International Journal of
Science Inventions Today
www.ijsit.com
ISSN 2319-5436
Research Article

BIOSTRATIGRAPHIC STUDIES OF X_1 and X_2 BOREHOLES ,X-FORMATION, DAHOMEY BASIN NIGERIA

CHIAGHANAM, O.I [1], OKENGWU, K.O [2], OKUMOKO, D.P [3], ITIOWE, K[4]

[1]*Department of Geology, Anambra State University Uli, Nigeria,*

[2,4]*Department of Geology, University of Port Harcourt, Nigeria, Nigeria,*

[3]*Dept. of Earth Sciences, Federal University of Petroleum Resources, Effurun, Nigeria.*

ABSTRACT

The Biostratigraphic studies were carried out on core samples of X- Formation atDahomey Basin was studied and some key evaluations were reached. The Paleocene age was assigned to the X- Formation which is confirmed by the associated Ostracods and Plank-tonic forams. The lithologic units of the succession is limestones. A total of ten samples were collected. 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. Paleontological Analysis reveals the following forms; *paracypris nigeriensis, veenia ornatoreticulata, buntonian, bairdia ilaroensis and quadracythere lagaghiroboensis.* These shows the age of the study area to be Paleocene.. These forms suggest a coastal swamp, tidal flat to estuarine, delta front to inner neritic environments of deposition.

Keywords: *Biostratigraphy, Foraminifera, Benthic, Marine, Dahomey, Basin,Ostracod*

INTRODUCTION

The Boreholes were drilled in the central part of the X-Formation, Dahomey Basin and was drilled up to the depth of 70ft. The studied X-Formation is one of the Paleocene strata bearing marine macrofossils. The Dahomey Basin is a very extensive sedimentary basin that extends from southeastern Ghana in the west to the western flank of Niger Delta in Nigeria. The Nigeria portion of the basin extends from the boundary between Nigeria and Republic of Benin to the Benin Hinge Line. The stratigraphy of the sediments in the Nigerian sector of the Benin basin is controversial. This is primarily because different stratigraphic names have been proposed for the same formation in different localities in the basin (Coker, 2002).

Aim of study: The main objective of this study is to determine the relative age of the rock sequence and paleoenvironment of deposition.

Geologic Setting: The Dahomey Basin is a very extensive sedimentary basin that extends from southeastern Ghana in the west to the western flank of Niger Delta in Nigeria. It is bounded to the west by the Ghana ridge, which is an extension of the Romanche Fracture Zone; and on the east, by the Benin Hinge line, a basement escarpment which separates the Okitipupa Structure from the Niger Delta Basin and also marks the continental extension of the Chain Fracture Zone (Wilson and Willians, 1979). The Nigeria portion of the basin extends from the boundary between Nigeria and Republic of Benin to the Benin Hinge Line. The stratigraphy of the sediments in the Nigerian sector of the Benin basin is controversial. This is primarily because different stratigraphic names have been proposed for the same formation in different localities in the basin (Coker, 2002). This situation can be partly blamed on the lack of good borehole coverage and adequate outcrops for detailed stratigraphic studies. Billman (1992) divided the stratigraphy of the entire basin into three chronostratigraphic packages; they are pre - lower Cretaceous folded sediments, Cretaceous sediments and Tertiary sediments (Fig. 2). In the Nigerian portion of the basin the Cretaceous sequence, as compiled from outcrop and borehole records, consists of the Abeokuta Group which is sub- divided into three formational units: Ise, Afowo, and Araromi Formations (Omatsola and Adegoke, 1981). Ise Formation overlies the basement complex unconformably and comprises of coarse conglomeratic sediments. Afowo Formation is composed of transitional to marine sands and sandstone with variable but thick interbedded shales and siltstone. Araromi is the uppermost formation and is made up of shales and siltstone with interbeds of limestone and sands. The Tertiary sediments consist of Ewekoro, Akinbo, Oshosun, Ilaro and Benin (coastal plain sand) Formations. X- Formation is made up of fossiliferous. Glauconitic rock bands and phosphatic beds define the boundary between the X-Formation and the rest (Kogbe, 1989).

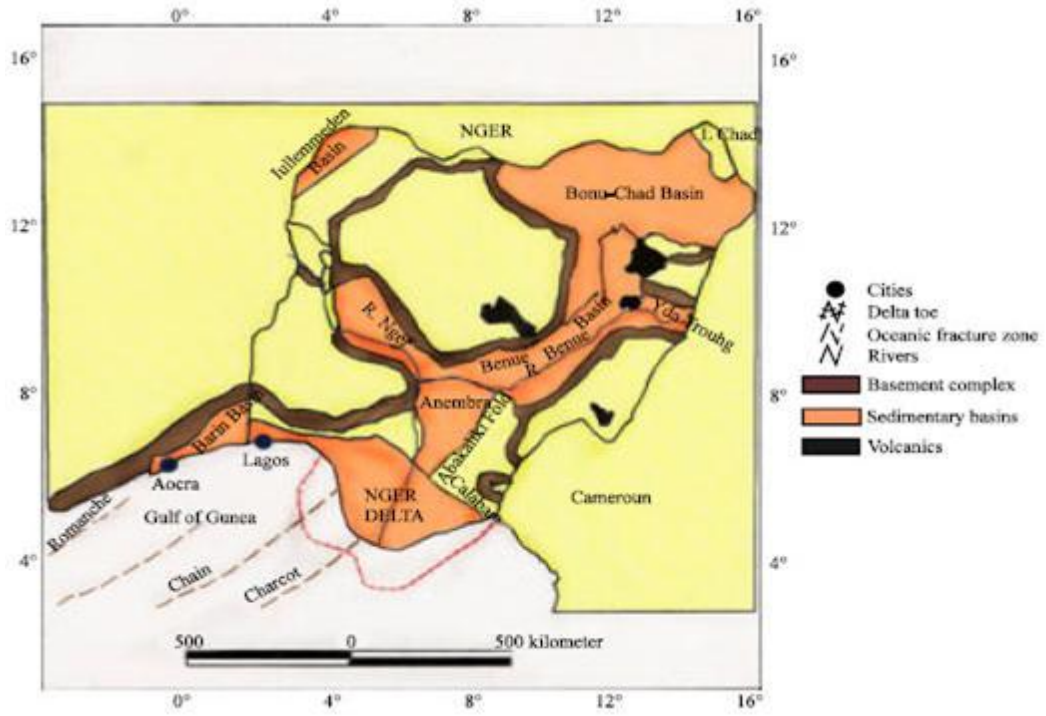

Figure 1: Map of Nigeria showing the different Sedimentary Basins. (Source: Ige, 2009)

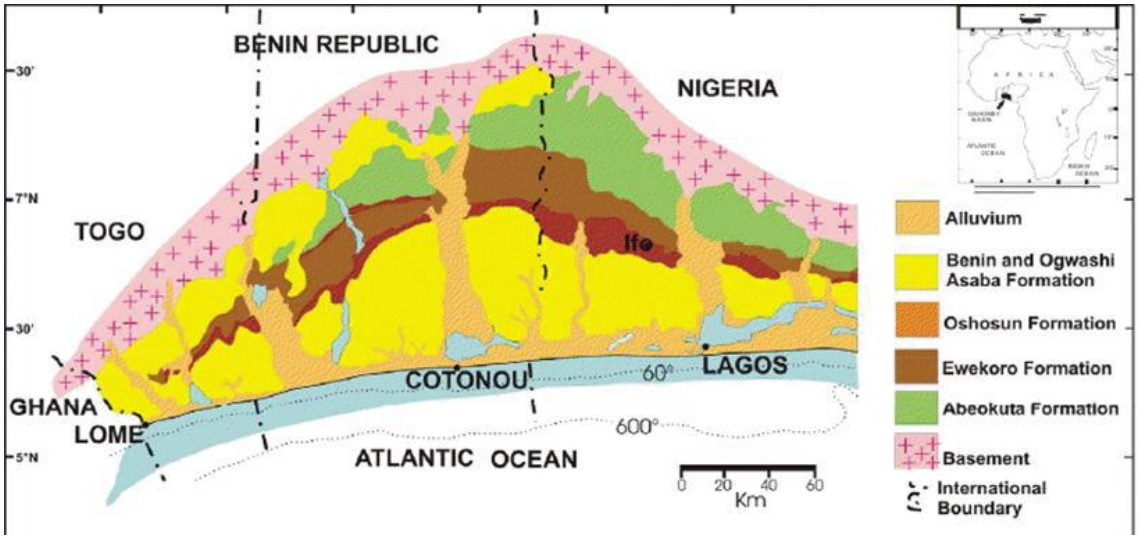

Figure 2: Map of Dahomey (Benin) Embayment (Source: Bankole *et al*., 2005)

Location: The study area See Figure 1, falls within Nigeria Sedimentary Basin; the Dahomey Basin. It is geographically in the South West Region of Nigeria around the Abeokuta Axis. The Study Area is denoted as

X_1- and X_2 Bore Holes and X-Formation as a result of Proprietary reason

METHODOLOGY

Lithostratigraphic Analysis: Sedimentologic analysis was carried out on the samples by visual inspection. Physical characteristics such as colour, texture, hardness, fissility, rock type etc were noted. Chemical tests were also carried out to determine the presence of calcareous materials out using 10% dilute Hcl.

Paleontological Sample Preparations:A total of Ten samples were subjected to paleontological sample preparation. 10grams of each sample was put into an enamel plate mixed with water and treated with 2 grams of sodiumcarbonate (Na_2CO_3). This is allowed to boil for 30mins in a hot plate. The essence of this is to disintegrate the clay and shaleand free the fossils from the matrix. Each boiled sample was then washed through a stack of sieves arranged in decreasing order. 106µm for the coarse grain fraction, 75µm for medium and 63µm for fine fraction using a jet of water. Residues from each sieve size were collected in a filter paper dried and labeled for analysis. Analyses of the dried samples were done using stereomicroscope. The dried samples were each sprinkled on smooth black surfaced rectangular paper, which was divided into grids. The fossils on each grid traversed were picked with a trimmed brush which wasconstantly moistened by dipping into water. The specimens where stored in a slides, which was labeled against the depth of occurrence. Precautions were made/taken by closing the slides with special cover slips. To also avoid contamination, the tray is constantly cleansed with a brush and a new slide used for each depth. The foramineferal identification was carried out using published references. Preservation problems especially those of post burial, test dissolution, test breakage, (deformation) and various Morphological variations were ob served and noted, which will be utilized in the interpretation.

RESULTS AND DISCUSSION

Lithostratigraphy the study Area: The various lithostratigraphic units penetrated composed of thick units of limestones which is gray to brownish gray, from moderately hard, sub-fissile to fissile, sandy, laminated with millimeters of siltstones bands and non calcareous with thin ironstone at the middle. The interval upper interval is made up of thick shale and rippled sandstone-clear quartz grain, light brown, off- white in parts, transparent to translucent from very fine to fine grained, sub angular to sub-rounded, with argillaceous cement. X- Formation has a sandy base which grades into the underlying, sandy Abeokuta Formation. This disconformity contact depicts a major change in the depositional regime. This change was accompanied by ceasation in deposition and erosion as evidenced by intense pot holing and scouring of the uppermost algal biosparite and red phosphatic biomicrite units.

Biostratigraphy Analysis:Ten (10) ditch cutting samples were analyzed for paleontology content and they yielded abundant and diverse forms useful for interpretation. They are foraminifera (See Plate 1 and Table

1), Mollusks, Ostracods, Echinoid., Echinoid spines and fish teeth, a gastropod which is also a universally accepted index fossil for Paleocene was encountered. Paleocene Ostracods were found to be very abundant in the studied sequence. However, Ostracods being among the fossils utilized as indicators of environment of deposition, they were used in this study likewise.

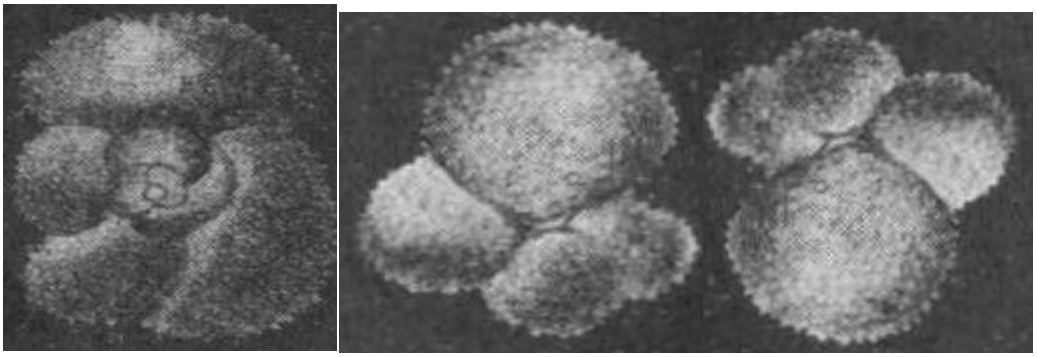

Plate 1: Some forms of foraminifera encountered in the study

SAMPLE	FAUNA	NUMERICAL COUNT
Sample 1	*Veenia ornatoreticulata,*	3
Sample 2	*Paracypris nigeriensis,*	5
Sample 3	*bairdia ilaroensis*	4
Sample 4	*Quadracythere lagaghiroboensis*	15
Sample 5	*Quadracythere lagaghiroboensis*	28
Sample 6	*Bolivina ottrensis*	6
Sample 7	*Buntonian sp*	5
Sample 8	*Haplophragmoides saheliense*	14
Sample 9	*Anomalina punctulata*	3
Sample 10	*cibicides sp.*	8

Table 1: Fauna in each sample and their numerical count

The minute Echiniod was recovered at almost all the depth traversed. The same goes for the Paleocene Ostracods

***Age*:** Reyment (1964) was the first to suggest the Paleocene age for the X- Formation and most subsequent workers except Fayose and Asseez (1972) have confirmed that, *Bolivina ottrensis, cibicides sp. and lenticulina midwayensis* from a shale underlying a thick limestone.He therefore correlated the limestone which the nearby X- Formation and assigned an Eocene age to it.The presence of *Bolivina ottrensis, cibicides sp. and lenticulina midwayensis* confirm Paleocene age for the study area. In this study, several macrofauna of diverse assemblages were recorded. These macrofauna include mollusks, ostracods and echinoids in these

two bore holes which are mainly Paleocene, the foraminiferal fauna recovered includes *anomalina punctulata, cibicides sp. e. cibicides succedens, dentalina sp., globigerina triloculinoides, quinoue coluilina* sp. etc. the universally accepted Paleocene index fossil, the minute *Echinoid, Togocyamus Seefreidi* were found to be very abundant in both boreholes. Infact they were collected from almost all the depth traversed. Since this fossil *Togocyamus Seefreidi* is a universally accepted Paleocene index fossil, its abundance in the studied sequence therefore confirms the Paleocene age assigned to X- Formation by earlier workers.

This is further supported by the associated Paleocene Ostracods and Foraminifera. Most of the molluscan fauna recovered are those that have been formed as Pseudomorphs of the original forms. A lot of the pseudomorphs are made of glauconitic materials while few are of pyritic materials. Moreover, these might possibly have formed by the infilling of the mould of the original form by glauconite and pyrite after the removal of the original material by dissolution and related processes. The abundance of *Togocyamus Seefreidi* therefore confirms the Paleocene age assigned to the X- Formation by previous workers which include Reyment, 1964; Jones, 1964 and others

REFERENCES

1. Adegoke, O. S., 1972a. macrfauna of the Ewekoro Formation (Paleocene) of southwestern Nigeria. African Geology, pp. 269-276, 3 pls.

2. Adegoke, O. S., 1972b. Tethyan affinities of west African Paleocene mollusca. Proc. 24th international Geol. Cong., Montreal, 1972, Paleontology, see 7, ppp. 441 – 449, 2 pls.

3. Adegoke, O. S., Jan Du Chene, R. E., Agumanu, A. E., and Ajayi, P. O., 1978: Palynology and Age of the Kerri- Kerri Formation Nigeria. Rev. Esp. Micropaleontol., vol. 10, n. 2, p. 267-283.
4. Avbovbo, s. a., 1970. Biostratigrapy of Ewekoro area. Unpublished B.Sc. Honours Geology Research Paper, University of Ibadan, Nigeria, 29pp. 3 pls.

5. Bankole, S. I., Schrank, E. Erdtmann, B. D and Akande, S. O. (2006): Palynostratigraphic Age and Paleoenvironments of the newly exposed section of the Oshosun Formation in the Sagamu Quarry, Dahomey Basin. *Nigerian Association of Petroleum Explorationists Bulletin* vol. 19, 1 pp. 25 - 3
6. Coker, S.J. L 2002: Field Excursion Guide to Tar Sand Outcrops in Benin Basin. *Nigerian Association of Petroleum Explorationists* Mini- Conference, p. 32.
7. Cushman, J.A. 1948 foraminifera, their classification and economic use 4th Edition. Publishers, Havard University Press, Cambridge Massa Chusetts.

8. Imeokparia E. G. and Onyeobi T. U. S. 2007. Geochemical and Depositional Characteristics of

Maastrichtian shales in parts of southwestern Nigeria. *Journal of Mining and Geology* Vol. 43 (2) 2007 Pp. 167 – 174

9. Jones, H.A. and HOCKEY, R.D. 1964. The geology of part of South-western Nigeria Geol. Surv, Nigeria, Bull, 31 pp. 1-87, 8 pls.

10. Ogbe, F. G. A., 1970 Stratigraphy and paleontology of strata exposed in the Ewekoro quarry, Western Nigeria. Unpublished M. Phil. Dissertation, University of Ife, IIe-Ife, Nigeria, pp. 1 – 110, 12 pls.

11. Ola – Buraimo o. a et al (2012), Palynological Investigation of a Type Section of Early Maastrichtian Arimogija – Okeluse Shale Sequence, Dahomey (Benin) Embayment, Southwestern Nigeria *International Journal of Science & Emerging Technologies*

12. Petters, S.W., 1978. Nigeria Paleocene benthonic foraminifera bostratigraphy, paleoecology and paleobogeography. Marine micropaleontology jour., V. 4 (1979), pp. 85 – 99.

13. Petters, S.W., 1982. Central West African Cretaceous – Tertiary benthic foraminifera and stratigraphy.

14. Reyment, R. A., 1965. Aspects of the Geology of Nigeria. Ibadan University Press.