Vermiculite $(Mg, Fe^{3+}, Al)_3(Si, Al)_4O_{10}(OH)_2 \cdot 4H_2O$

Crystal Data: Monoclinic. *Point Group:* $2/m$. As large crystalline plates, which may have a pseudohexagonal outline; in clay-sized particles.

Physical Properties: *Cleavage:* {001}, perfect, typically relic. *Tenacity:* Pliable, when in large replacement sheets. Hardness = ~1.5 D(meas.) = 2.2–2.6 D(calc.) = 2.26 Expands on heating into vermiform masses.

Optical Properties: Translucent; opaque when in large replacement sheets. *Color:* Colorless, white, yellow, green, brown; colorless in thin section. *Luster:* Dull to pearly, bronzy. *Optical Class:* Biaxial (–). *Pleochroism: X* in paler shades than *Y* and *Z*. *Dispersion:* $r < v$. $\alpha = 1.520–1.564$ $\beta = 1.530–1.583$ $\gamma = 1.530–1.583$ 2V(meas.) = 0°–15°

Cell Data: *Space Group: C*2/*m*. a = 5.24(2) b = 9.17(2) c = 28.60(5) $\beta = 94°36(24)'$ Z = 4, or *Space Group: C*2/*c*. a = 5.349(6) b = 9.255(10) c = 28.89(2) $\beta = 97°7(6)'$ Z = 4

X-ray Powder Pattern: Ajmer, India.
14.15 (10), 1.528 (7), 4.57 (6), 2.615 (5), 2.570 (5), 2.525 (4.5), 2.380–2.365 (3.5b)

Chemistry:

	(1)	(2)		(1)	(2)
SiO_2	34.92	32.97	Na_2O	0.32	0.00
Al_2O_3	13.97	17.88	K_2O	0.08	0.00
Fe_2O_3	6.25	4.76	H_2O^+		10.05
FeO	0.52	0.57	H_2O^-		11.42
MgO	20.37	22.36	H_2O	21.00	
CaO	2.15	0.00	rem.	0.42	
			Total	100.00	100.01

(1) Ajmer, India; corresponds to $(Mg_{2.37}Fe^{3+}_{0.37}Ca_{0.18}Na_{0.05}Fe^{2+}_{0.03})_{\Sigma=3.00}(Si_{2.72}Al_{1.28})_{\Sigma=4.00}O_{10}(OH)_2 \cdot 4.01H_2O$. (2) Corundum Hill, Macon Co., North Carolina, USA; corresponds to $(Mg_{2.68}Al_{0.35}Fe^{3+}_{0.29}Fe^{2+}_{0.04})_{\Sigma=3.36}(Si_{2.65}Al_{1.35})_{\Sigma=4.00}O_{10}(OH)_{2.00} \cdot 4.52H_2O$.

Mineral Group: A group name; individual minerals within the group are not specified.

Occurrence: An alteration product of biotite or phlogopite, by weathering or hydrothermal action. Formed at the contact between felsic and mafic or ultramafic rocks such as pyroxenites and dunites; in carbonatites and metamorphosed limestones; a clayey constituent of soils.

Association: Corundum, apatite, serpentine, talc; interstratifies with chlorite, biotite.

Distribution: Uncommon in large amounts. In the USA, at Milbury, near Worcester, Worcester Co., Massachusetts; from near Franklin, Macon Co., and at the Rutherford quarry, near Tuxedo, Henderson Co., North Carolina; in Brinton's quarry, Westtown, Chester Co., and on Chestnut Hill, Easton, Northampton Co., Pennsylvania; from Magnet Cove, Hot Spring Co., Arkansas; and at Libby, Lincoln Co., Montana. From Ajmer, Rajasthan, India. At Phalaborwa, Transvaal, South Africa. In Australia, from Mud Tank, Valley Bore, Northern Territory, and at Bulong, Western Australia. From the Kovdor massif, Kola Peninsula, and in the Potaninskoye deposit, Southern Ural Mountains, Russia. Many other minor localities are known.

Name: From the Latin *to breed worms*, alluding to the mineral's exfoliation upon rapid heating.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 664–668. (2) Deer, W.A., R.A. Howie, and J. Zussman (1963) Rock-forming minerals, v. 3, sheet silicates, 246–257. (3) Mathieson, A.M. (1958) Mg-vermiculite: a refinement and re-examination of the crystal structure of the 14.36 Å phase. Amer. Mineral., 43, 216–227. (4) Mukherjee, B. (1963) The structure of vermiculite and some interstratifications. Clay Minerals Bull., 5, 194–202. (5) Shirozu, H. and S.W. Bailey (1966) Crystal structure of a two-layer Mg-vermiculite. Amer. Mineral., 51, 1124–1143.