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Clay mineralogy

The scientific discipline concerned with all aspects of clay minerals including their properties, composition, classification, crystal structure, and occurence and distribution in nature. The method of study include X-ray diffraction, infrared spectroscopic analysis, chemical analyses of bulk and monomineralic samples, determinations of cationic exchange, capacities, electron-optical studies by differential thermal analysis and thermo-gravimetric methods.

Groups of clay mineral

These menerals can be classified on the basis of variation of chemical composition and atomic structure into nine groups

- Kaolin-serpentine.
- Pyrophyllite-talc.
- Mica
- Vermiculite
- Smectite
- Chlorite
- Sepiolite-palygorskite
- Interstratified clay minerals
- Allophane imogolite.

Clay minerals

They are the characteristics minerals of the earths near surface environments. They form in

Soils and sediments, and by diagenetic and hydrothermal alteration of rocks. Water is essential for clay mineral formation and most clay materials mineral are described as hydrous alumino silicates.

Properties of clay mineral

1) clay minerals as electron acceptors and/or donors in organic reaction:-

The electron-accepting and the electron donating sites of clay can be explained by the fact the electron acceptor sites are aluminium at crystal edges and transition metals in lower valency state.

2) Adsorptive and low permeability properties

As absorptive material, there are three ways clay minerals and clay-based minerals can exert non-covalent adsorptive power on various molecules from liquid to gaseous states.

3) Swelling behaviour

Clay mineral swelling is dependent on clay mineral type, the electrolyte concentration and the nature of the cations in the solution. The swelling mechanism can be divided into mechanical and physiochemical processes.

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Geology ⑤

Geology of Nigeria

The geology of Nigeria formed beginning in the Archean and proterozoic eaons of the Precambrian. The country forms the Nigerian province and more than half of its surface is igneous and metamorphic crystalline basement rock from the Precambrian. Between 2.9 billion and 500 million years ago, Nigeria was affected by three major orogeny mountain building events and related igneous intrusions.

Following the Pan-African orogeny, in the cambrian at the time that multi cellular life proliferated, Nigeria began to experience regional sedimentation and witnessed new igneous intrusions.

Nigeria has tremendous oil and natural gas resources housed in its thick sedimentary basins as well as reserves of gold, lead zinc.

Basement Complex

Is one of the 3 major litho-petrological component that make up geology of Nigeria. Nigerian Basement complex forms a part of the Pan African mobile belt and lies between West Africa and congo cratons and south of the tuareg shield.

Within basement complex of nigeria, four major petrol-lithological units are distinguishable mainly

1) Migmatite-Gneiss complex (MGC)
2) The schist Belt (Meta sedimentary & Metavolcanic rocks)
3) The older granites
4) Undeformed acid and basic dykes

Migmatite-Gneiss Complex

It is the most widespread of the component unit in Nigeria basement. Many areas in northern,

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Western and eastern nigeria are covered by rocks ~~This areas include b~~ examples are migmatite, ~~Gen Gne~~ es, granite - gneisses)

B - Schist Belt (Metasedimentary & meta Volcanic rocks): Phyllites, schists, marbles, quartzites and Pelites

C) The older granites (Pan African granitoids): Granites, granodiorites, monzonites, gabbro.

D) Undeformed acid and basic dykes (Muscovites - aplites, beryl-bearing, dolerite, basaltic and lamprophyric dykes.

Sedimentary Basin

Nigeria is underlain by 7 major sedimentary basins From the oldest

- Calabar Flank
- Benue trough
- Chad basin
- ~~Sf~~ Sokoto Basin.
- Dahomey basin
- Niger delta basin

1. Calabar Flank

Is part of the souther Nigerian sedimentary basin that is bound by Oban massif to the north, and the calabar hinge line delineating the Niger delta in the south.

Benue trough

Is a major geological structure underlying a large part of Nigeria and extends by 1000Km north east from bight

of benin to lake chad.

- Chad basin
  Is the largest endoheric basin in Africa, centered on lake chad. It has no outlet to the sea and contains large areas of semi-arid desert and savanna.

- Sokoto basin
  Is the South-so-eastern portion of the large Iullemmeden basin. The Iullemmeden basin covers north western Nigeria most parts of Niger republic, Benin republic, Mali, Algeria and Libya

- Dahomey Basin
  This is the combination of inland/coastal/offshore basin that stretches from southeastern Ghana through Togo and the republic of Benin to southwestern Nigeria. It is seperated from the Niger delta by a subsurface basement high referred to as the Okitipupa ridge.

- Niger delta basin
  This is refer to as the Niger delta province, is an extensional rift basin located on the niger delta and the gulf of guinea on the passive continental margin near the western coast of Nigeria.

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