Calciomurmanite \((\text{Na}_4,\square)_2\text{Ca(Ti,Mg,Nb)}_4[\text{Si}_2\text{O}_7]_2\text{O}_2(\text{OH,}O)_2(\text{H}_2\text{O})_4\)

**Crystal Data:** Triclinic. \(\text{Point Group:} \tilde{1}\). 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(meas.) = 58(5)° 
- 2V(calc.) = 57° 
- \(\alpha\) and \(\gamma\) are in the \(ab\) plane.

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

**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:**

<table>
<thead>
<tr>
<th>Element</th>
<th>Formula</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na(_2)O</td>
<td>5.39</td>
<td>0.85</td>
</tr>
<tr>
<td>K(_2)O</td>
<td>0.30</td>
<td>30.27</td>
</tr>
<tr>
<td>CaO</td>
<td>7.61</td>
<td>29.69</td>
</tr>
<tr>
<td>MgO</td>
<td>2.54</td>
<td>6.14</td>
</tr>
<tr>
<td>MnO</td>
<td>2.65</td>
<td>0.27</td>
</tr>
<tr>
<td>FeO</td>
<td>1.93</td>
<td>11.59</td>
</tr>
</tbody>
</table>

Total: 99.23%

(1) Lovozero and Khibiny complexes, Kola peninsula, Russia; average of 7 electron microprobe analyses supplemented by FTIR spectroscopy, \(\text{H}_2\text{O}\) by the Alimarin method; corresponds to \(\text{Na}_{1.14}\text{Ca}_{0.04}\text{K}_{0.05}\text{Mg}_{0.49}\text{Mn}_{0.20}\text{Fe}_{0.21}\text{Nb}_{0.36}\text{Ti}_{0.85}(\text{Si}_{3.87}\text{Al}_{0.13})\text{O}_{16.40}(\text{OH})_{0.60}(\text{PO}_4)_{0.03}(\text{H}_2\text{O})_{4.94}\). 
(2) \(\text{NaCa(Ti}_3\text{Mg}_{0.5}\text{Nb}_{0.5})[\text{Si}_2\text{O}_7]_2\text{O}_2(\text{OH})_1.5(\text{H}_2\text{O})_4\).

**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 (hyperalkaline) 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).