Biringuccite $Na_2B_5O_8(OH)\cdot H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Tiny crystals and microcrystalline clusters, in earthy masses.

Physical Properties: Hardness = n.d. D(meas.) = 2.32(1) (synthetic). D(calc.) = 2.297 Soluble in H_2O.

Optical Properties: Transparent. *Color:* White to pale yellow.
Optical Class: Biaxial (–) (synthetic). *Orientation:* $Y = b$; $Z \wedge a = 5.4(6)°$ $\alpha = 1.496(2)$ $\beta = 1.539(2)$ $\gamma = 1.557(2)$ 2V(meas.) = 62.7° 2V(calc.) = 64.6°

Cell Data: *Space Group:* $P2_1/c$ (synthetic). $a = 11.1955(7)$ $b = 6.5607(4)$ $c = 20.7566(9)$ $\beta = 93.891(6)°$ Z = 4

X-ray Powder Pattern: Synthetic.
3.45 (100), 10.32 (80), 3.05 (55), 3.03 (55), 2.589 (45), 5.18 (40), 2.853 (40)

Chemistry: (1) Larderello, Italy; identification depended on the chemical analysis interpreted as a mixture with nasinite, and the correspondence of lines in the mixture's X-ray powder pattern with those of synthetic material.

Occurrence: As scales on piping in a geothermal field.

Association: Nasinite, thénardite, orpiment, quartz.

Distribution: From Larderello, Val di Cecina, Tuscany, Italy.

Name: To honor Vannoccio Biringuccio (1480–1538/9), alchemist and metallurgist, author of the *Pirotechnia*.

Type Material: University of Florence, Florence, Italy, 16802/703; National Museum of Natural History, Washington, D.C., USA, 163785.

References: (1) Cipriani, C. and P. Vannuccini (1961) Hoeferite [= biringuccite] e nasinite: due nuori borati fra i prodotti di Larderello. Pt. I. Atti Rend. Accad. Lincei, 30, 74–83; Pt. II. 235–245 (in Italian). (2) Cipriani, C. A proposito del nome del borato naturale $2Na_2O\cdot 5B_2O_3\cdot 4H_2O$ di Larderello. Atti Rend. Accad. Lincei, 31, 141–142 (in Italian). (3) (1963) Amer. Mineral., 48, 709–711 (abs. refs. 1–2). (4) Corazza, E., S. Menchetti, and C. Sabelli (1974) The crystal structure of biringuccite, $Na_4[B_{10}O_{16}(OH)_2]\cdot 2H_2O$. Amer. Mineral., 59, 1005–1015. (5) Menchetti, S., C. Sabelli, A. Stoppioni, and R. Trosti-Ferroni (1983) Hydrothermal synthesis at 250 °C and X-ray study of resulting products in the $NaOH-B_2O_3-H_2O$ system. Neues Jahrb. Mineral., Abh., 148, 163–180.