Kihlmanite-(Ce) $Ce_2TiO_2(SiO_4)(HCO_3)_2 \cdot H_2O$

Crystal Data: Triclinic. *Point Group*: $\bar{1}$. Crystals elongated along [001] and flattened on {010}, displaying {010}, {100}, {001}, {110}, and {011}. As spherulites to 2 cm and sprays to 0.5 mm.

Physical Properties: *Cleavage*: Perfect on (010); parting ⊥ [001]. *Fracture*: Stepped. *Tenacity*: Brittle. Hardness = ~ 3 D(meas.) = 3.66(2) D(calc.) = 3.694

Optical Properties: Transparent. *Color*: Brown, yellowish brown in transmitted light. *Streak*: Pale yellowish brown. *Luster*: Vitreous, silky in aggregates. *Optical Class*: Biaxial (+). α = 1.708(5) β = 1.76(1) γ = 1.82(1) 2V(calc.) = 89(5)° *Orientation*: *Y* ^ c = 5°.

Cell Data: *Space Group*: $P\bar{1}$. *a* = 5.009(5) *b* = 7.533(5) *c* = 15.407(5) α = 103.061(5)° β = 91.006(5)° γ = 109.285(5)° Z = 2

X-ray Powder Pattern: Mt. Kihlman, Khibiny massif, Kola Peninsula, Russia.
15.11 (100), 7.508 (20), 3.563 (15), 2.896 (15), 4.993 (14), 6.912 (12), 3.065 (12)

Chemistry:	(1)		(1)
Na_2O	0.13	Ce_2O_3	27.33
Al_2O_3	0.24	Pr_2O_3	2.45
SiO_2	9.91	Nd_2O_3	8.12
CaO	1.50	Sm_2O_3	1.67
TiO_2	11.04	Gd_2O_3	0.49
MnO	0.26	CO_2	15.00
Fe_2O_3	0.05	H_2O	6.00
Nb_2O_5	2.79	Total	99.93
La_2O_3	12.95		

(1) Mt. Kihlman, Khibiny massif, Kola Peninsula, Russia; average electron microprobe analysis, H_2O and CO_2 by Penfield method and wet chemical analysis, identity of anionic groups determined by IR spectroscopy; corresponding to $(Ca_{0.16}Na_{0.11}Mn_{0.02})_{\Sigma=0.29}[(Ce_{0.98}La_{0.47}Pr_{0.09}Nd_{0.29}Sm_{0.06}Gd_{0.02})_{\Sigma=1.91}(Ti_{0.82}Nb_{0.12})_{\Sigma=0.94}O_2(Si_{0.97}Al_{0.03})_{\Sigma=1.00}O_{4.02}(HCO_3)_{2.01}](H_2O)_{0.96}$.

Occurrence: In a symmetrically-zoned pegmatite vein of arfvedsonite-aegirine-microcline in fenitized metavolcanic rock**.** Probably the product of low-temperature hydrothermal alteration of rinkite and loparite-(Ce).

Association: Tundrite-(Ce).

Distribution: From Mt. Kihlman, near the western contact of the Khibiny alkaline massif, Kola Peninsula, Russia.

Name: Honors Alfred Oswald Kihlman (Kairamo) (1858-1938), a Finnish geographer and botanist, for whom Mt Kihlman and the mineral are named.

Type Material: Mineralogical Museum, St. Petersburg State University (1/19598) and in the Geological and Mineralogical Museum, Geological Institute of the Kola Science Centre, Apatity, (GIM 6790), Russia.

References: (1) Yakovenchuk, V.N., S.V. Krivovichev, G.Y. Ivanyuk, Ya.A. Pakhomovsky, E.A. Selivanova, E.A. Zhitova, G.O. Kalashnikova, A.A. Zolotarev, J.A. Mikhailova, and G.I. Kadyrova (2014) Kihlmanite-(Ce), $Ce_2TiO_2[SiO_4](HCO_3)_2(H_2O)$, a new rare-earth mineral from the pegmatites of the Khibiny alkaline massif, Kola Peninsula, Russia. Mineral. Mag., 78(3), 483-496. (2) (2015) Amer. Mineral., 100, 2354 (abs. ref. 1).