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Assessment of Heavy Metals in Nnewi under Ground Water

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Abstract:- The Assessment of heavy metals distribution and their likely adverse effects in underground resources of Nnewi town of Anambra State within the sedimentary basin of south eastern Nigeria due to industries has been studied. The instrument used for data collection includes topographic map, geologic map aerial photograph, satellite image and fracture maps of Anambra drainage Basin. Ten (10) under ground water samples from borehole, springs and hand dug wells were collected, this was followed by laboratory studies of the water samples for the identification of heavy metals present. The result of the analysis of ten(10) water samples shows that chromium, copper, cadmium and zinc were observed to be high while orgon, mercury, molybdenum, nickel, lead, zirconium were not detected. The findings also show that cadmium (cd) was not in some places such as Nnewichi, Otollo and Umudim. Villages in Nnewi town shows an abnormal distribution of high chromium (cr) copper (cu) and zinc (zn). Above permissible limit, Cadmium causes cancer of the lungs, and high blood pressure, while chromium causes kidney damage, liver damage, circulatory and nerve tissue damage. Copper causes anemia, intestinal irritation, while zinc causes growth retardation, delayed sexual maturation, infection susceptibility and diarrhea. It was suggested that chemical analysis of water should be carried out periodically in the area since groundwater is subject to seasonal changes.

Keywords:- Anambra Basin, Heavy Metals, Industries, Diseases, Nnewi.

I. INTRODUCTION

The concentration of industries in Nnewi Town of Anambra State which are concerned with automobile metals, paints, spoons and pots and these constitute industrial clusters.

The area involved should be verified for toxic heavy metals, since they depend on borehole waters Adeyemi et al, (2007). According to the author, metals in underground water which may be carcinogenic are argon, calcium, chromium, copper, mercury, molybdenum, Nickel, lead, zinc and zirconium. They can enter human bodies when a person drinks underground water that is contaminated by them (Down and stock 1997). At high concentrations, they can lead to poisoning (Vodela et al 1997) World health organization WHO (2007), provided a guideline for accessing the limit of acceptance for the heavy metals, according to (Buynevich, 2011), they can lead to such ailments as high blood pressure, anaemia, intestinal irritation, damages to the nervous system, cancer of the lungs, nose cancer , kidney damage, growth retardation, eye and skin irritation.
At high concentrations, these heavy metals enter human body through drinking water contaminated by them (Vodela et al 1997) the purpose of this work is therefore to access the concentration of the selected heavy metals in the underground water regime of Nnewi Area .

The heavy metals in underground water are Argon, cadmium, chromium copper, mercury, molybdenum, Nickel, lead, zinc and zirconium.
Nnewi is located within Anambra sedimentary Basin of South Eastern Nigeria (Reymet, 1965).

It is bounded by latitude 6^0 55^1 51" (Ofomata, 1985). The topography is undulating and has average elevation of 93m (Ofomata, 1978). Drainage system is dendrite (Iloije 1995). Vegetation is of tropical type characteristic of south eastern Nigeria (Iloije 1995). It has a tropical climate and experiences two air masses-Equatorial maritime air masses associated with rain bearing south west winds from Atlantic Ocean, and dry and dusty harmattan wind from Sahara desert (Igbozurike, 1995). According to (Igbozurike 1995) the rainy season lasts from April to October, while the dry season lasts from November to March. The hottest period is between February and April ((Iloije 1981), while the average minimum temperature is between 25^0C to 32^0C.

According to (Iloije 1981) the humidity lies between 40% to 92% and appears high during the early hours of the day. The aquiferous source are those of Ameki/Nanka sands (Uma 1987). The study area therefore falls within Anambra Basin of South eastern Nigeria and underlain by Ameki/Nanka Sands which is Eocene in age (Uma, 1987).

Table 1: Generalized sedimentary sequence in south eastern Nigeria (modified from hoque, 1976)

AGE	L_1 THOSTRATGRAPHIC SEQUENCE	PETROLOGY OF SANDSTONE	BASIN
EOCENE	AMEKI FORMATION	QUARTZ	ANAMBRA
		ARENITE	
PALEOCENE	IMO SHALE		AND
UPPER	NSUKA FM		
CRETACEOUS	AJALLI SANDSTONE		AFIKPO
MAESTRICHTIAN	MAMU FM		BASIN
CAMPANIAN	NKPORO SHALE		
CANIACIAN		FELDSPATHIC	ABAKILIKI
SANTONIAN	AWGU SHALE	SAND STONE	BASIN
TURONIAN	EZEAKU SHALE		
CENOMANIAN	ODUKPANI FM		
LOWER	ASU RIVER		
CRETACEOUS	GROUP		
ALBIAN			

Fig 1: The stratigraphic succession of the area is shown in table 1

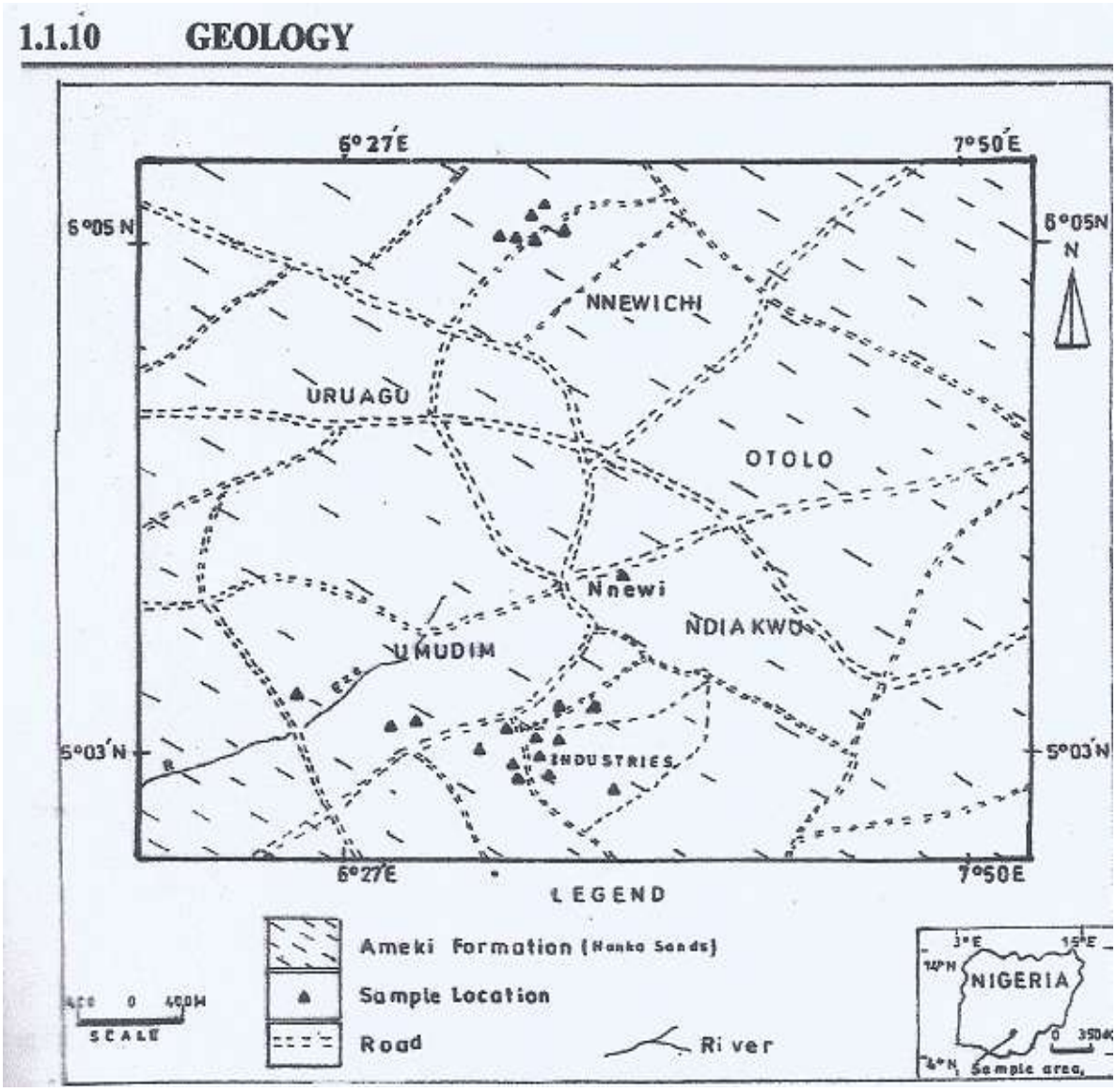
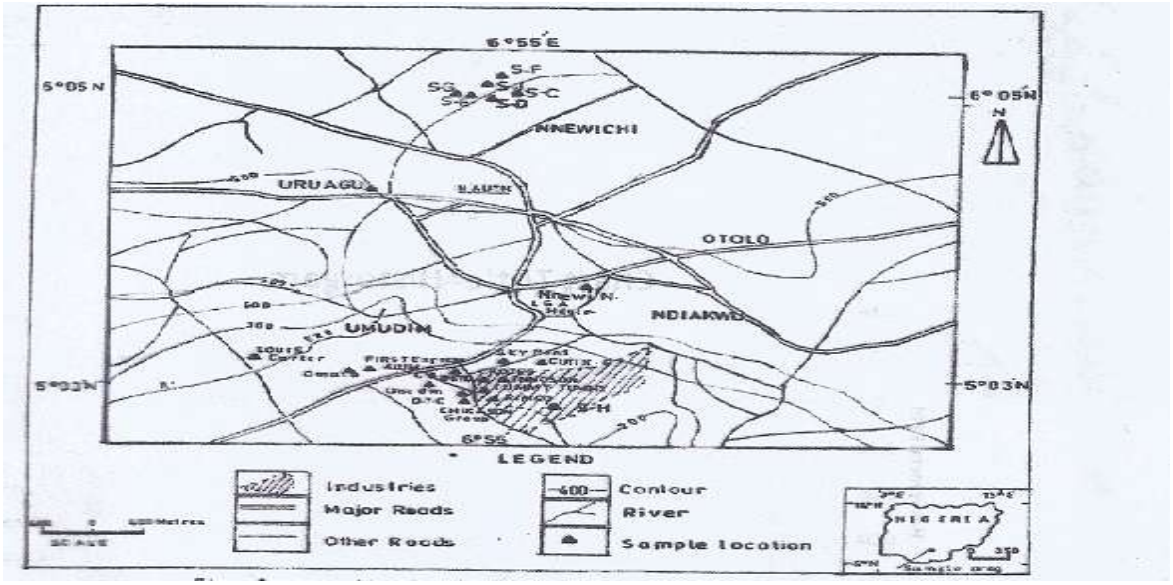


Fig 2: The topographic map of the area.



II. METHOD OF STUDY

The work was carried out in stages and involved review of reconnaissance work. Topographic and geologic maps of Anambra Basin on a scale of 1:125,000 was employed in the identification of rock formations and in establishing their stratigraphic/structural relationships and also detailed surface/subsurface and hydrologic studies were carved out. Activities involve the determination of volume mean levels, collection of underground water samples from boreholes and hand dug wells. The final phase was used for laboratory studies in which chemical analysis of water samples were carried out.

The instrument used for data acquisition include topographic map of the area, geologic map, aerial photograph, satellite images and fracture maps of Anambra drainage Basin.

Hydro geological investigations were carried out by identifying areas of ground water. Samples were arranged after digestion for the identification of heavy metals (Petti John, 1975), using 20 atomic spectrophotometer. The calibration pot method was used for the analysis. Air-acetylene was the frame used and hollow cathode lamp of the corresponding elements was the resonance line source. The wave lengths for the determination of the elements were 193.7, 228.8, 327.4, 379.4, 253.7, 313.26, 352.5, 217.0, 211.248 and 213.9 respectively. The digested samples were analyzed in duplicates with average concentration of the metals present, being analyzed in mg/L. by the instrument after extrapolation from the standard curried. The results of the analysis of ten (10) underground water samples were shown in table2.

Table 2: Result of heavy metal analysis in water samples

S/NO	SAMLE CODE	1	2	3	4	5	6	7	8	9	10
		(PPm) Ar	(PPm) Cd	(PPm) Cr	(PPm) Cu	(PPm) Hg	(PPm) Mo	(PPm) Ni	(PPm) Pb	(PPm) Zn	(PPm) Zr
1 URUAJU	A	ND	0.001	0.024	0.044	ND	ND	ND	ND	0.068	ND
2 NNEUILU	B	ND	ND	0.019	0.0039	ND	ND	ND	ND	0.060	ND
3 OTOLO	C	ND	ND	0.022	0.033	ND	ND	ND	ND	0.046	ND
4 UMUDIU	D	ND	ND	0.023	0.042	ND	ND	ND	ND	0.033	ND
5 UROGU	E	ND	0.002	0.031	0.050	ND	ND	ND	ND	0.125	ND
6 OTOLO	F	ND	ND	0.023	0.034	ND	ND	ND	ND	0.045	ND
7 URAFU	G	ND	0.001	0.025	0.043	ND	ND	ND	ND	0.061	ND
8 UMUDIM	H	ND	ND	0.020	0.040	ND	ND	ND	ND	0.034	ND
9 URUOGU	I	ND	0.001	0.032	0.051	ND	ND	ND	ND	0.124	ND
10 NNEUICHI	J	ND	ND	0.018	0.034	ND	ND	ND	ND	0.058	ND
Maximum contamination level for the detectable metals			0.005	0.1	1.3					5	

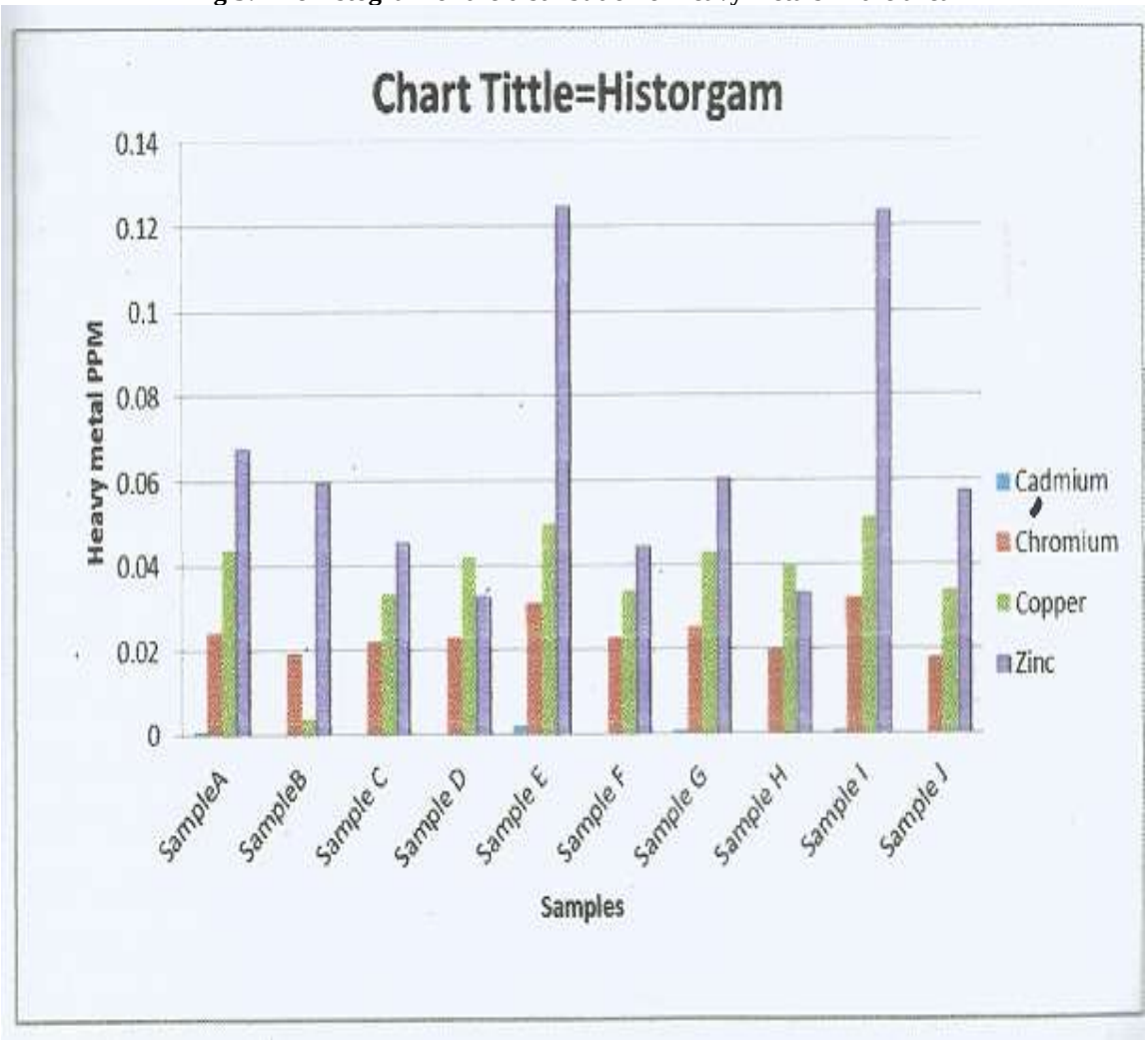
Out of the ten water sample analyzed cadmium, chromium, copper and zinc were observed to have abnormal high concentrations, while Argon, mercury, molybdenum, Nickel, lead and zirconium were not detected.

III. RESULTS

Results from all available underground water analysis after all necessary compilations were presented. Chromium copper, cadmium and zinc were observed to be high while Argon, Mercury, molybdenum, nickel, lead zirconium were not observed.

The water analysis records of the area were compared with maximum concentration level according to United States environmental protection agency 2013 (USEPA, 2013). The histogram of the distribution is shown in fig 3.

Fig 3: The histogram of the distribution of heavy metals in the area



The findings also shows that cadmium was not detected in some places, such as Nnewichi, Otolo and Umudim. All the village show an abnormal distribution of chromium (Cr), copper (Cu) and Zinc (Zn).

According to Robbert (1999), cadmium causes lung cancer, blood pressure, while chromium brings about kidney, liver damage circulatory and nerve tissue damage. From the findings of Tsvetkovagoleva and simeonovez (1984), copper causes anemia, liver irritation, stomach irritation and intestinal irritation while zinc brings about growth retardation, delayed sexual maturation, infection susceptibility and diarrhea. The undetected metals – Argon (Ar), Mercury (Hg), Molybdenum (Mo) Nickel (Ni) and zeconium (Zr) indicated their probably the industries in these areas dispose their wastes properly. Onunkwo-Akunne and Uzoije (2010). The fact that ground water is the only source of water supply in the area it should be tested periodically and seasonally too. Water chemistry examinations should be carried out seasonally since ground water is subject to periodical regional climatic changes (woolseyer et al (19975). Awareness should be created and brought to the knowledge of the community. There should be public orientation programme enlightening the community on the dangers of excess heavy metals in underground portable waters. Health institutions should be alerted on this discovery.

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