

## Ushkovite

 $\text{MgFe}_2^{3+}(\text{PO}_4)_2(\text{OH})_2 \cdot 8\text{H}_2\text{O}$ 

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**Crystal Data:** Triclinic. *Point Group:*  $\bar{1}$  or 1. As crystals, typically equant to short prismatic along [001], may be flattened on [001], showing prominent {001}, {010}, {1 $\bar{1}$ 0}, minor {100}, {110}, {210}, {0 $\bar{1}$ 1}, to 2 mm; in radiating fibrous aggregates. *Twinning:* On {hk0}.

**Physical Properties:** *Cleavage:* Perfect on {010}. *Tenacity:* Very brittle. Hardness = 3.5 D(meas.) = 2.38 D(calc.) = 2.40

**Optical Properties:** Transparent to translucent. *Color:* Pale yellow, yellow-orange, to light brown; faint yellow in transmitted light. *Streak:* Pale yellowish. *Luster:* Vitreous to pearly on cleavages, greasy on fractures.

*Optical Class:* Biaxial (-). *Orientation:*  $Y \wedge c = 26^\circ$ ; X and Y nearly in {010}.

*Dispersion:*  $r > v$ , strong.  $\alpha = 1.584(2)$   $\beta = 1.637(2)$   $\gamma = 1.670(2)$   $2V(\text{meas.}) = 50^\circ$

**Cell Data:** *Space Group:*  $P\bar{1}$  or  $P1$ .  $a = 5.196(9)$   $b = 10.70(2)$   $c = 7.14(2)$   
 $\alpha = 108.6(1)^\circ$   $\beta = 106.95(5)^\circ$   $\gamma = 72.70(5)^\circ$   $Z = 1$

**X-ray Powder Pattern:** Ilmen Mountains, Russia; close to laueite.  
9.86 (100), 6.57 (80), 3.20 (80), 3.28 (60), 4.95 (50), 4.85 (50), 4.01 (40)

**Chemistry:**

	(1)	(2)	(3)
P <sub>2</sub> O <sub>5</sub>	30.47	28.2	28.16
Al <sub>2</sub> O <sub>3</sub>	0.00	0.1	
Fe <sub>2</sub> O <sub>3</sub>	29.87	31.8	31.68
FeO	0.00		
MnO	1.88	0.2	
MgO	8.79	8.1	8.00
CaO	2.54		
H <sub>2</sub> O <sup>+</sup>	14.83		
H <sub>2</sub> O <sup>-</sup>	12.28		
H <sub>2</sub> O		[31.6]	32.16
Total	100.66	[100.0]	100.00

(1) Ilmen Mountains, Russia; part of H<sub>2</sub>O thought lost during sample preparation; after deduction of Ca and some P as francolite, and Mn as Mn oxide, corresponds to Mg<sub>1.15</sub>Fe<sub>1.98</sub><sup>3+</sup>(PO<sub>4</sub>)<sub>2.12</sub>(OH)<sub>2</sub>·7H<sub>2</sub>O. (2) Hagendorf, Germany; by electron microprobe, total Fe as Fe<sub>2</sub>O<sub>3</sub>, H<sub>2</sub>O by difference; corresponds to (Mg<sub>1.01</sub>Mn<sub>0.01</sub><sup>2+</sup>)<sub>Σ=1.02</sub>(Fe<sub>2.00</sub>Al<sub>0.01</sub><sup>3+</sup>)<sub>Σ=2.01</sub>(PO<sub>4</sub>)<sub>2.00</sub>(OH)<sub>2</sub>·8H<sub>2</sub>O. (3) MgFe<sub>2</sub>(PO<sub>4</sub>)<sub>2</sub>(OH)<sub>2</sub>·8H<sub>2</sub>O.

**Mineral Group:** Paravauxite group.

**Occurrence:** In granite pegmatites, as an alteration product of triplite formed by weathering.

**Association:** Triplite, francolite, mitridatite, beraunite, Fe–Mn oxides (Ilmen Mountains, Russia).

**Distribution:** On the southern shore of Lake Bol'shoy Tatkul', Il'men Mountains, Southern Ural Mountains, Russia. In the Palermo #1 mine, near North Groton, Grafton Co., New Hampshire; at the Dunton quarry, Newry, Oxford Co., Maine, USA. From the Sandamap pegmatite, west of Usakos, Namibia. At Boa Vista, near Galiléia, Minas Gerais, Brazil.

**Name:** To honor Sergei L'vovich Ushkov (1880–1951), Russian naturalist, student of the Il'men National Forest, Russia.

**Type Material:** Il'menskii Preserve Museum, Miass, iz4523; Mining Institute, St. Petersburg, 1293/1; Vernadsky Geological Museum, Moscow, 53492; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 82364.

**References:** (1) Chesnokov, B.V., V.A. Vilisov, G.Y. Cherepivskaya, and M.G. Gorskaya (1983) Ushkovite, MgFe<sub>2</sub><sup>3+</sup>(PO<sub>4</sub>)<sub>2</sub>(OH)<sub>2</sub>·8H<sub>2</sub>O, a new mineral. Zap. Vses. Mineral. Obshch., 112, 42–46 (in Russian). (2) (1984) Amer. Mineral., 69, 212–213 (abs. ref. 1). (3) Dunn, P.J. (1985) New occurrences for ushkovite and comments on laueite. Mineral. Record, 16, 463–464.

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