

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 cámarite.

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(meas.) = 80.9(6)° 2V(calc.) = 79.4° *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 (Na_{0.64}K_{0.38})(Na_{1.98}Ca_{0.02})(Li_{0.66}Mg_{1.42}Fe²⁺_{0.75}Mn²⁺_{0.26}Zn_{0.02}Fe³⁺_{1.69}V³⁺_{0.01}Ti⁴⁺_{0.14}Al_{0.03})(Si_{7.93}Al_{0.07})O₂₂(F_{1.57}OH_{0.16}O_{0.27}). (2) NaNa₂(Mg₂Fe³⁺₂Li)Si₈O₂₂F₂.

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) Cámara, F., F.C. Hawthorne, N.A. Ball, G. Bekenova, A.V. Stepanov, and P.E. Kotelnikov (2010) Fluoroleakeite, NaNa₂(Mg₂Fe³⁺₂Li)Si₈O₂₂F₂, a new mineral of the amphibole group from the Verknee 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).