## Becquerelite $Ca(UO_2)_6O_4(OH)_6 \cdot 8H_2O$



**Crystal Data:** Orthorhombic. *Point Group:* $mm2$. Crystals usually tabular on {001} having pseudohexagonal outline, also prismatic, elongated along [010] into thick laths; {010} is usually striated ‖ [100], to 3 cm; also as coatings and fine-grained aggregates.

**Physical Properties:** *Cleavage:* {001} perfect; {101}, {010}, and {110} imperfect. *Tenacity:* Brittle. Hardness = 2.5 D(meas.) = 5.09–5.2 D(calc.) = 5.10 Radioactive.

**Optical Properties:** Transparent. *Color:* Amber-yellow, golden to lemon-yellow, yellow-orange, brownish yellow; yellow in transmitted light. *Streak:* Yellow. *Luster:* Adamantine to greasy.
*Optical Class:* Biaxial (–). *Pleochroism:* $X$ = colorless to pale yellow; $Y = Z$ = yellow to deep yellow. *Orientation:* $X = c$; $Y = a$; $Z = b$. *Dispersion:* $r > v$, marked. $\alpha = 1.725$–$1.735$ $\beta = 1.815$–$1.825$ $\gamma = 1.825$–$1.830$ 2V(meas.) = 32(3)°

**Cell Data:** *Space Group:* $Pn2_1a$. $a = 13.8378(8)$ $b = 12.3781(12)$ $c = 14.9238(9)$ Z = 4

**X-ray Powder Pattern:** Shaba Province, Congo.
7.50 (10), 3.22 (9), 3.75 (8), 3.56 (8), 2.58 (7), 4.71 (6), 1.943 (5)

**Chemistry:**

| | (1) | (2) | (3) |
|---|---|---|---|
| $UO_3$ | 86.57 | 86.4 | 87.10 |
| CaO | 2.78 | 3.2 | 2.84 |
| $H_2O$ | 10.16 | [10.4] | 10.06 |
| Total | 99.51 | [100.0] | 100.00 |

(1) Shinkolobwe, Congo. (2) Congo; by electron microprobe, average of two analyses, $H_2O$ by difference; corresponding to $Ca_{1.15}(UO_2)_6O_4(OH)_6 \cdot 8.6H_{1.97}O$. (3) $Ca(UO_2)_6O_4(OH)_6 \cdot 8H_2O$.

**Occurrence:** A weathering product of uraninite in the oxidized portions of uranium deposits and, more rarely, in pegmatites.

**Association:** Uraninite, schoepite, soddyite, curite, fourmarierite, dewindtite, ianthinite, wölsendorfite, rutherfordine, masuyite, kasolite (Shinkolobwe, Congo); johannite, uranopilite, zippeite (Happy Jack mine, Utah, USA).

**Distribution:** From Shinkolobwe, Katanga Province, Congo (Shaba Province, Zaire). At Schlema-Harlenstein, Saxony, and Wölsendorf, Bavaria, Germany. From Mitterberg, Salzburg, Austria. In the Geevor mine, St. Just, Cornwall, England. From the Rabéjac uranium deposit, seven km south-southeast of Lodève, Hérault, France. In the USA, in the Monument No. 2 and Cato Sells mines, Apache Co., Arizona; in Utah, at the Delta, Consolidated, and Lucky Strike No. 2 mines, San Rafael Swell, Emery Co., from Seven Mile Canyon, Grand Co., in the Posey and Frey No. 4 mines, Red Canyon district, the Big Buck mine, Big Indian district, and the Happy Jack and Hideout mines, White Canyon district, San Juan Co.; at Pumpkin Buttes, Campbell Co., Wyoming; from Paguate, Valencia Co., New Mexico; and a few others of the Colorado Plateau uranium deposits. In Canada, from the Lake Athabaska district, and the LaRonge uranium mines, near Nistowiack Lake, Saskatchewan. In the South Alligator Valley, Northern Territory, Australia.

**Name:** For French physicist Antoine Henri Becquerel (1852–1908), who discovered radioactivity in 1896.

**Type Material:** Natural History Museum, Paris, France, 122.135.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 625–627. (2) Protas, J. (1957) Propriétés et synthèse d'un oxyde hydraté d'uranium et de calcium de Shinkolobwe, Katanga. Compt. Rendus Acad. Sci. Paris, 244, 91–93 (in French). (3) (1957) Amer. Mineral., 42, 920 (abs. ref. 2). (4) Frondel, C. (1958) Systematic mineralogy of uranium and thorium. U.S. Geol. Sur. Bull. 1064, 62–68. (5) Pagoaga, M.K., D.E. Appleman, and J.M. Stewart (1987) Crystal structures and crystal chemistry of the uranyl oxide hydrates becquerelite, billietite, and protasite. Amer. Mineral., 72, 1230–1238.