Vinogradovite  
$$(Na, K)_{4}Ti_{4}(Si, Al)_{8}O_{26} \cdot (H_{2}O, Na)$$

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.  
Twining: On {010}, uncommon.

Physical Properties:  
Cleavage: {010}, perfect.  
Fracture: Uneven.  
Tenacity: Brittle.  
Hardness = $\sim 4$  
$D(\text{meas.}) = 2.85-2.97$  
$D(\text{calc.}) = 2.88$

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:  
$Y = b; X \wedge a = 7^\circ$.  
Dispersion: $r > v$.  
$\alpha = 1.691-1.745$  
$\beta = 1.769-1.773$  
$\gamma = 1.773-1.818$  
$2V(\text{meas.}) = 41^\circ-82^\circ$

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

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:  
\[
\begin{array}{cc}
\text{Chemical} & \text{Amount} \\
\text{SiO}_2 & 40.70 \\
\text{TiO}_2 & 33.60 \\
\text{Al}_2\text{O}_3 & 6.20 \\
\text{Fe}_2\text{O}_3 & 1.67 \\
\text{Nb}_2\text{O}_5 & 1.39 \\
\text{MgO} & 0.36 \\
\text{CaO} & 1.00 \\
\text{BaO} & 1.02 \\
\text{Na}_2\text{O} & 12.00 \\
\text{K}_2\text{O} & 1.78 \\
\text{H}_2\text{O} & 4.80 \\
\end{array}
\]

Total 100.44 100.21

(1) Khibiny massif, Russia.  
(2) Mont Saint-Hilaire, Canada, by electron microprobe,  
$H_2O$ by TGA; corresponds to $(Na_{4.18}K_{0.31}Ba_{0.11})_{\Sigma=4.63}(Ti_{3.67}Fe_{0.29}Nb_{0.11})_{\Sigma=3.98}$  
$(Si_{6.63}Al_{1.41})_{\Sigma=8.04}O_{26} \cdot (H_2O, Na)$.

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

Association:  
Lorenzenite, lamprophylite, 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 Illaunussaq 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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