

# Hexahydroborite

# Ca[B(OH)<sub>4</sub>]<sub>2</sub>•2H<sub>2</sub>O

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**Crystal Data:** Monoclinic. *Point Group:* 2/*m*. As flattened prismatic crystals, to 2 mm.

**Physical Properties:** *Cleavage:* Two || elongation, perfect; another ⊥ elongation, imperfect. Hardness = ~2.5 D(meas.) = 1.84–1.87 D(calc.) = 1.88 Photoluminescent in shades of pale blue.

**Optical Properties:** Transparent. *Color:* Colorless; develops a pale blue tarnish on exposure. *Luster:* Vitreous.

*Optical Class:* Biaxial (+). *Orientation:*  $X \wedge c = 14^\circ$ . *Dispersion:*  $r > v$ , very strong.

$\alpha = 1.498\text{--}1.502$   $\beta = 1.503\text{--}1.505$   $\gamma = 1.510\text{--}1.509$  2V(meas.) = 83°

**Cell Data:** *Space Group:* *P2/a*.  $a = 8.006(2)$   $b = 6.649(2)$   $c = 8.012(2)$   $\beta = 104.21(2)^\circ$   $Z = 2$

**X-ray Powder Pattern:** Solongo deposit, Russia.

7.73 (10), 3.37 (9b), 3.118 (9), 2.550 (9), 2.792 (8), 2.469 (8), 2.283 (8)

## Chemistry:

|                               | (1)      | (2)    |
|-------------------------------|----------|--------|
| B <sub>2</sub> O <sub>3</sub> | 28.50    | 29.78  |
| MgO                           | 0.51     |        |
| CaO                           | 25.03    | 23.99  |
| H <sub>2</sub> O              | 45.96    | 46.23  |
| Total                         | [100.00] | 100.00 |

(1) Solongo deposit, Russia; (OH)<sup>1-</sup> and H<sub>2</sub>O confirmed by IR, recalculated to 100% after deduction of diopside and calcite impurities from an original total of 101.30%; then corresponds to (Ca<sub>1.04</sub>Mg<sub>0.03</sub>)<sub>Σ=1.07</sub>B<sub>1.91</sub>(OH)<sub>7.87</sub>•2.02H<sub>2</sub>O. (2) Ca[B(OH)<sub>4</sub>]<sub>2</sub>•2H<sub>2</sub>O.

**Occurrence:** A rare component of boron-enriched skarn deposits in metasomatized limestones.

**Association:** Pentahydroborite, frolovite, kurchatovite, sakhaite (Solongo deposit, Russia); olshanskyite, calcite (Fuka, Japan).

**Distribution:** From the Solongo boron deposit, Buryatia, Russia. At the Sayak-IV boron deposit, northeast Balkhash region, Kazakhstan. From Fuka, near Bicchu, Okayama Prefecture, Japan.

**Name:** For the composition, originally thought to contain six waters of hydration (later found by crystal-structure analysis to be incorrect).

**Type Material:** Russian Institute of Mineral Resources, Moscow; Moscow University, Moscow; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 80438.

**References:** (1) Simonov, M.A., S.V. Malinko, N.V. Belov, Y.V. Kazanskaya, Y.K. Yegorov-Tismenko, M.B. Fedorenko, Y.L. Belokoneva, N.A. Yamnova, and N.N. Kuznetsova (1977) Hexahydroborite – a new mineral, Ca[B(OH)<sub>4</sub>]<sub>2</sub>•2H<sub>2</sub>O. Zap. Vses. Mineral. Obshch., 106, 691–697 (in Russian). (2) (1978) Amer. Mineral., 63, 1283 (abs. ref. 1). (3) Simonov, M.A., N.A. Yamnova, E.V. Kazanskaya, Y.K. Yegorov-Tismenko, and N.V. Belov (1976) Crystal structure of a new natural calcium borate, hexahydroborite, CaB<sub>2</sub>O<sub>4</sub>•6H<sub>2</sub>O = Ca[B(OH)<sub>4</sub>]<sub>2</sub>•2H<sub>2</sub>O. Doklady Acad. Nauk SSSR, 228, 1337–1340 (in Russian). (4) Kusachi, I., Y. Takechi, S. Kobayashi, J. Yamakawa, Y. Nakamuta, K.-H. Lee, and S. Motomizu, (1999) Hexahydroborite from Fuka, Okayama Prefecture, Japan. Mineral. J. (Japan), 21, 9–14.