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# Taxonomic Notes on Marker Planktonic Foraminifera of Tomboy Field, Offshore Western Niger Delta, Nigeria

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**ABSTRACT**

The aim of the study is to identify and record the taxonomic notes on marker planktonic foraminifera in the study area. The area of study is located in the Tomboy field of the offshore western Niger Delta area of Nigeria. In all, 550 ditch cuttings samples were retrieved at 18.29 meter intervals from the five wells studied (TMB-1, TMB-2, TMB-4, TMB-5 and TMB-6), respectively. The standard micropaleontological preparation technique for foraminiferal samples was employed. The unwashed ditch cutting samples were initially rinsed to remove drilling mud and then dried. Twenty grams of each dried sample was soaked for four hours in kerosene and then detergent solution water overnight. The disaggregated samples were then washed under running faucet water over a 63 µm sieve mesh. The washed residues were then dried over a hot electric plate, and then sieved into three size portions: coarse, medium and fine. They were then put in labelled sample bags. Their foraminiferal contents were then identified under binocular microscope and recorded. Sixteen marker planktonic foraminifera species were identified and their taxonomic notes were documented accordingly.

**Keywords**: *Taxonomic notes, planktonic foraminifera, Tomboy Field, western Niger Delta, Nigeria*

## 1. INTRODUCTION

The area of study is located in the Tomboy field of the offshore western Niger Delta area of Nigeria (Fig. 1). The Niger Delta is situated in the Gulf of Guinea on the west coast of Central Africa. Niger Delta lies between latitudes 4° and 6° N and longitudes 3° and 9° E in the south-south geo-political region of Nigeria [13]. The Cenozoic Niger Delta is situated at the intersection of the Benue Trough and the South Atlantic Ocean where a triple junction developed during the separation of South America and Africa in the Late Jurassic [20]. The aim of the study is to identify and record the taxonomic notes on marker planktonic foraminifera in the study area.

## 2. GEOLOGICAL SETTING

Three main formations have been recognised in the subsurface of the Niger Delta [10], [17], [19], [1], [18]. These are the Akata, Agbada, and Benin Formations. These formations were deposited in marine, transitional and continental environments, respectively; together they form a thick, overall progradational passive-margin wedge [10]. The Akata Formation is Paleocene to Pliocene in age and it is the basal unit composed mainly of marine shales believed to be the main source rock within the basin. The Agbada Formation is made up of alternating sandstone, siltstone and shale sequences that constitute the petroleum reservoirs of the basin. Agbada Formation is Eocene to Quaternary in age (Figs. 2 and 3). On the other hand, the Benin Formation is Oligocene to Recent in age and it is mainly made up of non-marine fine to coarse-grained sands with a few mudstone and shaly intercalations [10].

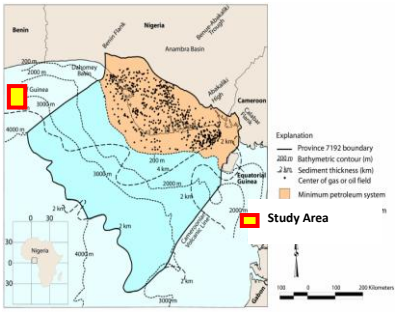



**Fig. 1. Location Map of the Study Area (Source: Tutle et al. [18])**

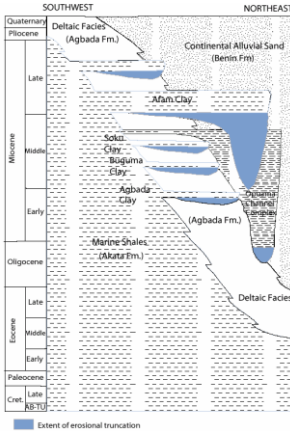



**Fig. 2. Stratigraphic column showing the three formations of the Niger Delta (after Tuttle et al.[18]; modified from Doust and Omatsola [11])**

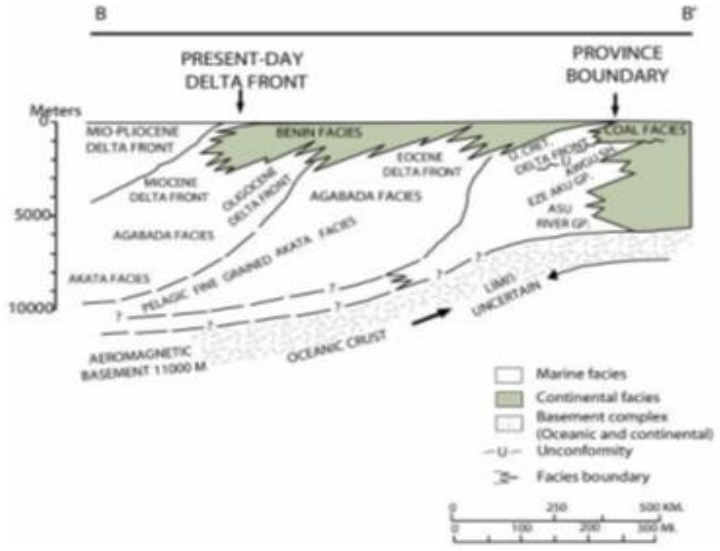



**Fig. 3. Southwest-Northeast (B-B') cross-section through the Niger Delta (modified from Whiteman [20])**

## 3. METHODS OF STUDY

In all, 550 ditch cuttings samples constituted by 113, 106, 111, 108 and 112 samples were retrieved at 18.29 meter intervals from the five wells studied (TMB-1, TMB-2, TMB-4, TMB-5 and TMB-6), respectively. The standard micropaleontological preparation technique for foraminiferal samples was employed. The unwashed ditch cutting samples were initially rinsed to remove drilling mud and then dried. Twenty grams of each dried sample was soaked for four hours in kerosene and then detergent solution water overnight. The disaggregated samples were then washed under running faucet water over a 63 μm sieve mesh. The washed residues were then dried over a hot electric plate, and then sieved into three size portions: coarse, medium and fine. They were then put in labelled sample bags. Their foraminiferal contents were then identified under binocular microscope and recorded.

## 4. RESULTS AND DISCUSSION

The systematics and taxonomic notes used in this study are based on the published methods [8], [9], [12], [6], [16], [15], [14]. The listing of synonyms and detailed descriptions of species were omitted because the encountered species are well described in published literature some of which have been mentioned in this paper. The numbers of planktonic foraminifera are 522, 278, 508, 477 and 580 specimens in TMB-1, TMB-2, TMB-4, TMB-5 and TMB-6 wells, respectively. Out of the population distribution in the five wells, a total of sixteen species were identified and their taxonomic notes are given below, while their photomicrographs are shown in Plate 1. The family and sub-family names are in bold font, while the genus and species names are given in italic font in line with international standards.

### 4.1 Family Globorotaliidae CUSHMAN

**Family Globorotaliidae** CUSHMAN

**Subfamily Globorotaliinae** CUSHMAN

Genus *Globorotalia* CUSHMAN

*Globorotalia mayeri* CUSHMAN & ELLISOR (Plate 1.1)

Remarks

This form is different from *Globorotalia opima* BOLLI in having an aperture with a distinctly arched slit. It is also different from *Globorotalia siakensis* LEROY and *Globorotalia foshi peripheroronda* BLOW & BANNER in having curved, spiral intercameral sutures and less lobate equatorial periphery. According to Bolli and Saunders [6], this species was used as zone marker by Brönnimann [7] and emended by Bolli [4], [5].
Age: Lower Oligocene to Middle Miocene [6].

*Globorotalia continuosa* BLOW (Plate 1.2)

Remarks:

This form is small and has four chambers and it is regarded by its author as closely related to the ancestral *Grt. nana* BOLLI and to be itself the ancestor of *Grt. acostaensis* BLOW, which appeared at the base of the Late Miocene. However, Bolli and Saunders [6], basing their argument on very strong reasons founded on more recent research findings, disagreed with earlier publication that *Grt. continuosa* BLOW is the ancestor of *Grt. acostaensis* BLOW. This species is distinguished from *G. mayeri* by its smaller size and by having only four instead of 5-6 chambers in the last whorl. However, it is identical to *Grt. mayeri* CUSHMAN & ELLISOR in its overall morphology, the range and the coiling pattern.

It is distinguished from *Grt. acostaensis* BLOW in having aperture that is high, comma-shaped arch while that of *Grt. acostaensis* BLOW is a low slit.
Age: top of Middle Miocene – base of Late Miocene [6].

*Globorotalia obesa* BOLLI (Plate 1.3)

Remarks

In this form, the last whorl is formed by four globular chambers, which are separated by deeply incised sutures in a more lobate equatorial periphery. This species is distinguished from *Grt. continuosa* BLOW in having more ovate and less inflated chambers.

Age: Early Miocene to upper Middle Miocene [6].

*Globorotalia menardii* 'A' BOLLI (Plate 1.4)

Remarks

According to Bolli & Saunders [6], the Middle Miocene *Grt. menardii* also called *Globorotalia menardii* 'A' was introduced by Bolli [5]. It differs from *Grt. praemenardii* CUSHMAN & STAINFORTH in having a more strongly developed peripheral keel, less inflated chambers and limbate intercameral sutures on the spiral side, six chambers in the last whorl and less lobate chambers in equatorial view. According to Bolli & Saunders [6], the Pleistocene – Holocene *Grt. menardii* has been designated *Grt. menardii* PARKER, while the older Middle Miocene taxa have been designated *Grt. menardii* 'A' BOLLI.

Age: Middle Miocene to Early Pliocene [6].

*Globorotalia fohsi lobata* BERMUDEZ (Plate 1.5)

Remarks

This species is different from *Grt. mayeri* CUSHMAN & ELLISOR and *Grt. obesa* BOLLI in having its last two to three chambers very elongated and forming strongly lobate and cockcomb-like equatorial periphery.

Age: Middle Miocene [6].

**4.2 Family Globigerinidae** CARPENTER, PARKER & JONES

**Family Globigerinidae** CARPENTER, PARKER & JONES

**Subfamily Globigerininae** CARPENTER, PARKER & JONES

Genus *Globigerina* D'ORBIGNY

*Globigerina praebulloides* BLOW (Plate 1.6)

Description

The test of this species is conspicuously elongated in equatorial view. The largest chamber is the last one.

Remarks

Blow and Banner [2] described the differences of the three species as follows: *Globigerina leroyi* BLOW & BANNER is distinguished from *Globigerina praebulloides* BLOW principally by its smaller umbilicus, lower and more symmetrical aperture, slower rate of chamber arrangement and greater degree of embrace between its chambers. *Globigerina occlusa* BLOW & BANNER differs from *Globigerina praebulloides* BLOW in possessing a smaller, shallower umbilicus, a smaller lower aperture which lacks a lip or rim and possessing a slightly thicker, tougher and more coarsely perforate wall. *Globigerina occlusa* BLOW & BANNER is distinguished from *G. leroyi* BLOW & BANNER in possessing a shallower umbilicus and an asymmetrical aperture which lacks a lip. According to Bolli and Saunders [6], the chambers of *G. occlusa* BLOW & BANNER are more embracing than those of *G. praebulloides* BLOW, but are less tightly embracing than those of G. *leroyi* BLOW & BANNER.
Age: Lower Eocene to Middle Miocene [6].

*Globigerina bulloides* D'ORBIGNY (Plate 1.7)

Remarks

This form is distinguished from its ancestor, *Globigerina praebulloides* BLOW, in having a more stout and elongate test and a high, asymmetrically arched aperture. According to Bolli and Saunders [6], *G. bulloides* D'ORBIGNY evolved in the Middle Miocene, where it overlaps with its ancestor *Globigerina praebulloides.*

Age: Middle Miocene [6].

*Globigerinoides obliquus* BOLLI (Plate 1.8)

Remarks

The species is distinguished from *Gds. trilobus* and *Gds. altiaperturus* in having the ultimate chamber slightly compressed in a lateral, oblique way. According to Bolli and Saunders [6], it is similar to *Gds. trilobus* REUSS in having a wider and higher primary aperture on its last chamber. However, it is different from *Gds. altiaperturus* BOLLI in having a lower and less semi-circular primary aperture.

Age: Early Miocene to late Early Pliocene [6].

*Globigerinoides extremus* BOLLI & BERMUDEZ (Plate 1.9)

Remarks

This species is distinguished from *Gds. elongatus* D'ORBIGNY and *Gds. ruber* (D'ORBIGNY) in having asymmetrical primary aperture and a more laterally compressed, asymmetrical last chamber.

Age: Late Miocene – Middle Pliocene [6].

*Globigerinoides quadrilobatus* D'ORBIGNY (Plate 1.10)

Remarks

This species is distinguished from *Globigerina occlusa* BLOW & BANNER in having spiral secondary aperture. It is also different from *Gds. primordius* BLOW & BANNER in being smaller in form. *Globigerinoides quadrilobatus* D'ORBIGNY is different from *Globigerinoides trilobus* REUSS and *Gds. immaturus* LEROY in having arched apertures.

Age: N10 – N12 (Middle Miocene) [6].

*Globigerinoides subquadratus* (BRÖNNIMANN) (Plate 1.11)

Remarks
This species is similar to *Globigerinoides trilobus* REUSS in having three chambers that formed the last whorl. However, it is different from *Globigerinoides trilobus* REUSS and similar to *Gds. altiaperturus* BBOLLI in having higher arched apertures symmetrically positioned above the sutures between earlier chambers. According to Bolli and Saunders [6], it has the same morphological features like *Globigerinoides ruber* (D'ORBIGNY) but different only in geochronological age. *Globigerinoides subquadratus* (BRÖNNIMANN) has a short range (N10-N13) Middle Miocene age, while *Globigerinoides ruber* (D'ORBIGNY) ranged from Middle Miocene to Holocene.

Age: N10 to N13 (Middle Miocene) [6], [16]

*Globigerinoides trilobus* REUSS (Plate 1.12)

Remarks
This species is similar to *Globigerinoides quadrilobatus* D'ORBIGNY and *Globigerinoides sacculifer* BRADY in having three final chambers that formed the last whorl. It is also similar to *Globigerinoides sacculifer* BRADY and different from *Globigerinoides quadrilobatus* D'ORBIGNY in having low arched apertures asymmetrically located above the sutures between earlier chambers. According to Bolli and Saunders [6], *Globigerinoides quadrilobatus* D'ORBIGNY was placed in synonym with *Globigerinoides immaturus* LEROY. Bolli [3] distinguished the species of *Globigerinoides trilobus* REUSS from the species of *Globigerinoides immaturus* LEROY using the position of a final chamber, which is larger than all the earlier chambers combined.

Age: Early Miocene to Holocene [6].

*Globigerinoides sacculifer* BRADY (Plate 1.13)

Remarks
This species is similar to *Globigerinoides trilobus* REUSS in having three final chambers that formed the last whorl and low arched apertures asymmetrically located above the sutures between earlier chambers. However, it is distinguished from *Gds. trilobus* REUSS in having an elongated and sac-like shaped final chamber.

Age: Early Miocene to Holocene [6].

**4.3 Subfamily Orbulininae** SCHULTZE

**Subfamily Orbulininae** SCHULTZE

Genus *Orbulina* D'ORBIGNY in DE LA SAGRA

*Orbulina suturalis* BRÖNNIMANN (Plate 1.14)

Remarks

This species differs from *Praeorbulina circularis* BLOW in having areal and sutural apertures. It is distinguished from the closely related *O. universa* D'ORBIGNY in having the earlier chambers of the test breaking the outline of the sphere.

Age: Early Miocene to Recent [6].

*Orbulina universa* D'ORBIGNY (Plate 1.15)

Remarks
This species is distinguished from *Orbulina suturalis* BRÖNNIMANN in having a completely spherical test, which shows the early chambers internally only when broken.

Age: Middle Miocene to Recent [6].

**4.4 Subfamily Catapsydracinae** BOLLI, LOEBLICH & TAPPAN

**Subfamily Catapsydracinae** BOLLI, LOEBLICH & TAPPAN

Genus *Globigerinita* BRÖNNIMANN

*Globigerinita naparimaensis* BRÖNNIMANN (Plate 1.16)

Remarks

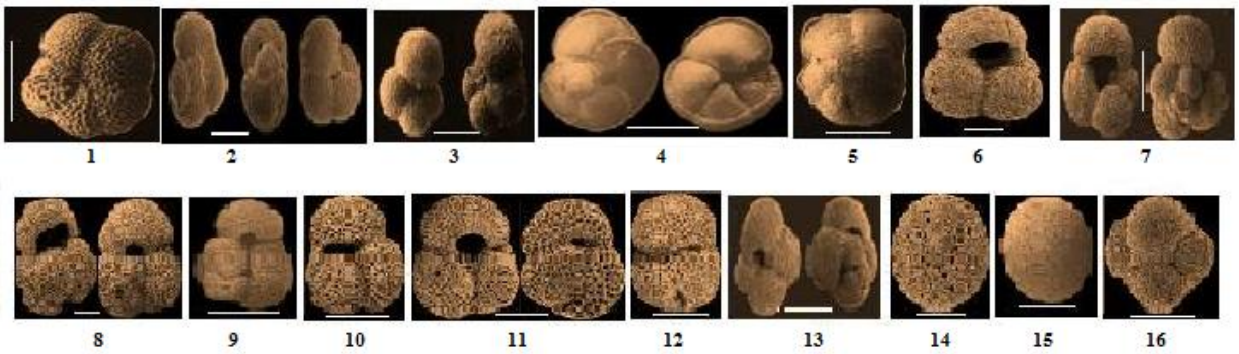
This species is similar to the holotype of Brönnimann [7]. It is distinguished from *Globigerina* in having an extra-umbilical primary aperture covered by a modified final chamber. However, it is different from *Tinophodella* in lacking true bullae.

Age: N6 (Early Miocene) to N23 (Holocene) [6].

## 5. CONCLUSION

The numbers of planktonic foraminifera are 522, 278, 508, 477 and 580 specimens in TMB-1, TMB-2, TMB-4, TMB-5 and TMB-6, respectively. Out of the population distribution in the five wells, a total of sixteen species identified and their taxonomic notes recorded are *Globorotalia mayeri* CUSHMAN & ELLISOR, *Globorotalia continuosa* BLOW, *Globorotalia obsea* BOLLI, *Globorotalia menardii* 'A' BOLLI, *Globorotalia foshi lobata* BERMUDEZ, *Globigerina praebulloides* BLOW, *Globigerina bulloides* D'ORBIGNY, *Globigerina obliquus* BOLLI, *Globigerinoides extremus* BOLLI & BERMUDEZ,

*Globigerinoides quadrilobatus* D'ORBIGNY, *Globigerinoides subquadrilobatus* (BRÖNNIMANN), *Globigerinoides trilobus* REUSS, *Globigerinoides sacculifer* BRADY, *Orbulina suturalis* BRÖNNIMANN, *Orbulina universa* D'ORBIGNY, *Globigerinita naparimaensis* BRÖNNIMANN. The value of the taxonomic notes is to contribute to the study of these species and also to help other researchers in the study area in easy and time-saving identification of these species. Taxonomic notes help in eradication of uncertainty and arbitrary identification of species.




1. *Globorotalia mayeri* CUSHMAN & ELLISOR
2. *Globorotalia continuosa* BLOW
3. *Globorotalia obsea* BOLLI
4. *Globorotalia menardii* 'A' BOLLI
5. *Globorotalia foshi lobata* BERMUDEZ
6. *Globigerina praebulloides* BLOW
7. *Globigerina bulloides* D'ORBIGNY
8. *Globigerina obliquus* BOLLI
9. *Globigerinoides extremus* BOLLI & BERMUDEZ
10. *Globigerinoides quadrilobatus* D'ORBIGNY
11. *Globigerinoides subquadrilobatus* (BRÖNNIMANN)
12. *Globigerinoides trilobus* REUSS
13. *Globigerinoides sacculifer* BRADY
14. *Orbulina suturalis* BRÖNNIMANN
15. *Orbulina universa* D'ORBIGNY
16. *Globigerinita naparimaensis* BRÖNNIMANN

**White Scale bars: 100 µm**

**Plate 1. Photomicrographs of Marker Planktonic Species**

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