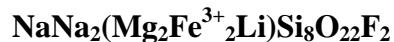


Fluoroleakite



Crystal Data: Monoclinic. *Point Group:* 2/m. Poorly-terminated prisms along [001], to 3 mm, display {100} and {110}; also in small aggregates and as inclusions in cámárite.

Physical Properties: *Cleavage:* Perfect on {110}, intersecting at ~56°. *Fracture:* Splintery. *Tenacity:* Brittle. *Hardness* = ~6 D(meas.) = n.d. D(calc.) = 3.245

Optical Properties: Transparent. *Color:* Black. *Streak:* Light gray to colorless. *Luster:* Vitreous. *Optical Class:* Biaxial (-). $\alpha = 1.663(2)$ $\beta = 1.673(2)$ $\gamma = 1.680(2)$ $2V(\text{meas.}) = 80.9(6)^\circ$ $2V(\text{calc.}) = 79.4^\circ$ *Orientation:* $X \wedge a = 14.1^\circ$ (in β obtuse), $Y \parallel b$, $Z \wedge c = 75.9^\circ$ (in β acute). *Pleochroism:* X = pale gray-green, Y = medium gray, Z = gray-brown.

Cell Data: *Space Group:* C2/m. $a = 9.8297(3)$ $b = 17.9257(6)$ $c = 5.2969$ $\beta = 103.990(1)^\circ$ $Z = 2$

X-ray Powder Pattern: Verknee Espe deposit, Akjailyautas Mountains, Kazakhstan.
2.718 (100), 8.434 (40), 4.464 (30), 3.405 (30), 3.137 (20), 2.541 (20), 2.166 (20)

Chemistry:	(1)	(2)
SiO ₂	53.34	55.52
TiO ₂	1.27	
Al ₂ O ₃	0.62	
V ₂ O ₃	0.05	
Fe ₂ O ₃	[15.10]	18.44
FeO	[6.00]	
MnO	2.04	
ZnO	0.18	
MgO	6.40	9.31
CaO	0.13	
Na ₂ O	9.08	10.74
K ₂ O	1.98	
Li ₂ O	[1.10]	3.45
H ₂ O	[0.16]	
F	3.33	4.39
-O=F	1.40	.
Total	99.39	100.00

(1) Verknee Espe deposit, Kazakhstan; average of 10 electron microprobe analyses, Li and Fe²⁺/Fe³⁺ from structure analysis; corresponds to $(\text{Na}_{0.64}\text{K}_{0.38})(\text{Na}_{1.98}\text{Ca}_{0.02})(\text{Li}_{0.66}\text{Mg}_{1.42}\text{Fe}^{2+}_{0.75}\text{Mn}^{2+}_{0.26}\text{Zn}_{0.02}\text{Fe}^{3+}_{1.69}\text{V}^{3+}_{0.01}\text{Ti}^{4+}_{0.14}\text{Al}_{0.03})(\text{Si}_{7.93}\text{Al}_{0.07})\text{O}_{22}(\text{F}_{1.57}\text{OH}_{0.16}\text{O}_{0.27})$. (2) $\text{NaNa}_2(\text{Mg}_2\text{Fe}^{3+}\text{Li})\text{Si}_8\text{O}_{22}\text{F}_2$.

Mineral Group: Amphibole supergroup, sodium amphibole group.

Occurrence: By the reaction of alkaline granite with post-magmatic fluids rich in Li and F.

Association: Cámarite, Li-bearing riebeckite, aegirine, astrophyllite.

Distribution: From the Verknee Espe rare-element deposit, Akjailyautas mountains, Eastern Kazakhstan District, Kazakhstan.

Name: As the fluorine-dominant analogue of *leakeite*.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (#3828/1).

References: (1) Cámar, F., F.C. Hawthorne, N.A. Ball, G. Bekenova, A.V. Stepanov, and P.E. Kotel'nikov (2010) Fluoroleakeite, $\text{NaNa}_2(\text{Mg}_2\text{Fe}^{3+}\text{Li})\text{Si}_8\text{O}_{22}\text{F}_2$, a new mineral of the amphibole group from the Verkhnee Espe deposit, Akjailyautas Mountains, Eastern Kazakhstan District, Kazakhstan: description and crystal structure. *Mineral. Mag.*, 74(3), 521-528.
(2) (2011) Amer. Mineral., 96, 1910 (abs. ref. 1).