Solid Mineral Deposits of Nigeria: Potentials, Challenges and Prospects

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Abstract

Nigeria is endowed with abundant mineral resources including gold, iron, lead, zinc, rare metals (SnNbTa), coal and gemstones which could be harnessed for its development. These mineral deposits were formed at different stages in the geological evolution of Nigeria. Sadly, despite this mineral endowment, the country's mineral sector has failed to meet public expectation of driving economic growth and generating employment to the teaming youth. Presently, the sector contributes less than 1% to the nation's annual GDP. Paradoxically, the country is so much endowed yet so poor! This abnormality can be attributed to overdependence on oil, political instability, poor legal, regulatory and institutional framework and lack of up to date geosciences data that can facilitate investment decision making. In this paper, we attempt to synthesize all the available data on Nigerian mineral resources including their geological setting, style of occurrences and highlight some new policies currently being promulgated by new government in order to woo key foreign investors who could be interested in investing in this vast, but yet grossly untapped mineral resources. In a broad sense, four important metallogenic and gemological "Eras" related to the formation of important mineral deposits corresponding to Paleoproterozoic, Neoproterozoic Mesozoic and Cenozoic have been identified in Nigeria. The Paleoproterozoic synformational schist belts which resemble the Archean greenstone belt are associated with orogenic gold, manganese and Alogoma type banded iron formation. The Neoproterozoic Pan-African orogenic cycle related to amalgamation of western Gondwana culminated with the formation of some mineralized pegmatite fields in Nigeria. This broad pegmatite belt also refers to as "the Older Tin Belt" is rich in Sn, Nb, Ta and world class gemstones including tourmaline, aquamarine, kunzite and spessartine garnet. The emplacement of silica saturated A-type granites (the Younger Granites) generally believed to be roughly coeval with the opening of the Atlantic Ocean in Jurassic, led to the formation of significant Sn-Nb-W mineralization and gemstones (emerald, topaz and fluorite). The Cretaceous Benue Trough in eastern Nigeria which forms the western part of the west and central African rift system (WCARS), hosts significant lead-zinc-barite mineralization and coal. Several tons of lead, zinc and barite have been mined from this rift basin. The Cenozoic alkaline volcanic rocks in Nigeria, like their counterparts in southeastern Asia, eastern Australia are also associated with some significant quality sapphire fields. Notable among these sapphire fields is the Mambilla sapphire field in northeastern Nigeria. As a new turnaround, a strategic roadmap has been put down by the present government aimed at providing up-to-date geosciences data and information, promulgating strong legal framework and creating conducive environment for foreign investors. This roadmap if vigorously pursued, thoroughly implemented and religiously sustained will significantly revamp the mineral sector and consequently improve revenue generation from the sector for better economic growth and development. The Nigerian mineral sector will be able to contribute at least 10% to the country's annual GDP.

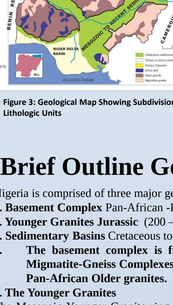

Fig. 1: Location of Nigeria on the political and Geological Map of Africa

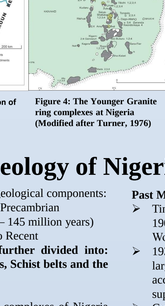

Figure 2: Geological Map of Nigeria

Figure 3: Geological Map Showing Subdivision of Lithologic Units

Figure 4: The Younger Granite ring complexes at Nigeria (Modified after Turner, 1976)

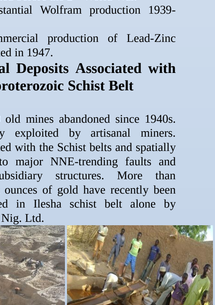

Figure 5: Geological Map of Nigeria Showing the Distribution of the Major Mineral Deposits from Obaje, (2009)

Brief Outline Geology of Nigeria and Minerals

Nigeria is comprised of three major geological components:

1. Basement Complex Pan-African -Precambrian

2. Younger Granites Jurassic (200 – 145 million years)

3. Sedimentary Basins Cretaceous to Recent

1. **The basement complex is further divided into: Migmatite-Gneiss Complexes, Schist belts and the Pan-African Older granites.**

2. The Younger Granites

The Mesozoic Younger Granite ring complexes of Nigeria form part of a wider province of alkaline anorogenic magmatism extending from Northern Niger Republic to South Central Nigeria. More than 50 complexes occur in Nigeria (Obaje, 2009).

3. Sedimentary Basins

The Cretaceous to Recent Basins in Nigeria include: Anambra Basin, Benue Trough, Bida, Bornu, Niger Delta and Sokoto Basins.

Major Minerals

Metallic Minerals

Tin, Columbite, Tantalite, Lead-Zinc. Manganese, Uranium, Iron ore

Precious Metals

Gold

Precious Stones

Rubby, Sapphire, Beryl, and other Gemstones

Industrial Minerals

Limestone, Baryte Kaolin, Gypsum e.t.c.

Past Mineral Production

- Tin (Cassiterite) production started in 1905 and up to 1972, Nigeria was the World's 6th largest producer.
- 1933-1965 Nigeria was the world's largest exporter of Columbite, accounting for about 95% of total world supply.
- Coal production started in 1915 and was the main energy source until 1960.
- Gold production started in 1913 and peaked before the 2nd World War.
- Substantial Wolfram production 1939-45.
- Commercial production of Lead-Zinc started in 1947.

Mineral Deposits Associated with Paleoproterozoic Schist Belt

Gold

Over 20 old mines abandoned since 1940s. Currently exploited by artisanal miners. Associated with the Schist belts and spatially related to major NNE-trending faults and their subsidiary structures. More than 1million ounces of gold have recently been delineated in Ilesha schist belt alone by Segilola Nig. Ltd.

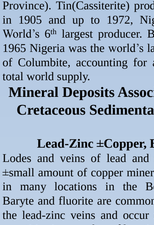

Figure 6: Geological Map of Nigeria Showing Mineral Provinces

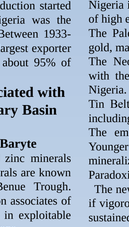

Figure 7: Distribution of the Major Mineral Deposits

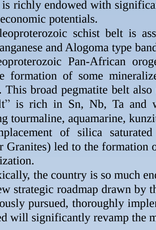

Figure 8: Gold artisanal miners in NW Nigeria

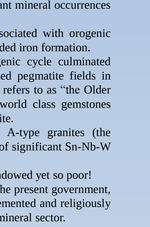

Figure 9:Local Processing of gold in Zamfara State, Northwestern Nigeria

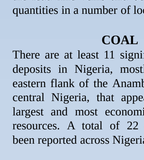

Figure 10: Statistic of Gold Production in Nigeria

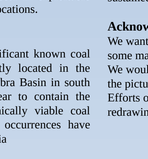

Figure 11:Manganese Deposits in Kebbi State, Northwestern Nigeria

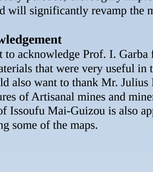

Figure 12:Ruby From Taraba, Northeastern Nigeria

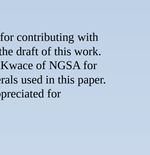

Figure 12:Beryl From Taraba, Northeastern Nigeria

Iron ore

Widespread occurrence of BIFs in the schist belts with grades seldom exceed 40% Fe. Purer iron ores are interbedded among basement gneisses in the Okene-Lokoja area, which are probably older relics, perhaps correlated with the ores in Liberia and Guinea.

- 150 MT (approx.) of 30-50% Fe reserve have been proved in Itakpe hills.
- Larger reserves of iron ore are found in the oolitic ores of the Agbaja plateau with higher grades but also higher content of deleterious phosphorous.

Mineral Deposits Associated with Neoproterozoic Pegmatites

Columbite-Tantalite (Coltan) ±Tin

- Nigeria was the largest producer in Africa in recent times (1995-2003).
- Between 40,000 and 70,000 lb/yr produced, by artisanal miners. Widespread deposits and occurrences in central and western half of Nigeria. Mostly coincident with the goldfields.
- The Neoproterozoic Pegmatites are also associated with the gemstones.

Mineral Deposits Associated with Mesozoiczoic Anorogenic Granite

Sn+Nb±W

Tin, Columbite, Pyrochlore in Mesozoic Ring Complexes of the Jos Plateau and surrounding regions (Younger Granite Province). Tin(Cassiterite) production started in 1905 and up to 1972, Nigeria was the World's 6th largest producer. Between 1933-1965 Nigeria was the world's largest exporter of Columbite, accounting for about 95% of total world supply.

Mineral Deposits Associated with Cretaceous Sedimentary Basin

Lead-Zinc ±Copper, Baryte

Lodes and veins of lead and zinc minerals ±small amount of copper minerals are known in many locations in the Benue Trough. Baryte and fluorite are common associates of the lead-zinc veins and occur in exploitable quantities in a number of locations.

COAL

There are at least 11 significant known coal deposits in Nigeria, mostly located in the eastern flank of the Anambra Basin in south central Nigeria, that appear to contain the largest and most economically viable coal resources. A total of 22 occurrences have been reported across Nigeria

Challenges facing Solid Mineral Development in Nigeria

- Low metal prices
- Depleted alluvial reserves (of tin and columbite),
- Inefficient State-owned corporations
- Unfavorable mining code
- Opaque and inefficient license administration system
- Prevalence of illegal mining
- Lack of adequate and reliable geoscience data
- Poor Management of the State Enterprise
- Excessive dependence on Petroleum Resources
- Policy Instability
- Lack of Credit and Financing
- Information on Minerals Mined

Current Mining Reform Strategy in Nigeria

- 100% Private sector ownership of Mining
- New Minerals and Mining Act (2007)
- Liberal and transparent access to mining rights
- Strengthening Geoscience data generation
- Competition for mining titles/rights on "first-come, first-served" basis.
- Removal of discretionary powers of government officials in mining title grant.
- Security of tenure of mining rights.
- Provision of the principle of "use it or lose it" in mining rights administration.
- Use of time limits for granting titles.
- Mining titles are transferable and amendable.
- Introduction of Community Development Agreement.
- Introduction of Mineral Resources and Environmental Management Committee in States to facilitate mining development

Conclusion

Nigeria is richly endowed with significant mineral occurrences of high economic potentials.

The Paleoproterozoic schist belt is associated with orogenic gold, manganese and Alogoma type banded iron formation.

The Neoproterozoic Pan-African orogenic cycle culminated with the formation of some mineralized pegmatite fields in Nigeria. This broad pegmatite belt also refers to as "the Older Tin Belt" is rich in Sn, Nb, Ta and world class gemstones including tourmaline, aquamarine, kunzite.

The emplacement of silica saturated A-type granites (the Younger Granites) led to the formation of significant Sn-Nb-W mineralization.

Paradoxically, the country is so much endowed yet so poor!

The new strategic roadmap drawn by the present government, if vigorously pursued, thoroughly implemented and religiously sustained will significantly revamp the mineral sector.

Acknowledgement

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