## Clinochrysotile $Mg_3Si_2O_5(OH)_4$



**Crystal Data:** Monoclinic or triclinic. *Point Group:* n.d. Asbestiform, fibrous along [100], curled to cylindrical; also bladed, massive.

**Physical Properties:** Hardness = 2.5 D(meas.) = 2.53(1) D(calc.) = 2.61

**Optical Properties:** Semitransparent. *Color:* White, pale green to dark green. *Luster:* Silky in fibrous aggregates.
*Optical Class:* Biaxial (–). $\alpha = 1.569(2)$ $\beta = [1.569]$ $\gamma = 1.570(2)$ 2V(meas.) = ∼42°

**Cell Data:** *Space Group:* n.d. $a = 5.3129(9)$ $b = 9.120(3)$ $c = 14.637(2)$ $\beta = 93°9.8(6)'$
Z = 4

**X-ray Powder Pattern:** Butler Estate chrome mine, California, USA.
7.31 (100), 3.65 (70), 4.57 (50), 1.535 (50), 2.270 (30), 2.205 (30), 2.092 (30)

**Chemistry:**

| | (1) | (2) | | (1) | (2) |
|---|---|---|---|---|---|
| $SiO_2$ | 42.2 | 43.37 | MnO | 0.06 | |
| $TiO_2$ | 0.002 | | NiO | 0.04 | |
| $Al_2O_3$ | 0.66 | | MgO | 41.7 | 43.63 |
| $Fe_2O_3$ | 1.2 | | CaO | 0.01 | |
| $Cr_2O_3$ | 0.02 | | $H_2O^+$ | 13.3 | 13.00 |
| FeO | 0.09 | | $H_2O^-$ | 0.95 | |
| | | | Total | 100.23 | 100.00 |

(1) Joe No. 5 pit, California, USA. (2) $Mg_3Si_2O_5(OH)_4$.

**Polymorphism & Series:** Polymorphous with antigorite, orthochrysotile, lizardite, and parachrysotile; may also be termed chrysotile-$2M_{c1}$.

**Mineral Group:** Kaolinite-serpentine group.

**Occurrence:** Intermixed with orthochrysotile in veinlets cutting serpentinite.

**Association:** Orthochrysotile, lizardite, corundum.

**Distribution:** Undoubtedly of common occurrence in asbestos deposits, but requires careful characterization for confirmation, which has been accomplished at only a few localities, such as: in the USA, from the Butler Estate chrome mine, Fresno Co., and the Joe No. 5 pit, New Idria, San Benito Co., California; in the Belvidere Mountain quarries, Lowell, Orleans Co., Vermont; and from the Salt River Canyon, near Globe, Gila Co., Arizona. At Thetford Mines, Quebec, Canada. From Quilla, Charsadda Tehsil, Pakistan. In Australia, from Woodsreef, New South Wales.

**Name:** Chrysotile from the Greek for *golden* and *fiber*; *clino* in reference to the mineral's crystallization in inclined axis crystal systems.

**Type Material:** n.d.

**References:** (1) Deer, W.A., R.A. Howie, and J. Zussman (1963) Rock-forming minerals, v. 3, sheet silicates, 170–190. (2) Whittaker, E.J.W. (1956) The structure of chrysotile. II. Clino-chrysotile. Acta Cryst., 9, 855–861. (3) Page, N.J. and R.G. Coleman (1967) Serpentine-mineral analyses and physical properties. U.S. Geol. Sur. Prof. Paper 575-B, B103–B107. (4) Wicks, F.J. and E.J.W. Whittaker (1975) A reappraisal of the structures of the serpentine minerals. Can. Mineral., 13, 227–243. (5) Middleton, A.P. and E.J.W. Whittaker (1976) The structure of Povlen-type chrysotile. Can. Mineral., 14, 301–306. (6) Yada, K. (1979) Microstructures of chrysotile and antigorite by high-resolution electron microscopy. Can. Mineral., 17, 679–691. (7) Bayliss, P. (1981) Unit cell data of serpentine group minerals. Mineral. Mag., 44, 153–156. (8) Wicks, F.J. and D.S. O'Hanley (1988) Serpentine minerals: structures and petrology. In: S.W. Bailey, Ed., Hydrous phyllosilicates. Rev. Mineral. 19, MSA, 91–167.