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## Challenges and prospects of mining of solid mineral resources in Taraba State, Nigeria

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The mining of solid mineral resources is a key driver to economic growth and development. Taraba state is one of the states in Nigeria that is well endowed with different kinds of solid mineral resources that is untouched and yet to be prospected. Some of these mineral resources have been explored and worked on in the past decades. Mining in Taraba state is dominated by artisanal and small scale miners. The aim of this paper is to discuss some of the challenges of mining of solid mineral resources in Taraba State and the prospect of the sector. Data for this study were generated through secondary (desk) research, to identify existing literature on the mineral resource potentials of the state and past mining activities in the area. Primary data generated from field observations and interviews were also used. The findings of the study show that large quantities of this mineral ore deposits have been mined out in the state resulting in large numbers of abandoned mine sites as a result of past mineral exploration /exploitation in the form of test pits, lots and open ponds. The Federal Ministry of Mines and Steel Development reported 192 titles issued out from Taraba state in 2012 and 77 in 2015. Some of the challenges include the fact that most of the mineral occurrences were just reported. Real evaluation of the grade of mineral ore or the reserve estimates were never carried out. Most of the mining operations were illegal and not known to government officials. This makes it difficult for the government to monitor their operations and also to enforce environmental regulations on them. Other challenges include lack of mining equipment, predominance of artisanal and small scale miners, poor technical capacity, lack of capital, poor database, poor infrastructures and accessibility among others. Presently, the Federal government is working hard to simplify the process of acquiring mining licence by creating an online web portal to facilitate the application and payment process. It is expected that with improvement in the mining policy in the country, more companies and individuals would apply for mining licence in the state. Based on the findings of the study, the following recommendations were made; provision of capital by way of soft loan, tax holidays for mining firm and synergy between Federal Ministry of Mines and Steel and the State Bureau of Solid Mineral Resources.

**Key words:** Mining, prospect, solid minerals, Taraba State

### INTRODUCTION

Mining industries have been viewed as key drivers of economic growth and the development process (Bradshaw, 2005) and as lead sectors that drive economic expansion

which can lead to higher levels of social and economic wellbeing (Bridge, 2008). The economic investment opportunity in the solid minerals sector is enormous,

considering the expansive areas of explored mineral potential as a result of over reliance on petroleum revenue. Previous studies have shown that solid mineral exploitation constitutes more than 1% of Nigeria's GDP as most of the mining activities are still mainly carried out by the informal sector with over 95% of mining activities carried out by artisanal and small scale miners, out of which 95% are illegal (Uzoka, 2001). The Federal Government generate large revenue from mining activities from mine license fees, mining permits, rents and royalties from mining companies. This money is deposited in special accounts and later shared among the different states of the Federation in Nigeria.

Artisanal and small scale mining of solid mineral resources is one important livelihood activity that can help to reduce poverty and achieve rural economic renewal through the development of non-farm income generating opportunities. The vast economic potentials of the mining sector in Nigeria where government holds all mineral rights has been widely reported (Merem et al., 2017). Mining of mineral resources is under the exclusive list of the Federal Government of Nigeria and no State or Local council has right to explore, prospect or exploit mineral resources found in their territory without licence from the Federal Government.

This development made many transnational mining companies (TMCs) to withdraw their financial and technical participation from Nigeria and other countries that adopted a similar policy (Gbite, 2004). Thus, the mining sector in Nigeria has been characterized over the years by failed policies, underinvestment, neglect and stagnation. The sector was practically collapsing as a result of dominance of artisanal, small scale and illegal miners whose activities made very little, if any, impact on Nigeria's GDP (Gbite, 2004). Nigeria loses huge amount of money to illegal mining of solid mineral resources. It was alleged that two companies robbed the country of over ₦100 billion while the total loss was put at about ₦400 billion in 2017.

In its effort to revive the sector, the Federal Government of Nigeria introduces a lot of reforms in the solid mineral resource sector which culminated in the 2007 Minerals and Mining Act. The Act vests entire right 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 (Gbite, 2004). This provisions of the Act are a reflection of the 1999 Constitution of the Federal Republic of Nigeria. The Mining Act has not reduced significantly the activities of illegal miners in the country. Most of the illegal miners are uneducated and doesn't understand the rudiments of applying for mining licence which is usually from the Federal Ministry of Mines and Steel development, located in Abuja, the Federal Capital Territory.

Taraba state is one of the states in Nigeria that is well endowed with different kinds of solid mineral resources that is untouched and yet to be prospected. Some of these mineral resources have been explored and worked on in

the past decades. With the present drive of the Federal Government of Nigeria for diversification of the economy, emphasis is shifting towards agricultural and solid mineral resource development among others. Mining in Taraba state is dominated by artisanal and small scale miners (informal mining activities undertaken by individuals or groups who rely heavily on manual labour, using simple implements and methods). The small scale and artisanal miners' and the large scale industrial miners indiscriminately carryout extensive mining activities without any consideration to the environment and other users. These mining operations are mostly surface mining carried out with little or no advanced technology to manage the environment degraded by the mining operations (Oladipo, 2006). Increasing environmental damage is made worst by the fact that most of the miners undertake their operations illegally and have no official permission and their areas of operations are not known to government officials (Ahmed, 2013). This makes it difficult for the government to monitor their operations and also to enforce environmental regulations on them. This makes it necessary to appraise the solid mineral potentials of the state, the challenges and prospects of exploiting this mineral resources for the development of the state.

## MATERIAL AND METHODS

### Description of Study Area

The geology and geological history of Taraba State is rather complex. Taraba State is underlain by Basement Complex and sedimentary rocks, each occupying a very distinctive part of the state (Oruonye and Abbas, 2011). The Basement Complex rocks occupy the greatest part of the state (above 80%), while the sedimentary rocks are found along the valleys of River Benue and its major tributaries such as Rivers Donga and Taraba. The Basement Complex rocks are Pre-Cambrian while the Sedimentary rocks date back from Albian to recent (Jeje, 1978). The undifferentiated Basement Complex rocks comprising of gneisses, migmatites, phyllites, schists and pegmatites cover a greater part of the Basement Complex area. The undifferentiated Basement Complex rocks, particularly the migmatites, generally vary from coarsely mixed gneisses to diffused textured rocks of variable grain size and are frequently porphyroclastic (Macleod et al., 1971). This rock unit constitutes principally the undifferentiated igneous and metamorphic rocks of Precambrian age (Grant, 1971).

The Pan African Older Granites are equally widespread in the area. They occur either as basic or intermediate intrusives (Turner, 1964). Different kinds of textures ranging from fine to medium to coarse grains can be noticed on the Older Granites (McCurry, 1976). Other localized occurrences of minor rock types include some doleritic and pegmatitic rocks mostly occurring as intrusive dykes and vein bodies (Oruonye and Abbas, 2011). These occurrences are common to both the undifferentiated

Basement Complex and the Older Granite rocks (Carter et al., 1963; McCurry, 1976). The Tertiary basalts on the other hand are found in the Mambila Plateau mostly formed by trachytic lavas and extensive basalts which occur around Nguroje (du Preez, 1965).

Between early Cretaceous and recent times, the Basement Complex area was subjected to repeated regressions and transgressions which led to the deposition of the sedimentary rocks (Ogezi, 2002). The earliest of this belongs to the Albian period. These rocks are partly terrestrial, marine, deltaic, estuarine, lagoonal and fluvio-marine in origin (Jeje, 1978). They consist mainly of poorly bedded grits, conglomerate, sandstones, shale, clay, mudstone etc.

The sedimentary rocks of the state belong to the sub group of the Middle Benue Basin/trough or Makurdi and Wukari Basins, which is one of the rocks of the sedimentary series that covers about 50% of the surface area of Nigeria (Ogezi, 2002). Sedimentary materials filling the basins vary in thickness and often display complete single or multiple cycles of development characterized by basal continental facies overlain by marine facies and, in turn by continental sediments (Ogezi, 2002). This varied geologic rock types provide rich solid mineral resource potentials for the state.

### Methods of Data Collection

The data used in this study were generated through secondary (desk) research, to identify existing literature on the mineral resource potentials of the state and past mining activities in the area. This include information from archival records of relevant government agencies and organizations such as the Federal Ministry of Mines and Steel Development in Jalingo and State Bureau of Solid Mineral Resources. Primary data were also generated from field observations and interviews also used. Interviews with staff of the Federal Ministry of Mines and Steel Development and State Bureau of Solid Mineral Resources in Jalingo town as well as with some traditional leaders and renowned licenced small scale miners in the state were carried out to obtain additional information required for the study. Field visit to some mining sites in the state was carried out during which recording of observations was made. Data were analyzed using simple frequency tables and percentages.

## RESULTS AND DISCUSSION

### Solid Mineral Resources Potentials

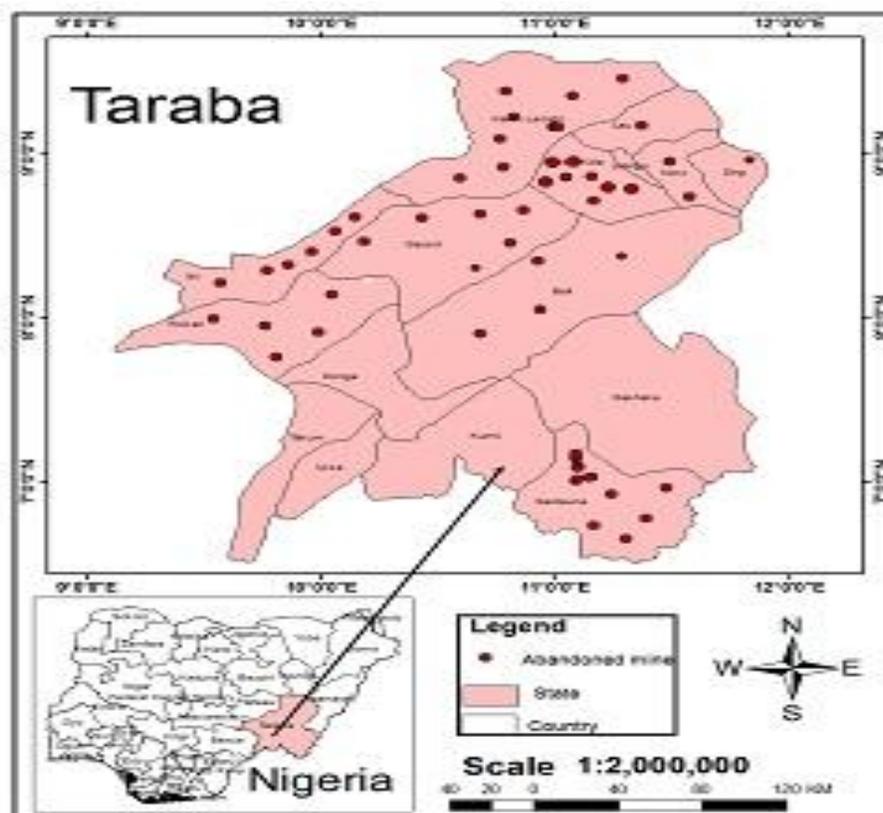
Taraba State is blessed with over 52 solid mineral resources distributed across the state. The State is richly endowed with mineral resources on account of the varied geologic rock types. Preliminary surveys by the State Bureau of Solid Mineral Resources and Nigerian Geological Survey Agency have shown the existence of large deposits of different mineral resources. Columbite and cassiterite

has been worked at Serti in 1949, however, existing potential is yet to be evaluated but field sample have been collected for exhibition. Galena deposits was worked on at Arufu in Wukari LGA in the 1940s and many parts of the state to date. Palladium was obtained in samples of galena collected from Karim Lamido LGA. The chemical analysis of the galena yielded 4% Palladium content. Barite ore have been commercially produced in Ibi and Karim Lamido LGAs since 1990 to date. The S.G. ranges from 4.0–4.5 and at depth. Over 7.5 million tonnes of barite was reported in Taraba and Bauchi states (Auwal, 2016). It occurs with sulphides such as galena, azurite and malachite. However, the reserve is yet to be determined. Calcite minerals was also found in Bali, Ibi, Karim Lamido, Lau, Wukari, Yorro LGAs. The mineral has been sampled, tested and found to contain higher or equal to 80%  $\text{CaCO}_3$ . In similar manner, Limestone deposit was equally reported in Ardo Kola, Ibi, Karim Lamido, Wukari LGAs with large occurrence in Lau LGA. The mineral has been sampled, tested and found to have high  $\text{CaCO}_3$  content of greater or equal to 70%. Graphite was found in Gashaka and Kurmi LGAs. Samples have been tested and found to contain 95% graphite carbon on beneficiation and has recovery of 80% with separation efficiency above 70% (Department of Solid Mineral Resource, 2005). Kaolin deposit was reported in commercial quantity in Bali, Donga, Lau, Gassol, Sardauna, Takum, Ussa LGAs. Brines (salt spring) for producing salt locally exist in Akwana and Arufu in Wukari and Karim Lamido LGAs and has long history of production in the areas.

Large quantities of sapphire gemstones have been exploited through illegal mining operations from Sardauna, Takum and Karim Lamido LGAs in the state. The Blue sapphire gemstone from Mambilla plateau have been traded in different parts of the world including Thailand and Sri Lanka over the years at very high prices (Oruonye, 2015). One stone was reportedly sold for more than 1 million US dollars in Thailand (Pardieu et al., 2014). The Gem merchants were reportedly said to be very excited by the quality and size of the stones produced from the state. Large clean stones were reported to weigh between 100 and 300 carats with nice blue color (Oruonye, 2015). Uranium ore deposits have been found in Lau, Yorro and Zing LGAs. Investigations by the Nigerian Uranium Mining Company (NUMCO) in 1980s obtained as reserve estimate of 52 metric tonnes in one site that was investigated in details (Oruonye and Ahmed, 2017). All other prospects are yet to be evaluated. The uranium reserve at Mika was put at about 52T eU. The grade was 0.63% eU, at depth of 130m (Siyan, N.D).

There are about 189 abandoned mine and quarry sites (Figure 1) recently identified by the authors in an ongoing research in the state, while an inventory of quarrying and mining titles in Nigeria in 2012 by the Federal Ministry of Mines and Steel Development reported 182 titles issued out from Taraba state and 10 under consideration amounting to 192 titles (Table 1).

Of the 182 mining lease and titles issued out from Taraba State, 172 were from 4 LGAs, Ibi (40), Karim Lamido (44),



**Figure 1:** Abandoned Mine and Quarry Sites in Taraba State

**Table 1.** Mining Leases in Taraba State

S/No.	Type of Title	Number	Type of Mineral
1.	Mining lease	42	Barites
2.	Mining lease	7	Gemstone
3.	Exclusive Prospecting licence	104	Barytes
4.	Exclusive Prospecting licence	27	Gemstone
5.	Exclusive Prospecting licence	2	Limestone
6.	Under consideration	10	
7.	Total	192	

Source: MSMD (2012)

**Table 2.** Mining Title in Taraba State (2015)

S/No.	Type of Title	Number
1.	Mine lease	6
2.	Quarry Lease	14
3.	Small Scale Mine Lease	18
4.	Exploration Lease	39
5.	<b>Total</b>	<b>77</b>

Source: MSMD (2015)

Sardauna (37) and Wukari (51). In 2015, there were 77 mining titles reported in the inventory of quarrying and mining titles issued by the Federal Ministry of Mines and Steel Development from Taraba state as shown in Table 2.

Findings of the study shows that large quantities of mineral ore deposits have been mined out in the state and large numbers of abandoned mine sites exist as a result of past mineral exploration /exploitation in the form of test pits,

lots and open ponds. Despite this large potentials, most of the mineral occurrences were just reported. Real evaluation of the grade of mineral ore or the reserve estimates were never carried out (Department of Solid Mineral Resource, 2005).

### Challenges of Mining in Taraba State

i. **Inconsistency in government Regulations/Policies** –most of the miners lacked good understanding of the Nigerian mining regulations and process of acquiring mine licence. This makes it difficult for them to seek for mining licence and engage in illegal mining of the few sites in the state. This is made worse by frequent changes in this policies and regulations over the years.

ii. **Inadequate mineral exploration equipment** - geophysical survey equipment that will help to determine the quantity and commercial viability of the mineral deposit is usually lacking. This makes it difficult to ascertain the deposit of such minerals and commercial viability.

iii. **Economic factor** - fluctuation in the prices of mineral resources which leads to sudden drop in the prices of mineral products could lead to abandonment of mining activities. Many other mines were abandoned as a result of insufficient minerals in the area, while others were abandoned when it was discovered that the mining is becoming unprofitable.

iv. **Predominance of Small Scale miners** - the mining landscape of the state is dominated by small and artisanal miners most of whom lack the required capital and equipment to carry out sustainable mining activity. Thus, the uncoordinated and uncontrolled occupation of mine sites by small scale and artisanal or illegal miners in Nigeria (who usually practice seasonal mining)(Ashawa, 2007) constitute a serious challenge to mining.

v. **Poor Technical capacity**–Miners lacked the required modern equipment to mine the deposits. Thus, some abandoned mine sites have rich mineral deposits sites that could be profitably exploited in the future.

vi. **Conflicts** - communal conflicts and clashes between crop farmers and cattle herders, also between miners and farmers, different ethnic and religious groups among others has led to the abandonment of mining sites as observed in Ibi and Sardauna LGAs.

vii. **Environmental** - these includes: unused open pits, deforestation, degraded landscape, mine shafts, impoverished soils, degradation and contamination of groundwater; pollution of surface water by sediments or overburdens, changes in groundwater regime, air pollution from dust or toxic gases and risk of falls into open pits, contamination of soils and aquatic sediments among others.

viii. **Proliferation of unreclaimed abandoned mine sites in the state**

ix. **Inaccessibility of sites** - Most mine sites were located in remote and inaccessible locations by any means of transportation. This will require long trekking for several kilometres and hours through bush path which will amount to more time and cost. This is made worst by poor

infrastructural development of the state. Thus limiting the exploitation of potential minerals in the state.

x. **Poor database.** There is insufficient information on the location of most solid mineral deposit sites especially those carried out illegally. This include lack of data on mineral estimates, viability and cadastral maps.

xi. **Lack of capital** - most local small scale mining firms lack the financial capital to acquire mining equipment. This limits them to use of simple tools and equipment which undermine their capacity to maximise their production. The Federal Government in recognition of this approved ₦5 billion capital to the solid mineral sector to boost production in the sector.

xii. **Problem of local communities.** Local communities are becoming very conscious of movement of strangers into their communities because of the recent security challenges in the state and region particularly between the herdsmen and farmers. Getting the cooperation of local communities are becoming serious challenges to small scale mining firms.

### Prospects of Mining in Taraba State

Findings from the study revealed that there are some small scale and artisanal mining that are not illegal contrary to previous speculations by some scholars. There is now an appreciable awareness among the small scale and artisanal miners and the mining communities that you cannot exploit a mineral resource without an approved mining licence/lease from Federal Ministry of Mines and Steel Development. Most of the small scale and artisanal miners on discovering a mineral deposit will look for a mining firm or individual who has a mining licence to lease the area of deposit (mine) to him. Most communities are becoming more conscious of protecting the mineral resources in their communities. The approved mining licence is the only document that allows the prospective miners the right to exploit the mineral deposit and the people's cooperation in this regard. One of the conditions of obtaining a mining lease or licence is payment of compensation of property to local communities. The Federal government is working hard to simplify the mining licence acquisition process by creating a web portal online to facilitate the application and payment process. It is expected that with improvement in the economy of the country, more companies and individuals would apply for mining licence in the state.

### Conclusion

This study has examined the challenges and prospects of mining of solid mineral resources in Taraba State. The Findings of the study shows that there are large deposits of different mineral resources in the state. These mineral ore deposits have been worked on over the years with large numbers of abandoned mine sites. Despite this large potentials, most of the mineral occurrences were just reported. Real evaluation of the grade of mineral ore or the

reserve estimates were never carried out. The study findings show that some of the challenges of mining in the state include lack of mining equipment, predominance of artisanal and small scale miners, poor technical capacity, lack of capital, poor database, poor infrastructures and accessibility among others. With the present effort of the Federal government to simplify the mining licence acquisition process it is expected that more companies and individuals would apply for mining licence in the state. This would increase productivity and contribution of the sector to the economy.

### Recommendation

Based on the findings of the study, the following recommendations were made;

1. There is need for synergy between the Federal Ministry of Mines and Steel and the Taraba State Bureau for Solid Mineral resources. This is important since mining is under the Federal exclusive legislative list and mining involves taking over lands in the states.

2. Severe sanctions should be meted to individuals/groups and organizations that operate and abandoned a mine or quarry site without proper reclamation as stipulated in the new mining guidelines of 2007.

3. There is need for exemption from payment of customs and import duties in respect of plant, machinery, equipment and accessories imported specifically and exclusively for mining operations. The Federal Government should grant waiver on mining equipment importation as was done between 1999 – 2003.

4. There is need to provide incentive to the solid mineral sector by way of tax relief for a period of time.

5. The Ministry of Mine and Steel Development should provide mining equipment on soft loan to artisanal miners as practice in Federal Ministry of Agriculture.

6. Rigorous licence application procedures should be reduced or avoided to allow small scale miners to acquire mining licence on time to reduce the issues of illegal mining.

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### Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

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