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Mapping and Characterization of Some Industrial Mineral Deposits in North-Central Nigeria as Raw Materials for Industrialization

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Abstract

Physical mapping and geochemical characterization of some industrial mineral occurrences in North-Central Nigeria have been undertaken as a basis for identifying the locations of their occurrence, the economic quantities, modes of occurrence and physico-chemical characteristics as raw materials for industrialization in the region. The North-Central region of Nigeria comprises the geopolitical states of Benue, Kogi, Kwara, Nasarawa, Niger, Plateau and the Federal Capital Territory. Physical mapping-surveys have been carried out on clay, marble and talc deposits in Niger State; barite and clay deposits in Nasarawa State and on clay, marble and feldspar deposits in Kogi State. Deposits of clay have been mapped in Niger State at Mashegu, Kutigi and Lemu, marble and clay at Kwakuti and talc at Kagara. In Nasarawa State barite deposits were mapped at Azara and Wuse and clay deposit at Shabu while in Kogi State clay deposits occur at Ahoko and Ojodu, marble at Jakura and Obajana and at Allo/Itobe and feldspar at Ajaokuta. All the mapped industrial minerals occur in economic quantities, although the exact reserves have not yet been measured.

Keywords: Industrial minerals; Nigeria; raw materials; industrialization; marble; barite.

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1. Introduction

Prior to the emergence of petroleum in the mid nineteen seventies as a major foreign exchange earner, the solid minerals sub-sector ranked second only to the agricultural sector as a source of export earnings. The sub-sector also contributed substantially to national output, accounting for about 10 per cent of the GDP in 1970. The annual average output in the sub-sector was put at some 130.8 thousand metric tonnes over the years 1970–1973. It employed, on the average, about 30% of Nigeria's total workforce per annum over the period 1958 – 1970. However, with the exit of foreign multinational mining companies and their expatriate professionals in the wake of the 1972 Indigenisation Decree, the performance of the sub-sector began to dwindle. Annual production declined considerably, particularly in metallic minerals.

With tumbling global oil prices and downturn in the Nigerian economy, there is the need to develop strategies that can take advantage of the opportunities available for the development of the nation's solid mineral resources within the context of a diversified economy where mining (including petroleum!!), industrial agriculture and manufacturing will be the key players. Nigeria as a nation is blessed with appreciable solid mineral resources distributed fairly in all the states of the federation. According to reports by the Nigerian Geological Survey Agency (NGSA), Nigeria has some 34 known major mineral deposits distributed in locations across the country that offer considerable attraction for investors.

The North-central region of Nigeria comprising Benue, Kogi, Kwara, Nasarawa, Niger, Plateau States along with the Federal Capital Territory (FCT) (Fig. 1) is very rich in mineral resources. The geological setting of the region is made up of igneous and metamorphic rocks of the Nigerian Basement Complex (in all the 6 States and the FCT) and sedimentary rocks of the Bida Basin (Niger, Kogi, Kwara, FCT), Middle Benue Trough (Benue, Nasarawa, Plateau) and the Northern Anambra Basin (Kogi, Benue). Fifty percent (50%) of the surface area in Nasarawa and Kogi States are covered with basement complex rocks. In Nasarawa State, the remaining 50% is made up of sedimentary rocks of the Middle Benue Trough while in Kogi State, the remaining 50% is made up of sedimentary rocks of the Southern Bida Basin and the Northern Anambra Basin. Basement Complex rocks cover about 60% of the surface area in Benue, 80% (along with the Younger Granites) in Plateau and 95% in Kwara State (Fig. 2). Industrial mineral deposits of economic to sub-economic quantities are associated with each of the components of the geology of the States in the North-Central geopolitical region of Nigeria. The industrial minerals under investigation (Clay, Barite, Marble, Talc, Feldspar) occur in different proportions in different or similar geological modes of occurrence, with different or similar geochemical characteristics (grades) and quantities in the six States and the FCT.

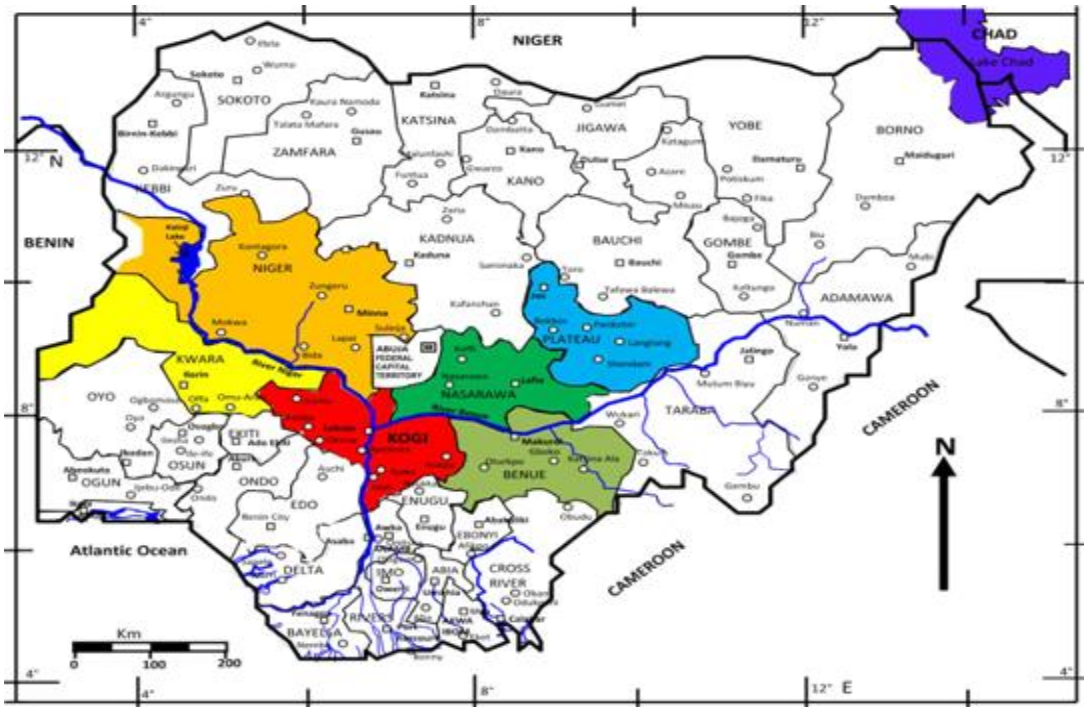

Figure 1: political map of Nigeria showing the states in the North-Central geopolitical region

2. Literature Review

2.1. Geology

2.1.1. Basement Complex

Obaje [1] gave a vivid account of the geology of the study area to be made up of the Basement Complex and the sedimentary rocks of the Bida, Middle Benue and Northern Anambra Basins (Fig. 2). 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 Tuareg Shield. It is intruded by the Mesozoic calc-alkaline ring complexes (Younger Granites) of the Jos Plateau and is unconformably overlain by Cretaceous and younger sediments. Within the basement complex of Nigeria three major petro-lithological units are distinguishable, namely:

1. The Migmatite – Gneiss Complex (MGC)
2. The Schist Belt (Metasedimentary and Metavolcanic rocks)
3. The Older Granites (Pan African granitoids)

The Migmatite – Gneiss Complex (MGC)

The Migmatite – Gneiss Complex is generally considered as the basement complex *sensu stricto* [2, 3] and it is the

most widespread of the component units in the Nigerian basement. It has a heterogeneous assemblage comprising migmatites, gneises, and a series of basic and ultra-basic metamorphosed rocks. They generally occur intricately associated with the Older Granites intruding into them and in some places along with schist belts, but chronologically the Migmatite-Gneiss complexes are oldest (older than Schist Belts older than Older Granites). In aerial cover, migmatite-gneisses are most prominent in Minna, Paiko, Suleija, Tegina and Kagara (Niger State); Keffi, Akwanga and Nasarawa (Nasarawa State); Ajaokuta, Okene, Lokoja East, Kabba, Obajana and Isanlu (Kogi State); Ilorin, Offa, Omuaran (Kwara); Gboko (Benue); along with the Younger Granites in Jos, Pankshin, Langtang (Plateau)

The Schist Belt (Metasedimentary and Metavolcanic rocks)

According to Dada [3], the Schist Belts comprise low grade, metasediment-dominated belts trending N-S which are best developed in the western half of Nigeria. These belts are considered to be Upper Proterozoic supracrustal rocks which have been infolded into the migmatite-gneiss complex. The lithological variations of the schist belts include coarse to fine grained clastics, pelitic schists, phyllites, banded iron formation, carbonate rocks (marbles/dolomitic marbles) and mafic metavolcanics (amphibolites). The belts are confined to a NNE-trending zone of about 300 km wide. The schist belts have been mapped and studied in detail in the following localities: Maru, Anka, Zuru, Kazaure, Kusheriki, Zungeru, Kushaka, Isheyin Oyan, Iwo, and Ilesha where they are known to be generally associated with gold mineralization [1]. In the study area, the Zungeru, Igara and Muro Hills Schist Belts are most prominent in Niger, Kogi and Nasarawa States respectively (Fig. 3).

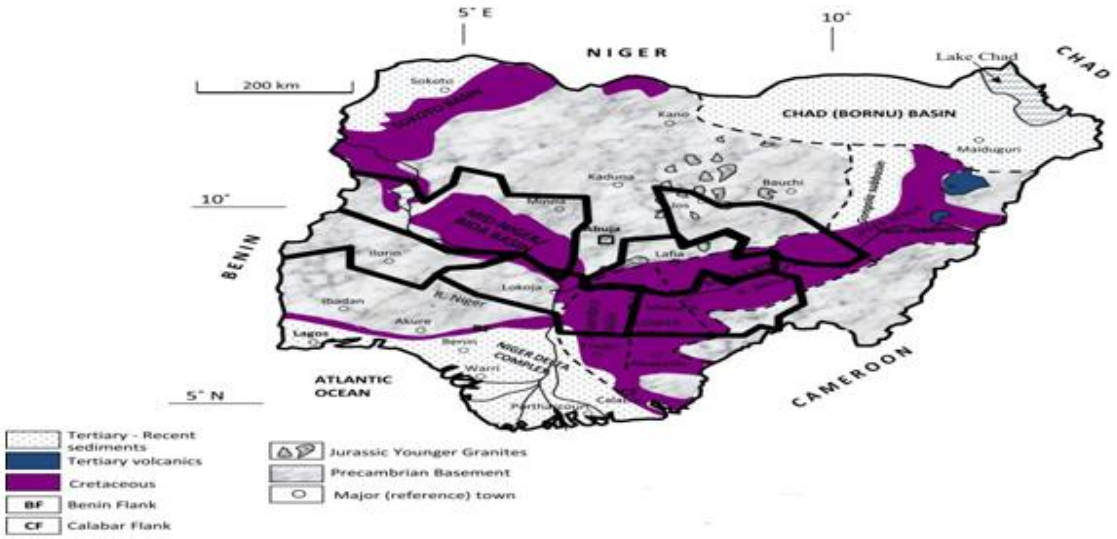

Figure 2: Generalized geologieal map of Nigeria showing the major geologieal covers in the states of the North-Central region

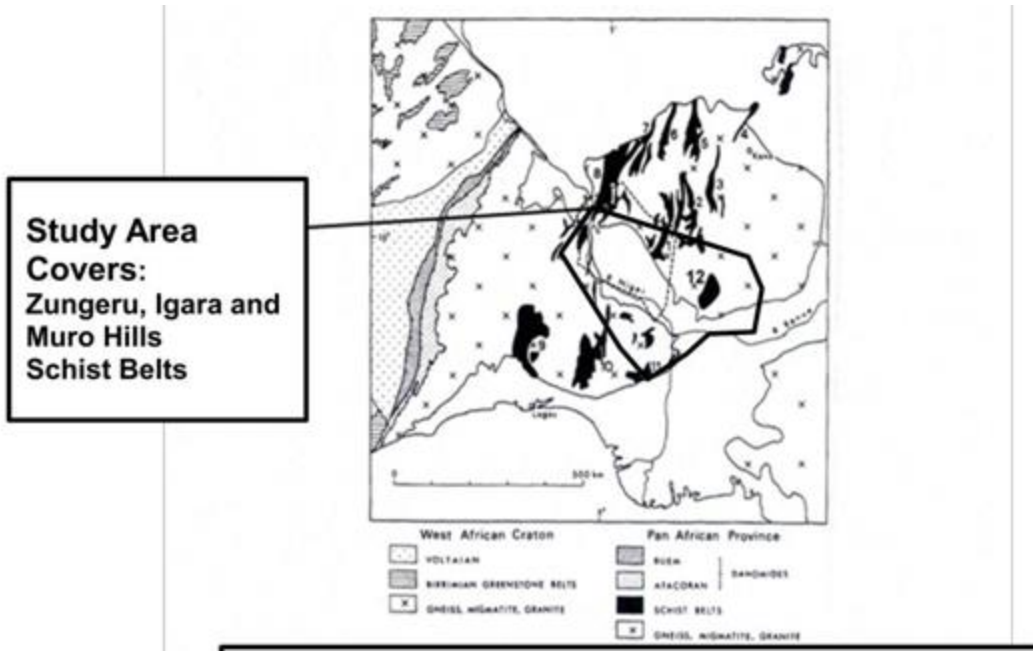

Figure 3: Schist belt localitites in Nigeria within the context of the regional geology of parts of west Africa (after wright, 1985)

1. Zungeru-Birnin Gwari
2. Kusheriki-Kushaka
3. Kazaure
4. Wonaka
5. Maru
6. Anka
7. Zuru
8. Iseyin-Oyan River
9. IIesha
10. Igara
11. Muro Hills

The Older Granites (Pan African Granitoids)

The term 'Older Granite' was introduced by Falconer [4] to distinguish the deep-seated, often concordant or semi-concordant granites of the Basement Complex from the high-level, highly discordant tin-bearing granites of Northern Nigeria. The Older Granites are believed to be pre-, syn- and post-tectonic rocks which cut both the migmatite-gneiss-quartzite complex and the schist belts. The rocks of this suite range in composition from tonalites and diorites through granodiorites to true granites and syenites. The Older Granites occur intricately associated with the Migmatite-Gneiss Complex and the Schist Belts into which they generally intruded. Older Granite rocks

therefore occur in most places where rocks of the Migmatite-Gneiss Complex or of the Schist Belt occur. In the study area, Older Granites are prominent in Minna, Paiko, Kudna, Suleija, Kagara in Niger State; Keffi, Akwanga, Panda in Nasarawa State and Lokoja East, Okene and Kabba in Kogi State; and the same localities listed for Migmatite-Gneiss Complexes for Kwara, Benue and Plateau.

The Younger Granites

The Precambrian Basement Complex rocks of Northern Nigeria are intruded by ring complexes and associated bodies of Jurassic age. Similar bodies occur in Air, Niger Republic. The Younger Granites are majorly concentrated around Jos represented by the prominent Jos-Bukuru, Rukuba, Amo-Buji, Ganawuri, Sara-Fier complexes, amongst others. The Afu and Mada complexes are in Nasarawa State. The Nigerian and Niger Younger Granites form a north-south trending zone and the Benue Trough cuts obliquely across the trend. This zone is parallel to the main Pan-African trends in the basement, indicating control by earlier structures. It also lies on a continuation of the African continental margin to the south and possibly formed in a region of crustal arching developed prior to the separation of the African and American plates in the Cretaceous. The Younger Granites show many features of classical ring structures. Burke and Whiteman [5] suggested that they mark the site of an r-r-r triple junction which failed to develop because large volumes of igneous rocks were produced. Whiteman [6] and Turner [7] think that the Jurassic igneous activity is part of a progression which involved the development of the Benue Trough and culminated in the formation of the Cameroun Volcanic Zone.

Major characteristics of the Younger Granites are their petrological peralkaline affinities (sodic-potassic feldspars; sodic-potassic amphiboles, e.g. arfvedsonite, riebeckite; and sodic-potassic pyroxenes, e.g. aegirine); as compared the calcalkaline and peraluminous affinities of Older Granites; their structural cross-cutting, discordant, and steeply occurring hilly outcrops in the form of ring dykes and cone sheets in contrast to the generally flat-lying nature of the Older Granites; their anorogenic occurrence in contrast to the orogenic origin of the Older Granites, and their stratigraphical Jurassic age as compared to the Precambrian age of the Older Granites. The age of the Younger Granites decreases from south to north. The Younger Granites are majorly associated with Tin (Cassiterite) mineralization. Other minerals associated with the Younger Granites are Columbite, Monazite, Wolframite, Pyrochlore and large clay deposits.

2.1.2. Sedimentary Rocks / Sedimentary Basins

Based on the works of Adeleye [8], Braide [9.10], and Obaje and his colleagues [11], sedimentary rocks in the study area comprise Cretaceous successions in the Northern Bida Basin (Niger, Kwara), the Middle Benue Trough (Benue, Nasarawa, Plateau), the Southern Bida Basin (Kogi) and Northern Anambra Basin (Kogi, Benue). The stratigraphic successions documented in Obaje [1] are shown in Fig. 4.

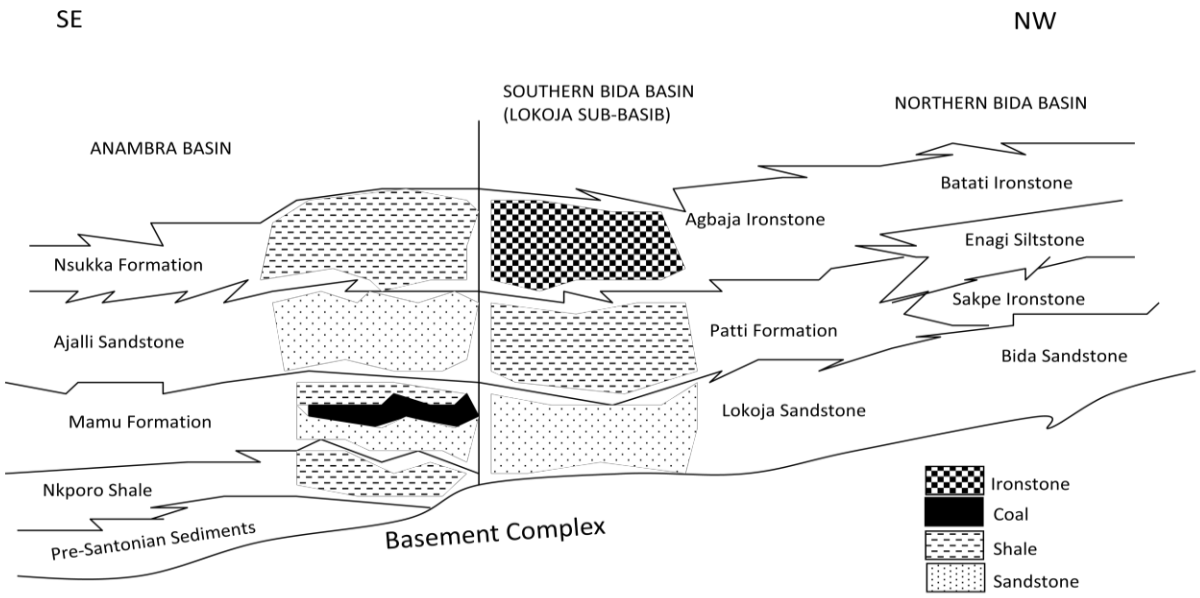

Figure 4a: Stratigraphic successions in the bida basin correlated to the anambra basin covering niger and kogi states (after obaje, 2009)

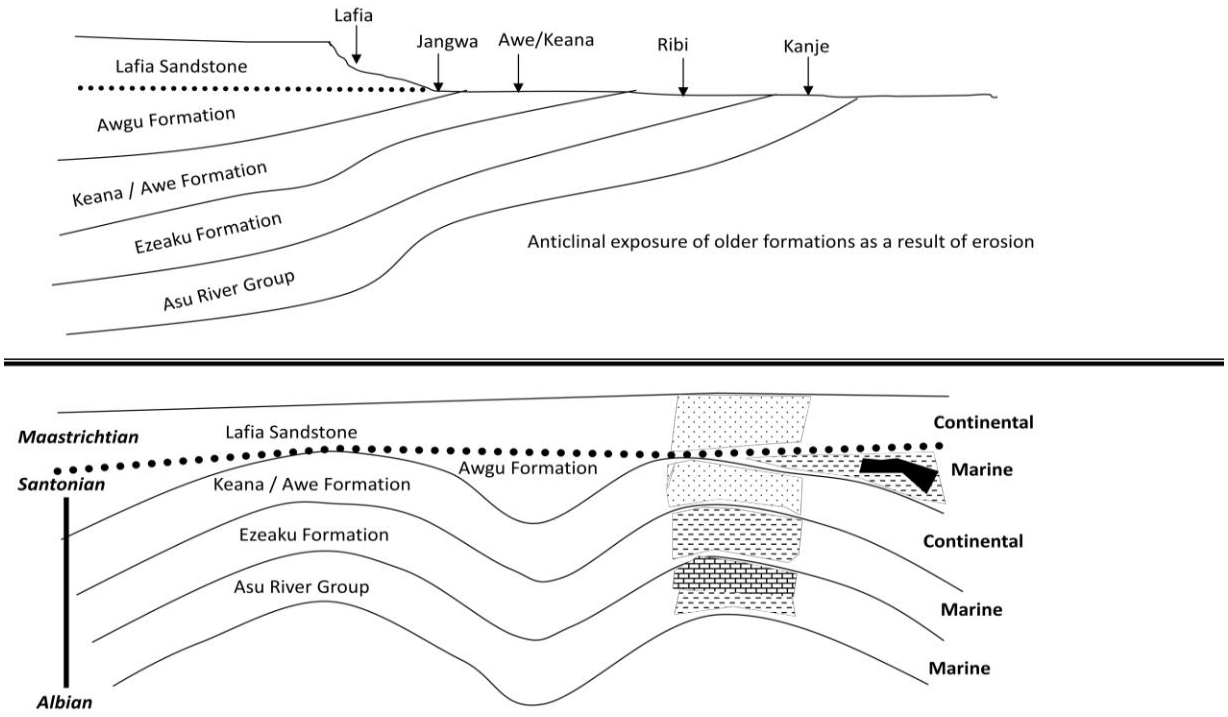

Figure 4b: Stratigraphic successions in the nasarawa state portion of the middle benue trough (after obaje, 2009)

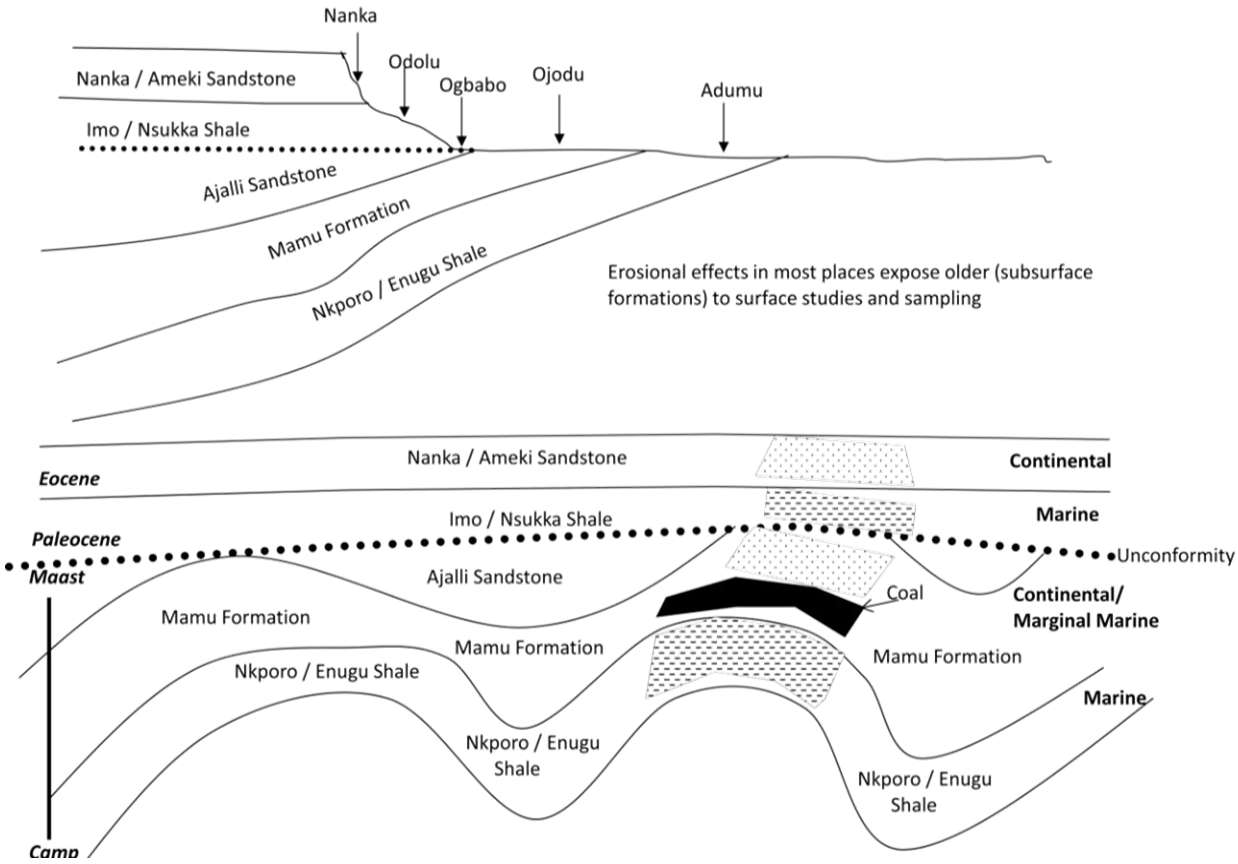

Figure 4c: Stratigraphic successions in Kogi state portion of the anambra basin (after obaje, 2009)

2.2. Industrial Minerals

Industrial minerals are geological materials which are mined for their commercial value, which are not fuel (fuel minerals or mineral fuels) and are not sources of metals (metallic minerals) [12]. They are used in their natural state or after beneficiation either as raw materials or as additives in a wide range of applications. Typical examples of industrial rocks and minerals are limestone, clays, sand, gravel, diatomite, kaolin, bentonite, silica, barite, gypsum, and talc. Some examples of applications for industrial minerals are construction, ceramics, paints, electronics, filtration, plastics, glass, detergents and paper.

In some cases, even organic materials (peat) and industrial products or by-products (cement, slag, silica fume) are categorized under industrial minerals, as well as metallic compounds mainly utilized in non-metallic form (as an example most of the titanium is utilized as an oxide TiO2 rather than Ti metal). The evaluation of raw materials to determine their suitability for use as industrial minerals requires technical test-work, mineral processing trials and end-product evaluation [13]

3. Methodology

i) Literature search and visitations to Ministries, Departments and Agencies of governments responsible for mining and mineral development in Nigeria in general and the 6 North-Central States and FCT in particular to obtain available information on the level of available data on the selected industrial minerals;

ii) Geological mapping was carried out in terrains of three North-Central States (Niger, Kogi, Nasarawa) to identify locations of the industrial minerals, estimate the areal and possible stratigraphical extents, modes of occurrence and collect samples;

iii) Laboratory geochemical analyses of the collected samples comprising X-Ray Fluorescence (XRF) and X-Ray Diffraction (XRD),

iv) Characterization of the deposits on the basis of the mapping and geochemical analysis and move forward to suggest industrial applications.

4. Results and Interpretations

Figure 5 shows the locations of industrial mineral and the types studied in the three North-Central States of Nigeria.

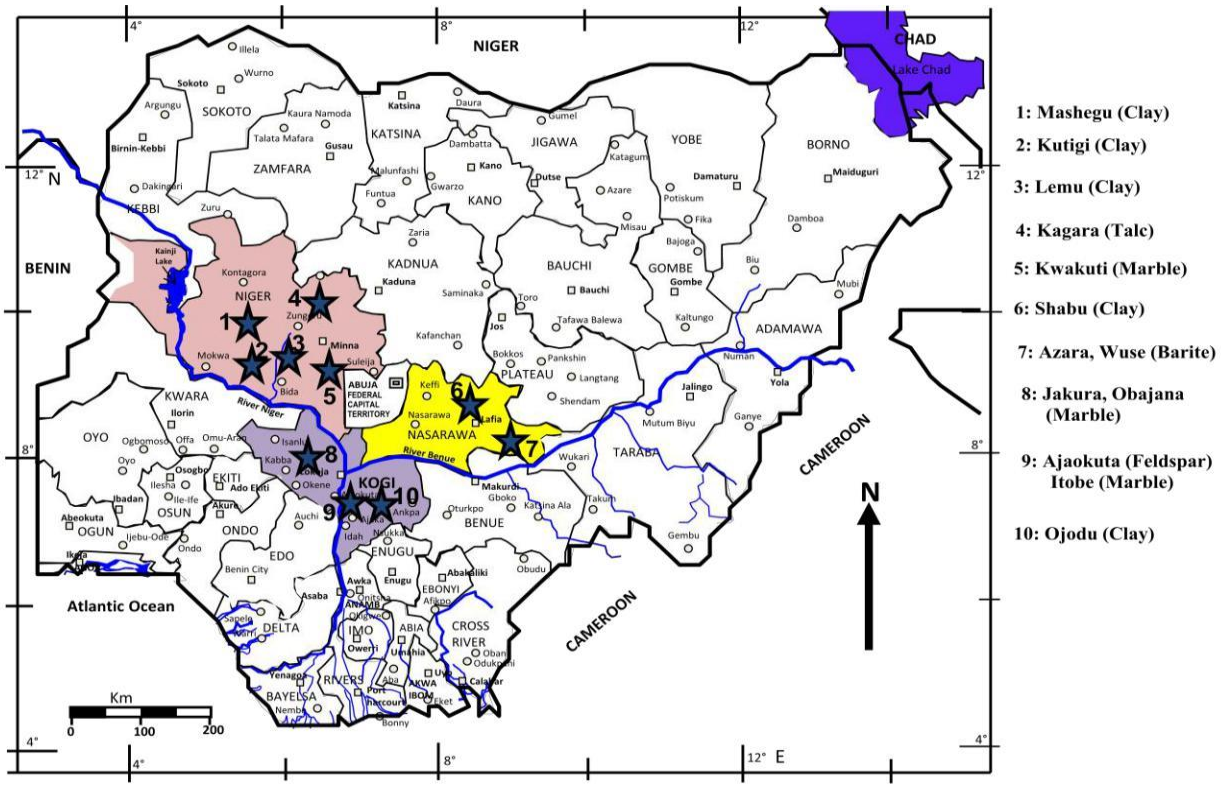

Figure 5: Political map of Nigeria showing locations of industrial mineral deposits studied in the three North-Central States

4.1. Niger State

Clay deposits at Mashegu (on the Tegina-Mokwa road), Kutigi (on the Bida-Mokwa road) and Lemu (on the Bida-Wushishi road) as well as Talc at Kagara (on the Tegina-Kaduna road) and Marble at Kwakuti (on the MInna-Suleija road) have been physically mapped and the field surveys are shown in Figs. 6-8. Some aspects of the geochemical analytical results carried out as a basis for their characterization are shown in Figs. 9-11.

Clays

The clay deposits at Mashegu, Kutigi and Lemu occur in economic quantities, although actual reserves have not yet been evaluated. These clay deposits constitute the greater portion of the Enagi Formation of the Bida Basin. They are generally whitish to grey white. The clays occur in a sequence of alternations of clays, siltstones and sandstones in a generally fining upward sequence, whereby the siltstones and claystones dominate the sequence. The clays at Kutigi have high content of kaolinite (on the basis of XRD examination) while those at Lemu and Mashegu have been diminished by high silica content (XRD and XRF measurements). The clays at Kutigi have the required economic quantity and chemical parameters for exploitation as raw materials for a ceramic/sanitary ware factory while those at Mashegu and Lemu are more suited for pharmaceutical industry. The clay deposits associated with marble deposits at Kwakuti resulted from weathering of basement schistose rocks. Geochemically, these clays have very high alumina content and can serve as needed raw material inputs in cement manufacture. The clay is characterized by a significant content of Zircon (Zr) traces.

Marble

Economic quantity of marble occurs at Kwakuti. These marbles are whitish calcitic and slightly brownish dolomitic. The marble occurs in a basement terrain associated with schists, granites and gneisses. A company exploiting the marble for a small scale cement and fertilizer production gave estimated reserves of 45 million tons for the marble deposit and capable of providing raw material for a medium to large scale cement production for 35 years. The sampled deposit (Kwakuti-1m-Adama and Kwakuti-1m-Dantoro) is highly calcitic (CaO 37-38%) and negligibly dolomitic (MgO 0.03-0.07). The deposit has significant content of Cu, Pb, Zn, and Ba traces.

Talc

The talc deposit at Kagara occurs as large talc schist intermingled with granites, migmatites and gneisses of the basement complex [13]. It was not possible to get to mine site (quarry) at the time of the mapping (for security reasons) but samples were collected from around the quarry. The talc is characterized by high silica content with significant amount of alumina (Al2O3) and Magnesium oxide (MgO). Iron content is also relatively high and may diminish the quality of the talc but can be ameliorated by beneficiation. The talc can support a cosmetic factory as well as a paper production industry.

Figure 6: Clay deposits at a), b) Mashegu: c), d) Kutigi (Niger State)

Figure 7: Examining clay deposits at Lemu (Niger State)

Figure 8: Examining marble deposits at Kwakuti (Niger State)

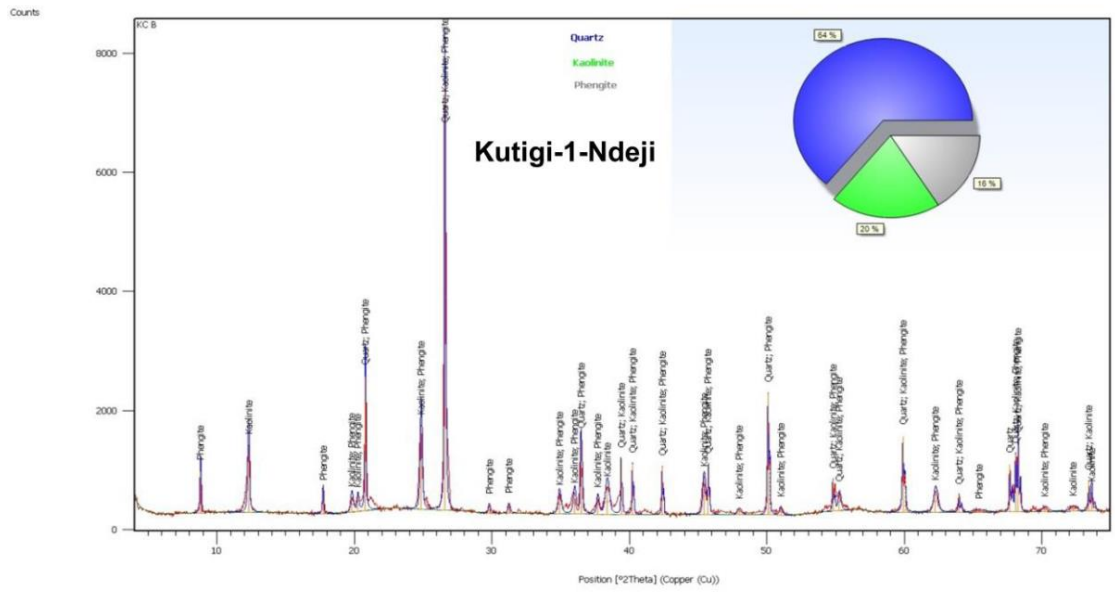

Figure 9: XRD characterization of lower layer of the Kutigi clay showing high quartz and low kaolinitc content

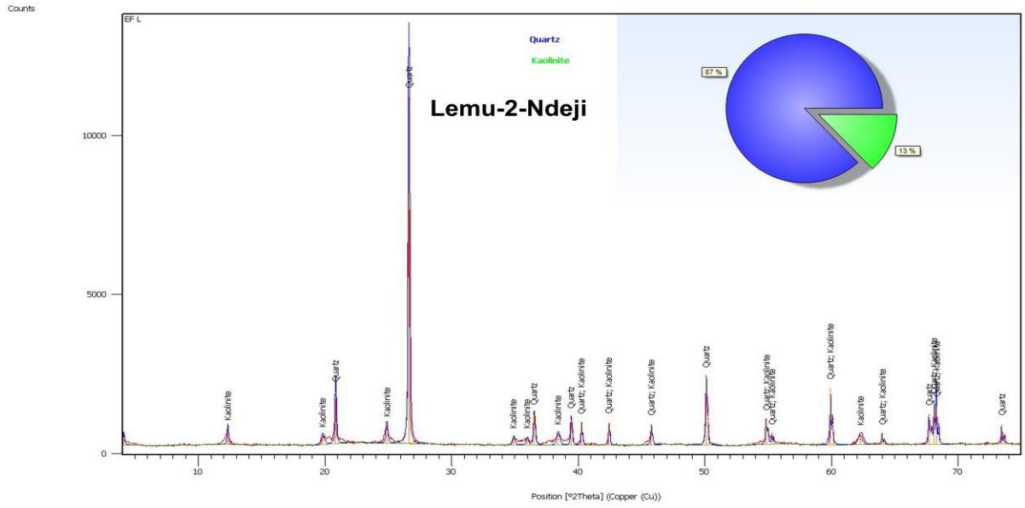

Figure 10: XRD characterization or middle layer of the Lam clay showing very high quanz content

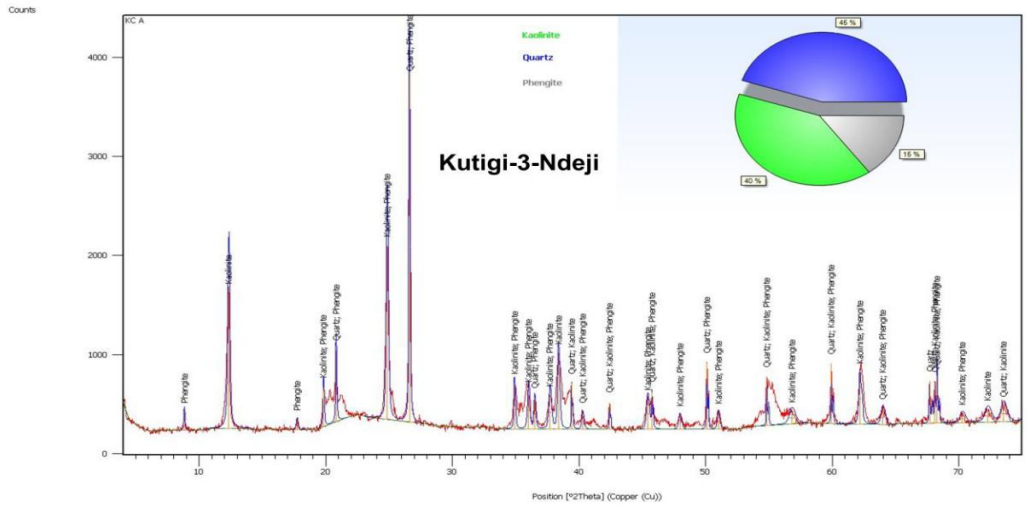

Figure 11: XRD characterization of upper laycr of the Kutigi clay showing high kaolinitc content

4.2. Nasarawa State

Clay deposits were located at Shabu near Lafia (on the Akwanga-Lafia road) and Barite deposits at Azara and Wuse (off the Lafia–Awe road) have been physically mapped and the part of field surveys are shown in Fig. 12 while some geochemical analytical results carried out as a basis for their characterization are shown in Fig. 13.

Clays

The clay deposits at Shabu occur in probable economic quantity as most portions of the deposits are heavily covered with overburden and forested vegetation. The Shabu clays, unlike the clay occurrences in Niger State, occur in flat lying terrains are generally underground and mappable through exposure of erosional surfaces or gully exposures. These clay deposits constitute the greater portion of the Lafia Formation in the Middle Benue Trough stratigraphy. The Shabu clay is generally grey to brownish. The clay demonstrates high level of physical plasticity. Geochemically, the clay has similar silica (SiO2) and alumina (Al2O3) contents as the clays in Niger State. However, the Shabu clay is the only clay amongst all the deposits studied that is characterized by measurable Molybdenum (Mo). Because of poor exposures at the time of the study, further works may be needed on the Shabu clays.

Barite

Economic quantities of barite occur at Azara and Wuse in Nasarawa State. The barites occur as solidified hydrothermal fluids that intruded pre-existing Cretaceous rocks in linear horizontal and vertical veins. Extensive local and organized mining activities are ongoing at the barite sites at Azara and Wuse. Geochemically, the barites contain ca 59-61% BaO in the Wuse deposit and 51% in the Azara deposit. The two deposits are high grade barites as a minimum of 45% BaO is required for drilling fluid and paint-making grade barites. The barites are characterized by measurable amounts of silver (Ag).

Figure 12: a) Large veins from which the barits have been mined at Azara (Nasarawa State).

b) Mined barites from the veins at Azara

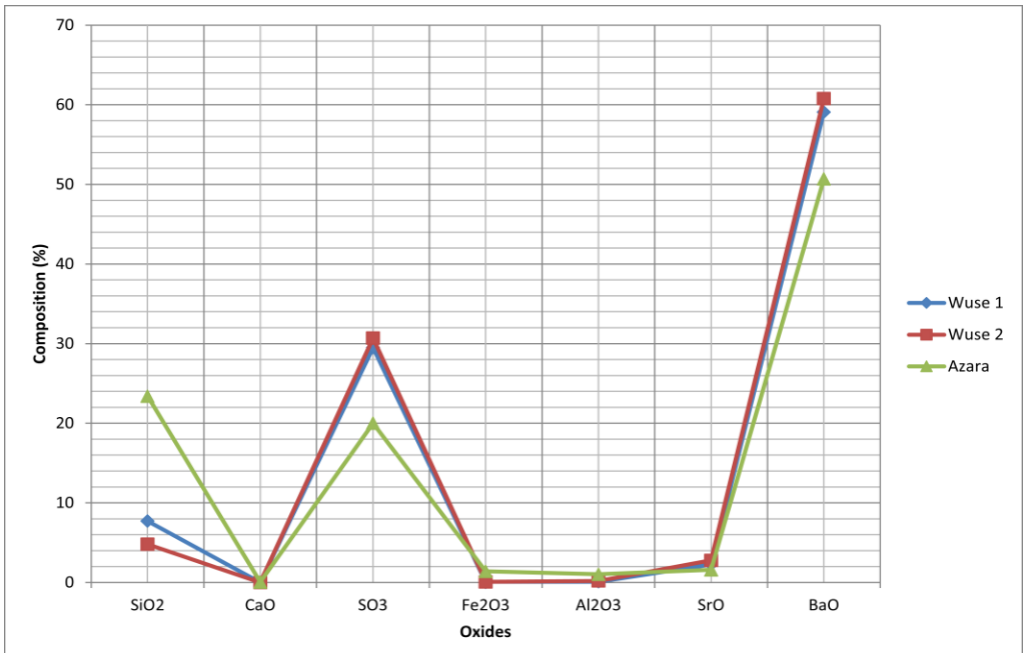

Figure 13: Major oxides distribution in Barites from Nasarawa State

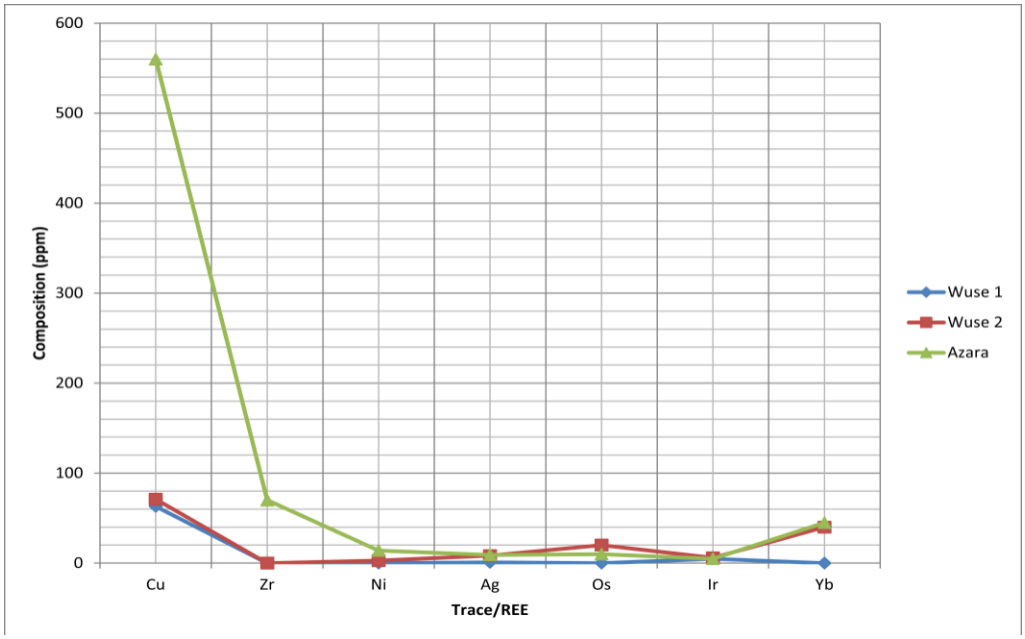

Figure 14: Trace elements distribution in Barites from Nasarawa State

4.3. Kogi State

Clay deposits at Ahoko (on the Lokoja-Abuja expressway) and Ojodu (on the Itobe-Anyigba road), marble minerals mined from Jakura and Obajana and the deposit at Allo near Itobe as well as feldspar deposits at Ajaokuta have been physically mapped and the field surveys are shown in Figs. 15-18 while geochemical analytical results carried out as a basis for their characterization are shown in Figs. 19-23.

Clays

The clay deposits at Ahoko and Ojodu occur in economic quantities, although again actual reserves have not yet been evaluated. The Ahoko clays occur in there varieties of white, brown and black (carbonaceous). The clays are being mined by a possible lease holder. The clays belong to the Patti Formation stratigraphic unit in the Southern Bida sedimentary basin. The Ojodu clay is entirely whitish and occurs within the Mamu Formation stratigraphic unit in the Northern Anambra Basin. The deposit at Ojodu is being mined locally. The clays at Ahoko show silica to alumina compositional ratio of generally 3:1 (on the basis of XRD examination). The Ojodu clay is highly siliceous with a silica to alumina ratio of almost 40:1. The Ahoko clays have high barium content in contrast to the very low content in the Ojodu clay. Naturally the brownish clay variety at Ahoko has a relatively high iron content. The clays at Ahoko have the required economic quantity and chemical parameters for exploitation as raw materials for a ceramic/sanitary ware factory while those at Ojodu can be used for same purpose but will need some beneficiation with feldspars or bauxite to upgrade the alumina value. The Ojodu clays are more suited for pharmaceutical industry due to the low alumina content.

Marble

Economic quantity of marble occurs at Jakura and at Obajana in the Kabba areas of Kogi State and at Alloh near Itobe on the Itobe-Anyigba road. Although the sites of Jakura-Obajana marble deposits were not physically mapped in this study, the mined marble minerals/rocks are available in large quantities at the processing plants of BN Ceramic Company Nig. Ltd at Ajaokuta where the marbles are being processed for tiles and other ceramic products. The deposit at Alloh was physically mapped at the mine site behind the Cinafidel Nig Ltd company site which has the license to mine to mine to mine the marble for cement manufacture. These marbles (both the ones at the Kabba areas and the ones at Alloh) have high CaO content of between 54-56% and very low on silica and alumina. The marbles occur in basement terrains associated with schists, granites and gneisses in the two different locations.

Feldspar

Highly feldsparthic granite rocks occur at Ajaokuta within undifferentiated basement rocks. As stated the rock is granitic but with dominating orthoclase feldspar mineral associated with minor quartz and mica. The rock is pinkish and very hard and dense. The mined rocks are processed to extract the feldspar content at the BN Ceramic company site and used in the mix with clays and marble to produce different varieties of tiles and sanitary wares.

Geochemical characterization indicates high silica content which may have come from the quartz admixture in the original rock. However, good amounts of Al2O3 of between 12-14% and K2O in similar range are recorded in the feldspar samples. Although the feldspars are being exploited at the present for tiles manufacture by BN Ceramics, they also constitute significant raw materials for glassmaking, fillers and extenders in paints, plastics and rubbers.

Figure 15: The Ahoko quarry near Gegu-Scki (Kogi State) on the Lokoja-Abuja expressway with exposure of extensive black clays along with other varieties of clay layers

Figure 16: Marble mined from Jakura and Obajana heaped up for processing for the manufacture of ceramics at the BN Ceramic factory site at Ajaokuta

Figure 17: Hill of marble deposit at Alloh near Itobie on the Itobe-Anyigba road and mined marble aggregates heaped up for processing for the manufacture of cement by Chinese-owned Cinafidel Company at Alloh

Figure 18: Largo clay deposit occurs at Ojodu on the Ajaokuta-Anyigba road (Kogi State)

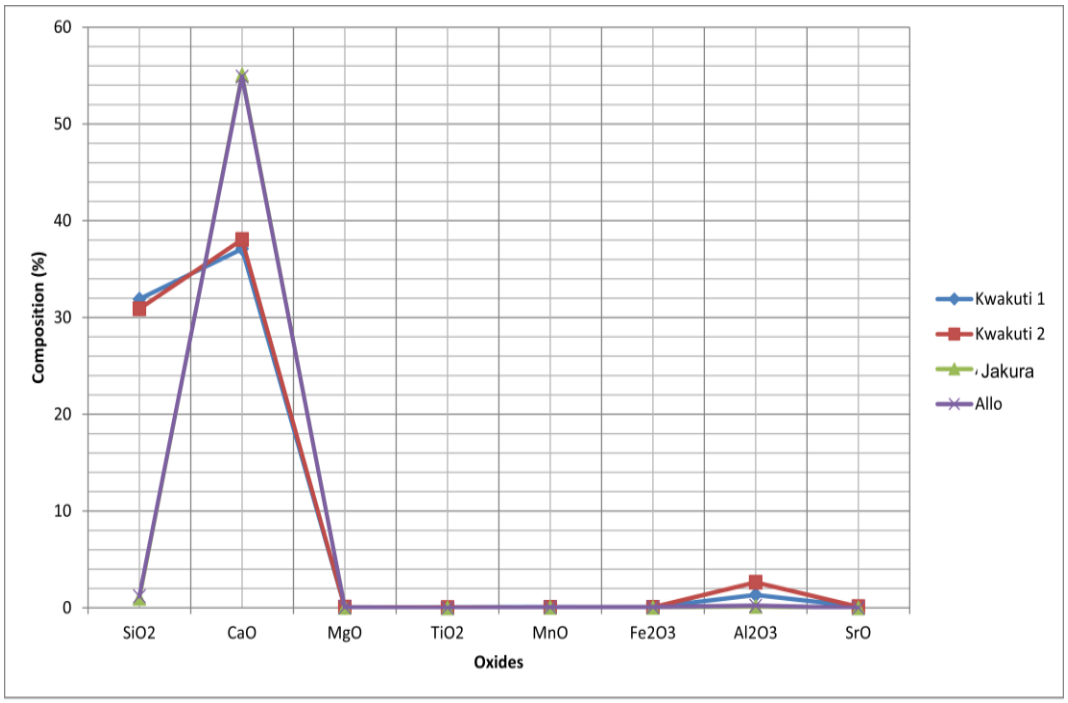

Figure 19: Major oxides distribution in Marble from Niger and Kogi States

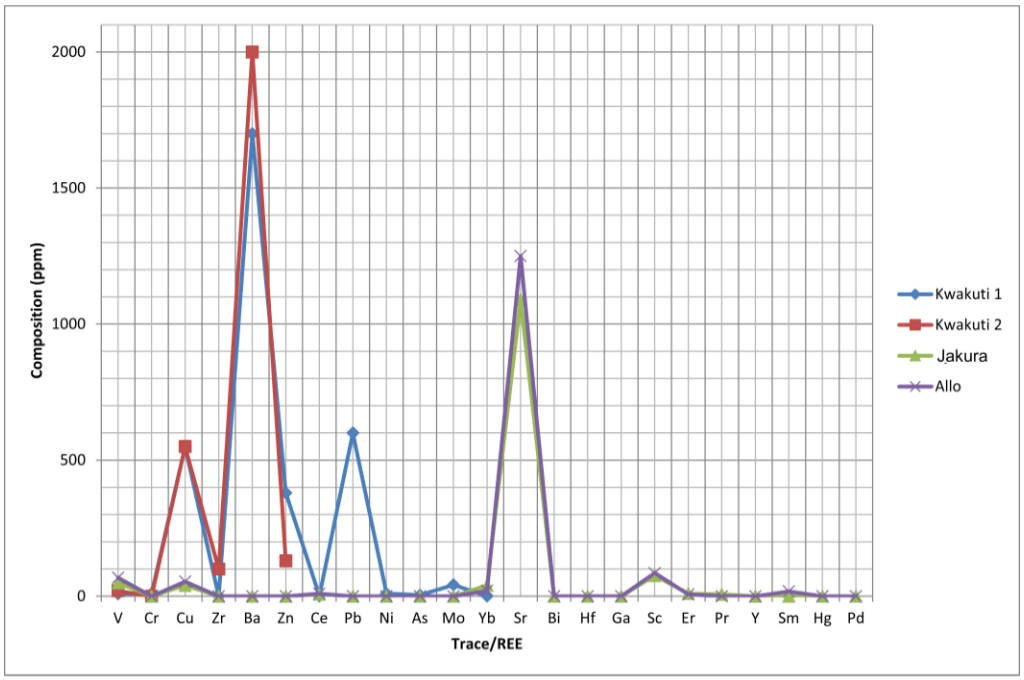

Figure 20: Trace elements distribution in Marble from Niger and Kogi States

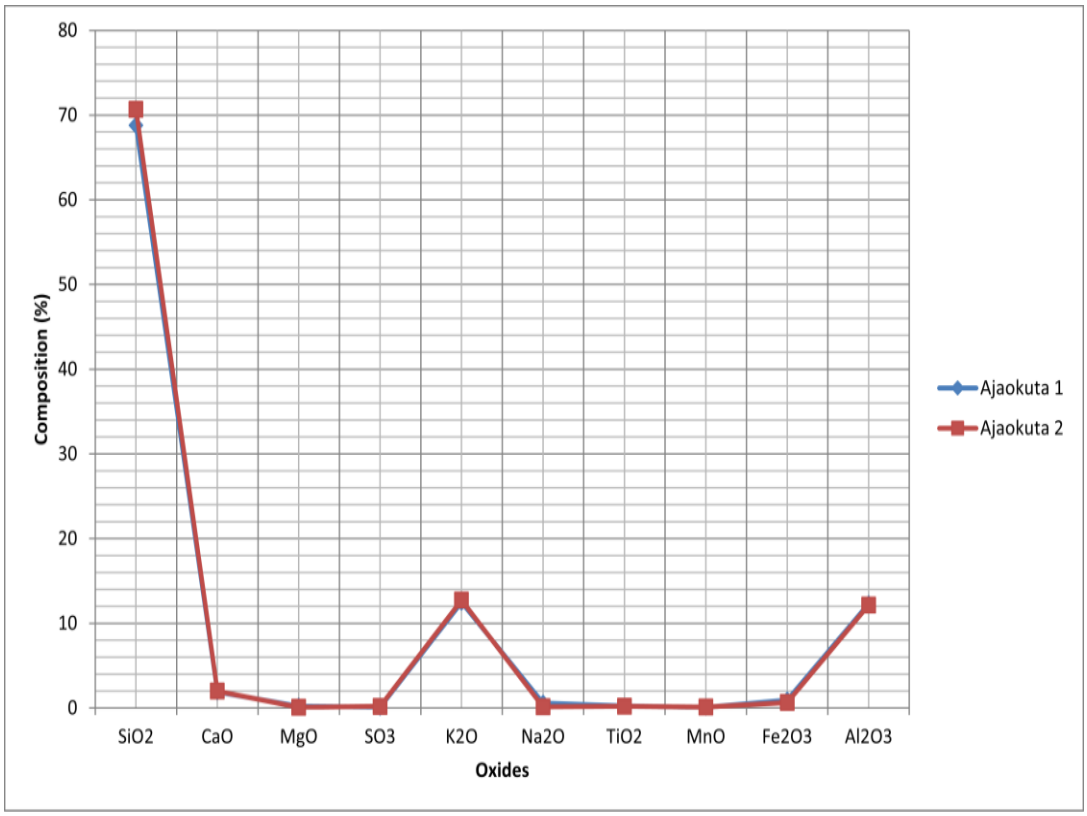

Figure 21: Major oxides distribution in Feldspars from Kogi State

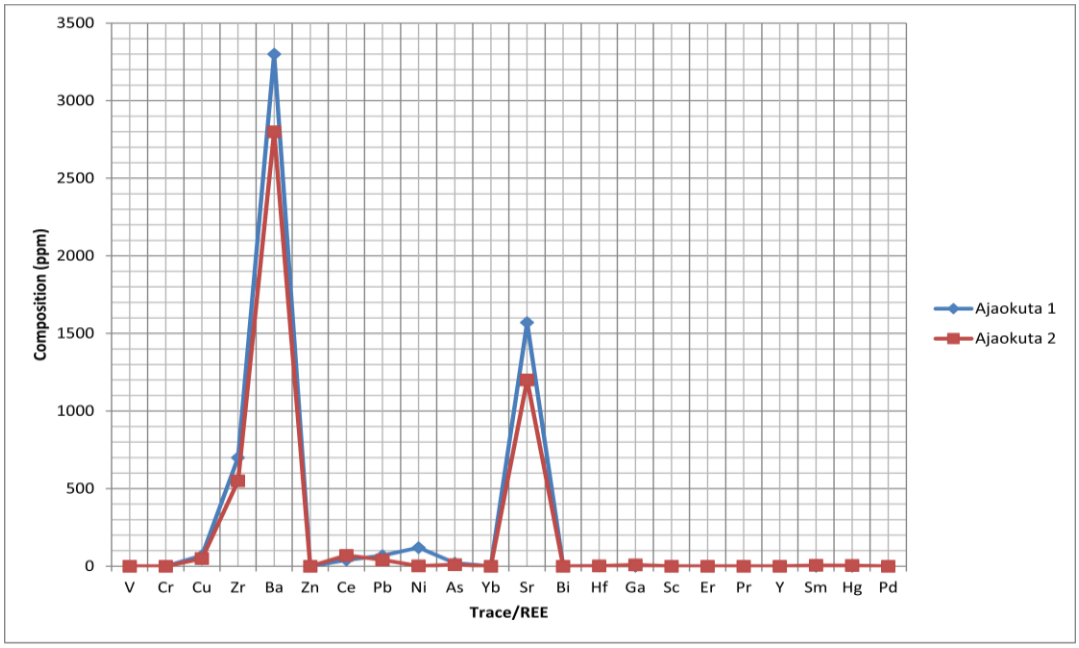

Figure 22: Trace elements distribution in Feldspars from Kogi State

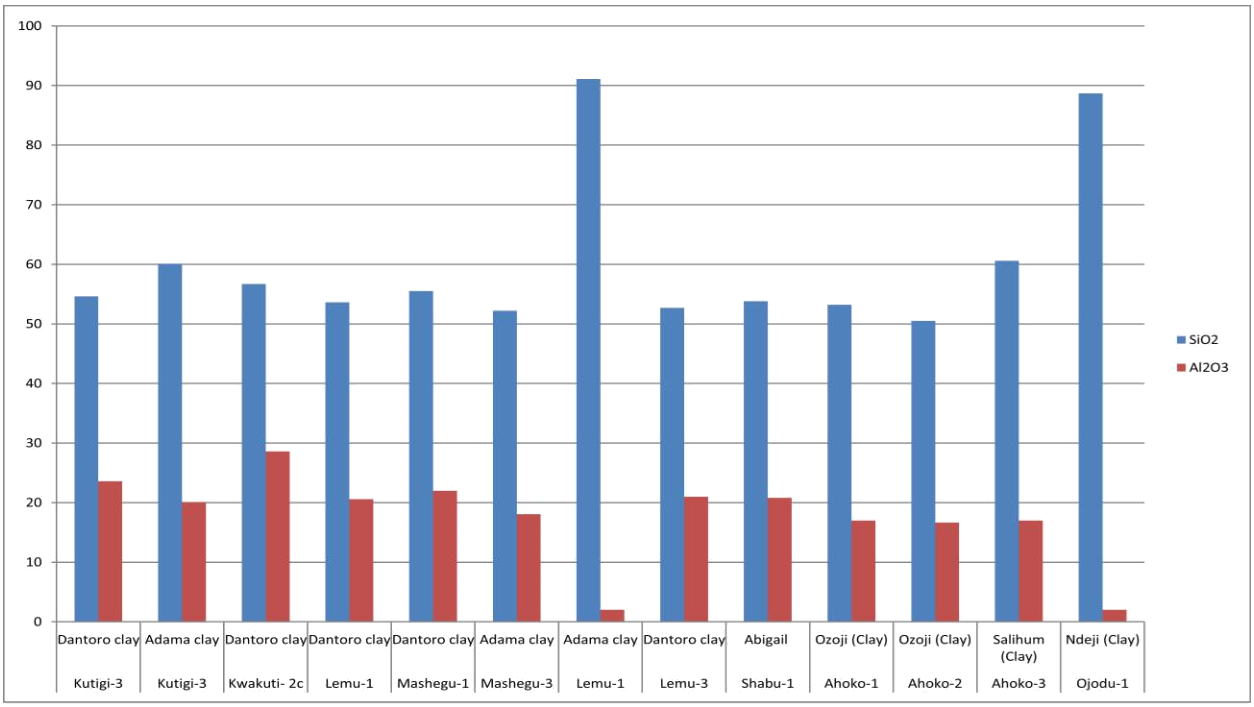

Figure 23: Silica to Alumina ratios in clay deposits from Niger, Nasarawa and Kogi States

5. Conclusions

This study is collaboration between the Raw Materials Research and Development Council and the Ibrahim Badamasi Babangida University Lapai. The study has assessed the occurrences and quality of some industrial mineral deposits in Nigeria's North-Central region with emphasis on Niger, Nasarawa and Kogi State. Economic deposits of clay have been mapped in Niger State at Mashegu, Kutigi and Lemu, marble and clay at Kwakuti and talc at Kagara while in Nasarawa State economic deposits of barite were mapped at Azara and Wuse and clay deposit at Shabu. In Kogi State, commercial clay deposits were mapped at Ahoko and Ojodu, marble at Alloh/Itobe and from Jakura and Obajana (studied at the processing site at Ajaokuta) as well as feldspar within the basement terrains at Ajaokuta. All the mapped industrial minerals occur in economic quantities, although the exact reserves were not established. The clays at Kutigi have high content of kaolinite (on the basis of XRD examination) while those at Lemu, Mashegu and Ojodu have been diminished by high silica content (XRD and XRF measurements). The marble deposits at Kwakuti, Jakura and Alloh/Itobe have high content of CaO and little MgO making them heavily calcitic and less dolomitic. The clays associated with marble at Kwakuti have high alumina content and a significant content of Zr traces.

The barites at Azara and Wuse have more than the required BaO to serve as raw materials for oil-field drilling fluids and for paint manufacture. The content of iron oxide (Fe2O3) in the talc at Kagara and clays at Lemu, Mashegu, Shabu and Ahoko (brownish variety) may constitute obstacles in their industrial applications. The clays at Kutigi

and Ahoko have the required economic quantity and chemical parameters for exploitation as raw materials for ceramic/sanitary ware industries while those at Mashegu, Lemu and Ojodu can be used for same purpose but with some beneficiation. The marble at Kwakuti can support a large size cement factory with raw material supply for 35 years. There are prospects to book additional reserves while those at Jakura and Alloh/Itobe are already being exploited as raw materials for ceramic and cement manufacturing. Additional investments can be made on these marble deposits. The talc at Kagara can support a cosmetic factory and a paper industry. The Shabu clays were poorly exposed and poorly accessible as a result of heavy overburden and thick vegetation but samples studied show that the qualities are similar to the clay deposits in Niger State except that the Shabu clays are characterized by measurable Molybdenum (Mo).

6. Recommendations

Resources available for the present study could cover only the three States of Niger, Nasarawa and Kogi. It is recommended that similar studies be carried out on industrial mineral deposits in Benue, Kwara, Plateau and the Federal Capital Territory (FCT) to cover the whole of the North-Central geopolitical region of Nigeria. The study can also move to the next phase of beneficiation geochemical and rheological cation exchanges and physico-chemical modification of the characterized industrial minerals for value addition. The results in this study are recommended to investors for the establishment of industrial clusters in the North-Central geopolitical region of Nigeria as a basis for employment generation, poverty alleviation and wealth creation.

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