

Clinohumite



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Crystal Data: Monoclinic. *Point Group:* $2/m$. Crystals complex, highly modified, to 2 cm; massive. *Twinning:* Common on {100}, simple, lamellar.

Physical Properties: *Cleavage:* {100}, poor. *Fracture:* Uneven to subconchoidal. *Tenacity:* Brittle. Hardness = 6 D(meas.) = 3.17–3.35 D(calc.) = 3.279

Optical Properties: Transparent to translucent. *Color:* White, yellow to brown with increasing Ti; in thin section, colorless, pale yellow to golden yellow. *Luster:* Vitreous. *Optical Class:* Biaxial (+). *Pleochroism:* X = golden yellow, yellow-brown, deep reddish yellow; Y = pale yellow, yellow-orange, light yellow; Z = pale yellow, yellow-orange, colorless. *Orientation:* $Z = b$; $X \wedge c = 9^\circ\text{--}15^\circ$. *Dispersion:* $r > v$, strong. $\alpha = 1.628\text{--}1.638$
 $\beta = 1.641\text{--}1.654$ $\gamma = 1.662\text{--}1.674$ $2V(\text{meas.}) = 73^\circ\text{--}76^\circ$

Cell Data: *Space Group:* $P2_1/c$. $a = 13.68$ $b = 4.75$ $c = 10.27$ $\beta = 100^\circ 50'$ $Z = 2$

X-ray Powder Pattern: Hämeenkylä, Finland. (ICDD 14-692).
1.738 (100), 5.02 (70), 3.70 (70), 2.76 (70), 2.54 (70), 2.51 (70), 2.26 (70)

Chemistry:	(1)	(2)	(1)	(2)	
SiO ₂	36.53	35.90	MgO	54.16	44.16
TiO ₂	0.26	5.59	CaO		0.01
Al ₂ O ₃	0.22		F	2.74	0.00
Fe ₂ O ₃	0.56		H ₂ O ⁺	1.52	2.64
FeO	5.04	11.21	H ₂ O ⁻	0.04	
MnO	0.34	0.50	–O = F ₂	1.15	
			Total	100.26	100.01

(1) Hämeenkylä, Finland; corresponds to $(\text{Mg}_{8.42}\text{Fe}_{0.50}^{2+}\text{Mn}_{0.06}^{2+}\text{Ti}_{0.02})_{\Sigma=9.00}(\text{SiO}_4)_4[\text{F}_{1.04}(\text{OH})_{0.93}\text{O}_{0.03}]_{\Sigma=2.00}$. (2) Francisa, Italy; corresponds to $(\text{Mg}_{7.33}\text{Fe}_{1.04}^{2+}\text{Ti}_{0.47}\text{Mn}_{0.05}^{2+})_{\Sigma=8.89}(\text{SiO}_4)_4[(\text{OH})_{1.04}\text{O}_{0.96}]_{\Sigma=2.00}$.

Mineral Group: Humite group.

Occurrence: In contact metamorphic zones in dolostones and metasomatized limestones adjacent to felsic plutonic rocks; in serpentine and talc schists; in a carbonatite.

Association: Grossular, wollastonite, forsterite, monticellite, cuspidine, fluorborite, ludwigite, dolomite, calcite, talc, biotite, spinel, vesuvianite, sanidine, meionite, nepheline.

Distribution: At Monte Somma and Vesuvius, Campania, and Francisa, Val Malenco, Lombardy, Italy. From Hämeenkylä and Ojamo, Lohja, Finland. At Broadford, Isle of Skye, Scotland. From Llanos de Juanar, Málaga Province, Spain. At the Kangerdlugssuaq Fjord, Greenland. Found near Lake Baikal, eastern Siberia, Russia. Large crystals from Kuche-Lal, Pamir Mountains, Tajikistan. In the USA, at the Tilly Foster iron mine, Brewster, Putnam Co., New York; at Buell Park, near Fort Defiance, Apache Co., Arizona; Crestmore, Riverside Co., and the Twin Lakes region, Fresno Co., California. At Cargill Lake, Ontario, Canada. In the Jacupiranga mine, São Paulo, Brazil.

Name: For its monoclinic crystal system and relation to *humite*.

Type Material: Natural History Museum, Paris, France, 106.395–106.556; National Museum of Natural History, Washington, D.C., USA, 94997.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 538–541. (2) Deer, W.A., R.A. Howie, and J. Zussman (1982) Rock-forming minerals, (2nd edition), v. 1A, orthosilicates, 379–417. (3) Robinson, K., G.V. Gibbs, and P.H. Ribbe (1973) The crystal structures of the humite minerals. IV. Clinohumite and titanclinohumite. Amer. Mineral., 58, 43–49. (4) Kocman, V. and J. Rucklidge (1973) The crystal structure of a titaniferous clinohumite. Can. Mineral., 12, 39–45.

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