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BASE AND PRECIOUS METALS DEVELOPMENT IN NIGERIA: CHALLENGES AND PROSPECTS

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ABSTACT
Nigeria is endowed with enormous mineral occurrences and deposits these include Base and Precious metals minerals which have remained largely under developed due to Nigeria's preoccupation with its oil industry. Although these two groups of minerals have been mined since 1903 as evidenced by the existence of several abandoned colonial base and precious metal camps on the Jos Plateau , Sokoto, Kaduna, llesha and Calabar, the experience gained has not translated to modern mining as the case is for example with mines of South African, Ghana and Zambia. Whereas the proven tin reserves on the Jos Plateau stands at about 31,773 tonnes, that of Iron Ore is about 200 million tonnes with an estimated life-span of over 100 years. The commercial ore grades range in ferrous (Fe) content from rich ores with over 50 per cent Fe, mediurn grade ores (30 - 50 per cent Fe), to poor ores (25 - 30 per cent Fe). The iron ore is expected to feed the Ajaokuta Steel Plant and for the production of super-concentrates at 68 per cent Fe, for the Delta Steel Plant at Aladja near Warri. Lead and Zinc minerals occur in commercial quantities in the Benue Trough, in a narrow belt over 560 km stretching from Ishiagu in the south-east to Bauchi State. Small-scale mining has been carried out in Abakaliki area, where reserves of about 100,000 tonnes of lead and 80,000 tonnes of zinc have been estimated. Other major lead-zinc occurrences are found Ameka, Ameri in Ebonyi State, Arufu and Zurak in Taraba State. Columbite, the ore for niobium, occurs in association with tin deposits on the Jos Plateau, and in Bauchi and Kano States. Associated mainly with the schist belts of the western half of Nigeria, Gold in Nigeria is found in alluvial, eluvial and primary veins from several parts of the schist belts in the Northwest and Southwest Nigeria. The reserves of gold occur in Okolom/Kogi State, with grades from 1.0-36g/ton; Dogondaji/Kogi State with grade values from 1.0-75g/ ton; Waya/Kebbi State, with grade values 0.4 - 11g/ton amongst several others. These minerals are very strategic to the growth and development of the country especially with regards to the provision of much needed strategic metals and alloys for the manufacturing in Industries and for exports. Although there are high prospects for the development of bases and precious in Nigeria, currently there are no significant modern mining companies in the country and most mining activities are either small-scale or artisanal.

KEYWORDS: Base Metals, Precious Metals, Jewelry, Metal Stock Market, Return on Investments, Bullion. Commodity Market

INTRODUCTION

Base Metals: The term base metal is used informally in chemistry to refer to a metal that oxidizes or corrodes relatively easily, and reacts variably with diluted hydrochloric acid (HCl) to form hydrogen. Examples of base metals include iron, steel (an alloy of iron and other metals), copper, (Copper is considered a base metal as it oxidizes relatively easily, although it does not react with HCl. It is commonly used in opposition to noble metal), brass (an alloy of copper and other metals), nickel, lead and tin and zinc. In costume jewelry, base metals are often plated with a very thin layer of gold, silver, nickel or rhodium (en.wikipedia.org/wiki/Base metal). In mining and economics, base metals refer to industrial non-ferrous metals such as copper, aluminum, lead, nickel, tin and zinc (excluding precious metals).

Precious Metals: A precious metal is a rare, naturally occurring metallic chemical element of high economic value, which is not radioactive (excluding natural polonium, radium, actinium and protactinium) (en.wikipedia.org/wiki/Precious metal). Chemically, the precious metals are less reactive than most elements, have high lustre, are softer or more ductile, and have higher melting points than other metals. Precious metals that historically were important as currency are now regarded mainly as investment and industrial commodities. Gold, silver, platinum, and palladium each have an ISO 4217 currency code. The best-known precious metals are the coinage metals gold and silver. While both have industrial uses, they are better known for their uses in art, jewellery and coinage. Other precious metals include the platinum

group metals: ruthenium, rhodium, palladium, osmium, iridium, and platinum, of which platinum is the most widely traded (www.Gold.net).

The demand for precious metals is driven not only by their practical use, but also by their role as investments and a store of value. Historically, precious metals have commanded much higher prices than common industrial metals. In December 2009, gold was over $1200.00/troy ounce, (it later dropped only to rise in May 10, 2010, (with an all time leap of $11 dollars) and silver was about $15.00/troy ounce, compared to copper at $0.11/troy ounce and nickel at $0.36/troy ounce during the same period. As with most rocks and minerals, what makes one valuable is its rarity combined with desirability. Whereas metals are mineral, some are rarer and some are more beautiful than others. Among the precious minerals traded at precious metal exchanges the most recognized are gold, silver, platinum and palladium. However, copper and mercury can also be found there. Historically, precious metals became the basics for a monetary standard. Rare metals were (and still are) used in art, jewelry and in minting coins. Today, rare metals are also used in some electronics applications such as high reliability connectors and other scientific fields such as dentistry.

The Element Gold is defined as a soft, yellow, corrosion-resistant element, the most malleable and ductile metal, occurring in veins and alluvial deposits and recovered by mining or by panning or sluicing. Gold's many unique properties have secured it a central role in history and human development. Gold is a remarkable, rare metal, with an unparalleled combination of chemical and physical properties. A good thermal and electrical conductor, gold is generally alloyed to increase its strength, and it is used as an international monetary standard, in jewelry, for decoration, and as a plated coating on a wide variety of electrical, mechanical components, tablewares and dental alloys. . It is also the only metal that forms no oxide film on its surface in air at normal temperatures, meaning that it will never rust or tarnish.
The metals industry is not vertically integrated like other industries such as oil and energy. In the metals industry, the companies that mine the gold typically do not refine it, and refiners rarely sell it directly to the public. The industry encompasses three main types of firms:

Exploration: Mining exploration companies do not necessary posses large assets. They explore and prove that base and precious metals exist in a particular area. The only major assets owned by exploration firms are the rights to drill and a small amount of capital, which is needed to conduct drilling and trenching operations.

Development: Once a base and precious metal such as gold deposit is discovered by exploration companies, they either try to become development firms, or they sell their gold find to development firms. Development firms are those operating on explored areas that have proven reserves to be mines.

Production: Producer firms are full-fledged mining companies that extract and produce base and precious metals from existing mines; this production can range from a hundred thousand ounces to several million ounces of gold production per year. While there may be a lot of overlap between the basics of mining gold and silver, the primary focus of here is on the gold market. Silver is less valuable than gold, and, as such, it is usually discovered either by accident or as a byproduct of gold/lead/copper mining.

The industry is very capital intensive with relatively long gestation period of between five to fifteen years depending on type and mine capacity Long-term survival requires heavy expenditures to finance production and exploration. Each operator in the supply chain has its own strengths and weaknesses. Some companies do well at extracting the metal from the earth, some refine, while others smelt and transform the commodity into a finished product. Unlike other industries, companies in the mining industry come in all shapes and sizes. Much of the production is done by large Mining Majors also known as Blue Chip companies, but the exploration side of the industry is full of Junior and minor mining companies with lower asset bases. The mining industry has plenty of opportunities for speculators and other income investors (Mallo 2009).

In the precious metal stock market gold is a commodity, and, as such, the price for gold fluctuates on a daily basis in the commodity markets. Gold prices are influenced by numerous variables that include fabricator demand, expected inflation, return on assets and central bank demand. Gold is strongly pegged to supply-and-demand patterns. In general, low prices result in low production, and high prices result in high production. Market forces determine price. A company's ability to control costs is critical to maintaining financial health and production levels in the face of declining gold prices. (*www.goldquote.net*).

THE POLYTICAL ECONOMY OF BASE AND PRECIOUS METALS

The growth and technological advancement of Nations hinges to a large extent on their ability to harness available base and precious metals resources. Gold, like no other metal, has a fascinating history and a special place in the world. For thousands of years it has been used as an ornament of kings, a currency and standard for global currencies, and more recently, in a wide range of electronic devices and medical applications. To these groups of minerals does the development of infrastructure, science and technology, medicine etc of countries heavily rely thereby impacting on the Human Developmental Index (HDI) of countries of the World. The Human Development Index is a comparative measure of life expectancy, literacy, education and standards of living for countries worldwide. It is used to distinguish whether the country is a developed, a developing or an under-developed country, and is also used to measure the impact of economic policies on quality of life. (http://en.wikipedia.org/wiki/Human_Development_Index). These minerals by their strategic importance have influence on international politics and economy. To this effect, Africa which by divine intervention harbors about 30% of the planets strategic mineral reserves, including 40% of gold, 60% cobalt and 90% of the world's Platinum group metal (PGM) reserves has since pre-industrial revolution period remains the Industrialized Nations focal point for mineral development and exploitation by multinational Mining Companies.(Mallo 2009) To these minerals the economies of South Africa, Ghana, Zimbabwe, Tanzania, Zambia, Botswana, Sierra Leone and DRC are heavily dependent even as they dominate the African mining industry. Gold can be found in South Africa, Ghana, Mali, the Alaskan Yukon, California, and the Northwest Territory of Canada and in many of the former Soviet states. Mali is Africa's third largest gold miner behind South Africa and Ghana (Business/International: 2012). The mining of gold in Nigeria has only been in term of artisanal mining. Gold is found in alluvial eluvial placers and primary viens from several parts of supra -crustal(schist) belts(Ilesha, Maru, Anka, Kushaka) in the north -west, the basement complex of the and south -west(Illesha-egbe-isanlu), north -west(Minna-Birnin Gwari, Yauri,Anka and Maru) of of the country. Gold in Nigeria has two main forms of occurrences or type of mineralization; these are primary and alluvial mineralization Table 1.

Table 1: Metallic Minerals in Nigeria

S/N	MINERAL	LOCATION	ESTIMATED RESERVE	USER INDUSTRIES	EX-LOCATION	QUALITY
1	Gold	llesha (Osun State) Niger State ,Igarra (Edo State), Sokoto State Kaduna State, Kwara State		Jewellery and ornament industries	Most of the deposits are not exploited	
2	Lead-Zinc Ore (Galena)	Ririwai (Kano State) Zuru (Kebbi State Wase (Plateau State) Ababaliki (Enugu State) Ohaozara, Ishiagu (Abia) Bauchi, Kogi and Cross River States	1,200,000 (in Abakaliki) other deposits are yet to be analysed	Lead and Zinc for battery manufacturing and engineering industries	Most of the deposits are not being exploited	Lead (Pb) 70% Zinc (Zn) 29%
3	Iron Ore	Itakpe (Kogi State), Benue State, Sokoto State, Bauchi State, Borno State, Plateau State, Enugu State	2,500,000,000	Steel manufacture and engineering works	Steel manufacturing and steel rolling mills have been established to exploit some of the deposits.	
4	Columbite	Plateau State, Kaduna State, Buachi State, Kano State, Akwa-Ibom State		Used for producing special steels, ferro-alloys, electronics tube filaments (in rocket and aircraft	Small quantities are being exploited. Level of exploitation is < low.	High grade

				manufacture)		
5	Ilmenite	Jos, Plateau State, Abakaliki in Enugu State		Production of titanium dioxide pigment, and in steel industries	Lack of appropriate technology that can convert ilmenite proven on the Jos Plateau	
6	Cassiterite	Jos, Plateau State, Kwara, Benue, Niger and Ondo States		Tin plating, hardening of copper and lead in alloys	Partial exploration and exploration	High grade
7	Uranium	Ammunition, defense industries, generating electricity			Very low exploration, investigation and exploitation	
8	Copper	Rishi (Bauchi) Zakare, and Banki in Kano State		Used in ammunition, communication and steel industries	Detailed exploration and evaluation required	
9	Molybdenite	Kigom, Plateau State and Ondo States		Special steel , radar equipment, chemical and paint industries	Detail exploration and evaluation required	
10	Manganese		Kaduna, Niger and Sokoto States	Special steel alloys abrasives, etc	Lack of detailed exploration and development	
11	Wolframite	Electrical and electronic industries	Plateau and Kaduna States	Special and electronic industries	More detailed exploration and evaluation needed	Good quality
12	Rutile and Diorite	Plateau and Kaduna State		Used in stainless and special steel for military hard wares, also as fillers	Lack of detailed investigation	High grade

Source: Mallo (2007)

Silver comes from Norway, Mexico, Chile, Ontario), Australia and Colorado. The largest blocks of silver come from Aspen, Colorado, but the greatest quantity is mined from the Guanajuato mine in Mexico. Silver can also be found in the island of Sardinia.

Platinum is found in rivers running down the Urals. Deposits are also found in Canada, South Africa, Colombia, Peru and the United States. Palladium is mined in South Africa, Russia, Ontario and Montana (Mallo, 2009).
The monetary values of Precious Metals like gold and silver have been in the past very important because the currencies of Nations were backed by their gold reserves. *Specifically* up until about 40 years ago all world currencies were pegged to the gold standard. It means anyone could take his money to a bank and come out with gold. As a consequence a country's central bank could only print money to the extent it had enough gold in reserve to back it up. But this all changed in 1971 when paper-money was deemed as trustworthy as gold (www.Gold.net). There has been a recent trend of world economies is to "diversify away from US dollar investments". In other words, world economies are losing faith in the dollar because the US finances its trade imbalance by printing more and more bills. China and India are huge exporters and holders of US currency are both avid buyers of gold. In India and China , gold is a keeper whereas dollars are not. Ultimately the two fastest growing economies may set the standard and history as to which asset will measure wealth and so far gold comes well ahead. (Giuseppe, 2007).

Although the strength of the currencies of Nations is now backed by a country's gross domestic production, investing in precious metals remains the most stable means of countering inflations hence very relevance in national and international economics. For the last several years, the consumption of gold, silver, platinum and

palladium has far exceeded its production. This is coupled by the fact that the market price of these precious metals has been kept relatively down by the selling of gold reserves by central banks. In addition to this, rich foreign investors from developing countries have been increasingly looking for an investment to store away their personal wealth. It would take a global recession to slow the demand for gold and other such precious metals. Precious metals have long been looked to as the repositories of *absolute value*--not the relative value of paper currency.

When most people think of investing in gold and precious metals, they think of bullion (bars and wafers). Although many people do invest in bullion, there are investments in many different forms. Precious metal investments can be made in jewelry, coins, bullion, futures, options, mining stocks (Table 2), or mutual funds. In this sense, they have tremendous liquidity especially with regards to gold and can be bought and sold without problems. Many investors chose to own securities that deal with precious metals, especially in the mining and processing aspects of the industry. Still others invest in precious metal mutual funds. These precious metals differ from industry or base metals because they keep their value historically at much higher prices than more common metals. Precious metal dealers are located worldwide and various ETFs (exchange traded fund) constantly update the latest market prices. . While there are nearly a dozen precious metals, the most commonly traded are gold, silver and platinum. Other precious metals that are not heavily traded are ruthenium, palladium and iridium. Table 2 shows the top 10 Precious Metal Stocks as at March 2010 with the highest short Interest as a percentage of the total shares outstanding.

Table2. Top 10 Precious Metal Stocks Trading with Highest Short Interest: HL, CDE, FCX, AEM, RGLD, JAG, SWC, GSS, KRY, SSRI (Mar 18, 2010

S/N	*Company*	*Highest Shortest Interest %*	*No of Cover Days Calculated as current Shortest Interest divide by average Daily Volume*	*Ranking in the Segment of Metal Stock Market*
1	*Hecla Mining Company (NYSE: HL)*	*14.2*	*2.12*	*1st*
2	*Coeur d'Alene Mines Corporation (NYSE: CDE)*	*8.3*	*9.1*	*2nd*
3	*Freeport McMoRan Copper & Gold Inc(NYSE: FCX)*	*5.5*	*0.94*	*3rd*
4	*Agnico –Mines LTD(USA) : (NYSE: AEM)*	*5.1*	*2.45*	*4th*
5	*Royal Gold Inc (NASDAG: RGLD)*	*4.8*	*3.15*	*5th*
6	*Jaguar Mining Inc. (NYSE: JAG)*	*4.5*	*3.68*	*6th*
7	*Stillwater Mining Company (NSYE: SWC)*	*4.2*	*2.38*	*7th*
8	*Goldenstar Resource Ltd (USA) (AMEX: GSS)*	*2.7*	*2.18*	*8th*
9	*Crystallex International Cor. (USA) (AMEX:KRY)*	*2.3*	*1.82*	*9th*
10	*Silver Standard Resource Inc.(USA) (NASDAG;SSR)*	*2.1*	*1.12*	*10th*

Source: Mallo 2012; Developed from en.wikipedia.org/wiki/Base metal

Precious metals in bulk form are known as *bullion*, and are traded on Commodity Markets. Bullion metals may be cast into ingots or minted into coins. The defining attribute of bullion is that it is valued by its mass and purity rather than by a face value as money. Precious metals are stable in times of worldwide uncertainty, or when the economy is bad. Used correctly, they can be an effective component of a diversified investment portfolio, but remember, they are an investment like any others, and have an element of risk (albeit more

modest). It's essential to achieve the proper mix by investing in Precious Metals. Worth noting is that Monex Precious Metals is America's billion dollar buy and sell market for bullion and precious metal trading and coin investing.

Many nations mint bullion coins. Although nominally issued as legal tender, these coins' face value as currency is far below that of their value as bullion. For instance, Canada mints a gold bullion coin (the Gold Maple Leaf) at a face value of $50 containing one troy ounce (31.1035 g) of gold—as of July 2009, this coin is worth about $1,075 as bullion. Bullion coins' minting by national governments gives them some numismatic value in addition to their bullion value, as well as certifying their purity (www.Gold.net). The weight of gold ingots varies from a mere gram to several kilograms; the "London Good Delivery Bar" weights in at 400 ounces, or 12.5 kilos. At today's price, each bar is worth nearly $400,000 (www.gold.net) .Many factors determine the price of gold, but it really but the driving market force is supply and demand. Demand typically does not fluctuate too much, but supply shocks can send prices either soaring or into the doldrums. The Spot price of gold is $1156.1 an ounce, while the total amount of gold in the world is 165,446 tones, the total value of all the gold in the world is put at $6,149.541, 474,138 bringing the value of gold person at $919(www.Gold.net).

The difference between production costs and the futures price for gold equals the gross profit margins for mining companies. Therefore, the second deciding factor is the cost of production. The main factors to look at are the following:

Location - Political unrest in developing nations has ruined more than one mining company. Developing nations might have cheaper labor and mining costs, but the political risks are huge.

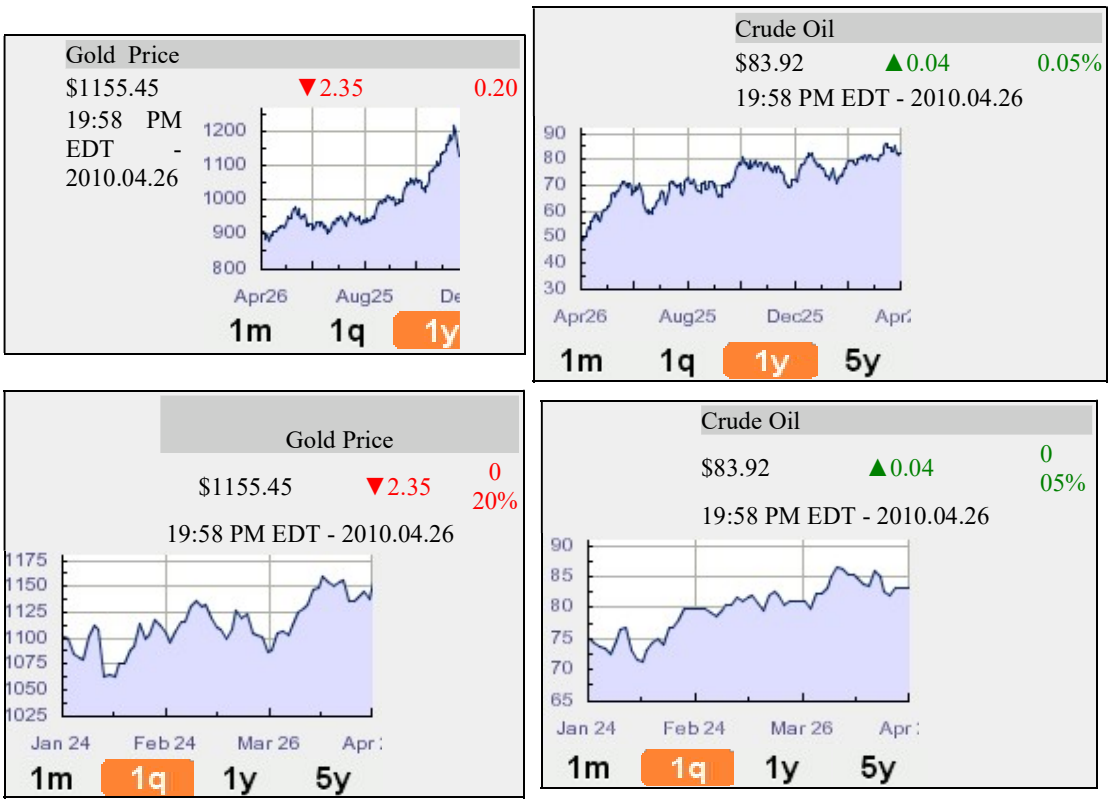
Ore Quality - Ore is mineralized rock that contains metal. Higher quality ore will contain more gold, which is usually reported as ounces of gold per ton of ore. At different points concentration of minerals within the earth's crust varies from their average, and it is those variations which produce workable ores for gold mining. Iron, for example, accounts for an average 5.8% of the content of the Earth's crust. It needs to be concentrated by natural variations to about 30% to be considered an ore, indicating a required geological concentration of about 5 times. A lower grade gold ore would contain something like 5 grams per tonne (5 parts per million). So gold ore needs to be concentrated by about 1,000 times above its average dispersion to become viable for gold mining (Gold Mining- BullionVault.com).

Mine Type: The type of mine a company uses is a big factor in production costs. Consequently, whereas alluvial and placer gold open-pit mining is relatively cheaper, most underground gold mine (gold veins or 'lodes' are produced in association with various metallic deposits, often including sulphides and pyrites) are more expensive than open pit mines.

The Stability of Gold to Oil: According to Giuseppe(2007 'Oil prices have increased significantly in recent years, due to a market condition called "peak oil", whereby consumption outpaces production and new discoveries. Spot Gold price has increased also, but is this increase tied to the same market conditions as crude oil? Gold and oil market dynamics differ in at least one way. Unlike manufactured or petroleum products, gold's price fluctuations are not tied to its extraction costs. The floating volume of gold (the amount of gold that would arrive on the market if its owners decide to sell it) at around 20,000 tons exceeds by far the 3,500 tons mined each year. Furthermore, trading prices currently at around $700/oz are multiples of actual extraction costs in the $150/oz range.

Like Oil however, the consumption of gold by the jewellery (One Karat measures the fineness of gold in 1/24 part which is 4.2%. Hence an 18 karat gold ring is made of 18/24 parts of gold, or 75% gold and 25% other metals), electronics and manufacturing industries has surpassed gold extraction for many years now. But to counter-balance this, hundreds of tons of gold are issued on the market every year by central banks, which attempt to liquidate as much as possible of this asset considered non-productive' (GIUSEPPE MARCONI, 2007). Fig 1. Shows the fluctuating nature of oil price to the gold on a monthly, quarterly, yearly and five yearly bases in 2010.

Fig. 1 Stability of Gold to Oil



Source; WWW.Gold.net

Major reasons for price rise of gold: Uncertainty due to war, Risk of high inflation and Lack of confidence in national economies and its leadership. For these major reasons Gold is regarded as a "blue-chip", stable investment. High inflation rates are believed to be the leading cause for high gold prices. More dollars buy less gold because the dollar is weak against all major currencies, consequently inflation is high. In addition, liquidity flooding BRIC World countries of China and Russia allow investors to invest in gold which they traditionally value. As inflation increases and the dollar depreciate, it is easy to count on the price of gold to increase. (Giuseppe Marconi, 2007). Total world gold demand fell 9% in the second quarter of 2009 from levels one year prior, equivalent to a 6% decline — $21.3 billion in dollar terms. This decline was mainly attributable to weakness in jewelry and industrial demand, which dropped 22% and 21%, respectively.

As a result of the global recession, however, jewelry and industrial demand only accounted for 69% of total demand in 2008.Continuing this trend, gold demand for jewelry and industry has accounted for only 53% of total world demand during the first half of 2009. The reduction in demand for gold jewelry was a global story with just one exception: China. In stark contrast to the overall 22% decline, Chinese gold jewelry demand increased by 6% — equivalent to a 9% increase in dollar terms, to $2.15 billion. The increase in Chinese gold jewelry demand is largely attributable to healthy rates of economic growth, stability in the local currency, and a raft of government measures aimed at mitigating the impact of the global downturn (Greg, 2009).

AN OVERVIEW OF MINING AND SMELTING OF BASE AND PRECIOUS METAL

The rudimentary methods of mining of Base and Precious metals in Nigeria of cassiterite and gold have traditionally been accomplished through the panning of sand in rushing water beds. This method of mining which is done on the surface of the earth is also known as alluvial mining- hence alluvial gold and alluvial tin etc. Today with the extinctions of mineable reserves of alluvial base and precious metals, the mining of deep seated minerals is a matter of technology. The only alternative left is for Nigerian geologists to employ physical and chemical methods to explore for favorable deposits which are often deep underneath the earth surface extending sometimes to several kilometers, such as the South African gold mines. Once the favorable geology is

established, remote sensing, airborne and ground geophysics and geochemistry are used to targets for drill testing.

Drilling is an essential component in mining which ensures that representative rock samples are collected from various areas. The rock samples are subsequently analyzed to determine the existence of base and precious metals, the size of the deposit, and the quality of the mineral. Based on the information gathered, the mining engineers can take informed decision on whether or not to undertake the mining. The geological information will determine: the type of mining method (surface or underground), the physical obstacles to getting the gold: and what impact the mine would have on the area's wildlife and environment. Nigeria has several deposits of iron ore, but the purest deposits are in and around Itakpe in Kogi State.

Nigeria's economy is dependant on oil and this oil economy has created an enclave economy that has minimal local value addition, low job creation potential and little to show in the area of technology transfer and its linkages with the rest of the economy. Globalization, or the internationalization, of production, technology, enterprise, and exchange of goods and services calls for the development of the primary industries of minerals and agriculture in order for a country like Nigeria to participate on the global arena. Metals utilization, production and consumption in any nation are index of their industrialization (Mallo 1999). The world's primary steel, aluminum and tin industries produce about 900, 23 and 0.2metric tones respectively per year. Africa has very low production levels of the above figures, for example, the consumption of aluminum metal, the per capita consumption of Africa and Nigeria is about 0.3kg compared to the world average of 5kg/capita. This implies that, Nigeria with a population of 120million should be consuming 120x0.005metric tones = 0.6metric tones of aluminum per year. Presently we have a smelter with capacity of 193,000metric tones. It means we need three such smelters (two added to the present one) to meet our domestic Aluminum requirements for us to meet the average world figure of 5kg/capita. Gold production in Nigeria dates back to pr-colonial times from 1914- the 1950s with peak productions of 40,000 to 45,000 Troy ounces/ annum between 1933 and 1942. The post-colonial gold mining has been very insignificant at all time low of 5,000 Troy Ounces per annum (Ajayi 2003). The works of Garba and Simon on Birnin Gwari reveals ore grade ranges of 3 and 7g/ton whilst in the alteration zones , they range in the order of 1-7g/ton. Simon (1998), estimated ore grade range of the order of 1-5/ton with an average ore grade of 2g/ton for the oxidized part of the (20-30 meters) of the deposits and possibly higher at depths. The exploration works carried out by the Nigerian mining corporation for example with regards to Anka mineralization indicates metal values of in the following range : Au=123-6320ppb, Ag=1.5-8.6 ppm, cu=647-5410ppm, and Pb=7550-22600 ppm(MSD-2010).

Australian Mines (ASX:AUZ) is presently one of the foreign mining companies which has officially been given an exploration license EL 9447 in the Anka region, North-Western Nigeria(Fig.2).The award of this High Priority Anka tenement sets the scene for more detailed soil sampling, geological mapping and possible follow-up drilling. Success in this work and on other AUZ tenements in the region and elsewhere in Nigeria could lead to the establishment of a major new gold province given the absence until recently of systematic modern day exploration activity in the country (Australian Mines Ltd 2011). A preliminary laboratory test of a total of twenty four grab samples taken by the company during prior visits to the tenement, from outcrops and small pits over an area 1400m long and 900m wide, nine returned greater than 5 g/t gold and all were anomalous (0.1-0.6 g/t gold). One sample returned 139 g/t, another 21 g/t and two others 15 g/t gold. Most of these high-grade samples also returned around 0.1% copper and 1% lead.

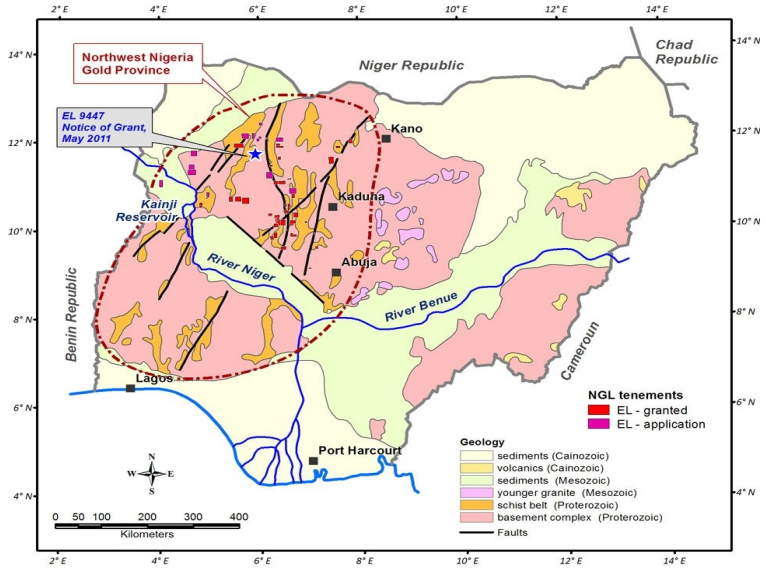


Fig.2 Geological Map of Nigeria overlain by AUZ Gold tenements at Anka Region. Source: AUZ 2011

The iron and steel sector had the potential to launch Nigeria into the prestigious club of industrialized nations. The expectation was that a vibrant iron and steel industry would provide the basis for Nigeria's growth. Development in the sector has a significant backward and forward linkage effect in the economy. The sector was also expected to contribute to wealth creation through providing employment opportunities and by equipping Nigerians with the requisite skills that could spread to the local small scale industries striving in the informal sectors. However, by 2004 when the first case of privatization was being carried out in the sector, almost all the companies and steel rolling mills within the sector were not functioning. Only Katsina rolling mill had a semblance of a working firm because private individuals went there occasionally to convert billets to rods and bars. It was therefore obvious that a lot of effort was needed to privatize the companies since they did not seem attractive to prospective investors. These states of affairs have been the guiding norm in the privatization process.

The Bureau successfully concluded the disposal of Oshogbo and Jos Steel Rolling Mills through liquidation of their assets in 2005. The sums of N1.8 billion and N800million were paid by the new owners of Oshogbo and Jos Steel Rolling Mills respectively. While the new owner of Oshogbo Rolling Mills is Kura Holdings Limited, Zuma Steel, a subsidiary of Dangote Group is the new investors in Jos Steel Rolling Mills. Outstanding is the over N3 billion pension liabilities owed to staff of the Steel Rolling Mills. The Federal Ministries of Mines and Steel Development, Finance are primarily responsible for the pension. The Bureau is assisting in facilitating the settlement of the pension liabilities of the companies. Some progress has been made in this regards.

In 2005, the Katsina rolling Mills was successfully liquidated, with Dana Holdings Limited emerging as its new owners. Dana Holdings Limited has paid an agreed bid price of N1.041 billion. The over N1 billion staff pension liabilities being addressed the same away as other Steel Rolling Mills. In 2004, FGN represented by the Ministry of Power and Steel (the Ministry) entered into a Concession Agreement with Global Infrastructure Limited (Global) to rehabilitate, complete, commission and operate Ajaokuta Steel Plant (ASCL). The Bureau had earlier served as a member of the FGN/Ajaokuta Monitoring Committee set up to monitor progress of the concession arrangement put in place between FGN through the then Federal Ministry of Power and Steel and Global Steel infrastructure Ltd (Mallo, 2010).

In May 2007, the FGN represented by Bureau of Public Enterprises (BPE) entered into another agreement with Global Infrastructure to convert the Concession Agreement into a Share Sale Agreement (SPA), at the directive of the Government. The transactions of the Iron and Steel Companies sales are presented in Table 3.

Table 3: Transactions of Sales of Steel Companies

S/N	Name of Company	Year of Sale	Purchase Amount	Buyer	Issues
1	Delta Steel Company	2004	$30 Million Dollars	Global Infrastructure Ltd	Settlement of N7BillionNaira Staff Pension
2	Aluminum Smelter Company of Nigeria	2007	$250 Million Dollars	Dayson/Rusal Ltd	Nil
3	Jos Steel Rolling Mill	2005	₦800 Million Naira	Zuma Steel West Africa Ltd	Settlement of ₦1.5 Million Naira Staff Pension
4	Oshogbo Steel Rolling Company	2005	₦1.8 Billion Naira	Kura Holdings Ltd	Settlement of ₦1.5 Billion Staff pension
5	Katsina Steel Rolling Company	2005	₦1.04 Billion Naira	Dona Holdings Ltd	₦1.0 Billion Staff Pension

Source: After Mallo, 2010

Tin/Columbite: Tin and columbite was extensively mined from the Jos Plateau, with more than 90% of the cassiterite mineral produced in Nigeria then coming from the plateau highlands. The mining however extended to the south as far as Wamba; in the west to Kafanchan in the north to Bura and in the East to the Jarawa hills. Mining activities also took place in Bauchi and Kano areas of Ningi and Ririwei respectively. Tin production increased rapidly from 1.36 tonnes in 1904 to 5,573 tonnes ten years later; reaching its peak production level of 15,842 tonnes in 1943.The sub-basalt tin of Ngell is believed to still have an untapped reserve of about 3500tonnes. The Makeri Smelting Company was later established in 1961 for the purposes of smelting high-grade alluvial tin concentrates in two standard oil fired reverberatory furnaces. The company had its highest production of 1,400tones per annum of concentrates in 1968 declining steadily thereafter, until, the late 70s and early 80s when the intake was already below 50000tonnes per annum. During the same period lead and zinc was also mined in Zurak and Ameri in Northern (Plateau) and Enugu/Ogoja- Southern Nigeria respectively (Mallo 2007).

Aluminum: There are yet no known commercial deposits of bauxite in Nigeria. But Nigeria has an Aluminum smelter – the Aluminum Smelting Company of Nigeria (ALSCON) located at Ikot Obasi in Akwa Ibom State. It has a design capacity of 193,000 metric tones metal ingots per annum and relies solely on imported bauxite. The smelter, established to utilize cheap natural gas reserves of the country, earn through export and conserve foreign exchange through reduced imports, supply of top-grade ingots and billets (to the aluminum downstream industries in the country), and stimulate industrial development and employment in the country (Mallo 2010).

ALSCON has officially been shutdown since June 1999 after the Federal Governments' inability to fulfill its equity obligations to the company and protracted disputes over pricing of gas between the Nigerian Gas Company (NGC) and ALSCON's management. Gas accounts for over 30% of the production input of the Smelter. The Federal Government had 70% equity holding with Ferrostaal of Germany and Reynolds of USA holding 20 and 10 percent respectively. Presently the National Council on Privatization (NCP) through the Bureau for Public Enterprises (BPE) is in the process of disposing the Federal Governments' equity holding in ALSCON (Mallo 2010). Table 4 provides the locations and stages of development of some metallic minerals in Nigeria while Table 5 gives the Characteristics of areas of Primary Gold Mineralization in Nigeria.

Table 4: Location and Development of Metallic Minerals in Nigeria

Mineral/Metal	Location	Stage of development	Proven Reserve (Metric tones)
Iron	Itakpe	Fully investigated. Ready for exploration	182.5million
	Agbaja	Investigated. But problem with high P_2 O_5 content, through Fe content is 50%	30.5million
	Muro Hills, Gadabuke	\under intensive investigation Highly promising	Not yet determined but believed to be larger than Itakpe
	Enugu	Quolitic, iron stone also investigate, Lov 43% Fe, Earliest mind metal along w various investigations still highly ex through open cost mining	Proven 14,222.5 estimated 17.874.5
* Tin-tantallum Niobium	Plateau Pegmatites of central Nigeria	Oldest mined meals, though with fluc production figures. Notable alluvial depo	Proven – 31.772
	Kano	Various investigations latest by Nige Mining Company. Highly promising Ririwari Mine, Kano`	
Lead-zinc	Benue Gongola Plateau Bauchi	Investigated at various times, Exploitati production dates back to 1951 though had been on a very small scale	711.237
*Gold	Sokoto Niger Kwara Osun	Mining of alluvial deposits started in Nigeria ceased to be a producer after history of mining 1914-1957. R activities as Ife-Ilesha gold filed by N Mining Corporation. Recently commenced on a small scale	Not fully known low grade but economically exploitable at present price of gold
Chromite	Sokoto	Occurrences under investigation	Not known
Manganese	Akwa Ibom Sokoto	Occurrences reported	Not known

Source: Mallo 2009

Table 5: Characteristics of areas of Primary Gold Mineralization in Nigeria. (After Garba 2000)

Area Or Site	-Local Host Rocks and Structures	Gold Paragenisis
Anka (AK)	-Quartzites,Schists and phyilites -Subsidiary of the Anka system	Gold paragneisis
Maru (MR)	-Quartzite,phylites, mica schists and also contact aureole of tonalite -Sub-paralellel shear zones apparently along anticlinal axes and linked to subsidiary fault of the Kalangni fault system	Gold, gelana, Pyrite, quartz, and Carbonates
Malele (ML)	-Biotite,granite-gneeiss and schist -En echelon veins of foliation, apparently following axes of tight folds, possibly linked to a subsidiary fault of the Kalangni fault system heamatite and quartz	Gold, pyrite, magnetite, quartz, tourmaline and chlorite
Birnin Yauri(BY)	-Hirnfels of granodiorire and batholith intruding phyllites -Brittle fault zone linked to the Anka fault system	God, pyrite,arsenopyrite,gelena.
Birnin Gwari (BG)	-Carbonceous (graphitic) schist and mica schists -Foliation-parallel shear zones possible along	Gold, pyrite, chalcopyrite, galena, magnetite, ilmenite, rutikle quartz, ferrian dolomite, chlorite tourmaline, and

	antidinall axes of tight folds linked to the Kalngai fault system	sercite
Okolom-Dogondaji (OD)	-Amphibolites, gneisses and schists -Foliation-paralllel shear zones possible anticlincal axes of tight folds linked to eh Ifewara fault	Gold,pyrite, marcasite, pyrrhotite, galena, sphaletite, magnetite, quartz and K-felpar
Iperindo (IP)	-Biotite granite-gneiss and mica schist -subsidiary fault sub-parallel and close to the Ifewara fault system	Gold, pryrite, marcasite, pyrrihotite, sphalerite, chalcopyrite, magnetite, imenite, rutile, quartz, calcite and K-felpar

PROSPECTS OF BASE AND PRECIOUS METALS

The Federal government has divested its interest from mining by privatizing its mining parastatals such as Gold, kaolin, Barytes and coal properties, the essence being to attract credible players into the mining sector. Government now plays the role of a Regulator-Administrator by providing an enabling environment for private sector participation It has consequently in line with best practices, has established the necessary institutional and regulatory framework. The mining Cadastre was established in addition to promulgating Nigerian Minerals and Mining Act in March, 2007 based on international best practices (Madueke, 2009)

There is a significant spread of precious and base mineral in Nigeria, evidenced by 34 different minerals distributed in the country's rich geology. The Nigerian government is increasing its efforts to portray and objectively show the potential hence encouraging investments in all. The ore is bagged and brought by motorcycle to villages like Dareta or Sunke, where villagers grind the ore and then wash the mix over a ridged board. Villagers who do the processing themselves then use mercury to extract the gold.The result is then sold to gold traders in Gusau, the capital of Zamfara, where remaining dirt and impurities are separated. The gold is driven to the Benin border and turned over to dealers from the port city of Cotonou. The dealers then sell this gold to wholesalers from Europe and the Middle East, who in turn introduce that gold to the worldwide market.

Gold and silver have been mined in Nigeria for a long time as also evidenced by abandoned colonial gold camps existing around Sokoto, Kaduna, llesha and Calabar. The production of gold as at 1913 stood at about 12 tonnes. Associated mainly with the schist belts of the western half of Nigeria, Gold in Nigeria is found in alluvial, eluvial and primary veins from several parts of schist belts in the Northwest and Southwest Nigeria. For example it occurs in primary, alluvial, eluvial forms and can be found at:Okolom/Kogi State, with grades from 1.0-36g/ton; Dogondaji/Kogi State with grade values from 1.0-75g/ ton ;Waya/Kebbi State, with grade values 0.4 - 11g/ton Iperindo/Osun State, as primary gold Recent drilling by CGA Mining (former Central Asia Gold) 3,000 metres of coring has proved more than 300,000 ounces. 2 million ounces estimated. Other major occurrences in Ogun, Adamawa, Edo, Kwara, Niger, Kaduna and Zamfara States Gold is a miners dream right now considering the huge spread between gold prices and production costs and that is precisely the mineral that is attracting the most attention to Nigeria. The price of gold in the international market today is nearly three times its production cost. Nigeria has several previously explored mines that could be re-opened. Nigeria has several high grade gold mines and with modern technology, low grade mines could also be worked on, thus significantly increasing the country's mining potential.

Long term investments in the developed economies such as pension funds and mutual funds are traditionally kept in around 4% of their assets in gold and platinum partly as a hedge against inflation. They are also kept partly as an alternative to major currencies such as the dollar, and partly as an insurance against major financial crises. To invest in gold they buy shares in gold mines or future contracts. The importance of gold is better appreciated in Asian countries where people prefer to keep their savings in gold rather than government paper money by buying gold in the form of jewelry or gold bars.

Rise in Energy Costs: The rise of the cost of a barrel of oil has had far reaching effects on the entire country, from costs of transportation, to costs for animal feed, to heating bills. OPEC countries and Big Oil companies point blaming fingers at each other, with little result to reverse many of these trends, but their rate with the threat of uncertain times ahead, gold takes on the glow of a stable commodity, which will always be able to buy goods and services.

The extent to which many an investor in developed economies buys into the gold market depends on how long they think the world economy will be on a downward trend. As Guiseppe puts it, 'In any case, keeping a diversified portfolio will still be a good rule of thumb, so no one should be thinking of keeping a gold hoard in their basement' (Giuseppe, 2008).

CHALLENGES OF BASE AND PRECIOUS METALS INVESTMENTS

The development of base and precious metals in Nigeria can hardly be accomplished free of challenges. A major challenge to Nigeria is the technical and financial challenges in the provision of an integrated approach to the development of an array of base and precious metals resource definitions through to the production of various metal concentrates in often-challenging investment environments. These investments require technical know-how in extensive design and operations experience as in technically critical areas such as material handling, comminution, flotation and hydrometallurgy and smelting of metals ores. In order to deliver the full suite of base and precious metals exploration, development and production critical areas requiring knowledge and financial capital base include the following: Open pit and underground mine design and optimization, Zinc processing plant design including crushing, storage, grinding, high pressure grinding rolls, flotation and dewatering, Design of metallurgical test-work research programs, Plant commissioning, ramp-up production and troubleshooting, Design of hydrometallurgical plant for zinc extraction including atmospheric and pressure leaching and SXEW, Custom design of specialized equipment such as leach reactors, autoclaves, SX mixer-settler and EW circuits.

Manpower Development: The current training of mining / Mineral processing engineers and sundry cadre of geo-scientists in Nigeria is deficient in scope and depth requiring urgent intervention by government. The mining and processing of base and precious metals requires adequate capacity building in the area of resource geology, minerals data assessment, geo-statistics, computerized geological modeling and resource estimation, mine engineering, data management, mine technical computing and mineral processing. Modern manpower development in the mineral industry requires in-depth knowledge in integrated application of all aspects of resource project development through geological modeling to mine optimization and design, process optimization, mill design and commissioning assistance, financial evaluation and operational support. Other areas include deep knowledge of mine tailings management, mine rehabilitation and environmental Impact Assessment. Mining training should ensure that students are equipped with in-depth knowledge of mine development issues /processes mine rehabilitation design, due diligence and strategic mine planning, mine optimization and design, including scheduling, equipment selection, rehabilitation, reserve estimation. The conditions for mining of base and precious metallic minerals are often by underground requiring mine cooling systems that can guarantee energy-efficient integration of ventilation, refrigeration, cooling distribution and pumping systems. The training of mining personnel in our Institutions must ensure that engineers are able to design and install systems in mines from concept to detailed engineering and implementation/ installation of underground mining tools and state of the art mining equipment (Mallo 2003).

Imitations and counterfeit commodities: The metallic industry because of its high profile nature is prone to imitations and circulation of counterfeit commodities to unsuspecting investors who especially in Nigeria are not knowledgeable in the characteristics of these base and precious minerals. The crime is perpetrated mostly during the time boom and rising prices of these commodities. This sharp practice by con men was witnessed especially during the boom sales of tantalum in the late 1990s in Nigeria where several short-term investors were swindled of huge sums of money. Short-term investments in this regard can be very bullish, erratic, unpredictable and undependable. But, long term investments are, relatively, considered safe and reliable

The counterfeiting of metallic commodities has been recorded even in developed economies as according to Merlin 2009, 'bankers in Hong Kong discovered that some gold bars originating from the US found to be actually gold plated tungsten i.e., fake gold bars. Acting fast, the Chinese officials found the perpetrators within hours. It seems that fake Tungsten blanks, between 1.3 and 1.5 million 400 oz, were manufactured in the US about fifteen years ago during the Clinton administration. Said to have been done by a very sophisticated refiner, 640,000 of these tungsten planks were gold plated and shifted to Fort Knox which is the United States Bullion Depository where the official gold reserves of the federal government are stored. At about the same period another counterfeit story made rounds as some of the gold bars in the vaults of the National bank of Ethiopia were found to be gold plated steel. It made news when the shipment of gold was returned by South Africa. Tungsten has the same density (19.25g/cm3) as gold, so a fake bar is indistinguishable by weighing it. In comparison the density of pure 24k gold is within 0.26% of tungsten' (Merlin, 2009).

Funding of Base and Precious Metal Mining: The Base and precious metals industry is very capital intensive and its gestation period is relatively long as compared to industrial minerals industry. Constructing mines and building production facilities requires huge capital out-lay. Long-term survival requires heavy expenditures to finance production and exploration. The source of financing is a principal barrier especially to new investors in

the precious-metals industry, which is heavily capital intensive. Constructing mines, production facilities, exploration and development and mining equipment all require large sums of capital. This capital is required before the mine starts production. Therefore, favorable financing terms are extremely important. In short, long-term survival in the precious-metal market requires significant capital. The metals industry is not vertically integrated like other industries such as oil and energy. In the metals industry, the companies that mine the gold typically do not refine it, and refiners rarely sell it directly to the public. Gold is the most popular precious metal for investors. Gold being a commodity, makes its price to fluctuate on a daily basis in the commodity market making the investment climate constantly a subject of monitoring and review for investors. Gold prices are influenced by numerous variables that include fabricator demand, expected inflation, return on assets and central bank demand and is therefore strongly pegged to supply-and-demand patterns. In general, low prices result in low production, and high prices result in high production.

CONCLUSION

The development and mining of base and precious metals in Nigeria dates back to the early 1900s with such metallic minerals as tin, columbite, lead/Zinc, gold, silver, etc by foreign companies. . This was followed by iron ore several decades later by the federal government of Nigeria. The development of precious metals such as gold and silver has not been particularly encouraging since the all time high record of 1913. The development of base and precious metals in Nigeria has not received adequate patronage by investors. However new foreign entrants in the industry such as Australian Mines Ltd portents a good signal for the opening-up of the sector to serious foreign and indigenous investors. Whereas there is huge potential/prospects in the base and precious metals sector of the Nigerian economy, the new investors and/ or entrants into this all important sector of the mineral industry are likely to face challenges which may include inconsistency of government with regards to regulatory, fiscal and monetary policies. Others are sources of financing, manpower and competitive rivalry for good reserves. The marketing constraints shall include availability of substitutes of base and precious metals for modern industrial applications in addition to the possibility of introducing imitations and counterfeit commodities to un- suspecting investors.

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