

Zaccagnaite**Zn₄Al₂(OH)₁₂(CO₃)·3H₂O**

Crystal Data: Hexagonal. *Point Group:* $6/m\ 2/m\ 2/m$ or $\bar{3}\ 2/m$. As minute hexagonal crystals, elongated along [0001] to 0.2 mm. *3R* polytype shows octahedral or hexagonal pyramidal and prismatic forms.

Physical Properties: *Cleavage:* Perfect on {0001}. *Tenacity:* n.d. *Fracture:* n.d. Hardness = n.d. D(meas.) = n.d. D(calc.) = 2.82

Optical Properties: Transparent to milky. *Color:* White to pale yellow. *Streak:* White. *Luster:* Subvitreous to adamantine. *Optical Class:* Uniaxial (-). Very high interference colors in thin section.

Cell Data: *Space Group:* $R\bar{3}\ m$. $a = 3.06616(1)$ $c = 22.6164(1)$ $Z = 3$ *3R* polytype
 $P6_3/mmc$. $a = 3.0725(3)$ $c = 15.114(4)$ *2H* polytype

X-ray Powder Pattern: Calagio quarry, Colonnata valley, Apuan Alps, Italy. *2H* polytype
 7.51 (vs), 1.542 (ms), 1.539 (ms), 3.794 (m), 2.511 (mw), 2.175 (mw), 1.830 (mw)

Chemistry:	(1)
CuO	0.24
ZnO	56.01
Al ₂ O ₃	18.44
SiO ₂	0.09
Total	74.78

(1) Calagio quarry, Colonnata valley, Apuan Alps, Italy; average electron microprobe analysis, CO₃ and H₂O confirmed; corresponds to [(Zn_{3.92}Cu_{0.02}Al_{2.06})(OH)₁₂][(CO₃)·3H₂O]. (2) El Soplao cave, northern Spain; average electron microprobe analysis, H₂O and CO₃ groups confirmed by TGA, mass spectroscopy, and FTIR spectroscopy; corresponds to (Zn_{3.0}Al_{2.0})(OH)₁₀(CO₃)_{1.0}·2.5H₂O.

Polymorphism & Series: *2H* and *3R* polytypes.

Mineral Group: Hydrotalcite-manasseite family.

Occurrence: In cavities in calcite veins in marble formed through alteration of sphalerite by aluminum-rich hydrothermal fluids (Italy). By diagenesis of Zn- and Al-rich ferromanganese speleo-stromatolites (Spain).

Association: Hydrozincite, fraipontite (Italy).

Distribution: From the Calagio quarry, Colonnata valley, Apuan Alps, Italy. At El Soplao cave, northern Spain.

Name: Honors scholar Domenico *Zaccagna* (1851-1940), who published the first geological map of the Apuan Alps and was a competent collector of minerals from the Carrara marble.

Type Material: Natural History Museum, University of Pisa, Italy.

References: (1) Merlino, S. and P. Orlandi (2001) Carraraite and zaccagnaite, two new minerals from the Carrara marble quarries: their chemical compositions, physical properties, and structural features. *Amer. Mineral.*, 86, 1293-1301. (3) Lozano, R.P., C. Rossi, Á. La Iglesia, and E. Matesanz (2012) Zaccagnaite-*3R*, a new Zn-Al hydrotalcite polytype from El Soplao cave (Cantabria, Spain). *Amer. Mineral.*, 97, 513-523.