Ivanyukite-Na $Na_2[Ti_4O_2(OH)_2(SiO_4)_3]\cdot 6H_2O$

Crystal Data: Hexagonal. *Point Group*: 3*m* (*T* Type). Cubic. *Point Group*: $\bar{4}$ 3*m* (*C* type). As mosaic pseudocubic crystals to 2 mm; as rims to 0.5 mm around crystals and polycrystalline aggregates of sitinakite. *Twinning*: Polysynthetic {0001} twins by merohedry (*T* type).

Physical Properties: *Cleavage*: Perfect on {10 $\bar{1}$ 1} (*T* type). *Tenacity*: Brittle. *Fracture*: Stepped. Hardness = ~4 D(meas.) = 2.60 (*C* type); 2.70 (*T* type) D(calc.) = 2.39 (*C* type); 2.58 (*T* type)

Optical Properties: Transparent to translucent. *Color*: Colorless, pale brown (*T* type) or pale orange (*C* type); colorless in thin section. *Streak*: White. *Luster*: Vitreous. *Optical Class*: Uniaxial (+). ω = 1.76(1) ε = 1.85(9) (*T* type). Isotropic. *n* = 1.73(1) (*C* type).

Cell Data: *Space Group*: *R*3*m*. *a* = 10.921(3) *c* = 13.885(4) Z = 3 or *P* $\bar{4}$ 3*m*. 7.856(6) Z = 1

X-ray Powder Pattern: Koashva Quarry, Khibiny Massif, Kola Peninsula, Russia. (*T* type) 7.88 (100), 3.175 (80), 2.607 (70), 3.277 (60), 1.960 (60), 2.730 (50), 2.471 (50)

Chemistry:

	(1)	(2)		(1)	(2)
Na_2O	7.46	5.19	MnO	0.05	0.33
Al_2O_3	0.07	0.21	FeO	0.54	2.17
SiO_2	23.75	25.47	Nb_2O_5	2.99	2.90
K_2O	5.89	6.34	BaO	0.14	
CaO	0.21	0.14	H_2O	19.00	19.15
TiO_2	38.89	37.81	Total	98.99	99.71

(1) Koashva Quarry, Khibiny Massif, Kola Peninsula, Russia; average electron microprobe analysis supplemented by IR spectroscopy, H_2O by the Penfield method; (*T* type) corresponding to $(Na_{1.82}K_{0.95}Ca_{0.03}Ba_{0.01})_{\Sigma=2.81}[(Ti_{3.68}Nb_{0.17}Fe_{0.06}Mn_{0.01})_{\Sigma=3.92}(Si_{2.99}\ Al_{0.01})_{\Sigma=3.00}O_{14.59}(OH)_{1.37}]\cdot 7.29H_2O$. (2) Do.; (*C* type) corresponds to $(Na_{1.17}K_{0.94}Ca_{0.03})_{\Sigma=2.14}[(Ti_{3.32}Fe_{0.21}Nb_{0.15}Mn_{0.03})_{\Sigma=3.71}(Si_{2.97}\ Al_{0.03})_{\Sigma=3.00}\ O_{12.87}(OH)_{2.87}]\cdot 6.01H_2O$.

Polymorphism & Series: *T* and *C* polytypes.

Mineral Group: Pharmacosiderite supergroup, ivanyukite group.

Occurrence: A late-stage, hydrothermal phase in natrolitized microcline-aegirine-sodalite lens in orthoclase-bearing urtite.

Association: Microcline, vinogradovite, sazykinaite-(Y), natrolite, djerfisherite.

Distribution: From the Koashva Quarry, Koashva Mountain, Khibiny Massif, Kola Peninsula, Russia.

Name: Honors Gregory Yur'evich *Ivanyuk*, Russian mineralogist and petrologist, head of the Laboratory of Self-Organized Mineral Systems, Geological Institute, Kola Science Center, Russian Academy of Sciences, for his contributions to the petrology and mineralogy of banded iron-formations, and alkaline and alkaline-ultrabasic massifs. The suffix indicates the dominant extra-framework cation, *Na*.

Type Material: Geological and Mineralogical Museum, Geological Institute, Kola Science Center, Russian Academy of Sciences, Apatity, Russia (6353 and 6355).

References: (1) Yakovenchuk, V.N., A.P. Nikolaev, E.A. Selivanova, Y.A. Pakhomovsky, J.A. Korchak, D.V. Spiridonova, O.A. Zalkind, and S.V. Krivovichev (2009) Ivanyukite-Na-*T*, ivanyukite-Na-*C*, ivanyukite-K, and ivanyukite-Cu: New microporous titanosilicates from the Khibiny massif (Kola Peninsula, Russia) and crystal structure of ivanyukite-Na-*T*. Amer. Mineral., 94, 1450-1458.