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THE GEOLOGY OF NIGERIA

The Geology of Nigeria was formed during the Archean and Proterozoic eons of the Precambrian. The Basement Complex is one of the petro-lithological units that form the geology of Nigeria and a part of the Pan-African mobile belt.

The crystalline basement rock of the country is grouped as the Nigerian Province, a southern continuation of the Central Hoggar reactivated basements. The Migmatite Gneiss is one of the four units within the basement complex of Nigeria. It covers half of Nigeria's surface area and encompasses Archean gray gneisses. Within this complex are occurencies of schist, migmatite, garnet and kyanite which together indicate high-level metamorphism

The Schist belt is another petro-lithological unit of the basement complex of Nigeria. They are low-grade metamorphic rocks which have isoclinal folding and faulted and sheared boundaries with the surrounding rocks. These schist belts have been interpreted to be the remains of paleo-rift systems.

In Nigeria, during the Pan-African orogeny, granite and diorite intrusions of between 700 and 500 million years ago and are known as the Older Granites. As the Older granites continued to emplace. The Granite intrusion formed batholiths and Charnokites

Large sedimentary basins were formed in Southern Nigeria, divided by the Okitipupa Ridge. The basins did not begin to fill with sediments until the Albian age of the Cretaceous. In the South-East, poorly bedded sandy shale alternates with layers of sandstone containing ammonite and echinoid fossils. Subsequently, some of these sedimentary rock layers experience lead and zinc mineralization

CLAY MINERALS AND THEIR PROPERTIES

Halloysites: These clay minerals are mainly characterized by their tubular nature, however, other morphological varieties are also known: prismatic, rolled, pseudospherical etc. Halloysite has a hydrated form with a composition of $Al_2Si_2O_5(OH)_4 \cdot H_2O$. This hydrated form irreversibly changes to a dehydrated variety at relatively low temperatures or low relative humidity

Kaolinites: These are 1:1 layer silicates. Their basic structural units consist of tetrahedral & octahedral sheets in which the anions at the exposed surface of the octahedral sheets are hydroxyls. kaolinite is electrostatically neutral and has triclinic symmetry. It has an ideal structural formula of $Al_2Si_2O_5(OH)_4$.

Vermiculite: These are unite structures that consist of sheets of trioctahedral mica or talk spperated by water molecules. These layers occupy a space of about 2 water molecules thick. Heating vermiculite to temperatures as high as 500°C drives the water out from between the mica layers, but the mineral quickly rehydrates at room temperature to maintain its normal basal spacing.

Smectite: These are 2:1 layer silicates which can be derived from the structures of pyrophillite and talc, but have a slight negative charge owing to ionic substitutions in the octahedral and tetrahedral sheets. The structural formula of smectite may be represented as $(Al_{2-y}Mg^{2+}_y)(Si_{4-x}Al_x)O_{10}(OH)_2 M^+_{x+y} \cdot nH_2O$.

Chlorites:

Chlorite structures are relatively thermally stable compared to other clay minerals, therefore, they are resistant to high temperatures. Chlorite structures consist of alternate micalike layers and brucite like hydroxide sheets. Structural formulas may be expressed by four end member compositions:

$(Mg_5Al)(Si_3Al)O_{10}(OH)_8$ — clinochlore

$(Fe_5^{2+}Al)(Si_3Al)O_{10}(OH)_8$ — chamosite

$(Mn_5Al)(Si_3Al)O_{10}(OH)_8$ — pennatite

$(Ni_5Al)(Si_3Al)O_{10}(OH)_8$ — nimite