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Forensic Palynological Data Acquisition for Niger Delta, Nigeria.

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ABSTRACT

Palynological Baseline data acquisition for superficial sediments were carried out within the parts of Delta State in the area bounded by Longitudes 6.49E and 8.33E and latitudes 4.47N and 8.35N for the purpose of forensic studies. The study area comprises Ogharefe, Otefe , Otuamara IbabaLume Town Amukpe, Amuokpokpo,Agbarha Ughelli, Ughelli ,Afiesere, Orogun, Owheru Town Avwon, Ogode Town Oguname Agoloma,Samples collected comprising of sandstone, siltstone and shale across a geographic spread from north to south. The palynomorphs recovered consist of *Delitschia sp ,Polyporisporites sp Psilastephanocolporites sp ,Brachysporisporites sp (1), Stereisporites sp, Octosporites sp, Lycopodiumsporites sp,Hypoxylonites sp Psilatricolpites sp, Aletesporites sp,.e.t.c* The identification of these palynomorphs helped to generate palyno-geographic distribution chart of different palynomorph groups giving credence to a robust data bank for forensic studies in the study area.

INTRODUCTION

Studies of palynomorphs trapped in material criminal or civil investigations are slowly gaining recogrution as valuable forensic techniques. Today, the country of New Zealand leads the world in the use of forensic palynology, and in the acceptance of this type of evidence in courts of law. To illustrate how important and diverse forensic palynology has become, we have successfully conducted research to a generate a data bank of for forensic studies in Delta State. In most of cases the palynomorph data were an important factor in either solving the case, or they were used to identify and link a suspect to the scene of a cnme.

Pollen and spore production and dispersion are important considerations in the study of forensic palynology which is the core focus of this research work. First, if one knows what the expected production and dispersal patterns of spores and pollen (called the pollen rain) are for the plants in a given region, then one will know what type of "pollen fingerprint" to expect in samples that come from that area.

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Therefore, the first task of the forensic palynologist is to try to find a match between the pollen in a known geographical region with the pollen in a forensic sample. Knowledge of pollen dispersal and productivity often plays a major role in solving such problems..

It is on record that the palynological data acquisition for forensic studies is yet to kick-off in Nigeria. It is on this basis that the Researchers deemed it fit to kick start the data acquisition for forensics studies Therefore, this study presents palynological data acquisition for forensics studies in part of Delta Stete

SIGNIFICANCE OF THE STUDY The outcome of this study will help to generate a palynological data base/bank for forensic studies in Delta State which hither to was not available

LOCATION AND ACCESSIBILITY OF THE STUDY AREA

The coordinates of the study areas range from latitudes 005^0 68 01.1 N and 05^0 15' 21.9" and longitudes 005^0 40' 56.3 "N and 006^0 01' 13 .5" N. The area of study covers some parts of Delta State. The are Ogharefe, Otefe,Otuamara IbabaLume Town Amukpe, Amuokpokpo,Agbarha Ughelli, Ughelli ,Afiesere, Orogun, Owheru Town Avwon, Ogode Town Oguname and Agoloma. **See Table 1**

(II) METHODOLOGY

(A) SAMPLE COLLECTION

The field work was carried out with the aid of some basic instruments such as road map, Global Positioning System (G.P.S), digital camera, marker, field notebook, pencil, eraser, masking tape, sample bags (used to collect samples from different locations). Hand auger and hand trowel was used to collect both surface and sub-surface samples (few meters deep). Samples were collected using the "pinch" method (Adams and Mehringer, 1975): collecting 10 pinches of soil throughout each sampled locations of about 50 to 100 square meters (Table 1). These pinches were combined into a single, sterile, plastic bag and then sealed. Multiple pinches from each sample area were combined to prevent the possibility of over-representation of a single pollen type.

Table1: : Sample Number, Towns and GPS Readings

Sample No.	Towns	Latitude	Longitude
1	Ogharefe Delta State)	05°58′01.1″N	005°40′56.3″E
2	Otefe, (Delta State)	05°53 19.3″N	005°40′47.7″E
3	Otuamara (Delta State)	05°55′35.3″N	005°41′47.8″E
4	Egbeku (Delta State)	05°54′26.6″N	005°42′47.6″E
5	Ibaba Lume Town (Delta State)	05°47′03.1″N	005°44′09.3″E
6	Amukpe (Delta State)	05°30′34.7″N	005°45′34.5″E
7	Amuokpokpo (Delta State)	05°30′45.7″N	005°45′38.5″E
8	Agbarha Ughelli (Delta State)	05°30′34.7″N	005°45′36.8″E
9	Ughelli (Delta State)	05°30′24.8″N	006°00′14.5″E
10	Afiesere (Delta State)	05°29′13.0″N	006°05′14.8″E
11	Orogun (Delta State)	05°30′52.0″N	006°07′46.9″E
12	Owheru Town (Delta State)	05°31′34.1″N	005°59′54.4″E
13	Avwon (Delta State)	05°32′12.6″N	005°04′15.9″E
14	Ogode Town (Delta State)	05°26′31.9″N	005°56′54.5″E
15	Oguname (Delta State)	05°10′21.8″N	006°04′31.2″E
16	Agoloma (Delta State)	05^0 02′ 11.3″ N	006^0 00 12.1 “E

The samples collected from different locations were well-labelled with sample and location number and then kept in a sample bag. The hand auger and hand trowel were washed thoroughly with water to ensure samples remain contamination-free (Bryant *et al*., 1990) through all stages of collection and storage until the analysis are over. It is also necessary to note that samples were collected from fresh and undisturbed sediments that has not experienced bush burning, farming or contains construction materials

(B) PALYNOLOGICAL SLIDE PREPARATION

The procedure is as follows;

- 16 Samples were prepared for Paly slides
- 5 gram of each sample was placed in a labeled cup in which 100ml of 70% hydrofluoric acid (HF) was added with the aim of separating the palynomorphs from the other rock debris by digesting the silica in sample.
- Samples were then washed and the slides prepared. A portion of the kerogen was mixed with 0.1% PVA solution, pipette onto a cover slip and allowed to dry
- The remainder of the kerogen was sieved at 20µ.
- Cover slip was then mounted on a labeled glass slide using two drops of the Norland optical adhesive.
- Resulting suspension was pipetted on a microscope glass slide, place on a hot plate and gently dried.
- The slides were properly labeled and observed under research microscope through which snapshot was taken.
- Prepared slides were examined under transmitted light microscope at x1000 magnification.
- Detailed identification (to species level where possible) was made by consulting the Published monographs works on palynomorphs.

(III) RESULTS AND DISCUSSION

Palynological Analysis of the samples from the various locations yielded pollen, spores, dinoflagellate and their numerical count and percentage distribution are presented in Table 1 to

Photo graph of sampled locations are shown on plate 1 to while the Photographs of the different palynomorphs encountered are presented in Plate 1---- the. GPS Location of the study area superimposed on palynomorphs percentage distribution charts and as a result Palyno-geographic disribution chart were generated. Interpretation are based on the Scheme of Sowunmi (1981) Germeraad et al (1968), Oloto,(1994)

(ii) LITHOLOGY DESCRIPTION

The lithological and textural characteristics of the samples collected were by the use of hand lens and physical examination. The samples collected were characterized by sandstone and siltstone, with the sand grains exhibiting fine to coarse grained size. They were well to moderately sorted with minor rootlets. The sand grains range from sub-angular to sub-rounded and light

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to dark grey in colour. The siltstone contains a significant fraction of clay.

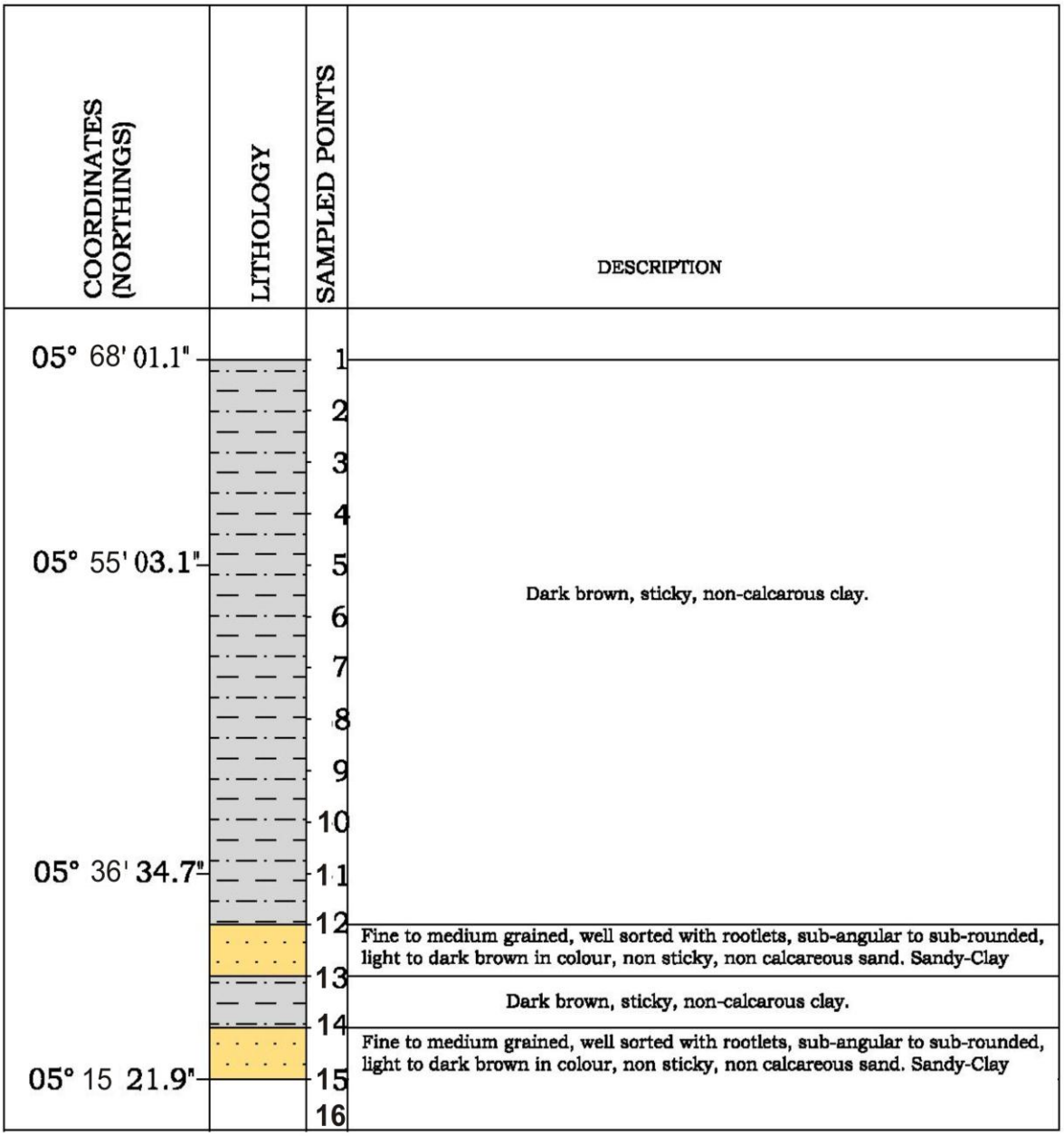


Figure 1: Lithology description of samples recovered in the study Area

(ii) PALYNOLOGICAL RESULT

The palynomorphs assemblage encountered in the study were composed of Pollen, Spores, Dinoflagellates, Foraminifera Test Lining, Algae and Diatom. The results of the palynological analyses of each location for the palynormophs identified with their individual counts are in given below..

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LOCATION 1

05°58′01.1″N 005°40′56.3″E



Pollen and spores*: Psilatricolporites sp (1), Involutisporonites,(1) Striadiporites reticulates , (1) Verrucatosporites sp(1),, Desmidiospora sp, (1) Monoporisporites sp(1), Zygnemasporites sp, (1) Cycadosporites sp, (1)Spirotremesporites sp, (1)Polyporisporites sp, (1) Tetradosporis sp, (1) Octosporites sp, (1) Selaginella myosurus, (1) Matonisporites(1)*

LOCATION 2 Otefe)

005°40′56.3″E005°40′56.3″E



Pollen and Spores: *Delitschia sp(1) ,Polyporisporites sp (2), Psilastephanocolporites sp(1) ,Brachysporisporites sp (1), Stereisporites sp(1), Octosporites sp(1), Lycopodiumsporites(1) spHypoxylonites sp (1), Psilatricolpites sp, (1) Aletesporites sp,(2) Striatricolpites catatumbus, (1) Hilidicellites teleutosporioides(1), Leiotriletes sp, (1), Didymoporisporonites poratus sp, (1) Spirotremesporites sp (1), Inaperturosporites sp(1)*

LOCATION 3

05°53 19.3″N005°41′47.8″E



Pollen and Spores *Spirotremesporitesspinosus (4), Fusiformisporites sp, (1) Psilatricolporites sp, (1), Striadiporites crucisstriatus, (1) ,Aletesporites clavatus, (1)Polyporisporites sp (1), ,Multiporisporonites sp (2), ,Spirotremesporites spinosus, (1) Cyathidites sp, (1) ,Rugulatisporites sp (2), ,Matonisporites sp, (1) ,Spirotremesporites sp,(2) Polyporisporites sp (1), Laevigatosporitesdiscordatus, (1) , Rivularia sp, ,Monoporisporites traversii (1),*

LOCATION 4;

05°54′26.6″N005°42′47.6″E



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Pollen and Spores *Spirotremesporites sp, (2) Retitriletas spinosa,(1) Striatricolpites-catumbus, (1) Verrucatosporites farvus, (1) Anthoceros psilate, (1)Pluricellaesporites cf alternate, (1) Monoporisporites sp, (1) Exisisporites sp, (1)Inapertisporites-nodulus, (1)Spirotremesporites-eminens, (1) Lycopdiumsporites sp, (1)*

LOCATION 5

005°44′09.3″E 005°44′09.3″E



Pollen and Spores: *Diporipollis melanii,(2) , Lycopodiumsporites sp,(3), Fungal hyphea, (2),Spirotremesporites eminens(1),, Involutisporites sp, (1), Monoporisporites trversii, (1), Inapertisporites clarkei, (2), Monosporites sp, (1),Trilete spore, (1)Striadiporites reticulates,(1),Sordariaceae sp, (1),Laevigatosporites discordatus, (1), Nympheapollis lotus, (1),Spirotremesporites cf eminens, (1),Monosporites lagenarius ,*

PERCENTAGE DISTRIBUTION OF PALYNOMORPHS

The distribution of palynomorphs varied considerably from one geographic location to another. The sampling points of the samples were arranged using their coordinates (latitudes) in a descending order, starting with the locations that have the highest latitude from North to South. It is important to note that the sampling was not done stratigraphically. Pollen and spores preservation was good in most of the samples and the microflora was rich and well-diversified.The summary of the percentage distribution of the various groups of palynomorphs as shown in Tables 1------ and are explained below

Numerical Count = Total number of each palynomorph group per sample.

Total Count = Sum total of all the numerical count per sample.

Percentage Count = $\frac{\text{Numerical Count}}{\text{Total Count}} \times 100$

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LOCATION 1

Sample 1 shows an abundance of pollen and spores which consists of 50% Pollen, 25% Spores, 5 % Dinoflagellate, 5% Acritarch, 5% Fungal spore and a low percentage of Diatom at 5%. The dominance of pollen and spores indicates a more terrestrial depositional environment.The presence of a few marine environment indicators in a pollen/spores dominated assemblage probably indicates infiltration of marine water into the terrestrial environment (Oloto, 2009).

Table 1: Percentage Distribution for Groups of Palynomorphs in Sample 1.

Group	Numerical Count	Total Count	Percentage Count (%)
Pollen	11	22	50
Spore	5	22	25
Dinoflagellate	1	22	5
Acritarch	1	22	5
Fungal spore	1	22	5
Foram linning	1	22	5
Diatom	2	22	5

LOCATION 2

Sample 2 is rich in palynomorphs as they are composed of 60% Pollen, 22% Spore, 10% fungal sporeand 8% acritarch.

Table 2 Percentage Distribution for Groups of Palynomorphs in Sample 2.

Group	Numerical Count	Total Count	Percentage Count (%)
Pollen	10	16	60
Spore	4	16	22
Fungal Spore	2	16	10
Acritarch	1	16	8

LOCATION 3

In sample 3 consist of 45% pollen, 40% spore 13% fungal spore, 5% dinoflagellate and 10% foram test lining. The dominance of pollen and spore indicate terrestrial depositional environment. The low number of chitinous foraminifer test lining probably indicates the

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environment of deposition was not favorable. Sample 3 is poor in palynomorphs but the numerical counts show that they are dominated by pollen and spore.

Table 3: Percentage Distribution for Groups of Palynomorphs in Sample 3

Group	Numerical Count	Total Count	Percentage Count (%)
Pollen	9	20	45
Spore	8	20	40
Fungal spore	1	20	5
Dinoflagellate	2	20	10

LOCATION 4

Fungal spore is highly present in this sample 14% Pollen, 29%, fungal spore, 28% Dinoflagellate, 30% and 14% acritarch. The abundance of the fungal spore/ Dinoflagellate implies deposition in a marine environment.

Table 4: Percentage Distribution for Groups of Palynomorphs in Samples 4

Group	Numerical Count	Total Count	Percentage Count (%)
Pollen	1	6	14
Fungal Spore	3	6	28
Dinoflagellate	2	6	30
Acritarch	1	6	14
Foram linning	1	6	14

LOCATION 5

The sample contains 46% pollen, 46% spore and 8% fungal spore. The sample contains an abundance of pollen and spore. The fungal spores indicate a swampy depositional environment.

Table 5: Percentage Distribution for Groups of Palynomorphs in Sample 5.

Group	Numerical Count	Total Count	Percentage Count (%)
Pollen	6	13	46
Spore	6	13	46
Fungal spore	1	13	8

DISCUSSION OF FINDINGS

PALYNOECOLOGICAL GROUPING: PALYNOGEOGRAPHIC DISTRIBUTION TREND

Some plants inhabiting specific environments tend to become genetically adapted to the environmental conditions such that they become more predominant than others (Nnamani and Agwu, 2008). Some plants also in habitat specific or are tolerant to a certain ecological site; they are seldom found elsewhere except in areas with the same or related ecological settings. Dieter and Heinz (1974) opined that the decline of such plants as a result of disturbances may alter the ecosystem. These disturbances may result from natural events such as draught, climate changes, volcanic activities, flood, diseases and wind.

The widely dispersed pollen and spores provide a broad picture of the surrounding vegetation of the areas in which they are produced. Some factors that aid in the dispersal are the size, shape and density of the pollen and spores, the position of the parent plants (that produce them) in the vegetation and the prevailing climatic conditions (Agwu, 2001). Vegetation is an assemblage of synusia existing together in a particular location that may be characterized by its component species or by combination of structural and functional characters, which characterize the appearance or the physiognomy of the vegetation.

The results of this study would provide baseline information on the forensic palynological data through conservation and sustainable exploitation of these indicator species through appropriate delineation of palynomorphs.in the study area

Samples obtained from Location 1- Ogharefe yielded abundant paylnomorphs,. The pollen assemblages gotten here include *Monoporites annulatus, Zonocostites ramonae, Retistepanocolpites gracillis, Elaeis guineensis, Echimonocolpites sp, Retitricolpites sp, Multitiareolites formosus, Magnaperiporites spinosus, Psilatriporites sp and Psilatricolpites opercatus.* The spores recovered here included; *Cyatheacidites sp, Laevigatosporites discordatus, Aletesporites sp, Trilete spore and Selaginella myosurus*, few acritarch, dinoflagellate and foram test lining were also present.

Location 3 samples obtained from Otumara village and yielded pollen such as *Gramminae cuticle, Zonocostites ramonae, Aletepollenites sp, psilastephanocolpites sp, Elaeis quineensis, psilamonocolpites,*

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Striatricolpites catatumbus, Nympheapollis clarus.

The samples collected in location 4 Egbeku located consist of spores which include *Stereisporites, Aletesporites* and *Trilete spore*. *Concentricyst circulus* was found here also along with very few fungal spores. Very few species of pollen was seen here. *Selenopemphix* and dinocyst indeterminate were the dinoflagellates present. Abundance of spores was seen in this sample.

Echitricolporites spinosus, Nympheapollis clarus, Peregrinipollis nigericus, Psilatriporites sp and Elaeis quineensis are the pollen assemblages represented in the samples collected from location 5 Amukpe. The spore's assemblages here include; *Laevigatosporites discordatus, Aletesporites sp, Trilete spore, Acrostichum aureum* and very *few fungal spores.*

From the Palyno-geographic disribution chart (Figure 3) it can be seen that Pollen terminates temporarily from Egbeku and reappears from Amukpe till Agoloma. There is abundance of acritarch from Ogharefe to Otumara, Some of these location is devoid of spores and pollens. This location falls in the Benin formation of the Niger Delta.

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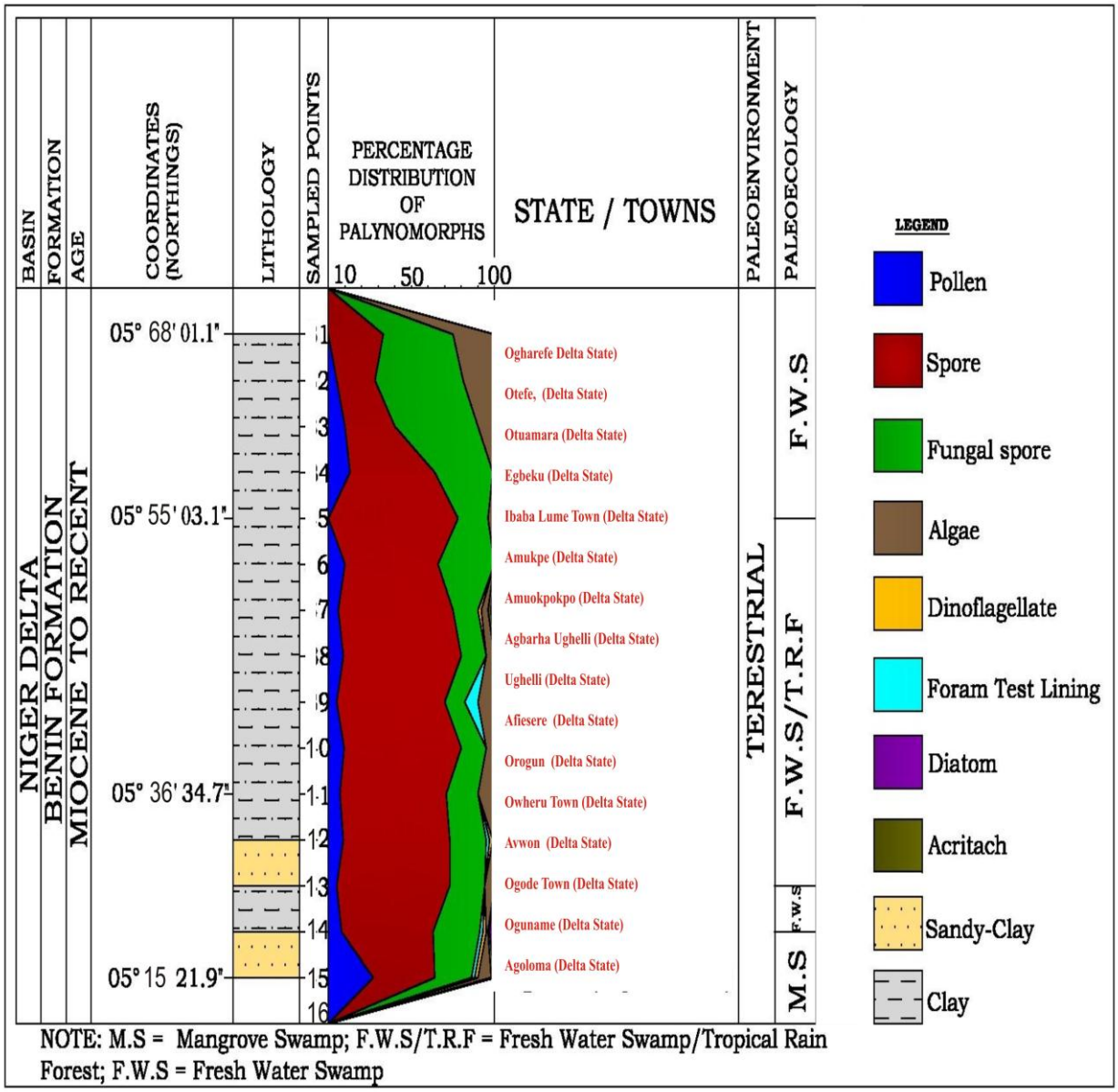


Figure. 3 Palyno-geographic distributution Chart showing the percentage distribution of various palynomorphs in the studied locations.

In this study, it was found that the pollen load of the entire study area varied quantitatively and qualitatively not only from locality to locality but also from one vegetation zone to the other. In the same way, similar palynological studies conducted in various parts of the world showed that there were variations of palynomorphs not only in vegetation zones concentration, but also locality to locality (Rogers and Levetin, 1998; Monlina *et al*., 2001; Njokuocha and Ezenwajiaku, 2010). According to Singh and Babu (1981) the major variation

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noticed in the palynomorphs counts (of families) and individual pollen types at different locality suggests that the concentration of palynomorphs is influenced not only by the meteorological factors, but is essentially a function of the frequency, density and abundance of plant species as well as their flowering behavior at a given locality. For instance, in this study, the higher values of *Elaeis guineensis*, *Poaceae*, *psilatricolporites crassus, echitriporites triangulisformis,, podoceiporites sp, , stereisporites sp, Echipriporites spinosus* pollen grains at location (Location 3) than at other sites may be largely due to the high density of these plants at these site than are present at other locations. The same explanation is applicable for the pattern of variation observed for other palynomorphs types in other locations in this study.

CONCLUSION

Accordingly, the most primary aim of this research work is to generate a baseline data of palynomorphs within the study area for forensic investigations in Nigeria. In this study, it was found that the palynomorphs load of the entire study area varied quantitatively and qualitatively not only from locality to locality but also from one vegetation zone to the other. In the same way, palynological studies conducted in various parts of the world also showed that there were variations of palynomorphs not only in vegetation zones concentration, but also locality to locality. The major variation noticed in the palynomorphs counts (of families) and individual palynomorphs types at different locality suggests that the concentration of palynomorphs is influenced not only by the meteorological factors, but is essentially a function of the frequency, density and abundance of plant species as well as their flowering behavior at a given locality.

Recommendations

The scope of this study covers Datat Aquisition for Forensic palynology of Delta State, It is recommended that a detailed state-wide/ regional data acquisition studies be carried out to give nation wide forensics palynological model of Nigeria. Such a model could be used to predict palynological flow attributes and regional variations for forensics studies.

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