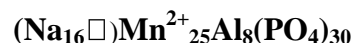


Manitobaite

Crystal Data: Monoclinic. *Point Group:* *m*. As ill-formed crystals to 4 cm and as grains.

Physical Properties: *Cleavage:* Perfect on {010}. *Fracture:* Hackly. *Tenacity:* Brittle. Hardness = n.d. D(meas.) = 3.621(6) D(calc.) = 3.628

Optical Properties: Opaque, translucent, transparent. *Color:* Green to brown. *Streak:* Colorless to very pale green or very pale greenish brown. *Luster:* Vitreous to resinous.

Optical Class: Biaxial (-). $\alpha = 1.682(1)$ $\beta = 1.691(1)$ $\gamma = 1.697(1)$ $2V(\text{meas.}) = 78.1(6)^\circ$

$2V(\text{calc.}) = 77.9^\circ$ *Pleochroism:* $Z = \text{greenish brown}$, $Y = \text{green}$, $X = \text{orange-brown}$.

Absorption: $Y \geq Z > X$. *Dispersion:* Medium, $r > v$.

Orientation: $X \wedge a = 31.7^\circ$ (in β obtuse), $Y \parallel b$, $Z \wedge c = 20.2^\circ$ (in β acute).

Cell Data: *Space Group:* *Pc*. $a = 13.4517(7)$ $b = 12.5266(7)$ $c = 26.6765(13)$ $\beta = 101.582(1)^\circ$
 $Z = 2$

X-ray Powder Pattern: Cross Lake, Manitoba, Canada.

2.715 (100), 2.730 (50), 3.494 (47), 3.078 (27), 2.518(22), 2.881 (21), 6.260 (20)

Chemistry:	(1)	(2)
P ₂ O ₅	44.19	44.42
Al ₂ O ₃	6.91	6.96
Fe ₂ O ₃	1.73	3.45
FeO	6.23	4.66
MnO	27.57	27.86
ZnO	0.54	0.53
MgO	0.73	0.81
CaO	1.71	1.59
Na ₂ O	9.97	8.94
Total	99.58	99.22

(1) Cross Lake, Manitoba, Canada (green variety); average of 10 electron microprobe analyses supplemented by Mössbauer and FTIR spectroscopy; corresponds to $\text{Na}_{15.55}\text{Ca}_{1.47}\text{Mg}_{0.88}\text{Fe}^{2+}_{4.19}\text{Mn}^{2+}_{18.78}\text{Zn}_{0.32}\text{Al}_{6.54}\text{Fe}^{3+}_{1.05}\text{P}_{30.08}\text{O}_{120}$. (2) Cross Lake, Manitoba, Canada (brown variety); average of 10 electron microprobe analyses supplemented by Mössbauer and FTIR spectroscopy; corresponds to $\text{Na}_{13.90}\text{Ca}_{1.37}\text{Mg}_{0.97}\text{Fe}^{2+}_{3.12}\text{Mn}^{2+}_{18.92}\text{Zn}_{0.31}\text{Al}_{6.58}\text{Fe}^{3+}_{2.09}\text{P}_{30.15}\text{O}_{120}$.

Occurrence: A primary phase in phosphate pods in a zoned granitic pegmatite.

Association: Interior-wall zone of the pegmatite: fluorapatite, chlorapatite, bobfergusonite, eosphorite, dickinsonite, triploidite, goyazite, perloffite, beusite, triplite, quartz, K-feldspar, muscovite, schorl, beryl, spessartine, gahnite, (Nb,Ta,Sn) oxides; core zone: fluorapatite, chlorapatite, triploidite, eosphorite, dickinsonite, fillowite, quartz, K-feldspar, muscovite, schorl, beryl, gahnite, (Nb,Ta,Sn) oxides.

Distribution: From pegmatite #22, Cross Lake, Manitoba, Canada.

Name: For the province of *Manitoba* (Canada) in which the mineral was discovered.

Type Material: Royal Ontario Museum, Toronto, Ontario, Canada (M53321).

References: (1) Ercit, T.S., K.T. Tait, M.A. Coper, Y. Abdu, N.A. Ball, A.J. Anderson, P. Černý, F.C. Hawthorne, and M. Galliski (2010) Manitobaite, $\text{Na}_{16}\text{Mn}^{2+}_{25}\text{Al}_8(\text{PO}_4)_{30}$, a new phosphate mineral species from Cross Lake, Manitoba, Canada. *Can. Mineral.*, 48, 1455-1463. (2) (2012) *Amer. Mineral.*, 98, 2068-2069 (abs. ref. 1). (3) Tait, K.T., T.S. Ercit, Y.A. Abdu, P. Černý and F.C. Hawthorne (2011) The crystal structure and crystal chemistry of manitobaite, ideally $(\text{Na}_{16}\square)\text{Mn}^{2+}_{25}\text{Al}_8(\text{PO}_4)_{30}$, from Cross Lake, Manitoba. *Can. Mineral.*, 49, 1221-1242.