

Crystal Data: Monoclinic. *Point Group:* 2/m. As prismatic crystals to 1 cm in bunches, sheaf-like or radial aggregates, typically in crusts.

Physical Properties: *Cleavage:* Imperfect. *Tenacity:* Brittle. *Fracture:* Uneven. Hardness = ~3.5 D(meas.) = n.d. D(calc.) = 3.915

Optical Properties: Transparent. *Color:* Colorless, pale green, pale yellow, light blue, pale lilac or pink. *Streak:* White. *Luster:* Vitreous.

Optical Class: Biaxial (-). $\alpha = 1.719(3)$ $\beta = \gamma = 1.732(3)$ $2V(\text{meas.}) = 15(10)^\circ$ $2V(\text{calc.}) = 0^\circ$
Dispersion: Medium, $r > v$. *Orientation:* $Y = b$.

Cell Data: *Space Group:* C2/c. $a = 11.8405(3)$ $b = 12.7836(2)$ $c = 6.69165(16)$ $\beta = 112.425(3)^\circ$
 $Z = 4$

X-Ray Diffraction Pattern: Arsenatnaya fumarole, Tolbachik Volcano, Russia.
2.758 (100), 2.735 (25), 3.220 (19), 2.910 (17), 3.509 (16), 1.661 (16), 2.620 (12)

Chemistry:	(1)	(2)		(1)	(2)
Na ₂ O	7.32	5.61	Fe ₂ O ₃	3.53	
K ₂ O	0.10		TiO ₂	0.01	
CaO	6.82	10.15	SiO ₂	0.03	
MgO	20.31	21.87	P ₂ O ₅	1.25	
MnO	0.68		V ₂ O ₅	0.10	
CuO	0.27		As ₂ O ₅	58.77	62.37
ZnO	0.02		SO ₃	0.13	
Al ₂ O ₃	0.56		Total	99.90	100.00

(1) Arsenatnaya fumarole, Tolbachik Volcano, Kamchatka, Russia; average electron microprobe analysis supplemented by Raman spectroscopy; corresponds to (Na_{1.30}K_{0.01}Ca_{0.67}Mg_{2.78}Mn_{0.05}Cu_{0.02}Al_{0.06}Fe³⁺_{0.24}) $\Sigma=5.13$ (As_{2.83}P_{0.10}S_{0.01}V_{0.01}) $\Sigma=2.95$ O₁₂. (2) NaCaMgMg₂(AsO₄)₃.

Mineral Group: Alluaudite supergroup, alluaudite group - arsenates.

Occurrence: A sublimate at an active volcanic fumarole.

Association: Hematite, tenorite, johillerite, nickenichite, bradaczekite, hatertite, magnesiohatertite, badalovite, apthitalite-group sulfates, langbeinite, calciolangbeinite, sanidine (As-bearing variety), fluorophlogopite, fluoborite, tilasite, anhydrite, pseudobrookite, rutile, sylvite, halite, lammerite, lammerite- β , urusovite, ericlxmanite, kozyrevskite, arsmirandite, svabite, popovite, dmisokolovite, shchurovskyite, yurmarinite, krashennnikovite, euchlorine, wulffite, alumoklyuchevskite, sellaitite, gahnite, corundum (shallow zone); badalovite, fluorophlogopite, sanidine, diopside, hematite, cassiterite, anhydrite, metathénardite, belomarinaite, sylvite, tilasite, svabite, arsenowagnerite (medium zone); anhydrite, diopside, hematite, svabite, berzeliite, schäferite, forsterite, magnesioferrite, ludwigite, rhabdobarite-group fluoroborates, powellite, baryte, fluorapatite, udinaite, arsenudinaite, paraberzeliite (deep zone).

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

Name: The prefix, *calcio*, identifies the calcium analogue of *johillerite*.

Type Material: A.E. Fersman Mineralogical Museum, RAS, Moscow, Russia (95621).

References: (1) Pekov, I.V., N.N. Koshlyakova, A.A. Agakhanov, N.V. Zubkova, D.I. Belakovskiy, M.F. Vlgasina, A.G. Turchkova, E.G. Sidorov, and D.Y. Pushcharovsky (2021) New arsenate minerals from the Arsenatnaya fumarole, Tolbachik volcano, Kamchatka, Russia. XV. Calciojohillerite, NaCaMgMg₂(AsO₄)₃, a member of the alluaudite group. Mineral. Mag., 85, 215-223.