Lomonosovite $Na_5Ti_2O_2(Si_2O_7)(PO_4)$

Crystal Data: Triclinic. *Point Group:* $\bar{1}$. Thin lamellar crystals, to 7 cm; also in scaly masses. *Twinning:* Around [100], composition plane {001}, simple contact to finely polysynthetic twinning.

Physical Properties: *Cleavage:* Perfect on {100}. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 3–4 D(meas.) = 2.88–3.13 D(calc.) = [3.04]

Optical Properties: Transparent in thin plates. *Color:* Cinnamon-brown, rose-violet, light yellow, black; dark brown in thin section. *Streak:* Light rose-cinnamon. *Luster:* Vitreous to adamantine on cleavages, greasy on fractures.
Optical Class: Biaxial (–). *Pleochroism:* Strong; X = yellow, pale yellow, nearly colorless; Y = brownish, yellow-orange, lilac; Z = yellowish brown, dark brown, dark blackish brown. *Orientation:* $X \wedge$ cleavage = 61°–66°; $Y \wedge$ cleavage = 59°-65°; $Z \wedge$ cleavage = 37°–41°. *Absorption:* $Z > Y > X$. α = 1.654–1.670 β = 1.736–1.750 γ = 1.764–1.778 2V(meas.) = 56°–69°

Cell Data: *Space Group:* $P\bar{1}$. $a = 5.49$ $b = 7.11$ $c = 14.50$ $\alpha = 101°$ $\beta = 96°$ $\gamma = 90°$ Z = 2

X-ray Powder Pattern: Lovozero massif, Russia.
2.83 (10), 1.778 (9), 1.840 (8), 2.73 (7), 2.65 (7), 2.60 (7), 2.08 (7)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SiO_2	24.07	23.94	23.76	MnO	3.17		
TiO_2	24.43	31.08	31.58	MgO	0.58		
ZrO_2	2.10			CaO	0.80	0.56	
Fe_2O_3	2.39			Na_2O	26.09	29.64	30.63
Nb_2O_5		0.54		Cl	trace		
Ta_2O_5	3.00			H_2O	0.26		
FeO		0.75		P_2O_5	12.84	14.23	14.03
				Total	99.73	100.74	100.00

(1) Lovozero massif, Russia. (2) Ilímaussaq intrusion, Greenland; by electron microprobe, average of six analyses; original analysis given as Si 11.19%, Ti 18.63%, Nb 0.38%, Fe 0.58%, Ca 0.40%, Na 21.99%, P 6.21%, here recalculated to oxides. (3) $Na_5Ti_2O_2(Si_2O_7)(PO_4)$.

Occurrence: In nepheline syenites and pegmatites cutting them (Lovozero massif, Russia); in lavas and gabbros near contacts with nepheline syenite (Ilímaussaq intrusion, Greenland).

Association: Nepheline, albite, pectolite, lorenzenite, ussingite, lamprophyllite, eudialyte, arfvedsonite, villiaumite, aegirine, and many other species.

Distribution: Widespread in the Lovozero massif, and on Mt. Rasvumchorr, Khibiny massif, Kola Penninsula, Russia. On the Kvanefjeld Plateau, in the Ilímaussaq intrusion, southern Greenland.

Name: For Mikhail Vasil'evich Lomonosov (1711–1765), Russian mineralogist and naturalist.

Type Material: n.d.

References: (1) Gerasimovskii, V.I. (1950) Lomonosovite, a new mineral. Doklady Acad. Nauk SSSR, 70, 83–86 (in Russian) (2) (1950) Amer. Mineral., 35, 1092–1093 (abs. ref. 1). (3) Vlasov, K.A., M.V. Kuz'menko, and E.M. Es'kova (1966) The Lovozero alkali massif. Akad. Nauk SSSR, 338–347 (in English). (4) Belov, N.V., G.S. Gavrilova, L.P. Solov'eva, and A.D. Khailov (1977) The refined structure of lomonosovite. Doklady Acad. Nauk SSSR, 235, 1064–1067 (in Russian). (5) Karup-Møller, S. (1983) Lomonosovite from the Ilímaussaq intrusion, South Greenland. Neues Jahrb. Mineral., Monatsh., 83–96.