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NEW STRATIGRAPHIC DATA ON THE PALEOGENE EWEKORO AND AKINBO FORMATIONS (SOUTHWESTERN NIGERIA) [1]

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ABSTRACT

Planktonic Foraminifera, Dinoflagellates, Pollen and Calcareous Nannofossils suggest an Upper Paleocene to Lower Eocene age for the Ewekoro and Akinbo Formations in the type area (Southwestern Nigeria).

RÉSUMÉ

Les foraminifères planctiques, les dinoflagellés, les pollen et les nannofossiles calcaires suggèrent un age Paléocène supérieur à Eocène inférieur pour les Formations d'Ewekoro et d'Akinbo dans la région type (SW Nigéria).

INTRODUCTION

Macro- and microfossils of the Paleocene and Eocene Formations of the Ewekoro area, South of Abeokuta, Nigeria (fig. 1), have been studied, amongst others, by ADEGOKE (1972, 1977), ADEGOKE et al. (1970), FAYOSE & ASSEEZ (1972), OGBE (1970, 1971) and REYMENT (1965, 1966).

The Formations are, from the top to the bottom:

a) Oshosun Formation

b) Akinbo Formation

c) Ewekoro Formation

The Ewekoro and Akinbo Formations have been described in the Ewekoro Quarry (fig. 1). The Oshosun Formation, on which no further investigations were made in this paper, was discussed in detail by ADEGOKE (1969).

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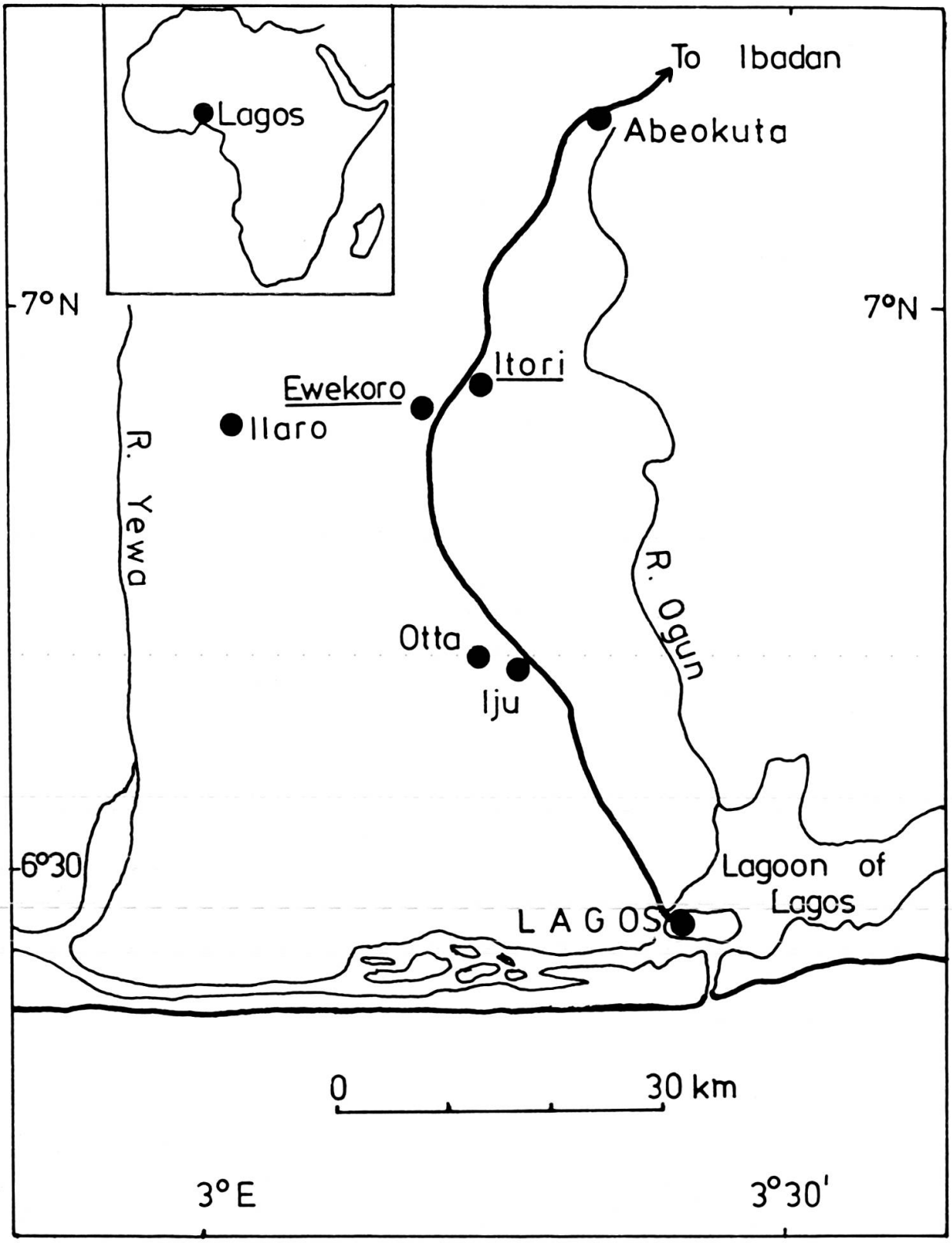


FIG. 1. — Geographical location of the Ewekoro Quarry and of Itori III borehole.

PLANKTONIC FORAMINIFERA FROM THE EWEKORO QUARRY

The Ewekoro Formation is divided into three major lithofacies: a sandy biomicrosparite at the base, a shaly biomicrite in the middle and an algal biosparite at the top. It is about 11 m thick in the quarry section and is disconformably overlain by the Akinbo Formation (fig. 2). The samples collected from the Ewekoro Formation at the quarry type section were barren of palynomorphs and calcareous nannofossils. Paleontologically, the Ewekoro Formation is of special interest because of the presence of *Nummulites ewekoroensis* SACHS & ADEGOKE 1975.

OGBE (1971) reported Paleocene planktonic foraminifera from the Ewekoro Formation including *Globorotalia pseudobulloides*, *G. acuta*, *Globigerina triloculinoides* and *Globorotalia velascoensis* which is diagnostic of the *G. velascoensis* Zone (P.5). The last species is not present in the Ewekoro type section, as shown in the present study.

The planktonic foraminiferal assemblage from the Ewekoro Quarry type section permit precise age correlation with the worldwide planktonic foraminiferal zonation (BERGGREN, 1972; STAINFORTH et al., 1975). As depicted in fig. 2, *Globorotalia pseudobulloides*, *Subbotina triloculinoides* and *Morozovella angulata* occur in the middle of the limestone. This planktonic association places this lithostratigraphic interval in the *G. Pusilla pusilla — M. angulata* Zone (P.3) of BERGGREN (1972). The planktonic foraminiferal microfauna of the marl bed about 50 cm below the top of the Ewekoro Formation is rich, diagnostic and well preserved. This assemblage comprises *Morozovella kolchidica*, *M. angulata*, *Globorotalia pusilla laevigata*, *G. ehrenbergi*, *G. chapmani*, *Subbotina velascoensis*, *Acarinina nitida*, *Chiloguembelina midwayensis*, *C. crinita* and *C. subtriangularis*. The known stratigraphic range of *M. kolchidica* is from *G. pusilla pusilla — M. angulata* Zone to the middle of the *Planorotalites pseudomenardii* Zone (P.4) according to STAINFORTH et al. (1975). *G. ehrenbergi* also has the same range (POSTUMA, 1971). The co-occurence of the above taxa with *G. pusilla laevigata* whose range is restricted to the *Planorotalites pseudomenardii* Zone, correlates the upper part of the Ewekoro Formation with the lower part of the *P. pseudomenardii* Zone, according to the above mentionned authors and BOLLI (1957).

The presence of the *Nummulites* species *(N. ewekoroensis)* in the Ewekoro Formation is of some age significance. *N. ewekoroensis* is very close to *N. deserti* (BLONDEAU, personnal communication, 7th African Micropal. Coll., Ile-Ife 1976) and suggests correlation of the Ewekoro Formation with the *Nummulites deserti* Zone of the Maqfi limestone (Unit III) of Egypt (LEROY, 1953). BERGGREN & AUBERT (1975) placed the *Nummulites deserti* Zone of LEROY within the *Planorotalites pseudomenardii* Zone (P.4). Thus, the age comparison of the Ewekoro Formation based on *Nummulites* seems to agree with the direct planktonic foraminiferal age assignement.

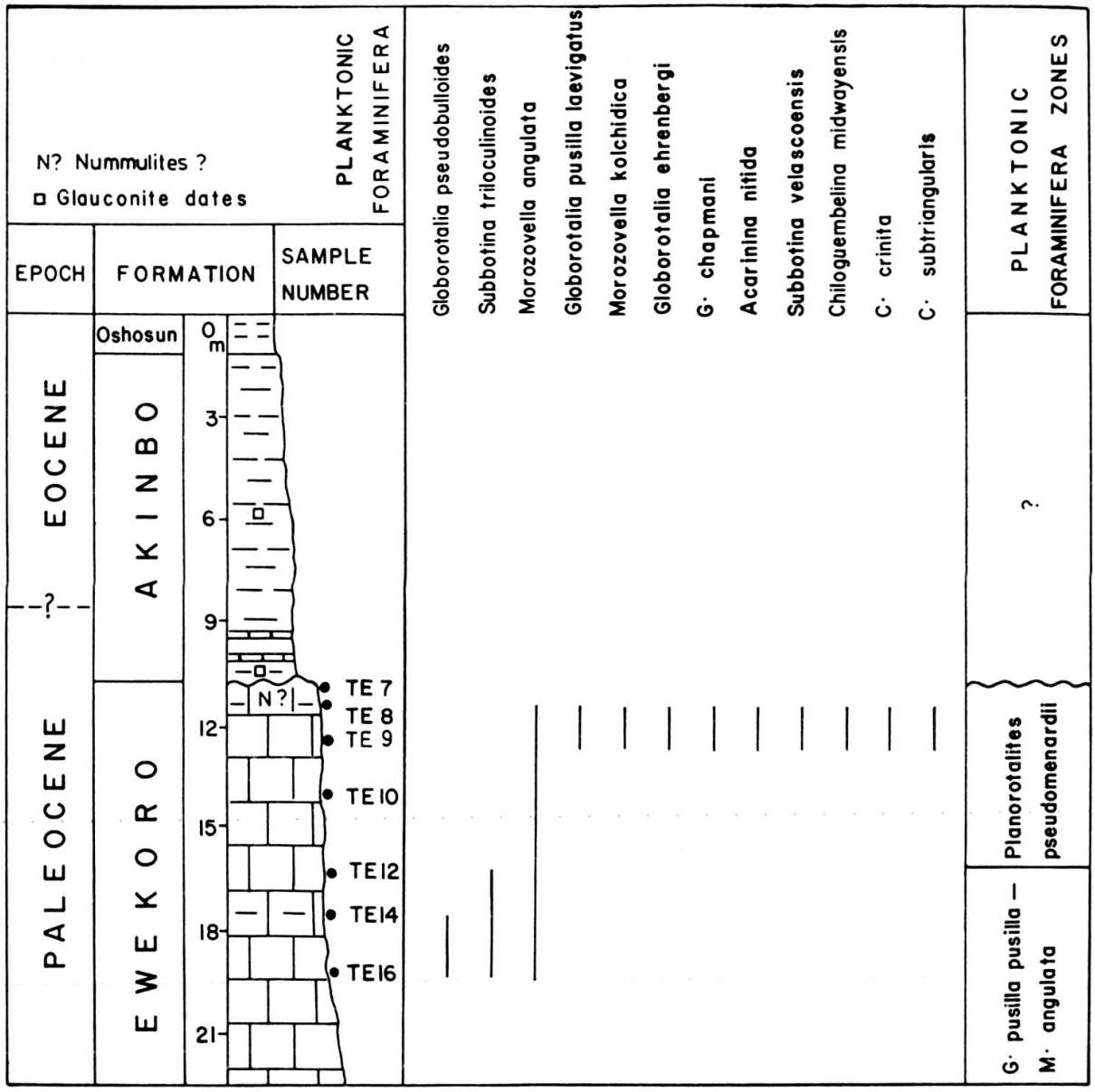


FIG. 2. — Lithology of the Ewekoro Quarry and distribution of the planktonic foraminifera.

However, the level from which *Nummulites ewekoroensis* was derived in the quarry was not specified by SACHS and ADEGOKE (1975). Since sample TE 8 (fig. 2) which is about 50 cm below the top of the Ewekoro limestone definitely belongs to the *Planorotalites pseudomenardii* Zone, it is likely that *N. ewekoroensis* comes from the topmost part of the quarry section.

THE AKINBO FORMATION

The Akinbo Formation consists of black to greenish-black shales with thin calcareous and glauconitic beds. The glauconite has been dated by ADEGOKE et al.

(1970) as 54.4 ± 2.7 my. The Akinbo Formation is considered to be the equivalent of the Imo shales of Southeastern Nigeria (ADEGOKE, 1969; FAYOSE 1970).

All samples collected in this Formation in the Ewekoro Quarry were barren of palynomorphs and calcareous nannofossils. But the black shales of the Itori III borehole, 5 km NE of Ewekoro (fig. 1) were also investigated and yielded organic as well as calcareous microfossils. The lithological succession at Itori III is the same as that in the quarry, including the two glauconitic beds.

PALYNOLOGICAL STUDY OF THE AKINBO FORMATION IN THE BOREHOLE ITORI III

The distribution of the organic microfossils in the Akinbo Formation in the borehole Itori III follows the coloration of the sediments. In the upper part of the borehole, between 4.00 and 11.50 m, the shales are beige to yellow. The samples from this interval were barren certainly because of too intensive oxydation. In the lower part of the borehole, the shales are grey to black and while black organic matter is abundant, organic microfossils are rare.

Between 12.00 and 18.50, the palynological association with *Retidiporites magdalenensis*, *Echitriporites trianguliformis*, *Proxapertites operculatus* and *Retibrevitricolpites triangulatus* places this interval at the limit between the *Retidiporites magdalenensis* Zone and the *Retibrevitricolpites triangulatus* Zone of GERMERAAD, HOPPING and MULLER (1968). These authors correlated the limit between these two zones to the Paleocene-Eocene boundary and gave it an absolute age of 54 my. This date corresponds very well with the 54.4 ± 2.7 my found by ADEGOKE et al. (1970) for the underlaying glauconitic beds.

The following pollen have also been found in the Upper Paleocene and Lower Eocene of Nigeria by VAN HOEKEN-KLINKENBERG (1966) and are present in our samples: *Retitricolpites clarensis*, *Psilatricolporites medius*, *Retitricolpites marginatus*, *Retitricolporites ellipticus*, *Retistephanocolpites regularis*.

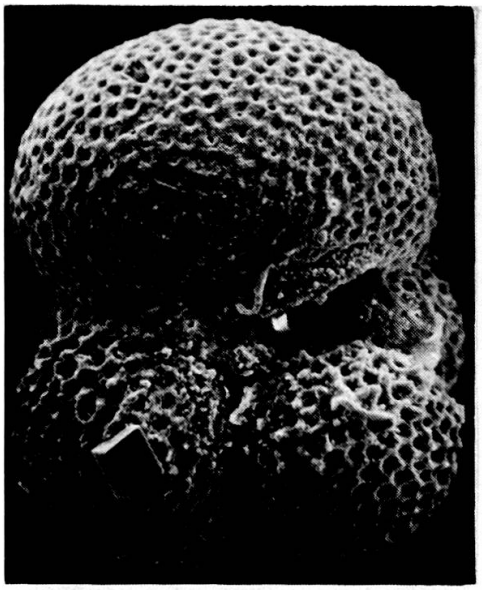
The Dinophyceae are more common than the pollen and a typical Paleogene assemblage was found: *Apectodinium homomorphum*, *Apectodinium hyperacanthum*, *Cordosphaeridium gracilis*, etc.

The presence of *Apectodinium homomorphum* and *A. hyperacanthum* give a minimal age to the sequence between 12.00 and 18.80 m. In Europe, the first occurrence of this two species and of the Wetzeliellaceae corresponds to the base of the calcareous nannofossils Zone of *Discoaster multiradiatus* of MARTINI (1971) (JAN DU CHÊNE, in press; COSTA & DOWNIE, 1976). In the *Marthasterites contortus* Zone, appears a group of more evolved Wetzeliellaceae: *Wetzeliella meckelfeldensis* Zone of COSTA & DOWNIE (1976). This species seems to be present in the top part of the Akinbo Formation (Itori III, 13.00 to 13.70 m).

AKINBO FORMATION								
18.80	18.50	18.30	16.50	15.00	13.70	13.00	12.00	Depth (Borehole Itori III)
×	×	×	×	×	×	×	×	POLLEN AND SPORES
	×				×	×	×	*Longapertites* sp.
						×	×	*Echitriporites* sp.
						×	×	*Monocolpites marginatus*
×	×		×			×	×	*Proxapertites operculatus*
						×		*Retitricolpites marginatus*
			×			×		*Retibrevitricolpites triangulatus*
×						×		*Retidiporites magdalenensis*
	×		×			×		*Leiotriletes* sp.
×	×					×		*Retistephanocolpites regularis*
						×		*Scabratriporites simpliformis*
	×							*Spinizonocolpites baculatus*
	×							*Spinizonocolpites echinatus*
×								*Retitricolporites ellipticus*
×								*Psilatricolporites medius*
×								*Retisyncolpites spiralis*
								DINOFLAGELLATES
					×		×	*Cordosphaeridium* sp.
	×		×		×	×	×	*Cordosphaeridium gracilis*
					×	×	×	*Achomosphaera alcicornu*
					×	×	×	*Cleistosphaeridium* sp.
×	×				×	×	×	*Apectodinium homomorphum*
							×	*Spiniferites crassipellis*
			×				×	*Spiniferites multibrevis*
							×	*Sp. ramosus ramosus*
							×	*Cyclonephelium exuberans*
×	×		×	×	×	×		*Apectodinium hyperacanthum*
								Cordosphaeridium filosum
×			×		×	×		*Adnatosphaeridium multispinosum*
×			×		×	×		*Hystrichosphaeridium tubiferum brevispinum*
						×		*Thalassiphora pelagica*
×					×	×		*Deflandrea* sp.
					×	×		*Wetzeliella* sp. cf. *meckelfeldensis*
×						×		*Cordosphaeridium triaina*

Apectodinium homomorphum zone	*Wetzeliella meckelfeldensis* zone ?	Dinoflagellate zonation (Costa & Downie, 1976; Jan du Chêne, in press)

Palynomorph distribution in Itoii III borehole.



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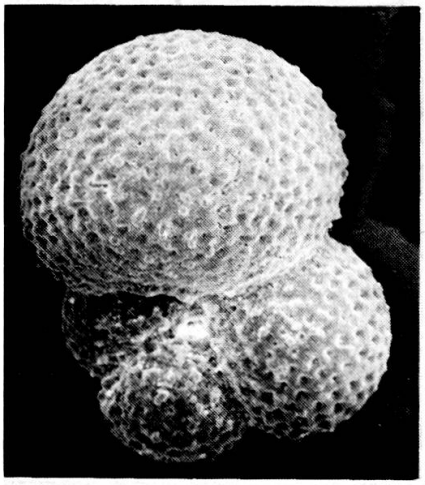

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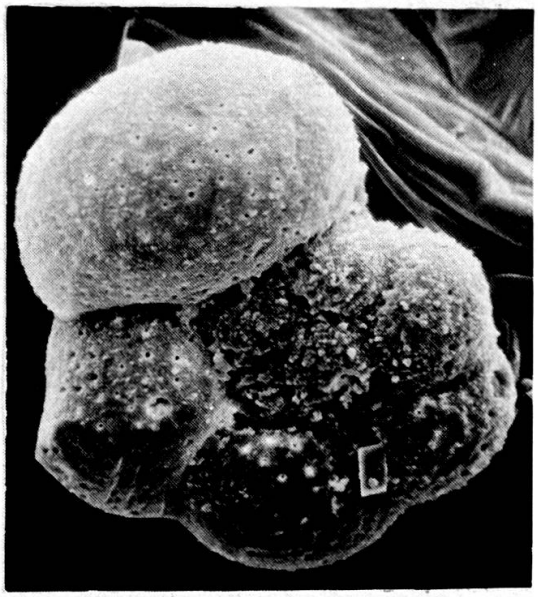

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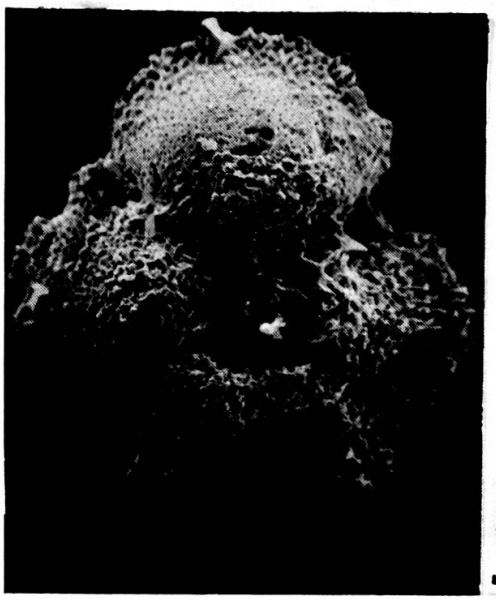

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PLATE I

1. — *Subbotina velascoensis* (Cushman). Umbilical view. TE 8.
2. — *Globorotalia pusilla laevigata* Bolli. Spiral view. TE 8.
3. — *Subbotina triloculinoides* (Plummer). Umbilical view. TE 14.
4. — *Globorotalia ehrenbergi* Bolli. Spiral view. TE 8.
5. — *Morozovella kolchidica* (Morozova). Umbilical view. TE 8.
6. — *Globorotalia pseudobulloides* (Plummer). Umbilical view. TE 14.

all scales = 10 μ

CALCAREOUS NANNOFOSSILS IN ITORI III BOREHOLE

Nine samples from the interval between 13.00 and 19.30 m which were studied for calcareous nannofossils, only contained very rare to few moderately well preserved forms. At 14.90 m, an assemblage containing *Ericsonia cava*, *Ellipsolithus distichus*, *Neochiastozygus* sp., *Fasciculithus tympaniformis* and *F. involutus*, *Toweius eminens*, *Sphenolithus primus*, *Chiasmolithus* sp., *Thoracosphaera operculata*, *Scapholithus rhombicus*, *Ericsonia subpertusa*, *Discoaster falcatus* and *Zygodiscus plectopons* was found. The presence of the latter two species suggests a latest Paleocene age, since these forms are usually found in the *D. multiradiatus* Zone (NP 9). Also *T. eminens* is usually found in the late Paleocene and only occasionally in the earliest Eocene. On the other hand, *Discoaster multiradiatus*, the zonal marker for the latest Paleocene, which also occurs in the earlier Eocene, was not found. Two other samples, at 15.95 and 16.20 m, contained rare to very rare coccoliths including *Thoracosphaera* sp., *Prinsius* sp., *E. cava*, *T. eminens*, *F. involutus*, *Z. plectopons* and *Discoaster* sp. Surprisingly, no members of the family of the Braarudosphaeraceae were found.

ATTRIBUTION OF THE EWEKORO AND AKINBO FORMATION TO THE PALEOCENE OR THE EOCENE

The stratigraphic position of the top part of the Ewekoro Formation and the Akinbo Formation corresponds to the base of the Ilerdian. In the first definition of this stage, HOTTINGER & SCHAUB (1960) placed it in the upper part of the Paleocene.

If we follow the proposition to include the Ilerdian in the Eocene and that the base of the *Discoaster multiradiatus* Zone and the first levels containing *Nummulites* correspond to the base of the Eocene (Colloque: Le contenu de l'Ilerdian et sa place dans le Paléogène, Bull. Soc. Géol. France, 1975, pp. 123-223), then the top of the Ewekoro Formation and the Akinbo Formation are Eocene in age.

If, on the other hand, we leave out the detour via the Ilerdian stage and go directly to the planktonic foraminiferal zonation as proposed i.e. in CARO et al. (1975), then the two formation belong to the Paleocene, excepted the interval containing *Wetzeliella meckelfeldensis* which is Lower Eocene.

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