Zincalstibite $Zn_2Al(OH)_6[Sb(OH)_6]$

Crystal Data: Hexagonal. *Point Group*: $\bar{3}$. As trigonal prismatic crystals, displaying {110}, {001}, and elongated along [001], to 50 μm (1*T* polytype). As curved disc-like tablets, to 20 μm, flattened on {001} and bound by indistinct forms in the [001] zone; in rosettes to 50 μm (9*R* polytype).

Physical Properties: *Cleavage*: On {001}. Hardness = n.d. D(meas.) = n.d. D(calc.) = n.d.

Optical Properties: Transparent. *Color*: Colorless (1*T*); pale blue (9*R*). *Streak*: White. *Luster*: Vitreous.
Optical Class: Uniaxial (-). ω = 1.647(2) ε = 1.626(2) (9*R*)

Cell Data: *Space Group*: $P\bar{3}$. a = 5.321(1) c = 9.786(2) Z = 1 (1*T*)

Space Group: $R\bar{3}$. a = 5.340(2) c = 88.01(2) Z = 9 (9*R*)

X-ray Powder Pattern: Lucchetti marble quarry, near Carrara, Apuan Alps, Tuscany, Italy. (1*T*)
4.987 (100), 2.343 (88), 4.180 (57), 1.806 (57), 4.615 (35), 2.667 (31), 3.366 (18)
X-ray Powder Pattern: Monte Avanza mine, near Pierabec, Friuli-Venezia Giulia, Italy. (9*R*)
4.886 (100), 2.338 (73), 1.798 (43), 4.550 (28), 2.6625 (27), 9.811 (23), 1.539 (18)

Chemistry:

	(1)	(2)	(3)
Sb_2O_5	34.12	33.45	33.19
ZnO	32.34	33.66	18.61
CuO			14.56
Al_2O_3	11.39	10.54	11.27
SiO_2	0.74		
H_2O	[21.41]	22.35	[22.77]
Total	100.00	100.00	100.64

(1) Lucchetti marble quarry, near Carrara, Apuan Alps, Tuscany, Italy; average electron microprobe analysis, H_2O by difference and OH^- confirmed by structure analysis; corresponding to $(Zn_{1.90}Al_{1.08}Sb_{1.02})O_{6.05}\cdot 5.7H_2O$ (1*T* polytype). (2) $SbZn_2Al(OH)_{12}$ or $Zn_2Al(OH)_6[Sb(OH)_6]$. (3) Monte Avanza mine, near Pierabec, Friuli-Venezia Giulia, Italy; electron microprobe analysis; corresponds to $(Zn^{2+}_{1.09}Cu^{2+}_{0.87}Al_{0.04})_{\Sigma=2.00}Al_{1.01}(Sb^{5+}_{0.97}Si_{0.02})_{\Sigma=0.99}(OH)_{12}$ (9*R* polytype).

Polymorphism & Series: 1*T* and 9*R* polytypes.

Mineral Group: Hydrotalcite supergroup, cualstibite group.

Occurrence: In cavities in marble likely an alteration product of different sulfides (sphalerite, zinkenite, stibioluzonite) by low-temperature Al-rich hydrothermal fluids (1*T*); a secondary mineral is the weathering zone of a tetrahedrite-tennantite, galena, sphalerite and pyrite deposit (9*R*).

Association: Mimetite, opal, an amorphous copper-silicate phase (1*T*); cyanophyllite, linarite, baryte, quartz, goethite (9*R*).

Distribution: From Italy, at the Lucchetti marble quarry, near Carrara, Apuan Alps, Tuscany (1*T* polytype) and the Monte Avanza Cu-Ag mine, southern side of Monte Avanza, near Pierabec, municipality of Forni Avoltri, Udine Province, Friuli-Venezia Giulia (9*R* polytype).

Name: For the composition, as a mineral with essential *zin*c, and structurally related to *cualstibite*.

Type Material: Natural History Museum of Los Angeles County, California, USA (63840). (9*R*)

References: (1) Bonaccorsi, E., S. Merlino, and P. Orlandi (2007) Zincalstibite, a new mineral, and cualstibite: Crystal chemical and structural relationships. Amer. Mineral., 92, 198-203. (2) Mills, S.J., A.G. Christy, A.R. Kampf, R.M. Housley, G. Favreau, J.-C. Boulliard, and V. Bourgoin, (2012) Zincalstibite-9*R*: the first 9-layer polytype with the layered double hydroxide structure-type. Mineral. Mag, 76, 1337-1345. (3) Mills, S.J., A.G. Christy, J.-M.R. Geńin, T. Kameda, and F. Colombo (2012) Nomenclature of the hydrotalcite supergroup: natural layered double hydroxides. Mineral. Mag., 76(5), 1289-1336.