

# Foraminiferal Biostratigraphy of Shales in Lokpaukwu Area

Ihunda, Chigozi Eze<sup>1</sup>; Asadu, A.N<sup>2</sup>; Ideozu, R.U<sup>3</sup>

<sup>1,3</sup>Department of Geology, University of Port Harcourt, Nigeria

<sup>2</sup>Department of Earth Sciences, Federal University of Petroleum Resources, Effurun, Nigeria

**Abstract**— The biostratigraphy of stratigraphic sections exposed at Ihube and Leru long the Port Harcourt – Enugu Expressway was studied. The lithologic units of the succession are basically shales and sandstone depicting a marine depositional environment. The method of study involved the collection of sample to evaluate the final subsequent laboratory analysis of collected sample to evaluate final observable features. A total of Twelve (12) samples were collected from the outcrops in the study area. From the laboratory analysis carried out, a lithological description of all samples collected depth by depth was made with 2.0m HCI to check the presence or absence of calcareous forms. The result shows more shale than sand in the sediment showing a marine origin of deposition. Also from Micropaleontological analysis made, benthic arenaceous foraminifera assemblages were recovered. They include; *Ammobaculites amabensis*, *Hapfragmoides saheliense*, *textularia gilbedina*, *Ammobaculities sp* and *Haplophragmoides sp*. They are the benthic and their ages span from Campanian -Maastrichtian which coincides with the marine incursion in the Anambra Basin. These forms suggest an inner neritic environment of deposition.

**Keywords**— Paleontology, Biostratigraphy, Benue Trough.

## I. INTRODUCTION

The study area falls within the Anambra Basin. The basin is located in the South Central Nigeria and covers about 40,000 sq km. The roughly triangular Anambra sedimentary basin has its southern boundary coinciding with the northern boundary of the Niger Delta Basin and the basin extends northwards beyond the lower Benue River. A field work was carried out to map out the surface geological features within the area, with a view to carrying out Biostratigraphical analysis. Samples

from exposures of the road cut were taken and labeled to assist for easy laboratory work.

### 1.1: Aim and Objective

The aim and objectives is to establishing the faunal characteristics of the outcrops with a view to predicting the age of the formation and Interpreting depositional environment.

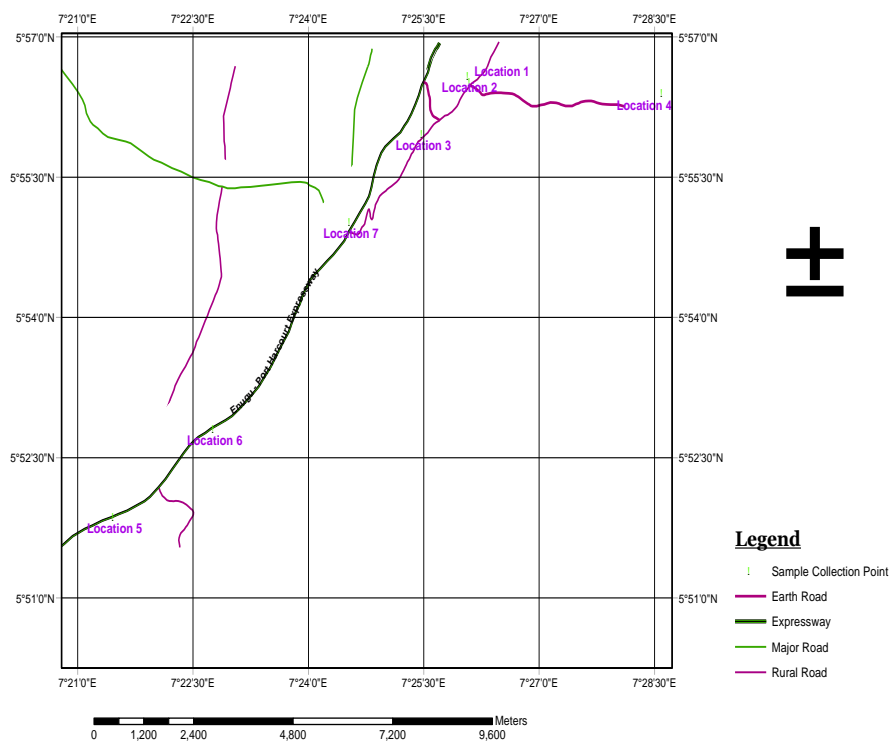


Fig. 1. Showing map of the study area.

### 1.2: Location and Accessibility

The study area is situated at Lokpokwu, Leru and Ihube which covers a rough distance of 15–20 kms. The study area is located within the Southern part of Nigeria between Longitudes 7° 30' and 8° 00' and Latitudes 6° 26' and 6° 30' south. Accessibility to the road cuts is facilitated by the Port Harcourt-Enugu expressway. They are outcropsexposed during the construction of the road.

### 1.3: Geology and Stratigraphy of the Study Area

The study area falls within the Anambra Basin in South-Eastern Nigeria. The sedimentary basins in the SE Nigeria came into being following the opening of South Atlantic and break-up of the South American and West African plates in the late Jurassic as a failed arm of the triple junction. Subsequently wrench movement along rejuvenated basement fault systems resulted in the formation of several basins and sub-basins along the (Benue).

The stratigraphic history of the region is characterized by three sedimentary phases (Short and Stauble, 1967; Murat, 1972; Obi *et al.*, 2001) during which the axis of the sedimentary basin shifted. These three phases were: (a) the Ahakaliki Benue Phase (Aptian-Santonian), (b) the Anambra-Benin phase (Campanian-Mid Eocene), and (c) the Niger Delta phase (late Eocene- Pliocene). More than 3000 meters of rocks comprising the Asu River Group and the Eze Aku and Awgu formations, were deposited during the first phase in the Abakaliki-Benue Basin, the Benue Valley and the Calabar Flank. The Second sedimentary phase resulted from the Santonian folding and uplift of the Abakaliki region and dislocation of the depocenter into the Anambra and Afikpo region. The resulting succession comprises the Nkporo Group. Mamu Formation, Ajali Sandstone, Nsukka Formation, Imo Formation and Ameki Group. The third sedimentary phase credited for the formation of the petroliferous Niger Delta commenced in the Late Eocene as a result of a major earth movement that structurally inverted the Abakaliki region and displaced the depositional axis further to the south of the Anambra Basin (Obi *et al.*, 2001). Reyment (1965) undertook the first detailed study of the Stratigraphy of the Southern Nigerian sedimentary basin, and he proposed many of the lithostratigraphic units in the region. Palaeogene time is represented by a sedimentary succession that is thicker than 3500m, and consists of the Nsukka Formation (350m), Imo Formation (1000m), Ameki Group (1900m) and Ogwashi Asaba Formation (250 m) (Reyment, 1965; Nwajide, 1979; Arua, 1986; Anyanwu and Arua, 1990).

## II. MATERIAL AND METHODOLOGY

### 2.1: Preparation of Samples

Fresh portions of each sample was taken at least log and was crushed into pieces in a mortar and was later transferred into a pan, mix and soaked with water and treated with 2 gram of sodium chloride salt and was left to boil for 30 minutes on hot plate at about 250°C. All this is done in order to disintegrate the clay and, shale particles and free the fossils from the matrix.

### 2.2: Wet Seiving/Washing

The boiled solution from each plate is discounted into a stack of sieve meshes arranged in decreasing order 250µm, 100µm and 75µm. The coarsest is placed at the top while the finest is, at the bottom. The disintegrate sample are then allowed to pass through the sieves using a shower of water. The washing continues until clear water observed on each of the sieves.

Residues from each sieve size are collected in a filter paper tagged is label for each sample depth and allowed for some minutes for water drip off before drying on the hot plate.

### 2.3: Drying Storage and Picking

The Filter paper containing the respective residual fractions of the sample is dried at temperature of 100°C on the hot plate. Excess heating usually avoided to ensure that the sample does not pour out or damaged. The three dried, fractions of the sample are then cooled and into an envelope marked with the following details. Analysis of the dried samples was done using a stereomicroscope. The dried samples from each pack; were gently spread on a picking tray that was placed under the stereomicroscope with a specific magnification Fossils were picked using a single trimmed brush which was constantly moistened by dipping it in water. The fossils picked were placed in plastic mountain slides and sealed with cover slips so as to avoid contamination and loss of fossils. The slides were labeled according to various depths. This operation was carried out repeatedly in the same form for each sample for coarse medium and fine grains. Once the fossils are sorted or mounted, the slide are then labeled and arranged in horizontal type slide cabinet. The identified forms are sketched and the total number of each form is note down which helps to know the ones that are abundant.

## III. RESULTS AND INTERPRETATION

The results and interpretation of the biostratigraphy analysis are presented on figure 2

### 3.1: Lithostratigraphy

The lithologic description of the relevant sequence was based on the physical inspection of the outcrops samples. The lithologic sequence of the study area covers a wide range of distance. Each sample was tested using hydrochloric acid, those that reacted with the acid-showing evidence of efflorescence bubble were termed calcareous while those that did not react with the hydrochloric acid were classified as been non calcareous.

### 3.2: Biostratigraphy

The foraminifera assemblage in Leru and Ihube outcrop is made up to very poor to scanty occurrence. About 9 different benthic species were found making up close to 60% of the total number of foraminifera encountered out of this number, the calcareous benthic constituted 4 (55%) – *Textulalia hackleyensis*, *Ammobaculites amobensis*, *Haplophregmoides*, *Reophox*, *Ostrecoda*, *Pelycepoda*, *Nomionell cretacea*, *Milliammina telemaquensis*, *Govelinella guineana*, *Ammonoastuta sp.*

Leru L<sub>7</sub>S<sub>1</sub>, L<sub>7</sub>S<sub>3</sub> and L<sub>7</sub>S<sub>5</sub>

This location recorded *Haplophregmoides sahariense*, *Haplophregmoide saheliens*, *Ammobaculites amobersis* and

*Hedbergella holmdelensis* as the only fossil that occur. Its age is Maastrichtian.

foraminifera Peters, (1982), Omoboriowo et al (2011), Omoboriowo, & Soronnadi-Ononiwu, (2011).

IV. SUMMARY AND CONCLUSION

The study area falls within the Anambra Basin and the geology of this area has been studied and described based on their biostratigraphy as well as their petroleum potentials. Key controls on sedimentation within this basin include primarily subsidence rates and eustatic sea level changes that determined the sediment distribution and full histories. Therefore, the age is of Maastrichtian base on the Foraminiferal assemblage and paleoenvironment of the Leru and Ihube outcrop in Anambra basin because of the two genera of forms *Ammobaculites* and *Haplophragmodes*.

Formation	Age	Depth (M)	Lithology	Lithologic Interpretation	Process Interpretation
AJALI SAND STONE	MAASTRICHTIAN	1		dark shale to gray, very fine, Laminated Trace Fossil, Fissile	Shallow Marine
		2			
		3			
		4			
		5			
		6			
		7			
		8			
		9			
		10			
		11			
		12			
		13			
		14			
		15			
		16			
		MAMU		17	
18					
19					
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21					
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24					
25					
26					
27					
28					

Brown	Top Soil
Yellow	Sand
Dark	Shale
Gray	Clay
Orange	Conglomerate
	Cross badly

Fig. 2. Lithologic description of the study area.

$L_5S_1$   $L_5S_2$  and  $L_5S_3$ :

In this location the arenaceous benthic take predominates the calcareous taxa which include *Ammobaculites amabensis* *Haplophragmoides coprolithiformis*, *Haplophragmoides sahariense* *Haplophragmoides sahelense* and *Milliammina telemaquensis* it age is Maastrichtian

$L_7S_3$ ,  $L_7S_6$ , and  $L_7S_{19}$

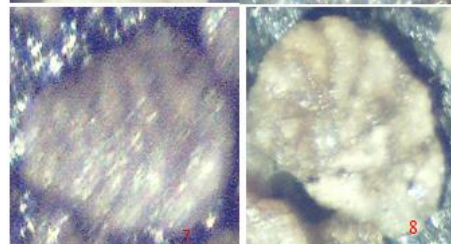
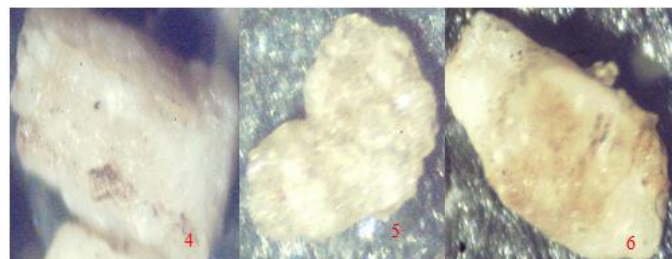
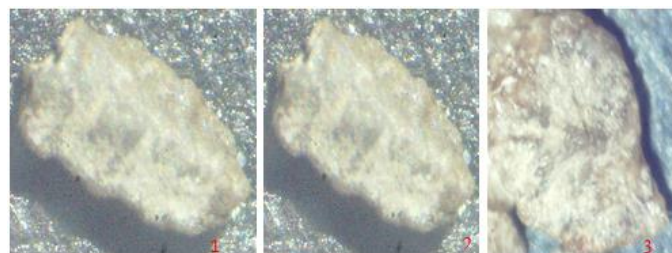
Base on this location the fossil that occurred are mainly benthic arenaceous taxa which is recorded as *Gevelinella guineana*, *Ammobaculites amobensis*, *Haplophragmoides sahariense*, *Haplophragmoides coprolithiformis*. Its age is Maastrichtian

*Ihube*  $L_5S_1$  and  $L_5S_3$ ,

The location recorded *Ammobaculites amabensis*, *Haplophragmoides coprolithiformis*, *Haplophragmoides sahariense* they are all benthic foraminifera. Its age is Maastrichtian-Paleocene.

3.3: Paleoenvironment

Paleoenvironmental interpretation were carried out base on the abundance and diversity of the micro fauna encountered and the presence of environmentally significant fauna is an indication of shallow marine environment fossils which are suspected to live on the sea floor and near-shore shallow marine environment because there is greater percentage of food in the shallow water of the sea floor. The only genera in the study are *Haplophragmoides* and *Ammobaculites* with no occurrence of Planktonic foraminifera. The high percentage of *Haplophragmoides* is an indicative of poorly aerated bottom condition. The predominance of simple-chambered *Haplophragmoides* and *Ammobaculites* of the study area suggest poor bottom oxygenation. This is also in accordance with Triangular plot for central West Africa benthonic



4 *Ammobaculites amabensis*, 3 *Haplophragmoides sahelense*, 1, 2, 7 and 8 *Textularia gilbedina*, 6 *Ammobaculites* sp 5 *Haplophragmoides* sp

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