

Hannayite

$(\text{NH}_4)_2\text{Mg}_3(\text{PO}_3\text{OH})_4 \cdot 8\text{H}_2\text{O}$

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Crystal Data: Triclinic. *Point Group:* $\bar{1}$. As tabular crystals, elongated and striated || [001], to 12 mm; in radial sprays of laths.

Physical Properties: *Cleavage:* Good on {001}; poor on {110}, {1 $\bar{1}$ 0}, and {130}.
Hardness = Soft. D(meas.) = n.d. D(calc.) = 2.03

Optical Properties: Transparent to translucent. *Color:* Pale yellow, pale brown, white; colorless in transmitted light.
Optical Class: Biaxial (-). *Dispersion:* $r < v$, weak. $\alpha = 1.504(2)$ $\beta = 1.522(2)$ $\gamma = 1.539(2)$
 $2V(\text{meas.}) = \sim 90^\circ$

Cell Data: *Space Group:* $P\bar{1}$. $a = 7.70$ $b = 11.51$ $c = 6.70$ $\alpha = 76.0^\circ$ $\beta = 99.8^\circ$
 $\gamma = 115.8^\circ$ $Z = 1$

X-ray Powder Pattern: Synthetic.
6.96 (100), 3.46 (73), 5.15 (28), 4.64 (23), 3.29 (22), 3.75 (18), 3.00 (15)

Chemistry:

	(1)	(2)
P ₂ O ₅	44.63	44.56
FeO	0.31	
MnO	0.09	
MgO	18.36	18.98
(NH ₄) ₂ O	8.10	8.18
H ₂ O	28.51	28.28
Total	100.00	100.00

(1) Skipton lava tube caves, Australia. (2) $(\text{NH}_4)_2\text{Mg}_3(\text{PO}_3\text{OH})_4 \cdot 8\text{H}_2\text{O}$.

Occurrence: As rare druses on guano-derived phosphate mineral crusts in caves.

Association: Biphosphammite, guanine, monetite, syngenite, apthitalite, struvite, brushite, newberyite, dittmarite, schertelite.

Distribution: In Australia, from the Skipton lava tube caves, 40 km southwest of Ballarat, Victoria, and in the Murra-el-elevyn Cave, Cocklebidy, Western Australia. At the Niah Great Cave, Sarawak, Malaysia.

Name: Honors James Ballantine Hannay (1855–1931), Scottish chemist, University of Manchester, Manchester, England.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 699–700. (2) Frazier, A.W., J.R. Lehr, and J.P. Smith (1963) The magnesium phosphates hannayite, schertelite and bobierrite. *Amer. Mineral.*, 48, 635–641. (3) Bridge, P.J. (1973) Guano minerals from Murra-el-elevyn Cave, Western Australia. *Mineral. Mag.*, 39, 467–469. (4) Catti, M. and M. Franchini-Angela (1976) Hydrogen bonding in the crystalline state. Structure of $\text{Mg}_3(\text{NH}_4)_2(\text{HPO}_4)_4 \cdot 8\text{H}_2\text{O}$ (hannayite), and crystal-chemical relationships with schertelite and struvite. *Acta Cryst.*, 32, 2842–2848.