

Garnet Group

$X_3Y_2(SiO_4)_3$

The garnet structure consists of isolated silica tetrahedra bonded laterally through cations in 6-fold and 8-fold coordination (see figure 16-5). In terms of composition, natural garnets can be divided into two groups – Pyrospite and Grandite. The Pyrospites (pyrope, almandine, and spessartine) all have Al^{3+} in the Y site and extensive substitution in the X site by Fe^{2+} , Mg, and Mn. The grandite group contains grossular and andradite (and if uvarovite is included it becomes the ugrandite group). The grandites contain Ca^{2+} in the X site.

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For more information, see the lecture notes section.

Identification:

Hand Sample:

Thin Section: Plane Light: Very high positive relief. The color in thin section is usually colorless or a pale version of the hand sample color. No pleochroism. Garnets do not have cleavage and usually display fracturing. Crystals are usually euhedral to subhedral dodecahedrons or trapezohedrons.

Crossed Polars: Isotropic.

Members of the Garnet group:

Type	Formula	Color in Hand Sample
Pyrope	$Mg_3Al_2(SiO_4)_3$	Deep red to nearly black
Almandine	$Fe_3Al_2(SiO_4)_3$	Fine, deep red
Spessartine	$Mn_3Al_2(SiO_4)_3$	Brownish to red
Grossular	$Ca_3Al_2(SiO_4)_3$	White, green, yellow, to pale brown
Andradite	$Ca_3Fe_2(SiO_4)_3$	Various shades of yellow and green
Uvarovite	$Ca_3Cr_2(SiO_4)_3$	Emerald-green