

Crystal Data: Hexagonal. *Point Group:* 6/*m*. As long- and short-prismatic hexagonal crystals, showing the forms {10 $\bar{1}$ 0}, {11 $\bar{2}$ 0}, {0001}, and less well-developed rhombohedral faces, to several cm. Commonly as irregular grains and granular aggregates.

Physical Properties: *Cleavage:* One direction, prismatic, distinct. *Tenacity:* Brittle. Hardness = 4.5 VHN = 367–372 D(meas.) = 4.11–4.29 D(calc.) = [4.27] Decomposed by H₂O, most Na going into solution; weakly magnetic.

Optical Properties: Transparent to translucent. *Color:* Pinkish or rosy, yellow, yellowish white or creamy, colorless; in transmitted light, colorless. *Streak:* White. *Luster:* Vitreous to dull.

Optical Class: Uniaxial (+); may be anomalously biaxial. $\omega = 1.472$ – 1.475 $\epsilon = 1.490$ – 1.493 $2V(\text{meas.}) = \leq 20^\circ$

Cell Data: *Space Group:* $P6_3/m$. $a = 5.987(2)$ $c = 3.5413(7)$ $Z = 1$

X-ray Powder Pattern: Verkhne-Espe massif, Kazakhstan. 1.717 (10b), 2.086 (9), 3.00 (5), 2.92 (5), 5.24 (3), 1.129 (3), 2.28 (2)

Chemistry:	(1)	(2)		(1)	(2)
SiO ₂	0.15		K ₂ O	0.10	trace
TiO ₂	trace		F	33.00	33.00
Al ₂ O ₃	0.60	trace	Cl	3.79	
RE ₂ O ₃	54.80	56.75	H ₂ O	0.07	
Fe ₂ O ₃	0.15	0.33	insol.		2.34
CaO	14.18	8.79	–O = (F, Cl) ₂	14.73	13.88
Na ₂ O	7.50	10.64	Total	99.61	97.97

(1) Verkhne-Espe massif, Kazakhstan; RE = La 1.2%, Ce 5.3%, Pr 1.0%, Nd 6.1%, Sm 4.8%, Gd 6.1%, Tb 2.2%, Dy 18.2%, Ho 3.6%, Er 10.6%, Tm 1.4%, Yb 10.1%, Y 29.4%. (2) Erzin massif, Russia; RE = La 0.8%, Ce 3.5%, Pr 0.8%, Nd 3.8%, Sm 3.8%, Eu 0.3%, Gd 10.5%, Tb 1.3%, Dy 11.3%, Ho 2.5%, Er 7.6%, Tm 0.7%, Yb 3.6%, Lu 1.3%, Y 48.5%. (3) Katugino massif, Kazakhstan; analysis not given, stated to correspond to Na_{0.6}(Ca_{0.95}Y_{0.72}Dy_{0.10}Gd_{0.09}Er_{0.04}Ho_{0.03}Sm_{0.03}Yb_{0.01}Nd_{0.01}Tb_{0.01}Ce_{0.01}) $\Sigma=2.00$ F_{5.41}.

Occurrence: As disseminations, segregations, and in veins and miarolitic cavities within Na-metasomatized alkalic granites and quartz-syenites.

Association: Riebeckite, pyrochlore, zircon, bastnäsite, tenerite, synchysite, yttrifluorite, elpidite (Verkhne-Espe massif, Kazakhstan); riebeckite, aegirine, zircon, fergusonite, polythionite, siderite, sphalerite, fluorite (Erzin massif, Russia).

Distribution: From the Bol'shoi and Malyi stocks, Verkhne-Espe alkaline massif, Tarbagatai Range, and the Katugino massif, Irkutsk region, Kazakhstan. In Russia, found in the Erzin alkaline massif, southeastern Tuva, and other undefined localities in eastern Siberia. Occurs in the vicinity of Lake Gjerdingen, Nordmarka, Norway. In the USA, found at Washington Pass, Okanogan Co., Washington.

Name: In honor of the first cosmonaut, Yuri Alekseevich Gagarin (1934–1968).

Type Material: Vernadsky Geological Museum, Moscow, 47307; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 62341–62343.

References: (1) Stepanov, A.V. and E.A. Severov (1961) Gagarinite, a new rare-earth mineral. Doklady Acad. Nauk SSSR, 141, 954–957 (in Russian). (2) (1962) Amer. Mineral., 47, 805 (abs. ref. 1). (3) Akelin, N.A. and M.E. Kazakova (1963) New discovery of gagarinite. Doklady Acad. Nauk SSSR, 149, 672–674 (in Russian). (4) Vlasov, K.A., Ed. (1966) Mineralogy of rare elements, v. II, 223–225. (5) Hughes, J.M. and J.W. Drexler (1994) Refinement of the structure of gagarinite-(Y), Na_x(Ca_xREE_{2-x})F₆. Can. Mineral., 32, 563–565.

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