



FORAMINIFERAL ANALYSIS AND PALEOENVIRONMENTS OF SEDIMENTS IN WELL -AA, DEEPWATER OFFSHORE, NIGER DELTA, NIGERIA.

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ABSTRACT

Foraminiferal analysis was carried out on twenty five (25) ditch cutting samples from well -AA, offshore Niger Delta covering a depth interval of 9000ft-11025f. The study was aimed at age deduction, zoning the well, and interpreting the paleoenvironment of deposition. Lithostratigraphic description carried out on the sample revealed that the bulk lithofacies constitute shale with streaks of sand (fine-medium) between 9170ft - 9210ft and 9360ft -9380ft. The entire analysed interval was barren of planktonic foraminifera while depth 9960ft revealed a spot occurrence of *Lagena spp*, representing the only calcareous benthic foraminifera recovered in the entire interval. Few to common occurrences of deepwater agglutinated foraminifera were found in the well, dominated by some species of *Haplophragmoides spp* and *Haplophragmoides narivaensis*. Other foraminifera with rare and scattered occurrence includes, *Cribrostomides spp*, *Bathysiphon spp*, *Trochammina spp*, *Cyclammina spp*, *Cyclammina cancellata*, *Valvulina spp*, and *Glomospira spp*. The only microfaunal associated accessory recovered is ostracod at depth 1080ft. The analysed intervals was assigned a Middle – Late Miocene (N17 and older age) based on the FDO of *Haplophragmoides narivaensis*. The environment of deposition is based on the distribution of typical deep water arenaceous foraminifera species recovered in the study. The predominance of the arenaceous forms over calcareous forms suggest outer shelf environment of deposition.

KEYWORDS: Foraminifera, Palaeoenvironment, Niger delta, Biostratigraphy.

INTRODUCTION

The Niger Delta is an important sedimentary basin with oil and gas fields in Nigeria. The basin is situated in the Gulf of Guinea (Figure 1) as defined by Klett *et al.* (1997). From the Eocene to Recent, the development of the Delta has prograded southwestward, forming depobelts that represents the active parts of the delta, (Doust and Omatsola, 1990).

The Niger Delta basin contains one recognized petroleum system the Akata-Agbada Petroleum System with numerous exploratory wells (Ekweozor and Daukoru, 1994; Kulke,1995).The relatively large amount of data obtained from several researchers (Ozumba, 1995; Fadiya, 1999; Basse and Alalade, 2005; Umoh *et*

al., 2011; Omoboriowo *et al.*, 2011, Oloto and Promise, 2014; Fadiya *et al.*, 2014; Umoh, 2015; Boboye *et al.*, 2017; Ifeoluwadun and Saka, 2018) in the Niger delta has led to a better understanding of the subsurface formations that characterise the basin and more quest to the discovery of oil and gas in the region. This study seeks to determine the bioevents, age of sediments and environment of deposition as contribution to the existing datasets of the Niger delta.

LOCATION OF THE STUDY AREA.

The study area lies within the Niger Delta between Longitudes 3°E and 9°E and Latitudes 4°N and 5°2'N. (Figure 1). The study well –AA, is an offshore well belonging to the OML 118 block.

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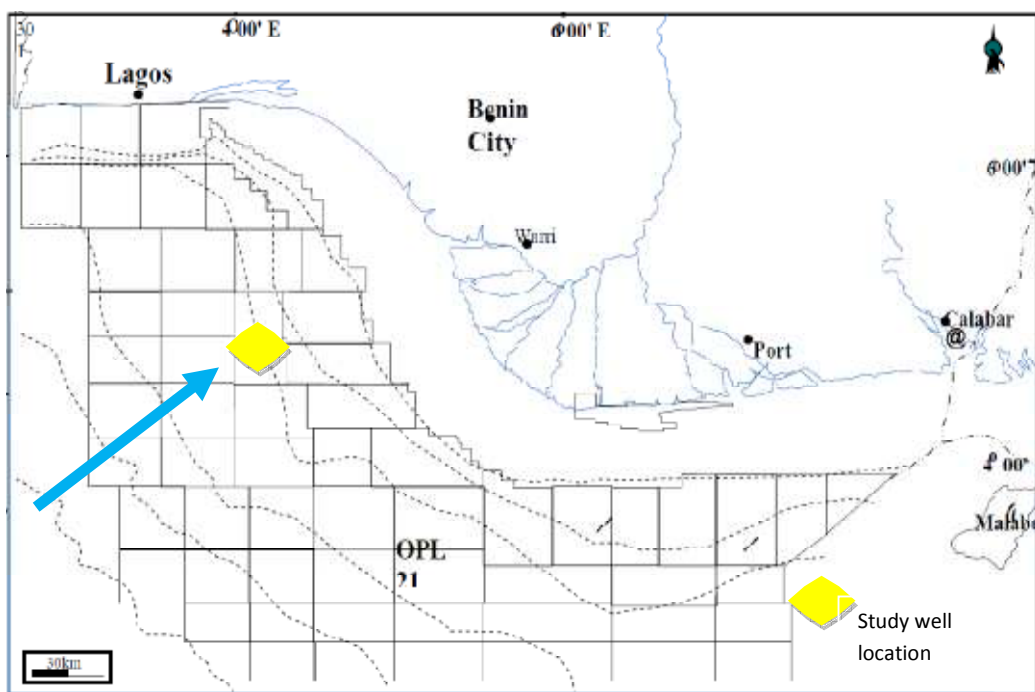


Figure 1: Map of Niger Delta Showing Study well location (Modified after Boboye *et al*, 2009).

MATERIALS AND METHODS

Twenty-five (25) ditch cutting samples from well AA, Offshore Niger Delta, at depth interval of 9000ft- 11025ft and Gamma ray log data were provided by Shell Petroleum Company, Nigeria.

The ditch cutting samples were subjected to depth by depth analysis under a Stereo-binocular microscope to determine the lithologic, texture and fossil content following the procedures in by Swanson, (1981). Gamma ray log measures the differences in radioactivity between shales and sands, with a scale ranging from 0 - 150 API units. The higher and lower gamma ray readings were used to indicate the shale and sand units respectively. The lithology of the study interval was determine from both petrographic and gamma ray interpretations.

About 25g of each ditch cutting samples was placed into aluminium sample preparation pan that were pre-labelled. Each sample was soaked in Hydrogen peroxide overnight to disaggregate, and later decanted, topped with water and left overnight. Each samples was washed with distil water through the 63 micron sieve

mesh and dried in an oven at temperature of 70°C. The dried samples were later left to cool and subsequently put in labelled sachets bags for further examinations.

The packaged samples were taken under the microscope for identification of foraminifera species, with the guidance of appropriate Foraminifera catalogues and literatures, including Loeblich and Tappan(1964, 1988); Cushman (1969). A check list was made of all foraminifera recovered and a distribution chart was produced. Photomographs of some of the species recovered were taken (Figure 3).

RESULTS AND DISCUSSIONS

The lithologic units of well -AA, is dominated by greyish shale with streaks of fine – medium grained sands (Figure 2). The sand grain ranges from sub-angular to rounded and are poorly sorted to well sorted. Shale units had thicker intervals, from 9000ft - 9160ft, 9220ft - 9310ft, and 9370ft- 11025ft, with streaks of sand from 9170ft - 9210ft and 9320ft-9360ft. From gamma ray logs description and petrographic analysis, the sediments of well – AA were predominantly shale units (Fig. 2).

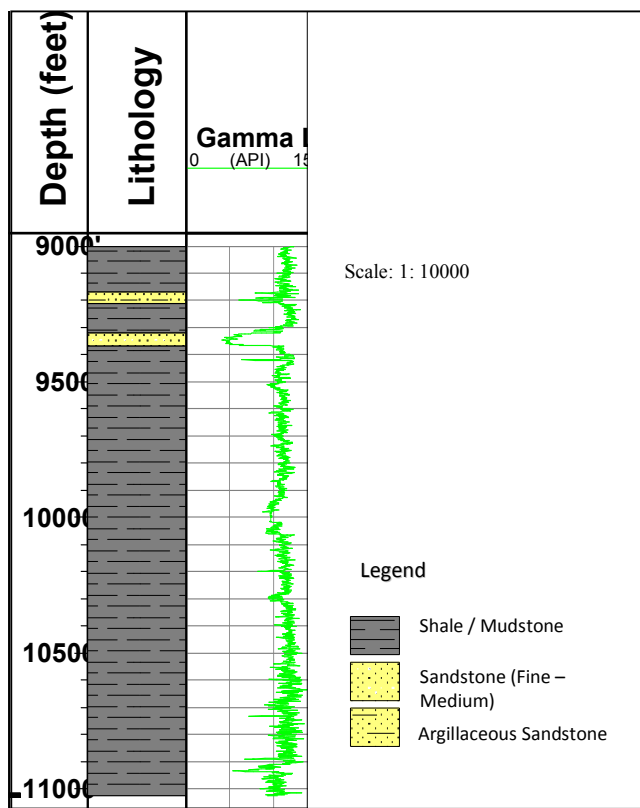


Figure 2: Lithologic description of well -AA.

BIOSTRATIGRAPHY

Abundance and Diversity of Foraminifera

Preservation of foraminifera assemblages in the ditch cutting samples of the study well was generally fair to poor. Foraminifera recorded included, calcareous benthic foraminifera - *Lagena spp*, agglutinated foraminifera - *Haplophragmoides spp*, *Haplophragmoides narivaensis*, arenaceous foraminifera - *Cribrostomides spp*, *Bathysiphon spp* and *Trochammina spp*, *Cyclammina spp* and *Valvulina spp*, *Cyclammina cancellata*, *Glomospira spp*. (Fig. 4).

BIOZONATION

Planktic Foraminiferal Zonation

The absence of planktic foraminiferal in the well interval negates a definite planktic foraminiferal Zonation based on Blow (1969, 1979) zonation scheme.

Stratigraphic Interval 9000ft - 9360ft

Zone: Indeterminate

Age: indeterminate

Remarks

Interval barren of foraminifera (Figure 4).

Stratigraphic Interval 9360ft -11025ft:

Zone: N17 or older.

Age:? Middle-Late Miocene

Remarks

Interval characterized by absence of planktic and paucity of calcareous benthic foraminifera with a spot occurrence of *Lagena spp* at depth 9960ft. The top (FDO) of *Haplophragmoides narivaensis* which is

commonly found within the N17 planktic zone has been used to delineate these interval.

BENTHIC FORAMINIFERAL ZONATION.

The well interval has been broadly zoned based on the observed agglutinated foraminiferal assemblage that dominated the well interval as follows:

Interval 9000ft – 11025ft;

Age:? Middle – Late Miocene

Zone: *Haplophragmoides spp* Zone

Remarks

Interval characterized by few to common occurrence of agglutinated foraminifera dominated by *Haplophragmoides narivaensis* and *Haplophragmoides spp*. Others include *cribrostomides spp*, *Bathysiphon spp*, *Trochammina spp*, *Cyclammina spp*, *Cyclammina cancellata*, *Valvulina spp* and *Glomospira spp*. (Figure 4).

PALAEOENVIRONMENT

The analysed well interval has been tentatively assigned to the marine environment based on the distribution of deepwater arenaceous foraminifera species such as; *Cribrostomides spp*, *Bathysiphon spp*, *Trochammina spp*, *Cyclammina spp*, *Cyclammina cancellata*, *Valvulina spp* and *Glomospira spp*. The predominance of the arenaceous forms over calcareous forms may also be interpreted as deposition in outer shelf dysoxic environment.



Figure 3. Photographs of some foraminifera recovered from the studied intervals

CONCLUSION

Foraminifera study has been carried out on Well-AA, offshore deepwater, Niger Delta within a depth interval of 9000ft – 11025ft. The lithology of the studied interval shows that the bulk lithofacies are grayish shales and fine – medium grain sandstones. The foraminifera assemblage in the study interval are poorly preserved and absent in planktic forms. The analysed section has tentatively been assigned to a Middle- Late Miocene (N17 and older), based on the First Downhole Occurrence (FDO) of *Haplophragmoides narivaensis*, an agglutinated foraminiferal species with FDO within the N17 Zone in the Niger Delta.

The section has been interpreted to be deposited in the marine environment based on the distribution of typical deep water arenaceous foraminiferal species. The predominance of the arenaceous forms over calcareous forms may also be interpreted as deposition in a outer shelf environment.

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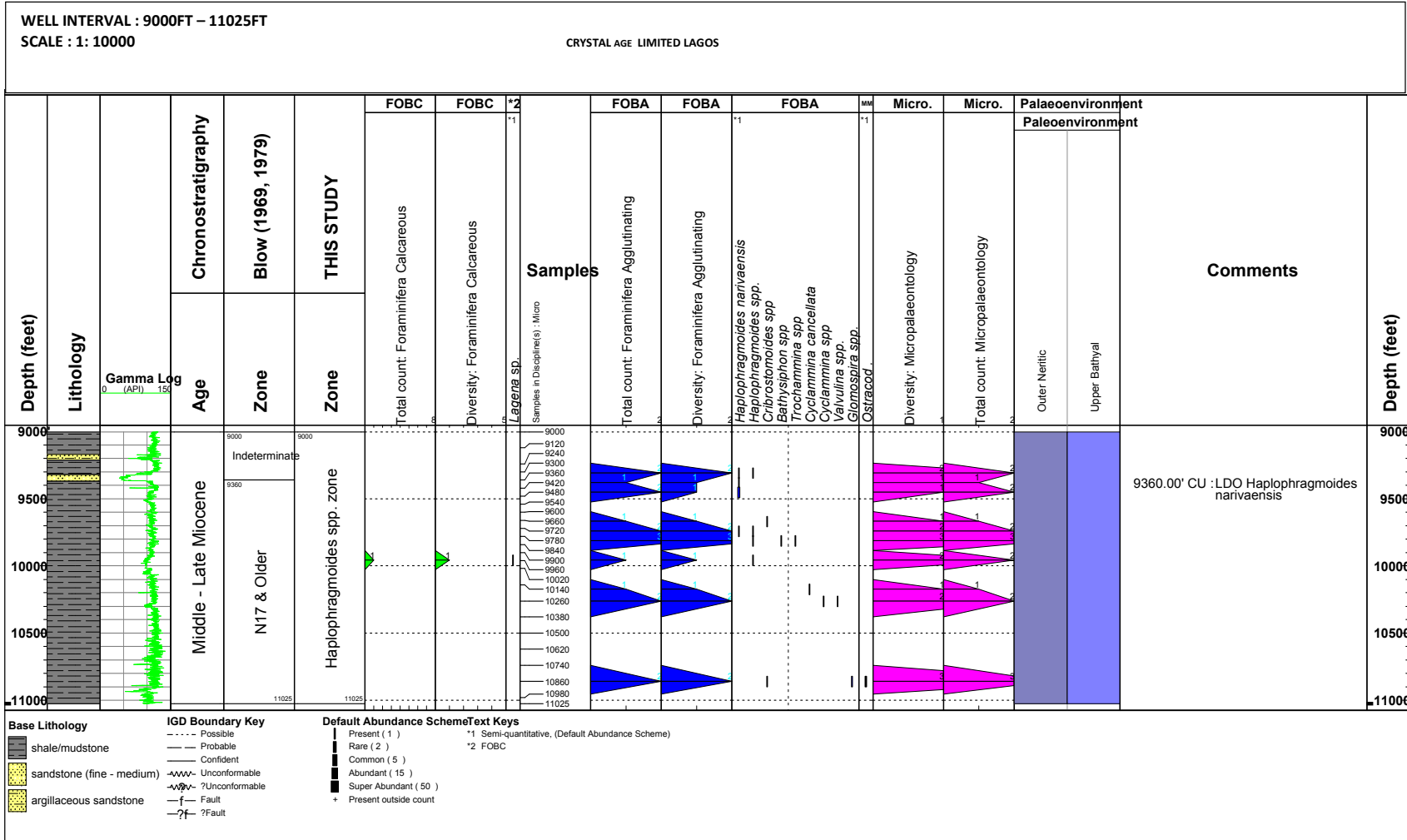


Figure 4: Foraminifera Distribution Chart for Well – AA.