ISSN: 2141 – 3290
www.wojast.com

MIOSPORE (POLLEN AND SPORE) BIOZONATION MODEL FOR LATE CRETACEOUS – TERTIARY SUCCESSION OF GBEKEBO-l WELL, BENIN FLANK, ANAMBRA BASIN NIGERIA.

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ABSTRACT: A detailed palynological study of ditch cutting samples of Gbekebo-l well was –carried out and the samples yielded dinoflagellate cysts, miospores, acritarchs and foraminifera test linings. On the basis of the first and last occurrences of the recovered miospore assemblages, a range chart was produced. The range chart has enabled the delineation of the age boundaries, which ranges from Maastritctian to Miocene. The chart has equally enabled the erection of a biozonation model for the miospore assemblages recovered within the succession of the well studied. A total of fourteen miospore biozones were erected based on the first and last occurrences *'of* two or more species. The biozones from bottom to the top of the succession are as follows: biozone A--- *Foveotriletes margaritae zone. B--Spinizonocolpites baculatus zone ,C---Ephedripites regularis zone, D---Mauritidites crassibaculatus zone,* E---*Verrucatosporites usmensis zone, F---Proxarpertites cursus zone,G---Spinizonocolpites echinatus zone ,H---Monoporites annulatus zone, I--Longapertites proxapertites zone, J---Retistephanocolpites williamsis zone,. K---Retitricolporites irregularis zone,* L--- *Pachydermites diedierixi zone,M---Retitriporites boltenhageni zone and N---Echitriporites trianguliformis zone* respectively.

INTRODUCTION

The research is aimed at identifying bio-events within the studied section of the well and use the data acquired to develop a miospore biozonation scheme of the late Cretaceous- Tertiary succession of Gbekebo-l well. The well is an exploratory well drilled by Shell-BP Petroleum Development Company of Nigeria. It is located within the Benin flank of Anambra basin in Southern Nigeria (Fig. 1)

Ditch cutting samples obtained from 34-35m to 998-999m depth intervals of the well were subjected to standard palynological processing technique. This involved the treatment of the samples with acids, oxidized, concentrated and then mounted on well-labeled slides. The samples yielded miospore assemblages, which has enabled the erection of a range chart. Fig.2. Interpretation of the stratigraphic distribution of the miospore species from bottom to top on the range chart helped in establishing a biozonation scheme for the interval studied, (Table 1).

GEOLOGIC SETTING

The Anambra Basin is a Cretaceous/Tertiary basin, which is the structural link between the Cretaceous Benue Trough and the Tertiary Niger Delta basin. Spatially, it is the Sedimentary wedge bordered by the Abakaliki anticlinorium to the East, the basement rock and the Benue hinge line to the north and northwest respectively.

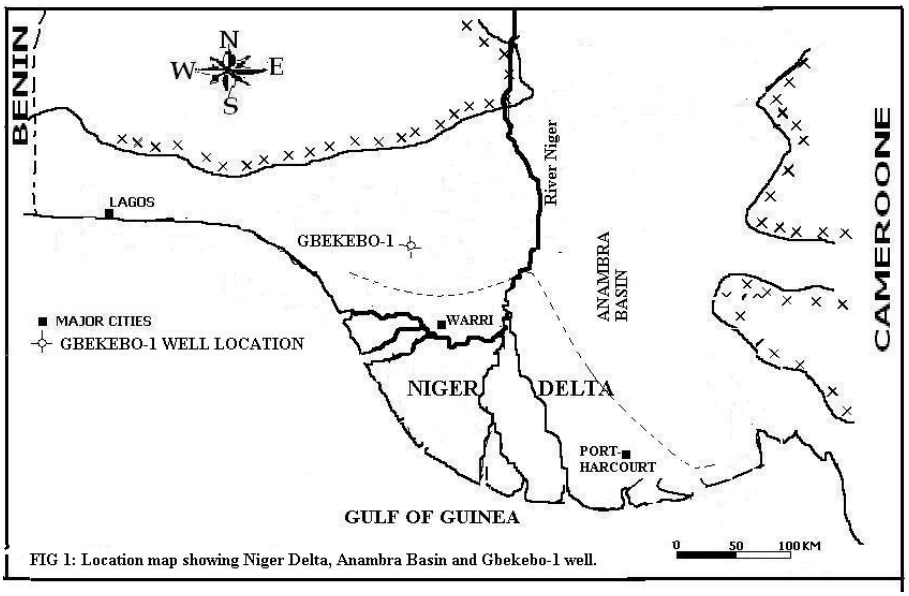


FIG 1: Location map showing Niger Delta, Anambra Basin and Gbekebo-1 well.

The basin originated as a fault-controlled depression within the Basement complex of the African shield. Structurally it is an interior fracture basin. Maximum sedimentation in the depression occurred in the Benue Trough and its enchelon equivalent, the Abakaliki trough. However, there was a structural inversion of the Abakaliki Trough during the structural movement of the Coniancian - Santonian times. This movement led to the formation of A depression on its two flanks. The small Afikpo syncline on the southeast and much wider Anambra basin on the Northwest (Cratchley and Jones, 1965; Reyment, 1965, Grant, 1971; Murat, 1972). Anambra Basin derives its sediments from the erosion of the Abakaliki anticlinorium, which had become the major site of deposition in the late Cretaceous-Eocene time.The southern part of the Anambra Basin is downwarped and overlapped by thick Tertiary deposits of the Niger Delta. .

RESULTS AND DISCUSSIONS

PALYNOSTRATIGRAPHY

Ranges of biostratigrahic significant taxa are shown for the Maastrichtian to Miocene. The zonal divisions recognized are based on the total cysts assemblage as presented on Figure 2. The zones are defined based on the use of the first and last occurrences of two or more species. In defining the assemblage zones, well-known species was used as the principal characteristic element. Though some less well known forms with precise stratigraphic ranges in the sequence studied were also used where appropriate.' The pollen and spore assemblage zones were compared with those of Germeraad *et al* (1968) (Table 2). A total of fourteen pollen and spore zones were delineated in this research.

MIOSPORE ASSEMBLAGE ZONES

The miospore assemblage zones start from bottom to top of the section of the well studied and they have been defined based on the first and last occurrences of two or more pollen and spore species, (Table 1)

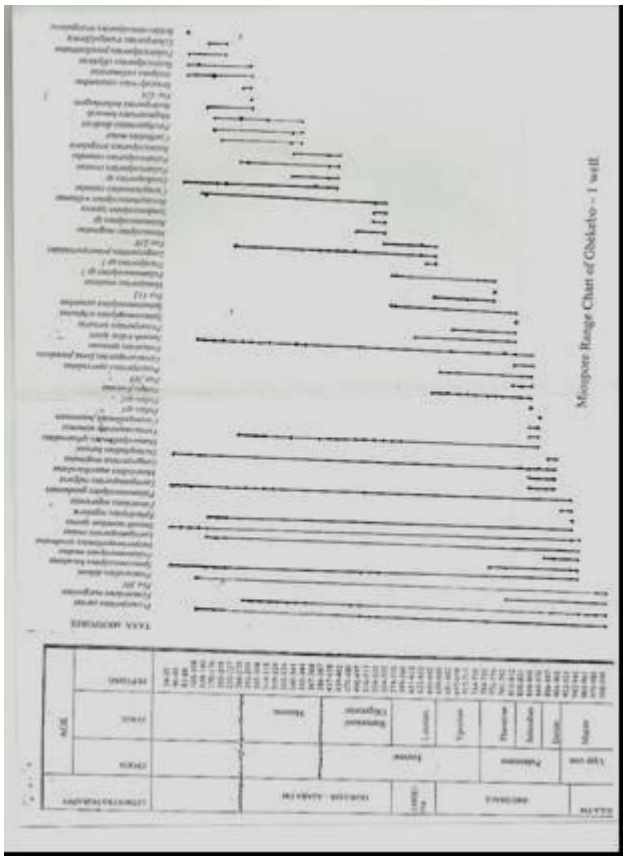
TABLE 1: MIOSPORE BIOZONATION OF GBEKEBO-1 WELL.

LITHOSTRATIGRAPHY	AGE: EPOCH	AGE: STAGE	DEPTH (M)	ZONE CODES	MIOSPORE ZONES
			14-35 46-49 85-88 105-108 108-111 138-140 170-176 205-208 233-237 305-308 314-318 319-324 332-336 340-341 343-344 367-368 386-387 437-438 459-462 474-480 496-497 516-517 534-535 554-555 574-575 599-560 611-612 622-623 641-642 659-660 681-682 697-698 716-717 735-736 754-755 773-774 791-792 811-812 830-831 844-845 869-870 886-887 904-905 923-924 942-943 960-961 979-980 998-990	N	*Echitriporites trianguliformis*
				M	*Retitriporites boltenhageni*
OGWASHI-ASABA FORMATION		Miocene		L	*Pachydermites diederixi*
				K	*Retitricolporites irregularis*
	EOCENE	Late Eocene/ Oligocene		J	*Retistephanocolpites williamsii*
				I	*Longapertites proxapertitoides*
AMEKI FM		Lutetian		H	*Monoporites annulatus*
IMO SHALE		Ypresian			
	PALEOCENE	Thanetian		G	*Spinizonocolpites echinatus*
				F	*Proxapertites operculatus*
		Selandian		E	*Verrucatosporites usmensis*
		Danian		D	*Mauritiidites crassibaculatus*
				C	*Ephedripites regularis*
NSUKKA FM	UPP CRET	Maastr		B	*Spinizonocolpites baculatus*
				A	*Foveotriletes margaritae*

TABLE 2: COMPARISM BETWEEN ERECTED BIOZONATION OF THIS STUDY AND OTHER ESTABLISHED ZONATION SCHEMES.

AGE	DEPTH(M)	ZONE CODES	DINOCYST ZONES THIS STUDY	Comparison with other established Biozonation schemes.
	14-35 46-49 105-108 108-111 138-140 170-176 205-208 314-318 319-324 340-341 343-344 367-368 386-387 437-438 459-462 474-480 496-497 516-517 534-535 554-555 574-575 599-560 611-612 622-623 641-642 659-660 681-682 697-698 716-717 735-736 754-755 773-774 791-792 811-812 830-831 841-845 869-870 886-887 904-905 923-924 942-943 960-961 979-980 998-990			
Lutetian		N	*Spinidinium mutus*	*Adnatosphaeridium* [illegible] zone (Williams and Bujak, 1977)
		M	*Polysphaeridium congregatum*	
Ypresian		L	*Spiniferites ramosus*	*Areoligera senonensis* Zone (Williams and Bujak, 1977)
Thanetian		K	*Apectodinium quinquelatum*	*Apectodinium hyperacanthum* Zone (Costa and Downie, 1976)
		J	*Deflandrea denticulata*	
		I	*Adnatosphaeridium vittatum*	
Selandian		H	*Fibrocysta lappacea*	
		G	*Apectodinium homomorphum*	
Danian		F	*Damassadinium californicum*	*Hafniasphaera cryptovesiculata* zone (Hansen, 1977)
		E	*Diphyes colligerum*	
Maastr.		D	*Palynodinium grallator*	*Palynodinium grallator* zone (Hansen, 1977)
		C	*Senegalinium microgranulatum*	
		B	*Svalbardella* sp	
		A	*Palaeocystodinium australinum*	

AGE	ZONES CODES	MIOSPORE ZONES THIS STUDY	Comparison with Germeraad et al (1968)
	n	*Echitriporites trianguliformis*	
	m	*Retitriporites boltenhageni*	
Miocene	l	*Pachydermites diederixi*	*Magnastriatites howardi*
	k	*Retitricolporites irregularis*	
Late Eocene Oligocene	j	*Retistephanocolpites williamsii*	
	i	*Longapertites proxapertitoides*	*Monoporites annulatus*
Lutet			
Ypres	h	*Monoporites annulatus*	
Than	g	*Spinizonocolpites echinatus*	*Retidiporites magdalenensis*
	f	*Proxapertites operculatus*	
Selan	e	*Verrucatosporites usmensis*	
	d	*Mauritiidites crassibaculatus*	
Dan	c	*Ephedripites regularis*	*Proteacidites dehaani*
Maastr	b	*Spinizonocolpites baculatus*	
	a	*Foveotriletes margaritae*	



Foveotrilletes margaritae zone -A
Reference section: 998 - 999 m.
Definition: The zone marks the base of the well. The zone is characterized by the first appearance of *Foveotriletes margaritae, Proxapertites cursus, Proteacidites dehaani.*

***Spinizonocolpites baculatus* zone -B**
Reference section: 942 - 943 m.
Definition: Base of the zone is the same as the top of zone a. The zone is marked by the first appearance of S*pinizonocolpites baculatus, Psilamonocolpites medius, Inaperturopollenites scrabratus, Leavigotosporites ovatus,* and *smooth monolete spores.*

***Ephedripites regularis* zone -C**
Reference section: 921 - 924 m.
Definition: Base of the zone is the same as the top of zone b. The zone is characterized by the first appearance of *Ephedripites regularis, Retidiporites magdalensis,Fitrotriletes nigeriensis, Laevigatosporites vulgaris.*

Mauriitidites crassibaculatus zone -D
Reference section: 886 - 887 m.
Definition: Base of the zone is the top of zone c. The zone is characterized by the first appearance of *Mauritidites crassibaculatus, Longapertites marginatus, Ditchtaphidites harassi, Monocolpollenites sphaeriodites.* Top of zone marks the last appearance of *Monocopollenites sphaeriodites.*

Verrucatosporites usmensis zone-E
Reference section: 844 - 845 m.

Definition: Base of zone is the top of zone d. The zone is characterized by the first appearance of *Verrucatosporites usmensis,Ccorsinipollenites jussiaensis, pollen sp* 1, *and pollen sp* 2. Species last occurring in this zone include *Dichtaphidites harassi, Retidiporites magdalensis.*

Proxerpertites operculatus zone -F
Reference section: 830 – 831 m.
Definition: Base of the zone is the top of zone -E. Zone is characterized by the first appearance of, smooth *Proxapertites operculatus, Verrucatosporites favus pseudosecondus, Fenestrites spinosus, Trilete spores, Nympa fruitinus.* Species last occurring in this zone include *Mauritidites crassjbaculatus.*

Spinizonocolpites echinatus zone-G
Reference section: 791 - 792 m.
Definition: Base of the zone is the top of zone F the zone is marked by the first appearance of *Spinizonocolpites echinatus,Proxapertites tertiaria, Spinozonocolpites catumbus, pco* 112.

Monoporites annulatus zone -H
Reference section: 735 - 736 m.
Definition:Base of the zone is the base of zone g. the zone is characterized by the first appearance *of Monoporites anulatus,Psilamonocolpites species,*

Longapertites proxapertites **zone-I**
Reference section: 622 - 623 m.
Definition: base of the zone is the top of zone h. The zone is characterized by the first appearance of *longapertites proxapertiodes, Monocolpites marginatus, Retistephanocolpites williamsi* zone-J.
Reference section: 496 - 497 m.
Definition: Base of the zone is the top of zone i. the zone is marked by the first appearance of *Retistephanocolpites williamsi, Retimonocolpites sp, Syndermicolpites typicus, Ctenolophonidites costatus.* Species last occurring in this zone include *Monocol pit es margunatus.*

Retitricolporites irreguiaris zone -K.
Reference section: 368 - 369 m.
Definition: Base of the zone is the top of zone J. the zone is marked by the first appearance of *Retitricolporites irregularis, Dyadosporites sp, Psilatricolporites crassus,Psilatricolporites rotundus.*

Pachydermites diederixi **zone** -L.
Reference section: 324 - 332 m.
Definition: Base of zone is the top of zone k. the zone is marked by the first appearance of *Pachydermites diederixi,Cyathidites minor and Magnastriatites howardi.*

Retitriporites boltenhageni zone -M
Reference section: 233 - 239 m.
Definition: Base of the zone is the top of zone 1. the zone is characterized by the first occurrence of *retriporites boltenhegeni, staitricolporites catatumbus, arelipites exilimuratus.* Species last occurring within zone include *verrucatosporites usmensis, feveotriletes margaritae.*

Echitriporites trianguliformis zone -N
Reference section: 138 - 140 m.
Definition: this zone marks the top of the well. It is characterized by the first appearance of *Echitriporites triangulifomis.* Species found at the top include *Dyadoporites sp, Dichtaphidites harassi, Laevigatosporites vulgaris and, spinozonocolpites baculatus.*

COMPARISON WITH OTHER BIOZONE

Biozones Foveotriltes margaritae-A and Spinizonocolpites baculatus-B are coeval to part of Evamy *et al* (1978) P-zone 100 while biozones Ephedripites regularis-C to Spinizonocolpites echinatus-G belong to Evamy *et al* (1978) P-zone 200.Zones H and I belong to P-zone 300,Zone J belongs to P-zone 400/500. Zones K,I, M, N belong to P-zone 600/700 of Evamy *et al*(1978) respectively. Futhermore the comparison of the present study biozones with those of Germraad *et al* (1968) is summarized in Table 2.

CONCLUSION

Detailed palynological analyses of ditch cutting samples of Gbekebo-1 well yielded rich assemblages, which have enabled the erection of fourteen dinoflagellate cyst zones. The zones compared well with other already established biozonation schemes. Maastritctian age was assigned to biozones A-E on the basis of the recognized diagnostic assemblages *within* the section. Also, biozones F-K was dated Paleocene and L-N dated as Eocene on the basis of the various diagnostics recovered in the sections studied. Comparison of this biozonation with the established biozonation schemes and this well dinoflagellate cyst biozones is summarized in Table 2.

REFERENCES

Adegoke, O. S., 1969: Eocene stratigraphy of Southern Nigeria. *Bull. Bur. Rech. Geol. Min. Mem. No.* 69, *p23-48*

Benkhelil, *J.,* 1989: The origin and Evolution of the Cretaceous Benue Trough, Nigeria. *Journ. Afri. Earth Sci,. v8, p251-282.*

Cratchley, C. R. and Jones, C. P., 1965: An introduction of the geology and gravity anomalies of the Benue valley, Nigeria. *Overseas geol. Surv. London. Geophy. Paper* 1, 26.

Evamy, B. D., Haremboure, J.,Kamerling, P.,Knaap, F. A., Molloy,F. A.,and Rowland, P. H.,1978: Hydrocarbon habitat of Tertiary Niger Delta. Bull.Am. Assoc. Petrol.Geol.,v. 62, No.1, 1-39.

Germeraad, J. H., Hopping, C. A.,and Muller, J., 1968: Palynology off Tertiary sediments from tropical areas. Review of Palaeobotany and Palynology, v.6, 189-348, pl.1-18.

Grant, N. K., 1971: South Atlantic, Benue Trough and Gulf of Guinea triple junction. *Bull. Geol. Soc. Amer, v82, p2295-2298.*

Murat, R. C., 1970: Stratigraphy and Paloegeography of the Cretaceous and Lower Tertiary Sediments *in* Southern Nigeria. *In: Dessuvagie, T. F J and Whiteman, A. J(ed) Ibid. p.251, 105-113.*

Hansen, J. M., 1977: Dinoflagellate Stratigraphy and Echinoid distribution in Upper Maastrichtian and Danian deposits from Denmark. *Geol. Soc. of Denmark Bulletin. V.* 26, *P.1-26.*

Oloto, I. N., 1984: Maastrichtian dinoflagellate cyst assemblages from Nkporo shale on the Benin Flank of the Niger Delta. *Rev. paleob. and Palyn. (57), p.173-186.*

Reyment, R. A., 1965: Aspects of the geology of Nigeria *Univ. Ibadan press, Nigeria,* 145 *p.*