Carbocernaite $(Ca, Na)(Sr, Ce, Ba)(CO_3)_2$

Crystal Data: Orthorhombic. *Point Group:* $mm2$. As tabular crystals with wedgelike terminations, to 4 mm, with dominant {100}, minor {010}, {001}, {021}, {540}, {210}, vicinal {305} and {210}; as grains and exsolution lamellae.

Physical Properties: *Cleavage:* {100}, {021}, and {010}, poor. *Tenacity:* Brittle. Hardness = 3 D(meas.) = 3.53 D(calc.) = 3.64

Optical Properties: Transparent to translucent. *Color:* Colorless; white, yellow, yellowish green, rose, or brown if altered. *Luster:* Vitreous, greasy on fractures. *Optical Class:* Biaxial (–). *Orientation:* $X = b$; $Y = a$; $z = c$. *Dispersion:* $r > v$, marked. $\alpha = 1.569(2)$ $\beta = 1.679(2)$ $\gamma = 1.708(2)$ 2V(meas.) = n.d. 2V(calc.) = 52°

Cell Data: *Space Group:* $Pb2m$. $a = 6.430$ $b = 7.301$ $c = 5.214$ Z = 2

X-ray Powder Pattern: Vuoriyarvi complex, Kola Peninsula, Russia. 3.00 (10), 2.015 (9), 1.813 (8), 2.60 (7b), 2.29 (7b), 3.66 (5), 2.082 (5)

Chemistry:

	(1)	(2)		(1)	(2)
CO_2	33.85	[32.02]	FeO	0.53	
Ce_2O_3	10.27	10.16	MnO		0.69
La_2O_3	8.78	13.26	CaO	16.68	17.15
Pr_6O_{11}	0.99	0.76	SrO	17.77	18.74
Nd_2O_3	2.47	1.82	BaO	5.24	1.64
Sm_2O_3	0.30	0.31	Na_2O	3.15	3.83
Gd_2O_3	0.39		H_2O	1.22	
			Total	101.64	[100.38]

(1) Bayan Obo deposit, China; corresponds to $(Ca_{0.78}Na_{0.26})_{\Sigma=1.04}(Sr_{0.44}RE_{0.40}Ba_{0.10})_{\Sigma=0.94}(CO_3)_2$. (2) Sarnu-Dandali complex, India; by electron microprobe, CO_2 calculated from stoichiometry; corresponds to $(Ca_{0.67}Na_{0.33})_{\Sigma=1.00}(Sr_{0.31}RE_{0.44}Ca_{0.15}Ba_{0.03}Mn_{0.03})_{\Sigma=0.96}(CO_3)_2$.

Occurrence: An uncommon accessory mineral in dolomite–calcite carbonatite associated with an alkaline ultramafic massif (Vuoriyarvi massif, Kola Peninsula, Russia); exsolved from calcite and in a carbonatite dike in fenitized melanephelinite (Sarnu-Dandali complex, India).

Association: "Chlorite", ankerite, alstonite, anatase, quartz (Vuoriyarvi complex, Kola Peninsula, Russia); dolomite, barite, "chlorite", mckelveyite-(Y), calkinsite-(Ce), khanneshite (Khanneshin complex, Afghanistan.).

Distribution: In Russia, from the Vuoriyarvi carbonatite complex and in the Khibiny massif, Kola Peninsula; at the Ozernyi carbonatite, southeastern Sakha. At the Khanneshin carbonatite complex, Afghanistan. In the Bayan Obo Fe–Nb–RE deposit, 130 km north of Baotou, Inner Mongolia, and at Weishan, Shandong Province, China. From the Phan Si Pan Range, Vietnam. At the Sarnu-Dandali alkaline complex, Barmer District, Rajasthan, India. In Canada, at Sturgeon Narrows, Sturgeon Lake, Thunder Bay district, Ontario; from Mont Saint-Hilaire, Quebec.

Name: For the essential chemical components, CARBOnate, CERium, and sodium, NAtrium.

Type Material: A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 64100.

References: (1) Bulakh, A.G., V.V. Kondrat'eva, and E.N. Baranova (1961) Carbocernaite, a new rare earth carbonate. Zap. Vses. Mineral. Obshch., 90, 42–49 (in Russian). (2) (1961) Amer. Mineral., 46, 1202 (abs. ref. 1). (3) Shi Nicheng, Ma Zhesheng, and Peng Zhizhong (1982) The crystal structure of carbocernaite. Kexue Tongbao, 27, 76–80 (in English). (4) Wall, F., M.J. Le Bas, and R.K. Srivastava (1993) Calcite and carbocernaite exsolution and cotectic textures in a Sr, REE-rich carbonatite dyke from Rajasthan, India. Mineral. Mag., 57, 495–513.