

Crystal Data: Monoclinic. *Point Group:* 2. As crystals, elongated and striated along [001], to 5 cm.

Physical Properties: Hardness = 3 VHN = 169–180 (100 g load). D(meas.) = 5.3 D(calc.) = [5.43]

Optical Properties: Opaque. *Color:* Lead-gray, with deep red internal reflections.

Streak: Chocolate-brown. *Luster:* Metallic. *Anisotropism:* Distinct.

R₁–R₂: (400) 40.0–43.0, (420) 39.3–42.6, (440) 38.6–42.2, (460) 38.0–41.8, (480) 37.4–41.5, (500) 36.9–41.2, (520) 36.3–40.7, (540) 35.6–40.1, (560) 34.9–39.3, (580) 34.2–38.5, (600) 33.6–37.6, (620) 32.8–36.7, (640) 32.1–35.8, (660) 31.3–34.8, (680) 30.6–34.0, (700) 30.0–33.4

Cell Data: *Space Group:* P2₁. *a* = 8.371(5) *b* = 70.49(5) *c* = 7.914(5) β = 90°8(2)'
Z = 4

X-ray Powder Pattern: Binntal, Switzerland. (ICDD 31-678).
2.990 (100), 4.11 (90), 3.423 (90), 2.350 (90), 2.093 (90), 1.931 (80), 1.917 (80)

Chemistry:	(1)	(2)	(3)
Pb	47.58	49.1	49.90
As	26.93	26.5	26.07
S	24.91	24.0	24.03
Total	99.42	99.6	100.00

(1) Binntal, Switzerland. (2) Do.; by electron microprobe. (3) Pb₉As₁₃S₂₈.

Occurrence: Of hydrothermal origin.

Association: Pyrite, sphalerite.

Distribution: From the Lenggenbach quarry, Binntal, Valais, Switzerland [TL].

Name: In honor of George D. Liveing (1827–1924), Professor of Chemistry, Cambridge University, Cambridge, England.

Type Material: n.d.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 462. (2) Le Bihan, M.-T. (1962) Etude structurale de quelques sulfures de plomb et d'arsenic naturels du gisement de Binn. Bull. Soc. fr. Minéral., 85, 15–47 (in French). (3) Nowacki, W. (1967) Über die mögliche Identität von "liveingit" mit Rathite-II. Neues Jahrb. Mineral., Monatsh., 353–354 (in German). (4) (1969) Amer. Mineral., 54, 1498 (abs. refs. 2 and 3). (5) Engel, P. and W. Nowacki (1970) Die Kristallstruktur von Rathite II [As₂₅S₅₆][Pb_{6.5}^{VI}Pb₁₂^{IX}]. Zeits. Krist., 131, 356–375 (in German with English abs.). (6) Pring, A. (2001) The crystal chemistry of the sartorite group minerals from Lenggenbach, Binntal, Switzerland – a HRTEM study. Schweiz. Mineral. Petrog. Mitt., 81, 69–87. (7) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 324.