Cordylite-(Ce) $(Na, Ca)Ba(Ce, La)_2(CO_3)_4F$

Crystal Data: Hexagonal. *Point Group:* $6/m\ 2/m\ 2/m$. As prismatic or thin to thick tabular crystals with hexagonal outline and dominant $\{10\bar{1}0\}$, $\{40\bar{4}.15\}$, $\{10\bar{1}1\}$, to 13 mm; may have scepterlike terminations with striations ∥ {0001}; in rosettes, subparallel and spherical aggregates of thin platy crystals.

Physical Properties: *Cleavage:* Good on {0001}. *Fracture:* Conchoidal to irregular. *Tenacity:* Brittle. Hardness = 4.5 D(meas.) = 4.01–4.44 D(calc.) = 3.97

Optical Properties: Transparent to translucent. *Color:* Colorless, white, wax-yellow, amber-yellow, pale yellow, yellowish green, greenish gray, may be radially zoned, ocher-yellow if altered; colorless to pale yellow in transmitted light. *Streak:* White. *Luster:* Adamantine, vitreous, resinous, oily, pearly on {0001}; waxy if altered.
Optical Class: Uniaxial (–). *Pleochroism:* Weak; O = greenish yellow; E = brownish yellow.
$\omega = 1.764–1.775$ $\epsilon = 1.576–1.598$

Cell Data: *Space Group:* $P6_3/mmc$. $a = 5.090–5.109$ $c = 23.049–23.289$ Z = 2

X-ray Powder Pattern: Mont Saint-Hilaire, Canada.
3.193 (10), 3.510 (9), 4.336 (8), 3.843 (8), 2.550 (8), 2.040 (8), 2.122 (7)

Chemistry:	(1)	(2)		(1)	(2)		(1)	(2)
CO_2	[25.36]	[24.50]	Pr_2O_3	1.78	1.46	BaO	22.22	20.91
Ce_2O_3	22.10	23.85	Sm_2O_3		0.21	Na_2O	4.73	3.96
La_2O_3	14.61	14.73	CaO	1.09	0.36	F	3.60	[2.64]
Nd_2O_3	4.58	4.90	SrO	1.44	0.74	$-O = F_2$	1.51	1.11
						Total	[100.00]	[97.15]

(1) Narssârssuk, Greenland; by electron microprobe, CO_2 by difference; corresponds to $(Na_{1.08}Ca_{0.14})_{\Sigma=1.22}(Ba_{1.03}Sr_{0.10})_{\Sigma=1.13}(Ce_{0.96}La_{0.64}Nd_{0.20}Pr_{0.08})_{\Sigma=1.88}(CO_3)_{4.10}F_{1.35}$. (2) Saint-Amable, Canada; by electron microprobe, CO_2 and F calculated from stoichiometry; corresponds to $(Na_{0.92}Ca_{0.04})_{\Sigma=0.96}(Ba_{0.98}Sr_{0.05})_{\Sigma=1.03}(Ce_{1.05}La_{0.65}Nd_{0.21}Pr_{0.06}Sm_{0.01})_{\Sigma=1.98}(CO_3)_4F$.

Occurrence: Rare in an alkali pegmatite (Narssârssuk, Greenland); a late-stage mineral in miarolitic vugs and fractures (Saint-Amable, Canada); in pegmatite dikes associated with an intrusive alkalic gabbro-syenite complex (Mont Saint-Hilaire, Canada).

Association: Aegirine, ancylite-(Ce), synchysite-(Ce), parisite-(Ce), neptunite (Narssârssuk, Greenland); analcime, aegirine, albite, pyrophanite (Mont Saint-Hilaire, Canada); parisite, cebaite-(Ce), barite (Bayan Obo deposit, China); vaterite, alstonite, ancylite-(Ce), kukharenkoite-(Ce), mckelveyite-(Y), fluorapatite, barite (Vuoriyarvi complex, Russia).

Distribution: From Narssârssuk, Greenland. In Canada, large crystals at Mont Saint-Hilaire, and from near Saint-Amable, Quebec. In the Khibiny massif, the Vuoriyarvi carbonatite complex, and the Lesnaya Varaka carbonatite, Kola Peninsula, Russia. From the Bayan Obo Fe–Nb–RE deposit, 130 km north of Baotou, Inner Mongolia, China.

Name: From the Greek for *club*, in allusion to its typical clublike crytal habit.

Type Material: University of Copenhagen, Copenhagen, Denmark.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 285–287. (2) Chen, T.T. and G.Y. Chao (1975) Cordylite from Mont St. Hilaire, Quebec. Can. Mineral., 13, 93–94. (3) Shen Jinchuan and Mi Jinxiao (1992) A discussion of the composition and structure of cordylite-(Ce). Acta Petrologica et Mineralogica, 11(1), 69–74 (in Chinese with English abs.). (4) (1994) Amer. Mineral., 79, 767 (abs. ref. 3). (5) Horváth, L., E. Pfenninger-Horváth, R.A. Gault, and P. Tarassoff (1998) Mineralogy of the Saint-Amable Sill, Varennes and Saint-Amable, Québec. Mineral. Record, 29, 83–118, esp. 96. (6) Giester, G., Y. Ni, D. Jarosch, J.M. Hughes, J. Rønsbo, Z. Yang, and J. Zemann (1998) Cordylite-(Ce): a crystal chemical investigation of material from four localities, including type material. Amer. Mineral., 83, 178–184.