**Ivanyukite-Na**

\[
\text{Na}_2[\text{TiO}_2(\text{OH})_2(\text{SiO}_4)_3]\cdot6\text{H}_2\text{O}
\]

**Crystal Data:** Hexagonal. *Point Group: 3m (T type).* Cubic. *Point Group: \( \bar{4} 3m \) (C type). As mosaic pseudocubic crystals to 2 mm; as rims to 0.5 mm around crystals and polycrystalline aggregates of sitinakite. *Twinning:* Polysynthetic \{001\} 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 (+). *\( \alpha = 1.76(1)\) *\( \varepsilon = 1.85(9)\) (T type). *Isotropic.* \( n = 1.73(1)\) (C type).

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

**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:**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{Na}_2\text{O} )</td>
<td>7.46</td>
<td>5.19</td>
<td>( \text{MnO} )</td>
<td>0.05</td>
<td>0.33</td>
</tr>
<tr>
<td>( \text{Al}_2\text{O}_3 )</td>
<td>0.07</td>
<td>0.21</td>
<td>( \text{FeO} )</td>
<td>0.54</td>
<td>2.17</td>
</tr>
<tr>
<td>( \text{SiO}_2 )</td>
<td>23.75</td>
<td>25.47</td>
<td>( \text{Nb}_2\text{O}_5 )</td>
<td>2.99</td>
<td>2.90</td>
</tr>
<tr>
<td>( \text{K}_2\text{O} )</td>
<td>5.89</td>
<td>6.34</td>
<td>( \text{BaO} )</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>( \text{CaO} )</td>
<td>0.21</td>
<td>0.14</td>
<td>( \text{H}_2\text{O} )</td>
<td>19.00</td>
<td>19.15</td>
</tr>
<tr>
<td>( \text{TiO}_2 )</td>
<td>38.89</td>
<td>37.81</td>
<td>Total</td>
<td>98.99</td>
<td>99.71</td>
</tr>
</tbody>
</table>

(1) Koashva Quarry, Khibiny Massif, Kola Peninsula, Russia; average electron microprobe analysis supplemented by IR spectroscopy, \( \text{H}_2\text{O} \) by the Penfield method; (T type) corresponding to \( (\text{Na}_{1.82}\text{K}_{0.95}\text{Ca}_{0.03}\text{Ba}_{0.01})\cdot2.81[(\text{Ti}_{1.68}\text{Nb}_{0.17}\text{Fe}_{0.06}\text{Mn}_{0.01})\cdot3.92(\text{Si}_{12.99}\text{Al}_{0.01})\cdot2.06\text{O}_{14.96}(\text{OH})_{13.7}]\cdot7.29\text{H}_2\text{O} \).

(2) Do.; (C type) corresponds to \( (\text{Na}_{1.13}\text{K}_{0.94}\text{Ca}_{0.03})\cdot2.14[(\text{Ti}_{1.32}\text{Fe}_{0.21}\text{Nb}_{0.15}\text{Mn}_{0.03})\cdot3.71(\text{Si}_{12.97}\text{Al}_{0.03})\cdot3.00\text{O}_{12.87}(\text{OH})_{2.87}]\cdot6.01\text{H}_2\text{O} \).

**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).