

**Benauite****SrFe<sub>3</sub><sup>3+</sup>(PO<sub>4</sub>, SO<sub>4</sub>)(PO<sub>3</sub>OH)(OH)<sub>6</sub>**

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**Crystal Data:** Hexagonal. *Point Group:*  $\bar{3} 2/m$ . As poorly formed, platy to scaly crystals, flattened on {0001}, to 1 mm, in radial aggregates.

**Physical Properties:** *Cleavage:* On {0001}, perfect. *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = ~3.5 D(meas.) = 3.65(5) D(calc.) = 3.648

**Optical Properties:** Transparent to translucent. *Color:* Yellow to brown. *Streak:* Yellowish. *Luster:* Vitreous to resinous.

*Optical Class:* Uniaxial (-), anomalously biaxial, with blue interference colors.

*Pleochroism:* O = yellow; E = nearly colorless.  $\omega = 1.872(5)$   $\epsilon = 1.862(5)$   $2V(\text{meas.}) = 20^\circ$

**Cell Data:** *Space Group:*  $[R\bar{3}m]$  (probable, by analogy to beudantite).  $a = 7.28(2)$   
 $c = 16.85(4)$   $Z = [3]$

**X-ray Powder Pattern:** Clara mine, Germany.

5.88 (10), 3.06 (9), 3.65 (6), 2.25 (6), 2.96 (5), 2.81 (5), 2.53 (5)

**Chemistry:**

	(1)		(1)
SO <sub>3</sub>	6.79	PbO	2.79
P <sub>2</sub> O <sub>5</sub>	18.53	CaO	0.07
As <sub>2</sub> O <sub>5</sub>	0.78	SrO	12.35
Al <sub>2</sub> O <sub>3</sub>	0.26	BaO	4.32
Fe <sub>2</sub> O <sub>3</sub>	40.85	K <sub>2</sub> O	0.07
CuO	0.03	H <sub>2</sub> O	[13.09]
ZnO	0.07	Total	[100.00]

(1) Clara mine, Germany; by electron microprobe, total Fe as Fe<sub>2</sub>O<sub>3</sub>, H<sub>2</sub>O by difference; stated to correspond to (Sr<sub>0.67</sub>Ba<sub>0.16</sub>Pb<sub>0.07</sub>Ca<sub>0.01</sub>K<sub>0.01</sub>) $\Sigma=0.92$ (Fe<sub>2.90</sub><sup>3+</sup>Al<sub>0.03</sub>) $\Sigma=2.93$ [(PO<sub>4</sub>)<sub>1.48</sub>(SO<sub>4</sub>)<sub>0.48</sub>(AsO<sub>4</sub>)<sub>0.04</sub>] $\Sigma=2.00$ (OH, H<sub>2</sub>O)<sub>8.3</sub>.

**Mineral Group:** Crandallite group.

**Occurrence:** A secondary mineral in the oxidized zone of a hydrothermal polymetallic barite–fluorite deposit.

**Association:** Kidwellite, fluorite, goethite.

**Distribution:** From the Clara mine, near Oberwolfach, Black Forest, Germany.

**Name:** For the Benauer Berg, Germany, near which the Clara mine is situated.

**Type Material:** Institute for Mineralogy and Crystal Chemistry, University of Stuttgart, Stuttgart, Germany; Museum Victoria, Melbourne, Australia.

**References:** (1) Walenta, K., W.D. Birch, and P.J. Dunn (1996) Benauite, a new mineral of the crandallite group from the Clara mine in the central Black Forest, Germany. *Chem. Erde*, 56, 171–176. (2) (1997) *Amer. Mineral.*, 82, 430 (abs. ref. 1).