Baumhauerite $Pb_3As_4S_9$

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Crystal Data: Triclinic, pseudomonoclinic. *Point Group:* $\overline{1}$ ($2/m$ pseudocell). Crystals are short prismatic parallel to [010], tabular on {100}; striated on {100} parallel to [010], as well as on {010} parallel to [001]; crystals may be rounded, to 2.5 cm. Also as aggregates of rounded grains. *Twinning:* Polysynthetic, on {100}.

Physical Properties: *Cleavage:* Perfect on {100}. *Fracture:* Conchoidal. Hardness = 3 VHN = 177–184, average 181. D(meas.) = 5.33–5.44 D(calc.) = [5.42]

Optical Properties: Opaque. *Color:* Lead-gray to steel-gray, may tarnish to iridescence; in polished section, white with deep red internal reflections. *Streak:* Chocolate-brown. *Luster:* Metallic. *Anisotropism:* Strong, dark brown, pale brown, pale brownish gray; may be colorful in green, violet, blue-green or yellow.
R_1–R_2: (400) 38.0–42.1, (420) 37.6–41.9, (440) 37.2–41.6, (460) 36.8–41.2, (480) 36.4–40.7, (500) 36.0–40.4, (520) 35.5–39.8, (540) 35.1–39.2, (560) 34.6–38.6, (580) 34.2–37.9, (600) 33.7–37.2, (620) 33.2–36.5, (640) 32.5–35.7, (660) 31.8–34.9, (680) 31.1–34.2, (700) 30.5–33.5

Cell Data: *Space Group:* $P\overline{1}$ ($P2_1/m$ pseudocell). $a = 22.80(1)$ $b = 8.357(5)$ $c = 7.894(5)$ $\alpha = 90°3(2)'$ $\beta = 97°16(4)'$ $\gamma = 89°55(2)'$ $Z = 4$

X-ray Powder Pattern: Binntal, Switzerland (close to baumhauerite-*2a*).
3.00 (100), 2.94 (100), 2.76 (100), 4.11 (80), 3.43 (80), 3.25 (80), 3.56 (80)

Chemistry:

	(1)	(2)	(3)
Pb	47.9	53.85	51.38
Tl	0.4		
As	27.2	23.22	24.77
Sb	0.6		
S	23.9	22.94	23.85
Total	100.0	100.01	100.00

(1) Binntal, Switzerland; by electron microprobe, average of two analyses; corresponds to $Pb_{2.79}As_{4.38}S_{9.00}$. (2) Mooseck, Austria; by electron microprobe, corresponds to $Pb_{3.35}As_{3.98}S_{9.00}$. (3) $Pb_3As_4S_9$.

Occurrence: In sugary dolostone (Binntal, Switzerland).

Association: With baumhauerite-*2a*, other lead sulfarsenides, realgar, pyrite, dolomite (Binntal, Switzerland).

Distribution: In the Lengenbach quarry, Binntal, Valais, Switzerland [TL]. From Mooseck, near Golling, Salzburg, Austria. In the Seravezza marble quarries, 20 km southwest of Carrara, Tuscany, Italy. In Canada, at Madoc, and in the Hemlo gold deposit, Thunder Bay district, Ontario. From Sterling Hill, Ogdensburg, Sussex Co., New Jersey, and at the Zuni mine, Silverton, Colorado, USA. From Novoye, Kaidarkan, Kyrgyzstan.

Name: For Professor Heinrich Adolph Baumhauer (1848–1926), German mineralogist, University of Fribourg, Switzerland.

Type Material: The Natural History Museum, London, England, 1926,1654.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 460–462. (2) Engel, P. and W. Nowacki (1969) Die Kristallstruktur von Baumhauerit. Zeits. Krist., 129, 178–202 (in German). (3) Pring, A., W.D. Birch, D. Sewell, S. Graeser, A. Edenharter, and A. Criddle (1990) Baumhauerite-*2a*: a silver-bearing mineral with a baumhauerite-like supercell from Lengenbach, Switzerland. Amer. Mineral., 75, 915–922. (4) Pring, A. (2001) The crystal chemistry of the sartorite group minerals from Lengenbach, Binntal, Switzerland – a HRTEM study. Schweiz. Mineral. Petrog. Mitt., 81, 69–87. (5) Berry, L.G. and R.M. Thompson (1962) X-ray powder data for the ore minerals. Geol. Soc. Amer. Mem. 85, 154.

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