

Alnaperbøite-(Ce)

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 (+). $\alpha = 1.778(2)$ $\beta = 1.784(2)$ $\gamma = 1.810(5)$ $2V(\text{meas.}) = 33.5(5)^\circ$ *Dispersion:* Weak, inclined. *Orientation:* $Z \wedge (001) = 30(3)^\circ$

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

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 ₂ O	0.56	1.54	Ho ₂ O ₃	0.04	
CaO	5.74	5.58	Er ₂ O ₃	0.12	
MnO	0.18		Yb ₂ O ₃	0.12	
BaO	0.04		Y ₂ O ₃	1.29	
La ₂ O ₃	6.29		ThO ₂	0.37	
Ce ₂ O ₃	17.29	40.86	MgO	0.09	
Pr ₂ O ₃	2.52		FeO	2.67	
Nd ₂ O ₃	9.31		Al ₂ O ₃	16.71	20.31
Sm ₂ O ₃	2.02		SiO ₂	27.79	29.92
Gd ₂ O ₃	1.13		H ₂ O	n.d.	1.79
Dy ₂ O ₃	0.56		Total	94.84	100.00

(1) Tysfjord granite, Norway; average of 15 electron microprobe analyses; corresponds to $(\text{Ca}_{1.10}\text{Mn}_{0.03}\text{Na}_{0.20}\text{La}_{0.42}\text{Ce}_{1.14}\text{Pr}_{0.16}\text{Nd}_{0.60}\text{Sm}_{0.13}\text{Gd}_{0.07}\text{Dy}_{0.03}\text{Er}_{0.01}\text{Yb}_{0.01}\text{Y}_{0.12}\text{Th}_{0.02})_{\Sigma=4.04}(\text{Al}_{3.54}\text{Fe}^{2+}_{0.40}\text{Mg}_{0.02})_{\Sigma=3.96}\text{Si}_{4.99}\text{O}_{20}(\text{OH})_2$. (2) $^A(\text{Ce}_{2.5}\text{CaNa}_{0.5})^M(\text{Al}_4)\text{Si}_2\text{O}_7(\text{SiO}_4)_3\text{O}(\text{OH})_2$.

Polymorphism & Series: Continuous solid solution with perbøite-(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 *perbøite-(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 alnaperbøite 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) Perbøite-(Ce) and alnaperbøite-(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.