Borcarite $Ca_4MgB_4O_6(CO_3)_2(OH)_6$

Crystal Data: Monoclinic. *Point Group:* $2/m$. As euhedral crystals, to 5 mm; in subparallel growths, dense massive, and in veins.

Physical Properties: *Cleavage:* Perfect on {100} and {110}; others on {hkl} and {$h0l$}. Hardness = 4–4.5 D(meas.) = 2.77–2.56 D(calc.) = 2.790

Optical Properties: Semitransparent. *Color:* Greenish blue to bluish green, pale brown, may be nearly colorless; colorless in thin section. *Luster:* Vitreous, slightly pearly on cleavages. *Optical Class:* Biaxial (–). *Orientation:* $Z = b$; $Y \wedge c = 28(4)°$. *Dispersion:* $r < v$, noticeable. $\alpha = 1.590–1.594$ $\beta = 1.632–1.653$ $\gamma = 1.641–1.660$ 2V(meas.) = 30(2)° 2V(calc.) = 20°

Cell Data: *Space Group:* $C2/m$. $a = 17.840(4)$ $b = 8.380(2)$ $c = 4.445(1)$ $\beta = 102.04(3)°$ Z = 2

X-ray Powder Pattern: Snezhnoye deposit, Russia.
7.57 (10), 2.67 (10), 1.886 (10), 2.91 (9), 2.27 (9), 2.21 (9), 1.610 (9)

Chemistry:

	(1)	(2)	(3)
CO_2	15.64	16.65	16.12
B_2O_3	24.77	25.38	25.51
Al_2O_3	0.26		
Fe_2O_3	0.02		
FeO	0.46	1.17	
MgO	7.40	6.02	7.38
CaO	41.31	40.50	41.09
Cl	0.00		
H_2O^+	10.20	10.06	9.90
H_2O^-	0.07	0.20	
Total	100.13	99.98	100.00

(1) Snezhnoye deposit, Russia; average of two analyses. (2) Fuka, Japan; by electron microprobe, B by ICP, CO_2 and H_2O by CHNS analyzer; borate, CO_3^{2-}, and $(OH)^{1-}$ confirmed by IR; corresponds to $Ca_{3.94}(Mg_{0.82}Fe_{0.09})_{\Sigma=0.91}B_{3.98}O_{5.70}(CO_3)_{2.01}(OH)_{6.10}$.
(3) $Ca_4MgB_4O_6(CO_3)_2(OH)_6$.

Occurrence: In kotoite marbles, near the contact with granodiorite (Snezhnoye deposit, Russia); a rare secondary mineral probably formed by reaction of late hydrothermal fluids with brucite (Fuka, Japan).

Association: Szaibélyite, uralborite, sibirskite, kotoite, magnetite, spinel, calcite (Snezhnoye deposit, Russia); olshanskyite, bultfonteinite, takedaite, calcite (Fuka, Japan).

Distribution: In Russia, from the Snezhnoye boron deposit, Izvestkovyi stream, Tas-Khayakhtakh Range, Polar Ural Mountains, and in the Solongo boron deposit, Buryatia, Siberia. At Fuka, near Bicchu, Okayama Prefecture, Japan.

Name: For BORate and CARbonate in the composition.

Type Material: Vernadsky Geological Museum, Moscow, 48151; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 68747, 68748.

References: (1) Pertzev, N.N., I.V. Ostrovskaya, and I.B. Nikitina (1965) The new mineral borcarite. Zap. Vses. Mineral. Obshch., 94, 180–186 (in Russian). (2) (1965) Amer. Mineral., 50, 2097 (abs. ref. 1). (3) (1965) Mineral. Abs., 17, 398 (abs. ref. 1). (4) Burns, P.C. and F.C. Hawthorne (1995) Hydrogen bonding in borcarite, an unusual borate-carbonate mineral. Mineral. Mag., 59, 297–304. (5) Kusachi, I., Y. Takechi, C. Henmi, and S. Kobayashi (1997) Borcarite from Fuka, Okayama Prefecture, Japan. Mineral. J. (Japan), 19, 115–122. (6) Pekov, I.V. (1998) Minerals first discovered on the territory of the former Soviet Union. Ocean Pictures, Moscow, 44–45.