Olmsteadite $KFe_2^{2+}(Nb,Ta)O_2(PO_4)_2 \cdot 2H_2O$

Crystal Data: Orthorhombic. *Point Group:* $mm2$. Crystals are prismatic, elongated along [010], thick tabular ‖ {100} to thin tabular ‖ {001}, to 1 mm. Forms include {001}, {100}, {111}, $\{1\bar{1}1\}$, {110}, {101}.

Physical Properties: Hardness = 4 D(meas.) = 3.31–3.36 D(calc.) = 3.41

Optical Properties: Semitransparent. *Color:* Deep brown, red-brown to black. *Streak:* Olive-green. *Luster:* Subadamantine, may be bronzy. *Optical Class:* Biaxial (+). *Pleochroism:* Marked; X = blue-green or dark blue; Y = yellow or light brown; Z = brown to dark brown. *Orientation:* $X = c$; $Y = a$; $Z = b$. *Absorption:* $X \gg Z > Y$. $\alpha = 1.725$–1.765 $\beta = 1.755$–1.775 $\gamma = 1.815$–1.835 2V(meas.) = ∼60°

Cell Data: *Space Group:* $Pb2_1m$. $a = 7.512(1)$ $b = 10.000(3)$ $c = 6.492(2)$ Z = 1

X-ray Powder Pattern: Big Chief mine, South Dakota, USA.
6.006 (10), 3.03 (7), 3.047 (6), 2.856 (6), 7.512 (5), 6.492 (5), 4.409 (5)

Chemistry:

	(1)	(2)	(3)
P_2O_5	26.6	28.3	28.29
Nb_2O_5	17.8	23.2	26.49
Ta_2O_5	7.6	0.2	
FeO	24.6	23.0	28.65
MnO	2.9	4.9	
K_2O	7.8	8.6	9.39
H_2O			7.18
Total	87.3	88.2	100.00

(1) Big Chief mine, South Dakota, USA; by electron microprobe, average of five analyses, original total given as 85.0%. (2) Hesnard mine, South Dakota, USA; by electron microprobe, average of two analyses. (3) $KFe_2NbO_2(PO_4)_2 \cdot 2H_2O$.

Occurrence: A rare mineral, presumably formed by hydrothermal leaching of primary phosphates and columbite-tantalite in complex granite pegmatites.

Association: Siderite, quartz (Big Chief mine, South Dakota, USA); rockbridgeite (Hesnard mine, South Dakota, USA).

Distribution: From the Big Chief mine, one km south of Glendale; the White Cap mine, three km south of Keystone; and the Hesnard mine, three km southwest of Keystone, Pennington Co., South Dakota, USA.

Name: Honoring Milo Olmstead, Rapid City, South Dakota, USA, amateur collector of microscopic minerals, who called attention to the mineral.

Type Material: National Museum of Natural History, Washington, D.C., USA, 135924.

References: (1) Moore, P.B., T. Araki, A.R. Kampf, and I.M. Steele (1976) Olmsteadite, $K_2Fe_2^{2+}[Fe_2^{2+}(Nb,Ta)_2^{5+}O_4(H_2O)_4(PO_4)_4]$, a new species, its crystal structure and relation to vauxite and montgomeryite. Amer. Mineral., 61, 5–11. (2) Dunn, P.J., D.R. Peacor, D.B. Sturman, R.A. Ramik, W.L. Roberts, and J.A. Nelen (1986) Johnwalkite, the Mn-analogue of olmsteadite, from South Dakota. Neues Jahrb. Mineral., Monatsh., 115–120.