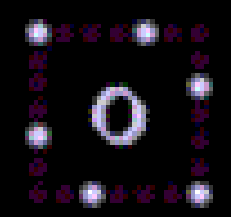


Clay Mineralogy

4.16 μm

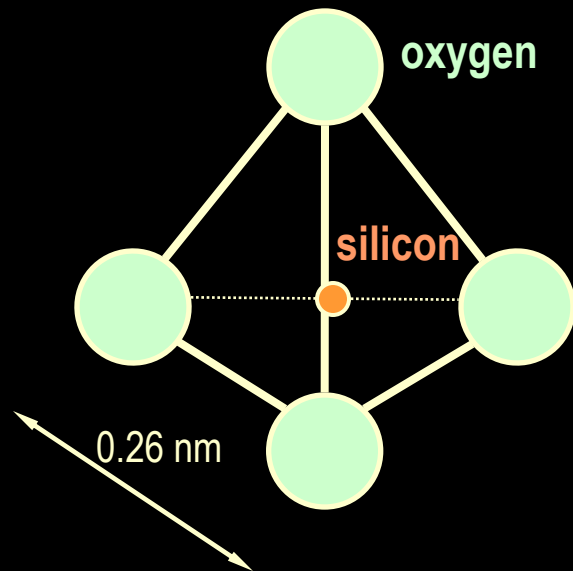


Atomic Structure

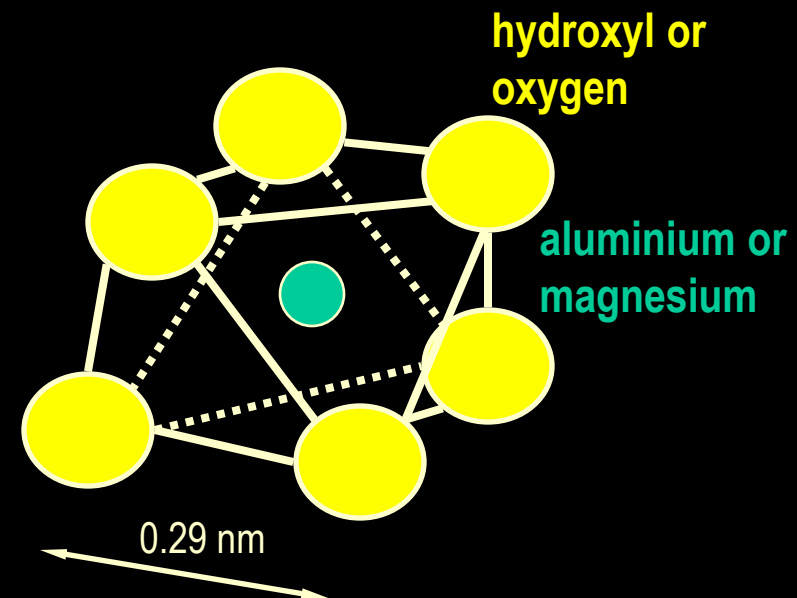


Basic Structural Units

Clay minerals are made of two distinct structural units.



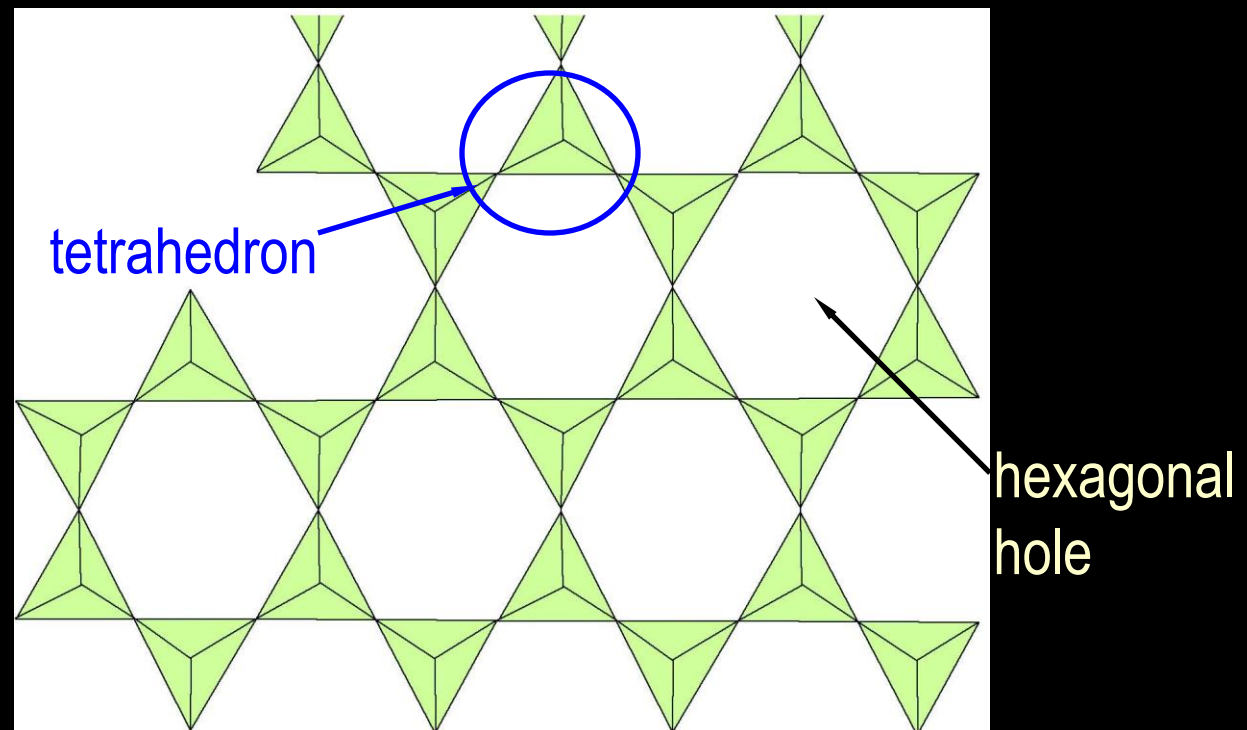
Silicon tetrahedron



Aluminium Octahedron

Tetrahedral Sheet

Several tetrahedrons joined together form a tetrahedral sheet.

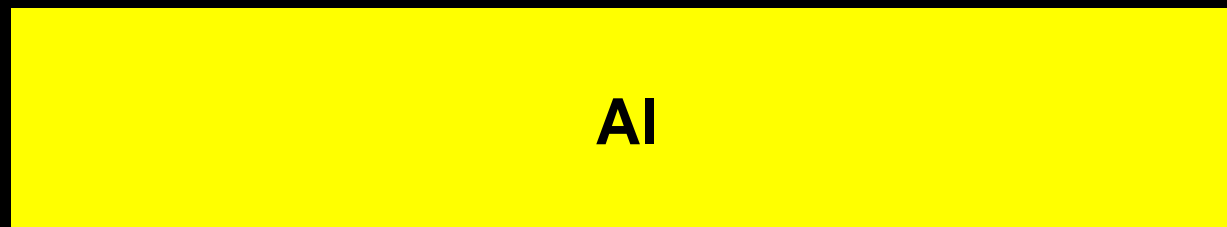


Tetrahedral & Octahedral Sheets

For simplicity, let's represent silica **tetrahedral sheet** by:



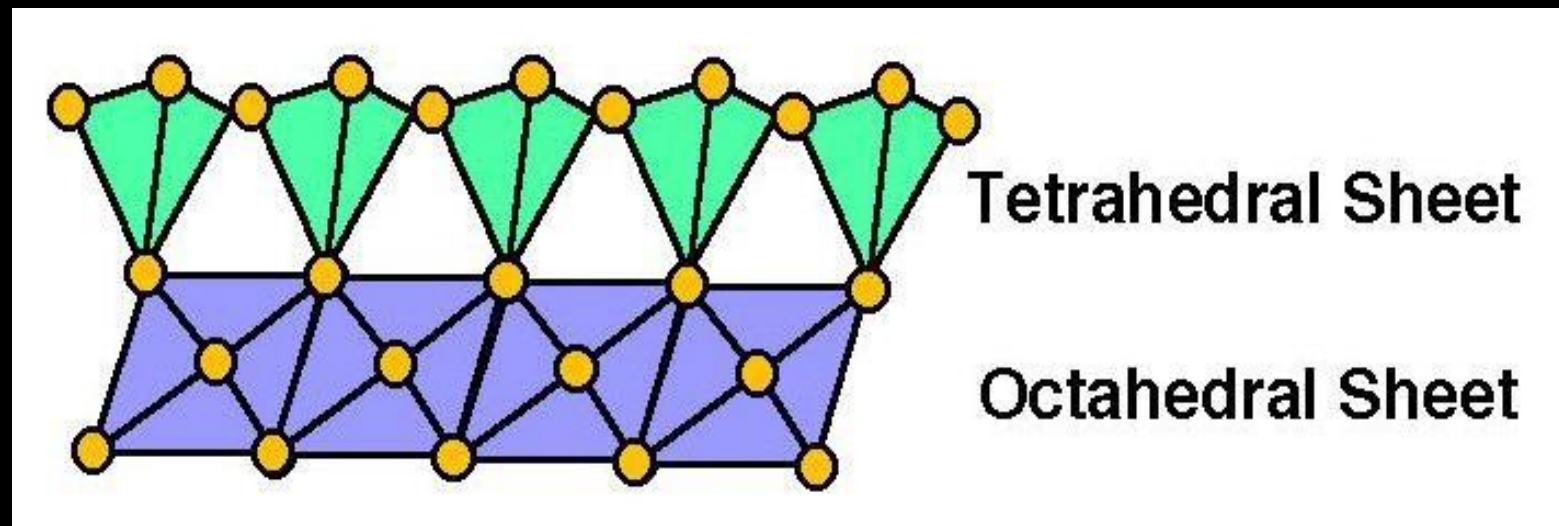
and alumina **octahedral sheet** by:



Different Clay Minerals

Different combinations of tetrahedral and octahedral sheets form different clay minerals:

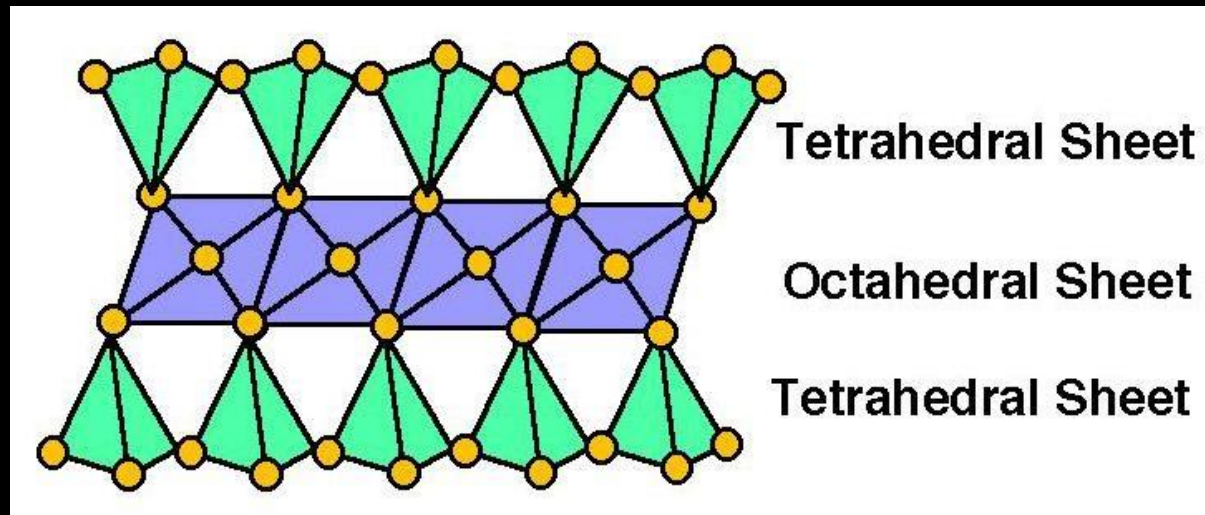
1:1 Clay Mineral (e.g., kaolinite, halloysite):



Different Clay Minerals

Different combinations of tetrahedral and octahedral sheets form different clay minerals:

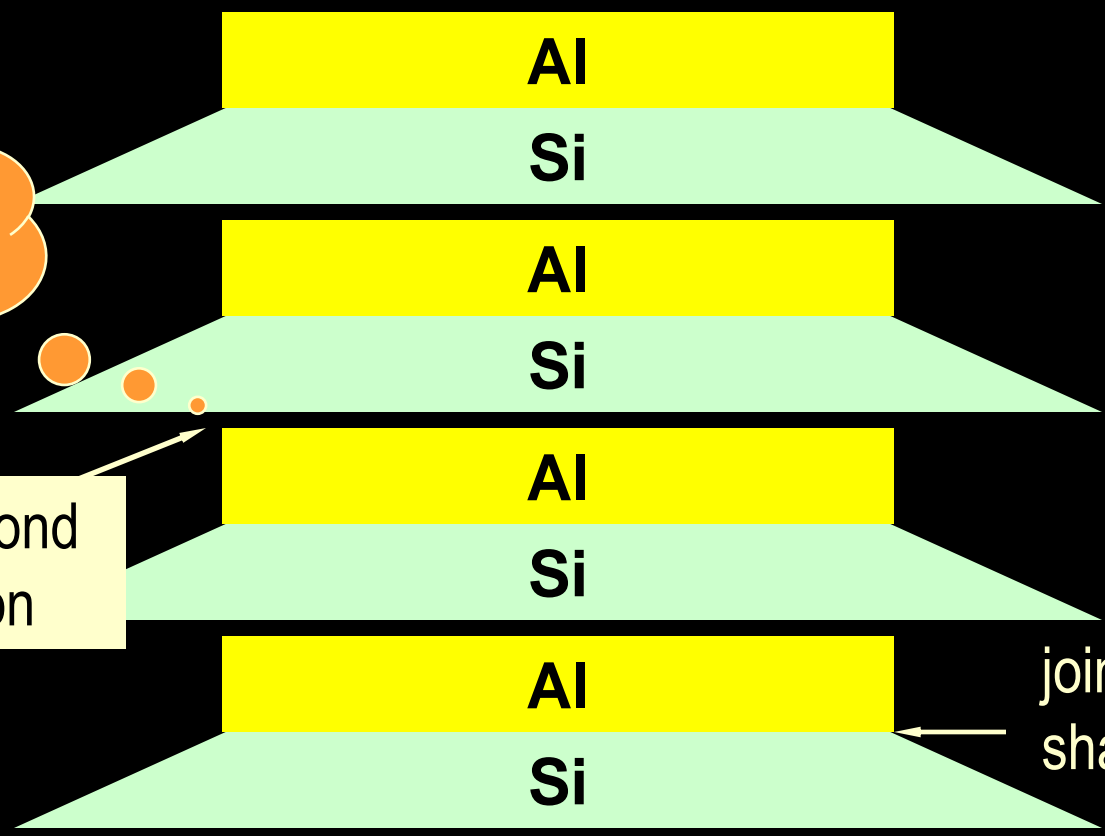
2:1 Clay Mineral (e.g., montmorillonite, illite)



Kaolinite



Typically
70-100
layers



0.72 nm

joined by strong H-bond
∴ no easy separation

joined by oxygen sharing

Kaolinite

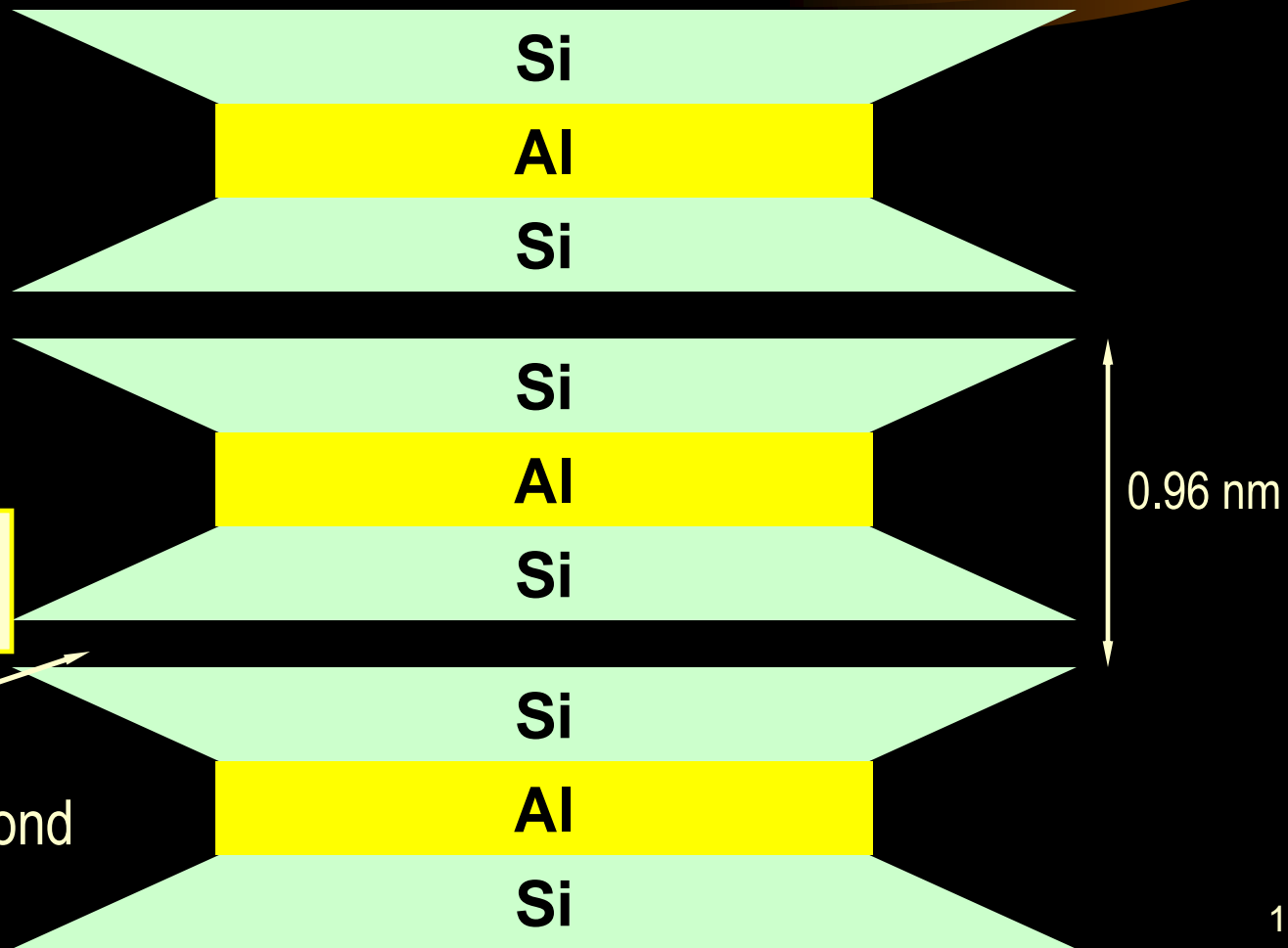
- used in paints, paper and in pottery and pharmaceutical industries
- $(\text{OH})_8\text{Al}_4\text{Si}_4\text{O}_{10}$

Halloysite

- kaolinite family; hydrated and tubular structure
- $(\text{OH})_8\text{Al}_4\text{Si}_4\text{O}_{10}\cdot 4\text{H}_2\text{O}$

Montmorillonite

➤ also called smectite; expands on contact with water



∴ easily separated
by water

joined by weak
van der Waal's bond

Montmorillonite

➤ A highly reactive (expansive) clay

➤ $(OH)_4Al_4Si_8O_{20} \cdot nH_2O$

swells on contact with water

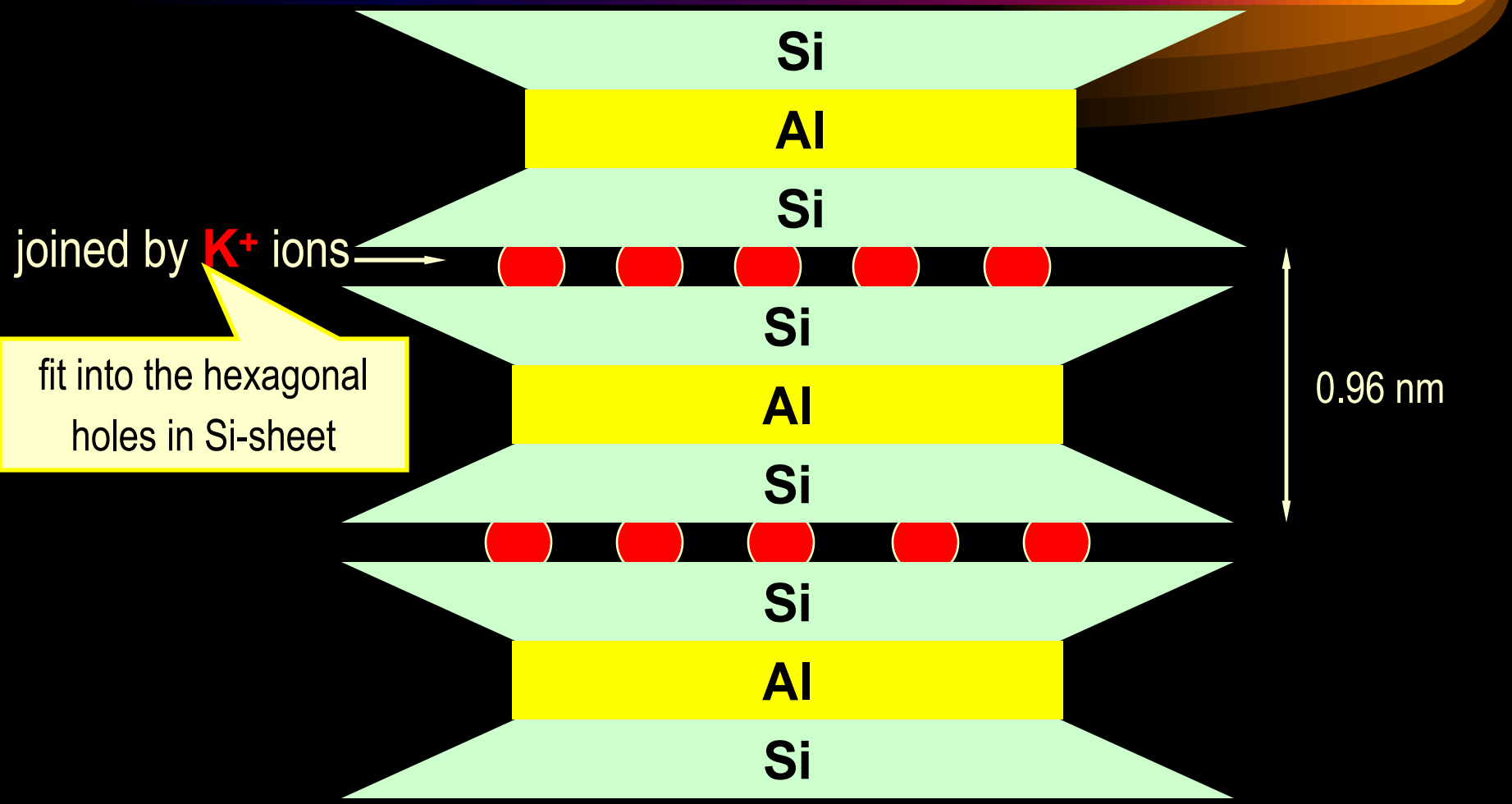
high affinity to water

Bentonite

➤ montmorillonite family


➤ used as drilling mud, in slurry trench walls, stopping leaks

Illite



Others...

Chlorite

- A 2:1:1 (???) mineral.
- Si Al Al or Mg
- 

Vermiculite

- montmorillonite family; 2 interlayers of water

Attapulgite

- chain structure (no sheets); needle-like appearance