Mitryaevaite $\mathbf{Al_{11}(PO_4,SO_3OH)_{10}F_3 \cdot 30H_2O}$

Crystal Data: Triclinic. *Point Group:* $\overline{1}$ or 1. As prismatic crystals, to 0.04 mm, rarely in globular nodules; massive, in veinlets and powdery coatings.

Physical Properties: *Cleavage:* On {001}, perfect; on {010}, {100}, good. Hardness = n.d. D(meas.) = 2.02 D(calc.) = 2.033

Optical Properties: Transparent in microcrystals. *Color:* White to colorless. *Streak:* White. *Luster:* Vitreous, dull in massive nodules.
Optical Class: Biaxial. *Orientation:* $Z \wedge b = 14°$; positive elongation. $\alpha = 1.504(1)$ $\beta =$ n.d. $\gamma = 1.515(1)$ 2V(meas.) = n.d.

Cell Data: *Space Group:* $P\overline{1}$ or $P1$. $a = 6.92(1)$ $b = 10.09(1)$ $c = 22.46(1)$ $\alpha = 92.42(4)°$ $\beta = 96.43(7)°$ $\gamma = 104.3(2)°$ Z = 1

X-ray Powder Pattern: Kazakhstan.
9.75 (10), 6.35 (3), 9.24 (2), 3.333 (2), 3.222 (2), 2.923 (2), 7.54 (1)

Chemistry:

	(1)	(2)
SO_3	5.50	5.49
P_2O_5	32.40	32.50
SO_2	trace	
Al_2O_3	30.00	29.47
Fe_2O_3	0.30	2.40
MgO	trace	
CaO	0.90	0.74
F	3.00	
H_2O^+	27.80	
H_2O^-	1.90	
H_2O		[29.40]
$-O = F_2$	1.27	
Total	100.53	[100.00]

(1) Kazakhstan; H_2O by TGA, corresponds to $Al_{10.08}[(PO_4)_{8.71}(SO_3OH)_{1.29}]_{\Sigma=10.00}$ $Al_{1.00}[F_{2.97}(OH)_{0.03}]_{\Sigma=3.00} \cdot 29.63H_2O$. (2) Do.; by electron microprobe, average of four analyses, total Fe as Fe_2O_3, thought high due to a film of secondary goethite on the surface, H_2O by difference.

Occurrence: A secondary mineral in fractures and veinlets, in altered and oxidized vanadium-bearing phosphatic black shales.

Association: Minyulite, crandallite, gorceixite, wavellite, variscite, evansite, aluminite, meta-aluminite, kaolinite, hewettite, gypsum.

Distribution: In the Kurumsak Formation, from the Taldyk mining district, northwestern Kara-Tau Range to the Zhabagly Mountains, Tien-Shan, southern Kazakhstan.

Name: To honor Dr. Nonna Mikhailovna Mitryaeva (1920–), for her contributions to the mineralogy of Kazakhstan.

Type Material: Geological Museum, Satpaev Institute of Geological Sciences, Alma-Ata, Kazakhstan, GM IGS 24/1270.

References: (1) Ankinovich, E.A., G.K. Bekenova, T.A. Shabanova, I.S. Zazubina, and S.M. Sandomirskaya (1997) Mitryaevaite, $Al_{10}[(PO_4)_{8.7}(SO_3OH)_{1.3}]_{\Sigma 10}AlF_3 \cdot 30H_2O$, a new mineral species from a Cambrian carbonaceous chert formation, Karatau Range and Zhabagly Mountains, southern Kazakhstan. Can. Mineral., 35, 1415–1419. (2) (1999) Amer. Mineral., 84, 194–195 (abs. ref. 1).