Kumtyubeite $Ca_5(SiO_4)_2F_2$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As grains, to 250 μm. *Twinning*: Simple, rarely polysynthetic, on (001).

Physical Properties: *Cleavage*: Distinct on (001), particularly for OH:F ≈ 1. *Tenacity*: Brittle. *Fracture*: n.d. Hardness = 5-6 VHN = 280-320, 300 average (50 g load). D(meas.) = n.d. D(calc.) = 2.866

Optical Properties: Transparent. *Color*: Light-pink, colorless in thin-section. *Streak*: n.d. *Luster*: Vitreous.
Optical Class: Biaxial (-) α = 1.594(2) β = 1.605(2) γ = 1.608(2) 2V(meas.) = 40°-55° 2V (calc.) = 54.8° *Orientation*: $X \wedge c$ = 15(2)°, $Z = b$.

Cell Data: *Space Group*: $P2_1/a$. a = 11.44637(18) b = 5.05135(8) c = 8.85234(13) β = 108.8625(7)° Z = 2

X-ray Powder Pattern: Upper Chegem caldera, Kabardino-Balkaria, Northern Caucasus, Russia. 1.9040 (100), 3.0344 (37), 1.8952 (37), 5.4202 (30), 1.6587 (28), 2.7737 (25), 1.8027 (23)

Chemistry:

	(1)	(2)
TiO_2	0.09	0.10
SiO_2	28.20	28.02
Fe_2O_3	0.04	0.02
CaO	66.19	66.38
MgO	0.05	0.04
MnO	n.d.	0.03
F	6.22	6.09
Cl	n.d.	0.03
H_2O	[1.25]	[1.33]
– O = F + Cl	2.64	2.56
Total	99.40	99.48

(1) Upper Chegem caldera, Kabardino-Balkaria, Northern Caucasus, Russia; average electron microprobe analysis supplemented by Raman spectroscopy, H_2O calculated for charge balance; corresponds to $Ca_5(Si_{1.99}Ti_{0.01})_{\Sigma=2}O_8[F_{1.39}(OH)_{0.61}]_{\Sigma=2}$. (2) Do.; average electron microprobe analysis supplemented by Raman spectroscopy, H_2O calculated for charge balance; corresponds to $Ca_{5.01}(Si_{1.98}Ti_{0.01})_{\Sigma=1.99}O_8[F_{1.36}(OH)_{0.62}]_{\Sigma=1.98}$.

Polymorphism & Series: Forms a series with reinhardbraunsite.

Mineral Group: Humite group.

Occurrence: A rock-forming mineral in contact-metasomatic, spurrite-rondorfite-ellestadite skarn in carbonate-xenoliths in ignimbrites.

Association: Rondorfite, lakargiite, kimzeyite, srebrodolskite, bultfonteinite, Ca-hydrosilicates, ettringite.

Distribution: From between Lakargi and Vorlan mountain peaks, Upper Chegem caldera, Kabardino-Balkaria, Northern Caucasus, Russia.

Name: Derives from *Kum-Tyube*, the name of a mountain plateau near where the mineral was found.

Type Material: A.E. Fersman Mineralogical Museum, Moscow, Russia (3732/1).

References: (1) Galuskina, I.O., B. Lazic, T. Armbruster, E.V. Galuskin, V.M. Gazeev, A.E. Zadov, N.N. Pertsev, L. Jeżak, R. Wrzalik, and A.G. Gurbanov (2009) Kumtyubeite $Ca_5(SiO_4)_2F_2$ - A new calcium mineral of the humite group from Northern Caucasus, Kabardino-Balkaria, Russia. Amer. Mineral., 94, 1361-1370.