Miserite $K_{1.5-x}(Ca, Y, RE)_5[Si_6O_{15}][Si_2O_7](OH, F)_2 \cdot yH_2O$

Crystal Data: Triclinic. *Point Group*: $\bar{1}$. Crystals, unterminated, to 12 mm. Prismatic fragments are largely composed of fine fibers; in cleavable masses. *Twinning*: Lamellar.

Physical Properties: *Cleavage*: Perfect on {100}, imperfect on {010}. *Fracture*: Subconchoidal to uneven. Hardness = 5.5-6 D(meas.) = 2.84-2.93 D(calc.) = 2.80

Optical Properties: Transparent to translucent. *Color*: Red-brown, raspberry-red, pink, with a lavender hue where weathered. *Streak*: White. *Luster*: Vitreous.
Optical Class: Biaxial (+). α = 1.576-1.587 β = 1.583-1.589 γ = 1.591-1.594 2V(meas.) = 65°-86° 2V(calc.) = 65°-87° *Orientation*: $Z \approx a$ on {100}; $Y \wedge c \approx 2°$ on {100}; $Y \wedge c = 11°$ on {010}. *Dispersion*: $r > v$, weak.

Cell Data: *Space Group*: $P\bar{1}$. a = 10.120(3) b = 16.079(3) c = 7.378(3) α = 96.62(2)° β = 111.15(2)° γ = 76.33(2)° Z = 2

X-ray Powder Pattern: Kipawa Lake, Canada.
15.42 (100), 3.14 (90), 3.18 (80), 3.17 (80), 1.667 (66), 2.377 (65), 3.106 (64)

Chemistry:	(1)		(1)
SiO_2	50.18	Yb_2O_3	0.47
Al_2O_3	0.60	Lu_2O_3	0.04
Y_2O_3	3.34	FeO	0.14
La_2O_3	0.59	MnO	0.45
CeO_2	1.00	MgO	0.37
Pr_6O_{11}	0.21	CaO	31.00
Nd_2O_3	0.86	Na_2O	0.81
EuO	0.04	K_2O	5.58
Dy_2O_3	0.58	F	2.04
Er_2O_3	0.31	H_2O	0.55
Tm_2O_3	0.03	Total	99.19

(1) Kipawa Lake, Canada; by electron microprobe, augmented by separate analyses for F, Cl, H_2O; corresponds to $K_{1.14}(Ca_{5.29}Y_{0.28}RE_{0.22})_{\Sigma=5.79}Si_{8.00}O_{22}[F_{1.03}(OH)_{0.28}]_{\Sigma=1.31}$. (2) Dara-i-Pioz, Tajikistan; electron microprobe and LOI analyses yield $K_{1.33}(Ca_{5.52}Y_{0.18}RE_{0.18}Fe_{0.04}Mn_{0.03}Mg_{0.02}Na_{0.02}Ti_{0.01})(Si_{7.99}Al_{0.01})(O,OH)_{22}[(OH)_{1.45}F_{0.55}]$.

Occurrence: In banded metamorphosed shales at the contact with a dike of nepheline syenite (Wilson Springs, Arkansas, USA); in a carbonatite vein (Kipawa Lake, Canada); in quartz-albite-aegirine veinlets and in albitites in syenites (Dara-i-Pioz massif, Tajikistan).

Association: Wollastonite, orthoclase, aegirine (Wilson Springs, Arkansas, USA); "hornblende," eudialyte, scapolite, fluorite, mosandrite (Kipawa Lake, Canada); baratovite, ekanite, titanite (Dara-i-Pioz massif, Tajikistan).

Distribution: In the USA, from the Wilson Springs (Potash Sulphur Springs) mine, between Hot Springs and Magnet Cove, Garland Co., Arkansas, and at Wausau, Marathon Co., Wisconsin. In Canada, from the [Sheffield Lake complex,] Kipawa River, Villedieu Township, and at Mont Saint-Hilaire, Quebec. From the Dara-i-Pioz massif, Alai Range, Tien Shan, Tajikistan. In the Murun massif, southwest of Olekminsk, Yakutia, and other less-well-defined localities in Russia.

Name: For Dr. Hugh Dinsmore Miser (1884-1969), geologist with the U.S. Geological Survey.

Type Material: National Museum of Natural History, Washington, D.C., USA.

References: (1) Schaller, W.T. (1950) Miserite from Arkansas; a renaming of natroxonotlite. Amer. Mineral., 35, 911-921. (2) Berry, L.G., H.-C. Lin, and G.C. Davis (1972) A new occurrence of miserite from the Kipawa Lake area, Temiscamingue Co., Quebec. Can. Mineral., 11, 569 (abs.). (3) Scott, J.D. (1976) Crystal structure of miserite, a Zoltai type 5 structure. Can. Mineral., 14, 515-528. (4) Mandarino, J.A. and V. Anderson (1989) Monteregian Treasures. Cambridge Univ. Press,

141. (5) Rozhdestvenskaya, I.V. and M.D. Evdokimov (2006) Refinement of the miserite crystal structure ($K_{1.29}\square_{0.21}$)[$Ca_{5.51}M^{3+}_{0.49}$]($Si_6(O,OH)_{15}$)(Si_2O_7)$(F,OH)_2 \cdot 0.25H_2O$ (M = Y, REE, Fe, Ti, Mn, Mg, Na) from the Dara-i-Pioz occurrence, Pamirs, Tajikistan. Dokl. Earth Sci., 406, 74-78 (in English); Dokl. Akad. Nauk, 406, 236-240 (in Russian). (6) (2006) Amer. Mineral., 91(11), 1953 (abs. ref. 5).