

# Wooldridgeite

# $\text{Na}_2\text{CaCu}_2(\text{P}_2\text{O}_7)_2 \cdot 10\text{H}_2\text{O}$

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**Crystal Data:** Orthorhombic. *Point Group:*  $mm2$ . As equant rhombic-dipyramidal crystals, typically with curved faces, to 200  $\mu\text{m}$ , isolated and in aggregates.

**Physical Properties:** *Fracture:* Irregular. *Tenacity:* Brittle. Hardness = 2–3  
D(meas.) = n.d. D(calc.) = 2.279

**Optical Properties:** Transparent. *Color:* Pale blue-green; colorless in transmitted light.

*Streak:* Very pale blue-green. *Luster:* Vitreous.

*Optical Class:* Biaxial (-) [*sic*]. *Orientation:*  $X = b$ ;  $Y = c$ ;  $Z = a$ .  $\alpha = 1.508(1)$   $\beta = 1.511(1)$   
 $\gamma = 1.517(1)$   $2V(\text{meas.}) = 76.2(5)^\circ$   $2V(\text{calc.}) = 71(10)^\circ$

**Cell Data:** *Space Group:*  $Fdd2$ .  $a = 11.938(1)$   $b = 32.854(2)$   $c = 11.017(1)$   $Z = 8$

**X-ray Powder Pattern:** Judkins quarry, Warwickshire, England.

6.52 (100), 4.05 (40), 3.255 (40), 2.924 (40), 8.23 (30), 2.807 (25), 2.614 (20)

## Chemistry:

	(1)	(2)
$\text{P}_2\text{O}_5$	39.37	38.30
CuO	20.24	21.46
MgO	0.24	
CaO	7.73	7.57
$\text{Na}_2\text{O}$	8.33	8.36
$\text{K}_2\text{O}$	0.17	
$\text{H}_2\text{O}$	[24.72]	24.31
Total	[100.80]	100.00

(1) Judkins quarry, Warwickshire, England; by electron microprobe, average of 10 analyses, presence of  $\text{H}_2\text{O}$  confirmed by IR and calculated from the structure analysis; corresponds to  $(\text{Na}_{1.96}\text{K}_{0.03})_{\Sigma=1.99}\text{Ca}_{1.00}(\text{Cu}_{1.85}\text{Mg}_{0.04})_{\Sigma=1.89}(\text{P}_{2.02}\text{O}_7)_2 \cdot 10\text{H}_2\text{O}$ . (2)  $\text{Na}_2\text{CaCu}_2(\text{P}_2\text{O}_7)_2 \cdot 10\text{H}_2\text{O}$ .

**Occurrence:** A rare weathering product of primary sulfides, the source of phosphorus enigmatic.

**Association:** Calcite, chalcopyrite, bornite, barite.

**Distribution:** From the Judkins quarry, Nuneaton, Warwickshire, England.

**Name:** Honoring James Wooldridge (1923–1995), amateur mineralogist and gemologist, who discovered the mineral.

**Type Material:** Manchester Museum, Manchester, England, N13200.

**References:** (1) Hawthorne, F.C., M.A. Cooper, D.I. Green, R.E. Starkey, A.C. Roberts, and J.D. Grice (1999) Wooldridgeite,  $\text{Na}_2\text{CaCu}_2^{2+}(\text{P}_2\text{O}_7)_2(\text{H}_2\text{O})_{10}$ : a new mineral from Judkins Quarry, Warwickshire, England. *Mineral. Mag.*, 63, 13–16. (2) (1999) *Amer. Mineral.*, 84, 1466 (abs. ref. 1). (3) Cooper, M.A. and F.C. Hawthorne (1999) The crystal structure of wooldridgeite,  $\text{Na}_2\text{CaCu}_2^{2+}(\text{P}_2\text{O}_7)_2(\text{H}_2\text{O})_{10}$ , a novel copper pyrophosphate mineral. *Can. Mineral.*, 37, 73–81.