

**Crystal Data:** Orthorhombic, pseudocubic. *Point Group:*  $mm2$ . Commonly as pseudocubic or pseudopyritohedral crystals, or combinations having striated faces as with pyrite, to as large as 8 cm, also as pseudo-octahedra; granular massive. *Twining:* About [111] as a pseudocubic three-fold axis, with {011} and {111} of the pseudocubic habit as twin planes, rare. Twin lamellae are commonly observed in polished section, which may exhibit a flamelike texture.

**Physical Properties:** *Cleavage:* Perfect on {001}. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 5.5 VHN = 1095–1346 D(meas.) = 6.33 D(calc.) = 6.328

**Optical Properties:** Opaque. *Color:* Silver-white. *Streak:* Grayish black. *Pleochroism:* Very weak, on grain boundaries.

R: (400) 48.2, (420) 48.0, (440) 47.7, (460) 47.8, (480) 48.2, (500) 48.9, (520) 49.6, (540) 50.4, (560) 51.2, (580) 51.9, (600) 52.6, (620) 53.1, (640) 53.5, (660) 53.7, (680) 53.8, (700) 53.8

**Cell Data:** *Space Group:*  $Pca2_1$ .  $a = 5.5833(7)$   $b = 5.5892(6)$   $c = 5.5812(8)$   $Z = 4$

**X-ray Powder Pattern:** Cobalt, Canada.

2.49 (100), 1.680 (100), 2.27 (90), 2.77 (80), 1.490 (80), 1.073 (80), 1.973 (60)

**Chemistry:**

	(1)	(2)	(3)
Co	28.64	33.2	35.53
Fe	4.11	2.8	
Ni	3.06	0.6	
As	44.77	43.4	45.15
S	19.34	20.6	19.32
Total	99.92	100.6	100.00

(1) Cobalt, Canada; corresponds to  $(Co_{0.80}Fe_{0.12}Ni_{0.09})_{\Sigma=1.01}As_{0.99}S_{1.00}$ . (2) Tunaberg, Sweden; by electron microprobe, corresponds to  $(Co_{0.88}Fe_{0.08}Ni_{0.02})_{\Sigma=0.98}As_{0.90}S_{1.00}$ . (3) CoAsS.

**Mineral Group:** Cobaltite group.

**Occurrence:** In high-temperature hydrothermal deposits, as disseminations, and as veins in contact metamorphosed rocks.

**Association:** Magnetite, sphalerite, chalcopyrite, skutterudite, allanite, zoisite, scapolite, titanite, calcite (Tunaberg, Sweden); numerous other Co–Ni sulfides and arsenides.

**Distribution:** In Sweden, fine crystals from Tunaberg, Södermanland; Riddarhyttan and Håkansboda, Västmanland; and at the Vena mines, near Askersund, Örebro. From Skutterud, Modum, Norway. At Bieber, near Hanau, Hesse, Germany. From Crown's Engine House, Wheal Cock, and the Botallack mine, St. Just, Cornwall, England. Good crystals from Espanola, and at mines in the Cobalt and Sudbury districts, Ontario; from Great Bear Lake, Northwest Territories, Canada. In Australia, at Broken Hill and Torrington, New South Wales; Bimbowrie, South Australia; and at Mt. Cobalt and Cloncurry, Queensland. From the Ait Ahmane mine, Bou Azzer, Morocco. Many more minor localities are known.

**Name:** In allusion to the elemental composition.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 296–298. (2) Giese, R.F., Jr. and P.F. Kerr (1965) The crystal structures of ordered and disordered cobaltite. *Amer. Mineral.*, 50, 1002–1014. (3) Bayliss, P. (1969) X-ray data, optical anisotropism, and thermal stability of cobaltite, gersdorffite, and ullmannite. *Mineral. Mag.*, 37, 26–33. (4) Bayliss, P. (1982) A further crystal structure refinement of cobaltite. *Amer. Mineral.*, 67, 1048–1057. (5) Fleet, M.E. and P.C. Burns (1990) Structure and twinning of cobaltite. *Can. Mineral.*, 28, 719–723. (6) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 104.

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