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18/ENG03/003 14/01/2021

ENG 313 (Geology) Assignment

Assignment Question: (1) Read and write extensively on geology of Nigeria

Write comprehensively on clay minerals and their distinct properties

1) Geology Of Nigeria

The geology of Nigeria formed beginning in the Archean and proterozoic eons 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 2.7 billion and 600 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, Nigerian began to experience regional sedimentation and stressed New igneous intrusions. By the Cretaceous period of the late Mesozoic, massive sedimentation was underway in different basins due to a large marine transgression. By the Eocene in the Cenozoic, the region returned to terrestrial conditions.

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

Nigeria has extensive natural resources and is the largest crude oil producer in Africa and 20 billion barrels of reserves. As such, petroleum is central to the Nigerian economy, producing 80 percent of government revenues.

The country also has extensive mineral deposits, although most are under-exploited. According to the Geological Survey of Nigeria Agency, Nigeria has some 34 known major deposits of minerals across the country. Exploration of solid minerals like tin, zinc, lead, gold etc goes back for more than 90 years.

The ~~states~~ of Anambra, Benue, Plateau and Taraba have small-scale lead & zinc mining from deposits that also have large quantities of Cadium, arsenic and antimony. Barite veins commonly contain lead & zinc in plateau state and other eastern Nigeria. Kwara State has iron ore in Abaja plateau and Itakpe hills.

Clay Minerals and their Properties

2) Clay minerals are hydrous aluminum phyllosilicates sometimes with variable amounts of iron, magnesium alkali metals, alkaline earths, and other cations found near some planetary surfaces.

Clay minerals form in the presence of water and have been important to life, may theories of abiogenesis involve them. They are important constituents of soils, and have been useful to humans since ancient times in agriculture and manufacture, most clay minerals are the product of chemical weathering of rock forming minerals such as feldspar and mica.

The three major clay minerals are Halloysite, chlorite and vermiculite

Halloysite:- is an alumino-silicate clay mineral with the empirical formula $Al_2Si_2O_5(OH)_4$. its main constituents are oxygen, silicon, aluminium and hydrogen. Halloysite typically forms by hydrothermal alteration of aluminosilicate minerals

chlorite:- This is a wide spread group of layered silicate minerals occuring in both macroscopic and clay grade sizes. They are hydrous aluminium silicates usually of magnesium and iron. The name from english translation of its greek name as "green" which refers to the chlorides common colour

Vermiculite:- is an hydrous phyllosilicate mineral which undergoes significant expansion when heated

- Exfoliation occurs when the mineral is heated sufficiently, and commercial furnaces can routinely produce this effect. Vermiculite forms by the weathering or hydrothermal alteration of biotite or phlogopite.

Properties of clay ~~materials~~ Minerals

These properties can be devided into two o Physical & chemical properties of clay minerals

Physical properties of clay minerals

- **Solubility**:- The solubility of the clay minerals in acids varies with the nature of the acid-to-clay ratio, the temperature, the duration of treatment, and the chemical composition of the clay mineral attacked.

i) **Size and shape**: These properties of clay minerals have been determined by electron micrographs. well-crystalline kaolinite occurs as well formed, six-sided flakes, frequently with a prominent elongation in one direction.

ii) **High temperature reactions**:- when heated at temperature beyond dehydroxylation, the clay minerals structure may be destroyed or simply modified, this scenerio is dependant on the composition and structure of the substance. In the presence of the fluxes, such as iron or potassium, fusion may rapidly follow dehydroxylation.

Chemical properties of clay minerals

- **Clay water relations:-** clay contains water in several forms. The water may be held in pores and may be removed by drying under ambient conditions.

- **Ion exchange:-** Depending on defect age in the positive or negative charge balance (locally or overall) of mineral structures, clay minerals are able to absorb certain cations and anions and retain them around the outside of the structural unit in an exchangeable state.

- **Interactions with organic & inorganic Compounds:-** chlorite, Vermiculite and other expansible clay minerals can accomodated relatively large inorganic cations between the layers due to this ability called multivalency, the interlayer space is only partially occupied by such inorganic cations that are distributed in the space like islands.