

Crystal Data: Monoclinic. *Point Group:* $2/m$. Crystals, to 2 mm, are prismatic along [001] to tabular on {100} and terminated by {011}; additional forms include {010} and striated {120}; in radial spheroidal aggregates.

Physical Properties: *Cleavage:* Perfect on {010}; good on {100}; imperfect on {001}. Hardness = 3.5–4 D(meas.) = 4.9–5.18 D(calc.) = 5.263

Optical Properties: Transparent. *Color:* Dark green. *Streak:* Pale green. *Luster:* Adamantine, vitreous on cleavage surfaces.

Optical Class: Biaxial (+). *Pleochroism:* Strong; X = pale blue; Y = sky-blue; Z = pale bluish green. *Orientation:* X = b; Z $\wedge$ c $\simeq$ 40°. *Dispersion:* $r \gg v$, very strong. $\alpha = \sim 1.89$ $\beta = 1.90$ –2.06 $\gamma = 1.95$ –2.14 2V(meas.) = 54(5)° 2V(calc.) = 50°

Cell Data: *Space Group:* $P2_1/a$. $a = 5.079(1)$ $b = 11.611(2)$ $c = 5.394(1)$ $\beta = 111.72(2)^\circ$ Z = 2

X-ray Powder Pattern: Laurani, Bolivia. 2.89 (10), 2.52 (9), 3.06 (8), 3.00 (8), 2.62 (8), 2.59 (8), 2.84 (7)

Chemistry:

	(1)	(2)
As ₂ O ₅	49.8	32.64
P ₂ O ₅		12.40
FeO	0.2	0.06
CuO	49.9	54.64
ZnO	0.8	0.11
MgO	0.2	
Total	100.9	99.85

(1) Laurani, Bolivia; by electron microprobe, absence of (OH)¹⁻ and H₂O confirmed by IR; corresponding to (Cu_{2.90}Zn_{0.05}Mg_{0.02}Fe_{0.01})_{Σ=2.98}(As_{1.00}O₄)₂. (2) Tolbachik fissure volcano, Russia; by electron microprobe, corresponding to (Cu_{2.96}Zn_{0.01})_{Σ=2.97}[(As_{0.62}P_{0.38})_{Σ=1.00}O₄]₂.

Occurrence: On an old mineral specimen (Laurani, Bolivia); in an oxidized zone in a dolostone-hosted hydrothermal polymetallic ore deposit (Tsumeb, Namibia); in volcanic sublimates (Tolbachik fissure volcano, Russia).

Association: Olivenite (Laurani, Bolivia); chalcantite, anhydrite, leightonite (Tsumeb, Namibia); euchlorine, melanothallite, dolerophanite, chalcocyanite, leningradite, tolbachite, anglesite, alarsite, fedotovite, klyuchevskite, nabokoite, atlasovite, langbeinite, hematite, tenorite (Tolbachik fissure volcano, Russia).

Distribution: From Laurani, Oruro, Bolivia. At Tsumeb, Namibia. From the Tolbachik fissure volcano, Kamchatka Peninsula, Russia.

Name: Honors Franz Lammer, mineral collector of Leoben, Austria, who provided the first specimen.

Type Material: Institute for Mineralogy and Crystal Chemistry, University of Stuttgart, Stuttgart, Germany; The Natural History Museum, London, England, 1980,357; Harvard University, Cambridge, Massachusetts, 117006; National Museum of Natural History, Washington, D.C., USA, 146966, 148264.

References: (1) Keller, P., W.H. Paar, and P.J. Dunn (1981) Lammerit, Cu₃[AsO₄]₂, ein neues Mineral von Laurani, Bolivien. *Tschermaks Mineral. Petrog. Mitt.*, 28, 157–164 (in German with English abs.). (2) (1982) *Amer. Mineral.*, 67, 415 (abs. ref. 1). (3) Hawthorne, F.C. (1986) Lammerite, Cu₃(AsO₄)₂, a modulated close-packed structure. *Amer. Mineral.*, 71, 206–209. (4) Filatov, S.K., I.M. Gaykamako, S.F. Glavatskikh, G.L. Starova, and N.D. Sorokin (1984) Lammerite, Cu₃[(As,P)O₄]₂ from Kamchatka volcanic exhalations. *Doklady Acad. Nauk SSSR*, 279, 197–200 (in Russian).

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