Kryzhanovskite $Mn^{2+}Fe_2^{3+}(PO_4)_2(OH)_2 \cdot H_2O$

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. Crystals are typically rough pseudo-octahedra, prismatic or as plates flattened on {010}, to 5 cm; may be granular.

Physical Properties: *Cleavage:* Perfect on {001}. *Fracture:* Uneven. Hardness = 3.5–4 D(meas.) = 3.31 D(calc.) = 3.35–3.46

Optical Properties: Translucent. *Color:* Deep red-brown, dark blackish brown to light golden-brown, bronze on cleavage surfaces. *Streak:* Yellowish brown. *Luster:* Vitreous to dull. *Optical Class:* Biaxial (+). *Pleochroism:* Strong; X = wine-yellow; Y = orange-brown; Z = reddish brown. *Orientation:* OAP $\perp$ {001}. *Dispersion:* $r < v$ or $r > v$, strong. *Absorption:* $X > Y > Z$ or $Z{=}X > Y$. $\alpha = 1.79(5)$ $\beta = 1.80$ $\gamma = 1.82(1)$ 2V(meas.) = 40°–82°

Cell Data: *Space Group: Pbna.* $a = 9.450(2)$ $b = 10.013(2)$ $c = 8.179(2)$ Z = 4

X-ray Powder Pattern: Kalba Range, Kazakhstan.
3.156 (10), 4.996 (7), 4.701 (5), 4.253 (5), 2.723 (5), 2.534 (5), 2.207 (5)

Chemistry:	(1)	(2)		(1)	(2)		(1)	(2)
P_2O_5	35.30	34.74	MgO	1.30		H_2O^+	8.75	8.82
Fe_2O_3	34.62	39.08	CaO	1.50		H_2O^-	0.95	
FeO	0.00		Na_2O	0.00		insol.	0.56	
MnO	16.39	17.36	K_2O	0.00		Total	99.37	100.00

(1) Kalba Range, Kazakhstan; $(OH)^{1-}$ calculated for charge balance, corresponding to $(Mn^{2+}_{0.95}Ca_{0.12}Mg_{0.10})_{\Sigma=1.17}Fe^{3+}_{1.82}(PO_4)_2(OH)_{1.82} \cdot 1.18H_2O$. (2) $Mn^{2+}Fe^{3+}_2(PO_4)_2(OH)_2 \cdot H_2O$.

Polymorphism & Series: Forms a series with garyansellite.

Occurrence: A rare low-temperature oxidation product of phosphate minerals in complex granite pegmatites and iron formations.

Association: Sicklerite, triphylite (Kalba Range, Kazakhstan); ferrisicklerite, triphylite (Clementine II pegmatite, Namibia); garyansellite, ludlamite, arrojadite, vivianite, metavivianite, souzalite, quartz (Rapid Creek, Canada).

Distribution: From [the Ak-Kezen' pegmatites,] near Belogorskii, Kalba Range, Kazakhstan. Abundant at the Clementine II pegmatite, Okatjimukuju farm, near Karibib, Namibia. Large crystals on the east side of Rapid Creek, one km north of Lake Creek, Yukon Territory, Canada. In the USA, in South Dakota, from the Bull Moose, Dan Patch, and Ferguson mines, near Keystone, and the Big Chief mine, one km south of Glendale, Pennington Co.; from the Tip Top mine, 8.5 km southwest of Custer, Custer Co.; in the Palermo #1 mine, near North Groton, Grafton Co., New Hampshire. At Hagendorf, Bavaria, Germany. From the Bendada pegmatite, near Guarda, and in the Mangualde pegmatite, near Mesquitela, Portugal. From the Pinilla de Fermoselle pegmatite, Zamora, Spain.

Name: Honors Vladimir Il'ich Kryzhanovskii (1881–1947), Russian mineralogist, Curator of the A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia.

Type Material: A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 50109–50115.

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