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GEOLOGICAL AGE OF THE SUCCESSION PENETRATED BY THE DRILL IN NASARA-1 WELL, GONGOLA BASIN, NORTHERN BENUE TROUGH

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Abstract

Nine (9) ditch cutting samples taken across the well between 1500ft and 5190ft were subjected to standard methods and techniques employed in the research institute and oil industry for foraminiferal analysis. A total of forty-three (43) foraminifera species were identified, with the agglutinated benthics making the larger percentage and very few planktic foraminiferal species. A Turonian – Early Maastrichtian age (Late Cretaceous Epoch) was assigned to the analyzed interval (1500ft-5190ft), due to the occurrence of benthic foraminiferal species- Haplophragmoides pindigaensis, Haplophragmoides bauchensis and Ammobaculites coprolithiformis, which are characteristic species of Turonian to Early Maastrichtian age, which corresponds with the works of previous authors. Turonian to Coniacian age was assigned to the interval between 5190ft and 3300ft, Campanian/early Maastrichtian age to interval 3300ft-2600ft and finally an early Maastrichtian age to interval 2600ft-1500ft.

Keywords: Ditch cutting samples, Nasara-1 well, Foraminiferal species, Turonian, Early Maastrichtian.

1. INTRODUCTION

The Gongola arm of the Northern Benue Trough is a N-S trending arm of the 1000km long Benue Trough. The mechanism of how the Trough was formed dominated most of the early studies carried out in the area and, although, still controversial, an unstable RRF (rift-rift fault) triple junction model leading to plate dilation and the opening of the Gulf of Guinea [1].

Biostratigraphy as a branch of stratigraphy focuses on correlating and assigning relative ages to rock strata by using the fossil assemblages contained within them. In the light of the above, it therefore means that exploration companies need to know the ages of strata within a given well succession, so correlation with other wells within the area can be carried out.

Location of well: Ditch cutting samples were collected from Nasara-1 well which lies between latitude 9^{o} $50^{'}$N and longitude 10^{o} $54^{'}$E (fig. 1), Gongola Basin, Northern Benue Trough.

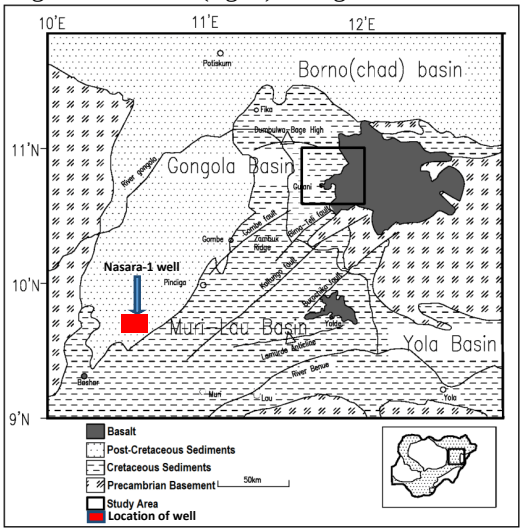

Fig. 1: Geological map of Northern Benue Trough showing location of Nasara-1 well arrowed. (Modified after [2]).

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Stratigraphy of Gongola Basin

Sedimentation in the Gongola basin started with the deposition of the continental Bima Sandstone which unconformably overlies the Precambrian Basement Complex (fig. 2).

Bima Sandstone: This was derived from the granitic Basement Complex. It is a sandstone consisting of feldspar and clays which pass upwards into medium to coarse grained sandstones with less feldspar. The sandstone unit was subdivided into three members namely; the Upper Bima (B_3), the Middle Bima (B_2), and the Lower (B_1) by [3, 4].

Yolde Formation: This conformably overlies the Bima Sandstone and it consists of a variable sequence of sandstones and shales. The sandstones are thin-bedded at the base, followed subsequently by alternations of sandy mudstones and shelly limestone [5].

Gongila Formation/Fika Formation: These are lateral equivalents of the Pindiga Formation [2].

Pindiga Formation: This is dominantly a marine shale facies having limestones at the base. The formation is believed to be deposited under marine conditions that prevailed during the late Turonian and Coniacian times in the Northern Benue Trough.

The Gombe Formation: It is a Maastrichtian coarsening-upward deltaic unit. It is made up of three major lithofacies; alternating beds of silty shales and fine medium grained sandstones with ironstone intercalations, overlain by medium grained quartz arenite with occasional and iron oxide cement, and brick-red coloured, fine – medium grained sandstone, with tabular cross-bedding highlighted by layers and streaks of pure white sandstones [2].

The Kerri-Kerri Formation: This is the youngest formation in the Gongola Basin. It is represented by the gently dipping continental conglomerates, sandstones, siltstones and clays which overstep into the Gombe Formation. It is of Paleocene age based on pollen evidence [6].

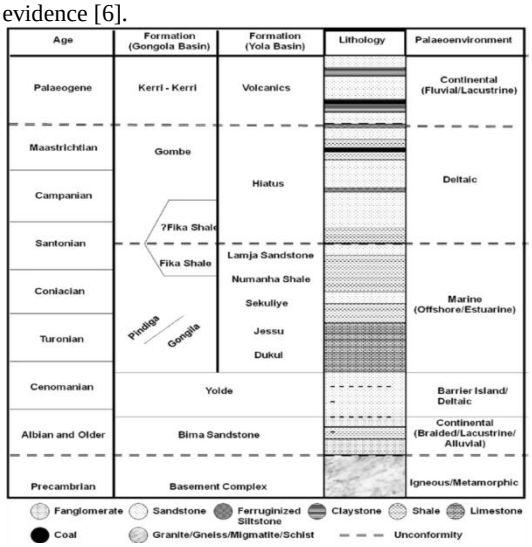

Fig. 2: Stratigraphic Successions of the Gongola Basin in Relation to the Northern Benue Trough. (Adapted from [7]).

2. MATERIALS AND METHODS

Nine (9) ditch cutting samples were taken at certain intervals within depth 1500ft-5190ft basically because of their shale facies content for foraminiferal analysis.

Foraminiferal sample preparation: The sample preparation was carried out by the standard methods given below.

Materials:sieves, distilled water, water jet, kerosene, aluminium bowls, liquid soap, hot plate, micropaleontological microscope.

Procedures: About 20gm of each sample was weighed into each sample bowl. Hot plate was switched on and regulated to temperature of about 80^0c. Samples were removed and allowed to cool to an extent. Depths on samples were correctly transferred into aluminium bowls. 30ml of kerosene was then poured into the sample and allowed to soak for two (2) hours. Decant kerosene and cover sample with water and leave for five (5) hours. Sieves were passed in blues methyle in order to easily identify any intruding contaminants. Each sample was washed over a 63microns sieve with water from the water jet. The residue collected from the sieve was replaced in the bowl and dried on a hot plate. The residue was sieved over 20 and 80 mesh sieves for the coarse and medium fractions, while the finest residue in the receiver was treated as fine fraction. All fractions were stored in a properly labeled sample phials and then transferred for picking and analyzing.

3. RESULTS AND DISCUSSIONS

Results obtained from foraminiferal analysis are given and discussed below.

Foraminiferal analysis results: The results from foraminiferal analysis carried out on nine (9) ditch cutting samples from interval 1500ft and 5190ft shows poor foraminifera assemblage. Some of the species recorded include; *Ammobaculites coprolithiformis, Ammobaculites sp, Ammoscalaris pseudospiralis, Haplophragmoides bauchensis, Haplophragmoides hausa, Haplophragmoides pindigaensis, Reophax sp, Haplophragmoides sp, Trochammina sp.*

Total foraminifera count

Total foraminifera count (T) = total number of agglutinated benthics + total number of planktic
Number of agglutinated benthics observed = 42 foraminifera species
Number of planktic observed = 1 foraminifera species
T = 42 + 1
T = 43 foraminifera species

Table 1: Foraminifera Biostratigraphic summary of Nasara-1 Well

Foraminiferal Biostratigraphic summary of Nasara-1well (First Downhole Occurrence of stratigraphically important Foraminiferal species)				
Depth (ft)	**Epoch/Period**	**Age (Ma)**		**Significant Foraminiferal datums**
1,500	First sample analyzed			
1,500 -2,610	Early Maastrichtian	70 – 72.1		Interval characterized by the occurrence of benthic marker species *Ammobaculites coprolithiformis*
2,610 – 3,300	Campanian/ early Maastricthian	72.1		Interval characterized by *Haplophragmoides bauchensis* and *Haplophragmoides hausa*
3,300 – 5,190	Turonian - Coniacian	>72.1		Occurrence of *Haplophragmoides pindigaensis*
5,190	Last sample analysed			

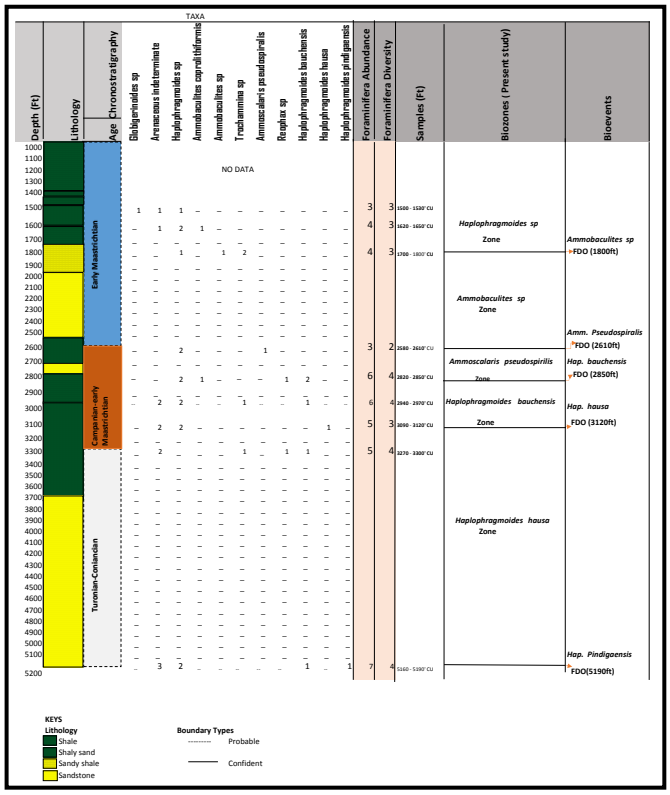

Fig. 3: Geological framework of succession penetrated by the drill in Nasara-1 well, with geologic ages assigned to the analyzed intervals.

AGE DETERMINATION

Ages (subdivisions) were established using key benthic markers based on their already published ranges by authors, especially [8, 9 and 10]. The key benthic markers used are *Ammobaculites coprolithiformis, Haplophragmoides bauchensis, Haplophragmoides hausa* and *Haplophragmoides pindigaensis.*

Turonian – Coniancian Age: Depth interval (3,300ft-5,190ft). The age assigned to this interval was based on the first downhole occurrence of *Haplophragmoides pindigaensis* at depth 5,190ft and the occurrence of *Haplophragmoides bauchensis*, which corresponds with the ranges of these key benthic markers given by [8, 9].

Campanian/Early Maastrichtian Age: Depth interval (2,610ft-3,300ft). Age was assigned to this interval based on the co-occurrences of *Haplophragmoides bauchensis* and *Haplophragmoides hausa,* which are key benthic markers of Campanian/Early Maastrichtian Ages.

Early Maastrichtian Age: Depth interval (1,500ft-2,610ft). Age was assigned basically by the occurrence of *Ammobaculites coprolithiformis* which is a key benthic marker of Maastrichtian age. A Turonian to Maastrichtian range was assigned to *Ammobaculites coprolithiformis*[10].

4. CONCLUSION

Based on the ranges of key benthic marker species such as *Ammobaculites coprolithiformis, Haplophragmoides bauchensis, Haplophragmoides hausa* and *Haplophragmoides pindigaensis,* a Turonian to Early Maastrichtian age has been assigned to the succession penetrated by the drill in Nasara-1 well, Gongola Basin, Northern Benue Trough. The assigned ages were guided by [8, 9 and 10].

5. ACKNOWLEDGEMENTS

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