Morinite $NaCa_2Al_2(PO_4)_2(F,OH)_5 \cdot 2H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. As tabular to blocky, prismatic crystals, to 1 cm; flattened on {100}, elongated along [010]; {hk0} faces striated ‖ [001]; subparallel aggregates of crystals terminated by {$\bar{1}$11}, {110} yield groups with serrated upper edges; as botryoidal crusts and radial fibrous aggregates.

Physical Properties: *Cleavage:* Perfect on {100}; imperfect on {001}. Hardness = 4–4.5 D(meas.) = 2.94–2.96 D(calc.) = 2.98

Optical Properties: Transparent to translucent. *Color:* Colorless to white, pale pink, wine-red. *Streak:* White. *Luster:* Vitreous to pearly on cleavages.
Optical Class: Biaxial (–). *Orientation:* $Y = b$; $X \wedge a = 45°$. *Dispersion:* $r < v$, weak.
$\alpha = 1.553$ $\beta = 1.565$ $\gamma = 1.567$ 2V(meas.) = 40°

Cell Data: *Space Group:* $P2_1/m$. $a = 9.454(3)$ $b = 10.692(4)$ $c = 5.444(2)$ $\beta = 105.46(2)°$ Z = 2

X-ray Powder Pattern: Hugo mine, South Dakota, USA.
2.94 (10), 3.47 (8), 1.783 (8), 4.70 (7), 2.63 (7), 9.11 (6), 3.73 (6)

Chemistry:

	(1)	(2)
P_2O_5	29.31	30.04
SiO_2	2.40	
Al_2O_3	22.46	22.33
MnO	0.02	
CaO	22.49	23.60
Na_2O	5.85	6.62
F	14.58	13.31
H_2O	9.80	9.98
insol.	0.14	
$-O = F_2$	6.12	5.60
Total	100.93	100.28

(1) Montebras, France. (2) Hugo mine, South Dakota, USA; corresponds to $Na_{1.00}Ca_{1.97}Al_{2.05}(P_{0.99}O_4)_2[F_{3.52}(OH)_{1.22}]_{\Sigma=4.74} \cdot 2H_2O$.

Occurrence: An uncommon late-stage mineral in complex granite pegmatites.

Association: Montebrasite, apatite, augelite, wardite, wavellite, cassiterite.

Distribution: From Montebras, Creuse, France. On the Greifensteine, near Ehrenfriedersdorf, Saxony, and at Hagendorf, Bavaria, Germany. In the Gunheath china clay pit, St. Austell, Cornwall, England. From the Viitaniemi pegmatite, near Eräjärvi, Finland. In the USA, in the Hugo mine, 1.5 km south of Keystone, Pennington Co., South Dakota; at the Stewart mine, Pala, San Diego Co., California; from the Silver Coin mine, near Valmy, Iron Point district, Humboldt Co., Nevada. In a pegmatite nearby Broken Hill, New South Wales, and at the Mt. Cleveland tin mine, 14 km southwest of Waratah, Tasmania, Australia.

Name: Honors Mr. E.A. Morineau, Director of the tin mine, Montebras, France, who supplied the first specimens.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 783–784, 784–785 [ježekite = morinite]. (2) Fisher, D.J. and J.J. Runner (1958) Morinite from the Black Hills. Amer. Mineral., 43, 585–594. (3) Hawthorne, F.C. (1979) The crystal structure of morinite. Can. Mineral., 17, 93–102. (4) Čech, F. and P. Povondra (1985) Identity of ježekite with morinite. Bull. Minéral., 108, 533–539.