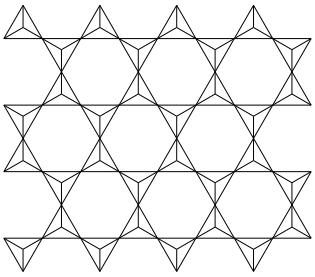
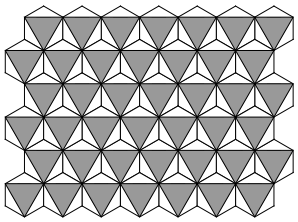
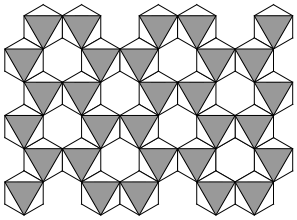
Lecture Notes - Mineralogy - Mica Structures

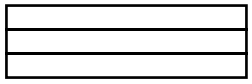


- The micas are a subset of the the **phyllosilicates** (sheet silicates) in which three of the four oxygens in each silicon tetrahedron is shared with an adjacent silicon tetrahedra. Classification of the phyllosilicates is based on their octahedral layers, which may be either all filled **trioctahedral** layers or two-thirds filled **dioctahedral** layers. For nearly every trioctahedral sheet silicate, there is an analogous dioctahedral sheet silicate. Every oxygen in a trioctahedral layer is bonded to three cations, typically a divalent cation like Mg+2 or Fe+2. Every oxygen in a dioctahedral sheet is bonded to two trivalent cations, generally Al+3. In either case the each oxygen needs additional bonds that provide an additional electrostatic bond strength of one. The simple possibilities include (1) sharing the oxygens with an adjacent octahedral layer, (2) bonding a hydrogen to each oxygen, and (3) sharing the oxygens with the otherwise unshared oxygens of a tetrahedral sheet.

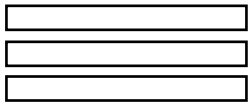




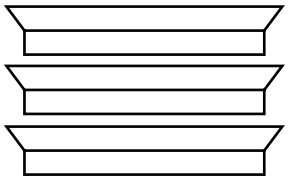
- The common trioctahedral minerals are as follows:



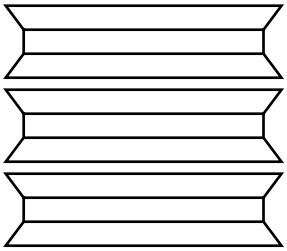
Mg_3O_3 — Periclase — MgO



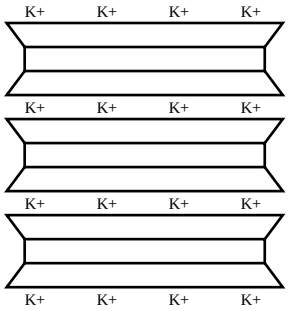
$Mg_3\frac{(OH)_3}{(OH)_3}$ — Brucite — $Mg(OH)_2$



$Mg_3\frac{(Si_2O_5)(OH)}{(OH)_3}$ — Antigorite, Lizardite (Serpentine) — $Mg_3(Si_2O_5)(OH)_4$

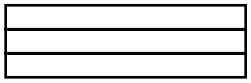


$Mg_3\frac{(Si_2O_5)(OH)}{(Si_2O_5)(OH)}$ talc $Mg_3(Si_4O_{10})(OH)_2$

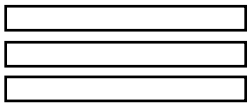


Phlogopite	$KMg_3(AlSi_3O_{10})(OH)_2$
Annite	$KFe_3(AlSi_3O_{10})(OH)_2$
Clintonite	$CaMg_3(AlSi_3O_{10})(OH)_2$
Siderophyllite	$K_2Fe_5Al(Al_3Si_5O_{20})(OH)_4$
Eastonite	$K_2Mg_5Al(Al_3Si_5O_{20})(OH)_4$

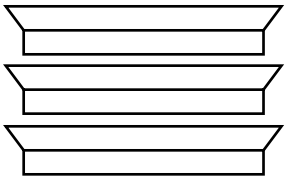
- The dioctahedral analogs of these minerals are:



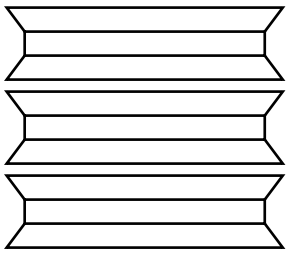
Al_2O_3 Corundum $[\ ]Al_2O_3$



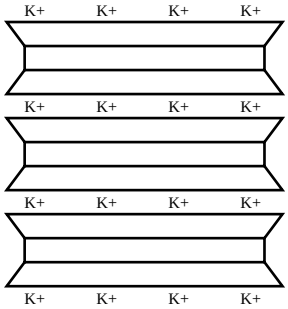
$Al_2\frac{(OH)_3}{(OH)_3}$ Gibbsite $[\ ]Al_2(OH)_6$



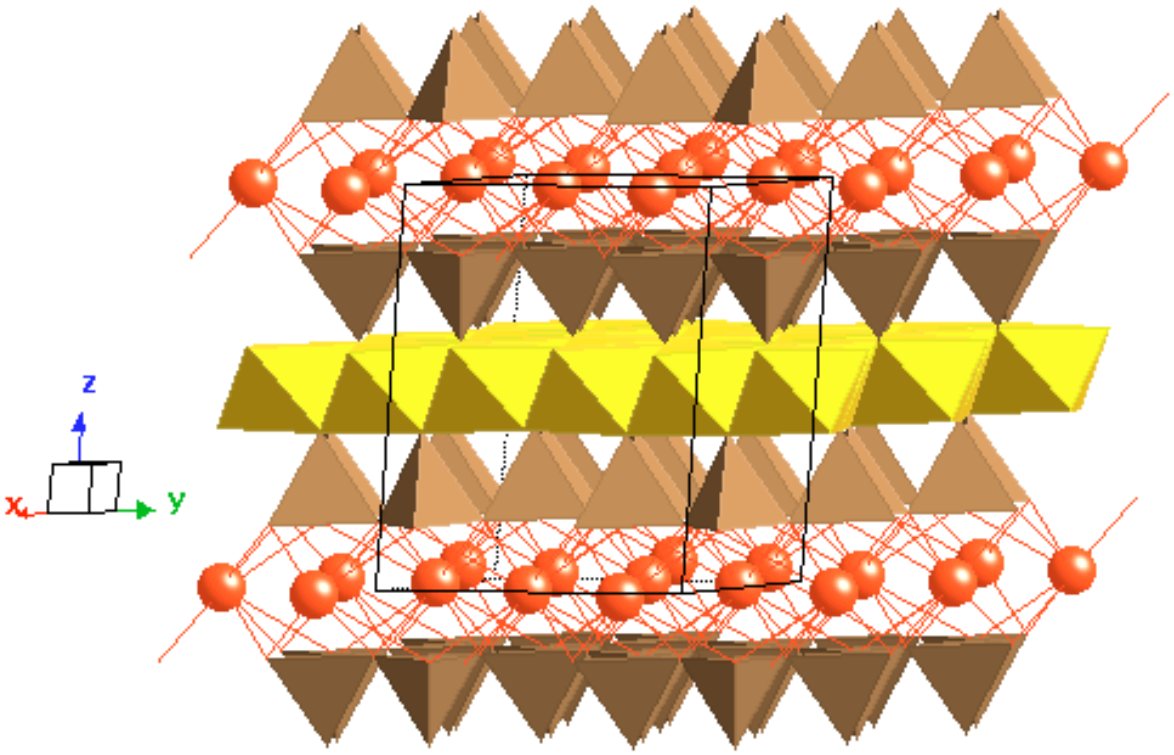
$Al_2\frac{(Si_2O_5)(OH)}{(OH)_3}$ Kaolinite $[\ ]Al_2(Si_2O_5)(OH)_4$



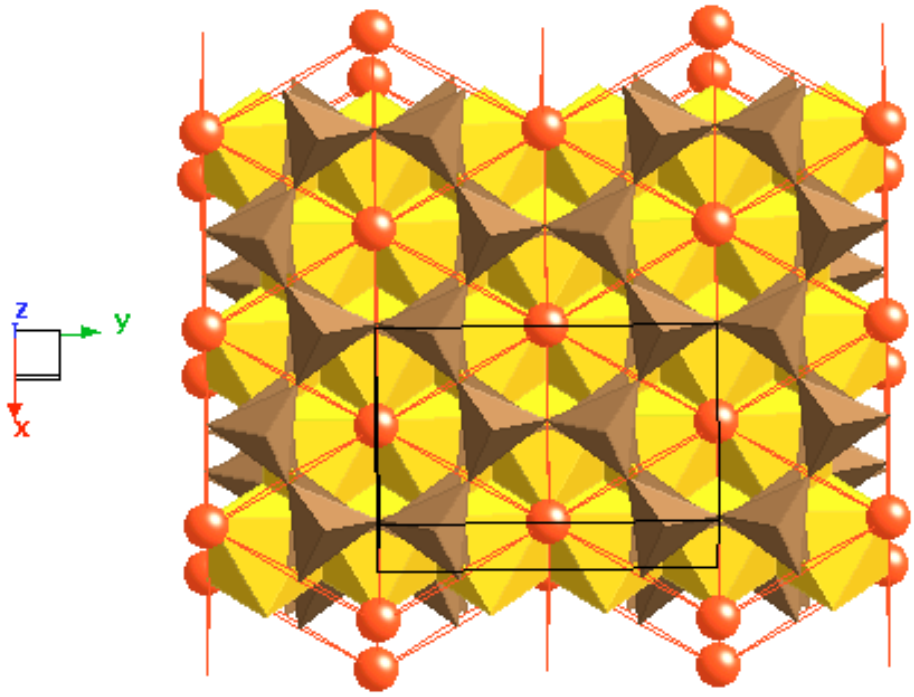
$Al_2\frac{(Si_2O_5)(OH)}{(Si_2O_5)(OH)}$ Pyrophyllite $[\ ]Al_2(Si_4O_{10})(OH)_2$



Muscovite	$K[\ ]Al_2(AlSi_3O_{10})(OH)_2$
Paragonite	$Na[\ ]Al_2(AlSi_3O_{10})(OH)_2$
Margarite	$Ca\ [\ ]Al_2(AlSi_3O_{10})(OH)_2$
Lepidolite	$K_2[\ ](Li,Al)_5(Al_2Si_6O_{20})(OH,F)_4$



Structure of phlogopite viewed approximately perpendicular to c as drawn by CrystalMaker



Structure of phlogopite viewed perpendicular to (001) as drawn by CrystalMaker ©.