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Research Article

LITHOFACIES AND PALEOENVIRONMENTAL ANALYSIS OF GURU WELL IN OFFSHORE NIGER DELTA

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ABSTRACT

The paleoenvironment and lithofacies analysis was carried out on seventeen (17) ditch cutting samples of GURU Well in offshore Niger Delta. The analysis aim to determine the age of rock and environment of deposition within the section under study, the lithostratigraphy of the sample indicate shale and sandstone which are calcareous, lithofacies analysis with a high percentage of rock fragment, calcite, quartz and mica flasks in few of the samples. Other lithofacies components in low percentage are rootlet, heavy mineral and fossils. Biofacie analysis showed some, Pelecypod and shell fragment which indicate the age of the Well to be Miocene. The presence of rootlet and some macrofauna phylum Mollusca which include Pelecypod and shell fragment found within the depth of 3040ft, 2080ft, 2020ft and 2000ft which may be used to characterize the age of the formation and majority of this macrofauna live in shallow marine to littoral water and some becomes adapted to fresh-water environments.

INTRODUCTION

Biostratigraphic analysis was carried out on seventeen (17) ditch cutting samples cuttings retrieved from GURU Well located in the region of Niger Delta environment. The growth of Niger Delta started during the Paleocene transgression with the formation of the proto-Niger Delta and the modern which has continued from Eocene to present(Murat, 1972). The Niger Delta is a coarsening upward sequence of tertiary clastics that prograde over a passive continental margin (Hospers, 1965). The environment of study in focus is a sedimentary depositional environment because sedimentary rocks are rocks formed at the surface of the earth under low temperature and low-pressure conditions which favors the rapid burial and preservation of fossils (Merki, 1972). These rocks results from accumulation and solidification of sediments materials transported in water air or ice (Burke *et al*, 1971). The three major depositional environments typical of most deltaic environment [marine, mixed and continental] are observable in the Niger delta and are represented by the Benin, Agbada and Akata Formations (White, 1996). The Niger delta province contains only one identified petroleum system and is referred to as tertiary Niger delta [Akata-Agbada] petroleum system(Murat, 1972). This work aimed at carrying out lithofacies, palaeontologic, deducing the paleoenvironment of deposition of the sediments based on the percentage distribution analysis of samples obtained from a GURU Well in the offshore Niger Delta.

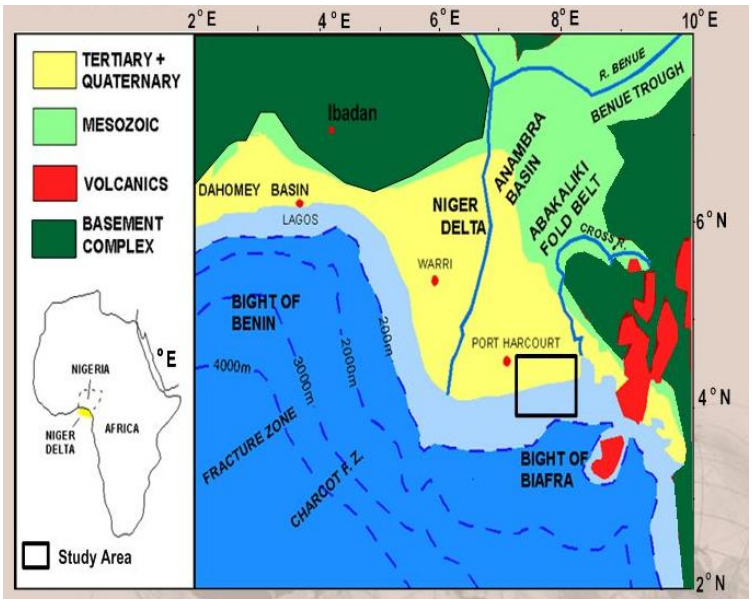


Figure 1: Location Map of the studied area.

GEOLOGICAL SETTING OF THE BASIN

The Niger Delta Basin is the largest basin on the continental margin of the Gulf of Guinea, covering an area of about 300,000 km2 (Kulke, 1995). With a sedimentary thickness of over 10 km in the basin

center(Kaplan,*et al*. 1994). It lies between longitudes 4^0E and 8.8^0E and latitudes 3^0Nand 6.5^0N (Fig. 1). The basin occupies the oceanward part of a larger and older tectonic feature, the Benue Trough; hence its evolution has been linked to the Benue-Abakaliki Trough - a sedimentary complex. According to (Murat, 1972 and Weber *et al*, 1975) the stratigraphic history of the Niger Delta Basin in terms of tectonic event revealed that the basin represents the third cycle in the evolution of the southern Nigerian sedimentary basins thus: (a) Benue-Abakaliki phase (Aptian - Santonian), (b) Anambra-Benin phase (Santonia - Early Eocene) and (c) Niger Delta phase (Late Eocene - Recent). Based on the dominant environmental influence, the sedimentary sequence of the basin consists in ascending order of three major diachronous facies units (Short et al 1967), namely, Prodelta facies (marine environment), Delta front facies (transitional environment) and Delta plain facies (continental enviroment).

METHODOLOGY

A total of 17 ditch cuttings were analysed for the GURU well from interval of 1050-3030ft. These samples were processed and analysed at 20ft. interval for planktic foraminifera using the standard micropaleontological sample preparation procedures. Samples were first laid out sequentially according to their depths. Labels were prepared for each sample. Clean sample plates are laid out. About 25g of samples were placed (for ditch cutting samples) into the sample plates. The samples were dried on a hot plate at about 800^0C for 1-2 hours. The sample plates were allowed to cool and weighed. The samples were decanted, topped with water and left overnight. The samples were washed with liquid soap and water through four sieve mesh sizes of 500, 250, 150 and 63 microns and dried. Samples were transferred into four different bags/phials and labelled accordingly. Foraminifera were picked from the packaged samples and studied with the aid of a reflected light binnocular Zeis microscope. All the planktic foraminifera recovered were analysed. Generic and species identification were based on Bolli and Saunders (1985).

RESULTS AND DISCUSSION

The litho-description follows the standard method of describing samples as described in the methodology. Four informal sedimentary units were deduced from the analysis of the GURU Well.

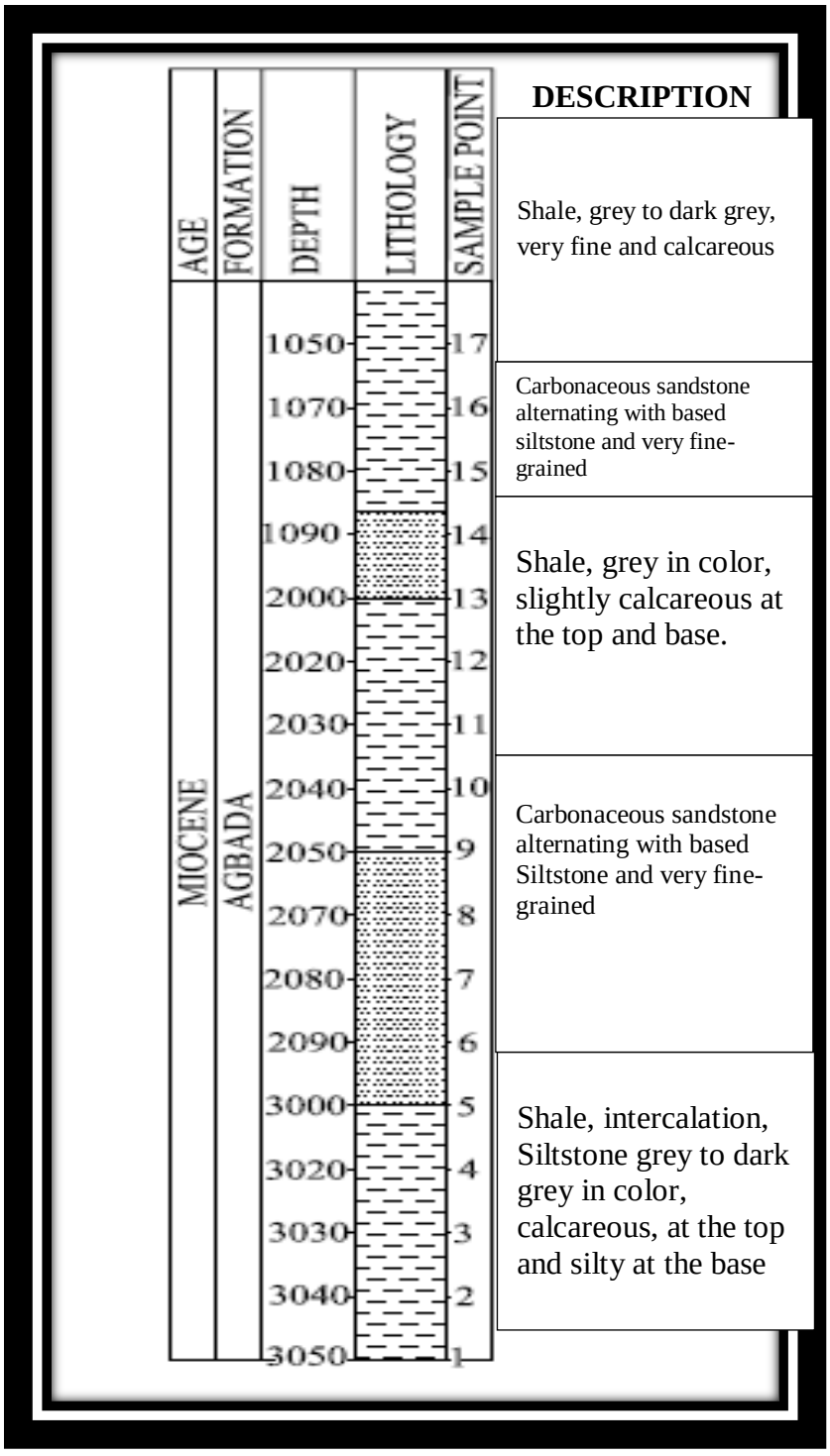


Figure 2: Lithology Description of the study area

SAND, SILT, CLAY, RATIO

The wet-sieve analysis that was carried out on each of the seventeen (17) ditch cutting samples

produced a grain size analysis table; the result of the wet sieve analysis is presented in table 1 and figure 2. The wet sieve analysis was used to determine the percentage of sand, silt and clay in the study area.

Serial number	Depth (ft)	Original weight of sample(g)	Weight of paper	A	%	B	%	C	%	D	%
1	1050	25	0.6	10	31.2	2.7	10.8	-	-	20.8	83.2
2	1060	25	0.6	8.8	2.4	2.4	9.6	-	-	18.4	73.6
3	1070	25	0.6	8.4	2.3	2.3	9.2	-	-	17.6	70.4
4	1080	25	0.6	2.3	9.2	2.6	10.4	-	-	19.6	78.8
5	1090	25	0.6	2.3	9.2	2.5	10	-	-	19.2	76.8
6	2000	25	0.6	2.4	9.6	2.1	8.4	-	-	18	72
7	2020	25	0.6	2.6	10.4	2.8	11.2	-	-	21.6	86.4
8	2030	25	0.6	2.5	10	2.8	11.2	-	-	21.2	84.4
9	2040	25	0.6	2.6	10.4	2.7	10.8	-	-	21.2	84.8
10	2050	25	0.6	2.3	9.2	2.5	10	-	-	19.2	76.8
11	2060	25	0.6	2.6	8.5	2.3	8	-	-	-	-
12	2070	25	0.6	2.5	10	1.5	6	1.4	5.6	4.6	86.4
13	2080	25	0.6	1.9	7.6	1.5	6	1.3	5.2	18.8	75.2
14	2090	25	0.6	2.3	9.2	2	8	0.9	3.6	28.8	83.2
15	3000	25	0.6	2.3	9.2	1.9	7.6	0.9	3.6	20.4	81.6
16	3020	25	0.6	3.2	12.8	2	8	0.2	0.8	21.6	86.6
17	3030	25	0.6	2.2	8.8	3.9	11.6	-	-	20.4	81.6

Table 1: Showing the grain size analysis.

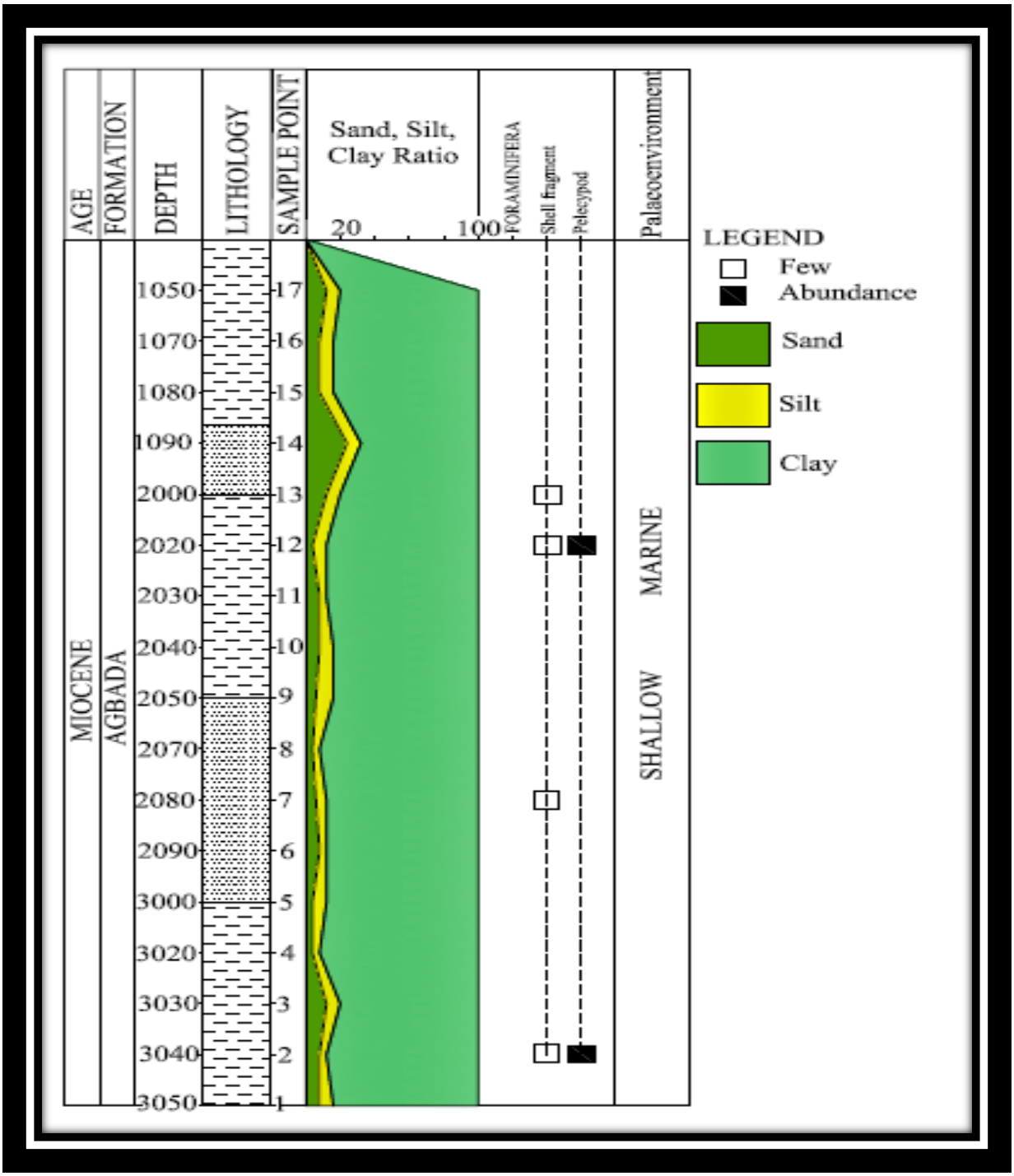


Figure 3: Percentage distributions of Sand, Silt Clay, Ratio of the Study Area

LITHOFACIES ANALYSIS

In this analysis, percentage distribution of the rock fragment, calcite, quartz, mica, heavy mineral, rootlet, leaflet and fossils are noted. The distribution of the lithofacies component within the depth interval of 1050-3030ft of GURU Well is tabulated below. The distribution of the lithofacies component in the depth under study (1050-3050ft) of GURU Well is presented in table 2 and figure 3

Sample point	Depth (ft)	Rock fragment	Calcite	Quartz	Mica	Heavy mineral	Rootlet	Leaflet
1	1050	-	-	-	-	-	-	-
2	1060	45	-	28	10	17	-	-
3	1070	40	30	15	5	10	-	-
4	1080	-	55	25	-	20	-	-
5	1090	-	75	20	-	5	-	-
6	2000	-	25	65	10	-	-	-
7	2020	-	30	56	4	10	-	-
8	2030	30	-	45	10	15	-	-
9	2040	50	15	20	5	10	-	-
10	2050	44	14	20	10	12	-	-
11	2070	40	15	35	10	-	-	-
12	2080	30	16	36	10	8	-	-
13	2090	-	30	50	5	10	5	-
14	3000	-	30	40	15	-	10	5
15	3020	50	10	30	10	-	-	-
16	3030	30	23	25	14	-	8	-
17	3050	30	20	30	10	-	10	-

Table 2: Showing the Lithofacies Analysis

DISCUSSIONS

The paleoenvironment and lithofacies analysis that was carried out shows that the sediment is of marine environment. From sample 1-7 with depth 3050ft to 2080ft marks an increase in rock fragment with a little decrease in calcite and also an increase abundant in quartz, mica and heavy mineral is also presence within these depths on a small scale. The presences of rootlet indicate a shallow marine depositional environment. The macrofauna which includeshell fragment and pelecypod at depth 3040ft and 2080ft provide information on environment of deposition in attributes to marine deposit and the majority of this macrofauna live in shallow marine and littoral water and some becomes adapted to fresh-water environments. From sample 8-11 with depth 2070ft to 2030ft shows a relative dominance with decrease in rock fragment over calcite and an increase in quartz, but within depth 2050ft to 2060ft at sample point 9-10 there is there is a fluctuation of mica, heavy mineral and calcareous. From sample 12-17 with depth 2020ft to 1050ft marks an increase in rock fragment with a little decrease in calcite and also an increase abundant in quartz, mica and heavy mineral is also presence within these depths; but in sample point12 shows the presence of mica and rootlet on a small scale, The macrofauna phylum (Molluca) which includepelecypod and shell fragment which may be insufficient to characterize the age of the formation.But an increase and decrease of the macrofauna within depth 2020ft to 2000ft which shows a remarkable abundant and few biofacies indicate poor benthonic marine depositional environment.

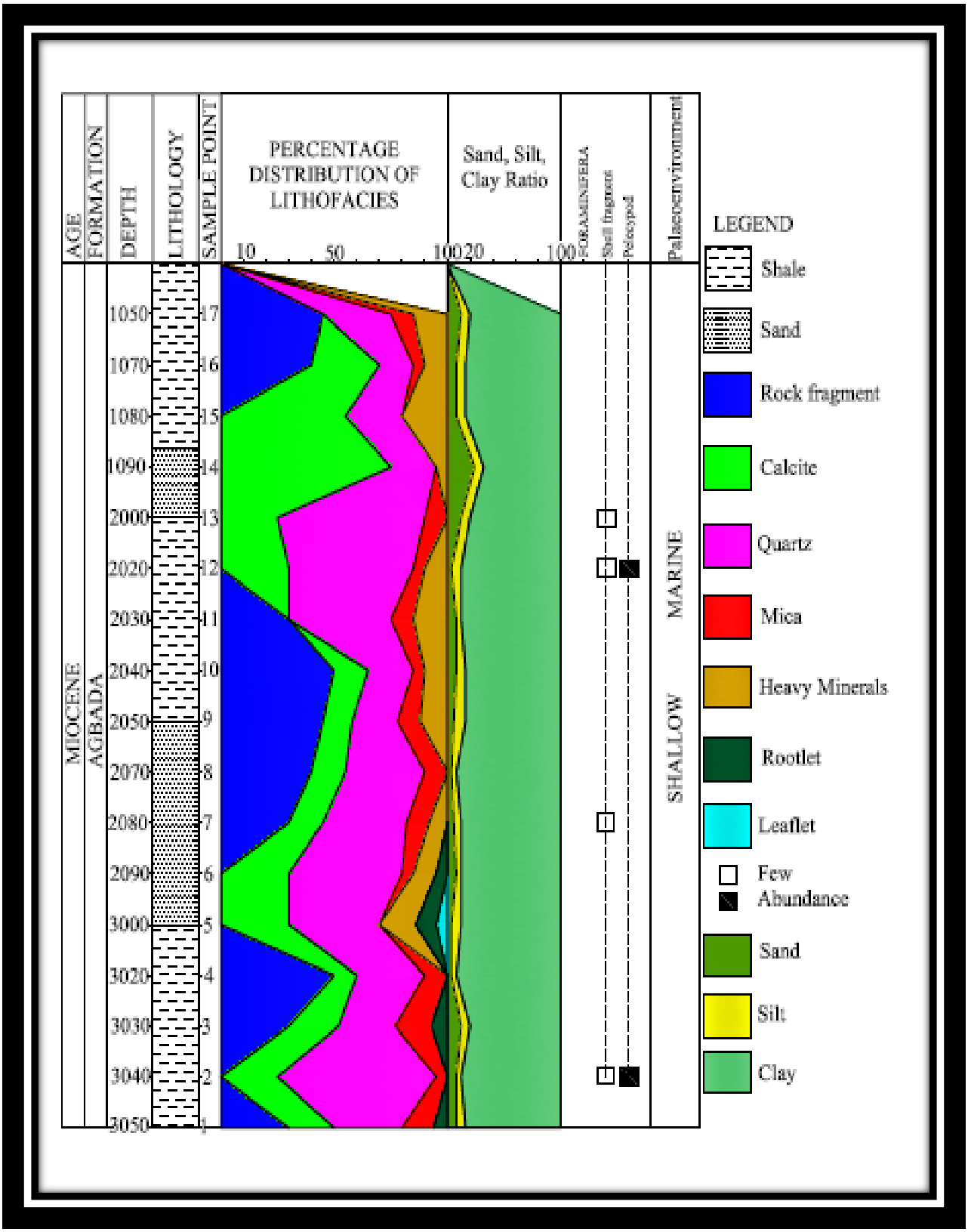
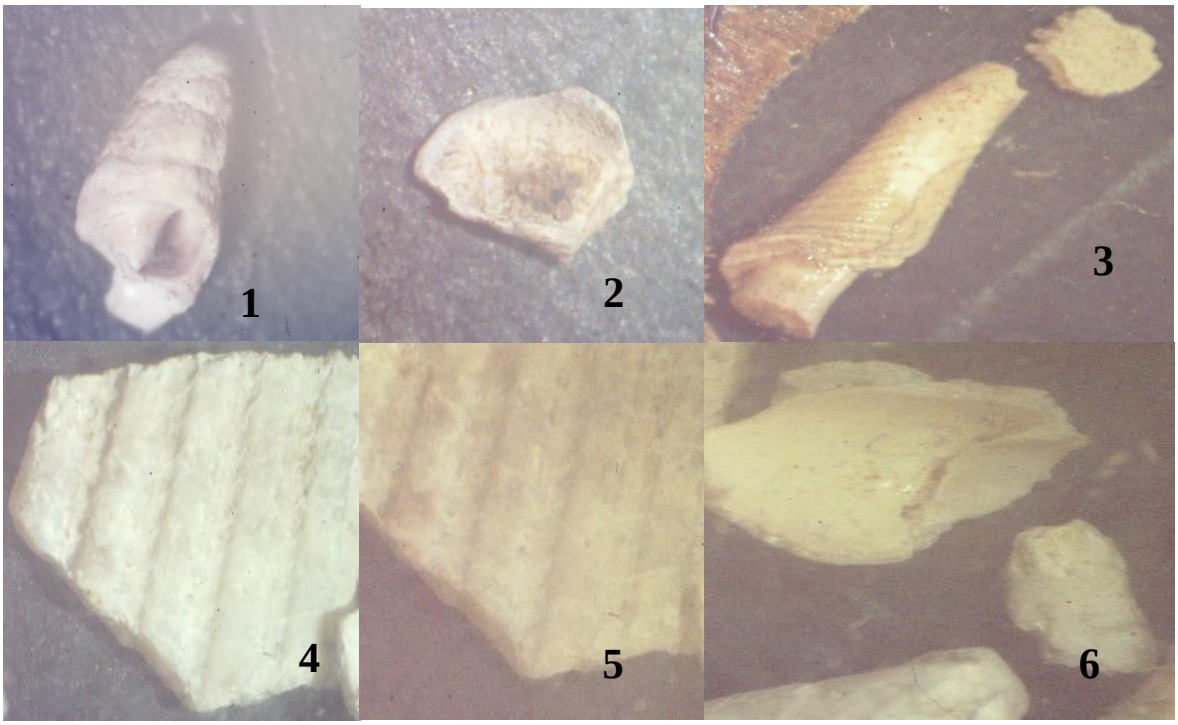


Figure 4: Percentage distribution of lithofacies, grain size and fossils

SUMMARY AND CONCLUSION

The paleoenvironment and lithofacies study have been derived from 17 ditch cutting within the section of GURU Well in the Niger Delta. This study has shed more light on the paleoenvironment and lithofacies of the Niger Delta thereby confirming the age as Miocene. The environment of deposition are inferred to be predominantly shallow marine (Near shore) to marginal marine because of the preponderance of macrofauna phylum (Molluca) includePelecypod and shell fragment found within the depth of 3040ft, 2080ft, 2020ft and 2000ft which may be used to characterize the age of the formation and the majority of this macrofauna live in shallow marine and littoral water and some becomes adapted to fresh-water environments. The ditch cutting yielded reasonable mineral affinities with 30% calcite, 50% quartz, 5% mica, 10% heavy mineral, 1% rootlet and 4% leaflet, from the sedimentological and micropaleontological studies carried out the well is suspected to have penetrated the Agbada formation.

PLATE 1



1. Gastropod

2, 3 and 6. Fish fragment

4-5. Pelecypod

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