Saddlebackite $Pb_2Bi_2Te_2S_3$

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. Crystals prismatic [010], also with prominent {101} and {310}, to 0.1 mm; commonly massive with a radiated fibrous structure, finely zoned with other arsenides. *Twinning:* As fivelings with {011} as twin plane; also forming cruciform penetration twins, as with arsenopyrite, with twin plane {101}.

Physical Properties: *Cleavage:* Distinct on {100}. *Fracture:* Uneven to conchoidal. *Tenacity:* Brittle. Hardness = 4.5–5 VHN = 792–882 (100 g load). D(meas.) = 7.2 D(calc.) = 7.471

Optical Properties: Opaque. *Color:* Tin-white, readily tarnishes to dark gray; in polished section, white. *Streak:* Grayish black. *Luster:* Metallic. *Pleochroism:* Weak. *Anisotropism:* Strong.
R_1–R_2: (400) 55.8–52.6, (420) 55.8–53.0, (440) 55.8–53.4, (460) 55.6–53.8, (480) 55.2–54.1, (500) 54.7–54.3, (520) 54.2–54.4, (540) 53.5–54.5, (560) 52.8–54.5, (580) 52.2–54.5, (600) 51.8–54.4, (620) 51.3–54.3, (640) 51.0–54.2, (660) 50.7–54.1, (680) 50.5–53.9, (700) 50.3–53.8

Cell Data: *Space Group: Pnnm.* $a = 5.173$ $b = 5.954$ $c = 2.999$ $Z = 2$

X-ray Powder Pattern: Cobalt, Canada. (ICDD 23-88).
2.379 (100), 2.572 (80), 2.597 (55), 1.862 (45), 1.849 (20), 1.650 (20), 1.636 (20)

Chemistry:

	(1)	(2)	(3)
Co	18.58	20.9	28.23
Fe	9.51	6.9	
Ni	0.00	0.3	
Cu	0.62		
As	70.36	69.3	71.77
S	0.90	2.6	
Total	99.97	100.0	100.00

(1) Schneeberg, Germany; corresponds to $(Co_{0.65}Fe_{0.35}Cu_{0.02})_{\Sigma=1.02}(As_{1.94}S_{0.06})_{\Sigma=2.00}$.
(2) Locality not specified; by electron microprobe, corresponds to $(Co_{0.70}Fe_{0.25}Ni_{0.01})_{\Sigma=0.96}$ $(As_{1.84}S_{0.16})_{\Sigma=2.00}$. (3) $CoAs_2$.

Polymorphism & Series: Dimorphous with clinosafflorite; forms a series with löllingite.

Mineral Group: Löllingite group.

Occurrence: In hydrothermal Co–Ni veins formed at medium temperature and pressure.

Association: Skutterudite, rammelsbergite, nickeline, silver, bismuth, löllingite.

Distribution: In Sweden, from Nordmark, Värmland [TL]; and at Tunaberg, Södermanland. In Germany, from Schneeberg and Annaberg, Saxony; at Bieber and Mackenheim, Hesse; from St. Andreasberg, Harz Mountains; and at Wittichen, Black Forest. From Burguillos de Cerro, Badajoz Province, Spain. In the Tynebottom mine, Garrigill, near Alston, Cumbria, England. At Sarrabus and Gonnosfanadiga, Sardinia, Italy. From Bou Azzer, Morocco. At the Talmessi and Meskani deposits, Anarak, Iran. In the USA, from the Quartzburg district, Grant Co., Oregon. At Cobalt and South Lorrain Township, Ontario; and from Great Bear Lake, Saskatchewan, Canada. In Australia, at Broken Hill, New South Wales. A number of other less prominent localities are known.

Name: From German *Safflor or Zaffer*, for *safflower*, in allusion to its use as a cobalt-blue pigment.

Type Material: Mining Academy, Freiberg, Germany, 3863.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 307–309. (2) Radcliffe, D. and L.G. Berry (1968) The saffloritе–loellingite solid solution series. Amer. Mineral., 53, 1856–1881.