Gmelinite-Ca $Ca_2(Si_8Al_4)O_{24}\cdot 11H_2O$

Crystal Data: Hexagonal. *Point Group*: 6/*m* 2/*m* 2/*m*. [As euhedral crystals, pyramidal, tabular, or rhombohedral, striated || (00*1) or less commonly, || [00*1], to 4 cm. Rarely in radiating aggregates or granular. *Twinning*: Penetration twins on {10*1}, common.]

Physical Properties: [*Cleavage*: {10*0}, distinct; parting on {00*1}. *Fracture*: Uneven.] *Tenacity*: Brittle. Hardness = 4.5 D(meas.) = 2.11(1) D(calc.) = 2.095 Piezoelectric.

Optical Properties: [Transparent to translucent, opaque. *Color*: Colorless, white, reddish white, salmon-red, yellowish, greenish white; colorless in thin section. *Luster*: Vitreous.] *Optical Class*: Uniaxial (-) or (+); may be anomalously biaxial. ω = 1.476-1.494 ε = 1.474-1.480

Cell Data: *Space Group*: $P6_3/mmc$. a = 13.800(5) c = 9.964(5) Z = 2

X-ray Powder Pattern: n.d.

Chemistry:

	(1)	(2)
SiO_2	46.89	50.06
Al_2O_3	19.19	18.55
CaO	5.55	6.28
SrO	6.72	1.28
Na_2O	1.17	3.01
K_2O	0.24	0.29
H_2O	20.16	20.53
Total	99.92	100.00

(1) Montecchio Maggiore, Italy; by electron microprobe, corresponds to $(Ca_{1.03}Sr_{0.68}Na_{0.39}K_{0.06})_{\Sigma=2.16}[Al_{3.91}Si_{8.10}O_{24}]\cdot 11.62H_2O$. (2) Great Notch, New Jersey, USA; corresponds to $(Ca_{1.12}Na_{0.98}Sr_{0.12}K_{0.06})_{\Sigma=2.28}[Al_{3.66}Si_{8.38}O_{24}]\cdot 11.45H_2O$.

Mineral Group: Zeolite group.

Occurrence: Formed from calcium-rich fluids, in basalts and related igneous rocks, also pegmatites.

Association: Analcime, chabazite, calcite, aragonite, quartz.

Distribution: Studied material from Montecchio Maggiore, Vicenza, Italy. At Glenarm and elsewhere in Co. Antrim, Ireland. On the Isle of Skye, Scotland. At Pyrgos, Cyprus. In the USA, from Bergen Hill, Hudson Co., and Great Notch, Paterson, and Prospect Park, Passaic Co., New Jersey; at Springfield, Lane Co., Oregon. On Pinnacle Rock, Five Islands, and Two Islands, Nova Scotia, Canada. In the Ilímaussaq intrusion, southern Greenland. At Sarbay-Sokolov, Kazakhstan. Large crystals from Bekiady, Madagascar. From around Flinders, Victoria, Australia.

Name: For Christian Gottlob *Gmelin* (1792-1860), mineralogist and chemist of Tübingen, Germany. The suffix indicates the dominance of Ca as the extra-framework cation.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 593-594. (2) Deer, W.A., R.A. Howie, and J. Zussman (1963) Rock-forming minerals, v. 4, framework silicates, 387-400. (3) Passaglia, E., D. Pongiluppi, and G. Vezzalini (1978) The crystal chemistry of gmelinites. Neues Jahrb. Mineral., Monatsh., 310-322. (4) Galli, E., E. Passaglia, and P.F. Zanazzi (1982) Gmelinite: structural refinements of sodium-rich and calcium-rich natural crystals. Neues Jahrb. Mineral., Monatsh., 145-155. (5) Coombs, D.S., A. Alberti, T. Armbruster, G. Artioli, C. Coltella, E. Galli, J.D. Grice, F. Liebau, J.A. Mandarino, H. Minato, and others (1997) Recommended nomenclature for zeolite minerals: Report of the Subcommittee on Zeolites of the IMA, Commission on New Minerals and Mineral Names. Can. Mineral., 35, 1571-1606.