

Tundrite-(Ce)**Na₂Ce₂TiO₂(SiO₄)(CO₃)₂**

Crystal Data: Triclinic. *Point Group:* $\bar{1}$. Crystals prismatic, displaying {100}, {010}, $\{\bar{1}01\}$, {201} and flattened on {010}, or acicular along [001] to 3 cm; as stellate groups or spherulitic masses. *Twinning:* On {010}, producing pseudorhomboheda.

Physical Properties: *Cleavage:* Perfect on {010}. *Fracture:* Splintery. *Tenacity:* Brittle. Hardness = ~3 D(meas.) = 3.70-4.12 D(calc.) = 4.19

Optical Properties: Transparent to translucent. *Color:* Brownish yellow, greenish yellow to bright light green. *Streak:* Yellowish gray to white. *Luster:* Vitreous to adamantine. *Optical Class:* Biaxial (+). $\alpha = 1.743$ $\beta = 1.80$ $\gamma = 1.88$ $2V(\text{meas.}) = 76^\circ\text{--}84(5)^\circ$ *Orientation:* $Z \wedge c = 4^\circ\text{--}14^\circ$; $X = [010]$. *Pleochroism:* Weak; X = pale yellow; Z = greenish yellow. *Dispersion:* $r > v$, strong.

Cell Data: *Space Group:* $P\bar{1}$. $a = 7.533(4)$ $b = 13.924(6)$ $c = 5.010(2)$ $\alpha = 99^\circ52(2)'$ $\beta = 70^\circ50(3)'$ $\gamma = 100^\circ59(2)'$ $Z = 2$

X-ray Powder Pattern: Ilímaussaq intrusion, Greenland.

13.49 (100), 2.505 (100), 3.448 (90), 2.766 (90), 3.535 (80), 6.784 (70), 1.914 (70)

Chemistry:	(1)	(2)		(1)	(2)
SiO ₂	10.03	9.32	Nb ₂ O ₅	3.44	2.31
TiO ₂	12.20	11.17	Ta ₂ O ₅		0.07
La ₂ O ₃	8.57	16.16	CaO	0.75	0.34
Ce ₂ O ₃	24.38	27.03	Na ₂ O	8.20	9.44
Nd ₂ O ₃	10.25	6.17	CO ₃	16.38	13.91
RE ₂ O ₃	5.80		H ₂ O		0.36
Pr ₂ O ₃		2.13	Total	[100.00]	98.80
Sm ₂ O ₃		0.39			

(1) Ilímaussaq intrusion, Greenland; by electron microprobe, C confirmed by loss on ignition; original analysis given as elements, here recalculated to oxides, corresponding to Na_{1.58}(Ce_{0.89}Nd_{0.36}La_{0.32}RE_{0.20}Ca_{0.08}) $\Sigma=1.85$ (Ti_{0.92}Nb_{0.16}) $\Sigma=1.08$ O_{2.12}(SiO₄)(CO₃)_{1.64}. (2) Mont Saint-Hilaire, Quebec, Canada, average of 20 electron microprobe analyses, H₂O and CO₂ by TGA, OH⁻ confirmed by IR and structure analysis, corresponding to (Na_{1.906}Ca_{0.039}) $\Sigma=1.945$ (Ce_{1.030}La_{0.621}Nd_{0.229}Pr_{0.081}Sm_{0.014}) $\Sigma=1.975$ (Ti_{0.875}Nb_{0.109}) $\Sigma=0.984$ O₂H_{0.250}(Si_{0.971}O₄)(C_{0.989}O₃)₂.

Occurrence: In pegmatite veins associated with nepheline syenites.

Association: Aegirine, lamprophyllite, lorenzenite, rhabdophane (Mt. Lepkhe-Nelm, Russia); natrolite, microcline, albite, aegirine, fluorite, rinkite, eudialyte (Ilímaussaq intrusion, Greenland); aegirine, albite, analcime, an astrophyllite-group mineral, catapleite, a eudialyte-group mineral, gonnardite, mangan-neptunite, monazite-(Ce), natrolite, quartz, rhodochrosite, sphalerite, vinogradovite (Mont Saint-Hilaire, Canada).

Distribution: On Mt. Lepkhe-Nelm, Lovozero massif, Kola Peninsula, Russia. In southern Greenland, from the Ilímaussaq intrusion, at Kringlerne, on the Kangerdluarssuk Plateau, and at Kvanefjeld. From Mont Saint-Hilaire, Quebec, Canada.

Name: After the Lovozero massif (formerly the Lovozero *tundra*), Kola Peninsula, Russia, where it was discovered, and a suffix for the cerium content.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (72020). Other studied material at Canadian Museum of Nature, Ottawa, Ontario (CMNMC 85806).

References: (1) Semenov, E.I. (1963) Mineralogy of the rare earths. Izdatelstvo Akad. Nauk SSSR, Moscow, 209-210 (in Russian). (2) (1965) Amer. Mineral., 50, 2097-2098 (abs. ref. 1). (3) Grice, J., R. Rowe, G. Poirier, and Q. Wight (2008) Tundrite-(Ce) from Mont Saint-Hilaire, Quebec: Crystal-structure analysis and species characterization. Can. Mineral., 46, 413-422. (4) (2008) Amer.

Mineral., 93, 1946 (abs. ref. 3). (5) Semenov, E.I., M.E. Kazakova, and R.A. Aleksandrova (1967) The Lovozero minerals - nenadkevichite, gerasimovskite, and tundrite - from Ilímaussaq, South Greenland. Medd. Grønland, 181(5), 1-11. (6) (1968) Amer. Mineral., 53, 1780 (abs. ref. 5). (7) Shumyatskaya, N.G., A.A. Voronkov, V.V. Ilyukhin, and N.V. Belov (1976) Tundrite, $\text{Na}_2\text{Ce}_2\text{TiO}_2[\text{SiO}_4](\text{CO}_3)_2$ - refinement of the crystal structure and chemical formula. Kristallografiya (Sov. Phys. Crystal.), 21, 705-715 (in Russian). (8) Moller, S.K. (1982) Tundrite from the Ilímaussaq alkaline intrusion, South Greenland. Neues Jahrb. Mineral., Monatsh., 481-494.