Johannite $Cu(UO_2)_2(SO_4)_2(OH)_2 \cdot 8H_2O$

Crystal Data: Triclinic, pseudomonoclinic. *Point Group:* $\overline{1}$. Crystals thick tabular {100} and elongated along on [001], or prismatic, in subparallel to drusy aggregates, to 6 mm; as scales or lathlike fibers, in spheroidal aggregates and efflorescent coatings. *Twinning:* Simple and repeated lamellar twinning with composition plane {010} about twin axis [001].

Physical Properties: *Cleavage:* On {100}, good. Hardness = 2–2.5 D(meas.) = 3.32 D(calc.) = 3.44 Radioactive; decomposed by H_2O, tastes bitter or sour.

Optical Properties: Transparent to translucent. *Color:* Dark emerald-green, dark green, grass-green, apple-green, yellowish green; pale green in transmitted light. *Streak:* Pale green. *Luster:* Vitreous.
Optical Class: Biaxial (+). *Pleochroism:* Strong; X = colorless; Y = pale yellow; Z = greenish yellow or canary-yellow. *Orientation:* X (–101°,85°); Y (37°,8°); Z (169°,85°) [with c (0°,0°) and b^* (0°,90°) using (ϕ,ρ)]. *Dispersion:* $r < v$ or $r > v$, strong. α = 1.572–1.577 β = 1.592–1.597 γ = 1.612–1.616 2V(meas.) = ∼90°

Cell Data: *Space Group:* $P\overline{1}$. $a = 8.903(2)$ $b = 9.499(2)$ $c = 6.812(2)$ $\alpha = 109.87(1)°$ $\beta = 112.01(1)°$ $\gamma = 100.40(1)°$ Z = 1

X-ray Powder Pattern: Great Bear Lake, Canada.
7.73 (10), 6.16 (9), 3.41 (8), 3.87 (7), 3.13 (7), 3.04 (7), 4.38 (6)

Chemistry:

	(1)	(2)
SO_3	16.59	16.44
UO_2	61.34	58.74
CuO	8.07	8.17
H_2O	13.84	16.65
Total	99.84	100.00

(1) Jáchymov, Czech Republic. (2) $Cu(UO_2)_2(SO_4)_2(OH)_2 \cdot 8H_2O$.

Occurrence: A rare secondary mineral in the oxidized portions of sulfide-bearing uraninite deposits, commonly of post-mine formation.

Association: Gypsum, zippeite, uranopilite, brochantite, chalcanthite.

Distribution: From the Eliáš mine, Jáchymov (Joachimsthal), Czech Republic. At Johanngeorgenstadt, Saxony, and Wölsendorf, Bavaria, Germany. From South Wheal Basset, Illogan, and the Geevor mine, St. Just, Cornwall, England. In France, from the Mas-d'Alary uranium deposit, three km south-southeast of Lodève, Hérault, and at the Limouzat mine, St.-Priest-la-Prugne, Loire. From the Taboshar uranium deposit, Kara-Mazar Mountains, Tajikistan. In the Mounana uranium mine, Franceville, Gabon. In the USA, from the Kirk, Wood, and other mines, Central City, Gilpin Co., in the Schwartzwalder mine, near Golden, Jefferson Co., and elsewhere in Colorado; in Utah, at the Oyler mine, Henry Mountains district, the Frey No. 4 mine, and the Happy Jack mine, White Canyon district, San Juan Co., and at Marysvale, Ohio district, Piute Co.; from Arizona, in the Hillside mine, about 5.5 km north of Bagdad, Yavapai Co.; on the Ram claims, Pinto Mountains, Riverside Co., California. From Great Bear Lake, Northwest Territory, Canada.

Name: Honors Austrian Archduke Johann Baptist Josef Fabian Sebastian (1782–1859), founder of the Landesmuseum, Graz, Austria.

Type Material: Natural History Museum, Vienna, Austria, A.a.186.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 606–607. (2) Frondel, C. (1958) Systematic mineralogy of uranium and thorium. U.S. Geol. Sur. Bull. 1064, 130–135. (3) Mereiter, K. (1982) Die Kristallstruktur des Johannits, $Cu(UO_2)_2(OH)_2(SO_4)_2 \cdot 8H_2O$. Tschermaks Mineral. Petrog. Mitt., 30, 47–57 (in German with English abs.). (4) Čejka, J., Z. Urbanec, J. Čejka Jr., and Z. Mrázek (1988) Contribution to the thermal analysis and crystal chemistry of johannite $Cu[(UO_2)_2(SO_4)_2(OH)_2] \cdot 8H_2O$. Neues Jahrb. Mineral., Abh., 159, 297–309.