Silicates : SiO_3^{2-}

Structure contains tetravalent SiO_4 units – each Si^{4+} is surrounded by 4 O^{2-} ions .

There are different types of silicate depending on:

1.) The number of shared corner O atoms.

2.) Overall negative charge of each SiO_4 unit.

3.) The linking of the tetrahedrons.

4.) Additional metal cations.

Orthosilicates : e.g. Na_2SiO_3 / $ZrSiO_4$ (zircon) have SiO_4^{4-} units.

Pyroxenes : e.g. $NaAl(SiO_3)_2$ (jade). Made up of SiO_4^{4-} units sharing two O atoms, actual repeating unit is SiO_3^{2-}.

The resulting chains can be packed differently

e.g. **ladder-like** $Ca_2Mg_5(Si_4O_{11})_2(OH)_2$ (tremolite) heat resistant, fibrous

e.g. **sheet-like** $Mg_3(Si_2O_5)_2(OH)_2$ (talc) soft slippery .

Aluminosilicates : Arise from replacement of Si^{4+} with Al^{3+} and additional M^+ species .

Feldspars: the most common type of aluminosilicates. More than half the Si(IV) species replaced by Al^{3+} e.g $KAlSi_3O_8$ (granite) .

Granite is weathered to form **clay** :

$$2KAlSi_3O_{8(s)} + 2H_2O_{(l)} + CO_{2(g)} \rightarrow K_2CO_{3(aq)} + 4SiO_{2(s)} + Al_2Si_2O_5(OH)_{4(s)}$$

On baking clay loses H_2O molecules (which lie between the sheets) giving **ceramics**.

Heating clay to 1500°C and allowing the clay to solidify gives **cement.** Cement is sold in its powdered form with $CaSO_4.H_2O$ (gypsum) added. A complex form of calcium silicates and aluminates is produced on wetting. Wet cement is a mixture of SiO_2, $Al_2Si_2O_5(OH)_4$ and $CaCO_3$