

Birchite**Cd₂Cu₂(PO₄)₂(SO₄)·5H₂O**

Crystal Data: Orthorhombic. *Point Group:* 2/m 2/m 2/m. As bladed to prismatic or acicular crystals, to 0.3 mm, elongated along [001] and sometimes flattened on (100). Forms are major {100} and {010}, and minor {101} and {001}; as sprays and aggregates of crystals to 0.75 mm.

Physical Properties: *Cleavage:* None observed. *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = 3.5-4 D(meas.) = 3.61(4) D(calc.) = 3.647 Non-fluorescent.

Optical Properties: Translucent (masses) to transparent (crystals). *Color:* Pale blue. *Streak:* White. *Luster:* Vitreous.

Optical Class: Biaxial (+). $\alpha = 1.624(4)$ $\beta = 1.636(5)$ $\gamma = 1.669(4)$ $2V(\text{calc.}) = 63^\circ$

Orientation: $X = b$, $Y = a$, $Z = c$; the optical axis plane lies within (100).

Pleochroism: Very faint, $X =$ pale bluish, $Z =$ pale greenish. *Absorption:* $Z \geq X$.

Cell Data: *Space Group:* *Pnma*. $a = 10.4768(8)$ $b = 20.8938(14)$ $c = 6.1640(3)$ $Z = 4$

X-ray Powder Pattern: Block 14 Opencut, Broken Hill, New South Wales, Australia. 10.451 (100), 1.919 (80), 2.902 (70), 3.484 (39), 4.223 (38), 2.719 (33), 2.652 (32)

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| Chemistry: | (1) |
| CdO | 36.79 |
| CuO | 21.22 |
| CaO | 0.17 |
| MnO | 0.17 |
| ZnO | 1.07 |
| P ₂ O ₅ | 20.21 |
| SO ₃ | 9.70 |
| <u>H₂O</u> | <u>[12.37]</u> |
| Total | 101.70 |

(1) Block 14 Opencut, Broken Hill, New South Wales, Australia; average of 13 electron microprobe analyses, H₂O calculated from crystal structure analysis; corresponding to (Cu_{1.94}Zn_{0.10}) $\Sigma=2.04$ (Cd_{2.09}Ca_{0.02}Mn_{0.02}) $\Sigma=2.13$ P_{2.07}S_{0.88}O₁₂·5H₂O.

Occurrence: A late-stage supergene mineral formed in small cavities and thin seams as part of a suite of secondary phosphate minerals under low-temperature condition in an intensely deformed and metamorphosed stratiform base metal deposit of submarine exhalative origin. In a quartz-garnet matrix with abundant disseminated corroded masses of galena, fluorapatite, chalcopyrite and covellite.

Association: Hinsdalite-plumbogummite, cerussite, anglesite, pyromorphite, libethenite, sampleite.

Distribution: From the Block 14 Opencut, Broken Hill, New South Wales, Australia.

Name: Honors William D. *Birch*, Senior Curator of Geosciences, Museum Victoria, Australia, for his contributions to Australian geological sciences, and his service to several professional organizations.

Type Material: Department of Mineralogy, South Australian Museum, Adelaide, South Australia (G30968).

References: (1) Elliott, P., J. Brugger, A. Pring, M.L. Cole, A.C. Willis, and U. Kolitsch (2008) Birchite, a new mineral from Broken Hill, New South Wales, Australia: Description and structure refinement. *Amer. Mineral.*, 93, 910-917.