

Obradovicite-NaCu

Crystal Data: Orthorhombic. *Point Group:* 2/m 2/m 2/m. Typically, as doubly terminated, bladed crystals, flattened on {001} and elongated parallel to [010], to ~0.1 mm. Forms include {001}, {110} and {101} with the {001} faces striated parallel to [010]. *Twinning:* None observed.

Physical Properties: *Cleavage:* None. *Tenacity:* Brittle. *Fracture:* Splintery. Hardness = ~2 D(meas.) = n.d. D(calc.) = 2.967

Optical Properties: Transparent. *Color:* Yellowish green. *Streak:* Very pale yellowish green. *Luster:* Vitreous to subadamantine.

Optical Class: Biaxial (-). $\alpha = 1.790(3)$ $\beta = 1.798(3)$ $\gamma(\text{calc.}) = 1.805$ $2V(\text{meas.}) = 86(5)^\circ$
Pleochroism: None. *Orientation:* $X = a$; $Y = b$; $Z = c$. *Dispersion:* Strong, $r > v$.

Cell Data: *Space Group:* Pnmb. $a = 14.872(4)$ $b = 11.091(3)$ $c = 15.032(4)$ $Z = 2$

X-ray Powder Pattern: Chuquicamata mine, Antofagasta, Chile.

8.936 (100), 10.483 (43), 2.989 (29), 3.226 (25), 2.980 (25), 2.598 (23), 2.773 (22)

Chemistry:

	(1)
Na ₂ O	2.97
K ₂ O	3.66
CaO	0.16
CuO	2.07
Fe ₂ O ₃	11.64
Al ₂ O ₃	0.01
SiO ₂	0.02
P ₂ O ₅	0.23
As ₂ O ₅	9.16
MoO ₃	51.97
H ₂ O	[18.11]
Total	100.00

(1) Chuquicamata mine, Antofagasta, Chile; normalized electron microprobe analysis, H₂O calculated; corresponds to [(Na_{1.99}K_{1.72}) $\Sigma=3.71$ (H₂O)_{15.29}(Cu²⁺_{0.58}Fe³⁺_{0.23}Na_{0.13}Ca_{0.06}) $\Sigma=1.00$ (H₂O)₆][Mo₈(As_{1.77}P_{0.07}Si_{0.01}) $\Sigma=1.85$ Fe³⁺_{3.00}O_{35.05}(OH)_{1.95}].

Mineral Group: Betpakdalite supergroup, obradovicite group.

Occurrence: A rare secondary mineral in the oxidized zone of a Cu-Mo porphyry deposit, in sugary aggregates intermixed with fragmented quartz crystals embedded in a porous boxwork.

Association: Obradovicite-KCu, quartz, hematite, goethite.

Distribution: From Chuquicamata, Antofagasta, Chile [TL].

Name: Honors Martin T. *Obradovic*, who provided the studied material. Two suffixes correspond to the dominant cations in the two different types of non-framework cation sites.

Type Material: Colorado School of Mines, Golden, Colorado (CSM 86-496); National Museum of Natural History, Washington, D.C. (164185), USA.

References: (1) Finney, J.J., S.A. Williams, and R.D. Hamilton (1986) Obradovicite, a new complex arsenate-molybdate from Chuquicamata, Chile. *Mineral. Mag.*, 50, 283-284. (2) (1987) *Amer. Mineral.*, 72, 1026 (abs. ref. 1). (3) Kampf, A.R., S.J. Mills, M.S. Rumsey, M. Dini, W.D. Birch, J. Spratt, J.J. Pluth, I.M. Steele, R.A. Jenkins, and W.W. Pinch (2012) The heteropolymolybdate family: structural relations, nomenclature scheme and new species. *Mineral. Mag.*, 76, 1175-1207.