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EXAMINATION OF THE EFFECT OF SOLID MINERAL MINING (LEAD) ON THE WATER RESOURCES IN ABAKALIKI, EBONYI STATE

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Abstract
Lead mining activities in Ishiagu have drastically affected the groundwater resource of the area, contaminating it with significant concentrations of metallic lead and zinc. Season affects lead concentrations adversely with dry season recording higher concentration values. Heavy metals (lead and zinc) distribution in the groundwater and fishes, follow the same pattern, indicating a close correlation between the levels in groundwater and in fishes. The fact that both dry and rainy season mean levels of lead exceeded WHO (1985) and NAFDAC (2006) recommended limits in food and water, suggested that both groundwater and fishes of the area are endemic for human consumption. Based on that, metal pollution in Ishiagushould be monitored closely due to possible health implication to consumers of the fishes and groundwater users in the area.

Keywords: Solid Mineral, Mining, Lead, Water Resources, Abakaliki

Introduction

Lead-Zinc ores are usually found together. They are often associated with copper and silver. Lead-zinc ores are used in the production of batteries, electrical cables, solders glass and even protective coatings for other metals.Mining industries are now viewed as key drivers of economic growth and the development process (Bradshaw, 2005), and as lead sectors that drive economic expansion which can lead to higher levels of social and economic well-being (Bridge, 2008).

Mineral is an inorganic substance found in nature with a characteristics chemical composition and in some cases, of definite crystal structure.In the absence of adequate portable water supply majority of residents depends on surface water streams namely Onuafia, Ihekoyi and Akpaudo, abandoned Zinc and lead Ores mining pits, and Ugwuadu spring for agricultural and domestic uses respectively. Geologically, the Ishaiagu Lead deposits form part of the Abakaliki Lead field (BESL. 2004). This field occurs within a substantial part of the largest cretaceous sedimentary

basis in Nigeria known as the Benue trough. The Ishiagu mineral belt is part of the tectonic – mineralization zone forming the lower Benue field.

Heavy metals are chemical elements with specific gravity (density) of at least five times that of water (Liprot, 1983). Heavy metals come from various sources; naturally occurring mineral deposits like lead, zinc, iron ore, marble limestone and chromium (Obienusi, 2004). Industrial processes such as mining activities are other sources of heavy metals. It is true that some metals are very useful to man and manufacturing industries, they are at the same time very toxic to man even at a low concentrations when they enter the aquatic environment.

The pollution of the aquatic environment with heavy metals has become a worldwide problem during recent years, because they are indestructible and most of them have toxic effects on organisms (MacFarlane and Burchett, (2000).

Among the environmental pollutants, metals are of particular concern, due to their potential toxic effect and ability to bioaccumulation in aquatic ecosystems, Censi, *et al*, (2006). The accumulation of heavy metals in freshwater ecosystem has been a major concern. Heavy metals generally enter the aquatic environment through natural (atmospheric deposition, erosion of geological matrix) or anthropogenic activities (caused by industrial effluent, domestic sewage, mining and agriculture wastes) Connell, and Miller (1984) and Vautukuru (2005).

Study Area

Ishiagu is located in the southern part of Ebonyi State where open cast mining of Lead (Pb) and Zinc (Zn) is common. It lies between latitude 7030` and7037` N and longitude 5052` and 6000` E. Ishaigu is richly endowed withmineral deposits, which are mainly heavy metal sulfide ores, mostly galena(PbS). It is intensively and competitively exploited by several mining industriesfor over thirty (30) years now. Ishiagu is made up of eleven (11) villages withfive active mining villages, namely: Amagu, Amaonye, Ihetutu and Ameze.It is surrounded byAfikpo to the North, LokpaNta to the East, Lekwesi to the West and Uburu to the South (Figure 1) and the study locations shown in Figure 2.

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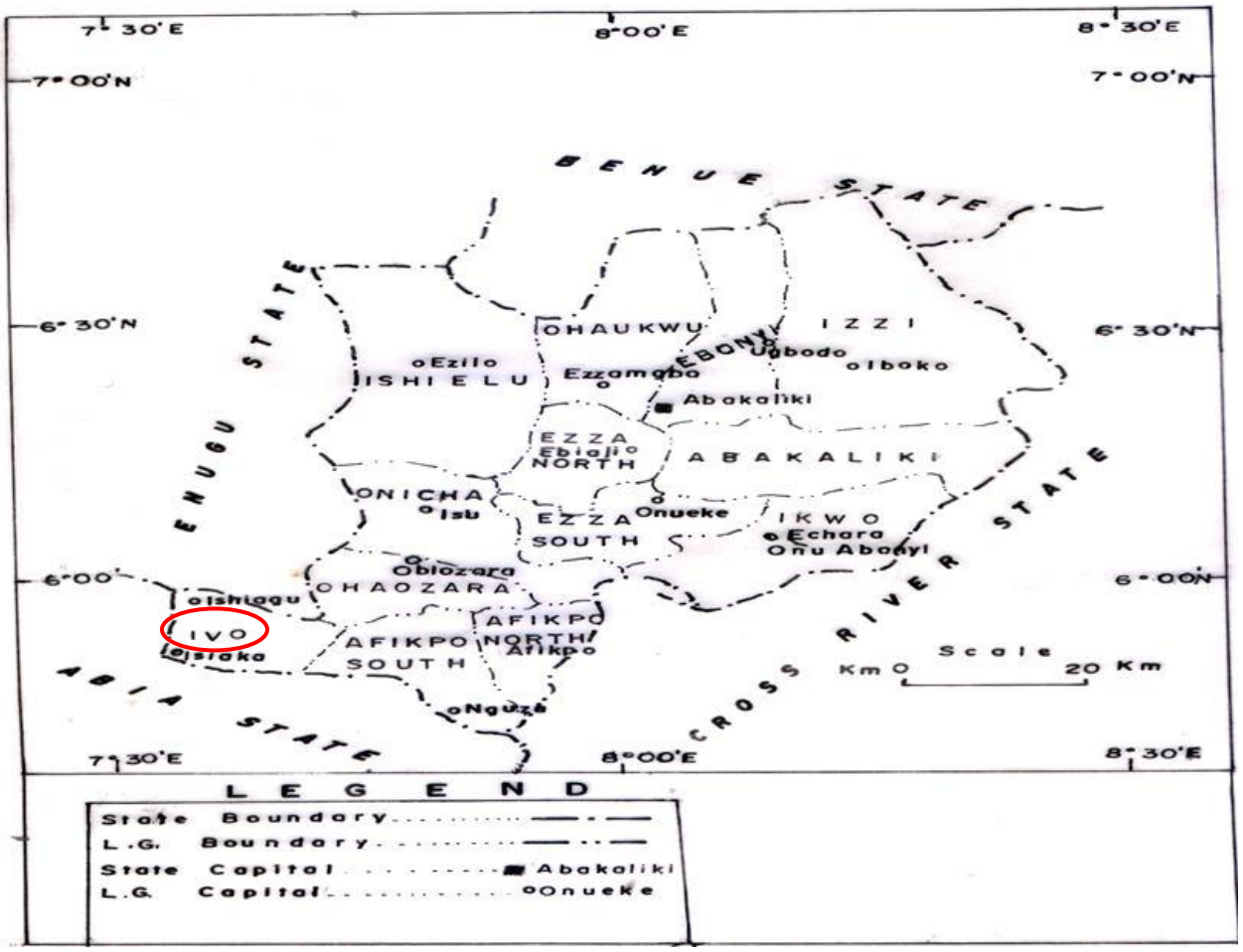

Fig. 1: Map of Ebonyi State showing Ivo L.G.A (Survey DeptAbakaliki).

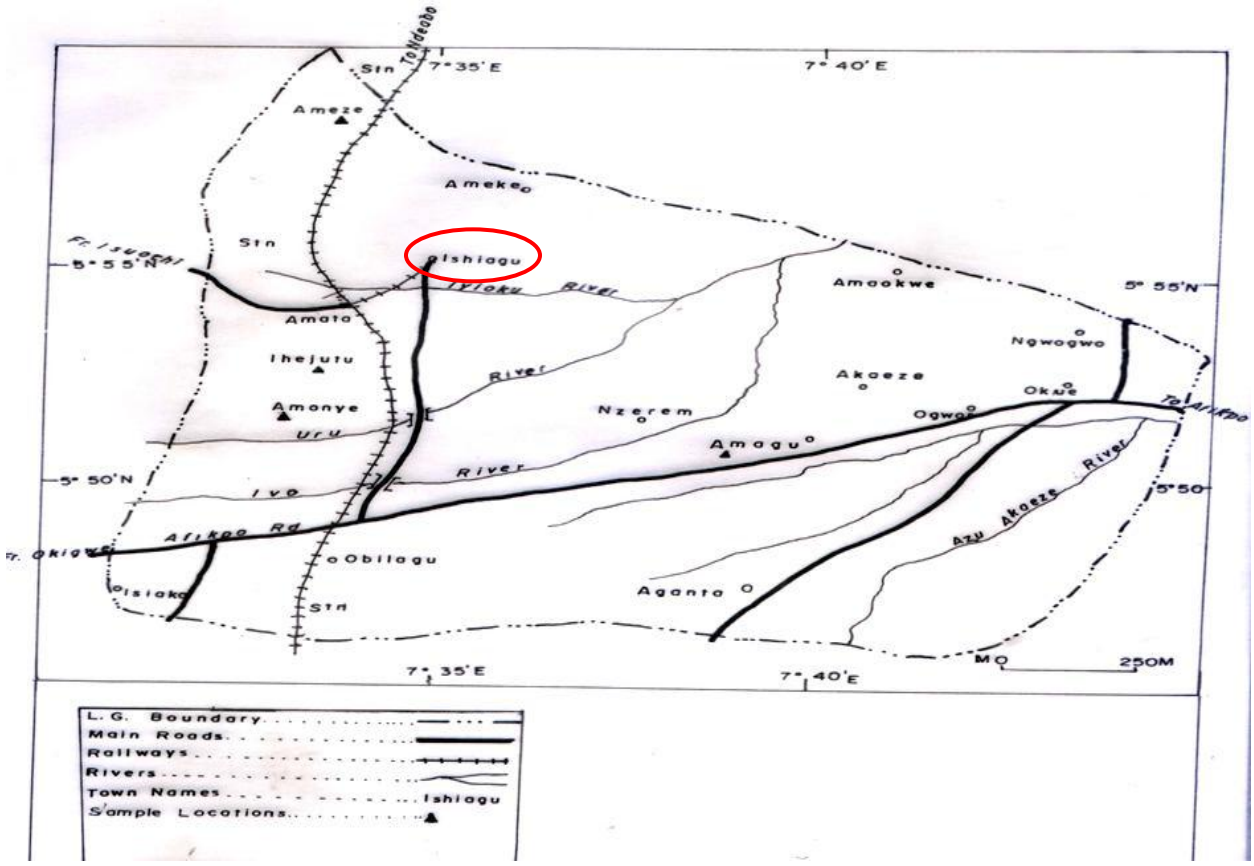

Fig. 2**:** Map of Ishiagu Showing Study Locations (Survey Department,Abakaliki).

Importance of Lead Mining

It is estimated that Nigeria has over 10,000,000 tons of lead ore deposit and it is an important component in car battery production. The prospect of global economy is promising, so the automotive industry which is closely related to the lead market, is witnessing growth thereby creating more demands for the product.Lead-zinc ores are used in the production of batteries, electrical cables, solders glass and even protective coatings for other metals

Effect of Lead Mining on Water

Socio-economically the people of Ishiagu are mainly farmers. The cropscultivated include yams, cassava and rice. Cassava and yam are commercially produced and thereforeform the economic base of the area.In the absence of adequate portable water supply majority of residents depends on surface water streams.

The mineral assemblage and associations in the area comprise both primary and secondary mineralization(Offordile 2001). The primary metalliferons deposits in the area include Galena,Sphalerite, Chaleopyrite, Marcasite Cerrurite and Pyromorphite while the gangue minerals associatedwith the metallic ores include siderite, calcite, fluorite, barite and quartz. Successive mining activitiesby various companies have depleted this reserve over the years.

Pollution of surface water streams andspring used for agricultural and domestic purposes, as well as, rising noise and suspended air particulatelevels across the Ishiagu communities. The presence of large excavated pits used for zinc and leads oresexploration/mining (without any form of backfilling as earlier indicated in Environmental ManagementPlans (EMP) by the various mining operators and its attendant land damage and degradation) hasforced farmers to source farmlands at far distances from their communities of domicile.

Furthermore, the pollution of Onuafia, Ihekoyi and Akpaudo streams and, in particular that of Ugwuadospring used for drinking purpose by the agrarian settlements (in an environment where amenities andservices such as clean water and health care are grossly inadequate is to say the least undesirable (Essaghah, Ogbona and Ugwuanyi 2006).

With the current levels of Suspended Particulate Matter (SPM)in all locations well above Federal Ministry of Environment and World Health Organization (WHO)standards (during the dry season), there is no doubt that the health status of these agrarian communitieshave become worse for it. Obviously policy has a role to play in reversing these negative socioeconomicand healthcare indications.

Air Quality

The concentration of gaseous pollutants were very low, particularly those ofhydrogen sulphide and carbon monoxide. However, the concentration of Suspended Particulate Matter (SPM) was muchhigher which could be attributed to dust haze.

Air pollutants are intimately associated with a number of respiratorydiseases, largely in aggravating existing disorders such as emphysema, bronchitis and asthma (Ardayfio-schandoof and Asiedu, 2003).

Loss of natural vegetation possess a risk for the surrounding area because the absence of vegetationfacilitates lateral wind erosion of metal contaminated particles, and may enhance the

volume of waterpenetrating through the soil and eventually reaching and contaminating the underlying ground water(Vangronsveld et al 1991; Vangronsveldet al 1995b). These consequences are undesirable in a fragile,rural, agrarian settlements sustained in large part by agriculture, and where amenities and services suchas clean water and health care are grossly inadequate.

Conclusion

The environmental impact of solid mining activities inIshiagu, a community known for large deposits of lead and zinc ores, has potential of becoming anindustrial area in Ebonyi State of Nigeria. One way of ensuring continued exploitation of valuableminerals and harness their positive contributions for sustainable economic and physical transformationof the local communities is to protect existing environmental systems and resources that support theagricultural pursuits and livelihood of the people (Essaghah 2010a; Essaghah and Alabi 2013).

Recommendations

In view of the adverse effect of lead mining on water resources in Ishiagu and the health implications of drinkingcontaminated water, the following measures are recommended to guard against the future and further drinking of such water and its deadly effect.

- Ebonyi State Government through the Ministries of Agriculture, Environment and Water resources should provide direct support services to the people in the area of rural water supply projects including distribution of subsidized water treatment chemicals/kits, fertilizer distribution and other farm implements without delay. This will help to amend the difficulties faced by the rural farmers and help arrest the rising incidence of dysentery, typhoid and respiratory related disorders and or diseases.

- EnvironmentalRegulatory Agencies should stipulate specific mitigation measures that industry and mining companiesmust implement in their host communities before granting approval permits.Rather than leave such decisions to individual companies. Regulatory agencies should embark on thedevelopment of data base on the problems resulting from

industrial operations in the implementation ofmitigation measures by investors in these areas.

- The Ebonyi State Environmental Protection Agency (EBSEPA) should rise up to its statutory responsibilities (in collaboration with the Ebonyi State Ministry of Environment) by embarking on effective monitoring of the activities of mining and quarrying industries in the state to ensure that industrial operators fulfill their social responsibilities to the communities where they operate.

- The Federal Government should adopt a deliberate policy of direct intervention in the provision ofnecessary social amenities in industrial areas to complement the efforts of industrial operators if itscurrent emphasis on industrialization and employment creation is to yield desirable results. This will goa long way in complementing the various residual mitigation measures usually adopted by miningcompanies in their areas of operation (Essaghah and Ugwuayi, 2006).

Until this is done industrial concerns in general and mining operators in particular will continue to smileto banks at the expense of the very poor rural farmers' land; teaming inhabitants who bear the impact of thedamages caused by them and at whose instance the government encourages industrialization.

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