Calcioandyrobertsite $KCaCu_5(AsO_4)_4[As(OH)_2O_2]\cdot 2H_2O$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. Crystals have {100} dominant, with {210}, {$10\bar{2}$}, {001}, and {011}. As a crystallographically continuous, lamellar intergrowth with andyrobertsite as plates, to 10 mm, that radiate from the center of an aggregate 1.4 cm long and 1 cm at the base.

Physical Properties: *Cleavage*: Good on (100). *Fracture*: Conchoidal. *Tenacity*: Brittle. Hardness = 3 D(meas.) = n.d. D(calc.) = 4.011

Optical Properties: Transparent. *Color*: Electric blue; greenish blue in transmitted light. *Streak*: Pale blue. *Luster*: Vitreous.
Optical Class: Biaxial (-). $\alpha = 1.713(3)$ $\beta = 1.743(1)$ $\gamma = 1.749(1)$ 2V(meas.) = 50(5)° 2V(calc.) = 48° *Orientation*: $X \wedge a = 12°$ (in β obtuse), $Y = b$, $Z = c$. Nonpleochroic.
Dispersion: Moderate, $r < v$, asymmetric.

Cell Data: *Space Group*: $P2_1/m$. $a = 9.8102(9)$ $b = 10.0424(6)$ $c = 9.9788(7)$ $\beta = 101.686(7)°$ Z = 2

X-ray Powder Pattern: Tsumeb mine, Namibia.
9.64 (100), 3.145 (50), 4.46 (40), 3.048 (40), 2.698 (40), 7.00 (30), 4.81 (30)

Chemistry	(1)
K_2O	4.05
CaO	3.52
MnO	0.86
CdO	1.26
ZnO	0.04
CuO	32.86
As_2O_5	49.56
H_2O	[4.61]
Total	96.75

(1) Tsumeb mine, Namibia; electron microprobe analysis supplemented by IR spectroscopy, H_2O calculated from structure analysis; corresponds to $K_{1.01}(Ca_{0.74}Cd_{0.12}Mn_{0.11})_{\Sigma=1.00}(Cu_{4.85}Zn_{0.01})_{\Sigma=4.86}(AsO_4)_{4.06}[As(OH)_2O_2](H_2O)_2$.

Occurrence: On a single specimen from a weathered polymetallic mineral deposit.

Association: Cuprian adamite, zincian olivenite, andyrobertsite, tennantite.

Distribution: From the Tsumeb mine, Namibia.

Name: The prefix, *calcio*, designates the calcium analog of *andyrobertsite*.

Type Material: Royal Ontario Museum, Toronto, Canada (M47022 and M47110) and the Natural Museum of Natural History, Washington, D.C., USA (171487).

References: (1) Cooper, M.A., F.C. Hawthorne, W.W. Pinch, and J.D. Grice (1999) Andyrobertsite and calcioandyrobertsite: two new minerals from the Tsumeb mine, Tsumeb, Namibia. Mineral. Record, 30(3), 181-186. (2) (2000) Amer. Mineral., 85, 1321 (abs. ref. 1). (3) Cooper, M.A. and F.C. Hawthorne (2000) Highly undersaturated anions in the crystal structure of andyrobertsite – calcio-andyrobertsite, a doubly acid arsenate of the form $K(Cd,Ca)[Cu^{2+}_5(AsO_4)_4\{As(OH)_2O_2\}](H_2O)_2$. Can. Mineral., 38(4), 817-830.