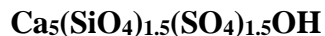


Hydroxyllelestadite



Crystal Data: Hexagonal. *Point Group:* 6/m. As prismatic crystals, massive, granular.

Physical Properties: *Cleavage:* Indistinct. *Fracture:* Irregular. *Tenacity:* Brittle. Hardness = 4.5 VHN = 590(30) (50 g load). D(meas.) = 3.068 D(calc.) = 3.046

Optical Properties: Translucent to transparent. *Color:* Pale rose, rose-pink, orange.

Streak: White. *Luster:* Vitreous.

Optical Class: Uniaxial (-). $\omega = 1.655(2)$ $\varepsilon = 1.650(2)$

Cell Data: Space Group: $P6_3/m$. $a = 9.496(2)$ $c = 6.920(2)$ $Z = 2$

X-ray Powder Pattern: Crestmore, California, USA.

2.843 (100), 2.751 (70), 3.458 (50), 2.800 (40), 1.964 (40), 1.855 (40), 2.651 (30)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
CaO	55.18	55.84	54.51	P ₂ O ₅	3.06	8.73	0.66
SrO			0.28	Cl	1.64	0.54	0.91
SO ₃	20.69	16.85	21.56	F	0.57	0.39	0.28
Na ₂ O			0.34	CO ₂			1.65
SiO ₂	17.31	14.73	17.30	H ₂ O ⁺	0.53		2.04
Al ₂ O ₃	0.13		trace	H ₂ O ⁻	0.10		0.72
Fe ₂ O ₃	0.22		0.21	H ₂ O		[1.45]	
MnO	0.01		0.04	-O = (F, Cl) ₂	0.61	0.29	0.32
MgO	0.47		trace	Total	99.91	98.24	100.25

(1) Crestmore, California, USA. (2) Cioclovina Cave, Romania; average of 8 electron microprobe analyses supplemented by FTIR and Raman spectroscopy, H₂O calculated for charge balance; corresponds to Ca_{5.14}[(SiO₄)_{1.26}(SO₄)_{1.08}(PO₄)_{0.64}]_{Σ=2.98}[(OH)_{0.83}F_{0.10}Cl_{0.08}]_{Σ=1.01}. (3) Chichibu mine, Saitama prefecture, Japan; includes K₂O=0.07, corresponds to (Ca_{4.70}Na_{0.05}Sr_{0.0135}Fe_{0.013}K_{0.007}Mn_{0.0005})_{Σ=4.77}(SiO₄)_{1.43}[(SO₄)_{1.338}(CO₃OH)_{0.186}(PO₄)_{0.046}]_{Σ=1.57}[(OH)_{0.938}Cl_{0.128}F_{0.073}]_{Σ=1.14}.

Polymorphism & Series: Chlorellestadite and fluorellestadite.

Mineral Group: Apatite supergroup, ellestadite group.

Occurrence: In contact metamorphosed limestone (Crestmore). In highly phosphatized, silicate-rich, carbonate-mudstone cave sediments heavily compacted and thermally transformed by in situ combustion of bat guano (Romania). In pyrometamorphosed rocks on coal mine spoil heaps.

Association: Diopside, wollastonite, vesuvianite, monticellite, okenite, calcite (Crestmore); berlinite (Cioclovina Cave); wilkeite, apatite, magnetite, chlorite, tremolite, calcite (Chichibu).

Distribution: From Crestmore, Riverside Co., California, USA. In Cioclovina Cave, SW side of the Şureanu Mountains and in the Oraviţa skarns, about 35 km SSW of Reşita, Romania. At the Chichibu mine, Saitama prefecture, Japan. On combusted spoil heaps at the Kukla mine, Oslavany, and the Ferdinand mine, Zastávka, Rosice-Oslavany coalfield, Czech Republic.

Name: Honors Dr. Reuben B. Ellestad (1900-1993), American analytical chemist, University of Minnesota, Minneapolis, Minnesota, USA, and the *hydroxyl*-end member of the *ellestadite* group.

References: (1) McConnell, D. (1937) The substitution of SiO₄- and SO₄-groups for PO₄-groups in the apatite structure; ellestadite, the end-member. *Amer. Mineral.*, 22, 977-986. (2) Onac, B.P., H. Effenberger, K. Ettinger, and S.C. Panzaru (2006) Hydroxyllelestadite from Cioclovina Cave (Romania): microanalytical, structural, and vibrational spectroscopy data. *Am. Mineral.*, 91, 1927-1931. (4) Sejkora, J., S. Houzar, and V. Šrein (1999) Cl-rich hydroxyllelestadite from Zastávka near Brno. *Acta Musei Moraviae, Scientiae Geologicae*, 84, 49-59 (in Czech with English abstract). (5) Harada, K., K. Nagashima, K. Nakao, and A. Kato (1971) Hydroxyllelestadite, a new apatite from Chichibu mine, Saitama prefecture, Japan. *Amer. Mineral.*, 56, 1507-1518.