Hellandite-(Y) $(Ca, REE)_4Y_2Al\square_2(B_4Si_4O_{22})(OH)_2$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. Crystals prismatic || [001], tabular || [010], to 30 cm. *Twinning*: Contact and polysynthetic, || {001} and {100}.

Physical Properties: *Cleavage*: Poor on {100}, {010}. Hardness = 4.5-6.5 D(meas.) = 2.95-3.63 D(calc.) = 3.161-4.06

Optical Properties: Semitransparent. *Color*: Nut-brown, brownish red, black, gray, green, yellow, cream, pinkish. *Luster*: Vitreous to dull.
Optical Class: Biaxial (+). *Orientation*: $X = b$, $Z \wedge c = 44°$-$53°$. $\alpha = 1.652$-1.656 $\beta = 1.657$-1.712 $\gamma = 1.662$-1.668 2V(meas.) = 48°-86°

Cell Data: *Space Group*: $P2/a$. $a = 18.99(1)$ $b = 4.715(5)$ $c = 10.30(1)$ $\beta = 111.4(1)°$ Z = 2

X-ray Powder Pattern: Kragerö, Norway.
2.812 (100), 4.69 (80), 2.635 (80), 2.603 (80), 3.436 (70), 3.198 (70), 3.068 (70)

Chemistry:

	(1)	(2)	(3)	(4)
SiO_2	26.65	25.57	24.41	24.35
TiO_2	0.39	< 0.2	< 0.02	
ThO_2	1.46		0.57	0.09
B_2O_3	10.5	[14.85]	8.47	15.32
Al_2O_3	2.58	3.04	4.59	4.85
Y_2O_3	21.68	18.07	26.53	31.60
RE_2O_3	15.63	16.0	19.19	5.96
Fe_2O_3	3.07	3.77	2.29	0.62
FeO	0.07			
MnO	0.41	0.70	0.58	7.71
MgO	0.60			
CaO	11.51	15.22	9.28	7.65
H_2O^+	3.75	[4.50]	5.3	
H_2O^-	1.89		2.0	[1.83]
Total	100.19	[101.92]	103.23	99.98

(1) Kragerö, Norway. (2) Predazzo, Italy; total Fe as Fe_2O_3; B_2O_3 and H_2O from stoichiometry. (3) Evans-Lou quarry, Canada. (4) Heftetjern pegmatite, Tørdal, Norway; electron microprobe analysis, H_2O calculated; corresponds to $Ca_{1.34}Mn_{1.07}Y_{2.75}Yb_{0.38}Al_{0.92}Fe_{0.08}Si_4B_4O_{21.21}(OH)_{2.79}$.

Mineral Group: Hellandite group.

Occurrence: In granite pegmatite (Norway; Wakefield Lake, Canada).

Association: Tourmaline, thorite, allanite, apatite, phenakite, zircon, titanite (Kragerö, Norway); quartz, chlorite, fergusonite, kainosite-(Y), tengerite, xenotime, wakefieldite, thorogummite (Evans-Lou quarry, Canada); microcline, albite, schorl, monazite, zircon (Crestmore, California, USA).

Distribution: At the Lindvikskollen pegmatite, near Kragerö and the Heftetjern pegmatite, Tørdal, Telemark, Norway. At Predazzo, Trentino-Alto Adige; Lago Vico, Viterbo, and near Vetralla, Lazio, Italy. In the Trimouns talc deposit, six km northeast of Luzenac, Ariµege, France. At Crestmore, Riverside Co., California, USA. In the Evans-Lou quarry, near Wakefield Lake, Quebec, Canada.

Name: For geologist Amund Theodor *Helland* (1846-1918), of Oslo, Norway. The suffix indicates the dominant REE at the Y site.

References: (1) Oftedal, I. (1965) Über den Hellandit. Tschermaks Mineral. Petrog. Mitt., 10, 125-129 (in German with English abs.). (2) Hogarth, D.D., G.Y. Chao, and D.C. Harris (1972) New data on hellandite. Can. Mineral., 11, 760-776. (3) Mellini, M. and S. Merlino (1977) Hellandite: a new type of silicoborate chain. Amer. Mineral., 62, 89-99. (4) Miyawaki, R., K. Momma, K. Yokoyama, M. Shigeoka, S. Matsubara, M. Ito, I. Nakai, and R. Kristiansen (2015) Mn-bearing hellandite-(Y) from the Heftetjern Pegmatite, Tordal, Norway. Can. Mineral., 53, 345-356. (5) CNMNC Newsletter No. 37 (2017) Eur. J. Mineral., 29, 533. (6) Oberti, R., G. Della Ventura, L. Ottolini,

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