Hexahydroborite $Ca[B(OH)_4]_2 \cdot 2H_2O$

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:* $X \wedge c = 14°$. *Dispersion:* $r > v$, very strong.
$\alpha = 1.498–1.502$ $\beta = 1.503–1.505$ $\gamma = 1.510–1.509$ 2V(meas.) = 83°

Cell Data: *Space Group:* $P2/a$. $a = 8.006(2)$ $b = 6.649(2)$ $c = 8.012(2)$ $\beta = 104.21(2)°$
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_2O_3	28.50	29.78
MgO	0.51	
CaO	25.03	23.99
H_2O	45.96	46.23
Total	[100.00]	100.00

(1) Solongo deposit, Russia; $(OH)^{1-}$ and H_2O confirmed by IR, recalculated to 100% after deduction of diopside and calcite impurities from an original total of 101.30%; then corresponds to $(Ca_{1.04}Mg_{0.03})_{\Sigma=1.07}B_{1.91}(OH)_{7.87} \cdot 2.02H_2O$. (2) $Ca[B(OH)_4]_2 \cdot 2H_2O$.

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, $Ca[B(OH)_4]_2 \cdot 2H_2O$. 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, $CaB_2O_4 \cdot 6H_2O = Ca[B(OH)_4]_2 \cdot 2H_2O$. 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.