Grossular $Ca_3Al_2(SiO_4)_3$

Crystal Data: Cubic. *Point Group:* $4/m\ \bar{3}\ 2/m$. Commonly in dodecahedra or trapezohedra, up to 15 cm, with striated faces. Also granular, compact, and massive.

Physical Properties: *Cleavage:* Parting on {110} rarely observed. *Fracture:* Uneven to conchoidal. *Tenacity:* Brittle. Hardness = 6.5–7 D(meas.) = 3.594 D(calc.) = 3.594 May fluoresce weak golden yellow under LW or SW UV.

Optical Properties: Transparent to opaque. *Color:* Yellow-green, pale to dark green; golden yellow, pink, red, orange, brownish red, yellowish brown; colorless, white, gray, black; may be sectored: colorless in thin section. *Streak:* White. *Luster:* Vitreous to resinous. *Optical Class:* Isotropic; weak strain birefringence. $n = 1.734$

Cell Data: *Space Group: Ia3d.* $a = 11.851$ Z = 8

X-ray Powder Pattern: Georgetown, Placer Co., California, USA. (ICDD 26-292). 2.647 (100), 1.581 (50), 2.959 (25), 1.921 (25), 1.643 (25), 2.417 (20), 2.321 (18)

Chemistry:

	(1)	(2)
SiO_2	39.30	40.02
TiO_2	0.00	
Al_2O_3	21.93	22.63
Fe_2O_3	0.80	
Cr_2O_3	0.13	
FeO	0.28	
MgO	trace	
CaO	37.10	37.35
H_2O	0.30	
Total	99.84	100.00

(1) Georgetown, Placer Co., California, USA; corresponds to $(Ca_{3.00}Fe^{2+}_{0.02})_{\Sigma=3.02}(Al_{1.92}Fe^{3+}_{0.05})_{\Sigma=1.97}(Si_{2.97}Al_{0.03})_{\Sigma=3.00}O_{12}$. (2) $Ca_3Al_2(SiO_4)_3$.

Polymorphism & Series: Forms three series: with andradite; with hibschite and katoite; and with uvarovite.

Mineral Group: Garnet group.

Occurrence: In contact and regionally metamorphosed calcareous rocks, or rocks which have undergone calcium metasomatism; in some schists and serpentinites.

Association: Calcite, dolomite, epidote, clinozoisite, wollastonite, scapolite, vesuvianite, diopside, tremolite, quartz.

Distribution: Many localities, even for fine crystals and gem material. In Russia, near Chernyshevsk, at the confluence of the Vilyui and Akhtaragda Rivers, Yakutia. In the Ala Valley, Piedmont, Italy. From the Zillertal, Tirol, Austria. At Ocna de Fier, Romania. In the Jeffrey mine, Asbestos, Quebec, Canada. In the USA, at Standish, Cumberland Co., Maine, and at the Belvidere Mountain quarries, Lowell, Orleans Co., Vermont. In California, from Crestmore, Riverside Co., the Old Cosumnes copper mine, El Dorado Co., San Carlos mine, Mazourka Canyon, Inyo Range, Inyo Co., and Santa Rosa, Sonoma Co.; on Vesper Peak, Sultan basin, Snohomish Co., Washington. In Mexico, large crystals from Xalostoc and Morelos, Chihuahua, and from the Sierra de la Cruces, near Lake Jaco, Coahuila. Gems from the Merelani Hills, southeast of Arusha, Tanzania. In the Taita Hills, near Voi, Kenya.

Name: From *Ribes Grossularium* or gooseberry; the botanical name, in reference to a typical greenish color.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 437–447. (2) Deer, W.A., R.A. Howie, and J. Zussman (1982) Rock-forming minerals, (2nd edition), v. 1A, orthosilicates, 468–698, esp. 603–616. (3) Novak, G.A. and G.V Gibbs (1971) The crystal chemistry of the silicate garnets. Amer. Mineral., 56, 791–825.