Tiberiobardiite $Cu_9Al(SiO_3OH)_2(OH)_{12}(H_2O)_6(SO_4)_{1.5}\cdot 10H_2O$

Crystal Data: Hexagonal. *Point Group*: $\bar{3}$. As thin crystals, tabular on {001}, to 200 μm, with a pseudo-hexagonal outline.

Physical Properties: *Cleavage*: Perfect on {001}. *Fracture*: Irregular. *Tenacity*: Brittle. Hardness = n.d. D(calc.) = 2.528

Optical Properties: Transparent. *Color*: Green. S*treak*: Pale green. *Luster*: Vitreous. *Optical Class*: n.d. *n*(calc.) = 1.568

Cell Data: Space Group: $R\bar{3}$. a = 10.6860(4) c = 28.3239(10) Z = 3

X-ray Powder Pattern: Cretaio Cu prospect, Massa Marittima, Grosseto, Tuscany, Italy. 9.4 (s), 4.67 (s), 2.576 (m), 2.330 (m), 2.041 (mw), 2.68(w), 1.548 (w)

Chemistry:

	(1)	(2)
SO_3	10.37	8.45
P_2O_5	3.41	
As_2O_5	0.05	
SiO_2	8.13	8.45
Al_2O_3	5.54	3.59
Fe_2O_3	0.74	
CuO	62.05	50.36
ZnO	0.03	
H_2O		29.15
Total	90.32	100.00

(1) Cretaio Cu prospect, Massa Marittima, Grosseto, Tuscany, Italy; average of 5 electron microprobe analyses supplemented by Raman spectroscopy; corresponds to $(Cu^{2+}_{8.69}Al_{0.21}Fe^{3+}_{0.10})_{\Sigma=9.00}Al_{1.00}(Si_{1.51}P_{0.54})_{\Sigma=2.05}S_{1.44}O_{12.53}(OH)_{13.47}\cdot 16H_2O$.
(2) $Cu_9Al(SiO_3OH)_2(OH)_{12}(H_2O)_6(SO_4)_{1.5}\cdot 10H_2O$.

Occurrence: The product of supergene alteration of Cu sulfide minerals (bornite, chalcocite, and covellite) in stockwork veins in deformed gabbro, in an oxidizing and hydrous low-temperature environment.

Association: Brochantite.

Distribution: From the Cretaio Cu prospect, near Prata, Massa Marittima, Grosseto, Tuscany, Italy.

Name: Honors mineral collector *Tiberio Bardi* (b.1960), for his contributions to the study of Tuscan mineralogy and for collecting the first specimens of this new mineral.

Type Material: Natural History Museum, University of Pisa, Italy (19900).

References: (1) Biagioni, C., M. Pasero, and F. Zaccarini (2018) Tiberiobardiite, $Cu_9Al(SiO_3OH)_2(OH)_{12}(H_2O)_6(SO_4)_{1.5}\cdot 10H_2O$, a new mineral related to chalcophyllite from the Cretaio Cu prospect, Massa Marittima, Grosseto (Tuscany, Italy): occurrence and crystal structure. Minerals, 8(4), 152. (2) (2020) Amer. Mineral., 105(8), 1284 (abs. ref. 1).