Richelsdorfite $Ca_2Cu_5Sb^{5+}(AsO_4)_4(OH)_6Cl \cdot 6H_2O$

Crystal Data: Monoclinic, pseudotetragonal. *Point Group:* $2/m$. Rare crystals, to 1 mm, flattened on {001}, with {001}, {010}, {101}, {210}; typically in spherical aggregates and botryoidal crystalline crusts. *Twinning:* On {001}, common.

Physical Properties: *Cleavage:* Perfect on {001}. Hardness = ∼2 D(meas.) = 3.20(3) D(calc.) = 3.27–3.33

Optical Properties: Translucent. *Color:* Turquoise-blue, sky-blue, greenish blue. *Luster:* Vitreous.
Optical Class: Biaxial (–). *Pleochroism:* X = pale blue to colorless; Y = greenish blue, blue; Z = light greenish blue, blue. *Orientation:* $Z = b$; $Y \simeq a$; X inclined to c. *Dispersion:* $r > v$. α = 1.640–1.698 β = 1.692–1.765 γ = 1.694–1.799 2V(meas.) = 10°–15°; 69(2)° 2V(calc.) = 21.6°; 68.7°

Cell Data: *Space Group:* $C2/m$. a = 14.078–14.079 b = 14.203–14.207 c = 13.470–13.49 β = 101.05°−101.06° Z = 4

X-ray Powder Pattern: Richelsdorf Mountains, Germany.
3.045 (100), 4.913 (70), 4.392 (60), 1.753 (60), 2.669 (50), 0.795 (50), 6.80 (30)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
As_2O_5	31.18	35.23	34.80	CaO	8.97	8.36	8.49
Sb_2O_5	11.88	12.13	12.25	Cl	1.83	2.44	2.68
FeO	0.01			H_2O	[17.19]	[11.98]	12.27
CuO	28.71	30.41	30.11	$-O = Cl_2$	[0.41]	0.55	0.60
ZnO	0.23			Total	[99.59]	[100.00]	100.00

(1) Richelsdorf Mountains, Germany; by electron microprobe, H_2O by difference. (2) Triembach-au-Val, France; by electron microprobe, H_2O by difference. (3) $Ca_2Cu_5Sb(AsO_4)_4Cl(OH)_6 \cdot 6H_2O$.

Occurrence: In cavities in sandstone in the Kupferschiefer (Richelsdorf Mountains, Germany).

Association: Duftite, tyrolite, azurite, tetrahedrite–tennantite, calcite (Richelsdorf Mountains, Germany); tetrahedrite–tennantite, galena, brochantite, devilline, harmotome, calcite (Samson mine, Germany); erythrite, chalcophyllite, cornwallite, strashimirite, tetrahedrite–tennantite, barite (Triembach-au-Val, France).

Distribution: In Germany, from Iba, near Richelsdorf, Richelsdorf Mountains, and Reichenbach, near Bensheim, Hesse; at the Sauberg mine, Ehrenfriedersdorf, Saxony; in the Samson mine, St. Andreasberg, and on the dumps of the Glücksrad mine, Oberschulenberg, Harz Mountains; in the Alte Buntekuh mine, near Niederschelden, and at Ramsbeck, North Rhine-Westphalia; in the Clara mine, near Oberwolfach, Black Forest. From Triembach-au-Val, Haut-Rhin, France. Large crystals at the Burrus mine, Pyramid district, Washoe Co., Nevada, USA.

Name: For its first observed occurrence in the Richelsdorf Mountains, Germany.

Type Material: Göttingen University, Göttingen, Germany; National Museum of Natural History, Washington, D.C., USA, 150229.

References: (1) Süsse, P. and G. Schnorrer-Köhler (1983) Richelsdorfit, $Ca_2Cu_5Sb[Cl/(OH)_6/(AsO_4)]_4 \cdot 6H_2O$, ein neues Mineral. Neues Jahrb. Mineral., Monatsh., 145–150 (in German with English abs.). (2) (1984) Amer. Mineral., 69, 211 (abs. ref. 1). (3) Süsse, P. and B. Tillman (1987) The crystal structure of the new mineral richelsdorfite, $Ca_2Cu_5Sb(Cl/(OH)_6/(AsO_4)_4) \cdot 6H_2O$. Zeits. Krist., 179, 323–334. (4) Sarp, H., B. Dominik, and P.-J. Chiappero (1994) Nouveau gisement (Triembach-Le Val, Vosges, France): nouvelles propriétés optiques et diagramme de poudre de la richelsdorfite, $Ca_2Cu_5Sb[Cl(OH)_6(AsO_4)_4] \cdot 6H_2O$ (in French, with English abs.). Schweiz. Mineral. Petrog. Mitt., 74, 273–277.