

Calciomurmanite

Crystal Data: Triclinic. *Point Group:* $\bar{1}$. As lamellae, to 0.6 cm, sometimes in fan-shaped aggregates to 3.5 cm.

Physical Properties: *Cleavage:* Perfect on {001}, distinct on two other directions nearly \perp to one another and (001). *Fracture:* Stepped. Hardness = 2.5-3 D(meas.) = 2.70(3) D(calc.) = 2.85

Optical Properties: Translucent. *Color:* Pale brown, purple; colorless in transmitted light. *Streak:* White. *Luster:* Pearly on cleavage; greasy on fracture surfaces. *Optical Class:* Biaxial (-). $\alpha = 1.680(4)$ $\beta = 1.728(4)$ $\gamma = 1.743(4)$ $2V(\text{meas.}) = 58(5)^\circ$ $2V(\text{calc.}) = 57^\circ$ *Orientation:* Y and Z are in the *ab* plane.

Cell Data: *Space Group:* $P\bar{1}$. $a = 5.3470(6)$ $b = 7.0774(7)$ $c = 12.1456(13)$ $\alpha = 91.827(4)^\circ$ $\beta = 107.527(4)^\circ$ $\gamma = 90.155(4)^\circ$ $Z = 1$

X-ray Powder Pattern: Lovozero and Khibiny complexes, Kola peninsula, Russia. 11.69 (100), 2.940 (100), 4.251 (89), 2.900 (79), 5.87 (68), 2.940 (47), 3.825 (44)

Chemistry:	(1)	(2)		(1)	(2)
Na ₂ O	5.39	4.18	Al ₂ O ₃	0.85	
K ₂ O	0.30		SiO ₂	30.27	32.43
CaO	7.61	7.83	TiO ₂	29.69	32.33
MgO	2.54	2.72	Nb ₂ O ₅	6.14	8.96
MnO	2.65		P ₂ O ₅	0.27	
FeO	1.93		H ₂ O	11.59	11.55
			Total	99.23	100.00

(1) Lovozero and Khibiny complexes, Kola peninsula, Russia; average of 7 electron microprobe analyses supplemented by FTIR spectroscopy, H₂O by the Alimarin method; corresponds to Na_{1.34}Ca_{1.04}K_{0.05}Mg_{0.49}Mn_{0.29}Fe_{0.21}Nb_{0.36}Ti_{2.85}(Si_{3.87}Al_{0.13}) $\Sigma=4$ O_{16.40}(OH)_{1.60}(PO₄)_{0.03}(H₂O)_{4.94}.

(2) NaCa(Ti₃Mg_{0.5}Nb_{0.5})[Si₂O₇]₂O_{2.5}(OH)_{1.5}(H₂O)₄.

Mineral Group: Murmanite group of the seidozerite supergroup.

Polymorphism & Series: Forms a continuous series with murmanite.

Occurrence: Formed by late-stage, low-temperature hydrothermal alteration (hydration and natural cation exchange) of a high-temperature, anhydrous phosphate-bearing titanosilicate, most likely lomonosovite and/or betalomonosovite, in peralkaline (hyperagpaitic) rocks.

Association: Microcline, aegirine, lorenzenite, fluorapatite (Mt Flora); microcline, aegirine, lamprophyllite, tsepinite-Ca, tsepinite-K (Mt. Eveslogchorr); betalomonosovite, aegirine, microcline, lamprophyllite, pectolite (Mt. Koashva).

Distribution: From Mt. Flora, Lovozero complex and Mt. Eveslogchorr and the Koashva open pit, Vostochnyi apatite mine, Khibiny complex, Kola Peninsula, Russia.

Name: As an analogue of *murmanite* with essential calcium and sodium.

Type Material: V.I. Spepanov collection, A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (ST4994, Mt Flora); Bel'kov Museum of Geology and Mineralogy, Geological Institute of Kola Science Center, Russian Academy of Sciences, Apatity, Russia (3667, Mt. Eveslogchorr).

References: (1) Lykova, I.S., I.V. Pekov, N.V. Chukanov, D.I. Belakovskiy, V.O. Yapaskurt, N.V. Zubkova, S.N. Britvin, and G. Giester (2016) Calciomurmanite, (Na, \square)₂Ca(Ti, Mg, Nb)₄[Si₂O₇]₂O₂(OH, O)₂(H₂O)₄, a new mineral from the Lovozero and Khibiny alkaline complexes, Kola Peninsula, Russia. *Eur. J. Mineral.*, 28, 835-845. (2) (2017) *Amer. Mineral.*, 102, 1565 (abs. ref. 1).