



SYSTEMATIC DESCRIPTION OF SILICATE MINERALS

I - NESOSILICATES:

The nesosilicates mainly bring together the following groups:

OLIVINE GROUP

Forsterite $Mg_2(SiO_4)$ Fayalite $Fe_2(SiO_4)$

Fayalite $Fe_2(SiO_4)$

GROUPE DES GRENATS $A_3B_2(SiO_4)_3$

Pyrope $Mg_3Al_2(SiO_4)_3$ Spessartite $Mn_3Al_2(SiO_4)_3$ Andradite $Ca_3Fe_2(SiO_4)_3$

Almandin $Fe_3Al_2(SiO_4)_3$ Grossular $Ca_3Al_2(SiO_4)_3$ Uvarovite $Ca_3Cr_2(SiO_4)_3$

GROUPE DU ZIRCON

Zircon $Zr(SiO_4)$

GROUPE DES SILICATES D'ALUMINE

Andalousite Al_2SiO_5

Sillimanite Al_2SiO_5

Kyanite ou cysanite Al_2SiO_5

Topaz $Al_2(SiO_4)(F,OH)_2$

Staurolite $Fe_2Al_9O_6(SiO_4)_4(O,OH)_2$

Sphene $CaTiO(SiO_4)$

OLIVINE GROUP or PERIDOTS:

$(Mg,Fe)_2[SiO_4]$ Orthorhombic

Series of solid solutions between Forsterite $Mg_2(SiO_4)$ (**magnesian pole**)

and Fayalite $Fe_2(SiO_4)$ (**iron pole**)

Usually small automorphic crystals in flattened prisms. Often in grains rounded, scattered in the rock or gathered in segregations (localized accumulations).

D = 3.3 / H = 6.5 to 7. Fragile. Distinct cleavage. Transparent to translucent. Bright glassy shine. Color greenish-yellow to olive green. Atmospheric alteration: release of reddish ferric oxides.

Typical high temperature mineral. Constituting intrusive rocks coming from the mantle (peridotites). Element of basalts and peridotite nodules brought up by basalts. In impure dolomitic limestones having undergone thermal metamorphism.



Use: refractory. Etymology: olive-green color.

GARNETS GROUP $A_3B_2(SiO_4)_3$ A = Ca, Mg, Fe, Mn et B = Al, Fe, Cr

Pyrope $Mg_3Al_2(SiO_4)_3$

Spessartite $Mn_3Al_2(SiO_4)_3$

Andradite $Ca_3Fe_2(SiO_4)_3$

Almandite $Fe_3Al_2(SiO_4)_3$

Grossularite $Ca_3Al_2(SiO_4)_3$

Uvarovite $Ca_3Cr_2(SiO_4)_3$

Etymology: from the Latin "granatus", similar to grains.





Cubic. Very common automorphic crystals. Usual shapes: Rhombododecahedron and trapezohedron. Often in irregular grains.

D = 3.5 to 4.3 H = 6.5 to 7.5. No cleavage. Irregular breakage. Color varies depending on the composition: dark red (Pyrope), yellow to red brown (Spessartite), pink (Almandin), brown to black Andradite, emerald green, dark green (Uvarovite), colorless yellowish green (Grossular). White dust. Vitreous or resinous sheen. Chlorite alteration.

In metamorphic rocks: gneiss, mica schists (var. almandine, Fe, Al); metamorphic limestones (var. grossular, Ca, Al). In Eruptive rocks: aplites, pegmatites, granites. (var. spessartite, Mn, Al and almandine); ultrabasic rocks (var. pyrope, Mg, Al).

Use: abrasive. The beautiful, well-colored crystals are sought after as gemstones (Pyrope, Uvarovite and Grossularite)

ZIRCON $Zr(SiO_4)$ Quadratic

Square section prisms. Sometimes in grains. Unclear divisions. Conchoidal breakage. D = 4.7 / H = 7.5. Transparent to opaque. Lively shine. Color: Yellowish, greenish, reddish-brown, red.



Common accessory mineral of eruptive rocks, especially acidic and sodic. Common in pegmatites.

Zirconium ore. Some varieties are gems.



GROUP OF ALUMINA SILICATES:

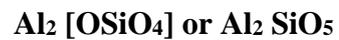
SILLIMANITE



Orthorhombic

Most often in long, thin rods with indistinct endings, grouped in sheaves or tangled. Perfect cleavage
 $D = 3.2 / H = 6 \text{ to } 7$. Transparent to translucent. Greyish, brownish, yellowish, greenish. Little alterable.
In gneisses and mica schists

ANDALUSITE



Orthorhombic (pseudo quadratic)

Generally in coarse prisms with a square section, sometimes poorly formed. Good Cleavage. $D: 3.2 / H = 7.5$ (on the unaltered mineral)

Most often stony and weathered. Rarely translucent. Color whitish, pink; often carbonaceous inclusions regularly arranged and drawing black crosses on the cross sections (chiastolite variety).

Frequently weathers to white mica and kaolin. Becomes opaque and tender.

Mineral of metamorphism, especially clay shales in contact with granitic intrusions. Also in gneisses, mica schists, associated with kyanite, sillimanite, cordierite, garnet. Pegmatite veins (pink, limpid andalusites).

Use: Raw material for the refractory industry resistant to thermal shock (e.g. atmospheric reentry cones for space cabins, etc.).



ANDALUSITE



Kyanite or kyanite

$Al_2 [OSiO_4]$ or $Al_2 SiO_5$

Triclinic

Long flattened prismatic crystals, often with striated faces. More or less radiated, lamellar or fibrous aggregates. Varied macles.

D = 3.5. H = 5 according to the elongation, 7 perpendicular to the elongation on a cleavage face. Break with a chopped appearance perpendicular to the elongation. Flexible. Perfect cleavage. Color sky blue to colorless, sometimes yellow, reddish, greenish Translucent to transparent. Vitreous, pearly shine on cleavage. Colorless dust.



Metamorphism mineral in gneisses and micaceous schists, with garnet, Staurolite, Corundum

TOPAZ

$Al_2 [(F,OH)_2 SiO_4]$

Orthorhombic

In prismatic crystals with various terminations. Very rich in shapes, reaching large dimensions (one meter or more). Also in massive, grainy, acicular aggregates.



TOPAZ



D = 3.4 to 3.6. H = 8. Conchoidal breakage. Excellent and characteristic basal cleavage. Color colorless to yellow, blue, greenish, grayish. Transparent to translucent. Glassy shine. Colorless dust.

Mineral from pneumatolytic deposits in granulites, greisens and pegmatitic veins. Association with cassiterite, lepidolite, beryl, tourmaline.

Well-colored and transparent topazes are sought after as gems. Change color when heated.

STAUROTIDE



Orthorhombic

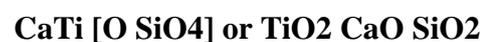
Still crystallized. Simple prisms, often flattened. Frequently m: maclée: cross macles.

D = 3.7 / H = 7 to 7.5. Conchoidal breakage. Color: blackish-brown to red-brown, sometimes ocher. Translucent to opaque. Vitreous shine. White dust.

In metamorphic rocks (schists and gneiss), associated with garnets, andalusite, kyanite, sillimanite, cordierite.



SPHENE (Titanite)



Monoclinic

Crystals of variable facies, flattened to tabular. Grainy aggregates, compact masses, sometimes lamellar. Frequent macles.

D = 3.5 / H = 5 to 5.5. Uneven breakage. Cleavage. Color: yellow to black-brown, green, gray, rarely colorless. Transparent to opaque. Adamantine to resinous luster. Colorless dust.

Frequent in eruptive rocks (amphibole granites, syenites, etc.), metamorphic rocks (amphibole gneisses, amphibolites, etc.), cavities and fissures in gneisses, metamorphic limestones.