

A MIOspore (POLLEN AND Spore) BIOZonation FOR THE MAASTRICHTIAN TO LUTETIAN SUCCESSION OF AJIRE-1 WELL, ANAMBRA BASIN NIGERIA.



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ABSTRACT

Biostratigraphically, significant miospores recovered from Ajire-1 well were used to erect a biozonation framework for the Maastrichtian to Lutetian success of Anambra Basin. Ten assemblage biozones were recognized and designated 'A' through 'J' in order of decreasing age. The base of each zone is defined by the first occurrence of a particular species, while the top is marked by the base of its suprajacent biozone. Within each zone information are presented on the stratigraphic section in which it is recognized and species that have their first and last occurrences in the biozone. The assemblage biozones from bottom to top are: *Leiotriletes triangulus* (A) *Proxapertites cursus* (B) *Retidiporites magdalenensis* (C) *Monocolpites marginatus* (D) *Ctenolophonidites costatus* (E) *Striatricolpites catatumbus* (F) *Syncoprites corrugatus* (G) *Monocolpites baculatus* (H) *Anacolosidites sp* (I) and *Grimsdalea polygonallis* (J) biozones respectively. Comparison of the biozones with the dinocyst and acritarch events recognized in this well coupled with subsequent calibration with International plankton zonal schemes allow for the estimation of their numerical ages.

INTRODUCTION

Ajire-1 well is located in the western part of Anambra Basin at Latitude 6°15'N and Longitude 6°45'E (Fig. 1). The total penetrated depth by the drill is 2500m. The well penetrated the thickness and most complete sub-surface Maastrichtian to Lutetian sedimentary succession in southern Nigeria. Four sub-surface lithostratigraphic formations – Ajali Sandstone, Nsukka Coal measure, Imo Shale and Ameki group were penetrated by the drill in the well.

MATERIALS AND METHOD

Fifty-one side wall samples recovered from the well were subjected to standard palynological maceration involving different stages of HCL, HF, HCL, Schultze's solution, KOH chemical digestions. The organic matter was recovered using zinc Bromide solution of 2.2 specific gravity. The organic residue was subsequently mounted on a glass slide in Canada balsam medium for microscopic investigation and analysis. Out of the identified palynomorphs, the miospores were evaluated and appraised for erection of a biozonation framework.

The comparison of the framework with the dinocyst and acritarch events in the well, coupled with subsequent comparison with Berggren *et al* (1995) plankton foraminifera biozonation scheme allowed for the estimation of the numerical ages of the biozones.

BIOZONATION

A total of ten miospores assemblage biozones have been identified. Within each zone, data are presented on the stratigraphic section in which it is recognized and species that have their first and last occurrences in the biozones. The biostratigraphic significance of species present within each zone is also highlighted. The biozones are compared with those of Gemeraad *et al* (1968) Evamy *et al* (1978) and Muller (1968). The calibration of the biozones with International planktonic foraminiferal biozonation of Berggren *et al* (1995) is summarized in Figure 2.

Lucas: A Miospore (pollen and spore) biozonation for the maastrichtian to lutetian succession of Ajire-1 well, Anambra Basin Nigeria.

The biozones are coded and discussed alphabetically in ascending order as follows:

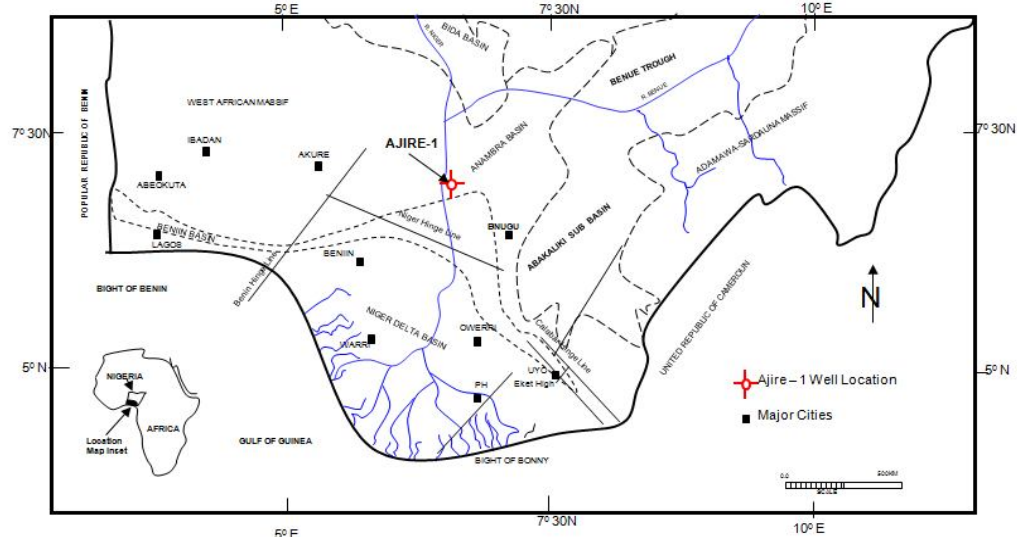


Fig. 1: Schematic map of Southern Nigeria Sedimentary Basins showing Ajire-1 Well Location

AGE (Ma)	EPOCH	STAGE	FORMATION	LITHOLOGY	SAMPLE DEPTH (m)	BIOZONATION		DATUM MARKERS/FAD AND LAD	Berggren et al (1995)	TIME (Ma)	
						CODE	POLLEN AND SPORE FAD				
						THIS WORK		THIS WORK			
49.00	Eocene	LUTETIAN	AMU		305	J	Grimaldesia Polygonalis	← LAD Anacoidites sp.	P10	49.0	
50.4					I	Anacoidites sp.	← FAD Spicocollites bruni ← FAD Mergocollites Vanheijze ← FAD S. poricosatus, LAD S. corrugatus	P 9 P 8	50.4		
52.3	Early Ypresian				71.4	H	Monocolpites beccatus	← FAD Proteoidites Otamiranales	P 7	52.3	
54.0					G	S. corrugatus	← FAD R. triangulatus				
54.7	Thanetian		IMB SHALE		59.5	F	Striatocollites castanubus	← FAD Triolites tenuistriatus, L. retusus	P 6 b	54.0	
55.9					E	Chenophonites costatus	← FAD Forna'v, c.gambensis, S. castanubus ← FAD P. okczelii, S. simploformis	P 5 a	54.7		
59.2	Late Selandian				1033	D	Monocolpites marginatus	← FAD Chenophonites beccatus ← FAD P. digitatus, LAD R. magdalenensis ← LAD L. triangulus	P 4	59.2	
60.0					1131			← FAD C. vanraadschoovenii, Q. L. triangulus			
61.0	Early Danian				1431	C	Retidiporites magdalenensis	← FAD Baculidiporites oriensis ← LAD M. cressibeccatus	P 3 b	60.0	
61.2					1406			← FAD M. cressibeccatus ← FAD P. africanus, F. emeritus			
64.9	Paleocene				1572	B	Protoporites curvus	← FAD M. cressibeccatus ← FAD P. africanus, F. emeritus	P 2 a	61.0	
65.0					1740			← FAD E. trianguliformis, L. vanraadschoovenii, L. marginatus ← FAD M. cressibeccatus, Ericaceae Sp. Synodiporites marginatus	P 1 c	61.2	
65.0	Late Oligocene				1921	A	Leitidites triangulus	← FAD C. minor, P. operculatus	Pc Po	64.9	
65.0					2386			← FAD L. stangulus			

Figure 2. Ajire-1 well miospores biozones calibration with Berggren *et al* (1995) planktonic foraminifera biozonation scheme.

Leiotriletes triangulus biozone (A)

Ajali to Nsukka, 3386m-1835m, Maastrichtian. This is defined from the first appearance of *Leiotriletes triangulus* at 2386m to FAD of *Proxapertites cursus* at 1835m. The top is coeval with FAD of *Danassadinium californicum* which was identified at 1835m in the well. This suggests a numerical age estimate of 65.0Ma for the top. Bio-events occurring within the biozone are FADs of *Mauriitidites crassibaculatus*, *ericalea sp* and *Syncolpites marginatus*. The zone is co-eval with Evamy et al (1978) zone P100.

Proxapertites cursus biozone (B)

Imo Shale, 1835m-1620m, Danian. This is defined from the FAD of *P. cursus* at 1835m to FAD of *Retidiporites magdalenensis* at 1620m. Selected bio-events occurring within the biozone are FADs of *P. Operculatus* and *Monoporites annulatus*. Regular occurrence of *P. cursus*, *Echitriporites trianguliformis* and *P. operculatus* suggests that the biozone is equivalent to the basal part of Germeraad et al (1968) *R. magdalenensis* zone. Furthermore it is also equivalent to the basal part of Evamy et al (1978) biozone P200. This again is also similar to a part of Muller (1968) *Proxapertites* zone of Pedawan and Plateau Sandstone Formation, Sarawak, Malaysia. FAD of *R. magdalenensis* marks the top of Danian and is estimated as 61.0Ma.

Retidiporites magdalenensis biozone (C)

Imo shale, 1620m-1406m. Early Selandian. This is defined from the FAD of *R. magdalenensis* at 1620m to FADs of *Mauriitidites crassiexinous* and *Monocolpites marginatus* at 1406m. Selected bio-events occurring within the biozone are FADs *Anacolosidites luteoides*, *Praedapollis africanus* and *Foveotricolporites ementitus*. The zone is equivalent to a part of the middle of *R. magdalenensis* of Germeraad et al (1968). It is characterized by regular occurrence of *R. magdalenensis*. It is also equivalent to the mid biozone P200 of Evamy et al (1978).

Monocolpites marginatus biozone (D)

Imo Shale, 1406m-1003m, early Selandian to Thanetian. This is defined from FADs *M. marginatus* and *Mauriitidites crassiexinous* at 1406m to FADs *Ctenophonidites costatus* and *C. Lisamae* at 1003m. Selected bio-events occurring within the biozone are LAD *R. magdalenensis* and FADs of *Baculatriporites orluensis* and *Perfotricolpites digitatus*. The biozone belongs to the upper part of Germeraad et al (1968) *R. magdalenensis* zone and upper part of Evamy et al (1978) biozone P200.

Ctenophonidites costatus biozone (E)

Imo Shale, 1003m-869m, Thanetian. This is defined from the FAD of *C. costatus* at 1003m to FADs of Forma'c', *Cramwellipollis gombeensis* and *Striatricolpites catatumbus* at 869m. Selected bio-events occurring within the biozone are FADs of *Psilatricolpites okeziei* and *Scrabratriporites simpliformis*. FAD of *P. Okeziei* at 960m marks the top of Thanetian stage which is estimated as 55.90 Ma, while the Thanetian/Ypresian boundary is defined by FADs of Forma'c' and *C. gombeensis* at about 936m and is estimated as 54.80 Ma. This zone is equivalent to the upper most part of Evamy et al (1978) biozone P200. It is to be noted that Evamy et al (1978) biozone P200 spans the whole of Paleocene. *P. Okeziei*, Forma'c' and *C. gombeensis* were originally described from the upper Eocene of Nigeria by Jan du Chene et al (1978).

Striatricolpites catatumbus biozone (F)

Imo Shale, 869m-796m, Ypresian. This is defined from the FADs of *S. catatumbus* and *C. gombeensis* at 869m to FAD of *Syncolporites corrugatus* at 772m. It is equivalent to lower part of Evamy et al (1978) biozone P330.

Syncolporites Corrugatus biozone (G)

Imo Shale, 772m-720m, Ypresian. This is defined from the FAD of *S. Corrugatus* at 772m to FADs of *Monocolpites baculatus* and *Retibrevitricolpites triangulatus* at 720m. This zone

belongs to Germeraad *et al* (1968) R. triangulatus zone. It is also equivalent to lower part of Evamy *et al* (1978) biozone P330.

Monocolpites baculatus biozone (H)

Imo Shale, 720m-675m, Ypresian. This is defined from the FAD of *Monocolpites baculatus* and *Retibrevitricolpites triangulatus* at 720m to FADs of *Anacolosidites sp* and *Proteacidites otamirinensis* at 675m. This zone belongs to the upper part of Germeraad *et al* (1968) R. triangulatus zone and lower part of Evamy *et al* (1978) biozone P370. *P. Otamirinensis* was originally described from upper Eocene of Nigeria by Jan Du Chene *et al* (1978)

Anacolosidites Sp biozone (I)

Imo Shale, 675m-391m, Ypresian. This is defined from the FADs of *Anacolosidites sp* *Grimsdalea polygonallis* and LAD of *Anacolosidites sp* at 391m. LAD of *Anacolosidites sp.* is an index event for the recognition of Ypresian/Lutetian boundary in Nigeria which is numerically estimated as 49.0 Ma. Selected bio-events occurring within the biozone are FADs of *M. vanwhijei* *S. poricostatus*, LADs of *S. corrugatus*, *M. baculatus* and *R. triangulatus*. The biozone belongs to the latest part of Germeraad *et al* (1968) R. triangulatus zone and upper part of Evamy *et al* (1978) biozone P370

Grimsdalea polygonallis biozone (J)

Ameki Formation, 391m; Lutetian. The base is defined by FAD of *G. polygonallis* at 391m. The mid-Eocene base coincides with the biozone base. The top is outside the scope of this study for lack of data.

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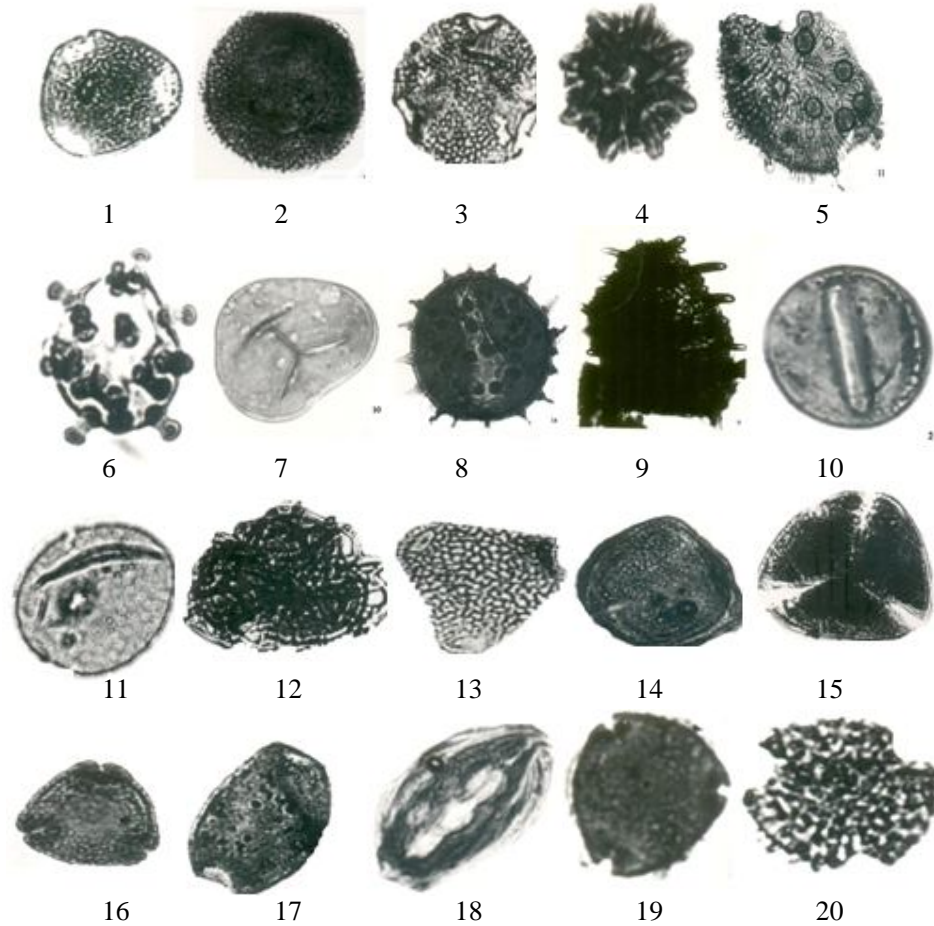


Plate 1: Miospores photographs indicating the slide number, England Finder's coordinates and magnification of individual specimen.

1. *Anacolosidites* sp. AJ2248B Q19/1 X750
2. *Bacutriporites orluensis* AJ2059B1 L26/2 X750
3. *Cramwellipollis gombensis* AJ2654B1 E16/2 X75
4. *Ctenolophonidites costatus* AJ1015B2 U32/1 X600
5. *Forma'C'* Jan du chene, onyike and Sowunmi 1978 AJ2895B2 014/3(4) X750
6. *Grimsdalea polygonallis* AJ1015B2 Q32/4 X500
7. *Leiotriletes triangulus* AJ4918B2 034/3 X600
8. *Mauritidites crassiexinus* AJ2745B2 T32 X750
9. *Monocolpites baculatus* AJ2400B1 G36/3 X500
10. *Monocolpites marginatus* AJ2248B1 E22 X600
11. *Monoporites annulatus* AJ2895B1 E39/4 X750
12. *Praedapollis africanus* AJ2574B1 F36 X750
13. *Proteacidites otamirinensis* AJ1981B2, X19/2 X500
14. *Proxapertites cursus* AJ2378B2 U15 X500

15. *Psilatricolpites okeziei* AJ2654B1 P21/1 X750
16. *Retibrevitricolporites triangulates* AJ1918B2, Q35/2 X500
17. *Retidiporites magdalenensis* AJ3405B4 Q34 X500
18. *Striatricolpites catatumbus* AJ2378B1 T18/1(3) X750
19. *Syncolporites corrugatus* AJ2895B2 D36/3 X900
20. *Verrutricolporites irregularis* AJ2895B2 R25 X750