ETHICAL EVALUATION OF THE IMPACTS OF MINING IN EBONYI STATE NIGERIA

BY

NKAMA, CHINYERE LILIAN

REG. NO. 2012097013F

DEPARTMENT OF RELIGION AND HUMAN RELATIONS

NNAMDI AZIKIWE UNIVERSITY

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CERTIFICATION

I, **NKAMA CHINYERE LILIAN**, with Reg. **No. 2012097013F**, hereby certify that this dissertation is original and has been written by me. It is a record of my research and has not been submitted before in part or full for any other diploma or degree of this or any other institution or any previous publication.

…… **Date……**

Nkama, Chinyere Lilian

(Student)

…….. **Date……**

Rev. Fr. Prof. A.B.C. Chiegboka

(Supervisor)

APPROVAL

We ratify that this dissertation carried out under our supervision, has been examined and found to have met the regulations of Nnamdi Azikiwe University, Awka. We therefore approve the work for the award of PhD Degree in Religion and Human Relations.

…… **Date……**

Rev. Fr. Prof. A.B.C Chiegboka

(Supervisor)

…… **Date……**

Very Rev. Dr. P.E. Nmah

(Head of Department)

…… **Date……..**

Prof.

(External Examiner)

DEDICATION

This work is dedicated to National Environmental Standards and Regulations Enforcement Agency (NESREA) Ebonyi State Office.

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Nkama, Chinyere Lilian

Department of Religion and Human Relations

LIST OF ABBREVIATIONS

SNTC	Swaziland National Trust Commission
EIA	Environmental Impact Assessment
NESREA	National Environmental Standards and Regulations Enforcement Agency
NOA	National Orientation Agency
ISO	International Standards Organization
ICMC	International Cyanide Management Codes
BPEMM	Best Practice Environmental Management in Mining
AMD	Acid Mine Drainage
ETP	Effluent Treatment Plant
LHD	Load –haul-Dump
IGR	Internally Generated Revenue
MOU	Memorandum of Understanding
UNEP	United Nations Environmental Programme

WHO	World Health Organization
ILO	International Labour Organization
UN	United Nations
GDP	Gross Domestic Product
NDVI	Normalized Differential Vegetation Index
AMI	Ambient Intelligence
VR	Virtual Reality
AR	Augmented Reality
ICT	Information and Communication Technology
SCAE	Swiss Committee on Animal Experiment
ECNA	Ethics Committee on Non-Human Biotechnology
GIS	Geographical Information System
IEP	Internet Encyclopedia of Philosophy
AI	Artificial Intelligence

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Abstract

This dissertation titled “ethical evaluation of the impacts of mining in Ebonyi State Nigeria” was carried out to find the extent to which mining operations in Ebonyi State were consistent with named ethical principles. It was geared towards unearthing the history of mining in Ebonyi State, examining the impacts of mining in Ebonyi State and the factors responsible for the impacts, evaluating the impacts of mining in the light of some ethical principles and ways the heavy impacts of mining can be ameliorated. Data were collected through oral interviews and use of available data in printed records, reports journals, text books and so on and were analyzed using discursive and analytical methods. The following were the findings of this research: in the early 30’s, local miners in Ebonyi State (the villagers) engaged in artisanal quarrying/ mining of lead employing traditional methods before the coming of expatriate miners in the early 40’s. Mining has impacted positively in various dimensions to the development of the State; the negative impacts are however severe and include habitat modification, deforestation, contamination of air, land pollution, underground and surface water pollution, destruction of roof tops through fly-rocks, soil erosion, crack effect on houses resulting from blasting, noise pollution, socio-political impacts and so on. The impacts were found to be a negation to the ethical principles of justice, human rights, sustainability and solidarity. The viable means of ameliorating the impacts were found to include: value re-orientation and education of miners to appreciate the above ethical principles; formation of health policy on mining by the state government, organizing awareness campaigns and sensitization programmes for people living in mine areas; removal of bottlenecks from government agencies in order to facilitate the procurement of Environmental Impact Assessment (EIA) by companies before operations; diversification of the economy of Ebonyi State through prioritizing agriculture in order to shift emphasis from mining; organizing artisanal miners into groups and co-operative societies for easy training and monitoring, enforcement of mine closure, revegetation and resettlement of fauna.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Swaziland Natural Trust Commission (2007) holds that mining of stone and metal had begun since pre-historic times, (that is before dating began) with available archeological records putting the dates at 43,000 years ago. At this time, Paleolithic humans mined hematite to make the red pigment ochre. The oldest mine according to the above record is the “Lion Cave” in Swaziland. There are also speculations that mines of similar age exist in Hungary and may have provided flint for weapons and tools. Hartman (1992) opines that early tools and weapons were especially made of flint mined for example at Grime Graves. These flint mines are Neolithic in origin dating as far as ca 4000 BC – ca 3000 BC. Other hard rocks mined or collected for axes at this period included the greenstone.

Shaw (2000) explains that ancient Egyptians mined malachite at Maadi. The bright Green malachite stones were used for ornamentations and pottery. This source explains further that there were mining expeditions abroad to the area of Wadi Maghara between 2613 and 2494 BC to secure minerals and other resources not available in Egypt but were needed for large building project. With such expeditions, quarries for turquoise and copper were found at Wadi Hamamat, Tura, Aswan and various other Nubian sites" on the Sinai Peninsula and at Timna. Other Mineral found at Nubia were gold.

In the Middle Ages mining as an industry underwent dramatic changes especially in Medieval Europe with the extraction of copper and iron. Such metals were obtained through open-pit mining with the ore primarily extracted from shallow depths. This historic overview will be incomplete if mention is not made of the German Scholar, Georgius Agricola whose two main works *“De Re Metallica”* and *“De Natura Fossilum”* were necessitated by capitalist expansion which increased the demands for metals, Eduardo (2003). Agricola collected, classified, illustrated and described the techniques for mining, prospecting, development and operation, the working of minerals and metals and metallurgy.

Eduardo (2003) notes with particular interest that "in the seventeenth century in England the times of the Stuarts, James I prohibited the burning of coals extracted from "Bell mines" because of the air and environmental pollution they caused. However, this led to an accelerated process of deforestation of the English country side due to need for heating during prolonged cold periods" (p 3). At the wake of eighteen century, coal burning resumed again because it was being used in steel production and later power generation.

The industrial revolution of 1700 is strongly believed to have triggered off modern large-scale mining. As documented in Nigerian Ministry of Solid Mineral Development (2006), mining was one of the oldest economic activities in Nigeria with evidence of a flourishing iron-working civilization of the Nok culture around 340 B.C. At about 705 AD, the Igboukwu bronze civilization also reached its pre-eminence. At about 1,000 years ago, the Hausa Kingdoms with the famous 'Golden Lands of Wangara' were noted for their gold mining, Ife and Benin were also noted for bronze works, between 1163 – 1200 and between 1630 – 48, respectively. These artistic civilizations, using metallic and non-metallic substances, reflect the ancient origin of mining in Nigeria. Organized mining began with the establishment of the mineral surveys of the Southern and Northern Protectorates in 1903 and 1904 respectively. Nigeria at a point became a major producer of tin, columbite and coal for export. The downturn in mining followed the discovery of oil in Oloibiri in 1956 and the Exodus of mining expatriates during the Nigerian Civil War, between 1966 – 1970.

Howbeit mining activities still go on in Nigeria today and there are evidences of Lead-zinc mineralization in Ebonyi State classified in the lower Benue Trough of Nigeria, Ministry of Solid Mineral Development, (2006). The lead zinc mineralization occurs in Ishiagu, Enyigba, Ameri and Ameka, with small-scale and artisanal mining activities in these areas.

There is no doubt that mining has important economic, labour and social effects, but it is also worthy of note that it can have significant, long-lasting negative environmental impacts. Jennings (2011) emphasizes that small-scale mining provides considerable employment, particularly in rural areas, but these jobs are precarious and do not conform to international labour standards. As such, the accident rates that occur in small mines are routinely six or seven times higher in larger operations with concomitant illnesses due to unsanitary conditions at some if not all of these sites. He also identified as challenging to the environment, the involvement and employment of children in small-scale and artisanal mining. Debopriya (2012) lending a voice to the foregoing, agrees with Jennings that mining, though the source of all the substances that cannot be obtained by industrial processes or agriculture, which also reaps huge profits for the companies that own them, provides employment to a large number of people and a source of revenue for the government, yet sadly enough affects the environment negatively. Whereas there are some environmental safeguards, both International and Indigenous measures and regulations such as those of the International Standards Organization (ISO) 1400, International Cyanide Management Codes (ICMC), Best Practice Environmental Management in Mining (BPEMM), National Environmental (Mining and processing of coals, ores and industrial minerals) Regulations, 2009; and National Environmental (Quarrying and Blasting Operations) Regulations, 2013 careless and unguarded mining activities are on-going in Ebonyi State Nigeria without recourse to these measures and standards to avert the obvious negative environmental effects in the state. There is no doubt that mining is contributing to the economic boost of Ebonyi State, however, the impacts are quite enormous on Ebonyi Environment, such as Acid mine Drainage (AMD), Erosion and sedimentation, heavy metal leaching and contamination, and so on. These constitute serious health threats to lives of Ebonyians.

Hence, the worry that no one gives real attention to the enormity of the effects and care about the danger ahead if the situation is unabated, has necessitated this study, which is geared to discuss the impacts of mining in Ebonyi state. The study will evaluate the harmful environmental effects of mining in the state in the light of some moral principles namely: justice, human rights and sustainability.

1.2 Statement of the Problem

Scholarly research abound on the subject of mining and impacts of mining especially in the field of science, however, there are yet some uncovered areas such as the ethical evaluation of the impact of mining hence, the problem of paucity of information in this area. While mining and its impacts may be predominantly domiciled in the sciences, there are little or no researches in the Arts and Humanities addressing the moral deliberation of the subject.

Apart from little or near absence of a systematic research in the Arts addressing the ethical content of mining impacts, there is also little dynamic study verifying the heavy impacts of mining in Ebonyi State even when there are laws and regulations guiding mining operations. In fact only a handful of her citizens let alone Nigerians know that there are mining operations in the state.

This brief reference to the state of research on the impact of mining in Ebonyi State has made this present research necessary. Howbeit, there is the need for further attention to the limitation of this present study and a large scale study of this subject matter especially from the Arts.

Hence, the devastating impacts of mining in Ebonyi that are unabated at the moment and the large scale ignorance of the citizens about the ugly trend have given rise to this study. It is in

this regard that this study is mounted to study the impact of mining in Ebonyi state and to investigate the ethical evaluation of the impacts in Ebonyi state.

1.3 Purpose of the Study

Based on the state of research on the impacts of mining in Ebonyi state, this study is undertaken to do the following:

1. Unearth the history of mining in Ebonyi State.
2. Examine the impacts of mining in Ebonyi state.
3. Identify the factors responsible for the impacts.
4. Evaluate the impacts of mining in the light of ethical principles
5. Identify ways the heavy impacts of mining can be ameliorated.
6. Make recommendations based on the findings.

1.4 Significance of Study.

1. The outcome of this research will be a source of information to the relevant government agencies in charge of mining and environment about the impacts of mining in Ebonyi state.
2. The study will be useful to the government in forming an encompassing policy on mining in Ebonyi state.
3. The suggestions and recommendations if accepted will help in ameliorating the impacts of mining in Ebonyi state.
4. This work will be a source of information to future researchers on a similar topic.
5. The data gathered in this study will be useful to Federal ministry of Environment in reviewing the existing regulations on mining where necessary.
6. The work will benefit posterity.

7. The work force involved in mining in Ebonyi state will benefit from the outcome of this research which seeks to highlight the precautions and opportunities for the advancement of their right among others

1.5 Research Method

The research design employed for this study is survey design. This method involves the investigation of the opinions, behaviors and so on of a particular group of people on a given subject, and is usually done by asking them questions. This study is a descriptive survey, as such both the primary and secondary methods of data collection will be employed. The primary source includes oral interviews and observation where oral questions will be asked the respondents. This also involves the researcher visiting the relevant sites and recording important facts observed at the sites of the investigations.

The secondary data collection includes the use of available data in printed records, reports, journals, textbooks and et cetera. It is expected that the methods adopted in this study will meet the demands of this research.

1.6 Scope of Study

The study is an attempt to examine the impacts of mining in Ebonyi State in the light of some moral principles. The exercise is limited to the three senatorial zones in Ebonyi State, namely: Ebonyi North, Ebonyi South and Ebonyi Central. The study in no way attempts to evaluate or review the mining regulations in Nigeria nor is it studying the extent to which environmental and mining regulatory Agencies have delivered on their job. Also the study will only examine the environmental cum health impacts of mining, its economic impacts and the Socio-political impacts in Ebonyi State.

Definition of Related Terms

There are number of concepts to be defined such as Ethics, Ethical valuation and Mining. Proper explanation of these concepts will make for a better understanding of their usage in the context of this present research.

1.7.1 Ethics

Singer (1979) explains that ethics is a universal set of principles, laws that govern human actions, which help to realize a universalizable judgment from the standpoint of an impartial spectator or ideal observer. He outlined some of these principles as individual's rights, the sanctity of life, justice, purity and so on.

From the views of Omoregbe (1993), ethics has no univocal definition just like philosophy itself, so has been defined variously as: the branch of philosophy which deals with morality of human actions; the branch of philosophy which studies the norms of human behaviour; the systematic study of the fundamental principles of the moral law; the normative science of human conduct, etc. Omoregbe appears to be more interested in the last of the four definitions as he further distinguishes a normative science from empirical or positive science. The later is descriptive the way thing are, but ethics as a normative science states the way things ought to be, and so deals with norms or standards of human behaviour. As such the aim of ethics is not to describe the way men behave in practice but to state the way men ought to behave. Thus for Omoregbe, ethics is the systematic study of the fundamental principles of the moral law or the normative science of human conduct.

Nzomiwu (2012) explains that ethics means one of two things: either the theory of what is right or wrong in human conduct or the body or system of what is regarded right or wrong in human action. In summary therefore, ethics in the context of this research is a study of the norms or standards of human behaviour.

1.7.2 Ethical Evaluation

Having attempted the meanings of ethics, brief explanation of the concept "ethical evaluation" will go a long way in describing the task of this present research. Ethical evaluation of the impact of mining will require an appraisal of the subject – "impact of mining", in the light of some ethical principles or standards. This is supported by Ward (2014) when he said that major questions in Applied Ethics include how existing principles apply to new issues, the ranking of rival principles, the standards of "best practice" in a profession and the ethical decision-making in the field. The argument here is that it is the gross violation of the norms, standards and regulations in mining that has brought about the impacts of mining, not because miners are ignorant of these regulations, but because they lack the moral will to implement the rules. Hence the task of this research is to put forward those relevant moral principles or standards of behaviour that will help form the right character and attitude in the miners and indeed all stakeholders in mining. The right character when imbibed will naturally produce the willingness to obey mining regulations. Thus, for the purpose of this research ethical evaluation is the application of ethical principles in assessing mining issues in Ebonyi State.

1.7.3 Mining

International Labour Organization (ILO) (1995) in its 82nd session defined the term "mine" as covering:

a. Surface or underground sites where the following activities, in particular, take place.

   i. Exploration for minerals, excluding oil and gas, that involves the mechanical disturbance of the grounds;

   ii. Extraction of minerals, excluding oil and gas;

   iii. Preparation, including crushing, grinding, concentration or washing of the extracted materials; and

b. All machinery, equipment, appliances, plant, buildings and civil engineering structures used in conjunction with the activities referred to in (a) above.

The new Encyclopedia Britannica (2010) defines mining as the process of extracting useful minerals from the surface of the earth. This definition as it were, is silent on all the processes that are involved.

Hill (2012) defines mining as the taking of minerals from the earth, including production from surface waters, and from well, usually excluding oil and gas. Further, it states that mining industry commonly includes such functions as exploration, mineral separation, hydrometallurgy, electrolytic reduction and smelting and refining, even though these are not actually mining operations.

Notably, both ILO (1995) and Hill (2012) definitions of mining agree that oil and gas exploration/processing are excluded in mining and mining industry. This suggests a definition of mining as a process of accessing natural resources which may involve the following: exploration for minerals, surface or underground extraction of minerals excluding oil and gas, preparation of the extracted minerals using machines using machines and materials and mine reclamation.

From the foregoing therefore, mining may be defined as: the exploration for and extraction of minerals excluding oil and gas, through surface or underground methods, using machines and materials.

CHAPTER TWO

LITERATURE REVIEW

This chapter deals with the review of related literature in the dissertation. Literatures are to be reviewed under the following sub-headings: Conceptual framework, theoretical framework and empirical studies and summary of literature review.

2.1 Conceptual Framework

This framework deals with the different concepts in the present study. The concepts to be examined are Ethics, Mining and Ethical evaluation.

2.1.1 Ethics

Ethics according to Omoregbe (1993) has no univocal definition just like philosophy itself, so has been defined variously as the branch of philosophy which deals with morality of human actions; the branch of philosophy which studies the norms of human behaviour; the systematic study of the fundamental principles of the moral law; the normative science of human conduct; and so on. Omoregbe appears to be more interested in the last of the four definitions as he further distinguishes a normative science from empirical or positive science. The later is descriptive of the way things are, but ethics as a normative science states the way things ought to be, and so deals with norms or standards of human behaviour. Thus, ethics does not aim at describing the way men behave in practice but at stating the way men ought to behave. Thus, for Omoregbe ethics is the systematic study of the fundamental principal of the moral law or the normative science of human conduct. Relating Omoregbe's 'norm' or 'standard' of human behaviour to mining, it simply implies what ought to be the norm or standard in mining and not the practice of mining so ethics from Omoregbe's view could be summarized as severing the practice in actuality from the standard.

Geisler and Feinberg (1980) explain that the moral philosopher puts himself in the place of a man who seeks principles to guide appropriate action. The task of a moral philosopher concerned with ethics differs from that of a common man who is concerned only with right action. The former moves further to verify deeply into the universal principles which justify that right action. Ethics for them is therefore, a theoretical subject, a branch of philosophy that studies principles which guide human actions. Geisler and Feinberg (1980) appear to have moved a step further than Omoregbe by the usage of "principles" other than "norms"/"standards".

Whereas "norms or standards of behaviour" may be synonymous with rules and regulations, "principles guiding appropriate actions" is synonymous with justifications for right actions. For example ethics in the understanding of Geisler and Feinberg (1980) will ask why is it good to mine responsibly with the given regulations?

Singer (1979) opines that ethics is a universal set of principles, laws that govern human actions, which help to realize a universalizable judgment from the stand point of an impartial spectator or ideal observer. He outlined some of the principles as individual's rights, the sanctity of life, justice, purity and so on.

While Geisler and Feinberg (1980) see ethics as a branch of philosophy that studies principles, Singer sees it as the principles itself (that govern human action). Human action in this context is mining, so for the mining activities to be judged good according to singer it must conform to the universal set of principles, say justice, human rights, and so on and not necessarily any man made regulations or laws.

Nzomiwu (2012) explains that ethics means one of two things, either the theory of what is right or wrong in human conduct or the body or system of what is regarded right or wrong in human action. By the second definition, Nzomiwu may be referring to rules, laws regulations that govern human conduct and if so may be aligning with Omoregbe (1993) to say that ethics is prescriptive.

Pojman (1995) shows Socrates in Plato's Republic as defining ethics or moral philosophy as the systematic endeavour to understand moral concepts and justify moral principles and theories. He further explains that "ethics is concerned with action and practice. It is concerned with values – not what is but what ought to be" (p.1) Pojman also expresses the same view as Omoregbe.

The definitions of the concept of ethics resonate some common denomination that:

(i) Ethics is in the domain of moral philosophy

(ii) It is representative and not descriptive

(iii) It is concerned with the principles and standard of human action.

Beyond the definitions of ethics, the details of the subject show that the field of ethics (or moral philosophy) involves systematizing, defending, and recommending concepts of right and wrong behavior. Internet Encyclopedia of Philosophy (2014) discusses three general subject areas of ethics such as: metaethics, normative ethics, and applied ethics. *Metaethics* investigates where our ethical principles come from, and what they mean. Are they merely social inventions? Do they involve more than expressions of our individual emotions? Metaethical answers to these questions focus on the issues of universal truths, the will of God, the role of reason in ethical judgments, and the meaning of ethical terms themselves. *Normative ethics* takes on a more practical task, which is to arrive at moral standards that regulate right and wrong conduct. This may involve articulating the good habits that we

should acquire, the duties that we should follow, or the consequences of our behavior on others. Finally, *applied ethics* involves examining specific controversial issues, such as abortion, infanticide, animal rights, environmental concerns, homosexuality, capital punishment, or nuclear war. However the major thrust of this present study is on environmental concerns.

By using the conceptual tools of metaethics and normative ethics, discussions in applied ethics try to resolve these controversial issues. The lines of distinction between metaethics, normative ethics, and applied ethics are often blurry. For example, the issue of environmental pollution is an applied ethical topic since it involves a specific type of controversial behavior. But it also depends on more general normative principles, such as Justice, human right, malevolence and so on which are litmus tests for determining the morality of that procedure.

2.1.1.1 Metaethics

The term "meta" means *after* or *beyond*, and, consequently, the notion of metaethics involves a removed, or bird's eye view of the entire project of ethics. IEP (2014) defines metaethics as the study of the origin and meaning of ethical concepts. When compared to normative ethics and applied ethics, the field of metaethics is the least precisely defined area of moral philosophy. It covers issues from moral semantics to moral epistemology. Two issues, though, are prominent: (1) *metaphysical* issues concerning whether morality exists independently of humans, and (2) *psychological* issues concerning the underlying mental basis of our moral judgments and conduct.

a. Metaphysical Issues: Objectivism and Relativism

Metaphysics is the study of the kinds of things that exist in the universe. Some things in the universe are made of physical stuff, such as rocks; and perhaps other things are nonphysical in nature, such as thoughts, spirits, and gods. The metaphysical component of metaethics

involves discovering specifically whether moral values are eternal truths that exist in a spirit-like realm, or simply human conventions. There are two general directions that discussions of this topic take, one *other-worldly* and one *this-worldly*.

Proponents of the other-worldly view typically hold that moral values are objective in the sense that they exist in a spirit-like realm beyond subjective human conventions. They also hold that they are absolute, or eternal, in that they never change, and also that they are universal insofar as they apply to all rational creatures around the world and throughout time. The most dramatic example of this view is Plato cited in Cooper (1997) who was inspired by the field of mathematics. He looked at numbers and mathematical relations, such as 1+1=2, they seem to be timeless concepts that never change, and apply everywhere in the universe. Humans do not invent numbers, and humans cannot alter them. Plato explained the eternal character of mathematics by stating that they are *abstract entities* that exist in a spirit-like realm. He noted that moral values also are absolute truths and thus are also abstract, spirit-like entities. In this sense, for Plato, moral values are spiritual *objects*. Medieval philosophers commonly grouped all moral principles together under the heading of "eternal law" which were also frequently seen as spirit-like objects.

A different other-worldly approach to the metaphysical status of morality is *divine commands* issuing from God's will. Sometimes called *voluntarism* (or divine command theory), this view was inspired by the notion of an all-powerful God who is in control of everything. God simply wills things, and they become reality. He wills the physical world into existence, he wills human life into existence and, similarly, he wills all moral values into existence. Proponents of this view, such as medieval philosopher William of Ockham cited in Freppert (1988) believe that God wills moral principles, such as "murder is wrong," and these exist in God's mind as commands. God informs humans of these commands by implanting us with moral intuitions or revealing these commands in scripture.

The second and more this-worldly approach to the metaphysical status of morality follows in the skeptical philosophical tradition, such as that articulated by Greek philosopher Sextus Empiricus cited in Annas and Barnes (1994). He denied the objective status of moral values. Technically, skeptics did not reject moral values themselves, but only denied that values exist as spirit-like objects, or as divine commands in the mind of God. Moral values, they argued, are strictly human inventions, a position that has since been called *moral relativism*. There are two distinct forms of moral relativism. The first is *individual relativism*, which holds that individual people create their own moral standards. Friedrich Nietzsche, for example, argued that the superhuman creates his or her morality distinct from and in reaction to the slave-like value system of the masses.

The second is *cultural relativism* which maintains that morality is grounded in the approval of one's society - and not simply in the preferences of individual people. This view was advocated by Sextus, and in more recent centuries by Michel Montaigne and William Graham Sumner. In addition to espousing skepticism and relativism, this-worldly approaches to the metaphysical status of morality deny the absolute and universal nature of morality and hold instead that moral values in fact change from society to society throughout time and throughout the world. They frequently attempt to defend their position by citing examples of values that differ dramatically from one culture to another, such as attitudes about polygamy, homosexuality and human sacrifice.

b. Psychological Issues in Metaethics

A second area of metaethics involves the psychological basis of our moral judgments and conduct, particularly understanding what motivates us to be moral. This subject might be explored by asking the simple question, "Why be moral?" Even if one is aware of basic moral standards, such as don't kill and don't steal, this does not necessarily mean that one will be

psychologically compelled to act on them. Some answers to the question "Why be moral?" could be to avoid punishment, to gain praise, to attain happiness, to be dignified, or to fit in with society. Moral psychology has three aspects namely: Egoism and Altruism, Emotion and Reason and Male and Female Morality.

i. Egoism and Altruism

One important area of moral psychology concerns the inherent selfishness of humans. 17th century British philosopher Thomas Hobbes cited in Curley (1994) held that many, if not all, of our actions are prompted by selfish desires. Even if an action seems selfless, such as donating to charity, there are still selfish causes for this, such as experiencing power over other people, et cetera. This view is called *psychological egoism* and maintains that self-oriented interests ultimately motivate all human actions. Closely related to psychological egoism is a view called *psychological hedonism* which is the view that *pleasure* is the specific driving force behind all of our actions. 18th century British philosopher Joseph Butler agreed that instinctive selfishness and pleasure prompt much of our conduct. However, Butler argued that we also have an inherent psychological capacity to show benevolence to others. This view is called *psychological altruism* and maintains that at least some of our actions are motivated by instinctive benevolence.

ii. Emotion and Reason

A second area of moral psychology involves a dispute concerning the role of reason in motivating moral actions. If, for example, one makes the statement "abortion is morally wrong," is he making a rational assessment or only expressing his feelings? On the one side of the dispute, 18th century British philosopher David Hume cited in Norton and Norton (2000) argued that moral assessments involve our emotions, and not our reason. We can amass all the reasons we want, but that alone will not constitute a moral assessment. We need

a distinctly emotional reaction in order to make a moral pronouncement. Reason might be of service in giving us the relevant data, but, in Hume's words, "reason is, and ought to be, the slave of the passions." Inspired by Hume's anti-rationalist views, some 20th century philosophers, most notably Ayer (1946), similarly denied that moral assessments are factual descriptions. For example, although the statement "it is good to donate to charity" may on the surface look as though it is a factual description about charity, it is not. Instead, a moral utterance like this involves two things. First, the speaker is expressing his personal feelings of approval about charitable donations and in essence saying "Hooray for charity!" This is called the *emotive* element insofar as the one is expressing his emotions about some specific behavior. Second, the speaker could be trying to get one donate to charity and essentially giving the command, "Donate to charity!" This is called the *prescriptive* element in the sense that one is prescribing some specific behavior.

From Hume's day forward, more rationally-minded philosophers have opposed these emotive aspects of ethics and instead argued that moral assessments are indeed acts of reason. 18th century German philosopher Immanuel Kant cited in Ellington (1985) is a case in point. Although emotional factors often do influence our conduct, he argued, we should nevertheless resist that kind of sway. Instead, true moral action is motivated only by reason when it is free from emotions and desires. A recent rationalist approach, offered by Baier (1958), was proposed in direct opposition to the emotivist and prescriptivist theories of Ayer and others. Baier focuses more broadly on the reasoning and argumentation process that takes place when making moral choices. All of our moral choices are, or at least can be, backed by some reason or justification. If one claims that it is wrong to steal someone's car, then he should be able to justify his claim with some kind of argument. For example, one could argue that stealing someone’s car is wrong since this would upset him, violate his ownership rights,

or put the thief at risk of getting caught. According to Baier, then, proper moral decision making involves giving the best reasons in support of one course of action versus another.

iii. Male and Female Morality

A third area of moral psychology focuses on whether there is a distinctly female approach to ethics that is grounded in the psychological differences between men and women. Discussions of this issue focus on two claims: (1) traditional morality is male-centered, and (2) there is a unique female perspective of the world which can be shaped into a value theory. According to many feminist philosophers, traditional morality is male-centered since it is modeled after practices that have been traditionally male-dominated, such as acquiring property, engaging in business contracts, and governing societies. The rigid systems of rules required for trade and government were then taken as models for the creation of equally rigid systems of moral rules, such as lists of rights and duties. Women, by contrast, have traditionally had a nurturing role by raising children and overseeing domestic life. These tasks require less rule following, and more spontaneous and creative action. Using the woman's experience as a model for moral theory, then, the basis of morality would be spontaneously caring for others as would be appropriate in each unique circumstance. On this model, the agent becomes part of the situation and acts caringly within that context. This stands in contrast with male-modeled morality where the agent is a mechanical actor who performs his required duty, but can remain distanced from and unaffected by the situation. A care-based approach to morality, as it is sometimes called, is offered by feminist ethicists as either a replacement for or a supplement to traditional male-modeled moral systems.

2.1.1.2 Normative Ethics

Normative ethics involves arriving at moral standards that regulate right and wrong conduct. In a sense, it is a search for an ideal litmus test of proper behavior. The Golden Rule is a classic example of a normative principle: We should do to others what we would want others

to do to us. Since one does not want his neighbour to steal his car, then it is wrong for him to steal his neighbours car. Since one would want people to feed him if he was starving, then one should help feed starving people. Using this same reasoning, one can theoretically determine whether any possible action is right or wrong. So, based on the Golden Rule principle, it would also be wrong for one to lie, to harass, victimize, assault, or kill others. The Golden Rule is an example of a normative theory that establishes a *single principle* against which we judge all actions. Other normative theories focus on a *set* of foundational principles, or a set of good character traits.

The key assumption in normative ethics is that there is only *one* ultimate criterion of moral conduct, whether it is a single rule or a set of principles. Three strategies will be noted here: (a) virtue strategy, (b) duty strategy, and (c) consequentialist strategy.

a. Virtue Ethics

Many philosophers believe that morality consists of following precisely defined rules of conduct, such as "don't kill," or "don't steal." Presumably, one must learn these rules, and then make sure each of his actions live up to the rules. Virtue ethics, however, places less emphasis on learning rules, and instead stresses the importance of developing *good habits of character*, such as benevolence. Once one acquired benevolence, for example, he will then habitually act in a benevolent manner. Historically, virtue theory is one of the oldest normative traditions in Western philosophy, having its roots in ancient Greek civilization. Plato cited in Cooper (1997) emphasized four virtues in particular, which were later called *cardinal virtues*: wisdom, courage, temperance and justice. Other important virtues are fortitude, generosity, self-respect, good temper, and sincerity. In addition to advocating good habits of character, virtue ethicists hold that we should avoid acquiring bad character traits, or *vices*, such as cowardice, insensibility, injustice, and vanity. Virtue ethics emphasizes moral

education since virtuous character traits are developed in one's youth. Adults, therefore, are responsible for instilling virtues in the young.

Aristotle cited in Jonathan (1984) argued that virtues are good habits that one acquires, which regulate ones emotions. For example, in response to ones natural feelings of fear, one should develop the virtue of courage which allows him to be firm when facing danger. Analyzing eleven specific virtues, Aristotle argued that most virtues fall at a mean between more extreme character traits. With courage, for example, if one does not have enough courage, he develops the disposition of cowardice, which is a vice. If one has too much courage he develops the disposition of rashness which is also a vice. According to Aristotle, it is not an easy task to find the perfect mean between extreme character traits. In fact, we need assistance from our reason to do this. After Aristotle, medieval theologians supplemented Greek lists of virtues with three Christian ones, or *theological virtues*: faith, hope, and charity. Interest in virtue ethics continued through the middle ages and declined in the 19th century with the rise of alternative moral theories. In the mid 20th century virtue theory received special attention from philosophers who believed that more recent ethical theories were misguided for focusing too heavily on rules and actions, rather than on virtuous character traits.

b. Duty Ethics

Many feel that there are clear obligations we have as human beings, such as to care for our children, and to not commit murder. Duty ethics base morality on specific, foundational principles of obligation. These ethics are sometimes called *deontological*, from the Greek word *deon*, or duty, in view of the foundational nature of our duty or obligation. They are also sometimes called *nonconsequentialist* since these principles are obligatory, irrespective of the consequences that might follow from our actions. For example, it is wrong to not care

for our children even if it results in some great benefit, such as financial savings. There are four central duty ethics.

The *first* is that championed by 17th century German philosopher Samuel Pufendorf, who classified dozens of duties under three headings: duties to God, duties to oneself, and duties to others. Concerning our duties towards God, he argued that there are two kinds:

1. A theoretical duty to know the existence and nature of God, and
2. A practical duty to both inwardly and outwardly worship God.

Concerning our duties towards oneself, these are also of two sorts:

1. duties of the soul, which involve developing one's skills and talents, and
2. duties of the body, which involve not harming our bodies, as we might through gluttony or drunkenness, and not killing oneself.

Concerning our duties towards others, Pufendorf divides these between absolute duties, which are universally binding on people, and conditional duties, which are the result of contracts between people. Absolute duties are of three sorts:

1. void wronging others,
2. Treat people as equals, and
3. Promote the good of others.

Conditional duties involve various types of agreements, the principal one of which is the duty to keep one's promises.

A *second* duty-based approach to ethics is *rights ethics*. Most generally, a "right" is a justified claim against another person's behavior - such as my right to not be harmed by you. Rights and duties are related in such a way that the rights of one person imply the duties of another

person. For example, if one has a right to payment of $10 by Smith, then Smith has a duty to pay him $10. This is called the correlativity of rights and duties. The most influential early account of rights ethics is that of 17th century British philosopher John Locke cited in Laslett (1963) who argued that the laws of nature mandate that we should not harm anyone's life, health, liberty or possessions. For Locke, these are our natural rights, given to us by God. Following Locke, the United States Declaration of Independence authored by Thomas Jefferson recognizes three foundational rights: life, liberty, and the pursuit of happiness. Jefferson and others rights theorists maintained that we deduce other more specific rights from these, including the rights of property, movement, speech, and religious expression. There are four features traditionally associated with moral rights. First, rights are *natural* insofar as they are not invented or created by governments. Second, they are *universal* insofar as they do not change from country to country. Third, they are *equal* in the sense that rights are the same for all people, irrespective of gender, race, or handicap. Fourth, they are *inalienable* which means that one cannot hand over his rights to another person, such as by selling oneself into slavery.

A *third* duty-based ethics is that by Kant, which emphasizes a single principle of duty. Influenced by Pufendorf, Kant agreed that we have moral duties to oneself and others, such as developing one's talents, and keeping our promises to others. However, Kant argued that there is a more foundational principle of duty that encompasses our particular duties. It is a single, self-evident principle of reason that he calls the "categorical imperative." A categorical imperative, he argued, is fundamentally different from hypothetical imperatives that hinge on some personal desire that we have, for example, "If one wants to get a good job, then he ought to go to college." By contrast, a categorical imperative simply mandates an action, irrespective of one's personal desires, such as "You ought to do X." Kant gives at least four versions of the categorical imperative, but one is especially direct: Treat people as an

end, and never as a means to an end. That is, we should always treat people with dignity, and never use them as mere instruments. For Kant, we treat people as an end whenever our actions toward someone reflect the inherent value of that person. Donating to charity, for example, is morally correct since this acknowledges the inherent value of the recipient. By contrast, we treat someone as a means to an end whenever we treat that person as a tool to achieve something else. It is wrong, for example, to steal my neighbor's car since I would be treating her as a means to my own happiness. The categorical imperative also regulates the morality of actions that affect us individually. Suicide, for example, would be wrong since I would be treating my life as a means to the alleviation of my misery. Kant believes that the morality of all actions can be determined by appealing to this single principle of duty.

A *fourth* and more recent duty-based theory is that by British philosopher W.D. Ross, which emphasizes *prima facie* duties. Like his 17th and 18th century counterparts, Ross argues that our duties are "part of the fundamental nature of the universe." However, Ross's list of duties is much shorter, which he believes reflects our actual moral convictions:

- *Fidelity*: the duty to keep promises
- *Reparation*: the duty to compensate others when we harm them
- *Gratitude*: the duty to thank those who help us
- *Justice*: the duty to recognize merit
- *Beneficence*: the duty to improve the conditions of others
- *Self-improvement*: the duty to improve our virtue and intelligence
- *Nonmaleficence*: the duty to not injure others

Ross recognizes that situations will arise when we must choose between two conflicting duties. In a classic example, suppose I borrow my neighbor's gun and promise to return it when he asks for it. One day, in a fit of rage, my neighbor pounds on my door and asks for

the gun so that he can take vengeance on someone. On the one hand, the duty of fidelity obligates me to return the gun; on the other hand, the duty of nonmaleficence obligates me to avoid injuring others and thus not return the gun. According to Ross, I will intuitively know which of these duties is my *actual* duty, and which is my apparent or *prima facie* duty. In this case, my duty of nonmaleficence emerges as my actual duty and I should not return the gun.

c. Consequentialist Ethics

It is common for us to determine our moral responsibility by weighing the consequences of our actions. According to consequentialism, correct moral conduct is determined *solely* by a cost-benefit analysis of an action's consequences:

Consequentialism: An action is morally right if the consequences of that action are more favorable than unfavorable. Consequentialist normative principles require that we first tally both the good and bad consequences of an action. Second, we then determine whether the total good consequences outweigh the total bad consequences. If the good consequences are greater, then the action is morally proper. If the bad consequences are greater, then the action is morally improper. Consequentialist ethics are sometimes called *teleological*, from the Greek word *telos*, or end, since the end result of the action is the sole determining factor of its morality.

Consequentialist ethics became popular in the 18th century by philosophers who wanted a quick way to morally assess an action by appealing to experience, rather than by appealing to intuitions or long lists of questionable duties. In fact, the most attractive feature of consequentialism is that it appeals to publicly observable consequences of actions. Most versions of consequentialism are more precisely formulated than the general principle above. In particular, competing consequentialist theories specify which consequences for affected groups of people are relevant. Three subdivisions of consequentialism emerge:

- *Ethical Egoism*: an action is morally right if the consequences of that action are more favorable than unfavorable *only to the agent* performing the action.
- *Ethical Altruism:* an action is morally right if the consequences of that action are more favorable than unfavorable *to everyone except the agent*.
- *Utilitarianism:* an action is morally right if the consequences of that action are more favorable than unfavorable *to everyone.*

All three of these ethics focus on the consequences of actions for different groups of people. But, like all normative ethics, the above three ethics are rivals of each other. They also yield different conclusions. Consider the following example. A woman was traveling through a developing country when she witnessed a car in front of her run off the road and roll over several times. She asked the hired driver to pull over to assist, but, to her surprise, the driver accelerated nervously past the scene. A few miles down the road the driver explained that in his country, if someone assists an accident victim, then the police often hold the assisting person responsible for the accident itself. If the victim dies, then the assisting person could be held responsible for the death. The driver continued explaining that road accident victims are therefore usually left unattended and often die from exposure to the country's harsh desert conditions. On the principle of ethical egoism, the woman in this illustration would only be concerned with the consequences of her attempted assistance as *she* would be affected. Clearly, the decision to drive on would be the morally proper choice. On the principle of ethical altruism, she would be concerned only with the consequences of her action as *others* are affected, particularly the accident victim. Tallying only those consequences reveals that assisting the victim would be the morally correct choice, irrespective of the negative consequences that result for her. On the principle of utilitarianism, she must consider the consequences for both herself and the victim. The outcome here is less clear, and the woman would need to precisely calculate the overall benefit versus disbenefit of her action.

i. Types of Utilitarianism

Jeremy Bentham presented one of the earliest fully developed systems of utilitarianism. Two features of his theory are noteworty. First, Bentham cited in Bowring (1838 - 1843) proposed that we tally the consequences of each action we perform and thereby determine on a case by case basis whether an action is morally right or wrong. This aspect of Bentham's theory is known as *act-utilitiarianism*. Second, Bentham also proposed that we tally the pleasure and pain which results from our actions. For Bentham, pleasure and pain are the only consequences that matter in determining whether our conduct is moral. This aspect of Bentham's theory is known as *hedonistic utilitarianism.* Critics point out limitations in both of these aspects.

First, according to act-utilitarianism, it would be morally wrong to waste time on leisure activities such as watching television, since our time could be spent in ways that produced a greater social benefit, such as charity work. But prohibiting leisure activities doesn't seem reasonable. More significantly, according to act-utilitarianism, specific acts of torture or slavery would be morally permissible if the social benefit of these actions outweighed the disbenefit. A revised version of utilitarianism called *rule-utilitarianism* addresses these problems. According to rule-utilitarianism, a behavioral code or rule is morally right if the consequences of adopting that rule are more favorable than unfavorable to everyone. Unlike act utilitarianism, which weighs the consequences of each particular action, rule-utilitarianism offers a litmus test only for the morality of moral rules, such as "stealing is wrong." Adopting a rule against theft clearly has more favorable consequences than unfavorable consequences for everyone. The same is true for moral rules against lying or murdering. Rule-utilitarianism, then, offers a three-tiered method for judging conduct. A particular action, such as stealing my neighbor's car, is judged wrong since it violates a moral rule against theft. In turn, the rule against theft is morally binding because adopting this rule

produces favorable consequences for everyone. John Stuart Mill's version of utilitarianism is rule-oriented.

Second, according to hedonistic utilitarianism, pleasurable consequences are the only factors that matter, morally speaking. This, though, seems too restrictive since it ignores other morally significant consequences that are not necessarily pleasing or painful. For example, acts which foster loyalty and friendship are valued, yet they are not always pleasing. In response to this problem, Moore (1903) proposed *ideal utilitarianism*, which involves tallying any consequence that we intuitively recognize as good or bad (and not simply as pleasurable or painful). Also, Hare (1952) proposed *preference utilitarianism*, which involves tallying any consequence that fulfills our preferences.

ii. Ethical Egoism and Social Contract Theory

It could be seen (in Section 1.b.i) that Hobbes was an advocate of the methaethical theory of psychological egoism—the view that all of our actions are selfishly motivated. Upon that foundation, Hobbes developed a normative theory known as social contract theory, which is a type of rule-ethical-egoism. According to Hobbes, for purely selfish reasons, the agent is better off living in a world with moral rules than one without moral rules. For without moral rules, we are subject to the whims of other people's selfish interests. Our property, our families, and even our lives are at continual risk. Selfishness alone will therefore motivate each agent to adopt a basic set of rules which will allow for a civilized community. Not surprisingly, these rules would include prohibitions against lying, stealing and killing. However, these rules will ensure safety for each agent only if the rules are enforced. As selfish creatures, each of us would plunder our neighbors' property once their guards were down. Each agent would then be at risk from his neighbor. Therefore, for selfish reasons alone, we devise a means of enforcing these rules: we create a policing agency which punishes us if we violate these rules.

2.1.1.3 Applied Ethics

The Internet Encyclopedia of Philosophy (IEP) explains that applied ethics is the branch of ethics which consists of the analysis of specific, controversial moral issues such as abortion, animal rights, or euthanasia. In recent years applied ethical issues have been subdivided into convenient groups such as medical ethics, business ethics, environmental ethics, and sexual ethics. Generally speaking, two features are necessary for an issue to be considered an "applied ethical issue." First, the issue needs to be controversial in the sense that there are significant groups of people both for and against the issue at hand. The issue of drive-by shooting, for example, is not an applied ethical issue, since everyone agrees that this practice is grossly immoral. By contrast, the issue of gun control would be an applied ethical issue since there are significant groups of people both for and against gun control.

The second requirement for an issue to be an applied ethical issue is that it must be a distinctly moral issue. On any given day, the media presents us with an array of sensitive issues such as affirmative action policies, gays in the military, involuntary commitment of the mentally impaired, capitalistic versus socialistic business practices, public versus private health care systems, or energy conservation. Although all of these issues are controversial and have an important impact on society, they are not all moral issues. Some are only issues of social policy. The aim of social policy is to help make a given society run efficiently by devising conventions, such as traffic laws, tax laws, and zoning codes. Moral issues, by contrast, concern more universally obligatory practices, such as our duty to avoid lying, and are not confined to individual societies. To qualify as an applied ethical issue, the issue must be more than one of mere social policy: it must be morally relevant as well.

In theory, resolving particular applied ethical issues should be easy. With the issue of abortion, for example, one would simply determine its morality by consulting our normative

principle of choice, such as act-utilitarianism. If a given abortion produces greater benefit than disbenefit, then, according to act-utilitarianism, it would be morally acceptable to have the abortion. Unfortunately, there are perhaps hundreds of rival normative principles from which to choose, many of which yield opposite conclusions. Thus, the stalemate in normative ethics between conflicting theories prevents us from using a single decisive procedure for determining the morality of a specific issue. The usual solution today to this stalemate is to consult several representative normative principles on a given issue and see where the weight of the evidence lies.

a. Normative Principles in Applied Ethics

The internet encyclopedia of philosophy further explains that arriving at a short list of representative normative principles is itself a challenging task. The principles selected must not be too narrowly focused, such as a version of act-egoism that might focus only on an action's short-term benefit. The principles must also be seen as having merit by people on both sides of an applied ethical issue. For this reason, principles that appeal to duty to God are not usually cited since this would have no impact on a nonbeliever engaged in the debate. The following principles are considered the most commonly appealed to in applied ethical discussions:

- *Personal benefit:* acknowledge the extent to which an action produces beneficial consequences for the individual in question.
- *Social benefit:* acknowledge the extent to which an action produces beneficial consequences for society.
- *Principle of benevolence:* help those in need.
- *Principle of paternalism:* assist others in pursuing their best interests when they cannot do so themselves.
- *Principle of harm:* do not harm others.

- *Principle of honesty:* do not deceive others.
- *Principle of lawfulness:* do not violate the law.
- *Principle of autonomy:* acknowledge a person's freedom over his/her actions or physical body.
- *Principle of justice:* acknowledge a person's right to due process, fair compensation for harm done, and fair distribution of benefits.
- *Rights:* acknowledge a person's rights to life, information, privacy, free expression, and safety.

The above principles represent a spectrum of traditional normative principles and are derived from both consequentialist and duty-based approaches. The first two principles, personal benefit and social benefit, are consequentialist since they appeal to the consequences of an action as it affects the individual or society. The remaining principles are duty-based. The principles of benevolence, paternalism, harm, honesty, and lawfulness are based on duties we have toward others. The principles of autonomy, justice, and the various rights are based on moral rights. For the purpose of this research, the following principles shall be applied in the ethical evaluation of the impacts of mining in Ebonyi State: Justice, Sustainability, human rights and solidarity.

An example found in the IEP will help illustrate the function of these principles in an applied ethical discussion. In 1982, a couple from Bloomington, Indiana gave birth to a baby with severe mental and physical disabilities. Among other complications, the infant, known as Baby Doe, had its stomach disconnected from its throat and was thus unable to receive nourishment. Although this stomach deformity was correctable through surgery, the couple did not want to raise a severely disabled child and therefore chose to deny surgery, food, and water for the infant. Local courts supported the parents' decision, and six days later Baby Doe

died. Should corrective surgery have been performed for Baby Doe? Arguments in favor of corrective surgery derive from the infant's right to life and the principle of paternalism which stipulates that we should pursue the best interests of others when they are incapable of doing so themselves. Arguments against corrective surgery derive from the personal and social disbenefit which would result from such surgery. If Baby Doe survived, its quality of life would have been poor and in any case it probably would have died at an early age. Also, from the parent's perspective, Baby Doe's survival would have been a significant emotional and financial burden. When examining both sides of the issue, the parents and the courts concluded that the arguments against surgery were stronger than the arguments for surgery. First, foregoing surgery appeared to be in the best interests of the infant, given the poor quality of life it would endure. Second, the status of Baby Doe's right to life was not clear given the severity of the infant's mental impairment. For, to possess moral rights, it takes more than merely having a human body: certain cognitive functions must also be present. The issue here involves what is often referred to as moral personhood, and is central to many applied ethical discussions.

Recall that ethics has three major domains -metaethics, normative ethics and applied ethics. Of the three, normative and applied ethics are of more relevance to this present investigation. Firstly, it is important to establish how the problem of this research is an applied ethical one. Applied ethics involves examining controversial issues such as environmental concern amongst other issues and in this case impacts of mining in Ebonyi State.

Given the afore mentioned criteria qualifying a subject as applied ethical issue, the impact of mining qualifies as one. First, impact of mining is a controversial one because mining as it were is not bad in its own right. Nevertheless, it impacts negatively on the society amidst its

numerous benefits in human society even when best standards are applied. The impacts worsen with abuse of mining standards and regulations.

The second argument which qualifies impacts of mining as an applied ethical issue is that the subject is concerned with a more universally obligatory duty of environmental protection. Hence impact of mining is a morally or ethically relevant issue.

Having considered earlier that normative ethics involves arriving at moral standards that regulate right and wrong conduct, it is pertinent to note that normative ethics principles are quite pivotal to any discussion on applied ethics such as the present one - "ethical evaluation of the impacts of mining in Ebonyi state". Thus for a successful deliberation on the subject matter, the normative ethics principles are indispensable.

This research posits that the exploitative tendencies in mining activities in Ebonyi State is not because there are no regulations guiding mining; not because the miners do not know the regulations, but because they lack the "good habits of character" which will naturally produce the willingness to obey the regulations and avert severe damage and impacts on the environment. This position is resonated by virtue ethicists as earlier seen in 2.1.1.2 who have de-emphasized learning rules and instead stressed the importance of developing good habits of character such as benevolence, avoidance of harm, justice, temperance and so on.

Furthermore, looking back at the duty ethicists' argument, it is also discovered that the four central duty ethics are invaluable to this present research. Duties to others which include to avoid wronging others, treating people as equals and promoting the good of others if imbibed as "good habit of character" by miners in Ebonyi State will help them play by the rules. The second duty-based approach to this normative ethics which is rights ethics brings to the fore nature's mandate that we should not harm anyone's life, health, liberty and possession.

Available evidence shows that mining activities in Ebonyi State pose threat to life, health and possession of Ebonyians.

The third duty based ethics which is that of Kant's categorical imperative, mandates an action irrespective of one's personal desire, such as "you ought to do x". As such, people for Kant, must be treated as an end. In other words, people should be treated with dignity. Now following this line of Kant's argument, irrespective of the desires of the miners to maximize profits while mining the natural resources in Ebonyi State, it therefore follows that they ought to check their activities so that it would not undermine the dignity of Ebonyi people as humans. The fourth and the last duty based ethics which is that W.D. Ross is rather a list of duties believed to be a reflection of our actual moral convictions and include: fidelity, reparation, gratitude, justice, beneficence, self improvement and non maleficence. Fidelity stresses the duty to keep promise mining companies in Ebonyi State when seeking mining lease make a lot of promises, how many keep to these promise? Reparation is a duty that demands to compensate others when harm is done to them to them, how often do miners repare the damaged environment? The degraded land, polluted air/water, the displaced fauna, deforested flora and so on are left like that because of lack of plans for proper mine closure and reclamation.

2.1.2 Mining

Hartman (1992) defines a mine as "an excavation made in the earth to extract minerals" and defines mining as "the activity, occupation and industry concerned with the extraction of minerals" (P.2). Depending on the context of usage, mining according to Hartman could be the activity concerned with the extraction of minerals. The occupation concerned with the extraction of minerals; or the industry concerned with the extraction of minerals.

On the contrary, International Labour Organization (1995) in its 82nd session defined the term 'mine' as covering:

(a) Surface or underground sites where the following activities, in particular take place:

(i) Exploration for minerals, excluding oil and gas, that involves the mechanical disturbance of the grounds;

(ii) Extraction of minerals, excluding oil and gas;

(iii) Preparation, including crushing grinding, concentration or washing of the extracted materials; and

(b) All machinery, equipment, appliances, plant, buildings and civil engineering structures used in conjunction with the activities referred to in (a) above.

From the foregoing therefore, ILO may be said to have explain the concept of mining as 'the exploration for extraction and preparation of minerals excluding oil and gas, through surface or underground methods, using machines and materials'.

Debopriya (2012) simply explains that mining refers to the process of extracting metals and minerals from the earth, whereas Wikipedia (2014) explains that mining is an activity that comprises of three distinct processes (i) Exploration (ii) extraction and reclamation which regarded as the complete mine circle.

The New Encyclopedia Britanica (2010) defines the concept of mining as the process of extracting useful minerals from the surface of the earth, resonating Hartman and Debopriya's mining of idea of the activity of extraction of mineral. Hill (2012) says that mining is the taking of minerals from the earth, including production from surface waters, and from well, usually excluding oil and gas. Notably, both ILO (1995) and Hill (2012) definition s of mining agree that oil and gas exploration/ processing are excluded in mining and mining and mining industry but disagree in the processes or steps in mining. Whereas ILO (1995) recognizes in its definition of mining the steps in mining cycle as exploration, extraction and

preparation, Wikipedia (2014) diverges by excluding preparation but including mine reclamation. They may have taken it for granted that extraction of minerals may naturally also involve the separation of useful minerals from the gangue (waste).

Care needs to be taken when defining mining to avoid a simplistic and superficial definition of the term such as merely the "process of extracting minerals from the earth such as simplistic definition is capable of watering down or shading the other major activities involved in mining that also impact heavily on the environment. It is therefore important that a holistic definition of mining be promoted, such that can incorporate the mining life cycle – from exploration (prospecting) to mine closure (reclamation). An appreciation by miners of the entire mining steps will help limit the "hit and run" attitude of miners and mining industry, who may just be interested in the exploration and extraction of minerals and less interested in the reclamation of mined area.

Hence, mining should be defined as a process of tapping natural resources which involves the exploration for minerals; surface or underground extraction of minerals excluding oil and gas; preparation of the extracted minerals all using machines and materials; and mine reclamation.

2.1.3 Ethical Evaluation

An ethical evaluation of any subject as a matter of fact belongs to the field of applied ethics as demonstrated in **2.1.1.3** above. Ward (2014) supports this position and further explains that major questions in Applied Ethics include how existing principles apply to new issues, the ranking of rival principles, the standards of best practice in a profession, the ethical decision making in the field. What concerns this present research most is how existing principles apply to new issues in mining.

There are some works on ethical evaluation in other fields than Mining such as those of de Boer, Brom and Vorsterbosch (1995) who researched on the "Ethical Evaluation of Animal

Biotechnology: The case of using clones in Dairy Cattle breeding". Their so-called network model determined fundamental moral principles that together constituted a framework for the detection of ethical issues in their research situations. As such, they defined four fundamental principles, namely; beneficence, non-malficence, justice and respect for the integrity of the animal. They applied same in their study by using the principles to evaluate the issue of animal biotechnology. Their study agrees with Ward's explanation of one the functions of ethical evaluation, namely, showing how existing principles apply to new issues.

Similarly, Michael and Raphael (2010) carried out an "ETICA PROJECT" which focused on the ethical evaluation of technologies such as affective computing; ambient intelligence (AMI); artificial intelligence (AI); bioelectronics; cloud computing; future internet, human machine symbiosis neuroelectronics; quantum computing; robotics; and virtual/augmented reality (VR/AR). Like de Boer, Brom and Vorsterbosch (1995), Michael and Raphael (2010) brought to bear and applied some ethical principles, namely: Human dignity; freedom; justice (considered as equality and solidarity); principle of proportionality; precautionary principle; and principle of transparency. For example, they singled out human dignity in particular and other principles in general, because according to them, serious threats to human dignity within the field of emerging ICT are most likely to arise with "ICT" implants in the human body so, they reserved the topic of human dignity mostly to issues of bodily integrity amongst all.

Similarly Swiss Committee on Animal Experiments (SCAE) and the Swiss Ethics committee on Non Human Biotechnology (ECNA) (2006) gave a report titled "Research on Primates – an ethical evaluation". In this ethical evaluation they weighed animal experimentation on the balance of some fundamental ethical positions such as anthropocentric, pathocentric and Biocentric positions. They concluded and so recommended that due to the close similarities of primates to humans and their cognitive faculties, they (primates) should be accorded a

special status. As such, for ethical reasons, the competent authority should only permit experiments involving primates with the utmost restraint.

Panikkar and Brugge (2007) carried out a historical analysis of a public health research conducted in the Navajo lands since the inception of uranium mining from the 1950s until the end of the 20th century. In that historical analysis, they examined the successes and the failures in the research initiatives conducted on Navajo lands, the ethical breaches of that research and the harms and benefits that the research brought to the community. In summary they discussed how scientific and moral uncertainty, lack off full stakeholder participation and community wide outreach and education can impact ethical decisions made in research. Panikkar and Brugge did not carry out an ethical evaluation of the health impact of Uranium Mining in Navajo land as may be suggested by their report title; rather their work was a criticism of a health research that was necessitated by a perceived adverse health impact of Uranium Mining in Navajo lands. They titled their survey "The Ethical issues in Uranium Mining Research in the Navajo Nation"

YU (2013), states that the traditional ethical principles of beneficence, avoidance of harm, autonomy, fidelity and justice apply to both research activities and clinical operations. He notes that the applications of these principles are crucial in the use of electronic health to avoid negative impacts of such information technology. This agrees with Michael and Raphael (2010) who applied similar principles of human dignity, freedom, justice, proportionality et cetera in evaluating some technologies.

Similarly, Fuente and Barkin (2013) defined the ethical debate on development and sustainability in territorial and political terms. They align themselves with the critics of the recent expansion of mining in the third world, emphasizing its role in the new stage of global capital accumulation described by Haney cited in Fuente and Barkin (2013) as 'mining within

the process of accumulation by dispossession'. They argue that defining sustainable development in mining within the model of comparative advantages is grievously erroneous and so redefined sustainability in terms of community right, justice - distributional Justice (social) and eco-justice (environmental).

Generally speaking, at the moment the concept of ethical evaluation in the sphere of mining seems to suffer a dearth of research.

Available researches are more on the impact of mining than on ethical evaluation of the impact of mining. It is such gap that this present research seeks to fill among others.

2.2. Theoretical Framework

The theoretical framework seeks to review literature on some theories of Environment due to the fact that present research borders on environmental ethics. It is expected that the theories which will be employed in this survey will contribute positively in this present research. Prominent amongst the environmental ethics theories are Anthropocentrism Biocentrism and Ecocentrism. These theories' major concern is to put forth ethical arguments on whose interests morally count in environmental protection issues. However they all agree that the environment needs be protected.

2.2.1. Anthropocentrism

Oughton (2012) explain that anthropocentrism is an approach to the environment that places human interests above those of any other species. This author outlines what is believed to be the key ethical arguments of anthropocentrism as follows:

(i) Non-human species and the environment have value only in so much as they satisfy human interest. Hence, non-human species only have extrinsic value.

(ii) Human are the only entities that have moral standing.

(iii) Environmental effects matter only to the extent that they affect human interests.

(iv) Humans are the only "valuers" (P.10)

The critics of anthropocentrism believe that the hallmark of this theory of environmental protection has meaning only within the context of human values and experience.

Ibeh (2003) identifies Australian Philosopher John Passmore and economic ethicist Peter Ulrich as proponents of anthropocentrism. The former insists that beings outside man have no right while the later says that the environmental debate concerns man and not the nature; "it is not nature but our culture (human culture) that gives value and attraction to alternative forms of life around man, nature does not speak for itself, we do it" (P.63). Their positions as identified by Ibeh (2003) supports the anthropocentrics' key ethical arguments as enunciated by Oughton (2012).

Mouchang and Yi (2003) lending credence to the foregoing maintain that Anthropocentrism is an ethics completely centred on the interest of human beings and added that non-anthropocentrics regard it as the source of the environmental crisis. They further identified the main criticisms of anthropocentrism as follows:

(i) Anthropocentrism is not deep philosophically. It emphasizes the separation of and tension between humans and nature, and the comparative distinction between human and animals. Some animals had evolved a rich communication system; others were able to make and use tools, solve problems, educate they offspring, and live in complicated social organizations and possessed esthetic consciousness, etc. therefore any distinction from humans was obviously a matter of degree.

(ii) Anthropocentrism is not complete in terms of values. It is believed that only humans had values, and living beings and nature did not have values. Because humans had goals, only humans had interests. This is also a partial truth. As a matter of fact life and nature have not only values, but also interest (i.e. they live according to

ecological rules). That is to say, living beings and nature are not only of value to humans as tools, but also have intrinsic value.

(iii) Anthropocentrism is imperfect ethically. According to the above views, traditional ethics believe that only human had goals; therefore only humans received moral treatment and enjoyed moral rights. Anthropocentrism believed that human features, such as reason, self consciousness, self control and the ability to communicate through symbols, were the basis for humans to be treated morally. Critics said that some humans, such as infants, the retarded, and Alzheimer patients, and vegetables did not have these abilities; and that intelligence, use of tools and self consciousness were characteristics of both humans and some animals. Therefore the status of moral object should be expanded to include life and nature.

(iv) Practically, anthropocentrism had led humankind into a difficult situation. The above anthropocentric views directed human behaviour and represented itself in practice as possessive utilitarian selfishness, to be developed into economism, consumerism and individualism. In economic development, economic growth was the only goal, often at the expense of the environment and resources, which led to environmental pollution and resource shortage on a global scale (P.2).

Mouchang and Yi believe that these criticisms led to modification of anthropocentrism and the birth of non-anthropocentric environmental ethics.

Boslaugh (2015) also maintain that anthropocentrism is a philosophical viewpoint that human beings are the central or most significant entities in the world, a belief embedded in many western religions and philosophies. She adds that many ethicists find the roots of anthropocentrism in the creation story told in the book of Genesis in the Judeo-Christian Bible, in which humans are created in the image of God and are instructed to “subdue” the Earth and to have “dominion” over all other living creature.

However, it is very important to note that environment ethicists, philosophers and so on are entitled to their opinions in the relation to anthropocentrism, but to state that its root (of exploitative tendencies) may be found in the biblical creation account of Genesis 1:26-28 is implausible. Again to assert that the criticism of anthropocentrism gave rise to stewardship position referred to in Genesis 2:15 is a false one.

The anthropocentric view which represents the perspective of some environmental ethicists does not in any way interpret the biblical narrative found in Genesis 1:26-28 which states:

"then God said, let us make man in our image, according to our likeness; let them have dominion over the fish of the sea, over the birds of the air, and over the cattle, over all the earth and over every creeping thing that creeps on the earth. So God created man in his own image; in the image of God he created him; male and female he created them. Then God blessed them, and God said to them, be fruitful and multiply; fill the earth and subdue it; have dominion over the fish of the sea, over the birds of the air, and over every living thing that moves on the earth" (NKJV). More so, the narrative in Genesis 2:15 which says "Then the lord God took the man and put him in the Garden of Eden to work it and take care of it" (NIV) did not just emerge after the criticism of anthropocentric position. Rather the problem with both the anthropocentrics and their critics are a misunderstanding and misinterpretation of the key word of the verse, namely "Dominion" and "work". Consequently an understanding of the meanings of the two key words will help in the interpretation of the verses in the question.

Brueggemann and Strong respectively cited in Jared and Christopher (2013) trace the Hebrew roots of "dominion" and "work" thus:

> The Hebrew word for "have dominion" in Genesis 1:26 is radah. A study of the verb reveals that it must be understood in terms of care –giving, even nurturing, not

> exploitation or malevolence. The Hebrew word for "work it" in Genesis 2:15 is abad. This word means 'to serve, till'. It means to be attentive to, to work the earth in a way that is to its benefit. This command focuses on the earth, particularly cultivation (Gen. 2:5, 15).This 'subduing' implies developing in the created order, offering to human beings the task of intra –creation development, of nurturing the world to its fullest possible potential (P.17).

Again the pontifical council for justice and peace (2014) insists and articulates that "the lord entrusted all of creation to their (humanity) responsibility, charging them to care for its harmony and development. This special bond with God explains the privileged position of the first couple in the order of creation" (P.451). Ibeh (2003) in furtherance of the pro-environment theology of Genesis chapter 1:26-28; and Genesis 2:15 says that, "man has a double position in relation to other creatures. On one hand, he is an integral part of the created order; on the other hand, he is empowered to use nature's gifts in a creative manner to satisfy his needs. This authority goes with responsibility and care, according to the duty and injunction to 'cultivate and guard in Genesis 2:15" (P.64).

From the foregoing anthropocentrism understood both from the dominion and steward stances have very serious contribution to environmental protection in the context of this research. Thus, miners and mining industry ought to embrace the "cultivate and guard" principles of anthropocentrism. The true understanding of the fact that they as part of the created order have the above responsibility will help them shun the exploitative tendencies while mining.

2.2.2 Biocentrism

George and Mc Namara (2003) explain that Biocentrism coined from Greek bios and Kentron meaning 'life' and 'centre' respectively, when used in a political and ecological sense, is an

ethical point of view that extends inherent value to all living things. It stands in contrast to anthropocentrism which centers on the values of humans. Advocates of biocentrism always promote the preservation of biodiversity, animal rights and environmental protection. Mouchang and Yi (2009) define biocentrism as a term that encompasses all environmental ethics that "extend the status of moral object from human beings to all living things in nature" (p.22). Hence the key arguments of biocentric can be summarized as follows:

(i) All species have inherent value not extrinsic value.

(ii) Humans are not inherently "superior" to other species in a moral or ethical sense.

(iii) Humans and all other species are members of earth's community.

(iv) All species are part of a system of interdependence.

Biocentric ethicists include Albert Schweitzer popularly associated with the ethics of "Reverence for life", Peter singer known for ethics of Animal liberation and Paul Taylor (a philosopher) known for ethics of biocentric egalitarianism. Mouchang and Yi (2009) explain that Albert Schweitzer's reverence for life principle was a precursor of modern biocentric ethics that denies any distinction between "high and low" or "valuable and less valuable" life forms. Schweitzer, they said, dismissed such categorization as arbitrary and subjective.

Similarly, singer (1979) argues that non-human animals deserve the same equality of consideration that is extended to human beings. His argument is roughly as follows:

(i) Membership in the species Homo sapiens is the only criterion of moral importance that includes all humans and excludes all non-humans.

(ii) Using membership in the species Homo sapiens as a criterion of moral importance is completely arbitrary.

(iii) Of the remaining criteria to be considered, only sentience is a plausible criterion of moral importance.

(iv) Using sentience as a criterion of moral importance entails that the same basic moral consideration (i.e. basic principle of equality) be extended to other sentient creatures than human beings.

(v) Therefore, the same equality of consideration extended to humans beings, ought to be extended to other animals.

Thus for Singer, other animals than human beings, should be considered because they too feel pain and suffer, and for him, that remains the only possible, explanation for their inclusion in the moral object argument.

Perhaps biocentrism is most commonly associated with Taylor (1986), who maintains that biocentrism is an "attitude of respect" (p.99), whereby one attempts to make an effort to live one's life in a way that respects the welfare and inherent worth of all living creatures. He states that:

(i) Humans are members of a community of life along with all other species, and on equal terms.

(ii) This community consists of a system of interdependence between all members, both physically and in terms of relationship with other species.

(iii) Every organism is a "teleological centre of life", that is, each organism has a purpose and reason for being, which is inherently "good" or valuable".

(iv) Humans are not inherently superior to other species.(p.99)

Paul Taylor's position above is similar to that of his co-proponents; the only difference is the addition of a teleological argument. Taylor added further to the key arguments of biocentrism that other species have purpose of being and there is no denial of the fact that no specie exists for nothing.

One of the criticisms of biocentric ethical theory grows out of the concern that it is an anti-human paradigm and that it will not hesitate to sacrifice human well-being for the greater good of other species. It has also been criticized for its individualism; emphasizing too much on the importance of individual life and neglecting the importance of collective groups, such as an ecosystem. A more complex of the criticisms focuses on the contradictions of biocentrism. Opposed to anthropocentrism (which sees humans as having a higher status than other species), Carlos (2011) points out that "Biocentrism puts human on par with the rest of nature, and not above it" (p.55), which could suggest that biocentrics are playing double standard.

However, biocentrism promotes some values useful to this research in terms of environmental protection. It draws man's attention to the fact that other species have value in themselves; not that accorded to it by man and therefore, demands to be handled with utmost care. Mining activities right from the exploration stage, disturbs the eco-system and so adversely affects fauna and flora. Thus, the appreciation of the above value of biocentrism by miners and mining companies will help them in implementing the resettlement of fauna and re-vegetation of flora at mine closure.

2.2.3 Ecocentrism (Land Ethic Theory).

Leopold (1949) points out that although throughout history women and slaves have been considered property, all people have now been granted rights and freedoms. He notes that today land is still considered property as people once were, and then asserts that ethics should be extended to the land as "an evolutionary possibility and an ecological necessity" (p.239). Leopold suggests that "the land ethic simply enlarges the boundaries of the community to include soils, water, plants and animals or collectively: the land" (p.239). In a sense, this attitude would encourage humans to co-operate with the land rather than compete with it.

J. Baird Callicot, Holmes – Rolston III and Arne Naess are amongst the proponents of ecocentrism, supporting Aldo Leopold. In addition to Leopold's position, Callicot and Holmes cited in Oughton (2012) are of the view that ecosystem and/or their components have intrinsic value or inherent value. Naess in Oughton also (2012) insists that humans have no right to interfere with the richness and diversity of the ecosystem except to satisfy vital needs.

On the whole, proponents of ecocentrism are unanimous in claiming that biotic and abiotic components of the ecosystem can and actually do have moral standing. Biocentrism and Ecocentrism may appear to be the same but while biocentrism emphasizes the value, rights, and survival of individual organic beings, ecocentrism on the other hand takes a more holistic approach, giving moral priority to species and ecosystems, rather than the individuals that compose them, insist Moucharg and Yi (2009). Rowe (1994) avers that:

> The environment that anthropocentrism misperceive as materials designed to be used exclusively by humans, to serve the needs of humanity, is in the profoundest sense humanity's source and support: its ingeneous, inventive life giving matrix. Econcentrism goes beyond biocentrism with its fixation on organisms, for in the ecocentric view people are inseparable from the inorganic/organic nature that encapsulates them. They are particles and waves, body and spirit, in the context of Earth's ambient energy. Ecocentrism is not an argument that all organisms have equivalent value. It is neither an anti human argument nor a put-down of those seeking social justice. It does not deny that myriad important homocentric problems exist. But it stands aside from these smaller, short-term issues in order to consider Ecological Reality. Reflecting on the ecological status of all organisms, it comprehends the Ecosphere as a being that transcends in importance any one single species, even the self-named sapient one (P.106-107).

Stan Rowe is only re-echoing that the eco-system living and non-living creatures (man inclusive) exist as a whole and should be seen so. He is redirecting the argument from value based (away from the tussle of moral importance) to that of ecosystem maintenance and harmony. Thus, ecocentric ethics theory's salient point and contribution to this research is the development of a non-contingent basis for protecting the natural world. It stresses that the protection of non-human nature should not be subject to the demands of human utility and never more than contingent on the demands of human welfare. Ecocentric ethical theory could be seen as the bridge between two extremes, namely anthropcentrism and biocentricism.

2.3. Empirical Studies.

The empirical study will review the findings of other researchers on the impacts of mining since at the moment, there is dearth of research on the ethical evaluation of the impact of Mining. Available researches abound on the impacts of mining. Nwadialor (2011) observed that, the extraction and processing through mining activities especially, of solid minerals are going on at different scale of intensity in Nigeria, resulting to negative impacts on the environment such as: land degradation, ecological disruption which gives rise to air, land and water pollution and death of flora and fauna, and so on. He further lamented that the disturbing situation and means to minimize them have surprisingly not been taken seriously because of lack of regulatory implementation impetus or due to the little revenue accruing from these resources which according to him is not meaningful to be reflected in the nation's Gross Domestic product (GDP). From his study, it was feared that natural catastrophes such as earthquake and volcanic eruptions, occasioned by possible geomorphological and geostatic equilibrium destabilization may be imminent in the country. He then recommended that a holistic approach to evaluating hazards represented by different kinds of mine wastes be put in place by adopting remote sensing and

Geographical information system (GIS) in assessing environment impacts of mining and its new developments.

A similar study was carried out by Musa and Jiya (2011). The duo observed that the vegetal cover in the area has to be removed from the activities of tin mining which consequently resulted into adverse environmental effect such as erosion and biodiversity disturbance. Thus, they adopted the Normalized Differential Vegetation Index (NDVI) techniques to ascertain the level of the effect of tin mining on the vegetation for the period between 1975 and 2007 using land sat satellite data. Their results revealed a decline in vegetated surfaces in 1986 ranging from 0.04 to 0.58 indicating 0.05 and continuous loss in vegetation over the study area in 2007 (vegetated surface decrease by 0.08 between 1986 and 2007), which they attributed to intensive mining among other factors.

Away from negative environmental impacts of mining, Hoedofia, Cheabu and Korang (2014) examined the "Effects of small scale Gold mining on living conditions: A case study of the West Gonja District of Ghana". Their study revealed that small scale mining has contributed positively in improving the lives of the people in the form of employment, revenue generation and meeting health, educational and basic family needs. It also confirmed the associated social and environmental negative effects of small scale mining. The paper concluded that in the absence of a viable alternative source of economic livelihood, the West Gonja District Assembly should organize small scale miners into groups, assist them to acquire equipment needed for their operations and regularly monitor and control their activities. The point of departure between this and the last two researches reviewed above is that while the former were exclusively pre-occupied with the negative environmental impacts of mining the later highlights more the positive economic effects of mining.

Owusu and Dwomoh (2012) add a behavioural dimension to the impacts of mining which totally distinguishes it from all others, the research work employed the use of oral interviews, observations and documentary sources to obtain data for the study. The outcome of the research showed that poverty, ignorance and get rich quick attitude of the youth were the factors responsible for illegal mining activities in the Kwaebibirem District. It also revealed that illegal mining activities have negative impact on the youth in relation to high rate of student drop-out, increase in teenage pregnancy, disrespect toward the elderly and engaging in undesirable behaviours such as smoking of hard herbs.

Wickham, et al (2013) explore "the overlooked terrestrial impacts of mountain top mining". They claim that the research was prompted by the predominance of ecological research on mountain top mining that had always focused on aquatic impacts, because of the overburden that are disposed of in nearby valleys leading to a wide range of water – quality impacts on the streams. Drawing attention away from aquatic impacts therefore, the researchers aver that there are also numerous impacts on the terrestrial environment from mountain top mining that had been overlooked, even though they are no less wide ranging, severe, and multifaceted. Hence, they reviewed the impacts of mountaintop mining on the terrestrial environment by exploring six broad themes: (i) the loss of topographic complexity (ii) forest loss and fragmentation (iii) forest succession and soil loss (iv) forest loss and carbon sequestration (v) loss of biodiversity and (vi) human health and well being impact.

The research of Schmidt, et al (2012) is a direct opposite of the last research above. While the former discussed the terrestrial impacts of mining the later dwelt on the aquatic influence. These present authors established that geologic processes strongly contribute and influence water and sediment quality in aquatic ecosystems, but are rarely incorporated into

routine bio-monitoring studies. They tested if elevated concentrations of metal in water and sediment were restricted to streams downstream of mines or areas that may discharge mine waters. They surveyed 198 catchments classified as “historically mined” or “unmined” and based on mineral – deposit criteria, to determine whether water and sediment quality were influenced by naturally occurring mineralized rock, by historical mining, or by a combination of both. By accounting for different geologic sources of metals to the environment, they were able to distinguish aquatic ecosystems limited by metals derived from natural processes from those due to mining. Thus, their study discovered that elevated concentration of metals in water and sediment were not restricted to mined catchments; rather, depauperate aquatic communities were found in unmined catchment. So, they conclude that the type and intensity of hydrothermal alteration and the mineral deposit type were important determinants of water and sediment quality as well as the aquatic community in both mined and unmined catchments. Hence, they suggested that biomonitoring studies should as well account for natural sources of metals in some geologic environments as contributors to the effect of mines on aquatic ecosystems, recognizing that in mining-impacted drainages, there may have been high pre-mining background metal concentration.

Thorslund et al (2012), is also among the researcher of the impact of mining on aquatic ecosystems. Previously, Schmidt reviewed above showed the contribution or influence of geologic process on the effects of mining in aquatic pollution. Thorslund, et al enunciates that mining and ore excavation can cause the acidification and heavy metal pollution of downstream water systems. In their study, they quantified the net impact of the unmonitored mining activities in the Zaamar Goldfield on heavy metal transport downstream Tuul River-Selerga River –Lake Baikal water system. They also noted that the Zaamar site shares the conditions of limited monitoring with many rapidly developing regions of the world. The heavy metal concentrations and flow data were obtained from historical measurement

campaigns, long term monitoring and a novel field campaign. The results indicated that natural mass flows of heavy metals in dissolved form increased by an order of magnitude because of mining; prevailing alkaline conditions in the vicinity of Zaamar limited the dissolution, maintaining the on-site concentrations below health –risk base-line values; and that however, suspend river concentrations were much higher than the dissolved concentrations. They concluded that the placer gold mining at the Zaamar site increased the total riverine mass flows of Al, As, Cu, Fe, Mn, Pb, and Zn by 44.300, 30.1, 65.7, 47.800, 1.480, 76.0 and 65.0 tonnes per year respectively.

Luss (2007) reviewed research in the health effects and risks associated with exposure to Asbestos (a soft grey mineral that does not burn, used especially in the past in building as a protection against fire or to prevent heat loss). This author used the scientific evidence got from the review to analyze the implications of Canada's policy on the use, manufacturing and export of Asbestos. The author then concluded that the main problem in the Canadian existing policies - Health Policy on Asbestos (HPA) is that they are not based on scientific evidence of the health effects of Asbestos, and are designed not to mitigate these effects, but to create an appearance of maintaining public health standards while yielding to corporate interests. She then avers that continuing health consequences of Asbestos are therefore a prime example of the way in which policy makers are choosing short-term economic benefits instead of minimizing scientifically established risks, to the great detriment of the communities concerned. The research of Luss above is uniquely different from all others so far reviewed both in terms of mineral mined, the impacts and its relation to policy formulation. Luss focused on the mining of Asbestos, its health impacts on Canadians and how it should influence policy making in that regard.

Mishra and Pujari (2008) analyzed agricultural productivity in a coal mining region f Orissa. Their analysis focused on paddy production, the main produce in the study area, and used

"Fisher and Tornqvist" indices. They performed a number of t-tests to examine whether the Total Factor Productivity (TFP) pattern in mining villages were different from that in the control villages. Their analysis provided evidence that there were loss in agricultural productivity due to mining activities. Apart from this, they also observed a shift in livelihood from agriculture to mining related work, a change they considered as an indicator of rural development in the mining area, in spite of a reduction in agricultural productivity. Thus, these authors were contending that (Coal) mining can bring about low agricultural productivity and at the same time fostering rural development. It agrees in part with the research of Hoedofia, Cheabu and Korang (2014) afore reviewed, in terms of improving living conditions of rural dwellers, while stressing the low agricultural productivity impact of coal mining.

Murray, Davies and Rees (2011) explore "Occupational lung disease in the South African Mining Industry: Research and policy implementation". While all other authors' works so far reviewed mostly centred on the impacts of mining on either the terrestrial or aquatic community as it were, Murray, Davies and Rees are pre-occupied by the impacts of mining on the miners themselves, in South Africa. They expressed disappointment that despite a plethora of research on the mining industry, (the gold mining industry in particular), research impact (including disease surveillance) on policy implementation and occupational health systems performances lags. They further explained that biologic and social factors combine to create a perfect storm for the interaction among Silicosis, TB and HIV, because the integrated, multifaceted remedies required to control these epidemics in terms of policy and policy implementation that should emanate from available research is a far cry. This present research is significantly similar to that of Luss (2007) who decries the attitude of policy makers in choosing short-term economic benefits instead of minimizing scientifically established risks to the detriment of the community.

Winkler and Dewitt (2009) identified seven environmental impacts resulting from large – scale disturbance of peat lands and the subsequent removal of peat, among which were:

(i) Toxic metal release from peat

(ii) Euthrophication of surface water;

(iii) Increased run off (including flooding and impacts on fisheries)

(iv) Release of organic pollutants;

(v) Changes of salt and fresh waters,

(vi) Changes in ground-water supply; and

(vii) Air pollution and fires.

This survey is entirely different in terms of the substance mined, but similar to other researches in this context, in terms of the environmental impacts. The substances mined in this particular review is peat – a soft black or brown substances formed from decaying plants just under the surface of the ground, especially in cool wet areas. It is burned as a fuel or used to improve garden soil.

Ontoyin and Agyemang (2014) discovered that small – scale gold mining in the districts has particularly impacted negatively on the rural livelihood such as crop and livestock farming, trade, fishing, firewood picking, hunting and shea nut picking. These authors collected the data using land satellite imagery, self-administered questionnaire, semi-structured interview, observation and text and document review. This research differs from that of Hoedofia, Cheabu and Korang (2014) as well as Owusu and Dwomoh (2014). While Ontoyin and Agyemang (2014) limited their research on the Talensi – Nabdam Districts of Ghana, the former had focused on the West Gonja and Kwaebibirem Districts of Ghana respectively. Significantly also while the impacts of gold-mining in the Talensi - Nabdam Districts were found to be negative on the people's livelihood, gold mining was seen to have impacted

positively on the living conditions of the West Gonja Districts, and has also impacted negatively on the youths of Kwaebibirem Districts all in Ghana .

Ahmed, et al (2014) adopting both primary and secondary sources of data collection, they discovered that the mining of Blackstone without recourse to proper planning and regulation has resulted to appreciable damage, degradation and deterioration of the environment and ecological damage to water, air and soil. They identified some of the impacts as: disposal of overburden, deforestation, acid mine drainage, air pollution due to gas and dust emission, noise pollution, mine fires, damage to flora and fauna (loss of biodiversity), and et cetera. It was also discovered in the study that the environmental impacts have resulted to negative impacts on the health of both the mine workers and local residents living in the mining area, such as respiratory disease, digestive problems and psychological problems. The outcome of the research under review is similar to those of Winkler and Delvith (1985) in terms of the mining impacts.

The research of Udiba, et al (2013) no doubt is similar to that of Thorslund (2012) and Schmidt, et al (2012) which predominately explored the impacts of mining on the river and how geologic process influence the effects of mining on aquatic ecosystems, respectively. The outcome of the latest review on mining impact on ground water is frightening.

After determining the physicochemical parameters of water quality in Dareta, Zamfara State (at the onset of the remediation exercise after deaths resulting from lead poisoning), the researchers discovered that the water temperature was above the WHO limits of 25^{o}c for domestic water supply; the water were generally acidic with a mean PH value of 6.34, below the WHO, EU, and Nigerian Standard for Drinking Water Quality Guidelines Values of 6.5-8.5 for potable water; the electrical conductivity levels of dissolved ionic substance were generally within the WHO, EU, and Nigerian Standard for Drinking Water Quality

permissible limits; all twelve hand dug wells sampled had Total Dissolved solid (TDS) values within the acceptable limits, et cetera.

2.4. Summary of Literature Review

This session highlights the areas of gap identified given the state of research in the conceptual theoretical and empirical frameworks. The normative principles of the concept of ethics have so far been poorly applied in discussing mining issues, as such there is a dearth of research using normative principles to assess mining impacts. More so, closely following the above is the deficiency in research in the metaethical aspect of the impact of mining. Hence, ethical evaluation of the subject of this research is a timely one to provide literature for future researchers. This stems from the established fact that the impacts of mining is indeed a metaethical issue.

Also important is the fact that of all the related literature reviewed on the empirical framework impacts of mining, non addressed the subject in relation to Ebonyi people. The indication is that there is little or no research on the impacts of mining in Ebonyi state. The present research is therefore mounted to breach such gap.

Finally, the reviewed literature under the theoretical framework, indicates that the tenets of the three environmental ethical theories namely, anthropocentrism, biocentrism and ecocentrism, adopted in this research are highly useful in breaching the gaps identified. Hence, the state of research so far discussed has further necessitated this present one which seeks to evaluate ethically, the impacts of mining in Ebonyi State, Nigeria.

CHAPTER THREE

MINING AND MINING TECHNIQUES IN EBONYI STATE

This chapter will ex-ray brief information on Ebonyi State and trace the history of mining in the state among others.

3.1 Brief Information on Ebonyi State

Historical information about Ebonyi contained in Ebonyi State Ministry of Commerce and Industry (2012) shows that Ebonyi State was created on October 1, 1996 with Abakaliki as its capital. The state was carved out of the former Abia and Enugu States. It derived its name from the Ebonyi River which is one of the major water ways that traverse the entire state linking it with Cross River and Benue River with their numerous tributaries. With a total landmass measuring approximately 5,935 square kilometers, Ebonyi State lies between the latitude 07^0 05^1N and longitude 08^0 30^1N. It is bordered on the east by Cross River State, to the North by Benue State and to the West by Enugu State, while Abia State occupies its Southern border. Its altitude is 91.44 meters above sea level. The annual mean temperature in Ebonyi State is in the range of 15^0C to 29^0C.

Administrative Areas: There are thirteen Local Government Areas (LGAs) in the State divided into three senatorial zones namely: Ebonyi North comprising Abakaliki, Ebonyi, Ishielu, Ohaukwu and Izzi LGAs; Ebonyi Central made up of Ikwo, Ezza North and Ezza South LGAs; and Ebonyi South made up of Afikpo North, Afikpo South, Ivo, Ohaozara and Onicha LGAs.

Mineralization in Ebonyi State: Ebonyi State is blessed with abundant mineral resources which are found in commercial quantities and scattered throughout the State. However, despite the confirmed abundance of these resources, they are yet to be fully and industrially exploited. On the table below are the major known mineral resources and their locations in the State.

s/no	Name	Location	Exploitation/dormancy	Utilization
1.	Brine (Sail)	1. Uburu 2. Okposi 3. Ameri 4. Amasiri 5. Idembia	Locally exploited	Refining yields native Milt, caustic soda, soda ash, sodium hypochloride, chlorine etc.
2.	Granite	1. Ishiagu (Ivo LGA) 2. Otam (Izzi LGA) 3. Inyinmagu (Izzi LGA)	Locally exploited	Chipping for road works and building construction.
3.	Lead-Zinc-Copper	Onicha. Enyigba Ameka. Ameri. Ivo, Mkpuma akwa okuku, Mkpuma Akpatakpa. Egu Umuobuna	Dormant Partly exploited	Pencils, solders, bearings, bait cries, alloys, ammunition bronze, brass, lithographic plates, galvanizing cables, conductors etc.
4.	Sands	1. Afikpo North 2.Uburu	Highly exploited locally	Motar and concrete production used

		(Ohaozara LGA) 3. Ikwo 4. Ezza 5. Ishielu		for road and building construction
5.	Limestone, Dolomite	Nkalagu, Amoffia Ngbo. Ishieke. Azuinyaba Effium, Odomoke. Okpoto, Akpoha. Ishiagu	Partially exploited	Cement making. Animal feeds, glass, construction, water treatment, tanning, chalk etc.
6.	Barites	Nwenyi-Igbeagu, Izzi, Ivo	Dormant	Drilling mud for oil companies
7.	Kaolin	1. Oziza Beach, Ndibe Beach. (Afikpo North) 2. Afikpo South 3. Ishiagu	Locally exploited	Ceramics, pharmaceuticals. Paints, detergents, rubbers, agriculture, steel.
8.	Marble Stone	Ishiagu (Ivo LGA). Ezza North-	Dormant	Building and art works

		Umuoghara		
9.	Gypsum	1. Asaga-Amtingwu Edda (Afikpo South LGA) 2. Okpoto (Ishielu LGA)	Dormant	Cement production, plastics, chalk, pharmaceuticals
10.	Fillers Earth	Unwana (Ubeyi LGA)	Dormant	Foundry, glass, abrasives, oil wells and breweries, electronics, water filtration
11.	Laterites	All parts of Ebonyi State	Partly exploited	Road construction
12.	Charcopyrites. False Gold, Uranium	1. Enyigba (Izzi LGA) 2. Ishiagu (Ivo LGA) 3. Enyigba (Izzi LGA)	Partly exploited	Ornaments, Gold plating, power generation
13.	Coal/Lignite	1. Afikpo North (Enohia, Oziza,	Partly exploited	Energy and power generation,

		Ndibe) 2. Ubeyi		batteries, pencils and make-up kits
14.	Pyrites	1. Enyigba 2. Ameri	Partly exploited	Motor brushings, vehicle parts etc
15.	Crude Oil/Gas (Suspected)	Edda (Afikpo South)	Dormant	Energy and power generation
16.	Doleritic (Pyroclastics)	Nkaliki (Abakaliki LGA)	Locally exploited	Road and building construction
17.	Copper Ore	Enyigba (Abakaliki LGA) Izzi	Locally exploited	Wires and alloys
18.	Iron Ore (Siderite)	Enyigba (Abakaliki LGA) Izzi	Locally exploited	
19.	Quartz	Abakaliki LGA, Izzi LGA. Ezza North and South	Partially exploited	Glass, diodes, scientific equipment etc.
20.	Igenous Rocks	Abakaliki. Amasiri, Ishiagu (Ivo LGA)	Fully exploited	Concrete production for building and roads
21.	Tar/Share	Ishiagu (Ivo	Partly exploited	Asphalt tar for

		LGA)		road construction
22.	Phosphates	Abakaliki-Ishielu LGA, Ori nta Eliti & Asaga-Amangwu (Afikpo South LGA)	Partly exploited	Fertilizer production and detergents

Adapted from Ebonyi State Ministry of Commerce and Industry Publication on Investment Potentials of the State During the 23rd Enugu International Trade Fair.

The vegetation of Ebonyi State is a mixture of Savannah and Semitropical forest. Ebonyi State has rich water resources confirmed by the fact that its name was derived from Ebonyi River. These natural attributes have endowed the state with enormous potential for sustainable agriculture and food security. With its favourable climatic condition as well as availability of arable land, Ebonyi State remains a force to be reckoned with in the production of both cash and food crops. As the mainstay of the state's economy, agriculture provides gainful employment for about 90 percent of Ebonyi people. With the thriving of many food and cash crops like rice, yam, cassava, groundnut, cowpea, maize, oil palm, cashew as well as citrus which are produced in commercial quantities, the state is justifiably and fondly referred to as the food basket of the South eastern zone of Nigeria.

However, due to the fact that agriculture is carried out extensively on a subsistence level, and that it is predominantly labour intensive, employing the use of such crude farming implements like machetes, cutlass and hoes among others, the sector is plagued by under utilization of resources which in itself has resulted in lower crop yield for the farmers.

The strategic location of the state is an added advantage to investors as it is located next door to the Export Processing Zone in Calabar, just across the river from Afikpo; Port-Harcourt, a Commercial Sea Port Complex; and Onitsha the Biggest market in West Africa. Its large network of fast going highways and proximity to two international and two domestic airports makes traveling fast, efficient and easy.

Demographically, Ebonyi has a vibrant annual growth rate of over 2.83% pushing its current population to over 3 million people. This population is over 60% rural with women constituting about 53%. The major religion is Christianity professed by more than 90% of the population. Culturally, the homogenous people of Ebonyi practice extended family structure. Family system is both patrilineal and matrilineal. Events and ceremonies derive value from festivals which are programmed by market days and dates. Ebonyi people are basically Igbos, speaking Igbo language with minor dialectical differences.

3.2 Mining in Ebonyi State

Mbam Darlington and Ekpe Samuel Nwangbo date earliest mining activities in Enyigba, (Abakaliki LGA) Ameka Ezza-South and Ameri as far as before colonial era. At this period the Dutch mined lead and Zinc in these communities. Apparently now at the sites are evidences like ditches, abandoned machines, heaps of overburden and make-shift buildings. These mines were not properly closed. The above sources further explain that Mkpuma Ekwaokuko mine in Ezza Inyimagu in Izzi LGA also witnessed early mining activities in the 1940s where Lead was mined underground. Quarrying (a major type of mining) is said to have begun decades before the creation of Ebonyi State in 1996.

At Ihetutu, Ishielu in Ivo L.G.A. of Ebonyi State, Elder Paulinus Okoro Said that mining of Lead/Zinc began in 1948 by an expatriate company called Amalgamated Tin Mining of Nigeria (ATMN). This company left at the heat of Nigerian Civil war abandoning the

underground mine which was not properly closed. Subsequently, C.C. Daniels overseas Ltd took over the lease, mined lead/zinc and succeeded in shipping the mined materials overseas. The company left after a misunderstanding with the community. Okwuosa Brothers & Sons Nig. Ltd took over still on the same lease, and was more of a family company. When Okwuosa died, the company collapsed as the children were no longer able to continue the business. They now leased it to Ped Magrek Nig. Ltd owned by Chukwu Ike, who mined lead/zinc, Buxite and et cetera. At the death of Chukwu Ike, Dr. Onuora, the Managing Director of Gexpam took over. After him came Henry Ahanotu, the owner of Greenfield metals Ltd. who occupies the leases till date. On the other hand, organized quarrying by a gigantic German Company, in Ishiagu called Crushed Rock began operations in 1978. Before this date, oral tradition holds that other expatriate companies had operated but also left.

Chukwu N. Ifeanyi has it that at Ihetutu village in the early 30's before the coming of expatriate mining company in 1948, the villagers mined lead using crude methods which exposed them to emissions from lead. As a result, most pregnant women gave birth to crippled children, a phenomenon that was attributed to affliction from water goddess believed to have come from the lakes formed through mine pits. With the coming of civilization and enlightenment, it was however discovered that it was not water goddess but lead emissions that afflicted them.

In 2001, Southeast Development Company started mining in Enyigba but their disagreement with the Federal and State Government made them to leave in 2003. At the moment, there are about 25 quarries operated by different companies and about 14 artisanal and large scale mines. On December 11, 2010, Ebonyi State entered into a mining lease agreement with an expatriate company, Royal salt for the exploitation of lead zinc and salt discovered in commercial quantities in Ameka Community (Ezza South), Ameri (Ikwo) and Enyigba

Communities (Abakaliki) Local Government Areas. The mine bedrock at Enyigba is about 350ft deep.

Royal Salt mining company currently mines lead/zinc at Ameri having been sacked from Ameka and Enyigba Communities for lack of due consultations with those communities. The 25 Quarries are spread across the following communities: Umuezeaka Ammofia Ngbo, Ukwagba, Ezzangbo, Umuoghara, Nkalagu, (Mkpuma Akpatakpa; Sharon; Ndieze) in Izzi Ebonyi North and Ishiagu, Amasiri, Afikpo Akpoha Ebonyi South. On the other hand, the Lead-Zinc Mines are located in these Communities: Ameri, Ohankwu, Enyim Agalegu, Alibaruhu (all in Ikwo LGA) and Ameka (Ezza South LGA). These first groups of communities are in Ebonyi Central. Others are Nkpumaekwaokuko and Ikenyi, in Izzi LGA and Enyigba in Abakaliki all in Ebonyi North. The last is Ihetutu, Ishiagu in Ebonyi South. Of the Fourteen (14) mines in the above communities only two mines in Ameri and Ishiagu are operated by mining companies- namely: Greenfield and Royal Salt, others are artisanal mines.

The maps below are topographic map of the area around the mine locations and Geologic map showing some mine locations within the study area.

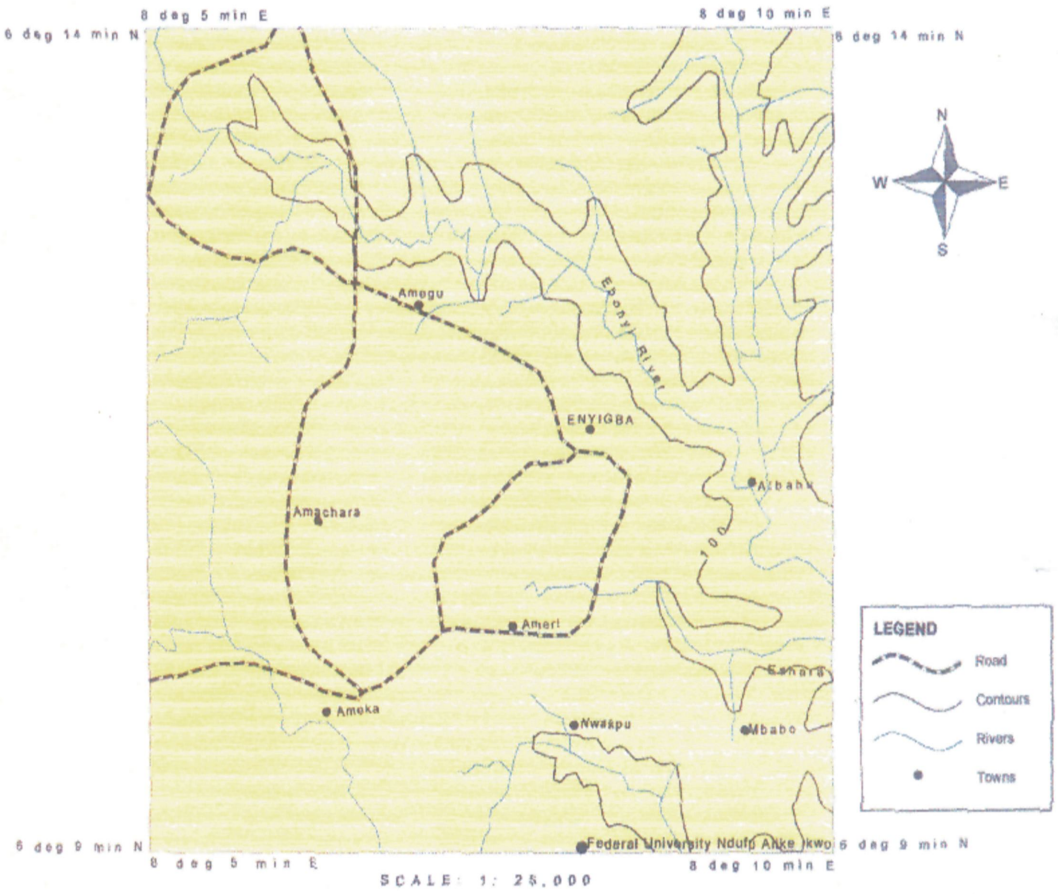

Fig 1 Topographic map of the area around the mine locations

Source: Dr. A. C. Ekwe. Department of Geology/Geophysics, Fed. University, Ndufu-Alike, Ikwo

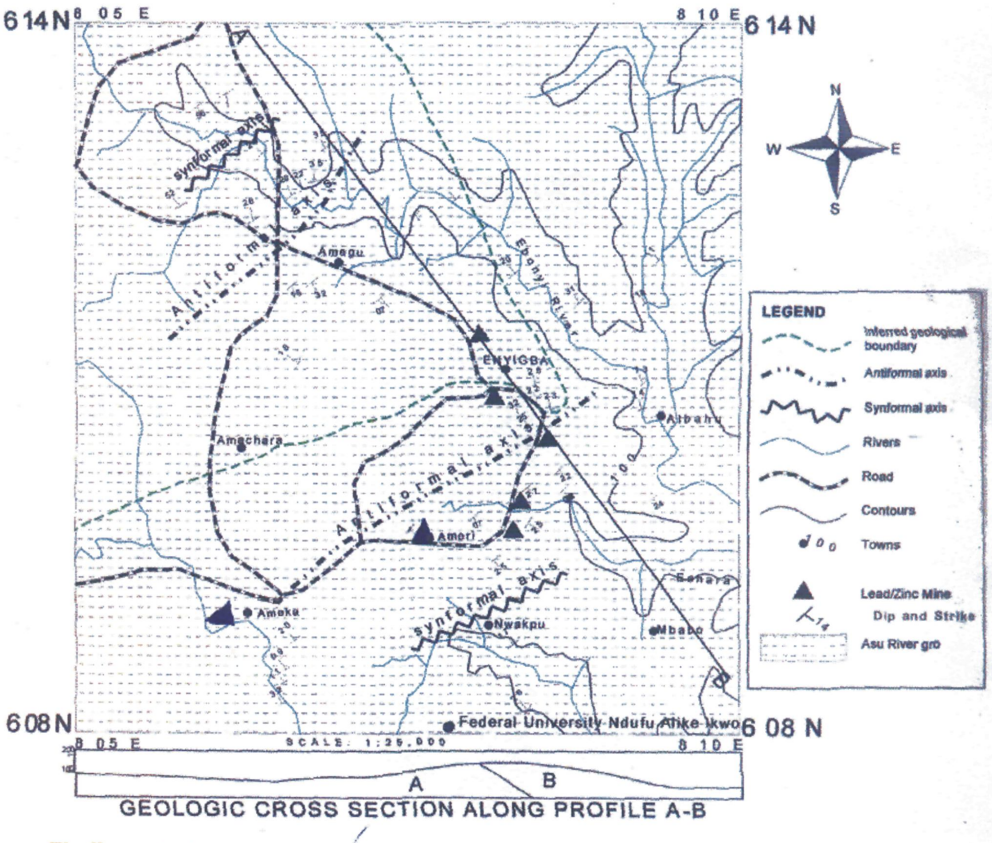

Fig II Geological map showing some mine locations within the study area

Source: Dr. A. C. Ekwe. Department of Geology/Geophysics, Fed. University, Ndufu-Alike, Ikwo

The geologic map indicates that there are three mines in Enyigba, two in Ameri and one in Ameka Communities in Abakaliki, Ezza South and Ikwo LGAs of Ebonyi North and Central Zones. The other mines not captured in the map are located in Ishiagu (Ebonyi South).

Overview of Quarry Facilities in Ebonyi State as at January, 2015

Quarry Facilities location	**No. Of Facilities That Conducted EIA Before Commencement**	**No. of facilities without EIA but paid violation**	**No. of facilities that conducted Audit**	**No. of Facilities that Applied for Permit**
North/Central	-	8	6	6
South	1	4	6	5

Total Number of Facilities (North/Central = 14) (South) = 11

Total Number of Facilities that conducted EIA before commencement (North/Central) = None

Total Number of Facilities that conducted EIA before commencement (South) = 1

Total Number of Facilities without EIA but paid violation (North/Central) = 8

Total Number of Facilities without EIA but paid violation (South) = 4

Total Number of Facilities that conducted Audit (North/Central) = 6

Total Number of Facilities that conducted Audit (South) = 6

Total Number of Facilities that applied for permit (North/Central) = 6

Total Number of Facilities that applied for permit (South) = 5

Source: *National Environmental Standards and Regulation Enforcement Agency (NESREA) Ebonyi State Office*

None of the companies mining lead and zinc has any EIA submitted to NESREA, non applied for permit and non has done auditing for the past three years.

EIA is mandated by EIA Act 1992 (Act CAP E12LFN 2004) for projects likely to have significant effects on the environment. Based on the act, a company is statutorily expected to make a submission of the envisaged impacts, a forecast of how their activities are likely to affect their host environment. It is aimed at making the company (ies) take the initial step in identifying, appreciating and forecasting the expected impacts of their operation in a locality, thereby taking responsibilities for it ab initio. In essence, the companies EIA states what steps the company will take to prevent negative impacts and to remedy those impacts that are unavoidable as well as those that may occur accidently at the course of its operation. A look back at the overview of available data on quarries in Ebonyi State shows that only one facility out of the identified 25 facilities engaging in Quarry operations in Ebonyi, stated their EIA before commencement. The interpretation of this hard truth is bewildering; its implication is that 24 other facilities plunged into exploitative quarry operation in the state without recourse to due process and minding the effect of their exploitation on the environment.

The overview of data further shows that out of the 25 facilities, only 12 that is less than half have conducted Environmental Audit mandated by NESREA 2007 to be carried out every three years by every company in Nigeria. The Auditing incorporates all stakeholders in the environmental safety business which includes environmental health experts and et cetera. It is aimed at monitoring the extent to which the facilities' operation has affected the environment, ascertaining causes of such effects and making recommendations where necessary. For 13 facilities not to have carried out environmental auditing for the past three

years further supports that exploitative quarry operations have been on-going unabated in Ebonyi.

In the same vein, the data for environmental permits which every company is to apply for, shows that only 11 facilities applied for it. Environmental permits for water/air pollution; and for biodiversity disturbances give a regulated permit to the company in its operation to discharge waste (in designated and controlled place and manner). The essence for these permits is to regulate the company's operation in those regards so as not to exceed the stipulated and allowed or permitted limit which will significantly affect the environment. The permit, experts say, is usually little or insignificantly above the original limits of waste discharge, air/water pollution and biodiversity disturbances. These permits are granted officially, bearing in mind that the companies have their EIA and Ecological Management Plan (EMP) ready to mitigate any adverse effect. In Ebonyi State, 14 facilities have not applied for permit, implying that mine wastes are indiscriminately discharged without treatment before disposal, also that air and water are heavily polluted and that biodiversity is highly disturbed.

3.3 Universal Mining Techniques

Mining in Ebonyi State replicates two of the three types of surface mining, namely open-pit mining and quarrying as well as underground mining. Hartman (1992) opines that mining techniques can be divided into two common excavation types: surface mining and sub-surface (underground) mining and further notes that at the present, surface mining is much more common and produces about 85% of minerals (excluding oil and gas) and 98% of metallic ores in the United States.

In the same vein, the New Encyclopedia Britannica (2010) like Hartman identifies two main techniques of mining viz: surface and underground mining. It further explains that "there are several types of surface mining but the three most common are open-pit mining, strip mining or open-cast mining and quarrying" (p.394). Doston and Hethmon (2011) agree with the *New Encyclopedia Britannica* (2010) cited above. They insist that there are three conventional methods of surface mining as outlined above.

Encyclopedia of Science and Technology (2012) gives a divergent view on mining techniques. It explains that:

> Mining is broadly divided into three basic methods: opencast, underground, and fluid mining. Opencast mining is done either from pits or gouged-out slopes or by surface mining which involves extraction from a series of successive parallel trenches. Dredging is type of surface mining with digging done from barges. Hydraulic mining (another type of surface mining) uses jets of water to excavate material. Underground mining involves extraction from beneath the surface, from depths as great as 10,000 ft (3km) by any of several methods. Fluid mining is extraction from natural brines, lakes, oceans, or underground waters and pumping to the surface; by melting underground materials with hot water and pumping to the surface; or by driving materials from well to well by gas drive, water or combustion (p.200).

Further away from these positions stated above, Underwood (2000) outlines four types of mining, viz; placer, hydraulic, hard rock and open-pit. According to him, placer mining involves any type of mining where raw materials are deposited in sand or gravel or any other surface and are picked up without having to drive, use dynamite or any other significant means. He mentioned panning, dredging, sluicing, using a rocker, or just picking up what lies on the ground as specific types of placer mining.

Hydraulic mining involves high pressure water. The water is sprayed at an area of rock and/or grand and the water breaks the rock up, dislodging ore and placer deposits. The water/ore mixture is then milled, whereas hard rock mining entails digging into solid rock to find minerals usually in their ore form, to get this done miners use picks and shovels, rock drills, dynamite and more. Miners dug either shafts that went straight down to follow ore bodies and veins, or tunnels; Open pit mines involves digging large open holes in the ground as opposed to a small shaft in hard rock mining.

Minerals Downunder Teacher Guide (2002) outline five types, namely: open-cut mining, strip mining, dredging, underground mining, and in situ leaching. The crux of the matter is that there are two main techniques of excavating the materials-surface and subsurface techniques whereas the various types of mining fall into any of these two categories.

3.3.1 Conventional Methods of Surface Mining Adopted in Ebonyi State

Open-pit mining: This method is adopted when mining hard or solid rock, which requires a discontinuous process of drilling and blasting prior to the loading and hauling stages. Open-pit mining is therefore employed to remove hard rock ore that is disseminated and/or located in deep seams and is typically limited to extraction by shovel and truck equipment. Some of the metals mined by open-pit method are gold, silver, diamonds, copper and so on. The operation in this method of mining is oval in shape.

Deposits mined by open-pit techniques are generally divided into horizontal layers called benches. The thickness (that is, the height) of the benches depends on the type of deposit, the mineral being mined, and the equipment being used. For large mines, it is on the order of 12 to 15 metres. Open-pit mining is generally conducted on a number of benches at any one time. The top of each bench is equivalent to a working level, and access to different levels is gained through a system of ramps. The width of a ramp depends on the equipment being

used, but typical widths are from 20 to 40 metres. Mining on a new level is begun by extending a ramp downward. This initial or drop cut is then progressively widened to form new pit bottom.

The walls of a pit have a certain slope determined by the strength of the rock mass and other factors. The stability of these walls, and even of individual benches and group of benches, is very important – particularly as the pit gets deeper. Increasing the pit slope angle by only a few degrees can decrease stripping costs tremendously or increase revenues through increase ore recovery, but it can also result in a number of slope failures on a small or large scale. Millions of tons of material may be involved in such slides. For this reason, mines have ongoing slope stability programs involving the collection and analysis of structural data, hydrogeologic information, and operational practices (blasting in particular), so that the best slope designs many be achieved. It is not unusual for five or more different slope angles to be involved in one large pit. As a pit is deepened, more and more waste rock must be stripped away in order to uncover the ore. Eventually there comes a point where the revenue from the exposed ore is less than the costs involved in its recovery. Mining then ceases. The ratio of the amount of waste rock stripped to ore removed is called the overall stripping ratio. The break –even stripping ratio is a function of ore value and the costs involved.

Quarrying: it is a term used to describe specialized open-pit mining techniques wherein solid rock with a high degree of consolidation and density is extracted from localized deposits. Quarried materials are either crushed and broken to produce aggregate or building stone, such as dolomite and limestone, or combined with other chemicals to produce cement and lime. Dimension stone such as flagstone, granite, limestone, marble, sandstone and slate represent a second class of quarried materials.

Although seldom used to form entire structure, stone is greatly valued for its aesthetic appeal, durability, and ease of maintenance. The most popular types include granite/ limestone, sandstone, marble, slate, gneiss, and serpentine. All natural stone used for structural support, curtain walls, veneer, floor tile, roofing, or strictly ornamental purpose is called building stone, and building stone that has been cut and finished for predetermined uses in building construction and monuments is known as dimension stone. The characteristics required of good dimension stone are uniformity of texture and colour, freedom from flaws, suitability for polishing and carving, and resistance to weathering.

Pit geometry: although quarrying is also done underground, using room-and-pillar techniques, most quarries involve the removal of blocks from hillsides or from an open-pit type of geometry. The first in developing such a quarry is the removal of the vegetative cover of trees and underbrush. Next, the overburden of topsoil and subsoil is removed and stockpiled for future reclamation.

The rock is quarried in a series of benches or slices corresponding to the thickness of the desired blocks. This is often on the order of 4.5 to 6 metres, but, since it is actual quarry practice to take advantage of any natural horizontal seams, block thickness may vary.

The quarrying process consists of separating large blocks, sometimes called loafs, from the surrounding rock. These blocks may be 6 metres high by 6 metres deep and 12 to 18 metres long, and they may weigh in the range of 1,200 to 2,000 tons. (Such large blocks are subsequently divided into mill blocks weighing 15 to 70 tons). The removal of blocks from the quarry has traditionally been done by one or more fixed derricks. As a result the plan area of a quarry has been determined not only by the geometry of the deposit and the amount of overburden but also by the reach of the derrick boom. However, derricks are gradually being replaced by highly mobile front-end loaders of sufficient capacity to remove, lift and carry

30-ton mill blocks, and the layout, design, and operating procedures of quarries are being modified accordingly.

There is a very high waste factor in the quarrying of dimension stone. For some quarries, the amount of usable stone is only 15 to 20 percent of that quarried. For this reason, an important aspect of quarry planning is the location of the waste or “grout” pile.

Strip Mining (open-cast mining): Strip mining or open-cast methods is applied in processing non-hard rock deposit and refers to extraction of ore bodies that are near the surface and relatively flat or tabular in nature and mineral seams. Unlike open-pit mining, strip mining or loose rock mining process is essentially with extraction and haulage steps running in series. It uses a variety of different types of equipment including shovels, trucks, drag lines, bucket wheel excavators and scrapers. Coal is the most common commodity that is strip mined from seams. The primary differences between these mining methods are the location of the ore body and the mode of mechanical extraction.

In strip mining a long narrow strip of mineral is uncovered by a dragline, large shovel, or similar type of excavator. After the mineral has been removed, an adjacent strip is uncovered and its overlying waste material deposited in the excavation of the first strip. Strip Mining method is scarcely adopted in Ebonyi State as all the mines visited are Open-pit and Quarries.

3.3.2 Production Process and Equipment in Surface Mining

Doston and Hethmon (2011) explain the following production process and equipment in surface mining**:**

a. **Drilling and Blasting:** Mechanical drilling and blasting are the first steps in extracting ore from most developed open-pit mines and are the most common method used to remove hard rock overburden. While there are many mechanical devices

capable of loosening hard rocks, explosives are the preferred method as no mechanical device can currently match the fracturing capability of energy contained in explosive charges. A commonly used hard rock explosive is ammonium nitrate. Drilling equipments is selected on the basis of the nature of the ore and the speed and depth of the holes necessary to fracture as specified tonnage of ore per day. For example, in mining a 15-m bench of ore, 60 or more holes will generally be drilled 15 m back from the current muck face depending on the length of the bench to be mined. This must occur with enough lead-time to allow for site preparation for subsequent loading and haulage activities.

b. **Loading:** Surface mining is now typically conducted utilizing table shovels, font-end loaders or hydraulic shovels. In open-pit mining loading equipment is matched with haul trucks that can be loading in three to five cycles or passes of the shovels; however, various factors determine the preference of loading equipment. With sharp rock and/or hard digging and/or wet climates, tracked shovels are preferable. Conversely, rubber-tyred loaders have much lower capital cost and are preferred for loading material that is low volume and easy to dig. Additionally, loaders are very mobile well-suited for mining scenarios requiring rapid movements from one area to another or for ore blending requirements. Loaders are also frequently used to load, haul and dump materials into crushers from blending stock piles deposited near crushers by haul trucks.

   Hydraulic shovels and cable shovels have similar advantages and limitations. Hydraulic shovels are not preferred for digging hard rock and cable shovels are generally available in larger sizes. Therefore, large cable shovels with payloads of about 50 cubic metres and greater are the preferred equipment at mines were production exceeds 200,000 tonnes per day. Hydraulic shovels are more versatile on the mine face and allow greater operator control to selectively load the ore from either

the bottom or top half of the mine face. This advantage is helpful where separation of waste from ore can be achieved at the loading zone thereby maximizing the ore grade that is hauled and processed.

c. **Hauling:** Haulage in open-pit and strip mines is most commonly accomplished by haul trucks. The role of haul trucks in many surface mines is restricted to cycling between the loading zone and the transfer point such as an in-pit crushing station or conveyance system. Haul trucks are favoured based on their flexibility of operation relative to railroads, which were the preferred haulage methods until the 1960s. However, the cost of transporting materials in surface metal and non-metal pits is generally greater than 50% of the total operating cost of the mine. In-pit crushing and conveying through belt conveyor system has been a primary factor in reducing haulage costs. Technical developments in haul trucks such as diesel engines and electrical drives have lead to much larger capacity vehicles. Several manufactures currently produce 240 tonne capacity trucks with expectation for greater than 310 tonne capacity trucks in the near future. In addition, the use of computerized dispatch systems and global satellite positioning technology allow vehicles to be tracked and scheduled with improved efficiency and productivity. Haul road system may use single or dual direction traffics. Traffic may be either left or right lane configuration. Left lane traffic is frequently preferred to improve operator visibility of tyre position on very large trucks. Safety is also improved with left hand traffic by typically limited to between 8 and 15% for sustained hauls and optimally are about 7 to 8%. Safety and water drainage requires long gradients to include at least 45-m sections with a maximum gradient of 2% for every 460 m of severe gradient. Road berms (elevated dirt borders) located between roads and adjacent excavations are standard safety features in surface mines. They may also be placed in the middle of the road to separate opposing traffic. Where switch-back haul roads exist, increasing elevation

escape lanes many be installed at the end of long steep grades. Road edge barrier such as berms are standard and should be located between all roads and adjacent excavations. High-quality roads enhance maximum productivity by maximizing safe truck speeds, reduced down-time for maintenance and reduced fuel consumption, longer tyre life and reduced repair costs. Rail haulage, under the best of conditions, is superior to other methods of haulage for transport of ore over long distance outside the mine. However, as a practical matter, rail haulage is no longer widely used in open-pit mining since the advent of electrical and diesel-powered trucks. Rail haulage was replaced to capitalize on the greater versatility and flexibility of haul trucks and in-pit conveyor systems. Railroads required very gentle grades of 0.5 to a maximum of 3% for up-hill hauls. Capital investment for railroad engines and track requirements is very high and requires a long mine life and large production outputs to justify return on investment.

d. **Ore handling (conveyance):** In-pit crushing and conveying is a methodology that has grown in popularity since first being implemented in the mid- 1950s. Location of a semi-mobile crusher in the mine pit with the subsequent transport out of the pit by a conveyor system has resulted in significant production advantages and cost savings over traditional vehicle haulage. High cost haulage road construction and maintenance and fuel are minimized. The purpose of the in-pit crusher system is primary to allow transport of ore by conveyor. In-pit crusher system may range from permanent facilities to fully mobile units. However, more commonly, crushers are constructed in a modular form to allow some portability within the mine. Crusher might be relocated everyone to ten years; it may require hours, days or months to complete the move depending on the size and complexity of the unit the relocation distance. Conveyors' advantages over haul trucks include instantaneous start up, automatic and continuous operation and high degree of reliability with up 90 to 95% availability. They are

generally not impaired by inclement weather. Conveyors also have much lower labour requirement relative to haul trucks; operating and maintaining a truck fleet may require ten times as many crew members as an equivalent-capacity conveyor system. Also, conveyors can operate at grades up to 30% while maximum grades for trucks are generally 10%. Using steeper grades lowers the need to remove low-grade overburden material and may reduce the need to establish high cost haulage roads. Conveyors systems are also integrated into bucket wheel shovels in many surface coal operations, which eliminate the need for haulage trucks (pp. 3-5).

3.4 Underground Mining Techniques

Hamrin (2011) explains that the choice of mining methods is influenced by the shape and size of the ore deposit, the value of the contained minerals, the composition, stability and strength of the rock mass and the demands for production output and safe working conditions (which sometimes are in conflict). While mining methods have been evolving since antiquity, this article focuses on those used in semi-to fully-mechanized mines during the late twentieth century. Each mine is unique, but they all share the goals of a safe workplace and a profitable business operation.

3.4.1 Flat room-and-pillar mining

Room-and-pillar mining is applicable to tabular mineralization with horizontal to moderate dip at an angle not exceeding 20^{o} . The deposits are often of sedimentary origin and the rock is often in both hanging wall and mineralization in competent (a relative concept here as miners have the option to install rock bolts to reinforce the roof where its stability is in doubt). Room-and-pillar is one of the principal underground coal-mining methods.

Room-and-pillar extracts an ore body by horizontal drilling advancing along a multi-faced front, forming empty rooms behind the producing front. Pillars, sections of rock, are left between the rooms to keep the roof from caving. The usual result is a regular pattern of rooms and pillars, their relative size representing a compromise between maintaining the stability of the rock mass and extracting as much of the ore as possible. This involves careful analysis of the strength of the pillars the roof strata span capacity and other factors. Rock bolts are commonly used to increase the strength of the rock in the pillars. The mined-out stops serve as roadways for trucks transporting the ore to the mine's storage bin.

The room-and-pillar stope face is drilled and blasted as in drifting. The stope width and height correspond to the size of the drift, which can be quite large. Large productive drill jumbos are used in normal height mines; compact rigs are used where the ore is less than 3.0m thick. The thick ore body is mined in steps starting from the top so that the roof can be secured at a height convenient for the miners. The section below is recovered in horizontal slices, by drilling flat holes and blasting against the space above. The ore is loaded onto trucks at the face. Normally, regular front-end loaders and dump trucks are used. For the low-height mine, special mine trucks and LHD vehicles are available. Room-and-pillar is an efficient mining method. Safety depends on the height of the open rooms and ground control standards. The main risks are accidents caused by falling rock and moving equipment.

3.4.2 Inclined room-and-pillar mining

Inclined room-and-pillar applies to tabular mineralization with an angle or dip from 15^{o} and 30^{o} to the horizontal. This is too steep an angle for rubber-tyred vehicles to climb and too flat for a gravity assist rocks flow.

The traditional approach to the inclined ore body relies on manual labour. The miners drill blast holes in the stopes with hand-held rock drills. The stope is cleaned with slushier scrapers.

The inclined stope is a difficult place to work. The miners have to climb the steep piles of blasted rock carrying with them their rock drills and the drage slushier pulley and steel wires. In addition to rock falls and accidents, there are the hazards of noise, dust, inadequate ventilation and heat.

Where the inclined ore deposits are adaptable to mechanization, “step-room mining” is used. This is based on converting the “difficult dip” footwall into a “staircase” with steps at an angle convenient for trackless machines. The steps are produced by a diamond pattern of stopes and haulage-ways at the selected angle across the ore body.

Ore extraction starts with horizontal stope drivers, branching out from a combined access-haulage drift. The initials stope is horizontal and follows the hanging wall. The next stope starts at short distance further down and follows the same route. This procedure is repeated moving downward to create a series of steps to extract the ore body.

Sections of the mineralization are left to support the hanging wall. This is done by mining two or three adjacent stope drives to the full length and then starting the next stope drive one step down, leaving an elongated pillar between them. Section of this pillar can later be recovered as cut-outs that are drilled and blasted from the stope below.

Modern trackless equipment adapts well tom step-room mining. The stoping can be fully mechanized, using standard mobile equipment. The blasted ore is gathered in the stopes by the LHD vehicles and transferred to mine truck loading, the trucks can filled in special loading bays excavated in the haulage drive.

3.4.3 Shrinkage stoping

Shrinkage stoping may be termed a “classic” mining method, having been perhaps the most popular mining method for most of the past century. It has largely been replaced by mechanized methods but is still used in many small mines around the world. It is applicable to mineral deposits with regular boundaries and steep dip hosted in a competent rock mass. Also, the blasted ore must not be affected by storage in the slopes (e.g., sulphide ores have a tendency to oxidize and decompose when exposed to air).

It most prominent feature is the use of gravity flow for ore handling: ore from stopes drops directly into rail cars via chutes obviating manual loading, traditionally the most common and least liked job in mining. Until the appearance of the pneumatic rocker shovel in the 1950s, there was no machine suitable for loading rock in underground mines.

Shrinkage stoping extracts the ore in horizontal slices, starting at the stope bottoms and advancing upwards. Most of the blasted rock remains in the stope providing a working platform for the miner drilling holes in the roof and serving to keep the stope walls stable. As blasting increase the volume of the rock by about 60%, some 40% of the ore is drawn at the bottom during stoping in order to maintain a work space between the top of the muckpile and the roof. The remaining ore is drawn after blasting has reached the upper limit of the stope.

The necessity of working from the top of the muckpile and the raise-ladder access prevents the use of mechanized equipment in the stope. Only equipment light enough for the miner to handle alone may be used. The air-led and rock drill, with a combined weight of 45 kg, is the usual tool for drilling the shrinkage stope. Standing on top of the muckpile, the miner picks up the drill/feed, anchors the leg, braces the rock drill/drill steel against the roof and starts drilling; it is not easy work.

3.4.4 Cut-and-fill mining

Cut-and-fill mining is suitable for a steeply dipping mineral deposit contained in a rock mass with good to moderate stability. It removes the ore in horizontal slices starting from a bottom cut and advances upwards, allowing the stope boundaries to be adjusted to follow irregular mineralization. This permits high-grade section to be mined selectively, leaving low-grade ore in place.

After the stope is mucked clean, the mined out space is backfilled to form a working platform when the next slice is mined and to add stability to stope walls.

Development for cut-and-fill mining in a trackless environment includes a footwall haulage drive along the ore body at the main level, undercut of the stope provided with drains for the hydraulic backfill, a spiral ramp excavated in the footwall with access turn-outs to the stopes and a raise from the stope to the level above for ventilation and fill transport.

Overhand stoping is used with cut-and-fill, with both dry rock and hydraulic sand as backfill material. Overhand means that the ore is drilled from below by blasting a slice 3.0 m to 4.0 m thick. This allows the complete stope area to be drilled and the blasting of the full stope without interruptions. The “uppers” holes are drilled with simple wagon drills.

Up-hole drilling and blasting leaves a rough rock surface for the roof; after mucking out, its height will be about 7.0 m. Before miners are allowed to enter the area, the roof must be secured by trimming the roof contours with smooth-blasting and subsequent scaling of the loose rock. This is done by miners using hand-held rock drills working from the muckpile. In front stoping, trackless equipment is used for ore production. Sand tailings are used for backfill and distributed in the underground stopes via plastic pipes. The stopes are filled almost completely, creating a surface sufficiently hard to be traversed by rubber-tyred equipment. The stope production is completely mechanized with drifting jumbos and LHD

vehicles. The stope face is a 5.0 m vertical wall across the stope with a 0.5 m open slot beneath it. Five-meter-long horizontal holes are drilled in the face and ore is blasted against the open bottoms slot.

The tonnage produced by a single blast depends on the face area and does not compare to that yielded by the overhand stope blast. However, the output of trackless equipment is vastly superior to the manual method, while roof control can be accomplished by the drill jumbo which drills smooth-blast holes together with the stope blast. Fitted with an oversize bucket and large tyre, the LHD vehicle, a versatile tool for mucking and transport, travels easily on the fill surface. In a double face stope, the drill jumbo engages it on one side while the LHD handles the muckpile at the other end, providing efficient use of the equipment and production output.

Sublevel stoping removes ore in open stopes. Backfill of stopes with consolidated fill after the mining allows the miners to return at a later time to recover the pillar between the stopes, enabling a very high recovery rate of the mineral deposit.

Development for sublevel stoping is extensive and complex. The ore body is divided into sections with a vertical height of about 100 m in which sublevels are prepared and connected via an inclined ramp. The ore body section are further divided laterally in alternating stopes and pillars and a mail haulage drive is created in the footwall, at the bottom, with cut-outs for draw point loading. When mined out, the sublevel stope will be a rectangular opening across the ore body. The bottom of the stope is V-shape to funnel the blasted material into the draw-points. Drilling drifts for the long-hole rig are prepared on the upper sublevels. Blasting requires space for the rock to expand in volume. This is accomplished by enlarging a raise from the bottom to the top of the stope to a full slot. After opening the slot, the long-hole rig begins production drilling on sublevel drifts following precisely a detailed plan designed by blasting experts which specifies all the blast holes, the collaring position, depth and direction

of holes. The drill rig continues drilling until all the rings on one level are completed. It is then transferred to the next sublevel to continue drilling. Meanwhile the holes are charged and a blasted ore drops to the stope bottom to be recovered by the LHD vehicles mucking in the draw-point beneath the stope. Normally, the long-hole drilling stays ahead of the charging and blasting providing a reserve of ready-to-blast ore, thus making for an efficient production schedule. Sublevel stoping is a productive mining method. Efficiency is enhanced by the ability to use fully mechanized productive rigs for the long-hole drilling plus the fact that the rig can be used continuously. It is also relatively safe because doing the drilling inside sublevel drifts and mucking through draw-points eliminates exposure to potential rock falls.

3.4.5 Vertical Crater Retreat Mining

Like sublevel stoping and shrinkage stoping, vertical crater retreat (VCR) mining is applicable to mineralization in steeply dipping strata. However, it uses a different blasting technique breaking the rock with heavy, concentrated charge placed in holes (“crater”) with very large diameter (about 165 mm) about 3 m away from a free rock surface. Blasting breaks a cone-shaped opening in the rock mass around the hole and allows the blasted material to remain in the stope during the production phase so that the rock fill can assist in supporting the stope walls. The need for rock stability is less than in sublevel stoping. The development for VCR mining is similar to that for sublevel stoping except for requiring both over-cut and under-cut excavations. The over-cut is needed in the first stage to accommodate the rig drilling the large-diameter blast holes and for access for a LHD vehicle (operated by remote control with the operator remaining outside the stope) to recover the blasting ore from the draw-points beneath the stope. The usual VCR blast uses hole in a 4.0 x 4.0 m pattern directed vertically or steeply inclined with charges carefully placed at calculated distances to free the surface beneath. The charges cooperate to break off a horizontal ore slice about 3.0 m

thick. The blasted rock falls into the stope underneath. By controlling the rate of mucking out, the stope remains partly filled so that the rock fill assists in stabilizing the stope walls during the production phase. The last blast breaks the over-cut into the stope, after which the stope is mucked clean and prepared for back filling. VCR mines often use am system of primary and secondary stopes to the ore body. Primary stopes are mined in the first stage, then backfill with cemented fill. The stope is left for the fill to consolidate. Miners then return and recover the ore in the pillars between the primary stope, the secondary stopes. This system in combination with the cemented backfill results in close to a 100% recovery of the ore reserves.

3.4.6 Sublevel Caving

Sublevel caving is applicable to mineral deposit with steep to moderate dip and large extension at depth. The ore must fracture into manageable block with blasting. The hanging wall will cave following the ore extraction and the ground on the surface above the ore body will subside. (It must be barricade to prevent any individuals from entering the area.)

Sublevel caving is based on gravity flow inside a broken-up rock mass containing both ore and rock. The rock mass is fractured by drilling and blasting and then mucked out through drift headings underneath the rock mass cave. It qualifies as a safe mining method because the miners always work inside drift-size openings.

Sublevel caving depends on sublevels with regular patterns of drifts prepared inside the ore body at rather close vertical spacing (from 10.0m to 20 0m). The drift layout is the same on each sublevel. (i.e., parallel drives across the ore body from the footwall transport drive to the hanging wall) but the patterns on each sublevel are slightly off-set so that the drifts on a lower level are located between the drifts on the sublevel above it. A cross section will show

a diamond pattern with drift in regular vertical and horizontal spacing. Thus, development for sublevel caving is extensive. Drift excavation, however, is a straightforward task which can readily be mechanized. Working on multiple drift headings on several sublevels favours high utilization of the equipment.

When the development of the sublevel is completed, the long –hole drill rig moves in to drill a blast holes in a fan-spread pattern in the rock above. When all of the blast holes are ready, the long-hole drill rig is moved to the sublevel below.

The long-hole blast fractures the rock mass above the sublevel drift, initiating a cave that starts at the hanging wall contact and retreats toward the footwall following a straight front across the ore body on the sublevel. A vertical section would show a staircase where each upper sublevels is one step ahead of the sublevel below.

The blast fills the sublevel front with a mix of ore and waste. When the LHD vehicles arrive, the cave contains 100% ore. As loading continues, the proportion of waste rock will gradually increase until the operator decides that the waste dilution is too high and stops loading. As the loader moves to the next drift to continue mucking, the blaster enters to prepare the next ring of holes for blasting.

Mucking out on sublevels is an ideal application for the LHD vehicle. Available in different sizes to meet particular situations, it fills the bucket, travels some 200m, empties the bucket into the ore pass and returns for another load.

Sublevel caving features a schematic layout with repetitive work procedures (development drifting, long-hole drilling, charging and blasting, loading and transport) that are carried out independently. This allows the procedures to move continuously from one sublevel to another, allowing for the most efficient use of work crews and equipment. In effect the mine is analogous to a departmentalized factory. Sublevel mining, however, being less selective

than other methods, does not yield particularly efficient extraction rates. The cave includes some 20 to 40% of waste with a loss of ore that ranges from 15 to 25%.

3.4.7 Blocking-caving

Blocking –caving is a large-scale method applicable to mineralization on the order of 100million tones in all directions contained in rock masses amenable to caving (i.e., with internal stresses which, after removal of the supporting elements in the rock mass, assist the fracturing of the mined block). An annual output ranging from 10 to 30 million tonnes is the anticipated yield. These requirements limit block-caving to a few specific mineral deposits. Worldwide, there are block-caving mines exploiting deposits containing copper, iron, molybdenum, and diamonds.

Block refers to the mining layout. The ore body is divided into large sections, blocks, each containing a tonnage sufficient for many years of production. The caving is induces by removing the supporting strength of the rock mass directly underneath the block by means of undercut, a 15m high section of rock fractured by long-hole drilling and blasting. Stresses created by natural tectonic forces of considerable magnitude, similar to those causing continental movements, create cracks in the rock mass, breaking the blocks, hopefully to pass draw-point openings in the mine. Nature, though, often needs the assistance of miners to handle oversize boulders.

Preparation for block-caving requires long-range planning and extensive initial development involving a complex system of excavation beneath the block. These vary with the site; they generally include undercut, draw-bells, grizzlies for control of oversize rock and ore passes that funnel the ore into train loading.

Draw-bells are conical openings excavated underneath the undercut which gather ore from a large area and funnel it into the draw point at the production level below. Here the ore is recovered in LHD vehicles and transferred to ore passes.

Boulders too large for the buckets are blasted in draw-point while smaller ones are dealt with grizzly. Grizzlies sets of parallel bars for screening coarse material, are commonly used in block-caving mines although, increasingly hydraulic breakers are being preferred.

Openings in a block-caving mine are subject to high pressure. Drifts and other openings, therefore, are excavated with the smallest suppose section. Nevertheless, extensive rock bolting and concrete lining is required to keep the openings intact.

Properly applied, block-caving is a low-cost, productive mass mining method. However, the amenability of a rock mass to caving is not always predictable. Also, the comprehensive development that is required result in a long lead-time before the mine starts producing: the delay in earnings can have a negative influence on the financial projections used to justify the investment.

3.4.8 Longwall Minning

Longwall mining is applicable to bedded deposits of uniform shape, limited thickness and large horizontal extension (e.g., a coal seam, a potash layer or the reef, the bed of quartz pebbles exploited by gold mines in South Africa). It is one of the main methods for mining coal. It recovers the mineral in slices along a straight line that are repeated to recover materials over a large area**.** The space closest to the face is kept open while the hanging wall is allowed to collapse at a safe distance behind the miners and their equipment.

Preparation for Longwall mining involves the network of drifts required for access to the mining area and transport of the mined product to the shaft. Since the mineralization is in the

form of a sheet that extends over a wide area, the drifts can usually be arranged in a schematic network pattern. The haulage drifts are prepared in the seam itself. The distance between two adjacent haulage drifts determines the length of the Longwall face.

3.4.9 Backfilling

Backfilling of mine stopes prevents rock from collapsing. It preserves the inherent stability of the rock mass which promotes safety and allows more complete extraction of the desired ore. Backfilling is traditionally used with cut-and-fill but it is also common with sublevel stoping and VCR mining.

Traditionally, miners have dumped waste rock from development in empty stopes instead of hauling it to the surface. F**o**r example, in cut-and-fill, waste rock is distributed over the empty stope by scrapers or bulldozers.

Hydraulic backfilling uses tailing from the mine's dressing plant which are distributed underground through bore holes and plastic tubing. The tailings are first de-slimed, only the coarse fraction being used for filling. The fill is a mix of sand and water, about 65% of which is solid matter. By mixing cement into the last pour, the fill's surface will harden into a smooth roadbed for rubber-tyred equipment.

Backfilling is also used with sublevel stoping and VCR mining, with crushed rock introduction as a complement to sand fill. The crushed and screened rock, production in a nearby quarry, is delivered underground through special backfill raises where it is loaded on trucks and delivered to the stopes where it is dumped into special fill raises. Primary stopes are backfill with cemented rock fill produced by spraying a cement-fly ash slurry on the rock fill before it is distributed to the stopes. The cemented rock fill hardens into a solid mass forming an artificial pillar for mining the secondary stope. The cement slurry is generally not

required when secondary stopes are backfilled, except for the last pours to establish a firm mucking floor (pp. 7-16).

3.5 Equipment for Underground Mining.

Underground mining is becoming increasingly mechanized wherever circumstances permit. The rubber – tyred, diesel-powered, four-wheel traction, articulated steer carrier is common to all mobile underground machines.

3.5.1 Face Drill Jumbo for Development Drilling

This is an indispensable workhorse in mines that is used for all rock excavation work. It carries one or two booms with booms with hydraulic rock drills. With one worker at the control panel, it will complete a pattern of 60 blast holes 4.0m deep in a few hours.

3.5.2 Long- Hole Production Drill Rig

Drills blast holes in a radial spread around the drift which cover a large area of rock and break off large volumes of ore. It is used with sublevel stoping, sublevel caving, blocking-caving and VCR mining. With a powerful hydraulic rock drill and carousal storage for extension rods, the operator uses remote controls to perform rock drilling from a safe position.

3.5.3 Charging Truck

The charging truck is a necessary complement to drifting jumbo, the carrier mounts a hydraulic service platform, a pressurized ANFO explosive container and a charging hose that permit the operator to fill blast holes all over the face in a very short time. At the same time, NONEL denators may be inserted for the correct timing of the individual blasts.

3.5.4 LHD Vehicle

The versatile load-haul-dump vehicle is used for a variety of services including ore production and materials handling. It is available in a choice of sizes allowing miners to select the model most appropriate for each task and each situation. Unlike the other diesel vehicles used in mines, the LHD vehicle engine is generally run continuously at full power for long period of time generating large volumes of smoke and exhaust fumes. A ventilation system capable of diluting and exhausting these fumes is essential to comply with acceptable breathing standards in the loading area.

3.5.5 Underground haulage

The ore recovered in stope spread along an ore body is transported to an ore dump located close to the hoisting shaft. Special haulage levels are prepared for longer lateral transfer; they commonly feature rail track installations with trains for ore transport. Rail has proved to be an efficient transport system carrying larger volumes for longer distances with electric locomotives that do not contaminate the underground atmosphere like diesel-powered trucks used in trackless mines.

3.5.6 Ore handling

On its route from the stopes to the hoisting shaft, the ore passes several stations with a variety of materials-handling techniques. The slushier uses a scraper bucket to draw ore from the stope to the ore pass. It is equipped with rotating drums, wires and pulleys, arranged to produce a back and forth scraper route. The slushier does not need preparation of the stope flooring and can draw ore from a rough muckpile.

The LHD vehicle, diesel powered and travelling on rubber tyres, takes the volume held in its bucket (sizes vary) from the muckpile to the ore pass. The ore pass is a vertical or steeply inclined opening through which rock flows by gravity from upper to lower levels. Ore passes

are sometimes arranged in a vertical sequence to collect ore from upper levels to a common delivery point on the haulage level.

The chute is the gate located at the bottom of the ore pass. Ore passes normally end in rock close to the haulage drift so that, when the chute is opened, the ore can flow to fill cars on the track beneath it.

Close to the shaft, the ore trains pass a dump station where the load may be dropped into a storage bin, a grizzly at the dump station stops oversized from falling into the bin. These boulders are split by blasting or hydraulic hammers; a coarse crusher may be installed below the grizzly for further size control. Under the storage bin is a measure pocket which automatically verifies that the load's volume and weight do not exceed the capacities of the skip and the hoist. When an empty skip, a container for vertical travel, arrivers at the filling station, a chute opens in the bottom of the measure pocket filling the skip with a proper load. After the hoist lofts the loaded skip to the head frame on the surface, a chute opens to discharge the load into the surface storage bin. Skip hoisting can be automatically operated using closed-circuit television to monitor the process.

CHAPTER FOUR

IMPACTS OF MINING IN EBONYI STATE

This chapter will consider the economic, environmental and health impacts, and Scio-political impacts of mining in Ebonyi State. It will also examine the National Mining/Quarrying Regulations that implicate the impacts of mining in Ebonyi State as well as discuss the factors responsible for the negative impacts of mining in the state.

4.1 Economic Impacts, Educational Support and Community Development

Jennings (2011) states an obvious fact that minerals and mineral products are the backbone of most industries. Some form of mining or quarrying is carried out in virtually every country in the world and has important economic, environmental, labour and social effects – both in the countries or regions where it is carried out and beyond. For many developing countries, mining accounts for a significant proportion of GDP and often for the bulk of foreign exchange earnings and foreign investment. For example, in Nigeria, the discovery of blue diamond and other precious stones in the remote village of Mayosina, Mambilla Plateu in Nguroje Sardauna of Taraba State in January 2014 has changed the jungle to densely populated settlement with an average population of over 200,000 persons. It is now a source of rich employment and livelihood for artisanal miners made up of Nigerians and Foreigners from neighbouring West African Countries like Niger, Cameroun, Ghana, Chad, Ivory Coast, Togo, Benin Republic and Senegal. These make huge sums of money from buyers who are readily available from different parts of the world. The above story holds true in Ebonyi where artisanal miners get paid a minimum of N8, 000- N9, 000 per fifty kilogram of pure lead, whereas 50kg of lead with impurities is sold between N4000-5000. It was discovered that different groups in mining communities owned their pits. A pit owned by an artisanal miner employs about 30 women and 37 men.

There is no gain saying that artisanal miners make a lot of money from lead mining in the State. From the proceeds, they send their children to school and solve other domestic problems. At Ishiagu where the crushed Rock Company is situated it is a beehive of business activities 90% of the haul trucks are owned by the villagers who make huge sums of money from it. It was observed that very beautiful houses – bungalows and Duplexes in the communities in Ishiagu were owned by men and women who have one business or the other to do with crushed rock company Ltd. The State Government on its part derives revenues from levies on business permit, tolls for haulage and other proceeds from about 30 companies involved in quarrying and mining in the state. This has served as a boost to the state's Internally Generated Revenue (IGR). Apart from the IGR that accrues to the state from the operations of these companies, other revenues are paid to Ministry of Solid Minerals, Federal Inland Revenue in addition to Ministry of Commerce and Industry. The companies on the other hand, provide employment for youths helping to reduce unemployment in the state and its attendant effect of high crime wave.

Additionally, these companies from inception enter into a memorandum of understanding with their host communities in which some developmental roles of the companies towards the communities are agreed. The Ministry of Commerce and Industry in the state monitor the companies and their operations mainly to ascertain the companies' level of compliance to the MOU in their host communities and to make sure that government revenues are collected from them. These MOU range from scholarship schemes to construction of roads, hospitals, class room/hostel blocks, and so on. For example Heninghorfen Primary school at Amaokue was built by Crushed Rock. These areas outlined above mirror positive impacts of mining in Ebonyi State.

However, the negative impacts of mining in Ebonyi State apparently outweigh its positive impacts. Mining in the state has brought about Loss of biodiversity; Acid mine drainage;

effluent emission and contamination; Soil/Gully erosion; fugitive Dust emission; Noise Pollution; Blasting effects; and Colossal health hazards among others.

4.2 Environmental and Health Impacts

In the course of large scale quarrying and metallic ore mining in Ebonyi State, natural vegetation for wild life is being destroyed as a result of excavation activities which remove vegetation, topsoil and displace fauna. Wildlife referred herein are all plants and animals (and or organisms) that are not domesticated. Survival of these species depends on the soil which is often disturbed in the process of removing overburden. In Izzi forests beside Ebonyi River the forest was a habitat for lions, pythons and other wild life, before the exploration/exploitation of Lead/Zinc in the early 1940s. Today, those species of wild life have gone extinct as there were no re-vegetation and mine reclamation plans by the early miners. More so, this scenario plays out in these areas of mining and quarrying because they are mostly done in forest areas with hills, valleys and rivers, that initially served as natural habitat to animals and organisms.

Apart from displacement of flora and fauna, Deacon Njoku Iheanyi (Operation Manager Crushed Rock Ishiagu) confirmed that natural sources of water most times are closed, because of the effect of mining/quarrying operations on the hydrogeology of the areas. For example he said that the springs that served Amaokue, Ngwogwo and Okue communities had to be closed because of the operation of Crushed Rock Company Ltd. the Company however provided an alternative source of water for the Communities.

Acid Mine Drainage (AMD): Hardrock mining or metallic ore mining exposes rocks that have lain exposed for geological eras as well as walls of open-pits, tailings and mined materials. When all these materials are exposed to oxygen and water, acid can form if iron

sulfide minerals are abundant and there is an insufficient amount of neutralizing material to counteract the acid formation. The acid then in turn leach or dissolve metals and other contaminants from mined materials and form a solution that is acidic, high in sulfate and metal-rich (including elevated concentrations of cadmium, copper, lead, zinc, arsenide, etc.). In Ebonyi State, the mined metals are mostly lead and zinc which are heavy metals on their own and found in rocks with sulfide minerals. Here and there, one can see heaps of rock piles, dumped tailings and open-pits often with water which are strong indications that AMD is already taking place. Experts explain that streams/rivers impacted by AMD have a PH value of 4 or lower similar to battery acid. A look at the geologic map earlier mentioned shows rivers criss-crossing the mine areas which further gives credence to the evidence of AMD impact and water contamination.

In Enyigba, Ameka and Ameri in particular, and Ebonyi in general open mine pits are seen everywhere around the mines with little or no neutralizing materials. Shocking enough, villagers make use of the water in these pits. This is quite lethal and poses health risk to individuals using it for domestic and other purposes. More shocking is the fact that AMD contaminates underground water meaning that the impact permeates beyond the mine areas to affect neighbouring towns and villages of considerable distances-away from mine locations. AMD is also known to leak into the air as evaporation takes place polluting the air and making it unfit for every life in the area. In actuality, Ebonyians living in mine areas and beyond are gradually accumulating heavy metals and acid in their body without knowing it. There are often cases of sudden death which are not verified to ascertain causes. More often than not, such deaths which may have been as a result of poisoning from lead or related complications are erroneously attributed to witchcraft. The impact of AMD in Ebonyi is apparently a reduction in life expectancy of Ebonyians.

Effluent Emission and Contamination: Effluent means any liquid waste discharged from mining facilities including mine water tailings (that is waste that contains mixture of impurities, trace metals and residue of chemicals), acid leaching, acid mine drainage, fuels and lubricants. In Ngbo and other quarry sites, there are evidences of oil spillage from serviced machines and around fuel dumps. Experts say this affects quality of underground water. In Ishiagu, mine tailings are used for road maintenance. This is highly and universally unacceptable because of the hydra-headed problems and health risks associated with it. More so, effluent emissions pollute the land and condemn it against agricultural purposes. These cause low agro yield.

In all the mining sites visited at Ishiagu, Enyigba, Ameri, Ihotor in Ameka, Ihetutu in Ishiagu, Ohankwu, Agalegu, and so on, it was discovered that mine water were drained from pits and channeled to nearby farm lands, bushes, main road and rivers. Ihetutu community also in Ishiagu has lost Okuiyi stream to pollution from the mine, more so overflow of water from mine pits kill economic plants and crops in farm lands that lie across the mine. Often times, the mine effluent flows into Ivo river connecting Okpanku river in Enugu State and also affecting Amonye, Ihie, Amagu and Ogwo. At mines in Ishiagu Enyigba, effluents specifically were channeled to Ebonyi River, Ohankwu mine effluents were channeled to Ako river that cuts across Ndufu-Alike Ikwo while Amajim Ameka mine effluents were channeled to Akpara river. All these rivers are tributaries to Ebonyi River that flows into Oferekpe river, the source of water for the state Oferekpe water scheme that is supposed to supply pipe borne water to the whole Abakaliki zone.

Fugitive Emissions: The largest sources of air pollution in mining operations are from particulate matter and gas emissions. Particulate matter are transported by the wind as a result of excavations, blasting, transportation of materials, wind erosion (more frequent in open-pit

mining), fugitive dust from tailings facilities, stockpiles, waste dumps and haul roads. Exhaust emission from mobile sources (cars, trucks, heavy equipment) raise these particulate levels. The Gaseous emissions are from the combustion of fuels in stationery and mobile sources for example exhaust fumes from generators and haul vehicles. It has been identified by experts that Fugitive dust can pose significant environmental problems at “some” mines. The inherent toxicity of the dust depends upon the proximity of environmental receptor and type of ore being mined. High levels of arsenic, lead and radionucleides in windblown dust usually pose the greatest risk. The proximity issue is of major concern here because it is co-relational to toxicity of the dust and gas as a matter of fact. The quarry located along Enugu Abakaliki road does not meet the required safe distance of 3000m (3km) away from homes and residence. This particular quarry site is almost at the road and very close to a military barracks. The health effects are diseases associated with respiratory tract infections/lung diseases. Residents around this quarry often suffer from common cold and pneumonia which they ignorantly attribute to exposure to cold weather. Dust emissions do not only affect the air, but dust settles on crops causing them to change colour. Additionally, it settles also on water, thereby introducing some elements to underground water absorbed by plants.

At Ishiagu Enyigba, Oketa Friday narrated his ordeal in a day he unexpectedly slept were he packed lead. He woke up to discover he had difficulty in breathing. He attributed that ordeal of respiratory attack to emission from lead. At Ishiagu Enyigba claim of Mrs. Ebere Eze, a Nurse of convulsion attack was corroborated by Oketa Friday mentioned above. They lamented that children between the age bracket of 2 -10 years frequently convulsed, a situation they learnt in a seminar organized by ministry of Environment was attributable to lead emission.

Soil and Gully Erosion: Erosion is the detachment, suspension and transportation of soil particles from their original source to a different location which could be caused by water (through rain drops/precipitation run off) or wind in arid environments. The extent of erosion depends on various factors, including the degree at which the surface has been disturbed, the prevalence of a vegetative cover, the type of soil, the slope length and the degree of slope. Mining activities are known to disturb the surface, thereby aiding erosion. In Nkalagu where heavy quarrying activities are taking place, there are sites of gully erosion attributed to quarrying. In addition, experts in Geological Sciences aver that earthquakes and other adverse physical phenomenon are likely to occur frequently in these areas because of mining activities in the nearest future.

Blasting Effects: Blasting operations are used to crack hard rocks in quarrying. Some of the chemicals used in blasting are super power 90 (High explosives), Ammonium Nitrate (Low explosives), Jelatine explosives, and so on. The concern however is that they are used beyond the recommended quantity/limit as such generating untold effects like cracks on buildings, fly rocks, building foundation collapse and outright collapse of building. At the moment, there are several of such cases now in Nkalagu, Abakaliki, Ngbo, Onuebonyi and et cetera. Some of the law-suits of cases like that are pending in the law-court. Anywhere blasting operations are done, at the firing of the shot, there is vibration affecting buildings, especially, those ones without civil Engineering approach. More so, the soil type in Ebonyi, in general have some properties of clay carrying particular minerals called montmorilonite which absorbs water, swells and contrasts during dry season. The dominance of this gives effect on the structures it carries, thereby making it more susceptible to cracks and collapse as a result of the effects of blasting.

The incidence of fly rocks is quite high in quarrying areas in Ebonyi State. Due to overcharge of holes with explosives, the fly rocks result and sometimes destroy roofs of houses. More so, fly rocks also result from secondary blasting operation which cannot be controlled even with reduction of explosives.

Noise Pollution: This impact is obvious so much so that residents around quarrying sites in particular suffer from high degree of noise over a longer period than stipulated by law. Noise pollution can lead to loss of hearing and other hearing impairment.

4.3 Socio-Political Impacts

Socially, education which is considered to be one of the powerful instruments of socialization has been adversely affected in mining communities. At the communities visited during the course of oral interview it was gathered that children preferred going to mine sites where they provide cheap labour for money. “Some of them who attempt going to school sneak out of school and retire to mine sites”, says John Emmanuel, a private investor at Enyigba. The high level of school drop outs in the mining communities is also attributed to mining.

It was also gathered that the rate of prostitution is high in those mining communities. Some of the men who work in mines make quick money which attracts commercial sex workers who are also there for “business”. It was observed that many hotels, drinking joints and relaxation centres abound in Ishiagu due to the presence of the miners who visit these places after the day’s hard labour. Respondents like Nwafor Julius, Nicodemus Agbalu, David Nwokporo at Ihotor Ameka testified to the fact that young people working in mine areas took hard-drugs like Tramadol, Indian Hemp, et cetera to boost their energy and morale for work, most especially, the stone breaking.

Politically, the atmosphere is usually charged and tensed up because of power tussle over community chairmanship position in Ihetutu and other Communities inhabiting Crushed Rock Company Ltd and Greenfield mining company. The community chairman is the middle man between the communities and the companies, who more often than not enjoys some privileges and benefits from the companies. For example, Crushed Rock Com. Ltd gives 3,000 tons of cheapings to the community for road construction, but most times, it is rather sold than utilized for that purpose. The money that accrues from the sale is then shared amongst the "stakeholders" with the chairman getting the lions share. Hence, the community (not LGA) chairmanship position is highly politicized and contested.

4.4 National Mining/Quarrying Regulations and Environmental Impacts of Mining in Ebonyi State.

All the environmental impacts examined in this study can be classified under four groups as stipulated in the National Regulations – National Environmental (Mining and Processing of Coal, Ores and Industrial Minerals) Regulations 2009; and National Environmental (Quarrying and Blasting Operations) Regulations 2013. The impacts are to be evaluated based on the provisions of the regulations under these four classifications:

(i) Effluent limitations.

(ii) Emission limitations.

(iii) Noise pollution and Control.

(iv) Blasting Operations Plan.

4.4.1 Effluent Limitations

The following standards in Part III Number 10-14 of the National Environmental (Mining and Processing of Coal, Ores and Industrial Minerals) Regulations 2009 negate and implicate

impacts of mining in Ebonyi described before such as Acid Mine Drainage (AMD) and Effluent Emission and Contamination:

10. (1) Every facility which discharges effluent shall treat it to an acceptable limit.

(2) Dilution of effluent to achieve the standards specified in Schedule 1 to these Regulations is prohibited.

In schedule 1, to the Regulation (B1167), the parameters, maximum permissible Discharge limit into surface water and its land application for Lead and Zinc largely mined in Ebonyi State are as follows:

S/N	**Parameter**	**Maximum Permissible Discharge Limit**	
		Into surface water	**Land Application**
1	Lead (mg/l)	<1.0	-
2	Zinc (mg/l)	<1.0	-

(3) Tailings containing heavy metals or other toxic materials or substances shall be treated and disposed off in a government approved designated landfill.

(4) Mine water containing heavy metals or other toxic materials or substances shall be treated to acceptable level before disposal.

(5) Every facility shall ensure that:-

a. No waste material beyond permissible limits is released from the premises at which the operation is being carried out; and

b. All effluents are cleaned and disposed off at an appropriate discharge point or waste treatment facility at the conclusion of each operation.

(6) Burrow pits containing mine water shall be safely secured.

(7) Heaps, dumps and spent solutions shall be detoxified to reduce deleterious chemical components such as cyanide, acidity and metal loadings.

(8) Acid Mine Drainage testing shall be carried out by the facility throughout operation and closure.

11. (1) There shall not be contamination arising from leakage of oil or fuel storage facility or chemicals likely to cause pollution to the environment including the surface water, ground water and soils.

(2) A facility shall have base for any ancillary equipment and provide an appropriate bond wall in the event of any unanticipated discharge or spillage.

12. (1) No facility shall cause to be discharged, any effluent into the natural water system and land without a permit from the Agency.

(2) Every facility shall apply for and obtain permit from the Agency during and upgrade or expansion of such facility.

(3) Every facility shall obtain Permit from the Agency for new point sources of pollution.

(4) No effluent with constituents beyond Permissible limit shall be discharged into mine pits or the ecosystem.

13. (1) The collection, treatment, transportation and final disposal of wastes within the specified standards and guidelines, shall be the responsibility of the facility generating the wastes.

(2) In the event of a pollution resulting in an impact on the environment whether socio-economically or health wise, the facility shall as specified in schedule 4 to these Regulations, be responsible for-

(a) The cost of clean-up;

(b) Remediation;

(c) Reclamation;

(d) Compensation to affected parties; and

(e) Cost of damage assessment and control.

14. The owner or operator of a facility shall prepare an emergency response plan that describes the measures to be taken in respect of deleterious substance to prevent any deposit or discharge out of the normal course of events of such a substance and to mitigate the effects of such a deposit or discharge and such emergency response plan shall include such details as specified in schedule 5 to these Regulations.

What is obtainable in Ebonyi is a direct opposite of the above regulations as have been explained section **4.2** of this research as such, mine tailings are used for road maintenance; trace materials allowed to leach into water bodies; Mine pits containing water are abandoned and ignorant villagers make use of the water; undetoxified heaps, dumps, spent solutions are abandoned across all the mines; Acid Mine Drainage (AMD) testing is seldomly done by the facilities throughout operations; leakage of spent oil allowed on mine areas; more than half of the facilities engaged in quarrying not applying for permits, et cetera.

4.4.2 Emission Limitation

Under the regulation being used as a standard, the provisions that negate the fugitive emission impact in Ebonyi State range from number 30-36 of part IX. Of particular interest to us are numbers 30-33.

30. (1) Operators involved in mining and processing of Coal, Ores and Industrial minerals shall ensure that their activities conform with prescribed guidelines for safe levels of air pollutants tolerable to human, aquatic organisms and vegetation.

(2) For the purpose of these Regulations, fugitive emission air pollutant sources shall include operations and related activities as specified in Schedule 9 to these regulations.

(3) In these Regulations, guidelines for emission limits from stationery sources represent maximum allowable levels of pollutants from a site process, stack or vent and similar sources, as specified in Schedule 9 to these Regulations. Some of the sources of fugitive emission listed in Schedule 9(B1180) are as follows: construction activities; mining and quarrying activities; haul-road; haul trucks; tailings piles and ponds; blasting activities; et. cetera.

31. Operators shall ensure that their activities do not impact on ambient and indoor air, beyond regulatory limits for conventional pollutants as specified in Schedule 10 to these Regulations.

32. Operators shall ensure that their activities do not impact on ambient and indoor air, beyond regulatory limits for safe levels of air pollutants for specific substances in the air as specified in Schedule 11 to these Regulations.

33. (1) The Agency may, as part of the requirements of an application for a permit in relation to a facility with a fugitive emission source, or as a requirement of a control order, require the applicant to submit a written fugitive emission control plan for the control of fugitive particulate emissions.

Provision I of Number 33 stated above does not strongly and adequately address the impact of fugitive emission. Fugitive emission is unavoidable in mining process given the myriad of its sources. Therefore, the requirement for fugitive emission control plan should be compulsory; at the moment, there is no available record that there is any emission control plan, submitted and actually implemented by any facility in Ebonyi State as should appropriately be done. In essence, this section of the regulation needs to be reviewed.

4.4.3 Noise Pollution and Control

This provision is in Part X numbers 37-41 and takes care of the Noise Pollution effects in the mining/quarrying communities.

37. Every facility shall evaluate its installations and ensure that routine controls are sufficient to prevent risks of noise pollution.

38. (1) Daily noise exposure for workers and the environment of the facility arising from its activities, should not exceed 90 decibels (dB) daily for an 8 –hour working period.

(2) For the purpose of these Regulations, equivalent 8-hours exposure limits to be maintained are outlined in National Environmental (Noise Standards and Controls) Regulations 2009.

(3) No person shall for an activity specified in these Regulations, emit noise in excess of the permissible noise level, unless permitted by a license issued under National Environmental (Permitting and Licensing System) Regulations 2009.

(4) Any person who contravenes sub regulation (1), (2), or (3) of this regulation commits an offense.

39. (1) The employer shall administer a continuing, effective hearing conservation programme, whenever employee noise exposures equal or exceed an 8-hour time-

weighted average sound level (TWA) of 90 decibels measures as outlined in schedule 13 to these regulations.

However, the general public has a role to play – that of informing the enforcement agency (who relies on information given to it by the public) of any violation to this provision. On the other hand, there is a problem of lack of knowledge of this provision by the public. The outcome is non-enforcement of the provision and consequent gross violation to the rule. The enforcement agency does not have to wait until informed by the public of violation of any of the provisions before they swing into action.

4.4.4 Blasting Operation

Part IV and V of the National Environmental (Quarrying and Blasting Operations) Regulations 2013, stipulate the blasting operation plan and the operating mechanisms and guidelines for blasting.

Part IV ranges from numbers 17-18 and provides that:

17. (1) A person intending to embark on blasting shall prepare a Blasting Operation plan.

(2) The blasting operation plan referred to in sub regulation (1) of this regulation shall contain information on the:

(a) Limitation the operator will meet with regard to ground vibration and air blast;

(b) Basis for those limitations; and

(c) Method to be applied in controlling the adverse effect of the blasting operations, including blast monitoring system in accordance with guidelines set in Schedule VI.

18. A person shall not carry out quarrying or blasting of rocks below ground level unless with a permit duly obtained from the relevant authority.

Part V has sub regulations 19 -23. Number 19 deals with registration with the Agency; 20 takes care of the Minimum safe distance of quarries/blasting from residential, commercial or industrial area which must exceed three kilometers (3km). Sub - regulations 21 and 22 are the prohibitions of blasting or falling of rock; and the Act of blasting or falling respectively. Number 23 deals with the blasting guidelines thus: Any person carrying out the act of blasting shall comply with the guidelines listed in this regulation:

(1) Any relevant existing guidelines including the explosives Act and Regulations made there under shall be adhered to.

(2) Blasting operations shall not be carried out at the rush hours of 7am – 10am and 5pm and beyond.

(3) A person shall not engage in blasting during weekends, except for incidental blasting.

(4) Charge Loading Density (CLD) of explosives shall not exceed 35 kilogrammes per hole and 3 metric tons per blast.

(5) The depth and space of blasting (Blast Design Parameters) shall comply with:

(a) The depth of:

(i) 8m -10m, for commercial blasting; and

(ii) 8m, for outcrop blasting;

(b) Spacing – where the distance between the drill-holes or charges in the same row shall not exceed 1.5m.

(6) The adjoining community shall be initially informed at least 48 hours prior to any type of blasting operation through the mass media and augmented locally by the use of siren, announcement letters, warning signs and other means deemed appropriate to convey an impending operation.

(7) Relay delays shall be used to control the vibration as well as limiting the transmission of energy below the damaging levels at any existing structure.

(8) The delay pattern shall be created to provide the energy relief immediately down the ditch in preference to a horizontal direction.

(9) The main type of delays shall be 17 milliseconds or 42 milliseconds and shall be environment-friendly.

(10) The amount of explosives used in each hole shall be limited to the manufacturer's recommendations and specifications, taking into account sub-regulation (4) of this regulation.

(11) Down hole delays shall be used where they are needed to meet specifications on maximum kilogram per delay allowed.

With all these guidelines meant to alleviate against the impact of blasting, the operations in Ebonyi State still result to untold effects such as those enumerated before, namely: fly rocks, cracks on buildings, and so on. The true position is that these guidelines are not strictly followed in the blasting operation.

4.5 Factors Responsible for the Negative Impacts of Mining in Ebonyi State.

The exercise in this session is limited only to the negative environmental impacts that have already been discussed, namely loss of biodiversity, effluent emission, AMD, and so on. On the other hand impacts of mining in the state such as economic is mostly positive and therefore not a source of worry. The negative socio-political impact is known to have resulted directly from the mining operations and could be Alleviated with a high sense of morality/discipline but the environmental impacts resulting from the mining operations though requiring high sense of morality and discipline to be mitigated, begs for attention to be drawn to the extraneous factors that have worsened the situation. Hence, when those factors are addressed, solutions would have been proferred to the high environmental impacts of mining operations.

4.5.1 Non-Compliance/Partial Compliance to Mining Regulations.

Referring back to the table illustrating level of compliance of quarrying companies to some of the known standards such as the conduct of EIA, conduct of Audit and application for permit, it is discovered that the level of compliance is very low. Evidence also showed that the mining companies in Ebonyi State namely Greenfield and Royal salt companies Ltd. were yet to comply to the conduct of EIA and submission of same to NESREA, Ebonyi State office as at the time of this research. It is a common truth that if mining/quarrying regulations are adhered to during operations, the impact on the environment will be ameliorated. However companies and private investors boycott the regulations for being expensive and minimize their gains. As such they resort to inhuman and sharp practices to maximize gain. For example, to mitigate against effluent emissions and contamination, the regulation provides that every mine must install at least an Effluent Treatment Plant (ETP). The reason here is that all effluents from mines/quarries should be collected in the tank, treated to an acceptable level that will not be harmful to the ecosystem before discharging it. The operators however consider the installation of the plant and treatment of effluent to be expensive. If companies and private investors adhere strictly to this regulation, the environmental impacts of effluent emission and contamination would have been ameliorated. It is shocking to note that in Ebonyi State, effluents from mines are neither collated or treated before discharge. It is rather discharged straight into nearby streams, bushes/farmland and road as seen in session **4.2** of this research.

4.5.2 Ignorance/Lack of Co-operation from Rural Mining Communities.

This factor is hydra-headed and ranges from ignorance of the villagers to connivance of community leadership with operators of the mining facilities. Most rural dwellers if not all in mining communities are ignorant of the provisions of the mining/quarrying regulations as well as the dangers people living in mine areas are exposed to. They are also ignorant of their rights to safe and healthy environments. Over 70% of mines in Ebonyi State are owned by

private individual and groups, making artisanal and small scale mining more prevalent. Yet, not up to 10% of the above percentage are aware of National mining and quarrying regulations. This scenario has resulted to crude form of mining in the state with its attendant high environmental impacts. The researcher discovered among other things that children and under aged persons were left to engage in mining activities, whereas this is contrary to the provisions of the regulation. Some adults go to take their bathe in mine pits with mine water while mined materials are packed in virtually every home stead; and so on. If rural dwellers in mine areas are organized and trained, the chain of ignorance with its effects on their health and environment would have been mitigated.

Another issue of concern is the unwillingness of mining communities to surrender useful information to Regulatory Agencies for fear of being looked at as having sabotaged the community and possibly victimized. As such, those communities die in silence even when private investors/companies are destroying their environment. They rather feel content with whatever insignificant compensations given to them by those who exploit them.

More, often than not, the community leadership connive with the companies for pecuniary reasons. Through gratification, these community leaders are bought over and or paid off by the companies and so lack the moral will to confront the miners when they and their communities are adversely affected.

4.5.3 Government Insensitivity and Bottle Neck

It was discovered at the course of this research that mining companies pay different kinds of revenue to various government ministries and agencies like Ministry of Commerce and Industry, Federal Inland Revenue and Ministry of Environment. Their interest ought not to stop at generating the revenues, it should bother them that the environment is adversely affected. One may be tempted to argue that National Environmental Standards and

Regulations Enforcement Agency was created by the government for such environmental concerns as well as ministry of environment yet, establishment of the agencies is not enough without government political power and will. It is strongly believed that government has the capacity to compel mining companies to operate within the boundaries of regulations, but this is a far cry. Nothing better interprets this reality than insensitivity. More so, what stops government from organizing the artisanal miners into small and medium scales, if not insensitivity. If the artisanal miners are grouped, government attention will help monitor and regulate their activities and operations. There are quite a number of benefits that will be reaped if individual artisanal miners receive government attention. First, they will be trained on less risky methods of mining to reduce the impacts on themselves and the environment. Secondly they will be exposed to the regulations that guard against high impacts. Thirdly, it will be easier for regulatory/enforcement agencies to monitor their operations, and level of compliance to best practices.

Significantly, another issue that is of major concern in this subject matter is the bottle neck along the process of acquiring an EIA. A consultant is supposed to prepare a company's EIA, but that is not until the federal mining cadastre office (in this case) has inspected the proposed site. Often times, the office is not able to carry out this preliminary function with dispatch especially when there are many who have applied. Such delays simultaneously affect the preparation of the EIA by the consultants. In order to forestall waste of time and financial resources probably got from banks, the mining company may consider the option of paying the penalty for violation, usually the sum of ₦1, 100,000 only which is even more cheaper than producing an EIA. The result is that the company plunges into mining without an EIA, further resulting to severe impacts without preparations to remediate the situation.

4.5.4 High Poverty Rate and Hostility of Mining Communities.

Artisanal mining has always been associated with very high environmental impacts due to the fact that the miners lack knowledge of the regulations that help to mitigate these impacts as well as the practice of applying crude mining methods. Those who are mostly engaged in artisanal mining are poor people without viable means of livelihood, or those who had other menial jobs that were not giving quick money and as lucrative as mining. For example, Oketa Friday in Ishiagu Enyigba in Abakaliki L.G.A was a plumber before abandoning that for artisanal mining. As at the time of the oral interview, he had 30 women and 37 men working in his mine pits. Attempts by the Regulatory body, NESREA or relevant government Agencies to intervene even with the best of motives, have always been greeted with hostilities and sometimes physical attacks. They are afraid that such interventions could take away their means of livelihood. However, the worsened situation should not be abandoned as it were, rather government ought to reach out to these communities consistently and lay bare their well meaning intentions to them.

CHAPTER FIVE

ETHICAL EVALUATION OF THE IMPACT OF MINING IN EBONYI STATE

The ethical evaluation of mining in Ebonyi state appreciates that ethics is the study of the norms or standards of human behaviour. What then are some of these standards? Singer (1979) identified some of the standards or principles as sanctity of life, justice, purity, and et cetera.

However, for the purpose of this research, five moral principles will be employed in the evaluation, namely: Justice, human rights, sustainability, solidarity. The reason for adopting these principles is because the discourse borders on environmental ethics and the principles are universal moral principles that have been helpful in addressing moral issues in other disciplines other than mining. Moral principles are universal in nature and can apply distributive to various disciplines in the widest sense.

5.1 Justice

Etymologically, the word 'justice' has a Latin root 'jus', meaning right or law, this explains why it is conveniently referred to as a moral concept. Oxford English Dictionary defines the "Just" person as one who typically "does what is morally right" and is disposed to "giving everyone his or her due", offering the word "fair" as a synonym. A brief analysis of the meaning attempted so far will help to a large extent in stepping down the concept of justice to simple understanding.

Every action taken is considered right or wrong given some principles, rules, laws and the nature of the action done in relation to the effect of such actions. In other words, the action taken is judged just or otherwise to the extent of its fairness to everyone concerned. Justice takes into account the inalienable and inborn rights of all human beings and citizens, the right of all people and individuals to equal protection before the law, of their civil rights, without

discrimination on the basis of race, gender, sexual orientation, gender identity, national origin, color, ethnicity, religion, disability, age, wealth, or other characteristic, (Wikipedia, the free Encyclopedia). This explanation of justice alludes to “fairness to all involved”.

Beyond the realm of interpersonal relationship, the meaning of justice is also determined at the level of political society to see how it applies to ethical and social decision making. For Plato, “justice is a virtue establishing rational order, with each part performing its appropriate role and not interfering with the proper functioning of other parts doing one’s own work and not meddling with what is not one’s own”. So this socio-political justice is each person doing the tasks assigned to him or her, and not interfering with others doing their appointed tasks (Reeve 1992). Aristotle says justice consists in what is lawful and fair, with fairness involving equitable distributions and the correction of what is inequitable. For Augustine, the cardinal virtue of justice requires that we try to give all people their due; for Aquinas, justice is that rational mean between opposite sorts of injustice, involving proportional distributions and reciprocal transactions. Hobbes believed justice is an artificial virtue, necessary for civil society, a function of the voluntary agreements of the social contract; for Hume, justice essentially serves public utility by protecting property. For Kant, it is a virtue whereby we respect others’ freedom, autonomy and dignity by not interfering with their voluntary actions, so long as those do not violate others’ rights; mill said justice is a collective name for the most important social utilities, which are conducive to fostering and protecting human liberty. Rawls (1971) analyzed justice in terms of maximum equal liberty regarding basic rights and duties for all members of society, of equal opportunity and beneficial results for all. He regards justice as “the first virtue of social institutions” (p.3).

Western philosophers generally regard justice as the most fundamental of all virtues for ordering interpersonal relations and establishing and maintaining a stable political society. The common denominators for all the definitions of justice by these western philosophers are

the understanding of justice in terms of respecting persons as free rational agents and in terms of human conduct conforming to laws which will in turn regulate interpersonal and inter-social relations. Though there may disagreements about the nature, basis and legitimate application of justice, the above are the core.

More so, from the definitions of the philosophers ex-rayed, one could also discover treads of types of justice. For example, justice in Aristotle's view consist in what is lawful and fair, with fairness involving distributions and correction of what is inequitable. Notably, "distributive" and "retributive" types of justice are evident here. The same trend runs through their various definitions of justice.

Types of Justice and its Implication on the Impacts of Mining.

Nzomiwu (2012) identifies five subdivisions of justice, namely: commutative justice, distributive, legal, social and retributive justice. scholars with interest in environment have developed another types of justice known as Eco-justice, purely ethechiates to the environment apart from this latest addition, the five other types have various degrees of indirect application to environmental justice.

5.1.1 Commutative Justice

Commutative justice governs interpersonal relations-the relation of individuals with regard to each other. Hearing in Nzomiwu (2012) states "commutative justice demands exact equality of value between what is given and what is due in return" (p.259). Hearing further explains that the principal violations of commutative justice are theft, fraud and unjust damage. Unbridled mining causes unjust damage to the environment and therefore a violation to commutative justice talking about equality of value between what is given and what is due in return nature has provided the resources that are mined. Therefore its due to be preserved and not destroyed. It is wicked to strip nature of its resources without returning to if its due. Its due is revegetation, proper mine closure, resettlement of fauna replacement of Flora, and et

cetera this line of argument therefore entails proportionality in terms of the give and take relations.

5.1.2 Distributive justice

Distributive justice governs the relation of society-family, state and the church with its individual members whereby they are given a share in the common good. The individual is the subject of the right in relation to the society in "distributive justice". Distribution justice is about the allocation of resources and burdens. Justice in distributing the common good requires that this allocation be done in accordance with certain rights (e.g. an equal right to a basic standard of living, merit or other criteria). This type of justice stresses fairness of what people get. Distributive justice by the foregoing, attempts to recognize that individuals who make up a community, state or a nation, have rights and privileges, which the state must preserve and guarantee. The objective of distributive justice here then is to ensure equity and fairness in the distributions of the good and burdens of the society. Since distributive justice is all about equitable, fair distribution of resources and burdens, narrowing it down to environmental issues in this context, the mining company ought to imbibe the principle of polluter must pay. It is unacceptable for them to be primarily concerned with the exploitation of natural resources and caring less about the impact of their activity on the immediate community who are left to bear the brunt of the impact. Hence, they need to understand that retributive justice demands that they should take responsibility for all the environmental problems that arise as a result of their activity in any locality. On the other hand, the gains of their enterprises should be shared with the host community in terms of employment and staying true to the MOU reached with the community.

5.1.3 Legal Justice

Legal justice governs the individual's relation to the society, where he owes the society the duty to subordinate himself to the demands of the common good. For example justice demands that citizens should pay taxes as contribution to the development of the society. From these taxes common good, namely- schools, hospitals, market, good roads and et cetera are built. It therefore follows that non-payment of taxes, embezzlement of tax payers' money, corruption, non provision of basic amenities, all amount to violation of legal justice.

By extension, legal justice in a sense applies to this present discourse on the platform of the mining community showing concern in what is happening around them. Those living in mine areas and beyond owe the state a responsibility of cooperating with the Environmental Regulation Enforcement Agency, who to a large extent depend on the information given to them to be able to enforce the regulation.

5.1.4 Social Justice

Social justice is particularly concerned with the common welfare of the underprivileged in the society. In social justice the emphasis is on the underprivileged. The deliberation on social justice received a boost by Pope Paul VI in Nzomiwu (2012). The Pope quips that social justice is that aspect of justice that aims at the "transformation of the classes which constitute society towards a more equitable distribution of riches in such a way that nobody lacks what is sufficient for life and nobody is allowed to an exaggerated and egoistical enjoyment of temporal goods when others are painfully deprived of them. In fact, distributive justice is often called social justice because both take into account the fair sharing of the common good. The difference is that social justice is "concerned primarily with the rights of the poor who may have nothing to give but still have natural rights to be respected by the community and men of property and possession"(p.259).

Nzomiwu (2012) enunciates that it is the obligation of the state to ensure that life of every member of the community; its sustenance and opportunity for work are safeguarded given the

demands of social justice. As such, it is unjust for any government to be predominantly concerned with the revenues that accrue from the tolls, business permits and other revenues generated from mining companies, without monitoring the level of compliance to environmental regulations and safeguards. The government, given the tenet of social justice ought to be more concerned with the sustenance of healthy environment for its citizenry than the pecuniary gains from mining companies.

5.1.5 Retributive Justice

The last sub division of justice is retributive justice also called vindictive justice, restorative justice, reparative justice, criminal justice, corrective justice, rectificatory justice, or punitive justice. All of these adjectives use for retributive justice serve to further explain its function and operation. The basic understanding here is that harm has been done and correction or restitution needs to be made to rectify the wrong and restore normalcy. Nzomiwu (2012) explains that retributive or vindictive justice aims at punishing the infringement of the right and restoring the enjoyment of right. He further states that it is the temperate will to restore violated justice by means of punishment proportionate to the guilt.

Other than the punitive aspect of retributive justice, this paper is more concerned with the restorative and restitutive aspects of retributive justice. As a matter of fact, the restitutive component best explains the principle of polluter must pay earlier mentioned. In fact as earlier has been noted all the processes of mining impact heavily on the environment which therefore necessitates that a restoration be made as fast as possible.

5.1.6 Eco- Justice

After the first earth day in 1972, the term 'eco-justice' emerged out of the concern for the natural world and for human life that recognizes that devastation of the environment and economic injustice go hand in hand, and that environmental and human rights are indivisible. Hessel (2007) recounts the emergence of the term thus:

> After the first earth day, "eco- justice" became the theme of a group of North American, ecumenically engaged Christian ethicists (including the author). In a seminal article "ecological responsibility and economic justice," Episcopal priest Norman Faramelli of the Boston industrial Mission emphasized that "choosing (to work for) ecology instead of (against) poverty, or vice versa, is to make a bad choice," the way ahead is to choose both… To foster converging commitments to ecology and justice (social) American Baptist leaders Richard Jones and Owen Owens introduced the term eco-justice. By 1973, a strategy to advance integrative ethics of ecology and justice became the focus of an ecumenical campus ministry initiative at Cornwell University called the Eco-Justice Project and Network (EJPN) initiated and then coordinated for two decades by a Presbyterian social ethicist, William E. Gibson (p.1).

Gibson in Hessel (2007) thus defines eco- justice as:

> The well being of humankind on a thriving earth,… an earth productive of sufficient food, with water fit for all to drink, air fit to breathe, forests kept replenished, renewable resources used as sparingly as possible so that they will be available (to future generations) for their most important uses… on a thriving earth, providing sustainable sufficiency for all, human well-being is nurtured not only by the provision of these material necessities but also by way of living within the natural order that is

> fitting: respectful of the integrity of natural systems and of the worth of nonhuman creatures, appreciative of the beauty and mystery of the world of nature (pp.1-2).

The concern of eco-justice hence permeates beyond environmental justice to include the exploration of specific environmental problems and related issues of hunger, sustainable agriculture, energy production and use, lifestyle integrity, economic development, debt relief, fair trade, good work, peacemaking, and environmental justice for poor people, racial minorities and women. The ethicists of eco-justice maintain that environmental justice is an important facet of, but is not synonymous with eco-justice, which has broader meaning.

However, this present paper is predominantly concerned with the environmental justice aspect of the eco-justice. Going by Gibson's definition of eco-justice, the impacts of mining in Ebonyi state is a total negation to the well-being and thriving of Ebonyians. On the way round, the mining activity that would have been considered just to the environment of Ebonyi is such that ought to have enhanced other than undermined food sufficiency, good water fit for drinking and other healthy purposes, air fit to breathe, forests kept replenished, renewable resources continuously renewed, non renewable resources used as sparingly as possible so as to be available to future generation, but the mining operations in Ebonyi have rather left more to be desired. This therefore strongly calls for a change of motive and attitude on the part of miners, mining companies, government and indeed all stake holders in mining in Ebonyi state, to embrace the virtue of justice.

5.2 Human Rights and the Impacts of Mining in Ebonyi State

John Locke the philosopher in Cranston (1973) identified human rights thus:

> All men are by nature equally free and independent, and have certain inherent rights, of which, when they enter into a state of society, they cannot, by compact, deprive or

> divest their posterity: namely, the enjoyment of life and liberty, with the means of acquiring and possessing property and pursuing and obtaining happiness (p.1).

Locke from the foregoing identified three human rights: right to life, liberty and property. Human rights are seen by scholars as those rights that are inherent in every person for the fact that he is a human being. Iwe (1986) asserts that human rights are "the inviolable and inalienable moral powers… of every human being to have, to do, to require from others…, to possess or give something"(p.156). According to Iwe (2000) inviolability of human rights means that no innocent person may be deprived of these rights or be stopped from enjoying them, against his will. Human rights are also inalienable implying that they are not exclusive preserve of some persons who may transfer them to others at will or determine when others are to enjoy their rights. Rather they are naturally endowed by God and rooted in the nature of man as human person.

Here in Nigeria, the fundamental human rights are contained in the 1999 Nigerian Constitution as follows:

1. Right to Life.

2. Right to dignity of human person.

3. Right to personal liberty.

4. Right to fair hearing.

5. Right to private and family life.

6. Right to freedom of thought, conscience and religion.

7. Right to freedom of expression and press.

8. Right to peaceful assembly and association.

9. Right to freedom of movement.

10. Right to freedom from discriminations.

11. Right to acquire and own immovable property anywhere in Nigeria.

The individual's right to a healthy environment is abundantly clarified in these instruments:

• Stockholm Declaration of the United Nations Conference on the Human Environment, 1972 (SL)

> Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being and he bears a solemn responsibility to protect and improve the environment for present and future generations. . . . (Principle 1)

• International Covenant on Economic, Social and Cultural Rights, 1976 (LD)

> The States Parties to the present Covenant recognize the right of everyone to the enjoyment of the highest attainable standard of physical and mental health. (Article 12.1)
>
> The steps to be taken by the States Parties to the present Covenant to achieve the full realization of this right shall include those necessary for: The improvement of all aspects of environmental and industrial hygiene. (Article 12.2b)

• African Charter on Human and People's Rights, Banjul, 1986 (SL)

> All peoples shall have the right to a general satisfactory environment favorable to their development. (Article 24)

• Experts Group on Environmental Law of the WCED, Legal Principles for Environmental Protection and Sustainable Development, 1987

All human beings have the fundamental right to an environment adequate for their health and well-being. (Article 1)

• Costa Rica Declaration of Human Responsibilities for Peace and Sustainable Development, 1989 (SL)

Observing the recognition by the international community that human beings have the fundamental right to live in an environment of a quality that permits a life of dignity and well-being, (Preamble)

• Declaration of the Hague, 1989 (SL)

The right to live is the right from which all other rights stem. Guaranteeing this right is the paramount duty of those in charge of all States throughout the world. Because the problem is planet-wide in scope, solutions can only be devised on a global level. Because of the nature of the dangers involved, remedies to be sought involve not only the fundamental duty to preserve the ecosystem, but also the right to live in dignity in a viable global environment, and the consequent duty of the community of nations vis-à-vis present and future generations to do all that can be done to preserve the quality of the atmosphere. (Preamble)

• Economic Commission of Europe Charter on Environmental Rights and Obligations, 1990 (SL)

Everyone has the right to an environment adequate for his general health and well-being. (Principle 1)

• The Hague Recommendation on International Environmental Law, 1991 (SL)

States should recognize the individual and collective fundamental human right to an environment which ensures a healthy, safe, and sustainable existence and spiritual well-being. (Principle I.3b)

• Agenda 21, 1992 (SL)

Health and development are intimately interconnected. Both insufficient development leading to poverty and inappropriate development resulting in overconsumption,

coupled with an expanding world population, can result in severe environmental health problems in both developing and developed nations. Action items under Agenda 21 must address the primary health needs of the world's population, since they are integral to the achievement of the goals of sustainable development and primary environmental care. (Paragraph 6.1)

In many locations around the world the general environment (air, water and land), workplaces and even individual dwellings are so badly polluted that the health of hundreds of millions of people is adversely affected. (Paragraph 6.39)

The overall objective is to minimize hazards and maintain the environment to a degree that human health and safety is not impaired or endangered and yet encourage development to proceed. (Paragraph 6.40)

• The Dublin Statement on Water and Sustainable Development, 1992 (SL)

Water has an economic value in all its competing uses and should be recognized as an economic good. Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources. (Principle 4)

• Rio Declaration on Environment and Development, 1992 (SL)

Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature. (Principle 1)

• Draft Declaration of Principles on Human Rights and the Environment; Sierra Club Legal Defense Fund, 1994

All persons have the right to a secure, healthy and ecologically sound environment. This right and other human rights, including civil, cultural, economic, political and social rights, are universal, interdependent and indivisible. (Part I. Principle 2)

All persons shall be free from any form of discrimination in regard to actions and decisions that affect the environment. (Part I. Principle 3)

All persons have the right to freedom from pollution, environmental degradation and activities that adversely affect the environment, threaten life, health, livelihood, well-being or sustainable development within, across or outside national boundaries. (Part II. Principle 5)

All persons have the right to protection and preservation of the air, soil, water, sea-ice, flora and fauna, and the essential processes and areas necessary to maintain biological diversity and ecosystems. (Part II. Principle 6)

All persons have the right to the highest attainable standard of health free from environmental harm. (Part II. Principle 7)

All persons have the right to safe and healthy food and water adequate to their well-being. (Part II. Principle 8)

All persons have the right to a safe and healthy working environment.

(Part II. Principle 9)

All persons have the right to adequate housing, land tenure and living conditions in a secure, healthy and ecologically sound environment. (Part II. Principle 10)

• Draft International Covenant on Environment and Development, IUCN, 1995

> Parties undertake to achieve progressively the full realization of the right of everyone to an environment and a level of development adequate for their health, well-being and dignity. (Article 12.1)
>
> All persons have a duty to protect and preserve the environment. (Article 12.2)
>
> All persons, without being required to prove an interest, have the right to seek, receive, and disseminate information on activities or measures adversely affecting or likely to affect the environment and the right to participate in relevant decision-making processes. (Article 12.3)
>
> All persons have the right to effect access to judicial and administrative proceedings, including for redress and remedy, in enforcing their rights under this Covenant.
>
> (Article 12.4)
>
> Parties shall respect and ensure the rights and the fulfillment of the duties recognized in this Article and shall devote special attention to the satisfaction of basic human needs, in particular the provision of potable water. (Article 12.5).

Under this subject of discussion, the right to life addresses the issue which is considered more fundamental. Office of the High Commissioner on Human Rights and United Nations Environmental Protection- OHCHR and UNEP (2012) in a joint report of the Rio + 20 summit recognized the relationship between human rights and the environment. They summarized the linkages between human rights and the environment thus:

> The linkages between human rights and environmental protection are multi-dimensional and reciprocal. Through legislation and jurisprudence, it has become generally accepted that: failure to respect, ensure and fulfill internationally- and domestically guaranteed human rights can lead to environmental destruction by ignoring the needs of individuals and groups who can contribute to environmental protection and economic development if they are consulted and are able to participate

> in decision-making about activities, programmes and policies that may impact them or their surroundings; failure to conserve natural resources and biodiversity can undermine human rights, for example, by destroying resources and eco system services on which many people, especially indigenous and local communities, depend; economic and other public activities, programmes and policies can either undermine or support the goals of environmental protection, human rights and sustainable development. Failure to provide information or consult affected persons, as well as activities that displace local communities can negatively impact both human rights and environmental protection. Conversely, environmental protection supports human rights through securing sustainable availability of critical natural resources and eco system services (p.20).

Internationally, the Stockholm Declaration of 1972 set out 25 common principles for the preservation and enhancement of the human environment. Principle 1 underlined that "man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of equality that permits a life of dignity and well-being, and he bears solemn responsibility to protect and improve the environment for present and future generations"(p.10). After the Stockholm declaration, human rights were now considered pre-requisite to effective environmental protection.

In 1992, the United Nations convened a second global conference on the environment at Rio de Janeiro, Brazil. Principle 10 of the Declaration that emerged from the conference stipulates that:

> Environmental issues are best handled with participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities and the

> opportunity to participate by in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided (p.11).

The above further gives credence to the fact that human rights are inextricably inter-twined with the environment and environmental protection. Giving an additional perspective to the human rights-environment relationship, the International Court of Justice's Judge, Weeremanty in OHCHR and UNEP (2012) stresses that the enjoyment of internationally recognized human rights depends upon environmental protection. He says:

> The protection of the environment is… a vital part of contemporary human rights doctrine, for it is a sine qua non for numerous human rights such as the rights to health and the right to life itself. It is scarcely necessary to elaborate on this, as damage to the environment can impair and undermine all the human rights spoken of in the Universal Declaration and other human rights instrument (p.12).

The truth expressed above cannot be improved upon. It is a reflection on the fact that some specific rights are inseparable from environmental quality. The most developed example is the right to water. In 1999, the United Nations General Assembly (UNGA) asserted that the right to food and clean water are fundamental human rights and their promotion constitutes a moral imperative both for national government and for the international community. Moreover OHCHR and UNEP (2012) explain that right to water and portable water and environmental conditions and their influence to the right to health are noted in the committee on Economic, Social and Cultural Rights' General comments Nos. 14 (The right to the highest attainable standard of health, 2000) and 15 (The right to water,2002). In the general comment 15 of the committee on Economic, Social and Cultural Rights in OHCHR and UNEP (2012) notes:

> The human right to water is indispensable for leading a life in human dignity. It is a pre requisite for the realization of other human rights. …the human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses. An adequate amount of safe water is necessary to prevent death from dehydration, to reduce risk of water-related disease and to provide for consumption, cooking, personal and domestic hygienic requirement.

Closely related to the right to water is the right to health, which also is inextricably linked to the environmental conditions. This truth is seriously recognized in some of the reports of the United Nations, where it has been identified that a fifth of the disease burden in developing countries can be linked to environmental risk factors. The glaring abuse of the environment through reckless mining undermine the health of the people, ignoring the fact that hazardous substances and wastes in water, air and soil do have serious, negative impacts on public health. The World Health Organization (1946) defines health as a "state of complete physical, mental and social-wellbeing, and not merely the absence of disease or infirmity" (p.100). In the case of Ebonyi State Nigeria, the mining impact on health is quite enormous as had been discussed earlier.

Regrettably, both the people's right to clean, safe, portable water and their right to health are being infringed upon. In fact the contamination of the rivers criss-crossing the mine areas (which hitherto had been the people's main sources of water for diverse purposes) through the Acid Mine Drainage (AMD) and the total pollution of the environment of Ebonyi State in general through unbridled mining are direct attacks, primarily, on the right to life of Ebonyians. The miners should be made to appreciate that the right to life is an imperative and therefore should take priority over and above economic gains and considerations.

5.2.1 Small-scale mining in Ebonyi State, Labour Standards and Workers Rights.

Generally speaking, artisanal mining or small scale mining industry is and indeed should be an important part of the minerals industry. The reason for this is because it is a traditional provider of employment and means of livelihood for the rural dweller where such operation is obtainable. Its role is however very often, poorly understood, its value almost not recognized especially because it relies for its economic competitiveness on low wages and zero environmental and occupational health and safety regulations. Statistics of artisanal mining industry are often not collected. One may even be forced to think that this industry is illegal.

This scenario is what plays out wholly in Ebonyi State small-scale mining industry. The workers most times are aggressive and very hostile to any government presence which they may interpret or understand to be nosing around them. On the other hand, employers of labour in the small-scale mining industry who happen to be private owners of mine pits as was observed in the survey carried out by the researcher employ cheap labour without recourse to labour standards which they do not even know. As such these cheap labourers (mostly women and youths) work under severe and precarious working conditions that endanger their health, with less pay for great work. Australian non-government organization (1998) notes that all labour laws need to take into account the basic instruments of the United Nations Conventions such as: The Convention on the Rights of the Child (CROC); International Covenant on Civil Political Rights (ICCPR); International Covenant on Social, Economic and Cultural Rights (ICSECR); Universal Declaration on Human Rights (UDHR); as well as the Convention on the Elimination of all Forms of Discrimination Against Women (CEAFDAW).

More so, the core International Labour Organization (ILO) convention which are more strongly worded on workers' rights include:

i. Conventions 29 and 105 on the abolition of forced labour.
ii. Conventions 87 and 98 on the rights to freedom of association and to collective bargain.
iii. Convention 111 and 100 on the prevention of discrimination in employment and equal pay for work of equal value; and
iv. Convention 138 on the minimum age of employment (child labour).
v. Of these rights and principles the following are of interest to the researcher due to the observations made: Equal pay for equal work/just reward, vocational training, the minimum age for admission to employment and freedom of association and to collective bargain.

Principle 23.2 of the UDHR States that, "everyone without discrimination has the right to equal pay for equal work". Principle 23.2 of the same instrument stipulates that "everyone who works has a right to just and favourable remuneration ensuring for himself/herself and his/her family an existence worthy of human dignity supplemented, if necessary, by other means of social protection".

What is obtainable in Ebonyi State small scale mining industry is appalling. At Enyim Chukwu in Ndufu-Alike, Ikwo, Opeke Echee testified that for a day's job, women working in the mine pits are paid a minimum of ₦250. 00 only while men who do the most straineous work in the pits get paid a minimum of ₦1, 000 of ₦1, 500 as the case may be. Though the pit owners argue that the women still make profit by gathering less grade lead/zinc, sale same and make more gains, N250. 00 per day is certainly not a just pay. Giving the dangerous nature of the work where sometimes pits may collapse and the workers trapped and so on, the amount above is not acceptable.

Principle 7.2 of the ICESCR provides that all people have the right to "technical and vocational guidance and training programmes, policies and techniques to achieve steady economic, social and cultural development and full and productive employment under conditions safeguarding fundamental political and economic freedoms". In their seeming State of helplessness, the artisanal miners in Ebonyi State cannot give themselves the recommended training required in the small-scale mining industries, let alone provide same for their unskilled daily workers in the mine pits. This is where government intervention is highly needed to make the above principle possible.

Principle 32.1 of the CORC stipulates "the right of the child to be protected from economic exploitation, from performing any work that is likely to be hazardous or to interfere with the child's education, or be harmful to the child's health or physical, mental, spiritual, moral or social development". As such, it further clarified in (CORC) 32.2a that the minimum age of eighteen (18) for admission to employment must be respected. In Ebonyi State children work in the mine pits, proceeds out of such work they claim to use to sponsor themselves in school. The irony of the matter is that some of them also work in the pits during school hours. The working in the mine pits also expose the children to health threats and is harmful to their physical, mental, spiritual, moral and social development. Ebonyi State government should seek to regulate and license small-scale mining operations in the state. This will not only provide legitimacy to the industry, but will also provide significant improvement in safety and proper working conditions of the artisanal miners.

5.2.2 Workers Rights and Catholic Social Teaching

Apart from the Various Instruments and covenants referred to in the last section, earlier documents in the catholic social teaching by the pontificates had in history promoted and

reinforced the imperative of workers' rights to equal pay for equal work/just reward, good working conditions and right to form labour unions/workers associations.

5.2.2.1 The Leonian Pontificate

Iwe (1986) explains that under the reign of Pope Leo XIII from 20th February 1878-20th July 1903, some landmarks were made in the field of human rights generally and specifically highlighting workers. During Leo XIII pontificate, Iwe (1986) further explains that "very important documents embodying inflexible assertions of the rights of man came to light" (p137). Among many documents of Leo XIII on human rights, those promoting workers rights included the Encyclicals "Humanum Genus" of 1884 and "Rerum Novarum" of 1891. While condemning false trends in the modern teaching and philosophy such as freemasonry, naturalism, atheistic rationalism and other false conceptions in both theology and political doctrines (dogmatic relativism and totalitarianism), the same document asserted the equality of all men and also approved the setting up of workers associations for the welfare of the workers and their family, and called upon the bishops of the world to extend their generosity to such projects.

Iwe (1986) avers that the "most important of all Leonine documents on human rights is "Rerum Novarum" of the 16th May 1891-dealing with the conditions in which workers found themselves in the early stages of the industrial Revolution" (p.139). The above Encyclical asserted and defended the fundamental and natural right to private property as well as the rights of workers to organize and form associations and to just salary. It is said to be referred to as the "Magna Carta" of the working class.

5.2.2.2 The Pontificate of Pope Pius XI

The pontificate of Pope Pius XI from 6th February 1922-10th February 1939 according to Iwe (1986) "was also marked by shining documents which stood in defense of the rights of man" (p.140) and substantially in agreement with those of Pope Leo XIII, especially with regard to the right of private property, to form associations, of the family and to adequate and just wages. Of these three Encyclicals relating to human rights, namely: "Divinillius Magistri" of 1929, "Quadragesimo Anno" of 1931 and "Divini Redemptoris" of 1934, that of 1931 confirmed the Socio-economic principles and rights already asserted in "Rerum Novarum" and up-dated its content. The "Quadragesimo Anno" of 15th May, 1931 Iwe (1986) avers, additionally turned to labour and capital, and singularly reconciled the intricate and mutual rights and claims of both the workers and the requirements of justice. He explains further that the document approved the principle of the salary system and also highlighted its personal, domestic and economic criteria. Having asserted the mutual indispensability of both capital and labour, "Quadragesimo Anno" called for the general amelioration of the labour conditions and to increase the status of the worker through an economic order whereby according to Pius XI cited in Iwe (1986):

> every effort must be made that at least in future a just share only of the fruits of production be permitted to accumulate in the hands of the wealthy, and that ample sufficiency be supplied to workers (p.141).

5.2.2.3 The Pontificate of Pope Pius XII (2nd March 1939-9th October 1958).

Pius XII is said to be figured as the Pope and Father of human rights. In his Sertum Laetitiae" of November 1939 were asserted the guiding principles of justice and Charity- the right to sufficient family wages and to form labour unions. Pius XII cited in Iwe (1986) enunciates that:

> Because sociability is one of man's natural requirements and since it is legitimate to promote by common effort, decent livelihood, it is not possible without injustice, to deny or to limit either to the producers or to the laboring and farming classes the free faculty of uniting in associations, by means of which they may defend their proper rights and secure the betterment of the goods of soul and of body, as well as the honest comforts of life (p.144).

In all, the pontificates have through those documents strengthened and re-emphasized the need for just wages for worker, good working conditions and the need for the workers to form associations that will help them in collective bargaining.

As such, workers at the mine pits in Ebonyi State do really have trade union rights as earlier promoted by the pontificate and provided by ILO convention 87 and 98 as well as the OECD guidelines that, stipulates collective bargaining as the fairest way for the employer employee relationship.

Hence the political will of Ebonyi State government is strongly needed to organize the artisanal miners in the state into small scale groups, train them vocationally in the field of mining, encourage and promote the formation of trade unions amongst the artisanal miners, which in turn will empower them to press for just wages.

5.3 The Principle of Sustainability and the Impacts of Mining in Ebonyi State.

Historically, like the principle of human rights, sustainability as a term common to environment and development was adopted at the historic UN Stockholm conference on Environment and Development in 1972. Hence interconnections between environment, development and sustainability were finally brought together under one concept. Again in 1992, the Rio Earth Summit brought the international community together to address global

sustainable development challenges including issues such as climate change, health and the environment, biodiversity and poverty alleviation.

Ajash and Vaibhav (2011) in their definition of the term "sustainability" see human activities as part of and dependent upon the natural world. They defined sustainability in terms of meeting basic human needs and wants; making decisions that recognize the connections between actions and effects in the environment, economy and society; and being concerned about the kind of legacy that is left for generations unborn.

The United Nations sustainable development platform, Rio+20 raises alarm that the world's population of 7 billion is likely to increase to 9 billion by 2050; the demand for diminishing natural resources (that is non-renewable resources) is growing; and income gaps are widening. Thus, sustainability is seriously linked to basic question of equity- that is fairness, social justice and greater access to a better quality of life.

While it is appreciated that the term is widely used in other subjects than the environment, in the context of this paper, sustainability borders on environmental preservation. Ibeh (2000) holds that development economists have adopted the term in an attempt to clarify the desired balance between growth on one hand and environmental preservation on the other hand. Hence, Todaro in Ibeh (2000) joined others afore mentioned to define sustainability as meeting the needs of the present generation without compromising the needs of future generation.

In this line of argument, sustainability therefore recognizes that: the unborn generation sure will also have need for both renewable and non renewable natural resources; they also will have the right to health, will need to live in an unpolluted, toxic-free environment and

therefore will need to meet an eco system that will be habitable. The all important moral questions that the present generation must answer are: is it fair and just to exploit and usurp all the renewable resources without renewing them and the non renewable resources, leaving nothing for the future generation? Is it fair to pollute the eco system and make it inhabitable for them?

Thus for the sake of posterity, the principle of sustainability forbids the miners in Ebonyi State from over-exploiting the non renewable natural resources in the state. It also demands from them a high sense of discipline in mining activities, such that will employ best practices that conform to led down regulations in mining, thereby imbibing the biblical injunction in Genesis 2:15, where man is commanded to "till the ground and keep it". It is only obedience to the injunction of "tilling and keeping" the ground that will preserve the eco system for future generation.

5.4 The Principal of Solidarity and the Impacts of Mining in Ebonyi State

Markkula Centre for applied ethics (2014) enunciable that the principal solidarity is an invitation to consider how we relate to each other in community and therefore assumes that we recognize that we are part of at least one family (our biological family) our local community and our national community solidarity challenges us to consider the full range of relationships with others. "others" in the context of this research includes biotic and abiotic community alike.

Ibeh (2003) avers that solidarity is one of the principles of environmental ethics and insists that "among the solid standards that demand the preservation of the bedrock of natural

resources is the principle of solidarity' (p.91). The function of this principle according to the above source is to foster relationship whereby the individual pursues the welfare of others and the community and vice versa. Marx in Ibeh (2003), stresses that this principle of solidarity stems from the dignity of the human person and the inseparable bond of relationship between persons in social life.

This may suggest that solidarity principle is only relevant in social life, interpersonal, community, state or international relationships. Howbeit, the solidarity principle is truly relevant and should be employed in line with Leopold's land ethic theory.

Furthermore, the solidarity principle could be seen as a reverberation of the land ethic theory (ecocentrism) afore discussed in section 2.2.3 of this research, where Leopold (1949) suggested that the land ethic simply enlarges the boundaries of the community to include soils, water, plants and animals collectively. He insisted that the attitude of encooperating the above as a community would encourage humans to co-operate with the "land" rather than compete with it. In essence therefore, the solidarity principle considers to what extent the activities of the miners in Ebonyi State have considered and indeed pursued the welfare of biotic and abiotic community.

The application of principle of solidarity, Markkula center avers should address these questions:

i. Who are all human stakeholders involved in this situation?
ii. Who are all human stakeholders?
iii. Is there a community of life (ecosystem) involved
iv. Are there any stakeholders-human and non-human who are especially vulnerable?

These questions shall form the spring board for moral reasoning on the impacts of mining in Ebonyi state applying solidarity principle.

The human stakeholders involved in mining in Ebonyi are a very wide range, and should not be limited to the companies, private investors and groups of artisanal miners directly involved in the activity. This position tries to move away from the traditional idea of stakeholder as a "person or company that is involved in a particular organization, project, system, and so on, especially because they have invested money in it" the human stakeholders involved in this situation (mining in Ebonyi State) should include among others the immediate community where the mining activities take place not because they have invested money, but because their health, life and general wellbeing are at stake. Another stakeholder should be the government whose primary responsibility it is to protect the lives of their subjects with every possible lawful means. Hence in Ebonyi State, the human stakeholders include the miners (of different categories as have been outlined), the communities, and the government.

Furthermore, the natural stakeholders involved in this particular situation include the trees, animals, water, land, air and indeed every biotic and abiotic component of the natural environment. In applying the principle of solidarity in this situation therefore, is the consideration that a community of life (eco-system) in relation to the physical environment is affected as seen in chapter 4 of this research. Thus it is clear that the human and non-human stakeholders are especially vulnerable.

What then ought to have been the right action to correct the anormally given the principle of solidarity? Recall that solidarity principles considers the relationship with "others" in a community. As such, the miners of different categories in Ebonyi State ought to consider that their activities especially impact heavily/negatively on the health of their host community and stick to rules that will help mitigate against the impacts, rather than get pre-occupied with

their gains. The government on the other hand ought to consider their responsibilities towards safeguarding the lives of their subjects. Hence enforcing political will to get the miners play by the rules, organizing and educating the artisanal miners on best practices, sensitizing the host communities on healthy lifestyle and their civic obligation of protecting their environment and so on all border on government concerns.

In relation to the natural non-human stakeholders, the miners ought to consider the biotic and abiotic components of the ecosystem-the land, air, water, trees/plants, animals and so on. therefore, land reclamation, effluent treatment tank installation, replacement of flora, resettlement of fauna and other practices should be addressed and planned for by the miners right from before the project commencement at the exploration stage.

CHAPTER SIX

SUMMARY AND CONCLUSION

6.1 Summary

This research is made up of six chapters. The background to the problem of this research, the importance and significance of the study are all contained in the chapter one of the dissertation. In the second chapter literature review, literature was reviewed under the following sub-headings: conceptual framework, theoretical framework, empirical studies and summary of literature review.

Chapter three dealt with mining and mining techniques in Ebonyi State highlighting brief information on Ebonyi State, the mining techniques and mining operations in the State. Impacts of mining in Ebonyi State were explored in chapter four under the following subheadings economic impacts, environmental and health impacts and socio-political impacts. In this chapter also, factors responsible for the negative impacts of mining in Ebonyi State were examined.

The fifth chapter which is the main thrust of this research evaluated the impacts of mining in Ebonyi State ethically, employing the following ethical principles- justice, human rights, sustainability and solidarity. The last chapter handled the summary, conclusion, and recommendations of this dissertation as well as suggestions for further research. This very last session of the dissertation is useful for students with research interest in mining in Ebonyi State from both the Humanities and Sciences.

6.2 Conclusion

The problem of heavy impacts of mining in the environment (Ebonyi State, Nigeria in particular) is hydra headed and not because there are no regulations guiding mining, rather because the people involved lack the character, discipline and moral will to implement and adhere to the regulations. Nnadi in Ocho (2005) maintains that the "greatness of the industrialized and technologically advanced countries does not lie in their sophisticated computers and weaponry but in the mind; the man behind the machines: his character, morality, self-discipline, submission to the rule of law..." (p. 85). In the same vein, Agha in Nkama (2010) quips that "Morality moulds a good man and the good man moulds the nation and society" (p. 97).

Nnadi's position above has a wider application. In this subject, the men directly behind the machine are those doing the mining. The moral/ethical part of the exercise (mining) should be most important to the miners. However, the inability of the miners to play by the rule in Ebonyi State which in turn results in environmental degradation eloquently testifies that they value the wealth more than the life of their host community, where as life is of the highest value. This calls for their re-orientation. Since it is an established fact that good procedures in mining though more expensive, reduce heavy impact on the environment to the barest minimum and these procedures/regulations are available and known by the operators, the other set of men behind the machine are the enforcement agencies. Here in Nigeria, we have the National Environmental Standards and Regulation Enforcement Agency (NESREA), Federal Ministry of Environment, and so on, which all have state offices in Ebonyi. They are charged with the responsibility of ensuring that miners, both expatriate and local, conform to standards and are sanctioned if non-compliant. Studies have shown that miners in Ebonyi State flagrantly abuse the rules, implying that more concerted efforts of NESREA and Ministry of Environment are urgently needed.

The research also indicates the ignorance of the people in Ebonyi State of;

i. Mining and Quarrying regulations;
ii. Their obligation in reporting to relevant Agencies; and
iii. The danger people living in mine areas are exposed to. These have contributed to the negative impacts of mining in the state. There is therefore an urgent need for sensitization and proper education of people living in mine areas in particular and the people of Ebonyi State, Nigeria in general.

6.3 Recommendations

From the observations of the research summarized above, the following are the suggestions of this research:

1. Value re-orientation: Miners need to be re-orientated so as to be able to reshape their values in the mining operation. Such will help them define and assess their motive in their operation which should not solely aim at exploiting the natural resources and making all the gains by boycotting the standards in order to minimize costs. Thus, at the preliminary stage, the Ministry of Environment (both State and Federal) and National Orientation Agency (NOA) should organize an orientation and interactive session for any company that wishes to operate. This will achieve sustainability in the mining operation, where the future generation will come and meet the environment still habitable. As such, both the state and Federal Ministry of Environment should re-orientate miners and mining companies on the tenets and demands of justice, human rights and sustainability as they tap the resources.
2. NESREA and other environmental enforcement agencies should re-strategize and brainstorm on how best to achieve their goals. They also need to establish in house mechanisms to checkmate fraud amongst their staff. This will ensure that no one

places personal interest in pecuniary benefits above statutory and legitimate responsibilities.

3. The host State Ministry of Environment and NESREA as well as National Orientation Agency have roles to play in educating and sensitizing the communities in mine areas of:

a. The content of the Regulations on Mining and general environmental regulations.

b. Their obligation in reporting to appropriate Agencies of any contrary practice in the operations of the miners in their area. This will help the enforcement Agency to be more efficient. They should be made to understand that they and their generation unborn have the right to a healthy and unpolluted environment.

c. The health dangers they face as people living in mine areas if they sit on the fence, ways of adopting healthy life styles and how not to expose themselves to emissions from the mines. This will motivate them to cooperate and partner with government agencies in the business of environmental safeguards.

4. Government of Ebonyi State should form a health policy on mining that will check effluent emission from mines. The enforcement of this policy should ensure that before any mine or quarry operates in Ebonyi State, it must have installed an Effluent Treatment Plant (ETP). This policy will not only be for mines owned by companies and private investors alone but should include those owned by groups of artisanal miners.

5. The bottlenecks experienced by mining companies in acquiring an EIA before operations should be removed by the federal mining cadastre office by ensuring that the preliminary inspections needed to be carried out by them are done promptly. This will enable the companies not to cut corners in terms of complying to the standard of getting an EIA before operations.

6. Government of Ebonyi State should diversify the economy of the state by building more industries taking Agriculture in the State from mere subsistence farming to commercial agriculture. This will reduce interest for artisanal mining which gives quick/cheap money, and cause Ebonyians to refocus on Agriculture.
7. The artisanal miners in the State should be group together by the government ministry of commerce industry into societies for easy monitory and training. When they are trained on the best practices in mining, the negative impacts would have been ameliorated.
8. The government should promote artisanal mining in the State to a small scale mining industry where the workers in the mine pits will be empowered to form unions in order to press for their collective welfare (just wage and good working conditions).
9. NESREA Ebonyi State office should enforce the closure of all abandoned mines in the State for example some artisanal mines at Ishiagu Enyigba in Abakaliki, Ameri and so on, to check Acid Mine Drainage.
10. Ebonyi State government should enforce a policy against child labour at the mine pits. By extension also, the policy will ensure that children of school age is find working in the mine pits.

7.4 Suggestions for Further Research

The following areas are suggested for further research which may amplify knowledge related to this field of investigation. There is the need for more scholarly research to be carried out on the subject matter to find out if the results will confirm those obtained in the present study.

It is also necessary that research be carried out to ascertain the suitability of using the Land Ethic Theory of Aldo Leopold in solving any environmental crisis problem caused by humans.

There is also the need to verify, through scholarly research, the claim by many ethicists that the creation accounts of Genesis chapter 1:26-28 is the root of anthropocentrism and exploitative use of the good of nature.

The level of effluent contamination of water bodies in Ebonyi State as indicated in the research calls for the need to carry out a scientific research to ascertain the portability of Oferekpe River which is the source of water for Ebonyi State Oferekpe water scheme that is supposed to supply pipe borne water to the whole Abakaliki Zone. At the course of this research it was discovered that children between 2-10 years of age in Ishiagu Enyigba, Abakaliki L.G.A. often had convulsion. There is need for a research by medical scientists to determine the correlation of convulsion in children and lead mining.

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Oral Participatory Interview

S/N	Name of Interviewee	Sex	Occupation Address	Age	Date	Interviewer
1	Chukwu N. Ifeanyi	M	Civil Servant Ogwor	+35	18/6/15	Nkama Chinyere Lilian.
2	David Nwokporo	M	Artisanal Miner Ameka (Ihotor)	+33	30/05/15	Nkama Chinyere Lilian.
3	Deacon Njoku Iheanyi	M	Operator Manager crushed Rock Ishiagu	+41	18/06/15	Nkama Chinyere Lilian.
4	Ebere Eze	F	Nurse Ishiagu Enyigba	+30	30/05/15	Nkama Chinyere Lilian.
5	Ekpe, Samuel Nwangbo	M	Civil Servant Ebonyi State Ministry of Commerce and Industry.	+50	14/11/14	Nkama Chinyere Lilian.
6	Elder Paulinus	M	Community Chairman Ihetutu Isiagu, Ebonyi State.	+66	18/06/15	Nkama Chinyere Lilian.
7	Eme Okoro	M	Civil Servant Abakaliki	+45	14/01/15	Nkama Chinyere Lilian.
8	Ikenna Austin	M	Artisanal Miner Ameka (Ihotor)	+30	30/05/15	Nkama Chinyere Lilian.
9	John Emmanuel	M	Private Investor Abakaliki	+48	30/05/15	Nkama Chinyere Lilian.
10	Mbam, Darlington.	M	Civil Servant. Ebonyi State Ministry of Works Transport Admin. Department HOD.	+45	20/11/15	Nkama Chinyere Lilian.
11	Nathaniel Godwin Doeko'os	M	NESREA Ebonyi State Office (Desk Officer, Mining)	+38	14/01/15	Nkama Chinyere Lilian.
12	Nicodemu Agbalu	M	Artisanal Miner Ameka (Ihotor)	+35	30/05/15	Nkama Chinyere Lilian.
13	Nwafor Julius	M	Civil Servant Ihotor Community Ameka, Ezza	+29	30/05/15	Nkama Chinyere Lilian
14	Nwali Sunday Paul	M	Artisanal Miner Ameka (Ihotor)	+36	30/05/15	Nkama Chinyere Lilian.
15	Nworie Elijah	M	Ikwo, Ebonyi State (Civil Servant)	+30	05/02/14	Nkama Chinyere Lilian.
16	Okeh Sunday	M	Artisanal Miner Ohankwu Ikwo	+27	30/05/15	Nkama Chinyere Lilian.
17	Oketa Friday	M	Artisanal Miner before Plumber	+45	30/05/15	Nkama Chinyere Lilian.
18	Opeke Echee	M	Artisanal Miner (Pit owner) Enyimchukwu-Ndufu-Alike Ikwo.	+50	31/07/15	Nworie Elijah
19	Pele Egbagiri	M	NESREA Ebonyi State Office (State Coordinator)	+42	14/01/15	Nkama Chinyere Lilian.

APPENDIX I

Guideline for Oral Interview

Category A: Miners Mining Company

1. When did you start the mining operation in this village?

(i) What is the greatest depth you have mined so far?

(ii) Would you classify your operation as surface or underground mining?

2. How has your mining operator benefited host community?
3. Since you started the operation, what negative impacts have you identified to affect the community?
4. What factors do you think are responsible for the negative impacts of your mining activities in the community?
5. What measures do you think can be taken to ameliorate the negative impacts of your operation in the community?

Category B: Villagers in mining communities.

1. When did mining operation in your village begin?
2. Do you also engage in artisanal Mining?
3. What negative impacts have you identified in your community since mining began?
4. How has mining helped to improve your life and community?

Category C: NESREA, State Ministry of Environment; and Ministry of commerce and Industry.

1. How many Mining/Quarry sites do we have in Ebonyi State?
2. What are the negative environmental impacts of mining in Ebonyi State?
3. How has mining operations improved the economy of the State?
4. What are the standards and Regulations in mining/Quarrying?
5. To what extent do Mining/ Quarrying industries comply to regulatory standards?

6. What are some of the factors to which your Agency can attribute the negative impacts of mining in Ebonyi State?
7. What measures could be taken to ameliorate if not eradicate the negative impacts of mining in Ebonyi State?

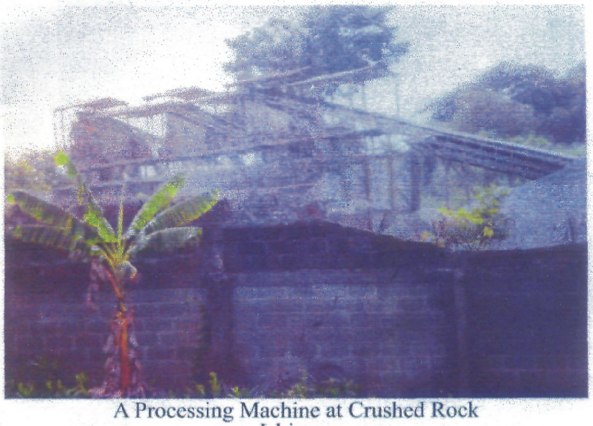
Appendix II

Some pictorial representation of Cities visited by the Researchers

Researcher Conducting an Interview with the Operations Manager of Crushed Rock Co. Ltd.

Researcher with Operation Manager of Crushed Rock Com. Ltd. Ishiagu at the quarry

Quarry pit of about 60m in benches at Crushed Rock Co. Ltd., Ishiagu.

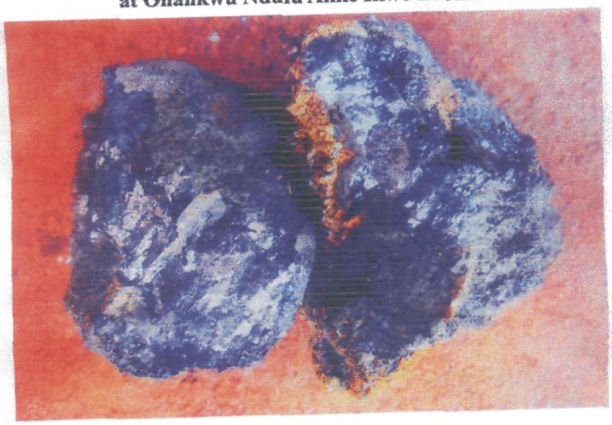


A Processing Machine at Crushed Rock
Ishiagu.

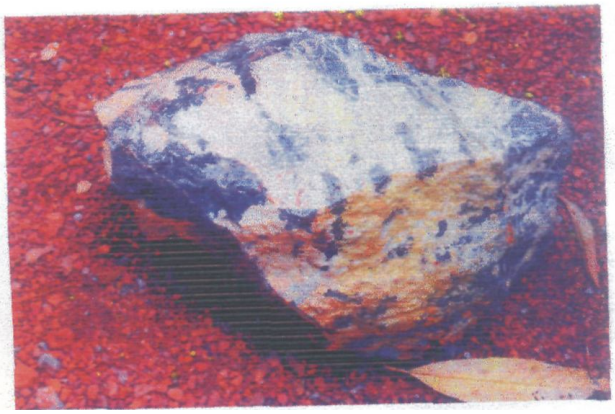
Mine pit at Ishiagu Enyigba Effluent Channeled
to farmland /Road.

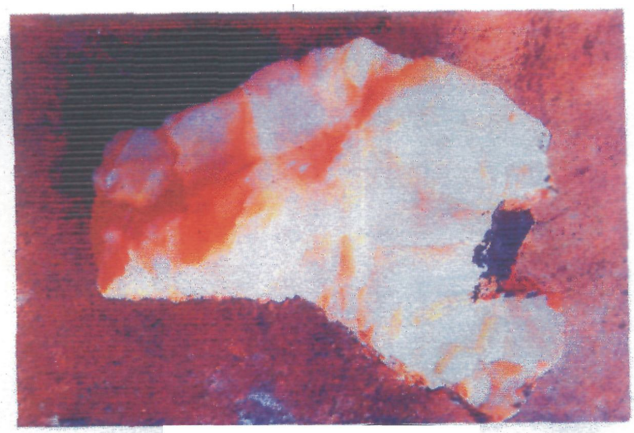
Mine pit with Effluent Channelled to Akpara River
Ihoto Ameka Ezza, Ezza South L.G.A.

Lead Zinc packed in bags in the residence of an Interviewee at Ohankwu Ndufu Alike Ikwo L.G.A.

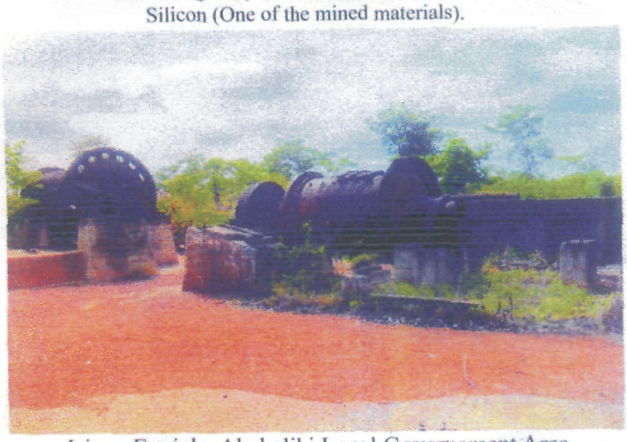


A Sample of Zinc

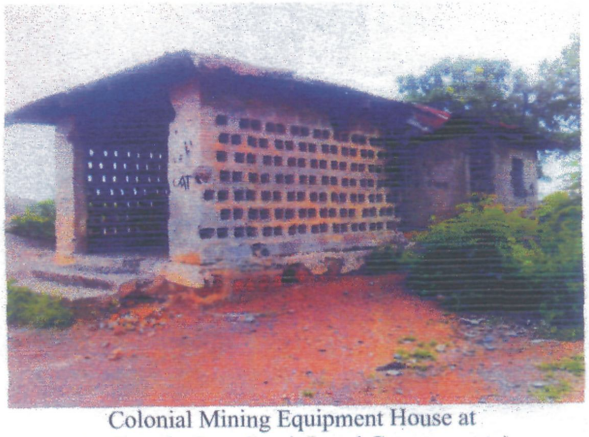




Silicon (One of the mined materials).



Isiagu Enyigba Abakaliki Local Governement Area
Ebonyi State. An abandoned machine by the colonial miners.



Colonial Mining Equipment House at
Ameka Ezza in Ezza South Local Government Area,
Ebonyi State.

Isiagu Enyigba Abakaliki L.G.A.
Abandoned Mine pit by Artisanal Miners

Ameka Ezza, Ezza South L.G.A. Lake formed from mine pits where people also bath and swim bathe

Isiagu Enyigba Colonial Miner Building
Abakaliki L.G.A.

Mine pit at Ohankwu Ndufu Alike in
Ikwo Local Governemnt Area, Ebonyi State.

Isiagu Enyigba Abakaliki Local Governement Area
Mine Effluent Channeled to the road.

Ishiagu Enyigba Abakaliki L.G.A.
Abandoned by Colonial Miner

Enyigba Where the Ebonyi River Passes across the mining area, through Omege Agalagu Ebonyi River, Abakaliki L.G.A.

Isiagu Enyigba Abakaliki L.G.A.
Colonial Mining Equipment Abandoned.