



ACEMP
Africa Centre For Energy And Mineral Policy

UNDERSTANDING ARTISANAL
AND SMALL-SCALE MINING (ASM)
OPERATIONS IN UGANDA

A MAPPING STUDY REPORT



With funding support from



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ACRONYMS

ACEMP	Africa Centre for Energy and Mineral Policy
ANGMA	Angariama Mining Association
ASM	Artisanal and Small Scale Mining
ASMO	Artisanal and Small scale Mining Organisation
BASMA	Buteba Artisanal and Small scale Mining Association
BUSCO	Busia United Small Scale Mining Company
CAO	District Chief Administrative Officer
CBO	Community Based Organisation
CDO	Community Development Officer
DDI	Domestic Direct Development
DGF	Democratic Governance Facility
ECO	Ecological Christian Organisation
EWAD	Environmental Women in Action for Development
GDP	Gross Domestic Product
GSMD	Geological Survey and Mines Department
MDP	Minerals Development Program
MMMP	Mining, Minerals and Materials Program
NEMA	National Environment Management Authority
NGO	Non-Governmental Organisation
NKIP	North Kibaran Igneous Province
SAMA	Syanyonja Artisan Miners Alliance
TISSMA	Tiira Small Scale Miners Association
TMT	The Mining Team
UNRA	Uganda National Roads Authority

SUMMARY

Artisanal and Small Scale Mining (ASM) in Uganda has important implications for sustainable development. However, it has to date received inadequate attention despite its potential to impact livelihoods, provide crucial inputs for domestic economic development, have closer links with the local economy, generate more local jobs and ultimately contribute to poverty reduction.

ASM operations exist in an uncertain legal and regulatory environment, with a lack of publicly available and easily accessible geological data, which exacerbates wasteful exploration and discourages investment in the sector. The ASM mining communities in Uganda remain quite poor and prone to conflict and social unrest.

This study attempts to understand the entire environment surrounding ASM, the nature of their activities, challenges, economic potential and viability in an increasingly mechanised society.

This study started with a review and analysis of available information on ASM activities in Uganda followed by stakeholder identification and study site selection for field visits. The stakeholders identified and interviewed included existing ASM Associations and active mining companies in mining districts of Uganda, local government representatives and community members in the mining districts.

This study specifically looked at High Value Minerals and Precious Metals like Gold (Mubende, Namayingo, Busia, Buhweju, Kaabong, Nakapiripirit, and Amudat Districts); Tin, Wolfram and Iron Ore (Isingiro, Ntungamo, Kabale, Kisoro and Kanungu Districts). It also considered Low Value Minerals and Materials (also called Development Minerals) like Salt, Sand, Dimension Stones and Construction Materials (Granite, Shale and Quartzite), Pozzolana, Limestone and Marble (Wakiso, Mukono, Mbale, Lira, Gulu, Moroto, Soroti and Dokolo Districts).

Field work was conducted from 1st to 22nd of December 2016 and the stakeholders were interviewed and/or engaged in focus group discussions on site during field visits. A tentative study question check list was developed to guide the field teams and to make sure the data collected was sufficient for the intended purpose and objectives.

A total of 36 active ASM sites distributed throughout the whole country were investigated during this study and the total number of both male and female miners in each mine was determined.

ASMs are generally disorganized and people are allowed in the mine irrespective of where they come from as long as they are willing to work with the already existing communities. It was also difficult to investigate the exact ratio of male to female miners as well as children in every mine site since the sites claim not to allow children despite visual evidence to the contrary.

The total number of ASMs from the sites investigated was found to be 256,708, 35% of whom were women who directly and indirectly benefit from mining. The areas investigated excluded most of the active stone quarries in Wakiso District along Kampala-Gulu road via Bombo road.

ASM provides formal employment to very many Ugandans in the rural areas directly from operating mines, with the rest working mostly in mine construction or in the transportation of mine outputs. The employment benefit of the mining industry also extended beyond these direct jobs to create indirect and induced jobs. The indirect jobs were created as suppliers – such as contractors and engineering firms – hired new workers in response to spending by the mining industry. ASM therefore provides essential jobs throughout Uganda and reduces rural-urban-migration since communities get an alternative form of employment apart from just practicing agriculture which is seasonal.

A miner's wage is spent locally with most of them investing in agriculture development and small enterprises.

1.1. Study Background

Africa Centre for Energy And Mineral Policy (ACEMP), with funding support from the Democratic Governance Facility (DGF), contracted TMT Mining Limited to carry out a mapping study to collect data about Uganda's ASM sub-sector. TMT Mining is a leading mining consultancy in Uganda and the East African Region.

Artisanal mining in Uganda has important implications for sustainable development. However, it has received inadequate attention from the government, private sector and development partners despite its potential to impact livelihoods, provide crucial inputs for domestic economic development, have closer links with the local economy, generate more local jobs and ultimately reduce poverty in Uganda.

ASM operations are characterised by an uncertain legal and regulatory environment and insufficient publicly available and easily accessible geological data which exacerbates wasteful exploration and discourages investment in the sector. The oversight of environmental, social, health and safety issues is often inadequate, weak or even non-existent as well as technical extension services such as skills training, capacity building, access to technology, finance, etc.

The study therefore presents the details of the key actors in the ASM sub-sector, including the number of people involved in the sub-sector, the nature of their activities, the economic value that their mining operations bring to both the local economies of mineral rich districts and nationally.

1.2. Study Objectives

This report details a mapping study about Uganda's ASM sub-sector covering High Value Minerals and Precious Metals as well as Low Value Minerals and Materials, with a view to helping inform the work of policy makers, civil society, mining companies and development agencies that focus on Uganda's mining sector.

The specific objectives of this study were to establish:

- ◆ The location and nature of ASM activities and the different actors

in the sub-sector;

- ◆ An approximate number of people involved in ASM in both High Value and Low Value Minerals and Materials;
- ◆ The approximate economic value of ASM to the local economies of mineral rich districts.

1.3 Methodology

The methodology that was adopted for this study was as follows:

a) Desktop review of relevant literature and legal frameworks

This study started with a review and analysis of available information on ASM activities in Uganda and the existing policy, legal and regulatory framework.

b) Stake holder identification and study site selection

This phase involved identifying the active ASM stakeholders basing on the above literature, reviewing results and compiling the relevant list of questions for data collection. A tentative study question check list was developed to guide the field teams and to make sure the data collected was sufficient for the intended purpose and objectives.

The stakeholders identified included:

- Existing ASM Associations and active companies to interview;
- Active ASM mining sites to visit and interview miners;
- ASM miners from those sites to interview and/or engage in focus group discussions;
- Informants or experts to interview, including local government representatives and community members in the above mining sites.

Due to limited funding, this study considered selected High Value Minerals and Precious Metals namely gold, tin, wolfram, and iron ore. The Low Value Minerals and Materials (Development Minerals) were salt, sand, dimension stones and construction materials (granite, shale and quartzite), pozzolana, limestone and marble.

The active mining districts for the above commodities selected for this study are summarized in Table 1 below.

Artisanal mining in Uganda has potential to impact livelihoods provide crucial inputs for domestic economic development, have closer links with the local economy, generate more local jobs and ultimately reduce poverty in Uganda.

Table 1: Commodities and ASM mining districts selected for this study

Commodity	ASM Districts
Gold	Mubende, Namayingo, Busia, Buhweju, Kaabong, Nakapiripirit, Amudat
Tin, Wolfram, and Iron ore	Isingiro, Ntungamo, Kabale, Kisoro, Kanungu.
Development Minerals (salt, sand, clay, shale /slate, granite, quartzite, pozzolana, limestone and marble	Wakiso, Mukono, Mbale, Lira, Gulu, Moroto, Soroti, and Dokolo

According to the African, Caribbean, Pacific Group of States, and the European Union (ACP-EU) Development Minerals Programme, High Value Minerals and Low Values Minerals can be categorized as follows:

High Value Minerals

- » Precious stones: a historical term that somewhat arbitrarily eliminates diamond, ruby, emerald and sapphire as stones with exceptional beauty, geological hardness, durability and availability/rarity
- » Non-ferrous metals, excluding precious metals: a historical term that denotes metals that are prone to oxidization and corrosion. e.g. copper, lead, nickel, zinc.
- » Precious metals: high value metal that is chemically less-reactive, e.g. gold, silver and platinum group metals.
- » Other High Value Minerals include rare earth elements, iron and manganese, energy minerals (coal, oil shale), mineral sands, etc.

Fieldwork commenced with identifying of the informants and consultations with the District Authorities, the mining communities, Local Council leaderships, ASM associations where available, the local people and miners involved in the mining activities that were on the sites visited.

Further grassroots consultations were made subsequently by the research teams with specific stakeholders, especially at the selected ASM mining sites.

This involved:

- Interviewing ASM associations, mine site chairpersons, and landlords in the active mining areas;
- Focus group discussions with ASM miners in the respective districts
- Informant or expert interviews with purposively sampled stakeholder representatives, including Chief Administrative Officers (CAOs), Natural Resources Officers, Commercial Officers and representatives from the Ministry of Energy and Mineral Development, among others.

Low Value Minerals and Materials

- » Industrial minerals: substance of economic value, exclusive of metal ores, mineral fuels, and gemstones. e.g. barite, bentonite, borates, calcium carbonate, clays, diatomite, feldspar, granite, gypsum, industrial sand, kaolin, silica, soda ash, talc, wollastonite and zeolite.
- » Construction material (sometimes called 'industrial rocks'): e.g. gravel, limestone (cement), construction sand, aggregate, scoria, glass, ceramics, bricks.
- » Dimension stones: rock quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape. E.g. granite, marble, slate, sandstone.
- » Semi-precious stones: a mineral crystal or rock that is generally cut and polished to make jewelry, but that does not include precious stones. E.g. garnet, aqua-marine, opal, pearl.

d) Report compilation

All the above information collected has been put together to constitute this study report. The nature of each of the visited ASM site, number of people involved, economic, social and environmental positive and/or negative impacts identified for each study area were captured and used as the main input to this report.

c) Data collection

Acquisition of primary data involved interacting with respondents during field visits through individual and group interviews between 1st and 22nd of December 2016.

This phase involved extensive field visit to most of the ASM sites in the above identified mining Districts. Field investigations were conducted by three different groups that consisted of a Geologist, Mining Engineer as well as a Social and Environment Expert.

1.4. Desktop Review of the Relevant Literature

Artisanal and Small Scale Mining (ASM) is a subsistence form of mining where men and women use basic tools like pick axes, hammers, shovels etc., to extract a wide range of minerals (See Figure 1). Their activities are predominantly informally organized, disorganized, un-mechanized and often characterized by hazardous working conditions, lack of planning, child labour, poor health conditions and gender

inequalities.

Usually, ASM comprises all mining operations and associated activities that are smaller in scale than medium scale mining. A typical ASM operations' value chain is shown below:



Figure 1: Typical ASM mine site: Artisanal miners extracting sand from a swamp

Mineral discovery in Uganda was started by artisanal miners in the colonial days. The ASM activities started with the production of iron and salt in South Western Uganda followed by gold and base metal mining in several places in Uganda. Wild cat type of mining was widespread throughout the country and blacksmiths added some value to the minerals before they could be locally utilized throughout the country.

In 1919, the Geological Survey and Mines Department (GSMD) of Uganda was established and subsequently 'modern' mining started in the early 1920s.

Artisanal mining in Uganda started with the discovery and establishment of a number of colonial gold and tin mines across South Western Uganda between the 1920s and 1950s when small scale mining was introduced to the indigenous Banyankole, Batoro, Bakiga, and other Bantu speaking tribes of that region.

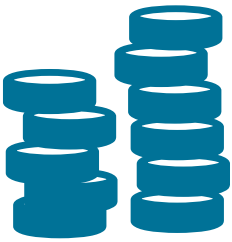
In 1929, colonialists settled in Busia District (Tiira) after the discovery of the Busia gold field and started mining gold with the assistance of the local people who also realized that there was gold in the area. This in general led to small migrations into mining areas by various local tribes as well as Rwandese and Congolese, whose descendants

still populate many of the mining areas in Uganda today (Hinton et al. 2011).

Formal mining started with the arrival of the British explorers between the 1950s and 1970s leading to the establishment of Falconbridge's Kilembe Mine as the first and only large scale mine in the country, producing over 271,000 tonnes of blister copper as well as cobalt, at the time.

Phosphates, limestone and several small to medium mines for tungsten, tin, beryl, niobium, tantalum, gold were operated in the 1930s–60s (e.g., Kitaka, Mwerasandu, Kirwa, Ruhizha) and several other commodities. During this period these mines were the third GDP contributor after coffee and cotton, contributing up to 35% of the country's foreign export earnings.

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With the relative stability experienced from the mid 1980s, a series of gold and base metal discoveries by artisanal miners generated rushes that drew between 1,000 and 5,000 people and introduced ASM to a number of farming and pastoral communities.

political tension and insecurity led to the exodus of skilled man power out of Uganda and subsequent collapse of the mining industry. After independence, Uganda's peace and stability was gradually restored and small scale mining resumed. The international investors that had fled the country were hesitant to return and therefore mining continued on small scale. There were a few medium scale mining operations especially of strategic minerals like limestone for cement manufacture, but precious metals, base metals and others continued to be exploited on small scale by artisanal miners.

With the relative stability experienced since the mid 1980s, a series of gold and base metal discoveries by artisanal miners generated rushes that drew between 1,000 and 5,000 miners and introduced ASM to a number of farming and pastoral communities.

Most of these ASM activities have been alluvial, but those few occurring in hard rock deposits have led to the establishment of small to medium scale mechanized operations where mining, crushing, grinding, and gravity concentration equipment replaced the manual hauling, crushing, grinding, and panning methods that characterize ASM across the country. At Busitema for example, cyanide vat leaching was introduced as an alternative to mercury amalgamation which is still practiced by ASM in that region. Although licensing of several other smallscale, hard rock operations (vis-à-vis "Location licenses" for small operations) also resulted from a series of discoveries in the 1980s through to today, these operations continue to be highly manual, employing essentially the same practices as unlicensed and/or illegal miners.

Other commodities like sand, clay, dimension stones and construction materials (aggregates) have been mined locally by communities and homesteads throughout the whole country to support the domestic construction industry. The production rate is controlled by demand and it is also seasonal and varies from region to region.

1.5. Government Policy and Legal Framework Regarding Mineral Resources

Minerals in Uganda are governed by the National Mineral Policy of 2001, the Mining Act of 2003 as well as the Mining Regulations 2004a (rules) and Mining Regulations 2004b (First Schedule of the Mining Act). Because

mining activities involve access to land, soil and water resources as well as generate various social and environmental impacts, it must be conducted in accordance with several other pieces of legislation, including but not limited to the National Environment Management Act, the National Forestry and Tree Planting Act, the Water Act (Cap. 157), the Wildlife Act (Cap.200 – particularly Sections 15 & 16), the Town and Country Planning Act (Cap.246), the Land Act (Cap.227), the Local Government Act (Cap. 243 – particularly the Second Schedule) and the Investment Code Act (Cap. 92).

The Policy Goal is to develop the mineral sector to contribute significantly to sustainable national economic and social growth by creating gainful employment and providing alternative source of income and eradicating poverty. Recently the Government of Uganda embarked on the review of the Mineral Policy 2001.

The Mineral Policy 2001, provides a balanced policy framework and demarcates government and private sector roles, recognizes the role of artisanal and small scale mining, espouses the principles of sustainability, stability, predictability of the fiscal, legal and regulatory framework, stakeholder engagement and gender, labour and children rights. As a result of the above provisions in the Mineral Policy 2001, fiscal laws for the mineral sector were amended and the Mining Act, 2003 was enacted which attracted a number of exploration and mining companies and boosted mineral trade in Uganda.

During the last ten years of implementation of the Mineral Policy 2001 and applicable Laws, the average annual growth rate of the mineral sector was 10.94% with growth rates peaking 19.4% in FY 2006/07 (Draft Green Paper on the Minerals and Mining Policy 2015).

In the same period, 2 large scale gold mines, 1 large scale copper mine, 1 large scale phosphate and iron ore mine, 1 large scale marble mine, 2 large scale tin mines, several medium scale mines for gold, iron ore, coltan, wolfram and industrial minerals and a number of small scale mines mainly for gold, tin, wolfram, marble, gypsum and kaolin were established. Also, exploration of other minerals including uranium, rare earth elements, iron ore, copper, nickel, chromium and zirconium commenced and is ongoing.

Despite these achievements, the mineral sector continues to face challenges including the inadequate balancing of national and sub-national interests, a lack of clarity of responsibilities and accountability between institutions, poor harmonization of land and natural resources use, speculation, insufficient exploration, an ineffective and inefficient licensing and contractual regime. The sub-sector is also shrouded in uncertainty of security of title and tenure, a continuing need for fair and just collection, accounting and equitable sharing of benefits arising from the extraction of mineral resources, unsustainable ASM activities, insufficient integration of the mining sector with other sectors of the economy, low human capacity of government to administer the sector, lack of value addition of minerals and beneficiation, environmental degradation and inadequate grievance mechanisms.

The review of the Mineral Policy 2001 has been influenced by a number of important developments: international best practices existing in other jurisdictions with mineral wealth, updated geological aerial survey of 2014, National Development Strategy under National Development Plan 11 (NDP11) and Vision 2040. For example, the existing policy framework is not in harmony with other current national strategies and policies particularly the short term National Development Strategy under National Development Plan (NDP) framework and the long term Development Strategy espoused under Vision 2040. There is also need for the Policy to reflect recent regional and global developments in mineral sector governance and sustainable development.

The policy framework, therefore, seeks to provide principles, objectives and policy strategies that are aimed at improving the legal and regulatory framework, and to establish a sound Mines and Mineral Policy for promotion of the mining sector to contribute to socio-economic development, enhance value added elements within the country, promote linkages with other sectors, harmonise land use and mineral resource exploitation, detail licensing and contractual regime, promote ASM and strengthen health, safety, environmental and social management.

The Mining Act 2003 and Mining Regulations 2004 provide for various mining licenses which can be acquired by an individual, a group of persons or by a company intending to carryout mining or trading of minerals. The Act obliges applicants for mineral rights to declare various key information, including their capital investment and human resource commitments, a topographic map of the area being applied for at a scale of 1:50,000, intended work plan and respective cost per activity,

as well as endorsement by the appropriate Chief Administrative Officer in presence of a witness of high moral standing (e.g. local leader such as District Chairperson or local Councillor).

2. Location and Nature of ASM Activities in Uganda

ASM in Uganda provides a source of livelihood for almost 200,000 women and men (Hinton et al., 2011), over half of which are engaged in production of industrial minerals to serve the construction industry demands for the country's rapidly growing population.

The women and men miners generally use basic tools such as pick axes, hammers, shovels, hoes etc. to extract a wide range of minerals though out the whole country. These activities are predominantly informally organized or disorganized, un-mechanized and often characterized by hazardous working conditions, lack of planning and issues related to child labour, poor health conditions and gender inequalities. Most often women and men enter the ASM sub-sector as it may be the most financially lucrative, most viable or sometimes the only livelihood option.

For this study, the commodities mined from the active ASM mining districts were identified and selected for field investigations (Figure 2). The teams visited the gold, tin, wolfram, and iron ore mining sites for the High Value Minerals and Precious Metals, and salt, sand, dimension stones and construction materials (granite, shale and quartzite), pozzolana, limestone and marble for the Low Value Minerals and Materials.

2.1 Gold

Detailed analyses of historic and recent information on active and abandoned artisanal gold mines and alluvial workings indicate that ASM dominates the gold mining sector in Uganda (SOMO and CRSS, 2016). The gold mining communities are widely spread out and are hosted by the Neoarchean Busia-Kakamega granite-greenstone belt in the South Eastern part of Uganda, the Paleoproterozoic Rwenzori fold belt in Central Uganda (e.g. Mubende, Mityana areas), the platform sedimentary rocks of the post Rwenzori fold belt (e.g. Buhweju, Mashonga, Kitaka areas), the reworked Archaean basement rocks and/or in the upper amphibolite-lower granulite facies rocks of the Neoproterozoic Mozambique fold belt in North Eastern and Western Uganda and in the Northern part of the Karamoja region.

Other areas in Uganda where alluvial gold

The review of the Mineral Policy

2001

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National Development Strategy under National Development Plan 11 (NDP11) and Vision

2040.

mineralisation and/or shallow gold workings are reported comprise the Kitgum area within the Aswa shear zone in Northern Uganda, the Western Nile area which represents the Western extremity of the Bomu-Kibalian shield of NE Congo, and the Kabale-Kisoro area hosted in the Mesoproterozoic North Kibaran fold belt in South Western Uganda.

In 2008, at least 20,000 ASM miners were engaged in gold mining mostly in the Busia Greenstone belt, Mubende-Singo gold fields, the Karamoja Region in the East and Northeast as well as in the Kigezi and Buhweju-Mashonga goldfields across the West and Southwest of the country. A UNEP study in 2009 indicated that this level had increased by 20–40 per cent in 2009 and therefore one can conclude that there are around 60,000 miners involved in gold ASM in 2016.

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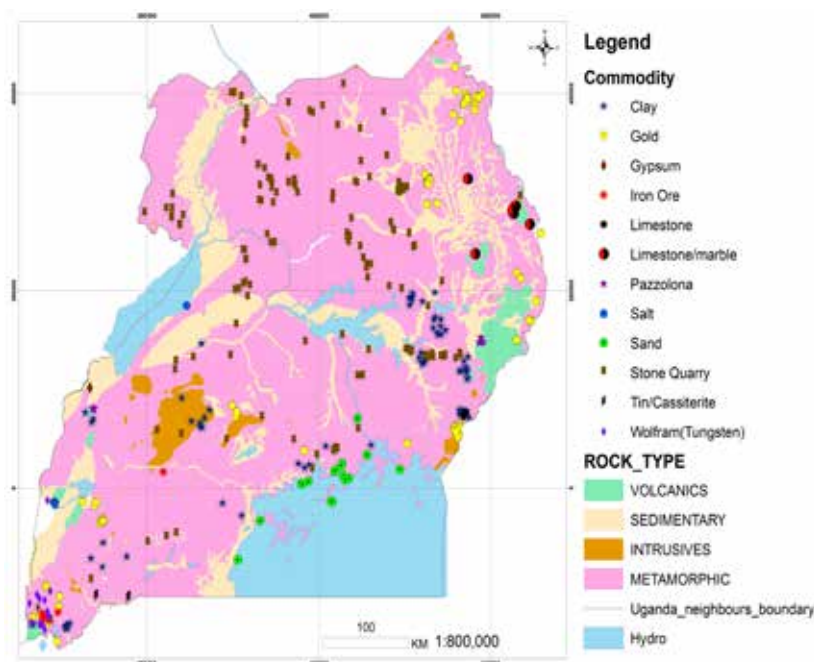


Figure 2: Current location map of the Active ASM Mining areas and Commodities mined in Uganda

2.1.1 ASM Gold Mining in Mubende

The Mubende gold mining area is located approximately 100 Km West of Kampala in central Uganda and contains the Kamalenge and Kisita gold mines, which are surrounded by numerous alluvial gold workings.

At the start of 2013 a 'gold rush' occurred at Kitumbi sub-county where locals have mined gold for decades and this was captured in a number of media reports (Uganda losing millions in illegal gold mining, New Vision, 29 May 2013).

The gold rush attracted an influx of thousands of illegal miners and people from all over the country and from neighbouring countries such as Rwanda, Burundi, Tanzania and DRC as observed and reported by ASMs interviewed on site (Figure 3). An interview with the Community Development Officer (CDO) of Kitumbi sub-county stated that there is a total of 60,000 ASMs registered within the sub-county. Of these, 25,000 are directly

involved in mining and the remaining 35,000 are indirectly involved as service providers but tied to the mining cycle.

Artisanal gold mining is spread across four of the sub counties of Mubende, along a stretch of 7 Km from Bukuya to Kitumbi and located within the Mubende and Singo gold fields, both relatively new and very large areas according to the Kitumbi CDO.

The specific mining areas as per the four sub-counties are as follows:

- ♣ Kitumbi sub-county has 9 ASM locations;
- ♣ Bukuya sub-county has 2 ASM locations;
- ♣ Makokota sub-county has 1 ASM location and;
- ♣ Butologo sub-county has 1 ASM location.

Seven mining groups from the above locations have registered with the sub-county as Community Based Organisations (CBOs) namely; Ssinga Artisanal and Small scale Miners' Association Ltd, Kitumbi Kayonza Miners Association Ltd,

Semutooke Miners Association Ltd, Namulanda Artisanal Miners' Association, Bukuya Traders Mining Group and Rahim Miners and Gold Dealers.

There are several mining sites in the area among which are Lubaali, Lugini I a.k.a "Kampala" by the miners, and Lugini II. Other sites spread across the four sub counties include: Kayonza, Kamusenene-Kagaba, Bukuya, Lukwago, Kikadde, Kyaliwolela, Kapyia, Masaka, Kamalenge, Walukwago, Kayindiyindi and Kabaada-the newest site.

Lubaali-Kitumbi is the largest artisanal mining camp which is situated on the AUC mining lease with a high concentration of ASM operations.

The Kayonza mining site lies on two hills of Mugobwa and Katuugo aligned in a north-south trend with the gold prospect in between. Some of the ASMs in this area are operating under the Kitumbi-Kayonza Company's Location License. The company has restricted sites and has workers on their sites. Others are working in private companies that own no license but have secured their sites with armed guards after agreement with land owners to either lease or buy off the land under which they are operating.

Figure 3: A distant view of an artisanal gold-mining camp in Mubende



The Kayonza site was the first gold rush area and has been ongoing since 2010 for more than five (5) years. While at its peak, the area had gathered over 10,000 women, men and children although these have drastically reduced to around 500 women, men and children, all engaged in various activities from mining, drying ores, pounding and grinding ores and panning, to cooking and selling food items, erecting shelters and loading ores on trucks. The Kayonza gold prospect area is held under Exploration License EL1093 licensed to M/S Gemstones International Ltd.

The main Actors in the Mubende ASM Gold mines

License holders: These are the owners of the various Location and Exploration Licenses under which the artisanal miners are operating.

Note: According to the Mining Laws, it is the license holder's obligation to ensure that all group members operating under the license meet the license's requirements with regard to protection of environment, payment of legal fees etc.

Landlord: The landlord is the owner of the land under which mining is taking place. He gives permission for the group to operate on his land and charges a fee depending on the type of activity that one intends to carry out. For example, one could either carry out mining or alternatively set up a cyanide processing unit on the land. The charges are dependent on the stretch of land that one intends to use.

Pits are owned by individuals who hire workers to extract the gold. These workers tend to be semi-permanent or permanent and can be dubbed as workers or miners. Other casual work entails hauling ore from the underground pits to the drying centres downhill.

Mineral Dealer: These are persons who buy the gold produced in any particular camp. Some of them are Ugandans but others come from Tanzania, Kenya and United Arab Emirates (UAE).

Casual labourers: These are people who offer labour for conducting various activities from extraction to milling within the mining cycle, especially hauling the ore from the pits to the drying area and extracting ore.

Service providers: These include the ball and hammer mill operators and panners. These service providers charge a fee for each service delivered.

The Nature of ASM gold mining activities in Mubende District

Ore Extraction: There is underground mining of hard rock ore and only men are engaged in this activity. Each shaft has 15-30 persons. There are over 200 mining pits in the District. Shafts are sunk as deep as 50-200 feet and are accessed by makeshift ladders (Figure 4 A, B and C). The mining method is semi-mechanized and the miners use function hammers to aid in rock breaking and subsequent extraction (Figure 4D).

At the Lubaali site, hard rock mining takes place along the hill side and alluvial mining is concentrated in the swamp area at the valley bottom. Open pit mining method is used to extract hard rock to the surface. The mine shafts at Lubaali are approximately 30 meters deep.

The powder from the milling is then taken to the Z-cyanide processing units, hence skipping the panning phase.



Figure 4: Photographs of the Kamusenene - Kagaba shafts: A, B, and C: entrances and some of the active shafts accessed by make-shift ladders;

The shafts have ventilation pipes (2 inch water pipes) running through the tunnels with air being tapped from outside the shafts and pumped into the underground areas. Also bulbs have been placed in every corner of the mine to aid in lighting. These bulbs and the function hammer are powered using a diesel generator.

Figure 5: Four underground mining pits being supplied by one generator (pictured in the bottom left corner)



The gold extraction is carried out throughout the day and night in two shifts (7am – 4pm and 6pm to 4am respectively).

Haulage: After extraction, the ore is packed in sacks which are hauled to the surface by casual labourers and to the milling sites. The casual labourers charge ten thousand shillings per sack. Haulage is done manually and the ore is carried along the ladders that are located in the pits.

Drying of ore: After the ore is crushed using hammers, it is dried under the sun on tarpaulins in open space close to the milling areas. These areas also serve as open stores or collection points where all extracted ore is dried and heaped ready for milling. Drying is another service offered by panners to the ore owners such that after it has been milled the panner gets the business of panning. The panners charge a fee and thereafter sell the tailings for an additional income.

Milling: Two types of mills are being used at this site, the hammer mills and ball mills (Figure 6). Milling has been costing Shs.50,000 per sack but by the time of the visit, it had dropped to Shs. 20,000 per sack. The price is not fixed and can be negotiated between the mill operator and the owner of the ore. All mill owners are men although both women and men work at the mills, especially to feed the mills with ore. There were 9 mills on site. Water is added in some ball mills which operate as a wet mill and mercury is added to that mixture as well.



Figure 6: Photographs of the ball mills and a hammer mill

Panning: From the mill, panning and whole ore amalgamation commences. Panning is a women's domain at these sites (Figure 7C). A sample is first panned to gauge the grade of the given ore (Figure 7D). Mercury is introduced at this stage. Skilled panners use less mercury compared to the less skilled ones. Although on average, a sack of powder is panned at Shs. 6,000 using four grams of mercury. Each mercury gram is sold at Shs.1,000. The amount of mercury used is determined by the quality of the ore being washed.

At the point of milling the tailings, processors commonly known as Z's because of their Zig-Zag sluice boxes are used. The Z-operators usually ferry the water in tanks that are loaded on lorries and drained in water dams at the panning sites (Figure 7A and B). One tank can hold up to 1000 litres of water. Panning is employed by the owners of small quantities of ore for example, the mine

workers. The "bosses" / owners of the pits take their ore powder directly to cyanide processing units where they are able to sell it in bulk. They normally ferry the ore after accumulating a large amount, at least a truck or two.

Amalgam heating, weighing and sales: The amalgam is heated on a metallic spoon, using gas, to free pure gold from the mercury. The gold is weighed and sold to buyers on-site. Some locals are involved in buying of this gold and a few middle men from Kampala. A gram costs Shs. 100,000. This entire process takes place in dealers' tents.

Loading and transportation of tailings to Z sites:

The tailings are then loaded and ferried by "Z" (cyanide processing unit) operators to their sites for reworking using cyanide and several other chemicals like carbon. One lorry of tailings costs Shs. 70-100,000.



Figure 7: A and B: Trucks carrying tanks of water to the mine and Women panning the milled ore

"Z" – Cyanide Processing Unit:

Lwesambya Artisan Miners Association is one of the several sites processing tailings from panning. The residues are fed into a leaching tank (Figure 8B and C) to which a combination of chemicals is introduced (cyanide and other chemicals, Figure 8D).

These chemicals are mixed in what the site manager refers to as the barren tank. The barren tank and the leaching tank are fed with water from the tanks which are erected close by. The water tanks are also fed with water from the nearby streams which are extracted using pipes and water pumps.

After a certain period has elapsed the leaching tank is checked to determine whether the gold is being extracted or not. The testing is done in parts per meter (ppm), the colour tests and estimated grams expected vis-a-vis what is being collected in the next stage of processing, at the column based chambers. 24 medium sized trucks fill the leaching tank. The site has two (2) owners and ten (10) workers as follows: One (1) female cook, eight (8) loaders and two (2) operators – one (1) mixing chemist in charge of mixing the chemicals in the barren tank and in the chambers and another one (1) in charge of the water pump and all other machinery on site.

At the column chamber, there are five (5) columns:

- o Column I: The first column called the head, has corks that are closed and opened at the time of measuring whether the expected gold from the leaching tank has all been collected.
- o Column II: In this section, carbon is introduced to further trap the gold.
- o Column III: Is a section for colour testing to determine the amount of gold being extracted at a given time.
- o Column IV: More carbon is introduced into this chamber
- o Column V: Is the chamber of final testing and the last chamber where gold is finally extracted.

The column chamber (Figure 8E and F) section is inside a permanent building which is always under lock.

Workers live on the site in make shift houses mainly made of tarpaulin. These workers are paid Shs. 300,000 per month for

strong extraction of

the ore, while food and accommodation are offered by the plant owners.

Local Ugandans from across the country have been operating these Z sites for a while. However, currently Indians and Tanzanians have joined the business and they are buying off most of the tailings at higher rates. For example, one man of Asian origin has 12 leaching tanks and two column chamber units. He employs 30 workers. Another relatively large plant is owned by a Tanzanian.

Within the Lwesambya area, there are eight (8) Z processing sites. In Lubaali – Kitumbi site, there is a Chinese processing site that is further processing tailings from the Z- processors using a technology that was referred to as CIP. However, even in those tanks a combination cyanide, carbon, tailings and water are at play in the process.

There is also an edge/wet mill site in the area that is involved in processing of tailings from the mine sites.



Figure 8: A: The Zig-Zag sluice box; B and C Barren leaching tank for mixing chemicals; D Cyanide drum containing the cyanide imported and used;

E and F: The column chambers



2.1.2 ASM Gold Mining in Namayingo and Busia areas

The Busia greenstone belt hosting the several ASM gold mine sites in Namayingo and Busia districts is located approximately 214km from Kampala in SE Uganda. The geology of the area encompasses rocks of the Neoarchean Busia Kakamega greenstone belt sequences (Nyanzian and Kavirondian Super Groups; 2.7–2.5 Ga; Gabert 1990) intruded by pre- and post-tectonic Neoarchean granites and granitoids.

Gold was first discovered in the Busia gold district in 1932 in the Osipiri area (Combe 1933). Small-scale mining operations on vein and alluvial deposits began soon after this discovery in Tiira, Makina, Amonikakine and Osapiri villages and are ongoing at present. In the recent past, gold rushes have been reported in the Bude, Nakudi and Busuma gold mines in Namayingo District where fieldwork was first undertaken. Just like in the Mubende mine sites, the gold operations in the district have also attracted people from many parts of Uganda.

Artisanal mining has persisted in the area up to today mostly on licensed areas by illegal artisanal miners. The fact that these people have continued mining in these areas suggests that they are recovering good quantity of gold.

Prior to the granting of large concessions to formal mining and exploration companies in these areas, the majority of rural households were engaged in gold mining or processing, either on a full-time or part-time basis. The community members worked in family units who were sometimes joined by close friends and other work groups comprised of community based self-employed miners tied into units of 7-12 members. To date, mining in Busia is currently dominated by ASMs, commonly using rudimentary tools, informal, with some miners working on a part time and or temporary basis

and others are involved in mining on a permanent basis.

Also, unlike other regions of Uganda, gold mining in Busia generally includes underground workings and surface mining of both alluvial and hard rock ores. Busia's principle livelihood activities are trade, mining and agriculture, although the latter is done on a small scale (Busia District Development Plan, 2015). The Estimated number of Busia ASM Gold Miners is 600 within Buteba, Sikuda and Busitema sub-counties, with a ratio of four (4) men: (one) 1 woman; individual incomes are estimated at about Shs.17 million per year. (Environmental Women in Action for Development Report, 2015).

Busia has a mixture of organized groups, registered with their District as Community Based Organisations namely: Buteba Artisanal and Small scale Mining Association (BASMA) in Agaata village of Amonikakinei Parish, Buteba Sub county of Busia District. There is also Syanyonja Artisan Miners' Alliance (SAMA) in Syanyonja Parish, Tiira Small Scale Miners Association (TISSMA) in Tiira village. There is also Busia United Small Scale Mining Company located in Tiira village, Sikuda sub-county, Busia District is registered by the registrar of companies as a company limited by shares.

ASM Miners Associations' Profiles in Busia

Busia United Small scale Miners' Company (BUSCO)

Busia United Small scale Mining Company Limited (BUSCO) was a consortium of three mining groups namely; Eastern Miners' Association, Victory Miners' Association and Umoja Miners' Association that came together and sought for legal status. Subsequently, BUSCO was incorporated as a company with the Registrar of Companies, Kampala on the 31st of January, 2011. Women Juu was also later appended to this company. BUSCO further obtained its mining license (known as a Location License –LL) on the 28th of May 2012 that covers approximately 14 hectares. The group

Gold mining in Busia generally includes underground workings and surface mining of both alluvial and hard rock ores. Busia's principle livelihood activities are trade, mining and agriculture, although the latter is done on a small scale (Busia District Development Plan, 2015).



Tiira Small Scale Mining Association (TISSMA) has been in existence since 2003, although it was not formally registered. In April 2013, TISSMA officially registered with the local government as a Community Based Organisation. The group has

57

members,

31

men:

26

women. .

is currently involved in gold mining only.

Each group is headed by a director under whom are permanent miners albeit some times when need arises, casuals are hired. BUSCO has 50 members; 35 men: 15 women. Originally, it had 105 members with 60 males and 45 females. However, due to the harsh working conditions then, coupled with unstable incomes, several miners withdrew from the activity.

BUSCO's activities are largely manual; mainly using hand tools throughout the Systems of Production save for the ball mills that aid them in ore size reduction and the water pump that drains the pit when it gets flooded with underground water. Occasionally, high tech equipment is hired to reduce the burden of extraction and the rest of the work is done manually by members of the ASMO and hired labourers. BUSCO practices open cast mining of hard rock ore and concurrently mines alluvial gold or weathered ore.

Angariama Mining Association (ANGMA)

Angariama Mining Association (ANGMA) is a community based organization that is membership constituted and owned, headed by an executive committee that was democratically elected by all members and which committee is representative of all key factions of ANGMA's membership inclusive of women, men, religious leaders, among others. Membership comprises of (15) women and (15) men miners, who are largely family units and friends or neighbours who came together to conduct mining business.

Syanyonja Artisan Miners' Alliance (SAMA)

Syanyonja Artisan Miners' Alliance (SAMA) was officially registered in 2013 with the Busia local government officials at Sub county level. It is made up of four core groups which are clearly defined by the shafts in which they operate. These core groups form the Alliance.

SAMA has made tremendous progress beginning from scratch to building a strong, vibrant and operational association that has transformed the face of ASM in Syanyonja. The members have accumulated enough capital to invest in timbering of the shafts and construction of washing ponds for the members. SAMA's activities are largely manual and they are specifically involved in underground mining of hard rock ore. They mainly use hand tools throughout their system of production save for the crusher that aids them in ore size reduction.

SAMA's numbers have tremendously declined due to the unsustainable methods and harsh

working conditions leading to very low incomes. In 2012, SAMA had a total of 87 members; 60 males and 27 females. Today, the group has 35 actives ASMs. SAMA is made up of four core groups with each having 7-20 members working a specific shaft. It is these four shafts that define the core groups of the ASMO. These groups are comprised of family members and or close friends due to trust issues. Currently, SAMA is undertaking underground workings.

In SAMA, individuals are engaged in specific tasks of digging, pounding, hauling and processing the gold ore. The gender-based division of labour has not been streamlined, albeit men are largely engaged in ore extraction whereas women are mainly mineral selectors picking from the low ore grade materials that they can take home to process. Women are also engaged in processing at the stages of sluicing and panning.

Tiira Small Scale Mining Association (TISSMA)

Tiira Small Scale Mining Association (TISSMA) has been in existence since 2003, although it was not formally registered. In April 2013, TISSMA officially registered with the local government as a Community Based Organisation. The group has 57 members, 31 men: 26 women.

The group is operating two open pits which are under land that belongs to its group members. Most of the work in this group is done by group members who participate in the entire mining cycle up to the point of sharing proceeds. It is at that point that these individuals get paid for all the labour invested in the business. However, at certain points where skilled manpower is required especially at the point of sluicing and panning, the group hires labourers to work alongside some of the group members who have the art of sluicing and or panning. Also the ball mill is commercial and this calls for the group to pay a fee for using the service.

TISSMA has a written understanding with Busia United Small scale Mining Company Limited to operate under its location license.

TISSMA's activities have largely stalled due to the incapacity to drain the open pit due to flooding. As a result, one of its pits has remained

unworked for a long period although efforts are being made to revamp the pit.

The group is mainly carrying out hard rock/ore extraction using the open cast method and alluvial gold workings. In its initial stages as an ASMO, TISSMA experienced challenges during its operations due to the heavy rains and the poor occupational health and safety mechanisms. However, it has now adopted appropriate mining methods like the use of sluice boxes and ponds, use of the retort, crushing using a ball mill, etc.

Buteba Artisanal and Small Scale Mining Association (BASMA)

Buteba Artisanal and Small Scale Mining Association (BASMA) is operating in Agata Village, Amonikakine, Buteba Sub County in Busia District. BASMA officially registered with Buteba Sub County (local government) in 2012 as a Community Based Organisation (CBO). The group has 33 members, 17 men: 16 women.

BASMA operates under an individual's mineral right, a location license owned by a one George Onega who is also a member of the Association and has a written understanding and good working relationship with the other members of the Association. The landlord of the area is a member of the ASMO and has granted them written permission to operate their businesses.

BASMA's activities are largely manual except for the ball mill that is hired to crush the ore into powder.

BASMA as a group has also tried to adopt some new technologies and ways of working by setting up a processing area away from the stream where milling, sluicing and panning are taking place.

BASMA is largely carrying out open pit mining of hard rock. The group also has a women's unit that is involved in alternative income generating projects namely goat rearing and fish farming.

The main Actors in the Busia-Namayingo ASM gold mining sites

License holders: These are the owners of the various Location and Exploration Licenses under which the ASGMs are operating. The licenses are being operated as follows:

- SAMA has a Memorandum of Understanding to operate under the exploration license owned by a foreign company- Roraima.
- BASMA has permission to operate under the location license owned by an individual who is also a member of the group.
- BASMA has a location license co-owned by three directors who are as well part of the group and have granted written permission to the group members to work under that license.
- TISCA is also operating two pits under the BUSMA mineral right and with written permission to do so.

Several other informal groups and individuals are also in operation under the above mineral rights and others without written permission.

NOTE: It is the license holder's obligations to ensure that all group members operating under the license meet the license's requirements with regards to protection of environment, payment of legal fees etc.



In Buteba, where a land lord does not work, he will earn one equal share of dividends as the person who has worked for the longest period. If he decided to work along with the group, he will earn two such shares. He also keeps the records to track the amount that he should get at the end. He doubles as foreman in charge of record taking. He is also charged with backfilling of the pits. The group agrees that before sharing of the money takes place.

In SAMA, the landlords charge 5% of the profits and two (2) shares as a member or 15% of the profits and one (1) share as a member.

In BASMA, the land lord does not engage in mining but earns a lion's share of approximately 40% with the argument that he owns the land that hosts the gold. The percentage usually differs and this is dictated by the landlord.

Even for other informal groups operating on one's land, the arrangements are either of those mentioned above.

Mineral Dealer/Middleman: These are persons involved



In BASMA, the land lord does not engage in mining but earns a lion's share of approximately

40%

with the argument that he owns the land that hosts the gold.

in gold buying. They usually pre-finance the mining activity by giving money for payment of casual labourers, payment at the ball mill and panning or sluicing if need be and finally for purchase of mercury. Upon getting the final product, in the presence of all group members, the dealer deducts his pre-finance capital and gives the group the balance that is shared according to their agreed upon mode of sharing. Having pre-financed the activities, he automatically becomes the buyer of the group's gold.

Group Members: The role of members of BASMA is to actively participate in mining and processing of the group's ore. The members also attend AGMs and other adhoc meetings as and when required to decide on issues as they arise. The members are also involved in self-policing to ensure that no member cheats the others or dodges work.

Casual labourers: Casuals are usually hired when members cannot come to work or during peak seasons when the group intercepts the vein and work must be hurried to avoid thefts or during processing especially at panning phase. They are contracted for a defined period and their mode of payment is agreed upon at the time of hire, in the presence of the rest of the group members.

Service providers: These include the ball mill operators, sluice box operators and panners. The ball mill operator charges a fee for

processing the ore. Also if the members have very rich ore, they hire services of sluice box operators along with the water pumps and also if need be, skilled personnel to pan their gold as they watch over the process.

ASM Mines Sites visited

Bude ASM gold mine which is located 7km before Namayingo town, along Mayuge – Namayingo road is the oldest of the three artisanal mines visited. The mine covers an area of 98,383 square meters but at the moment, there are few artisanal miners operating, as the majority of them have moved to newly discovered Nakudi and Busuma.

Nakudi ASM gold mine which is approximately 19.5 km south of Bude site covering an area of 24,545 square meters is the busiest of the three mines (Figure 9B and C), employing about 300 people although the number was increasing at an alarming rate, according to the Local Council Chairperson. The mine has attracted people from all corners of the country as well as neighbouring Kenya.

Busuma ASM gold mine is located approximately 3.5 km east of Nakudi and covers an area of 6,609 square meters. This mine employs about 150 people, mostly women.



Figure 9: A: a series of abandoned ASM pits at Bude gold mine site, B: ASM Pits at Nakudi Mine site; C: Overview of the Nakudi Mine site

Syanyonja

Syanyonjo small scale mines are being operated by Syanyonjo Artisanal Miners Alliance. The pit that was fenced off for demonstration of this project area is located at 616953mE/60998mN. it is about 3 is meters deep.

The second pit is located at 616933mE/61033mN. This pit is being mined actively and about 10m deep. The bedrock has not been intercepted yet (Figure 10A). The wall is made up of Reddish brown soft soils. The pit is about 3 meters deep with walls supported by timber.

The third pit is located at 616953mE/60954mN. This pit is also being mined actively and the clayish reddish brown soft soils are being supported by the timber. The depth of the pit is about 13m and the bedrock has not been intercepted. The wall is made up of Reddish brown soft soils.

Tiira 1

Tiira 1 pit is located on a gently sloping ridge at Tira village and is operated by Tiira Small Scale Mining Association. At present the pit is about 14m deep and 10m wide and is partially filled with water. Accessing this pit is almost impossible since there are no steps/benches for easy access to the pit; the soil on the wall is soft and slippery. Moreover, the overburden from the pit has been piled near the pit. This makes the hanging wall weak and may collapse. The wall of the pit is mainly made up of reddish brownish soils with some quartz veins intersecting each other. The bed rock made up of cherty quartzitic and Banded Iron Formation (BIF) was intercepted at about 14m. It was reported by the miners that the main gold is recovered from those veins rocks in the overburden and in the BIF in the bedrock.

Tiira 2

There are many pits which are operated by Busia United Small Scale Mining Company Ltd in Tiira 2, some of which are active while others have been abandoned and are filled with both groundwater and rainwater which are currently used for sluicing (Figure 10B).

619973mE/56871mN. This pit is about 15m deep and 10m length and 3m wide. The bedrock was intercepted at about 10m and is mainly fractured, jointed and sheared quartzitic rock and this is where main gold is recovered. The overburden is mainly made of Lateritic soils.

The second pit being mined actively is located at 620017mE/56893mN on the gently slope towards the River Tiira. The depth of this pit is about 10m and the bed rock was intercepted about 9m, the overburden is also lateritic soils while the bedrock is made up of fractured, jointed and sheared quartzitic rock. In this pit, haulage is mainly done by women. However, also children (Figure 10C), youths and adult men do engage in the haulage activity as and when they need some money.

Other three pits were located at 620023mE/56946mN, 620012mE/56957mN and 619992/56700mN and are filled with water mainly groundwater. These three pits are currently used for sluicing and panning.

Amonikakinei

The Amonikakinei pits are located at 618584mE/62697mN and are being operated by Buteba Artisanal Small Scale Miners. The pits are very many with varying depths though still shallow and scattered in the whole mining area (Figure 10D). Currently, they are mining in lateritic soils where they are finding gold quartzitic rock in the veins.

The overburden from the pit has been piled near the pit. This makes the hanging wall weak and may collapse.



Figure 10: Photographs of some of the ASM sites in Busia. A: Syanyonja ASM active open pit with adits; B: One of the Tiira1 pits; C: Amonikakinei abandoned pits; D: Children miners transporting the ore from the pits to the drying area in Tira



Rock extraction is mainly done by men. If the ore body is “so hard”, the group contracts additional labour (“mercenaries”) to assist them extract the rock and these are paid per day on an agreed upon rate, usually

5,000
shillings
to
7000
shillings.

Nature of the Busia ASM Activities

Among the registered groups, only SAMA is operating an underground mine. The rest of ASGMs across the gold field are operating open pits. Gold mining in Busia includes underground workings and surface mining of both alluvial and hard rock ores. During the field investigations, it was noted that artisanal and small scale miners are employing similar ore extraction and gold recovery methods in the Busia greenstone belt.

Hard Rock Ore

Stage One: Pit Works (Extraction)

Most of the work in the pits is done by men using rudimentary tools, working either in small groups or as individuals (Figure 11A)

Removal of overburden is the first activity and this is done by both women and men. Women continue to work in the pits for as long as they are shallow but they are barred from working in deep pits because it is believed that women cannot manage that type of work. A few women have however broken these barriers as they persist and continue working along with the men throughout the rock extraction especially when the ore is found to be rich.

Rock extraction is mainly done by men. If the ore body is “so hard”, the group contracts additional labour (“mercenaries”) to assist them extract the rock and these are paid per day on an agreed upon rate, usually Shs. 5,000 to Shs. 7000. Thereafter, the ore is hauled to the surface of the pit in an open space (Figure 11B) where all group members can monitor the ore being extracted as they work.

If it is a sunny season and the ore is found to be of low grade and therefore accumulation of the ore may not be viable, the little ore extracted is dried up immediately. However, if it is a dry season and the ore seems to be of good grade, it is stored until a good amount is collected such that members get better dividends after sharing.

In Buteba, at the pit, the dealer, landlord and one representative of the miners counts the sacks or basins that have been extracted at the end of the day. For security purposes while at the pit, on a rotational basis one of the members does not work but rather sits at the top of the pit overseeing the ore that is brought out and ensuring security of fellow miners while in the pit. The member oversees for only one shift and works in the next shift as another member takes up the overseeing role.

If the ore is found to be so rich, all members sleep over at the pit to ensure that no theft is experienced during the night by fellow members and non-members alike. A member, who cannot sleep over, must send a representative or pay a fine as the group decided for that day.

Stage Two: Collection Point

The ore is either ferried in basins carried on individuals' heads or they make a human chain (usually conducted along steep steps that are haphazardly dug along the pit walls and quite often they are very small and wet) from the bottom of the pit where individuals send the basin from one person to the next up to the top most person situated at the top of the pit. This person then pours the ore in a heap near the pit. This is commonly referred to as the collection point. This point is for all group members to know the production of the day. This is measured in basins or sacks (Figure 11C).

The ASMs quite often intercept underground water and most times the pits have water which covers the ore thereby making it difficult to extract. Besides, it is time wasting to remove the water from the pit since they usually use basins and it is also very expensive because even at this point “mercenaries” are contracted to ensure fast drainage of the pits.

All the above activities are conducted by both women and men at the pits and it is at the collection point that the people who have extracted the ore decide whether to proceed as a group or to work individually in the processing activity. If the ore is shared amongst the members, they proceed with the same activities as the group only that work is done individually and not as a group, and the individual can hire “mercenaries” or the group can hire them too depending on the activity and the amount of labour required. If the members decide to proceed to processing as a group, they allocate activities to each other up to the final stage where they all meet to share the proceeds. The group will store their ore in a designated enclosed place (store) if the ore is bulky. However if it is not very much, the group immediately proceeds to process the ore after taking off two to three hours of rest following the heavy and tedious work done during the rock extraction phase.

Some stores are located in one of the rooms within the landlord's house in which case the landlord doubles as the storekeeper. In other cases, the store is close to the mine or processing area and the lock has three padlocks with each key kept by a different person.

At the store all sacks are sewn on the top and the

finishing is specially done such that no one can tamper with the sack. Also the last ore is specifically piled in a unique manner. All this is done to ensure that the ore is not stolen.

Stage Three: Drying and Crushing of Ore

Drying precedes the storage/sharing activity. This for individuals is done in an open yard, usually in the compounds back at home and for groups this is usually done close to the store and a few times; it is done at an appointed member's home. Thereafter, the group assigns members to crush the rocks into smaller sizes. Both women and men are involved in this activity. After, crushing the ore, they again measure it for everybody to know how many basins/sacks have been produced for that day.

Stage Four: Manual Grinding/ Pounding or Milling

After crushing, the group either grinds/pounds the ore manually using metallic mortars or they together take the ore to the commercial ball mill where they pay money to have their ore ground.

NOTE: Stages three and four have almost been phased out as almost all ASMs in the area have resorted to ball mills and crushers (Figure 11E) for size reduction and this is done at a fee.

Milling: All members are present at the ball mill to avoid being cheated. The sacks that are realized after milling are recorded by the landlord as well.

Stage Five: Sluicing / “Washing”

Sluicing involves a sluice box which is a flat bottomed trough, lined with a carpet, mat or riffles. Powder is fed unto the sluice box and water is also constantly streamed over the box. The lighter gauge materials flow over the sluice box and the gold is trapped or settles at the bottom of the carpet / riffles because it has a property of being heavy. The gold is then removed. Activities at the sluice box are done in the presence and under close watch of all members.

In such circumstances, the group pays only for the sluice box and the water pump at a rate of Shs. 25,000 (20,000/= for the water pump and 5,000/= for the sluice box for the entire day). Sluicing is done to reduce the material and workload for panning.

Stage Six: Panning and Amalgamation

The panning is done immediately due to suspicion of being cheated amongst members. Panning is however done by only skilled people who may or may not be part of the association. For the members who do not know how to pan, they hire skilled persons as members to do it.

One basin is panned at Shs. 1,000 or Shs. 2,000 basing on the ore grade. All the group members witness the activity.

This activity is done by both women and men. If the ground ore (powder) is much more than what can be washed for the day, it is first measured in basins/sacks and then stored for the next day. The powder is washed at the stream (Figure 11D) and by this stage, mercury has already been secured from financiers (middlemen) commonly known as “Boss”, landlords, group savings or from individual group members.

During panning, estimates of the amount of mercury to be used are made by merely looking at the amount of concentrate and deciding how much gold can be caught by a given amount of mercury. Approximately, one gram of mercury is used to trap two grams of gold. Also, one gram of mercury costs only Shs. 1000 at Tiira village but gets more expensive away from Tiira where demand is less.

Sluicing and panning activities have been relocated closer to the nearby streams so as to be able to easily tap water for the processes. In some mines, panning is



During panning, estimates of the amount of mercury to be used are made by merely looking at the amount of concentrate and deciding how much gold can be caught by a given amount of mercury. Approximately, one gram of mercury is used to trap two grams of gold. Also, one gram of mercury costs only Shs.

1000

at Tiira village and gets more expensive away from Tiira where demand is less.

NOTE:

All processing is done in one day. Even if it gets dark, a kerosene lamp is lit to enable the processing to proceed. This is done so that all members go back home aware of how much gold has been realized from the processing. The dealer is around throughout all the processes including during the night processing.

Middlemen argue that open air affects the weight of the gold because it adds oxygen, giving a false value.

done at designated places where ponds have been constructed.

Stage Seven: Amalgamation and Heating

The mercury is introduced during the washing process where the ore is amalgamated with mercury in a basin (Figure 11F). Usually one gram of mercury is introduced into three to five handfuls of powder mixed with water, roughly about a basinful. If the rock is mineral rich, the mercury dries up and more is introduced as per the need.

After washing, excess mercury is squeezed out of the amalgam onto the banks of the stream/ground, using a cloth. Amalgam heating/burning is usually done immediately for transparency purposes, so that all group members witness what they have got out of the processing. Sales are all transacted right away the burning is done.

The registered groups have undergone training under a Fair Trade Gold Project. Accordingly, they have adopted the use of retorts which enables self-protection of the miners from inhaling mercury vapour and at the same time, the surrounding non-mining community and the environment are protected. The amalgam is placed in a retort where it is heated up until the gold is liberated from the mercury. The retort is then opened, the gold is removed and the mercury is recovered and stored for future use.

Stage Eight: Weighing

After heating the amalgam, it is carried by one of the members as the rest of the group follows immediately behind him or her for weighing. Middlemen argue that open air affects the weight of the gold because it adds oxygen, giving a false value. Consequently, some groups/individuals weigh the gold in an enclosed place. This is also done for privacy purposes. This enclosed room approach is especially necessary in situations where the group borrowed money from the landlord or middle men.

The amalgam is weighed in presence of all group members, then the 'Boss'/middleman deducts the money he invested in the group throughout the entire process and hands over the rest of the money to the group leader. The group leader then deducts the landlord's share. This is usually 40–60% depending on the agreement that the group had with him or her. The other group members then share the remaining money amongst themselves.

Stage Nine: Profit Sharing and Expenditure

Sharing of the proceeds is usually done instantly after sales. The proceeds are then shared as follows:

The pre-finance capital from the dealer or landlord or individual group member which covered all expenditures throughout the process (including hiring labourers, payments at the ball mill, fuel for the water pump and food costs) are deducted. Thereafter, all members including the landlord share the profits equally. The only difference is that the landlord gets one share whether he worked or not. However, if he or she chooses to work along with the group, he or she will then get two shares.

NOTE: Many times, landlords make losses when miners do not cover up the pits after ore extraction and the landlord remains with void pits within his or her land which have to be filled at his/her cost. Sometimes the landlord may be forced to sell a cow or goats to raise capital to fill up a pit.

Under normal circumstances there is a by-law that miners must first cover the pit before they proceed to process and share the profits, although this may be abused. It is therefore better that the landlord inspects the pits to ascertain whether work is still on-going or else the members first cover up the pit before they proceed with processing.

Also, Sometimes the profits realized after processing are directly equivalent to the pre-finance capital and accordingly the whole group loses as they get no money at all after the entire process. This calls for pre-sampling to ensure that the amount of gold that will be recovered will pay up for the pre-finance capital and also a balance remains for the members to share and take home some money.

Alluvial Gold

This is mainly worked by women. They dig from pits at the bank of the stream and extract mud and rock pieces. After extraction, the ore is washed, the loose gold is removed and the rocks are treated as hard rock gold and taken through all the stages as described previously. The mud is right away washed using a sluice box where the loose gold is retained on the sluice as the hard rock pieces are hand picked off the sluice. After drying, the hard rock ore is ground/pounded then panned. It is in the "loose" gold from the sluice box that mercury is introduced.

From alluvial gold, yields can be realized without any mercury introduced. In this case, the loose gold is directly hand picked off the sluice box after every round of washing and it is stored in a cup or a tin. After it has accumulated to a reasonable amount, the miner looks for a middleman.

Sharing

- o Usually the group agrees to share the profits in percentages or according to shares that

each member has. Either way, the production expenses are deducted first.

- Diggers often get more than the rest of the group members because it is argued that they work harder and expend much more energy.
- After the Boss/Middleman has deducted the expenses, the landlord usually dictates the next stage of sharing the proceeds.
- The landlords often take higher shares with the argument that the land where the gold is being extracted belongs to them.

- Most expenses are usually catered for by the middleman although in some instances the landlord or some of the group members finance the process.
- Some landlords even ask for an advance of the money before extraction commences.
- It is only in Amonikakine where landlords get equal shares with the miners. They are taken just as the group members only that they do not engage in the various activities that lead to gold production but only come in at heating of the amalgam, weighing and sales.



Figure 11: A: Miners working in groups breaking a rock from a quartz vein believed to be having gold at Nakudi mine site; B: Quartz vein/reef that has been extracted consisting of sulphide mineralisation and box work structures containing gold; C: Ore material from the Tiira pit packed in sacks ready for transporting to the milling site; D: Panning at the Tiira river; E: Drying and milling site for the rocks; F: A miner holding a mercury amalgam on bare hands which can be a health risk.



For security purposes, the store has three padlocks whose keys are kept by three different members i.e. storekeeper, foreman and one member of the group.

Underground Mining

In SAMA, individuals are engaged in specific tasks of digging, pounding, hauling and processing the gold ore. The gender-based division of labour has not been streamlined, although men are largely engaged in ore extraction. Women are mainly mineral selectors picking from the low ore grade materials that they can take home to process. Women are also engaged in processing at the stages of sluicing and panning. Majority of the activities are manual.

Shafts are sunk until the gold-enriched rock is encountered. The rock is cracked using hand tools like hammers, shovels and hoes. The ore is then placed in sacks which are hauled to the surface. There must always be someone at the surface to witness and temporarily guard the ore to avoid thefts. This member will not work for that day and will only watch over the ore. This guarding is rotationally done amongst the group members. This is usually the foreman and another member once in a while. The foreman records the number of basins/sacks as they are brought out.

At the end of the day, all members of the group meet and the foreman counts before them, the number of sacks produced before they are ferried to the store. At the store, all members are present as the foreman once again counts the sacks before they are received and kept by the store keeper. For security purposes, the store has three padlocks whose keys are kept by three different members i.e. storekeeper, foreman and one member of the group.

From the ore produced, sampling is done to determine the ore grade. If the grade is found to be low, it is stored for a period ranging between two weeks to one month so as to accumulate a quantity that will be profitable to process. If the ore is found to be of high grade, processing progresses right away. During processing, the whole group pauses the ore extraction and work at the shaft is temporarily stopped as they process all the ore in the store to make the process quicker and to avoid being cheated.

At an agreed upon time, all members move to the drying point with the ore from the store. Drying is done concurrently with rock breaking in order to reduce the sizes. After drying, all members move along with the ore to the hammer mill owned by one of the members to witness the powder that has been realized. A subsidized fee of Shs. 4000 per basin to cater for the operator and maintenance of the mill is charged. This is relatively cheap compared to other ball mills around the area which cost Shs. 7000 per basin crushed.

Sluicing follows, witnessed by all members as they each contribute to the activity by either pouring water or the powder onto the sluice box or by mixing the powder with the water as it is poured onto the sluice box.

Panning and amalgamation follow right after, where some members do the panning on behalf of the others since this is an activity that requires a special expertise and therefore, not all group members can pan. At times, most especially when the ore has been found rich, the group hires skilled labourers to merge efforts with the group members who can pan. No member leaves the processing site until all the ore has been processed even if the activity progresses into the night.

After panning, excess mercury is squeezed out of the amalgam using a cloth and thereafter the amalgam is placed in a retort and burnt to liberate the gold from the mercury.

The gold is then weighed and sold off to the local dealer who usually is the one who pre-finances the production. From the money realized, the group deducts the capital borrowed from the dealer, as well as the landlord's share. Then the rest of the members share the remaining money.

NOTE: Throughout all these stages, all members of the group are present to avoid being cheated by fellow group members.

Sharing Procedure

Usually the landlords charge 5% of the profits and two (2) shares as a member or 15% of the profits and one (1) share as a member. After the dealer's pre-financing capital and the landlord's percentage have been deducted, all members including the landlord take equal shares albeit the landlord may take one or two such equal shares as described above. The gold dealer benefits from the low price which he offers to the ASMs. In Kampala, he sells the gold at a much higher price than what he paid the ASMs.

It was observed that at all the mines; there are at least one or two grinding machines, where miners take their ore samples for grinding at a cost. The ore is crushed to fine powder and after which washing is done in basins using water collected on tarpaulin sheets. In the final extraction of gold, the miners use mercury to increase efficiency and limit losses.

2.1.3 ASM Gold Mining in the Karamoja Region

The Karamoja region in North Eastern Uganda was first mapped at a scale of 1:250,000 and published in the 'Geology of Karamoja' by Macdonald (1961, 1966), Williams (1966), Elepu et al. (2012) and Baglow et al. (2012) sub-divided the rocks of the Karamoja region into the Karamoja and the Karasuk. The Karamoja Group is made up of a mixed assemblage of granite gneiss, migmatite, biotite gneiss, banded biotite and garnet gneiss, granulite and charnockite, leucocratic granite gneiss, and minor intrusive rocks. The Karasuk

Group consists of a mixture of undifferentiated granite gneiss, quartzite with amphibolite bands and marble.



Most the known ASM areas are in Morulem, Lodiko, Sokodo, Lopei, Loith, and Karita and some of the ASM alluvial working sites include Nakapel-Kekuul, Nariobwol, Kopoth, Alerek, Lokemer, Angorom, Rogomolim west and Rupa. It should be noted that gold mining in the Karamoja Region is seasonal and increases during the rainy season. By the time of this research, most of the mine sites had been abandoned and most of the information collected was from the sub-county headquarters.

Karita Sub County in Amudat District has had the most number of ASMs. In 2012 at Riamatuam and Chepkwarat mine sites, over 600 artisanal women and men miners were engaged in gold mining. The site had no sanitation facilities and no kind of associations. When we visited this site, all that was left were deep abandoned pits, some had collapsed and/or were covered by soil. Apart from a few people in homesteads, there were no signs of mining in the site (Figure 12 A and B).

In Lopedo (Figure 12C), Karita and other localities in Nakapiripirit, the artisanal miners targeted narrow granite veins with minor ex-sulphide. Veins are hosted by strongly deformed biotite gneiss. In 2013, a gold rush was reported approximately 10 Km NE of Nakapiripirit town centre. By April 2014, over 10,000 women and men artisanal miners from all over the region had relocated to this site which quickly evolved into a small village (Figure 12E). Several open pits remain in the area, some deeper than 10 meters and have been developed into underground adits (Figure 12F).

Simon Nangiro, head of the Karamoja Miners Association, estimated that around 120,000 people in the region make a living panning for gold of which 20,000 are based in Rupa alone. It has to be noted that gold mining is seasonal (mostly depending on the weather) and the number of miners therefore fluctuates considerably during the year. Also, gold miners are mobile and move from one area to another.

Hinton et al. (2011) estimated that extra-legal or informal gold miners may number up to 18000 Karamajongs which engage in mining seasonally, depending on rainfall and security conditions. Methods are extremely manual, typically including pits, shafts and tunnels dug with sticks, in some cases iron rods, while if gold is associated with hard rock (e.g. in quartz veins) rather than alluvial deposits, rock is ground to fine powder using grinding stone or pounded using hard rocks.

Separation of gold from waste minerals is done either by plastic basins or calabashes. Miners expose themselves to a number of occupational risks including chronic exposure to dust and heat (sun scorching), accidents from flying rock fragments, falling debris and collapse of open pit walls or underground tunnels leading to loss of life. "Wildcat pitting" renders livestock grazing and free passage of humans difficult, if not impossible, at ASM sites because of the risk of falling into pits. A typical artisanal small-scale gold mining day begins at dawn (5 a.m.) and ends at 2 p.m.

Currently the gold selling prices range from Shs. 100,000 to Shs.150,000 per gram and is mainly sold to buyers from Teso, Kampala and to a lesser extent, Somalia and Kenya.

ASM in Karamoja is often practiced as an entire family's survival strategy involving the husband, wife (or wives) and children. On many days, artisanal miners yield little if any gold from non-producing pits. However, even when production is small, based on seasonal variations in production, miners are estimated to earn at most Shs. 10,000 per person/day in the dry season but according to the locals this increases during the rainy season. At some gold sites like Rupa up to 90% of miners are women.

Key Actors in the Karamoja ASM gold mining activities

Like in the Mubende and Busia areas, the actors are the same apart from the fact that land in Karamoja is communal and mining is family based.

Currently the gold selling prices range from

Shs. 100,000 to Shs.150,000 per gram and is mainly sold to buyers from Teso, Kampala and to a lesser extent, Somalia and Kenya.



Figure 12: A and B: Overview of the ASM gold mining sites in Karita and some of the abandoned pits; C; Abandoned pits at Lopedo mine site; D: Abandoned ASM pits at Alerek which is risky because it is almost covered by the bush; E and F: Gold rush site 10 Km NE of Nakapiripirit

2.1.4 ASM Gold Mining in the Buhweju gold fields

The Buhweju gold fields are located approximately 330 Km from Kampala in South West Uganda. The geology of the area is characterised by Paleoproterozoic rocks of the Rwenzori fold belt and the platform sedimentary rocks of the post Rwenzori fold belt. The rocks of the Rwenzori fold belt and post-Rwenzori fold belt

have been deformed by complex fault and shear zones and several generations of foliations which is known to host numerous gold mines including the shallow open pits and adits of the Mashonga mine, adits in the Buckley's and Anderson's reefs, and underground stopes in the Kitaka mine.

According to Combe (1932), alluvial gold in this area was first mined in the valleys and streams within the quartzitic sandstone. Since then, alluvial gold has been exploited at Rwengwe, Bisya, Muti River, Chonyo River, Kampono, Nyamunyomwa River, Kitomi River, Kanywambogo, Kyangwahanda River and Nyakahita valley.

Currently, the mining has spread to the Nyasisana, Akashasha, Nganvu, Kagogoro and Katenga alluvial ASM mine sites.

However, the Buhweju gold field communities are still grappling with poverty and poor social services. For this research, our team visited Kagogoro–Katenga gold mines. Buhweju District has eight sub-counties and half of them have gold deposits with over 20,000 ASMs. Nine companies are today operating in this area but all the nine gold dealing companies have only prospecting licenses.

At Kagogoro artisanal gold mine in Katenga village, alluvial gold is panned by hundreds of energetic men and women from the valleys and swamps and the wetland is steadily vanishing (Figure 13A) something that raises key environmental worries. In 2013, there was a directive from President Museveni that these ASMs leave the mines sites but this was not implemented.

The mining method is still by use of simple tools such as hoes, pick axes and shovels for digging pits, some as deep as 8–12 meters to extract sand which they sieve to get gold (Figure 13A to C). “I come here every day to look for money. Using my hoe and spade, I dig the ground to extract the sand where I get gold from. Sometimes the sand is too deep in some areas so I dig much deeper” says Musinguzi Richard.

However, not every day is good for Musinguzi and his colleagues. Richard Matsiko, a miner in Nyasisana another neighbouring gold mining village revealed that on many occasions, one can dig the whole day without encountering any gold. “Sometimes we work the whole day and fail to get anything but we must go on the next day,” he said.

Apart from failure to earn a penny, these determined Ugandans have to also cope with flooding of their mining area since it’s a swamp, ‘harassment’ from

Environmental Officers, fluctuating gold prices that are dependent on the local dealers in the area as well as unfriendly weather conditions during the rainy season.

Despite all these hardships, those involved in the industry are happy with the way things are moving as they have been able to earn a living from the trade. Gold mining in the area has also attracted more than 100 people who participate in food selling, boda boda riding, and groceries.

According to the District Chairperson, Juvenal Asiimwe, the district does not get taxes from the gold dealing companies operating in the area neither are they engaged in any activity as part of their corporate social responsibility. “These companies are not giving us any money because they are only prospecting according to their licenses. They are also not involved in any pro-society act like road construction yet they use the district infrastructures. The roads in the district leading to the gold mining sites are in a very terrible condition (Figure 13D). I can honestly say that as a district, we get nothing from them and from our gold”, he elaborated.

A visibly unhappy Asiimwe explains that the licenses given to the companies ought to be clear to the district. “We are not getting any money from these companies because they claim to be prospecting in our district. What is unclear to us is where they take the gold they get in the process of prospecting. If we knew the amount of gold they get, we would be in position to levy something like a tax on them.”

In every mining area we visited, over 70 percent of the miners were energetic young men and women of school going age. Olive Koyekyenga, the District Woman Member of Parliament says that many youngsters have abandoned schooling to join the gold mining industry where they get ‘quick’

“Sometimes we work the whole day and fail to get anything but we must go on the next day,”

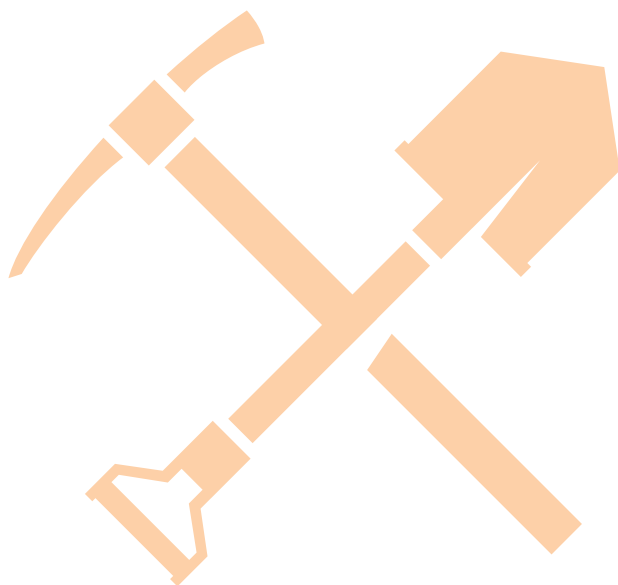




Figure 13- A: Miners digging pits for gold in swampy areas of Buhweju; B: Young energetic men and women miners excavating gravel from one of the open pits and ferrying the ore using basins to the surface; C: A miner panning for gold from sand using a basin in a swamp; D: The poor road network to the mining site in Buhweju District.

2.2 Tin/Cassiterite

The Tin province of Uganda (all the cassiterite deposits known in Uganda) is hosted by the Mesoproterozoic North Kibaran fold belt which is composed of metamorphosed clastic sedimentary rocks, to synkinematic, foliated to isotropic porphyritic and pegmatite granite attributed to the North Kibaran Igneous Province (NKIP; Harma et al. 2011). The system predominantly consists of argillites with arenites and silty rocks regularly distributed as thin bands throughout and Cassiterite (SnO_2) is confined to the shales and sandstones of this system. Tin occurs in alluvial, detrital, pegmatitic and hydrothermal vein deposits.

Tin mining has been known in S.W. Uganda for over 70 years now. This mining however, concentrated on large veins and their immediate alluvium. Work on the industry started as far back as the 1920's. In 1925 the first deposit at Kikagati was discovered, followed by Mwirasandu in 1926, Kaina in 1927 and Nyinamaherere (Figure 14A) in

1928. Tin enjoyed monopoly of Uganda's mining sector until 1931 and this was followed later by a Tin boom in the 1960's and 1970's favoured by good world prices. During the boom, 22% of the total Cassiterite exported fetched \$2,786,781 representing 56% of the total earnings from tin exports.

Tin production in Uganda has been largely on small scale both for underground and surface working. Mwirasandu mine has a large pile of coarse tailings with an estimated quantity of 120,000–135,000 tonnes while fine tailings dump has 195,000 – 210,000 tonnes. Our team visited the tin mine sites in Ruhaama and Kikagati in Isingiro.

Tin Mining in Ruhaama

The Tin mining hill is located 27 Km from Ntungamo Town and just 15 Km to the Uganda–Rwanda border. This hill that is a lifeline to more than 15,000 people is naked with protruding rocks. Makeshift shelters majorly made out of tarpaulin are spread all over.

In 1925
the first tin deposit was
discovered at Kikagati
followed by Mwirasandu
in
1926,
Kaina in
1927
and Nyinamaherere in
1928.

On a single day, there are over 300 people hacking the rocks for the treasure. Scooping and scratching takes place deep beneath all sides and points of the hill. Sacks of sandlike materials are got from underground and then sieved using basins and sand mesh (Figure 14B). Miners run the sand through sand mesh and what remains on top are black pellets.

Most of the people living in the three parishes of Rwamwire, Ruhaama and Kafunjo survive on Tin mining business, directly or indirectly. Matsiko William of Nyamitoma cell, Nyakika Parish in Ruhaama Sub County says there are two types of tin in the hill: the leaf tin and grovel tin. Leaf tin mining involves following up tin that is placed like a branch of a tree, underground. The mineral keeps branching for yards underground until it is no more. Then the miner will go and look for another 'branch'. This method is what is currently used in Rwamwire.

Grovel Tin mining on the other hand is an open cast system where the miners use iron bars and dig holes of about two feet. This is normally in virgin mining areas where Tin has not been mined.

"Tin is our crop, everyone in these parishes touches Tin money," says Mr. Sylver Byamukama, Kitojo village chairperson.

"We get tin from the ground, come here, separate it from other stones, wash and sell it. They give us very little money compared to the risks we go through but it's better than growing coffee," Tibyampasha Wilson, a miner says.

Occasionally, a group of miners emerge with torches fastened to their foreheads, dusty and fatigued, shoving sacks of sand and stones. Mohamoud Musonera, one of them, boasts of having attained a lot of property from this job and says he is going to die a miner. "How can I leave mining? We all know there are many risks, and some people are caught up inside and buried there, but what do we do? We just continue mining, it's always their day. All I have, I got it from mining, I have been coming to this hill ever since I knew how to eat. We are getting money from here," Musonera says.

With the money he has got from mining Tin, Musonera says he has bought seven acres of land, has three motorcycles doing boda-boda business, pays school fees for his 15 children and takes care of his three wives.

The mining area chairperson Ernest Saturday says a lot of Tin had already been extracted by the time the mines were abandoned by white miners in the 1970s. "The first miners found tin on top of the ground and picked it. But now, the hill has been penetrated and there are very large tunnels

underground. The mineral was almost exhausted. For us who use hoes and pick axes, we cannot get as much they used to," he says.

Karuhaama is one of those who worked at the mine at its prime. He mined Tin for over 40 years before retiring. "We had ready market for all the Tin we were mining. This is no longer the case. The tag (a mining, processing and export/ marketing license) was withdrawn and now people simply sell Tin at any price they get because they have nowhere to take it. You could not go into the hill and come out with less than 100 kilograms, now they tell me they can even fail to get a single kilogram," Karuhaama laments.

When Karuhaama used to mine, the Tin deposits were still high since the colonial miners had not gotten into big business with machines. When they came into the sector in the late sixties, using heavy machines, they dug big tunnels and mined whatever Tin was available, before fleeing Idi Amin's government. By the time they left, a lot of Tin had already been mined and now, the current miners look for it in the old tunnels and mines that were left. "I had four cars, bought land, married a wife and produced children. I fed them and if any of my children wanted to study I was able to give him or her school fees. There was money but now all the hill is filled with tunnels that are empty. Maybe machines can get more minerals. There is even no market," Karuhaama says.

According to a former miner, miners had a selling point in Kikagate, Isingiro district near Tanzania between 1950 and 1978 that is no longer there. So now, most of them sell the mineral illegally in Rwanda.

There have also been several attempts to discover more mineral zones in Ruhaama and neighbouring areas.

Zanak Holdings Uganda, a German company has acquired a license to extract tin in the area and is struggling to get a tag for mineral trade. Gerevasio Tinfayo Kikaito, the Rwamwire mines project manager says that they have been promised a tag for both extraction and trade which will soon improve the mining. "For almost three years that we have been here, we have been buying and storing tin in



"We get tin from the ground, come here, separate it from other stones, wash and sell it. They give us very little money compared to the risks we go through but it's better than growing coffee,"

TIBYAMPASHA WILSON, MINER

Kampala waiting for a tag. If we have a tag we shall even employ machines. The company has bought many for mining but cannot deploy them since they are not sure of where they will sell the mined Tin," he says.

Zanak buys between 20 to 100 kilograms of tin from miners every day but says huge stocks of the mineral goes to illegal trade especially in the neighbouring Rwanda and Tanzania. As a contracted explorer, Zanak is supposed to get all the tin mined from the hill. However due to the low prices they offer compared to those in Rwanda, they end up not getting the quantity required. All the tin that finds its way out of the country without Zanak control is regarded as an illegal sell. A miner gets Shs14, 000 from each kilogram of tin sold to Zanak but can earn up to Shs20, 000 in illegal trade. Dealers are spread in towns of Ruhaama, Omukikoona, Kafunjo, Mirama Hills, Kitwe and Kishami.



Figure 14: A – Overview of the Nyinamaherere hill where ASM Tin mining is taking place in Ruhaama; B: Men excavating tin that is sieved using basins and sand mesh.

2.3 Wolfram

Wolframite in Uganda is found in two regions; South Western Uganda and the Ssinga area in Mubende. The major former Wolfram producing mines in Uganda in 1960s to early 1970s were Kirwa, Ruhizha and Bjordal in south western Uganda. Tungsten, also known as Wolfram, lapis ponderous or Heavy Stone, has highest melting point of all elements except carbon – sources in scientific literature vary between 3387°C and 3422°C. It also has excellent high temperature mechanical properties and the lowest expansion coefficient of all metals. A temperature of about 5700°C is needed to bring tungsten to boil – which corresponds approximately to the temperature of the sun's surface. With a density of 19.25 g/cm³, Tungsten is also among the heaviest metals. Its electrical conductivity at 0°C is about 28% of that of silver which by itself has the highest conductivity of all metals.

ASM Tungsten mining in Kabale and Kisoro

Kisoro is one of Uganda's richest districts in mineral deposits including tin, gold and Wolfram/Tungsten. Our team took a trip up the hills of Gasinza village in Nyakabande sub-county to visit a Wolfram mine owned by Kigezi Diocese Catholic Church.

Rushunga Wolfram Mines in Muko Sub-county

At Muko hills in Kabaya village, Muko sub-county, there are over 20 men scrounging with chisels

and hammers in a deep hole of about 100 metres of suspected wolfram deposits, as others crash rocks in search of the mineral.

The quarry manager, Umar Kabwekye, said they are hired by his father, Francis Kabwekye of Rushunga Mines, a Kabale small scale-based mining company. Umar Kabwekye said they can collect between 40 – 100 Kg of Wolfram a day. He added that he employs more than 40 men in this mine. However unauthorized people enter their mines and steal the ore at night. They collect and sell Tungsten at Ug. Shs.10,000 per Kilogram. According to Umar, on some occasions the thieves sell the ore as high as Ug. Shs. 17, 000 per Kilogram. The buyers then sell it to businessmen in Kigali at Ug. Shs 37,000 per Kilogram.

Krone Uganda Limited

Krone (U) Ltd is the largest miner and exporter of Wolfram (Tungsten) in Uganda. The mine (also formerly known as BJORDAL MINES) is located in Western Uganda – about 435 Km South West of Uganda's Capital-Kampala towards the Uganda-Rwanda-Democratic Republic of Congo (Tri-National Border Corner). The size of the mining area is about 176 hectares with enormous exploitable mineral reserves. This mine has been in existence since 1932.

During our visit, we found the operations Manager Mr. Muliisa Ronald who narrated that apparently he employs more than 1500 people and out of

A miner gets
Shs 14,000
from each kilogram of tin
sold to Zanak but can earn
up to
Shs 20,000
in illegal trade

these only 2 are women due to the nature of work. Krone owns a mining lease over wolfram where they use excavators and tractors to remove the overburden (Figure 15 C and D) before casual laborers come in with local tools like hummers, chisels spades to start up adits.

Mining in the adits during rainy season can be hectic says Muliisa, adits are flooded with water and it's impossible for workers to enter and extract ore.

However, the mine has improved the living of the local people around it. 90% of the casual employees are local people; food supplies are bought from Kabale, and the road to the mine from the main Kabale-Kisoro highway was also constructed by the company. The company also provides support in form of money to the health centers in addition to the royalties paid to the government of Uganda since it owns a mining lease.



Figure 15: A: Wolfram ore packed in a sack; B: A series of adits in a hill where casual employees extract wolfram ore; C and D: An excavator removing overburden on the hill.

Kigezi Diocese Catholic Church Wolfram Mine

Located in Gasiza Nakabande sub-county in Kisoro district, this wolfram mine is wholly owned by the church which leases it out to local miners. "The mine is apparently closed because the person we leased it to failed to pay the agreed fee," says Sam Ndaginze, the care taker. More than 50 people earn a living from this mine every day when it's operating. They mine from adits expected to be about 200 metres deep (Figure 16).

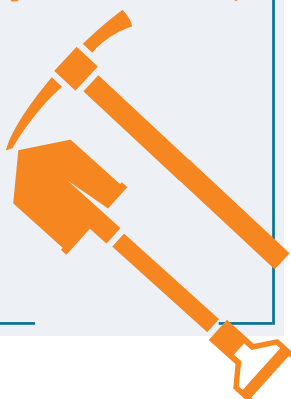
Here miners get more than 150 Kgs to 200 Kgs a day and sell it to buyers from Kampala at 10,000 Uganda Shillings per kg. However, the prices keep fluctuating and sometimes illegal miners enter their adits at night. Mining from the hill gives no chance to get water enough for

90%
of the casual
employees are
local people.



panning **Figure 16: A series of adits in a Wolfram mine owned by the Church**

Magnetite and hematite are the conventional ores that are utilised in the steel industry the world over due to their superior quality and easy-to-process nature,



2.4 Iron Ore

Iron ore being rocks and minerals from which metallic iron can be economically extracted means that, the ores should be very rich in iron oxides. Usually the ores occur in form of magnetite, hematite, goethite, limonite and siderite. Magnetite and hematite are the conventional ores that are utilised in the steel industry, the world over, due to their superior quality and easy-to-process nature, as opposed to the unconventional ones.

Uganda is endowed with conventional iron ore reserves in form of hematite and magnetite, although, unconventional occurrences also exist in the south western part of the country. Despite this, there has been very limited production of iron ore in Uganda to date. What is produced is mainly for use as an additive in the steel scrap smelting in Jinja and for special cement by Hima Cement.

Iron ore in form of hematite occurs at Muko and Butare areas, in Kabale district and in Kashenyi, Kyanyamuzinda and Kamena areas in Kisoro district, where it occurs in lenses and as scattered boulders. Similar hematite iron ore occurs at Mugabuzi in Mbarara district and in Nyaituma in Hoima District.

In form of magnetite, Iron ore occurs at Sukulu in Tororo district, Bukusu in Manafwa district, at Toror in Kotido district, and at Napak in Napak district. In general, magnetite in Uganda is associated with the carbonatite complexes.

The mine employs more than a hundred 100 people and out of these, 20 are women.

Iron ore mined from this area is purchased by Steel Rolling Company which is further transported to its various factories in Kampala and Jinja. Mr. Byamugisha added that a tonne of iron ore costs Ug.Shs. 80,000. However he complained about the impassable roads and poor means of mining.



Figure 17: Iron ore open pit mine at the ridge top in Muko Sub-county

2.5 Salt

The largest mineral water reserves are the brines and evaporites of Lake Katwe, saline crater lake in the Western Rift Valley in south western Uganda, on the northern edge of Lake Edward in Kasese district.

Salt for human and animal consumption has been extracted on a large scale from the floor of crater lakes at Katwe and Kasenyi in Kasese district for many centuries. Recent research (Kirabira, et al. 2015) revealed that over 15,000 people are employed in local salt extraction, 75% of them women, operating in over 10,000 salt pans.

Salt at Lake Katwe exists as a mixture of sodium and potassium chlorides, carbonates, bicarbonates and sulphates, with lesser amounts of gypsum (calcium sulphate) and traces of bromides and other constituents. Total reserves of 22 Million tonnes of trona with mixed salts have been estimated at Katwe. 50,000 tonnes per annum could be produced for at least 10 years before any decline would become evident. The current method of production is based on solar evaporation in ponds (Figure 18A) and the product is crude (Figure 18B) due to mixing of the salts during fractionation and crystallization as well as with mud at the lake bottom.

Salty water of Lake Katwe is posed by the great percentages of impurities that are fundamentally not desirable in common salt such as calcium, magnesium compounds present in significant quantities. The challenge is faced by the current mining and processing of the ore as these impurities such as clay, organic matter, calcium and magnesium compounds need to be removed.

In 1975 a plant was constructed in the Katwe deposit and worked for a few years

until it failed due to corrosion of heat exchanger tubes. Attempts to repair it were unsuccessful and the plant has since remained inoperative (Figure 18C). The challenge now is how to devise feasible extraction technology that augurs well with the chemistry of the salt of Lake Katwe to tackle the corrosion issue, so as to engage large scale commercial production to produce edible salt.

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Figure 18: A: A Salt Pan at Lake Katwe; B: Pile of crude salt; C: Abandoned Katwe Salt Factory

Inside lake Katwe Salt Extraction

Lake Katwe is a crater lake situated inside Queen Elizabeth National Park. Several streams drain into the lake but it has no outlets, so intense evaporation during the dry seasons leads to the water becoming extremely salty. For centuries, people near Lake Katwe, have mined salt by hand. Salt mining remains their only means of livelihood with more than 15,000 people working in over 10,000 salt pans.

Salt mining is one of Uganda's oldest surviving industries. Mining has played a significant political and economic role in the history of the Katwe area.

Workers construct salt pans (Figure 19A) at the margins of the lake to intensify the evaporation

To extract salt, the miners have to construct large semi-permanent pools around the edges of the lake to intensify the evaporation,

and concentrate the salt. Workers extract three main products from the Lake; block of rock salt (Figure 19B), high quality crystals that can be served as high table salt and salty mud (Figure 19C) that is used as salt licks for animals.

Extraction of the salt from Lake Katwe is done by hand by both men and women and involves standing waist or chest deep in water for hours at a time. The air is infused with the rotten egg smell of hydrogen sulphide gas and traces of ammonia. The salt extraction method has changed little over decades.

To extract salt, the miners have to construct large semi-permanent pools around the edges of the lake to intensify the evaporation. Katende Charles explains, "These are the man-made features around Lake Katwe and they're called



“You own a pan like you own land at home – it’s your property.”

salt-pans and within the pans that's where salt forms naturally. Ugandans own pans individually, you own a pan like you own land at home – it's your property.” After the salt is extracted from the pans, it is transported using wooden logs (Figure 19D) off the water.

The work is back-breaking, but this is the only trade in Katwe. Notwithstanding, salt extraction has been a source of prosperity for decades, but today's miners work in appalling conditions.

Before it can be bagged and sold, the black mud is spread out and dried. The mud dries quickly in the intense equatorial sun (Figure 19E and F). The salty water turns cuts or wounds on the workers bodies into painful sores. In an effort to protect themselves from the toxic water men tie plastic bags around their genitals or wear condoms. Some women put flour inside their private parts. These strategies have little effect and reproductive health problems are common nonetheless.

Despite the challenges, salt miners are able to make some good money and live comfortable lives outside of the salt lake. Sam Mugisha is one of the miners and he has spent all of his life here at the lake. He says that in a good month he makes about Shs. 1,500,000 which he uses to support his family.

“We mine salt in the dry season and every week, we produce salt and I'm able to make enough money to feed my family.”

The salt yield from Katwe has dwindled in recent years and become more unpredictable because of Uganda's increasingly uncertain climate. Climate scientists are predicting that weather patterns in Uganda will shift as a result of global warming – hence resulting in too much rain and not enough evaporation to produce salt.

“We depend on high temperature. It first forms on top of the brine and it's called scam, then the scam has to be segmented. We segment for about three to ten days – after that, you remove it and wash the crystals. After washing the crystals we directly take them to the market for sale.”

Analysts say that Lake Katwe can sustain salt production for decades to come, as it has supported many generations in the past. But in its present form, it will continue to be challenging and hazardous work for the thousands of people who have no other work options.

Ownership of the salt pans is very crucial because the owner takes a cut of the profits. One person can own as many salt pans as they can afford. These salt pans are very fascinating. They actually are not like the usual plots of land that you will come across in the rest of Uganda; they are simply ponds of about 10 x 12 feet wide, 3-5 feet deep. These are demarcated along the lake shores, and privately owned by individuals or even families and in some instances, inherited.

Mining within the central part of the lake is only done by individuals with licenses. The Association for Rock Salt Extraction is responsible for issuing the extraction licenses for the rock salt from the center of this lake. This sort of arrangement was put in place to make certain that the salt in this lake is extracted in a very systematic process devoid of causing extinction.

The salt yield from Katwe has dwindled in recent years and become more unpredictable because of Uganda's increasingly uncertain climate. Climate scientists are predicting that weather patterns in Uganda will shift as a result of global warming – hence resulting in too much rain and not enough evaporation to produce salt.



Figure 19: A: Man made salt pans at the Lake to intensify the evaporation and concentrate the salt; B: Blocks of rock salt ready for sale; C: Salty mud that is sold for used as salt licks for animals; D: Wooden logs used for transporting rock salt off water in L. Katwe; E: Drying Mud salt under

intensive sun; F: Dried salt packed in sacks ready for shipment.

2.6 Sand

Sand is a general term used for broken granules of minerals or rocks, technically between 0.17 to 2 mm in diameter falling between silt and gravel in a spectrum of sizes. It can be used in a wide range of industrial processes such as construction materials (mixed with water and

cement for brick laying and plastering), glass making and to create molds and castings, depending on the quality of the sand.

So far, in Uganda, sand has been mainly utilized in the construction industry as part of concrete material. However, there are promising deposits of glass sand suitable for commercial purposes at the shores of Lake Victoria.

Glass sand is associated with narrow quaternary



to recent beaches along the shores of Lake Victoria and some lake Victoria Islands contain deposits of glass sand at several locations including:

- Kome Island (Buvuma district);
- Diimu (Rakai district),
- Katosi in Njeru,
- Bukakata and Lwera (Masaka district); and
- Nyoka-Nalumuli Bay (Mukono district).

It should be noted however that all over the country, sand is mined from almost all the rivers and streams to serve the local construction industry by both ASMs using hoes and shovels and medium scale construction industry using excavators (Figure 20 A and B). Sand production simply involves digging and loading onto trucks. In some cases, value can be added by sand selection and screening since different sand types are priced differently.



Figure 20: A- ASM digging sand using hoes and shovels in Lwera; B: Sand excavation and loading on trucks using an excavator at Katosi.

2.7 Stone Aggregate and Dimension Stones

Aggregates are a broad term that describes crushed stone, gravel, or sand used in the construction and building industry. Granite, gneiss, gabbro, dolerite, marble, basalt, quartzite, shale, marble, slate and sandstone are the most common rocks in Uganda that is being mined for aggregates and dimension stones by both ASMs and medium scale companies. The rocks have been crushed and used as aggregates, hard cores, rock fill, borrow pit sand, drainage channel, finishing and covers, man hall covers, and walk ways among others.

Uganda's construction industry demand is growing at more than 6% per year and contributes 12% of Uganda's GDP. The abundance and demand makes aggregate production a competitive business in the country for the local market. Dimension stone imports amounts to millions of dollars (despite in-country resources). Currently only DAO marble and Building Majesty Limited produce marble and granite slabs and other tile products, respectively.

Uganda has several varieties of granite in abundant quantities in many locations throughout the whole country where it is quarried and supplied locally for construction purposes. The main granite quarries include Laroo and Kidere in Gulu District, Peta in Tororo District, Ochuloi in Soroti, Dokolo in Dokolo District, Akiya in Lira, and several localities in Mubende and Kiboga Districts.

Quartzites and slates are mined in several localities in the central region (Wakiso, Kampala, Lugazi, Mukono, Luwero etc) and in all the districts in the western and southwestern region overlain by metasedimentary sand, siltstone, sandstone and quartzite ridges. The materials are supplied to support the construction industry in both the urban and village areas. The slates are commonly used as decorative stones in houses and the dealers we interviewed in Eastern Uganda all stated that the suppliers are the same and trucks collect several varieties from different quarries. They are generally the mineral dealers who supply to local business men to market the products. The slate dealers in Kampala, Wakiso and Eastern Uganda all claim that the slates are quarried from Rakai and from the metasedimentary rocks on the Kibaran Fold Belt in western Uganda.

Uganda's construction industry demand is growing at more than 6% per year and contributes 12% of Uganda's GDP. The abundance and demand makes aggregate production a competitive business in the country for the local market.

There is noticeable decline in food and cash crop production and education in the areas within the quarrying communities since all the elders, women, men, the youths and children all engage in quarrying to earn a living.

Laroo and Kidere Stone Quarry in Gulu

The Laroo and Kidere stone quarry in Gulu have been operating since 1989 by Laroo Quarry Works Association and the Kidere Stone Quarry Association respectively. Other areas have been licenses for Dimension stone production and the companies are currently engaging the local community before starting the projects.

Structurally, the features of the Laroo and Kidere quarry rocks include tight, isoclinal folding in banded biotite-hornblende gneiss and regular banding in gneiss with alternating mafic and felsic layers. A set of mafic and felsic layers, representing probably alternating sedimentary and volcanogenic material is locally mapped on the rock outcrops. This makes the rocks to appear very beautiful and attractive for

Dimension stone production.

Most of the exposed rocks in the Laroo area are exploitable by artisanal women and men miners (Figure 21A and B). Since the rock is near depletion, over 300 members of Laroo Quarry Works Association in Gulu district are now asking the Government to give them a grant to start other income-generating activities. The request is also a result of women member's complaints that stone quarrying required a lot of energy and was men's work.

Under the Sustainable Management of Mineral Resources Project in 2008, officials from the Ministry of Energy and Mineral Development trained some of these miners in geology, mineral processing, value addition and best practices in mining. Some of the miners still observe safety as a priority but with younger miners joining the business, safety, waste management and other environmental issues are still a problem.

The number of people in Laroo quarry alone has dropped from about 500 to 300 now and the locals said it is because formerly internally displaced persons started returning to their villages.

During the interview, a member said that most of the people breaking stones were widows, school drop-outs and orphans, who are looking for school fees. The school children are however only allowed at the quarry works on weekends because on weekdays they should be at school. The residents also complained that much as they pay a fee of Shs 200,000 every year to Bungatira sub-county to exploit the quarry, the road leading to the quarry remains in a poor state. They also lack health services and latrines.

At Kidere, rock body is however still well exposed and the artisanal miners have not exploited most of the out crop (Figure 21C). So most of the miners in the community have relocated to Kidere where there are over 2000 male and female miners.



Figure 21: Photographs taken from the Laroo and Kidere quarries. A: The remaining exposed rock at Laroo quarry; B: Communal area where women and children are involved in rock crushing and piling aggregates ready for pick up by trucks at Laroo; C: One of the Kidere ASM quarry sites

Dokolo stone quarry

The exposed granite ridges are generally north-west trending belt of variously migmatitised and deformed Neoproterozoic granites. Generally, the porphyritic texture of the rock is well-preserved, but with progressive migmatitisation, granite grades into a mixed rock composed of palaeosome fragments of migmatite and superficially variable granite. The granite bodies are well exposed in several small hills and kopjes.

The visited outcrop that is being quarried for road construction in Lira is brownish grey, porphyritic biotite granite with large, euhedral K-feldspar phenocrysts (augen) in a fine- to medium-grained quartz-feldspar-biotite matrix. Over 10,000 ASM

are believed to be operating in this site on top of the construction company that is blasting and breaking the rocks for a road construction project in Lira.

Ochuloi quarry, Soroti – Lira road

This is a very large porphyritic hornblende granodiorite outcrop body approximately 12km on Soroti Lira road from Soroti. At the Ochuloi hill, the rock is extensively used for aggregate production (Figure 22A). The porphyritic hornblende granodiorite is rather homogeneous, and the weak foliation is noticeable only in the preferred orientation of hornblende prisms and biotite flakes. The majority of the miners are men and youths but also women and children are involved in the crushing of the stones (Figure 22B)



The Akiya quarry (Figure 23) falls within the known Otukei charnockite (684 ± 6 Ma) rock body in Lira District. The area is generally a hilly terrain hosting the Akiya quarry approximately 8km to the east from Lira town. The outcrop is a homogeneous charnockite and is commonly used for artisanal quarrying of rock aggregates. These rocks show contrasting light to brownish weathering colors and dark grey colors when fresh.

A sample from this quarry was collected by the GTK consortium in 2012 and polished in order to evaluate the dimension stone potential of the area. These homogeneous charnockites show a beautiful dark surface when polished, and occur in very large volumes close to a major town and, consequently, could well be among the most promising candidates for commercial dimension stone production in Uganda. The area falls in an active License status EL 0946 and TN2121 and the License owners have been involved in engaging the ASMs to have a memorandum of understanding where they can also produce tiles and slabs from this material.

Over 10,000 ASM are believed to be operating in this site aside from the construction company that is blasting and breaking the rocks for a road construction project in Lira.



Figure 23: Photograph of one of the most active Akiya Hills in Lira Quartzite, meta-sandstone and Sandstone

Quartzite, Meta-sandstone and Sandstone

The rocks are mined as aggregates and slates which are commonly used in various forms in construction – as aggregate, hardcore, building blocks and wall cladding. The beautiful coloured rocks just like the granite, gnesiss, marble and gabbro are used in the dimension stone industry as decorative tiles and blocks (Figure 24 A).

We interviewed some of the dealers in slates and stone slabs and told us that normally a truck delivers blocks of various sizes from quarry sites in Rakai, Western Uganda and Wakiso and they do the cutting themselves to desired sizes as required by the customers in the construction industry (Figure 24 B).



Figure 24: A: Quartzite slates on Luwero road; B: A pile of slates and decorative stones in Mbale ready for sale

Quartzite, meta-sandstone and Sandstone

We visited a few stone quarries in Mukono (Mbalala) and Wakiso Districts. The Mbalala stone quarry in Mukono is very extensive (Figure 25) and is mined in a family property. The miners come from different parts of the country and pay to the land owner a fee depending on the rocks mined and sold like in any other atone quarry.

The Stone quarrying industry in Uganda employs over 15,000 people and construction companies such as Jomayi stones, Roko, Stirling, Mex, and others quarry these rocks in different types and size for any kind of construction job.



Figure 25: Overview of the Mbalala stone quarry in Mukono.

The quarrying methods in these sites are similar as detailed below:

Rock Breaking/Extraction

ASM quarrying starts with rock breaking manually with the help of sledge hammers, picks and pry bars to create/exploit fractures and/or break big rocks. Apart from large/formal construction companies that blast the rocks to break, the ASMs normally burn firewood on the surface of small fractures or adjacent to rock and then pour cold water on the hot rock which then automatically causes the rock to

crack, creating zones of weakness. (Figure 26A and B).

This heating and cracking of the rock is the simplest, lowest cost but least efficient for rock breaking and is the most common method used. This method is time consuming and it is difficult to control the rock sizes. The sledge hammers are then used to further break the rock into transportable sizes and women carry the blocks to the crushing area.



Figure: 26- A miner burning firewood on the rock surface in Tororo limestone quarry; B: Male miners breaking large rocks.

Comminution (Crushing)

At the crushing area, women, a few men and children miners manually crush the rocks to various sizes as specified by the intended use in construction projects. The products include hard core, aggregates of various sizes, slates etc. (Figure 27).

Marketing

The price of the aggregates and slates depends on the location, region and quality of the rock and also depends on the demand and season. Granite aggregates cost a lot more than quartzite aggregates and during the rainy season, the costs go up depending on how good the road is from the quarry to the urban centers.



Figure 27- A: Piles of stone aggregates of various sizes and price at La- roo ready for pick up by trucks: B : A female miner crushing stones in Tororo.

Over
300
million tonnes of pure white, smoky white and pink commercial marble deposits exist in the Karamoja region, some of which are being exploited and transported to Tororo, Jinja and Mbale for cement manufacture and other construction products like slabs, tiles, terrazzo, aggregates, paint making, etc.

2.8 Marble and Limestone

Marble has been mined in Moroto, by both ASMs and medium scale mining companies for years. Limestone on the other hand has been mined for cement and lime production in several places in Uganda including Moroto, Tororo Kinanira, Kigezi, Kisoro District, Muhokya, Kasese Dura and Kamwenge.

Over 300 million tonnes of pure white, smoky white and pink commercial marble deposits exist in the Karamoja region, some of which are being exploited and transported to Tororo, Jinja and Mbale for cement manufacture and other construction products like slabs, tiles, terrazzo, aggregates, paint making, etc.

The main ASM mine sites include:

- Katiekile marble in Moroto District
- Moroto marble in Moroto district (extensive and variable in grades);
- Lokupoi and Morungeber in Moroto district
- Forest Reserve marble;
- Karikacham
- Toror Hill in Kotido district
- Naunyet, Ngolapulon and Nakagelmoru, Nakadapalait, in Kotido district
- Napak Hill in Napak district;

- Morumeri in Nakapiripirit District

Currently, there are companies that are mining or exploring for marble in the region that include; Tororo Cement Ltd, African Minerals Ltd, Great Lakes Ltd, Moroto Cement Industries (U) Ltd, Tiger Cement Ltd, Harambe African (U) Ltd, and Supercom International Ltd. Since 2012, Dao Marble Limited has been exploring and exploiting marble East of Moroto town.

In Moroto, Marble is mined mostly by the ASMs using hoes, sticks, iron bars and hammers like any other stones described above. Currently, a 5 tonne truck costs Shs.80,000 including loading. The cost also varies from season to season as explained by miners. During the rainy season, the market is scarce due to poor roads from the region to Mbale and therefore marble is sold cheaply unlike the dry seasons where demand is high.

Escalating poverty and climate variability over the past decade have sent natives into artisanal mining. Over 15,000 people are involved in marble mining. Marble involves breaking boulders into portable pieces as an additive to cement (Figure 28A). The stones are sold for cash to middle men, who transport them to Tororo Cement Industry.



Figure 28- A: ASM crushing marble from one of the quarries in Moroto; B: Marble horizon at the slopes Mt Mororo with fragmented rocks on the surface

Lime production in Tororo

Lime from the Tororo lime producers is used for plastering houses, road stabilization when mixed with murrum, improving soil fertility, and paint production among others. Limestone is manually quarried (Figure 29A) by both women and men miners (300 people) and then crushed to about 10 – 15 cm and piled (Figure 29B). This is then carefully sorted and the ones with more impurities are sold as aggregates and the rest burnt in a Kiln, cooled, water added before sieving and packing in bags for sale. This process takes 4 to 6 days and during firing the limestone changes to quick lime.

The burnt lime is manually taken out by male miners using shovels and hoes and carried using wheelbarrows to the processing house through the access created by the miners below the Kiln. At the processing house, the lime is spread-out on the ground and water is directly added slowly on the surface. This generates heat and the lime turns into powder. After cooling, lime is sieved and packed into paper bags of 25 Kilograms each ready for sale (Figure 29D). The buyers are usually road constructors.



Figure 29- A: Tororo Quarry where the lime producers get limestone; B: A pile of sorted limestone ready to be loaded in the Kiln; C: Some of the Kilns used by the Tororo Lime producers; D: Packed lime in 25kg bags ready for sale.

2.9 Clays

Clay deposits suitable for the manufacture of bricks, tiles, pottery, etc. are widely distributed throughout Uganda. No detailed systematic investigation has been carried out throughout the country except around a few areas such as Kajjansi in Wakiso district; Bugungu near Jinja in Mukono district; Buteraniro in Mbarara district; Butende; Kasukengo in Masaka district; Malawa in Tororo district and Butema in Hoima district.

They are of variable quality, in terms of iron and quartz content and therefore show a highly variable reaction to firing. Careful and detailed investigation could show potential for better quality clays, including refractory material and china clay.

Clay in Uganda is a major raw material for various bricks and tiles in the building industry and pottery (Figure 30A and B). High aluminous clays with low iron content are used in making refractory

bricks for lining furnaces, in making porcelain and in fine ceramics such as china ware (plates, cups), sanitary ware (toilet pans, basins, etc.) and pipes. Brick laying is still locally done in almost all villages in Uganda especially the swampy areas with the men mixing the mud and women mostly involved in ferrying water to the sites especially during the dry seasons.

Brick making is one of the most serious threats to wetlands in Uganda today. This leaves behind big holes, which greatly hinder movement and communication. It is also associated with the clearing of vegetation around the wetlands so as to provide fuel with which to make them. Fires that are both natural and those started by man destroy the fertility of the wetlands. The fertility that had accumulated over the years in the soil is lost during the burning of the existing vegetation. These fires are caused by prolonged drought or clearing land for human activity.

3. Approximate number of people involved in the ASM sub-sector in Uganda

The ASM sub-sector in Uganda directly and indirectly involves several categories of people including men and women, the youth, children and the elderly from different places within and outside the country. For example, the current gold rush in the Mubende sites visited during this study has attracted an influx of thousands of illegal miners and people from all over the country and from neighbouring countries such as Rwanda, Burundi, Tanzania and DRC as observed and reported by ASMs, District officials, Community Development officers and representatives of the existing ASM association interviewed on site. An interview with the Community Development Officer of Kitumbi sub-county stated that there is a total of 60,000 ASMs registered with the sub county. Of these, 25,000 are directly involved in mining and the remaining 35,000 are indirectly involved as service providers but tied to the mining cycle.

The ASMs in the mining sites are mostly engaged in digging/ extraction of ore, drying ores, pounding and grinding ores, panning, cooking and selling food items, erecting shelters; loading ores in trucks, etc. Most commonly there are a number people on the camps who are also involved in other forms of income generating activities such as restaurants, food supply and distribution, bars, hotels, lodges, hire of generators and other mining tools such as jack hammers, ball mills, shovels, pick axes, mercury trading, brokers, general merchandise shops, provision of mobile toilet facilities, prostitution, erecting tents, supplying water and so on. All the people involved in these activities indirectly benefit from mining and their livelihoods have been improved.

A total of 36 active ASM sites distributed throughout the whole country were investigated during this study and the total number of both male and female miners in each mine is summarized in Table 1 below. At every location, the team managed to identify the Chairperson for the miners who was interviewed and in most cases they had records of the number of people working in the area. Also individual miners were interviewed in order to get a clear estimate of the number of people working on site. Where an association exists, it was easier to identify the number of miners in that association since they register with their chairperson. Furthermore, in all mine sites, there was always a land owner who rents land to the miners at a fee either as a group or as an individual and there he/she could easily tell our team the number of people on the land.

The ASMs are generally much disorganized and people are allowed in the mine irrespective of where they come from as long as they are willing to work with the already existing communities. Most of the ASMs claim to have joined mining in order to generate enough capital to be able start other forms of business. It was also difficult to investigate the exact ratio of male to female miners as well as children in every mine site since the sites claim not to allow children and yet we saw some of the kids on site. The total number of ASMs from the sites investigated during the study was found to be 256,708, 35% of whom are women who directly and indirectly benefit from mining.

Table 2: Visited mining Areas of Uganda and the number of people Involved

Commodity	Location/ Area	Men	Women	Total people
Gold	Kitumbi sub-county,	48,000	12,000	60,000
	Lubaali, Lugginggi I and Lugginggi II,	6,000	1,500	7,500
	Lugongwe site	5,000	1,000	6,000
	Kayonza	400	100	500
	Kamusenene- Kagaba	1,200	300	1,500
	Nyasisana, Buhweju	50	3	50
	Akashasha Nganvu, Buhweju	2,500	500	3,000
	Busia Illegal locations, homesteads			90,000
	Nakudi			10000
	Bude			70
	Busuma			150
	ANGARIAMA	28	15	43
	SAMA	4	31	35
	BUSCO	15	35	50
	BASMA	16	17	33
	TISCA	26	31	57
	Rupa	130	40	170
	Karita	300	200	500
	Nakapiriprit	10,000	3,000	13000
	Kidere	15,000	5,000	20000
Granite	Laroo quarry	120	180	300
	Ochuloi quarry	600	400	1000
	Dokolo	300	400	700
	Matuga	200	40	240
	Akya quarry	3,500	1,500	5000
Quartzite	Mbalala stone quarries	300	200	500
	Nkiima stone quarry, Namulanda	300	150	450
	Muyenga Stone quarries	120	80	200
Pazzolona	Harugongo, Kabarole District	40	10	50
Salt	Katwe, Kasese District	8,000	7,000	15,000
Iron ore	Hamuguma,Gwara, Kabala District	300	100	400
Tin	Nyanamaherere,Ntungamo District	300	200	500
	Kikagati,Isingiro	60	40	100
Wolfram	Nyamuliro Mine, Rubanda Kabale	1,570	50	1,620
	Rusunga Mine, Muko, Rubanda Kabale	40	20	60
	Nyakabande Gasiza,Kisoro District	50	30	80
Marble/ Limestone	Mt Moroto	5,000	250	5,250
	Rupa	8,000	3,500	11,500
	Katikekile	500	300	800
Lime	Tororo Lime Producers	100	200	300
Total				256,708

The above areas investigated excluded most of the active stone quarries in Wakiso district along Kampala-Gulu road.

4. The Economic Value of ASM to Uganda's Local and National Economy

Artisanal and small-scale mining (ASM) generally constitutes an increasingly important livelihood for tens of millions of people around the world.

Because ASM is largely informal and unlicensed (and in many cases undertaken seasonally to supplement agricultural livelihoods), contributions to mineral production and local economies are rarely captured by official statistics and women and men miners are often invisible to the mainstream or, in some cases, regarded as criminals (Hinton et. al., 2011). However, most of the mineral discovery in Uganda started with the presence of ASMs in a community before the formal exploration companies joined in the search for exploitable mineral reserves.

ASM activities contribute directly to the Local and National economy both formally and informally through several ways as detailed below.

Legal fees/taxes and Non Tax Revenues (NTRs)

Direct and indirect tax collected from miners and business persons who get licenses to trade in minerals contributes to all levels of government revenues to the Central and Local Governments. Exploration and Location licenses pay fees to acquire those licenses and other non-tax revenues like royalties, among others. These are accumulated at the Central Government coffers and later redistributed to Central, Local Government and land owners. While taxes and fees are retained in the Consolidated Fund, as per the Mining Act (2004), royalties are currently divided according to a formula i.e. 80% of royalties retained by Central Government, 17% to Local Government and 3% to the Land Owner. It should be noted that most of the ASM activities are informal and a lot of taxes are lost since government only collects taxes from formal organisations.

Source of raw materials for other industries

More than 100,000 artisanal and small scale miners (about 50% of whom are women) work to produce industrial or "building" minerals like limestone, stone aggregate, gypsum, sand and clay. These minerals are the foundation for Uganda's construction sector, thus ASM is an important driver of the Ugandan economy. Overall, more than 90% of most minerals mined in Uganda are produced by ASM including gold, tin, wolfram, columbite-tantalite (coltan), gypsum, limestone, stone aggregate, and clay, sand and marble. These commodities are crucial to other industries including steel making, manufacturing, construction, and pharmaceuticals.

The metallic minerals exported annually from Uganda is produced by ASM and not always captured in the official annual statistics since it is produced without licenses and the minerals are smuggled out of the country without going through the designated channels. For instance, Uganda's 2015 official gold export statistics show only 0.54 kg of gold originating from Mubende, which was exported to Korea. Research by SOMO and CRSS (2016) estimated that 20 Kgs of gold could be produced on the Lubali mining site (in Mubende) alone per month. The destination of the gold is often said to be Dubai. UN Com trade export statistics confirm significant gold export from Uganda to the United Arab Emirates; 1,937 kilos in 2014. This year (2016), the Observer reported that the gold exports hit \$300 million but Bank of Uganda is baffled since the origin and exporters are not known.

Cash flow within the ASM sites

All activities from discovery, mining, mineral processing to finding the market (e.g. for gold from ore extraction, size reduction, drying, milling, panning, further reworking of tailings from panning at the cyanide processing units and sale among others), entail execution at a fee. Subsequently, there is a lot of money being generated from mining. And as estimated by the Community Development Officer in Mubende for example, if the ASMs alone are Shs. 60,000 then the indirect beneficiaries are millions more. Additionally, also the equipment used in the entire process is bought at a fee from the function hammers, mercury and other chemicals and sluice boxes. The mercury used in gold mining sites is got from Kenya, Tanzania and United Arab Emirates and it is as well bought at a fee by the local ASMs engaged in panning, which generates money in and out-flows.

Trading licenses from the small shops and market dues commonly called "mpooza" from the market are collected on a daily basis. According to the Community Development Office (CDO), Kitumbi

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Sub county, the market dues are paid on a daily basis at a rate of Shs.1,000 per unit per day because the businesses look temporary and can be no more at any time.

Unregulated illegal fees

Apart from fees paid by the license holders to the Central Government, some local governments levy licenses fees illegally. In Moroto District for example, license applicants are charged Shs. 500,000 for their applications to be signed by the District Chief Administrative Officer (CAO). Miners in general also make several unspecified and unregulated fees payments to various individuals and Local Governments.

In Mubende, an operational tax of Shs. 3,000,000 is illegally levied annually on the "Z", cyanide processing units in the Mubende and Singo gold fields. A number of processors are paying up, although also several of them have never paid. Illegal extortion of money has also been reported amongst the Mubende and Singo gold fields from some of the license owners who charge any business or activity that is conducted on the site from sale of roasted ground nuts to shops among others. These are charged daily and also the license owners were reported to demand half a share of all the gold produced at any given site within their license scope. The license owners had also set up road blocks to extort money from any one accessing their area.

For sand, stone aggregates, dimension stones and clay, fees are paid to the land owners, quarry owners, road tolls to UNRA, Local Government and to NEMA.

This is part of the money got out of the existence of ASM activity in the community and this is used within the communities to improve individual livelihoods as well as the communities.

Jobs

The ASM mining industry employs over 400,000 workers directly. These jobs include workers at operating mines, with the rest working mostly in mine construction or in the transportation of mine output. The employment benefit of the mining industry also extends beyond these direct jobs to create indirect and induced jobs. The indirect jobs created include suppliers – such as contractors and engineering firms – hired new workers in response to spending by the mining industry.

ASM therefore provides essential jobs throughout Uganda and reduces rural-urban-migration since communities get an alternative form of employment apart from just practicing agriculture which is seasonal.

Increasing small- and medium- enterprise opportunities

ASM increases demands for locally produced goods (e.g. tools, food, and housing) used in mining communities and by miners and their families. In addition, employees of mining firms and their suppliers use their salaries and wages to purchase goods and services (e.g. food, water and clothing). These purchases induce businesses within the communities and therefore not everyone who goes there is a miner but most of them also supply goods and services. The chain of businesses range from entertainment to food sale, clinics, places of worship, hard wares and retail shops selling general merchandise, petrol stations, lodges, bars, saloons, and barber shops, and an excavator hire centre among others.

There are also heavy duty generators that supply energy to the population in large mine sites especially regions where there is a gold rush. The one stationed at Lugiingi I "Kampala" site for example collects approximately. Shs. 30,000,000 per day while other generator owners collect anywhere between 10 and 20 million shillings per day. In general, one bulb is charged Ug.Shs. 1,000 per day for those businesses at the site that require electricity. The bulbs and the function hammer are powered using a diesel generator that charges.Shs. 20,000–50,000 per function hammer per day and the bulbs are lit for free as a bonus. A fridge is charged Shs. 7,000 per day and a Television set is charged.Shs. 5,000 per day.

The area's housing status greatly improves with mining. For example, in Mubende before the gold rush (four years ago), there were only two (2) iron roofed houses in Nambunda village. However, currently majority of the houses have iron roofs, solar panels and most of the grass thatched, mud and wattle houses have been destroyed and replaced with permanent brick houses.

Prostitution is also on the rise in these areas. Women and girls come from as far as Kampala and neighbouring districts on top of some locals, to indulge in prostitution. One round of sex, commonly referred to as "short" is charged.Shs. 5,000.

Many ASMs often invest their earnings into agriculture development and small enterprises, thereby increasing their resilience and capacity amidst the increasing impact of climate change and escalating costs of living as commodity prices drop.

Conclusions and Recommendations

A total of 36 active ASM sites distributed throughout the whole country were investigated during this study and the total number of both male and female miners in each mine was determined. The ASMs are generally much disorganized and people are allowed in the mine irrespective of where they come from as long as they are willing to work with the already existing communities.

It was also difficult to investigate the exact ratio of male to female miners as well as children in every mine site since the sites claim not to allow children and yet we saw some of the kids on site. The total number of ASMs from the sites investigated was found to be 256,708, 35% of whom are women who directly and indirectly benefit from mining. The areas investigated excluded most of the active stone quarries in the Wakiso district along Kampala–Gulu road via Bombo road.

Most of the mineral discoveries in Uganda were through ASM activities and they act as the main source of raw materials for the construction industry and minerals exported from Uganda. ASM contributes to Uganda's economic development by stimulating local businesses and increasing the cash component of household income (as most mining revenues are spent locally), by providing a labour-intensive, non-agricultural source of employment and reducing rural-urban migration. Although the potential development contributions are significant, ASM is often characterized by unsafe working conditions, environmental degradation, poor mining methods, disorganization, illegality and serious community health issues.

There is also an issue of mercury and cyanide use in the gold extraction in order to maximize the recovery of gold by the artisanal

miners. This has been observed as an environmental health issue in the areas of Mubende and Busia, given the fact that the mining areas are within agricultural lands and close to Lake Victoria– some mines are on the shores of Lake Victoria. There is a real issue of mercury contamination through fish and food crops in this part of the country. There is need for proper regulations on the use of dangerous chemicals such as mercury. Efforts should be invested in finding an alternative chemical/ method that is as effective as mercury. It should however be noted that most of the companies or individuals using cyanide in these mine sites are not Ugandans and are not expected to respect Uganda's environment. There is therefore need for the Government and all stake holders to start regulating the use of these chemicals on site.

Government should carryout in-depth mapping of the ASM mine sites in order to understand the industry in depth for planning purposes. The issue of kids is complex because there is no one with the mandate to arrest kids but associations are encouraged to keep avoiding children on the mine sites. Relevant studies should aim at identifying the number of children involved in these ASM activities and their positive and negative impacts to the society and the next generation.

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