

**Matulaite****CaAl<sub>18</sub>(PO<sub>4</sub>)<sub>12</sub>(OH)<sub>20</sub>•28H<sub>2</sub>O**

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**Crystal Data:** Monoclinic. *Point Group:* 2/m. As rosettes of pseudo-hexagonal thin tabular scaly crystals, to 1 mm; botryoidal and as spherules.

**Physical Properties:** *Cleavage:* Perfect on {100}. *Tenacity:* Slightly flexible but not elastic. Hardness = 1 D(meas.) = 2.330 D(calc.) = [2.33]

**Optical Properties:** Translucent. *Color:* Colorless, white, grayish white. *Luster:* Pearly. *Optical Class:* Biaxial (-). *Orientation:* Y = b; Z ∧ c = 8°. *Dispersion:* r < v, strong. α = [1.558] β = 1.576(2) γ = 1.582(2) 2V(meas.) = ~60°

**Cell Data:** *Space Group:* P2<sub>1</sub>/c. a = 20.4(1) b = 16.7(1) c = 10.6(1) β = 98.2(5)° Z = 2

**X-ray Powder Pattern:** Hellertown, Pennsylvania, USA. 9.96 (10), 6.37 (4), 4.42 (4), 2.395 (4), 4.83 (3), 3.79 (3), 3.66 (3)

| <b>Chemistry:</b>              | (1)  | (2)   | (3)   |                               | (1)          | (2)           | (3)           |
|--------------------------------|------|-------|-------|-------------------------------|--------------|---------------|---------------|
| P <sub>2</sub> O <sub>5</sub>  | 33.5 | 35.22 | 33.93 | CaO                           | 1.59         | 1.67          | 2.23          |
| SiO <sub>2</sub>               | 3.0  |       |       | BaO                           | 0.06         |               |               |
| TiO <sub>2</sub>               | 0.12 |       |       | Na <sub>2</sub> O             | 0.06         |               |               |
| Al <sub>2</sub> O <sub>3</sub> | 34.0 | 35.75 | 36.56 | K <sub>2</sub> O              | 0.04         |               |               |
| Fe <sub>2</sub> O <sub>3</sub> | 1.05 |       |       | H <sub>2</sub> O <sup>+</sup> | 10.64        | 11.18         |               |
| MnO                            | 0.07 |       |       | H <sub>2</sub> O <sup>-</sup> | 15.39        | 16.18         |               |
| CuO                            | 0.09 |       |       | H <sub>2</sub> O              |              |               | 27.28         |
| ZnO                            | 0.14 |       |       | <b>Total</b>                  | <b>99.75</b> | <b>100.00</b> | <b>100.00</b> |

(1) Hellertown, Pennsylvania, USA. (2) Do.; analysis (1) recomputed to 100% after deduction of quartz and hematite impurities, and removal of minor oxides 0.58%.

(3) CaAl<sub>18</sub>(PO<sub>4</sub>)<sub>12</sub>(OH)<sub>20</sub>•28H<sub>2</sub>O.

**Occurrence:** An uncommon secondary mineral in the oxidized zone of phosphatic iron deposits.

**Association:** Beraunite, rockbridgeite, dufrénite, cacoxenite, strengite, wavellite, goethite, hematite.

**Distribution:** In the USA, from the Bachman iron mine, Hellertown, Northampton Co., and at General Trimble's mine, Chester Co., Pennsylvania; in the LCA pegmatite, Bessemer City, Gaston Co., North Carolina; at the Candelaria mine, Candelaria district, Mineral Co., Nevada. From the Rotläufchen iron mine, Waldgirmes, near Wetzlar, Hesse, and at Hagendorf, Bavaria, Germany.

**Name:** Honors Margaret Mary Matula (1925–), Allentown, Pennsylvania, USA, who supplied some of the first specimens.

**Type Material:** The Natural History Museum, London, England, 1984,138; National Museum of Natural History, Washington, D.C., USA, 137020.

**References:** (1) Moore, P.B. and J. Ito (1980) Jungit und Matulait: Zwei neue taflige Phosphat-Mineralien. *Aufschluss*, 31, 55–61 (in German with English abs.). (2) (1980) *Amer. Mineral.*, 65, 1067 (abs. ref. 1).