INSTITUTE OF GEOLOGICAL SCIENCES

OVERSEAS GEOLOGY AND MINERAL RESOURCES

VOLUME 10, NUMBER 1

LONDON
HER MAJESTY'S STATIONERY OFFICE
1966

PRICE 15*s.* NET

A NOTE ON PALEOCENE NAUTILOIDS FROM NIGERIA

By R. A. REYMENT, M.Sc., Fil.Lic., Fil.Dr.
Geologiska Institutet, Stockholms Universitet

ABSTRACT

THE SPECIES *Cimomia landanensis* (Vincent), *C. sudanensis* Miller, *Deltoidonautilus molli* (Douvillé) and *D. lemoinei* Miller are recorded from Paleocene formations in north-western and western Nigeria. All of these species are known from other parts of West Africa and it has been a cause of conjecture as to why these nautiloids have not been found in the well-developed Nigerian Paleocene. The present record is therefore palaeogeographically important.

Introduction

THE FIRST published record of nautiloids in Nigeria was made by Jones (1948, p. 39), who observed that the 'Calcareous Group' at Dange[1] in Northern Nigeria had yielded 'echinoderms, lamellibranchs, gasteropods, crinoids, foraminifera, a few corals and a *Nautilus*'. The formation, now known as the Kalambaina Formation, has its main development in the Republic of Niger and extends as far north as Mali. French workers have described and figured nautiloids from this formation, and as early as 1903 de Lapparent recorded '*Nautilus* (*Cimomia*) *lamarcki* Deshayes' from the Republic of Niger. In 1909, nautiloids were noted from the 'French Sudan' by Lemoine and in 1911, Garde noted several occurrences of nautiloids in the central parts of former French West Africa. Later, Douvillé (1920) described nautiloids from Senegal and the Republic of Niger. A comprehensive evaluation of nautiloids from these areas was made by Miller (1951). He described and figured the following species from the Kalambaina Formation in the former French colonies:

Cimomia sahariensis (Keller) from west of Asselar
C. sudanensis Miller from near Asselar
Deltoidonautilus chudeaui (Douvillé) from Adrar Tiguirirt
D. lemoinei Miller from Anou Mellene
D. molli (Douvillé) from Tamaské

The ages of some of these occurrences were given by Miller as Lower Eocene. Detailed work on the microfaunas of the Kalambaina Formation by the writer shows, however, that the entire formation is Paleocene in age.

The outcrops at Wurno,[2] Sokoto Province, Northern Nigeria, have yielded the three species of nautiloids:

Cimomia sudanensis Miller
Deltoidonautilus molli (Douvillé)
D. lemoinei Miller

[1] Dange (lat. 12° 51′ N, long. 5° 21′ E) is 16 miles SSE of Sokoto.
[2] Wurno (lat. 13° 7′ N, long. 5° 26′ E) is 20 miles NE of Sokoto.

Cephalopods are rather rare, although fossils of other groups, particularly pelecypods and echinoids, are common. Microfossils are locally very abundant.

The Ewekoro Formation of Western Nigeria consists of a thick limestone of partly coquinoid origin. It wedges out to the east around the town of Ijebu-Ode, and continues westwards, through Dahomey, to Togo. For many years, this limestone was thought to be Lower Eocene, but studies by the present writer (Reyment, 1959, 1960, 1963) and Slansky (1962) have shown that these deposits belong to the Paleocene. In 1916, Oppenheim figured a nautiloid from the Togo extension of this formation, which Miller (1951, p. 20) has referred to the genus *Deltoidonautilus* as the species *D. togoensis* Miller.

Slansky (1962), in his detailed study of the sedimentary rocks of the Dahomey Embayment of the Nigerian coastal basin, recorded '*Hercoglossa* cf. *diderrichi* Vincent' from the Paleocene of the Kpone area. The only nautiloid yet found in the Nigerian part of the Ewekoro Formation is *Cimomia landanensis* (Vincent) from the type locality at Ewekoro quarry (lat. 6° 54′ N, long. 3° 12′ E) and it seems clear that these cephalopods are rare in the Paleocene of coastal Nigeria, Dahomey and Togo.

Palaeogeographic Remarks

Cimomia landanensis appears to be very common at Landana in the Cabinda enclave, where Miller (1951, p. 42) observes it to be the most

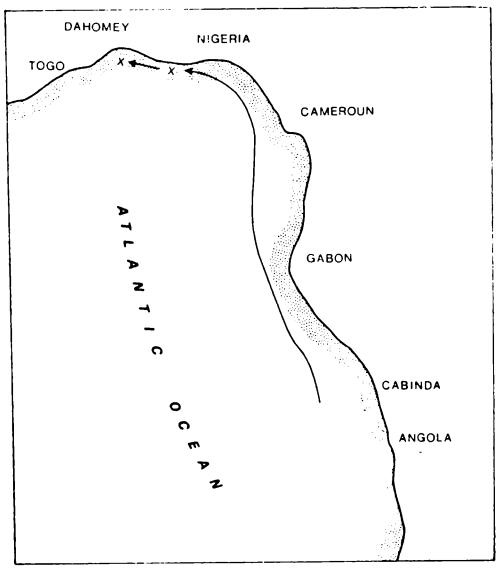

Fig. 1. Reconstruction of the Paleocene coastline of West Africa, showing the postulated direction of drift of empty nautiloid shells. The crosses mark the sites of occurrence of shells of species common at Cabinda, but rare elsewhere.

abundant nautiloid by far. *Hercoglossa diderrichi* was also observed by him to be fairly common at the same locality. It seems reasonable to assume that the main habitat of these cephalopods was off the coast of Angola. This would explain the relatively large concentration of shells at Landana. Occasional empty shells deriving from the nautiloid community could have drifted northwards with coastal currents. This suggests the existence of a northerly coastal stream along the west coast of Africa, during the Paleocene. Practical investigations by the writer (Reyment, 1958) show that the nautiloid shell has great postmortal buoyancy properties. For example, empty nautiloid shells are well known to be carried by ocean currents from the Philippines (where they have part of their natural range) to the coasts of Japan, and the shell of *Spirula* has been found on coasts almost all over the world, although the actual area in which this dibranchiate lives is quite restricted. Hence, the normal course of events for a nautiloid shell, after the death of the animal and the decay and loss of the body, will be a period of nekroplanktonic dispersal, which, for all practical purposes, will only be terminated when the shell becomes permanently stranded. Laboratory experiments indicate that it requires extremely rough treatment to cause a nautiloid shell to sink.

Descriptions

THE STUDY material comprises in all only five specimens. Nautiloids are very rare in the Paleocene of Nigeria and Dahomey and it took the writer many years to get together even this small collection. There is no doubt that specimens will be found from time to time and that in the future it may be possible to treat Nigerian nautiloids on a larger scale. It is here worth mentioning that nautiloids have not yet been found in the Nigerian Cretaceous, although ammonites are in places very common. A result achieved by the present study is that it serves to confirm further the surge of nautiloid evolution during the Paleocene and the rapid decline of this group thereafter to the present day. The West African material had previously seemed to indicate that the Paleocene surge continued almost undiminished into the Lower Eocene. However, these conclusions were based on stratigraphic results that are now known to have been erroneous and that the Lower Eocene of the French authors is really Paleocene.

The following taxonomic section is confined to a description of the material and there is no speculation concerning the validity of existing species concepts concerning the nautiloids of West Africa. The classification adopted is that given in Miller (1951).

Family HERCOGLOSSIDAE Spath, 1927

Cimomia landanensis (Vincent)

Plate 1, figs. 1, a-c

1951 *Cimomia landanensis* Vincent, Miller, p. 38; pl. 2, figs. 1, 2; pl. 3, figs. 1, 2; pl. 4, figs. 1, 2; pl. 5, figs. 1, 2; pl. 6, figs. 1, 2; pl. 7, figs. 1-3; pl. 8, figs. 1, 2.

For prior synonymy, see Miller (1951, pp. 38, 39).

Remarks: The single specimen available is large, being 19 cm. in diameter. It consists of inner whorls and about one-third of what might be the final whorl. It appears to comprise also the first part of the body chamber. The penultimate whorl has the same shape as the final whorl. The umbilicus is narrow, with sloping sides and there is relatively well-developed umbilical callus. Growth lines are preserved on the shell of the penultimate whorl; they swing backwards strongly on the venter. The shell seems to be fairly thin. The sutures agree well with the figures given by Miller (1951), including the flat appearance of the lateral saddles. The sutures have also the same incised appearance.

Only two reliable measurements could be made on whorl height and whorl breadth. These are: breadth = 64 cm., height = 53 cm., and breadth = 91·5 cm., height = 81 cm. Hence, the whorls are broader than they are high. Corresponding measurements made on figures published by Miller are for his pl. 3, fig. 2: breadth = 183·6 mm., height = 113·4 mm. A sketch of a whorl in cross section is shown in Fig. 2.

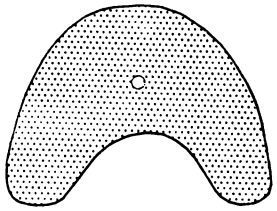

Fig. 2. Schematic section of whorl of *Cimomia landanensis*. (×0·45)

Measurements on the increase in whorl height for each chamber were made on the Nigerian specimen as well as several of the figures published by Miller (1951: pl. 2, fig. 1; pl. 3, fig. 2; pl. 5, fig. 2; pl. 7, fig. 2). These are

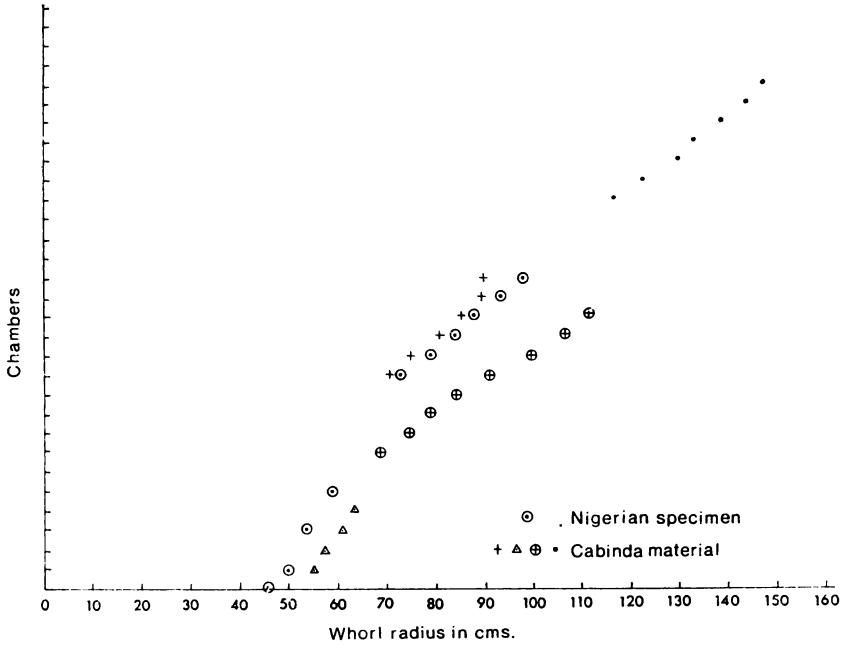

Fig. 3. Increase in whorl height for *Cimomia landanensis*, measured at intervals of one chamber. Comparison is made with measurements made on material figured by Miller (1951).

graphed in Fig. 3. The diagram is not to be read as though the various series of plots are continuous and interrelated, as the choice of place of start on the axis for chambers is arbitrary. The graph is designed to show similarity in growth rates, which will be indicated by parallelism in the lines of plots. The graphs for *C. landanensis* show that the increase in whorl height for inner whorls is greater than for large whorls and that there is excellent agreement for growth increases between the material from Cabinda and the Nigerian specimen.

Occurrence: Ewekoro Formation, Ewekoro quarry, Western Nigeria.

Repository: The repository of the figured specimen is Department of Geology, University of Stockholm, Sweden (C1038).

Collector: Dr. M. O. Oyawoye.

Cimomia sudanensis Miller

Pl. 1, figs. 4, a-b

1951 *Cimomia sudanensis*, Miller, p. 44, pl. 9, figs. 1, 2; pl. 10, figs. 1, 2.

Remarks: This slightly crushed specimen agrees well with the figures given by Miller (1951). The venter is narrowly rounded, the umbilicus is small and provided with steep walls. The chambers are short. A pair of measurements on height and breadth of whorl gave: breadth = 36 mm., height = 31 mm. The measurements for the two figured specimens in Miller (1951) are: breadth = 75 mm., height = 64 mm., and breadth

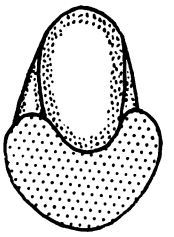

Fig. 4. *Cimomia sudanensis* in ventral aspect. (×0·6)

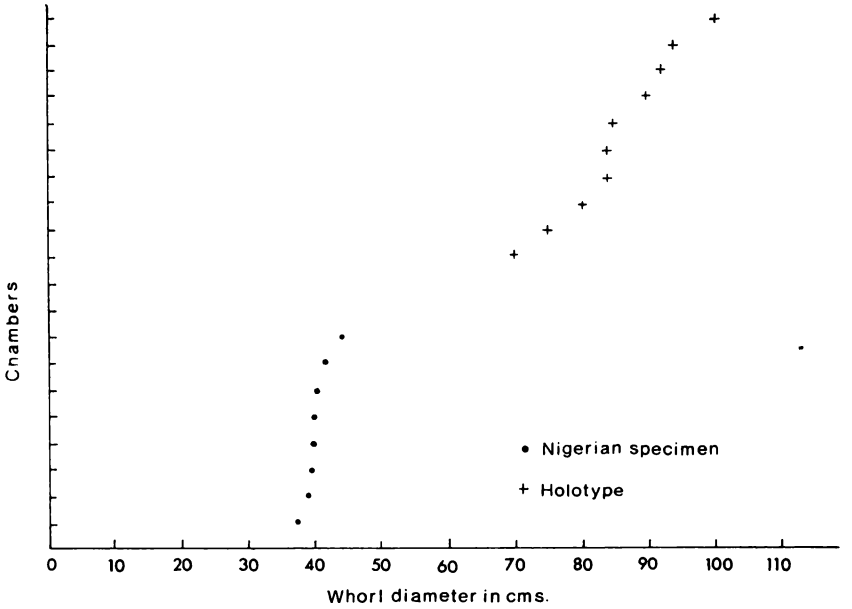

Fig. 5. Increase of whorl diameter for *Cimomia sudanensis* measured at intervals of one chamber. Comparison is made with measurements made on material figured by Miller (1951).

= 41 mm., height = 54 mm. It is therefore clear that whorl breadth is greater than whorl height. A sketch of the specimen in ventral aspect is shown in Fig. 4. Both plots in Fig. 5 show a sinuous kind of development, which could be due to distortion, but which possibly could be a primary feature of the pattern of growth of the whorls. Each suite of plots represents exactly one whorl.

Occurrence: Kalambaina Formation, Wurno, Sokoto Province, northwestern Nigeria.

Repository: The figured specimen is kept at the Department of Geology, University of Stockholm, Sweden (C1039).

Collector: The author.

Genus **Deltoidonautilus** Spath, 1927

Deltoidonautilus molli (Douvillé)

Pl. 1, figs. 2, 3, a-b

1951 *Deltoidonautilus molli* (Douvillé), Miller, p. 57, pl. 24, figs. 3, 4; pl. 25, figs. 1, 2; pl. 26, figs. 1, 2; pl. 27, fig. 7.

Previous synonymy in Miller (1951, p. 57).

Remarks: The two specimens available are slightly crushed. The larger of these shows that the maximum width of the whorls occurs on the flank just beyond the umbilical shoulder. The umbilicus is slightly open. The siphuncle seems to be located about half way up the cameral face, but this is not certain, owing to distortion of this part of the specimen. Crowding of the sutures of the last part of this specimen suggests that part of the body chamber is preserved. The diameter of this fragment is about 115 mm., and it comprises 10 sutures. This specimen agrees well with the figures of the holotype, published by Miller (1951), which has also lost the inner whorls. The holotype comprises 14 complete chambers and part of the body chamber. It comes from Tamaské in the central part of the Republic of Niger. The lateral saddles of our specimen are broader than those shown for the holotype (Miller, 1951, pl. 25, fig. 2), but this seems to be due to slight lateral crushing of the specimen. The second specimen in our material is also slightly crushed. It is septate, but owing to the bad state of preservation, the shape of these cannot be made out. The venter of the second last whorl is visible; it is well rounded. The

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PLATE I

(*opposite*)

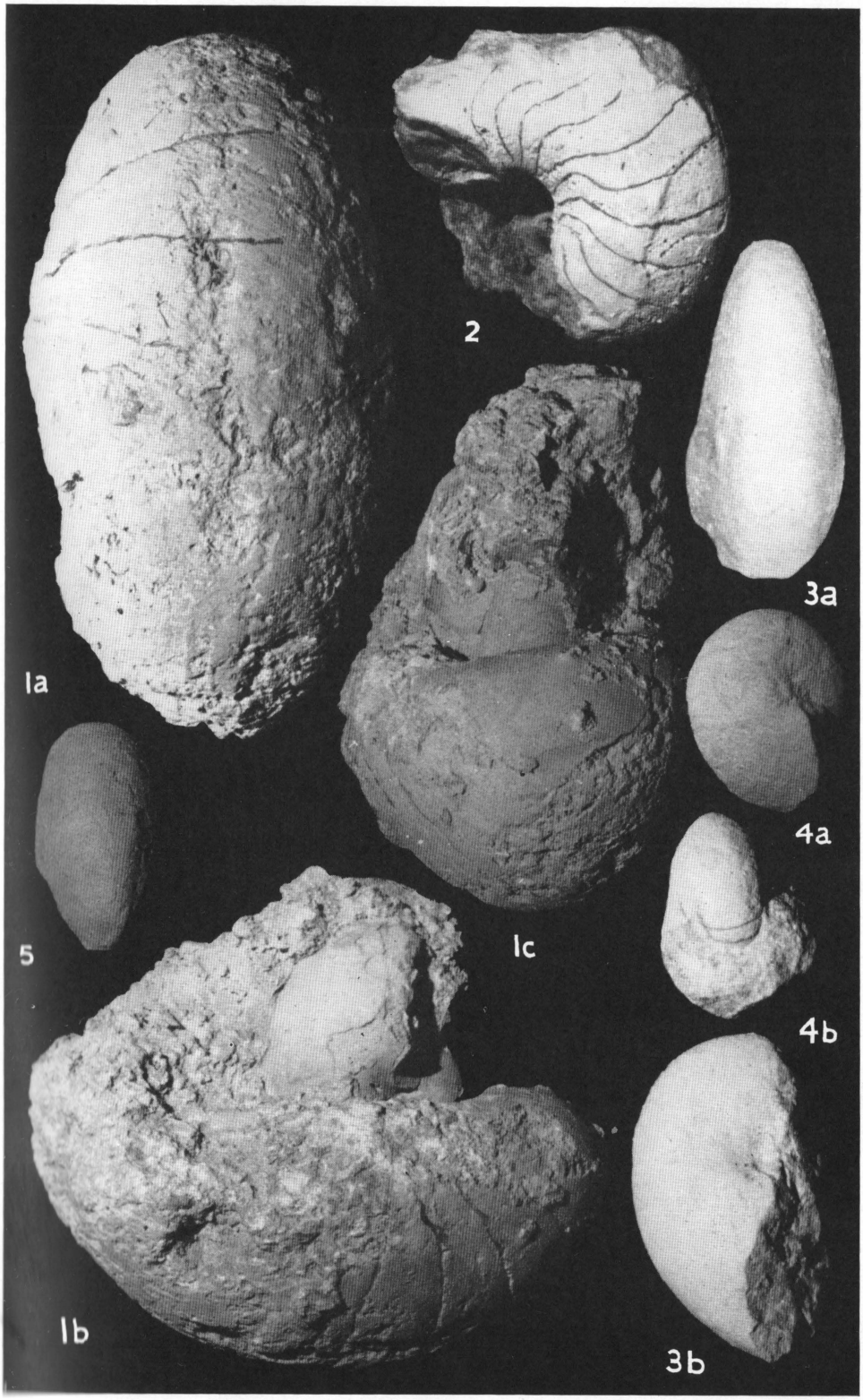
Figs. 1a–1c *Cimomia landanensis* (Vincent). Ewekoro Formation, Ewekoro quarry, Western Nigeria. 1a, ventral view of largest whorl, ×0·6. 1b, lateral view showing penultimate whorl, ×0·45. 1c, ventral view, ×0·45.

Fig. 2 *Deltoidonautilus molli* (Douvillé). Kalambaina Formation, Wurno, northwestern Nigeria. Lateral view of a slightly crushed specimen, ×0·45.

Figs. 3a, 3b *Deltoidonautilus molli* (Douvillé). Ventral (3a) and lateral (3b) views of slightly crushed specimen, ×0·6. Same provenance as specimen in Fig. 2.

Figs. 4a, 4b *Cimomia sudanensis* Miller. Kalambaina Formation, Wurno, northwestern Nigeria. 1a, lateral view, ×0·6. 1b, ventral view, ×0·6. Slightly crushed specimen.

Fig. 5 *Deltoidonautilus lemoinei* Miller. Kalambaina Formation, Wurno, northwestern Nigeria. Fragment of whorl in ventral aspect, ×0·6.



[*Photos: R. A. Reyment*

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[*facing page 52*

plot of whorl height against chambers (Fig. 6) reflects the distortion of particularly the smaller of the Nigerian specimens (diameter = 83·5 mm.). A sketch of a suture of the larger specimen is shown in Fig. 7.

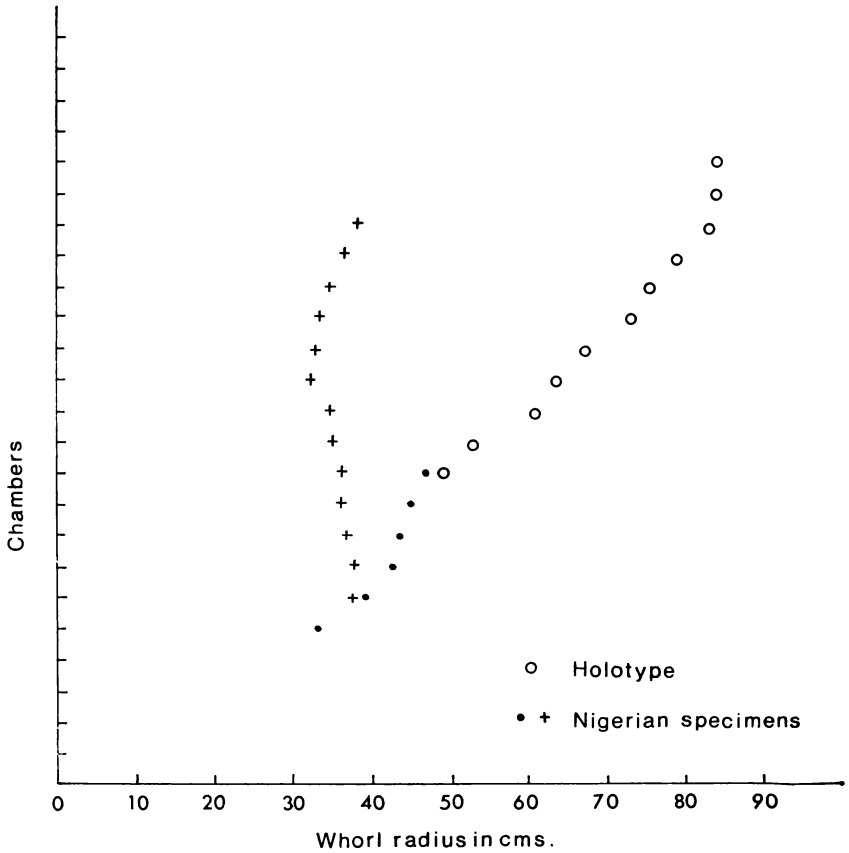

Fig. 6. Increase of whorl height for *Deltoidonautilus molli*, measured at intervals of one chamber. Comparison is made with measurements taken on the figure of the holotype given by Miller (1951).

Occurrence: Kalambaina Formation, Wurno, Sokoto Province, north-western Nigeria.

Repository: Both specimens are kept at the Department of Geology, University of Stockholm, Sweden (C1040, C1041).

Collector: The author.

Fig. 7. Suture of *Deltoidonautilus molli*. (×0·45)

Deltoidonautilus lemoinei Miller

Pl. 1, fig. 5

1951 *Deltoidonautilus lemoinei*, Miller, p. 55, pl. 18, figs. 1, 2; pl. 19, fig. 1.

For previous synonymy, see Miller (1951, p. 55).

Remarks: The Nigerian material consists of a fragment of a whorl, the venter of which is at first acute and then round. The umbilicus is narrow and the flanks broadly rounded. The morphology of the venter is an important characteristic for identifying *D. lemoinei* and this is one of the principal differences between it and *D. molli*, the venter of which is rounded throughout maturity. *D. senegalensis* (Douvillé) is somewhat similar, but it has a different whorl section and a less slender appearance in ventral aspect. Fig. 8 shows the growth of whorl height with respect to chambers. A direct comparison with the holotype is not possible,

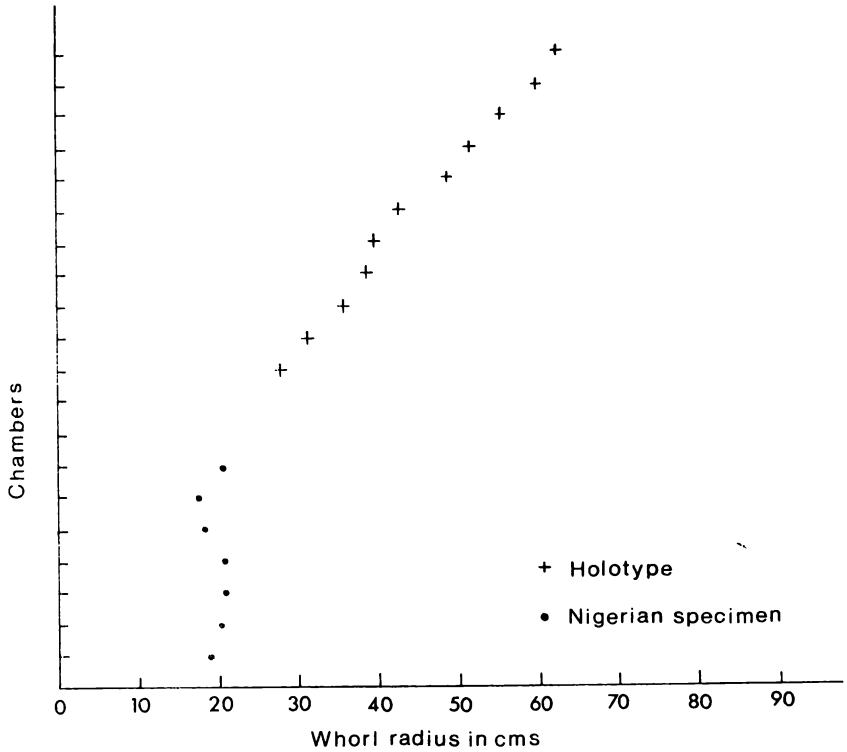

Fig. 8. Increase of whorl height for *Deltoidonautilus lemoinei* measured at intervals of one chamber. Comparison is made with measurements taken on the figure of the holotype given by Miller (1951).

owing to the greatly different sizes involved. There is, however, a suggestion that an initial period of relatively rapid increase in whorl height is followed by a phase in which the whorl height increases less rapidly.

Occurrence: Kalambaina Formation, Wurno, Sokoto Province, northwestern Nigeria.

Repository: Department of Geology, University of Stockholm, Sweden (C1042).

Collector: Mr. S. Ituen.

Conclusions

THE PRESENT material, small though it is, forms an important intermediate link between the information available concerning the nautiloids of south-west Africa and that on those of the Sahara. It indicates that the Nigerian coastal basin was, during Paleocene times at least, probably not an area with endemic nautiloids, and that the species occurring off Cabinda were possibly locally restricted. The evidence for this is that *C. landanensis*, so common at Cabinda, is apparently very rare elsewhere. The microfaunas of the Kalambaina Formation agree in detail with those of the Ewekoro Formation. Since Saharan nautiloids have not yet been found in the latter formation, this could indicate that the marine connection was tortuous indeed, and that nekroplanktonically-dispersing nautiloids were stranded long before travelling so far.

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Note added in proof

During an excursion to Ewekoro in 1964 a fine specimen of *Deltoidonautilus togoensis* Miller was found by E. Omatsola. This species is thus of Paleocene age. The specimen is in the collection of the Department of Geology, University of Stockholm (C1043).