Frolovite $CaB_2(OH)_8$

Crystal Data: Triclinic. *Point Group:* $\overline{1}$. As veinlets and dense aggregates of grains, to 0.15 mm.

Physical Properties: *Tenacity:* Brittle. Hardness = 3.5 VHN = 151–181, 168 average (25 g load). D(meas.) = 2.14–2.22 D(calc.) = 2.259 Violet cathodoluminescence.

Optical Properties: Opaque, translucent through thin edges. *Color:* White, with a grayish tint; colorless in transmitted light. *Luster:* Vitreous to dull.
Optical Class: Biaxial (+). $\alpha = 1.572$ $\beta = 1.573$ $\gamma = 1.586$ 2V(meas.) = ∼75°

Cell Data: *Space Group:* $P\overline{1}$. $a = 7.774(2)$ $b = 5.680(1)$ $c = 8.136(2)$ $\alpha = 113.15(1)°$ $\beta = 101.67(2)°$ $\gamma = 107.87(2)°$ Z = 2

X-ray Powder Pattern: Novofrolovskoye deposit, Russia.
6.08 (10), 3.858 (9), 3.471 (8), 2.357 (8), 2.522 (7), 2.330 (7), 2.65 (6)

Chemistry:

	(1)	(2)	(3)
SO_3	1.78		
SiO_2	0.57		
B_2O_3	34.20	34.57	35.20
Fe_2O_3	0.10		
MgO	0.72		
CaO	28.70	27.67	28.36
H_2O^+		35.57	
H_2O^-		2.06	
H_2O	32.96		36.44
Total	99.03	99.87	100.00

(1) Novofrolovskoye deposit, Russia; estimated gypsum 3% impurity. (2) Fuka, Japan; corresponds to $Ca_{1.00}B_{2.01}(OH)_{8.03}$. (3) $CaB_2(OH)_8$.

Occurrence: A rare alteration product of hydrothermal boron minerals in skarn deposits.

Association: Calciborite, calcite, gypsum, garnet, magnetite (Novofrolovskoye deposit, Russia); olshanskyite, parasibirskite, sibirskite, takedaite, pentahydroborite, nifontovite, calcite (Fuka, Japan).

Distribution: In Russia, from the Novofrolovskoye copper deposit, near Krasnoturinsk, Turinsk district, Northern Ural Mountains, and in the Solongo boron deposit, Buryatia. At the Sayak-IV boron deposit, northeast Balkhash region, Kazakhstan. From Fuka, near Bicchu, Okayama Prefecture, Japan.

Name: For the first-noted occurrence in the NovoFROLOVskoye deposit, Russia.

Type Material: Institute of Mining-Chemical Stock, Moscow, Russia, 1317a.

References: (1) Petrova, E.S. (1957) Frolovite, a new hydrous calcium borate. Zap. Vses. Mineral. Obshch., 86, 622–625 (in Russian). (2) (1958) Amer. Mineral., 43, 385–386 (abs. ref. 1). (3) Kusachi, I., C. Henmi, and S. Kobayashi (1995) Frolovite from Fuka, Okayama Prefecture, Japan. Mineral. J. (Japan), 17, 330–337. (4) Simonov, M.A., E.V. Kazanskaya, Y.K. Yegorov-Tismenko, E.P. Zhelezin, and N.V. Belov (1976) Redetermination of the crystal structure of frolovite $Ca[B(OH)_4]_2$. Doklady Acad. Nauk SSSR, 230, 91–94 (in Russian).