondary minerals, many new species of which he discovered.

**Type Material:**  
Museum of Natural History, Bern, Switzerland (NMBE 42804).

**References:**  