

Luetheite

$\text{Cu}_2\text{Al}_2(\text{AsO}_4)_2(\text{OH})_4 \cdot \text{H}_2\text{O}$

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Crystal Data: Monoclinic, pseudo-orthorhombic. *Point Group:* $2/m$. As thin-bladed crystals showing prominent {100}, with {140}, {011}, to 0.2 mm; generally in spherulitic aggregates. *Twinning:* Observed during crystal structure refinement, at a very fine scale.

Physical Properties: *Cleavage:* On {100}, fair to good. *Tenacity:* Brittle, slightly flexible. Hardness = 3 D(meas.) = 4.28(5) D(calc.) = 4.40

Optical Properties: Semitransparent. *Color:* Blue, pale green on alteration, may be tan. *Streak:* White.

Optical Class: Biaxial (+). *Pleochroism:* Faint; in pale blues. *Orientation:* $X = b$; $Z \wedge c \simeq 10^\circ$. *Dispersion:* $r < v$; moderate. *Absorption:* $Y = Z > X$. $\alpha = 1.752$ $\beta = 1.773$ $\gamma = 1.796$ $2V(\text{meas.}) = \text{n.d.}$ $2V(\text{calc.}) = 88^\circ$

Cell Data: *Space Group:* $P2_1/m$ or $P2_1/a$. $a = 14.743$ $b = 5.093$ $c = 5.598$
 $\beta = 101^\circ 49'$ $Z = 2$

X-ray Powder Pattern: Patagonia district, Arizona, USA.
3.498 (10), 7.21 (7), 2.507 (5), 1.803 (5), 1.270 (4), 2.546 (3), 2.454 (3)

Chemistry:	(1)	(2)
As ₂ O ₅	41.7	42.18
Al ₂ O ₃	18.9	18.71
CuO	29.8	29.19
H ₂ O	9.6	9.92
Total	[100.0]	100.00

(1) Patagonia district, Arizona, USA; by microchemical methods, Cu by AA, H₂O by the Penfield method, recalculated to 100% from a total of 97.1% averaged from several analyses; corresponds to $\text{Cu}_{1.98}\text{Al}_{1.95}(\text{AsO}_4)_{1.97}(\text{OH})_{3.91} \cdot 0.87\text{H}_2\text{O}$. (2) $\text{Cu}_2\text{Al}_2(\text{AsO}_4)_2(\text{OH})_4 \cdot \text{H}_2\text{O}$.

Mineral Group: Forms a series with chenevixite.

Occurrence: A rare mineral filling cavities in intensely altered volcanic rock (Patagonia district, Arizona, USA); in the oxidized zone of a copper deposit (Majuba Hill, Nevada, USA).

Association: Chenevixite, cornubite (Patagonia district, Arizona, USA); pharmacosiderite, arthurite, scorodite, chenevixite, zeunerite (Majuba Hill, Nevada, USA).

Distribution: In the USA, from a prospect about 2.7 km southeast of the Flux mine, Patagonia district, Santa Cruz Co., Arizona; at the Majuba Hill mine, Antelope district, Pershing Co., Nevada. From the Bali Lo copper prospect, 11 km west-southwest of Ashburton Downs homestead, Capricorn Range, Western Australia.

Name: Honors Ronald D. Luethe (1944–), geologist for Phelps Dodge Corporation, Douglas, Arizona, USA, who found the first material.

Type Material: The Natural History Museum, London, England, 1980,536; Harvard University, Cambridge, Massachusetts, 119098; National Museum of Natural History, Washington, D.C., USA, 135810.

References: (1) Williams, S.A. (1977) Luetheite, $\text{Cu}_2\text{Al}_2(\text{AsO}_4)_2(\text{OH})_4 \cdot \text{H}_2\text{O}$, a new mineral from Arizona, compared with chenevixite. *Mineral. Mag.*, 41, 27–32. (2) (1977) *Amer. Mineral.*, 62, 1058 (abs. ref. 1). (3) Burns, P.C., J.V. Smith, and I.M. Steele (2000) Arizona porphyry copper/hydrothermal deposits. I. The structure of chenevixite and luetheite. *Mineral. Mag.*, 64, 25–30.

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