

Table S1. Electron microprobe analyses of fluorapatite-Cl-fluorcalciobritholite solid-solution shown in Fig. 1. Point locations are shown in Fig. 1. bd: Below detection. Also, K, Mn, Er, Yb, Al, Na and Mg were also analyzed, but were below detection.

Point#	115	116	117	118	119	120	121	122	123	124	125
SiO ₂	16.4	14.6	15.7	10.4	9.83	8.54	7.67	7.49	5.44	4.4	2.85
Y ₂ O ₃	4.3	4.1	3.8	4	3.8	3.8	4.5	4.3	3.7	3.5	2.3
La ₂ O ₃	7.6	5	5.3	2.8	2.5	1.8	1.1	1.1	0.4	0.3	0.2
Ce ₂ O ₃	19	16	17	9.7	9.3	6.8	4.7	4.7	2.4	1.9	1.2
Pr ₂ O ₃	2.3	2.4	2.4	1.6	1.5	1.3	1	0.94	0.59	0.47	0.3
Nd ₂ O ₃	5.6	7.7	7.5	5.7	5.6	4.8	4.1	4	2.8	1.9	1.2
Sm ₂ O ₃	0.9	1.5	1	1	1	1	1	1	0.9	0.6	0.5
Gd ₂ O ₃	2.8	2.2	2.2	1.6	1.5	1.2	1.4	1.2	1	0.83	0.5
Dy ₂ O ₃	0.6	0.8	0.5	0.4	0.7	0.8	1	0.6	1	0.7	0.6
CaO	22	25.5	24.6	34.3	35.6	38.5	40.5	41.4	45.2	48.1	50.5
FeO	3.5	3.1	3.4	2.4	2.4	2.2	2	1.8	1.6	1.3	1.2
SrO	0.3	0.2	0.3	0.4	0.3	0.2	0.3	0.3	0.2	0.2	0.2
P ₂ O ₅	12	15	14	23	24	26	27	29	31.6	33.7	36.5
SO ₃	0.06	0.05	0.06	0.05	bd	bd	bd	bd	bd	bd	bd
Cl	1.1	0.91	0.92	0.71	0.54	0.38	0.23	0.23	0.11	0.084	0.04
F	2.48	2.18	2.07	2.58	2.61	2.51	2.38	2.33	3.15	3.3	2.71
- O = F, Cl	1.29	1.12	1.08	1.25	1.22	1.14	1.05	1.03	1.35	1.41	1.15
Total	99.65	100.12	99.67	99.39	99.96	98.69	97.83	99.36	98.74	99.88	99.65