

Crystal Data: Monoclinic. *Point Group:* 2/*m*. As flat cleavage fragments, to 4 mm, and rounded grains. *Twinning:* May be present.

Physical Properties: *Cleavage:* Perfect on {100}, less perfect on {001}. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 2.5 VHN = 84 (25 g load). D(meas.) = 12.5–12.6, 11.5 (synthetic). D(calc.) = [11.42]

Optical Properties: Opaque. *Color:* Gray; creamy white in reflected light. *Streak:* Black. *Luster:* Metallic, splendent, tarnishes quickly. *Anisotropism:* Evident, in pale and dark grays. R₁–R₂: (400) —, (420) 50.7–52.9, (440) 51.9–54.3, (460) 53.1–55.5, (480) 54.3–56.4, (500) 55.2–57.2, (520) 55.7–57.8, (540) 56.1–58.4, (560) 56.5–59.0, (580) 56.9–59.6, (600) 57.4–60.2, (620) 57.7–60.7, (640) 58.0–61.1, (660) 58.5–61.4, (680) 58.8–62.0, (700) 59.3–63.0

Cell Data: *Space Group:* C2/*m*. *a* = 12.74 *b* = 4.29 *c* = 5.71 β = 102°27' *Z* = [4]

X-ray Powder Pattern: Frood mine, Canada. 2.77 (100), 1.556 (80), 2.97 (70), 2.48 (70), 2.21 (70), 1.637 (60), 1.419 (60)

Chemistry:	(1)	(2)	(3)
Pd	20.3	19.3	20.29
Bi	79.7	81.5	79.71
Te		0.39	
Total	100.0	101.19	100.00

(1) Frood mine, Canada; by electron microprobe, corresponding to Pd_{1.00}Bi_{2.00}. (2) Oktyabr mine, Russia; by electron microprobe, corresponding to Pd_{0.95}(Bi_{2.03}Te_{0.02}) $\Sigma=2.05$. (3) PdBi₂.

Occurrence: In mill concentrates of As–Pb–Cu-rich ores (Frood mine, Canada); in Pd–Pt-bearing layered or pipe-like ultramafic intrusives.

Association: Chalcopyrite, cubanite, pyrite, pentlandite, altaite, hessite, galena, bismuth, pyrrhotite, tsumoite, parkerite, sudburyite, michenerite, sperrylite, insizwaite, niggliite, cabriite, mooihoekite.

Distribution: In Canada, from Sudbury, in the Frood [TL], Creighton, Coleman, and Strathcona mines, Ontario; and at the Pipe mine, Manitoba. In the USA, from Fox Gulch, Goodnews Bay, Alaska, and in the Duluth Gabbro complex, near Hibbing, St. Louis Co., Minnesota. In Russia, at the Oktyabr mine, Talnakh area, Noril'sk region, western Siberia; from the Karik'yavr Cu–Ni deposit, Kola Peninsula; and in the Kingash massif, eastern Sayan. From the Koillismaa complex, northeast Finland. In the Merensky Reef, Bushveld complex, Transvaal, South Africa. In Australia, at Mulga Springs, northeast of Broken Hill, New South Wales.

Name: For the Frood mine in Canada, from where it was first noted.

Type Material: Canadian Geological Survey, Ottawa; Royal Ontario Museum, Toronto, Canada, M29438; Harvard University, Cambridge, Massachusetts, USA, 108371.

References: (1) Hawley, J.E. and L.G. Berry (1958) Michenerite and froodite, palladium bismuth minerals. *Can. Mineral.*, 6, 200–209. (2) (1959) *Amer. Mineral.*, 44, 207 (abs. ref. 1). (3) Cabri, L.J., D.C. Harris, and R.I. Gait (1973) Michenerite (PdBiTe) redefined and froodite (PdBi₂) confirmed from the Sudbury area. *Can. Mineral.*, 11, 903–912. (4) Cabri, L.J., Ed. (1981) Platinum group elements: mineralogy, geology, recovery. *Can. Inst. Min. & Met.*, 104–105, 155.