International Journal of Advances in Engineering and Management (IJAEM)
Volume 6, Issue 07 July 2024, pp: 76-87 www.ijaem.net ISSN: 2395-5252

Geochemical Evaluation Of Quarry Dust And Soils Around Quarries In Ngbo And Abakaliki Areas, Southeastern Nigeria.

Laniyan, D. M[1]; Nnabo, P. N[1]; Obasi, P. N[2©] Ozibo, G. O[3]
[1]Department of Geology, Ebonyi State University, Abakaliki, Nigeria
[3]Department of Geology/Geophysics, Alex Ekwueme Federal University, Ndufu-Alik, Nigeria

Date of Submission: 25-06-2024 Date of Acceptance: 05-07-2024

ABSTRACTS
The need for infrastructural development has increased the establishment of quarries in Ebonyi state, Nigeria. Quarry operations have been linked to the introduction of heavy metals in the environment as the breakdown of rock materials into aggregates exposes them to weathering processes. This study has evaluated the concentration of heavy metals in quarry dust and soils around the Abakaliki and Ngbo areas. Twenty (20) samples; 8 dust samples and 12 soil samples were analysed for heavy metals (Pb, Zn, Cu, Fe, Co, Ni, Ag, As, Hg, Mn, Cd, and Cr) using Atomic Absorbtion Spectrophotometric method. Result shows low geochemical concentration of heavy metals in all the dust samples analysed. Only Cd recorded mean concentration values that exceeded the average continental shale values. Soil samples were comparatively low except for Pb and Mn which recorded high concentration above the threshold around Ezillo and Umuogharu quarry sites. Heavy metals dominance from soils of the study area is in the order Fe > Mn > Zn > Pb > Cr > Ni > Co > Cu > Cd >As..
This shows low effect of quarry operations on the arable soils of the area.

I. INTRODUCTION

The quest for harnessing geologic materials for building and construction purposes has been on the increase as the demand for their use in areas of need by humans continues to increase rapidly. In addition, quarrying of these materials has become a source of income and revenue for both the government and individuals. Humans are always carried by the gains of harnessing these natural resources without much consideration for the protection of the bio-environment within the areas of these quarrying activities. Studies have established that heavy metals like Pb, As,Fe, Cu,Zn, and Cd which contribute to the pollution of arable soils emanate from rocks and other mining activities (Obasi and Akudinobi, 2019, 2020; Ahmed, 2020; Onwe et al, 2020; Eyankware et al., 2020; Eyankware et al., 2022; Ekpa et al., 2023; Suneetha and Gupta, 2018; Obasi, 2009). These metals could also affect aquatic plants, animals, human health, and the ecosystem (Kalu, 2018).

In the Abakaliki and Ngbo areas, there have been continuous increases in quarrying activities due to an increase in demand for these litho materials for various construction purposes in the southern part of Nigeria. The abundant deposit of igneous materials – pyroclastic, granitic, and sedimentary materials - the limestone, sandstones, and the highly indurated shales of Abakaliki have made quarrying activity in the area a very lucrative venture. It is a huge source of income, employment, and investment opportunities; however, its attendant environmental consequences can never be relegated. Quarrying activity can adversely alter preexisting ecosystems when there are changes in hydrogeological and hydrological regimes (Abate, 2016; Ekpa et al; 2023). This in turn induces damage to property, depletion of groundwater, loss of fertile topsoil, forest degradation, deterioration of aquatic biodiversity, and public health challenges.

Globally, with particular emphasis on Africa, quarrying is not often well managed for environmental friendliness and sustainability. The methods often used are very crude, as there are cases of collapse of quarry sites, and when this occurs, there is no effort towards rehabilitation of such quarries; hence they are usually left open. These give rise to land acquisition and the influx of outsiders in the areas that are relatively free from these effects with increased demand for social amenities (Mulatu, 2013). The problems associated with quarrying differ from one site to the other

International Journal of Advances in Engineering and Management (IJAEM)
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therefore proper assessment needs to be done to delineate the impact of quarrying at a particular site. These will guide towards devising the proper remedial measures towards limiting the environmental effect of quarrying in a given site. The release of harmful dust and gaseous pollutants into the atmosphere, not only results in air pollution but most of the time results in outbreaks of epidemics (Aghamelu, et al 2011).

Heavy metals (HM) such as zinc, cadmium, lead, iron, and mercury are common air pollutants emitted mainly from various industrial activities. Although the atmospheric levels are low, they contribute to the deposition and build-up in soils. Heavy metals are persistent in the environment and are subject to bioaccumulation in food chains (Obasi, 2020; Igwe et al., 2022; Obasi and Akudinobi, 2019). According to (Otles and Cagindi, 2010) exposure of HMs in human beings over a long period of time may lead to muscular, physical and neurological degenerative processes that mimic Alzheimer's disease, muscular dystrophy, and multiple sclerosis. HM is found in soil, water, sediment, air, plants and may spread to environment components which may be caused by nature of interactions occurring in this natural system. The interaction of HM chemically or physically may trigger change in the environment; this may result to pollution of water bodies and soil. HM toxicity has proven to be major sources of concern as it pose several health risks to humans. They play important biological role in the human body, but on the contrary their toxicity may lead to malfunctioning of humans (Alkesh, 2017). Vanbussel et al., 2014 reported that low concentration HMs in soil such as Cu, Ni, and Co, Zn, in soil are needed for certain biochemical and physiological processes in living organisms. When these HMs exceed the stated threshold concentrations they may be considered toxic. Faroon et al., (2012) pointed out that Cd is one of the major HM that is considered to cause harmful effects on physiological processes of animals, humans, plants and aquatic organism. According to Nwoyo et al., 2017, high concentrations of HM reduce plant growth, lower biomass production, reduces protein content and synthesis of chlorophyll pigments, which could lead to severe reduction in crop yields. Sprynskyy et al; 2007 and Jardoa et al; 2006 suggested that the uptake of HM by plants via absorption and subsequent accumulation is a potential threat to animal and human's health.HM toxicity on plants, human and environment cannot be under estimated as it has led to several health challenges and even death of animal and man across various states in Nigeria.

It is against this background that a detailed physicochemical evaluation of quarry dust, soils and water resources is being carried out. This research will determine the levels of physicochemical parameters in the quarry dust, water sources, and soils. It will compare the concentration of toxic heavy metals in surface water and groundwater from the study area with World Health Organization (WHO) permissible limits for drinking water. And assess the occurrence and spatiotemporal distribution of toxic heavy metals in the soils and compare them with known standards.

II. GEOLOGY AND PHYSIOGRAPHY

The study area, Abakaliki and Ngbo are located in Ebonyi State, (see Fig. 1); the area is known in southeastern Nigeria for the hosting of most quarry industry in the region. It lies between latitudes 6º15'0''N to 6º40'0''N, and longitudes 7º45'0''E to 8º22'0''E, in the Lower Benue Trough. The area is underlain by the Abakaliki shales of the Asu River Group. The sediments are also associated with saline seepages, lead-zinc mineralization, basic intrusions and pyroclastics (Agamunu, 1989). The group consists of fossiliferous shales, siltstones, limestones and minor fine to coarse grained sandstones (Agumanu, 1989). These sediments were intruded by the Santonian tectonic event alongside the Cenomanian – Turonian Sediments (Orazulike, 1994). The shale formation of the Abakaliki area is characterized by an average thickness of about 500 meters; with the dominant shale litho unit being dark grey coloured, highly consolidated; and with micaceous mineralogy in most locations. According to Ozibo et al., (2023), in the Ngbo area the beds are exposed at Akpegu Amoffia Ngbo, abandoned SGEEN and Macdaniel's Quarry sites in Amoffia Ngbo, Seaman Mining and Construction Ltd., Umuezaka Ngbo. When subjected to intense weathering, the calcite cemented shale turns light brown or very brownish within the area where they are exposed (Okogbue and Aghamelu 2010). These highly consolidated sandstone deposits in the formation have equally attracted the attention of various construction to the exploration of the pyroclastic materials of the Abakaliki area and that of other intrusive and extrusive rock materials of Abakaliki, Amasiri, and even Ishiagu areas, all in Ebonyi State respectively..

The study area falls within the tropical rainforest zone of southeastern Nigeria

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characterized with average annual rainfall varying from 1750mm-2250mm (Inyang, 1975). Two seasons rainy and dry seasons are typical in the area. The rainy season lasts from March to October, with its peak in July through August and September, accompanied by dry season from November to February which most often is occasioned by seasoned water drought. The Northeast trade wind known as the harmattan wind keeps the humidity low from December to January. The mean annual temperature range of the dry season is about 27^{o}C and occurs in the months of February and March. The vegetation of the area is parkland, which is derived savannah. This is characterized by stunted trees and pockets of derelict woodland and secondary forests consisting of few shrubs with dispersed large trees and climbers.

III. METHODOLOGY

3.1 Sample collection and preparation of dusts and soils

A total of twenty samples consisting of eight (8) dust samples and twelve (12) soil samples (Table 1; Figure 1) were collected within the study area for this anaysis. The dust samples collected were passed through a sieve and samples from the fines were measured into small sample bags and taken to the laboratory for analysis. Collection of the soil samples was done using a hand auger at depths of 15 - 30cm. During the sampling, about 1 kg of each soil sample was collected using a stainless-steel spade and a plastic scoop. The soil samples were air-dried at room temperature, disaggregated mechanically, and separated by an automated sieve shaker into various fractions of grain. All the dust and soil samples collected were stored in sealed small polythene bags and taken to the laboratory for pre-treatment and analyses.

Table 1. Locations and Coordinates of dust and soil samples

S/no.	Sample no	Coordinates		Sample type	Location
1	DL05	6° 27′ 48″N	8° 02′ 08″E	Quarry dust	Umuezaka Ngbo
2	DL06	6° 27′ 48″N	8° 02′ 08″E	Quarry dust	Umuezaka Ngbo
3	DL13	6° 30′ 21″N	8° 00′ 27″E	Quarry dust	Uduoye Quarry
4	DL18	6° 26′ 48″N	7° 52′ 13″E	Quarry dust	Jingchiang quarry, Ezilo
5	DL25	6° 18′ 30″N	8° 02′ 06″E	Quarry dust	Stone crusher, UmuogharaEzza
6	DL27	6° 18′ 28″N	8° 02′ 06″E	Quarry dust	Stone Crusher, Umuoghara
7	DL28	6° 18′ 28″N	8° 02′ 06″E	Quarry dust	Stone Crusher, Umuoghara
8	DL29	6° 18′ 28″N	8° 02′ 06″E	Quarry dust	Stone Crusher, Umuoghara
9	DL03	6° 27′ 46″N	8° 02′ 07″E	Soil	Quarry pit Seaman quarry, Umuezaka Ngbo
10	DL04	6° 27′ 46″N	8° 02′ 07″E	Soil	Quuarry pit Seaman quarry, Umuezaka Ngbo
11	DL08	6° 27′ 38″N	8° 3′ 12″E	Soil	Azuakadoro market, Umuezaka Ngbo
12	DL 12	6° 30′ 21″N	8° 00′ 27″E	Soil	Uduoye Quarry
13	DL14	6° 29′ 38″N	8° 00′ 24″E	Soil	NdiaguIdaka, Amoffia Ngbo
14	DL20	6° 25′ 28″N	7° 52′ 20″E	Soil	EgworOkpoto
15	DL22	6° 18′ 21″N	8° 02′ 06″E	Soil	Abandoned quarry pit, Umuoghara, Ezza
16	DL24	6° 18′ 23″N	8° 02′ 05″E	Soil	Around quarry at Umuoghara, Ezza
17	DL30	6° 18′ 28″N	8° 02′ 06″E	Soil	Stone Crusher, Umuoghara

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18	DL31	6° 24′ 53.35″N	7° 47′ 47.36″E	Soil	Proxy Investment Ltd, Ezillo
19	DL33	6° 24′ 30″N	7° 47′ 45″E	Soil	Quarry pit at Proxy Investment Ltd, Ezillo
20	DL35	6° 47′ 40″N	7° 47′ 47″E	Soil	Near stream at Proxy Investment Ltd, Ezillo

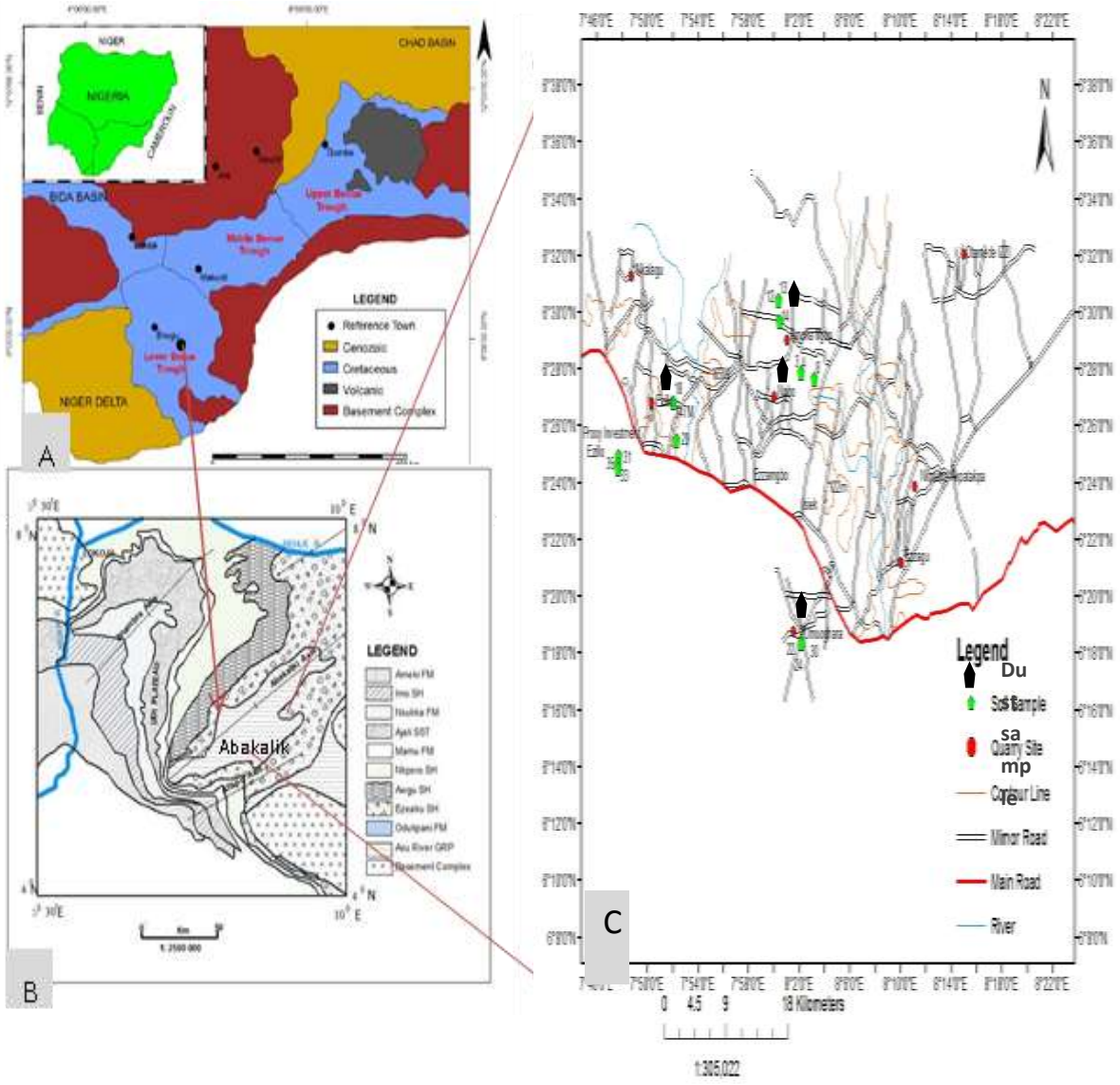

Fig 2(A) Geologic Map of the Lower Benue Trough (LBT) Zaborski, 1998) (B) Stratigraphic Settings of the LBT (modified from Nwajide, 2013) (C) Location map the study area showing soils and dust sample locations.

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3.2 Laboratory Analysis.

The dust and soil samples were digested in aqua-regia (HNO_3/HCl) in the ratio 1:3. The digested samples were analyzed for Pb, Zn, Cu, Fe, Co, Ni, As, Mn, Cd, and Cr. The analysis was done using an Atomic Absorption spectrophotometer (AAS) at the Analytical Concept Laboratory, Port-Harcourt. Standard stock solutions for all the elements were procured from Merck as well as prepared in the laboratory following the procedures as described in APHA (2012). The glassware used was Pyrex, which was washed several times with soap, distilled water, and diluted nitric acid to remove any impurities. Similarly, water samples were directly aspirated into the AAS, and the concentration of each metal (Pb, Zn, Cu, Fe, Co, Ni, As, Mn, Cd and Cr) was determined when extracts were sprayed into the flame, light rays from a hollow cathode lamp is shone through the flame, thereby triggering atoms of the elements to be determined, leading to radiation absorption. The rate of absorption is directly proportional to the concentration of the element. Each element is detected with its cathode lamp, and the concentrations are recorded in mg/L units.

IV. RESULT AND DISCUSSION

4.1Results of quarry dust and soil samples

The results obtained from the in-situ measurements and laboratory analysis of quarry dust and soil samples are presented herewith (Table 2 and 3) respectively.

Table 2: Concentration of heavy metals in quarry dust samples (ppm)

Heavy Metals	DL 05	DL06	DL 13	DL 17	DL 25	DL 27	DL 28	DL 29	Min.	Max.	Mean	Ave. Shale value
Pb	12.70	23.84	18.49	16.13	18.20	6.42	21.01	26.13	6.42	26.13	17.87	20.00
Zn	15.28	14.86	36.33	39.06	28.46	29.02	32.84	35.17	14.86	39.06	28.88	95.00
Cu	0.75	1.75	2.10	8.87	7.90	4.68	13.41	5.63	0.75	13.41	5.64	45.00
Fe	4032.70	398140	4012.10	4089.50	3831.30	3893.20	4141.90	3941.30	3831.30	4141.90	3990.40	65000.00
Co	3.42	5.31	6.35	19.28	9.28	5.01	15.44	8.80	3.42	19.28	9.11	19.00
Ni	13.15	8.89	24.88	73.50	48.00	17.12	75.80	20.91	8.89	75.80	35.28	50.00
Ag	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
As	0.01	0.02	0.02	0.08	0.07	0.04	0.12	0.05	0.01	0.08	0.05	13.00
Hg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
Mn	597.60	639.10	268.10	427.30	460.40	480.70	489.10	607.80	268.10	639.10	496.26	850.00
Cd	0.30	0.28	0.74	0.70	0.67	0.55	0.67	1.31	0.28	1.31	0.81	0.30
Cr	8.21	9.07	32.32	97.22	73.06	13.65	117.20	25.40	9.07	117.20	67.02	90.00

Table 3: Results of heavy metal concentration from analysis of soil samples.

Code	Pb	Zn	Cu	Fe	Co	Ni	As	Mn	Cd	Cr
DL03	17.7400	16.5900	1.4600	4208.6000	8.7500	9.6500	0.0100	607.4000	0.0200	9.7300
DL04	13.1400	17.5000	0.3800	4057.7000	6.1300	12.1600	0.0050	261.0000	0.0400	8.4400
DL08	17.8200	19.8100	3.7600	4035.7000	18.0200	13.6300	0.0300	332.1000	0.1200	8.5100
DL12	2.2200	6.4700	0.0005	3995.4000	0.4800	1.1300	0.0050	60.1000	0.0400	7.8000
DL14	0.2900	5.2800	0.0005	3193.9000	0.3000	3.0600	0.0050	90.3000	0.0005	2.3800
DL18	**20.4700**	28.0400	4.5500	4105.5000	6.2300	14.7400	0.0400	312.4000	0.1200	32.8000
DL20	3.1100	42.3600	6.5800	2922.7000	3.7200	6.6800	0.0600	267.5000	0.1500	14.6800
DL22	10.4100	19.0900	1.7200	4047.7000	6.2800	7.6600	0.0200	602.8000	0.0005	4.3600
DL24	**27.8100**	12.7500	1.1900	3891.3000	13.7900	4.9900	0.0100	**1154.0000**	0.0005	6.1900
DL30	**24.6800**	27.7400	5.9100	3997.1000	12.0900	20.9100	0.0500	482.8000	0.1900	17.5100
Min	0.2900	5.2800	0.0005	2922.700	0.3000	1.1300	0.0050	60.100	0.0005	2.3800
max	27.8100	42.3600	6.6800	4208.600	13.7900	20.9100	0.0600	1154.0000	0.1900	32.8000
mean	13.7690	19.5630	2.5551	3845.5600	7.5790	9.4610	0.0235	417.0400	0.0682	11.2400
Ave. cont. value	20.0000[a]	95.0000[a]	45.0000[a]	65000.0000[b]	19.0000[a]	68.0000[a]	10.0000[a]	850.0000[a]	0.8000[a]	90.0000[a]

All values are presented in parts per million, kg/mg.

Note: 'a' represents average continental values after Wedepohl (1971);'b' represents values adopted from Shaw (1956). All values are presented in partsper million, ppm.

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4.2. Discussion

4.2.1 Heavy metals in the sampled dust from the study area

The result from the laboratory analysis of the quarry dust samples collected and analyzed for heavy metal (Pb, Zn, Cu, Fe, Co, Ni, Ag, As, Hg, Mn, Cd, and Cr) within the study area is presented (Table 2). The respective distributions of the concentrations for each heavy metals in all the sampling locations were also presented (Fig.2a-i). It was observed that the concentration values for the following heavy metals; Pb, Zn, Cu, Ag, As, Hg, and Mn, obtained in all the sampling locations where quarry dust samples were analyzed, lie below the background values. In this study, the average continental shale values were adopted (Wedepohl, 1971; Adamu et al., 2015; Ochelebe et al., 2020; Ekwere et al., 2021). Furthermore, the respective heavy metals including Pb, Co, Ni, Cd, and Cr, showed concentration values obtained to have exceeded the average shale concentration employed as the background value in this study. The heavy metals and their respective locations with concentration values include: Pb showed values that exceeded the background at DL06 (23.86), DL28 (21.01), DL29 (26.13); Co showed values that exceeded the background only at DL17 (19.28); Ni showed values that exceeded the background at DL17 (73.50),

DL28 (75.80); Cd showed values that exceeded the background at DL13 (0.74), DL17 (0.70), DL25 (0.67), DL27 (0.55), DL28 (0.67), DL29 (1.31); Cr showed values that exceeded the background at DL17 (90.22), DL28 (117.20).

Also, the statistical summary of results obtained (Table 2) showed that from all the quarry dust samples analyzed, only Cd recorded mean concentration values that exceeded the average continental shale values. While mean concentration values of the other heavy metals (Pb, Zn, Cu, Fe, Co, Ni, Ag, As, Hg, Mn, and Cr), are all below their respective background values.

The mean concentration of Pb was observed to be 19.51 with a range of values between 6.42 - 26.13; Co showed a mean concentration value of 11.21 with a range of values between 3.42 - 19.28; Ni showed a mean concentration value of 43.35 with a range of values between 8.89 - 75.80; Cd showed a mean concentration value of 0.85 with a range of values between 0.28 - 1.31 ; Cr showed a mean concentration value of 63.01 with a range of values between 8.21 - 117.20; Mn showed a mean of 499.77 and ranged in values from 268.10 - 639.10; Fe showed a mean of 4011.62 and ranged in values between 3831.30 - 4141.90; Zn showed a mean of 30.16 and ranged in values between 14.86 - 39.06; Cu showed a mean of 7.77 and ranged in values between 0.75 - 13.41; while As showed a mean of 0.07 and ranged in values from 0.00 - 0.12.

4.2.2 Assessment of heavy metals levels and their distribution in soils

Results of the heavy metal concentrations in soils from the study area are presented (Table 3). It reveals minimum, maximum and mean values of heavy metal concentrations from soils in the study area, and compared with average continental values from shale (Wedepohl, 1971) representing the background values employed in the study. It was revealed that all the heavy metals analyzed in the soil samples were below the average shale values, except Pb and Mn. Pb recorded high values above the background values at the locations DL18 (20.47), DL24 (27.81) and DL30 (24.68), Mn recorded such vales at DL24 (1154.00). These metals may have been released into the soil environment through natural process of weathering of the host rock as suggested by some previous authors (Adamu et al., 2015; Ochelebe et al., 2020).

On the basis the mean concentration values, all the heavy metals are present in amounts less than the average continental shale values after Wedepohl (1971). The soil sample show that Pb recorded an average concentration of 13.77 with a range of 0.29–27.81, while Mn had a mean of 417.04 and ranged from 60.10 – 1154.00. The other metals analyzed from the soil samples had average values and ranges (in bracket) respectively as; Fe (3845.56, 2922.70 – 4208.60), Zn (19.56, 5.28 – 42.36), Cr (11.24, 2.38– 32.80), Ni (9.46, 1.13 – 20.91), Co (7.58, 0.30 – 18.02), Cu (2.56, 0.00 – 6.58), Cd (0.07, 0.00 – 0.19), and As (0.02, 0.00 – 0.06).

Based on the mean values obtained, heavy metals dominance from soils of the study area is in the order Fe > Mn > Zn > Pb > Cr > Ni > Co > Cu > Cd >As. High concentrations of Fe, Zn and Pb in the soils could be related to the weathering of shales present within the study area or metallic sulphide deposits elsewhere from parts the lower Benue Trough which have been transported (Ekwere et al., 2013; Ekwere, 2019) as well as from anthropogenic activities within the area. Noticeable major human activities that may lead to heavy metal contamination in soils and sediments include automobile repair and service workshops, urban dumpsites and other communal waste disposal practices. The distribution patterns of the heavy metals in soils were presented (Fig. 2a-j).

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The variation in concentration of heavy metals analyzed suggests a great influence of the underlying geology and the type of human activities prevalent within and around the study area. These metals are dominant within the underlying shales, limestones, sandstones and pyroclastic materials within the study area. It was observed that Pb, Fe, Co and Mn show a variation trend in the NW-SE trend, while Zn, Cu, As, Cd and Cr all show a NE-SW trend. Highest concentrations of these metals maybe from the shales within the study area, since they serve as sinks hosting these metals (Zarei et al., 2014; Adamu et al., 2015; Ekwere et al., 2021). Thus, the metals are released and transported within the soil from the elevated basement terrains to the lower plains of the basins.

The spatial distribution patterns of the heavy metals in soils were presented (Fig. 2a-j). The variation in constituent metal concentration level suggests a great influence on the underlying geology and the type of human activities prevalent in the study areas. These metals are dominant within the underlying shales, limestones, sandstones, and pyroclastic materials within the study area. It was observed that Pb, Fe, Co, and Mn show a variation trend in the NW-SE trend, while Zn, Cu, As, Cd, and Cr all show an NE-SW trend. The highest concentrations of these metals may be from the shales within the study areas since they serve as sinks hosting these metals (Zarei et al., 2014; Adamu et al., 2015; Ekwere et al., 2021). Thus, the metals are released and transported within the soil from the elevated basement terrains to the lower plains of the basins.

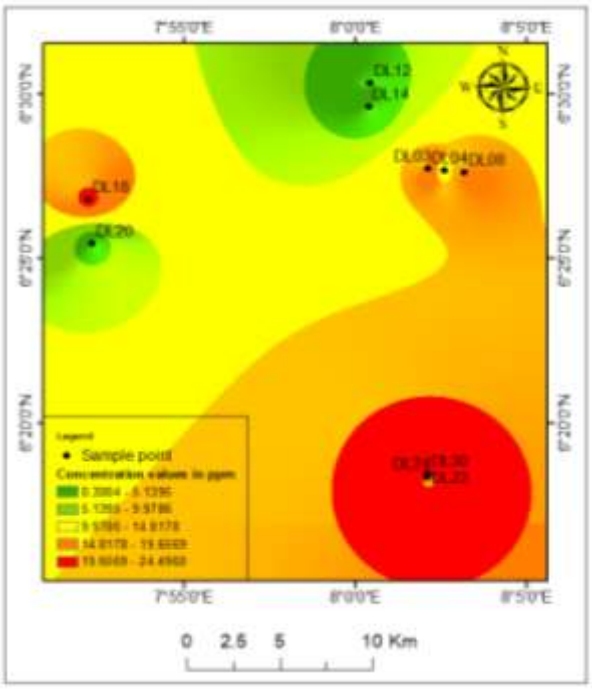

Figure 2a: Distribution pattern for Pb in soils and dust Umuoghara. Ezzillo, Unezakan of the study area

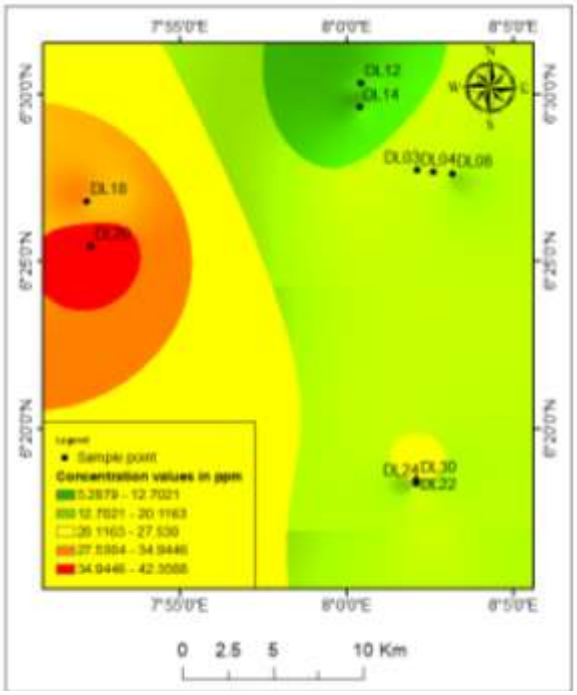

Figure 2b: Distribution pattern for Zn in soils of the Umuogbara. Ezzillo, Umuezaka studv area

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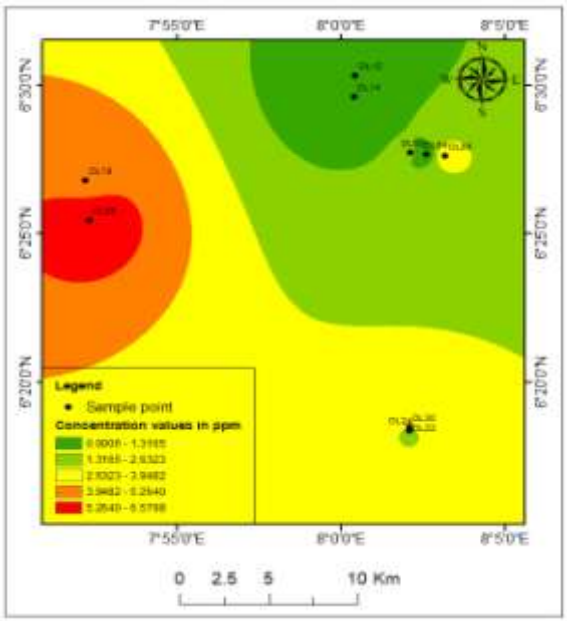

Figure 2c: Distribution pattern for Cu in soils of the study area

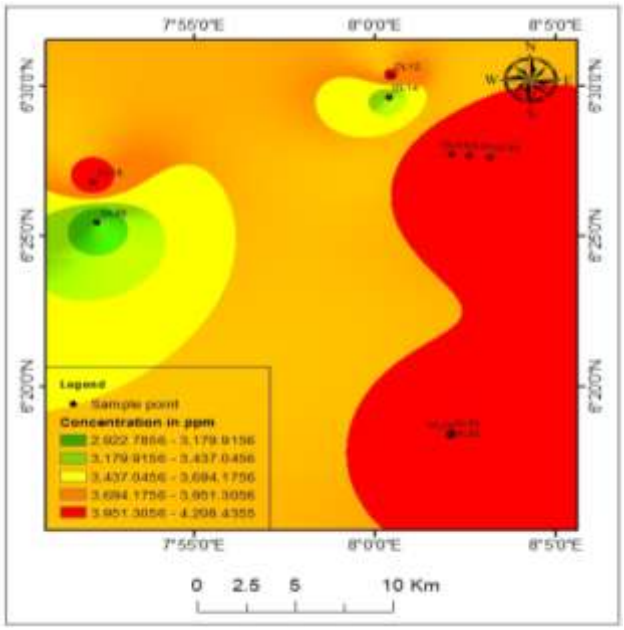

Figure 2d: Distribution pattern for Fe in soils of the study area

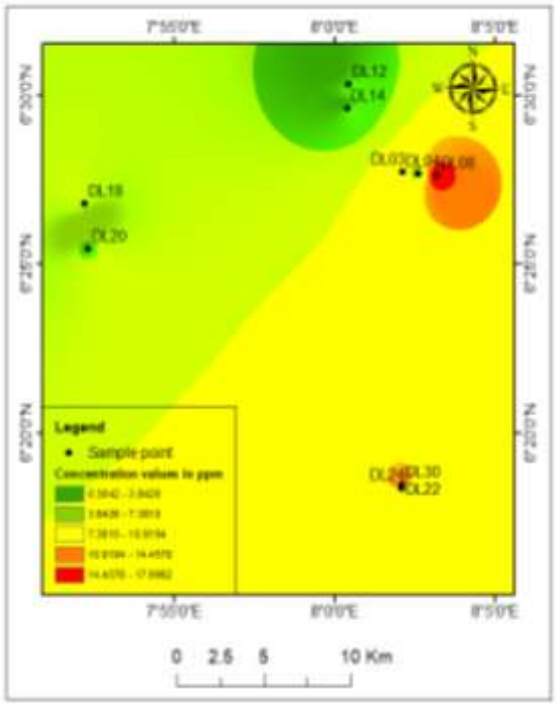

Figure 2e: Distribution pattern for Co in soils of the study area

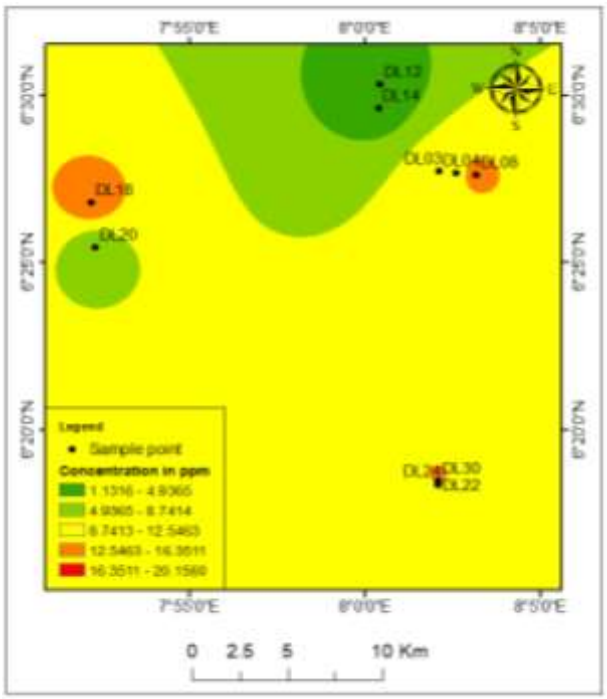

Figure 2f: Distribution pattern for Ni in soils of the study area

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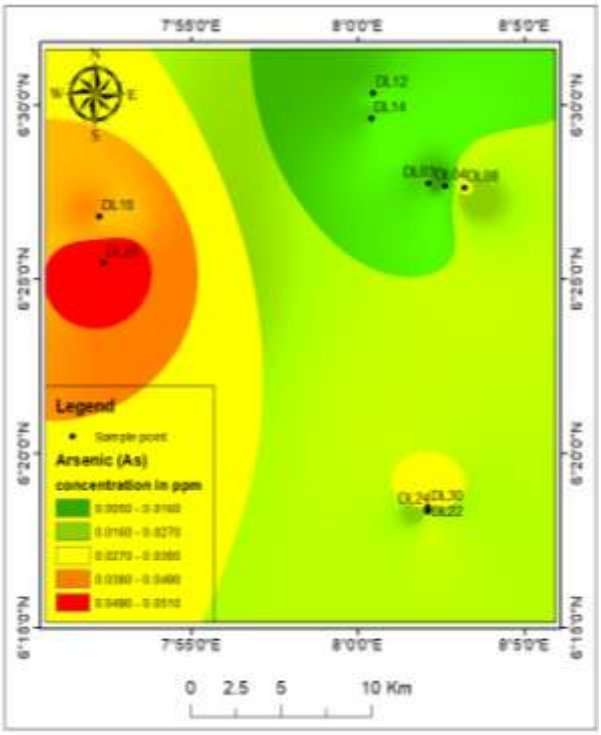

Figure 2g: Distribution pattern for Asin soils of the study area

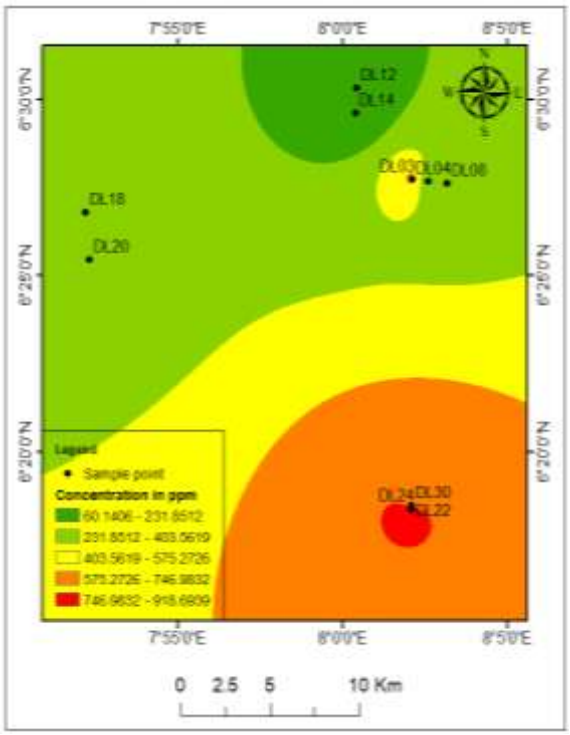

Figure 2h: Distribution pattern for Mn in soils of the study area

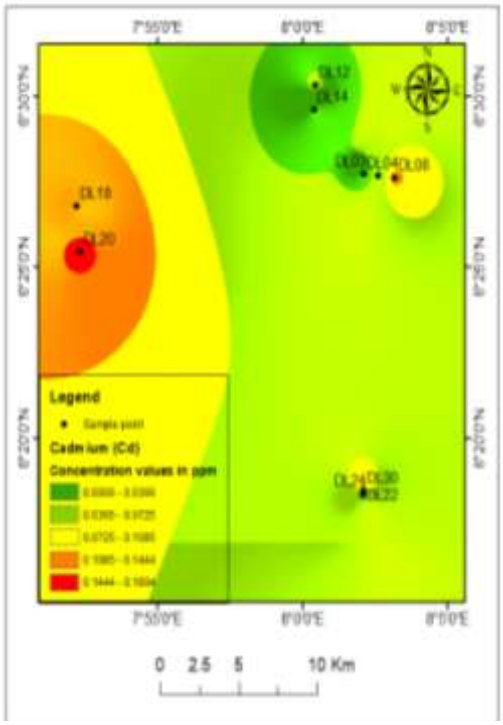

Figure 2i: Distribution pattern for Cd in soils of the study area

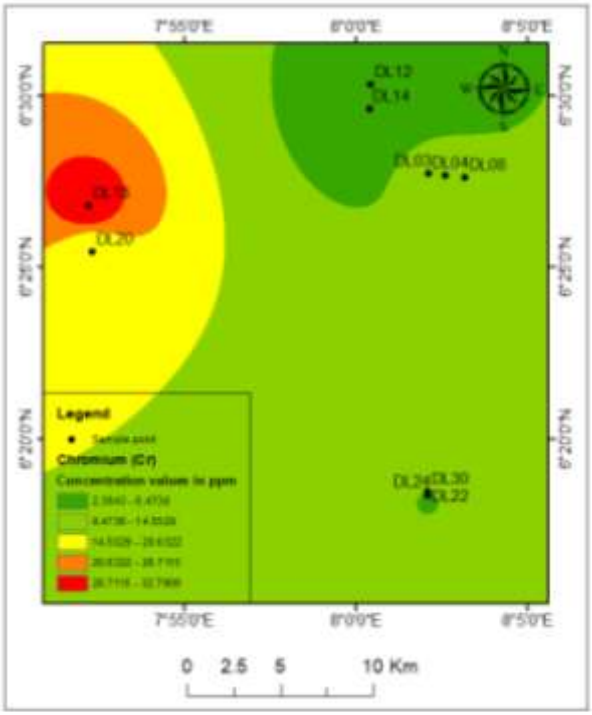

Figure 2j: Distribution pattern for Cr in soils of the study area

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Volume 6, Issue 07 July 2024, pp: 76-87 www.ijaem.net ISSN: 2395-5252

V. CONCLUSION

Heavy metals such as Pb, Zn, Cu, Fe, Co, Ni, Ag, Hg, Mn and Cr showed that values of their mean concentrations from the dust samples obtained and analyzed, alllie below the background values, except Cd that had a value 0.8 mg/l which exceeds 0.3 mg/l (the background value). Furthermore, it was observed that the through the natural process of weathering of the underlying host rocks, heavy metals have been released in the soil environment. Values of the mean concentrations of heavy metals in soils all lie below their respective background values, although there is exception to some local variation that exists. These variations observed may be attributed to a great influence of the underlying geology and the nature of human activities prevalent in the study area. On the basis of mean concentration values, heavy metals in soils are in the order Fe > Mn > Zn > Pb > Cr > Ni > Co > Cu > Cd > As.

REFERENCES

[1]. Abate, Z. (2016). Impact of Stone Quarrying on Environment and Livelihood of Local Community in Addis Ababa Peri-Urban Areas. The Case of Hana Mariam Cobble Stone Quarry Site. MA Thesis, Addis Ababa.

[2]. Adamu, C. I., Nganje, T.N., and Edet, A.E. (2015). Major and trace elements pollution of sediments associated with abandoned barite mines in parts of Oban massif and Mamfe embayment, SE Nigeria. Journal of Geochemical Exploration 151: 17-33.

[3]. Ahmed, F. Y. (2020). Criteria for identifying groundwater in rifting basins in arid and semi-arid zones: A case study Sharm El Bahary in Egypt. Environmental Earth Science.https:// doi.org/ 10. 1007/ s12665- 020- 09232-8

[4]. Aghamelu, O. P., Nnabo, P. N and Ezeh H. N. (2011). Geotechnical andEnvironmental Problems Related to Shales in the Abakaliki Area, Southeastern Nigeria. African Journal ofEnvironment and Technology, 5(2): 80 - 88.

[5]. Alkesh I. S. (2017). Heavy Metal Impact on Aquatic Life and Human Health – An Over View. 37th Annual Conference of the International Association for Impact Assessment; 4 - 7 April 2017

[6]. APHA.(2012) Standard Methods for Examination of Water and Wastewater (25th Edition).American Public Health Association, Washington DC, USA.

[7]. Ekpa, I. D., Laniyan, D.G., Agbor, C.N., Okon, J.E., 2023. Effect of air pollution from quarry activities on agriculture and plants biodiversity in South-Eastern Nigeria. Environmental Monitoring and Assessment. 195:837.https://doi.org/10.1007/s10661-023-11445-w

[8]. Ekwere, A.S., Kudamnya, E.A., and Osung. W.E., (2021). Assessment of potentially toxic metals and their mineral species in soils of arable farmlands in the south eastern Niger Delta basin, Nigeria. Soil Environ 40(2): 119-126.

[9]. Ekwere, A.S. (2019). Heavy metal concentration of sediments from the Eastern Niger Delta Basin,

[10]. South-Eastern Nigeria. In: Petrogenesis and Exploration of the Earth's Interior. Advances in Science, Technology and Innovation (ASTI). D.M. Doronzo, E. Schingaro, J.S. Armstrong-Altrin and B. Zoheir (eds.) Springer Nature Switzerland AG 2019-08-10.

[11]. Ekwere, A.S., Ekwere, S.J., and V.N. Obim. (2013). Heavy metal geochemistry of stream

[12]. sediments from parts of the Eastern Niger Delta Basin, South-Eastern Nigeria. RMZ-Materials and Geoenvironment 60: 205-210.

[13]. Ekwere, A.S. and A.A. Elueze. 2012. Trace element assessment of stream sediments around the

[14]. Aluminium Smelting Company in Ikot Abasi, south-eastern Nigeria. Research Journal of Applied Science, Engineering & Technology 4(4): 256-261.

[15]. Eyankware, M.O., Akakuru, C. O., Ulakpa, R. O. E., Eyankware, E.O. (2022).Hydrogeochemicalapproach in the assessment of coastalaquifer for domestic, industrial, and agricultural utilities inPort Harcourt urban, southern Nigeria.International Journal of Energy and Water Resources.https://doi.org/10.1007/s42108-022-00184-2

[16]. Faroon, O., Ashizawa, A., Wright, S., Tucker, P., Jenkins, K., Ingerman, L., Rudisill, C. (2012). Toxicological Profile for Cadmium, Agency for Toxic

Substances and Disease Registry Toxicological Profile, Atlanta, Georgia

[17]. Harikumar, P. S., and Jisha, T. S. (2010). Distribution Pattern of Trace Metal Pollutants in the Sediments of an Urban Wetland in the Southwest Coast of India. International Journal of Engineering Science and Technology, 2: 840-850.

[18]. Harikumar, P. S., Nasir, U. P. and Mujeebu-Rahman, M. P. (2009). Distribution of heavy metals in the core sediments of a tropical wetland system. International J. Environ. Sci. Tech., 6(2):225-232.

[19]. Jordao, C. P., Nascentes, C.C., Cecon PR, Fontes RLF and Pereira JL. (2006). Heavy metal availability in soi amended with composted urban solid wastes. Env Monitoring and Assess. 112: 309–326. DOI: https://doi.org/10.1007/s10661-006-1072-y

[20]. Kalu 2018 = Environmental Impact of Stone quantity Activity in Ishvigu and Alleda Ebonyi State.

[21]. Journal of Asrneed Studies in Agricultural, Brological and Enviromental Sciences (JABE) Vol. 5 Issue 2. 2018 (April - June)

[22]. Mulatu, S. (2013). Environmental Impact of Coarse Aggregate Production in and around Addis Ababa, Ethiopia. M. Sc. Thesis submitted to the School of Graduate Studies, Addis Ababa Institute of Technology, Department of Civil Engineering, p. 1-90

[23]. Nwogo, A. O., Stella E. O., Sunday, O. E., Kalu M. K., Chinyere A., Ikechuku O. I. , Chikwado, C. I., Justus C. A. (2017). Health Risk Assessment of Heavy Metals In Ameri Lead-Zinc Mining Community Via Consumption of Cassava (ManihotesculentaCruz) In Ikwo L.G.A., Ebonyi State, Nigeria. American-Eurasian Journal of Sustainable Agriculture. 11(6): 22-30.

[24]. Nyakeni ga (2009): Assessment of environmental Impact of stone Quarrying Activities in Nyambera location Kistu country Kenya.

[25]. Research B.sc degree unpolished Kenya University.

[26]. Obasi, P. N. (2020), Occurrence and Distribution of Heavy Metals in Arable Soils Around Lead- Zinc Mining Sites of Abakaliki, Southeast Nigeria. Springer – Modelling Earth Systems and Environment. https//doi.org/10.1007/s40808-020-00800-2

[27]. Obasi, P. N and Akudinobi, B. E. B (2020) Potential Health Risk and Levels of Heavy Metals in Water Resources of Lead- zinc Mining Communities of Abakaliki, Southeast Nigeria. Springer-Applied Water Science https //doi.org/ 10.1007/s40808-020-00800-2

[28]. Obasi, P. N., and Akudinobi, B. E. B., (2019b), Heavy Metals Occurrence, Assessment and Distribution in Water Resources in the Lead- Zinc Mining Areas of Abakaliki, Southeastern Nigeria. Springer - International jour. of Envi science and technology. https//doi.org/10.1007/s13762-019-02489-y

[29]. Obasi, P. N., and Akudinobi, B. E. B., (2019a), Pollution Status of arable Soil and Stream Sediment in the Mining Areas of Abakaliki, Lower Benue Trough. Springer - International jour. of Envi science and technology. https//doi.org/10.1007/s13762-019-02337-z

[30]. Obasi, P. N., and Akudinobi, B. E. B., (2015), Geochemical Assessment of Heavy Metal Distribution and Pollution Status in Soil/Stream Sediment in the AmekaMinning Area of Ebonyi State, Nigeria. African Journal of Geo-Science Research, 2015, 3(4): 01-07

[31]. Obasi, P. N. (2009). Hydrochemical Investigation of Okposi and Uburu Areas of Ohaozara and Environs of Ebonyi State, Nigeria. Unpublished M.Sc thesis, Nnamdi Azikiwe University, Awka.

[32]. Ochelebe, I. and Kudamnya E. A. (2022). Hydrochemistry and an appraisal of surface water and groundwater quality for domestic and irrigation use in parts of Southern Benue Trough, Nigeria. Sustainable Water Resources Management, 8:174. https://doi.org/10.1007 /s40899-022-00762-6

[33]. Ochelebe, I., Nkebem, G. E., &Kudamnya, E. A. (2020). Assessment of Heavy Metals Concentration and Enrichment Levels in Soils around Quarries and Barite Mine Sites in Part of

Akamkpa and Biase Area, Southeastern Nigeria. Journal of Geosciences and Environment Protection, 8, 107-128. https://doi.org/10.4236/gep.2020.88009

[34]. Okogbue, C. E. and Aghamelu, O. P. (2010). Comparison of the geotechnical properties of crushed shales from south eastern Nigeria. Bull. Eng. Geol. Env., 69(4): 587-597.

[35]. Otles S, Cagindi O (2010). Health importance of arsenic in drinking water and food. Environ. Geochem. Hlth. 32:367-371

[36]. Onwe, I. M; Eyankware, M. O; Obasi, P. N; Ifeanyichukwu, K. A (2022).Hydrochemical and statistical approaches in the evaluationof groundwater quality for drinking and irrigation uses around aroundEzzangbo–Ngbo area, Southeastern Nigeria Modeling Earth Systems and Environmenthttps://doi.org/10.1007/s40808-022-01503-6

[37]. Ozibo, G. O, Eme C. E., Alieze, I. V, Omeokachie, A. I, Nworie., C. D, Edene, E. N., and Obasi, P. N (2023). Hydrochemical Evaluation of Groundwater Resources in Ngbo Areas, Ebonyi State, Southeast Nigeria. International Journal of Research and innovation in Social Science (IJRISS) ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue VI

[38]. Sprynskyy M, Kosobucki P, Kowalkowski T and Buszewsk B.(2007). Influence of clinoptilolite rock on chemical speciation of selected heavy metals in sewage sludge. J of Hazardous Material. 149: 310–316. DOI: https://doi.org/10.1016/j.jhazmat.2007.04.001

[39]. Suneetha N, Gupta G (2018) Evaluation of groundwater potential and saline water intrusion using secondary geophysical parameters: A case study from western Maharashtra, India. E3S Web of Conferences 54:00033. https://doi.org/10.1051/e3sconf/20185400033

[40]. Wedepohl, K. H. (1971). Environmental Influences on the Chemical Composition of Shale and Clays. In L. H. Ahrens, F. Press, S. K. Runcom, & H. C. Urey (Eds.), Physics and Chemistry of the Earth (Vol. 8, pp. 305-335). Oxford: Pergamon Press. https://doi.org/10.1016/0079-1946(71)90020-6

[41]. Whitehead, P. (2007). Environmental Impacts of Mining. Retrieved on 9th December 2007. Whitehead@jeu-edu.au

[42]. World Health Organization, WHO (2012). Nitrate and Nitrite in drinking water. World Health Organization, Geneva

[43]. Yisa, J., and Jimoh, T. (2010). Analytical studies on water quality index of river Ladzu. Am. J.

[44]. Appl. Sci., 7:453–458

[45]. Younger, E.E (2002) Heavy Mental Contaminations in Holliston River Basin (Tennessee) Archives of Environmental Contamination Toxicology, 11:250-310.

[46]. Zarei, I., Pourkhabbaz, A. and Khuzestani, R. B. (2014). An assessment of metal contamination risk in sediments of Hara Bioshere Reserve, southern Iran with a focus on application of pollution indicators. Environ. Monit. Assess., DOI: 10.1007/s10661-014-3839-x