



Mineral Exploitation and Environmental Consequences in Edo State, Nigeria

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ABSTRACT

The economic growth of Edo State has greatly benefited from the extraction of solid minerals. Numerous people engage in it as a source of income because it is one of the State's sources of foreign exchange. However, it has been discovered that there are numerous difficulties associated with the extraction and processing of solid minerals as a result of improper mining and exploitative operations utilizing convectional techniques, which have severely damaged the environment and ecology. The air quality (AQ) in the mining region has largely been polluted, and the value of the AQ is beyond the World Health Organization acceptance levels of 10 $\mu\text{g}/\text{m}^3$ as the annual mean value and 25 $\mu\text{g}/\text{m}^3$ as the 24-hour mean value for particulate matter PM_{2.5} and 20 $\mu\text{g}/\text{m}^3$ and 50 $\mu\text{g}/\text{m}^3$ for PM₁₀ respectively. The majority of the illnesses that are reported in these locations, including asthma and breathing difficulties, are caused by the poor air quality. High amounts of particulate matter can also alter overall environmental health by making lakes and streams acidic, changing nutrient balance in coastal waters and large river basins, depleting soil nutrients, damaging forests and crops, contributing to acid rain, and affecting ecosystem diversity. Due to the tiny size of PM's particles, which can enter the body, travel through the airways and lungs, and even reach the circulation, many of its harmful health consequences can be attributed to them. Therefore, it is essential that the government, through the Ministry of Environment, implement a set of environmental protection rules in order to control mining operations and guarantee the employment of modern machinery and experienced labour.

Key words: Particulate matter, Solid minerals, Air Quality, Edo State

1. INTRODUCTION

A variety of industrial minerals, including coal, tin, gold, marble, limestone, and others, as well as precious metals, stones, and an abundance of solid minerals, including coal, make up some of Nigeria's plentiful resources in recent years [1;2]. Even though they have not yet been fully mined on a significant scale, the core of these mineral resources dispersed around the nation continue to be a major draw for both informal and traditional mining activity. Nigeria, like other nations, has a legacy of dereliction from past and present mining activity, including artisanal mining more recently and colonial mines from the late 19th and early 20th centuries. This is not a widespread issue, with a few states being the exception, such Plateau State and Enugu State. However, some of the incidents are serious, such as the abandoned sites in Kuru, Jos South LGA, which have turned into a significant source of pollution, and the abandoned Okpara Mine site in Enugu, which is now being used as a hideout by criminals and has turned into a significant social issue and also the total air pollution in Ikpeshi, Edo State.

It is now obvious that mining exploration leaves a lasting impression on the suffering environment, with the modification of the natural conditions being particularly significant. Large mineral deposits are dispersed throughout Nigeria, from Jos (tin and columbite) in the north to Edo (lead) in the south, Enugu (coal) in the east, and Ogun (limestone) in the west, thus tales of the damaging effects of mining on the environment are inevitable. According to records, behind crude oil, the solid mineral industry is the second largest contributor of pollution [3]. Large piles and dumps of solid waste, tailings, and effluent that are released alter the ecosystem's normal functioning and quality of

life [4]. The inflow of people, which frequently puts pressure on the already stressed environment, is one of the elements that is always connected to mining operations. It is advisable to see a more noticeable decay in the form of landscape damage, increased soil erosion, deforestation, loss of vegetation, loss of cultivable land, and ecological imbalance because local artisans are constantly ill-equipped with knowledge, machinery, and laws or regulations governing their operations and environmental standards. A country's wealth is mostly derived from its mineral resources, but these resources must first go through the processes of discovery, mining, and processing [5] before they can be used. The environment and the health of workers and those leaving the nearby mining regions are also impacted by these activities. According to [6], environmental degradation has a negative impact on agriculture, plants, and wildlife and even puts the health of those who work in mines or quarries and everyone else who lives in the area at risk. Reviewing the aforementioned effects of mining in Nigeria is the goal of this essay.

Mining and exploitation activities are actions taken to disturb and interfere with the earth and its natural processes by drilling, cutting, and scarring. By increasing the carbon emissions from the mining plants and equipment as well as the suspended particulate matter, the effects of mineral exploitation specifically constitute a serious threat to the environment. Again, changes in the microclimate are caused by toxicity and pollution brought on by chemical wastes or weathering of mining waste, among other things [7]. Mining and exploitation operations could be used to describe the process of removing natural resources from below the surface of the earth, such as rock. It produces a lot of dust with a diameter between one and seventy-five microns (m) [8]. The respiratory systems of both people and animals can be exposed to aerodynamic and particle sizes of about 10 m and 50 m, which can be suspended in air and carried over great distances [9]. According to numerous researchers, these mechanisms are to blame for a variety of health issues. Table 1 shows the mineral production in Nigeria in 2018.

Table -1 Mineral Production Figure in 2018 according to States

State	Production Figure (tonnes)
Abia	174,562.12
Adamawa	76,567.70
Akwa Ibom	1,918,604.34
Anambra	221,675.52
Bauchi	191,989.20
Bayelsa	-
Benue	805,277.10
Borno	8,403.30
Cross River	3,493,458.00
Delta	242,300.60
Ebonyi	1,486,660.96
Edo	1,705,607.36
Ekiti	70,177.81
Enugu	136,672.60
FCT	1,894,280.63
Gombe	1,465,130.88
Imo	42,900.00
Jigawa	119,583.25
Kaduna	838,983.66
Kano	795,244.86
Katsina	928,331.35
Kebbi	176,878.35
Kogi	15,134,541.35
Kwara	75,596.55
Lagos	1,311,503.86
Nasarawa	108,276.21
National	55,810,964.55
Niger	107,124.48

Ogun	16,497,405.04
Ondo	1,435,697.92
Osun	84,202.25
Oyo	568,498.26
Plateau	90,654.90
Rivers	19,548.68
Sokoto	1,644,826.34
Taraba	336,328.00
Yobe	41,591.49
Zamfara	1,561,879.66

Source: National Bureau of Statistics (NBS), 2018

It is clear that sound natural resource management and planning are essential to addressing the issues above and promoting sustainable development [11, 12]. Mining activities represent human actions that cut through the landscape, scarring and interfering with the conditions of the natural habitat as well as micro-climatic conditions. In particular, it is known that the environmental effects of limestone mining and cement production deplete the host environment's flora and fauna, cause sediment deposition in riverine systems, result in the formation of mining spoil mounds and deep mining lakes primarily, cause the loss of timber resources and other vegetal cover, result in toxification and pollution due to chemical wastes or weathering of mining spoils, change the microclimate, and several others [13, 14]. These ecosystem-altering effects take place both on and off-site. These, in turn, dramatically change the surrounding environments in the impacted locations. These ecosystem-altering effects take place both on and off-site. These, in turn, dramatically change the surrounding environments in the impacted locations. Rocks are typically located on or below the land's surface and are obtained through the process of quarrying. Quarrying produces a significant amount of dust with a diameter of 1-75 m (microns) [15, 16]. Inhalable particles, also known as PM10 or Total Suspended Particulate Matter (TSP), can travel great distances and enter the human respiratory system. Particles with an aerodynamic diameter of less than ten micrometers (m) can also travel great distances and become suspended in the atmosphere [17]. Several health issues have been linked to these processes, according to numerous researchers.

2. IMPACT OF MINERAL EXPLORATION IN EDO STATE

The mining and processing of industrial rocks and other minerals in this region of Edo State has an adverse effect on the environment because it pollutes the air, water, and soil, which affects people's health, their quality of life, and the ecosystem's ability to function normally [5], [8]. The mining sector in Edo State has enormous potential and the ability to contribute to domestic and international currency earnings as well as draw foreign direct investment, ultimately strengthening the nation's economy [18]. These areas' exploitation of these economic basic commodities has some environmental consequences. The quarry sites, processing facilities, and neighbouring areas may all be seen to be affected. The deterioration of the environment has had an impact on farming, vegetation, and wildlife, and even poses a hazard to the health of quarry or mine workers and everyone else who lives in the area [18]. Some of the solid mineral exploitation sites and map of the study area are shown in Table 1 and Figure 2 respectively.

Table -2 Some of the mineral deposits in the study area

Mineral deposit	State of exploration	Mining company	Lateral extent of deposit
Egbigele marble	Fairly exploited	Unknown	0.42km ²
Egbigele-Ate marble	Unexploited	Unexploited	2 km ²
Ekpedo marble	Unexploited	Unexploited	5.27 km ²
Eruru/Ojirami marble	Fairly exploited	Unknown	0.42 km ²
Igarra marble	Moderately exploited	Geoworks Nig Ltd	9.0 km ²
Igwe marble	Fairly exploited	Freedom, Hussler	16 km ²
Ikpeshi marble	Moderately exploited	Freedom Group of Companies	4.5 km ²
Ikepi marble	Unexploited	Unexploited	3.9 km ²
Imekebu feldspar	Fairly exploited	Freedom Group of Companies	1.2 km ²
Isikwi kaolin	Fairly exploited	Freedom Group of Companies	3.2 km ²
Oguda marble	Highly exploited	Gamblers Nigeria Limited	0.8 km ²
Sasaro marble	Fairly exploited	Eshevesho Nigeria Limited	1.1 km ²
Ubo marble	Fairly exploited	Freedom Group of Companies	24 km ²
Ukpella marble	Highly exploited	Unknown	4 km ²

Source: [18]

2.1 Pollution

Surface waters, groundwater, and the atmosphere are frequently harmed by mining operations. With the potential to have disastrous consequences on surrounding streams and rivers, rainwater seeping through spoil piles may become highly contaminated, corrosive, or turbid. When trace metals (including cadmium, cobalt, copper, and others) are concentrated in water, soil, or plants after being leached from mining wastes, they may be hazardous or sicken people and other animals who consume contaminated water, plants, or soil. Specially designed runoff collection ponds can be useful, but they cannot solve every issue. The destruction of the nearby vegetation may be caused by the massive amounts of dust produced by explosions, transportation, and processing. Chemicals used in extraction procedures, such as drilling mud, are frequently very polluting materials [20].

Source: [19]

2.2.1. Air Pollution

Air pollution is the term used to describe the contaminating of the air as a result of the presence of substances in the

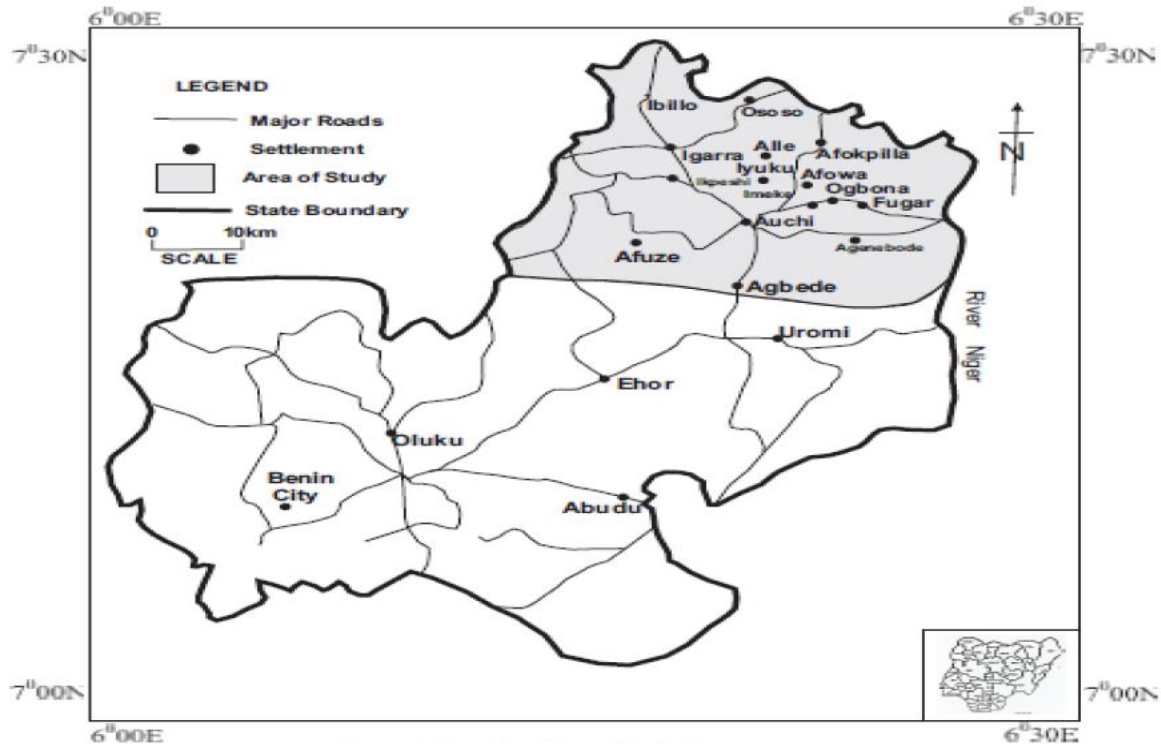


Figure 1: Location Map of Study Area (Northern part of Edo State, Nigeria)

atmosphere that are hazardous to the health of people and other living things or harm the environment or materials. [21] It is also the contaminating of indoor or outdoor environments, whether by chemical processes, physical, or biological agents, that changes the inherent characteristics of the atmosphere. [22] Air contaminants come in a wide variety of forms, including gases (such as ammonia, carbon monoxide, sulfur dioxide, nitrous oxides, methane, and chlorofluorocarbons), particles (both organic and inorganic), and biological molecules. Humans are susceptible to air pollution-related illnesses, allergies, and even death. It can also harm other living things, including animals and food crops, and harm the built environment (acid rain, for instance), as well as the natural environment (climate change, ozone depletion, or habitat degradation). [24] Both human activity [24] and natural occurrences can contribute to air pollution. [25]

Global climate and ecological changes have a direct impact on air quality. The burning of fossil fuels is one of the main causes of air pollution and is also a major producer of greenhouse gases. [2] Numerous pollution-related disorders, including as lung cancer, heart disease, COPD, and respiratory infections, are at increased risk due to air pollution [26]. There is mounting evidence that exposure to air pollution may be harmful to fatal health, lower IQ scores, decreased cognition, and an increased risk of psychiatric illnesses like depression. [26] Although the impacts of poor air quality on human health are extensive, the respiratory and cardiovascular systems of the body are primarily impacted. Individual responses to air pollutants are influenced by the kind of pollutant, the amount of exposure, the person's health, and heredity. [25]

One of the leading causes of human death, outdoor air pollution from burning fossil fuels alone accounts for 3.61 million yearly fatalities [6] [13], with anthropogenic ozone and PM_{2.5} accounting for another 2.1 million. Four of the six ailments that are most frequently reported in Igarra, according to the findings [10] are afflicted by dust pollution. In addition to catarrh, poor breathing, and headaches, over 50% of the respondents claimed to have experienced

asthmatic attacks. The stated incidence of heart attacks is only 28%. Each of the illnesses typically coexists with the parasites that cause malaria [10].

2.2.2 Land Pollution

The presence of xenobiotic (man-made) such as exploitation of solid minerals, chemicals or other changes in the natural soil environment are what produce soil contamination, soil pollution, or land pollution as a component of land degradation. Industrial activity, agricultural chemicals, or inappropriate waste disposal are the usual culprits. Petroleum hydrocarbons, polynuclear aromatic hydrocarbons, solvents, insecticides, lead, and other heavy metals are the most frequent substances implicated. Industrialization levels and chemical substance concentrations are associated to contamination. The main causes of worry regarding contaminated soil are the health concerns associated with coming into contact with it directly, breathing in contaminated air, or secondary pollution of water sources found inside and beneath the soil. [27] An understanding of the history of industrial chemistry as well as knowledge in geology, hydrology, chemistry, computer modeling, and GIS in environmental contamination are all necessary for mapping contaminated soil sites and the ensuing cleanups, which are time-consuming and expensive processes. [27]. Due to unrestricted and improper mineral mining, the majority of Edo State's land has been degraded. The yield of several agricultural goods has decreased as a result of this change.

2.2.3 Water pollution

When water bodies are contaminated, generally as a result of human activity, it usually has a detrimental impact on how they are used. This is known as water pollution (or aquatic pollution). [1]: 6 Lakes, rivers, oceans, aquifers, reservoirs, and groundwater are examples of water bodies. When toxins get into these bodies of water, contamination occurs. There are four main causes of contamination: sewage discharges, industrial operations, agricultural operations, and urban runoff, including stormwater. [2] There are two types of water contamination: surface water pollution and groundwater pollution. When people utilize contaminated water for irrigation or drinking, this type of pollution can result in a variety of issues, including the destruction of aquatic ecosystems and the development of diseases that are transmitted through the water.

Sources of water pollution are either point sources or non-point sources. Point sources have one identifiable cause, such as a storm drain, a wastewater treatment plant, or an oil spill. Non-point sources are more diffuse, such as agricultural runoff. [4] Pollution is the result of cumulative effects over time. Pollution may take the form of toxic substances (e.g., oil, metals, plastics, pesticides, persistent organic pollutants, industrial waste products), stressful conditions (e.g., changes of pH, hypoxia or anoxia, increased temperatures, excessive turbidity, changes in salinity), or the introduction of pathogenic organisms. Contaminants may include organic and inorganic substances. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers.

3. CONCLUSION

Exploiting solid minerals has significant economic advantages for both Nigeria as a whole and Edo State specifically. Additionally, if not done correctly, it might be harmful. Due to the related environmental and ecosystem contamination, it may have more negative effects than positive ones. For example, there are numerous environmental degradations taking place right now in the mineral extraction zones of Ikpeshi, Okpella, and Igarra. The majority of the illnesses that are reported in these locations, including asthma and breathing difficulties, are caused by the poor air quality. The vast majority of their agricultural areas have also degenerated as a result of constant contamination from the extraction of mica, quartz, limestone, etc. Reclaiming the land is urgently needed in order to increase agricultural production and increase food security because the agricultural yield per hectare has drastically reduced. The rate of carbon emissions and suspended particulate matter, which degrade the environment and damage it, should thus be reduced by mineral exploration businesses carefully adhering to the standard and using environmentally friendly procedures.

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