Khanneshite $(Na, Ca)_3(Ba, Sr, Ce, Ca)_3(CO_3)_5$

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Crystal Data: Hexagonal. *Point Group:* 6*mm*. As elongated hexagonal crystals, to 1 cm, in radially fibrous or fine-grained aggregates.

Physical Properties: *Cleavage:* One, parallel elongation, indistinct; and a transverse parting. *Tenacity:* Brittle. Hardness = "Soft". D(meas.) = 3.8–3.9 D(calc.) = 3.94

Optical Properties: Semitransparent. *Color:* Pale yellow to nearly colorless. *Optical Class:* Uniaxial (–). $\omega = 1.620$–1.623 $\epsilon = 1.608$–1.610

Cell Data: *Space Group:* $P6_3mc$. $a = 10.65(1)$ $c = 6.58(1)$ $Z = 2$

X-ray Powder Pattern: Khanneshin complex, Afghanistan.
2.66 (100), 3.08 (62), 2.19 (55), 3.78 (50), 2.09 (42), 1.691 (40), 5.34 (30)

Chemistry:

	(1)	(2)	(3)
CO_2	28.48	28.85	[30.59]
RE_2O_3	10.41	11.18	
La_2O_3			4.07
Ce_2O_3			10.46
Pr_2O_3			1.01
Nd_2O_3			3.60
CaO	6.40	9.25	5.37
SrO	7.16	8.32	9.04
BaO	36.38	31.92	22.99
Na_2O	8.63	8.39	11.86
K_2O	0.95	0.77	0.00
H_2O	1.59	1.32	
Total	[100.00]	[100.00]	98.99

(1) Khanneshin complex, Afghanistan; recalculated to 100% from an original total of 99.98% after deduction of admixed barite, dolomite, and "chlorite" 1.98%; RE = Y 7.5%, La 20.3%, Ce 44.0%, Pr 6.0%, Nd 9.5%, Sm 6.0%, Eu 0.1%, Gd 4.8%, Tb 0.5%, Dy 0.3%, Ho 0.2%, Er 0.8%, Yb 0.5%; corresponds to $(Na_{2.13}Ca_{0.87})_{\Sigma=3.00}(Ba_{1.82}Sr_{0.53}RE_{0.49}K_{0.15})_{\Sigma=2.99}(CO_3)_{4.96} \bullet 0.67H_2O$. (2) Do.; recalculated to 100% from an original total of 100.87% after deduction of admixed barite, dolomite, and "chlorite" 2.55%; RE= Y 5.8%, La 20.9%, Ce 51.2%, Pr 4.7%, Nd 7.3%, Sm 4.7%, Eu 0.1%, Gd 3.7%, Dy 0.4%, Ho 0.1%, Er 0.9%, Yb 0.2%; corresponds to $(Na_{2.02}Ca_{0.98})_{\Sigma=3.00}(Ba_{1.55}Sr_{0.60}RE_{0.51}Ca_{0.25}K_{0.12})_{\Sigma=3.03}(CO_3)_{4.89} \bullet 0.55H_2O$. (3) Khibiny massif, Kola Peninsula, Russia; corresponds to $(Na_{2.75}Ca_{0.23})_{\Sigma=2.98}(Ba_{1.08}Sr_{0.63}Ca_{0.46}Ce_{0.46}La_{0.18}Nd_{0.15}Pr_{0.04})_{\Sigma=3.00}(CO_3)_{5.00}$.

Occurrence: Disseminated in hydrothermally-altered fine-grained carbonatite (Khanneshin complex, Afghanistan); in a drillcore in a carbonatite veinlet from a differentiated alkalic massif (Khibiny massif, Kola Peninsula, Russia).

Association: Dolomite, calkinsite-(Ce), carbocernaite, mckelveyite, barite, "chlorite" (Khanneshin complex, Afghanistan); calcite, dawsonite, magnetite (Khibiny massif, Kola Peninsula, Russia).

Distribution: From the Khanneshin carbonatite complex, Afghanistan. At Tuliylukht Bay, Khibiny massif, Kola Peninsula, Russia.

Name: For the Khanneshin complex, Afghanistan, its first-noted occurrence.

Type Material: Mining Institute, St. Petersburg; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia.

References: (1) Yeremenko, G.K. and V.A. Bel'ko (1982) Khanneshite, $(Na, Ca)_3(Ba, Sr, RE, Ca)_3(CO_3)_5$ – a new mineral of the burbankite group. Zap. Vses. Mineral. Obshch., 111, 321–324 (in Russian). (2) (1983) Amer. Mineral., 68, 1249 (abs. ref. 1). (3) Pekov, I.V., N.V. Chukanov, and Y.V. Belovitskaya (1998) Khanneshite and petersenite-(Nd) from Khibiny massif. Zap. Vses. Mineral. Obshch., 127(2), 92–100 (in Russian with English abs.).

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