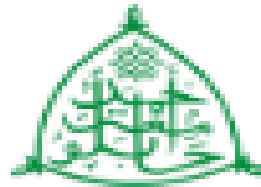


NEOGENE BIOSTRATIGRAPHY IN THE NIGER DELTA BY INTEGRATING FORMINIFERA AND PALEOCEONOGRAPHIC CONDITONS

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PRESENTED BY
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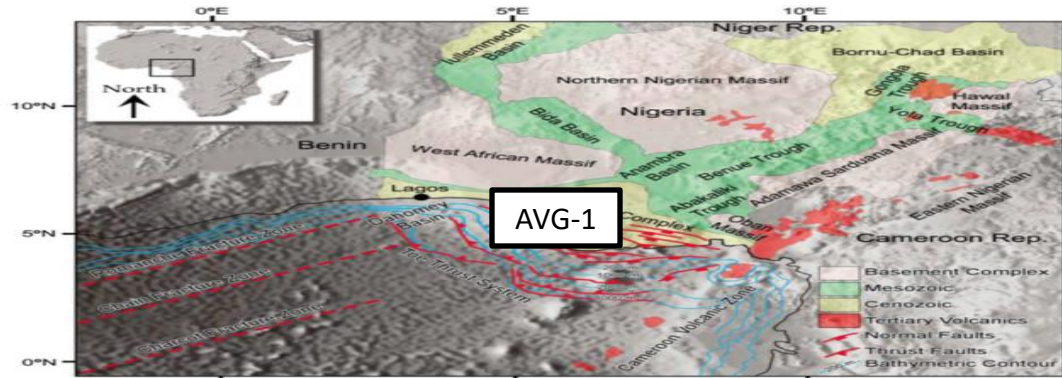


Presentation Outline

- **Background of the study**
- **Statement of research problems**
- **Methodology**
- **Results and Discussion**
- **Conclusions**
- **Recommendations**
- **References**

Background of the study

- Nigeria's oil province, the Niger Delta, is situated on the continental shelf of West Africa.
- The Niger Delta Basin exhibits an upward transition ranging in age from early Tertiary to Recent, moving from marine pro-delta shales (Akata Formation) through a paralic (Agbada Formation) to a continental sequence (Benin Formation).
- AVG-1, which is part of OML-95, is located at latitude $5^{\circ}30'20''\text{N}$ and longitude $4^{\circ}30'48''\text{E}$, northwest of the Niger Delta.



Part of West Africa and the Gulf of Guinea Showing Nigeria's Sedimentary Basin and In set is a map of Africa showing the Location of the Niger Delta region (Corredor *et al.*, 2005)

Statement of Research Problems

- ❑ The research work published by STRATCOM committee and part of its objectives was to harmonize the biostratigraphy data of onshore and conventional offshore wells using foraminifera to unravel the geological information of the Niger Delta Basin Adegoke *et al.* (2017), however there still remain more to be done.
- ❑ Taxonomic usage of foraminifera for age determination in the Niger Delta still has some degree of knowledge deficiency and ambiguity.
- ❑ The problems in the application of the First Downhole Occurrence(FDO) and Last Downhole Occurrence(LDO) datum for biochronologic correlations.
- ❑ However, the biostratigraphy, sequence stratigraphy and palaeoenvironment of the present study well have not been documented. This research would contribute to the already existing knowledge Northwest of the Niger Delta Basin.

Aim and Objectives

The project aim to integrate the palaeoenvironment, sequence stratigraphy, and biostratigraphy of the sediments in the studied well. The objectives consist:

- Describe the lithostratigraphic framework.
- Provide an age and biostratigraphic zone proposal.
- Establish the sequence stratigraphic framework.
- Based on the microfossil assemblages, ascertain the paleoenvironment.

METHODOLOGY

1. Materials: ditch cutting samples and wireline logs. Eight (80) ditch cuttings samples from AVG-1 well (830–5580ft interval) were sampled at 30ft for foraminifera studies respectively.

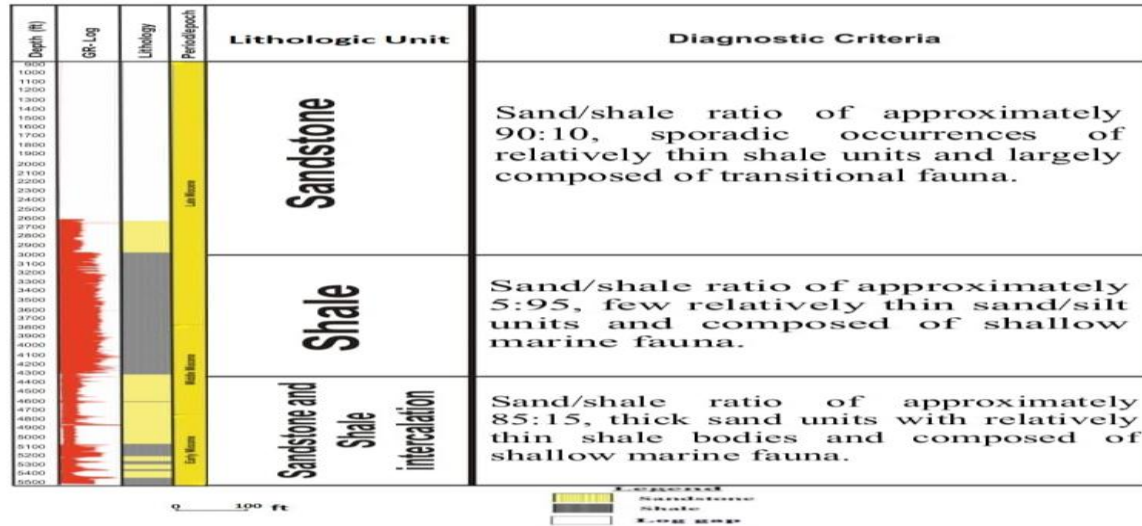
2. Methods

- Lithostratigraphy
- Foraminifera Sample Preparation
- Biostratigraphic method
- Sequence Stratigraphy
- Paleoenvironmental analysis: paleobathymetry and paleosalinity

RESULTS AND DISCUSSION

Lithostratigraphic Units

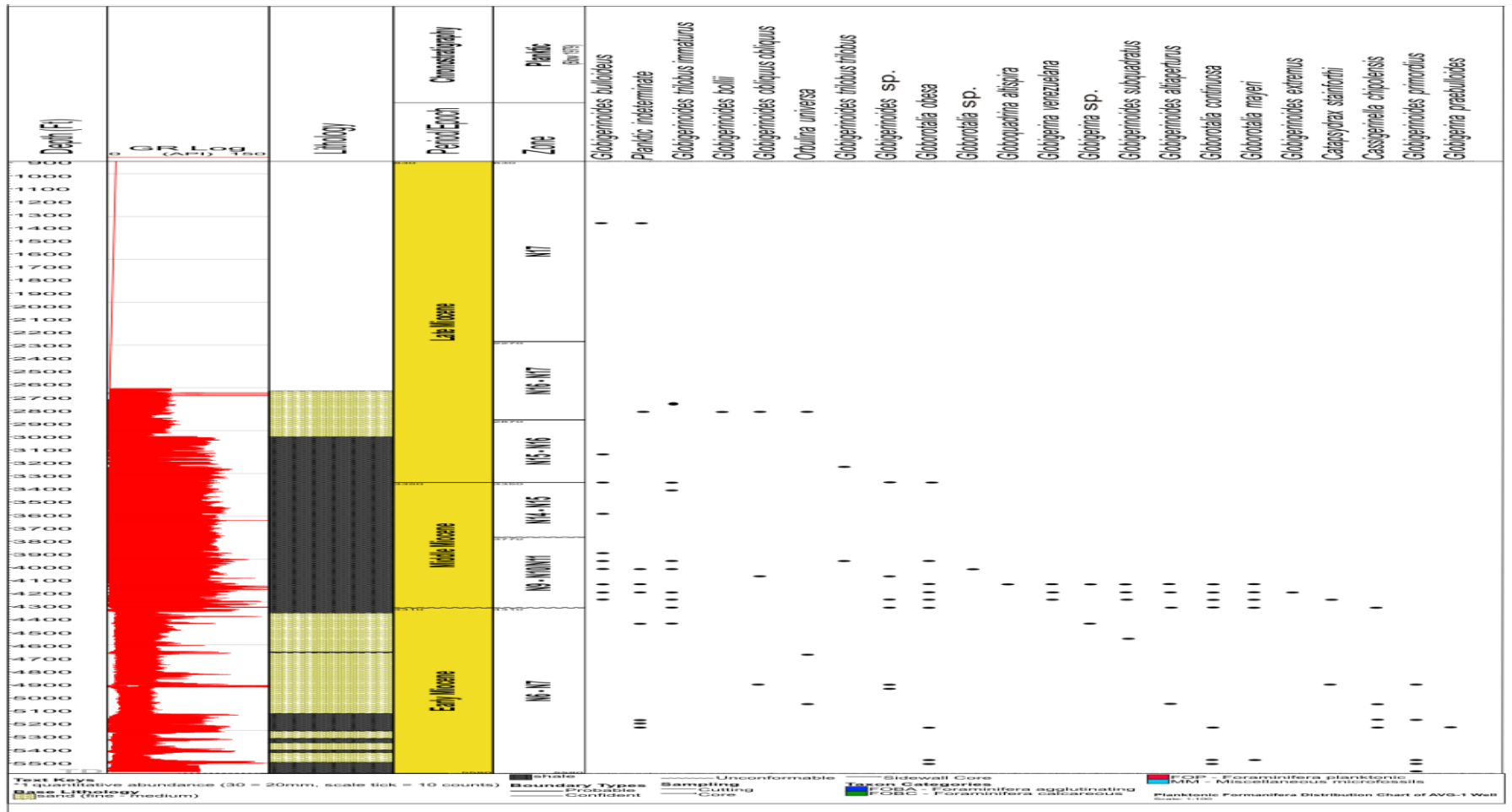
- ❑ **Sandstone:** milky white to glassy, fine to coarse grained, sub-angular to sub-rounded, angular, poorly sorted to well sorted, and some carbonaceous fragments.
- ❑ **Shale:** Brownish to greyish, flaggy to platy, fissile, carbonaceous. Rare occurrences of ferruginous materials, mica flakes, pyrite, gluconite pellets and rare shell fragments.



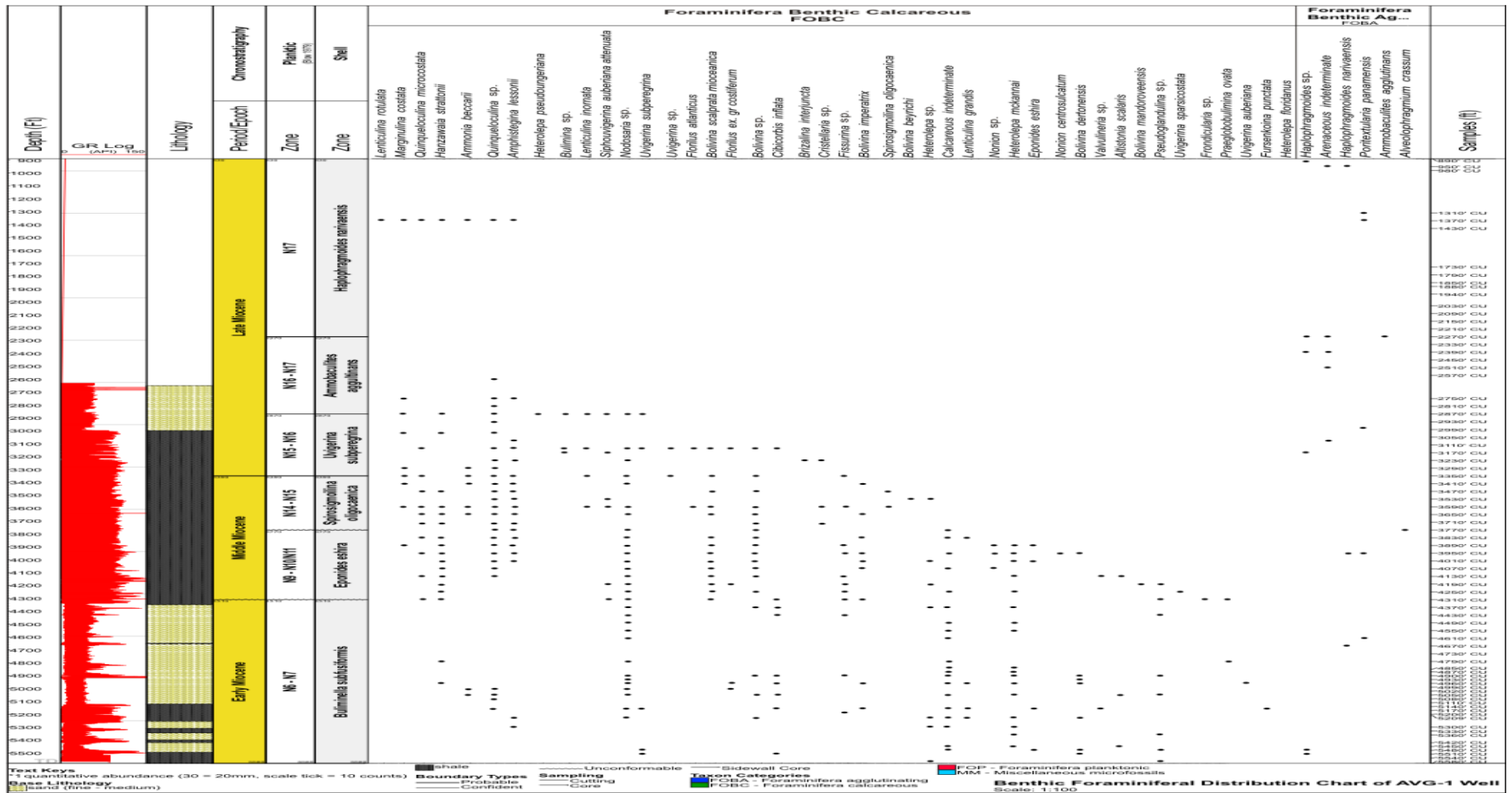
Lithologic log of AVG-1 well.

Micropaleontological Data

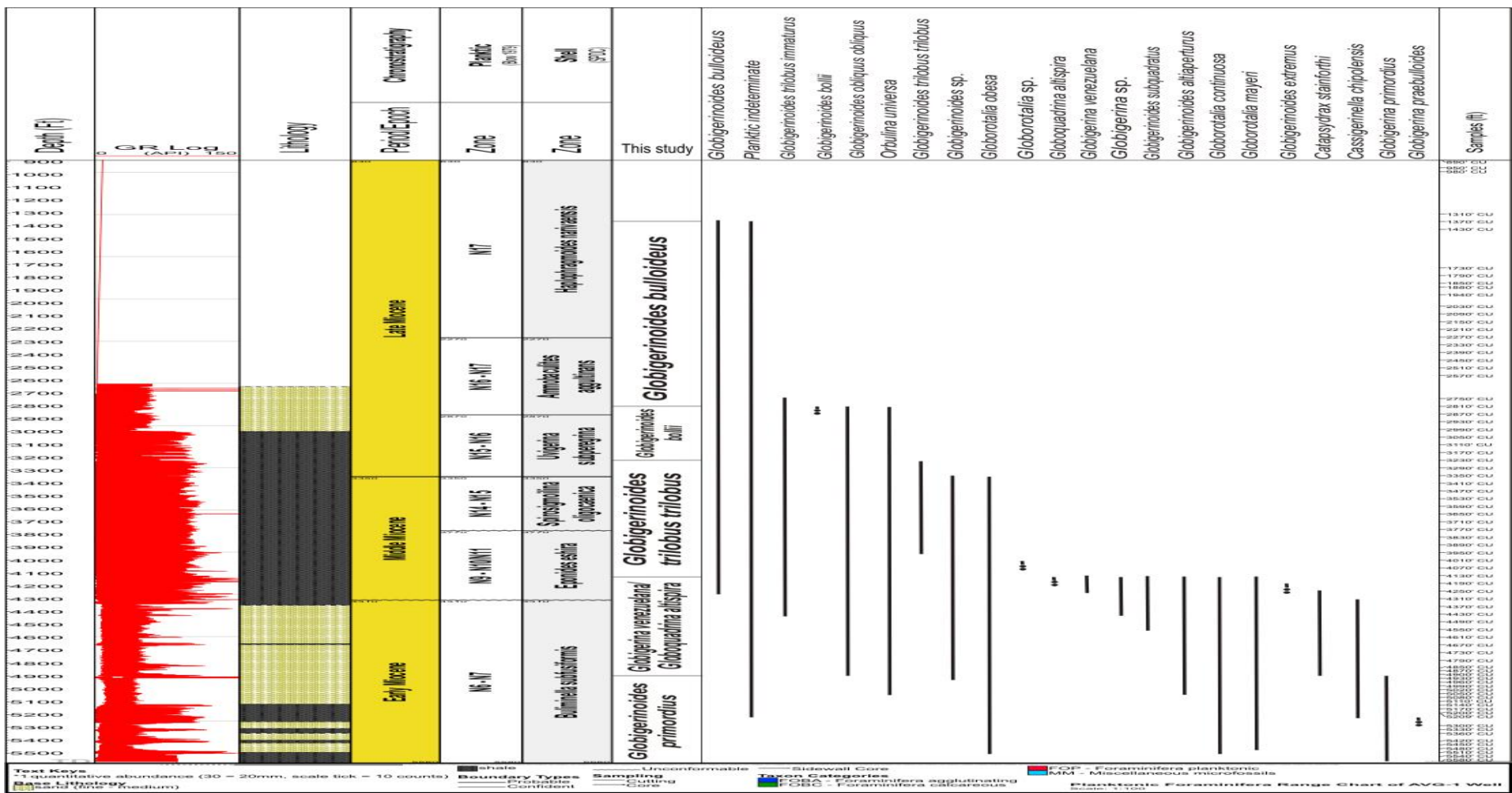
- **Foraminifera Microfauna:** Foraminiferal recoveries were generally good, well preserved and with a high diversity.
- Planktonic foraminifera such as; *Catapsydrax stainforthi*, *Orbulina universa*, *Globigerinoides bulloideus*, *Globorotalia mayeri* and *Globorotalia continuosa*. Showed the age of the study well to be Early to Late Miocene (N6-N17).



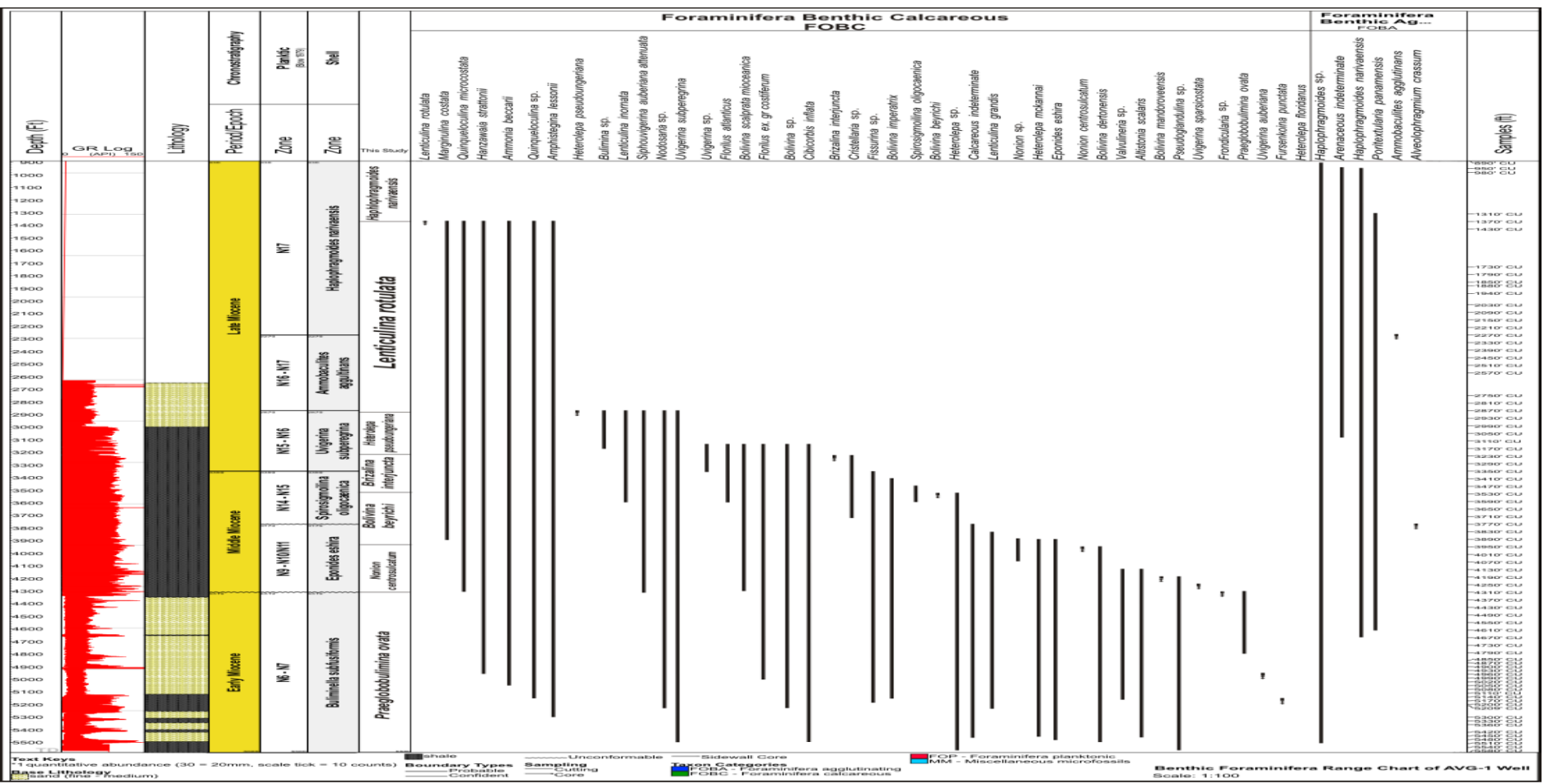
Planktonic foraminiferal distribution chart for AVG-1 well



Benthonic foraminiferal distribution chart for AVG-1 well.



Biostratigraphic range chart of planktonic foraminifera for AVG-1 well.



Biostratigraphic range chart of Benthonic foraminifera for AVG-1 well.

Depositional sequence

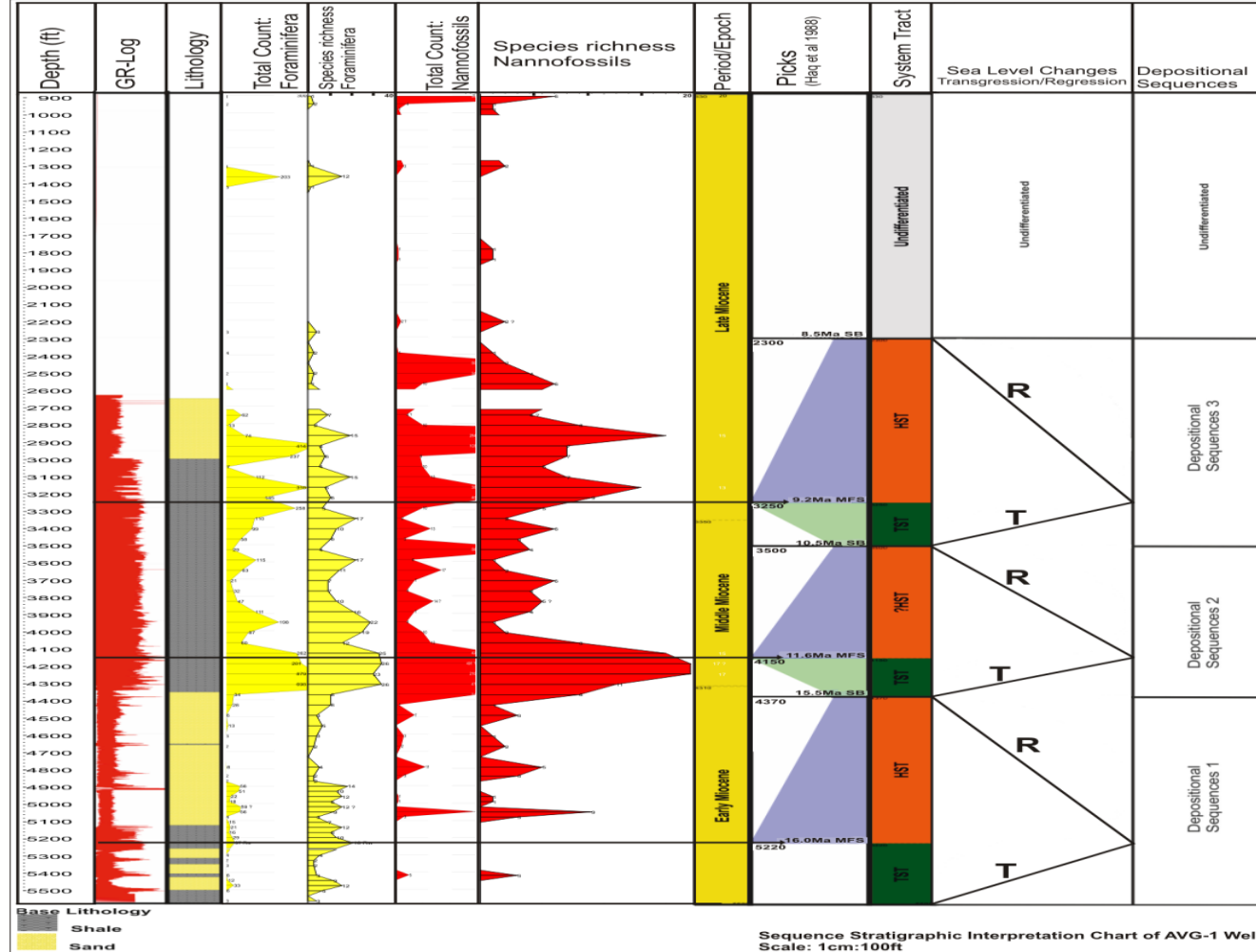
Three depositional sequences were recognized in the study well. The depth summary of the depositional sequences is presented in Table 1.

Table 1: Depth summary of sequence present in the study well

Sequence	Depth Range (ft)	Age
Sequence 1	5580-4370	Early Miocene
Sequence 2	4370-3500	Early Miocene to Middle Miocene
Sequence 3	3500-2300	Middle Miocene to Late Miocene

Associated key surfaces

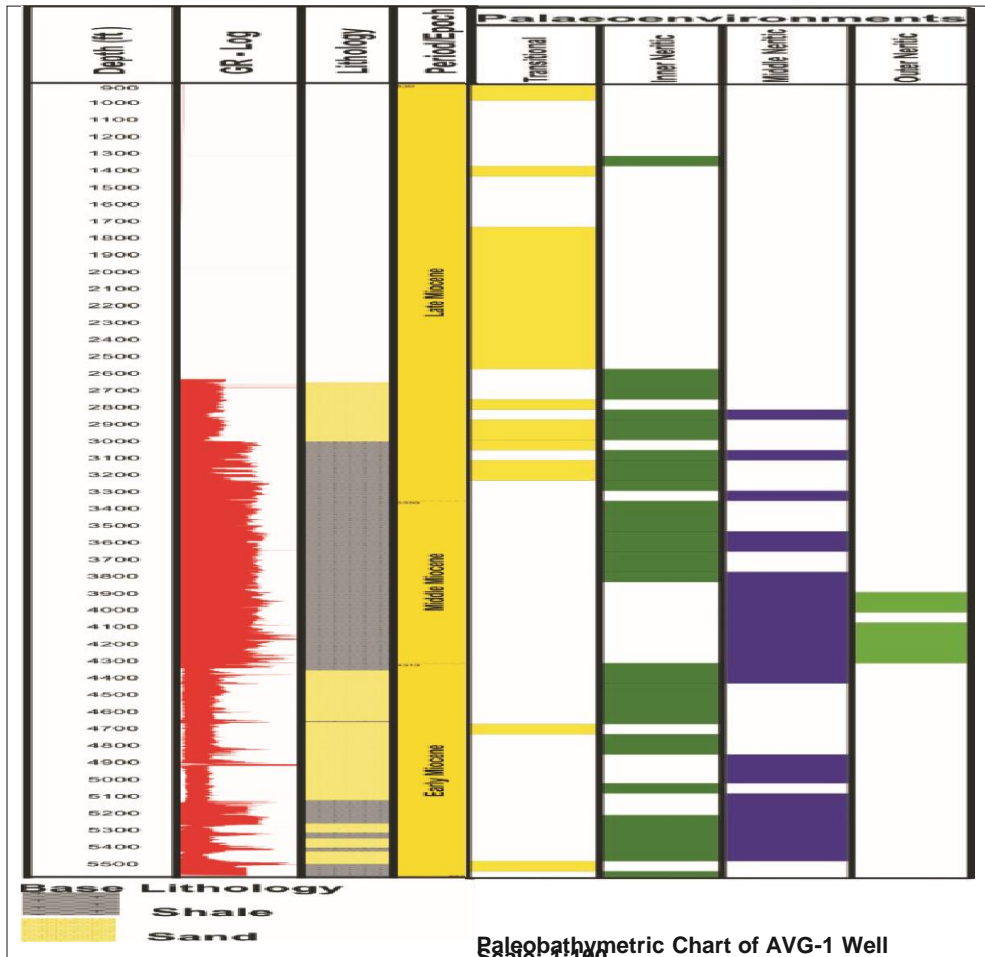
- ❑ **Maximum Flooding Surface (MFS)**; at 5220ft (16.0Ma), 4150ft (11.6Ma) and 3250ft (9.2Ma)
- ❑ **Sequence Boundaries (SB)**; at 4370ft (15.5Ma), 3500ft (10.5Ma) and 2300ft (8.5Ma).
- ❑ **Sedimentary cycle interpretation** ; based on the ages of the three MFS correlated to Haq *et al.*, (1988) chronostratigraphic chart, reveals that the studied well interval went through three cycles of deposition: Early (Cycle 7), Middle Miocene (Cycle 9) and Late Miocene (Cycle 10).



Sequence Stratigraphy Chart of AVG-1well.

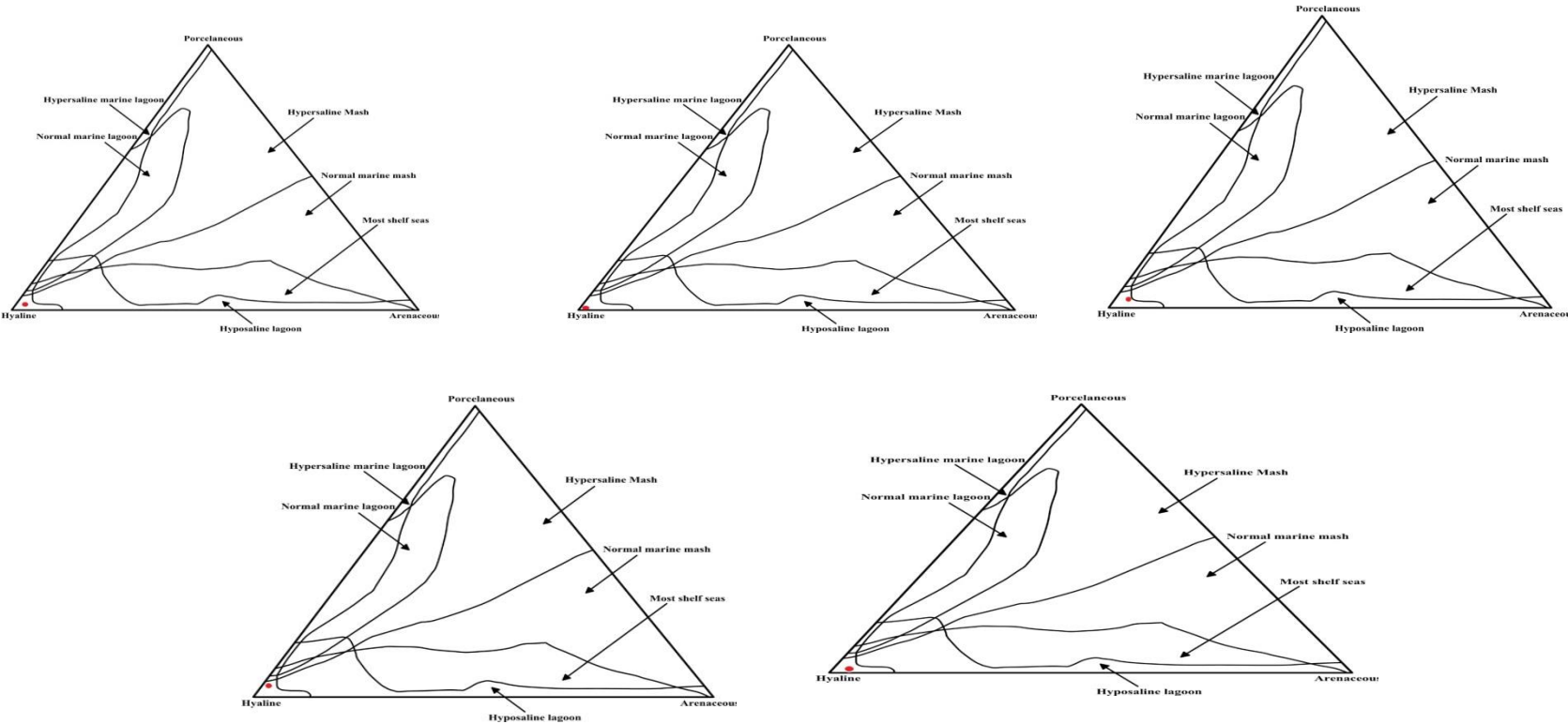
Paleobathymetry

- ❑ **Transitional environment:** high sand ratio (high-energy environment). *Amphistegina lessonii* and *Quinqueloculina microcostata*
- ❑ **Inner neritic-middle neritic environment:** sandstone and high shale ratio, mica flakes, pyrite, glauconite pellets and ferruginous materials (supports a low-energy shallow marine environment). *Ammonia beccarii*, *Cibicorbis inflata* and *Florilus atlanticus*,
- ❑ **Outer Neritic:** presence of planktonic foraminifera such as *Globigerinoides* sp., *Catapsydrax stainforthi*, *Uvigerina sparsicostata* and *Brizalina mandoroveensis*.



Paleoenvironment Chart of AVG-1well.

Paleosalinity interpretations; The triangular plots reveal the dominance of the hyaline calcareous (over 90%) shell type suggesting a normal marine shelf sea environment.



Triangular plots of shell-type ratio within the study well.

Research contribution to knowledge

- ❑ The micropalaeontologic and lithological description showed that the sediments for the study interval belong to the Early to Late Miocene paralic Agbada Formation. The biozones that were proposed, correlates to standard Mid-latitudinal zones.
- ❑ The GR log and microfossils abundance revealed three episodes of sea level rise and fall, influenced by eustacy and regional tectonics within the Niger Delta during the Miocene.
- ❑ The foraminiferal bathymetric ranges of: *Haplophragmoides narivaensis*, *Ammonia beccarii*, *Lenticulina inornata*, *Uvigerina subperegrina*, *Eponides eshira* and wall composition triangular plot, which showed the dominance of the hyaline calcareous (over 90%). These revealed that the sediment deposition occurred within a shallow to inner shelf settings.

Plate I

All the foraminifera species illustrated in Plate I (adapted from Adegoke *et al.*, 2017). Were collected from AVG-1 Well, Niger Delta. Below is the species name, corresponding depth of occurrence and magnification.

1. *Florilus atlanticus* (Cushman, 1947), (3110-3350ft), side view $\times 175$.
2. *Florilus costiferum* (Cushman, 1926), (3110-4900ft), side view ($\times 200$)
3. *Amphistegina lessonii* (d'Orbigny, 1826),(1370-5209ft),($\times 55$)
4. *Eponides eshira* (de Klasz and Rerat, 1962), (3890-5480ft), umbilical view, ($\times 175$)
5. *Lenticulina grandis* (Cushman 1927), (3770-5510ft) apertural view, ($\times 500$)
6. *Lenticulina inornata* (d'Orbigny, 1846), (2850-3170ft), apertural view, ($\times 75$)
7. *Uvigerina subperegrina* (Cushman and Kleinpell, 1934), (2850-5209ft), side view, $\times 500$.
8. *Uvigerina sparsicostata* (Cushman and Laiming, 1931; LeRoy, 1944), (4190-5580ft), side view, $\times 260$
9. *Globigerinoides extremus* (Bolli and Bermudez, 1965), (4010ft) umbilical view, ($\times 300$)
10. *Globigerinoides obliquus* (Bolli, 1957), (2850-4930ft) umbilical view, ($\times 182$)
11. *Globigerinoides primordius* (Blow and Banner, 1962), (4930-5580ft) spiral view, ($\times 149$)
12. *Bolivina mandoroveensis* (Graham, de Klasz, and Rerat, 1965) (3900-5360ft), side view, $\times 300$.
13. *Eponides eshira* (de Klasz and Rerat, 1962), (3890-5480ft), umbilical view, ($\times 175$)
14. *Hanzawaia strattoni* (Applin, 1925), (1370-4310ft), ventral view, $\times 500$.
15. *Catapsydrax stainforthi* (Bolli, Loeblich and Tappan, 1957), (4250-4930ft) $\times 214$
16. *Cibicorbis inflata* (d'Orbigny, 1846), (3110-5200ft) $\times 200$.
17. *Haplophragmoides narivaensis* (Bronnimann, 1953), (950-4620ft) $\times 225$

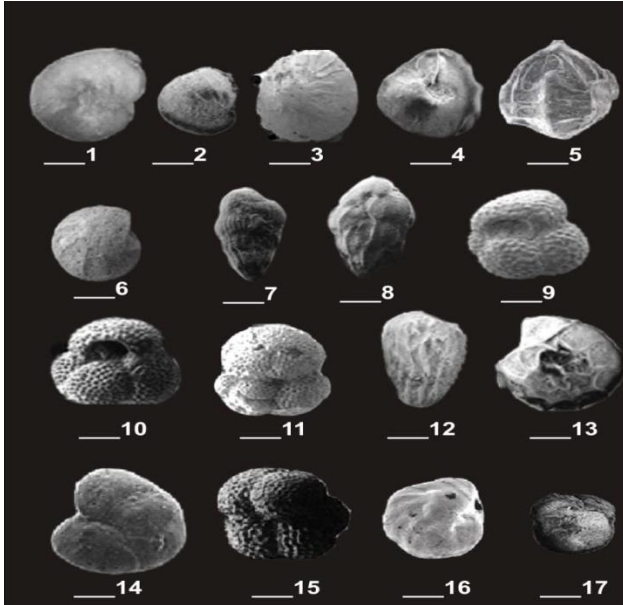
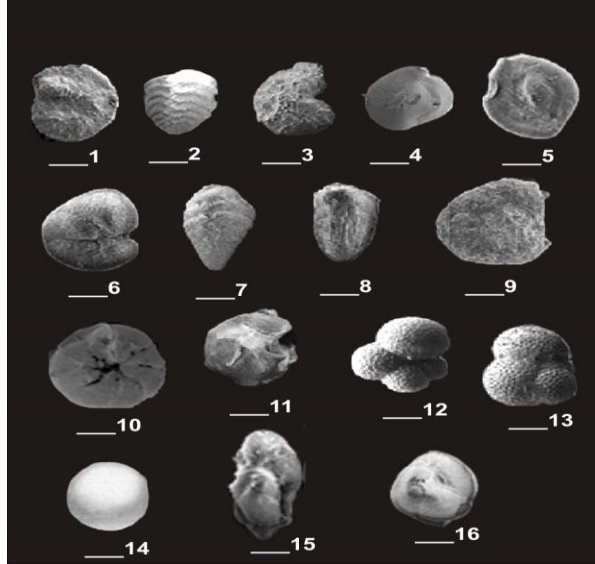


Plate II



All the foraminifera species illustrated in Plate II (adapted from Adegoke *et al.*, 2017) .Were collected from AVG-1 Well, Niger Delta. Below is the species name, corresponding depth of occurrence and magnification

1. *Alveolophragmium crissum* (Shchedrina, 1936), (3770ft) $\times 330$.
2. *Poritextularia Pananemsis* (Cushman, 1918), (2270ft) side view, $\times 50$.
3. *Ammobaculites agglutinans* (d'Orbigny, 1846), (2270ft) $\times 100$.
4. *Quinqueloculina microcostata* (Natland, 1938), (1370-3900ft) side view, $\times 160$.
5. *Spirosigmoilopsis oligocaenica* (Parr, 1942), (3410-5200ft), side view, $\times 450$.
6. *Nonion centrosulcatum* (de Klasz, Le Calvez, and Rerat, 1964), (3910-5540ft), side view, $\times 275$.
7. *Bolivina beyrichi* (Reuss, 1851), (3470-3590ft) side view, $\times 420$.
8. *Brizalina imperatrix* (Graham, de Klasz, and Rerat, 1965), (3330-5200ft), side view, $\times 225$.
9. *Valvulineria sp* (Cushman, 1926), (3950-5540ft) spiral view, $\times 480$.
10. *Ammonia beccarii* (Linne, 1758), (1370-4960ft) umbilical view, $\times 300$.
11. *Heterolepa pseudoungeriana* (Cushman, 1922), (2700-5209ft) umbilical view, $\times 150$.
12. *Turborotalia obesa* (Bolli, 1957), (3320-5540ft) umbilical view, $\times 325$.
13. *Globigerinoides bulloideus* (Crescenti, 1966), (1370-4250ft) umbilical view, $\times 130$.
14. *Orbulina universa* (d'Orbigny, 1839), (2850-4730ft) side view, $\times 150$.
15. *Altistoma scalaris* (de Klasz and Rerat, 1962), (4130-5140ft) side view, $\times 200$.
16. *Praeglobobulimina ovate* (d'Orbigny, 1846), (4130ft) side view, $\times 200$.

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THANK YOU