

Crystal Data: Tetragonal, pseudocubic. *Point Group:* $\bar{4}, \bar{4}2m$ based on morphology. As short tetragonal prisms with pyramids, sphenoids, and bisphenoids, to 3 mm; fine-grained aggregates, massive. *Twinning:* Penetration twinning on (101) produces pseudocubic triplets; pseudotrigonal contact twins with composition planes (10 $\bar{1}$) and (01 $\bar{1}$).

Physical Properties: *Cleavage:* Distinct on {101}, fair on {110}. *Fracture:* Conchoidal. Hardness = ~4 D(meas.) = 2.33(1) D(calc.) = 2.34–2.35 Piezoelectric; fluorescent and phosphorescent red to rose-pink under UV; photochromic, pale colors become pink on exposure to sunlight or X-rays.

Optical Properties: Transparent to translucent. *Color:* White, pink, carmine, bluish, greenish; colorless in thin section. *Luster:* Vitreous. *Optical Class:* Uniaxial (+); anomalously biaxial. *Pleochroism:* Weak violet to weak red-orange. $\omega = 1.492\text{--}1.496$ $\epsilon = 1.499\text{--}1.502$ $2V(\text{meas.}) = < 10^\circ$

Cell Data: *Space Group:* $I\bar{4}$. $a = 8.640(1)$ $c = 8.873(1)$ $Z = 2$

X-ray Powder Pattern: Tugtup agtakôrfa, Greenland. 3.52 (100), 6.13 (80), 3.57 (60), 2.497 (60), 2.023 (60), 4.40 (40), 2.331 (40)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SiO ₂	51.58	50.45	51.38	Na ₂ O	25.52	23.26	26.50
Al ₂ O ₃	11.15	12.56	10.90	K ₂ O	0.12	0.40	
Fe ₂ O ₃	trace			Cl	7.28	6.04	7.58
Ga ₂ O ₃		0.04		H ₂ O ⁺		1.50	
BeO	5.40	5.30	5.35	H ₂ O ⁻	0.03	1.51	
MgO	0.20			S	0.33		
CaO		0.50		–O = Cl ₂ , S ₂	1.99	1.37	1.71
				Total	99.62	100.19	100.00

(1) Ilímaussaq intrusion, Greenland. (2) Lovozero massif, Russia. (3) Na₄AlBeSi₄O₁₂Cl.

Occurrence: Replaces chkalovite in hydrothermal veins cutting sodalite syenite and syenite (Ilímaussaq intrusion, Greenland); an alteration product in pegmatites in a differentiated alkalic massif (Lovozero massif, Russia).

Association: Albite, analcime, aegirine, natrolite, tetranatrolite, chkalovite, lithian mica, epistolite, niobophyllite, monazite, rhabdophane, gerasimovskite, nenadkevichite, beryllite.

Distribution: In Greenland, in the Ilímaussaq intrusion, at Tugtup agtakôrfa, around the Tunugdliarfik Fjord and on the Kangerdluarssuk Plateau; on Qeqertausaq Island; in the Gletscherelv Valley; and on the Kvanefjeld and Taseq Plateaus. From Mts. Sengischorr and Punkaruaiiv, Lovozero massif, Kola Peninsula, Russia. At Mont Saint-Hilaire, Quebec, Canada.

Name: For the occurrence at Tugtup agtakôrfa, Greenland.

Type Material: University of Copenhagen, Copenhagen, Denmark, 1970.276; The Natural History Museum, London, England, 1967.394.

References: (1) Sørensen, H. (1962) On the occurrence of steenstrupine in the Ilímaussaq massif, southwest Greenland. *Medd. om Grønland*, 167(1), 1–251, esp. 218–219. (2) (1963) *Amer. Mineral.*, 48, 1178 (abs. ref. 1). (3) Danø, M. (1966) The crystal structure of tugtupite – a new mineral, Na₈Al₂Be₂Si₈O₂₄(Cl,S)₂. *Acta Cryst.*, 20, 812–816. (4) Sørensen, H., M. Danø, and O.V. Petersen (1971) On the mineralogy and paragenesis of tugtupite. *Grønlands Geologiske Undersøgelse Bull.* 95, 38 p. (5) Petersen, O.V. (1978) The twin formation of tugtupite, a contribution. *Mineral. Mag.*, 42, 251–254. (6) Hassan, I. and H.D. Grundy (1991) The crystal structure and thermal expansion of tugtupite, Na₈[Al₂Be₂Si₈O₂₄]Cl₂. *Can. Mineral.*, 29, 385–390.

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