Zvyaginite $NaZnNb_2Ti[Si_2O_7]_2O(OH,F)_3(H_2O)_{4+x}$ ($x < 1$)

Crystal Data: Triclinic. *Point Group*: $\bar{1}$. As rectangular platy crystals to 2 cm, flattened on {001}, probably pseudomorphs after vuonnemite.

Physical Properties: *Cleavage*: Perfect on {001}, two other distinct sets are nearly perpendicular to each other and to {001} under a microscope. *Fracture*: Stepped. *Tenacity*: Brittle. Hardness = 2.5-3 D(meas.) = 2.88(3) D(calc.) = 2.94

Optical Properties: Transparent to translucent. *Color*: Colorless, pearly-white, creamy, yellowish brown, pale pink or lilac-pink. *Streak*: White. *Luster*: Pearly on crystal faces, greasy on breaks. *Optical Class*: Biaxial (-). $\alpha = 1.626(5)$ $\beta = 1.714(3)$ $\gamma = 1.740(5)$ 2V(meas.) = 45(15)° 2V(calc.) = 55° *Dispersion*: Weak, $r < v$. *Orientation:* Y and Z in the (001) plane.

Cell Data: *Space Group*: $P\bar{1}$. $a = 8.975(3)$ $b = 8.979(3)$ $c = 12.135(4)$ $\alpha = 74.328(9)°$ $\beta = 80.651(8)°$ $\gamma = 73.959(8)°$ $Z = 2$

X-ray Powder Pattern: Mt. Malyi Punkaruaiv, Lovozero complex, Kola Peninsula, Russia. 11.72 (100), 4.289 (86), 2.862 (72), 2.916 (57), 5.28 (53), 5.83 (40), 3.896 (36)

Chemistry:

	(1)	(2)		(1)	(2)
Na_2O	4.74	3.89	SiO_2	29.42	30.13
K_2O	0.22		TiO_2	12.33	10.02
CaO	0.77		Nb_2O_5	27.22	33.33
MnO	1.36		F	1.94	
FeO	0.24		H_2O	12.65	12.43
ZnO	9.61	10.20	$-O=F_2$	0.82	.
Al_2O_3	0.19		Total	99.87	100.00

(1) Mt. Malyi Punkaruaiv, Kola Peninsula, Russia; average of 5 electron microprobe analyses, H_2O by modified Penfield method; corresponding to $Na_{1.24}K_{0.04}Ca_{0.11}Mn_{0.16}Fe_{0.03}Zn_{0.96}Nb_{1.66}Ti_{1.25}(Si_{3.97}Al_{0.03})_{\Sigma=4}O_{15.07}(OH)_{2.10}F_{0.83}(H_2O)_{4.64}$. (2) $NaZnNb_2Ti[Si_2O_7]_2O(OH)_3(H_2O)_4$.

Mineral Group: Epistolite group.

Occurrence: In a hydrothermally-altered peralkaline pegmatite lens in a peripheral part of the ussingite core near its contact with the aegirine-eudialite zone; the pegmatite is part of a larger complex alkaline igneous intrusion. Possibly the product of a cation exchange reaction between epistolite and low-alkali aqueous (late hydrothermal) solutions enriched in Zn^{2+}.

Association: Microcline, sodalite, arfvedsonite, sphalerite, pectolite-sérandite, mangan-neptunite, murmanite, vigrishinite, epistolite, belovite-(Ce), steenstrupine, chkalovite, tugtupite, polylithionite, galenite.

Distribution: From pegmatite #71, Mt. Malyi Punkaruaiv, Lovozero alkaline complex, Kola Peninsula, Russia.

Name: Honors Russian crystallographer, crystal chemist and physicist Boris Borisovich Zvyagin (1921-2002), who was a pioneer and expert in electron diffraction studies of materials.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (# 94140).

References: (1) Pekov, I.V., I.S. Lykova, N.V. Chukanov, V.O. Yapaskurt, D.I. Belakovskiy, A.A. Zolotarev Jr., and N.V. Zubkova (2014) Zvyaginite $NaZnNb_2Ti[Si_2O_7]_2O(OH,F)_3(H_2O)_{4+x}$ ($x < 1$) - a new mineral of the epistolite group from the Lovozero alkaline pluton, Kola Peninsula, Russia. Zap. Ross. Mineral. Obshch., 143(2), 45-63 (in Russian with English abstract). Geol. Ore Deposits, 56(8), 644-656 (in English). (2) (2015) Amer. Mineral., 100, 338-339 (abs. ref. 1).