

# Wavellite

# $\text{Al}_3(\text{PO}_4)_2(\text{OH}, \text{F})_3 \cdot 5\text{H}_2\text{O}$

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**Crystal Data:** Orthorhombic. *Point Group:*  $2/m\ 2/m\ 2/m$ . Euhedral crystals uncommon, short to long prismatic, elongated and striated || [001], with {010}, {110}, {101}, {111}, {121}, with many {hk0} forms, to several mm. Commonly in flat to spherical radial aggregates, to 3 cm; may be stalactitic, in crusts, rarely opaline massive.

**Physical Properties:** *Cleavage:* Perfect on {110}; good on {101}; distinct on {010}. *Fracture:* Uneven to subconchoidal. *Tenacity:* Brittle. Hardness = 3.5–4 D(meas.) = 2.36 D(calc.) = 2.37

**Optical Properties:** Translucent. *Color:* White, greenish white, green, yellow, yellowish brown, turquoise-blue, brown, brownish black, may be zoned; colorless in transmitted light.

*Streak:* White. *Luster:* Vitreous to resinous, pearly.

*Optical Class:* Biaxial (+). *Pleochroism:* Weak; X = greenish; Z = yellowish.

*Absorption:*  $X > Z$ . *Orientation:*  $X = b$ ;  $Y = a$ ;  $Z = c$ . *Dispersion:*  $r > v$ , weak.

$\alpha = 1.518\text{--}1.535$   $\beta = 1.524\text{--}1.543$   $\gamma = 1.544\text{--}1.561$   $2V(\text{meas.}) = 60^\circ\text{--}72^\circ$

**Cell Data:** *Space Group:*  $Pcmn$ .  $a = 9.621(2)$   $b = 17.363(4)$   $c = 6.994(3)$   $Z = 4$

**X-ray Powder Pattern:** Black River Falls, Jackson Co., Wisconsin, USA.

8.67 (100), 8.42 (100), 3.22 (60), 5.65 (50), 3.42 (42), 4.81 (25), 2.573 (25)

## Chemistry:

	(1)	(2)
$\text{P}_2\text{O}_5$	33.40	34.46
$\text{Al}_2\text{O}_3$	37.44	37.12
$\text{Fe}_2\text{O}_3$	0.64	
F	2.79	
$\text{H}_2\text{O}$	26.45	28.42
$-\text{O} = \text{F}_2$	1.17	
Total	99.55	100.00

(1) Clonmel, Ireland. (2)  $\text{Al}_3(\text{PO}_4)_2(\text{OH})_3 \cdot 5\text{H}_2\text{O}$ .

**Occurrence:** A secondary mineral in low-grade metamorphic rocks and phosphate deposits; rare in hydrothermal veins.

**Association:** Crandallite, variscite.

**Distribution:** Many localities. In the High Down quarry, Filleigh, near South Moulton, Devon, England. At Clonmel, Co. Tipperary, Ireland. In Germany, in the Rotläufchen mine, Waldgirmes, at the Dünsberg, near Giessen, from Oberscheld, near Dillenburg, and elsewhere in the Lahr-Dill area, Hesse; on the Wachtelberg, Langenstriegis, west of Freiberg, Saxony; from the Lichtenberg quarry, near Ronneburg, Thuringia; and elsewhere. At Čerhovice, near Beroun (Beraun), Czech Republic. Near Bihain, Belgium, large rosettes. At Montebas, Creuse, France. In the USA, from General Trimble's mine, Chester Co., Pennsylvania; in the Wood mine, Cocke Co., Tennessee; abundant around Avant, as on Dug Hill, Garland Co., and from the Mauldin Mountain quarry, near Mt. Ida, Montgomery Co., Arkansas; in the Willard mine, Willard district, Pershing Co., Nevada. In Bolivia, fine examples from Llallagua, Potosí, and Oruro. At the Moculta phosphate quarry, northeast of Angaston, and the Iron Monarch quarry, Iron Knob, South Australia.

**Name:** For William Wavell (?–1829), physician, of Horwood Parish, Devon, England, discoverer of the species.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 962–964. (2) Araki, T. and T. Zoltai (1968) The crystal structure of wavellite. *Zeits. Krist.*, 127, 21–33. (3) Klemic, H. and M.E. Mrose (1972) Geologic relations and X-ray crystallography of wavellite from Jackson County, Wisconsin, and their geologic implications. *U.S.Geol. Surv. Prof. Paper* 800C, 53–62.

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