## Bottinoite $NiSb_2^{5+}(OH)_{12}\cdot 6H_2O$



**Crystal Data:** Hexagonal. *Point Group:* $3m$, 32, or $\overline{3}\ 2/m$. Crystals tabular on {0001}, with $\{10\overline{1}0\}$, in roselike and spherulitic aggregates, to 3 mm. *Twinning:* Inability to solve the structure was attributed to possible twinning.

**Physical Properties:** *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = ∼3
VHN = 94–110, 105 average (10 g load). D(meas.) = 2.83(1) (synthetic). D(calc.) = 2.81

**Optical Properties:** Transparent. *Color:* Pale blue to blue-green. *Streak:* Very pale blue.
*Luster:* Vitreous.
*Optical Class:* Uniaxial (+). $\omega = 1.600(10)$ $\epsilon = 1.605(10)$

**Cell Data:** *Space Group:* $P31m$, $P3m1$, $P312$, or $P\overline{3}1m$. $a = 16.026(3)$ $c = 9.795(2)$
Z = 6

**X-ray Powder Pattern:** Bottino mine, Italy.
4.62 (100), 3.36 (100), 2.34 (80), 1.806 (70), 2.09 (60), 1.751 (60), 4.88 (50)

**Chemistry:**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $As_2O_5$ | | 0.53 | | |
| $Sb_2O_5$ | 62.6 | 69.12 | 52.07 | 52.65 |
| $SiO_2$ | | 0.31 | | |
| NiO | 15.2 | 15.92 | 12.04 | 12.16 |
| $H_2O$ | 32.9 | | 35.40 | 35.19 |
| Total | 110.7 | | 99.51 | 100.00 |

(1) Bottino mine, Italy; by electron microprobe, average of four analyses, with apparent loss of $H_2O$ in electron beam; $H_2O$ by TGA, $(OH)^{1-}$ and $H_2O$ confirmed by IR. (2) Brownley Hill mine, England; by electron microprobe, average of four partial analyses. (3) Synthetic; by AA, $H_2O$ by TGA; corresponds to $Ni_{0.99}Sb_{1.98}H_{24.13}O_{18}$. (4) $NiSb_2(OH)_{12}\cdot 6H_2O$.

**Occurrence:** Adjacent to and incrusting ullmannite in oxidized hydrothermal base-metal deposits.

**Association:** Ullmannite, galena, sphalerite, chalcopyrite, pyrite, quartz, calcite, bindheimite, cerussite, hydrozincite, chrysocolla, malachite, hemimorphite, pyromorphite, wulfenite.

**Distribution:** In the Bottino mine, near Seravezza, Tuscany, Italy. In England, at the Brownley Hill mine, Nenthead, Cumbria. From the Hendre Felen mine, Ysbyty Ystwyth, Dyfed, and the Mynydd Gorddu mine, Bont gôch, Ceulanymaesmawr, Wales. In Germany, from Dörnberg, Ramsbeck, North Rhein-Westphalia.

**Name:** For its occurrence in the Bottino mine, Italy.

**Type Material:** University of Florence, Florence, Italy, 1747/RI.

**References:** (1) Bonazzi, P., S. Menchetti, A. Caneschi, and S. Magnanelli (1992) Bottinoite, $Ni(H_2O)_6[Sb(OH)_6]_2$, a new mineral from the Bottino mine, Alpi Apuane, Italy. Amer. Mineral., 77, 1301–1304. (2) Clark, A.M. (1993) Bottinoite, a mineral new to Britain. Mineral. Mag., 57, 543–544.