

Crystal Data: Orthorhombic. *Point Group:* 2/m 2/m 2/m. Crystals are usually tabular on {100}, or equant, showing {001}, {010}, {100}, {021}, {102}, {111}, many other forms, to 2.5 cm; powdery, compact.

Physical Properties: *Cleavage:* {010}, perfect; {001}, imperfect. *Hardness* = 3–3.5
D(meas.) = 2.10 D(calc.) = [2.13] Slightly soluble in H₂O.

Optical Properties: Transparent. *Color:* Colorless to gray. *Luster:* Vitreous.
Optical Class: Biaxial (+). *Orientation:* X = a; Y = b; Z = c. *Dispersion:* r < v, perceptible.
 $\alpha = 1.514(3)$ $\beta = 1.517(3)$ $\gamma = 1.533(3)$ $2V(\text{meas.}) = 44^\circ 46'$

Cell Data: *Space Group:* Pbc_a. a = 10.203–10.24 b = 10.679–10.74 c = 9.99–10.018
Z = [8]

X-ray Powder Pattern: Paoha Island, California, USA and Skipton lava tube caves, Australia.

5.34 (100), 4.71 (60), 3.460 (40), 3.083 (40), 2.580 (40), 5.94 (30), 3.039 (30)

Chemistry:

	(1)	(2)
P ₂ O ₅	40.73	40.71
Fe ₂ O ₃	0.85	
Mn ₂ O ₃	0.21	
MgO	22.37	23.12
H ₂ O	[35.84]	36.17
Total	[100.00]	100.00

(1) Skipton lava tube caves, Australia; H₂O by difference. (2) Mg(PO₃OH)·3H₂O.

Occurrence: In caves, formed directly from bat guano.

Association: Hannayite, struvite (Skipton lava tube caves, Australia); biphosphammite (Petrogale Cave, Australia); monetite, struvite (Paoha Island, California, USA).

Distribution: In the Skipton lava tube caves, 40 km southwest of Ballarat, Victoria, and the Petrogale Cave, near Madura, Western Australia. At the Niah Great Cave, Sarawak, Malaysia. Around Mt. Erebus, Victoria Land, Antarctica. On Réunion Island, Indian Ocean. From Ascension Island, south Atlantic. In the USA, on Paoha Island, Mono Lake, Mono Co., California. From near Mejillones, Antofagasta, Chile. From Ficus and Boon's Caves, Transvaal, South Africa.

Name: To honor James Cosmo Newbery (1843–1895), geologist, Melbourne, Australia, who initially found the mineral.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 709–711. (2) Cohen, L.H. and P.H. Ribbe (1966) Magnesium phosphate mineral replacement at Mono Lake, California. *Amer. Mineral.*, 51, 1755–1765. (3) Bartl, H., M. Catti, W. Joswig, and G. Ferraris (1983) Investigation of the crystal structure of newberyite, MgHPO₄·3H₂O, by single crystal neutron diffraction. *Tschermaks Mineral. Petrog. Mitt.*, 32, 187–194.