

**Vitusite-(Ce)****Na<sub>3</sub>(Ce, La, Nd)(PO<sub>4</sub>)<sub>2</sub>**

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**Crystal Data:** Orthorhombic, pseudohexagonal. *Point Group:* *mm*2. Crystals prismatic, to 5 mm, elongated along [001], showing {100}, {010}, {110}, {120}, {210}, {101}; granular, and in fine-grained aggregates. *Twinning:* Common, on {160}, forming cross triplets, and on {120}, forming combined cross doublets; composition planes may be {130}, {140}, and {1.11.0}.

**Physical Properties:** *Cleavage:* On {100}, {010}, {001}, good. Hardness = 4.5  
D(meas.) = 3.60–3.70 D(calc.) = [3.63]

**Optical Properties:** Transparent. *Color:* White, pale pink, pale green, pale yellow, pinkish tan, gray, black; colorless in thin section. *Luster:* Vitreous, may be greasy.

*Optical Class:* Biaxial (-). *Orientation:* X = a; Y = b; Z = c. α = 1.602–1.604  
β = 1.646–1.650 γ = 1.649–1.654 2V(meas.) = 28.5°–30°

**Cell Data:** *Space Group:* *Pc*2<sub>1</sub>*b*. a = 5.3356(8) b = 18.6722(9) c = 14.0546(9) Z = 8

**X-ray Powder Pattern:** Ilímaussaq intrusion, Greenland.

2.811 (10), 2.801 (10), 6.580 (9), 4.665 (9), 4.634 (9), 3.512 (9), 2.690 (9)

**Chemistry:**

	(1)	(2)		(1)	(2)
P <sub>2</sub> O <sub>5</sub>	36.27	36.50	Pr <sub>2</sub> O <sub>3</sub>	1.24	1.13
SiO <sub>2</sub>	0.25	0.15	Nd <sub>2</sub> O <sub>3</sub>	4.39	4.33
La <sub>2</sub> O <sub>3</sub>	15.56	12.20	CaO	0.92	4.75
Ce <sub>2</sub> O <sub>3</sub>	19.95	16.50	Na <sub>2</sub> O	23.15	22.50
			Total	101.73	98.06

(1) Ilímaussaq intrusion, Greenland; by electron microprobe, corresponds to (Na<sub>2.92</sub>Ca<sub>0.06</sub>)<sub>Σ=2.98</sub>(Ce<sub>0.47</sub>La<sub>0.38</sub>Nd<sub>0.10</sub>Pr<sub>0.03</sub>)<sub>Σ=0.98</sub>[(PO<sub>4</sub>)<sub>2.00</sub>(SiO<sub>4</sub>)<sub>0.01</sub>]<sub>Σ=2.01</sub>. (2) Mt. Sengischorr, Kola Peninsula, Russia; by electron microprobe, corresponds to (Na<sub>2.83</sub>Ca<sub>0.33</sub>)<sub>Σ=3.16</sub>(Ce<sub>0.39</sub>La<sub>0.29</sub>Nd<sub>0.10</sub>Pr<sub>0.03</sub>)<sub>Σ=0.81</sub>[(PO<sub>4</sub>)<sub>2.00</sub>(SiO<sub>4</sub>)<sub>0.01</sub>]<sub>Σ=2.01</sub>.

**Occurrence:** An alteration product of steenstrupine in differentiated alkalic massifs (Ilímaussaq massif; Kola Peninsula, Russia); in sodalite xenoliths associated with an intrusive alkalic gabbro-syenite complex (Mont Saint-Hilaire, Canada).

**Association:** Steenstrupine, aegirine, analcime, lovozerite, sphalerite, villiaumite, arfvedsonite, albite, microcline, nepheline, sodalite (Ilímaussaq intrusion, Greenland); steenstrupine, belovite-(Ce), neptunite, leucosphenite, sazhinite-(Ce) (Jubilee pegmatite, Kola Peninsula, Russia); vuonnemite, sodalite, eudialyte, steenstrupine, kogarkoite, sidorenkite, rasvumite (Mont Saint-Hilaire, Canada).

**Distribution:** From Kvanefjeld, Ilímaussaq intrusion, southern Greenland. In the Jubilee pegmatite, on Mt. Karnasurt, and on Mt. Sengischorr, Lovozero massif; on Mts. Rasvumchorr and Koashva, Khibiny massif, Kola Peninsula, Russia. At Mont Saint-Hilaire, Quebec, Canada.

**Name:** To honor Vitus Bering (1681–1741), Danish-Russian explorer of the Arctic seas, and the dominant rare earth, *cerium*.

**Type Material:** Geology Museum, Kola Branch, Academy of Sciences, Apatity, 5544; Mining Institute, St. Petersburg, Russia, 1209/1; University of Copenhagen, Copenhagen, Denmark; National School of Mines, Paris, France; The Natural History Museum, London, England, 1994,36.

**References:** (1) Rønsbo, J.G., A.P. Khomyakov, E.I. Semenov, A.A. Voronkov, and V.K. Garanin (1979) Vitusite – a new phosphate of sodium and rare earths from the Lovozero alkaline massif, Kola, and the Ilímaussaq alkaline intrusion, South Greenland. *Neues Jahrb. Mineral., Abh.*, 137, 42–53. (2) (1980) *Amer. Mineral.*, 65, 812 (abs. ref. 1). (3) Horváth, L. and R.A. Gault (1990) The mineralogy of Mont Saint-Hilaire, Quebec. *Mineral. Record*, 21, 284–359, esp. 345–346. (4) Finch, A.A. and J.G. Fletcher (1992) Vitusite – an apatite derivative structure. *Mineral. Mag.*, 56, 235–239. (5) Mazzi, F. and L. Ungaretti (1994) The crystal structure of vitusite from Ilímaussaq (South Greenland): Na<sub>3</sub>REE(PO<sub>4</sub>)<sub>2</sub>. *Neues Jahrb. Mineral., Monatsh.*, 49–66.

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