

Bernalite**Fe(OH)₃·nH₂O** (n = 0.0 to 0.25)

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Crystal Data: Orthorhombic, pseudocubic. *Point Group:* 2/m 2/m 2/m. As flattened pyramidal crystals and pseudo-octahedra, to 3 mm, with slightly concave faces.

Twinning: Polysynthetic, crosshatched, observed in thin section, probably pinacoidal.

Physical Properties: *Fracture:* Uneven to conchoidal. *Tenacity:* Brittle. *Hardness* = 4
D(meas.) = 3.32(2) D(calc.) = 3.35

Optical Properties: Transparent to opaque due to goethite inclusions. *Color:* Dark bottle-green to yellow-green; in thin section, yellowish bottle-green. *Streak:* Apple-green.

Luster: Vitreous to adamantine when fresh; resinous on crystal surfaces.

Optical Class: Biaxial. *n* = 1.92–1.94 2*V*(meas.) = n.d.

Cell Data: *Space Group:* *Pmmn*, probable, or *Immm*, possible. *a* = 7.544(2)
b = 7.560(4) *c* = 7.558(2) *Z* = 8

X-ray Powder Pattern: Broken Hill, Australia.

3.784 (100), 1.692 (17), 2.393 (16), 2.676 (15), 1.892 (10), 1.545 (9), 2.023 (6)

Chemistry:

	(1)
SiO ₂	2.99
Fe ₂ O ₃	65.53
ZnO	1.13
PbO	2.70
H ₂ O	25.2
CO ₂	1.0
Total	98.55

(1) Broken Hill, Australia; by electron microprobe, average of eight analyses, Fe³⁺ confirmed by Mössbauer spectroscopy, H₂O and CO₂ by CHN analyzer; corresponds to (Fe_{0.93}³⁺Si_{0.06}Zn_{0.01})_{Σ=1.00}[(OH)_{2.95}O_{0.04}]_{Σ=2.99}·[(H₂O)_{0.04}(CO₂)_{0.03}Pb_{0.01}]_{Σ=0.08}.

Occurrence: On a museum specimen from a metamorphosed Pb–Zn deposit, probably from the surface oxidation zone.

Association: Goethite, coronadite.

Distribution: From the Proprietary mine, Broken Hill, New South Wales, Australia.

Name: To honor John Desmond Bernal (1901–1971), eminent British crystallographer and historian of science.

Type Material: Museum Victoria, Melbourne; South Australian Museum, Adelaide, Australia, G17627.

References: (1) Birch, W.D., A. Pring, A. Reller, and H.W. Schmalte (1993) Bernalite, Fe(OH)₃, a new mineral from Broken Hill, New South Wales: description and structure. *Amer. Mineral.*, 78, 827–834. (2) McCammon, C.A., A. Pring, H. Keppler, and T. Sharp (1995) A study of bernalite, Fe(OH)₃, using Mössbauer spectroscopy, optical spectroscopy and transmission electron microscopy. *Phys. Chem. Minerals*, 22, 11–20.