Kapellasite $Cu_3Zn(OH)_6Cl_2$

Crystal Data: Hexagonal. *Point Group*: $\bar{3}$ 2/*m*. As crusts and aggregates to 0.5 mm, composed of sprays of bladed or needle-like indistinct crystals to 0.2 mm, strongly distorted with elongation perpendicular to [0001].

Physical Properties: *Cleavage*: Good on {0001}. *Tenacity*: Brittle. *Fracture*: Uneven. Hardness = 4 VHN = 200(30) (25 g load). D(meas.) =3.55(10) D(calc.) = 3.62

Optical Properties: Transparent. *Color*: Green-blue. *Streak*: Light green-blue. *Luster*: Adamantine. *Optical Class*: Uniaxial (-). ω = 1.80(1) ε = 1.76(1) *Pleochroism*: Distinct, *E* = pale green, *O* = green-blue.

Cell Data: *Space Group*: $P\bar{3}\,m1$. a = 6.300(1) c = 5.733(1) Z = 1

X-Ray Diffraction Pattern: Lavrion, Greece. Preferred orientation || {0001}. 5.730 (100), 2.865 (11), 2.464 (9), 1.976 (5), 2.730 (4), 1.910 (4), 2.533 (2)

Chemistry:

	(1)	(2)
CuO	58.86	52.80
ZnO	13.92	20.44
NiO	0.03	
CoO	0.03	
Fe_2O_3	0.04	
Cl	16.70	16.58
H_2O	[12.22]	[12.27]
-O = Cl	3.77	3.74
Total	98.03	98.35

(1) Sounion No. 19 mine, Lavrion, Greece; average electron microprobe analysis supplemented by FTIR spectroscopy, H_2O calculated; corresponds to $(Cu_{3.24}Zn_{0.75})_{\Sigma=3.99}(OH)_{5.94}Cl_{2.06}$. (2) Juliushütte, Harz mountains, Germany; average electron microprobe analysis supplemented by FTIR spectroscopy, H_2O calculated; corresponds to $(Cu_{2.90}Zn_{1.10})_{\Sigma=4.00}(OH)_{5.96}Cl_{2.04}$.

Polymorphism & Series: Polymorph of herbertsmithite.

Occurrence: From weathering copper and zinc minerals in the presence of chloride ions.

Association: Gypsum, paratacamite, atacamite, gordaite, beaverite, hydrozincite, smithsonite, glaucocerinite, plumbojarosite, bianchite, herbertsmithite, anglesite, cumengéite, serpierite, ktenasite, calcite, quartz, pyrite, galena (Greece); cumengéite, diaboleite, gypsum (Germany).

Distribution: From the Sounion No. 19 mine, Kamariza, Lavrion, Greece [TL]. In weathered slag of the Juliushütte, near Goslar, Harz mountains, Germany.

Name: Honors Christo *Kapellas* (1938-2004), collector and mineral dealer from Kamariza, Lavrion, Greece.

Type Material: Mineralogical Institute, University of Bochum, Germany (IMA-2005-009).

References: (1) Krause, W., H.J. Bernhardt, R.S.W. Braithwaite, U. Kolitsch, and R. Pritchard (2006) Kapellasite, $Cu_3Zn(OH)_6Cl_2$, a new mineral from Lavrion, Greece, and its crystal structure. Mineral. Mag., 70, 329-340. (2) Colman, R.H., C. Ritter, and A.S. Wills (2008) Toward Perfection: Kapellasite, $Cu_3Zn(OH)_6Cl_2$, a New Model *S* = 1/2 Kagome Antiferromagnet. Chem. Materials, 20, 6897-6899.