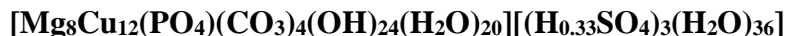


Ramazzoite

Crystal Data: Cubic. *Point Group:* $\bar{4}3m$. As cubes to 0.15 mm on edge. *Twinning:* Merohedral indicated by the structure refinement.

Physical Properties: *Cleavage:* Perfect on {100}. *Fracture:* Conchoidal. *Tenacity:* Very brittle. Hardness = 2.5 D(meas.) = 1.98 D(calc.) = 1.962 Soluble with mild effervescence in dilute HCl.

Optical Properties: Transparent. *Color:* Blue to greenish blue. *Streak:* Pale blue.

Luster: Vitreous to oily.

Optical Class: Isotropic. $n = 1.491(1)$

Cell Data: Space Group: $P\bar{4}3m$. $a = 13.3887(10)$ $Z = 1$

X-ray Powder Pattern: Monte Ramazzo mine, near Genova, Liguria, Italy.

13.37 (100), 9.43 (24), 4.043 (11), 3.252 (9), 2.857 (9), 4.224 (8), 2.730 (5)

Chemistry:	(1)	(2)	(3)
MgO	22.61	16.73	10.75
CuO	30.30	22.43	31.84
P ₂ O ₅	3.38	2.50	2.37
SO ₃	11.51	8.52	8.01
CO ₂		[6.21]	5.87
<u>H₂O</u>		<u>[43.60]</u>	<u>41.16</u>
Total		99.99	100.00

(1) Monte Ramazzo mine, Liguria, Italy; average of 5 electron microprobe analyses supplemented by Raman spectroscopy, H₂O calculated based on 36 H₂O in the interstitial unit to approximate the measured density, CO₂ calculated from structure; corresponds to [(Mg_{8.00})(Cu_{8.00}Mg_{3.78})(PO₄)(CO₃)₄(OH)₂₄(H₂O)₂₀][(H_{0.65}S_{1.01}O₄)₃(H₂O)₃₆]. (2) Do.; normalized.

(3) [Mg₈Cu₁₂(PO₄)(CO₃)₄(OH)₂₄(H₂O)₂₀][(H_{0.33}SO₄)₃(H₂O)₃₆].

Occurrence: A late-stage, secondary mineral hosted in serpentinite in contact with basalt dikes and pillow lavas. Likely crystallized from a low-temperature, aqueous solution.

Association: Magnetite, chlorartinite, chrysotile, dypingite, goethite, lepidocrocite, nesquehonite, an unidentified Mg sulfate-carbonate.

Distribution: From the Monte Ramazzo mine, near Genova, Liguria, Italy.

Name: For the locality, the Monte Ramazzo mine.

Type Material: Natural History Museum of Los Angeles County, Los Angeles, California, USA. (66691 and 66692).

References: (1) Kampf, A.R., G.R. Rossman, C. Ma, D. Belmonte, C. Biagioni, F. Castellaro, and L. Chiappino (2018) Ramazzoite, [Mg₈Cu₁₂(PO₄)(CO₃)₄(OH)₂₄(H₂O)₂₀][(H_{0.33}SO₄)₃(H₂O)₃₆], the first mineral with a polyoxometalate cation. *Eur. J. Mineral.*, 30(4), 827-834. (2) (2019) *Amer. Mineral.*, 104(12), 1869 (abs. ref. 1).