Calculation of the chemical formula for Olivine group

Lab No 4

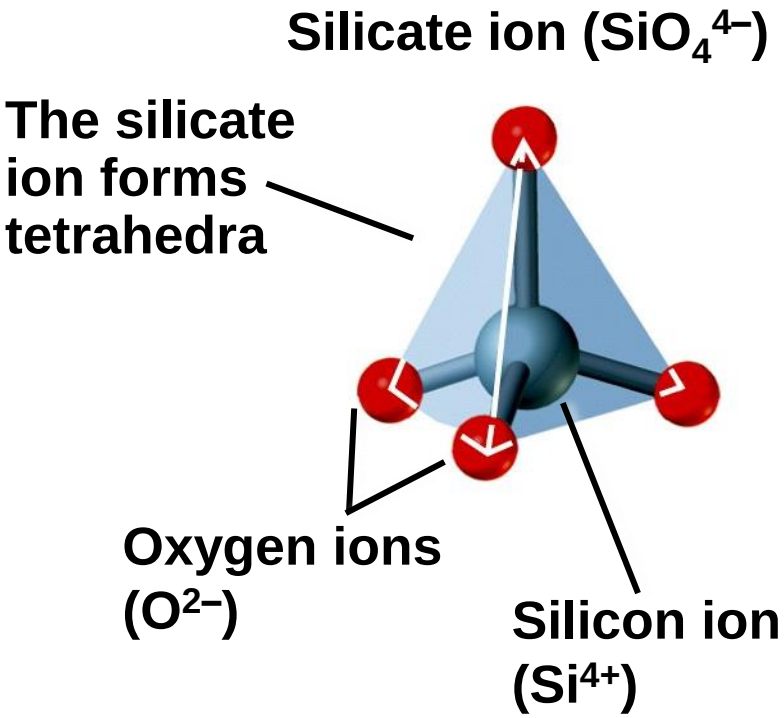
Silicate minerals

- The silicate mineral are largest and very important class of rock forming mineral and make up a large part of the earths crust nearly 90% of which 60percent is feldspar and 12 percent quartz .The predominance of silicate and aluminosilicate reflects the abundance of oxygen ,silicon and aluminum.

- The fundamental unit of silicate minerals is tetrahedron of one silicon atom and four oxygen atoms.

- The different silicate types arise from the various ways in which these silicon-oxygen tetrahedra are related to one another.

Fundamental unit of silicate minerals

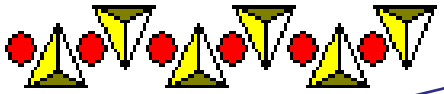


Types of silicates

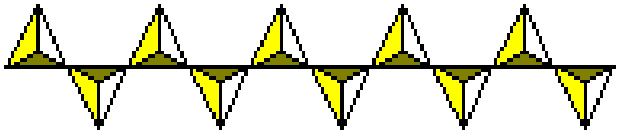
Silicate minerals are classified based on ***how the silica tetrahedra are bonded together***:

- **Nesosilicates**: single tetrahedra
- **Sorosilicates**: two tetrahedra
- **Cyclosilicates**: cyclic groups of tetrahedra
- **Inosilicates**: single and double chains of tetrahedra
- **Phyllosilicates**: sheets of tetrahedra and
- **Tectosilicates**: frameworks of silica tetrahedra, where all the oxygens are shared.

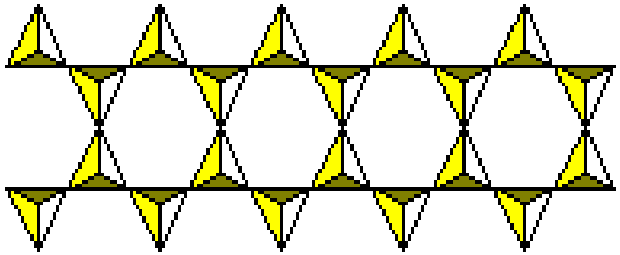
Olivine



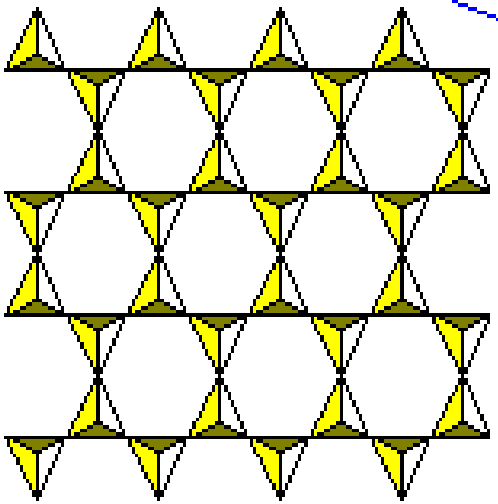
Pyroxene



Amphibole



Biotite



Ca-Plagioclase
$CaAl_2Si_2O_8$

Na-Plagioclase
$NaAlSi_3O_8$

K-Feldspar
$KAlSi_3O_8$

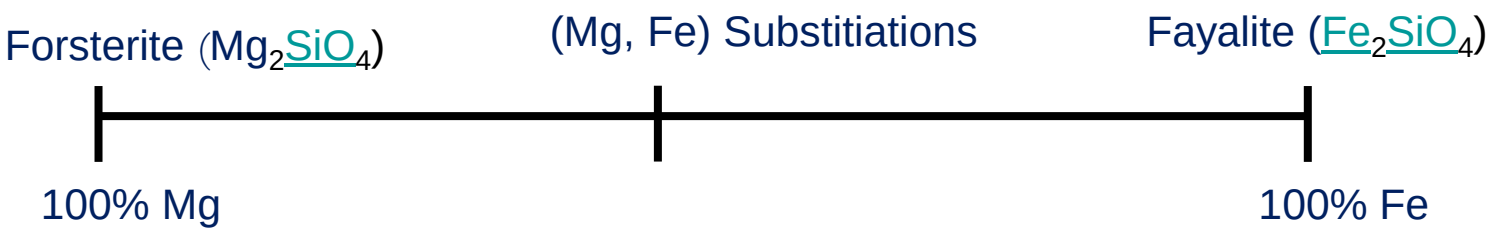
Muscovite

Quartz

Bowen's reaction series

Olivine group

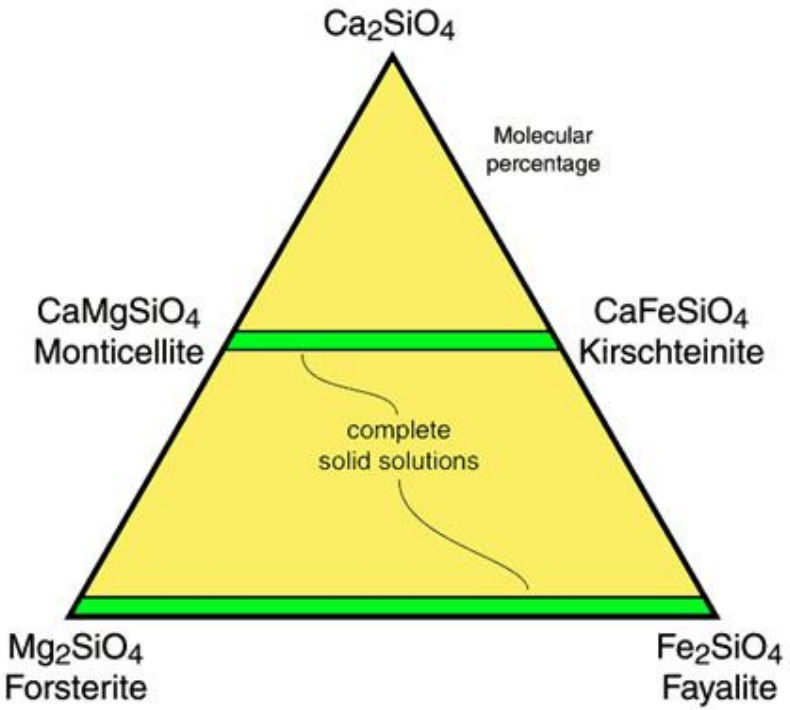
- The mineral olivine is a magnesium iron silicate with the formula $(Mg, Fe)_2SiO_4$.
- It is a common mineral in the Earth's subsurface but weathers quickly on the surface.
- It is belong to nesosilicate subclass.The Individual tetrahedra linked together by iron and magnesium ions.



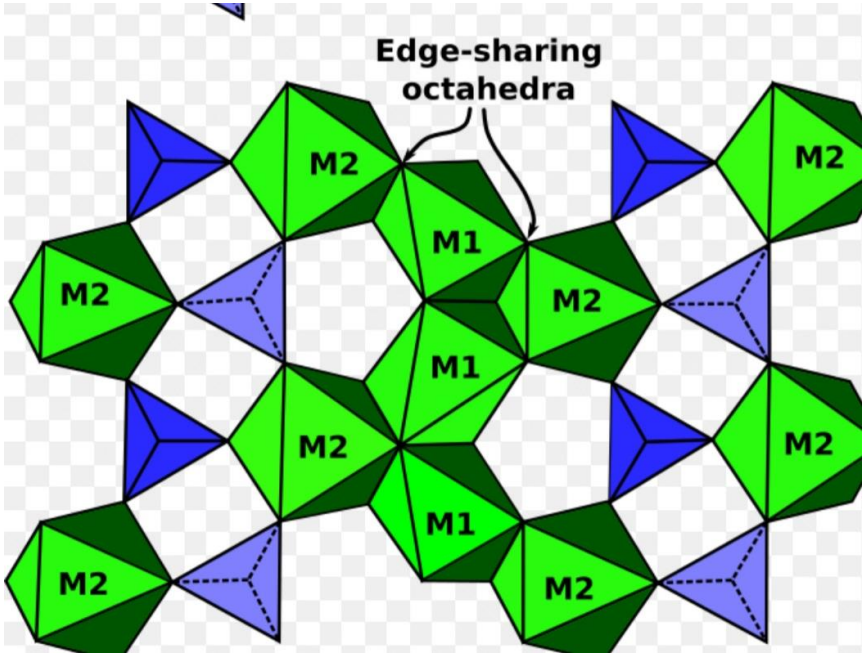
Olivine group

The composition of the majority of olivines can be represented in the system CaO-MgO-FeO-SiO_2.The most common series in this group is **forstrite** Mg_2SiO_4 to **fayalite** Fe_2SiO_4.

Relatively rare olivines occur also along monticellite $CaMgSiO_4$ to kirschteinite $CaFeSiO_4$.



The general formula for olivine group is $(X^{2+})_2SiO_4$, when X = Mg, Fe and Mn.



Presence of pure fayalite or forstrite is rare in nature always there is certain replacement between Fe and Mg.

Olivine with variable composition can expressed in terms of percentage of the component.

1-$fo_{0.91}$ $fa_{0.09}$ 2-$fo_{0.63}$ $fa_{0.37}$

3-$fo_{0.40}$ $fa_{0.60}$ 4-$fo_{0.21}$ $fa_{0.79}$

So olivine $fo_{0.15}$ indicate olivine with 15% Mg_2SiO_4 and 85%Fe_2SiO_4 in its composition.

Exercise: Below are the analytical results for four samples of Olivine mineral, find out the weight percentage (wt%) for an Olivine mineral .Draw relation between FeO content and density.

Note: The number of oxygen atoms in Olivine mineral is 4.

Oxides	S1 wt%	S2 wt%	S3 wt%
SiO_2	40.99	38.40	33.72
FeO	8.58	31.48	47.91
MnO	0.20	0.22	0.41
MgO	50.0	30.50	18.07
Density (gm/cm^3)	3.3	3.65	3.85