Lemmleinite-Ba $Na_4K_4Ba_{2+x}Ti_8(Si_4O_{12})_4(OH, O)_8 \cdot 8H_2O$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As sheaf-like aggregates of prismatic crystals to 2 cm, showing {001}, {100}, {010} and two other forms.

Physical Properties: *Cleavage*: Imperfect. *Tenacity*: n.d. *Fracture*: n.d. Hardness = 5.5 D(meas.) = 3.03(1) D(calc.) = 3.05(1)

Optical Properties: Transparent. *Color*: Orange to a light coffee-color. *Streak*: White. *Luster*: Vitreous.
Optical Class: Biaxial (+). $\alpha = 1.683(1)$ $\beta = 1.690(2)$ $\gamma = 1.820(5)$ 2V(meas.) = 37(10)º 2V(calc.) = 27(6)º *Orientiation*: $a = Z$, $b = Y$, $c \wedge X = 27°$ in obtuse β. *Dispersion*: Medium, $r > v$. *Pleochroism*: $X = Z$ = colorless, Y = light brown.

Cell Data: *Space Group*: *C*2/*m*. $a = 14.216(2)$ $b = 13.755(3)$ $c = 7.767(5)$ $\beta = 116.7(1)°$ Z = 1

X-ray Powder Pattern: Mt. Kukisvumchorr, Khibiny alkaline massif, Kola Peninsula, Russia. 3.16 (100), 6.31 (28), 6.93 (26), 3.02 (25), 2.577 (25), 3.55 (24), 3.09 (24)

Chemistry:

	(1)		(1)
Na_2O	5.32	Al_2O_3	0.03
K_2O	6.96	SiO_2	38.00
SrO	0.11	ZrO_2	0.11
ZnO	0.09	TiO_2	25.12
BaO	12.63	Nb_2O_5	0.43
FeO	0.38	H_2O	8.02
MgO	0.39	Total	99.17
MnO	1.58		

(1) Mt. Kukisvumchorr, Khibiny alkaline massif, Kola Peninsula, Russia; average electron microprobe analysis, H_2O by TGA; corresponds to $Na_{4.34}K_{3.74}(Ba_{2.08}Sr_{0.03})_{\Sigma=2.11}(\square_{1.07}Mn_{0.56}Mg_{0.24}Fe_{0.13})_{\Sigma=2}[(Ti_{7.94}Nb_{0.08}Zr_{0.02})_{\Sigma=8.04}O_{6.40}(OH)_{1.60}][Si_4O_{12}]_4 \cdot 10.46H_2O$.

Mineral Group: Lemmleinite subgroup of the labuntsovite group.

Occurrence: In alkaline pegmatites in an alkaline massif.

Association: Calcite, strontianite, aegirine, microcline, nepheline (Mt. Kukisvumchorr); kuzmenkoite-Mn, aegirine, mangan-neptunite, chabazite, nontronite (Mt. Karnasurt); microcline, aegirine (Mt. Maly Punkaruaiv).

Distribution: From the Kirovskii mine, Mt. Kukisvumchorr [TL], Khibiny alkaline massif and at Mt. Karnasurt and Mt. Maly Punkaruaiv, Lovozero massif, Kola Peninsula, Russia.

Name: Suffix, *Ba*, refers to the barium-dominance in the D site of a member of the *lemmleinite* subgroup.

Type Material: A.E. Fersman Mineralogical Museum, Moscow, Russia (90235).

References: (1) Chukanov, N.V., I.V. Pekov, R.K. Rastsvetaeva, A.E. Zadov, and V.V. Nedel'ko (2001) Lemmleinite-Ba, $Na_2K_2Ba_{1+x}Ti_4(Si_4O_{12})_2(O,OH)_4 \cdot 5H_2O$, a new mineral of the labuntsovite group. Zap. Vseross. Mineral. Obshch., 130(3), 36-43 (in Russian, English abs.). (2) (2002) Amer. Mineral., 87, 1733-1734 (abs. ref. 1). (3) Chukanov, N.V., I.V. Pekov, and A.P. Khomyakov (2002) Recommended nomenclature for labuntsovite-group minerals. Eur. J. Mineral., 14, 165-173. (4) Pekov, I.V. (2007) New minerals from former Soviet Union countries, 1998-2006. Mineral. Almanac, 11, 31.