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Research paper

Foraminiferal biostratigrpahy of oshi-13 field, coastal and central swamp depobelt, Niger delta basin, Nigeria

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Abstract

A high resolution Foraminiferal biostratigrpahic study has been carried out using data from three wells located in the Coastal and Central Swamp depobelts of Niger Delta.
The study defined six (N6-N15) Foraminiferal zones for the early to middle Miocene Niger Delta on the basis of index Foraminiferal and this was correlated to Blow, 1969 and Bergreen et al., 1995. Foraminiferal analysis shows that Oshi-13
Field is very rich in calcareous and araneceous benthics, calcareous and planktic foraminiferal. The abudance of fossils and index fossils are responsible for constructing the biostratigraphic chart and hydrocarbon saturation in the field. The biostratigraphy chart constructed act as a basis in establishing the ages of sediments/ sequence in the studied field.

Keywords: *Benthics; Planktic Foraminiferal; Biostratigraphy.*

1. Introduction

The Tertiary Niger Delta covers an area of some 75,000 square kilometers and it is composed of an overall elastic succession with a maximum thickness of 912000mm (Evamy et al., 1978).
The Niger Delta is the most prolific hydrocarbon province in the West.
Africa Continental margin. It produces hydrocarbon from rocks of Eocene-Pliocene age. Exploration activities have been concentrated in the past over these sequences but as the delta becomes better understood exploration efforts are gradually being shifted to both the offshore (Pliocene-Pleistocene Sections) and the flanks of the delta where the cretaceous prospects are expected.
The Niger Delta started to evolve in Eocene times and depositions is still on going offshore. The development of the delta depends on the interplay between sediment supply and subsidence. The stepwise outbuilding of the delta has been explored in the Escalator-Regression model of Knox and Omatsola (1980). The early Miocene-Pliocene Section has been the most explored, most drilled, most hydrocarbon-bearing and therefore has the most readily available data.
The objectives of the paper are to construct a robust biostratigraphic chart and discussed the contribution of the Foraminifera Species recovered from three wells and (Oshi-13, A, B and C) in Coastal and Central Swamp in Niger Delta Basin (Figs. 1&2).
The data used for this study were extracted from Oshi-13 wells A, B and C. The well data were kindly provided by Nigeria Agip Oil Company, Ltd, Port Harcourt, Nigeria.
Biostratigraphic data which includes foraminiferal (F) data for Oshi-13 B well. These were useful in biozonation and age dating as well as bioevents interpretation of the sequences. Foraminiferal diversity and abundance and microfloral abundance and diversity. Base map (Fig. 1) showing location of the field was also provided. Biostratigraphic data was extracted from Oshi- 13 B and correlated to wells A and C.

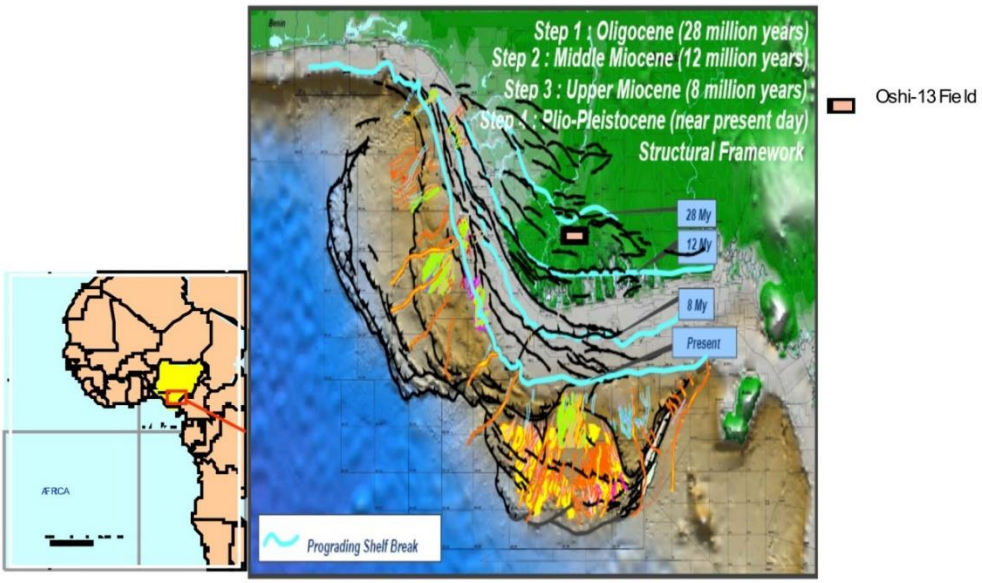

Fig. 1: Map Showing the Location of the Oshi-13 Field in Niger Delta Basin.

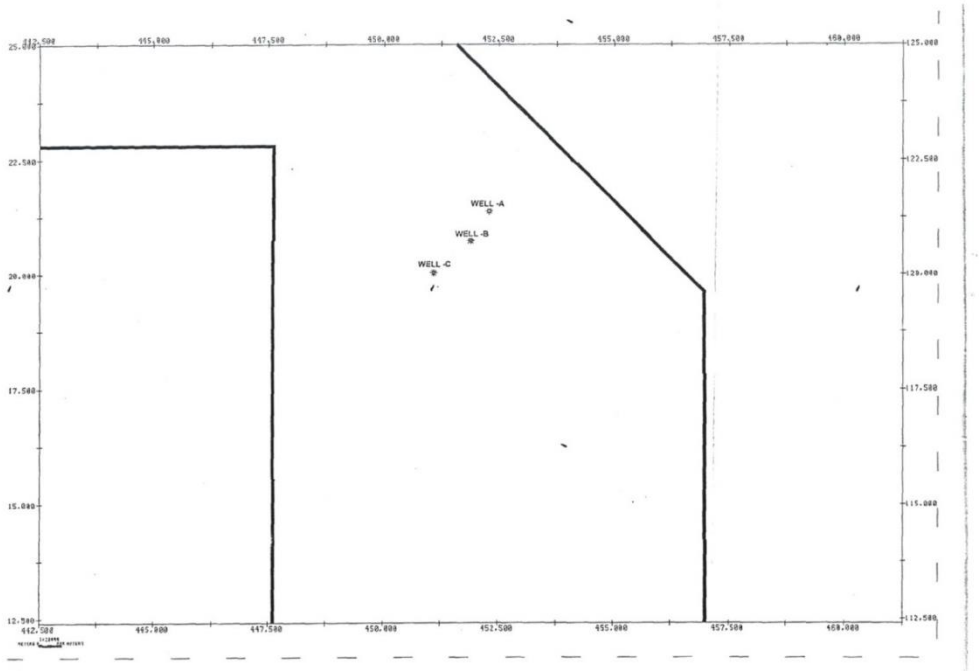

Fig. 2: Oshi-13 Fieldbase Map Showing Positions of the Three Wells.

2. Method

The micropaleontological interpretations were based on planktic foraminiferal diversity and abundance, benthic diversity and abundance and the distribution of individual diagnostic foraminiferal species in the well section. These data were extracted from cores, sidewall samples and ditch-cuttings from the well. They were used to constraint the age and depositional environment of the Agbada formation penetrated by the wells. The biozonation scheme of Bergreen et al., (1995) and Blow (1969) were used in zoning and dating the sequences.

3. Result and discussion

3.1. Biofacies foraminiferal distributions

Results of foraminiferal analysis showed that the Oshi-13 B well is very rich in calcareous and araneceous benthic and calcareous planktic forams (Fig.3). The calcareous and araneceous benthics and planktic foraminiferal assemblages in the interval 4250m-3950m show high abundance and diversity. The forams in this interval are Catapsdrax dissimilis, Chilogumbelina victoriana (planktics) and Buliminela subfusiformis (benthic). The paleoenvironment is middle neritic –upper bathyal environment; this is supported by the occurrence of Buliminela subfusiformis.

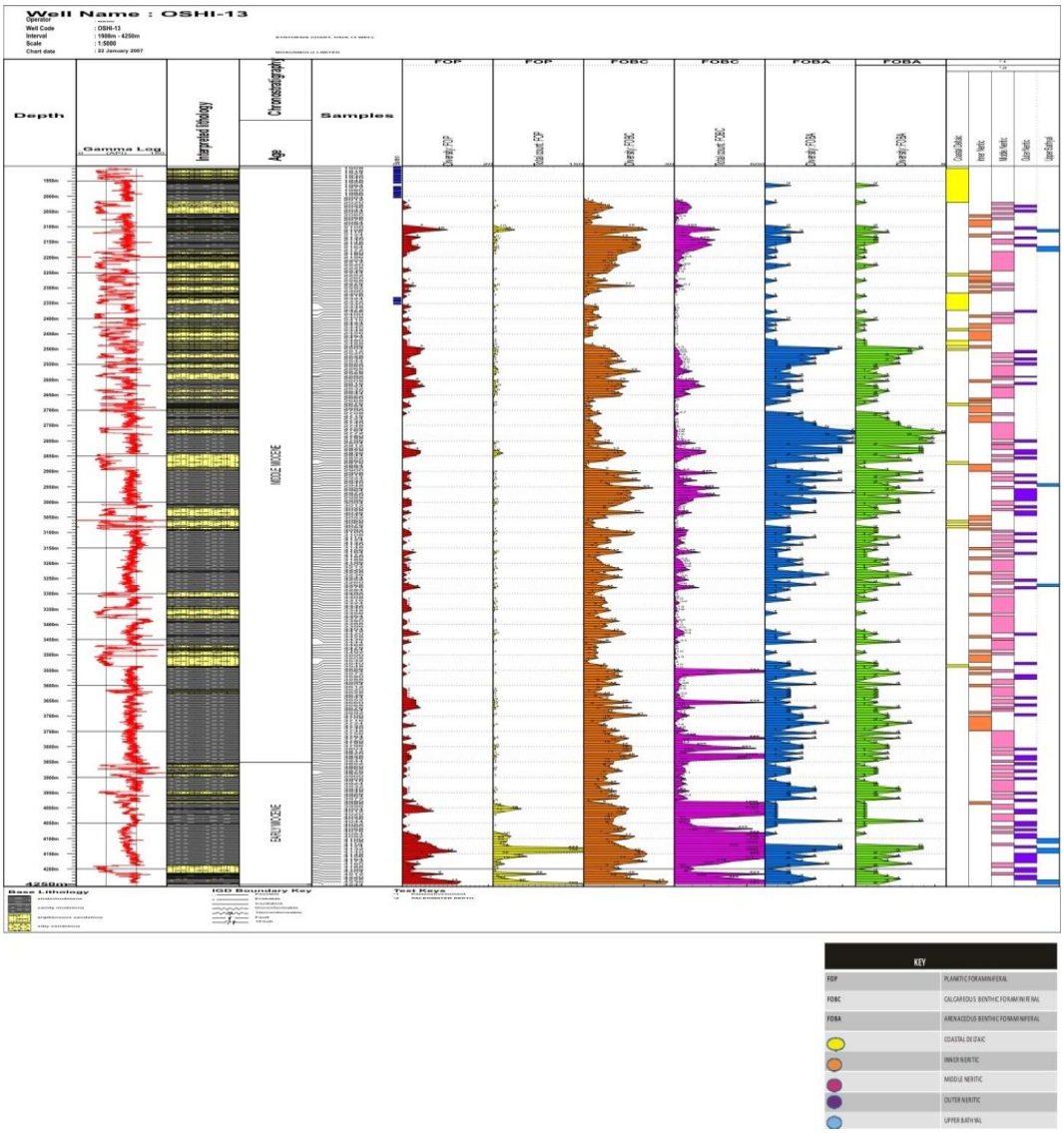

Fig. 3: Foraminiferal Distribution Chart of Osh-13 B Wells.

The planktics foraminiferal assemblages over the interval 3400m-2890m show low abundance and diversity. The calcareous benthics in the interval 3400m2890m are moderately high while araneceous benthics show high abundance and diversity. The forams in this interval are Praeorbulina glomerosa, Globorotalia peripheroacuta (planktic), Lenticulina Grandis and Epondes eshira (Benthic). The paleoenvironment is middle-outer neritic environment based on the occurrence of Lenticulina Grandis and Epondes eshira.

The planktics foraminiferal assemblages over the interval 2890m-2450m show low abundance and diversity. The calcareous benthics in the interval 2860m2450m show moderate abundance and diversity while araneceous benthics are moderately high abundance and diversity. The forams in this interval are Globigerinodes subquadratus, Globorotalia obsea (planktic), Brazilina mandoroveensis, Uvigerina sparsicostata (Benthic). The paleoenvironment is inner neritic-outer neritic environment based on the occurrence of Brazilina mandoroveensis and Uvigerina sparsicostata.

The planktics foraminiferal assemblages over the interval 2450m-1950m show low abundance and diversity. The calcareous and araneceous benthics in the interval 2450m-1950m show moderate abundance and diversity. The forams in this interval are Globorotalia mayeri, Globorotalia continuosa, Cassigerinella chipolensis Globorotalia accostaensis (planktic), Spirosigmolina oligocaenica Uvigerina superegrina (Benthic). The paleoenvironment is inner-outer neritic environment this is based on the occurrence of Brazilina mandoroveensis and Uvigerina sparsicostata.

2.2. Foraminiferal zonation

Foraminiferal data from Oshi-13 B well has been used to interpret and correlate the wells in the field. Intervals 1905m-1500m was not analysed because it was sandy.

The interval 1905m to 3868m has been dated middle Miocene based on the presence of Brizalina mandoroveensis /Eponides eshira. The interval 3868m to 4250m was dated early Miocene based on the occurrence of the Globigerinoides triolobis/Globigerinoides primodus and Nonion centrosulcatum/Brazilian impertra. (Nigeria Agip Oil Company). Six foraminiferal zones on the basis of index forams were recognized within the interval 4250m-1905m of the well (Fig. 4).

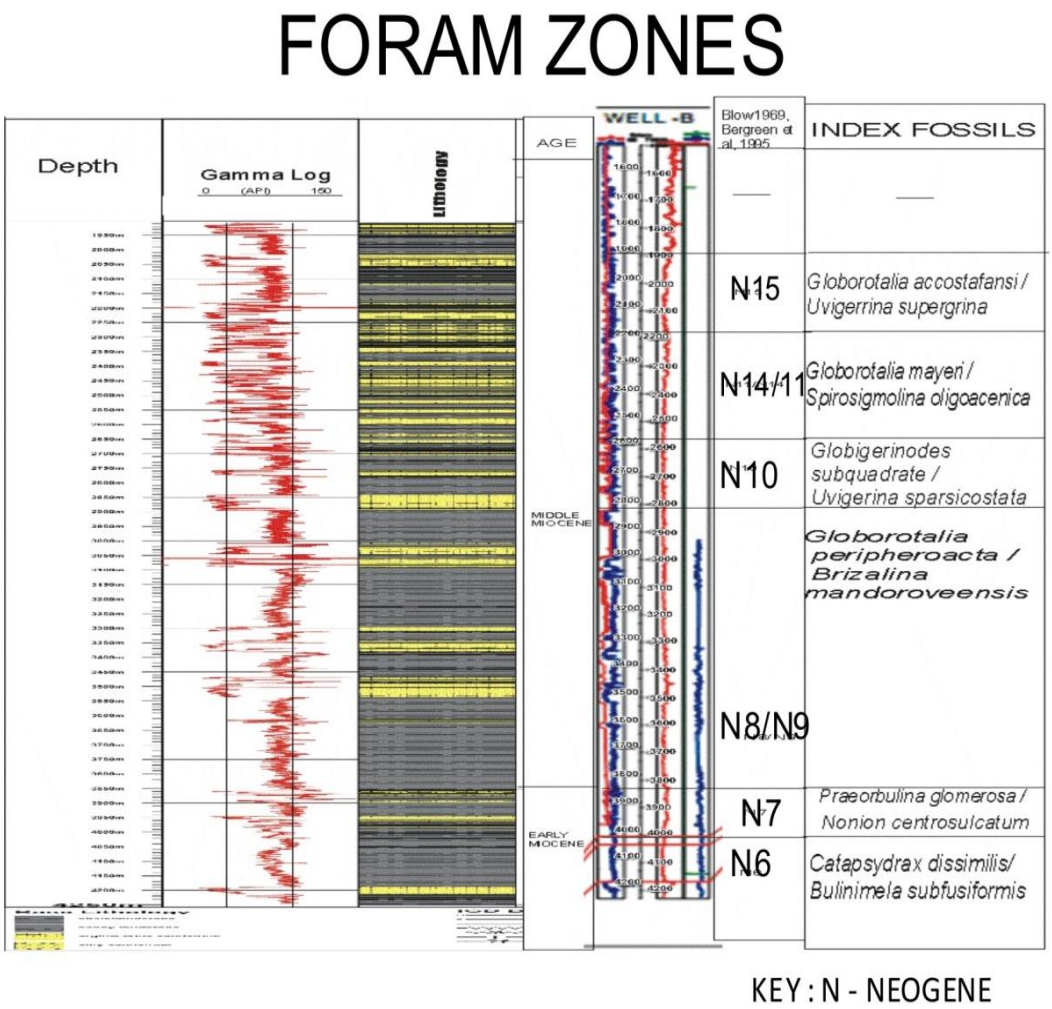

Fig. 4: Foraminiferal Biozonation of Osh-13 B Wells.

These include the N15 zone (2200m-1905m), the N14/11 zone (2584m2200m), the N10 zone (2844m-2584m), the N9 zone (2904m-2844m), the N8 zone (3852m-2904m), the N7 zone (4116m-3852m) and the N6 zone (4250m-4116m TD). These zones are discussed as follows:

N6 ZONE (4250m-4116m)

This zone was recognized on the basis of the first downhole occurrence of Catapsydrax dissmillis/Buliminela subfusiformis (Blow, 1969; Bergreen et al. 1995) at 4116m which marks the top of this zone. The base of this zone is probably below the total depth at 4250m. The zone is dated early Miocene in age.

The top and base of the interval were correlated to Oshi-13 C well at 4280m and 4350m and Oshi-13 A well at 3970m and 4150m (Table 1).

THE N7 ZONE (4116m-3852m)

The top of this zone is defined at 3852m by the first downhole occurrence of Praeorbulina glomerosa/Nonion centrosulcatum (Bergreen et al. 1995; Blow, 1969) and the base of this zone is marked at 4116m by the first downhole occurrence of Catapsydrax dissmillis/Buliminela subfusiformis (Bergreen et al. 1995 and Blow, 1969). This zone is dated early Miocene in age with the early Miocene-middle Miocene boundary is marked at 3852m (MD). Other characteristic forams are Orbulina universa, Globigerinodes bisphericus and Chilogumbelina victoriana.

The top and base of this zone were correlated to Oshi-13 C well at depths of 3650m and 4280m (MD) and to Oshi-13 A at depths intervals of 3480m and Chilogumbelina Victoriana.

The top and base of this zone were correlated to Oshi-13 C well at depths of 3650m and 4280m (MD) and to Oshi-13 A at depths intervals of 3480m and 3970m (MD) respectively (Table 1).

THE N9 /N8 ZONE (3852m-2844m)

No diagnostic foram to separate N9 and N8 zones. This interval has been assigned middle Miocene age. The top of N9 was recognized based on the top occurrence of diagnostic index fossils Globorotalia peripheroacuta /Brizalina mandoroveensis at 2908m (Bergreen et al. 1995; Blow, 1969) and the base of N8 was marked by the first downhole occurrence Praeorbulina glomerosa/Nonion centrosulcatum at 3852m (Bergreen et al. 1995; Blow 1969). Other characteristic forams are Eponides eshira and Lenticulina grandis. The top and base has been correlated to Oshi-13 C well at depth of 2950m and 3650m (MD) and Oshi-13 A well at 2870m and 3480m (MD) respectively (Table 1).

TABLE 1 FORIMINEFERAL BIOZONES AND CORRELATION OF OSHI-13 WELLS

DEPTH (M)	OSIII – 13 C	OSIII – 13 B	OSIII – 13 A	AGE	INDEX FOSSILS	FORAMINIFERA ZONES BERGREEN ET AL 1985, BLOW 1969	
1000 -					Barren		
		1905m	1880m				1905m
	1950m		2070m		*Globorotalia accostaensis/ Uvigerina Subpergrina*		
2000 -	2250m	2200m	2560m	MIDDLE MIOCENE		N15	2200m
	2590m	2584m	2760m		*Globorotalia mayeri /Spirosigmoilina oligocaenica*	N14/N11	2584m
	2850m	2840m			*Globigerinodes subquadrate/ Uvigerina sparsiccostata*	N10	2844m
3000 -					*Globorotalia peripheroacuta/ Brizalina mandoroveensis*		
		3852m	3780m			N9/N8	3852m
	3990m		3920m		*Praeorbulina glomerosa /Nonion centrosulcatum*	N7	4116m
4000 -	4280m	4116m	4150m	EARLY MIOCENE	*Catapsydrax dissmillis/ Bulminela subfusiformis*	N6	4250m
	4350m	4250m					
5000 -							

THE N10 ZONE (2844m-2584m)

The top of the zone was defined by the first downhole occurrence of Globigerinodes subquadrate/Uvigerina sparsiccostata at 2584m (Bergreen et al. 1995; Blow 1969) and the base was defined by the first downhole occurrence of Globorotalia peripheroacuta/Brizalina mandoroveensis at 2844m (Bergreen et al. 1995; Blow 1969). The zone is also dated middle Miocene in age. Other characteristic forams are Globorotalia obese and Globigerinodes subquadratus.

The top and base of this zone were correlated to Oshi-13 C at 2580m and 2850m (MD) and Oshi-13 A at 2560m and 2760m respectively (Table 1).

THE N14/N11 ZONE (2584m-2200m)

No diagnostic foram to identify and separate N12 and N13 zones while the base of NII was recognized based on the first downhole occurrence of Globigerinodes subquadrate/Uvigerina sparsicostata at 2584m (Bergreen et al, 1995; Blow 1969) and the top of N14 zone has been identified by the first downhole occurrence Globorotalia mayeri /Spirosigmolina oligocaenica at 2200m.

(Bergreen et al., 1995; Blow 1969). The zone is also dated middle Miocene. Characteristic forams in this zone are Globorotalia mayeri and Globorotalia obesa.

The top and base of this zone were correlated to Oshi-13 C at 2130m and 2580m (MD) and Oshi-13 A at 2070m and 2560m (MD) respectively (Table 1).

THE N15 ZONE (2200m-1905m) the top of the zone is marked by the occurrence of Globorotalia acostaensis/Uvigerina subpergrina at 1905m and the base was defined by the first downhole occurrence of Globorotalia mayeri /Spirosigmolina oligocaenica at 2200m (Bergreen et al. 1995; Blow 1969). The zone is dated middle Miocene.

Other characteristic forams are Globorotalia continuosa, Spirosigmolina oligocaenica and Cassigerinella chipolensis. The top and base of this zone were correlated to Oshi-13 C at 1930m and 2250m (MD) and Oshi-13 A at 1885m and 2170m (MD) respectively (Table 1).

4. Conclusion

The Oshi-13 Field which contains both planktics and benthics has been divided into the early to Middle Miocene Biozones. These chronostratigraphic intervals are recognized through the Neogene zones. Thus, the recognition of certain foraminiferal biozones serves to identify key chronohorizons. The early Middle Miocene boundary is defined by the occurrence of the Orbulina datum (Blow, 1969 and Bergreen et al., 1995) which is represented by the appearance of Orbulina Universa at 3868m.

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