Götzenite **$Na_2Ca_5Ti(Si_2O_7)_2F_4$**

Crystal Data: Triclinic. *Point Group:* $\overline{1}$. Crystals prismatic, acicular, to 1 cm, may be skeletal. *Twinning:* Lamellar twinning on {001}, twin axis [010], ubiquitous.

Physical Properties: *Cleavage:* Perfect on {100}, good on {001}. Hardness = n.d. D(meas.) = 3.03–3.14 D(calc.) = [2.84]

Optical Properties: Transparent. *Color:* Colorless, white to honey-yellow. *Luster:* Greasy. *Optical Class:* Biaxial (+). *Orientation:* $Z' \wedge c \simeq 58°$. *Dispersion:* $r > v$, strong. $\alpha = 1.651–1.660$ $\beta = 1.653–1.662$ $\gamma = 1.659–1.670$ 2V(meas.) = 52°–84° 2V(calc.) = 53.5°

Cell Data: *Space Group:* $P\overline{1}$. $a = 9.667$ $b = 5.731$ $c = 7.334$ $\alpha = 90°$ $\beta = 101.05°$ $\gamma = 101.31°$ Z = 1

X-ray Powder Pattern: Mt. Shaheru, Congo.
3.100 (100), 2.986 (100), 1.911 (50), 2.648 (40), 2.511 (25), 1.696 (25), 3.994 (15)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SiO_2	32.50	32.34	34.01	BaO	0.09	0.00	
TiO_2	9.72	8.74	11.31	Na_2O	4.85	6.32	8.77
ZrO_2		0.19		K_2O	0.14	0.09	
Al_2O_3	4.26	0.45		F	8.33	9.15	10.76
RE_2O_3		1.84		Cl	0.15	0.00	
Fe_2O_3	0.35	0.02		H_2O^+	0.26	0.57	
Nb_2O_5		3.36		H_2O^-	0.14	0.04	
FeO	0.45	0.14		CO_2	0.00		
MnO	0.07	0.62		P_2O_5	0.01	0.00	
MgO	0.29	0.04		SO_3	0.19	0.00	
CaO	41.80	38.95	39.68	$-O = (F, Cl)_2$	3.54	3.85	4.53
SrO	0.00	0.87		Total	100.06	99.88	100.00

(1) Mt. Shaheru, Congo. (2) Lovozero massif, Russia. (3) $Na_2Ca_5Ti(Si_2O_7)_2F_4$.

Occurrence: In a nephelinite from the wall of the crater of an extinct volcano (Mt. Shaheru, Congo); in hornfels and marble xenoliths in an intrusive alkalic gabbro-syenite complex (Mont Saint-Hilaire, Canada).

Association: Combeite (Mt. Shaheru, Congo); aegirine, apatite, fersmanite, pectolite (Kola Peninsula, Russia); cancrinite, fluorite, titanite (Azov region, Ukraine).

Distribution: On Mt. Shaheru, the extinct southern cone of Mt. Nyiragongo, Kivu Province, Congo (Zaire). In Russia, from Mt. Yukspor, Khibiny massif, and the Lovozero massif, Kola Peninsula. At Barkevik, Langesundsfjord, Norway. From the Azov region, Ukraine. Near Kirchberg, Saxony; in the Kaiserstuhl, Baden-Württemberg; and around the Laacher See, Eifel district, Germany. At Mont Saint-Hilaire, Quebec, Canada.

Name: For Count Gustav Adolph von Götzen (1886–?), noted German traveller who climbed Mt. Shaheru, Congo (Zaire), in 1894.

Type Material: The Natural History Museum, London, England, 1957,702; Royal Museum of Central Africa, Tervuren, Belgium, RGM8037; National Museum of Natural History, Washington, D.C., USA, 142981.

References: (1) Sahama, T.G. and K. Hytönen (1957) Götzenite and combeite, two new silicates from the Belgian Congo. Mineral. Mag., 31, 503–510. (2) (1958) Amer. Mineral., 43, 790

(abs. ref. 1). (3) Sahama, G. (1960) Identity of calcium rinkite and götzenite. Amer. Mineral., 45, 221–224. (4) Cannillo, E., F. Mazzi, and G. Rossi (1972) Crystal structure of götzenite. Kristallografiya (Sov. Phys. Crystal.), 16, 1167–1172 (in Russian). (5) Bulakh, A.G. and Y.L. Kapustin (1973) Götzenite from alkaline rocks of the Tur'ev Peninsula (Kola Peninsula). Zap. Vses. Mineral. Obshch., 102, 464–466 (in Russian). (6) (1974) Mineral. Abs., 25, 130 (abs. ref. 5). (7) Deer, W.A., R.A. Howie, and J. Zussman (1986) Rock-forming minerals, (2nd edition), v. 1B, disilicates and ring silicates, 343–347.