



## **Kenya NGO Earth Summit 2002 Forum**

### **NATURAL RESOURCES – MINERALS**

***A REPORT OF THE CIVIL SOCIETY REVIEW OF THE  
IMPLEMENTATION OF AGENDA 21 IN KENYA***

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# 1:INTRODUCTION

## **1.1:Mineral Mining**

Mineral products are at the core of today's civilized world that we live in. The manufacturing sector, the high technology industries and even the resource industries are all dependent, in one way or the other on the mining industry. In order to achieve national and industrial development, any country including Kenya requires large supplies of raw materials such as aggregates for the construction industry and other metallic and non-metallic industrial minerals. Mining must be carried out in the process of trying to satisfy this demand.

Mining is any activity that involves excavating the earth surface for the purpose of exploiting and processing the mineral wealth for economic and industrial development both for local and export markets. This process normally has a negative impact on the environment.

There are two main methods of mining;

- a) Underground mining
- b) Open cast mining

### **1.1.1:Underground Mining**

This refers to any sub-surface vertical or horizontal excavations that are made for the extraction of minerals. An example of this is the lead ore mines (Gelena) at Kinangoni mine in Kilifi district. This method has little effect on the vegetation and the ecosystem in general.

### **1.1.2:Open-casting Mining**

This refers to uncovered excavations made on the ground for the purpose of mineral or rock exploitation such as the open quarries, pits, trenches, etc. This is the most common method of mining in Kenya, in particular in the Coast province where there are abundant mining activities. Examples of these includes gemstone mines like Kapanga Kasingau and Mangare areas of Taita-Taveta district, Bamburi Portland cement quarries, Jaribuni Iron ore works, Roka gypsum workings, Kokotoni Ballast quarries, Maji ya Chumvi slabs quarries at Mariakani and Taru all in Kilifi district and Msambweni glass sand or silica sand quarries, just to mention some.

## **1.2:Mineral Development**

These are the chemical and physical processes in which the excavated ores and rocks are prepared for local and export markets either as finished products or preparing them for further Industrial processes. These operations involve both physical and chemical treatment methods and vary from one industry to the other depending on the ores being mined. For instant minerals such as barites ( $\text{BaSO}_4$ ) or Gelena ( $\text{PbSO}_4$ ) are separated from gangue minerals such as quartz, clay and soils by density as they are heavy minerals while gold is separated from its ore or lead from sulphur through complex physical and chemical processes such as floatation, smelting and cynidation.

### **1.3:Impact of Mining on the Environment**

Any mining operation draws ores and other raw materials from the earth and this has a direct impact on the biological and physical environment. The nature and degree of impacts vary widely depending on the location and type of operation. However, mining operations will generally affect the hydrological functions and hence water quality. This is because mining interferes with the ground water table by lowering it and introducing pollutants to the aquifer.

Mining operations such as sluicing and dredging have profound impacts on transport rates of heavy metals. On affecting the hydrological functions all the biological life forms are affected. Special species such as microbiota, benthos, algae, bacteria, fungi, protozoa and invertebrates bear direct consequences.

Mining operations often involve cutting the land surface and moving the earth to other locations as waste materials. This affects the natural topography and scenic beauty as well as removing the surface vegetation which affects the ecosystem, thereby disturbing the balances of nature.

Sand and gravel degrading along rivers can increase sediments bed load through suspension, hence physically eliminate several organisms and destroy fish spawning and nursery areas, all of which ultimately change aquatic community composition. It can also lower the riverbed, steepen and destabilize riverbanks causing erosion and channel widening.

Mining activities normally generate a lot of noise, dust, toxic fumes and solid or liquid waste effluent which find its way into the surroundings causing pollution into the environment. It often competes with ecologically protected zones such as National Reserves and gazetted forests. It poses, just like any other industry both environmental and safety hazards which are contributed by; The prospectors tend to mine on a dig-and-dump basis to win both precious, or semi-precious and industrial minerals in increasing quantities causing adverse effects on the environment at local or regional scale.

These effects can either be physically or chemically influenced depending on the mining activities. Mining disturbs land by removing surface vegetation and changing topography and affects hydrological functions and water quality, causes soil erosion and stream sedimentation that cause death of trees along river banks, produces dust, lowers the water tables or destroys wildlife habitat. The additional vehicular traffic around a mine site brings noise and increases wear on the roads.

#### **1.3.1:Physical Effects**

This occurs as a result of mining activities on any area during and after the mining operations. During mining or quarrying, vegetation and soil covers are removed to facilitate the extraction of minerals or rocks by digging pits, trenches, etc. Explosives may be used to say blast the rocks. This leads to the distortion of the landscape into scarred, disfigured and very different from the original state. This results to soil erosion facilitation from erosion agents such as wind and run-off water that leave the rock out-

crop bare. It also causes pollution as dust and fumes are circulated into the atmosphere while soil particles end up in watercourses as sediment. Unfilled pits and trenches of varying sizes and depths may act as water reservoirs during the rainy seasons, which may become dangerous death traps for human and animal population. They may also become breeding areas for harmful insects such as mosquitoes and other microorganisms.

Excavations and use of explosives near roads and water or oil and gas pipelines can influence localized earth movement such as mudflows and landslides that cause damage to the environment.

### **1.3.2: Chemical Effects**

Chemical effects are as a result of industrial operations or dumping of refuse, which can either be in the form of solid, liquid or gas. This waste may be toxic and would have a direct or indirect effect on the environment. These chemicals include, sulphur dioxide, cyanide, arsenic and mercury vapours, which are known to be environmental hazards at even very low concentration levels. During the mining of gold for example either cyanide or mercury is used. Both of these chemicals are toxic and if not properly handled, may enter into wastewaters and into the hydrosphere causing adverse effects on life. Mining equipment such as diesel engines used in the underground mines give out soot and poisonous gas emissions that pose serious safety hazards to workers and life in general.

## **2:MINERALS AND AGENDA 21**

Agenda 21 is a detailed action plan for implementing the Rio principles on sustainable development, evolved from the 1992 UN Conference on Environment and Development, has no specific chapter dealing with the mineral sector as there is for agriculture, protecting and promoting human health etc

However, there are a host of provisions of direct and indirect relevance to minerals development. In particular Chapter 10 presents a program for integrated planning and management of land resources. It's broad objective is to facilitate allocation of land to the uses that provide the greatest sustainable benefits. Its specific objectives are "to review and develop policies to support the best possible use of the land and the sustainable management of land resources", "to improve and strengthen institutions and coordinating systems," and "to create mechanisms to facilitate the active involvement and participation of all concerned, particularly communities and people at the local level, in decision-making on land use and management".

To implement even a portion of these suggestions would radically change the resource planning and allocation process in any country.

Other examples include Chapter 4 (Changing Consumption Patterns) which advocates for reduction in unsustainable demand for natural resources, greater efficiency in the use of energy and resources, minimizing generation of wastes, and environmentally sound pricing; Chapter 13 (Mountain Development), that suggests alternatives to minerals development to prevent soil erosion, landslides, and loss of habitat and genetic diversity; Chapter 17 (Protection of Oceans), addresses also the degradation of the marine environment from oil and gas activities and Chapter 26 (Strengthening the Role of Indigenous People) that calls for protecting indigenous people's lands from activities which are environmentally unsound or that they may consider to be socially and culturally inappropriate.

Agenda 21 also proposes two programs;

- 1) Interfirm cooperation with government support to transfer technologies to minimize waste and increase recycling,
- 2) Responsible entrepreneurship that encourages self-regulation, environmental research and development, worldwide corporate standards, and partnerships in clean technology.

### **3:KENYA'S MINERAL RESOURCES**

#### **3.1:Mineral Occurrence in Kenya**

Minerals found in Kenya include; Soda ash, Fluorspar, Barite, Gypsum, Salt, Dimension stones, Silica sand, Kisii stone (Soapstone), Manganese, Zinc, Wollastonite, Graphite, Kaolin, Copper, Nickel, Chromite, Pyrite, various Clays, Rare Earth Elements and Phyrochlore.

The main geological sources are;

- (a) Archean Nyanzian shield area of Western Kenya: Metallic mineralization is common and has potential for Ferrous and ferrous metals.
- (b) The Proterozoic Mozambique Belt that is most extensive in Kenya Central, North to South in which metamorphic minerals such as Kyarite, Corundum, Graphite, Wollastonite, Marble, kaolin and a variety of gemstones are found together with minerals associated with basic and granitic rocks, such as mica and iron ore.
- (c) The Sedimentary rocks that are also widespread and range from Palaeozoic to recent. They are possible sources and hosts of hydrocarbons, limestone, gypsum, clays, manganese and construction materials. Base metal mineralisation, lead-zinc are known to occur in the sedimentary basin along the Coastal belt. Heavy mineral sand also occur along the Coastal beach sand.
- (d) The Volcanic rocks associated with the rift system host and yield a variety of minerals and construction materials. These volcanic-Sedimentary accumulations have deposits of Clays, Trona , Diatomite, Natural Carbon dioxide, Kunkar and Gypsum. The geothermal fields are found in this area (Davies and Mathu, 1996). Geothermal electricity generation has a potential of 2,200MW is mined at the Rift Valley province.
- (e) The Mrima ore of the Carbonatite which has a potential for niobium and other rare earth elements is found in the coast basin south of Mombasa. This ore has been found to contain large deposits of rutile, ilmenite and zircon that contain titanium.

Figure 1 below shows the geological map of Kenya.

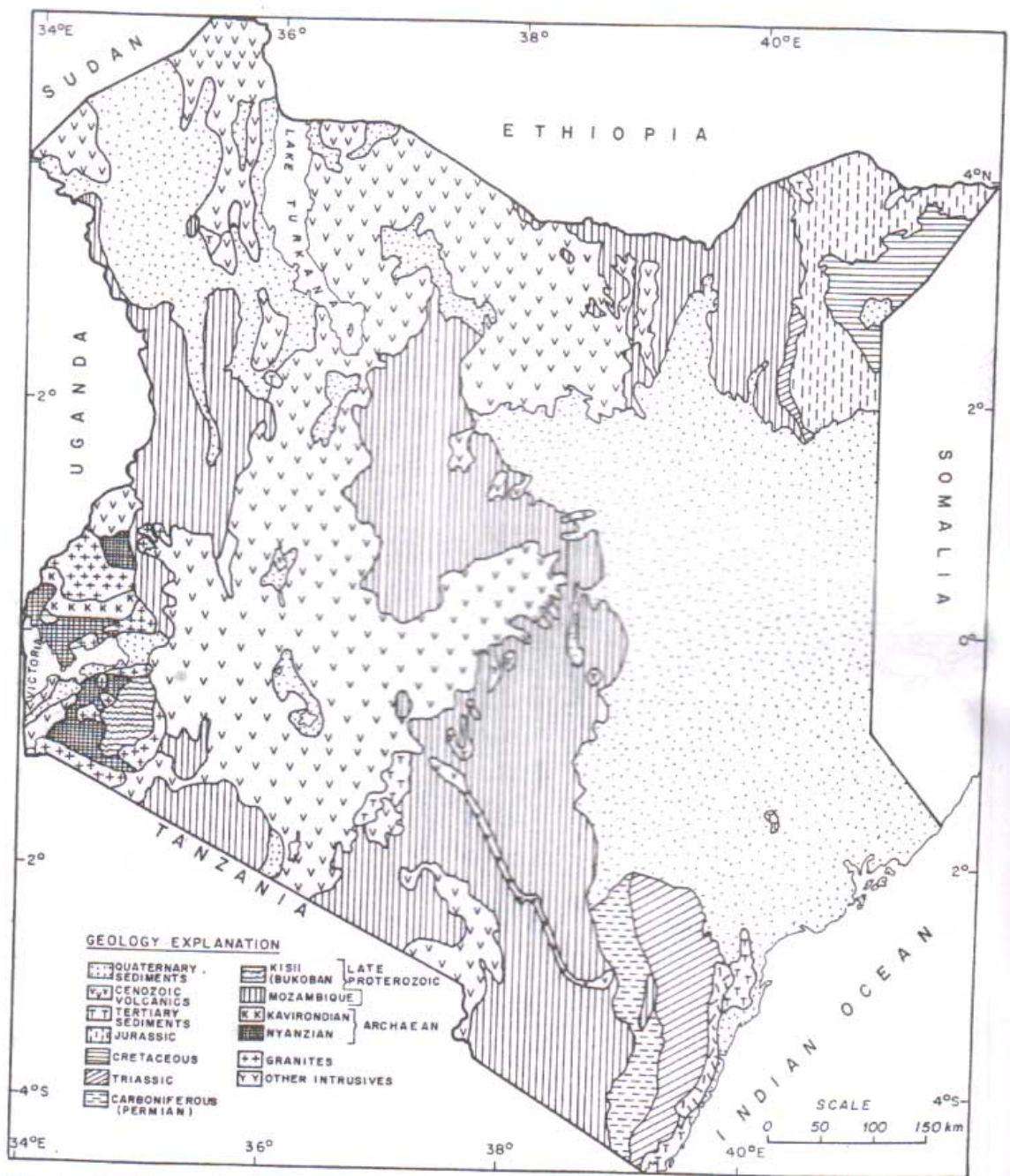


Figure 6. Simplified geological map of Kenya showing the major geological units and their distribution.

Figure 1: Geological Map of Kenya

### **3.2:Legislation**

Searching and exploitation of mineral resources in Kenya is regulated by, the Mining Act Cap. 306 established in 1940 and revised in 1987, and the Environmental Management and Co-ordination Act of 2000 of the Laws of Kenya. Section 2 of the Mining Act define minerals as precious metals, precious stones or non-precious minerals, but does not include mineral oil, clay, murram, limestone, sandstone, mineral water, brine, dolomite, kaolin, gravels, dimension stones, Kisii stone (pyrophyllite), sodium and potassium compounds except those forming part of Lake Magadi saline deposit and ornamental stones.

Ownership of the minerals is vested in the Government of Kenya and includes minerals found within Kenya's Continental Shelf, Territorial waters and the Exclusive Economic Zone. Currently the Government policy in mineral resources development is to ensure that the private sector takes the leading role in mineral development while it assumes a promotional, encouragement and regulatory role by providing basic geological data and necessary fiscal incentives. The Government of Kenya undertakes reviews of policies, mineral legislation, promotion measures and publicizes the mineral investments in Kenya through the Mines & Geology Department in the Ministry of Environment and Natural Resources.

This Department also undertakes regional mapping and exploration, encouragement of industrial mineral prospecting and exploitation to local miners, evaluation and investigation of mineral deposits using drilling rigs, rehabilitation of disused mines and quarries among other things. Over 90% of the country has been geologically surveyed.

### **3.3:Mineral Development Policy**

In the National Development Plan of 1964-1970, the mineral resources were regarded as insufficient to make substantial contribution to the economy of Kenya. No major deposits such as iron ore, coal or oil had been discovered to serve as prime movers for rapid expansion of the economy. However, Kenya's Geology then showed that there were economically viable mineral deposits such as copper, gold, silver, lead, iron ore, phosphate, platinum, manganese and nickel.

The seventh National Development Plan of 1994-1996, titled 'Resource Mobilization for Sustainable Development' has Chapter nine outlining the government policy on mineral resources and recognizes the importance for preservation of a clean environment and the involvement of the private sector for sustainable development. The Government policy on mineral resources development is to ensure that private sector takes the lead in the development of minerals.

The Governments role is that of promotion and encouragement by creating favourable incentives, conducive to private investment by both domestic and foreign investors. The Government of Kenya proposes to undertake reviews of policies, mineral legislation, promotional measures and publicizing of the mineral investment potential of Kenya

(OVP&MPND, 1993). This is through the Department of Mines and Geology, which also proposes to undertake regional mapping and exploration, encouragement of industrial mineral prospecting and exploitation by local miners; evaluation and investigation of mineral deposits and rehabilitation of disused mines and quarries.

### **3.4: Mining Operations Before Agenda 21**

Mining operations before Agenda 21 were legislated by the Mining Act Cap.306 only, which is silent on the environment. The quarrying activities were, as they are now under Local Government Act that required good environmental practice. Due to lack of legislation and poor enforcement where required no environmental or sustainable development practices were carried out in the mining or quarrying industry.

### **3.5: Mineral Economic Contribution**

The contribution of mining to the Gross Domestic Product (GDP) in Kenya is less than one percent and is mainly from non-metallic minerals such as Soda ash & Fluorspar (Central Bureau of Statistics, 2000).

The table below shows the total tonnage of production and the economic contribution of the main minerals in Kenya between 1995 and 1999. Table 1

**Table 1: Production and Economic Contribution of Kenya's Minerals**

<b>Minerals ( tonnes)</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>
Soda ash	218,450	223,000	257,640	242,910	245,680
Fluorspar	74,230	83,000	68,700	60,854	93,602
Salt	73,484	41,000	6,280	21,742	44,886
Limestone products	29,574	31,935	32,668	32,000	32,000
Refined Soda	362,000	375,000	392,000	370,000	335,230
Other	9,017	10,276	10,934	9,823	10,682
<b>Total</b>	<b>766,755</b>	<b>764,211</b>	<b>768,222</b>	<b>737,329</b>	<b>762,080</b>
<b>Value K\$'000</b>					
Soda ash	69,652	85,100	94,701	73,668	92,426
Fluorspar	13,076	20,816	16,555	17,086	32,563
Salt	5,475	1,543	1,177	3,313	6,812
Limestone products	1,439	1,509	1,556	1,589	1,580
Refined soda	1,393	1,702	1,895	1,474	1,849
Other	6,584	19,830	16,122	15,927	36,912
<b>Total</b>	<b>97,619</b>	<b>130,500</b>	<b>132,006</b>	<b>113,048</b>	<b>172,142</b>

Source: Department of Mines and Geology

### **3.6: Mining Activities**

The mining industry in Kenya is not large. The current mineral exploitations in Kenya is dominated by the non-metallic minerals such as, fluorite, soda ash, diatomite, vermiculite, gypsum, limestone, a variety of gemstones and ornamental and constructional stones including sand harvesting. 70 – 80% of mining in Kenya is done by small-scale to artisan miners. The main mining operations under small scale include gemstone mining at the coast region, gypsum mining at Kajiado and alluvial gold mining in western and northern Kenya (Osumo, 2001)

#### **3.6.1: Alluvial Gold Mining**

The artisan miners of alluvial gold mining in the western part of the country use mercury metal that reacts with native gold in its raw form to amalgamate the gold. They then evaporate the mercury barely in the air to be left with the gold (Davies, 1994). This is a potentially health hazard to the miners and very potent environment pollutant as mercury is highly toxic to life. Initially there were co-operatives societies set up by the gold prospectors. There were at least four major societies recognized by the government i.e;

- (i) Kakamega Co-operative Society -Kakamega
- (ii) Korpu Co-operative Society- Turkana
- (iii) Lake Side Victoria Co-operative Society- Migori
- (iv) Lalua Marich Co-operative Society- West Pokot

The Government through the Commissioner of Mines was able to control and facilitate mining operations in these areas through the co-operative societies. Licensing of the operations was also possible and the government was able to collect revenue. Good environmentally mining operations and rehabilitation of the mines were officiated by the Mines Department.

The societies collapsed due to institutional mismanagement and the prospectors vanished from the Commissioner of Mine's eyes. This was as a result of corrupt practice; mainly on the side of the officials of the various co-operatives embezzling funds or/and equipments. This set out problems of good environmental practice, lack of collection of funds, lack of rehabilitation programs, loss of revenue and equipments and above all political aspects cropped in and the artisans were literally left alone and mining goes on uncontrolled with all the environmental hazards and deterioration unabated. The safety, health and environmental impact of these artisans in these areas are enormous.

#### **3.6.2: Gypsum Mining**

Gypsum mining is mainly done at small-scale level in Kajiado district in the southwest part of Kenya. The mining fields are in the Maasai community trust land that proves difficult to administer from the central government due to political interventions. In this regard open cast mining goes on uncontrolled bringing with it all the environmental. The open grounds are abandoned at will and poses risks to wild and domestic animals. It is common for animals to get stuck and drown in the abandon water filled mines (Osumo, 2001).

### 3.6.3:Gemstone Mining

This is among the most lucrative small-scale mining operations in Kenya. It is done in the coastal region, mainly in Taita Taveta and Kwale districts. There are conflicts of interest and land use as most of the mines fall in the National Parks or other protected areas. Human settlements also interfere with smooth running of the mines. In this regard, most of mining operations in this area go on unsanctioned by the Commissioner of Mines and Geology Department. These results to uncontrolled mining, loss of revenue, environmentally unfriendly practices and non-rehabilitation programs after mineral exploitation.

### 3.7:Quarrying Activities

Quarry operations are under the respective Local Authorities in their areas of occurrence. However the Commissioner of Department of Mines and Geology sanctions use of explosives for the purpose of blasting the rocks. That is, there always exist conflicts and misuse of the two licensing bodies in quarrying. The table below list the activities in quarrying and the impact of it to the environment, Table 2

Table 2: Activities Involved in Quarrying

ACTIVITY	POSITIVE IMPACT	MEASURABLE PARAMETERS	NEGATIVE IMPACTS	MEASURABLE PARAMETERS
Clearance of the over-burden	-creation of employment -provide raw materials for the construction industries -encourage cottage industries -generate income -earn revenue for the government - -	-people in employment -products in running feet or tons -amount of money earned -improvement of lifestyles.	-destruction of vegetation -destruction of fauna habitats -loss of scenery -enhancement of soil erosion	-area cleared in km <sup>2</sup> -depletion in number of plant and animal species
Drilling	-creation of employment	-number of people employed	-generation of dust -generation of noise	-percentage of particulates in the air -noise levels in decibels >85, hearing protection is required
Blasting	-creation of employment	-number of people employed	-ground vibrations -flyrock generation of dust generation of	-amplitude and frequency using seismographs -number of damaged structures -number of

			noise -surface land disruption -explosive fumes (gases)	structural cracks developed -number of pieces of stones thrown out -area in km <sup>2</sup> -percentage of particulates in the air -noise levels in decibels >85, hearing protection is required
Splitting	-creation of employment	-number of people employed	-flying stones pieces	-number of people and structures damaged -percentage of particulates in the air -noise levels in decibels >85, hearing protection is required
Stone dressing	-creation of employment	-number of people employed	-generation of dust	-percentage of particulates in the air -noise levels in decibels >85, hearing protection is required

Source; Mines and Geology

### **3.8:Impact of Quarrying Activities**

<b>Impact</b>	<b>Degree of Significant</b>	<b>Mitigation Measures</b>
Destruction of flora	Major	Re-vegetation
Destruction of fauna habitats	Major	Provision of animal diversity that will contribute to a stable and compatible ecosystem.
Surface land disruption	Major	Rehabilitation
Ground Vibrations	Major	Discontinue the use of explosives or use of proper designs. Recommended frequency is less than 40Hz Vibration levels are as follows;

		-< 1.91cm/s for modern houses and dry wall constructions -< 1.27cm/s for older houses with plaster on-lathwalls -<0.254cm/s where local altitude is hostile to mining
Flyrock	Minor	Use of proper blast design
Noise pollution	Moderate	Discontinue the use of explosives. >85 decibels hearing protection is required.
Generation of dust	Moderate	Provide workers with filter masks and respirators and use proper blasts designs
Loss of scenery ( abandoned excavation)	Major	Creation of landforms which are compatible with the adjacent landscape

Source; Mines and Geology

### **3.9: Mining Impact in Kenya**

Mining in Kenya is mainly open cast due to the nature and occurrence of minerals mined. Instances of environmental degradation due to mining are therefore more severe and are reflected in the waterways of most nearby environments. For example the Kerio Valley area is heavily polluted by the fluorite which is mined by the fluorspar mines through open cast, pollution of the atmosphere and water ways of Greenstone Belt of western Kenya by mercury which is used in amalgamating the alluvial gold in the area, the dust produced in the mining and processing of diatomite at Kariandusi in Gilgil and the effect of escaped volatiles and spent liquor in the processing of Trona at Lake Magadi and Energy production at Geothermal Station in Hells Gate, Naivasha.

In the quarries dotted all over the country, dust and sound pollution has adversely affected the neighbourhood residents. The Karen-Ngong Environmental Self Help Group of Nairobi is instrumental in stopping of quarrying for dimension stones in Ololua forest. The quarrying had been authorized by the City Council of Nairobi in conjunction with the Forest Department, which incidentally, falls under the Ministry of Environment and Natural Resources. Kayole Resident Association in Nairobi effectively managed to relocate the huge stone crushing industry from their area, but not after the impact on their buildings and health. Dust and dynamite explosive impact were responsible for lung related diseases and the cracks developed on the buildings in the area. The huge open cast left behind however, pose a high risk to residents and their children. Several deaths have occurred in the nearby estate, Doonholm where such abandoned quarry mines were left uncovered.

Sand harvesting has caused a lot of soil erosion particularly in the neighbouring Machakos district, which is the main supplier of sand to the Nairobi construction industry. The Government has constantly intervened in the process but to very little effect. Large tracks of land and fertile soil has been washed down stream and gone to waste due to the practice.

### **3.10: Mining and Land Use Conflicts**

Mining competes with other land uses naturally due to location of the minerals. Minerals also determine the mining practices to be employed as well as the reclamation and possible choices for post-mining land use. That is mining effects are long lasting and will affect the land use almost irreversibly. In this context mining activities will always portend conflicts with other land users.

The Commissioner of Department of Mines and Geology grants exploration and mining licenses to companies and individuals who want to explore for and mine minerals in Kenya. The areas applied for may be agricultural lands, ranches, gazetted forest, National Parks and Game Reserves, burial grounds, Trust lands, private lands, industrial areas, urban areas or areas set aside for commercial activities and so on. The Law however requires that the owners of the lands must give consent before an exploration or a mining license is issued.

In the process of mining, vegetation and over-burden must be removed and stockpiled elsewhere. As mining progresses the excavation or pit will expand and more area is affected. The land use changes although it is well known that mining will not continue forever, it has a definite period once the deposit is exhausted. Once the mining is over the land may be restored for the previous use but like in many cases other uses are introduced. In many of the cases in this country, abandoning of the site with out rehabilitation is usually the case, particularly for those activities carried out before the enactment of the Environmental and Management Act. These issues will definitely breed conflicts with miners and other land users including neighbouring residents and Environmentalists. Known cases of conflicts arising from mining and quarrying activities include;

- a) Mining Vs Wildlife habitat e.g Tsavo West National Park
- b) Quarrying in Towns Vs Neighbouring Residents e.g. Nairobi, Mombasa, Kisumu, Cities and Nakuru Town.
- c) Quarrying Vs Forests e.g. Ololua forest
- d) Mining Vs Human Settlement e.g. Mwananchi Ranch
- e) Mining Vs Environmentalist e.g. Kwale district, Tiomin Ltd

#### **3.10.1: Mining Vs Wildlife Habitat**

Some of the mineral ores in Kenya are found in the National Parks especially in the Tsavo National Park where the Mozambique belt rock underlies. The Mozambique belt associated with basic and granitic rocks is well endowed with precious minerals and other minerals such as kyanite, corundum, graphite, wollastonite, marble, asbestos, fluorspar, magnesite, kaoline and a variety of gemstones.

The conflict is brought about the two government departments, one the Mines and Geology Department that licenses prospectus and miners in one hand and the Kenya Wildlife Service Department that mans the National Parks and claims the Parks are protected areas and that no prospecting or mining should be allowed.

### **3.10.2:Quarrying in Towns Vs Neighbouring Residents**

Quarrying in towns started way back during the colonial government. The present area of Mathare slums was once a quarry. Licensing of quarries is vested on Local Authorities since dimension stones and ballast are not minerals as defined by The Mining Act Cap.306 of the Laws of Kenya. In Nairobi, the City Council is responsible for the licensing of quarries and since residential or property development always encroaches onto the quarries proper planning is required as most quarries cannot coexist with residential or property development. Quarries are supposed to be isolated from development mainly because explosives are occasionally used to blast rocks. Explosives produce, vibrations, noise, chemical fumes, ground tremor and fly rock. Ground vibrations cause serious cracks in structures making them unstable, while fly-rock and air blast are a threat to life

### **3.10.3:Quarrying Vs Forests**

A case in point is the Ololua forest in Nairobi. In 1998, the City Council in conjunction with the Forest Department, which also falls under the Ministry of Environment and Natural Resources, licensed quarrying in Ololua forest in Karen area. The residents commissioned and environmental study that proved that the mining was above all affecting their nearby homes and lives in addition to the destruction of the unique forest in the City. The quarrying was stopped, though rehabilitation of the already affected land has not been done.

### **3.10.4:Mining Vs Human Settlement**

A case in point is the Mwananchi Ranch in Taita Taveta District. The Ranch is underlain by the gemstones rock bearing formations. For many years the Commissioner of Mines and Geology has licensed people to prospect and mine in the Ranch. Currently the Director of Settlement is settling people in the ranch although it is not suitable for agricultural activities. The area is semi-arid and is conflict with the Laws of Kenya. This will breed conflict and contribute to more poverty in both the settling community and the displaced mining community (Osumo,2001).

### **3.11:Environmental Protection Measures**

Mining activities are very important economically since they promote and encourage industrial development, create employment and lead to opening up of rural areas by improving infrastructure and communication within. Mining and mineral exploitation in Kenya is governed by mining laws and regulations stipulated in the mining Act cap 306, of the Laws of Kenya and the Environment Management and Co-ordination Act The National Environment Secretariat (NES) was set up in 1974 in preparation for the United Nation's Conference on the Human Environment. In the late 1970's, NES promoted a national environmental impact assessment (EIA) requirement that was intended to apply to all major projects, both public and private. Its main objectives were to promote environmental awareness and environmental protection.

### **3.12:Environmental Impact Assessments (EIA)**

#### **3.12.1:Public-Masinga Dam**

Environmental impact assessment on all new private and public funded projects was made a requirement as early as mid 1970's. The enforcing body was then National Environmental Secretariat (NES). In 1976 the first environmental impact assessment was undertaken for the Upper Tana Reservoir in light of building Masinga Dam. The reservoir expected to be 1000 ha (about the size of lake Naivasha) was anticipated that it might lead to environmental problems (Davies and Mathu,1996). For example people would have to be resettled, the lake would provide potential for fishing and tourism, or provide the site for the incursion of harmful weeds, important forests might have be destroyed and the changes in river flow could affect the people living down stream, while land use on the margins of the lake could have a bad effect on the lake itself. On studying all these aspects the recommendations were that there were no good environmental reasons for aborting the project In later years other similar public projects were studied for environmental impact a case in point is the Sondu Miriu in Western Kenya that is under way.

#### **3.12.2:Private-Tiomin Kenya Ltd**

Titanium prospecting and mining in Kwale district is probably the latest and maybe the only major new project to be undertaken by private investors in independent Kenya's history. There are as stated earlier precious mineral ores in the rocks underling in the Mozambique belt, which runs from the north through central Kenya to the eastern boarder of Tanzania and to the coastal part of Kenya (Ochieng, 2001). It is established that there are about 3.2 billion tons worth of mineral ore at the coast with about 3.0 billion tons up north coast and 0.2 billion tons in Ramisi in Kwale district. Tiomin plc, a public listed company of Canada established a local subsidiary in Kenya, Tiomin Kenya Limited, to undertaken and perform mining operations and processing of world-class heavy minerals for rutile, ilmenite and zircon for export. Tiomin (K) Ltd proposed to invest a total of US\$150million in Kwale. The main project components include a mine at Kwale site, a wet plant and mineral processing plant at the Kwale site and a shiploading facility at Shimoni (Coastal, 2001). The actual processes involved are;

At the mine site

- (a) mining using bucket wheel excavators
- (b) mineral separation
- (c) tailings disposal

At Shimoni

- (a) shiploading facility

In light of this, Tiomin (K) Ltd was required under the Environmental Management and Coordination Act of Kenya to undertake a comprehensive EIA. Tiomin (K) Ltd undertook detailed EIA using several professionals and filed a comprehensive report. Among the major environmental issue highlighted by the assessment include;

#### **Physical Environmental Impact**

- (a) Changing of the topography and geology of the area permanently

- (b) Hydrological effects of surface and shallow groundwater bodies such as River Mukurumudzi .
- (c) Impacts on soil and land use

### **Natural Environmental Impact**

- (a) Loss of annual and tree crops
- (b) Loss of habitat for the animal diversity
- (c) Loss of wetlands
- (d) Loss of high plant diversity and ethnobotanical
- (e) 450 households would be displaced resulting to; loss of households, loss of community infrastructure and disruption of community networks.

### **3.13: Community Based Organisations**

Community Based Organisations with the help of NGOs have been in the forefront in awareness, prevention and alleviation campaign of environmental degradation due to mining or quarrying in the neighbourhood. While it is gainsaid that mining or mineral exploitation is not evil, the practice should be sustainable as provided for by the agenda 21. Mineral exploitation is irreversible, however other profitable and sustainable use of the exploited land should be found after an environmentally friendly exploit of the said mineral. Several CBOs have successfully lobbied for the removal of bad mining operations.

The current issue on Tiomin at the coast has landed the prospectors in court of law through the Coast Environmental CBOs and NGOs, in the process of stopping the implementation of the project so as to alleviate the looming environmental impact assessed. The prospectors propose to put in place compensation and rehabilitation programs that would be sustainable. The Agenda 21 is on Environment and Sustainable Development and since the Environmental Management and Coordination Act is in place, then the enforcement of the Act in accordance to Agenda 21 will and should prevail.

The Kayole Residents Association in the Kayole area of Nairobi with the help of some NGOs have managed to have the quarrying in their area stopped and the activities transferred to another site. Under normal circumstances residential or property development encroaches into quarrying activities. This is usually under a well thought plan by the local authority planning departments and hence their involvement in quarrying. With poor planning, property development will get to the quarries faster than the quarrying communities have exploited the quarries fully. This results to the forced coexisting of quarries and human settlements, a fact that is well known not to be sustainable.

The Ololua forest case was one of quarrying activities going back to the residents and above all human life is precious and cannot be compromised. The CBO and the NGOs that highlighted and stopped the quarrying activities were right in their approach and should go ahead and rehabilitate the affected areas.

## **4:REHABILITATION OF MINES**

The Mining Act Cap. 306 of the Laws of Kenya is silent on rehabilitation of mines after mineral exploitation. However, the Environmental Management and Coordination Act 2000 require good environmental practice even after exploitation of the mineral. Hence it is mandatory for the rehabilitation of mines. One of the major constraints in rehabilitation programs is the informal mining operations existing and the land tenure as far as the mines are concerned. In particular the licensing and administration of quarries leaves room for environmental malpractices. The Environmental Act is relatively new and its implementation has yet to be realized since the enacting body National Environmental Management Authority (NEMA) is not fully in force. In spite of this there are private miners that have taken the initiative to rehabilitate their used mines a case in point is the Bamburi Portland Cement Company Ltd

### **4.1:Bamburi Portland Cement Company Ltd**

Bamburi Portland Cement is a cement making company that has been in operation in this country for the last several decades. Its first site of operation in this country was at the coast near its limestone mines at the north coast of Mombasa city. It owns the land on mining and manufacturing site, and with time the exploited mines occupied a large portion of the unused and environmentally unfriendly land. The company with the help of environmentalist developed a recreation center, Nature Trail Centre; that accommodates almost all the flora and fauna including some of the large mammals that can habituate in the coast region. The Nature Trail earns revenue to the company and is an environmental boost to the City of Mombasa.

This a good example of environmentally friendly land use with sustainable development. The Agenda 21 advocates for such use and this is one of the rare examples in this country. It should be born in mind that land tenure comes into play in this issue. Bamburi owns the land and since limestone mining, just like quarrying is not controlled by the Commissioner of Mines and Geology, the onus of rehabilitation lies with the landlord.

Other mines like the Kajiado gypsum mines owned collectively by the Maasai clans are environmental disasters and risky zones to both humans and animals. The abandoned sites are left unmanned and animals stray into them and get stuck in the mud in them as they attempt to quench their thirst. Likewise, the community may be helped to reclaim the land and make good use of it.

## **5:RECOMMENDATIONS**

The Government of Kenya has well intended policy of mineral development in this country as stipulated by the Agenda 21. The participation of private investors as the vehicle for mineral development is one of the provisions in Agenda 21. It has as well reviewed the legislation of the mineral development activities to accommodate the environment and sustainability of the activities.

However, the enactment of the legislation has taken a snail slow speed make the laws ineffective as nobody is aware or adheres to them. The enacting body NEMA, for example is toothless, what without an executive director to at least steer the activities that have been vested on NEMA from NES by Law would be effective. The ratification or disqualification of EIAs done by and for various firms need to done by the executive to avoid other ill equipped government departments to misinform the mining sector and the public at large.

Quarrying activities and any other open cast mining should come under one government department, say the Department of Mines and Geology, which by a well intended thought is under the Ministry of Environment and Natural Resources that is also a host to NEMA and the Forest Department. Quarrying activities are currently licensed by the Local Authorities who have no manpower or skills to do so. They operate from revenue collection and land allocation only without any regard to the actual activities carried out. They are unable to assess the quantity and production capacity and hence duration of quarrying to go hand in hand with their development plans. The unable to assess the environmental degradation and the rehabilitation program thereof required after the quarrying/or mining.

Quarries should be rehabilitated after use. This should be the onus of the land owner who after all has collected revenue from the exploits. There are many post quarrying uses such as that of Bamburi Company, fish farming, recreational small lakes or even property development. Mathare slums site was once a quarry and the land can provide a very firm construction foundation for buildings.

Kajiado gypsum disused sites may attract tourism plus recreation areas if well rehabilitated. Wildlife may also thrive well in this place if the mines were fenced off and only accessible edges were opened to the animals for watering.

The government/NGOs should look at the possibility of re-establishing mining co-operative societies for the small scale and artisan mining. Environmental issues are a concern of all of us and individuals may not be able to handle or rehabilitate some the mines.

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