Hydrocalumite $Ca_2Al(OH)_6[Cl_{1-x}(OH)_x]\cdot 3H_2O$

Crystal Data: Monoclinic, pseudohexagonal. *Point Group:* $2/m$. Pseudohexagonal crystals, tabular on {001}, bounded by {120}, {$\bar{1}$20}, and {10$\bar{1}$}, to 1 cm; massive. *Twinning:* Common on {32$\bar{2}$} as contact twins.

Physical Properties: *Cleavage:* {001}, perfect; another inclined at ~60° to {100}, poor. Hardness = 3 D(meas.) = 2.09–2.15 D(calc.) = 2.09–2.15 Strongly pyroelectric.

Optical Properties: Transparent. *Color:* Colorless to light green; colorless in thin section. *Luster:* Vitreous, pearly on cleavages.
Optical Class: Biaxial (–). *Orientation:* $Y = b$; $X \wedge c = 3°$. $\alpha = 1.528–1.535$ $\beta = 1.552–1.553$ $\gamma = 1.556–1.557$ 2V(meas.) = 24°–40°

Cell Data: *Space Group:* $P2/c$. $a = 9.953–10.047$ $b = 11.466–11.523$ $c = 16.271–16.292$ $\beta = 104.20°–104.46°$ Z = 8

X-ray Powder Pattern: Scawt Hill, Ireland.
7.92 (vvs), 3.99 (vs), 2.87 (s), 2.46 (s), 1.657 (ms), 2.70 (m), 2.24 (m)

Chemistry:

	(1)	(2)	(3)
Al_2O_3	18.1	18.8	18.6
MgO			1.0
CaO	40.0	41.5	38.3
Na_2O			0.1
Cl			6.2
$H_2O + CO_2$	40.3		
H_2O		38.5	34.1
CO_2		1.8	1.0
Total	98.4	100.6	99.3

(1–2) Scawt Hill, Ireland. (3) Boisséjour, France; corresponding to $(Ca_{1.92}Mg_{0.07}Na_{0.01})_{\Sigma=2.00}$ $Al(OH)_6[Cl_{0.48}(OH)_{0.37}(CO_3)_{0.06}]_{\Sigma=0.91}\cdot 4H_2O$.

Occurrence: A rare late-stage hydrothermal mineral in skarns formed from contact metamorphism of limestone or in xenoliths in lava.

Association: Afwillite, portlandite, ettringite, larnite, plombièrite, hydrogrossular, calcite.

Distribution: At Scawt Hill, near Larne, Co. Antrim, Ireland. From Boisséjour, near Ceyrat, Puy-de-Dôme, France. At Campomorto, Montalto di Castro, Lazio, Italy. From the Bellerberg, Rothenberg, and Emmelberg volcanos, near Mayen, Eifel district, Germany. At Kopeysk, Chelyabinsk coal basin, Southern Ural Mountains, Russia. In the Daba marbles, Jordan.

Name: For a HYDROus mineral containing CAlcium and ALUMinum.

Type Material: n.d.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 667–668. (2) Buttler, F.G., L.S. Dent Glasser and H.F.W. Taylor (1959) Studies on $4CaO\cdot Al_2O_3\cdot 13H_2O$ and the related natural mineral hydrocalumite. J. Amer. Ceramic Soc., 42, 121–126. (3) Grünhagen, H. and J. Mergoil (1963) Découverte d'hydrocalumite et afwillite associées à l'ettringite dan les porcélanites de Bousséjour près Ceyrat (Puy-de-Dôme). Bull. Soc. fr. Minéral., 86, 149–157 (in French). (4) Fischer, R., H.-J. Kuzel, and H. Schellhorn (1980) Hydrocalumit: Mischkristalle von "Friedelschem Salz" $CaO\cdot Al_2O_3\cdot CaCl_2\cdot 10H_2O$ und Tetracalciumaluminat-hydrat $CaO\cdot Al_2O_3\cdot Ca(OH)_2\cdot 12H_2O$? Neues Jahrb. Mineral., Monatsh., 322–334 (in German with English abs.). (5) E. Passaglia and M. Sacerdoti (1988) Hydrocalumite from Montalto di Castro, Viterbo, Italy. Neues Jahrb. Mineral., Monatsh., 454–461. (6) Sacerdoti, M. and E. Passaglia (1988) Hydrocalumite from Latium, Italy; its crystal structure and relationship with related synthetic phases. Neues Jahrb. Mineral., Monatsh., 462–475.