Alnaperbøeite-(Ce) $^{A}(Ce_{2.5}CaNa_{0.5})^{M}(Al_4)Si_2O_7(SiO_4)_3O(OH)_2$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As chemically-zoned prismatic crystals elongated along [010], to 400 μm, and displaying {101}, {100} and {001}.

Physical Properties: *Cleavage*: Good on {100}, imperfect on {001}. *Fracture*: Irregular. *Tenacity*: Brittle. Hardness = 6-7 D(meas.) = n.d. D(calc.) = 4.308

Optical Properties: Transparent. *Color*: Very pale green. *Streak*: White. *Luster*: Vitreous. *Optical Class*: Biaxial (+). α = 1.778(2) β = 1.784(2) γ = 1.810(5) 2V(meas.) = 33.5(5)° *Dispersion*: Weak, inclined. *Orientation*: Z ^ (001) = 30(3)°

Cell Data: *Space Group*: $P2_1/m$. a = 8.9277(6) b = 5.6548(6) c = 17.587(1) β = 116.475(8)° Z = 4

X-ray Powder Pattern: Calculated pattern.
2.9831 (100), 15.7426 (92), 2.6188 (56), 2.8274 (47), 3.4986 (42), 2.7509 (32), 4.6160 (30)

Chemistry:	(1)	(2)		(1)	(2)
Na_2O	0.56	1.54	Ho_2O_3	0.04	
CaO	5.74	5.58	Er_2O_3	0.12	
MnO	0.18		Yb_2O_3	0.12	
BaO	0.04		Y_2O_3	1.29	
La_2O_3	6.29		ThO_2	0.37	
Ce_2O_3	17.29	40.86	MgO	0.09	
Pr_2O_3	2.52		FeO	2.67	
Nd_2O_3	9.31		Al_2O_3	16.71	20.31
Sm_2O_3	2.02		SiO_2	27.79	29.92
Gd_2O_3	1.13		H_2O	n.d.	1.79
Dy_2O_3	0.56		Total	94.84	100.00

(1) Tysfjord granite, Norway; average of 15 electron microprobe analyses; corresponds to $(Ca_{1.10}Mn_{0.03}Na_{0.20}La_{0.42}Ce_{1.14}Pr_{0.16}Nd_{0.60}Sm_{0.13}Gd_{0.07}Dy_{0.03}Er_{0.01}Yb_{0.01}Y_{0.12}Th_{0.02})_{\Sigma=4.04}$ $(Al_{3.54}Fe^{2+}_{0.40}Mg_{0.02})_{\Sigma=3.96}Si_{4.99}O_{20}(OH)_2$. (2) $^{A}(Ce_{2.5}CaNa_{0.5})^{M}(Al_4)Si_2O_7(SiO_4)_3O(OH)_2$.

Polymorphism & Series: Continuous solid solution with perbøeite-(Ce).

Mineral Group: Epidote supergroup.

Occurrence: A late primary phase in REE-bearing quartz-microcline pegmatite.

Association: Yttrian fluorite, törnebohmite-(Ce), allanite-(Ce), bastnäsite-(Ce).

Distribution: From the Hundholmen, Stetind, and Nedre Eivollen pegmatites in the Tysfjord granite, Norway.

Name: Emphasizes the chemical relationships with *perbøeite-(Ce)*, the dominance of Al in the M3 site and the role of Na to charge balance the dominance of a trivalent cation in the M3 site of the REE-epidote module. The root name alnaperbøeite should apply to any *ET* polysome composition in which (1) trivalent cations are dominant at the M3 site and aluminum is dominant among them and (2) the charge balance in A sites is dominantly achieved by substitution of Na for REE (rather than A^{2+} for REE).

Type Material: Natural History Museum, University of Florence, Italy (3114/I).

References: (1) Bonazzi1, P., G.O. Lepore, L. Bindi, C. Chopin, T.A. Husdal, and O. Medenbach (2014) Perbøeite-(Ce) and alnaperbøeite-(Ce), two new members of the epidote-törnebohmite polysomatic series: Chemistry, structure, dehydrogenation, and clue for a sodian epidote end-member. Amer. Mineral., 99, 157-169.