Cuspidine $Ca_4Si_2O_7(F,OH)_2$

Crystal Data: Monoclinic. *Point Group:* $2/m$. Crystals spearhead-shaped, minute. *Twinning:* Simple, lamellar, polysynthetic on {100}.

Physical Properties: *Cleavage:* Very good on {001}; distinct on {110}. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 5–6 D(meas.) = 2.85–2.96 D(calc.) = 2.978

Optical Properties: Transparent to translucent. *Color:* Pale rose-red; in thin section, rose-red to colorless. *Luster:* Vitreous.
Optical Class: Biaxial (+). *Orientation:* $Y = b$; $Z \wedge c = 6°$. *Dispersion:* $r > v$, marked, inclined. *Absorption:* Moderate. $\alpha = 1.586–1.592$ $\beta = 1.595$ $\gamma = 1.598–1.606$ 2V(meas.) = Large.

Cell Data: *Space Group:* $P2_1/a$. $a = 10.906(5)$ $b = 10.521(6)$ $c = 7.518(3)$ $\beta = 109.30(3)°$ Z = 4

X-ray Powder Pattern: Monte Somma, Italy.
3.062 (100), 2.943 (35), 3.259 (30), 2.900 (30), 2.873 (30), 3.034 (25), 2.018 (18)

Chemistry:

	(1)	(2)	(3)
SiO_2	31.79	32.36	32.79
MnO		0.71	
MgO	0.00		
CaO	59.16	61.37	61.21
Na_2O	trace	0.48	
K_2O	trace	0.27	
F	10.05	9.05	10.37
Cl	trace		
H_2O^+	0.28		
H_2O^-	0.16		
CO_2	0.62		
$-O = (F,Cl)_2$	4.23	3.81	4.37
rem.	1.53		
Total	99.36	100.43	100.00

(1) Monte Somma, Italy; remainder is trivalent oxides. (2) Franklin, New Jersey, USA. (3) $Ca_4Si_2O_7F_2$.

Occurrence: In tuff ejecta (Monte Somma, Italy); in contact metamorphosed limestone (Franklin, New Jersey, USA); in melilite skarn (Dupezeh Mountain, Iraq).

Association: Augite, "hornblende," diopside, grossular, biotite, phlogopite, monticellite, wollastonite, calcite, spinel, magnetite, perovskite.

Distribution: At Monte Somma and Vesuvius, Campania, and in the Alban Hills, as at Ariccia, Lazio, Italy. From Carlingford, Co. Louth, Ireland. At Broadford and Camas Malag, Isle of Skye, and Camas Mór, Isle of Muck, Scotland. From the Bellerberg volcano, two km north of Mayen, Eifel district, Germany. In the USA, at Franklin, Sussex Co., New Jersey; in the Alder district, Custer Co., Idaho; at Crestmore, Riverside Co., California; on Cascade Mountain, Adirondack Mountains, Essex Co., New York. On Dupezeh Mountain, near Hero Town, Qala-Diza region, Iraq. In the Hatrurim Formation, Israel. From Fuka, near Bicchu, and in the Sampo and Mihara mines, Kawakami, Okayama Prefecture, Japan.

Name: From the Greek *cuspis*, for a *spear*, the characteristic shape of the twinned crystals.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 533. (2) Tilley, C.E. (1947) Cuspidine from dolomite contact skarns, Broadford, Skye. Mineral. Mag., 28, 90–95. (3) Van Valkenberg, A. and G.F. Rynders (1958) Synthetic cuspidine. Amer. Mineral., 43, 1195–1202. (4) Saburi, S., A. Kawahara, C. Henmi, I. Kusachi, and K. Kihara (1977) The refinement of the crystal structure of cuspidine. Mineral. J. (Japan), 8, 286–298.