Hancockite $(Ca, Pb, Sr)_2(Al, Fe^{3+})_3(SiO_4)(Si_2O_7)O(OH)$

Crystal Data: Monoclinic. *Point Group:* $2/m$. As very small lath-shaped crystals, showing {001}, {100}, {101}, {$\bar{1}$01}, and {$\bar{1}$11}, striated parallel to their length and with rounded faces; subhedral grains, sometimes hollow. In drusy cellular aggregates and compact masses.

Physical Properties: *Cleavage:* {001}, perfect. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 6–7 D(meas.) = 4.03 D(calc.) = [4.03]

Optical Properties: Translucent. *Color:* Crystals yellowish brown, yellow-green; massive material dull brick-red, brownish red, or maroon. *Luster:* Vitreous.
Optical Class: Biaxial (–). *Pleochroism:* Strong; X = colorless, pale rose, greenish yellow; Y = pale brownish yellow, yellow; Z = pale rose, greenish yellow, green. *Dispersion:* $r > v$, perceptible. *Absorption:* $Z > X$. $\alpha = 1.788(3)$ $\beta = 1.81(1)$ $\gamma = 1.830(3)$ 2V(meas.) = ∼50°

Cell Data: *Space Group:* $P2_1/m$. $a = 8.958(20)$ $b = 5.665(10)$ $c = 10.304(20)$ $\beta = 114.4(4)°$ Z = 2

X-ray Powder Pattern: Franklin, New Jersey, USA. (ICDD 17-212).
2.91 (100), 3.49 (50), 2.60 (50), 2.81 (40), 2.71 (40), 2.18 (40), 1.90 (40)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SiO_2	30.99	29.1	27.48	PbO	18.53	26.3	32.44
TiO_2			0.10	MgO	0.52	trace	0.00
Al_2O_3	17.89	16.3	14.52	CaO	11.50	10.0	9.20
Fe_2O_3	12.33	14.5	13.09	SrO	3.89	3.6	
Mn_2O_3	1.38	2.7		BaO			0.32
MnO	2.12		0.19	H_2O^+	1.62	[1.37]	[2.66]
				Total	100.77	[103.9]	[100.00]

(1) Franklin, New Jersey, USA; corresponds to $(Ca_{1.17}Pb_{0.47}Sr_{0.21}Mn^{2+}_{0.17})_{\Sigma=2.02}(Al_{1.95}Fe_{0.88}Mn^{3+}_{0.10}Mg_{0.07})_{\Sigma=3.00}(Si_{2.95}Al_{0.05})_{\Sigma=3.00}O_{12}OH$. (2) Do.; by electron microprobe, H_2O from theoretical $CaPbFeAl_2Si_3O_{12}(OH)$. (3) Jakobsberg, Sweden; by electron microprobe, H_2O by difference; corresponds to $(Ca_{1.07}Pb_{0.95}Mn_{0.02}Ba_{0.01})_{\Sigma=2.05}(Al_{1.87}Fe^{3+}_{1.08}Ti_{0.01})_{\Sigma=2.95}Si_{3.00}O_{12}OH$.

Mineral Group: Epidote group.

Occurrence: In a metamorphosed stratiform zinc deposit (Franklin, New Jersey, USA); in a metamorphosed manganese-iron orebody in skarns enclosed in dolomitic marble (Jakobsberg, Sweden).

Association: Andradite, franklinite, manganaxinite, clinohedrite, roeblingite, datolite, prehnite, willemite, barite, hendricksite, barian feldspar, phlogopite, lead, copper (Franklin, New Jersey, USA); melanotekite, hematite, garnet (Jakobsberg, Sweden).

Distribution: From Franklin, Sussex Co., New Jersey, USA. At Jakobsberg, Värmland, Sweden.

Name: For Elwood P. Hancock (1836–1916), of Burlington, New Jersey, USA, collector of minerals from Franklin.

Type Material: Yale University, New Haven, Connecticut, USA, 2.4751.

References: (1) Dana, E.S. (1899) Dana's system of mineralogy, (6th edition), app. I, 32. (2) Penfield, S.L. and C.H. Warren (1899) Some new minerals from the zinc mines at Franklin, N.J., and note concerning the chemical composition of ganomalite. Amer. J. Sci., 8, 339–353. (3) Palache, C. (1935) The minerals of Franklin and Sterling Hill, Sussex County, New Jersey. U.S. Geol. Sur. Prof. Paper 180, 98. (4) Dollase, W.A. (1971) Refinement of the crystal structures of epidote, allanite and hancockite. Amer. Mineral., 56, 447–464. (5) Dunn, P.J. (1985) The lead silicates from Franklin, New Jersey: occurrence and composition. Mineral. Mag., 49, 721–727. (6) Holtstam, D. and J. Langhof (1994) Hancockite from Jakobsberg, Filipstad, Sweden: the second world occurrence. Mineral. Mag., 58, 172–174.