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Paleoenvironmental Analysis of Well "K27" In the Niger Delta, South-Eastern Nigeria

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Abstract: *A palaeo-environmental analysis was carried out on well "K27", using ditch cuttings and well log data from the Greater Ughelli depobelt of the Niger delta. This paper attempts to reconstruct the depositional environment of sediments penetrated by well 'k27". Palaeoenvironmental analysis and interpretation of well "27" was achieved using an integrated approach that included foraminifera assemblages, lithologic and wireline log data. This integrated data was used to infer the various palaeodepositional environments and also determine the paleobathymetry. After careful analysis, deductions showed that the lithology is dominated by alternating shales and sands belonging to the Agbada formation of the Niger delta. Results suggest sediments were deposited in a non-marine (fluvial) to shallow marine paleoenvironment (shallow inner – middle neritic) further analysis of well "k27" suggested that paleoenvironments included distributary channel fills, regressive to trangressive shore face delta and delta front.*

Keywords: *Paleoenvironmental, Niger Delta, Foraminifera, Paleobathymetry, Well logs*

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I. Introduction

The Niger Delta is located on the continental margin of the Gulf of Guinea in equatorial West Africa (Fig. 1), between latitudes 3^0N and 6^0N and longitude 5^0E and 8^0E (Reijers *et al*., 1997). The Niger Delta is an intermediate class of Delta exhibiting aspects of fluvio-wave and tide influence (equilibrium state). It is believed to be currently in an intermediate state between extreme low and extreme high accommodation and sediment supply regime (Chiagham *et al*., 2011). Onshore, a portion of the Niger Delta province is delineated by the geology of southern western African shield, (Murat, 1972). These include; Benin flank and Calabar flank at the North-western and Eastern edges of the Niger Delta basin respectively, the Gulf of Guinea borders it's southern edge and the base of the Benue trough, while Anambra Basin and Abakaliki high lie at the northern boundary. As a result of this geological configuration in the Niger Delta basin, there is a basinward decrease in age which reflects an overall regression of the depositional environment within the Niger Delta clastic model (Oyedele *et al.*, 2012 and 2013). Sediments were supplied from the weathering of continental basement outpouring through the Benue – Niger drainage system (Stacher, 1995).

During the Tertiary, the Niger Delta prograded into the Atlantic Ocean producing a delta with a total area of about 75, 0000km at the mouth of the Niger-delta river systems. This delta is composed of clastics up to 12,000m thick at its central park, resulting in the Niger Delta being the largest in Africa, having a sediment volume of 500,000km^3, which extends beyond 300km from the mouth. (Ejeh, 2010; Reijers, 1996; Onyekuru *et al.*, 2012; Adegoke, 2012).Well "k27" is a well in the Greater Ughelli depobelt of the Niger delta (Fig. 2). This work involves the use of ditch cuttings and wireline logs (Gamma ray and resistivity) from "K27" well interval (2590m-3300m) in the Niger delta to reconstruct the various paleoenvironments penetrated by well "K27". The primary objective is a paleonvironmental interpretation of the well under investigation.

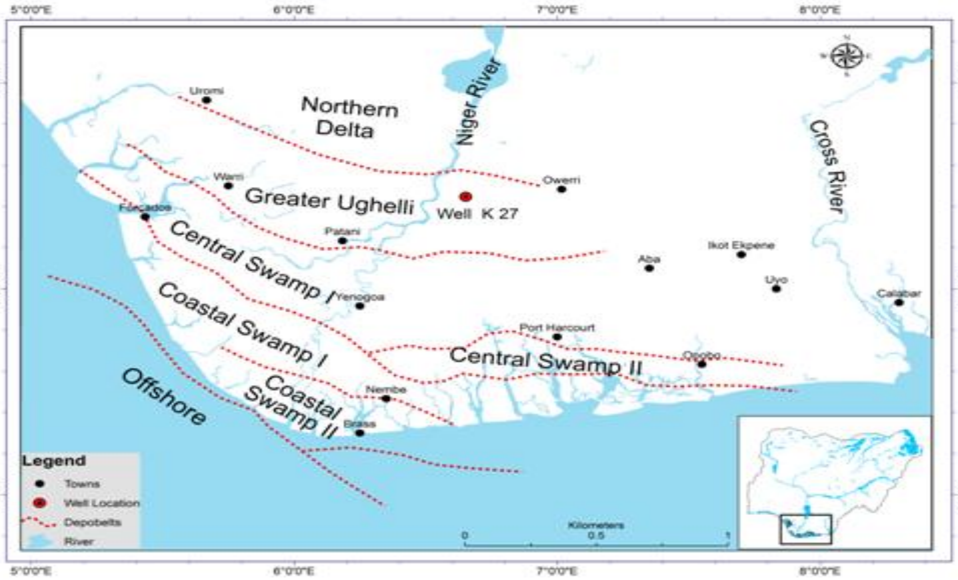

Fig. 2 A map of Niger delta depobelts showing location of well "K27".

II. Materials And Methods

In order to achieve the aim of this research, the following data sets were utilized.

a. Ditch cutting samples from the well under study

b. Well logs consisting of gamma ray (GR) and resistivity log suits.

A total of seventy one (71) ditch cutting samples (interval 2590m-3300m) used for this study were collected at 10 meters (10m) interval.

Foraminiferal, lithologic and palaoenvironmental analysis were carried out using laid out standard procedures.

2.1 Foraminiferal analysis

The standard approach outline by Brasier (1979) and Armstrong and Brasier (2005) for the processing of samples in biostratigraphy was utilized in well "k27".The foraminfera were then mounted on microfossil slides and sorted into morphological similar species. The identification of various foraminiferal taxa was done basically by comparing with those published by various authors (Bolli and Saunders, 1985; Petters, 1995 and others).

2.2 Litho logic analysis

The residue left after picking the foraminiferal samples were used for lithologic analysis by examining each interval under binocular microscope. The lithologic description involved grain size sorting and grain constituents, 10% dilute hydrochloric acid was used on some of the samples to infer the presence or absence of calcareous minerals and species.

2.3 Palaeonvironmental analysis

Paleoenvironmental analysis and interpretation of the study well was done using an integrated approach which included foraminiferal and wireline log data, together with published materials (Petters, 1995 and others). Foraminiferal data was utilized in paleobathymetry and involved the use of relative abundance and diversity of the different foraminiferal forms integrated with regression relationship between bathymetery and the percentage of planktonic foraminiferal (%P) with respect to the fossil foraminiferal population and some depth related charts. Wireline log shapes (Fig. 3) of Gamma ray, lithologies and biofacies can be used to infer the various paleo-depositional environments under study (Onyekuru *et al*, 2012; Olaburaimo and Boboye, 2010) (fig. 2).

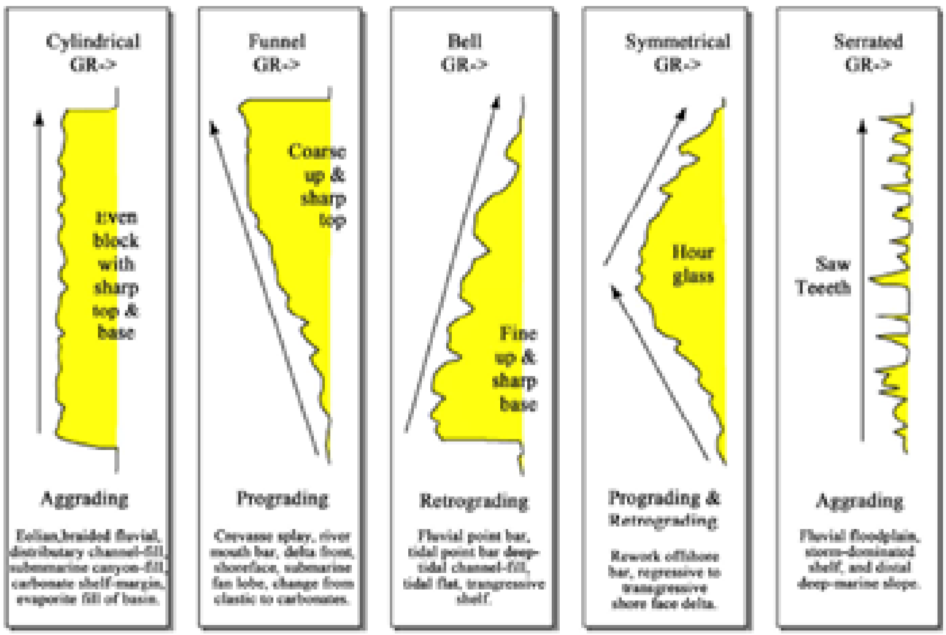

Fig. 2: Well log response character for different environments (Onyekuru et al. 2012).

III. Results And Discussions

3.1 Lithologic description

A lithologic description of seventy one (71) ditch cutting samples from well "k27" (interval 2590m-3300m) was carried out. The studied well is characterized by fine-coarse grained, moderately sorted, subangular to subrounded, carbonaceous and ferruginsed sands/sandstone with minor siltstone and with intercalations of dark grey, subfissile to fissile, hard to moderately hard, calcareous and micromicaceous shale. Based on lithologic description along with characteristic log motifs (Gamma ray/resistivity log), the lithostratigraphy of well "k27" was established as presented in table 1.

Table 1: Depth and related lithofacies of sediments in Well 'K27'

Depth (m)	Lithofacies	Facies	Lithostratigraphy
2590-2630	This facies is composed of sand unit with intercalations of siltstone. This facies is barren	A	AGBADA FORMATION
2630-2850	This facies is predominantly composed of shale. It is rich in foraminifera assemblage	B	
2850-3250	This facies is composed of sandstone and shale in equal parts. This facies is poor in foraminifera assemblage	C	
3250-3200	This facies is mainly composed of shale but little intercalations of sandstone and siltstone. This facies is rich in foraminifera	D	
3200-3300	This facies is predominantly of sand/shale intercalation with a siltstone unit. It is basically devoid of foraminifera	E	

3.2 Micropaleontologic analysis

Micropaleontological (foraminieral) analysis of seventy one (71) ditch cutting samples from "K27" well (interval 2590m-3300m) was carried out at 10m interval. The foraminiferal assemblage recovered was relatively high throughout the well section except for some barren areas especially at the top and bottom of the well and also at the intervals (297om-2940m) and (3030m-3050m) respectively. (fig.3)

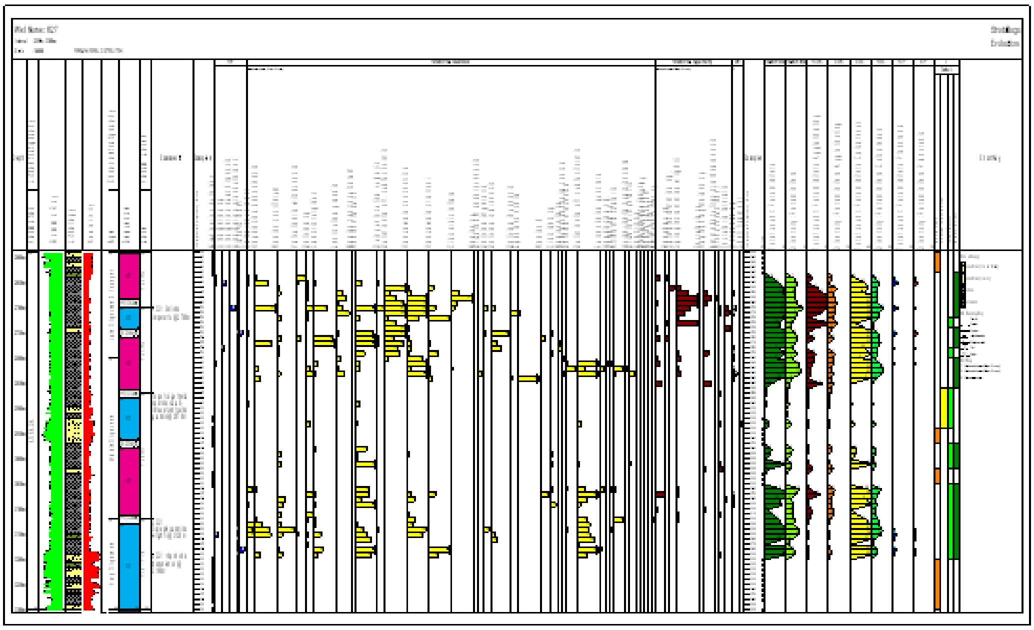

Fig. 3. Biostratigraphic chart of well "K27"

A total count of two thousand three hundred and ninety three (2,393) foraminifera specimens were identified. Out of this number, two thousand three hundred and seventy five (2,325) are benthics representing 99.25% of the total number of foraminiferal species while the planktonic foraminifera were 16 (sixteen) only constituting 0.25 (fig. 4a and 4b).

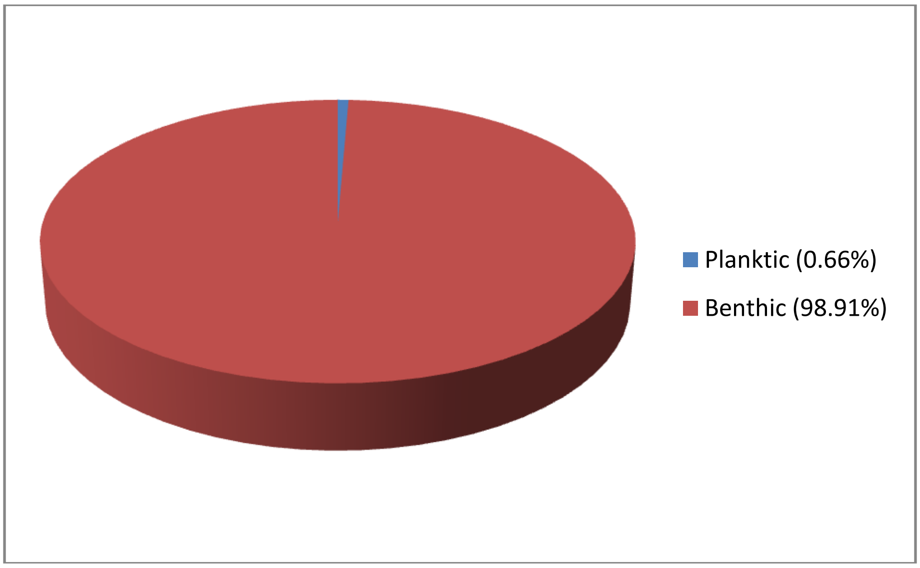

Fig.4a: Pie chart showing foraminiferal types in K27 well.

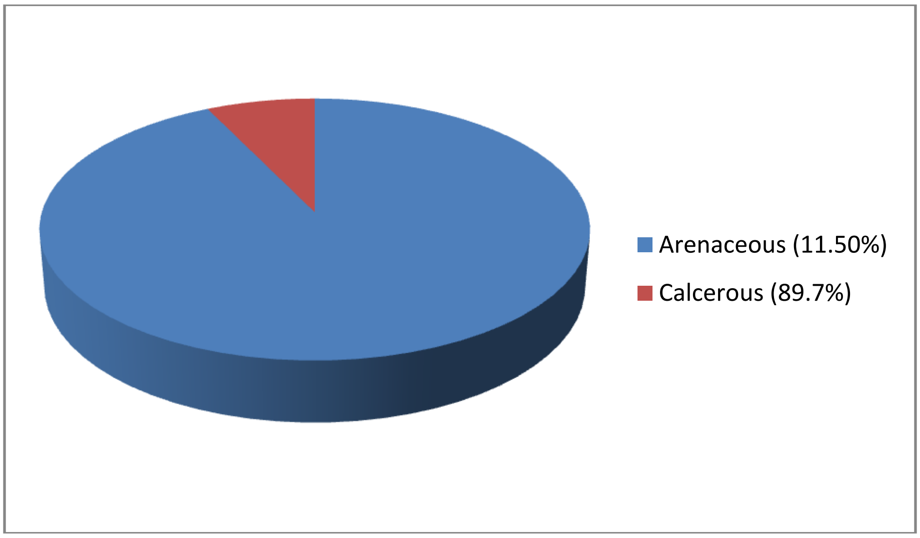

Fig. 4b: Pie chart showing Benthic foraminiferal

3.3 Paleoenvironmental analysis of well "k27" well

A detailed Paleoenvironmental analysis of the sediments penetrated by "k27" well was achieved using a multi-disciplinary approach. This involved the integration of biofacies, wireline log and lithologic data. Micropalaeontology requires the use of fossil benthonic foraminera to determine paleoenvironmental conditions prevalent on the seabed at the time of deposition of marine sedimentary rocks (Wilson, 2005). The whole foraminiferal assemblages constituting of planktics and benthics may be used to infer the paleobathymetric trends. Foraminiferal species diversity is assumed to increase with increasing water depth in the shelf areas (Gibson and Buzas, 1973). Planktonic percentage of foraminiferal assemblages is generally correlated with water depth however, factors such as fresh water inflow, differential preservation of planktonic taxa, (reworked and transported), up-welling, the quantity of variation on benthics at different seabed and depth may vary from one area or time to another (Wilson, 2005).

These factors affected the distribution of foraminiferal in well "K27". The deductions obtained from the paleobathymetric setting in well 'k27" are presented in table 2 and involved the following:

1. Determination of the ratio of benthic calcareous foraminifera to benthic arenaceous foraminiferal (Obaje *et al* 2004). This percentage increases with water depth (%FOBC:FOBA).
2. Determination of the tau value using Tau value (u) =%P X number of benthics (Murray, 1991) Tau value increases with water depth.
3. Determination of water depth using D=e (%p+81.9)/24 (De Rikj *et al*, 1999) where D=water depth.

Obtained results from the analysis of well "K27" suggested paleoenvironment ranging from distributary channels fill to delta front. The paleo- water depth was inferred to range from non-marine to middle Neritic (Fig. 3 and Table 2). The deductions of these depositional settings are presented below.

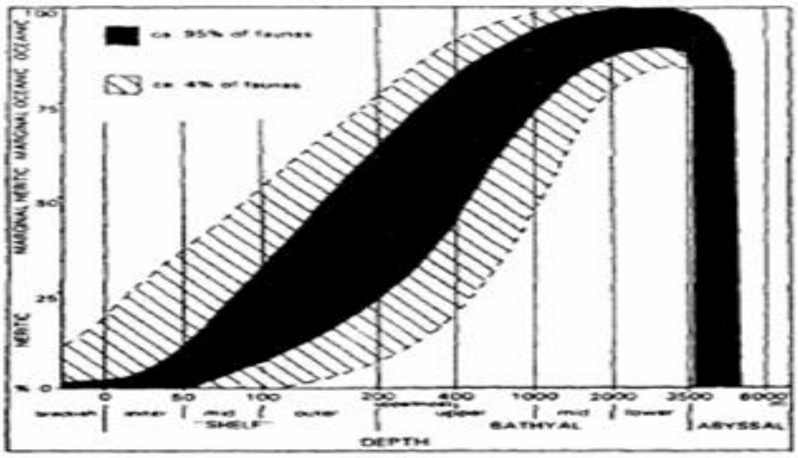

Fig. 5. Variation in the ratio of planktonic to benthonic foraminera with depth (from Hayward,.1990).

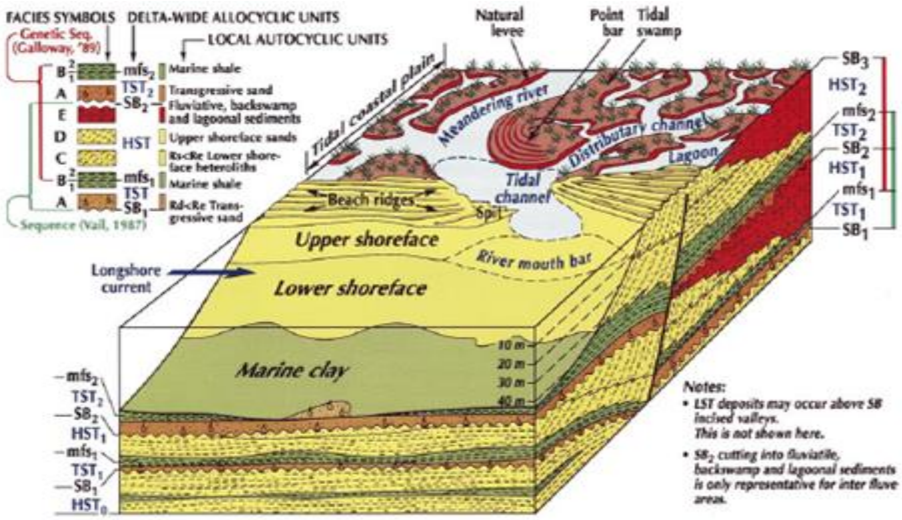

Fig. 6: Geomorphology, cyclic sedimentation and an active fault in the Tertiary Niger Delta.

Interval: 3200m – 3300
Paleobathymetry: Non-Marine
Paleoenvironment: Distributary channel fill.

This interval is completely barren of foraminifera. It consists basically of shale and sandstone intercalations. It covers part of the trangressive system tract, which is the oldest unit in 'K27' – well. The high resistivity kick is indicative of a possible hydrocarbon accumulation; it also has a high gamma ray kick. The sandstone intercalations in shale could serve as good reservoirs and the shale could make good seals, so this interval could possibly be hydrocarbon bearing. The aggrading log display on the gamma ray log is suggestive of a distributary channel fill paleoenvironment. (Onyekuru *et al.*, 2012).

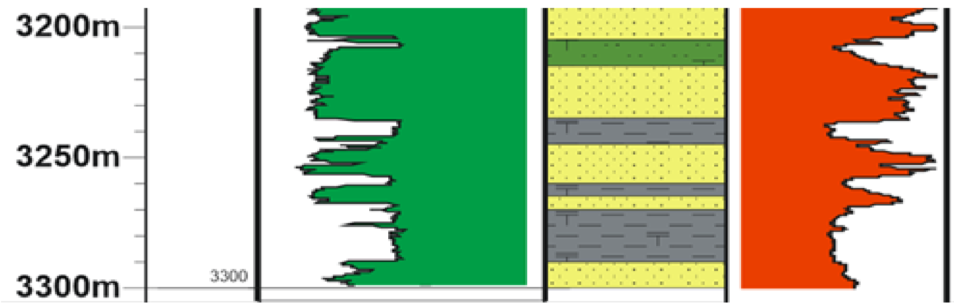

Fig. 7: Log signature of interval 3200m – 3300

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 3050m-3200m
Palelobathymetry: Inner neritic-middle neritic
Paleoenvironment: distributary channel fill.

This interval is characterized by a high abundance/diversity of foraminifera taxa. Planktic percentage in this interval is about 0.68, this is low and is indicative of a shallow water paleoenvironment because fewer planktics tend to settle in shallower environment like the shelf and more planktic tend to settle in deeper water. The tau values is about 67.3 which is relatively low and the further indicates an inner neritic-Middle neritic setting since tau values increases with water depth (Murrary, 1991).

The ratio of FOBC to FOBA ranges from 93.02-6.695. This is equally indicative of an inner neritic-middle neritic since the percentage ratio of Benthic calcareous foraminfcfera to Benthic arenaceous foraminifera increases with water depth (Obaje *et al*, 2004).

The foraminaferal assemblage has a low planktic foraminiferal abundance/diversity though *Globigerina praebulloides, Globigerina bulloides* and planktic indet were recovered. The benthic calcareous taxa in this interval include a high abundance of *Noninella auris, Buliminella. aff. subfusiformis, Hanzawaia concentrica, Nonion costiferum, Hopkinsina bononiensis*. Abundance of *Hanzawaia strattoni, Bolivina sp, Cancris turgidus,* *Altistoma scalaris, Nonion sp., Bolivina imperatrix, Bolivina isidroensis, Cibicides sp, Fursenkoina punctata, Ammobaculites sp., Spiroplectammina wrightii, Haplophragmoides sp., Textularia lateralis.*

Among these forms, *Nonion costiferum, Nonionella auris, Hanzawaia strattoni, Hopkinsina Bonnoiensis, Spiroplectammina wrightii* and *Textularia lateralis* are indicative of an inner neritic-middle neritic paleobathymetry (Okoson & Chukwu, 2012).

The aggrading pattern on the resistivity and the Gammaray log suits are indicative of a distributary channel fill (Onyekuru *et al.*, 2012).

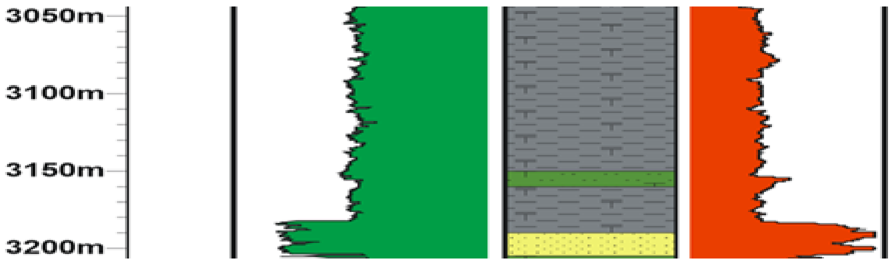

Figure 8: Log signatures for interval 3050m – 3200m

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 3010m-3050m
Paleobathymetry: Non-marine
Paleoenvironment: Distributary channel fill.

This interval is completely barren of foraminifera. It is part of the high stand systems tract that overlies the oldest unit in well "K27". It consists of shale with a sandstone intercalation. This interval could be hydrocarbon bearing because the sandstone unit could serve as a reservoir while the shale could serve as seal, the spike in the Gamma and resistivity log suite could also be indicative of a hydrocarbon accumulation.

The aggrading pattern on the Gamma and resistivity log suit indicates a distributary channel fill. (Onyekuru *et al.*, 2012).

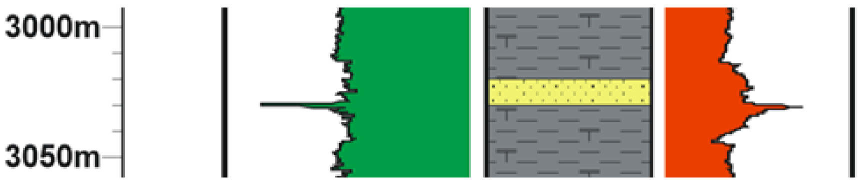

Figure 9: Log signatures for interval 3010m – 305

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 2970m-3010m
Paleobathymetry: Inner neritic-middle neritic
Paleoenvironment: Distributary channel fill.

This interval is characterized by a low abundance/diversity of foraminifera taxa planktic percentage in this interval is zero (0%). This infers a shallow water environment because planktics percentage increases as depth increases (Murray, 1991). The tau value is zero (0) as well; this further infers an inner neritic-middle neritic paleoenvironment though the complete absence of planktics could be as a result of sediment supply. The ratio of FOBC to FOBA ranges from 89.89-10.24. This infers an inner neritic-middle neritic paleoenvironment since the ratio of benthic calcareous foraminifera to benthic arenaceous foraminifera increases with water depth (Obaje *et al.*, 2004) (Fig .5).

The benthic calcareous taxa in this interval include *Nonion costiferum, Nonionella auris, Hanzawaia concentrica, cibicides sp., Buliminella aff. subfusiformis, Brizalina imperatrix, Quinqueloculina sp., Ammobaculites sp., Haplophragmoides sp.* and some arenaceous indet, amongst these forms *Nonion costiferum, Nonionella auris, Hanzawaia concentrica* and *Quinqueluculina sp.* are indicative of inner neritic-middle neritic paleoenvironment (chukwu *et al.*, 2012).The aggrading pattern on the gamma ray log suit infers a distributary channel fill paleoenvironment (Onyekuru *et al.*, 2012).

FIGURE 10: Log signatures for interval 2970m – 3010m

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 2930m-2970m
Palaeobathymetry: Non-marine
Paleoenvironment: Regressive to trangressive shore face delta.
This interval is barren of foraminifera. The lithology is basically a sandstone unit; The prograding and retrograding pattern on the gamma ray log suit infers a regress delta (Onyekuru *et al.*, 2012).

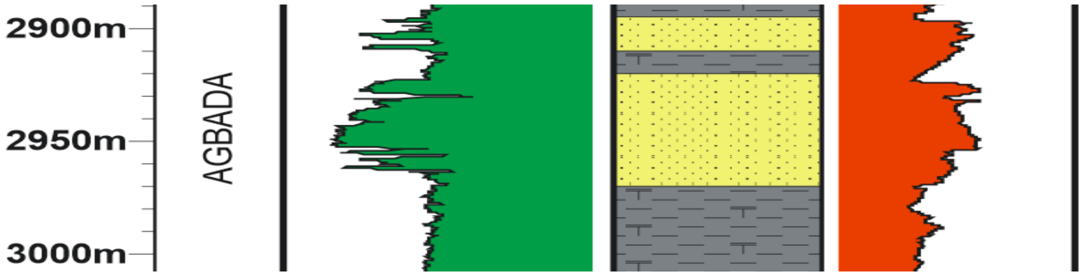

FIGURE 11: Log signatures for interval 2930m – 2970m

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 2850m-2930m
Paleobathymetry: Shallow inner neritic-inner neritic
Paleoenvironment: Distributary chanel fill.

This interval shows a major decrease in abundance and diversity of foraminifera taxa. it is almost barren of foraminifera taxa. Agglutinated species with simple wall structure such as *Textularia lateralis, Ammobaculites sp, Quinqueloculina sp* are common foraminifera species in this sub environment (Boersma, 1978), other foraminifera recovered include *Nonionella auris, Eponides eshira, Cancris sp., Buliminella off. subsiformis*, and *Bolivina sp.* Tau values are basically zero (0) and the ratio of FOBC-BOBA is 77.8 -19.6,this values are in order because the ratio of FOBC:FOBA increases with depth (% FOBC:%FOBA of Obaje *et al.*, 2004) (fig. 5). The presence of a sandstone unit in this interval gave rise to an aggradational sequence as indicated in the gamma ray log and corresponding kick in the resistivity log, this infers a distributary channel fill paleoenvironment (Onyekuru *et al*, 2012)

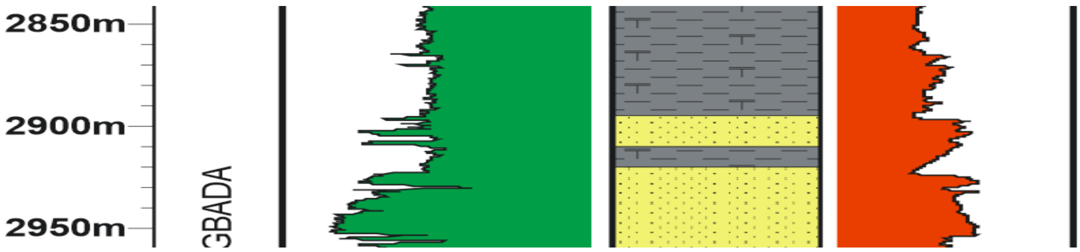

Figure 12: Log signatures for interval 2850m – 2930m

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 2800m-2850m
Paleobathymetry: Middle neritic
Paleoenvironment: Distributary chanel fill.

This interval shows an increase in foraminiferataxa.The calcareous forms present in this interval include *Hazawaia concentrica, Buliminella aff. subfusiformis, Eponides eshira, Nonionella auris, Lenticulina grandis, Cancris turgidus, Bolivina sp, Nonion costiferum, Hospkinsina bononiensis, Hanzawaia strattoni, Cibicorbis inflata, Brizalina mandoroveensis, Pseudonosaria conica, Bolivina miocenica, Fursenkoina punctata, Uvigerina sp, Altisoma scalaris, Uvigerinella sparcostata, Brizalina imperatrix*. Among this forms

Nonionella auris, Hanzawaia strattoni, Eponides eshira, Hopkinsina bononiensis, are indicative of the middle neritic paleoenvironment (Okosun and Chukwu, 2012).

Arenaceous foraminifera present *include spiroplectammina wrightii, Haplophragmoides sp, Textularia lateralis, Ammobaculites sp.* and some arenaceous indet. There is also the presence of some ostracod species. Among these forms *Spiroplectammina wrightii* indicates a middle neritic paleoenvironment (Okosun and Chukwu, 2012; Chukwu *et al.*, 2012; Renz, 1948).

The planktic percentage here is 0.37 which is low and this further suggests a shallow paleobathymetry. The tau, values is approximately 98.8. This is as a result of the low planktic percentage, the low planktic percentage and tau values are both indicative of a shallow paleoenvironment, because tau values and planktic foraminifera abundance varies with depth (Murray, 1991).

The ratio of FOBC to FOBA which ranges from 89.84-10.11 is also in line with the paleobathymetric interpretation because the ratio FOBC: FOBA has been known to increase with depth (Obaje *et al.*, 2004). This interval has a monolithic lithofacies basically composed of shale. The cylindrical shaped log display on the gamma ray log suggest a distributary channel fill paleoenvironment (Onyekuru *et al.*, 2012)

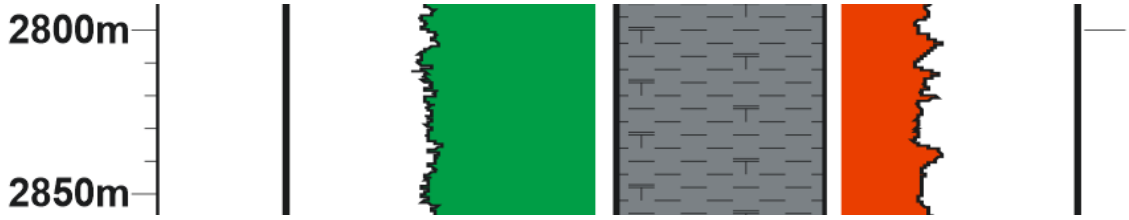

Figure 13: Log signatures for interval 2800m – 2850m

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 2780m - 2800m
Paleobathymetry: Inner neritic
Paleoenvironment: Distibutary channel fill.

The foraminifera taxa recovered from this interval were relatively sparse. The calcareous forms present include: *Hanzawaia concentrica, Hopkinsina bononiensis, Globigeria sp, Nonion costiferum, Lenticulina grandis, Nonionella auris, Buliminella aff. subfusiformis, Hanzawaia strattoni* and *Bolivina isidroensis,* these forms are indicative of a shallow paleoenvironmental setting.

The arenaceous forms *Haplophragmoides sp, Spiroplectammina wrightti* and *Ammobaculites sp.* were recovered from this interval and they are suggestive of an inner neritic paleobathymmetry this is in line with the work of Boersma (1978) who recorded agglutinated species with simple wall structures in this subenvironment.

The planktic percentage in this interval is approximately 0.32%, this infers an inner neritic paleobathymetry since planktic percentage increases as depth increased (Murray, 1991). The tau value is approximately 100 which is not high and corresponds to the paleobathymetry assigned to this interval, since tau values is known to increase with depth (Murrary, 1991).

The ratio of FOBC to FOBA is 94.36-5.34, this indicates very shallow water because the ratio of FOBC-FOBA increases with depth (%FOBC:%FOBA of Obaje *et al.*, 2004). The lithology is basically shale. The cylindrical log pattern on the gamma ray log suggests and distributary channel full paleoenvironment (Onyekuru *et al., 2012).*

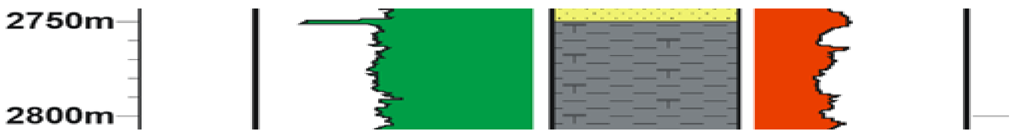

Figure 14: Log signatures for interval 2780m – 2800m

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 2740m - 2780m
Paleobathymetry: Middle neritic
Paleoenvironment: Distributary channel fill.

This interval has abundance of some benthic calcareous foraminiera taxa. They include *Buliminella aff. subfusiformis, Nonionella auris, cancris turgidis,* others include *Hopkinsima bononiensis, Nonion costiferum, Lenticulina grandis, Valvulineria wilcoxensis, Hanzawaia concentrica, Hanzawaia strattoni, Bolivina Isidroensis, Nonion 8,cibicides sp,* amongst these forms *Hopkinsina bononiensis, Hanzawaia strattoni, Nonion* *costiferum* and *Lenticulina grandis* are indicative of a middle neritic paleobathymetry (Okosun & Chukwu, 2012).

The Arenaceous foraminifera taxa in this interval include *Ammobaculites sp, Textularia lateralis, Haplophragmoid. es sp, Reophax sp,* these forms are suggestive of a shallow paleobathymetry (Boersma, 1978).

The planktic percentage in this interval is approximately 0.425 and tau value is approximately 150, which are relatively low, these values are consistent with the paleobathymetry assigned to this interval because planktic percentage and tau values increases with depth (Murray, 1991).

The ratio of FOBC to FOBA which ranges from 89.9-9.9 is consistent with the paleobathymetry assigned to this interval because the ratio FOBC: FOBA has been known to increase with depth (Obaje *et al.*, 2004). This interval is mainly composed of shale but a sandstone unit occurs at the top of this interval. The kick at sandstone unit on the gamma ray log could be indicative of hydrocarbon. The cylindrical log display on the gamma ray log suit is consistent with a distributary channel fill paleoenvironment (Onyekuru *et al.*, 2012).

Figure 15: Log signatures for interval 2740m – 2780m

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 2720m - 2740m
Paleobathmetry: Inner neritic
Paleoenvironment: Distributary channel fill.

The foraminifera taxa recovered from this interval is relatively of low abundance and diversity, the forms recovered include: *Nonion costiferum, Bolivina sp, Lenticulina grandis, Nonionella auris Buliminella aff. subfusiformis, Hanzawaia concentrica, Hanzawaia strattoni* and *Nonion sp.* Amongst these *Nonionella auris, Nonion costiferum* and *Hanzawaia strattoni* are indicative of a shallow paleobathymetry.

The agglutinating foraminifera taxa present in this interval include *Ammobaculites sp, Reophax sp., Spiroplectammina wrightii, Ammobaculites strathearnensis, Textularia latelaris* and some Arenaceous indet Boersma, (1978) reported similar agglutinated species with simple wall structure from the inner neritic subenvironment. The planktic percentage in this interval is 0.63%, the tau value is approximately 199, which are low, these values are consistent with Murray (1991), who reported that planktic percentage and tau values increases as depth increases.

The ratio of FOBC to FOBA varies from 85.44-14.46, this is in line with the Paleobathymetric interpretation for this interval because according to Obaje *et al.* (2004) the ratio of FOBC to FOBA increases with depth. This interval consists mainly of shale. The cylindrical log display on the gamma ray log suggests a distributary channel fill
paloenvironment (Onyekuru, 2012).

Figure 16: Log signatures for interval 2720m – 2740

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 2630m - 2720m
Paleobathymetry: Middle neritic
Paleoenvironment: Distributary channel fill.

This interval has a high abundance and diversity of calcareous foraminifera taxa. These forms include calcareous benthics such as *Hopkinsina bononiensis, Nonion costiferum, valvulineria wilcoxensis, Bolivina sp, Cancris turgidus, Lenticulina grandis, Nonion centrosulcalum, Nonionella auris, Quinqueloculina vulgaris, Buliminella aff. subfusiformis, Hanzawaia concentrica, Hanzawaia strattoni, Cibicobis inflata, Brizalina mandoroveensis, Bolivina imperatrix* and *Bolivina isidiroensis*. Amongst these forms *Hopkinsina bononiensis*, *Nonion costiferum*, *Hanzawaia strattoni* and *Lenticulina grandis* are indicative of the middle neritic paleobathymetry (Okosun & Chukwu, 2012; Chukwu *et al.*, 2012).

This interval also has a high abundance of arenaceous foraminifera especially *spiroplectammina wrightii*, this taxon is indicative of the middle neritic paleobathymetry (Okosun & Chukwu, 2012; Chukwu *et al.*, 2012; Renz,1948), other arenaceous taxa recovered in this interval include *Ammobaculites*, *Reophax sp, Textularia sp, Haplophragmoides, Ammobaculites strathearnensis, Textularia lateralis,* Arenaceous indet and some ostracod species.

The planktic percentage is approximately 2.88 in this interval while the tau value is approximately 237. These values are consistent with the middle neritic paleoenvironment assigned to this interval because according to Murray (1991), tau values and planktic percentage increases with depth.

The ratio of FOBC to FOBA ranges from 74.63 - 18.7, this is consistent with the designation of middle neritic paleoenvironment for this interval, based on the work of Obaje *et al*. (2004).

This interval is basically composed of shale with a siltstone unit at the top. The gamma ray log display is cylindrical suggesting a distributary channel fill (Onyekuru *et al.,* 2012).

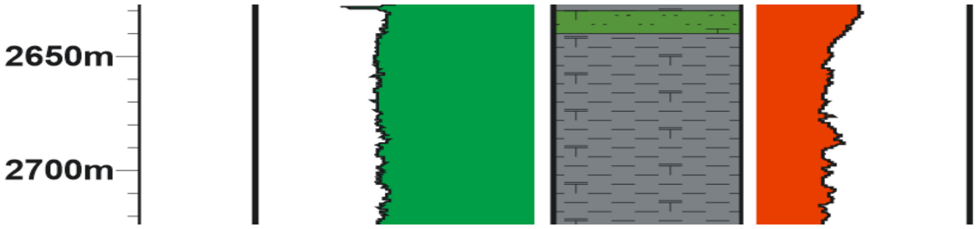

Figure 17: Log signatures for interval 2630m – 2720m

Legend
Green: Gamma ray log
Red: Resistivity log

Interval: 2590m-2630m
Paleobathymetry:Non marine
Paleoenvironment: Distributary channel fill/Delta front

This interval of well "k27" is basically barren of foraminifera taxa. The 2680m depth is marked by a sillstone and shale intercalation. The kicks on both the gamma and resistivity logs are indicative of a possible hydrocarbon accumulation in the sandstone units because they could serve as good reservoirs while the shales serve as good seals. The aggrading/prograding log display on the gamma ray log is indicative of a distributary channel fill/delta front paleoenvironment (Onyekuru *et al.,* 2012).

Figure 18: Log signatures for interval 2590m – 2630m

Legend
Green: Gamma ray log
Red: Resistivity log

IV. Conclusion

Paleoenvironmental analysis of well "K27" (interval 2590m-3300m) in the Niger Delta was carried out using a multi-disciplinary approach which included the use of well logs, lithologic and biostratigraphic techniques.

This methodology revealed that the sediments penetrated by well K27 were basically of distributary channel, regressive to transgressive shore face delta and delta front paleoenvironments. Four (4) paleobathymetric zones were delineated in the studied well and these include; non-marine, shallow inner neritic, inner neritic, and middle neritic

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