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CLAY MINERALS

Clay minerals refers to a group of hydrous aluminosilicates that predominate the clay-sized fraction of soil. These minerals are similar in chemical and structural composition to the primary minerals that originate from the Earth's crust. However, transformation in the geometric arrangement of atoms and ions within their structures occur due to weathering. Primary minerals form at elevated temperatures and pressures and are usually derived from igneous or metamorphic rocks. Inside the Earth these minerals are relatively stable, but transformations may occur once exposed to the ambient conditions of the Earth's surface.

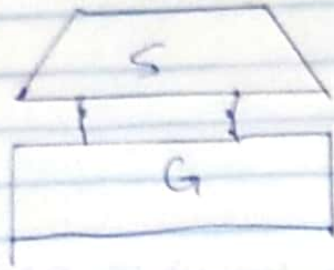
The secondary minerals are the culmination of either alteration of the primary mineral structure or neoformation through precipitation or recrystallization of dissolved constituents into a more stable structure. These secondary minerals are often referred to as phyllosilicates.

CLAY MINERALS are hydrous aluminum phyllosilicates sometimes with variables of magnesium, alkali metals, alkaline earths, iron and other cations found on or near some planetary surfaces.

CLAY MINERALOGY is the scientific discipline of all aspect of clay minerals, including their composition, properties, classification, crystal structures and occurrence in nature.

STRUCTURE OF CLAY MINERALS

These consist of two ~~two~~ units,
The octahedral sheet and tetrahedral sheet.



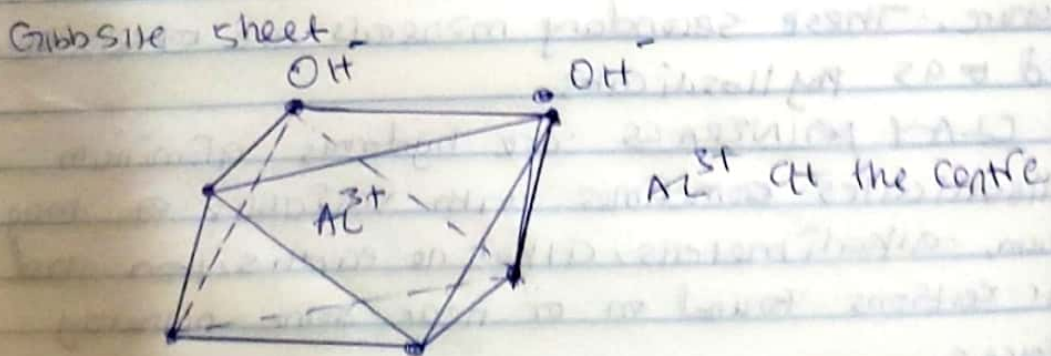
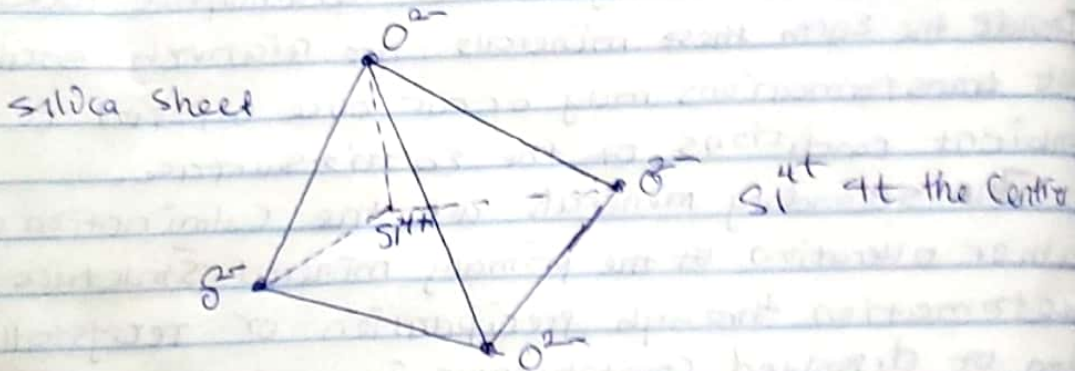
Tetrahedral sheet
Silica sheet

Octahedral sheet
Alumina/Gibbsite sheet

~~silica sheet~~

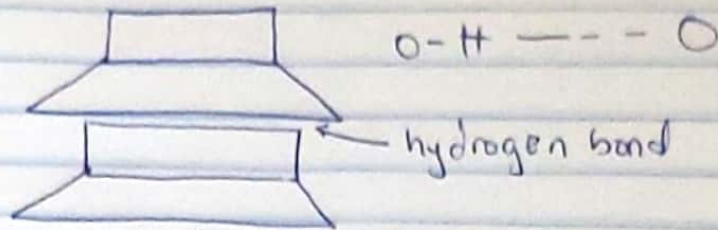
The silicate tetrahedron is the foundation of all silicate structures. It consists of four O^{2-} ions and one Si^{4+} ion.

The minerals in the octahedral sheet are brucite $Mg(OH)_2$ and gibbsite $Al(OH)_3$.



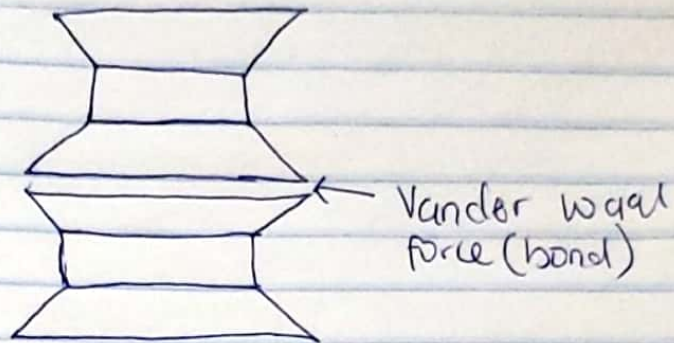
The process of replacing one structural cation for another of similar size is referred to as isomorphous substitution.

* Kaolinite



These structural unit are join together by hydrogen bond between hydroxyls of aluminum and oxygen.

* Montmorillonite:



Join together by Vander waal bond

We also have Vermiculite (tri octahedral) and chlorite (tri octahedral)

PROPERTIES OF CLAY MINERAL

CHEMICAL PROPERTIES

1) Ion exchange .. eg
Kaolinite has an exchange capacity of 3-15, illite (10-40), chlorite (10-40)

2) clay-water relations

3) Interaction with inorganic and organic compounds.

PHYSICAL PROPERTIES

- size and shape, high temperature reaction, solubility.

Q II Geology of Nigeria

The Basement Complex

This is one of the three major tectono-geological components that make up the geology of Nigeria. The Nigerian basement complex forms a part of the Pan-African mobile belt and lies between the West African and Congo cratons and south of the Turgay shield. It is intruded by the Mesozoic calc-alkaline igneous complexes of the Jos Plateau and is unconformably overlain by Cretaceous and younger sediments. The Nigerian basement was affected by the 600 Ma Pan-African orogeny and it occupies the reactivated region which resulted from plate collision between the passive continental margin of the West African craton and the active Pharusian continental margin.

The basement rocks are believed to be the result of at least four major orogenic cycles of deformation, metamorphism and remobilization corresponding to the Liberian (2,700 Ma), the Eburnean (2000 Ma), the Kibaran (1100 Ma) and the Pan-African cycles (600 Ma).

The SEDIMENTARY BASINS

The Sokoto Basin

The Fullemmenden Basin in north-western Nigeria is known as Sokoto Basin. It consists predominantly of a gently undulating plain with an average elevation varying from 250-400m above sea level. This plain is occasionally interrupted by low mesas. A low escarpment known as the Dange Scarp is the most prominent feature in the basin.