Mottanaite-(Ce) $Ca_4Ce_2Al(Be_{1.5}\square_{0.5})[B_4Si_4O_{22}]O_2$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As crystals tabular on {010} to 0.5 mm.

Physical Properties: *Cleavage*: None. *Tenacity*: Brittle. *Fracture*: Conchoidal.
Hardness = n.d. D(meas.) = 3.61(4) D(calc.) = 3.88

Optical Properties: Transparent. *Color*: Brown. *Streak*: White. *Luster*: Vitreous.
Optical Class: Biaxial (-). α = 1.680(5) β = 1.694(2) γ = 1.708(5) 2V(meas.) = ~90°

Cell Data: *Space Group*: *P*2/*a*. *a* = 19.032(9) *b* = 4.746(3) *c* = 10.248(5) β = 110.97(5)° Z = 2

X-ray Powder Pattern: Calculated pattern.
2.854 (100), 2.916 (86), 2.646 (86), 3.085 (85), 2.647 (84), 2.635 (84), 3.243 (80)

Chemistry:

	(1)		(1)		(1)
SiO_2	23.85	CaO	24.46	Dy_2O_3	0.024
B_2O_3	13.85	BaO	0.002	Er_2O_3	0.020
BeO	2.94	La_2O_3	7.42	Gd_2O_3	0.094
Li_2O	0.037	Ce_2O_3	12.63	Dy_2O_3	0.024
TiO_2	0.560	Y_2O_3	0.073	Yb_2O_3	0.002
Al_2O_3	2.53	Pr_2O_3	1.103	ThO_2	4.01
Fe_2O_3	3.06	Nd_2O_3	2.36	UO_2	0.430
Cr_2O_3	0.00	Sm_2O_3	0.137	H_2O	0.390
Mn_2O_3	0.00	Eu_2O_3	0.005	F	1.00
MgO	0.140	Gd_2O_3	0.094	- O = F	0.421
				Total	100.71

(1) Tre Croci, near Vetralla, Viterbo province, Latium, Italy; electron microprobe analysis; B, Be, Li, OH and F by SIMS; corresponds to $Ca_4[REE^{3+}_{1.45}Ca_{0.37}(Th,U)^{4+}_{0.17}Y_{0.01}]_{\Sigma=2}(Al_{0.50}Fe^{3+}_{0.38}Ti^{4+}_{0.17}Mg_{0.03})_{\Sigma=0.98}(Be_{1.18}\square_{0.37}Li_{0.02})B_{3.99}Si_{3.98}O_{22}O_5[O^{2-}_{1.04}F_{0.53}(OH)_{0.43}]_{\Sigma=2}$ or $^{X}Ca_4{}^{Y}[REE^{3+}_{1.46}Th^{4+}_{0.66}Ca_{0.37}]_{\Sigma=2}{}^{Z}Al_{0.98}{}^{T}(Be_{1.18}\square_{0.37}Li_{0.02})_{\Sigma=1.57}[B_4Si_4O_{22}]^{W}[O_{1.57}(OH)_{0.43}]_{\Sigma=2}$.

Mineral Group: Hellandite group.

Occurrence: In miarolitic cavities and voids in feldspathoid-bearing alkali-syenitic pyroclastic ejecta. Formed by late-stage post-magmatic hydrothermal fluids enriched in Zr, Ti, REEs, and actinide elements.

Association: Britholite-(Ce), sanidine, plagioclase (An 20-80%), nepheline, biotite, clinopyroxene, titanian andradite, magnetite, zircon, titanite, baddeleyite, a phase with composition near cheralite-brabantite.

Distribution: From the "lower pyroclastic flow" of the Sabatini volcanic complex, at Monte Cavalluccio, Sacrofano, north of Rome, Italy.

Name: Honors Annibale *Mottana*, Professor of Mineralogy, University of Roma Tre (Italy), for his leadership and support of investigations and cataloguing of Latium minerals, during which the mottanaite-(Ce) sample was found; the suffix indicates the dominant REE.

Type Material: Mineralogy Museum, the University of Rome, Italy (30023/1).

References: (1) Della Ventura, G., P. Bonazzi, R. Oberti, and L. Ottolini (2002) Ciprianiite and mottanaite-(Ce), two new minerals of the hellandite group from Latium (Italy). Amer. Mineral., 87, 739-744. (2) Oberti, R., A. Langone, M. Boiocchi, E. Bernabè, and F.C. Hawthorne (2019) News from the hellandite group: the redefinition of mottanaite and ciprianiite and the new mineral description of ferri-mottanaite-(Ce), the first Fe^{3+}-dominant hellandite. Eur. J. Mineral., 31, 799-806.