

STRATIGRAPHY AND PALYNOLOGY OF AUCHI SEDIMENTS, SOUTH-WESTERN NIGERIA

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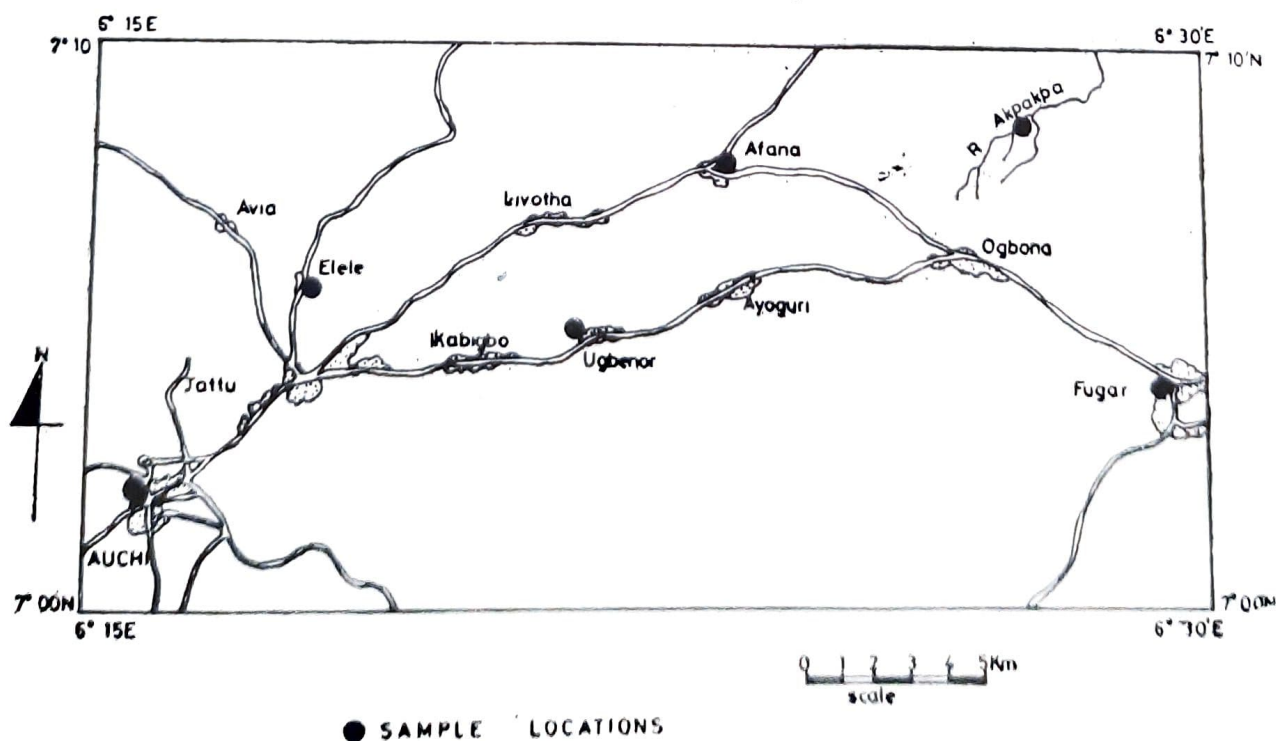
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Abstract

The miospore assemblage from the Auchi sediments includes *Retidiporites magdalensis*, *Echitriporites trianguliformis* (*Proteacidites longispinosus*), *Syncolporites minutus*, *Stephanocolpites costatus*, *Proteacidites terrazus*, *Proxapertites operculatus*, *Cingulatisporites ornatus*, *Germmatricolpites scabratus*, *Inaperturites cristatus*, *Mauritiidites* sp. A and *Longapertites vaneendenburgi*. This assemblage suggests a Maastrichtian age for the Auchi sediments. The miospore evidences indicate that these sediments could be parts of lateral equivalents of the three sub-units of the Coal Measures in Eastern Nigeria and the Abeokuta Formation in the Western Nigeria.

Introduction

The Geological Survey map (sheet 62) indicates that the whole area of Auchi and the east of it belong to the Coal Measures (Carter, 1965). Okezie (1974) differentiated these sediments as Asata Nkporo, Lower Coal Measures, False bedded sandstones and Upper Coal Measures. A detailed study of the Auchi sediments collected from six different locations (Text-fig. 1) has been carried out particularly to date these sediments.



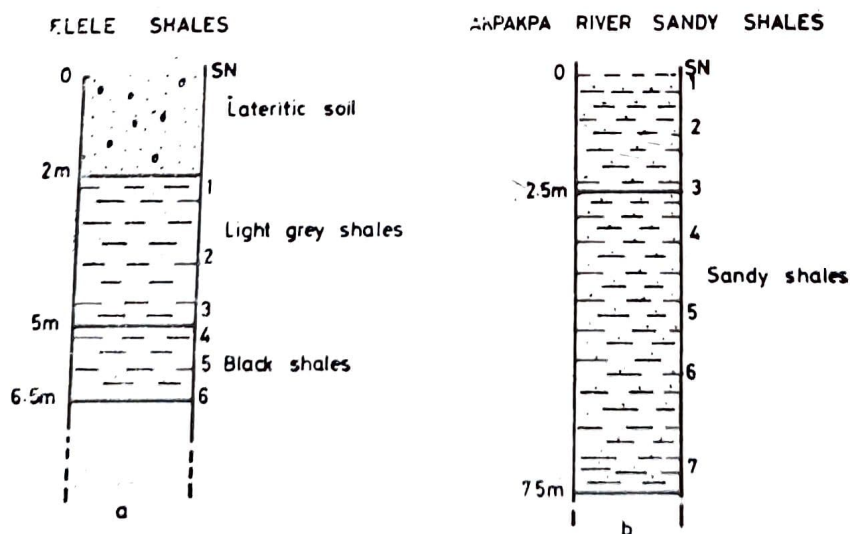
Text-fig. 1

Stratigraphy

The Auchi sediments were collected from Elele, Auchi, Ugbenor, Afana, Akpakpa River Valley and Fugar (ore).

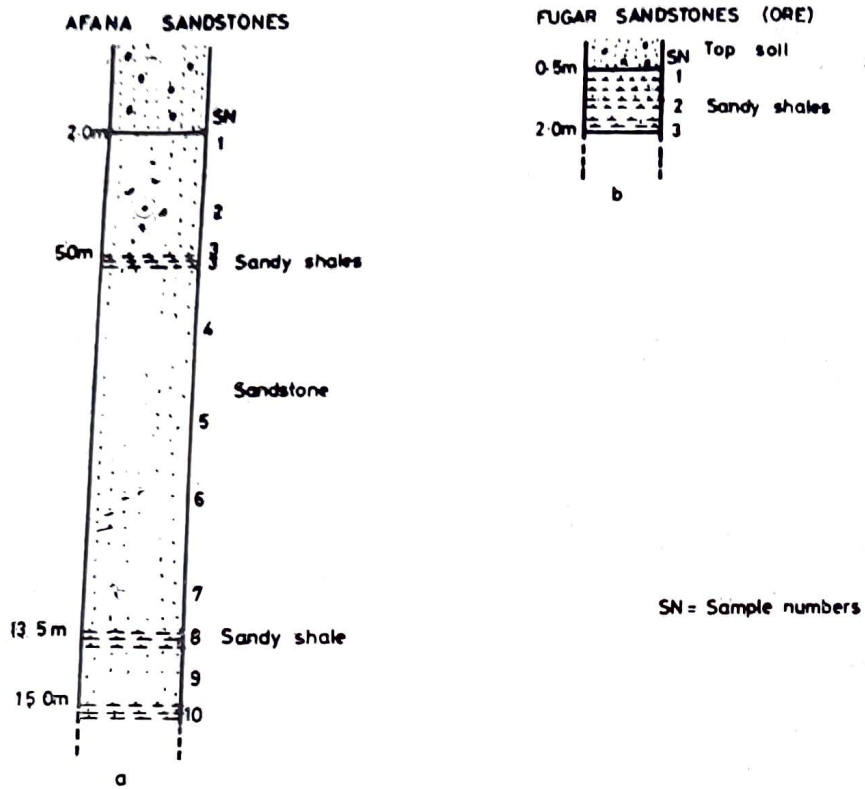
- (i) *Auchi shales (Text-fig. 4a)*—The sediments are well exposed on both sides of the road. The top is lateritic (1.5 m) and within the shales are 5-6 bands of indurated sandstones. The shales are light-dark grey and highly laminated.
- (ii) *Elele shales (Text-fig. 2a)*—This section is just after the Oil Palm plantation on the right side of the road (Auchi-Okene Road). The top is lateritic (2 m), the light grey and dark/black shales are massive. The black shales appear to be a low grade coal
- (iii) *Ugbenor shales (Text-fig. 4b)*—The section is exposed on the outskirts of Ugbenor Village near a small stream on the Auchi-Agenebode Road. The lithology consists of a lateritic top soil, clayey sandstone, grey clay, light/dark grey shales which are in many places highly laminated.
- (iv) *Afana sandstones near Afana Village (Text-fig. 3a)*—The outcrop consists of mainly sandstones with very thin bands of shales, sandy shales and indurated bands of sandstones.
- (v) *Akpakpa River sandy shales (Text-fig. 2b)*—This section is situated at the foot of one of the sandstone ridges along River Akpakpa Valley. The major sandstones (white fine grained) unit has been eroded except this small sandy shale unit (6 m) below. This is the only possible source of information on the age in this extensive sandstone region.
- (vi) *Fugar sandy shales (Text-fig. 3b)*—This section was found along a newly excavated gas pipe-line on the outskirts of Fugar towards Ore. The lithology consists of very fine grained sandstones with thin bands of shales and rich sandy shales 2 m thickness. The Fugar and Akpakpa/sandstones closely resembles in physical characteristics and they both belong to the Ajali sandstones (Ajali Formation).

The lateritic soils, sandy shales, light and dark grey shales in the various locations are similar in their physical characteristics. It is only at Elele that there

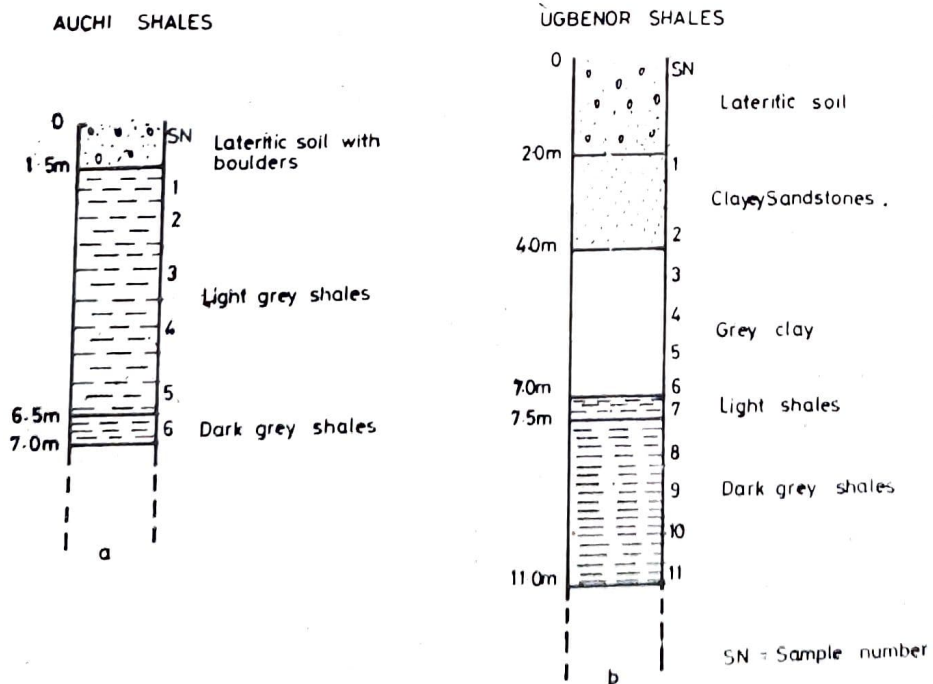


SN = Sample numbers

Text-fig. 2—Stratigraphic sections of Elele shales and Akpakpa River sandy shales (Lower Coal Measures).



Text-fig. 3—Stratigraphic sections of Afana and Fugar sandstone (false bedded sandstone).



Text-fig. 4—Stratigraphic sections of Auchi and Ugbenor shales (Upper Coal Measures).

appears to have some evidence of low grade coal in the area. The total thicknesses of these various sediments vary in the different locations. The Elele black shales and Akpakpa River sandy shales could belong to the Lower Coal Measures, the Apana, Akpakpa sandstones and Fugar sandy shales (False-bedded sandstones), while the Auchi and Ugbenor shales belong to Upper Coal Measures.

On the basis of present study the following stratigraphic sequence has been established for the area.

<i>Stratigraphic Units</i>	<i>Formations</i>
Auchi and Ugbenor shales (Upper Coal Measures)	Nsukka Formation
Akpakpa, Afana and Fugar shaly Sandstone (False-bedded Sandstone)	Ajali Formation
Elele black shales and Akpakpa River sandy shales (Lower Coal Measures)	Mamu Formation

It appears therefore that parts of the three sub-units of the Coal Measures are present in the area. The Lower and Upper Coal Measures sediments were identified on the basis of the miospore content and the major sandstone unit between them is the False-bedded sandstone (Ajali Formation).

Palynoflora

The spores and pollen grains recovered from these sediments include : *Granulatisporites subgranulosus*, *Echitriporites trianguliformis*, *Stephanocolpites (Ctenolophonidites) costatus*, *Gulatisporites ornatus*, *Tricolpites* spp., *Gemmatricolpites scabratus*, *Proteacidites terrazus*, *Proxapertites operculatus*, *Matonisporites major* and *M. minor*.

Jardine and Magloire (1965) recorded *Tricolpites* spp., *Proteacidites longispinosus (Echitriporites trianguliformis)*, and *Proteacidites terrazus* in the Upper Cretaceous of Senegal and Ivory Coast. Adegoke (1980) also indicated the presence of *Echitriporites* sp., *Proxapertites operculatus* and *Longapertites vanneedenburi* in the Ondo State Bituminous sand. *Longapertites vaneendenburgi*, according to Germeraad, Hopping and Müller (1968), is restricted to the *Foveotricolpites margaritae* and *Retidiporites magdalensis* zones (Palaeocene of the Caribbean) and *Proteacidites dehaani* (Senonian) and disappearing in the Lower *Retidiporites magdalensis* zone (Palaeocene) in Nigeria. They also recorded *Echitriporites trianguliformis* in the *Proxapertites operculatus* zone of Borneo, Caribbean, Pan Tropical and Atlantic areas (Senonian Lower Eocene), but apparently disappeared at the top of the *Verrucatosporites usmensis* zone (Upper Eocene). Muller (1968) encountered this species in *Rugubivesiculites* and *Proxapertites* zones of western Sarawak (Malaysia). Hergreen (1975) recorded it in his Zone IV (Campanian), and Zone II (Upper Maastrichtian) of Brazil; while van Hoeken-Klinkenberg (1964) also described it from the Upper Coal Measures (Maastrichtian) bore-hole at Inyi (Nigeria). She also recorded *Inaperturites cristatus*, *Syncolporites minutus*, *Gemmatricolpites scabratus*, *Mawiidites* sp. and *Proxapertites operculatus* from the Upper Coal Measures of Nigeria and *Cingulatisporites ornatus* from the Lower Coal Measures (Maastrichtian). Germeraad *et al.* (1968) indi-

cated the presence of *Retidiporites magdalensis* in the *Proxapertites operculatus*—*Monoporites annulatus* zones (Senonian-Mid. Eocene) of the Carribean and in the *Proxapertites operculatus*+*Retidiporites magdalensis* zones (Senonian-Paleocene) of Nigeria. *Ctenolophonidites costatus*, according to van Hoeken-Klinkenberg (1964), Kuyl, Muller and Waterbolk (1955) indicated the occurrence of *Ctenolophon* grain type in the Upper Cretaceous and Tertiary of Nigeria, and described this species from the Lower Coal Measures of Nigeria (Maastrichtian).

It, therefore, appears that the presence of the various species discussed above could suggest a Maastrichtian microfloral assemblage for the Auchi sediments when compared with van Hoeken-Klinkenberg (1964), Muller (1966), Boltenhagen (1967), Jardine et Magloire (1965), Hengreen (1975), Hengreen and Chlonova (1981) though some of the range into the Tertiary (Palaeocene) sediments.

Age of sediments

Proteacidites longispinosus (*Echitriporites trianguliformis*) is absent in the Auchi sediments which appears fairly common in the Ahoko sediments from the Nupe Basin. The Elele black shales is characterized mainly by *Cingulatisporites ornatus* and the Akpakpa River sandy shales include *Syncolporites minutus*, *Ctenolophonidites costatus*, *Longapertites vaneendenburgi* (Lower Coal Measures). The Akpakpa, Afana and Fugar sandy shales (False bedded sandstones) do not contain any miospores, while the Auchi and Ugbenor shales consisting *Proxapertites operculatus*, *Tricolpites*, *Mauritiidites* sp. A, *Inaperturites cristatus*, *Gemmatricolpites scabratus*, *Retitriporites magdalensis*, *Proteacidites terrazus*, etc. appear to be important in the Upper Coal Measures (Hoeken-Klinkenburg, 1964).

The Auchi sediments are quite rich in miospores except for the Akpakpa, Afana and Fugar sandstones. The age of these sediments is very clear particularly when diagnostic Lower and Upper Coal Measures miospores have been identified (at least when compared with the Nigerian Upper Cretaceous microflora) and the presence of False bedded sandstone belonging to the Ajali Formation separating the Lower and Upper Coal Measures is also recorded in the area. The six locations studied may, therefore, be assigned the Maastrichtian age (Table 1) the Elele and Akpakpa River sandy shales belong to Lower Maastrichtian, the Akpakpa, Afana and Fugar sandy shales belong to Middle Maastrichtian, and the Auchi and Ugbenor shales belong to Upper Maastrichtian.

Table 1—Diagnostic miospores associated with the Auchi sediments

Stratigraphic Units	Formations	Diagnostic miospores	Age
Auchi and Ugbenor shales (Upper Coal Measures)	Nsukka Formation	<i>Inaperturites cristatus</i> , <i>Mauritiidites</i> sp. A, <i>Proxapertites operculatus</i> , <i>Retidiporites magdalensis</i> , <i>Gemmatricolpites scabratus</i>	Upper Maastrichtian
Akpakpa, Afana and Fugar shaly sandstones (False-bedded sandstone)	Ajali Formation	No fossil recorded	Middle Maastrichtian
Elele black shales and Akpakpa River sandy shales (Upper Coal Measures)	Mamu Formation	<i>Cingulatisporites ornatus</i> , <i>Stephanocolpites</i> , <i>Longapertites vaneendenburgi</i>	Lower Maastrichtian

Conclusion

The Auchi sediments represent parts of the three sub-units of the stratigraphic section of the Coal Measures (Maastrichtian) in Bendel State, and thus may be the lateral equivalents of the sediments from GSN Bore-hole no. 1001 near Enugu, GSN bore-hole no. 1108 and 1122 in Anambra State (Hoeken-Klinkenberg, 1964), and Ondo State Bituminous sands (Adegoke, 1980). They show some similarities with the Upper Cretaceous of Senegal and Ivory Coast (Jardine & Magloire, 1964), the Turonian palynofloras of Africa and South America, the Senonian Palmae Province (Herngreen & Chlonova, 1981) and the Upper Cretaceous of Gabon (Boltenhagen, 1967).

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