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BATONIITE

The 2023 "Mineral of the Year" award has been assigned to batoniite. The mineral was discovered in a sample collected at the Cetine di Cotorniano mine, Siena Province, Tuscany, Italy, and was fully characterized by a research team lead by Daniela Mauro from the Department of Earth Sciences, University of Pisa, Italy.

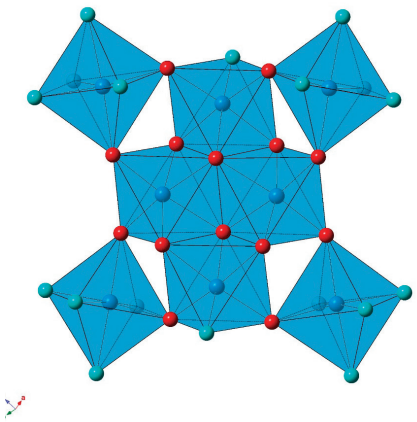
More precisely, batoniite was found in the Garibaldi tunnel, the lowest mining level of the Cetine di Cotorniano mining complex, and occurs as hemispherical aggregates up to 1 mm in diameter, formed by {011} tabular crystals. Crystals are colorless to white, and are transparent. Associated minerals are gypsum and a low-crystalline Al–Fe sulfate not yet characterized.

The ideal chemical formula of batoniite is $Al_8(SO_4)_5(OH)_{14}(H_2O)_{18}\cdot 5H_2O$ and it is the first natural species containing the $[Al_8(OH)_{14}(H_2O)_{18}]^{10+}$ polyoxocation. Thus, it is a new addition to the small number of polyoxometalates that currently represent less than 1% of all recognized mineral species.

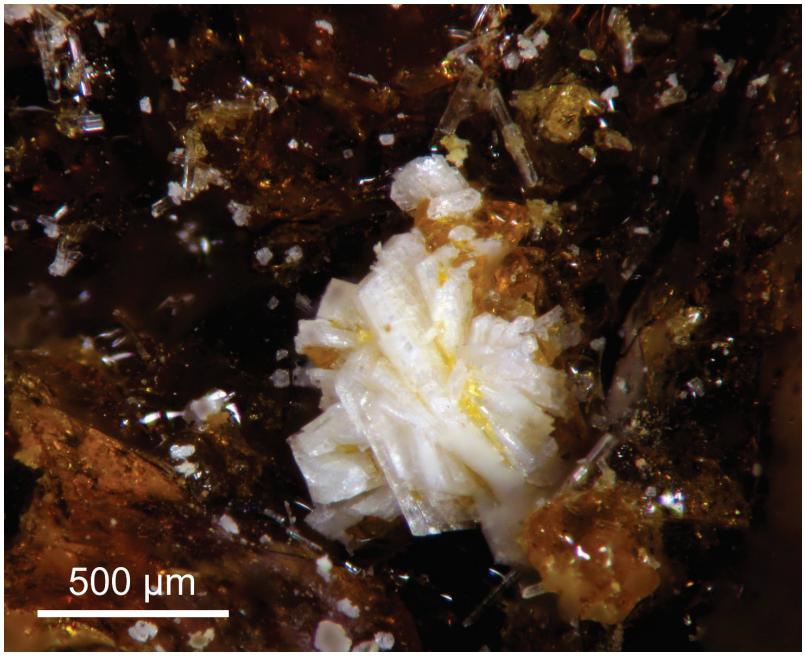
Batoniite is triclinic with space group *P*-1. Its unit-cell parameters are a = 9.1757(6) Å, b = 12.0886(9) Å, c = 20.9218(15) Å, α = 82.901(3)°, β = 87.334(3)°, γ = 86.999(2)°, V = 2297.8(3) Å^3, Z = 2. The crystal structure has been refined by single-crystal X-ray diffraction data to R = 9.2%. The structure is characterized by isolated $[Al_8(OH)_{14}(H_2O)_{18}]$ polyoxocations, H-bonded to five interstitial (SO_4) and five H_2O groups. The mineral name is after Massimo Batoni (b. 1948), for his contribution to the knowledge of Italian mineralogy.

Batoniite is the first Italian "Mineral of the Year," and it is the fifth new mineral species discovered at the Cetine di Cotorniano mine, after brizziite, cetineite, onoratoite, and rosenbergite.

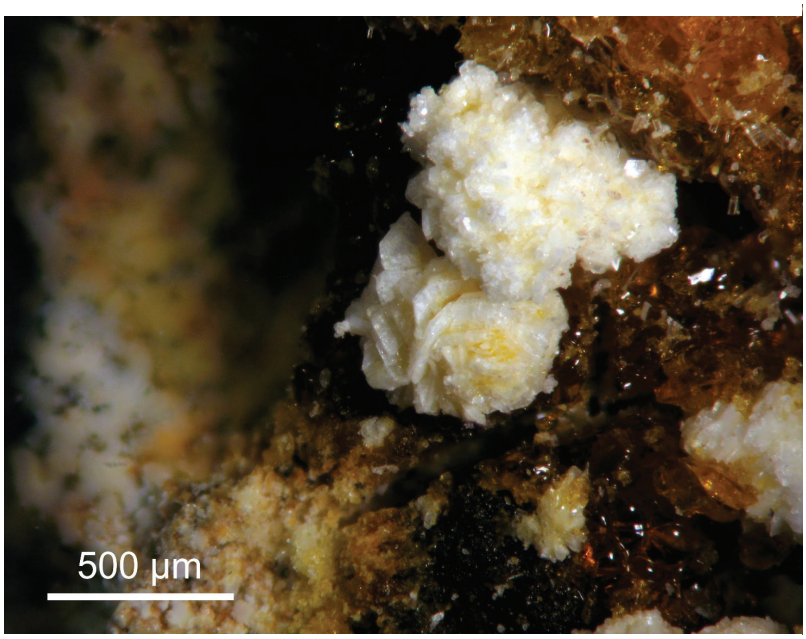
The full description of the new mineral has been published in the *European Journal of Mineralogy*: Mauro D, Biagioni C, Sejkora J, Dolníček J, Škoda R (2023) Batoniite, $[Al_8(OH)_{14}(H2O)_{18}](SO_4)_5\cdot 5H_2O$, a new mineral with the $[Al_8(OH)_{14}(H_2O)_{18}]^{10+}$ polyoxocation from the Cetine di Cotorniano Mine, Tuscany, Italy. European Journal of Mineralogy 35: 703-714, doi: 10.5194/ejm-35-703-2023



The polyoxocation $[Al_8(OH)_{14}(H_2O)_{18}]$ observed in batoniite. Red and light blue circles represent (OH) and (H_2O) groups, respectively. Blue polyhedra are Al-centered octahedra.



Aggregate of white tabular crystals of batoniite with colorless crystals of gypsum and orange-brown resinous unidentified, low-crystalline, Al-Fe sulfate. Garibaldi tunnel, Cetine di Cotorniano mine, Siena Province, Tuscany, Italy. Type material, Natural History Museum of Pisa University, catalogue number 20028. Photo D. Mauro.



Aggregates of white tabular crystals of batoniite with orange-brown resinous unidentified, low-crystalline, Al-Fe sulfate. Garibaldi tunnel, Cetine di Cotorniano mine, Siena Province, Tuscany, Italy. Type material, Natural History Museum of Pisa University, catalogue number 20028. Photo D. Mauro.