Radiometric Characterization of IDOANI Basement Complex Rocks, Southwestern, Nigeria.

ERINFOLAMI T.G[1], ADELEYE O. T[2], SARAFA C.K.3
[1]*Department of Geosciences, university of Lagos, Akoka Lagos, S.W. Nigeria.*
[2]*Department of Earthsciences, Adekunle Ajasin, University, Akungba Akoko Ondo state, Nigeria.*
Corresponding Author: Erinfolami Tunde Gideon.
[3]*Department of Geosciences university of Lagos, Akoka, Lagos, S.W. Nigeria.*

Abstract- ***The radionuclides and Radiometric assessment of the rocks in Idoani basement complex in Ondo state, Southwestern, Nigeria were carried out with a view to determine the level of radioactive materials in the rocks. The radiometric ground survey was carried out using a very sensitive Sodium Iodine Scintillation Counter, Scrintex Model SGL-ISL with the serial number 8001089.The analysis for the radionucluides such as uranium, thorium and strontium(in ppm) was done by instrumental Neutron Activation Analysis (INAA) at the department of applied geology,Federal university of technology, Minna, Niger state, Nigeria, using the method of Brunfelt and Steines,1969 at Geology laboratory of Victoria university,New Zealand. The results of the radiometric ground survey shows the anomalous radiometric counts observed in the granites(1690cps) and granite gneiss(1650cps) as compared to the low radiometric counts ((940-1300cps) observed in the metasedimentary rocks.The overall radiometric assessment showed that the mean activity concentration of Uranium-238, Thorium-232,Strontium-87,Vanadium-50.8, Cobalt-589 and Rubidium-87 in the metasedimentary rocks(quartzites,phyllites and quartz mica schists) conformed to the world acceptable range of (Th(15.38),Sr(2.90),V(10.20),Co(4.90) and Ru(38.0). This study showed that the granite and granite gneiss of the study area might likely posed environmental hazards if used for any domestic and human consumption purposes such as grinding stones and foundation gravels and may be harnessed as potential Hot Dry Rock(HDR) geothermal resources.***

Ket words: Radiometric, metasedimentary, geothermal , foundation, hazard.

I. INTRODUCTION

The Nigeria basement complex is situated in the pre drift mobile belt defined by (5) as east of the west African and San Luis Cratons(figure 1). The western half of Nigeria (Nw and Sw), which form the object of this synthesis, is generally referred to as the schist belts to distinguish it from the area east of longitude 8^0 which is largely granitic with much lower development of metasediments.

In Idoani area, porphyritic granites intrude the granite gneiss and metasediments (Quartzites, quartz mica schists).The metasedimentary rocks comprises mainly of phyllites, quartz mica schists And quartzites while other rock types in the area are granites and granite gneisses.

According to Olarewaju (4) the distinct high activity concentration of radionuclides in the granites and granite gneisses of the study area are due to the high concentration in the distribution patterns of the radionuclides in the rocks formed after the consolidation of the last magmatic deposits which are mainly composed of the rare earth elements (REE) such as UraNIUM-238 AND Thorium-232..According to (7) most of the radioactivity of sediments and metasediments is derived from the weathering of the granitic and gneissic rocks. Only a small percentage of these materials are chemically weathered from Agricultural activities, industrial activities and pollutions.

In view of this, this study aim at elucidating the radiometric and radionuclides concentrations in the rocks in Idoani area and its environment for Hot Dry Rocks(HDR) geothermal resources (5,1) as well as to confirm the suitability of the rocks in the area for domestic and consumption purposes such as grinding stones and foundation gravels.

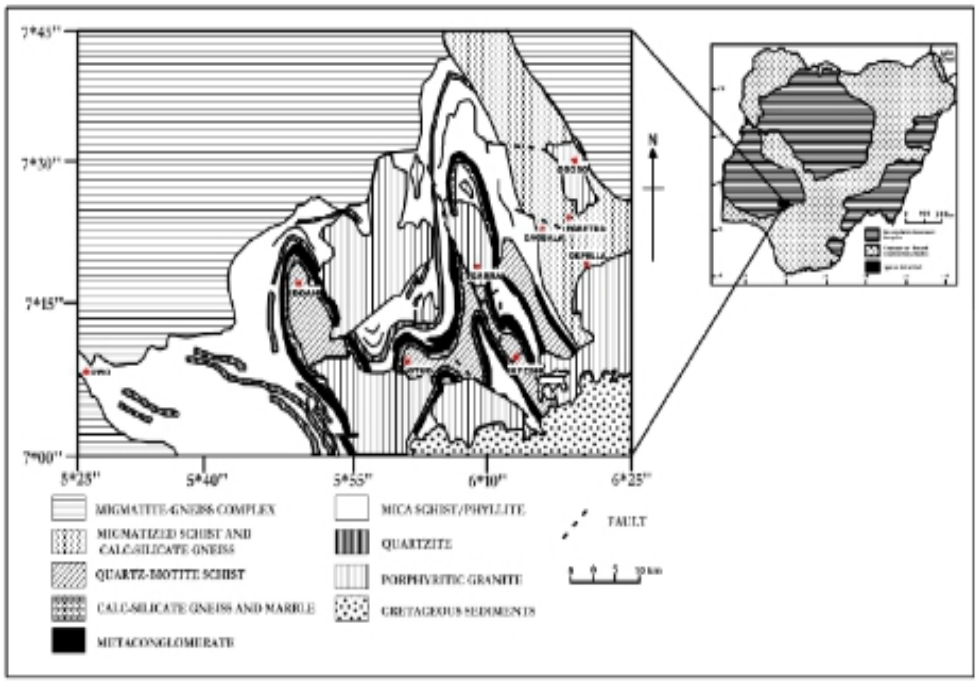

Fig. 1: Geological Map of Igarra Schist Belt showing Idoani area (after Odeyemi, 1988)

LOCATION OF THE STUDY AREA

Idoani is located in the northern part of Ose local government area of Ondo state, Nigeria and lies between longitudes 5^0 49^1E and $5^0$$54^0$E. and latitude $7^0$$15^1$N and $7^0$$19^1$N occurring in the northern portion of Owo northwestern sheet(225) of the federal survey of Nigeria(1978).The area measures about 60square kilometers. The study area is accessible by a tarred road linking the area with the main Oba-Afo road to the west. The bifurcated road serves as a major transit route for heavy duty vehicles travelling to and fro from the northern part of the country.The vegetation of the study area is typical of tropical rainforest and the climate is hot humid and tropical type.Ido-ani and its surrounding towns are characterized by dendritic drainage system pattern and the study area is characterized by low lying relief with a few highlands at the southwestern part of the area.

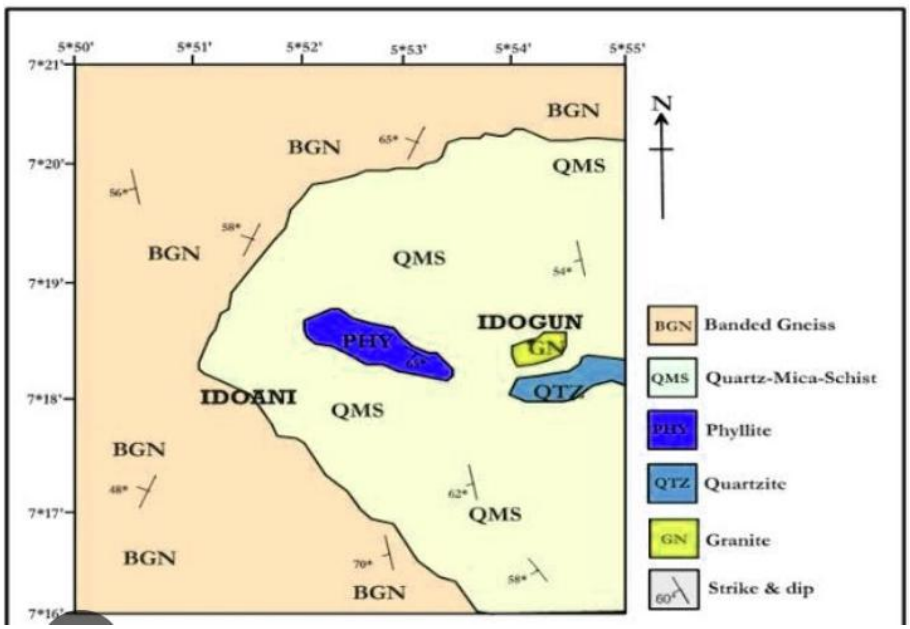

Figure 2: the geological map of the study area

II. MATERIALE AND METHODS

Two major geological methods are deployed in course of the research work namely;

a. Radiometric ground survey
b. Radionuclides Analysis

a. Radiometric measurement of the gamma dose rate were performed on the rocks observed in the study area at every location. The measurements were carried out using an instrument named Sodium Iodine Scincillation counter, Scirintex model SGS;ISL with the serial number 8001089 powered by four batteries of 1.5ev.

The cover of the equipment was placed in an opened position to allow current flow through the diodes and the readings in count per seconds(cps) were measured and recorded as the equipment was aligned horizontally the rock.

Figure 3: corresponding author taking reading on quartz mica schist in the study area.

B. RADIONUCLIDES ANALYSIS

Ten fresh representative samples were collected and analyzed for the mean radionuclides counts. The analysis for the Uranium and Thorium contents(in ppm) was done using instrumental Neutron Activation Analysis (INAA).The analysis of the Uranium and Thorium contents(in ppm) was done using INAA at the department of geology laboratory of Victoria University, New Zealand.in preparation of the radionuclides the following materials were used for the analysis; Sieve, Gamma ray spectroscope, Rock cutter and Grinding stone. The samples were then sieved, dried and then stored for necessary radionuclides analysis to confirm the percentage of radionuclides such as strontium, cobalt, vanadium and rubidium present in the studied rocks.

III. RESULTS AND DISCUSSIONS

Figure 1 and table 1 show the average gamma counts observed on the different rock types found in the study area. It was observed from this study that the percentage of radionuclides activity concentrations were higher in both the granites and granite gneisses as this further support the high average radiometric counts observed on the granites (1690cps) and granite gneisses (1650cps)(table1) as compared to the low average radiometric counts observed on the metasedimentary rocks(quartzites(980cps),Quartz mica schists(1200cps) and phyllites(1050cps) respectively. The high radiometric counts observed on the outcrops of the granites and granite gneisses must have been as a result of the concentration of materials crystallizing after the consolidation of the last molten magma.

Table1: showing radiometric gamma count dose observed in the study area

LOCATION	LITHOLOGY	RMC IN COUNT PER SECONDS	AVERAGE RMC IN COUNT PER SECONDS
IDS1 IDS2	GRANITE GRANITE	1680 1710	1690(1)
IDS3 IDS4	GRANITE GNEISS GRANITE GNEIS	1800 1550	1650(2)
IDS5 IDS6	QUARTZITE QUARTZITE	990 970	980(3)
IDS7 IDS8	MICA SCHIST MICA SCHIST	1150 1250	1200(4)
IDS9	PHYLLITE	900	
IDS10	PHLLITE	1200	1050(5)

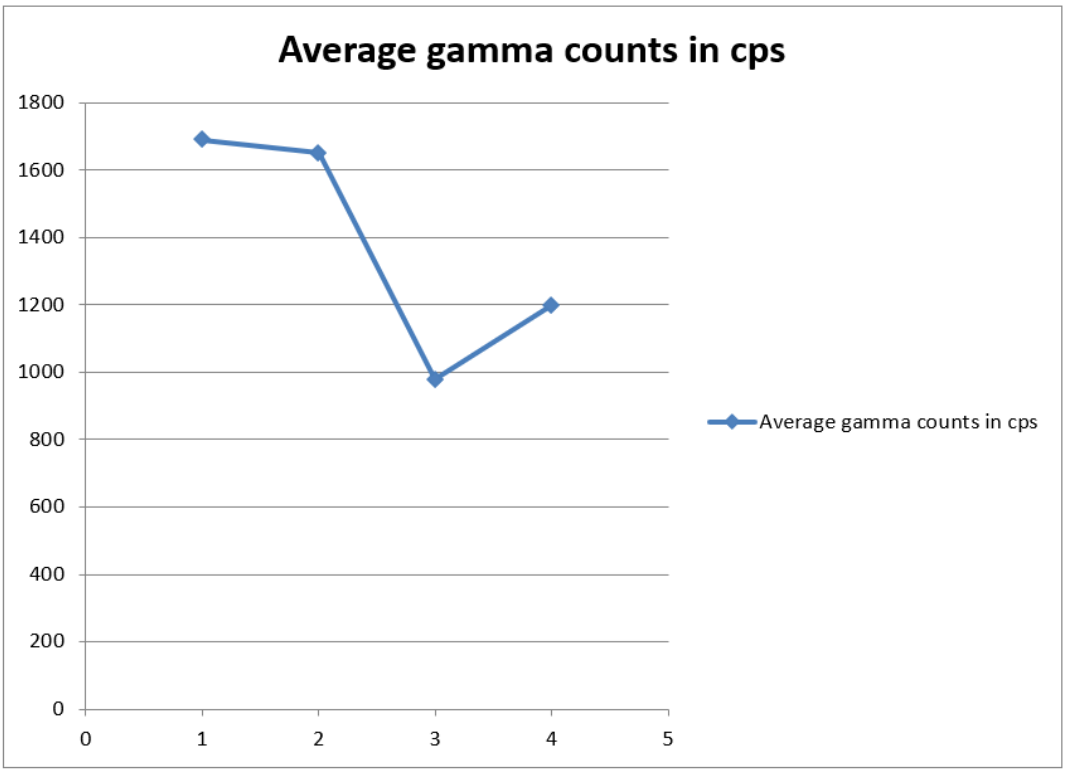

Figure 3: showing average gamma count observed in the rocks of the study area

Figure2 and table 2 showed the percentage of activity concentrations of radionuclides observed in both granites and granite gneisses of Idoani area as well as the radionuclides observed in the metasedimentary rocks(quartzites, mica schists and phyllites).The percentage of the activity concentration of the radionuclides as observed in Uranium(u-238) is highest in the granites (67.0)(IDS1) while the lowest in the outcrop of quartzite (22.30).This further support the claim of (6) that the activity concentration of radionuclides is higher in the rocks formed after the crystallization of molten of magma as such the high value of uranium and thorium observed in the outcrops of granites and granite gneisses of the study area might not be the indication of any uranium mineralization but can be used as harness of Hot Dry Rocks (HDR) geothermal resources as stipulated by (6).The granites and granite gneisses of the study area might have derived their activity concentrations from the rocks formed after the crystallization of molten magma.

location / Radionuclides	IDS1	IDS2	IDS3	IDS4	IDS5	IDS6	IDS7	IDS8	IDS9	IDS10
Radionuclides / Lithology	G	G	GN	GN	QUZ	QUZ	QMS	QMS	PHY	PHY
U-238(URANIUM)	65.00	67.0	50.9	62.9	25.0	22.3	32.4	33.60	38.62	37.8
TH-232(THORIUM)	47.3	46.0	30.62	32.9	13.9	13.89	14.80	14.92	15.32	15.6
S-87(STRONTIUM)	10.61	12.3	12.58	10.62	2.68	2.52	2.90	2.72	2.89	2.82
V-50.8(VANADIUM)	22.30	22.90	17.5	18.9	8.80	8.89	9.80	9.85	10.0	10.12
CO-58.9(COBALT)	12.36	11.48	10.2	10.8	3.00	3.16	3.86	3.69	4.80	4.89
R-87(RUBIDIUM)	62.90	64..1O	50.90	50.61	35.20	35.9	36.20	36.39	38…0	37.90

Table 2: showing activity concentration of Radionuclides observed in the study area.

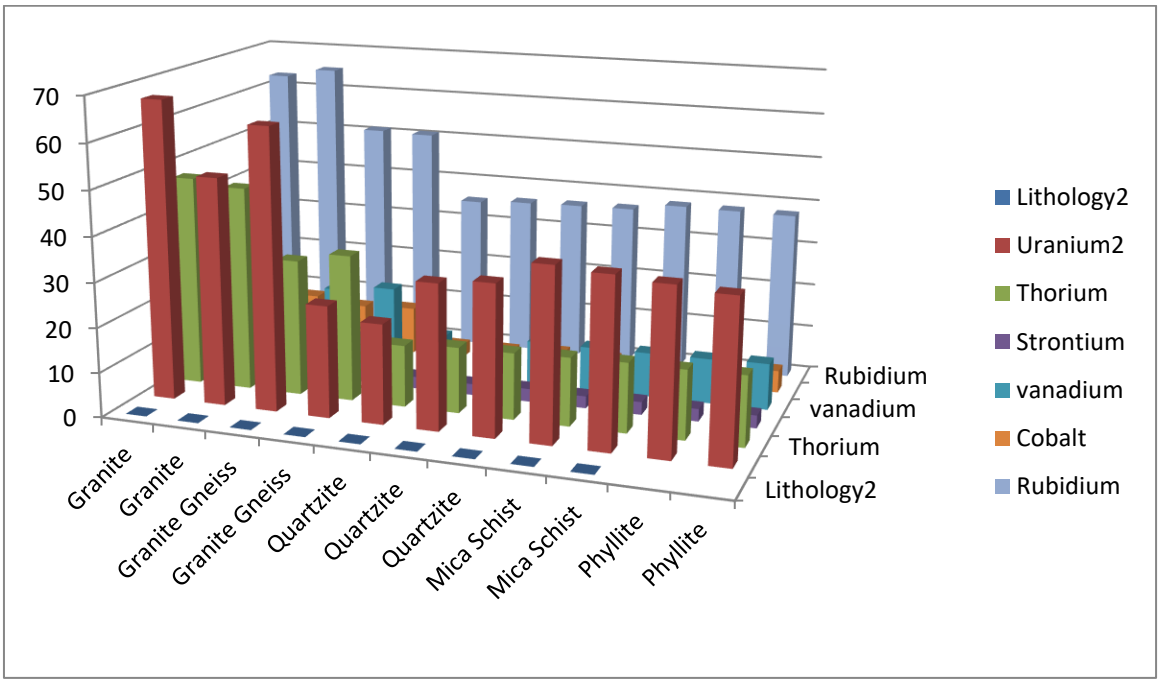

Figure 4: Showing a percentage of radionuclides observed in the study area.

The general low activity concentration of radionuclides such as strontium, vanadium, cobalt, rubidium, thorium and uranium in the metasedimentary rocks hen showed that the metasedimentary rocks might not pose any environmental hazards if used for any consumption purposes such as grinding stones, decorating stones and foundation gravels as against the high activity concentration of radionuclides observed on both the granite and granite gneisses of the study area which might pose serious health hazards if used for any consumption purposes(2).

When compared with the world average of radionuclides it was observed that the activity concentration of Radionuclides in the granites and granit gneisses were above the world average range .The stipulated world range of each of the radionuclides is {(Th-232(15.8),U-238(40.62),Ru-87(8.80),Co-58.9(40.9), V-50.8(10.22) and St-87(2.96)} while the radionuclides observed in the metasedimentary rocks fall within the stipulated world average range.

IV. CONCLUSION

Since the activity concentration of the radionuclides in the granites and granite gneisses of the study area fall outside the world average range as such the rocks cannot be used for any domestic or consumption purposes such as grinding stones, decorating stones and foundation gravels as they will pose serious health problems if used at any point in time but might be harnessed for Hot Dry rocks (HDR) geothermal resources (4).

V. RECOMMENDATION

I strongly recommend that the use of the granites and granite gneisses of Idoani should not be used for consumption purposes such as grinding stones or used as a foundation gravels during any constructional works.

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