Mrázekite $Bi_2Cu_3O_2(PO_4)_2(OH)_2 \cdot 2H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. As acicular to slender bladed crystals, tabular on {101}, elongated along [010] or $[20\overline{1}]$, with wedgelike terminations, to 2 mm; in rosettes or spherules of radial acicular crystals, and as crusts.

Physical Properties: *Cleavage:* On $\{20\overline{1}\}$. Hardness = 2–3 D(meas.) = 4.90(2) D(calc.) = 5.00

Optical Properties: Translucent to transparent. *Color:* Cerulean blue. *Luster:* Vitreous. *Optical Class:* Biaxial (–). *Pleochroism:* Very faint; in ink-blue tints. *Orientation:* $X = b$; $Y \simeq a$; $Z \wedge c = 16°$; or $Z = b$; $X \wedge c = 27°$; $Y \wedge a = 15°$. *Dispersion:* $r < v$, strong. *Absorption:* $X < Y < Z$. $n = 1.865(5)$ or $1.89(5)$ 2V(meas.) = 66(5)°–68(2)°

Cell Data: *Space Group:* $P2_1/n$. $a = 9.065(1)$ $b = 6.340(1)$ $c = 21.239(3)$ $\beta = 101.57(1)°$ Z = 4

X-ray Powder Pattern: Lubietová, Slovakia.
3.040 (100), 2.924 (83), 7.625 (78), 3.014 (63), 5.200 (52), 5.145 (45), 5.410 (43)

Chemistry:

	(1)	(2)	(3)
P_2O_5	15.89	15.16	15.76
As_2O_5	0.11	0.26	
V_2O_5		0.25	
Bi_2O_3	51.97	50.09	51.74
CuO	26.14	25.44	26.50
PbO		0.10	
H_2O	[5.90]	[6.00]	6.00
Total	[100.01]	[97.30]	100.00

(1) Lubietová, Slovakia; by electron microprobe, original total given as 100.00%, H_2O calculated from stoichiometry, IR confirms $(OH)^{1-}$, H_2O, $(PO_4)^{3+}$; corresponds to $Bi_{2.01}Cu_{2.96}O_{2.00}[(P_{1.01}As_{0.01})_{\Sigma=1.02}O_4]_2(OH)_2 \cdot 1.95H_2O$. (2) Reichenbach, Germany; by electron microprobe, average of 14 analyses, H_2O calculated, presence of $(OH)^{1-}$ and molecular H_2O confirmed by FTIR spectroscopy; corresponds to $Bi_{2.05}Cu_{2.99}O_{2.00}[(PO_4)_{1.95}(AsO_4)_{0.02}(VO_4)_{0.02}]_{\Sigma=1.99}(OH)_{1.98} \cdot 1.88H_2O$. (3) $Bi_2Cu_3O_2(PO_4)_2(OH)_2 \cdot 2H_2O$.

Occurrence: A rare secondary mineral formed by oxidization of polymetallic sulfides.

Association: Chalcopyrite, tetrahedrite, chalcocite, malachite, pyromorphite, pseudomalachite, libethenite, reichenbachite, beudantite, bismutite, mixite, chrysocolla.

Distribution: From L'ubietová, near Baňská Bystrica (Libethen, near Neusohl), Slovakia. At Gadernheim and Reichenbach, near Bensheim, Hesse, Germany. From Sainte-Marie-aux-Mines, Haut-Rhin, France. In the Morass Creek Gorge, 15 km north of Benambra, Victoria, Australia.

Name: Honors Zdenek Mrázek (1952–1984), who collected the first specimens and recognized their unusual characteristics.

Type Material: Charles University, Prague; National Museum, Prague, Czech Republic, P1N 88529.

References: (1) Řídkošil, T., V. Šrein, J. Fábry, J. Hybler, and B.A. Maximov (1992) Mrázekite, $Bi_2Cu_3(OH)_2O_2(PO_4)_2 \cdot 2H_2O$, a new mineral species and its crystal structure. Can. Mineral., 30, 215–224. (2) (1992) Amer. Mineral., 77, 1306 (abs. ref. 1). (3) Effenberger, H., W. Krause, K. Belendorff, H.-J. Bernhardt, O. Medenbach, J. Hybler, and V. Petříček (1994) Revision of the crystal structure of mrázekite, $Bi_2Cu_3(OH)_2O_2(PO_4)_2 \cdot 2H_2O$. Can. Mineral., 32, 365–372. (4) Birch, W.D., D.A. Henry, and A. Pring (1995) A new occurrence of mrazekite [*sic*] from Benambra, Victoria, Australia. Mineral. Record, 26, 107–113.