Vesuvianite $Ca_{19}(Al,Mg)_{13}B_{0-5}Si_{18}O_{68}(OH,O,F)_{10}$

Crystal Data: Tetragonal or monoclinic. *Point Group:* $4/m\ 2/m\ 2/m$ or $2/m$. Commonly as short pyramidal to long prismatic crystals, to 15 cm, morphologically complex, with up to 30 forms reported on one crystal; columnar, granular, massive. *Twinning:* Twinned domains observed at a very fine scale.

Physical Properties: *Cleavage:* {110}, poor; {100} and {001}, very poor. *Fracture:* Subconchoidal to irregular. *Tenacity:* Brittle. Hardness = 6–7 D(meas.) = 3.32–3.43 D(calc.) = 3.42

Optical Properties: Transparent to translucent. *Color:* Yellow, green, brown; colorless to white, blue, violet, bluish green, pink, red, black, commonly zoned; in transmitted light, colorless to light yellow, green, brown. *Streak:* White. *Luster:* Vitreous to resinous. *Optical Class:* Uniaxial (–); uniaxial (+) and biaxial examples are common, sectored. *Pleochroism:* Weak; O = colorless to yellowish; E = yellowish, greenish, brownish. *Dispersion:* Strong. $\omega = 1.703–1.752$ $\epsilon = 1.700–1.746$

Cell Data: *Space Group:* $P4/nnc$ or $P2/n$. $a = 15.4–15.7$ $c = 11.6–11.9$ $Z = 2$

X-ray Powder Pattern: Canzoccoli [Canzòcoli, Val di Fiemme, Trentino-Alto Adige], Italy. 2.759 (10), 2.599 (8), 1.625 (8), 2.948 (6), 2.465 (6), 2.128 (5), 1.767 (5)

Chemistry:	(1)	(2)		(1)	(2)		(1)	(2)
SiO_2	37.03	35.01	Fe_2O_3	1.91	3.76	CaO	36.70	35.31
TiO_2	0.52	0.43	FeO	1.42	3.67	H_2O	[2.80]	[0.86]
B_2O_3		3.18	MnO	0.06	0.13	Total	[99.65]	[99.32]
Al_2O_3	17.04	12.13	MgO	2.17	4.84			

(1) Jeffrey mine, Asbestos, Canada; by electron microprobe, FeO by wet chemical analysis, H_2O calculated from stoichiometry; corresponds to $Ca_{19.14}(Al_{9.77}Mg_{1.57}Fe^{3+}_{0.70}Fe^{2+}_{0.58}Ti_{0.19}Mn_{0.02})_{\Sigma=12.83}Si_{18.16}O_{68}[(OH)_{9.10}O_{1.16}]_{\Sigma=10.26}$. (2) Tulare Co., California, USA; by electron microprobe, FeO by wet chemical analysis, H_2O calculated from stoichiometry; corresponds to $Ca_{19.00}(Al_{7.18}Mg_{3.62}Fe^{2+}_{1.54}Fe^{3+}_{1.42}Ti_{0.16}Mn_{0.06})_{\Sigma=13.98}B_{2.76}Si_{17.58}O_{68}[O_{7.30}(OH)_{2.88}]_{\Sigma=10.18}$.

Occurrence: In skarns formed during contact or regional metamorphism of limestones; in garnetized gabbros, mafic and ultramafic rocks, and serpentinites; uncommon in alkalic igneous rocks.

Association: Grossular, diopside, wollastonite, epidote, scapolite, spinel, calcite.

Distribution: Good crystals are found throughout the world. In Italy, at Monte Somma and Vesuvius, Campania; Ariccia, Lazio; Val di Fassa, Trentino-Alto Adige; and Val d'Ala, Piedmont. From near Zermatt, Valais, Switzerland. At Arendal, Stromskien, and Egg, Norway. In Russia, at the Akhmatovsk mine, near Zlatoust, Ural Mountains, and near Chernyshevsk, at the confluence of the Akhtaragdy and Vilyui Rivers, Yakutia. In the USA, at Amity, Orange Co., and Olmsteadville, Essex Co., New York; in the Belvidere Mountain quarries, Lowell, Orleans Co., Vermont; Sanford, York Co., and Auburn, Androscoggin Co., Maine; Georgetown, El Dorado Co., and Crestmore, Riverside Co., California; near Ludwig, Yerington district, Lyon Co., Nevada. In Canada, at Litchfield, Asbestos, and Mont Saint-Hilaire, Quebec. At Xalostoc, Morelos, and Lake Jaco, Chihuahua, Mexico. From Baluchistan, Pakistan.

Name: For its occurrence at Vesuvius, Italy.

Type Material: Mining Academy, Freiberg, Germany, 23278.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 477–482. (2) Deer, W.A., R.A. Howie, and J. Zussman (1982) Rock-forming minerals, (2nd edition), v. 1A, orthosilicates, 699–718. (3) Domańska, E., J. Nedoma, and W. Żabiński (1969) X-ray powder data for idocrase. Mineral. Mag., 37, 343–348. (4) Allen, F.M. and C.W. Burnham (1992) A comprehensive structure-model for vesuvianite: symmetry variations and crystal growth. Can. Mineral., 30, 1–18. (5) Groat, L.A., F.C. Hawthorne, and T.S. Ercit (1992) The chemistry of vesuvianite. Can. Mineral., 30, 19–48.