Hydrowoodwardite $Cu_2Al_2(SO_4)(OH)_8 \cdot nH_2O$.

Crystal Data: Hexagonal. *Point Group:* $\overline{3}\ 2/m$ (probable). As porous botryoidal crusts and small stalactitic aggregates.

Physical Properties: *Fracture:* Uneven. *Tenacity:* Brittle upon partial dehydation. Hardness = n.d. D(meas.) = 2.33(8) D(calc.) = 2.48 Slowly and reversibly dehydrates to woodwardite.

Optical Properties: Translucent. *Color:* Blue to pale blue. *Streak:* Pale blue. *Luster:* Vitreous.
Optical Class: [Uniaxial.] $n = 1.549(5)$–$1.565(5)$ ω = n.d. ϵ = n.d.

Cell Data: *Space Group:* $R\overline{3}m$ (probable). $a = 3.070(7)$ $c = 31.9(2)$ Z = 3

X-ray Powder Pattern: St. Briccius mine, Germany.
10.5 (100), 5.26 (17), 3.50 (6), 2.60 (5b), 1.524 (4b), 2.46 (2b), 2.23 (2b)

Chemistry:

	(1)
SO_3	15.50
SiO_2	5.60
Al_2O_3	19.20
CuO	28.39
ZnO	0.41
Na_2O	0.10
H_2O	30.10
Total	[99.30]

(1) St. Briccius mine, Germany; by ICP-MS, SiO_2 from admixed amorphous silica, H_2O by TGA, $(SO_4)^{2-}$, $(OH)^{1-}$ and H_2O confirmed by IR, original total given as 99.3%; corresponds to $(Cu_{1.92}Zn_{0.04})_{\Sigma=1.96}Al_{2.04}(SO_4)_{1.04}(OH)_{7.96} \cdot 5.08H_2O$. (2) St. Christoph mine, Germany; analysis not given, $(CO_3)^{2-}$ from stoichiometry and presence confirmed by IR; then stated to correspond to $(Cu_{1.96}Zn_{0.04})_{\Sigma=2.00}(UO_2)_{0.04}Al_{2.00}[(SO_4)_{0.64}(CO_3)_{0.36}]_{\Sigma=1.00}(OH)_8 \cdot nH_2O$.

Occurrence: Rare in the oxidized portions of base metal sulfide mines.

Association: Woodwardite, schulenbergite, namuwite, brianyoungite, langite, linarite, allophane, amorphous silica.

Distribution: In Germany, in Saxony, from the St. Briccius mine, Königswalde, near Annaberg; in the Gelbe Birke mine, Schwarzenberg; at the St. Johannes mine, Wolkenstein, near Marienberg; and from the St. Christoph mine, Bärenhecke. At Simdde Dyllhan, Drws-y-Coed, near Nantlle, Gwynedd, Wales.

Name: As the hydrated analog of *woodwardite*.

Type Material: Mining Academy, Freiberg, Germany, 76639.

References: (1) Witzke, T. (1999) Hydrowoodwardite, a new mineral of the hydrotalcite group from Königswalde near Annaberg, Saxony/Germany and other localities. Neues Jahrb. Mineral., Monatsh., 75–86. (2) (1999) Amer. Mineral., 84, 1465 (abs. ref. 1). (3) Nickel, E. (1976) New data on woodwardite. Mineral. Mag., 43, 644–647.