Usturite $\{Ca_3\}[Sb^{5+}Zr](Fe^{3+}{}_3)O_{12}$

Crystal Data: Cubic. *Point Group*: $4/m\ \bar{3}\ 2/m$. As crystals confined by {110} to 10 μm as aggregates with lakargiite and Fe^{3+}-dominant kimzeyite replacing zircon.

Physical Properties: *Cleavage*: n.d. *Fracture*: n.d. *Tenacity*: n.d. Hardness = n.d.
D(meas.) = n.d. D(calc.) = 4.470

Optical Properties: n.d. *Color*: Light brown or yellow. *Streak*: White with yellow tint.
Luster: Strong vitreous.
Optical Class: Isotropic. n(calc.) = ~1.9

Cell Data: *Space Group*: $Ia\bar{3}\ d$. a = 12.49 Z = 8

X-ray Powder Pattern: Calculated pattern.
1.669 (100), 3.123 (93), 4.416 (77), 2.550 (77), 2.793 (62), 1.975 (20), 1.732 (15)

Chemistry:

	(1)		(1)
UO_3	0.64	HfO_2	0.25
V_2O_5	0.03	ThO_2	0.04
Nb_2O_5	0.18	Al_2O_3	8.29
Sb_2O_5	18.79	Cr_2O_3	0.02
SiO_2	1.52	Fe_2O_3	18.74
TiO_2	2.39	FeO	0.87
ZrO_2	15.92	CaO	25.54
SnO_2	6.15	MgO	0.06
		Total	98.43

(1) Upper Chegem caldera, Northern Caucasus, Kabardino-Balkaria, Russia; average of 11 electron microprobe analyses supplemented by Raman spectroscopy; corresponding to $(Ca_{3.002}Th_{0.001})_{\Sigma=3.003}(Sb^{5+}{}_{0.776}Zr_{0.852}Sn^{4+}{}_{0.269}Ti^{4+}{}_{0.067}Mg_{0.010}Nb^{5+}{}_{0.009}Hf_{0.008}Cr_{0.002}U^{6+}{}_{0.015})_{\Sigma=2.008}(Fe^{3+}{}_{1.548}Al_{1.072}Si_{0.167}Ti^{4+}{}_{0.130}Fe^{2+}{}_{0.080}V^{5+}{}_{0.002})_{\Sigma=2.997}O_{12}$.

Polymorphism & Series: Solid solution series with kimzeyite-schorlomite and toturite garnets.

Mineral Group: Garnet supergroup, bitikleite group.

Occurrence: In the cuspidine zone of high-temperature skarns in a carbonate-silicate xenolith at the contact with ignimbrites.

Association: Cuspidine, larnite, wadalite, rondorfite, fluorite, hydroxylellestadite, ettringite group minerals, perovskite, magnesioferrite, hibschite, afwillite, hillebrandite, tobermorite-like minerals, hydrocalumite.

Distribution: Within the Upper Chegem caldera, Northern Caucasus, Kabardino-Balkaria, Russia.

Name: Formerly bitikleite-(ZrFe). For *Ustur* Mountain near the type locality.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (3841/1).

References: (1) Galuskina, I.O., E.V. Galuskin, T. Armbruster, B. Lazic, P. Dzierżanowski, V.M. Gazeev, K. Prusik, N.N. Pertsev, A. Winiarski, A.E. Zadov, R. Wrzalik, and A.G. Gurbanov (2010) Bitikleite-(SnAl) and bitikleite-(ZrFe): New garnets from xenoliths of the Upper Chegem volcanic structure, Kabardino-Balkaria, Northern Caucasus, Russia. Amer. Mineral., 95, 959-967.
(2) Grew, E.S., A.J. Locock, S.J. Mills, I.O. Galuskina, E.V. Galuskin, and U. Hålenius (2013) Nomenclature of the garnet supergroup. Amer. Mineral., 98, 785-811.