Cooperite **(Pt, Pd)S**

Crystal Data: Tetragonal. *Point Group:* $4/m\ 2/m\ 2/m$. As distorted crystal fragments elongated ‖ [101] with {110}, {111}, and {001}; as irregular grains, to 1.5 mm. *Twinning:* Rarely.

Physical Properties: *Cleavage:* {011}. *Fracture:* Conchoidal. Hardness = 4–5 VHN = 743–1018 (100 g load). D(meas.) = 9.5 D(calc.) = 10.2

Optical Properties: Opaque. *Color:* Steel-gray; in polished section, brownish. *Luster:* Metallic. *Pleochroism:* From white to creamy white to bluish white. *Anisotropism:* Strong, greenish gray to whitish yellow to brown-gray and brown. R_1–R_2: (400) 40.9–46.6, (420) 42.0–47.3, (440) 42.6–47.9, (460) 42.7–48.3, (480) 42.2–48.4, (500) 41.5–48.2, (520) 40.4–47.8, (540) 39.4–47.2, (560) 38.5–36.6, (580) 37.8–46.1, (600) 37.2–45.5, (620) 36.6–45.1, (640) 36.0–44.7, (660) 35.6–44.2, (680) 35.1–43.7, (700) 34.6–43.3

Cell Data: *Space Group:* $P4_2/mmc$. $a = 3.4700$ $c = 6.1096$ $Z = 2$

X-ray Powder Pattern: Potgietersrus district, Transvaal, South Africa. 3.013 (10), 1.911 (8), 1.507 (7), 2.450 (6), 1.753 (6), 1.732 (5), 1.231 (5)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
Pt	85.1	79.7	85.89	Ni	0.7	0.1	
Pd	0.6	5.6		S	13.9	14.3	14.11
				Total	100.3	99.7	100.00

(1) Potgietersrus district, Transvaal, South Africa; by electron microprobe, corresponding to $(Pt_{0.98}Pd_{0.01}Ni_{0.03})_{\Sigma=1.02}S_{0.98}$. (2) Stillwater complex, Montana, USA; by electron microprobe, corresponding to $(Pt_{0.90}Pd_{0.12})_{\Sigma=1.02}S_{0.98}$. (3) PtS.

Polymorphism & Series: Dimorphous with braggite.

Occurrence: A significant platinum ore mineral, found in ultramafics, gabbros, dunites, chromitites, typically layered; in massive chalcopyrite–pyrrhotite orebodies; in alluvial placers.

Association: Braggite, vysotskite, sperrylite, moncheite, platarsite, laurite, malanite, hollingsworthite, platinum, Pt–Fe alloys and many other PGM species, chalcopyrite, bornite, cubanite, pentlandite, pyrrhotite, pyrite, chromite.

Distribution: In South Africa, from the Rustenburg [TL] and Potgietersrus districts, and various other localities along the Merensky Reef of the Bushveld complex, Transvaal. In the Freetown complex, Sierra Leone. From the Stillwater complex, Montana; at the junction of the Trinity and Klamath Rivers, Humboldt Co., and from the Merced River at Snelling and Cressy, Merced Co., California, USA. In Canada, in the Lac des Iles complex, Ontario, and the Tulameen district, British Columbia. In Russia, in the Severnyi mine, Noril'sk region, western Siberia; at the Konder massif, Aldan Shield, Sakha; in the Gusevogorskii magnetite deposits, Ural Mountains; and the Baimka placer, Chukotka, Far Eastern Region. At Round Hill, near Orepuki, New Zealand. A number of additional localities are known, generally in small amounts or in placers of uncertain origin.

Name: Honors Richard A. Cooper (1890–1972), South African metallurgist, Johannesburg, South Africa, who first described the mineral.

Type Material: The Natural History Museum, London, England, 1932,1301; Harvard University, Cambridge, Massachusetts, USA, 101935.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 258–259. (2) Cabri, L.J., J.H.G. Laflamme, J.M. Stewart, K. Turner, and B.J. Skinner (1978) On cooperite, braggite, and vysotskite. Amer. Mineral., 63, 832–839. (3) Cabri, L.J., Ed. (1981) Platinum group elements: mineralogy, geology, recovery. Can. Inst. Min. & Met., 100–101. (4) Berry, L.G. and R.M. Thompson (1962) X-ray powder data for the ore minerals. Geol. Soc. Amer. Mem. 85, 71. (5) Criddle, A.J. and C.J. Stanley (1985) Characteristic optical data for cooperite, braggite and vysotskite. Can. Mineral., 23, 149–162.