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# CRETACEOUS AND EOCENE MICROFOSSIL AGES FROM THE SOUTHERN BENUE TROUGH, NIGERIA<sup>1</sup>

BY

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## ABSTRACT

An appraisal of the biostratigraphic value of microfossils in the Benue Trough affirms the suitability of calcareous nannofossils and planktic foraminifera for age determination of the fully marine stratigraphic levels. Thus, the Awgu Formation is dated as Turonian (?) along the Enugu-Port Harcourt expressway, Coniacian (?) along the Calabar-Itu road, and Early Coniacian in the Nkalagu quarries. The exposure of the Ameke Formation along the Enugu-Port Harcourt expressway contains early Eocene planktic foraminifera and late Early to early Middle Eocene coccoliths.

## INTRODUCTION

Calcareous nannofossils and planktic foraminifera are used in this article to establish the ages of two important marine levels in the southern Benue Trough (fig. 1). The Benue Trough is an intracratonic rift basin that extends from the Gulf of Guinea in the southeast through the Nigerian Shield and links with the Chad Basin in the northeast. About 5,000 m of lower Lower and Upper Cretaceous deposits fill the southern part of the Benue Trough. These deposits comprise shallow epicontinental shales and limestones in the central parts of the basin and paralic sandstones along the margins of the basin. The Awgu Formation, on account of its high fossil content, represents the deepest marine Cretaceous deposit in the southern Benue Trough. While the rest of the Benue Trough has been emergent since Early Tertiary times, clastic sedimentation continued in the south in the Niger Delta. Outcropping along the northern flanks of the Niger Delta are shallow shelf clastic Paleogene beds of which the Eocene Ameke Formation (fig. 1) appears to be the most marine in the exposed part in eastern Nigeria. Since the Niger Delta is located in the southern, oceanward extension of the Benue rift, the Ameke Forma-

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tion may be considered as the youngest exposed marine cycle in the Benue Trough.

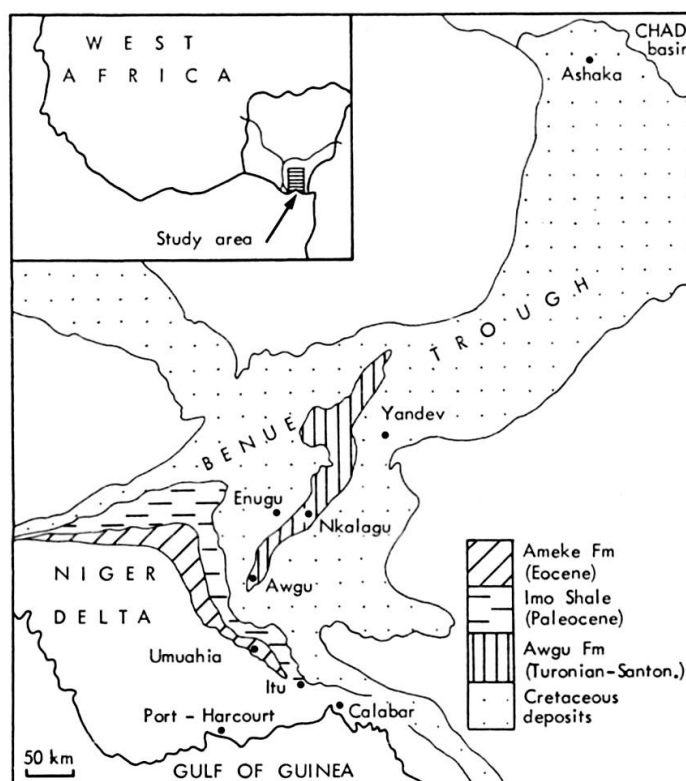


FIG. 1. — Outline map of the Benue Trough showing the Awgu and Ameke Formations and sample localities.

The sedimentary fill of the Benue Trough was influenced by five major paleo-oceanographic events in the South Atlantic Ocean (REYMENT, 1980), namely:

- (1) Late Middle Albian shallow marine connexion between the North and South Atlantic Oceans and initial flooding of the southern Benue Trough,
- (2) Late Cenomanian to Early Turonian transgression which swamped marginal areas of the Gulf of Guinea and extended marine influence into the northern parts of the Benue Trough,
- (3) Late Turonian to Early Santonian transgression during which fully oceanic conditions were established in the Gulf of Guinea and the Awgu Formation was deposited in the southern Benue Trough,
- (4) Late Campanian to Early Maastrichtian transgression that swamped the southern Benue Trough wherein coal beds accumulated,
- (5) the circulation of deep and well oxygenated water during the Paleogene and the deposition of the Ameke Formation in the southern Benue Trough.

The recovery of common calcareous nannofossils and planktic foraminifera from the Awgu and Ameke Formations is therefore due to the prevalence of fully marine conditions in the southern Benue Trough during the deposition of these beds. Other stratigraphic levels which were sampled in quarries at Ashaka and Yandev were either devoid of calcareous nannofossils and foraminifera or extremely poor. In the Ashaka quarry the Fika Shale Formation of Late Cretaceous age (CARTER et al. 1963) contained *Heterohelix* sp., *Guembelitria* sp. and arenaceous foraminifera, but no coccoliths. At Yandev the alternating limestone and shale sequence of probably Albian age contains the benthonic foraminiferal species *Gavelinella* sp., and only very rare coccoliths, mainly *Watznaueria barnesae*, a species that ranges from Mid Jurassic through the Cretaceous. *Thoracosphaera*, a calcareous dinoflagellate which is often found in sediments which were deposited under non-normal marine conditions was also found in the Yandev profile. The paucity of planktic microfossils at Ashaka and Yandev is due to the deposition of these beds towards the limits of the marine transgressions which came from the Gulf of Guinea in the South and shoaled northeastwards where abnormal marine conditions prevailed (PETTERS, 1978).

The calcareous nannofossils were studied in smearsides with a light microscope (oculars 12.5 and objective 100x with oil immersion). This allows the determination of most coccoliths larger than 2 to 3 microns, but makes the finding of very rare larger forms rather difficult. Among the assemblages studied, the samples from the Eocene Ameke Formation would certainly be worth a closer look and a monographic study to allow detailed comparisons with contemporaneous assemblages from both, other low latitude and high latitude shelf and open ocean environments. Closer study would also be beneficial in the case of the Middle Cretaceous samples from the Awgu Formation in Nkalagu, where *Marthasterites furcatus* is very well developed and common.

## AWGU FORMATION

The Awgu Formation, about 900 m thick, comprises bluishgrey and black well-bedded shales with limestone and sandstone intercalations (DESSAUVAGIE, 1975; REYMENT, 1965). Fresh exposures of the Awgu Formation occur in quarries at Nkalagu, in roadcuts along the new Enugu-Port Harcourt expressway, and along the Calabar-Itu road.

The profiles exposed in the Nkalagu limestone quarries consist of massive limestone at the base overlain by highly fossiliferous, calcareous, micaceous, dark grey shales with *Inoceramus* impressions along the shale bedding planes, and intercalations of limestone and marl (fig. 2). The Nkalagu profiles were dated Early Turonian on ammonite evidence (ARUA & RAO, 1978; REYMENT, 1965), and also on the basis of foraminifera (FAYOSE & DE KLASZ, 1976) and ostracodes (NEUFVILLE, 1973),



Awgu Formation. Here are exposed black and pale grey flaggy shales with marl nodules (fig. 3). The association of the Early Turonian planktic foraminiferal species *Lunatriella spinifera* (EICHER & WORSTELL, 1970), the Turonian-Santonian species *Hedbergella crassa* (BOLLI, 1959), the Turonian-Campanian form *Heterohelix reussi*

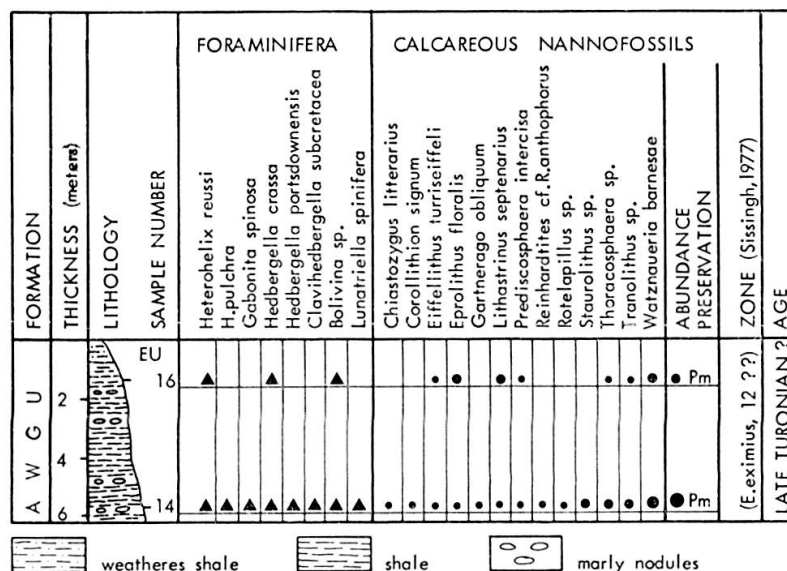


FIG. 3. — Distribution of planktic microfossils in the Awgu Formation exposed in a roadcut on the Enugu-Port Harcourt expressway, 47 km before the expressway — old Umuahia road junction.

(PESSAGNO, 1967; PETTERS, 1977), together with *Gabonita spinosa* of Senonian age (DE KLASZ & RERAT, 1963) suggests at most Turonian-Santonian age. However, the presence of *Lunatriella spinifera* and the absence of *Marthasterites furcatus* and *Eiffellithus eximius* from the coccolith assemblage suggest an Early Turonian age for this part of the Awgu Formation. On the other hand, the presence of the Senonian *Gabonita spinosa* and *Lithastrinus septenarius* (Coniacian-Santonian) would suggest a younger age. A compromise is expressed on fig. 3, with the questionable assignment to zone 12 of SISSINGH (1977), which is defined from the first occurrence of *Eiffellithus eximius* to the first occurrence of *M. furcatus*. *E. eximius* was not found, but it is also only very rare together with *M. furcatus* in one of 5 samples in the Nkalagu profile, and thus is not a reliable marker in this part of the world. *L. septenarius* usually is found above the first occurrence of *M. furcatus* (PERCH-NIELSEN, 1979) but was here found without it. We must thus conclude that it here occurs earlier than *M. furcatus* or that the latter is not a very reliable marker, either.

Fossiliferous exposures of the Awgu Formation were also sampled at about 34 km from Calabar, on the Calabar-Itu road. In this roadcut are exposed about 8 m of dark grey, calcareous, nodular mudstone with fairly abundant planktic micro-





A M E K E		FORMATION	THICKNESS (meters)	LITHOLOGY	SAMPLE NUMBER	Foraminifera	CALCAREOUS NANNOFOSSILS			
6	2		28 27	EU	30	<i>Acarina pseudotopilensis</i> <i>A. enensis</i> <i>A. pentacamera</i> <i>Pseudohastigerina micra</i> <i>Chiloguembelina cubensis</i> <i>C. martini</i>	<i>Foraminifera</i>	30 28 27		
4	28 27				28 27	28 27	28 27	28 27	28 27	28 27
2	28 27				28 27	28 27	28 27	28 27	28 27	28 27
1	28 27				28 27	28 27	28 27	28 27	28 27	28 27
silt clay marl gypsum										

### *Calcareous nannofossils*

The presence of *C. gigas* allows the assignment of these assemblages to CP 13b, the *C. gigas* Subzone of OKADA & BUKRY, 1980, the presence of *N. fulgens* together with *Chiasmolithus solitus* to the *N. fulgens* Zone, NP 15, of MARTINI, 1971. NP 15 is usually regarded as belonging to the Middle Eocene, but was shown by BERGGREN, 1972, to extend down into the Lower Eocene.



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