

Cobalt pentlandite

(Co, Ni, Fe)₉S₈

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Crystal Data: Cubic. *Point Group:* $4/m\bar{3}2/m$. As exsolved lamellae, granular and as separate crystals, to 4 mm.

Physical Properties: *Cleavage:* {100}. Hardness = n.d. VHN = 278–332 (100 g load). D(meas.) = n.d. D(calc.) = 5.22

Optical Properties: Opaque. *Color:* In polished section, slightly lighter bronze-yellow than pentlandite. *Luster:* Metallic.

R: (400) 36.9, (420) 41.9, (440) 45.9, (460) 49.2, (480) 51.7, (500) 53.8, (520) 55.6, (540) 57.0, (560) 58.2, (580) 59.2, (600) 60.0, (620) 60.5, (640) 61.0, (660) 61.2, (680) 61.4, (700) 61.5

Cell Data: *Space Group:* $Fm\bar{3}m$. $a = 9.973$ $Z = 4$

X-ray Powder Pattern: Outokumpu mine, Finland.

3.008 (100), 1.763 (100), 1.918 (80), 5.75 (60), 2.878 (60), 1.018 (60), 2.288 (50)

Chemistry:	(1)	(2)	(3)	(4)
Co	49.33	54.1	34.3	67.40
Ni	9.06	10.4	27.6	
Fe	10.32		6.3	
S	31.29	34.2	32.6	32.60
Total	100.00	98.7	100.8	100.00

(1) Varislahti deposit, Finland; corresponding to $(\text{Co}_{6.86}\text{Fe}_{1.52}\text{Ni}_{1.27})_{\Sigma=9.65}\text{S}_{8.00}$. (2) Langis mine, Canada; by electron microprobe, corresponding to $(\text{Co}_{6.88}\text{Ni}_{1.33})_{\Sigma=8.21}\text{S}_{8.00}$. (3) Amianthus mine, South Africa; by electron microprobe, corresponding to $(\text{Co}_{4.58}\text{Ni}_{3.70}\text{Fe}_{0.89})_{\Sigma=9.17}\text{S}_{8.00}$. (4) Co_9S_8 .

Polymorphism & Series: Forms a series with pentlandite.

Mineral Group: Pentlandite group.

Occurrence: With other sulfides and arsenides in hydrothermal deposits.

Association: Pyrite, marcasite, pyrrhotite, troilite, chalcopyrite, cubanite, bornite, chalcocite, digenite, linnaeite, siegenite, parkerite, bravoite, langisite, magnetite.

Distribution: In Finland, from the Varislahti [TL], Kuusjärvi, and Savonranta pyrrhotite deposits and in the Outokumpu mine, northern Karelia, Finland. At Långban, Värmland, Sweden. From Vilsan, Romania. In the Erglodd mine, ??, Wales. [??D8,ckMinWales??] From near Eretria, Othris Mountains, and near Perivoli, Pindos Mountains, Greece. In Canada, at the Langis mine, Casey Township, Cobalt-Gowganda area, Ontario, and the Vauze mine, north of Noranda, Quebec. From the Salamanca mine, Mendoza Province, Argentina. In the Amianthus mine, Kaapsche Hoop, Barberton, and the Loolekop carbonatite, Phalaborwa, Transvaal, South Africa. At the Talmessi mine, near Anarak, Iran. From the Mundonguara deposit, Chimoio district, Mozambique. In Japan, at the Shimokaua mine, Hokkaido, and the Kamaishi mine, Iwate Prefecture. On the Mid-Atlantic Ridge at 14°45'N.

Name: For the cobalt content and the relation with pentlandite.

Type Material: n.d.

References: (1) Kouva, O., M. Huhma, and Y. Vuorelainen (1959) A natural cobalt analog of pentlandite. *Amer. Mineral.*, 44, 897–900. (2) Gellers, S. (1962) Refinement of the crystal structure of Co_9S_8 . *Acta Cryst.*, 15, 1195–1198. (3) Stumpfl, E.F. and E.M. Clark (1964) A natural occurrence of Co_9S_8 , identified by x-ray microanalysis. *Neues Jahrb. Mineral., Monatsh.*, 240–245. (4) Petruk, W., D.C. Harris, and J.M. Stewart (1969) Langisite, a new mineral, and the rare minerals cobalt pentlandite, siegenite, parkerite, and bravoite from the Langis mine, Cobalt-Gowganda area, Ontario, Canada. *Can. Mineral.*, 9, 597–605. (5) Rajamini, V. and C.T. Prewitt (1975) Refinement of the structure of Co_9S_8 . *Can. Mineral.*, 13, 75–78. (6) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 103.

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