Vinogradovite $(Na,K)_4Ti_4(Si,Al)_8O_{26}\cdot(H_2O,Na)$

Crystal Data: Monoclinic, pseudo-orthorhombic. *Point Group:* $2/m$. In prismatic crystals, elongated along [100], sword-shaped or bladed, to 4 mm; commonly in spherulites, to 1 cm, and irregular fibrous aggregates. *Twinning:* On {010}, uncommon.

Physical Properties: *Cleavage:* {010}, perfect. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = ∼4 D(meas.) = 2.85–2.97 D(calc.) = 2.88

Optical Properties: Transparent. *Color:* Colorless, white, mauve, pink; in transmitted light, colorless to brownish. *Luster:* Vitreous.
Optical Class: Biaxial (–). *Pleochroism:* Weak; X = colorless; Z = brownish. *Orientation:* $Y = b$; $X \wedge a = 7°$. *Dispersion:* $r > v$. $\alpha = 1.691–1.745$ $\beta = 1.769–1.773$ $\gamma = 1.773–1.818$ 2V(meas.) = 41°–82°

Cell Data: *Space Group:* $C2/c$. $a = 24.38–25.01$ $b = 8.66–8.72$ $c = 5.21–5.23$ $\beta = 99.50°–104.43°$ Z = 2

X-ray Powder Pattern: Khibiny massif, Russia.
3.21 (10), 3.07 (10), 1.614 (8), 2.72 (7), 1.558 (7), 1.494 (7), 1.434 (7)

Chemistry:

	(1)	(2)
SiO_2	40.70	39.18
TiO_2	33.60	28.87
Al_2O_3	6.20	7.08
Fe_2O_3		1.67
Nb_2O_5		1.39
MgO	0.36	0.05
CaO	1.00	
BaO		1.02
Na_2O	12.00	15.81
K_2O	1.78	1.46
H_2O	4.80	3.68
Total	100.44	100.21

(1) Khibiny massif, Russia. (2) Mont Saint-Hilaire, Canada, by electron microprobe, H_2O by TGA; corresponds to $(Na_{4.18}K_{0.31}Ba_{0.14})_{\Sigma=4.63}(Ti_{3.67}Fe_{0.20}Nb_{0.11})_{\Sigma=3.98}(Si_{6.62}Al_{1.41})_{\Sigma=8.03}O_{26}\cdot(H_2O,Na)$.

Occurrence: A late-stage hydrothermal mineral in cavities and veins, and replacing titanium-bearing minerals, in alkalic pegmatites in differentiated alkalic massifs (Kola Peninsula, Russia).

Association: Lorenzenite, lamprophyllite, catapleiite, neptunite, labuntsovite, titanite, calcite.

Distribution: In the Khibiny, Lovozero, and Kovdor massifs, Kola Peninsula, and the Inagli massif, 30 km west of Aldan, Yakutia, Russia. At Mont Saint-Hilaire, Quebec, Canada. In the Ilímaussaq intrusion, southern Greenland.

Name: In honor of Academician Aleksander Pavlovich Vinogradov (1895–1975), Russian geochemist, Director of the Vernadsky Institute of Geochemistry and Analytical Chemistry, Academy of Sciences, Moscow, Russia.

Type Material: Vernadsky Geological Museum, Moscow, 44801; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 57962, vis4737, vis4739.

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