Fluorcalciobritholite $(Ca, REE)_5(SiO_4, PO_4)_3F$

Crystal Data: Hexagonal. *Point Group*: 6/m. As euhedral hexagonal prismatic crystals to 10 mm.

Physical Properties: *Cleavage*: n.d. *Tenacity*: n.d. *Fracture*: n.d. Hardness = 5.5
D(meas.) = 4.2(1) D(calc.) = 4.3 Metamict if radioactive.

Optical Properties: Transparent. *Color*: Pale pinkish to brown, colorless in thin section.
Streak: White. *Luster*: Vitreous to greasy; resinous (metamict).
Optical Class: Uniaxial (-). $\omega = 1.735(5)$ $\varepsilon = 1.730(5)$ Nonpleochroic.
Optical Class: Isotropic or slightly anisotropic (metamict).

Cell Data: *Space Group*: $P6_3/m$. $a = 9.580(7)$ $c = 6.985(4)$ $Z = 2$

X-Ray Diffraction Pattern: Mount Kukisvumchorr, Khibiny complex, Kola Peninsula, Russia.
2.85 (100), 3.15 (70), 2.78 (60), 3.51 (45), 1.122 (30), 1.965 (25), 1.236 (25)

Chemistry:	(1)		(1)		(1)
CaO	21.89	Nd_2O_3	6.21	P_2O_5	10.44
MnO	0.34	Sm_2O_3	0.82	SO_3	0.05
SrO	0.25	Gd_2O_3	0.74	F	2.02
Fe_2O_3	0.05	Dy_2O_3	0.61	Cl	0.06
Y_2O_3	2.88	Er_2O_3	0.30	-O = (F+Cl)	0.86
La_2O_3	12.36	Yb_2O_3	0.44	Total	99.36
Ce_2O_3	21.22	ThO_2	1.44		
Pr_2O_3	1.86	SiO_2	16.24		

(1) Mount Kukisvumchorr, Khibiny complex, Kola Peninsula, Russia; average electron microprobe analysis; corresponds to $[Ca_{2.80}(Ce_{0.93}La_{0.54}Nd_{0.26}Y_{0.18}Pr_{0.08}Sm_{0.03}Gd_{0.03}Dy_{0.02}Yb_{0.02}Er_{0.01})_{\Sigma=2.12}Th_{0.04}Mn_{0.03}Sr_{0.02}]_{\Sigma=4.99}[(Si_{1.94}P_{1.06})_{\Sigma=3}O_{12}][F_{0.76}O_{0.22}Cl_{0.01}]_{\Sigma=0.99}$.

Mineral Group: Apatite supergroup, britholite group.

Occurrence: In veinlets cross-cutting fenitized gneiss xenoliths in foyaite (Khibiny). In alkaline metasomatite.

Association: Orthoclase, nepheline, sodalite (Khibiny); fluorbritholite-(Ce), potassic feldspar, albite, alkali pyroxene, fluorapatite, natrolite (Burpala).

Distribution: On the eastern slope of Mount Kukisvumchorr, at the source of the Tuliok river, Khibiny alkaline complex, Kola Peninsula, Russia. In the Sol'skoye REE deposit, Burpala and Ulan-Erge alkaline massifs, Siberia, Russia.

Name: The prefix, *calcio*, indicates an analog of *fluorbritholite*-(Ce) with calcium dominant over rare earth elements.

Type Material: A.E. Fersman Mineralogical Museum, RAS, Moscow, Russia (3420/1).

References: (1) Pekov, I.V., M. Pasero, A.N. Yaskovskaya, N.V. Chukanov, D.Yu. Pushcharovsky, S. Merlino, N.V. Zubkova, N.N. Kononkova, Y.P. Men'shikov, and A.E. Zadov (2007) Fluorcalciobritholite, $(Ca,REE)_5[(Si,P)O_4]_3F$, a new mineral: description and crystal chemistry. Eur. J. Mineral., 19, 95-103. (2) (2008) Amer. Mineral., 93, 252 (abs. ref. 1). (3) Pasero, M., A.R. Kampf, C. Ferraris, I.V. Pekov, J. Rakovan, and T.J. White (2010) Nomenclature of the apatite supergroup minerals. Eur. J. Mineral., 22, 163-179.