Zincobradaczekite $NaCuCuZn_2(AsO_4)_3$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As oblique-angled prismatic crystals to 0.08 mm, sometimes strongly distorted, equant or tabular crystals to 0.05 mm. Crystal surfaces may be rough and ribbed in densely stacked parallel aggregates.

Physical Properties: *Cleavage*: One poor direction. *Tenacity*: Brittle. *Fracture*: Uneven. Hardness = 3.5 D(meas.) = n.d. D(calc.) = 4.713 Visually indistinguishable from bradaczekite.

Optical Properties: Transparent. *Color*: Blue, greenish blue, gray-blue or bluish gray, sometimes with lilac hue. *Streak*: Pale bluish. *Luster*: Vitreous.
Optical Class: Biaxial (-). $\alpha = 1.786(5)$ $\beta = 1.846(8)$ $\gamma = 1.90(1)$ 2V(meas.) = 80(5)º 2V(calc.) = 84º *Orientation*: $Y = b$ (by analogy within alluaudite-group arsenates). *Dispersion*: Strong, $r > v$. *Pleochroism*: Strong: Z = deep green, Y = grayish to bluish green, X = pinkish violet. *Absorption*: $Z > Y > X$.

Cell Data: *Space Group*: *C*2/*c*. $a = 12.0375(13)$ $b = 12.4500(13)$ $c = 7.2213(8)$ $\beta = 117.506(7)$º Z = 4

X-Ray Diffraction Pattern: Yadovitaya fumarole, Tolbachik volcano, Kamchatka, Russia. 2.691 (100), 3.416 (70), 6.21 (31), 2.779 (23), 1.841 (20), 3.200 (17), 1.680 (14)

Chemistry:

	(1)	(2)		(1)	(2)
Na_2O	4.07	4.44	Fe_2O_3	0.90	
K_2O	0.53		TiO_2	0.03	
CaO	0.01		P_2O_5	0.41	
MgO	0.71		V_2O_5	1.05	
MnO	0.01		As_2O_5	47.10	49.42
CuO	19.89	22.81	SO_3	1.01	.
ZnO	24.21	23.33	Total	99.95	100.00
Al_2O_3	0.02				

(1) Yadovitaya fumarole, Tolbachik volcano, Kamchatka, Russia; average electron microprobe analysis supplemented by Raman spectroscopy; corresponding to $Na_{0.90}K_{0.08}Cu_{1.70}Mg_{0.12}Zn_{2.03}Fe^{3+}_{0.08}(As_{2.79}S_{0.09}V_{0.08}P_{0.04})_{\Sigma=3.00}O_{12}$. (2) $NaCuCuZn_2(AsO_4)_3$.

Polymorphism & Series: Forms an isomorphous series with Mg-poor bradaczekite.

Mineral Group: Alluaudite supergroup, alluaudite group - arsenates.

Occurrence: A sublimate in active volcanic fumaroles.

Association: Bradaczekite, lammerite, lammerite-β, borisenkoite, mcbirneyite, sanidine, hematite, tenorite, pseudolyonsite, lyonsite, starovaite, rutile, tripuhyite, pseudobrookite, piypite, langbeinite, calciolangbeinite, aphthitalite, alumoklyuchevskite, palmierite.

Distribution: From the Yadovitaya fumarole, Second scoria cone, Northern Breakthrough of the Great Tolbachik Fissure Eruption, Tolbachik volcano, Kamchatka, Russia.

Name: Indicates the zincian analogue of *bradaczekite*.

Type Material: A.E. Fersman Mineralogical Museum, RAS, Moscow, Russia (95617).

References: (1) Pekov, I.V., I. Lykova, N.N. Koshlyakova, D.I. Belakovskiy, M.F. Vigasina, A.G. Turchkova, S.N. Britvin, E.G. Sidorov, and K.S. Scheidl (2020) A new mineral species zincobradaczekite, $NaCuCuZn_2(AsO_4)_3$, and a new isomorphous series bradaczekite-zincobradaczekite in the alluaudite group. Physics and Chemistry of Minerals 47, 36, 1-12.
(2) Hatert, F. (2019) A new nomenclature scheme for the alluaudite supergroup. Eur. J. Mineral., 31, 807-822.