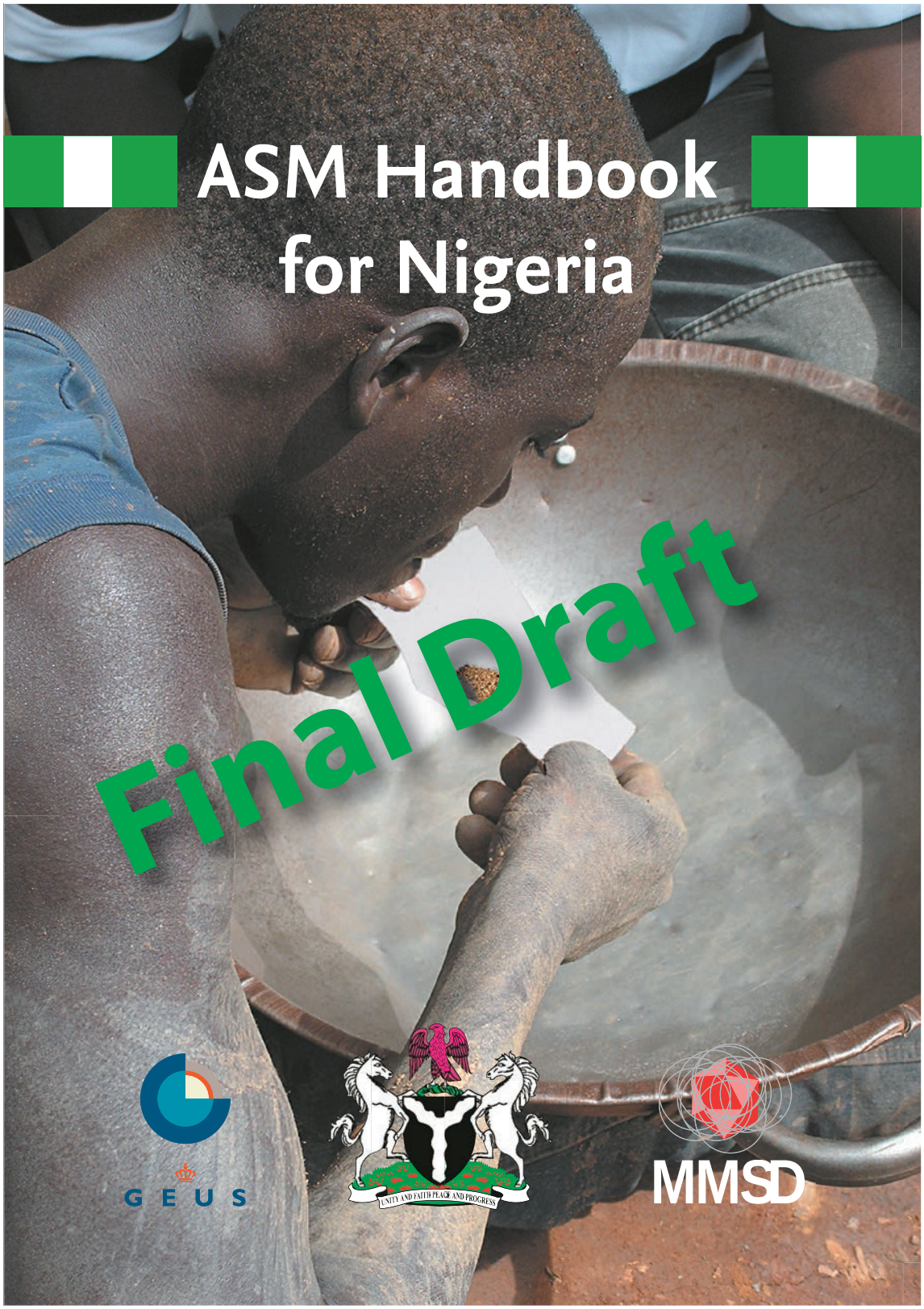

FEDERAL REPUBLIC OF NIGERIA

MINISTRY OF MINES AND STEEL DEVELOPMENT
Sustainable Management of Mineral Resource Projects

ASM Handbook for Nigeria

GEUS

MMSD

The project 'Technical Consultancy Services for the Development of artisanal and small-scale (ASM) Handbook and Training of ASM and Environmental Field Officers, and operators in Nigeria' has been financed and implemented by the Sustainable Management of Mineral Resources Project (SMMRP) in the Ministry of Mines and Steel development (MMSD) in the Federal Republic of Nigeria. This handbook was prepared by Geological Survey of Denmark and Greenland, Rambøll Denmark and Mindre Associates, 2011.

The editor is responsible for all results and conclusions presented in the Handbook, which do not necessarily reflect the position of the Sustainable Management of Mineral Resources Project (SMMRP).

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Ministry of Climate and Energy
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"Now a miner, before he begins to mine the veins, must consider seven things, namely: the situation, the conditions, the water, the roads, the climate, the right to ownership and the neighbours".

From the book De Re Metallica by Georgius Agricola, 1556 –
Even today the thoughts of Georgius Agricola,
a German scholar and scientist, are appropriate when starting a mining operation.

Contents

Abbreviations

ASM:	Artisan and Small-scale Mining
CBO:	Community Based Organisations
EIA:	Environment Impact Assessment
EL:	Exploration License
FEPA:	Federal Environmental Protection Agency
FMoE:	Federal Ministry of Environment
GEUS:	Geological Survey of Denmark and Greenland
LSM:	Large Scale Mining
MMSD:	Ministry of Mines and Steel Development
MCO:	Mining Cadastre Office
MECD:	Mines Environmental Compliance Department
MID:	Mines Inspectorate Department
MMSD:	Ministry of Mines and Steel Development
NASREA:	National Environmental Standards and Regulation Enforcement Agency
NGO:	Non Governmental Organisations
PMU:	Project Management Unit
QL:	Quarry Lease
RP:	Reconnaissance Permit
SME:	Small and Medium Enterprises
SMMRP:	Sustainable Management of Mineral Resources Project
SMO:	State Mines Officers
SSML:	Small Scale Mining Lease
WPU:	Water Use Permit

Women sorting stones in tailing from ASM operations, Azara, Nasarawa state

g from ASM
tate

1. Introduction

1.1. Why this Handbook?

This ASM Handbook has been written to help improve the performance of ASM operators in Nigeria. Every chapter responds to needs and issues that Nigerian female and male miners have said are important to them.

ASM operators throughout Nigeria face many challenges, the most important being lack of training and information in:

- Geology
- Mining methods
- Mineral processing methods
- Business skills to improve mining operations
- Safety and health practices
- Environmental management.

Communities in ASM areas are affected by the mining operations in many positive and negative ways; therefore this Handbook also provides guidance on how to address issues that are critical to community health, environment and development. This will hopefully lead to:

- Legalisation of ASM operations
- Improvement of safety
- Healthier working conditions and environment
- Access to financing improving operations
- Increased profits

1.2. Who is the Handbook for?

This Handbook was *mainly* written for:

- *Government Officers in MMSD*, who want to fulfil their mandate to support the national poverty reduction objectives by improving the performance of ASM nationally, in their state, county or village

- *ASM operators.* They can use very basic, manual methods or be more organised and somewhat mechanised

- *Community-Based and Non-Governmental Organisations* (CBOs/NGOs) who are trying to develop Nigeria.

The ASM Handbook is a reference guide, training manual and source of information for any individual or organisation who wants to see ASM operators benefit their communities and their country.

1.3. How to use the Handbook

It is our hope that the answer to most questions related to ASM activities in Nigeria are contained within this book - from clay and sand, over gold and coltan to stone aggregate and marble, from ASM close to towns and cities to the ASM in the most remote parts of the country.

You can read the Handbook cover-to-cover to increase your knowledge about all the topics or you can select the chapter or section that seems useful to you and start from there.

Use the handbook as a reference book. Go through the table of contents and find the sections that help you deal with different issues as they come up.

1.4. What is mining?

Mining is the activity of extracting and processing economically valuable minerals. The mining industry also includes finding (prospecting and exploring for) mineral resources to make mining possible.

Some examples of economically valuable minerals are:

- Metals and metal-bearing minerals: gold, copper, zinc, lead, niobium and tantalum (coltan), tungsten (wolfram), tin (cassiterite), aluminium (bauxite) and iron (magnetite)
- Dimension stone: limestone, stone aggregate, granite, marble, kaolin, clay and sand
- Gemstones: diamonds, rubies, emeralds, tourmaline, garnet, beryl and amethyst
- Other useful minerals, such as salt, phosphates and diatomite.

1.5. What is Artisanal and Small-scale Mining (ASM)?

ASM is one of those terms that do not lend itself to a universally acceptable definition. The term can be used to cover a broad spectrum of activities:

- Individuals panning for gold in remote regions of the Brazilian Amazon
- Simple rural folks digging for rock phosphate in Danji/Shini in Sokoto state to the ones digging for barite and tourmaline in Azara, Nasarawa State and Iseyin, Oyo State, respectively.

ASM is a livelihood strategy adopted primarily in rural areas. Minerals extracted by artisanal and small-scale mining by people working with simple tools and equipment, usually in the informal sector, outside the legal and regulatory framework. When not formalised and organised, ASM can be viewed negatively by governments, environmentalists, etc; because of its potential for environmental damage, social disruption and conflicts.

However, The Federal Government of Nigeria and donor agencies like the World Bank believe that ASM can contribute to socioeconomic development in poor and rural areas when properly formalised.

Currently, artisanal and small-scale mining ranges from artisanal miners to small-scale mechanised outfits and within this range are various levels depending on their financial capacity.

Artisanal Mining according to Minerals and Mining Act, 2007 means:

- Mining operations limited to the utilisation of non-mechanised methods of reconnaissance, exploration, extraction and processing of mineral resources within a small-scale mining lease area.

Small-scale Mining according to Minerals and Mining Act, 2007 means:

- Artisanal, alluvial and other forms of mining operations involving the use of low-level technology or application of methods not requiring substantial expenditure for the Conduct of Mining Operations within Small-Scale Lease Areas.

The ASM Department in the Ministry of Mines and Steel Development points out the following charateristics of ASM operation in Nigeria:

- ASMs exploit marginal or small mineral deposits

- Application of very basic and rudimentary mineral extraction techniques
- Lack or low level of mechanisation
- Unskilled personnel are involved at all levels of operation: technical and managerial
- Inefficient mining and processing techniques are most often adopted
- Low level of production
- Poor access to markets and support services
- Chronic lack of investment capital
- Low level of consideration to health and safety
- Have significant negative impact on the environment
- Low level of income amongst operators
- Operating without legal mining titles
- Gender issues and child labour
- Conflicts.

1.6. History of mining in Nigeria

For over 2,400 years, the mineral resources of Nigeria have been exploited using artisanal methods – from basic clays to base metals and gold.

Between 400 BC and 200 AD vibrant societies and kingdoms such as the Nok culture exploited iron and clay deposits and produced the famous terracotta figurines. Between the 11th and 12th century, the Ife and Oyo Kingdoms mined and used a variety of minerals. From 1903 to 1940, ASM operation dominated mining in Nigeria, particularly for tin. From 1970 till date, ASM has continued to dominate mining in Nigeria.

ASM accounts for over 90% of solid minerals mining in the country. Minerals produced include, but are not limited to, gold, barite, limestone, gemstones and gypsum. More than 107 ASM sites are identified in the country and more than 200,000 people are directly involved (Wardell Armstrong, 2008).

Mining gypsum i Alamgafi, Yobe State

Mining operation in Kaduma State

2. The obligations of the Department of Artisanal and Small-Scale (ASM) Mining to the Artisanal and Small-Scale Miners

The obligations of the Ministry of Mines and Steel development (MMSD) through the Artisanal and Small-Scale Mining Department are in accordance with the Nigerian Minerals and Mining Act, 2007, to provide Extension Services to mining communities in the following areas:

- *Prospecting and exploration services shall be provided for registered mining co-operatives to determine the geological setting, structure and nature of occurrence, quantity and quality of minerals being mined*
- *Provide mineral testing standards and the determination of mineral grades*
- *Provide proven mineral reserve evaluation including feasibility reports*
- *Assist small scale miners on mine design and planning suitable for the deposit*
- *Teach adequate skills in mining to small scale and artisanal miners and regularly introduce them to new mining technology*
- *Provision of teaching equipment and plant for hire on an arrangement with manufacturers of leasing companies and proper linkage and guarantees provided*
- *Introduce appropriate mineral processing technology skills in order to meet market demands and optimise profit*
- *Provision of environmental impact assessment report and detailed guidelines on waste and tailing disposal*
- *Introduction of health and safety procedures in the mines, provision of water and health facilities to large mining camps*
- *Holding regular workshops to update miners' knowledge about legal, marketing, business skills and infrastructural support, facilitate mineral testing and the determination of mineral grades*
- *Facilitate mineral testing and the determination of mineral grades.*

3. Basic geology as guide on how to discover mineral deposits

Commodities mined by ASM operators occur at or near the Earth's surface. Some of them, however, were formed deep in the Earth's crust. The description below aims at giving, in brief, the ASM operators an understanding of the geological processes and the environment in which the commodities in question were formed. This may help the miners to discover further deposits.

The continents consist of rocks of different origin (Fig. 3-1). Some of the rocks are remnants of volcanic eruptions such as lava and volcanic ash others are sediments such as clay, sand and gravel all deposited on the Earth's surface. Others are what we call metamorphic rocks. Metamorphic rocks formed deep in the crust of the Earth where sediments and volcanic rocks were heated to temperatures between 300 and 1100°C and were deformed due to pressure.

How did the sedimentary and volcanic rocks end up deep in the crust of the Earth? This happens when more and more sediments and material from volcanic eruptions are piled on top of each other. Another way is the formation of mountains, where the Earth's surface is compressed and rock units are thrust on top of each other. The rock pile will gradually sink into the crust where high pressure and temperature prevail. Layers of sand will be consolidated and metamorphosed into sandstones and quartzites, and clay into shales and schists. Well-developed foliation and folds due to rock deformation are characteristics of metamorphic rocks.

Hydrothermal deposits

There are basically two types of hydrothermal deposits; (1) magmatic-hydrothermal, and (2) hydrothermal without a relationship to magmatism.

At high temperatures some of the rocks start to melt and eventually form magmas, which are large bodies of molten rocks called igneous rocks. These magmas are gradually squeezed further up in the crust, where they start to cool and crystallise. Many elements such as gold, tantalum and boron cannot be accommodated in the minerals which crystallise in the magma, but are concentrated at the top of the magma chambers. When pressure builds up, the rocks above start to crack and fluids from the top of the magma chamber flow up into the cracks. These hot fluids are called hydrothermal fluids. The cracks are gradually filled with quartz and with the elements, which could not be accommodated in the magma such as gold, tantalum-forming tantalite and boron-forming tourmaline (rube-

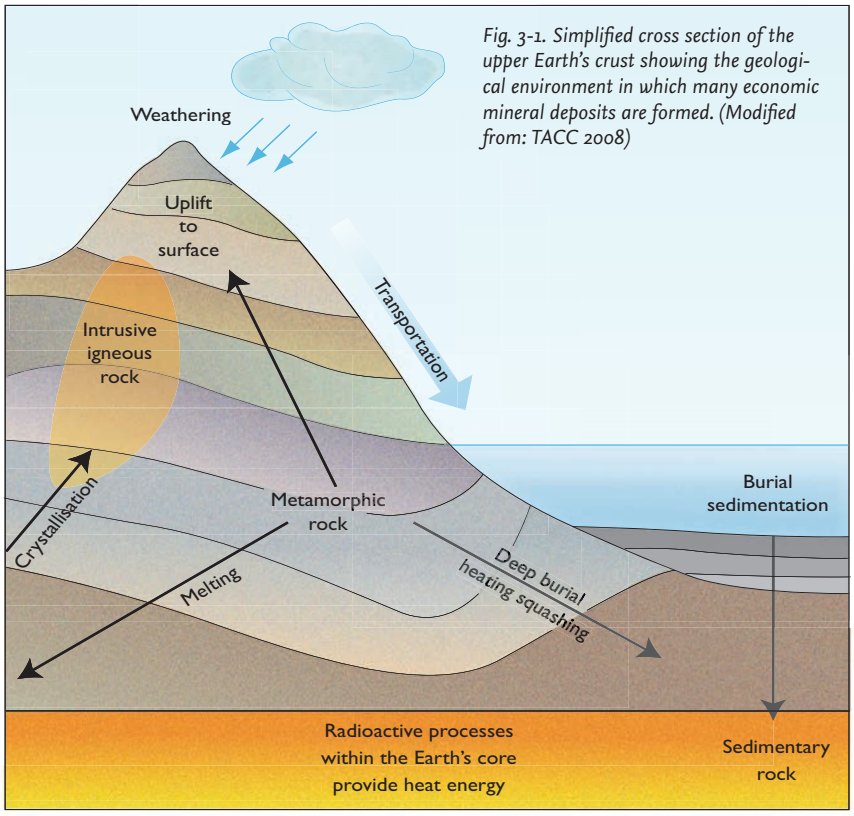

Fig. 3-1. Simplified cross section of the upper Earth's crust showing the geological environment in which many economic mineral deposits are formed. (Modified from: TACC 2008)

lite) found in quartz veins. These types of deposits are collectively called magmatic-hydrothermal deposits and are found close to the igneous rocks, commonly granite.

The second type is found in the form of quartz-carbonate veins or as impregnations in sediments and volcanic rocks. These rocks are often strongly overprinted and do not look like their original counterparts. Such unusually looking sediments or volcanic rocks can be used as a tracer to find hydrothermal deposits. These deposits also form from hot fluids that migrated through the rock, but have not been formed from crystallising melt. They could be old rain water that percolated through the rocks for some time picking up the elements of interest that can be gold, barium, copper, lead and zinc. Barium forms barite that is very often associated with a massive sulphide accumulation hosting a copper-lead-zinc mineralisation. Gold mineralisation is often hard to distinguish from the first type of hydrothermal deposits, because it is also hosted within quartz veins.

Magmatic deposits

There are again two types of magmatic deposits; (1) light-coloured, coarse-grained rocks as dykes, and (2) dark to black, medium-grained rocks.

Sometimes, part of the magma is squeezed into the cracks where it cools and crystallises to a coarse-grained rock type, namely pegmatite, which occurs in dyke-shaped bodies. Pegmatites often contain rare minerals such as tantalite, emeralds and rubelite.

During crystallisation of magmas, economic minerals such as chromite, magnetite, nickel and platinum will appear as bands in the magmatic rocks. These deposits can be recognised by checking for magnetite and for massive and semi-massive sulphide occurrences, because it is those that host nickel and platinum. These types of mineral deposits called magmatic deposits are a target for small-scale miners.

Surficial deposits

This type of deposit was formed at or near the surface. Some were later brought into the crust but at very low levels and were thus not subject to high temperature and pressure. Nigerian examples comprise gypsum, bentonite and diatomite deposits.

Gypsum was formed in restricted basins, i.e. salt lakes, where sediments such as clay were brought in by rivers. During prolonged dry conditions the basins dried out, and the components dissolved in the water, such as calcium and sulphate, were precipitated on the floor together with the clay minerals. During low temperature and low-pressure conditions, gypsum deposits were formed consisting of impure layers of shale and gypsum and, locally, very pure gypsum layers may have formed.

Bentonite is a clay mineral formed by surface weathering of ancient very fine-grained volcanic rocks. These deposits are found close to active and old inactive volcanoes.

Diatomite represents accumulations of algae (diatoms) which lived in lakes, in the tidal zones and in oceans. When the diatoms died they accumulated on the bottom. Later compaction resulted in a very light white stone.

When continental rocks are eroded, the material is flushed down the rivers. Also

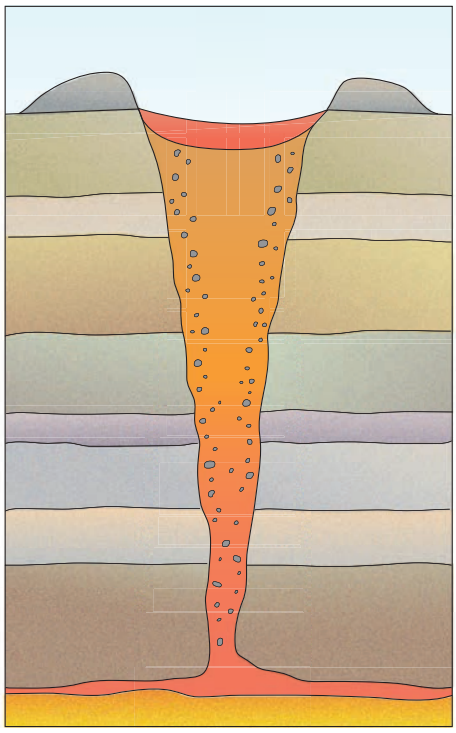

Fig. 3-2. Simplified cross section of a kimberlite pipe showing parts of the crust from which boulders were carried with the kimberlite magma towards the surface of the Earth. The dark red-coloured upper part of the kimberlite shows the weathered soft blue and yellow ground kimberlite. (Modified from: TACC 2008)

primary mineral deposits can be eroded. On their way down-stream, the minerals are separated according to density whereby so-called placer gold deposits can be formed. These deposits can be found in dry river beds as well as in rivers and streams, mainly where the flow-velocity of the water changes rapidly.

Kimberlite

Kimberlite is the host rock of diamonds. Diamonds have recently been found in Nigeria. It is thus appropriate to give a short description of the geological setting of diamonds.

Diamond is a high-pressure form of the element carbon. Amongst the low-pressure forms graphite and coal can be mentioned. Diamonds occur deep down in the Earth. They are brought up to the surface by volcanic eruptions, which are not the type that produces the volcanoes commonly seen on the surface of our planet, such as Kilimanjaro. These volcanic rocks originate much farther up in the crust. Kimberlitic volcanism originates from depths at or below 150 km. Kimberlitic magmas pick up diamonds on their way up. When the volcanic eruption ap-

proaches the surface of the Earth a funnel-shaped body filled with kimberlite is formed. This is called a kimberlite pipe (Fig. 3-2). Dykes of kimberlite are abundant below and around the funnel-shaped kimberlite pipe.

In kimberlite small and large blocks of country rocks are abundant. Those blocks were torn off from the surrounding rocks in the crust and brought towards the surface, when the kimberlitic magma rose. In exposed kimberlite pipes, the kimberlite has been altered and now appears as a very soft rock with colours ranging from yellow to blue (called yellow ground and blue ground). These soft rocks can be dug with shovels and diamonds are easily separated out of the soft rock merely by passing the soft rock with water through a sieve. They are thus easy targets for ASM.

The concentration of diamonds in kimberlite is very low, but if the diamonds are of good quality the yield is very high. The weight of diamonds is in carats and five carats equals one gram. The largest diamond ever found is the Cullinan diamond found on 26 January, 1905, in Premier Mine in South Africa weighed 3106,75 carats (621,35 g).

3.1. How to discover a mineral deposit

This description focuses on how to find the minerals and mineral occurrences frequently exploited by small-scale miners in Nigeria. The mineral deposits are divided into three classes: 1. Metalliferous minerals; 2. Industrial minerals and 3. Gemstones.

Mineral deposits are discovered in two ways:

- **Luck.** This is how the majority of mineral deposits are discovered. Observant people walk the fields and notice strange looking stones lying on the ground. They pick them up, crack them open and wonder whether the stones have any value. Rusty rocks and stones, black coating and bluish-greenish colours often betray metalliferous deposits such as copper, lead and zinc.

- **Hard work.** In areas where mining is or has been carried out, there is often a good chance of finding more mineable mineral deposits. This requires mostly tedious work involving extensive sampling either by digging pits and trenches, sampling river and stream sand and gravel or expensive geophysical investigations.

3.1.1. Exploration methods for ASM

Most ASM operators have limited financial means to embark on sophisticated exploration methods. The most common way for ASM operators to find new deposits is to trace the geological unit, which is known to host economic deposits and then search the surface soil for possible indications of the deposit. If they find such indications they must dig trenches in order to see fresh rock. If the ASM operators have access to aerial photographs and are focussed on mining gold-quartz veins then they may be able to see a regional structural pattern, which may host more gold-bearing quartz veins.

3.2. How to identify interesting minerals

A minimum knowledge of what the mineral looks like is required when exploring for a mineral deposit. Minerals are the building blocks of rocks. A rock consists of one or more minerals. Minerals can be indentified by a number of characteristics of which the following represent the first steps in the identification of the mineral:

- Colour
- Transparency/translucency
- Hardness
- Magnetic or not

Minerals that may interest ASM vary in colour from pitch black to white. They may also vary in hardness or have particular physical properties such as being attracted by a magnet or not.

Mineral	Mohs hardness	Absolute hardness	Chemical formula
Diamond	10	1600	C
Corundum	9	400	Al_2O_3
Topaz	8	200	$Al_2SiO_4(OH^-,F^-)_2$
Quartz	7	100	SiO_2
Orthoclase Feldspar	6	72	$KAlSi_3O_8$
Apatite	5	48	$Ca_5(PO_4)_3(OH^-,Cl^-,F)$
Fluorite	4	21	CaF_2
Calcite	3	9	$CaCO_3$
Gypsum	2	3	$CaSO_4{\cdot}2H_2O$
Talc	1	1	$Mg_3Si_4O_{10}(OH)_2$

Fig. 3-3. Mohs Hardness Scale.

Fig. 3-4. White quartz richly mineralised with gold. Centimetre-scale for estimating size. Sample from Lasa, Borno State.

The hardness of minerals helps identifying them. The scale on Fig. 3-3 shows ten minerals representative of each hardness group, from Mohs Hardness scale. In general, a mineral from one group can scratch the minerals in the lower groups. Quartz can scratch all minerals in groups 1 to 6. Diamonds being the hardest mineral and can scratch all minerals. A fingernail has the hardness just above 2, so it can scratch minerals from group 1 and 2. A pocket knife has hardness of 5 and can scratch minerals in groups 1 to 4. Quartz has hardness just above glass and can thus scratch a bottle.

Characteristics of the most common minerals extracted by ASM in Nigeria are listed below:

3.2.1. Metalliferous minerals

Gold mostly occurs as very fine grains in quartz (Fig. 3-4). Hardness 2,5 to 3. However, the grains are mostly too small to be seen. Gold often has a rich yellow colour but may also occur in light yellow grains. The colour depends on how much silver is included in the gold. The more silver the more light yellow the gold looks. Gold is a soft mineral which can be easily scratched with a knife.

Fig- 3-5. Galena (lead mineral) with characteristic metallic grey lustre and cubic shapes. The yellow mineral is pyrite consisting of iron and sulphur. Sample is 13 cm long, and is from Gwana, Bauchi State.

Fig. 3-6. Sphalerite (zinc mineral) with dark-brownish colour. Small amounts of galena can be seen. The yellow mineral is pyrite consisting of iron and sulphur. Sample is 15 cm long, and is from Zumo, Adamawa State.

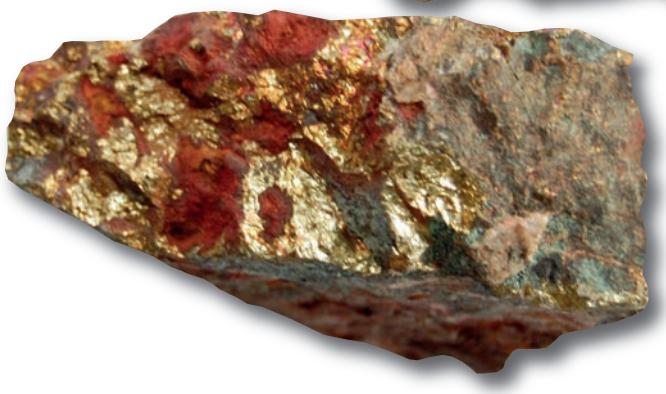

Fig. 3-7. Chalcopyrite (copper mineral) with characteristic yellowish colour. Sample is 10 cm long, and is from Gwana, Bauchi State.

Galena is the main source of lead but also of silver. Hardness 2.5. It is very easy to identify. It is very heavy, it looks metallic. It has a grey colour and is often cubic in shape (Fig. 3-5). It can easily be scratched with a knife. It is not attracted by a magnet. Galena is often found together with zinc and copper minerals such as sphalerite and chalcopyrite.

Sphalerite is the main source of zinc. Hardness 3.5 to 4. It is dark brown to light honey-coloured and can easily be scratched by a knife (Fig. 3-6). It is not attracted by a magnet. It is often rather fine-grained and can thus be difficult to identify. The mineral is often found together with galena and chalcopyrite.

Fig. 3-8. Tantalum-rich columbite (tantalite) as veinlets in quartz and as loose crystals. Samples are about 2 cm long, and are from Andaha, Nasarawa State.

Chalcopyrite is the main source of copper. Hardness 3.5 to 4.5. It can be scratched by a knife and it is not attracted by a magnet. The colour is yellow, but not the same yellow as gold (Fig. 3-7). The chalcopyrite is yellow with a faint greenish hue. Chalcopyrite is often betrayed by a bluish-green mineral called malachite, which occurs in cracks and on surfaces of rocks containing chalcopyrite. Malachite is very soft.

Tantalite/columbite is a black, very heavy mineral, which is not attracted by a magnet, but has the same dull black colour as the strongly magnetic mineral magnetite (Fig. 3-8). Hardness 6. The mineral has several names. The trade name is coltan. It is called columbite or tantalite depending on which metals are dominant, niobium or tantalum. It cannot be scratched by a knife. The mineral is the source of a number of metals of which the most prominent is tantalum which is a key metal in every mobile phone. The mineral is often found together with coarse, centimetre-scale quartz. Tantalite often contains high amounts of uranium. Uranium is highly radioactive and produces the radioactive gas radon. If the mineral is stored indoors the risk of people inhaling it is very high.

3.2.2. Industrial minerals

Gypsum is a soft grey to white mineral. It is the dihydrate form of calcium sulphate ($CaSO_4.2H_2O$) and is found in association with anhydrite ($CaSO_4$, the anhydrous form of calcium sulphate) and shale. It has a specific gravity of about 2.3 and a hardness of 2 with the anhydrite having a specific gravity of about 2.85 and a hardness of about 3. They can both be scratched by a finger nail and are sometimes transparent, but mostly not (Fig. 3-9). Gypsum often forms in platy crystals and is not attracted by a magnet.

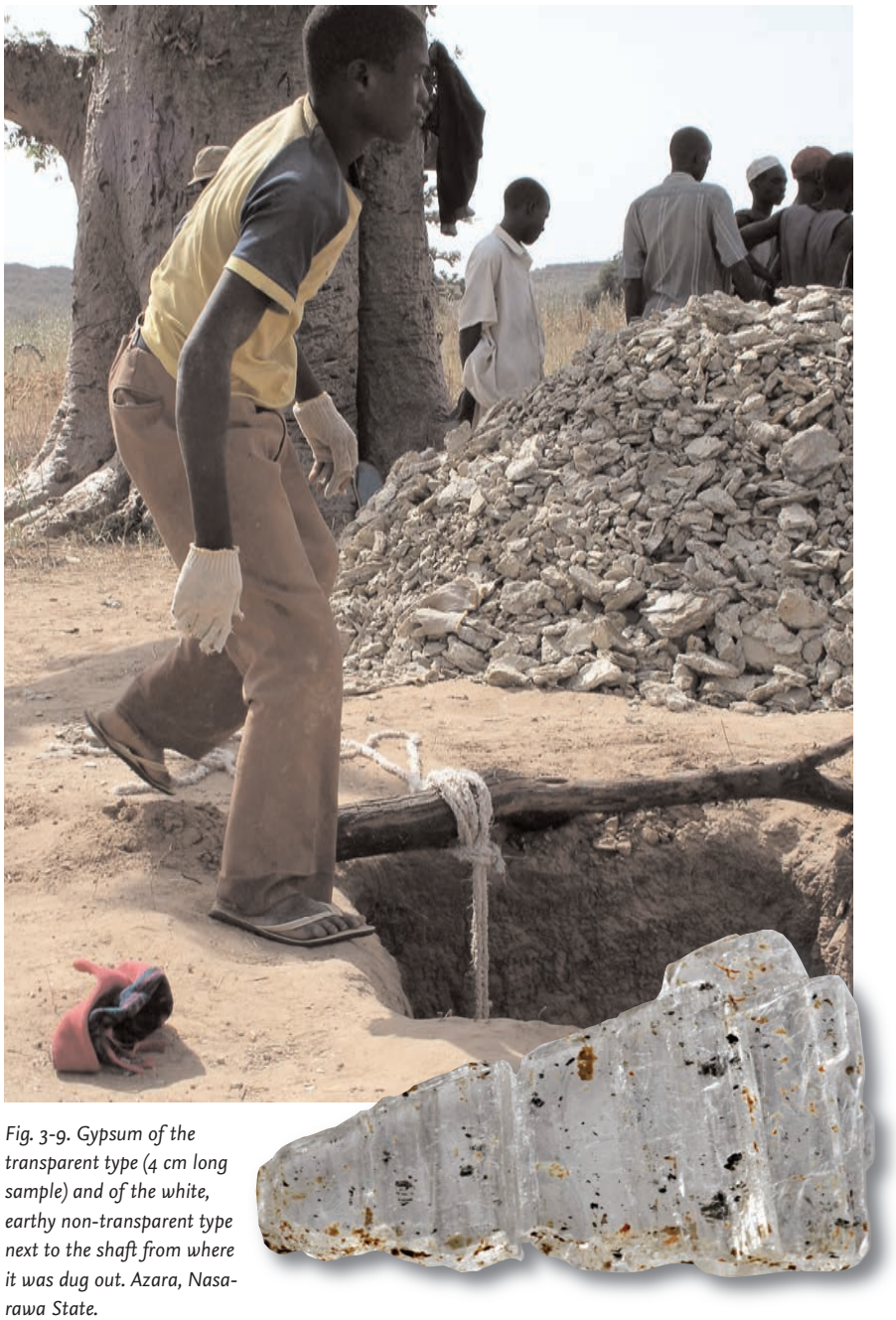

Fig. 3-9. Gypsum of the transparent type (4 cm long sample) and of the white, earthy non-transparent type next to the shaft from where it was dug out. Azara, Nasarawa State.

Fig. 3-10 Barite, white partly translucent. Sample is about 10 cm long, from Gabu, Cross River State.

Barite also called barite, cawk, tiff or heavy spar, is barium sulphate having a calculated specific gravity of 4.5, but inclusions of other minerals may reduce this figure considerably. It occurs in many colours, although shades of white to gray and black are most common (Fig. 3-10). Barite has a hardness of 2.5 to 3. It is non-magnetic as well as being insoluble in water and acid.

Bentonite is a hydrous aluminium silicate composed of essentially clay mineral and smectite (montmorillonite). It is commonly divided into the high-swelling or sodium, low-swelling or calcium, and moderate-swelling or intermediate types.

It ranges in colour from white over yellow, olive green and brown to blue and has a characteristic soapy texture and waxy appearance. Weathered sodium bentonite has a distinctive popcorn texture while that of calcium bentonite has an alligator skin texture (Carr, D. D., 1994).

Diatomite is not a mineral, but a white rock that consist of remnants of tiny small algae (diatoms). Diatomite is soft and can be cut with a knife. A characteristic feature with diatomite is that it is has a chalky appearance and is very light (Fig. 3-11) possessing a bulk density of about 0.3 to 0.5 g/cm3.

The colour may vary from snow white in a pure, well-bleached and dry deposit, to olive green or darker where substantial organic remains are still present and where the moisture content is high. It may exhibit stratification, caused by either, or both, sedimentation of particularly flat beds or a large number of discoid diatoms, or by seasonal rhythmic deposition of clay and other impurities.

Fig. 3-11. White, very light diatomite being dug out of the ground, Alamgafi, Yobe State.

Mineral	Chemical formula	Commercial use
Gold	Au	Jewelry and electronics
Galena	PbS	Source of lead and silver
Sphalerite	ZnS	Source of zinc and cadmium
Tantalite/columbite	$(Fe,Mn)(Nb,Ta)_2O_6$	Tantalum used in electronics
Gypsum	$CaSO_4.2H_2O$	Cement and Plaster of Paris
Barite	$BaSO_4$	Drilling mud for oil drilling
Bentonite	$(Al,Mg)(OH)_2Si_4O_{10}$	Drilling mud for oil drilling
Diatomite	Not a mineral	Dynamite, beer and wine
Rubelite		Gemstone
Ruby/sapphire	Al_2O_3	Gemstone and abrasive
Diamond	C	Gemstone and for drill rods

The chemical composition and some of the uses of the described minerals.

3.3. Types of mineral deposits

Exploitable mineral deposits can be divided into the following classifications:

1. Vein type deposits
2. Layered /banded deposits
3. Placer/regolith deposits

3.3.1. *Vein type deposits*

This is one of the most frequent types of mineral deposits exploited by small-scale miners. Veins are irregular bodies cutting through the wall rocks with a sharp contact. Veins range in width from a few millimetres to several metres. They can be hundreds of metres long and extend deep below the surface. Following a vein can be very difficult. Sometimes the vein is very wide sometimes it pinches out and sometimes it disappears. In the latter case, the vein may have died out or it has just been offset. The problem is to find in which direction it is offset. The vein may pinch out downwards or continue below the reach of small-scale miners. Typical examples of vein type deposits are gold quartz veins, lead-zinc-copper veins and barite-rich veins.

3.3.2. *Layered or banded deposits*

This type is characterised by the minerals occurring as bands or layers in their host rocks. The bands and layers are generally very extensive and can be followed for kilometres. They range in thickness from a few millimetres to many tens of metres.

Typical examples of this type are gypsum, bentonite and diatomite deposits.

3.3.3. *Placer/regolith deposits*

These deposits occur mainly in loose sediments or soils. Placer deposits are formed in river systems and consist of sand, gravel and boulders with minor amounts of economic minerals. Regoliths are soft deposits, mainly soil, which were formed by weathering of hard rocks. Placer and regolith deposits are surface deposits and thus easy to outline.

A typical example of placer deposit is gold. A typical example of a regolith deposit is tantalite/columbite mined near the village Jyelu.

3.4. How do minerals frequently exploited by ASM in Nigerian occur?

3.4.1. *Metalliferous deposits*

Gold-bearing quartz veins. This is the most common type of gold deposit exploited by ASM. The veins vary in width from a few millimetres to several metres. The veins can be single or appear as many narrow parallel veins. The quartz is often fairly coarse-grained. Bluish-grey to grey quartz is very often associated with the richest gold mineralisation. Milky-white quartz is often barren or contains less gold. The veins can be followed up to several hundred metres, but often they suddenly disappear and it is a major problem for the ASM to find the continuation of the vein if there is any. There is no preferred orientation of the veins. They can be flat-lying or steeply dipping, but usually, once defined, they don't change orientation along strike and down-dip.

There is no relation between gold content and width of the vein. Very narrow veins may have high gold contents and wide veins have low contents and vice versa. The gold is generally too fine-grained to be seen, but millimetre- to centimetre-sized nuggets are sometimes found.

Gold-bearing quartz veins often consist of gold and quartz only, and those are the easiest for ASM to exploit. However, other minerals are locally found in the gold quartz veins. Lead, zinc and copper minerals are locally abundant.

Placer gold. Placers are river sediments consisting of sand, gravel and boulders, which originate from the surrounding and upstream land. If there is gold along the path of the rivers then the gold will be washed out of the land and end in the river sediments. It is characteristic that the gold is found between boulders and in coarse-grained sand rather than in the fine-grained sand. Much of the gold in a placer deposit is fine-grained but locally nuggets are found. These can weigh more than 50 kg but are generally smaller. Nuggets are made of tiny gold particles which assembled to nuggets. Gold nuggets are collector's item and often fetch a higher price than the equivalent gold price.

Lead, zinc and copper occur in many types of rocks. However the ones which are of interest to ASM are veins. These veins are often steeply dipping and occur in a variety of host rocks such as sandstones. The veins can be metres wide and consist of coarse-grained galena (lead mineral) and fine- to medium-grained zinc and copper minerals. The veins can often be followed for hundreds of metres, and then they bifurcate or disappear. The minerals are often massive or occur as stringers together with quartz.

Fig. 3-12. Steeply dipping barite vein partly mined out by ASM operators, Azara, Nazarawa State.

Tantalite/columbite occurs in quartz veins or in a rock type called pegmatite. Pegmatite is a coarse-grained rock which occurs as irregular bodies with sharp contacts to wall rocks. Tantalite in pegmatite is generally not a target for ASM operators because pegmatite is very hard, which makes it difficult to extract the tantalite. Furthermore, the amount of tantalite grains in pegmatite is often low. ASM operators can therefore only exploit tantalite if the pegmatite has been weathered over time and has left the tantalite as up to centimetre-sized loose grains in the soil covering the pegmatite.

3.4.2. Industrial minerals

Gypsum occurs mainly as thin layers in fine-grained shales. The gypsum layers are from a few millimetres to several centimetres wide. They can be followed in the same level for tens to hundreds of metres. In the smaller layers, gypsum may have a fibrous texture. Some of the thin gypsum layers are very pure and transparent. They are well suited for producing Plaster of Paris. Most of the gypsum, however, is mixed with shale and is best suited for cement production.

The Nigerian gypsum is found in association with shale in sedimentary formations evidenced by, amongst others, the Nafada, Bajoga, Fika gypsum fields in the Gombe and Yobe states as well as those located in the Gboko and Wurno in

Benue and Sokoto States. Gypsum deposits can be discovered by scouting in salt formations for gypsum or anhydrite crystals along river banks or sides of gullies left behind by gully erosion followed by scout pitting around the area where gypsum or anhydrite crystals are found.

Barite occurs mainly in vein and cavity fillings, residual deposits and bedded formations. The veins can be up to several metres wide and be traced for up to hundreds of metres (Fig. 3-12). The veins can occur as single veins or bifurcating systems. Barite deposits often contain lead and zinc minerals as well as quartzite, calcite, iron minerals.

Nigerian barite deposits are found in vein and cavity filling as well as in residual deposits. These deposits are mostly discovered by scout searching for distinctively heavy but moderately soft white to gray coloured rocks (barite). The presence of these rocks can be confirmed by trenching and / or pitting if the deposit is of the residual type.

Bentonite is mainly found intermixed with other minerals like gypsum and occurs in layers which range from a few centimetres to metres in thickness. The layers can be traced for long distances.

Bentonite is mostly formed as a result of in situ weathering of volcanic ash or tuff. It is found in bedded formations that can be extensive or exist as small lens-shaped bodies with a limited lateral extent.
Bentonite deposits are generally characterised by the presence of high surface cracks especially in areas where the bentonite clay occurs near the surface.

Bentonite deposits are discovered by scout searching for the characteristics weathered features of alligator skin and popcorn textures as well as the massive cracked surfaces followed by pitting to confirm occurrence.

Diatomite occurs in centimetre to metre thick layers, interlayered with shale. The layers can be traced for hundreds of metres.

Diatomaceous silica is not pure silica but contains other intimately associated elements. Associated with the diatomaceous silica, and integrated as part of the diatomite, may be variable amounts of organic matter, soluble salts, and particles of rock-forming minerals that were co-deposited or precipitated with the diatom frustules. Sand, clay, carbonate, and volcanic ash are typical common contaminants.

Diatomite deposits are discovered by locating the occurrence of the distinctive very light and white diatomite masses followed by pitting or trenching to confirm its presence.

3.4.3. *Gemstones*

Gemstone deposits
Ruby and sapphire often occur in metre wide bands or lenses which can be a few hundred metres long.

Rubelite, which is a variety of the mineral tourmaline, is found in metre wide zones of pegmatites which can be traced for hundreds of metres and can be mined tens of metres down. The near surface deposits are altered and can be mined by digging, whereas deeper deposits are mined using blasting and hand sorting.

Amethyst is associated with quartz-rich pegmatites which can be metres wide and traceable for many tens of metres.

Diamonds occur in a rock called kimberlite which is of volcanic origin. The diamondiferous kimberlites are funnel shaped with diameters up to many tens of metres.

Gemstones are also often found in river gravel.

3.5. How to follow-up on a promising discovery

When a promising mineral occurrence has been found, the next step is to discover whether it is big enough to start a mining operation. This can be done in a number of ways depending completely on the type of commodity and the geometry of the deposit.

3.5.1. *Vein type deposits*

When the vein has been located, its width must be found as well as how far it can be traced. The concentration of the commodity must also be estimated.
In order to locate the vein, small pits or trenches have to be dug down to the bedrock. The number of trenches and pits to be dug depends on the size of the vein. Once the vein is located and the width and length have been determined, the grade of the vein has to be evaluated. This will require sampling and analysing a number of samples across the width of the vein and along the vein.

If the size and grade are satisfactory, the next step is to obtain a mining licence.

3.5.2. Layered or banded deposits

This type of deposit requires a different approach. Pits and shafts must be dug to determine the thickness of the mineralised layer or band and to determine how far below the surface the deposit is located. When this has been done, more pits must be sunk in an appropriate pattern to determine the extent of the deposit. Sampling through the thickness of the deposit and at several sites will determine whether the deposit has the potential to create a mine.
The next step is to obtain a mining licence.

3.5.3. How to find the source of placer gold or tantalite showing

Specks of gold or tantalite are sometimes found in rivers and streams. The number of specks or grains is so big that they may betray an unknown metalliferous deposit somewhere upstream from the point where the specks have been found.

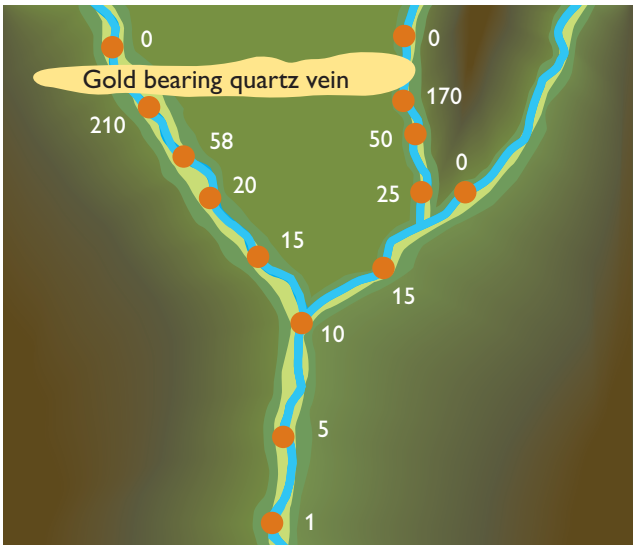

Fig. 3-13. Sketch map showing how to find a gold deposit by collecting samples of river sand and gravel. In the main river a few grains of gold is found. Upstream more gold grains are found. Farther upstream in both river branches, large number of gold grains are found until one branch is barren. The two other branches prove to contain a higher and higher number of gold grains going upstream until no more gold grains are found. Then the gold deposit must be situated below the sample sites with no gold grains. The numbers indicate how many gold grains are found at each sample site.

It is often possible to trace where the gold or tantalite came from. The trick is to collect samples of sand and gravel in the stream and use a gold digger's washing pan to concentrate the sample. Then the number of gold specks is counted. Next sample is collected upstream, concentrated and number of gold specks counted. The closer you get to the source of the gold the more gold specks occur in the pan. The procedure is to collect samples upstream until no more gold specks are found. Then the deposit must be below the spot with no specks and above the last sample with many gold specks (Fig. 3-13). The distance from the spot in the river where you found the first specks of gold up to where the gold came from may be up to many kilometres.

A similar procedure can be used for tracing the origin of tantalite. This does, however, require analyses of the mineral concentrates since it is not possible to distinguish small grains of tantalite from other black heavy mineral grains. The majority of the black grains are mostly a mineral called magnetite, which can be separated from the other black minerals with a simple magnet.

Diatomit

Diatomite mining in Alamgafi, Tobe State.

Mining Gypsum in Alamgafi, Yobe State

i, Yobe State

4. How to apply for ASM-related mining titles

As an ASM operator in Nigeria you need to get a licence to legally mine and there are many reasons for miners to get a licence. These include:

- *Training and support:* Miners are more likely to get the training and support they need from the government to help them make more money, mine more safely and protect the environment in their activities
- *Secure tenure:* Licensed miners cannot be kicked out of their mining area by other land developers, exploration companies or mining companies while their licence is valid
- *Access to financing:* Licensed miners can use their mine as collateral to get bank loans, helping them get the equipment and tools they need to improve their operations. Grant programmes for small enterprises usually need applicants to be licensed also
- *A voice with Government:* It is easier to approach local leaders, the DGSM and other Government officials to voice your issues and concerns when you are working legally, paying taxes and fees and the government recognises you as contributing to local and national development!

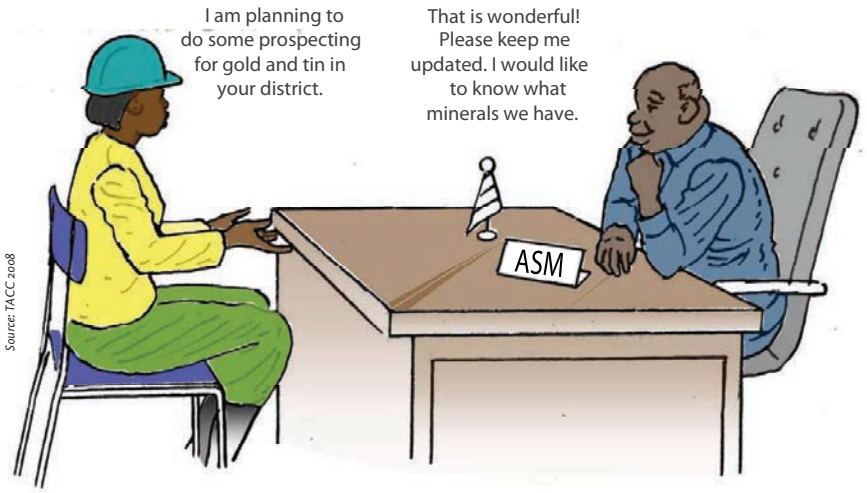

Fig. 4-1. If you intent to start an ASM operation you should see the ASM officer in your state and update him or her on you prospecting activities.

Having the piece of paper that says you are licensed is not enough! As a mining right holder, you have obligations to fulfil. This chapter deals with the steps to take to get your legal right to mine and the obligations required of licence holders. This is all contained in the Nigerian Minerals and Mining Act, 2007, National Minerals and Mining Policy, 2008 and Minerals and Mining Regulations, 2011 and parts of other legislations (related to environment, land, forests, national parks, labour and other sectors).

In many ways ASM operators are very different from large-scale miners (LSM) in terms of the resources they have and legislation they have to comply with. Because of power imbalances between the ASM and LSM, access to resources can be somewhat unequal and illegal miners can easily be displaced from where they are working!

ASM activities are a major challenge because they are mainly informal and disorganised, can have negative environmental impacts and usually work outside the reach of regulators and tax collectors. A policy that provides consistent and easy-to-access incentives to make the operation legal is believed to be the foundation for technical, socio-economic and environmental improvements of ASM.

4.1. Mining Legislation

Legislation (or statutory law) is a law which has been promulgated (enacted) by Parliament or other governing body. It can refer to a single law or the collected body of enacted law. The Mining Legislation of Nigeria makes up the rules and procedures needed to fulfil the goals and objectives of the Mineral Policy of Nigeria. These laws and regulations try to be investor friendly while recognising the limited technical possibilities and financial difficulties faced by ASM operators in Nigeria.

Mine Cadastre Office (MCO) is responsible for:

- Receiving and disposing of applications for the transfer, renewal, modification, relinquishment of mineral titles or extension of areas
- Maintaining a chronological record of all applications for mineral titles
- Addressing the issues of transparency in the grant/access to titles
- Dealing with matters of overlapping titles.

Five Mining titles are currently relevant to ASM operations in Nigeria. These are:

- Reconnaissance Permit
- Exploration Licence
- Small-Scale Mining Lease
- Quarry Lease
- Water Use Permit.

The first two apply mainly to the small-scale mining companies with the last three expected to cover the needs of the ASM operators.

Mine Inspectorate Department (MID) is responsible for:

- Supervision of all reconnaissance, exploration and mining operations
- Enforcement of all health and safety regulations as approved by law at mine sites
- Inspection and investigation necessary for ensuring compliance with applicable regulations.

As a general requirement, when applying:

- Individuals should not be under the age of 18 years, be undischarged bankrupt or otherwise declared bankrupt under any written law
- A company or cooperative, any of its directors holding controlling shares must not have been convicted of any criminal offence or committed an offence under the Nigerian Minerals and Mining Act, 2007 or Mineral Regulations. See Form AT-1 at the end of this chapter.

Application forms for these titles can be obtained from:

- Mining Cadastre Office (MCO), Wuse, Abuja
- ASM Department, Ministry of Mines and Steel Development, Abuja
- State ASM and Mines Offices.

ASM Operators are expected to register with Artisanal and Small Scale Department by completing Form 45 to qualify them for Extension Services Programmes and Incentives. See Form 45 at the end of this chapter.

All completed forms (in triplicates) are to be submitted to the MCO office, Abuja.

The breakdown of the relevant titles and their requirements are outlined below:

Reconnaissance Permit (RP)

Conditions / Requirements

- The permit is non-exclusive
- The permit has a duration of one (1) year and is renewable annually
- Duly completed RP application forms (in triplicates)
- Description of work area and the activities to be carried out
- Attestation of no conviction of criminal offences under the Nigerian minerals and mining act, 2007
- Receipt of payment of N10,000.00 application processing fee
- Evidence of technical competence
- Certified true copy of certificate of registration or incorporation
- Evidence of financial capability, see Form 42
- A valid RP application shall be granted and issued within 30 days of filing application.

Exploration Licence (EL)

Conditions / Requirements

- The licence is exclusive and has a maximum area of 200 km^2
- The licence has a duration of three (3) years and is renewable twice for two (2) years each.
- Duly completed EL application forms (in triplicates)
- Detailed minimum work programme
- Evidence of financial capability, see Form 42
- Evidence of technical competence
- Consent from land owners/land occupiers
- Attestation of non conviction of criminal offences under the Nigerian minerals and mining act, 2007.

Small Scale Mining Lease (SSML) OR Quarry Lease (QL)

Conditions / Requirements

- Both leases are exclusive. The SSML has a maximum area of 3 km² while the QL has a maximum area of 5 km².
- The SSML has a duration of five (5) years for alluvial deposit and ten (10) years for lode formation and is renewable for further periods of five (5) years for alluvial formation and ten (10) years for lode formation while QL has a duration of ten (10) years and is renewable as often as required provided the minimum work obligation is met
- Duly completed SSML or QL application forms (in triplicates)
- Pre-feasibility study report
- Evidence of financial capability, see Form 42
- Evidence of technical competence
- Consent from land owners/land occupiers
- Attestation of non conviction of criminal offences under the Nigerian Minerals and Mining Act, 2007
- Certified true copy of certificate of registration or incorporation
- Evidence of payment of N10,000.00 SSML application processing fee or N20,000.00 QL application processing fee
- Area specified to be surveyed in accordance with provisions of survey Coordination Act
- A valid SSML or QL application shall be granted and issued within 45 days of filing application.

Water Use Permit (WUP)

Conditions / Requirements

- Duly completed WUP form (in triplicates)
- A copy of the 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
- Evidence of payment of N10,000.00 application processing fee
- It has the same duration with the mining title granted
- A valid Water Use permit application shall be granted and issued within 7 days from grant of lease approval.

4.2. Managing Natural Resource Conflicts

Conflicts often arise over the occupation, use, management and control of land. Finding minerals requires access to large areas of land, much of which is subject to different uses or conflicting claims of ownership.

Source: TACC 2008

Fig 4-2. Be prepared to explain mineral rights versus land rights.

Natural resource conflicts related to mineral rights usually arise because:

- Land occupants and users often confuse mineral rights and land rights, sometimes believing that mineral-rights holders are there to take the land – even when they are only doing prospecting or exploration
- Lawful occupiers and landowners sometimes do not understand the terms of compensation for any land disturbances (e.g. to crops) or re settlement
- Sometimes ownership (land title) and lawful occupancy are not clear.

Procedures for resolving or arbitrating these disputes for Location Licences are well laid out in the Nigerian Minerals and Mining Act, 2007 (Section 116, 117, 100-110 and 112-113).

FEDERAL REPUBLIC OF NIGERIA

MINING CADASTRE

MINERAL TITLE APPLICATION FORM
Version 3.0 – February 2006

RECONNAISSANCE PERMIT

APPLICATION N° ⊖

I – APPLICANT'S IDENTIFICATION

☐ BODY CORPORATE ☐ CO-OPERATIVE ☐ INDIVIDUAL * | HAVE YOU APPLIED BEFORE ? * ☐ YES ☐ NO

Full name			Registration No *		
			ID card No * if any		
Address	Street / Road *		No *		P.O. Box
	City / Town *		Zip		
	State *				
	LGA *				
	Country of origin				
Communication	Telephone *				
	Fax				
	Mobile *				
	Email *				
	Web site				

II – REPRESENTATIVE

Full name			ID card No * if any		
Address	Street / Road *		No *		P.O. Box
	City / Town *		Zip		
	State *				
	LGA *				
Communication	Telephone *				
	Fax				
	Mobile *				
	Email *				
	Web site				

III – DOCUMENTS SUBMITTED

- ☐ Certified copy of the certificate of incorporation (Body corporate)
- ☐ Attestation of non conviction of criminal offence or an offence under the Minerals and Mining Act 2007
- ☐ Receipt of payment for application fees
- ☐ Other(s)

IV – RECORD DATA ⊖

Date	DD	MM	YYYY	Office	

V - SIGNATURES

Applicant or Representative	Mining Cadastre Officer + Stamp

⊖ To be filled in by the Mining Cadastre Officer - *Application submitted in 3 copies*
* Mandatory information *PLEASE USE CAPITAL LETTERS ONLY*

RECORDED REGISTER SIGTIM ☐

FEDERAL REPUBLIC OF NIGERIA

MINING CADASTRE

MINERAL TITLE APPLICATION FORM
Version 3.0 – February 2008

EXPLORATION LICENCE

APPLICATION N°

I – LOCATION OF THE REQUESTED LICENSE

States *	LGAs *	Topo sheet(s) *

II – APPLICANT'S IDENTIFICATION

☐ BODY CORPORATE ☐ CO-OPERATIVE *

HAVE YOU APPLIED BEFORE ? * ☐ YES ☐ NO

Full name			Registration No *		
Address	Street / Road *		No *		P.O. Box
	City / Town *		Zip		
	State *				
	LGA *				
	Country of origin				
Communication	Telephone *				
	Fax				
	Mobile *				
	Email *				
	Web site				

III – REPRESENTATIVE

Full name			ID card No * if any		
Address	Street / Road *		No *		P.O. Box
	City / Town *		Zip		
	State *				
	LGA *				
Communication	Telephone *				
	Fax *				
	Mobile *				
	Email *				
	Web site				

IV – DOCUMENTS SUBMITTED *

- ☐ Description of the minimum work programme
- ☐ Certified copy of the certificate of incorporation (Body corporate)
- ☐ Attestation of non conviction of criminal offence or an offence under the Minerals and Mining Act 2007
- ☐ Receipt of payment for application fees
- ☐ Other(s)

⊖ To be filled in by the Mining Cadastre Officer - *Application submitted in 3 copies*

* Mandatory information

PLEASE USE CAPITAL LETTERS ONLY

MINERAL TITLE APPLICATION FORM

V – COORDINATES

Type Corners of the perimeter ☐ Center of the cadastral units ☐ Number of CUs ☐

#	Longitude X			Latitude Y		
	D	M	S	D	M	S
1						
2						
3						
4						
5						
6						
7						
8						
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16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Additional Coordinates sheets

Yes ☐ No ☐

Quantity ☐

#	Longitude X			Latitude Y		
	D	M	S	D	M	S
26						
27						
28						
29						
30						
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45						
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47						
48						
49						
50						

VI – RECORD DATA ⊖

Date	DD	MM	YYYY	Time	HH	MM	Office	

WARNING TO THE APPLICANT

If the title issued from the present application surrounds one or more other titles and/or pending application(s), the applicant agrees that if those latter come to expire or are simply abandoned by their owners or not granted by the Mining Cadastre, they will be fully integrated into their own title with all obligations, including payment of fees, related thereto

VII - SIGNATURES

Applicant or Representative	Mining Cadastre Officer + Stamp

⊖ To be filled in by the Mining Cadastre Officer - *Application submitted in 3 copies*

* Mandatory information

RECORDED REGISTER SIGTIM ☐

FEDERAL REPUBLIC OF NIGERIA

MINING CADASTRE

FEDERAL REPUBLIC OF NIGERIA

MINING CADASTRE

MINERAL TITLE APPLICATION FORM
Version 3.0 – February 2008

LEASE APPLICATION N°

I – TYPE OF LEASE

☐ SMALL SCALE MINING LEASE
☐ MINING LEASE
☐ QUARRY LEASE

Requested duration (If less than the maximum time allowed) Year(s)

Licence Type Number (Emerging from (if any))

I – LOCATION OF LEASE

States *	LGAs *	Topo sheet(s) *

II – APPLICANT'S IDENTIFICATION

☐ BODY CORPORATE ☐ CO-OPERATIVE ☐ INDIVIDUAL * | HAVE YOU APPLIED BEFORE ? * ☐ YES ☐ NO

Full name		Registration No *			
		ID card No * if any			
Address	Street / Road *		No *		P.O. Box
	City / Town *		Zip		
	State *				
	LGA *				
	Country of origin				
Communication	Telephone *				
	Fax				
	Mobile *				
	Email *				
	Web site				

III – REPRESENTATIVE

Full name		ID card No * if any			
Address	Street / Road *		No *		P.O. Box
	City / Town *		Zip		
	State *				
	LGA *				
Communication	Telephone *				
	Fax				
	Mobile *				
	Email *				
	Web site				

IV – DOCUMENTS SUBMITTED

☐ Pre feasibility study
☐ Certified copy of the certificate of incorporation (Body corporate)
☐ Attestation of non conviction of criminal offence or an offence under the Minerals and Mining Act 2007
☐ Receipt of payment for application fees
☐ Other(s)

⊖ To be filled in by the Mining Cadastre Officer - *Application submitted in 3 copies*
* Mandatory information

PLEASE USE CAPITAL LETTERS ONLY

MINERAL TITLE APPLICATION FORM

V - MINERAL(S) TO BE MINED			
1		6	
2		7	
3		8	
4		9	
5		10	

VI - MINERAL(S) LOCATED IN THE AREA APPLIED			
1		6	
2		7	
3		8	
4		9	
5		10	

VII – COORDINATES

Type Corners of the perimeter ☐ Center of the cadastral units ☐ Number of CUs ☐

#	Longitude X			Latitude Y		
	D	M	S	D	M	S
1						
2						
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15						
16						
17						
18						
19						
20						
21						
22						

Additional Coordinates sheets

Yes ☐ No ☐

Quantity ☐

#	Longitude X			Latitude Y		
	D	M	S	D	M	S
23						
24						
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26						
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44						

VIII – RECORD DATA

Date	DD	MM	YYYY	Time	HH	MM	Office	

WARNING TO THE APPLICANT

If the title issued from the present application surrounds one or more other titles and/or pending application(s), the applicant agrees that if those latter come to expire or are simply abandoned by their owners or not granted by the Mining Cadastre, they will be fully integrated into their own title with all obligations, including payment of fees, related thereto

IX - SIGNATURES

Applicant or Representative	Mining Cadastre Officer + Stamp

⊖ To be filled in by the Mining Cadastre Officer - *Application submitted in 3 copies*

* Mandatory information

RECORDED REGISTER SIGTIM ☐

FEDERAL REPUBLIC OF NIGERIA

MINING CADASTRE

FEDERAL REPUBLIC OF NIGERIA

MINING CADASTRE

MINERAL TITLE APPLICATION FORM
Version 3.0 – February 2008

WATER USE PERMIT

APPLICATION N° ⊖

I – RELATED TITLE ON WHICH THE PERMIT IS REQUESTED

Number * **Remark**

Type *

Number of cadastral unit(s) *

Period of the WUP requested (Only if different from the related title) **From** DD MM YYYY **To** DD MM YYYY

II – LOCATION OF WUP

States *	LGAs *	Topo sheet(s) *

III – APPLICANT'S IDENTIFICATION

☐ BODY CORPORATE ☐ CO-OPERATIVE ☐ INDIVIDUAL *

Full name		Registration No *			
		ID card No * if any			
Address	Street / Road *		No *		P.O. Box
	City / Town *		Zip		
	State *				
	LGA *				
	Country of origin				
Communication	Telephone *				
	Fax *				
	Mobile *				
	Email *				
	Web site				

IV – REPRESENTATIVE

Full name		ID card No * if any			
Address	Street / Road *		No *		P.O. Box
	City / Town *		Zip		
	State *				
	LGA *				
Communication	Telephone *				
	Fax				
	Mobile *				
	Email *				
	Web site				

⊖ To be filled in by the Mining Cadastre Officer - *Application submitted in 3 copies*
* Mandatory information

PLEASE USE CAPITAL LETTERS ONLY

MINERAL TITLE APPLICATION FORM

V – DOCUMENTS SUBMITTED *

- ☐ Copy of mining title granted
- ☐ Topographical map with the size and configuration of the water use permit area
- ☐ Preliminary water use plan
- ☐ List of names of all persons and parties likely to be affected by the grant of the permit
- ☐ Consent of any persons likely to be adversely affected by the grant of the permit
- ☐ Receipt of payment for application fees
- ☐ Other(s)

VI – IDENTIFICATION OF WATER RESOURCES IN THE AREA APPLIED if any

1	
2	
3	
4	
5	

VII – DESCRIPTION OF WATER USE OPERATIONS AND QUANTITY TO BE USED *

Description

Quantity		m³ per	☐ Day	☐ Month	☐ Year

VIII – COORDINATES *

Type Corners of the perimeter ☐ Center of the cadastral units ☐ Number of CUs ☐

#	Longitude X			Latitude Y		
	D	M	S	D	M	S
1						
2						
3						
4						
5						
6						
7						
8						

Additional Coordinates sheets

Yes ☐ No ☐

Quantity ☐

#	Longitude X			Latitude Y		
	D	M	S	D	M	S
9						
10						
11						
12						
13						
14						
15						
16						

IX – RECORD DATA ⊖

Date	DD	MM	YYYY		Office	

X - SIGNATURES

Applicant or Representative	Mining Cadastre Officer + Stamp

⊖ To be filled in by the Mining Cadastre Officer - *Application submitted in 3 copies*

* Mandatory information

RECORDED *REGISTER* ☐
SIGTIM ☐

FEDERAL REPUBLIC OF NIGERIA

MINING CADASTRE

FEDERAL REPUBLIC OF NIGERIA

Ministry of Mines and Steel Development
Abuja, Nigeria

FORM AT-1

MINING CADASTRE OFFICE

ATTESTATION OF NO CONVICTION OF CRIMINAL OFFENCE OR OFFENCE UNDER THE MINERAL AND MINING ACT, 2007

Name of the legal Practitioner or Legal Firm:.....

.....

Address:.....

.....

.....

Telephone No. (Office/Mobile):.....

Fax:.....*Email:*.....

do hereby attest that

Messrs / Mr / Mrs / Miss.....

.....

is legally capable and has no criminal or felony conviction or conviction under the Minerals and Mining Act, 2007.

Dated.....

Signature and Seal

FEDERAL REPUBLIC OF NIGERIA
MINISTRY OF MINES AND STEEL DEVELOPMENT
The Nigerian Mineral and Mining Act 2007
Regulation 117 (3) (d)
Form 42

BANKER'S GUARANTEE

WHEREAS (1) ..... have/has applied to the for the grant of a .....

AND WHEREAS (2) ..... of .....

Have undertaken to provide the said (3) .....

with sufficient money to ensure the payment to.....

of .....or any other sum which may become due to them as a result of the exercise of the rights under a .....

NOW THEREFORE I HEREBY GUARANTEE that I will at any time on the request of the ..... deposit with ..... the money required to make such payments, provided always that the sum shall not exceed the sum of ..... and provided further that this Guarantee shall be irrevocable by me except with the prior consent of the .....

Dated this ..... day of ..... 20 .....

Signed: .....

(4) .....

In the presence of .....

(5) .....

To the .....

Stamp duty: _____

1. Name, address and occupation of person guaranteed
2. Name, address and occupation of guarantor
3. Name of person guaranteed
4. Signature of guarantor
5. Signature of witness

FEDERAL REPUBLIC OF NIGERIA
MINISTRY OF MINES AND STEEL DEVELOPMENT
The Nigerian Minerals And Mining Act, 2007
Regulation 144 (3)
Form 45
REGISTRATION FORM FOR MINING COOPERATIVES, QUARRYING ASSOCIATION AND
SMALL-SCALE MINING OPERATORS

1. Name of cooperative/association/organisation: .....
2. Date registered: .....
3. Registration number: .....
4. Business Address.....
5. Number of members: ..... (Attach list of members)
6. Mineral (s) being mined/quarried: .....
7. Mining/quarrying site (s): .....
   (State location to the nearest village)
8. State years of operation at location: .....

.....

(Signature of Chairman with Stamp)

DOCUMENTS TO BE ATTACHED

i. Certificate of Registration
ii. Copy of the bye-laws
iii. List of members stating position held
iv. Licence over area of operation (if any)
v. Proof of payment

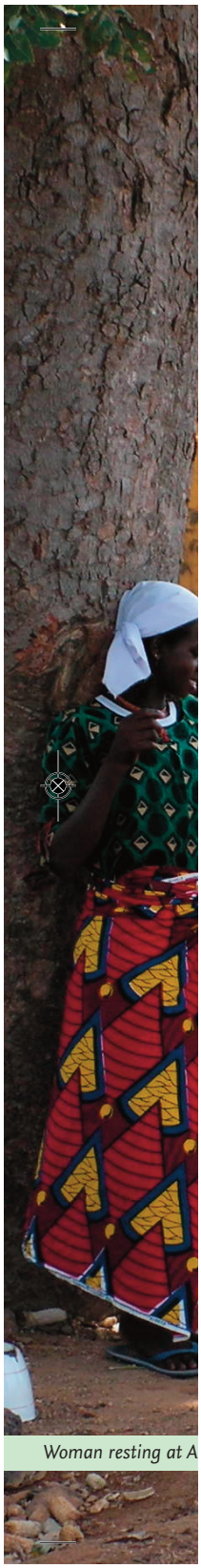
(For official use only)

i. Date of receipt:.....

ii. All attachments checked by:.....

iii. Application form checked by:.....

.....



Woman resting at A