MINERAL RESOURCES OF NORTH-CENTRAL NIGERIA

THIS IS A PLACEHOLDER. IF YOU WANT TO HAVE AN ACTUAL STATEMENT HERE, YOU HAVE TO MAKE SOME CHOICES USING BOOK'S METADATA MODAL.

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FIRST EDITION

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The book production component is one of the three areas of intervention of the TETFund Book project. The others are the revitalization of academic publishing and the support of academic journals. This first phase of the book production intervention is directed at the production of peer-reviewed basic textbooks written by Nigerian academics for universities, polytechnics and colleges of education and specialized books in various subject areas as well as the publication of books of high quality PhD theses from Nigerian Universities that have successfully gone through a rigorous assessment process. This would contribute to solving the problem of paucity of books in Nigeria's higher educational institutions.

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We wish to express our immense appreciation to the Vice Chancellor, Ibrahim Badamasi Babangida University Lapai, Prof. Abu Kasim Adamu, for trusting us and providing a conducive atmosphere, which is required to consummate and actualize this manuscript. The Director General of Raw Materials Research and Development Council (RMRDC) of the Nigerian Federal Ministry of Science and Technology, Prof. Hussaini Doko Ibrahim, who in 2019 funded a project carried-out by Geology and Mining Department, Ibrahim Badamasi Babangida University Lapai, titled 'Mapping and Characterization of Some Industrial Mineral Deposits in North-Central Nigeria as Raw Materials for Industrialization', which actually form part of this work and also the then Director Industrial Chemicals and Minerals at the RMRDC, Dr. Moses Omojola, is highly acknowledged for supervising and guiding the project at all the stages.

We are indebted to Tertiary Education Trust Fund (Tetfund) for creating a platform whereby creative work in form of book manuscript can be show cased for sponsorship. We are greatly inspired by the upgrading of the Department of Geology and Mining, Ibrahim Badamasi Babangida University Lapai, by the Nigerian National Petroleum Cooperation to Center of Excellence and domiciling a professorial chair in basinal analysis of which our own very Head of the Department, Geology and Mining, Prof. N.G. Obaje was appointed as the pioneer Professorial Chair. To all Staff of the Department of Geology and Mining, we say thank you for your support.

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FOREWORD

Nigeria as a country has diversed geological terrains associated with highly varied assemblages of mineral occurrences and deposits. The schist belts are well known for their gold deposits which in North Central Nigeria are represented by the Zungeru, Kushaka, Kusheriki Schist Belts in Niger State and the Muro Hills in Nasarawa State. The migmatite-gneisses and Older Granites contain large deposits of feldspars and micas in and around Suleija (Niger State), Lokoja (Kogi State) and Egbe-Omuaron areas in Kwara State. Younger Granites with their well-documented tin and columbite mineralization dominate the geological terrains of Plateau State and some parts of Nasarawa State. Sedimentary rocks in North Central Nigeria contain varied mineral deposits of barite, lead, zinc in the Adudu and Azara areas of Nasarawa State, large deposits of limestones at Yandev (Benue State) and at Awe (Nasarawa State) and economic deposits of clay at Gada-Biyu (FCT), Kutigi (Niger State), Ahoko and Ojodu (Kogi State).

Professor Cornelius Kogbe published the book on the Geology of Nigeria in 1979 as a collection of many contributors and the book was very elucidating (Rockview). Professor Nuhu Obaje also published the book on the Geology and Mineral Resources of Nigeria (Springer) in 2009 and that contributed immensely to knowledge on Nigeria's regional geology. This book by Dr Sunday Idakwo and others is a more focused and more detailed concentration on North Central Nigeria, comprising Nigeria's geopolitical States of Benue, Kogi, Kwara, Nasarawa, Niger, Plateau States and the Federal Capital Territory (FCT). It is very useful for teaching of regional geology in tertiary institutions at home and abroad, research on mineral locations in Central Nigeria, policy makers and investors. It is a very good compilation and recommended for inclusion in our personal and institutional libraries.

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January 2023

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PREAMBLE

The North-central region of Nigeria comprising Benue, Kogi, Kwara, Nasarawa, Niger, Plateau States along with the Federal Capital Territory (FCT) 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 and sedimentary rocks of the Bida Basin (Niger, Kogi, Kwara, FCT), Middle Benue Trough (Benue, Nasarawa, Plateau) and the Northern Anambra Basin (Kogi, Benue). The major known mineral deposits distributed in the six States and the FCT across the Northcentral region offer considerable attraction for investors as solid mineral deposits of economic significance that include gold, iron ore (Itakpe, Ajabanoko, Agbado-Okudu, Chokochoko, Agbaja, Koton-karfe, Tajimi, Ebiya -all in Kogi State has estimated value of 2,522MT), cassiterite, columbite, wolframite, pyrochlore, monazite, marble, coal (Obi-LafiaCoal in Nasarawa State-estimated value of 128.3 MT), limestone, clays, barites, lead-zinc, etc, occur in the different geologic segments of region, which are of very good grade and substantially large quantities to sustain industrial and technological development as well as earn foreign exchange and create jobs.

By virtue of its long history of tin mining in the northcentral Nigeria, Plateau State had occupied a center-stage in the development of the mining sub-sector in Nigeria as a whole. Jos city had attracted and is still attracting a number of mining establishments and headquarters of geosciences professional bodies such as the Secretariat of the Nigerian Mining and Geosciences Society (NMGS), the Institute of Mining and Geosciences, which was also inaugurated in January 2007 is also cited in Jos. We may also recall that the defunct headquarter of Nigerian Mining Cooperation was sited in Jos. Worthy to mention also are the Nigerian Iron Ore Mining Company (NIOMCO) which mines iron ore at Itakpe, the National Steel Raw Materials Exploration Agency (NSRMEA) which concentrates on exploration of iron ore and coking coals, the National Metallurgical Development Centre (NMDC) whose focus is on research in mineral processing and downstream utilization studies on minerals, all of which report to the Ministry of Power and Steel, and the Raw Materials Research and Development Council (RMRDC) located in the Ministry of Science and Technology to source local raw materials – agricultural, forest, minerals and chemical – for domestic industries.

While the enormous Mineral deposits portray potentials for industrial and technological development, the revenue realized from the Nigerian petroleum industry has been the country's fiscal mainstay and remains a major revenue source but the reality of the recent downward trend of oil prices and its impact on the revenue and foreign reserves of the country however means that it has never been more vital for Nigeria as a whole to protect herself by diversifying her revenue streams and adopt some policy modifications for the northern States to derive maximum economic benefits from her mineral resources endowment (oil and solid minerals). Development in the Nigeria solid minerals sector is however slow despite several attempts by the Government to ensure rapid development in the industry, probably due to the overreliance on crude oil.

Furthermore, policy inconsistencies on the part of the Government scares away foreign investors as there is noguarantee of their investments. The attitude of the artisanal and small-scale miners who presently dominate the solidminerals industry leaves much to be desired as they use crude and unconventional methods to extract the mineral resources with severe consequence on the environment and pollution of water sources and soils, resulting in severaldeaths. Their activities are usually not documented, and in most cases the minerals are exported to international markets illegally, resulting in loss of revenue to the Government. The Government should ensure consistent and business friendly policies, while at the same time give guarantees and grants to mining companies as is applicable in the agricultural sector. The environmental protection policies and the requirement for environmentalassessment under the new Nigeria Minerals and Mining Act should be strictly enforced by the relevantgovernmentagencies empowered by law to do so.

This work is in attempt to synthesize all the available data on North Central Nigerian mineral to provide the much-needed information on sourcing, utilization and development in the sector, thus the book shall serve as an invaluable companion to all the stakeholders in the minerals sector. It is hoped that the information provided will assist potential investors and increase the awareness of entrepreneurs in establishing small- scale industries. The Nigerian mineral sector will be able to contribute at least 10% to the country's annual GDP. Also provided are details on the latest procedures for obtaining mining rights in Nigeria.

It is the interest of the northern States and FCT to acquire the much-needed mineral data which will serve as a source of vital background information to both local and foreign investors. The States of the north-central and FCT is endowed with vast economic mineral resources such as columbite-tantalite associated with tin in the granite and pegmatites of the Basement complex. Associated with the granites are molybdenite, wolframite, galena and sphalerite. Occurrence of galena and sphalerite have also been reported within the sedimentary sequence of the middle Benue Trough that crisscrossed especially Plateau State at Kanam and Wase LGAs) and at Arufu, Akwana, Azara, Keana and Awe in Nasarawa State. Radioactive minerals ores are largely obtained as by-product from the processing of tin occur as accessory minerals in the granites of the Jurassic Younger granites. Other accessory minerals are monazite, zircon, pyrochlore, thorite, fergusonite and Xenotime. Another category of mineral of utmost important is gemstone, although there are no reports of any detailed evaluation of the gemstone potential of Northcentral part of Nigeria. The greatest gemstones are in the Younger volcanics, granitic rocks of the Younger Granites complex. The most frequently available gems include aquamarine, sapphire, gernet, zircon, amethyst and smoky quartz. Industrial minerals such as clay and kaolin are also available in large quantities in the north-central of Nigeria.

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CHAPTER ONE

INTRODUCTION

1.1General Statement

Nigeria, the most populous country within West Africa and Organization of Petroleum Exporting Countries (OPEC), has around 208 million inhabitants (Fig. 1.1 and Table 1.1). Abuja, the capital since 1991, has a population of more than one million. English is Nigeria's official language, lies approximately between latitudes 4°N and 15°N and Longitudes 3°E and 14°E, with a landmass of 923,768 sq. km. (Fig.1.2), the third-biggest country in West Africa by area and 32nd largest in the world, located within the Pan African mobile belt in between the West African and Congo cratons (Obaje, 2009; Fig. 1.2). It is bordered to the north by the Republics of Niger and Chad and to the west by the Republic of Benin (Fig. 1.2). It shares the eastern borders with the Republic of Cameroon right down to the shores of the Atlantic Ocean forming the southern limits of the Nigerian Territory. About 800 km of coastline confers on the country the potentials of a maritime power. vast land is in abundance in Nigeria for agricultural, industrial and commercial activities.

Geopolitically, Nigeria is subdivided into North–South geopolitical dichotomy (Fig. 1.3) and further, for any political exigency, into North–West–East tripartite subdivisions (Fig. 1.4), which coincidentally accommodate the three major tribes (ethnic groups) in Nigeria. The Hausas constitute the major ethnic group in the North; the Yorubas in the West and the Ibos in the East. There are about 250 ethnic groups in total in Nigeria such that each of the regions with its major ethnic group carries a significant percentage of minority ethnic groups (Fig. 1.3). In fact, about 10 ethnic/linguistic groups constitute more than 80% of the population: the other large groups are Tiv, Ibibio, Ijaw, Kanuri, Nupe, Gwari, Igala, Jukun, Idoma, Fulani, Itsekiri, Edo, Urhobo and Ijaw. For further administrative reasons and for the purposes of further political exigencies, the country is grouped into six (6) geopolitical zones (Fig. 1.5).

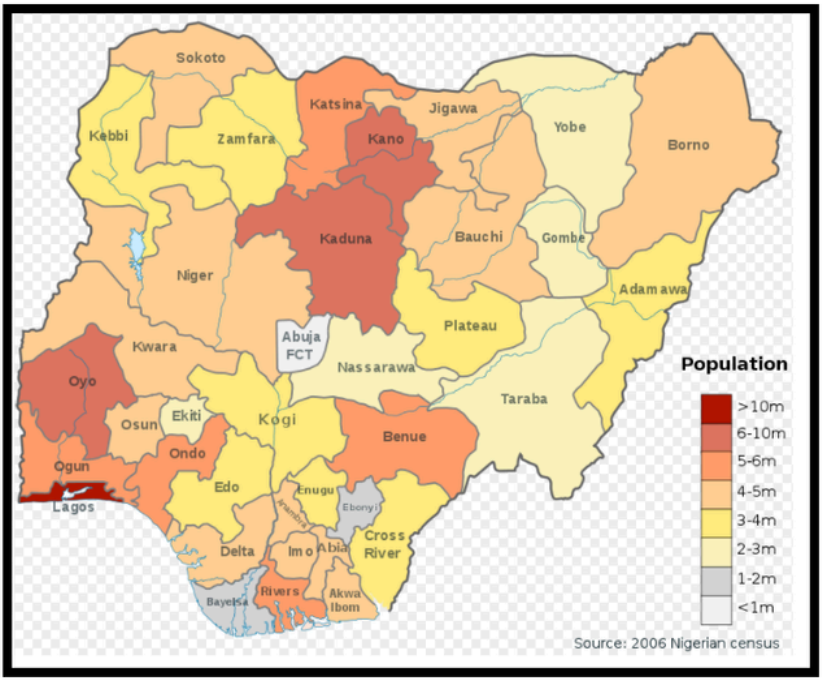

Fig. 1.1.Map of Nigerian states by total population (Source: 2006 census)

Fig.1.2.Location of Nigeria sandwiched between the West African and the Congo Cratons (Adopted from Obaje, 2009).

Table 1.1 Data of Nigeria as at 2019

Below data covers 2019

Population (million inhabitants)	208.28
Land area (1,000 sq km)	924
GDP per capita ($)	2,284
GDP at market prices (million $)	475,820
Value of exports (million $)	64,787
Value of petroleum exports (million $)	45,106
Current account balance (million $)	-17,016
Proven crude oil reserves (million barrels)	36,890
Proven natural gas reserves (billion cu. m.)	5,761
Crude oil production (1,000 b/d)	1,737.4
Marketed production of natural gas (million cu. m.)	47,827.9
Refinery capacity (1,000 b/cd)	446.0
Output of petroleum products (1,000 b/d)	8.2
Oil demand (1,000 b/d)	469.8
Crude oil exports (1,000 b/d)	2,008.2
Exports of petroleum products (1,000 b/d)	20.1
Natural gas exports (million cu. m.)	35,953.1

- b/d (barrels per day)
- cu. m. (cubic metres)
- b/cd (barrels per calendar day)

Source: Annual Statistical Bulletin 2020

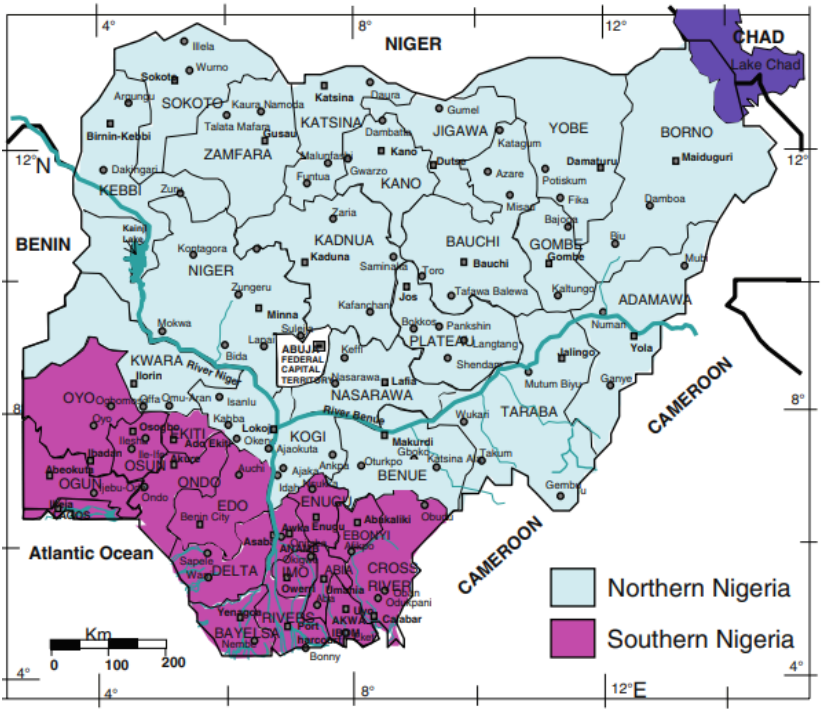

Fig. 1.3.Nigeria's geopolitical divide in a North - South dichotomy (After Obaje, 2009).

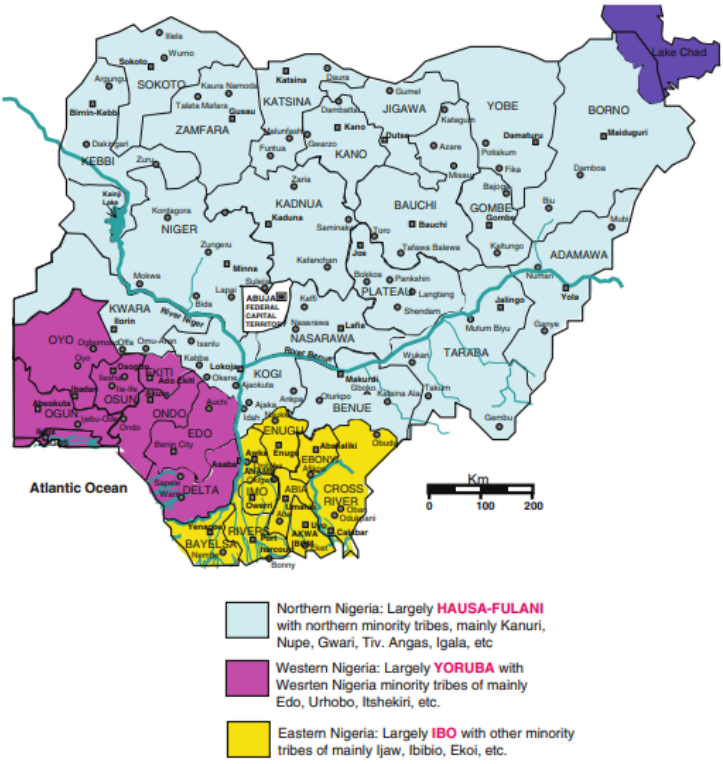

Fig. 1.4.Nigeria's geopolitical tripartite divide into North, East and West (After Obaje, 2009).

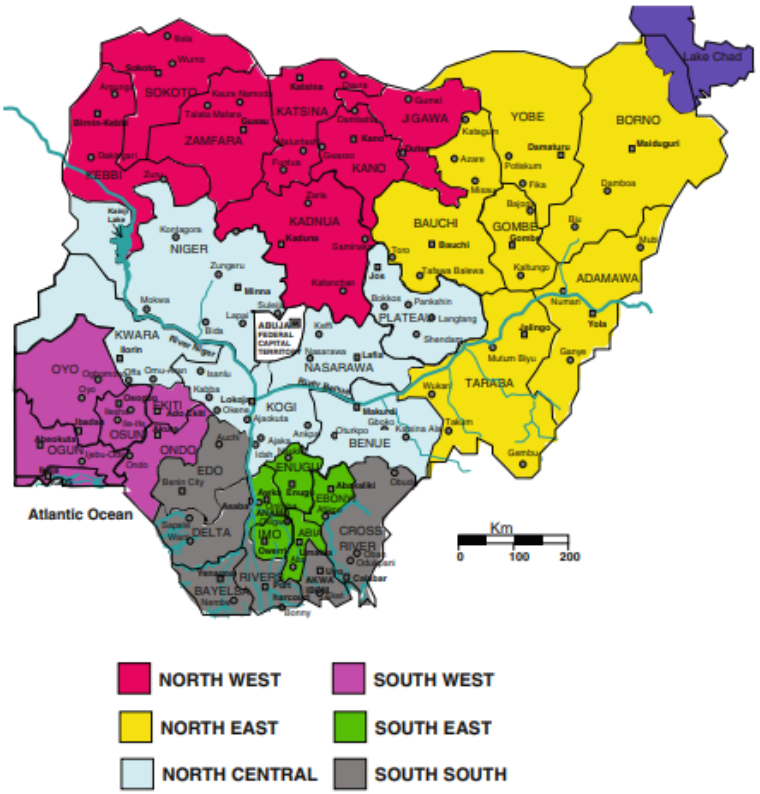

Fig. 1.5.Currently used six geopolitical zones in Nigeria (After Obaje, 2009).

Although Nigeria is wholly within the tropics, its climate varies from the tropical at the coast to sub-tropical further inland. There are two marked seasons: The rainy season lasting from April to October and the dry season from November to March. The maximum temperature in the coastal areas of the south can go up to 37˚C while the absolute minimum temperature is 10˚C. The climate is drier further north where extremes of temperature may range from 40˚to 50˚C.

The geology of Nigeria is made up of three major litho-petrological components, namely, the Basement Complex, Younger Granites, and Sedimentary Basins (Fig. 1.6). The Basement Complex, which is Precambrian in age, ismade up of the Migmatite-Gneiss Complex, the Schist Belts and the Older Granites. The Younger Granites comprise several Jurassic magmatic ring complexes centered around Jos and other parts of North-Central Nigeria. They are structurally and petrologically distinct from the Older Granites. The Sedimentary Basins, containing sediment fill of Cretaceous to Tertiary ages, comprise the Niger Delta, the Anambra Basin, the Lower, Middle and

Upper Benue Trough, the Chad Basin, the Sokoto Basin, the Mid-Niger (Bida-Nupe) Basin and the Dahomey Basin.

Abundant mineral deposits occur in all the components of Nigerian geology

(Basement, Younger Granites, Sedimentary Basins). Solid mineral deposits of economic significance that include gold, iron ore, cassiterite, columbite, wolframite, pyrochlore, monazite, marble, coal, limestone, clays, barites, lead-zinc, etc, occur in the different geologic segments of Nigeria (Obaje, 2009; Fig. 1.7).

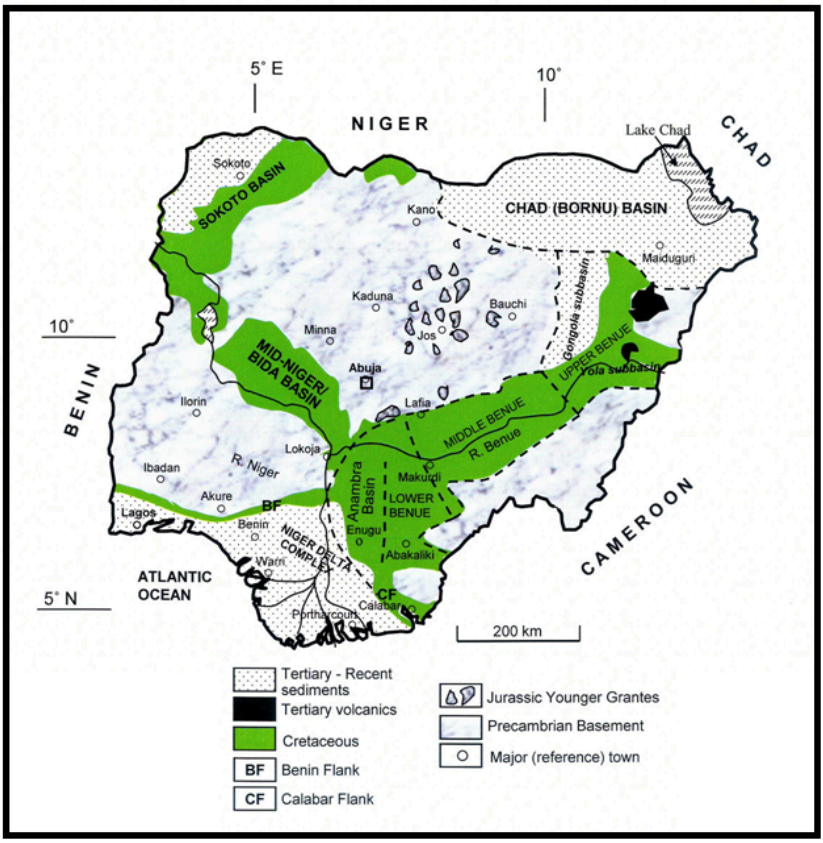

Fig. 1.6.Geological sketch map of Nigeria showing the major geological components: Basement, Younger Granites, and Sedimentary Basins (After Obaje, 2009).

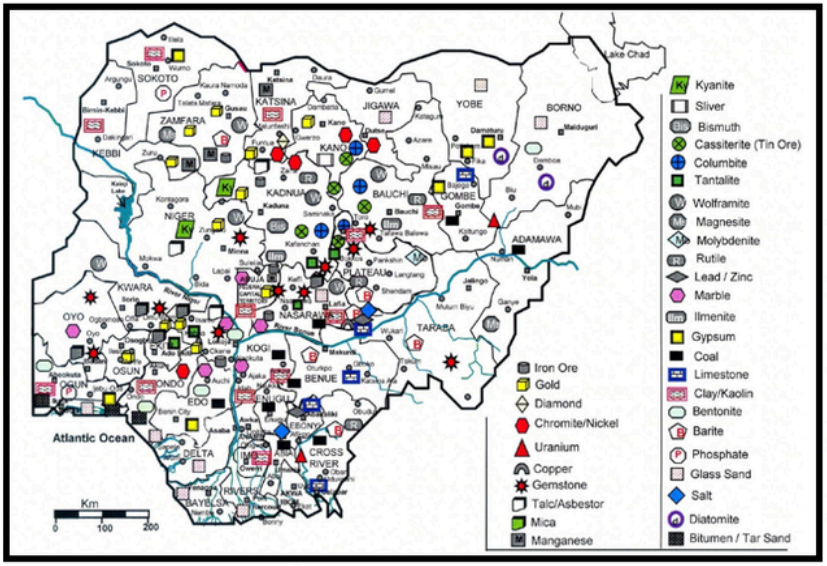

Fig. 1.7:An Overview of the Solid Mineral Resources Distribution Map of Nigeria (Unlikepetroleum, every state in the federation has a fair representation of solid mineral deposits).

The North-Central region of Nigeria comprising Benue, Kogi, Kwara, Nasarawa, Niger, Plateau States along with the Federal Capital Territory (FCT) (Fig. 1.5) is very rich in mineral resources.

This work is in attempt to synthesize all the available data on North-central Nigerian mineral to provide the much-needed information on sourcing, utilization and development in the sector, thus the book shall serve as a very useful companion to all the stakeholders in the minerals sector. It is hoped that the information provided will assist potential investors and students to increase the awareness of entrepreneurs in establishing small-scale or large industries. This will in turn significantly revamp the mineral sector and consequently improve revenue generation from the sector for better economic growth and development. Also provided are details on the latest procedures for obtaining mining rights in Nigeria.

1.2Geology of the North-Central Nigeria

The North-Central region of Nigeria comprising Benue, Kogi, Kwara, Nasarawa, Niger, Plateau States along with the Federal Capital Territory (FCT) (Obaje et al., 2019; Figs. 1.8 and 1.9) 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 (Obaje et al., 2019; Figs. 1.8 and 1.9).

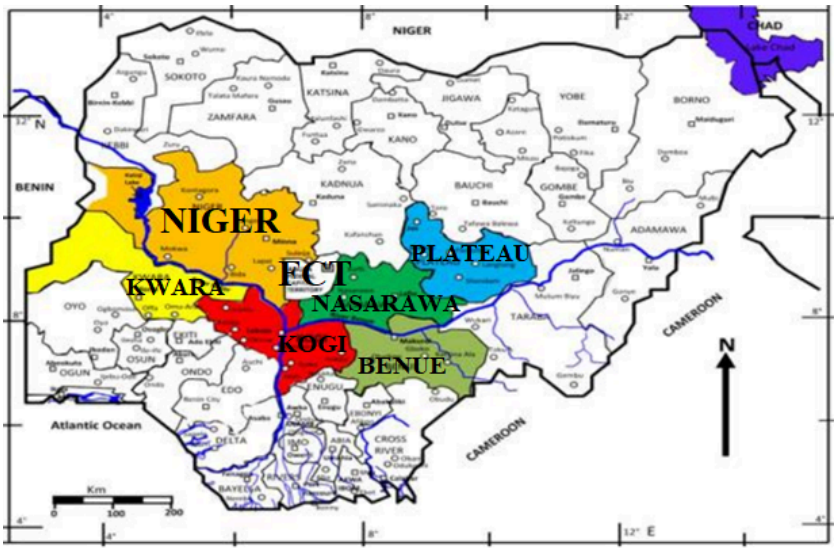

Fig. 1.8. Political map of Nigeria showing the states in the North-Central geopolitical region (After Obaje et al., 2019).

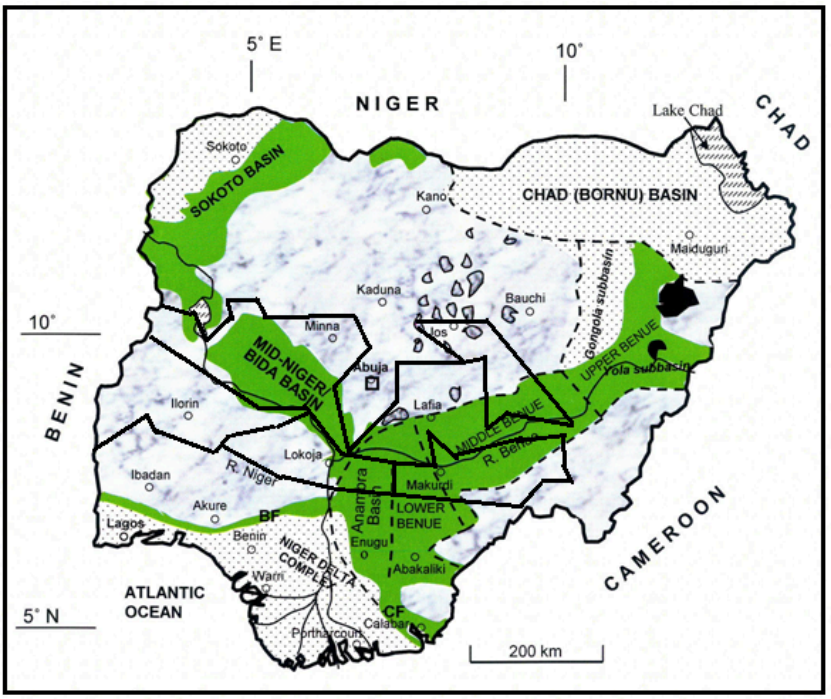

Fig. 1.9.Generalized geological map of Nigeria showing the major geological coversin the states of the North-Central region (Modified after Obaje, 2009).

1.2.1Rock Units in the North-Central Region of Nigeria

1.2.1.1Basement Complex

Obaje (2009) gave a vivid account of the geology of the North-Central to be made up of the Basement Complex and the sedimentary rocks of the Bida, Middle Benue and Northern Anambra Basins (Fig. 1.9). 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

The Migmatite—Gneiss Complexis generally considered as the basement complex sensu stricto (Rahaman, 1988; Dada, 2006; Obaje, 2009) and it is the most widespread of the component units in the Nigerian basement. It has a heterogeneous assemblage comprising migmatites, gneisses, 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) (Fig. 1.9).

The Schist Belt (Metasedimentary and Metavolcanic rocks)

According to Dada, (2006), 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, IsheyinOyan, Iwo, and Ilesha where they are known to be generally associated with gold mineralization (Obaje, 2009). Within the North-Central, the Zungeru,Kusheriki-Kushaka,Igara and Muro Hills Schist Belts are most prominent in Niger, Kogi and Nasarawa States respectively (Fig. 1.10).

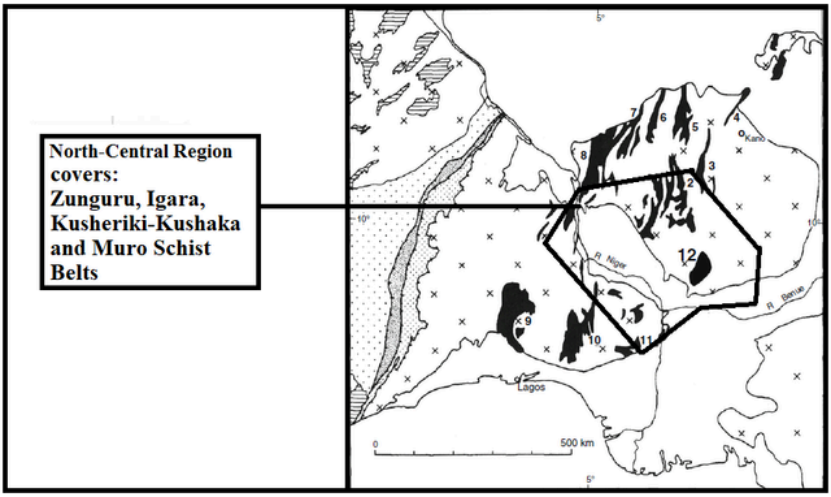

Fig. 1.10. Schist belt localities in North-Central Nigeria within the context of the regional geologyof parts of west Africa(Modified after Wright, 1985).

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 (1911) 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 State.

The Younger Granites

The Precambrian Basement Complex rocks of North-Central 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 (Fig. 1.11; Obajeet al., 2019). 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 (1973) 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 (1982) and Turner (1983) 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 calc-alkaline and per-aluminous 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 (Fig. 1.12; Obaje, 2009) 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 (Lar et al., 2007; Obajeet al., 2019).

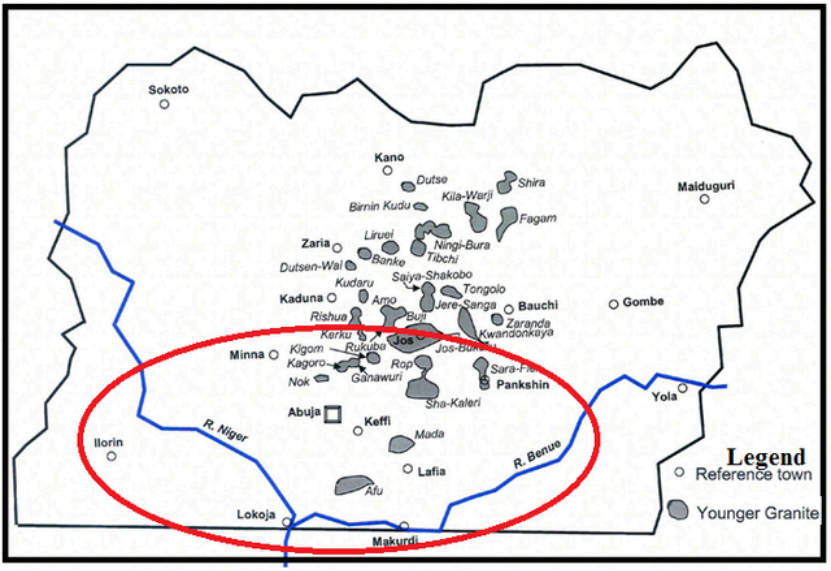

Fig. 1.11.Major Younger Granites Localities in Nigeria showing the major states covered in the North-Central region (Modified after Obaje, 2009).

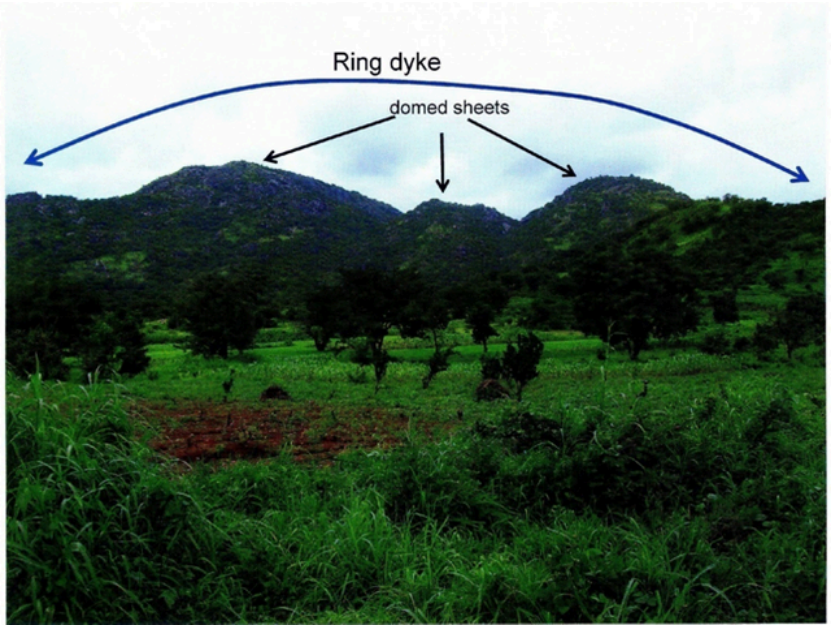

Fig. 1.12.A portion of the Mada Younger Granite Complex near Akwanga in Nasarawa State.

Note the migrating domed sheets and the circular nature of the Complex (Adapted from Obaje, 2009).

Fig. 1.3.Different views of the Jos-Bukuru Younger Granites Complex.(Viewed approaching Jos from Tilde Fulani). Note outer ring and inner ring.(Adapted from Obaje, 2009).

1.2.1.2Sedimentary Rocks / Sedimentary Basins

Based on the works of Adeleye (1974); Braide (1992a and b); Obaje et al. (2004), sedimentary rocks in the North-Central 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) (Fig. 1.9). The stratigraphic successions documented in Obaje (2009) are shown in Figs. 1.13 to 1.15.

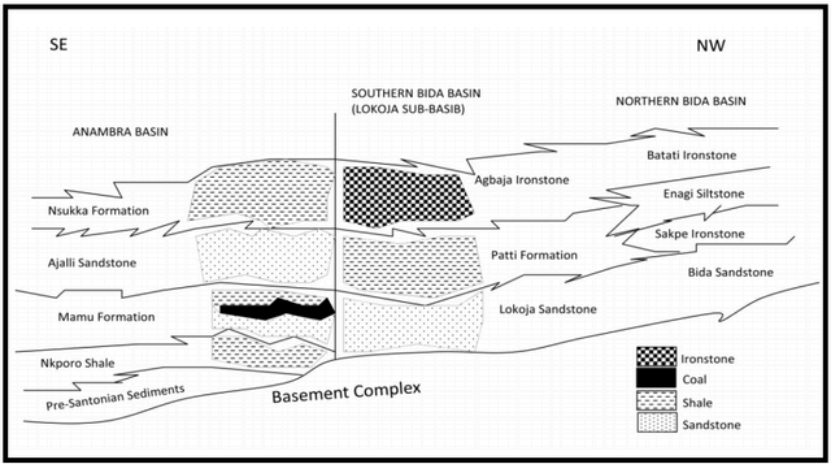

Fig. 1.13.Stratigraphic successions in the Bida basin correlated to the Anambra basin covering Niger and Kogi states (after Obaje, 2009).

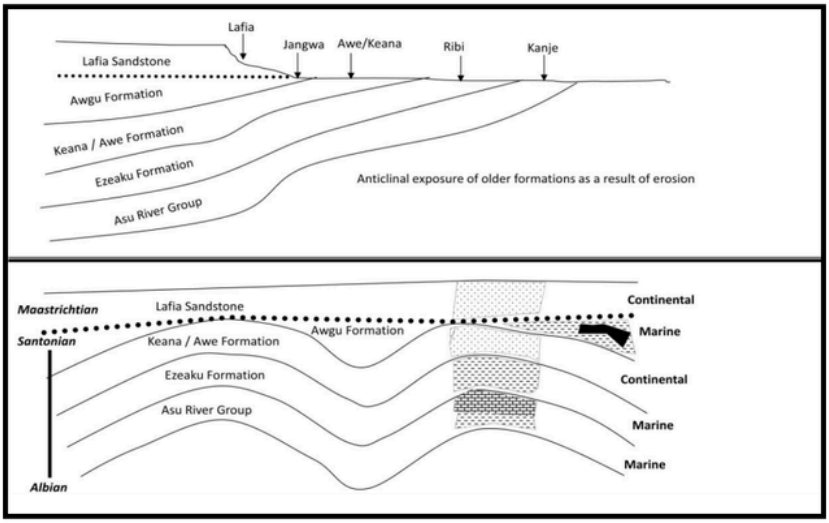

Fig. 1.14.Stratigraphic successions in the Nasarawa State portion of the Middle Benue Trough (after Obaje, 2009).

Some Annextures on the Middle Benue Trough as described by Obaje et al. (2006)

Fig. 9. The Awe Formation at an up-dip exposure at Old Awe; a potential reservoir facies

Sandstone of the Awe Formation (Cenomanian) deposited under high tidal influence at the Old Awe village (Middle Benue Trough), Nasarawa State

Laterally extensive tidally influenced sandstone beds of the Awe Formation (Cenomanian) at the salt mining pond area at Ribi Village (Middle Benue Trough), Nasarawa State

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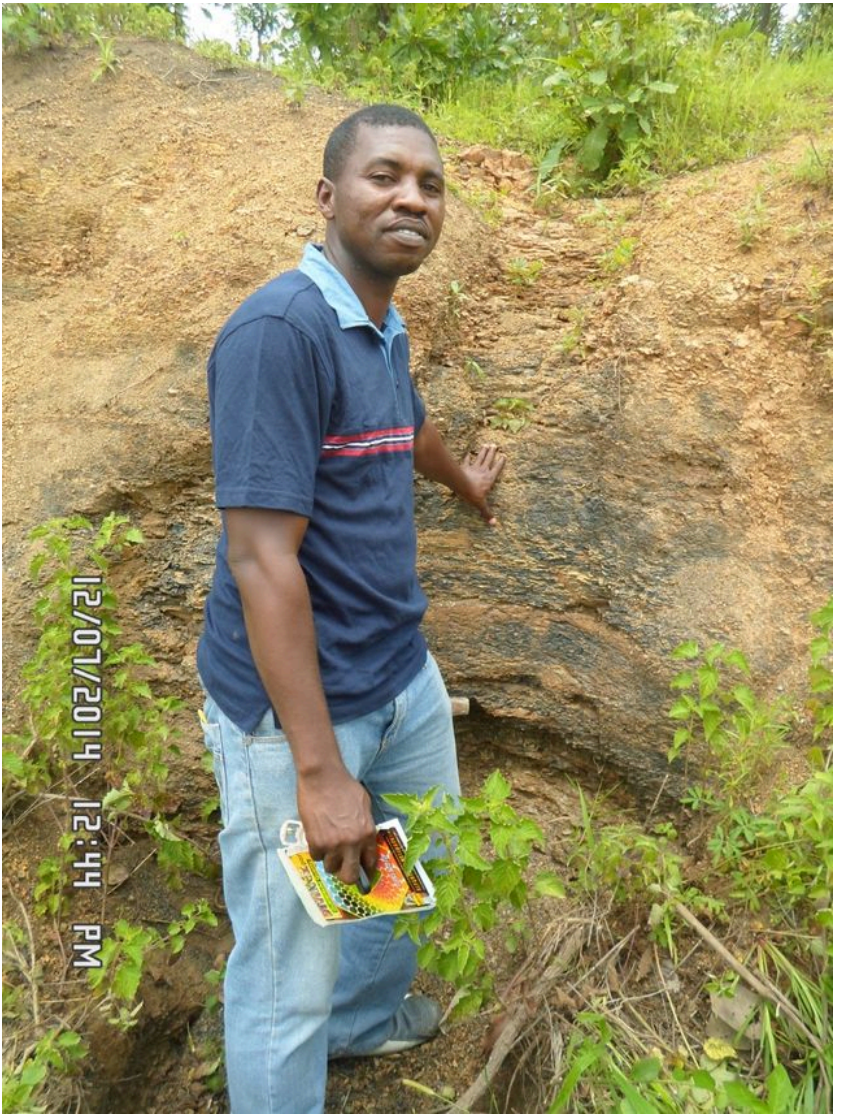
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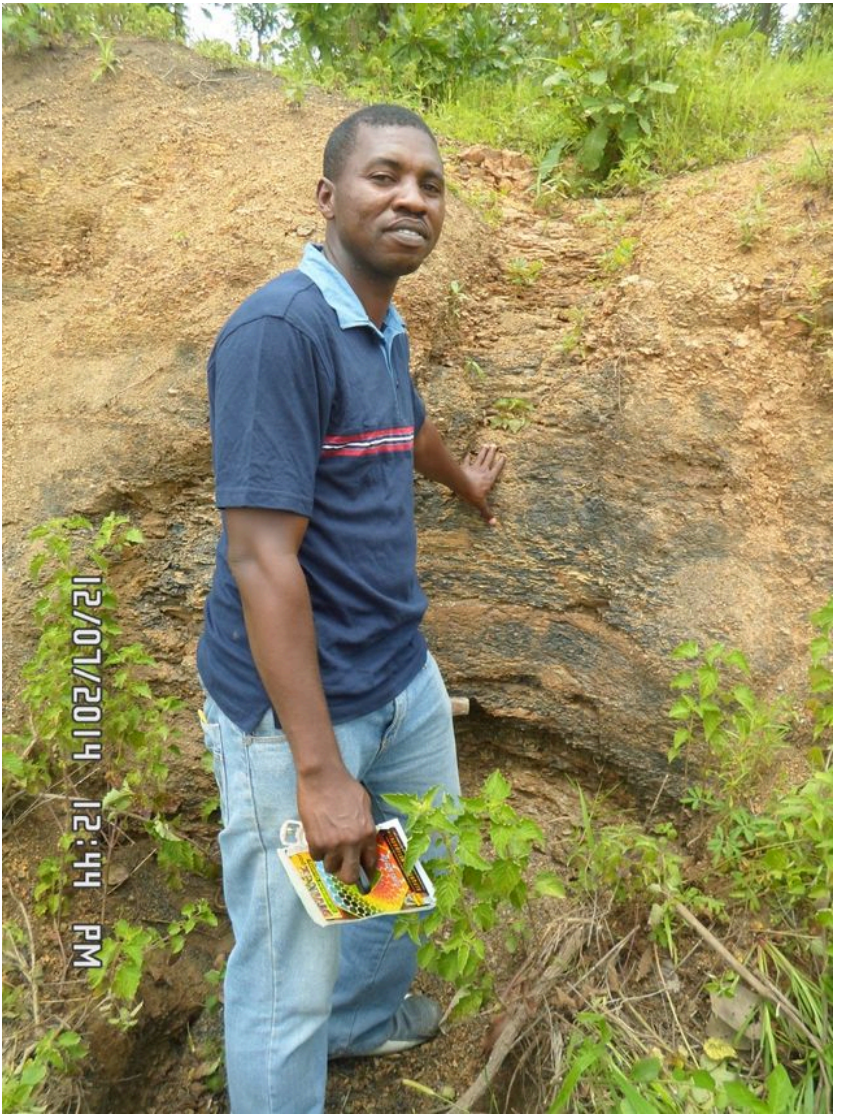
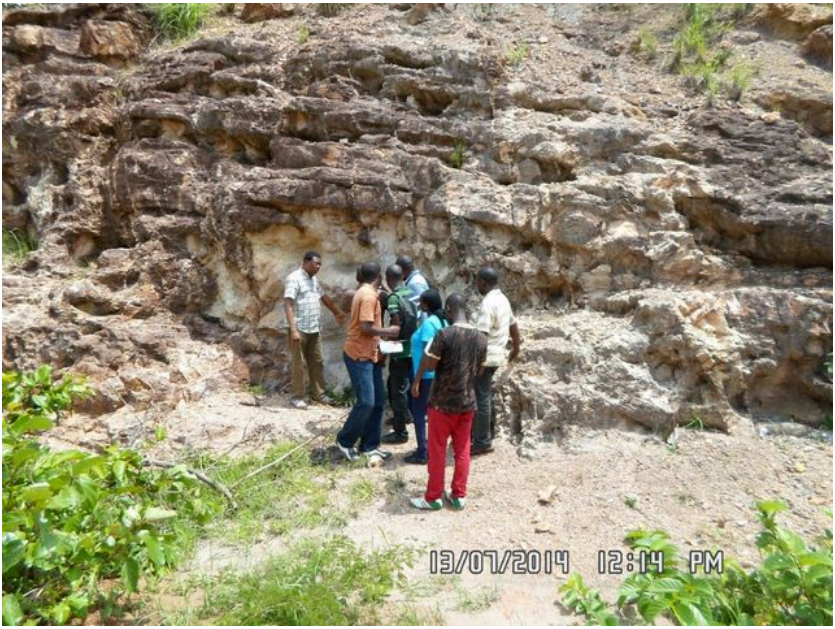


Carbonaceous shales within the Keana Formation (Cenomanian) in a gully section at Keana (Middle Benue Trough), Nasarawa State

Highly carbonaceous shales (baked) of the Ezeaku Formation (Cenomanian) at the entrance bridge at Ribi Village (Middle Benue Trough), Nasarawa State

Highly carbonaceous shales (baked) of the Ezeaku Formation (Cenomanian) at the entrance bridge at Ribi Village (Middle Benue Trough), Nasarawa State



Clay members of the Keana Formation exposed extensively on the Obi-Keana road(Middle Benue Trough), Nasarawa State

Coal/shaley coal of Lafia-Obi coal deposits within the Awgu Formation (Turonian-Coniacian) at the River Dep bank at Jangwa (Middle Benue Trough), Nasarawa State

Coal bands of Lafia-Obi coal deposit within the Awgu Formation (Turonian-Coniacian) at the River Dep bank at Jangwa (Middle Benue Trough), Nasarawa State

Coal bands of Lafia-Obi coal deposit within the Awgu Formation (Turonian-Coniacian) at the River Dep bank at Jangwa (Middle Benue Trough), Nasarawa State

dip

dip

Coal bands of Lafia-Obi coal deposit within the Awgu Formation (Turonian-Coniacian) at the River Dep bank at Jangwa (Middle Benue Trough), Nasarawa State

(Note the high dip resulting from the Santonian deformation)

Thicker coal layer

Thicker coal layer

A thicker coal layer of the Lafia-Obi coal deposit within the Awgu Formation (Turonian-Coniacian) at the River Dep bank at Jangwa (Middle Benue Trough), Nasarawa State

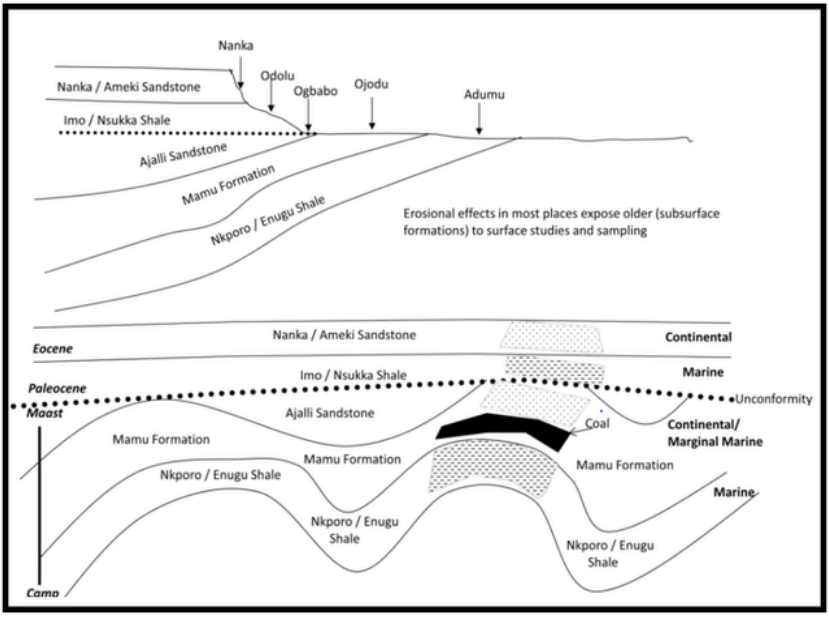


Fig. 1.15.Stratigraphic successions in Kogi State portion of the Anambra Basin (after Obaje, 2009).

Some Annexures on the Anambra Basin as described by Obaje et al. (2006)

A section of the clayey member of the Mamu Formation at Ojodu, on the Ajaokuta-Anyigba road, Kogi State, Northern Anambra Basin

Logging the clayey member of the Mamu Formation at Ojodu, Kogi State, Northern Anambra Basin (Note some mining of the clay has taken place)

Coal/coaly shale/shaley coal deposit within the Mamu Formation at the Okaba coal mine, Northern Anambra Basin

Coal/coaly shale/shaley coal deposit within the Mamu Formation at the Okaba coal mine, Northern Anambra Basin

Near surface /underground mining of coal deposits within the Mamu Formation at the Okaba coal mine, Northern Anambra Basin

A section of the very finely sorted whitish beach sands of Ajalli Sandstone at Ochadamu, on the Ajaokuta-Anyigba road, Kogi State, Northern Anambra Basin

8

CHAPTER THREE

INVESTMENT OPPORTUNITIES ON MINERAL RESOURCES WITHIN THE NORTH-CENTRAL

3.1Introduction

Despite Nigeria's huge resources, development is done mostly by artisanal and small-scale miners. Artisanal mining refers to informal activities undertaken by individuals and groups which are heavily dependent on manual labour and using simple implements and methods of exploration and exploitation. The Nigeria minerals and mining act (section 164) defines artisanal mining as mining operations limited to the utilization of non—mechanized methods of reconnaissance, exploration, extraction and processing of mineral resources within a small-scale mining lease area (Gyang et al., 2010).

3.2Marble deposits

Marble occurs within the migmatite-gneiss-schist-quartzite complex as relicts of sedimentary carbonate rocks. These are Upper Proterozoic schist belt meta-sediments which are normally marked by a general absence of carbonates. Several of these marble deposits are currently being exploited for cement (Ukpilla, Obajana) and decorative stone (Jakura, Kwakuti and Igbetti) with some production of ground rock for industrial use. Such marble deposits appear to be limited to the western portions of the south and central parts of the country. It has been established that Abuja has 20 percent of marble located in the country. Large marble deposits occur in the Muro Hills and at Ugya in Toto Local Government Area of Nasarawa State. The deposits in these areas (Muro Hills and Ugya) are being mined sparingly and locally. The deposits are large enough to attract the attention of more investment in cement manufacturing.

3.3Gemstone Mining, Processing and Marketing

The availability of different varieties of gemstones on the Jos Plateau other within other states like Niger, Nasarawa, Kogi and the relatively low cost of their recovery has attracted a large of entrepreneurs to the North-Central part of Nigeria. Exploitation and trade in these resources have provided income for many families. Although accurate figures of recovery are unavailable, it is estimated that over 10 tons of the different varieties of gemstones have been exploited from Plateau State alone over the last two decades (Lar *et al.*,, 2007). Investment potential in gems is therefore high in view of the expected profit margin. Recent survey, according to Olugbenga and Olufemi (2003) shows that for open-cast mining of gemstones, the operational costs such as mobilization to site, clearing, excavation and gem recovery are around #1.34m. Mining equipment which is a function of the type of terrain will attract about #6.635m while

laboratory testing equipment costs #77,000.00. thus, the total initial investment outlay required for the commencement of a gemstone mining operation is less than #10m but with current economic trend and exchange rate we should expect double initial investment outlay.

3.4Industrial mineral grinding

This will be an outfit that will produce powdered minerals from marble, kaolin, feldspar, galena etc. these minerals form a vital input in the chemical, metallurgical and non-metallurgical industries such as for the manufacture of abrasives, fillers and ceramics.

The use of these minerals is enormous. They are used in the glass, paper, paint, ceramic, refractory, chemical, plastic, rubber, pharmaceuticals and other mineral based industries. These raw materials are mineral ores which occur in various localities of the states within the North-Central in Nigeria.

The production process involves quarrying, blasting, crushing and milling. The mineral fragments are crushed into aggregates, usually under 25mm sizes. The aggregates milled into powder materials of various sizes where they are screened to appropriate sizes then bagged for sale.

The major machinery and equipment required include; jaw crusher, disintegrators, pulverizes, rotary screens, weighing balance and bagging or stitching equipment.

For the establishment of an outfit with a production capacity of 6,000MT per annum of fine ground industrial minerals, it will require an initial investment capital of 17.5m (RMDC, 2003), with the current economic trend and exchange rate we should expect double initial investment outlay.

3.5Granite/marble cutting and polishing

From a geotechnical standpoint; granites may be regarded as crystalline rocks that are suitable for building and construction purposes. Marble is a metamorphic rock consisting largely of calcite or dolomite.

The major products and by-products are marble chips, dust, palladiary, pre-cast engravement tiles and sculptures. Polished granites and marble are used in large amounts by the building industries for beautification purposes. Thy have very high export potential.

Granites are widely distributed within the different states that make up the North-Central with Abuja. Granites are mainly used for floor tiles and wall slabs. The rocks are cut into slabs by means of a circular sawing machine. Trimming machine is used to cut the ends of the slabs.

The machines/equipments needed for the operation include; diamond multiple blade saw, grinding and polishing line, circular saw machine, trimming machine. Sourcing of

this machinery could be local or imported. The spare parts such as diamond blades, belts etc could be sourced locally.

The project will involve cutting of granite or marble into blocks of different sizes (1cm thick for wall, 1.5cm for floor). A total of 12 slabs (i.e. 6 of each slab is approximately $2m^2$. According to RMDC, 2003) report, project of this kind will require an investment capital of 46.31m.

3.6Kaolin processing

Kaolin is found in large quantity in various places of the states within the North-Central, particularly at Major porter, Nahuta (Barkin-Ladi, in Plateau State), Share (Ifelodun LGA, Kwara State), Kajita (Pategi LGA, Kwara State), Ahoko, Agbaja plateau and Emu in Lokoja (Kogi Sate), Ojodu (Ofu LGA, Kogi State), Agbenema, Ofejiji, Udane-Biomi (Dekina LGA, Kogi State), Awe and Keffi deposits in Nasarawa State account for about 45,000MT of Nigerian Kaolin. Kaolin has a wide application in cosmetic, pulp and paper, chalk, agro-allied and pharmaceutical industries. It is also a raw material in soap and paint industries. The total consumption of kaolin in Nigeria is estimated at about 19,000 tonnes per annum (Lar et al., 2007).

Raw kaolin is first crushed and mixed with water into slurry. At this level some amount of diatomite reagent maybe added to decolourise the clay if necessary, after which the slurry is pumped into vibro-screen to extract foreign particles and impurities. The slurry is therefore pumped into a filter press to eject the water. Finally, the filtered cake of kaolin is dried, pulverized, milled and classified. The final product is then packaged for sale.

The equipment that an investor will require include blunger, hydro cyclones, sieves, tanks, filter presses, dryers, vibrating screen, separator, hammer mill, calciners, pumps, conditioners, flotation machines, weighing and bagging machines.

According to a report by Lar et al. (2007), the minimum capacity for the plant to be economical is 10,000 tons per annum and will require an initial investment capital of 37.34m.

3.7Floor tiles (clay) production

Clay flooring tiles are made from clay and clay-based materials. As the name implies, they are used mainly as floor and terrace coverings. There are several places within the North-Central where clay is found as earlier mentioned, particularly at Major porter, Nahuta (Barkin-Ladi, in Plateau State), Share (Ifelodun LGA, Kwara State), Kajita (Pategi LGA, Kwara State), Ahoko, Agbaja plateau and Emu in Lokoja (Kogi Sate), Ojodu (Ofu LGA, Kogi State), Agbenema, Ofejiji, Udane-Biomi (Dekina LGA, Kogi State), Awe and Keffi deposits in Nasarawa State. The tiles are generally made like roofing units and are burnt in continuous kilns. In some cases, revolving presses are

used for processing the tiles. However, it is quite possible to set up a small-scale unit with hand presses with limited financial resources and investment. These floor tiles are in high demand all over the country.

The machineries and equipments required include double screw clay mixer with crushing rollers., sieve (electromagnetic), pubmill or ball mill, blunger, jaw crusher, screw press/tile press, conveyor, cutting table, glaze machinery, spray dryer, kiln with chimney, scale, generator.

For the establishment of a plant with a production capacity of 5,000,000 units of flooring tile per annum, the investor will require an investment capital of about #19.8million (RMDC, 2003).

3.8Crushed granite stone production

Granitic rocks crushed into granite stones are among the most abundant natural resources and major basic raw materials used in the construction industries. Granite stones are also used together with cement in concrete works. Granite stone is obtained from dismantling large granitic rock boulders. The crushed stones can be produced in variable sizes depending on mode of application.

The state capital of all the North-Central state as well the local governments headquarters are fast growing metropolitan cities. There is a high rate of development going on as a result of the increasing population to meet the shelter and physical infrastructure needs of the people. Thus, the demand for the stone aggregates can only continue to increase. Consequently, semi-mechanized mining of crushed stones can be set up in various states within the North-Central to meet the demand.

The machinery and equipment required include primary jaw crusher, secondary jaw crusher, hammer mill, air compressor, rotary screens, conveyor belt etc. To set up a plant that would produce 12,000 MT of granite stone per annum, it will require an initial investment capital of about #13.86million (RMDC, 2003).

3.9Lead/Zinc smelting

Lead and zinc deposits have been mined at Zurak in Wase LGA of Plateau State, although lead and zinc deposits occur within the sedimentary successions at Arufu, Akwana, Azara, Keana and Awe in Nasarawa State, Zurak has a long history of lead/zinc mining since colonial days. The deposit is reported to contain high content of silver.

Zinc (Zn) ranks third and lead (Pb) forth in the world metal consumption (RMDC, 2003). Within the country, lead is used in the manufacture of acid lead batteries, while zinc is used in galvanizing, alloy and chemical industries.

We are of the view that for successful exploration of sub-basalt tin, an integrated electrical resistivity with electro-magnetic methods will be adequate since this method has the advantage of determining the thickness of the bed rock and aquifer, the nature of

the tin deposits, the characteristics of the overlying cover (hard or soft) and consequently enables a definition of the sub-surface topography of the potential tin-bearing areas. With this, the investment capital will be lower since drilling operations will be reduced tremendously.

We recommend solution-mining method as an alternative to the conventional open-cast mining where substantial landmass is devasted constituting a menace to the environment. This mining method is successfully practiced in countries like Bolivia and Malaysia, which present a relatively similar geology and other socio-economic factors.

3.10 Value addition

The availability of the mineral resources alone cannot drive the solid minerals sector of Nigeria. It is equally driven by the ability of stakeholders to exploit and market the products to the overall economic benefit of the country. Universal best practices involve value addition to the quality of the raw minerals to attract buyers and increase utilization in the various industries.

Value addition requires laboratory testing, further processing and beneficiation. There are quite a number of industries involved in the processing and beneficiation of Nigeria's solid minerals with majority of them in the industrial minerals sub-sector. Several kaolin processing and other industrial mineral processing companies can be seen in Plateau State, such as Kavitex, monumental kaolin and the Global industrial raw materials company, while Baryteand Bentonite are processed in Nasarawa and Edo States amongst others. The National Iron ore mining company ofNigeria is expected to be the hub of Nigerian Iron ore industry and is saddled with the responsibility of exploiting, mining, processing and supplying of iron ore concentrates to the major steel plants of Ajaokuta and Aladja on annual basis (it is worth mentioning however, that a lot of mineral resources in Nigeria are illegally mined and exported to the international markets with no official records what so ever (Gyang et al., 2010).

Minister in charge of the Ministry of Solid Minerals Development stated that in order to give the reforms in the mining sector a more meaningful approach, the leadership of the Ministry has prioritized the development of Seven Strategic Minerals (7SM), Coal, Bitumen, Limestone, Iron Ore, Barytes, Gold and Lead/Zinc. These seven minerals are world class and have been carefully chosen for development in view of their strategic importance to Nigeria's economy and their availability in quantities that are sufficient to sustain mining operations for years. One obvious implication of the above is that potential investments in any of these seven may receive accelerated response from the government as such investments would be seen as been in alignment with the government broader goal of enhancing infrastructural development across the six geopolitical zones of the country and their expected contribution to the nation's GDP (Ministering briefing, 2019).

Legislative Framework. The Federal Government of Nigeria is generally creating an enabling environment that will enable business to flourish. The enabling environment with respect to the mining sector includes the development of a new legislative framework. The legislative framework is embedded in the Mineral and Mining Act 2007 ("the Act"). The Act contains specific provisions that will enhance private sector leadership in the development of the mining industry in the country. Some of the salient provisions contained in the Act are as follows:

Ownership and control of minerals. The Act vests entire property in and control of all Mineral Resources in, under, or upon any land in Nigeria, its contiguous continental shelf and all rivers, streams and water courses throughout Nigeria, any area covered by its territorial waters or constituency and the exclusive economic zone in the Federal Government of Nigeria. This provision essentially mirrors the Constitution of the Federal Republic of Nigeria.

Transfer of Property in Mineral Resources Section 1(3) of the Act however provides that property in mineral resources shall pass from the Government to the person by whom the mineral resources are lawfully won upon their recovery in accordance with the Act.

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CHAPTER FOUR

NATIONAL POLICY ON SOLID MINERALS AND MINING INCENTIVES

4.1 Policy Evolution and Governance of the Sector

To a large extent, the performance of the solid minerals subsector has depended on the evolution of government policies over the years. Organised mining activities began in Nigeria between 1902 and 1923 following the commissioning in 1903 and 1904 of mineral surveys of the Southern and Northern Protectorates by the then British Secretary of State for the colonies. Modern mining of tin ore (cassiterite and associated minerals) was initiated by the Royal Niger Company in 1905. The mining of gold began in 1914 in areas located within present day Niger and Kogi States. Coal mining began at Enugu in 1916. By 1919, the Geological Survey of Nigeria was established as a department of government to take over and continue mineral surveys of the country.

The Minerals Ordinance of 1946 and the Coal Ordinance No. 29 of 1950 provided the legal basis for the development of solid minerals in Nigeria. The former vested ownership of all minerals in the British crown. It provides that "the entire property in land and control of minerals and mineral oils, in or under or upon anylands in Nigeria, and of rivers, streams and water courses throughout Nigeria, is and shall be vested in the state". The Minister of Mines and Power was empowered to grant prospecting and mining rights and leases to individuals and/or corporate organizations on application and payment of appropriate fees.

From the foregoing it is clear that the original cardinal principle of government's policy on prospecting and extracting mineral resources of the country on commercial basis was non-investment of public funds in the risk of mining investment. It was believed that investment in mining activities involved large sums of money on prospecting without any certainty of remunerative returns. The policy engendered a situation whereby large-scale foreign companies and small-scale indigenous miners concentrated their efforts on the production of minerals with export potential, neglecting minerals meant for local industries. Apart from coal which was mined by a government department, the mining of solid minerals was entirely in the hands of private expatriate and indigenous companies and entrepreneurs.

Prior to 1971, British mining companies dominated the scene with up to 120 companies at the peak of tin mining. These companies were well equipped. They employed qualified staff and paid detailed attention to efficiency considerations. All these combined contributed to large-sized output and employment. The Minerals Ordinance of 1946 and allied regulations which were re-enacted as the Minerals Act of 1959 applied globally to the exploration and exploitation of minerals without any particular distinction to special sets of minerals singly or in groups. However, as years

passed, the development of mining particular minerals necessitated special regulations and led to the enactment of special Acts to govern the exploitation of special minerals. Such Acts included the Nigerian Coal Mining Act of 1950, the Gold and Diamond Trading Act, the Explosives Act of 1964, the Tin Act No. 25 of 1967, and the Quarries Act and Allied Regulations of 1969.

In 1971 the government policy on solid minerals was drastically reviewed. Government decided to act as catalyst in the mining sector through the establishment of mining corporations which would use government funds for mining. The main policy thrust was the rejection of the concept of private-sector-led development of the solid mineral subsector. Government was of the opinion that the objective of that ensuing mining policy would be to secure the development, conservation and utilisation of the mineral resources of Nigeria in the best possible manner so as to bring about economic benefit for the largest possible period, and that there was no reason to suppose that the private investor was the best instrument with which to achieve the objective. It thus meant that if prospecting and exploitation of minerals were to remain solely in the private sector, the country would be at a disadvantage.

To achieve the objectives of the new policy, government which had hitherto refrained from direct participation decided to participate directly in the mining industry. It established the Nigeria Mining Corporation (NMC) in 1972 to engage in direct investment in the exploitation of known economically viable minerals other than coal and marble. Through subsidiaries, the NMC engaged in the exploitation of kaolin, barytes, cassiterite, columbite, limestone and clays. The Nigerian Coal Corporation (NCC) was responsible for mining coal. Later the Nigerian Uranium Mining Company (NUMCO) was incorporated to mine and develop uranium.

Government direct involvement in the solid minerals' subsector has been conducted through three parastatal organizations and an agency. Minerals like coal, iron ore and bitumen have always been under the complete control of government both in exploration and exploitation. In addition to the above parastatals (under the Ministry responsible for solid minerals) through which government exercised control and direct involvement, there are other parastatals whose activities interface with those of the former but which report to other Ministries. These include the Nigerian Iron Ore Mining Company (NIOMCO) which mines iron ore at Itakpe, the National Steel Raw Materials Exploration Agency (NSRMEA) which concentrates on exploration of iron ore and coking coals, the National Metallurgical Development Centre (NMDC) whose focus is on research in mineral processing and downstream utilization studies on minerals, all of which report to the Ministry of Power and Steel, and the Raw Materials Research and Development Council (RMRDC) located in the Ministry of Science and Technology to source local raw materials – agricultural, forest, minerals and chemical – for domestic industries.

Despite the heavy public expenditure involved in the maintenance and operations of the above corporations, the expected economic advantages that informed the 1971

review of mining policy were still far from being realized.

With the exit of multinational companies and their expatriate professionals following the Indigenisation Decree of 1972, the bulk of mining operations by the private sector rested on the shoulders of small-scale indigenous miners. The surface, near surface and shallow depth deposits of the minerals had by then been variably depleted. These factors were largely responsible for production decline particularly in the metallic minerals. As a consequence, there was a shift of the tempo of mining activities to industrial non-metallic minerals needed for construction, building and industrial application for domestic industries. Furthermore, the downturn of the country's economy adversely affected the exploration as well as exploitation of even the non-metallic minerals. The Inspectorate Department of the Ministry of Mines and Power (as it was then known) was ill-equipped. It lacked adequate and suitable manpower to carry out surveillance of the minefields with a view to ensuring compliance to safety standards and to man the exit points to identify mineral commodities being exported. Illegal mining and speculative pegging by legal title holders were rife. These problems were further compounded by administrative bottlenecks which included cumbersome procedures in processing mining applications leading to long delays, difficulties in obtaining consent to enter land for the purpose of prospecting and mining, and procedural reports necessary for the approval of applications.

The Nigerian Minerals and Mining Act6 (the "Act" or "Mining Act") is the principal legislation which regulates the Nigerian mining sector. The Act has made provisions in relation to licensing, ownership and control of minerals, and implementation. There are other legislative and policy instruments which further regulates Nigeria's mining sector in addition to the primary.

The quest for the diversification of the Nigerian economy towards activating other sources of revenue, given the country's vast human and natural resources and against the backdrop of the decline in oil revenue is currently on the upswing. One key sector which offers great potential in achieving diversification is the solid minerals sector. Consequently, the government of Nigeria has affirmed its commitment to the exploration and development of solid minerals and metals by approving a N30billion financial intervention, and prioritized for exploitation seven strategic minerals of vital importance to the economy, i.e., coal, bitumen, iron ore, barites, gold and lead/zinc which are available in ample qualities to sustain mining activities.

The potential of the Mining sector to significantly contribute to Nigeria's economy cannot be over-emphasized. An attestation to this fact is the increase in the contribution of mining and quarrying to the nation's Gross Domestic Product (GDP) which now stands at 23.54% as at Q1 2018. In addition to this, international investor interest in the sector continues to improve by the day with the federal government also recognizing the sector as a potential prime income generator away from oil. Given the large mineral deposits in the country, Nigeria has the potential to be a market leader in the mining sector. The Roadmap for the Growth & Development of the Nigerian Mining Industry

of 2016 highlights the potential for increase in the sector's contribution to GDP from 5% in 2015 to 10% by 2020, thus supporting forecasts that a concentrated exploration of Nigeria's solid minerals wealth may in the short term exceed her oil wealth. It is envisaged that this shift would translate to increased public and private sector investment, more employment creation for the citizenry and overall economic and financial stability for the economy.

The use of Incentives as a veritable tool in sustaining investors' interest has become increasingly recognized globally, as most countries of the world, irrespective of their stages of development, now employ a wide variety of inducements in pursuing their economic goals. The application of incentives now exists virtually in all sectors of the economy like industries, agriculture, manufacturing, petroleum, solid minerals, energy, tourism and others. There are different kinds of incentives; and the three basic categories are financial, fiscal, and regulatory which are variously employed by most governments. The financial incentives are public-support mechanisms in the form of grants or repayable subsidies. It is common with developed countries, while developing countries prefer fiscal incentives because of the fact that they are easily affordable in promoting investment and do not require up-front utilisation of government funds. Regulatory incentives on the other hand are in the form of concessions, exemptions from labour or environmental standards and subsidized infrastructure which are also applicable in most countries.

4.2 Mining Incentives

The Act provides for the following fiscal and tax incentives.

In determining its total profits, a license holder is entitled to deduct from its assessable profits a Capital Allowance of 95% of Qualifying Capital Expenditure incurred in the year in which the investment was made on all- certified exploration, development and processing expenditure including feasibility study and sample assaying cost. - Infrastructure costs incurred regardless of ownership or replacement.

The amount of any loss incurred by a license holder shall be deducted as far as is possible from the assessable profits of the first year of assessment after that in which the loss was incurred and in so far as it cannot be so made then from such amounts of such assessable profits of the next year of assessment and so on up to a limit of four years after which period any unregistered loss shall become lapse.

All operators shall be granted the following benefits: Exemption from payment of customs and import duties in respect of plant, machinery, equipment and accessories imported specifically and exclusively for mining operations Expatriate quota and resident permit in respect of the approved expatriate personnel; and Personal remittance quota for expatriate personnel, free from any tax imposed by any enactment for the transfer of external currency out of Nigeria. The machinery, equipment and accessories to be imported shall be approved by the Mines Inspectorate Division. The plant,

machinery, equipment and accessories imported pursuant to this section may be disposed of by the holder of Mineral Title upon full payment of customs and import duties in respect thereof.

The Central Bank of Nigeria (CBN) may permit a holder of a Mineral Title who earns foreign exchange from sale of his minerals to retain in a foreign exchange domiciliary account a portion of his earnings for use in acquiring spare parts and other inputs required for the mining operations which would otherwise not be readily available without the use of such earnings.

The Act also guarantees free transferability of funds through the CBN in convertible currency of - payments in respect of loan servicing where a certified foreign loan has been obtained by the holder for his mining operations- the remittance of foreign capital in the event of sale or liquidation of the mining operations or any interest therein attributable to foreign investment.

The Act provides a tax relief period of 3 years for any company granted a Mineral Title under the Act. The tax relief period may be extended for a further period of 2 years by the Minister on the fulfillment of certain conditions. The tax relief period commences on the date that the license holder commences operations. Under the Companies Income Tax Act (CITA) mining companies are only granted a tax relief period of 3 years without an option for an extension. There are ongoing debates over the validity or otherwise of the extension period granted under the Mining Act. This is however beyond the scope of this paper.

Section 30 of the Act provide for deductibility of environmental cost. It specifically states that: "A tax deductible reserve for environmental protection, mine rehabilitation, reclamation and mine closure costs shall be established by companies engaged in the exploitation of mineral resources, provided however, that the appropriateness of the reserve is certified by an independent qualified person considering the determination made under the provisions of this Act: - (a) the reserve is recorded in the audited financial statements of the companies. (b) Tax deductibility will be restricted to actual amount incurred for the purpose of the reclamation; and (c) a sum equivalent to the reserve amount is set aside every year and invested in dedicated account or trust fund managed by independent trustees appointed pursuant to the provisions of the Act.

A tax-deductible amount established in accordance with the applicable rate set out in the Pension Reform Act shall be imposed on mining companies or enterprises, towards the payment of pensions to each employee. Section 32 provides for Annual Capital Cost Indexation. It states that the unclaimed balance of capital cost shall be increased yearly by 5 percent for mines that start production within 5 years from the date of enactment of the Mining Act.

The Act provides that any mineral obtained in the course of exploration or mining operations shall be liable to pay royalty as prescribed in any regulations made under the Act. However, the Minister may also defer the payment of royalty on any minerals for a specific period, on the approval of the Federal Executive Council.

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CHAPTER FIVE

PROCEDURES FOR OBTAINING MINING RIGHTS

5.1 Shapes of licenses and lease

In accordance with the Mining Regulations 2011, applications for exclusive license and leases must be submitted in conformity with the allowed geometric shapes of polygons, and must be regular and parallel to coordinates system used in national topographic maps. The polygons should have a minimum dimension which is called a CADASTRAL UNIT (also simply referred to as SQUARE). A license polygon should always be made up of a certain number of Cadastral Units (CU) or squares. Consequently, the dimensions of the sides of any polygon corresponding to the license area will always be multiples of the size of the Cadastral Unit. The CUs must be adjoining by the sides not the edges (i.e. placed side by side to each other). The polygons cannot also be "floating" or placed anywhere. They must be located coherently with pre-defined and standardized grid.

For Nigeria, the cadastral topographic maps of 1: 50,000 scale are divided by a grid of 15 seconds by 15 seconds (15" x 15"), using the Geographic Coordinate System (latitude/longitude: degree/ minute /seconds).

The average area of one CU (square) of 15" x 15" is roughly 20 Hectares. That means a polygon of one minute by one minute (1'x1') will have 16 CUs (squares) with area of about 300 Hectares (or 3 Km^2).

The coordinate values limiting the license polygons can be obtained by direct readings from the cadastral maps (topo-sheets of 1:50,000 scale), or by readings from the field using the Global Positioning System (GPS) with the correct settings (i.e. Longitude/Latitude, WGS 84 – Minna Datum).

Applicants are required to submit their applications for licenses together with coordinates of either the corners of the entire polygons or CUs applied for or of the centre of the CUs. The coordinates will therefore have an incremental rate of 15 seconds (15") on both the x and y axes of the polygons. There is also the need to submit survey plans for lease applications. The Mining Cadastre Office will generate the license plans upon acceptance of the application.

The Nigeria Mining Cadastre Office has exclusive responsibility to administer mineral titles in accordance with the following statutory guidelines:

i. Consider applications for mineral titles and permits, issue, suspend and upon written approval of the Minister, revoke any mineral title;

ii. Receive and dispose of applications for the transfer, renewal, modification, relinquishment of mineral titles or extension of areas;

iii. Maintain a chronological record of all applications for mineral titles in a Priority Register which is to be specifically used to ascertain the priority and registration

of applications for exclusive rights or vacant areas;

iv. Maintain a general register which is to be used for all other types of applications where registration of the priority is not required;

v. Under take such other activities reasonably necessary for the purpose of carrying out its duties and responsibilities under the provisions of the Nigerian Minerals and Mining Act, 2007.

5.2 Types of mineral titles

In line with section 46 of the Nigerian Minerals and Mining Act, 2007, the right to search for, or exploit minerals in Nigeria, is governed by one of the following mineral titles:

Reconnaissance Permit
Exploration License
Small Scale Mining Lease
Mining Lease
Quarry Lease
Water Use Permit

5.2.1 Reconnaissance Permit (Section 47, 57 and 58 of NMMA, 2007)

The Mining Cadastre Office, shall within 30 days of the receipt of application of any qualified applicant and upon the payment of the prescribed fees, grant and issue a Reconnaissance Permit to search for minerals. The permit enables the holder to carry out reconnaissance on non-exclusive basis. The holder of a Reconnaissance Permit is not to engage in drilling, excavation or other sub-surface techniques, and must conduct activities in an environmentally and socially responsible manner and compensate for any damage to crops or Property in the course of prospecting. The permit is issued for one year and it is not transferable, but renewable annually as further spelt out in sections 57 and 58 of the Nigeria Minerals and Mining Act, 2007 and the Mining Regulation 2011.

5.2.2 Exploration Licence (Section 48 and 59 of NMMA, 2007)

The Nigeria Mining Cadastre Office, on receipt of a valid application, is obliged by the law to grant and issue an Exploration Licence within 30 days. A licence will not be granted over any land that is subject of an existing Exploration Licence, Mining Lease, Small Scale Mining Lease, Quarry Lease or closed to prospecting/mining activity (e.g. forest reserves, military areas, government development areas, national heritage area etc).

The duration of an Exploration Licence is three (3) years, provided that title holder has complied with minimum work commitment/programme and all other legal

requirements. The area of land covered by an Exploration Licence shall not exceed 200Km^2 i.e. 930 CUs.

5.2.3 Small Scale Mining Lease (Section 49 of NMMA, 2007)

The Mining Cadastre Office, on receipt of a valid application, grants and issues a Small-Scale Mining Lease (SSML) within 45 days. A SSML shall not be granted in respect of any area within an exploration license area, mining lease area or quarry lease area to any person except the holder of an exploration license, quarry lease or mining lease covering the area. The duration of a SSML is five (5) years and is renewable for further periods

Of five years provided that the minimum work obligations have been met. The area of land for a SSML shall not exceed 3Km^2. When the level of operations of a Small-Scale Mining Lease exceeds any of the criteria established in definition of SSML, the holder shall convert such a lease into mining lease by submitting a written application to the MCO.

5.2.4 Mining Lease (Section 50 of the NMMA, 2007)

The Mining Cadastre Office, on receipt of a valid application, grants and issues a Mining Lease within 45 days of the application. The duration of a Mining Lease is 25 years, renewable every 20 years, provided that the holder has complied with minimum work commitments and that all other legal and regulatory requirements have been met.

The lease area shall be determined in relation to the ore body as defined in the feasibility study, in addition to an area reasonably required for the working of the deposit, not exceeding 50Km^2 (245 CUs).

5.2.5 Quarry Lease (Section 51 of the NMMA, 2007)

All operations for the extraction of construction materials are to be carried out under a Quarry Lease. On receipt of a valid application, the Mining Cadastre Office shall grant a Quarry Lease to the applicant within 45 days. The duration of a Quarry Lease shall not exceed five (5) years and may be renewed every five years as required, provided the renewal application is made within three (3) months before the expiration of the lease. The area of land shall not exceed 5Km^2. (25 CUs).

5.2.6 Water Use Permit (Section 52 of the NMMA, 2007)

The area of land in respect of which any water use permit (WUP) is granted shall not exceed the area reasonably required for the purpose of the permit as defined in the regulation. A WUP will remain in force as long as the mining lease, SSML, or quarry lease for which the water use permit was granted remains valid.

5.3 Requirementsforapplicationfor mineral titles

The requirements for application for various mineral titles are as stated below:

5.3.1 Mining Leases

a) Pre-grant conditions

* Duly completed application forms
* Pre-Feasibility Report
* Prospecting plan/reserve estimation
* Valid exploration license
* Evidence of financial capability
* Evidence of technical competence
* Consent from land owners'/land occupiers.
* Attestation of non-conviction of criminal offences under the Act.
* Evidence of payment of appropriate fees and rents.
* Certified true copy of certificate of incorporation.
* Mineral/s to be exploited (section 64).
* Area specified to be surveyed in accordance with provisions of Survey Co-ordination Act (section 79).
* Notice to land owner (private or state land) with a response on rate to be paid, (section 102).

b) Pre-Development conditions (Post-grant)

* EIA-Environmental Impact Assessment - (section 119)
* CDA - Community Development Agreement - (section 116)
* Compensation -(section 107)
* Closure plans/Rehabilitation plan - (section 61)
* Reports from state bodies/ MIREMCO

5.3.2 Quarry Leases/Small Scale Mining Leases

a) Pre-grant conditions

* Duly completed application forms
* Pre-Feasibility Report
* Evidence of Financial capabilities - (section 54 of the NMMA)
* Evidence of Technical capabilities (CV of Technical Person(s) (Section 54 of the NMMA)
* Consent from land owners/land occupiers-(section 100 of the NMMA)
* Attestation of no conviction of criminal offences under the Act (section 53 of the NMMA)
* Certified true copy of certificate of incorporation

* Evidence of payment of fees and rents
* Area specified to be surveyed in accordance with provisions of Survey
* Coordination Act - (section 79 of the NMMA)
* Notice to land owner (private or state land) with a response on rate to be paid - (section 102 of the NMMA)
* Mineral/s to be exploited - (section 64 of the NMMA)

b) Pre-Development conditions (Post Grant)

* EIA-Environmental Impact Assessment - (section 119)
* CDA - Community Development Agreement - (section 116)
* Compensation – (section 107)
* Submit closure plan/rehabilitation plan - (section 61)
* Reports from state bodies/ MIREMCO

5.3.3 Exploration License

(a) Pre-grant conditions

* Duly completed application forms
* Minimum work programme (Detailed)
* Evidence of financial capabilities (section 54 of the NMMA)
* Evidence of technical competence (section 54 of the NMMA)
* Consent from land owners/land occupiers-(section 100 of the NMMA)
* Attestation of non-conviction of criminal offences under the Act
* Certified true copy of certificate of incorporation
* Evidence of payment of fees and rents
* Minerals to be explored (section 64 of the NMMA)

(b) Pre-Development conditions (Post grant)

* EIA-Environmental Impact Assessment (section 119 of the NMMA)
* Compensation
* Closure plan/rehabilitation plan
* Reports from state bodies/ MIREMCO

5.3.4 Reconnaissance Permit

(a) Pre -grant conditions

* Duly completed application forms
* Description of the work area and the activities to be carried out
* Attestation of non-conviction of criminal offences under the Act
* Receipt of payment of the application fee
* Evidence of technical competence (section 54 of the NMMA)
* Evidence of financial capability (section 54 of the NMMA)

b.) Pre-Development Conditions Post-Grant Compensation Section 56.

5.3.5 Water Use Permit

(a) Pre-grant conditions

* Duly completed application forms
* Copy of mining title granted
* Description of area and water use plan
* Agreement with all persons likely to be adversely affected by the grant of the permit
* Receipt of payment of the application fee.

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APPENDIX

Table 1: Solid mineral resources of Niger state and geological setting.

S/No	Mineral Name	Geological formation
1.	Galena (PbS)	Igneous and metamorphic
2.	Gold (Au)	Igneous, metamorphic and sedimentary
3.	Graphite	Igneous and metamorphic
4.	Iron Ore	Igneous, metamorphic and sedimentary
5.	Kaolinitic clay	Igneous, metamorphic and sedimentary
6.	Kyanite	Igneous and metamorphic
7.	Marble/Dolomite	Metamorphic
8.	Silica sand/quartzite	Igneous, metamorphic and sedimentary
9.	Talc	Igneous and metamorphic
10.	Tourmaline, beryl	Igneous and metamorphic
11.	Scheelite ($CawO_4$)	Igneous and metamorphic
12.	Wolframite (Fe,Mn) WO_4)	Igneous and metamorphic

*Source: (*Idris-Nda et. al., 2018)

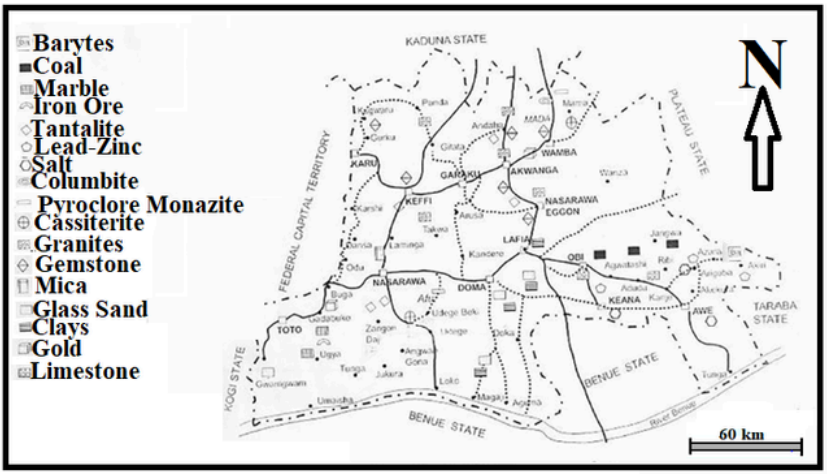

Fig. 1. Mineral resource map of Nasarawa State (Modified after Obaje*et al.*,, 2007).

Table 2: Summary of Solid minerals in Nasarawa State

S/N	LGA / Locality	Minerals
1	Akwanga	Cassiterite,Clay, Columbite, Mica, Granite, Limenite

2	Awe (Azara, Wuse, Aloshi)	Baryte, Clay, Galena, Salt, Limestone
3	Doma	Clay, Silica sand
4	Keana	Baryte, Galena, Salt, Zinc, Lead, Limestone.
5	Karu (Panda)	Clay, Glass sand, Granite, Tantalite, Mica
6	Keffi(Ungwar Doka, Tudun Jenjela)	Clay, Tale, Gemstone (Tourmaline, Aquamarine, Sapphire)
7	Kokona(Bakin-Aini, Rafin Gabas)	Mica, Chalcopyrite, Gemstone (Tourmaline and Aquamarine)
8	Lafia (Shabu)	Clay, Silica sand, Gemstone (Topaz
9	Nassarwa Eggon (Wana, Alogani, Mada station, Ungwar Gyawa)	Quartz, Mica, Granite, Gemstone (Emerald, Aquamarine, Topaz, Amethyst)
10	Obi	Baryte, Clay Coal
11	Nassarawa(Udege-mbeki)	Cassiterite, Clay, Columbite, Tantalite
12	Toto (Ugya)	Marble, Iron ore, Mica
13	Wamba(Randa, Gongon)	Cassiterite, Tantalite, Granite, Columbite, limonite, Aquamarine

Table 3. Summary table of mineral resources in Kogi State.

S/N	Mineral	Location	LGA	S/N	Minerals	Location	LGA
1.	**Beryl**	Ikoyi	Ijumu	12.	**Columbite**	Isanlu-Esa	Yagba West
2.		Aku	Adavi			Okoloke	Yagba west
3.	**Clay**	All over				Odo-Eri	Yagba west
4.	**Coal**	Odokpono	Ankpa			Ejiba	Yagba west
		Okobo	Ankpa			Iddo	Yagba east
		Odaogbo (Okaba)	Ankpa			Takete-Isao	Yagba East
		Ogboyaga	Dekina			Idibo	Ajaokuta

		Okpakiri	Dekina
		Dekina	Dekina
5.	**Kaolin**	Agbaja plateau	Lokoja
		Emu	Lokoja
		Agbaja Hill	Bassa
		Angba	Igalamela/Odolu
6.	**Feldspa**	Isanlu-Esa	Yagba West
		Egba	Yagba West
		Osara	Adavi
		Aku	Adavi
		Zariaji	Adavi
		Lokoja	Lokoja
7.	**Mica**	Egba	Yagba West
		Isanlu-Esa	Yagba west
		Idofin	Yagba East
		Zariaji	Adavi
		Aku	Adavi
		Lokoja	Lokoja
8.	**Gold**	Okolom	Yagbe East
		Dgondaji	Yagba East

13	**Magnetite**	Agbaja plateau	Lokoja
		Tajimi Ridge	Lokoja
		Gboloko	Bassa
		Akpogu	Mopa Muro
14	**Marble**	Oyo-Iwa	Lokoja
		Jakura	Lokoja
		Okoloke	Yagba West
		Ekinrin-Ade	Ijumu
		Osara	Adevi
		Itobe	Ofu
		Ubo	Adavi
		Mopa	Mopa Muro
15	**Fire clay**	Ahoko-koto	Kogi
16	**Garnet**	Isanlu	Yagba East
		Takete-Isao	Yagbe East
		Odo-Ara	Yagbe West
17	**Muscovite**	Isanlu-Esa	Yagba West
		Idofin	Yagba East
		Aku	Adavi
		Zariaji	Adavi
18	**Quartz**	Isanlu-Esa	Yagba West

		Okoloke	Yagba East			Idofin	Yagba East
		Ejiba	Yagba West			Aku	Adavi
		Katcha Katcha	Omala			Lokoja	Lokoja
9.	**Silica sand**	All Over		19	**Talc**	Ejiba	Yagba West
10.	**Granite**	All over the western	Flank of the state			Okolom-Isanlu	Yagba East
11.	**Iron Ore**	Itakpe	Adavi			Odogbe-Isanlu	Yagba East
		Ajagbanoko	Adavi			Iye-Isanlu	Yagba East
		Agbado-Okudu	Lokoja	20	**Tantalite**	Idofin	Yagba East
		Agbaja	Lokoja	21	**Tourmaline**	Okoloke	Yagba West
		Oshokoshoko	lokoja			Odo-Eri	Yagba West
		Tajimi	Lokoja			Idibo	Ajaoku
		Ebiya	Ajaokuta				
		Koton-Karfi	Kogi				

(Source: MMSD, 2012)

Table 4. Summary of information on mineral resources in Plateau State

S/No	Mineral	Location (LGAs)	Status	Uses
	Metallic Ores			
1.	Cassiterite	Barakin-Ladi, Bassa, Bokkos, Jos East, Jos north, Jos south, Mangu, Riyom	Partly evaluated but more detailed exploration and evaluation needed.	Tin plating, Food canning and decorative industries. Hardening of copper and lead in alloys etc.

2.	Columbite	Barakin-Ladi, Bassa, Bokkos, Jos East, Jos north, Jos south, Mangu and Riyom	Partly evaluated but more detailed exploration and evaluation needed.	Sources of niobium and tantalum. Ferro-alloys, special steels, electronics, tube filaments in rocket and aircraft manufacturing
3.	Tantalite	Riyom, Mangu, Paknshin, Kanke, Kanam	Reserves not determined	In aircraft manufacturing, mobile phones and computer parts.
4.	Magnetite	Jos South, Jos North, Jos East, Riyom, Barakin-Ladi, Bassa, Mangu, Kanam	Yet to be evaluated	Source of iron, floor tiles, paint industries etc.
5.	Ilmenite	Jos South, Jos North, Jos East, Bassa, Barakin-Ladi, Mangu	No detailed investigation	Source of titanium oxide for paints, titanium metal for alloys, deoxidixzer and ore stabilizer.
6.	Galena/Sphalerite	Kanam (Mambyan), Kanke, Pankshin, Langtang south, Shendam, Wase, (Zurak, Gimbi).	No detailed inestigation	Iron/steel industries for alloying and in automobile batter manufacture.
7.	Molybdenite	Riyom (Kigom)	Require full investigation	Used in special steel, radio equipment etc.
8.	Wolframite	Riyom (Kigom)	More detailed exploration and evaluation required.	Used in electrical/ electronic industries.
	Radioactive mineral ores			

9.	Thorite	Barakin-Ladi, Bassa, Jos north, Jos south, Mangu and Riyom.	More detailed exploration and evaluation required.	Alloy in electric filament, ceramic and chemicals, used in manufacture of electronic tubes, photos cells, aircraft engines and nuclear fuel.
10.	Zircon	Barakin-Ladi, Bokkos, Jos south Riyom.	More detailed exploration and evaluation required.	In spark gas lighters, colour television and other electronic devices.
	Industrial minerals			
11.	Clays	Jos south, Jos north, Jos East, Riyom, Barakin-Ladi, Bassa, Mangu and Riyom	Large	Pottery, bricks, floor tiles, paint, building etc.
12	Kaolin	Barakin-Ladi, (Major Porter) Riyom, Kanam, Bassa, Bokkos, (Mazat, Pyakmalu). Jos north, Pankshin.	Very large	Ceramic wares, fillers, and extenders in papers, paint, cosmetics, rubber and pharmaceutical industries.
13	Baryte	Langtang north and south, Mikng, Quan-Pan, Shendam.	Required detailed exploration. Locally mined due to lack of adequate modern mining equipment.	High demand in the petroleum drilling industry. In chemical industries as source of barium metals used in various alloys.
14.	Gypsum	Wase, Kanam	Require detailed exploration.	For plaster of Paris (POP), in cement manufacture, soil conditioning, as filer in paper and cotton.
15.	Marble	Mangu, Pankshin	Very large	Used in the construction and

				cement industry.
16	Mica	Jos north, Jos East, Riyom, Kanam, Pankshin, Kanke.	Very large	Electrical insulators, as fillers in paint and rubber industries. As dry lubricants, decoration on wall papers.
17.	Feldspar	Langtang North, (Belan), Kanam (Bugaur), Bassa, Barkin-Ladi, Riyom, Pankshin.	Very large	Glass, ceramics, tiles etc.
18.	Talc	Pankshin	Reserve not known	Extender in paints, filler in rubber and asbestor, in ceramics, cosmetics and in the manufacture of roofing paper.
19.	Salt	Shendam, Mikang, Quan-Pan, Langtang south	Large	Used in the chemical industry, food seasoning and preservation.
20.	Granite	Found all over the state.	Very large	Used as decorating, ornamental or facing stones in construction industry.
21.	Quartzite	Langtang North (Gazum), Kanke, Riyom, Barakin-Ladi, Bassa, Jos North, Jos East and Kanam.	Large	Glass. Silica, bricks, optical and piezoelectric (watches and clock) ceramics, gemstones etc.
22.	Sand	Found all over the State	Very large	Making of sandcrete blocks, other construction works.

23.	Laterite	Found all over the state.	Very large	For building and road construction works.
24.	Glass sand	Jos north, Jos South, Pankshin, Barakin-Ladi, Mikang.	Reserves not determined yet.	Glass ceramics, refractory, foundry, synthetic marble.
25.	Topaz	Langtang, North (Gazum), Pankshin (Turmun) Makpwartem) Riyom (Rim and Tom), Mangu (Bulli Langai, Mangun) Jos North and Jos Souh, Jos South, Bokkos, Bassa and Kanam.	Reserve not known	Necklaces, beads, bracelets, pendants, rings and earirngs.
26.	Garnet	Pankshin (Akwordyis), Mangu (Kerang) Bokkos, Kanke, Kanam	Reserve not known.	Abbrasives
27.	Olivine	Mangu (Kerang)	Reserve not known	Jewelry and ornament
28.	Tourmaline	Pankshin (Giming and Bok Dikka) Mangu (Tim) Kanke.	Reserve not known	Jewelry and ornament
29.	Sapphire	Bokkos (Horopp, Rom) Barakinladi, (Sho), Mangu and Pankshin.	Reserve not known	Jewelry and ornament
30	Amethyst, smoky quartz, aquamarine and emeralds.	Jos north and Jos South, Bokkos, Bassa, Riyom, Mangu, Pankshin, Kanassm and Langtang North.	Reserve not known	Jewelry and ornament

Source: RMRDC, 2006 and Lar *et al.* 2007.

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Table 5. Summary of information on mineral resources of Kwara State

Commodity	Class	Location	LGA	Geology	Status
Feldspar	Ceramic	Pepele/ Agbeyangi	Ilorin East	Gneisses, granite, quartzo-feldspatic.	Abandoned site
Clay	Ceramic Mineral	Tsaragi	Edu	Intercalation of sandstone and clay.	Occurrence
Clay	Industrial Mineral	Oke- Oyi	Ilorin	Basement gneisses and migmatites - weathered residual deposits	Occurrence
Tourmaline	Gemstone	BabanlaIfelodun	Irepodun	Muscovite schist/pegmatite vein	Abandoned
Tourmaline	Gemstone	Odo-Ore	Irepodun	Muscovite schist	Abandoned
Tourmaline	Gemstone	Babanla	Ifelodun	Schists, gneisses and pegmatite	Active
Tourmaline	Gemstone	Dogondaji Oro	Irepodun	Talc schistose rock	Active
Tourmaline	Gemstone	Alabe	Ifelodun	Quartz and pegmatite	Abandoned site
Marble	Industrial	Elebu	Moro	Lenses of dolomite in gneisses and reported	

				occurrence of limestone which is possibly an inlier	Occurrence	Lensoi
Dimension Stone	Industrial	Gbagutu	Edu	Granitic rocks	Prospect	Intrusi
Dimension Stone	Industrial	Gbagutu	Edu	Granitic rocks	Prospect	Intrusi
Dimension Stone	Industrial	Yowere	Asa	Migmatitic Gneisses	Prospect	Massiv
Marble	Industrial	Osara	Osara	Marble bands in strongly folded metamorphic basement associated with Kyanite bearing gneiss. Tabular body, dip 10° -15° SE	Deposit	Dolom
Dimension Stone	Industrial	Ojoku	Oyun	Granodiorite	Prospect	Massiv
Kaolin	Industrial	Share	Ifelodun	Sedimentary	Artisanal	Massiv
Kaolin	Industrial	Kajita	Pategi	Sedimentary	Leased Quarrying	Massiv

Marble	Industrial	Elebu	Moro	Quartz - schist - marble suite with intrusives	Occurrence	Dolomit
Dimension Stone	Industrial	Ifelodun, Elerinjare	Ilorin West	Gneissic rocks.	Prospect	Massive
Marble	Industrial mineral	Owa-Kajola	Ifelodun	Dolomite and Calcite occurs as lenses of metasediments associated with base rocks such as gneisses and migmatite in the terrain.	Abandoned	Lensoid
Marble	Industrial mineral	OkeOyan	Ifelodun	Dolomite and calcite occur as lenses of metasediments associated with base rocks such as gneisses and migmatite in the terrain.	Prospect	Lensoid calcitic
Talc	Industrial mineral	Bare Oja	Ifelodun	Grey-Brownish Talc and Talc Schistose rock associated with metasediments (marble) and		

				gneisses of the basement rocks	Occurrence.	Lenso
Tin	Metallic	Kaiama	Kaiama	Mineralization hosted in 2 major quartz veins within schistose rocks and gneisses.	Prospect, active artisanal	Vein (Wolfram gold, tantalite)
Tin	Metallic	Odo-Owa	Irepodun	Muscovite Schist	Abandoned	Pegm dyke (Tourmal
Columbite	Metallic	Sagbe	Ifelodun	Associated with pegmatite and pegmatite schist hosted within biotite gneisses	Abandoned pit noted	Pegm vein
Tantalite	Metallic	Arandun	Irepodun	Quartz Schist	Abandoned	Vein t

Tin	Metallic	Arandun	Irepodun	Quartz schist	Abandoned	Vein type (Tantalite)
Tantalite	Metallic	Olokin	Irepodun	Mica Schist	Abandoned at the instance of land owners and commodity price crash. 200m X 20m	Vein type
Tin	Metallic	Olokin	Irepodun	Mica schist	Abandoned	Pegmatite vein trending 90° (Tantalite, tourmaline, beryl.)
Tantalite	Metallic	Olokin	Isin	Pegmatite bodies with large quantity of milky quartz and k-feldspars.	Abandoned	Vein type

Tantalite	Metallic	Sagbe	Ifelodun	Associated with pegmatite and pegmatite schist hosted within biotite gneisses	Abandoned pit noted	Vein type	
Tantalite	Metallic	Eri-Alhaji	Ifelodun	Pegmatite and Granite.	Artisanal mining, surface and underground.	Vein type	
Tantalite	Metallic	Amalase	Irepodun	Quartz-Muscovite-Schist weathered into reddish clayey soil.	Abandoned	Vein type (Tourmaline, Beryl)	da ta wa pr fr mi ab yr
Tantalite	Metallic	Amalase	Irepodun	Quartz-Muscovite-Schist weathered into reddish clayey soil	Abandoned	Vein type	da ta wa pr fr ab

Tantalite	Metallic	Dogondaji	Pategi	Pegmatite Granite	Abandoned site	Vein type	e x
Tantalite	Metallic	Dina, Ndanaku	Pategi	Pegmatite, vein quartz/ granite	Active, Open cast	Vein type	1 d le
Tantalite	Metallic	Gbugbu	Edu	Amphibolite, gneisses and schistose.	Active artisanal mining	Vein type (Tin and columbite)	
Gold	Precious Metals	Kermanji	Kaiama	Iron rich schist with some biotite gneisses	Abandoned artisanal mining	Vein type	

Gold	Precious Metals	Gidan Sani	Edu	Gneisses and Schists.	Abandoned mine	Prin vein typ
Gold	Precious Metals	Koro	Ekiti	Pegmatite	Inactive	Ellu
Gold	Precious Metals	Elemere	Moro	Vein Quartz that is crushed, ground, washed to produce gold.	Prospect	Vei
Gold	Precious Metals	Ologomo	Ifelodun	Amphibolites, Schist, Granite Gneiss.	Lease applied. No prospect active mining. Pitting, 150 X300	Vei elluvial alluvial
Gold	Precious Metals	Agboro Oputa	Pategi	Hornblende granite	No active mining now.	Prin vein
Beryl	Precious Stone	Olokin	Irepodun	Mica Schist	Abandoned	Peg vein trendin
Beryl	Precious Stone	Amalase	Irepodun	Quartz-Muscovite-Schist weathered into reddish clayey soil	Abandoned	Vei (Tantali and tourma
Wolframite	Specialty Metals	Kaiama	Kaiama	Mineralization hosted in 2 major		

quartzo-feldspatic veins within schistose rocks and gneisses	Active artisanal mining	Vein type (Gold and Tantalite)	N/A	Exploration of resources required to estimate reserve as the nature of mineralization and mining method does not allow for proper estimation. Covered an area of more than 100m radius and depth being mined 4- 6m

Source:(Dada and Ajadi, 2017