Thadeuite $(Ca, Mn^{2+})(Mg, Fe^{2+}, Mn^{2+})_3(PO_4)_2(OH, F)_2$

Crystal Data: Orthorhombic. *Point Group:* 222. Cleavable massive, to ∼1 cm, also granular.

Physical Properties: *Cleavage:* On {010}, very good; another perpendicular. Hardness = < 4 D(meas.) = 3.25(1) D(calc.) = 3.21

Optical Properties: Translucent. *Color:* Yellow-orange. *Streak:* White. *Luster:* Vitreous. *Optical Class:* Biaxial (–). *Orientation:* $X = c$; $Y = b$; $Z = a$. α = [1.568] β = 1.597(2) γ = 1.600(2) 2V(meas.) = 33(2)°

Cell Data: *Space Group:* $C222_1$. $a = 6.412(3)$ $b = 13.563(8)$ $c = 8.545(5)$ Z = 4

X-ray Powder Pattern: Panasqueira, Portugal.
3.38 (100), 3.00 (31), 2.793 (31), 2.626 (23), 2.185 (18), 3.61 (16), 1.696 (11)

Chemistry:

	(1)
P_2O_5	38.7
FeO	11.3
MnO	5.6
MgO	24.3
CaO	14.7
F	2.4
OH	[7.1]
$-O = (F_2, OH)$	[4.3]
Total	[99.8]

(1) Panasqueira, Portugal; by electron microprobe, average of three analyses, total Fe as FeO, total Mn as MnO; $(OH)^{1-}$ calculated for P:(OH+F) = 1:1; corresponds to $(Ca_{0.96}Mn_{0.04})_{\Sigma=1.00}(Mg_{2.21}Fe_{0.57}Mn_{0.25})_{\Sigma=3.03}(PO_4)_{2.00}[(OH)_{1.53}F_{0.46}]_{\Sigma=1.99}$.

Occurrence: A very rare primary mineral in the margins of hydrothermal veins, formed between 230°–360° C and 100–1000 bars.

Association: Fluorapatite, wolfeite, topaz, muscovite, sphalerite, quartz, chalcopyrite, pyrrhotite, siderite, arsenopyrite, chlorite, vivianite, althausite, panasqueiraite.

Distribution: In the Panasqueira Sn–W deposit, Portugal.

Name: Honoring Professor Décio Thadeu, Technical University, Lisbon, Portugal, for his studies on Portuguese ore deposits.

Type Material: Department of Geology and Mineralogy, University of Michigan, Ann Arbor, Michigan; National Museum of Natural History, Washington, D.C., USA, 143141.

References: (1) Isaacs, A., D.R. Peacor, and W.C. Kelly (1979) Thadeuite, $Mg(Ca, Mn)(Mg, Fe, Mn)_2(PO_4)_2(OH, F)_2$, a new mineral from Panasqueira, Portugal. Amer. Mineral., 64, 359–361. (2) Isaacs, A.M. and D.R. Peacor (1982) The crystal structure of thadeuite, $Mg(Ca, Mn)(Mg, Fe, Mn)_2(PO_4)_2(OH, F)_2$. Amer. Mineral., 67, 120–125.