Tochilinite $6Fe_{0.9}S \cdot 5(Mg, Fe^{2+})(OH)_2$

Crystal Data: Monoclinic or triclinic. *Point Group:* 2, m, $2/m$ or 1. As radiating aggregates of cylindrical acicular crystals, which may be hollow, to 1 cm; as paper-thin coatings, felted masses, and as clots.

Physical Properties: *Cleavage:* On {001}. Hardness = n.d. VHN = 15–49 (5 g load). D(meas.) = 2.96 D(calc.) = 3.03

Optical Properties: Opaque. *Color:* Bronze-black; yellowish brown in reflected light. *Luster:* Moderately metallic. *Pleochroism:* Strong, from yellowish brown to yellowish gray. *Anisotropism:* Strong, pinkish cream to gray.

R_1–R_2: (400) — , (420) — , (440) 9.3–15.0, (460) 9.2–15.8, (480) 9.1–16.3, (500) 8.9–16.9, (520) 8.8–17.4, (540) 8.8–17.8, (560) 8.7–18.2, (580) 8.6–18.8, (600) 8.4–19.3, (620) 8.3–19.8, (640) 8.2–20.2, (660) 8.1–20.5, (680) 8.0–20.8, (700) 8.0–21.0

Cell Data: *Space Group:* $P2$, Pm, or $P2/m$ with $a = 5.42$ $b = 15.77$ $c = 10.74$ $\beta = 95°$ Z = 6, or *Space Group:* $C1$ with $a = 5.37$ $b = 15.65$ $c = 10.72$ $\alpha = 90°$ $\beta = 95°$ $\gamma = 90°$ Z = 1

X-ray Powder Pattern: Voronezh region, Russia.
5.34 (10), 10.68 (9), 1.845 (7b), 2.20 (6b), 2.04 (5b), 1.537 (5vb), 3.57 (4)

Chemistry:	(1)	(2)		(1)	(2)		(1)	(2)
Fe	40.25	44.92	MgO	16.87		H_2O	11.25	
FeO	6.56		S	23.00	21.73	rem.	1.60	
Mg		10.94	$(OH)^{1-}$		[20.99]	Total	99.53	[98.58]

(1) Voronezh region, Russia; by electron microprobe, remainder deducted as gibbsite, $Al(OH)_3$; corresponds to $2(Fe_{0.88}S) \cdot 1.67[(Mg_{0.71}Fe_{0.29})_{\Sigma=1.00}(OH)_2]$ by analogy to valleriite.
(2) Dumont property, Canada; by electron microprobe, $(OH)^{1-}$ calculated; corresponds to $2(Fe_{0.94}S) \cdot 1.82[(Mg_{0.73}Fe_{0.27})_{\Sigma=1.00}(OH)_2]$.

Occurrence: In sulfide-rich serpentinized ultramafic bodies, where it may be of rock-forming mineral abundance; in some carbonaceous chondrite meteorites.

Association: Troilite, pyrrhotite, sphalerite, calcite, lizardite (Voronezh region, Russia); pyrrhotite, forsterite, clinohumite, hydromagnesite, graphite, calcite (Bancroft, Canada).

Distribution: In Russia, in the Voronezh district, from the Nizhnii Mamon Cu–Ni deposit, Nizhnii Mamon intrusive, 45 km southeast of Pavlovsk [TL], and in the Staromelovatskii intrusive; in the Mir, Udachnaya, and Obnazhennaya diamond pipes, Sakha. At the Grace mine, Morgantown, Berks Co., and the Cornwall open pit, Lebanon Co., Pennsylvania, USA. In Canada, in the Stephen Cross and Maxwell quarries, near Wakefield, and from the Dumont property, near Amos, Quebec; in the Muskox intrusion, Northwest Territories; from near Bancroft, Ontario; other occurrences are known. At the Jacupiranga mine, São Paulo, Brazil. In the Kamaishi mine, Iwate Prefecture, Japan. At the Mt. Keith nickel deposit, 15 km north of Betheno, Western Australia. From The Lizard, Cornwall, England. At Vâlsan, Romania.

Name: In honor of Professor Mitrofan Stepanovich Tochilin (1919–1968), mineralogist and geologist, Voronezh University, Voronezh, Russia.

Type Material: A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia.

References: (1) Organova, N.I., A.D. Genkin, V.A. Drits, S.P. Molotkov, O.V. Kuz'mina, and A.L. Dmitrik (1971) Tochilinite, a new sulfide-hydroxide of iron and magnesium. Zap. Vses. Mineral. Obshch., 100, 477–487 (in Russian). (2) (1972) Amer. Mineral., 57, 1552 (abs. ref. 1). (3) Organova, N.I., V.A. Drits, and A.L. Dmitrik (1973) Structural study of tochilinite. Part I. The isometric variety. Kristallografiya (Sov. Phys. Crystal.), 17, 761–767 (in Russian). (4) Jambor, J.L. (1976) New occurrences of the hybrid sulphide tochilinite. Geol. Surv. Can. Paper 76-1B, 65–69. (5) Zolensky, M.E. and I.D.R. Mackinnon (1986) Microstructures of cylindrical tochilinites. Amer. Mineral., 71, 1201–1209. (6) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 579.