Enneasartorite $Tl_6Pb_{32}As_{70}S_{140}$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As imperfectly formed crystals.

Physical Properties: *Cleavage*: Good on {100}. *Tenacity*: Brittle. *Fracture*: Conchoidal. Hardness = 3-3.5 VHN = 199-213 206 average (25 g load). D(meas.) = n.d. D(calc.) = 5.1

Optical Properties: Opaque. *Color*: Lead-gray; gray-white in reflected light, deep red internal reflections rare. *Streak*: Dark brown. *Luster*: Metallic. *Anisotropism*: Moderate to weak in brown-violet and deep green tints. *Bireflectance:* Weak. *Pleochroism*: Weak.
Optical Class: n.d.
R_1-R_2: (400) 39.2-41.6, (420) 38.3-40.9, (440) 37.6-40.4, (460) 37.0-40.0, (470) 36.7-39.7, (480) 36.4-39.5, (500) 35.9-38.9, (520) 35.2-38.3, (540) 34.5-37.6, (546) 34.0-37.2, (560) 33.7-36.8, (580) 32.9-35.8, (589) 32.4-35.4, (600) 32.0-34.9, (620) 31.2-34.0, (640) 30.5-33.1, (650) 30.2-32.8, (660) 29.9-32.4, (680) 29.4-31.9, (700) 29.2-31.6

Cell Data: *Space Group*: $P2_1/c$. a = 37.612(6) b = 7.8777(12) c = 20.071(3)
β = 101.930(2)° Z = 1

X-ray Powder Pattern: Calculated pattern.
3.51 (100), 2.949 (76), 2.751 (73), 2.752 (71), 9.82 (67), 3.86 (63), 2.953 (61)

Chemistry:

	(1)	(2)
Tl	7.44	6.97
Pb	37.17	37.70
Sb	1.09	
As	28.99	29.81
S	25.42	25.52
Total	100.12	100.00

(1) Lengenbach quarry, Binntal, Wallis, Switzerland; average of 12 electron microprobe analyses; corresponds to $Tl_{6.42}Pb_{31.68}(As_{68.31}Sb_{1.59})_{\Sigma=69.90}S_{140.00}$. (2) $Tl_6Pb_{32}As_{70}S_{140}$.

Polymorphism & Series: Anion-omission derivative, $N = 3$ homeotype of the sartorite homologous series with a nine-fold superstructure. Chemical analysis and/or single-crystal X-ray diffraction is needed to distinguish heptasartorite, enneasartorite and hendekasartorite from one another.

Occurrence: In dolostone.

Association: Heptasartorite, rathite, baumhauerite.

Distribution: At the Lengenbach quarry, Binntal, Wallis, Switzerland.

Name: For a member of the *sartorite* homologous series with a nine-fold superstructure.

Type Material: Natural History Museum, Vienna, Austria (N 9860).

References: (1) Topa, D., E. Makovicky, B. Stoeger, and C. Stanley (2017) Heptasartorite, $Tl_7Pb_{22}As_{55}S_{108}$, enneasartorite, $Tl_6Pb_{32}As_{70}S_{140}$ and hendekasartorite, $Tl_2Pb_{48}As_{82}S_{172}$, three members of the anion-omission series of 'sartorites' from the Lengenbach quarry at Binntal, Wallis, Switzerland. Eur. J. Mineral., 29(4), 701-712. (2) Makovicky, E., D. Topa, and B. Stoeger (2018) The crystal structures of heptasartorite, $Tl_7Pb_{22}As_{55}S_{108}$, and enneasartorite, $Tl_6Pb_{32}As_{70}S_{140}$, two members of an anion-omission series of complex sulfosalts from Lengenbach, the Swiss Alps, and comparison with the structures of As-Sb sartorite homologues. Eur. J. Mineral., 30, 149-164.
(3) (2018) Amer. Mineral., 103, 828-829 (abs. refs. 1 & 2).