

Autunite

Ca(UO₂)₂(PO₄)₂•10–12H₂O

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Crystal Data: Tetragonal. *Point Group:* $4/m\ 2/m\ 2/m$. As thin to moderately thick crystals, tabular on {001} and with rectangular or octagonal outline, to 2 cm; commonly in subparallel growths, foliated or scaly aggregates, and in crusts. *Twinning:* On {110}, interpenetrant, rare.

Physical Properties: *Cleavage:* Perfect on {001}; {100}, indistinct. Hardness = 2–2.5 D(meas.) = 3.05–3.2 (varies with hydration). D(calc.) = 3.14 (for 10.5H₂O). Strong yellow-green fluorescence in UV. Dehydrates in air. Radioactive.

Optical Properties: Transparent to translucent. *Color:* Lemon-yellow to sulfur-yellow, greenish yellow to pale green; may be dark green to greenish black. *Streak:* Pale yellow. *Luster:* Vitreous, pearly on {001}.

Optical Class: Uniaxial (–), commonly anomalously biaxial (–). *Pleochroism:* X = colorless to pale yellow; Y = Z = yellow to dark yellow. *Orientation:* Z = c; Y = {110}.

Dispersion: $r > v$, strong. $\omega = 1.575$ $\epsilon = 1.572$ $\alpha = 1.553$ – 1.555 $\beta = 1.575$ $\gamma = 1.577$ – 1.578 $2V(\text{meas.}) = 10^\circ$ – 53°

Cell Data: *Space Group:* $I4/mmm$. $a = 6.989$ $c = 20.63$ $Z = 2$

X-ray Powder Pattern: Les Oudots mine, France. (ICDD 41–1353). 3.569 (100), 10.35 (85), 5.185 (65), 2.074 (60), 3.502 (40), 2.187 (40), 4.930 (35)

Chemistry:

	(1)	(2)
UO ₃	60.84	58.00
P ₂ O ₅	13.40	14.39
CaO	5.31	5.69
H ₂ O	20.33	21.92
Total	99.88	100.00

(1) Autun, France. (2) Ca(UO₂)₂(PO₄)₂•12H₂O.

Mineral Group: Autunite group.

Occurrence: A secondary mineral derived from primary uranium-bearing minerals under oxidizing conditions, in hydrothermal veins, granite pegmatites, etc.

Association: Meta-autunite, torbernite, phosphuranylite, saléeite, uranophane, uranophane-beta, sabugalite.

Distribution: Widespread, many minor localities, but few for outstanding specimens. In France, at L'Ouche d'Jau, Saint-Symphorien-de-Marmagne, and the Les Oudots mine, Autun district, Saône-et-Loire; from the Margnac mine, Compreignac, Haute-Vienne; large crystals from the Gagnol mine, Lachaux, Puy-de-Dôme. From Sabugal, Urgeiriça, and elsewhere in Portugal. At Peveragno, near Cúneo, Piedmont, Italy. Large crystals from Bergen, Vogtland, Germany. From a number of localities in Cornwall, England. Fine groups from the Dahl (Daybreak) mine, near Mt. Spokane, east of Elk, Spokane Co., Washington, USA. At Malacacheta, Minas Gerais, Brazil. Large crystals from Mt. Painter, Flinders Ranges, South Australia.

Name: For Autun, France, near to which the first specimens to be analyzed were collected.

Type Material: Natural History Museum, Paris, France, H6307.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 984–987. (2) Frondel, C. (1958) Systematic mineralogy of uranium and thorium. U.S. Geol. Survey Bull. 1064, 160–170. (3) Takano, Y. (1961) X-Ray study of autunite. Amer. Mineral., 46, 812–822.

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