Kotulskite Pd(Te, Bi)

Crystal Data: Hexagonal. *Point Group:* n.d. As minute grains included in other minerals.

Physical Properties: Hardness = n.d. VHN = 165–184; 277–322, 291 average (15 g load). D(meas.) = n.d. D(calc.) = 9.18

Optical Properties: Opaque. *Color:* Steel-gray; in polished section, cream or pale yellow. *Luster:* Metallic. *Pleochroism:* Distinct, from pale cream to darker grayish cream. *Anisotropism:* Strong, from gray to dark bluish gray.
R_1–R_2: (400) — , (420) 46.3–46.5, (440) 50.5–52.1, (460) 54.2–57.1, (480) 57.1–61.1, (500) 59.7–64.2, (520) 61.4–66.3, (540) 62.7–67.9, (560) 64.0–69.4, (580) 64.6–70.2, (600) 65.8–71.2, (620) 66.3–72.7, (640) 67.0–72.9, (660) 67.5–73.4, (680) 67.3–73.5, (700) 68.6–74.6

Cell Data: *Space Group:* n.d. $a = 4.145(5)$ $c = 5.67(1)$ Z = [1]

X-ray Powder Pattern: Rustenburg mine, South Africa.
3.03 (100), 2.22 (90), 2.08 (70), 1.52 (30), 1.72 (20), 1.67 (20), 1.32 (10)

Chemistry:

	(1)	(2)	(3)	(4)
Pd	44.3	43.0	45.9	45.47
Pt	2.3			
Bi	1.8	7.0	17.2	
Te	53.5	49.4	38.0	54.53
Total	101.9	99.4	101.1	100.00

(1) Thierry mine, Canada; by electron microprobe, corresponds to $(Pd_{0.97}Pt_{0.03})_{\Sigma=1.00}(Te_{0.98}Bi_{0.02})_{\Sigma=1.00}$. (2) Messina, South Africa; by electron microprobe, corresponds to $Pd_{1.00}(Te_{0.96}Bi_{0.08})_{\Sigma=1.04}$. (3) Rustenburg mine, South Africa; by electron microprobe, corresponds to $Pd_{1.00}(Te_{0.69}Bi_{0.19})_{\Sigma=0.88}$. (4) PdTe.

Occurrence: A minor accessory mineral, of primary or secondary hydrothermal origin, in many Pt–Pd-bearing Cu–Ni deposits in ultramafic rocks.

Polymorphism & Series: Forms a series with sobolevskite.

Association: Sobolevskite, merenskyite, melonite, michenerite, moncheite, braggite, many other Pt–Pd minerals, chalcopyrite, bornite, pentlandite, pyrrhotite, pyrite.

Distribution: Some prominent localities include: in Russia, from the Monchegorsk Cu–Ni deposit, Kola Peninsula [TL]; in the Noril'sk region, western Siberia; from the Lukkulaisvaara layered intrusion, Karelia. In South Africa, at the Rustenburg platinum mine, in the Merensky Reef of the Bushveld complex; and in the Artonvilla mine, Messina, Transvaal. In Canada, in the Levak West and Creighton mines, Sudbury; the Lac des Iles complex; and from the Thierry mine, near Pickle Lake, Ontario. In the Stillwater complex, Montana; at the New Rambler Cu–Ni mine, Medicine Bow Mountains, east of Encampment, Albany Co., Wyoming; in the Key West mine, east of Moapa, Bunkerville district, Clark Co., Nevada. In China, at Shiaonanshan, Inner Mongolia, and at Danba, Sichuan Province.

Name: To honor Vladimir Klement'evich Kotul'skii (1879–1949), Russian economic geologist and authority on Cu–Ni sulfide deposits, of the Mining Institute, St. Petersburg, Russia.

Type Material: Geology Museum, Kola Branch, Academy of Sciences, Apatity, Russia, 5966.

References: (1) Genkin, A.D., N.N. Zhuravlev, and E.M. Smirnova (1963) Moncheite and kotulskite – new minerals – and the composition of michenerite. Zap. Vses. Mineral. Obshch., 92, 33–50 (in Russian). (2) (1963) Amer. Mineral., 48, 1181 (abs. ref. 1). (3) Kingston, G.A. (1966) The occurrence of platinoid bismuthotellurides in the Merensky Reef at Rustenburg platinum mine in the western Bushveld. Mineral. Mag., 35, 815–834. (4) Patterson, G.C. and D.H. Watkinson (1984) Metamorphism and supergene alteration of Cu–Ni sulfides, Thierry mine, northwestern Ontario. Can. Mineral., 22, 13–21. (5) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 297.