Dzhuluite $Ca_3SbSnFe^{3+}{}_3O_{12}$

Crystal Data: Isometric. *Point Group*: 4/*m* $\bar{3}$ 2/*m*. Forms trapezohedral {211} crystals to 15 μm, with cores of the Ti-analog of kerimasite. As rims on lakargiite. Also as poikilitic crystals < 50 μm with inclusions of wadalite or katoite-grossular pseudomorphs after wadalite, in some cases substituted by cuspidine.

Physical Properties: *Cleavage*: None. *Fracture*: n.d. *Tenacity*: n.d. *Hardness* = n.d. D(meas.) = n.d. D(calc.) = 4.708 [analysis 1] - 4.750 Partially metamict.

Optical Properties: Translucent to transparent. *Color*: Light yellow to dark brown.
Streak: Creamy. *Luster*: Strongly vitreous.
Optical Class: Isotropic. *n*(calc.) = 1.94

Cell Data: *Space Group*: *Ia*$\bar{3}$ *d*. *a* = 12.536(3) Z = 8

X-ray Powder Pattern: Calculated.
1.6752 (100), 2.5589 (95), 4.43 (87), 3.1340 (84), 2.8031 (47), 1.4016 (35), 1.3363 (29)

Chemistry:

	(1)		(1)
UO_3	6.30	Al_2O_3	6.17
Nb_2O_5	0.08	Sc_2O_3	0.05
Sb_2O_5	16.73	Fe_2O_3	19.82
SiO_2	0.28	FeO	2.20
TiO_2	2.62	MgO	0.02
ZrO_2	4.21	CaO	23.86
SnO_2	16.70	Total	99.04

(1) Upper Chegem Caldera, Northern Caucasus, Kabardino-Balkaria, Russia; average of 9 electron microprobe analyses, valences inferred from Raman spectroscopy; corresponding to $(Ca_{2.954}Fe^{2+}{}_{0.043}Mg_{0.003})_{\Sigma=3.000}(Sn_{0.850}Sb^{5+}{}_{0.764}Zr_{0.121}U^{6+}{}_{0.127}Ti^{4+}{}_{0.070}Sc_{0.009}Nb^{5+}{}_{0.058}Hf_{0.001})_{\Sigma=2.001}$ $(Fe^{3+}{}_{2.051}Al_{0.653}Fe^{2+}{}_{0.182}Ti^{4+}{}_{0.087}Si_{0.028})_{\Sigma=3.001}O_{12}$.

Polymorphism & Series: Forms complex series within the group, $\{Ca_3\}[Sb^{5+}Sn^{4+}](Fe^{3+}{}_3)O_{12}$.

Mineral Group: Bitikleite group, garnet supergroup**.**

Occurrence: From fluorine metasomatism of a thermally-altered carbonate-silicate xenolith (20 m long) in ignimbrite, the heat from which created sanidinite facies metamorphism in the xenolith.

Association: Kumtyubeite, cuspidine, fluorchegemite, larnite, fluorite, wadalite, rondorfite, hydroxylellestadite, perovskite, lakargiite, kerimasite, elbrusite, srebrodolskite, bultfonteinite, ettringite group minerals, hillebrandite, afwillite, tobermorite-like minerals, hydrocalumite, hydrogrossular.

Distribution: From the north end of Xenolith No.1, the Upper Chegem Caldera, Northern Caucasus, Kabardino-Balkaria, Russia.

Name: Originally named *bitikleite-(SnFe)*. Subsequently re-named after *Dzhulu* Mountain, located near the site from which the first specimens were collected.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (#4025/1).

References: (1) Galuskina, I.O., E.V. Galuskin, J. Kusz, P. Dzierżanowski, K. Prusik, V.M. Gazeev, N.N. Pertsev, and L. Dubrovinsky (2013) Dzhuluite, $Ca_3SbSnFe^{3+}{}_3O_{12}$, a new bitikleite-group garnet from the Upper Chegem Caldera, Northern Caucasus, Kabardino-Balkaria, Russia. Eur. J. Mineral., 25, 231-239. (2) (2015) Amer. Mineral., 100, 1322-1323 (abs. ref. 1).