Ferro-obertiite $NaNa_2(Fe^{2+}{}_3Fe^{3+}Ti)Si_8O_{22}O_2$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As prismatic to acicular crystals, to 1.25 mm, elongated on [001].

Physical Properties: *Cleavage*: Perfect on {110} with 56° intersections. *Fracture*: Splintery. *Tenacity*: Brittle. *Hardness* = 6 D(meas.) = n.d. D(calc.) = 3.330

Optical Properties: Transparent. *Color*: Black. *Streak*: Gray. *Luster*: Vitreous. *Pleochroism*: X = dark brown, Y = brown, Z = dark gray. *Orientation*: $X \wedge a = 77.3°$ (in β acute), $Y \parallel b$, $Z \wedge c = 91.2°$ (in β obtuse).
Optical Class: Biaxial (+). $\alpha = 1.671(1)$ $\beta = 1.674(1)$ $\gamma = 1.675(1)$ 2V(meas.) = 60(3)° 2V(calc.) = 59.9°

Cell Data: *Space Group*: *C*2/*m*. $a = 9.845(4)$ $b = 18.018(8)$ $c = 5.296(3)$ $\beta = 103.86(3)°$ Z = 2

X-ray Powder Pattern: Coyote Peak, Humboldt County, California, USA.
2.722 (100,), 8.448 (80), 3.407 (60), 3.144 (50), 2.596 (50), 2.533 (40), 2.178 (30)

Chemistry:

	(1)	(2)		(1)	(2)
SiO_2	52.47	50.65	Na_2O	8.70	9.80
Al_2O_3	0.09		K_2O	1.51	
TiO_2	6.51	8.42	Li_2O	0.17	
Fe_2O_3	[4.54]	8.41	F	0.51	
FeO	18.43	22.72	H_2O	0.58	
MgO	5.74		-O=F	0.21	.
MnO	0.15		Total	100.09	100.00
CaO	0.90				

(1) Coyote Peak, Humboldt County, California, USA; average of 10 electron microprobe analyses, Fe^{3+} calculated from structure analysis; corresponding to $^{A}(Na_{0.72}K_{0.29})(Na_{1.85}Ca_{0.15})(Mg_{1.30}Fe^{2+}{}_{2.35}Mn^{2+}{}_{0.02}Fe^{3+}{}_{0.52}Al_{0.01}Ti_{0.75}Li_{0.10})(Si_{7.99}Al_{0.01})O_{22}(O_{1.16}F_{0.25}OH_{0.59})$. (2) $NaNa_2(Fe^{2+}{}_3Fe^{3+}Ti)Si_8O_{22}O_2$.

Polymorphism & Series: Forms a series with oberite.

Mineral Group: Oxo amphibole.

Occurrence: As metasomatic reaction products in lithic-wacke sandstone fragments in an alkali diatreme.

Association: Aegirine, alkali feldspar.

Distribution: From Coyote Peak, Humboldt County, California, USA.

Name: To conform to IMA nomenclature for a ferrous (*ferro*)-dominant analog of *oberite*.

Type Material: Royal Ontario Museum, Toronto, Canada (M54035).

References: (1) Hawthorne, F.C., N.A. Ball, and G.K. Czamanske (2010) Ferro-obertiite, $NaNa_2(Fe^{2+}{}_3Fe^{3+}Ti)Si_8O_{22}O_2$, a new mineral species of the amphibole group from Coyote Peak, Humboldt county, California. Can. Mineral, 48, 301-306. (2) (2011) Amer. Mineral., 96, 941 (abs. ref. 1). (3) Hawthorne, F.C., R. Oberti, G.E. Harlow, W.V. Maresch, R.F. Martin, J.C. Schumacher, and M.D. Welch (2012) Nomenclature of the amphibole supergroup. Amer. Mineral., 97, 2031-2048.