

## 32. UPPER CRETACEOUS BENTHONIC AGGLUTINATED FORAMINIFERA, LEG 27 OF THE DEEP SEA DRILLING PROJECT

V. A. Krasheninnikov, Geological Institute of the Academy of Sciences of the USSR, Moscow

### ABSTRACT

Upper Cretaceous brown, zeolitic clays were penetrated in the northeast Indian Ocean at Site 260 in the Gascoyne Abyssal Plain and at Site 261 in the Argo Abyssal Plain. The sediments which are assumed to have been deposited below the lysocline, contain an assumedly autochthonous fauna of characteristic agglutinated foraminifera. The 21 genera distinguished are: *Haplophragmoides*, *Labrospira*, *Recurvoides*, *Paratrochamminoides*, *Haplophragmium*, *Pseudobolivina*, *Bolivinopsis*, *Plectorecurvoides*, *Trochammina*, *Praecystammina*, *Uvigerinammina*, *Verneuilina*, *Dorothia*, *Plectina*, *Glomospira*, *Glomospirella*, *Ammodiscus*, *Saccammina*, *Pilulina*, *Hormosina*, and *Hyperammina*. Sixteen of the 44 recognized species are new, 12 were described for the first time from the Upper Cretaceous zeolitic clays of the northwestern part of the Pacific Ocean (Leg 20, Sites 196 and 198A), and 16 are known from earlier micropaleontological publications.

Based on the systematic composition, two assemblages of agglutinated foraminifera are distinguished: an upper assemblage with *Praecystammina globigerinaeformis* and a lower assemblage with *Haplophragmium lueckeii*.

The brown clays at Site 260 with agglutinated foraminifera of the upper assemblage also contain reworked planktonic foraminifera of Albian (?), Cenomanian, and upper Turonian-Coniacian age. Thus,

the age of sediments containing the upper assemblage of foraminifera is not older (within the Upper Cretaceous) than upper Turonian-Coniacian.

The upper and lower assemblages of agglutinated foraminifera have some species in common. Therefore, the age of the sediments with the lower assemblage which do not contain planktonic forms is also considered Upper Cretaceous, but slightly older than the upper assemblage.

The agglutinated foraminifera are characterized by having small dimensions (0.15-0.40 mm) and a fine-grained or homogeneous thin wall with a smooth surface, features that reflect deep-water conditions.

The upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis* has been recognized in the Upper Cretaceous of the Indian (Leg 27) and Pacific (Leg 20) oceans. Thus, this type of microfauna can be used for correlating noncalcareous deep-water brown clays, which are usually extremely poor in organic remains.

The assemblages of agglutinated foraminifera described herein differ strongly from those in contemporaneous Cretaceous marine sediments on continents, where deep-water brown clays of this age are unknown.

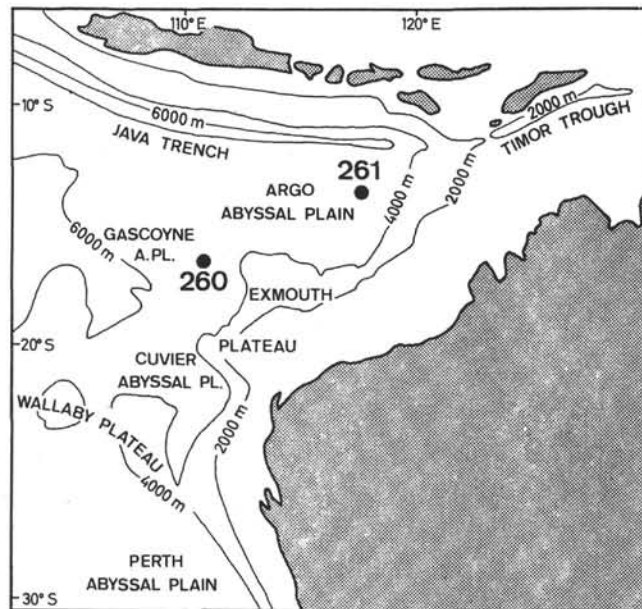


Figure 1. Location of Leg 27 Sites 260-261.

### INTRODUCTION

Upper Cretaceous benthonic agglutinated foraminifera were found in the northeastern part of the Indian Ocean at two Sites: 260 (Gascoyne Abyssal Plain) and 261 (Argo Abyssal Plain). The depth of the recent ocean in the vicinity of these two sites is 5709 meters and 5687 meters, respectively. The Cretaceous sediments are deep-water noncalcareous, brown, red-brown, dark yellow, and olive-gray, zeolitic clays with

subordinate streaks of iron oxide. These sediments were formed below the carbonate compensation depth. Consequently, benthonic foraminifera are represented only by species with an agglutinated (siliceous) test wall.

Based on their systematic composition, two assemblages of agglutinated foraminifera have been identified. They are here named "the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*" and "the lower assemblage of agglutinated Foraminifera with *Haplophragmium lueckeii*."

The upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis* was recognized at Sites 260, Core 6 and 261, Cores 5 and 6. The most common species are *Haplophragmoides fraudulentus* Krasheninnikov, *H. bulloides* (Beissel), and *Praecystammina globigerinaeformis* Krasheninnikov. They are accompanied by the less-frequent *Haplophragmoides constrictus* Krasheninnikov, *H. perexplicatus* Krasheninnikov, *H. decussatus* Krasheninnikov, *H. multiformis* sp. nov., *Labrospira pacifica* Krasheninnikov, *Paratrochamminoides vitreus* Krasheninnikov, *P. intricatus* Krasheninnikov, *Recurvoides pseudosymmetricus* sp. nov., *Pseudobolivina munda* Krasheninnikov, *Ps. lagenaria* sp. nov., *Trochammina gyroidinaeformis* sp. nov., *T. globigeriniformis altiformis* Cushman and Renz, *Uvigerinammina jankoi* Majzon, *Glomospira corona* Cushman and Jarvis, *Glomospirella gaultina* (Berth.), *Ammodiscus cretaceus* (Reuss), *Saccammina complanata* (Franke), *Pilulina antiqua* sp. nov., *Hyperammina* ex gr. *elongata* Brady.

The following species are comparatively rare: *Haplophragmoides multicamerus* Krasheninnikov, *H. linki* Nauss, *H. pseudokirki* sp. nov., *H. menitens* sp. nov., *Recurvoides pentacameratus* sp. nov., *R. ex gr. deflexiformis* (Noth), *Bolivinopsis parvissimis* Krasheninnikov, *Plectorecurvoides parvus* Krasheninnikov, *Trochammina lobulata* sp. nov., *T. pseudo-vesicularis* sp. nov., *Verneuilina cretacea* Karrer, *Dorothia oxycona* (Reuss), *Plectina* aff. *conversa* (Grzyb.), *Ammodiscus cretaceus rugosa* Schijfsma.

Although the upper assemblage of agglutinated foraminifera is rather diverse in generic (16) and specific (about 40) composition, the number of specimens in the sediment is small. The red-brown, zeolitic clay frequently contains only sporadic foraminifera or is devoid altogether of microfaunas.

The red-brown, zeolitic clay of the northeastern part of the Indian Ocean containing the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis* is the stratigraphic equivalent of the Upper Cretaceous sediments of the northwestern part of the Pacific Ocean penetrated at Sites 196 and 198A of Leg 20. In this deep-water area of the Pacific Ocean (6194 m at Site 196, 5858 m at Site 198A), the Upper Cretaceous sediments consist of abyssal, noncalcareous, red-brown, zeolitic and manganese-rich clay that is characterized by having only agglutinated foraminifera. It is from here that *Haplophragmoides multicamerus*, *H. fraudulentus*, *H. constrictus*, *H. perexplicatus*, *H. decussatus*, *Labrospira pacifica*, *Plectorecurvoides parvus*, *Pseudobolivina munda*, *Bolivinopsis parvissimis*, *Praecystammina globigerinaeformis*, *Paratrochamminoides vitreus*, *P. intricatus* were described for the first time (Krasheninnikov, 1973). These species, with identical size and morphological features, have now also been found in the Cretaceous sediments of the Indian Ocean.

Based on a relatively poor assemblage of radiolarians, the age of the red-brown, zeolitic clays of the Pacific Ocean with siliceous foraminifera is Campanian-Santonian, probably early Campanian (Foreman, 1973). This preliminary age probably represents the upper age limit of the agglutinated foraminifera-bearing clays. The

lower age limit of the clays containing the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis* is well established in the Indian Ocean. At Site 260, a set of samples taken from Core 6, Section 1, 71-73, 85-87, 106-108, 139-141 cm, includes calcareous benthonic and planktonic foraminifera of Albian, Cenomanian, upper Turonian, and Coniacian age (see Krasheninnikov, this volume, Cretaceous and Paleogene planktonic foraminifera, Leg 27 of DSDP).

The mixed assemblages of calcareous planktonic foraminifera is due to deposition by turbidity currents with the foraminifera being redeposited into noncalcareous, red-brown clays. The youngest planktonic foraminifera is not older than upper Turonian-Coniacian. Consequently, the age of red-brown, zeolitic clays of the Indian Ocean with *Praecystammina globigerinaeformis* cannot be older than upper Turonian-Coniacian.

Thus, the age of the red-brown zeolitic clays of the Indian and Pacific oceans containing the assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis* is within the upper Turonian-Coniacian to lower Campanian interval. At present it is difficult to establish the exact age of the sediments within this interval because the agglutinated foraminifera are represented by new species, with unknown stratigraphic ranges. Hopefully, in the near future, Upper Cretaceous calcareous clays from slightly shallower depths containing in addition to these agglutinated foraminifera also calcareous (foraminifera, nannoplankton) and siliceous (Radiolaria) plankton will be recovered from the Pacific or Indian oceans. These groups of planktonic microorganisms should help in resolving the age of these red-brown clays with the peculiar assemblage of agglutinated foraminifera.

The recognition of similar assemblages of agglutinated foraminifera in the Upper Cretaceous of the Pacific and Indian oceans (in the Indian Ocean this assemblage is more diverse in specific composition) confirms the great importance of agglutinated foraminifera for the correlation of abyssal, noncalcareous, clayey sediments that are in general extremely poor in organic remains.

The lower assemblage of agglutinated foraminifera with *Haplophragmium lueckei* was observed only in red-brown zeolitic clay penetrated at Site 261 (Cores 7 and 8). This clay underlies similar sediments containing the upper assemblage of foraminifera with *Praecystammina globigerinaeformis*.

The foraminiferal assemblage with *Haplophragmium lueckei* is characterized by the frequent occurrence of *H. lueckei* (Cushman and Hedberg), *Pseudobolivina normalis* sp. nov., *Plectorecurvoides rotundus* sp. nov. together with less-frequent *Haplophragmoides incredibilis* sp. nov., *Labrospira inflata* sp. nov., *Pseudobolivina cuneata* sp. nov., *Bolivinopsis abyssalis* sp. nov., *Trochammina insueta* sp. nov. All these species are absent in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

In addition to the above-mentioned species, the lower assemblage of foraminifera with *Haplophragmium lueckei* includes *Haplophragmoides bulloides* (Beissel), *H. multiformis* sp. nov., *Recurvoides pseudosymmetricus* sp. nov., *Plectorecurvoides parvus* Krasheninnikov,

*Trochammina globigerinaeformis* sp. nov., *Glomospira corona* Cushman and Jarvis, *Glomospirella gaultina* (Berth.), *Ammodiscus cretaceus* (Reuss), *Saccammina complanata* (Franke), *Hyperammina* ex gr. *elongata* Brady, and sporadic *Haplophragmoides decussatus* Krasheninnikov, *Paratrochamminoides vitreus* Krasheninnikov, *Pseudobolivina munda* Krasheninnikov. All these continue into the overlying layers containing the upper foraminiferal assemblage with *Praecystammina globigerinaeformis*.

The number of benthonic species (22) in the lower assemblage is about half that of the upper assemblage. In addition, the upper assemblage is characterized by 24 species of *Haplophragmoides*, *Labrospira*, *Recurvoides*, *Pseudobolivina*, *Bolivinopsis*, *Praecystammina*, *Trochammina*, *Uvigerinammina*, *Verneuilina*, *Dorothia*, *Plectina*, *Ammodiscus*, and *Pilulina* which were not found in the lower assemblage.

Because the red-brown zeolitic clays containing the lower assemblage of agglutinated foraminifera were penetrated only at Site 261, the stratigraphic significance of these beds is not known. Two interpretations are possible: (1) these beds are an independent stratigraphic horizon located throughout the Indian Ocean below the deposits with *Praecystammina globigerinaeformis*; (2) these beds represent a special facies type contemporaneous with the *Praecystammina globigerinaeformis* assemblage and, consequently, the reason for the change of the microfauna is not evolution, but facies. The author favors the first interpretation.

The age of deposits containing the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii* should also be considered Upper Cretaceous, somewhat older than that of deposits characterized by the upper assemblage of foraminifera with *Praecystammina globigerinaeformis*. These two assemblages have a number of species in common. Furthermore, some species (*Haplophragmoides bulloides*, *Haplophragmium lueckeii*, *Trochammina globigeriniformis altiformis*, *Glomospira corona*, *Glomospirella gaultina*, *Ammodiscus cretaceus*) from the lower assemblage of foraminifera are also known from the Upper Cretaceous of Europe and America. However, the exact age of the lower assemblage within the Upper Cretaceous remains uncertain.

Analysis of the specific composition of the two assemblages of agglutinated foraminifera shows that new species are strongly predominant in both of them (including the species described for the first time from Upper Cretaceous clays of the Pacific Ocean penetrated at Holes 196 and 198A). These species are characterized by some common morphological features that may reflect deep-water conditions—dimensions of tests (0.15-0.40 mm) and wall structure (thin, semi-transparent when moistened with water, homogeneous, or fine-grained with a smooth surface). Therefore, the assemblages of agglutinated foraminifera from the calcs of the Indian Ocean differ rather strongly from the microfauna described from the Upper Cretaceous deposits of Australia, New Zealand, Japan, California, the Gulf of Mexico, North Africa, the Near East, the Crimean-Caucasian area, West and Central Europe. Only a few species of agglutinated foraminifera

(*Haplophragmoides linki*, *H. bulloides*, *Haplophragmium lueckeii*, *Trochammina globigeriniformis altiformis*, *Uvigerinammina jankoi*, *Verneuilina cretacea*, *Dorothia oxycona*, and some trivial species of *Glomospira*, *Glomospirella*, *Ammodiscus*, *Saccammina*, *Hormosina*), are common to both the Upper Cretaceous deposits in the Indian Ocean and on the continents.

It is likely that true deep-water (abyssal) sediments of the oceanic type (red-brown zeolitic clays) are exceedingly rare or even absent on continents and large islands. Benthonic agglutinated foraminifera are closely related to facies, and drilling into the abyssal plains of the Indian and Pacific oceans provided new deep-water representatives of this group, which were not previously known. Similar considerations on the specific composition of benthonic agglutinated foraminiferal faunas from the Upper Cretaceous of the Pacific Ocean were presented in the Initial Report of Leg 20 of *Glomar Challenger* (Krasheninnikov, 1973).

There is a great similarity in generic composition of the assemblages of agglutinated foraminifera from the clays of the Indian and Pacific oceans, and the flysch and flysch-like Upper Cretaceous deposits of the Carpathians, of Roumania (Neagu, 1962, 1968, 1970); Hungary (Majzon, 1943); USSR (Myatliuk, 1966, 1970; Soliman, 1972); Poland (Geroch, 1960, 1962, 1966); Czechoslovakia (Hanzlikova, 1969, 1972, 1973; Scheibnerova, 1961, 1968); and Austria (Noth, 1951, 1952). The Upper Cretaceous is characterized by numerous representatives of *Haplophragmoides*, *Recurvoides*, *Paratrochamminoides*, *Haplophragmium*, *Bolivinopsis*, *Pseudobolivina*, *Plectorecurvoides*, *Trochammina*, *Verneuilina*, *Karrieriella*, *Plectina*, *Dorothia*, *Uvigerinammina*, *Ammodiscus*, *Glomospira*, *Glomospirella*, *Saccammina*, *Pelosina*, *Hyperammina*. This similarity appears to be due to some common factors in physical-chemical conditions, for example, high solubility of carbonates in the bottom layer of the water. Nevertheless, certain environmental factors affecting the microfauna differed considerably. The assemblages of benthonic agglutinated foraminifera from the Upper Cretaceous of the Indian Ocean differ from those of the Carpathians, both in general morphology of tests and in specific composition.

The specimens from the Carpathian Upper Cretaceous are characterized by large dimensions and by typically agglutinated granular walls. The differences in the specific composition of the two regions may be explained to a considerable extent by paleobiogeographic reasons. However, the influence of environmental factors is also of importance as demonstrated by the presence of different assemblages of species in the shallow-water Upper Cretaceous of regions (e.g., Australia, New Zealand, Japan), situated relatively close to the northeastern Indian Ocean.

Almost all of the species of agglutinated foraminifera from red-brown oceanic clays of the Upper Cretaceous are attributed to known genera established on shallower-water forms (*Praecystammina globigerinaeformis* is an exception). Some of the species, however, are characterized by morphological peculiarities that distinguish them from typical representatives of these genera. For instance, some species of



*Haplophragmoides* (*H. fraudulentus*, *H. multicamerus*, *H. constrictus*, *H. perexplicatus*) have semiinvolute tests, others strongly involute tests (*H. multiformis*), and still others slightly asymmetrical tests (*H. menitens*, *H. incredibilis*). The species of *Labrospira* are entirely involute, with a short, slit-like aperture and thin septal sutures in *L. inflata* and *L. pacifica* and an inflated test in *L. inflata*. The streptospiral volution of the species attributed to the genus *Recurvoides* (*R. pentacameratus*) is not distinct.

Representatives of the genus *Trochammina* display some variation in test shape and chamber arrangement. In addition to typical forms (*T. globigeriniformis altiformis*, *T. lobulata*, *T. pseudovesicularis*) there are also present: (1) types with a *gyroidina*-like test, a flat spiral side and a small rounded aperture near the umbilical area (*Trochammina gyroidinaeformis*) that resembles the aperture of the genus *Adercotryma*, and (2) types with irregularly trochoid coiling and slightly convex ventral sides on which a previous whorl can be seen (*T. insueta*).

Finally, many species of *Haplophragmoides*, *Labrospira*, *Recurvoides*, *Paratrochamminoides*, *Pseudobolivina*, *Plectorecurvoides*, *Trochammina*, *Praecystamina*, *Dorothia*, etc. are characterized by a homogeneous, thin, smooth, semitransparent (when moistened with water), siliceous wall, which differs considerably from the granular wall of agglutinated foraminifera from shallow-water deposits. The question arises whether this siliceous wall is really agglutinated, consisting of tiny particles of red-brown clays or whether it is secretional, composed of siliceous cement excreted by the microorganism itself. Can secretional siliceous and fine-grained agglutinated walls be distinguished, and if so, what is the implication to taxonomy?

It is possible that eventually peculiarities of morphology in abyssal agglutinated foraminifera of the Upper Cretaceous (general test shape, degree of involution, shape of aperture, microstructure of wall, etc.) may lead to new taxonomic units on the generic or subgeneric level. However, at the present time it seems preferable to include the taxa here described in existing genera such as *Haplophragmoides*, *Labrospira*, *Trochammina*. If representatives of a genus live in several distinct environments, one would expect that certain generic characters might change at various depth.

Considerable difficulties are also encountered in assigning the herein described species of agglutinated foraminifera. Many possess such unique morphological characters that they are certain to be new species. Others (*Haplophragmoides bulloides*, *Haplophragmium lueckeii*, *Trochammina globigeriniformis altiformis*, *Dorothia oxycona*) are similar to already known species in terms of their morphology, but are smaller in size. Such forms were assigned to previously known species and the smaller dimensions of tests explained by development under abyssal conditions.

Some of the agglutinated foraminifera from the Indian Ocean are similar but not identical in morphology to known species. They differ considerably in possessing a homogeneous, thin, semitransparent siliceous wall with a smooth surface. Such forms are

here described as new species. This is done in the belief that the microstructure of the wall is important for taxonomy. The feature is constant in that all specimens of a given agglutinated species from the Indian and Pacific oceans are characterized by the same wall microstructure. Individual species of agglutinated foraminifera are also selective in regard to the size of particles forming the wall. In a given sample there may occur together species with a homogeneous siliceous (secretional? or fine-grained) wall and others with a typical uneven, granular, agglutinated wall (*Haplophragmium lueckeii*, *Uvigerinammina jankoi*, *Trochammina globigeriniformis altiformis*, *Hyperammina ex gr. elongata*, *Hormosina ovulum*, *Plectina* aff. *coversa*, *Trochammina insueta*, etc.).

Thus, benthonic agglutinated foraminifera from abyssal Upper Cretaceous deposits of the Indian Ocean are worth studying not only from the viewpoint of stratigraphic correlation, but also from the standpoint of morphology, taxonomy, and paleoenvironment.

#### SYSTEMATIC DESCRIPTION

Special attention is paid to those species of benthonic agglutinated foraminifera that are important for the stratigraphic subdivision and correlation of Upper Cretaceous abyssal deposits. They include representatives of the families Lituolidae, Textulariidae, Trochamminidae, and, to some extent, Ataxophragmiidae. Primitive agglutinated foraminifera, representatives of the families Astorhizidae, Saccaminidae, and Ammodiscidae, are considered in less detail. The similar species of *Haplophragmoides*, *Labrospira*, *Praecystamina*, *Pseudobolivina*, *Bolivinospis*, *Paratrochamminoides*, and *Plectorecurvoides* are compared with ones originally described from the Upper Cretaceous abyssal clays of the northwestern part of the Pacific Ocean (Leg 20 of *Glomar Challenger*) and are only briefly described.

The holotypes of new species and originals of other species described in this paper are kept in the Micropaleontological Laboratory of the Geological Institute of the Academy of Sciences of the USSR, Moscow, under Collection Number 4013. The photographs of the foraminifera were taken by A. I. Nikitin and retouched by A. N. Makarevich. The author expresses to them his sincere thanks.

#### Family LITUOLIDAE

Genus HAPLOPHRAGMOIDES Cushman, 1910.

Attributed to the genus *Haplophragmoides* are involute and partially evolute, planispirally coiled, agglutinated foraminifera with a slit-like interiomarginal aperture: tests are usually symmetrical, in rare cases becoming slightly asymmetrical.

Based on the characters of coiling and symmetry, the Upper Cretaceous representatives of *Haplophragmoides* can be divided into three morphological groups. The first includes partially evolute and slightly evolute species (*H. fraudulentus*, *H. constrictus*, *H. multicamerus*, *H. perexplicatus*). The second group consists of involute species (*H. decussatus*, *H. linki*, *H. pseudokirki*, *H. bulloides*, *H. multiformis*). The third group includes species somewhat lacking in symmetry due to the development of a lobe on one side of the test that extends over the umbilicus (*H. menitens*, *H. incredibilis*). These species of *Haplophragmoides* resemble representatives of the genus *Arenonionella* Marks, but their opposite side is completely involute (the test of the genus *Arenonionella* is slightly trochospiral, chambers of all whorls being partially seen on one of the sides).

#### *Haplophragmoides fraudulentus* Krasheninnikov (Plate I, Figures 1a, b, 2a)

1973. *Haplophragmoides fraudulentus* Krasheninnikov (Krasheninnikov, 1973. p. 207, pl. 1, fig. 9a, b)

**Originals:** N 4013/1 (Figures 1a, b), Sample 260-6-1, 71-73 cm; N 4013/2 (Figure 2a), Sample 260-6-1, 136-138 cm; Indian Ocean; Upper Cretaceous.

**Remarks:** A distinct species characterized by a small low, planispiral evolute test, with rounded peripheral margin, lobulate outline,

and shallow, wide umbilical area; the last whorl contains six to seven almost spherical chambers. The wall is glassy, homogeneous, smooth, semitransparent when moistened.

The morphological features and dimensions (diameter 0.17-0.24 mm, thickness 0.05-0.07 mm) are identical with those of the specimens from the Upper Cretaceous abyssal clays of the Pacific Ocean (Holes 196 and 198A). Some Indian Ocean specimens have somewhat larger dimensions (diameter 0.28 mm, thickness 0.08 mm).

**Stratigraphic range:** *H. fraudulentus* is frequent in samples from abyssal clays of the Upper Cretaceous (not older than the Upper Turonian-Coniacian) of Sites 260 (Gascoyne Abyssal Plain) and 261 (Argo Abyssal Plain). It has been found only in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

**Haplophragmoides constrictus Krasheninnikov**  
(Plate 1, Figures 3a, b)

1973. *Haplophragmoides constrictus* Krasheninnikov (Krasheninnikov, 1973, p. 207, pl. 1, Fig. 5a, b)

**Original:** N 4013/3, Sample 260-61, 71-73 cm; Indian Ocean; Upper Cretaceous.

**Remarks:** The planispiral test is small to medium in size (diameter 0.30-0.40 mm, thickness 0.12-0.15 mm), partially evolute and low, with a rounded peripheral margin and a slightly lobulate outline; wide, shallow umbilicus; the last whorl consists of six to seven trapeziform chambers, somewhat compressed laterally; the wall is thin, smooth, very fine grained, and semitransparent when moistened.

Specimens of this species from the Upper Cretaceous of the Indian and Pacific (Holes 196 and 198A) oceans are identical.

**Stratigraphic range:** *H. constrictus* is frequent in the Upper Cretaceous abyssal clays (not older than the Upper Turonian-Coniacian), of the northeastern part of the Indian Ocean (Sites 260 and 261). It is restricted to the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

**Haplophragmoides multicamerus Krasheninnikov**  
(Plate 1, Figures 4a, b)

1973. *Haplophragmoides multicamerus* Krasheninnikov (Krasheninnikov, 1973, p. 215, pl. 1, Fig. 1a, b, 2a, b.)

**Original:** N 4013/4, Sample 260-6-1, 71-73 cm; Indian Ocean; Upper Cretaceous.

**Remarks:** A small (diameter 0.13-0.20 mm, thickness 0.05-0.07 mm) partially evolute, low, planispiral test, with a rounded peripheral margin and slightly lobate outline; the umbilicus is wide and shallow; the last whorl consists of 8-10 narrow trapeziform chambers; the wall is thin, glassy, smooth, and semitransparent when moistened.

The morphological characters of *H. multicamerus* from the Upper Cretaceous of the Indian Ocean are the same as in those from the synchronous deposits of the Pacific Ocean (Holes 196 and 198A), except the dimensions are somewhat smaller; the number of specimens is very small in the Indian Ocean sediments.

**Stratigraphic range:** Upper Cretaceous (not older than the upper Turonian-Coniacian), northeastern part of the Indian Ocean, Sites 260 and 261. Restricted to the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

**Haplophragmoides perexplicatus Krasheninnikov**  
(Plate 1, Figures 5a, b)

1973. *Haplophragmoides perexplicatus* Krasheninnikov (Krasheninnikov, 1973, p. 208, pl. 1, fig. 6a, b.)

**Original:** N 4013/5, Sample 260-6-1, 85-87 cm; Indian Ocean; Upper Cretaceous.

**Remarks:** The planispiral test of medium height is very small (diameter 0.24-0.28 mm, thickness 0.07-0.09 mm) and slightly evolute with only a small portion of the previous whorl visible. Height of whorl increases rapidly. The peripheral margin is rounded, and the outline of the test slightly lobate. The last whorl contains five to six chambers, flattened laterally. The wall is thin, glassy, homogeneous or fine grained, and semitransparent when moistened.

The morphological characters and dimensions of specimens from the Upper Cretaceous of the Indian and Pacific (Holes 196 and 198A) oceans are identical.

**Stratigraphic range:** Upper Cretaceous (not older than the Upper Turonian-Coniacian), northeastern part of the Indian Ocean (Sites 260 and 261). The species is frequent in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

**Haplophragmoides decussatus Krasheninnikov**  
(Plate 1, Figures 6a, b)

1973. *Haplophragmoides decussatus* Krasheninnikov (Krasheninnikov, 1973, p. 208, pl. 2, fig. 3a, b.)

**Original:** N 4013/6, Sample 260-6-1, 145-147 cm; Indian Ocean; Upper Cretaceous.

**Remarks:** The planispiral test is very small (diameter 0.18-0.21 mm, thickness 0.12-0.15 mm) and entirely involute. The four chambers of the last whorl are thick, slightly compressed laterally; test periphery broadly rounded, and slightly lobulate. The wall is thin, smooth, homogeneous, and semitransparent when moistened.

Specimens from the Upper Cretaceous of the Indian and Pacific (Holes 196 and 198A) oceans possess identical morphology and dimensions.

**Stratigraphic range:** Upper Cretaceous (not older than the Upper Turonian-Coniacian), northeastern part of the Indian Ocean (Sites 260 and 261). The species appears in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii* and is a regular component of the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

**Haplophragmoides linki Nauss**  
(Plate 1, Figures 7a, b)

1947. *Haplophragmoides linki* Nauss (J. Paleont., v. 21, p. 339, pl. 49, fig. 7.)

**Original:** N 4013/7, Sample 260-6-1, 71-73 cm; Indian Ocean; Upper Cretaceous.

**Description:** The test is small, planispiral, entirely involute, and moderately compressed laterally. Almost circular in lateral view, with an even outline. The peripheral margin is rounded, the sides are convex and flattened. Umbilical areas are small, deep, and cone shaped. The whorls increase gradually, the last contains seven to eight narrow subtriangular chambers. Septal sutures are almost straight, thin, depressed, and sometimes poorly recognizable. The apertural face is oval, rather high. The low, slit-like aperture at its base has a lip in the form of an overhanging beak; the wall is fine grained, smooth.

The size of the lip above the slit-like aperture varies considerably. Specimens with a well-developed lip (Plate 1, Figures 7a, b) occur together with others having a hardly noticeable lip. Septal sutures are usually slightly depressed and thin; in some specimens they are flat and poorly visible.

**Dimensions:** Diameter 0.21-0.30 mm, thickness 0.12-0.17 mm.

**Comparison:** Morphology and dimensions compare well with *H. linki* Nauss described from the Upper Cretaceous of the Vermilion area, Alberta, Canada. The only difference lies in the presence of a lip which is weakly developed in some of the Indian Ocean specimens, but which is always absent in the Canadian specimens.

*H. linki* resembles *H. glabra* Cushman and Waters (Upper Cretaceous, Texas, USA) and *H. herbichi* Neagu (Turonian, Roumania). However, the first differs in a greater number (up to 11) of narrow curved chambers, the second in the absence of an umbilical deepening.

**Stratigraphic range:** The species is frequent in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*, Upper Cretaceous (not older than upper Turonian-Coniacian), northeastern part of the Indian Ocean (Site 260).

**Haplophragmoides pseudokirki sp. nov.**  
(Plate 1, Figures 8a, b)

**Holotype:** N 4013/8, Sample 261-5, CC; Indian Ocean; Upper Cretaceous.

**Description:** The test is small, planispiral, entirely involute, inflated, and almost spherical. It is regularly rounded in lateral view, broadly oval, with convex lateral sides in peripheral view. The peripheral margin is broadly rounded. Umbilical depressions are absent. Whorls are low, slowly increasing, the last with four broad subtriangular chambers. The septal sutures are straight, thin, and flat. The apertural face is low, arch-shaped. The aperture at its base has the form of a high arch; its position is equatorial and does not extend toward the umbilical area. The wall is thin, smooth, homogeneous, or with hardly observable grains.

**Dimensions:** Diameter 0.19-0.23 mm, thickness 0.17-0.19 mm.

**Comparison:** This species is similar to *H. kirki* Wickenden, described from the Upper Cretaceous of Alberta, Canada (Wickenden, 1932) and California, USA (Martin, 1964; Sliter, 1968). However, *H. kirki* possesses a greater number of chambers in the last

whorl (four to six), an oval test compressed laterally, depressed septal sutures, and a low, long, slit-like aperture.

Hanzlikova (1972) described *H. kirki* from the Campanian and Maestrichtian of Czechoslovakia. It is very likely that these agglutinated forms belong to another species of *Haplophragmoides*. They differ from *H. pseudokirki* in a large spherical test with a coarsely arenaceous wall and low, slit-like aperture.

**Stratigraphic range:** Upper Cretaceous (not older than upper Turonian-Coniacian), upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*, northeastern part of the Indian Ocean (Site 261).

***Haplophragmoides bulloides* (Beissel)**  
(Plate 1, Figures 9a, b, 10b, 11b)

1891. *Haplophragmium bulloides* Beissel, K. Preuss. Geol. Landesanst., Abh., n.s., N 3, p. 17, pl. 2, fig. 1-3; pl. 4, fig. 24-30).

**Originals:** N 4013/9 (Figure 9), N 4013/10 (Figure 10), Sample 260-6-1, 145-147 cm; N 4013/11 (Figure 11), Sample 261-8-3, 42-44 cm; Indian Ocean; Upper Cretaceous.

**Description:** The test is relatively small, planispiral, entirely involute, inflated, slightly compressed laterally, and almost spherical. In lateral view the test is somewhat elongate, almost rounded, and in peripheral view irregular oval (due to a rapid increase of whorl thickness). The peripheral margin is broadly rounded. The sides are convex, their central parts with small umbilical depressions. Size of chambers gradually increases. The last whorl consists of six to seven relatively narrow chambers of a triangular shape. The chambers are divided by thin straight sutures, slightly deepened between last chambers, poorly visible between early ones. The apertural face is a low, strongly curved arch. A low, long, slit-like aperture is at its base. The wall is thin, smooth, glassy, homogeneous, or fine grained.

**Dimensions:** Diameter 0.27-0.33 mm, thickness 0.23-0.30 mm.

**Variability:** Test shape, apertural face, and aperture are variable. In adult specimens, the arch-like aperture is strongly curved (Plate 1, Figures 9b, 10b), in juvenile forms only moderately curved (Plate 1, Figure 11b). In rare cases the aperture has a thin lip.

**Remarks:** The species closely resembles calcareous forms of the genus *Nonion* (or *Melonis*). Based on shape of test, chambers, septal sutures, apertural surface, and character of the wall, this species is identical with *Haplophragmoides bulloides* Beissel, first described from the Upper Cretaceous (Senonian) of Aachen (Federal Republic of Germany), but its dimensions are two to four times smaller (diameter of Aachen *H. bulloides* is 0.56-1.36 mm, thickness is 0.47-1.09 mm).

The question arises, whether such an extreme difference in test size can be related to ecological factors. The red-brown, abyssal clays of the Indian Ocean were certainly formed under conditions quite different from those of the synchronous shallow-water Upper Cretaceous sediments of Western Europe. It is quite possible that these two forms represent two different species.

The species *H. bulloides* Beissel was described by Neagu (1968, 1970) from the Cenomanian-Turonian of Roumania. The morphological characters and dimensions (diameter 0.29-0.24 mm) of this species are very close to those of *H. bulloides* from the Upper Cretaceous of the Indian Ocean. Hanzlikova (1972) doubts whether Neagu's determination is correct, pointing to the considerable difference in size of the *Haplophragmoides* specimens from the Upper Cretaceous of Roumania and *H. bulloides* from the Cenonian of Aachen. Hanzlikova attributes *H. bulloides* Beissel from the Upper Cretaceous of Roumania (as interpreted by Neagu) to *H. impensus* Martin, first described from the Campanian-Maestrichtian of California. Specimens from the Upper Cretaceous of Czechoslovakia considered by Hanzlikova as *H. impensus* are strongly deformed; this makes their comparison with the holotype of *H. impensus* from California and the forms here described from the Upper Cretaceous of the Indian Ocean difficult.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261). The species is frequent in both the lower assemblage of agglutinated foraminifera with *Haplophragmium luecke* and the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

***Haplophragmoides multiformis* sp. nov.**  
(Plate 2, Figures 1a, b, 2a, b)

**Holotype:** N 4013/12 (Figures 1a, b), Sample 260-6-1, 106-108 cm;

Paratype: N 4013/13 (Figures 2a, b), Sample 261-7-1, 82-84 cm; Indian Ocean; Upper Cretaceous.

**Description:** The test is small to medium in size, planispiral, entirely involute, and compressed laterally. When viewed laterally, the test is more or less oval, with a slightly lobulate outline. In edge view it is oval, with a rounded peripheral margin and flattened lateral sides. The chambers are high, rather rapidly increasing in size. The last whorl contains four broad subtriangular or trapeziform chambers. They are strongly involute—their umbilical ends not only reach the umbilical area, but cover umbilical ends of preceding chambers. The septal sutures are slightly incised, distinct, almost straight. The apertural face is oval, the slit-like aperture situated at its base. The wall is thin, smooth, glassy, homogeneous, siliceous, and semitransparent when moistened.

**Dimensions:** Diameter 0.23-0.38 mm, thickness 0.12-0.20 mm.

**Remarks:** Together with four-chambered specimens (Figure 1), there are frequent specimens with only two chambers in the last whorl (Plate 2, Figure 2). They may be regarded as early (juvenile) stages.

In terms of shape and arrangement of chambers, this species differs considerably from other Cretaceous representatives of the genus *Haplophragmoides*.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261). The species is frequent in both the lower assemblage of agglutinated foraminifera with *Haplophragmium luecke* and the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

***Haplophragmoides menitens* sp. nov.**  
(Plate 2, Figures 3a, b, 4a, b)

**Holotype:** N 4013/14 (Figure 3), Sample 260-6-1, 136-138 cm; Paratype: N 4013/15, Sample 260-6-1, 139-141 cm; Indian Ocean; Upper Cretaceous.

**Description:** The test is small to medium size, planispiral, entirely involute, lens-like, oval in lateral view, with a regular outline. The test is regularly oval in peripheral view, with convex lateral sides and a subrounded peripheral margin. The chambers are high, rapidly increasing in size. The last whorl contains 4-4.5 chambers, which are broad, flattened, and subtriangular. The septal sutures are thin, flat or slightly deepened, almost straight. The umbilical ends of chambers meet in the center. The umbilicus is small and narrow. The apertural face is oval, with a slit-like aperture at its base, that does not reach the umbilical ends of a chamber. The wall is thin, smooth, homogeneous, siliceous, and glassy.

**Dimensions:** Diameter 0.27-0.38 mm, thickness 0.17-0.23 mm.

**Remarks:** The morphological features of the species are constant. Some specimens can be slightly asymmetrical.

The new species is rather peculiar. The form of the test resembles representatives of the genus *Florilus* (or *Nonion*) with a calcareous granular wall. The following species of *Haplophragmoides* characterized by a lens-like test with a narrowly rounded margin were described from the Cretaceous of various countries: *H. herbichi* Neagu, *H. gigas minor* Nauss, *H. akkeshiensis tokotanensis* Yoshida, *H. glabra* Cushman and Waters, *H. eggeri* Cushman, *H. colusaensis* Cushman and Goudkoff, etc. However, they all differ from the new species in a larger number of narrow chambers (6-10) forming the last whorl, a clearly granular (agglutinated) wall, and other features.

**Stratigraphic range:** Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261); upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*; rather rare.

***Haplophragmoides incredibilis* sp. nov.**  
(Plate 2, Figures 5a, b, c)

**Holotype:** N 4013/16, Sample 261-7-2, 80-82 cm; Indian Ocean; Upper Cretaceous.

**Description:** The test is small to medium size, planispiral, entirely involute, lens-like. In lateral view, the test is broadly oval, with a slightly lobulate peripheral outline, lens-like in edge view, with convex sides and a narrowly rounded peripheral margin. The last whorl contains 8-10 narrow, moderately curved chambers with a flat surface. The septal sutures are thin, slightly depressed, poorly visible in the initial part of the last whorl. The umbilicus is distinct, narrow, deep,



and cone-shaped. The apertural face is high and oval. The umbilical ends of the last chamber form elongate convex lobes in adult specimens, embracing the early stage of the last whorl. A plate separated from the early chambers by a slit (Plate 2, Figures 5b, c) is detached from the umbilical lobe. In some specimens the umbilical lobes of the last chamber differ somewhat in size, the test thus becoming slightly asymmetrical. The aperture is slit-like at the base of the apertural face. The wall is thin, agglutinated, with distinct grains, its surface uneven (rough).

**Dimensions:** Diameter 0.30-0.54 mm, thickness 0.23-0.33 mm.

**Remarks:** The test wall is thin and fragile; as a result tests are frequently damaged, especially the last chamber.

The new species resembles representatives of the genus *Florilus* or *Nonionella* with a calcareous granular wall. The only similar species is *Haplophragmoides nonionelloides* Israelsky from the upper part of the Lodo Formation in California (upper part of the lower Eocene). It is characterized by different sizes of the two umbilical lobes resulting in a clearly asymmetrical test and in the absence of umbilical depressions.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Site 261), lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

#### Genus LABROSPIRA Höglund, 1947

Two species of siliceous (agglutinated) foraminifera observed in abyssal Cretaceous clays of the northeastern part of the Indian Ocean have been attributed to the genus *Labrospira*—*L. pacifica* Krasheninnikov and *L. inflata* sp. nov. The first had previously been established in coeval abyssal clays of the northwestern part of the Pacific Ocean.

The assignment of these two species to *Labrospira* requires some explanation, especially because the validity of this genus is questioned.

*Labrospira* Höglund, 1947, is regarded by some authors (Orlov et al., 1959; Loeblich and Tappan, 1964) as a junior synonym of *Cribrostomoides* Cushman, 1910. This is based on the assumption that the type species of *Labrospira* (*Haplophragmium crassinargo* Norman, 1892) and of *Cribrostomoides* (*Lituola subglossum* Sars, 1871 = *Cribrostomoides bradyi* Cushman, 1910) are synonyms. I believe that this assumption is erroneous, as *Haplophragmium crassinargo* and *Lituola subglossum* differ in a number of characteristics (shape of the test, aperture, chambers, septal sutures, degree of involution of test, etc.).

Taking into account the recent and fossil representatives of *Labrospira* and *Cribrostomoides*, differences in morphological features of these genera are as follows: the aperture of *Cribrostomoides* is an areal elongated curved slit only during the early stages of evolution; in adult specimens it is subdivided by tooth-like projections and becomes multiple, consisting of rounded openings. The aperture of *Labrospira*, on the other hand, has the shape of an areal arch-like slit, changing during evolution from a long narrow arch-like slit to a short and relatively high arch-like slit arranged near the equatorial plain; it is usually provided with a thin lip. In addition, *Labrospira* is characterized by a laterally moderately compressed, not entirely involute test. As a result, a small umbilical depression is present. The chambers are trapeziform.

The test shape and arrangement of chambers of the two planispiral involute agglutinated foraminifera described herein are uncommon and only fit the genera *Cribrostomoides* and *Labrospira*. With their areal aperture, common to both species, they have to be placed into one of these two genera. *Cribrostomoides* can be excluded because the aperture of the above two species remains areal slit-like (not multiple) during all stages of evolution.

It seems unlikely that these two species are present only as juvenile stages in all the populations from the Upper Cretaceous of the Indian Ocean (and for *Labrospira pacifica* from the Upper Cretaceous sediments of the Pacific Ocean). The type of aperture is in fact the only feature that prevents assignment of *Labrospira pacifica* and *L. inflata* to *Cribrostomoides*. However, within each genus of the subfamily Haplophragmoidinae (*Haplophragmoides*, *Cribrostomoides*, *Recurvoides*, *Labrospira*, *Trochamminoides*, *Adercotryma*, *Thalmanamina*, etc.), the character of the aperture is so typical that it is of taxonomic significance.

Although the two species described below have the general apertural characteristics of *Labrospira* (differing only slightly in the shape of the aperture, which is oval slit-like instead of arch-like), they differ from this genus in possessing an entirely involute test in contrast to the evolute species described so far under this genus. The involute test may

be compressed laterally as in *Labrospira pacifica* or be spherically inflated as in *L. inflata*.

The question now arises, whether to amend the genus definition for *Labrospira* to include also involute forms, or to erect for them a new genus. *Haplophragmoides*, for instance, is also represented at Sites 260 and 261 by entirely involute and distinctly evolute, as well as laterally compressed and inflated species. In following this wide generic interpretation, it would seem preferable to include the involute species described below in *Labrospira*.

Consequently, *Labrospira* as defined here includes planispiral agglutinated foraminifera, entirely involute or semiinvolute (shape of chambers and umbilicus changing accordingly), compressed laterally or inflated, with an areal slit-like aperture (varying from long arch-like to short oval).

#### *Labrospira inflata* sp. nov.

(Plate 2, Figures 6a, b, 7b)

**Holotype:** N 4013/17 (Figure 6), Sample 261-7, CC; Paratype: N 4013/18 (Figure 7), Sample 261-7-2, 80-82 cm; Indian Ocean; Upper Cretaceous.

**Description:** The test is small, planispiral, entirely involute, inflated, and irregularly spherical. In lateral view it is irregularly oval, with an even, hardly noticeable lobulate peripheral outline; in edge view it is broadly oval with a wide, rounded peripheral margin and convex sides. The coiling is tight, chambers are low, slightly increasing in size and markedly enlarging in thickness. The last whorl contains three inflated, arch-like, broad chambers of an oval or irregularly triangular shape in lateral view. In rare cases a small portion of the fourth chamber appears (Plate 2, Figure 7). Septal sutures are thin, hardly noticeable, depressed, slightly curved, almost straight. The umbilical ends of the last chamber somewhat overlie the previous chambers; an umbilical depression is absent. The apertural face is convex, and arch-shaped. The aperture is areal, in the form of a short and broad oval slit; it lies near the equatorial plain of the test, sometimes surrounded by a thin lip. The wall is thin, smooth, glassy, homogeneous, sometimes fine grained, and semitransparent when moistened.

**Dimensions:** Largest diameter and largest thickness of the test are equal, ranging from 0.30 to 0.38 mm.

**Remarks:** The morphological features of the species are quite constant. The species differs from *Labrospira pacifica* in having a strongly inflated ball-like test.

**Stratigraphic range:** Relatively rare in the Upper Cretaceous of the northeastern part of the Indian Ocean (Site 261). Only in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

#### *Labrospira pacifica* Krasheninnikov

(Plate 3, Figures 1a, b, 2a, b)

1973. *Labrospira pacifica* Krasheninnikov (Krasheninnikov, 1973, p. 209, pl. 2, fig. 4a, b, 5a, b.)

**Originals:** N 4013/19 (Figures 1a, b) Sample 260-6-1, 70-72 cm; N 4013/20 (Figures 2a, b), Sample 260-6-1, 85-87 cm; Indian Ocean; Upper Cretaceous.

**Remarks:** Typical specimens of *L. pacifica* from Upper Cretaceous deposits of the Indian Ocean (Plate 3, Figures 1a, b) closely compare with those from the Upper Cretaceous of the Pacific Ocean. They are characterized by a small, lens-like, ovoid, entirely involute test with convex lateral sides and circular peripheral margin. The 3 to 3.5 chambers in the last whorl are gradually increasing in size. They are broad, irregularly oval or reniform-shaped, and flattened. The last chamber strongly envelopes parts of the previous chamber; an umbilical depression is absent. Septal sutures are thin, slightly depressed or flat, sometimes hardly noticeable. The apertural face has the form of a high curved arch; the aperture is an oval slit, short and rather broad, usually bordered by a thin lip, forming a rostrum-like projection (Plate 3, Figure 1a). The wall is smooth, glassy, homogeneous, and semitransparent when moistened.

The thickness of typical specimens is two-thirds of the diameter of the test. Considerably less frequent are large, broadly oval specimens of *L. pacifica* where the thickness is about three-fourths of the diameter of the test (Plate 3, Figures 2a, b).

The size of the test varies within rather wide limits (diameter 0.20-0.40 mm, thickness 0.12-0.30 mm). Some Indian Ocean tests exceed in size those of the Pacific Ocean.

**Stratigraphic range:** The species is common in the Upper Cretaceous (not older than the upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261), upper assemblage of agglutinated foraminifera with *Praecystamina globigerinaeformis*.

Genus PARATROCHAMMINOIDES Soliman, 1972

This genus is similar to the genus *Trochamminoides* in the character of chambers and aperture and in having an evolute test, but it differs considerably in the coiling pattern of the whorls. The test shape of *Paratrochamminoides* is variable, irregularly planispiral, irregularly trochospiral, and of bizarre shape. The species of this genus from the Upper Cretaceous of the Pacific and Indian oceans differ from typical representatives of *Paratrochamminoides* with coarse-grained walls from the Upper Cretaceous of the Carpathians, in having thin, glassy, homogeneous or fine-grained walls. These features are explained by the abyssal conditions under which the forms lived. The peculiar microstructure of the wall makes the placing of the two species described below into the genus *Paratrochamminoides* provisional.

In addition to *Paratrochamminoides vitreus* and *P. intricatus*, broken specimens apparently belonging to different species of this genus, were observed in the Upper Cretaceous of Sites 260 and 261. Their incomplete state of preservation did not permit specific identification.

**Paratrochamminoides vitreus** Krasheninnikov  
(Plate 4, Figures 1a, b, c)

1973. *Paratrochamminoides* ? *vitreus* Krasheninnikov (Krasheninnikov, 1973, p. 212, pl. 3, fig. 1a, b, c.)

**Original:** N 4013/21, Sample 260-6-1, 85-87 cm; Indian Ocean; Upper Cretaceous.

**Remarks:** Morphology and dimensions (diameter 0.25-0.40 mm, thickness 0.15-0.20 mm) equal those of specimens from the Upper Cretaceous of the Pacific Ocean. The small irregularly shaped test has an oval form with lobulate outline; one side is flattened, the other convex or also flattened. The initial whorls are irregular, the coiling is close to planispiral in the last whorl (a very low trochoid spiral). The last tubular whorl is divided into six to nine spherical chambers. The septal sutures are distinctly depressed and straight. The aperture is rounded, like the open end of a tubular chamber, but its height is always less than that of the chamber width. The wall is thin, glassy, smooth, homogeneous, fine grained, and semitransparent when moistened.

**Stratigraphic range:** Common in the Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261). Present mostly in the upper assemblage of agglutinated foraminifera with *Praecystamina globigerinaeformis*; sporadic small specimens were also recorded in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

**Paratrochamminoides intricatus** Krasheninnikov  
(Plate 4, Figures 2a, b, c)

1973. *Paratrochamminoides* (?) *intricatus* Krasheninnikov, (Krasheninnikov, 1973, p. 212, pl. 3, fig. 2a, b, c.)

**Original:** N 4013/22, Sample 260-6-1, 71-73; Indian Ocean; Upper Cretaceous.

**Remarks:** Upper Cretaceous specimens from the Indian and Pacific oceans are similar in morphology and dimensions (largest diameter 0.43-0.57 mm, thickness 0.24-0.32 mm). The irregularly shaped test has a low, irregularly trochoid initial part. The coiling plane of the last tubular whorl changes sharply (approximately by 90°), progressing from the middle of one lateral side of the test to the opposite side. This whorl contains four to six subspherical convex chambers divided by depressed, straight septal sutures. The aperture is a low, arch-like opening at the base of the apertural face. The wall is smooth, glassy, homogeneous, or fine-grained.

**Stratigraphic range:** Common in the Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261), in the upper assemblage of agglutinated foraminifera with *Praecystamina globigerinaeformis*.

Genus RECURVOIDES Earland, 1934

Typical representatives of this genus with streptospiral (recurvoid) coiling and areal oval aperture make up an essential component of the assemblages of agglutinated foraminifera in abyssal Upper Cretaceous deposits of the Indian Ocean.

**Recurvoides pseudosymmetricus** sp. nov.  
(Plate 3, Figures 3a, b, c)

**Holotype:** N 4013/23, Sample 260-6-1, 139-141 cm; Indian Ocean; Upper Cretaceous.

**Description:** The test is small to medium size, with streptospiral coiling of chambers, which are inflated, almost spherical, laterally very slightly compressed. The test is circular in lateral view, with an even outline. In edge view, the test is broadly oval, the lateral sides are strongly convex. One side of the test is entirely involute (Plate 3, Figure 3a); a very small portion of the previous whorl whose chambers are coiling in a different plain is visible on the spiral side (Plate 3, Figure 3b). The last whorl consists of six to seven arch-like, curved chambers. In lateral view they are relatively broad, and subtriangular in shape. The septal sutures are slightly depressed or flat, poorly visible, straight. The spiral suture is short, not well marked, slightly depressed. The apertural face is convex, its form like a low arch, at right angles to the previous whorl, or slightly sloping towards it. The aperture is areal, a short and broad oval slit; it lies somewhat above the base of the apertural face, in the central part and is bordered by a marked thin lip. The wall is typically agglutinated, fine-grained, with a rough surface.

**Dimensions:** Greatest diameter 0.23-0.54 mm, thickness (of the last chamber) 0.20-0.50 mm.

**Remarks:** Two morphological varieties can be distinguished within the species.

The first contains relatively large, laterally slightly compressed forms (diameter 0.45-0.54 mm), with a slightly depressed spiral suture and, relative to the previous whorl, slightly sloping apertural surface. They occur in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

The second variety differs in having a somewhat smaller diameter (0.35-0.45 mm) and inflated spherical test in which diameter and thickness are the same; the spiral suture is poorly seen, and the apertural face is perpendicular to the previous whorl. The test looks symmetrical, resembling representatives of *Labrospira*. However, this apparent symmetry does not exist. When moistened with water, the streptospiral chamber arrangement becomes visible. This second variety occurs in both the upper and lower assemblage of agglutinated foraminifera.

The typical features of the species (spherical pseudosymmetrical test with an oval areal aperture and a fine-grained wall) noticeably distinguish *Recurvoides pseudosymmetricus* from other species of this genus. A remote similarity exists with *R. globulosus* (Grzybowski), but the latter has a deeply incised spiral suture, coarse-grained wall, and a small, rounded aperture in asymmetrical position relative to the plane of coiling.

**Stratigraphic range:** Common in the Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261). Occurs in the lower (with *Haplophragmium lueckeii*) and upper (with *Praecystamina globigerinaeformis*) assemblages of agglutinated foraminifera.

**Recurvoides pentacameratus** sp. nov.  
(Plate 3, Figures 6a, b, c)

**Holotype:** N 4013/24, Sample 260-6-1, 136-138 cm; Indian Ocean; Upper Cretaceous.

**Description:** The test is small, with streptospiral coiling, chambers not numerous, irregularly spherical. In lateral view the test is oval, with an even or slightly lobulate outline; in peripheral view it is broadly oval, with a rounded peripheral margin and strongly convex lateral sides. Five, less frequently 4.5 convex, semispherical chambers form the outer whorl. The coiling planes of adjacent chambers are at an angle to one another, which results in the streptospiral volution. Four strongly embracing chambers are visible on each side of the test. They are separated by slightly depressed, curved septal sutures; a spiral suture is absent. The lateral sides are not symmetrical. The apertural face is low, arch-shaped. A short, narrow or rather broad oval areal aperture lies in approximately the center part of this face. The wall is thin, smooth, fine-grained, almost glassy, and semitransparent when moistened.

**Dimensions:** Diameter of the test (0.27-0.33 mm) only a little larger than its thickness (0.22-0.31 mm).

**Remarks:** It is a very characteristic species of *Recurvoides*, and differs from other representatives of this genus in its small subspherical test with a streptospiral arrangement of its few chambers and the absence of the spiral suture. A remote similarity with *R. higginsii*



Bronnimann from the middle-upper Miocene of Trinidad can be observed, but the test of the latter is biumbilicate; the last whorl has six to seven chambers, the spiral suture is outlined, and the wall is coarsely arenaceous.

**Stratigraphic range:** Relatively rare in the Upper Cretaceous (not older than the upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261). Occurs in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

**Recurvoides ex gr. deflexiformis (Noth)**

(Plate 3, Figures 4a, b, c, 5a, b)

**Originals:** N 4013/25 (Figures 4a, b, c), Sample 260-6-1, 106-108 cm; N 4013/26 (Figures 5a, b), Sample 261-5-1, 80-82 cm; Indian Ocean; Upper Cretaceous (not older than the upper Turonian-Coniacian). Occurs in upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

**Remarks:** One more interesting species of *Recurvoides* was found in addition to the two described above. It is characterized by a small oval test (diameter 0.21-0.30 mm, thickness 0.14-0.20 mm) with moderately convex lateral sides and a rounded peripheral margin. The coiling planes of adjacent whorls are at right angles (the change in coiling direction can be seen well in Plate 3, Figure 4a). A preceding whorl is visible on the spiral side (Plate 3, Figures 4b, 5a), the spiral suture is depressed. On the opposite side, chambers of the previous whorl are poorly exposed (Plate 3, Figure 4a), sometimes they are almost entirely enveloped by the chambers of the last whorl. The latter contains six to eight trapeziform chambers divided by obscure, straight, septal sutures. The arch-shaped apertural face lies towards one side of the chamber. The aperture is areal, round, or oval. The wall is agglutinated, fine grained, smooth.

Based on the streptospiral coiling (change of coiling planes 90°) and shape of the test, the specimens are attributed to *Recurvoides deflexiformis* (Noth). The species occurs in Late Cretaceous-early Tertiary deposits of some Carpathian regions. The specimens of *Recurvoides* from the Upper Cretaceous of the Indian Ocean differ from the holotype of *R. deflexiformis* in having compressed chambers and vague septal sutures, and from *R. deflexiformis* as interpreted by Geroch (1960) and Hanzlikova (1972), in one side of the test being more involute and in a fine-grained wall.

Specimens are rare in the zeolitic clays of Sites 260 and 261. The variability of this species which is described here in open nomenclature is therefore difficult to assess.

Genus HAPLOPHRAGMIUM Reuss, 1860

**Haplophragmium lueckeii (Cushman and Hedberg)**

(Plate 4, Figures 3a, b, 4a, 5a)

1941. *Ammobaculites lueckeii* Cushman and Hedberg (Cushman and Hedberg, 1941, p. 84, pl. 21, fig. 4a, b.)

**Original:** N 4013/27 (Figures 3a, b), N 4013/28 (Figure 4), N 4013/29 (Figure 5), Sample 261-7-3, 105-107 cm; Indian Ocean; Upper Cretaceous.

**Description:** The test is small to medium size, consisting of two stages: an initial one with streptospiral coiling of chambers and a later one with uncoiled and rectilinear chambers. The last whorl of the streptospiral stage consists of four to six chambers, which are irregularly spherical, gradually increasing in size, and separated by depressed septal sutures. In addition to typical streptospirally coiling tests, there are specimens with irregular low trochospiral coiling. The aperture of the initial stage is round and arranged areally, on the lateral side of the chamber above the septal suture, or it occupies a terminal position. The uniserial rectilinear stage contains two to three, seldom four convex chambers. The last of these chambers is inflated, subspherical, the earlier ones subcylindrical. The septal sutures are distinct, depressed, straight. The wall is typically agglutinated, fine grained, and the surface is rough.

**Dimensions:** Length 0.24-0.50 mm, diameter of the streptospiral stage 0.15-0.21 mm.

**Remarks:** The chamber arrangement is variable in the early part of the test. The specimens with an initial low irregular trochoid spire could have erroneously been placed in the genus *Ammobaculites*. *Haplophragmium lueckeii* differs considerably from other Cretaceous species of this genus.

*H. lueckeii* was first described from the Upper Cretaceous Colon Formation of Colombia (Cushman and Hedberg, 1941). The

specimens of the Indian Ocean are identical to the holotype in morphology and dimensions. *H. lueckeii* has also been recorded in Campanian-Maestrichtian deposits of California (Sliter, 1968) and Czechoslovakia (Hanzlikova, 1972), and in the Turonian-Campanian of Roumania (Neagu, 1970). However, in these areas the species dimensions are two to three times larger and the specimens possess a coarse-grained wall.

**Stratigraphic range:** The species is frequent in the Upper Cretaceous of the northeastern part of the Indian Ocean (Site 261), in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

Family TEXTULARIIDAE

Genus PSEUDOBOLIVINA Wiesner, 1931

**Pseudobolivina munda Krasheninnikov**

(Plate 4, Figures 6a, b, 7a)

1973. *Pseudobolivina munda* Krasheninnikov (Krasheninnikov, 1973, p. 210, pl. 2, fig. 10, 11.)

**Originals:** N 4013/30 (Figures 6a, b), Sample 260-6-1, 106-108 cm; N 4013/31 (Figure 7), Sample 260-6-1, 145-147 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** Morphological characters are the same as in the specimens from the Upper Cretaceous of the Pacific Ocean (Sites 196 and 198A). The small test has a narrow wedge-like elongated shape, somewhat compressed laterally, gradually tapering toward the base, with a slightly lobulate contour. The chambers are biserially arranged, four to seven in each row, convex in the initial part, trapeziform, subspherical inflated at the apertural end. The septal sutures are depressed, horizontal between early chambers, and oblique between later chambers. The medial suture is slightly curved at the base of the test and has a zigzag shape in its later part. The aperture is terminal, rounded, with a short neck and a thickened rim. The apertural neck is sometimes visible also in the penultimate chamber (Plate 4, Figures 6a, b). The wall is thin, smooth, glassy, homogeneous, or fine grained.

Dimensions of many specimens are as small as in the Pacific area: length 0.17-0.22 mm, width in the apertural part 0.08-0.10 mm. Larger specimens with a length of 0.30-0.38 mm, and a width of 0.12-0.15 mm are also present.

**Stratigraphic range:** Indian Ocean, Sites 260 and 261, Upper Cretaceous, rare in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*, common in the upper assemblage of foraminifera with *Praecystammina globigerinaeformis*.

**Pseudobolivina cuneata sp. nov.**

(Plate 4, Figures 8a, b, 9a)

**Holotype:** N 4013/32 (Figures 8a, b), Sample 261-8-4, 49-51 cm; Paratype: N 4013/33 (Figure 9), Sample 261-8-3, 42-44 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is small, broadly wedge-like, rapidly tapering toward the base, pointed at the base, with lobulate outline, laterally very slightly compressed, with a rounded peripheral margin. The arrangement of chambers is biserial, four to five in one row. Early chambers are small, subspherical or trapeziform. Chambers increase rapidly in size, the last three to four chambers are large, inflated, spherical. The septal sutures are depressed and curved. The medial suture is hardly noticeable in the initial part of the test, later it becomes zigzag shaped and depressed. The aperture is round, terminal, sitting on a well pronounced, rather high neck. The wall is thin, fine-grained, almost homogeneous; the surface is slightly rough, and semitransparent when moistened.

**Dimensions:** Length 0.22-0.33 mm, width of the apertural part 0.19-0.24 mm.

**Stratigraphic range:** Indian Ocean, Site 261, Upper Cretaceous; the species occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

**Pseudobolivina lagenaria sp. nov.**

(Plate 5, Figures 1a, b, 2a)

**Holotype:** N 4013/34 (Figures 1a, b), Sample 260-6-1, 145-147 cm; Paratype: N 4013/35 (Figure 2), Sample 260-6-1, 71-73 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is small, narrow, elongate, with sharply lobulate contour, laterally slightly compressed, irregularly rounded at the base and truncated in the apertural part. The chambers have a

biserial arrangement, two to three in one row. The first two to three chambers are subspherical, small. The later increasing rapidly in size, becoming inflated, bottle-shaped (the Latin name of the species, "lagenaria" means "bottle-shaped"), loosely joined and with a tendency towards a uniserial, rectilinear arrangement. The sutures between chambers are distinct, depressed, oblique. The aperture is round, terminal, situated at the end of a high apertural neck. The wall is thin, smooth or slightly rough, shiny, and semitransparent when moistened.

**Dimensions:** Length 0.19-0.40 mm, width of the last chamber 0.09-0.15 mm.

**Remarks:** The species differs considerably from other species of *Pseudobolivina* (including *P. cuneata*) in its tendency to a uniserial arrangement of only loosely joined bottle-shaped chambers with a distinct neck.

**Stratigraphic range:** Upper Cretaceous (not older than the upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the upper assemblage of agglutinated foraminifera with *Praecystamina globigerinaeformis*.

***Pseudobolivina normalis* sp. nov.**

(Plate 4, Figures 10a, b)

**Holotype:** N 4013/36, Sample 261-7-2, 80-82 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is very small, narrow, wedge-like, elongate, laterally compressed, with a slightly lobulate outline, becoming gradually narrower toward the base, where it is pointed; rounded in the apertural part, sometimes slightly twisted. The peripheral margin is rounded. The arrangement of chambers is biserial, three to four chambers in each row. The initial chambers gradually increase in size, are trapeziform, and flattened laterally. The two last chambers are large, ovoid, convex. The septal sutures are distinct, oblique, depressed. The medial suture is depressed, slightly zigzag shaped. The aperture is long, loop shaped or oval, arranged perpendicular to the base of the apertural face, bordered sometimes by a thin lip. The aperture is in contact with the base of the apertural surface, sometimes somewhat higher in this base. The wall is thin, smooth, glassy, homogeneous, semitransparent when moistened.

**Dimensions:** Length 0.14-0.24 mm, width of the apertural part 0.07-0.12 mm.

**Remarks:** The species is similar to *Pseudobolivina variabilis* (Vasicek) from the Lower Cretaceous (Barremian-Albian) of Czechoslovakia (Vasicek, 1947) and Poland (Geroch, 1966); however, the latter is characterized by a narrow lanceolate test with a great number of chambers (6-10 in one row). The representative of *Pseudobolivina* described by Neagu (1970) from the Upper Cretaceous (Cenomanian-lower Turonian) of Roumania appears to belong to another species of this genus. It differs considerably from *P. normalis* sp. nov. by the tendency of the last chambers to become irregular uniserial.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Site 261); the species is frequent in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

Genus **BOLIVINOPSIS** Yakovlev, 1891

The representatives of the genus *Bolivinopsis* from the abyssal clays of the Upper Cretaceous are characterized by a siliceous (agglutinated) wall. In contrast to *Spiroplectamina*, the genus has in its initial part an incomplete whorl around the proloculus, followed by a long narrow biserial part; in macrospheric specimens the diameter of the spiral part is the same or somewhat exceeds the width of the biserial part, in microspheric specimens the diameter is less than the width of the biserial part, but is never so small as in *Spiroplectamina*.

***Bolivinopsis parvissimus* Krasheninnikov**

(Plate 4, Figure 11a)

1973. *Bolivinopsis parvissimus* Krasheninnikov (Krasheninnikov, 1973, p. 210, pl. 2, fig. 8, 9.)

**Original:** N 4013/37, Sample 260-6-1, 139-141 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** Morphological characters and dimensions (length 0.15-0.22 mm, width of the apertural end 0.06-0.08 mm) of *B. parvissimus* specimens are identical in the Upper Cretaceous of the Indian and Pacific oceans. The tiny elongate test is compressed laterally, with a hardly noticeable lobulate outline. The planispiral part consists of a

proloculus and four to five tiny subspherical chambers forming an incomplete whorl. Each row of the biserial stage consists of four to five chambers, which are slightly convex, oval or almost equilateral, slightly increasing in size. The width of the biserial part is almost the same throughout. The sutures are weakly depressed, poorly visible. The aperture is a low slit at the base of the apertural face. The wall is very thin, fragile, glassy, smooth, homogeneous, or with very fine grains.

**Stratigraphic range:** Not numerous in the Upper Cretaceous (not older than the upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the upper assemblage of agglutinated foraminifera with *Praecystamina globigerinaeformis*.

***Bolivinopsis abyssalis* sp. nov.**

(Plate 4, Figures 12a, 13a)

**Holotype:** N 4013/38 (Figure 12), Sample 261-7-1, 82-84 cm; Paratype: N 4013/39 (Figure 13), Sample 261-8-4, 49-51 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is small, slightly elongate, moderately compressed laterally, with a rounded peripheral margin and an even, faintly lobulate outline; consists of a relatively large planispiral whorl and a short biserial part. The incomplete planispiral whorl is formed by 4-4.5 chambers of, trapeziform or subtriangular shape, closely arranged, moderately convex; the septal sutures are straight, slightly depressed. The short biserial part is formed by three, very seldom four, chambers in each row. The chambers are slightly convex, their height and width approximately equal, the shape subsquare. The size of chambers within the biserial part remains constant, and the width of this part is also constant, equal to the diameter of the early planispiral whorl. The septal sutures are straight, horizontal, slightly depressed. The medial suture is distinctly zigzag shaped. The aperture is a low slit at the base of the apertural face. The wall is fine-grained, glassy, smooth or slightly rough; siliceous.

**Dimensions:** Length 0.20-0.30 mm, width 0.12-0.15 mm.

**Remarks:** A certain similarity exists with *B. brevis* (Montanaro Gallitelli) from the Upper Cretaceous of Italy, but this species is characterized by clearly pronounced oblique septal sutures in the biserial part. *B. webberi* (Tappan) from the Upper Cretaceous of Alaska differs from *B. abyssalis* in strongly compressed lateral sides, gradual flaring towards the apertural part and in a greater number of chambers (three to five) in each row of the biserial part.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Site 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

Genus **PLECTORECURVOIDES** Noth, 1952

***Plectorecurvodes parvus* Krasheninnikov**

(Plate 5, Figures 3a, b, c)

1973. *Plectorecurvodes parvus* Krasheninnikov (Krasheninnikov, 1973, p. 210, pl. 2, fig. 6a, b, c, 7a, b, c.)

**Original:** N 4013/40, Sample 260-6-1, 106-108 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** Morphological characters and dimensions of *P. parvus* are identical in the specimens from the Upper Cretaceous of the Indian Ocean and the northwestern part of the Pacific (Holes 196 and 198A); however, the Indian Ocean specimens are better preserved. This applies in particular to the shape and position of the aperture. The following are the major features of *P. parvus*:

The test is small, inflated, subspherical, with convex lateral sides and a widely rounded peripheral margin, the outline is slightly lobulate. It consists of two rows of alternating chambers, planispirally coiled relative to the plane of symmetry. In each row there are four to five moderately convex, irregularly oval chambers, separated by obscure slightly depressed septal sutures. The two adjacent rows of chambers are separated by an irregularly zigzag suture running along the peripheral margin. The whorls are low, their height increasing slowly. The apertural face is low, arch shaped, and formed by two adjacent chambers. The suture between them either lies in the center or is shifted towards one side of the test. The aperture is oval, short, slit-like, parallel to the base of the apertural face, and situated in an areal position slightly above it (Plate 5, Figure 3c). The aperture of only the last chamber is visible. The foramen of the next to the last chamber has exactly the same shape (Plate 5, Figure 3b, broken specimen). The wall is agglutinated, homogeneous or fine-grained, smooth or slightly rough.

**Dimensions:** Diameter 0.18-0.30 mm, thickness 0.19-0.26 mm.

The species differs from *P. alternans* Noth in having a smaller number of wide chambers and from *P. irregularis* Geroch in having an inflated subspherical test with a more regular symmetrical arrangement of the two rows of chambers.

**Stratigraphic range:** Common in the Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*, and upper assemblage of foraminifera with *Praecystamina globigerinaeformis*.

***Plectorecurvoides rotundus* sp. nov.**  
(Plate 5, Figures 4a, b, c, 5c, 6c)

**Holotype:** N 4013/41 (Figure 4), Sample 261-8-3, 42-44 cm; Paratype: N 4013/42 (Figure 5), Sample 261-7-3, 105-107 cm, and N 4013/43 (Figure 6), Sample 261-8-5, 49-51 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is small to medium size, inflated, spherical, planispirally coiled, biserial, consisting of two rows of alternating chambers arranged symmetrically relative to the equatorial plane. In lateral view the test is circular, with an even contour; rounded (Plate 5, Figure 4), or broadly or irregularly oval (Plate 5, Figures 5, 6) in peripheral view. The peripheral margin is irregularly rounded. The whorls are low, with their height increasing very slowly and their thickness increasing rapidly; as a result, the last chambers resemble overhanging limbs. In the last whorl, each of the rows contains five to six chambers that are irregularly oval in peripheral view, subtriangular in lateral view. The chambers are separated by thin, flat, slightly curved septal sutures. The suture between the adjacent rows of chambers is irregularly zigzag shaped, flat, and thin (Plate 5, Figure 5). Sutures between the last two to three chambers of each row of the last whorl can hardly be seen. The sutures are not visible in the initial part. The apertural face of the test is low, arch-shaped, formed by the apertural face of two adjacent chambers positioned at angles to one another (Plate 5, Figures 4c, 6c). The aperture is areal, short, slit-like or oval, situated parallel to the base of the apertural face, or somewhat at an angle, near the equatorial plane of the test (i.e., not far from the suture between the two adjacent chambers). The foramen has the same shape in earlier chambers. The wall is agglutinated, siliceous, fine-grained, with a rough surface.

**Dimensions:** Diameter 0.30-0.45 mm, thickness 0.25-0.46 mm.

**Remarks:** The morphological features of the species are stable. The diameter/thickness ratio of the test is somewhat variable in spherical tests and forms that are slightly compressed laterally. Specimens where the sutures between chambers are not recognizable and where the biserial arrangement of chambers is visible only on the apertural surface are rather frequent.

This species can be readily distinguished from *P. irregularis* Geroch and *P. parvus* Krasheninnikov by its inflated spherical test and obscure, flat septal and medial sutures, and its subtriangular chambers with flattened sides. The species compares better with *P. alternans* Noth, the spherical test of which differs in having well-pronounced, frequently bicontoured sutures, a greater number of chambers (six to seven), and a slower increase in thickness of the last chambers.

**Stratigraphic range:** *Plectorecurvoides rotundus* is frequent in the Upper Cretaceous of the northeastern part of the Indian Ocean (Site 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

**Family TROCHAMMINIDAE**

**Genus PRAECYSTAMMINA** Krasheninnikov, 1973

This genus is characterized by a streptospiral coiling of strongly overlapping chambers; as a result, a small number (three to five) of semispherical or reniform chambers are visible. The aperture is areal, oval, parallel to the base of the chamber, with a lip or low neck.

***Praecystamina globigerinaeformis* Krasheninnikov**  
(Plate 6, Figures 1a, b, c, 2a, 3a)

1973. *Praecystamina globigerinaeformis* Krasheninnikov (Krasheninnikov, 1973, p. 210, pl. 2, fig. 1a, b, c, 2.)

**Originals:** N 4013/44 (Figure 1), Sample 260-6-1, 71-73 cm; N 4013/45 (Figure 2), Sample 260-6-1, 145-147 cm; N 4013/46 (Figure 3), Sample 261-6-5, 58-60 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** Morphological characters and dimensions (diameter 0.15-0.26 mm, thickness 0.13-0.18 mm) of this species are identical in

the specimens from the Upper Cretaceous of the Indian Ocean and the Pacific (Sites 196 and 198A).

The test is very small, globigerina-like, with a lobate subtriangular outline and broadly rounded peripheral margin. The last whorl consists of three semispherical, oval, or reniform-shaped chambers. The sutures between the chambers are depressed. The aperture is areal, oval (Plate 6, Figures 1c, 3a), sometimes circular (Plate 6, Figure 2a), parallel to the basal margin of the chamber, bordered by a thick lip (Plate 6, Figures 1c, 3a) or on a low neck (Plate 6, Figure 2a). The wall is siliceous, glassy, smooth, shiny, homogeneous or with very fine grains, and semitransparent when moistened.

**Stratigraphic range:** The species is frequent in the Upper Cretaceous (not older than the upper Turonian-Coniacian) of the northeastern part of the Indian Ocean; occurs in the upper assemblage of agglutinated foraminifera with *Praecystamina globigerinaeformis*.

**Genus TROCHAMMINA** Parker and Jones, 1859

***Trochammina gyroidinaeformis* sp. nov.**  
(Plate 5, Figures 7a, b, c, 8a, b, c, 9c)

**Holotype:** N 4013/47 (Figure 7), Sample 261-8-3, 42-44 cm; Paratypes: N 4013/48 (Figure 8), Sample 261-6-5, 58-60 cm; N 4013/49 (Figure 9); Sample 260-6-1, 106-108 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is small, trochospiral, conical (Plate 5, Figure 9c), subconical (Plate 5, Figure 7c) and vault-like (Plate 5, Figure 8c), with a flat spiral side and strongly convex, conical or semispherical umbilical side. The peripheral margin is rounded. In spiral view, the test has a regular or slightly lobulate outline.

About three whorls are visible on the spiral side. The whorls are strongly overlapping; hence, the first two appear as narrow bands and are poorly visible. There are five to six trapeziform flat chambers separated by slightly depressed, almost straight septal sutures in the last whorl. The central part of the spiral side is set down.

The chambers have a triangular shape seen from the umbilical side and are separated by slightly depressed radial septal sutures. The umbilical area is small, but well outlined, cone shaped. The apertural face is long, narrow, arch shaped; at its base, near the umbilicus is the very small circular aperture.

The wall is agglutinated, thin, homogeneous, fine grained, smooth or slightly rough.

**Dimensions:** Diameter 0.14-0.27 mm, thickness 0.09-0.23 mm.

**Remarks:** The morphological features of the species show little variability. The shape of the test, as mentioned above, varies from conical to semispherical; the peripheral margin from rounded to subacute. The small conical umbilicus is sometimes closed.

*Trochammina gyroidinaeformis* is a very characteristic species. There are few species with a flat spiral and an inflated umbilical side in the genus *Trochammina*. Morphologically similar species are *T. gyroides* Cushman and Waters (Upper Cretaceous, Navarro Formation, Texas, USA) and *T. quinqueloba* Geroch (Berriasian-Cenomanian, Poland). The first differs from *T. gyroidinaeformis* in its narrow triangular chambers, oblique septal sutures on the spiral side, and subacute periphery; the second in its slightly convex spiral side, markedly lobate contour, and narrow, slightly overlapping whorls on the spiral side.

The above species of agglutinated foraminifera with a conical test and small rounded aperture near the umbilicus resemble representatives of the calcareous genus *Gyroidina*. They could possibly be regarded as an independent new genus.

**Stratigraphic range:** Frequent in the Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261); occur in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*, and upper foraminiferal assemblage with *Praecystamina globigerinaeformis*.

***Trochammina globigeriniformis altiformis***  
**Cushman and Renz**  
(Plate 6, Figures 4a, b, c, 5a)

1946. *Trochammina globigeriniformis* (Parker and Jones) var. *altiformis* Cushman and Renz (Cushman and Renz, 1946, p. 24, pl. 3, fig. 7-11.)

**Originals:** N 4013/51 (Figure 5), Sample 261-8-5, 49-51 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is medium size, trochospiral, with convex spiral and umbilical sides. In spiral view, the test is subtetragonal, with a lobate outline; seen from the periphery it is broadly oval, with a rounded peripheral margin. About 2-2.5 whorls are seen on the spiral



side. Each contains four chambers arranged at right angles to one another; they are narrowly oval or reniform in shape and divided by depressed sutures. On the ventral side the chambers are broadly oval, the septal sutures are depressed, almost straight. The umbilicus is small, narrow. The aperture is a narrow arch-shaped slit located at the base of the last chamber, near the umbilicus, and does not extend towards the peripheral margin. The wall is typically agglutinated, fine and middle grained, its surface uneven, rough.

**Dimensions:** Diameter 0.63-0.25 mm, thickness 0.48-0.20 mm.

**Remarks:** The shape of the spiral side of the test may vary considerably from strongly convex (Plate 6, Figure 4a) to moderately convex (Plate 6, Figure 5a).

The Indian Ocean specimens are very similar to *T. globigeriniformis altiformis* described by Cushman and Renz (1946) from the basal layers of the Lizard Springs Formation of Trinidad (Late Cretaceous-Paleocene) and they are assigned to this subspecies. The subspecies seems to have a wide geographical distribution; *T. altiformis* Cushman and Renz was described by Geroch (1960) from the Senonian of Poland.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the upper assemblage of agglutinated foraminifera with *Praecystamina globigerinaeformis*, and the lower assemblage with *Haplophragmium lueckeii*.

#### *Trochammina insueta* sp. nov.

(Plate 6, Figures 6a, b, c)

**Holotype:** N 4013/52, Sample 261-7-1, 82-84 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is small to medium size, with irregular trochospiral coiling. It is rounded with a lobate outline in spiral view, with a rounded peripheral margin in peripheral view.

The coiling of early whorls is irregularly trochospiral or streptospiral; the last whorl forms a very low, almost planispiral, trochoid spire. The spiral side is flattened or planoconcave, its central part depressed, with a proloculus and some chambers of the initial whorl visible. The last whorl strongly embraces the earlier whorls; it has five convex semispherical trapeziform chambers separated by depressed, straight septal sutures. The umbilical side is planoconvex, its central part occupied by a previous whorl, where the change of the coiling plane is clearly visible (Plate 6, Figure 6b). The last whorl slightly embraces the previous whorl, chambers are oval or reniform, the septal sutures straight, depressed.

The aperture is arch shaped, at the base of the last chamber, arranged nearer to the peripheral margin (Plate 6, Figures 6b, c). The wall is typically agglutinated, fine grained, its surface uneven, rough.

**Dimensions:** Diameter 0.30-0.45 mm, thickness 0.19-0.23 mm.

**Remarks:** The number of chambers forming the initial part of the test is variable.

In addition to the coiling character, it differs from many other species of the genus in its test shape; the spiral side is flat, depressed in its central portion; the umbilical side is convex and without distinct umbilicus. Species of *Trochammina* with irregularly trochoidal coiling are rare in the Cretaceous: *T. intermedia* Grzybowski, *T. nodoza* Zaspel., and *T. subbotinae* Zaspel. *T. insueta* differs from them in the regular, almost planispiral coiling of its semispherical chambers forming the last whorl.

A remote similarity exists with some representatives of the genera *Trochaminoides* and *Paratrochaminoides*. However, *T. insueta* possesses a slit-like basal aperture, typical for the genus.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Site 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

#### *Trochammina lobulata* sp. nov.

(Plate 6, Figures 7a, b, c)

**Holotype:** N 4013/53, Sample 260-6-1, 145-147 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is extremely small, low trochospiral, with a convex spiral and a flat umbilical side. The test is rounded, with a distinct lobate contour in spiral view; it is irregularly oval, with a rounded margin in peripheral view. On the spiral side 2-2.5 whorls forming a narrow spire are visible. Each contains five small spherical, inflated chambers separated by depressed straight septal sutures. The spiral suture is distinct and also depressed. Seen from the umbilical side, the five chambers forming the last whorl are convex, subtri-

angular; the septal sutures are depressed, radial. The umbilicus is small, well outlined and deep. The aperture is small, arch-shaped, at the base of the last chamber. The wall is thin, siliceous, glassy, and homogeneous with a smooth surface.

**Dimensions:** Diameter 0.12-0.15 mm, thickness 0.07-0.10 mm.

**Remarks:** In addition to being similar to some Recent species (*T. malovensensis* Heron, Allen, and Earland, *T. pacifica* Cushman), *T. lobulata* is similar to the following Cretaceous species characterized by a small test and low trochoid coiling: *T. minuta* Crespin (Lower Cretaceous of Australia) differing in a compact adherence of flat, oval chambers and level septal sutures; *T. rainwateri* Cushman and Applin (Upper Cretaceous of the Gulf Coast) which differs in having a biconvex test with subacute peripheral margin and six slightly inflated chambers separated on the spiral side by oblique septal sutures; *T. ribstonensis* Wickenden (Upper Cretaceous of Alberta, Canada) characterized by a broad low-trochoid test, subangular peripheral margin, and six to seven chambers in the last whorl.

**Stratigraphic range:** Rare in Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Site 260); occurs in the upper assemblage of agglutinated foraminifera with *Praecystamina globigerinaeformis*.

#### *Trochammina pseudovesicularis* sp. nov.

(Plate 6, Figures 8a, b, c)

**Holotype:** N 4013/54, Sample 2606-1, 145-147 cm; Upper Cretaceous; Indian Ocean.

**Description:** The test is tiny, high trochospiral, with flat umbilical side and strongly convex, vault-like spiral side. It is oval with lobate outline in spiral view; vault-like with rounded peripheral margin in edge view.

On the spiral side, 2.5-3 narrow whorls are visible, each with five narrow, oval or reniform, long, moderately convex chambers. The spiral and septal sutures are thin, slightly depressed, obscure in the initial whorls. Chambers are convex, subtriangular in umbilical view, and the septal sutures are thin, radial, depressed; the umbilicus is small, well outlined.

The aperture is a narrow slit at the base of the last chamber, close to the umbilicus. The wall is siliceous, thin, glassy, smooth, and homogeneous.

**Dimensions:** Diameter and thickness are approximately the same—0.09-0.13 mm; the diameter may slightly exceed the thickness.

**Remarks:** The species differs considerably from other Cretaceous representatives of *Trochammina*. Based on the shape of the test, a remote similarity exists with the Recent *T. vesicularis* Goës and the Eocene *T. claybornensis* Howe.

**Stratigraphic range:** Fairly frequent in the Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the upper assemblage of agglutinated foraminifera with *Praecystamina globigerinaeformis*.

#### Family ATAXOPHRAGMIIDAE

##### Genus UVIGERINAMMINA Majzon, 1943

The genus is characterized by a high trochospiral test with three chambers in each whorl. The chambers are arranged spirally, but not in parallel rows as *Verneuilina*.

#### *Uvigerinamina jankoi* Majzon

(Plate 6, Figures 9a, b, 10a)

1943. *Uvigerinamina jankoi* Majzon (Mittell. Jb. Kgl. Ung. Geol. Anst., Bd. 37, H. 1, str. 158, table II, fig. 15a, b.)

**Originals:** N 4013/55 (Figure 9) and N 4013/56 (Figure 10), Sample 260-6-1, 85-87; Upper Cretaceous; Indian Ocean.

**Description:** The test is small, highly trochoid, broadly fusiform or pear shaped, rounded in cross-section. The chambers are arranged in a trochoid spire, three per whorl. Chambers are very small in the initial whorls; their dimensions increase considerably in the last whorl, whose three oval chambers make up more than a half of the whole test volume. The sutures are depressed between the last chambers, obscure in the initial whorls. The aperture is small, rounded, situated terminally on a short neck. The wall is typically agglutinated, fine grained, its surface rough.

**Dimensions:** Length 0.28-0.33 mm, thickness (in a cross-section) 0.20-0.27 mm.

**Remarks:** The Indian Ocean specimens show a marked morphological similarity to *U. jankoi* Majzon and are therefore included in

this species. The *U. jankoi* is widely developed in flysch deposits of the Carpathian Upper Cretaceous, where it is recorded from Hungary (Majzon, 1943); Poland (Geroch, 1957); Roumania (Neagu, 1970); and Czechoslovakia (Hanzlikova, 1973).

**Stratigraphic range:** Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

Genus VERNEUILINA d'Orbigny, 1839

*Verneuilina cretacea* Karrer  
(Plate 7, Figures 1a, b, c)

1870. *Verneuilina cretacea* Karrer, Austria Geol. Reichsanst., Jahrb., Bd. 20, p. 164, pl. 1, fig. 1.

**Original:** N 4013/57, Sample 260-6-1, 71-73 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** This species is represented by sporadic specimens. The test has the shape of a low trihedral pyramid, with a pointed initial and a broad apertural part; it is triangular in cross-section. The lateral sides are slightly concave, the peripheral keels subacute, with indistinct spines. The arrangement of the chambers is triserial, of trapeziform shape, increasing rapidly in width, and only slowly in height. The septal sutures are oblique, obscure, slightly depressed. The wall is agglutinated, with very fine grains, almost smooth. The aperture is a rather high arch at the base of the last chamber.

**Dimensions:** Length 0.30-0.38 mm, width of the apertural part being 0.33-0.42 mm.

In terms of general morphology, the species appears to be very similar to *V. cretacea* Karrer, which is widespread in the Cretaceous of various countries. Other Cretaceous species of *Verneuilina* with a trihedral test and subacute keels (*V. tricarinata* d'Orbigny, *V. cretosa* Cushman, etc.) differ from *V. cretacea* in a number of features.

**Stratigraphic range:** Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Site 260); occurs in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

Genus DOROTHIA Plummer, 1931

*Dorothia oxycona* (Reuss)  
(Plate 7, Figures 2a, b)

1860. *Gandryina oxycona* Reuss, K. Akad. Wiss. Wien, Math.-Natur. Cl., Sitzber., Bd. 40, (p. 229, pl. 12, fig. 3a, b, c.)

**Original:** N 4013/58, Sample 260-6-1, 71-73 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** The test is small to medium size, conical, with a pointed base and a flat or slightly concave apertural end, gradually tapering, in cross-section almost circular. The small chambers of the initial part have a trochospiral arrangement, approximately four to five per whorl, septal sutures between them are indistinct; the later stage is biserial; chambers are narrow, long, separated by flat obscure horizontal sutures. The medial suture is of a zigzag type. The aperture is a low slit at the inner margin of the last chamber. The wall is siliceous, glassy, homogeneous or very finely granular, smooth, and glittering.

**Dimensions:** Length 0.30-0.40 mm, width 0.33-0.42 mm.

The specimens compare morphologically very closely to *D. oxycona* (Reuss) in which they are included. It is a cosmopolitan species known from the Upper Cretaceous of many countries of Europe, Australia, and North America. The specimens of *D. oxycona* from the Indian Ocean differ in their smaller dimensions (about half the size) and in having a very fine-grained (or homogeneous) wall, a feature likely related to the abyssal conditions under which the specimens lived.

**Stratigraphic range:** Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

Genus PLECTINA Marsson, 1878

*Plectina aff. conversa* (Grzybowski)  
(Plate 7, Figures 3a, b, 4a)

**Originals:** N 4013/59 (Figure 3), Sample 260-6-1, 106-108 cm; N 4013/60 (Figure 4), Sample 260-6-1, 71-73 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** The test is medium size, elongate, consisting of an initial trochospiral and a later biserial part. The initial part is cylindrical in

shape, with a blunt, pointed base; it consists of a high trochoid spire formed by several whorls. Each contains numerous (four to five), compactly arranged oval chambers, with very indistinct sutures between them. The biserial part is somewhat compressed laterally, slightly twisted, and separated from the initial part by a weak constriction; five to seven oval or trapeziform chambers occur in each row; the septal sutures are depressed, almost horizontal, the median suture of the zigzag type. The aperture is small, rounded, areal, sometimes almost terminal, in rare cases with a small tooth. The wall is typically agglutinated and fine grained with a rough surface.

**Dimensions:** Length 0.30-0.60 mm, width 0.12-0.15 mm.

The species is very similar to *P. conversa* found in Upper Cretaceous flysch deposits of the Carpathians. The small number of specimens found makes a full comparison with *P. conversa* difficult.

**Stratigraphic range:** Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

Family AMMODISCIDAE

Genus GLOMOSPIRA Rzehak, 1885

*Glomospira corona* Cushman and Jarvis  
(Plate 7, Figures 5a, b)

1928. *Glomospira charoides* (Jones and Parker) var. *corona* Cushman and Jarvis (Contrib. Cushman Lab. Foram. Res., v. 4, p. 89, pl. 12, fig. 9-11).

**Original:** N 4013/61, Sample 260-6-1, 106-108 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** The test is small, cylindrical, with almost parallel lateral sides and a vault-like initial part; it is formed by four to five whorls of a thin tubular spire. The last one to two whorls are irregularly coiled. The aperture is an open end of the tube. The wall is siliceous, homogeneous, and smooth.

**Dimensions:** Height 0.13-0.25 mm, width 0.12-0.25 mm.

The given species is frequent in the Upper Cretaceous and Paleocene of various countries and continents.

**Stratigraphic range:** It is common in the Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii* and upper assemblage with *Praecystammina globigerinaeformis*.

Genus GLOMOSPIRELLA Plummer, 1945

*Glomospirella gaultina* (Berthelin)  
(Plate 7, Figures 6, 7)

1880. *Ammodiscus gaultinus* Berthelin (Mém. Soc. géol. France, sér. 3, t. 1 (5), Berthelin, 1880, p. 19, fig. 3.)

**Originals:** N 4013/62 (Figure 6), N 4013/63 (Figure 7), Sample 260-6-1, 85-87 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** The test is oval, laterally compressed. The initial part is glomospiral, composed of some trochoid whorls of the tubular chamber. A later planispiral stage consists of 1.5-2 whorls, which are clearly visible in Plate 7, Figure 6; sometimes with transverse constrictions (Plate 7, Figure 7). The spiral suture is depressed, distinct. The aperture is an open end of the tubular chamber. The wall is siliceous, homogeneous, smooth, and shiny.

**Dimensions:** Diameter (the largest) 0.30-0.45 mm, thickness 0.12-0.15 mm.

This cosmopolitan species is known from the Lower Cretaceous (Albian) and Upper Cretaceous of many countries.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii* and upper assemblage with *Praecystammina globigerinaeformis*.

Genus AMMODISCUS Reuss, 1862

*Ammodiscus cretaceus* (Reuss)  
(Plate 7, Figure 8)

1845. *Operculina cretacea* Reuss, Stuttgart, Schweizerbart, Abt. 1, (Reuss, 1845, p. 35, pl. 13, fig. 64-65.)

**Original:** N 4013/64, Sample 260-6-1, 139-141 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** The test is small to medium size, discoidal, with concave lateral sides, planispiral, composed of five to seven whorls of tubular

chamber. The whorls are relatively broad, their height slowly increasing; each whorl moderately embraces the previous one. The spiral suture is depressed, distinct. The aperture is an open end of the tube. The wall is siliceous, homogeneous or with very fine grains, smooth, and shiny.

**Dimensions:** Diameter 0.30-0.47 mm, thickness 0.09-0.12 mm.

The species is cosmopolitan, typical for the Upper Cretaceous. Morphologically similar species are *A. glabratus* Cushman and Jarvis and *A. rotalarius* Loeblich and Tappan. The first is distinguished in having a strongly compressed test with numerous narrow whorls, the second in its broad, slightly embracing chambers.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii* and upper assemblage with *Praecystammina globigerinaeformis*.

***Ammodiscus cretaceus rugosa* Schijfsma**  
(Plate 7, Figure 9)

1946. *Ammodiscus cretaceus* (Reuss) var. *rugosa* Schijfsma, (Netherl. Geol. Sticht., Meded., ser. C, sec. 5, N 7, pl. 6, fig. 2.)

**Original:** N 4013/65, Sample 260-6-1, 139-141 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** In terms of test shape, character of coiling, and dimensions, this variety is similar to *A. cretaceus cretaceus*. However, the wall of *A. cretaceus rugosa* is typically agglutinated, fine grained, its surface uneven, rough, with distinct transverse constrictions in some specimens, whereas the wall of *A. cretaceus cretaceus* is homogeneous, almost porcelain-like, smooth, and shiny. If *Ammodiscus cretaceus rugosa* Schijfsma 1946 is to be regarded as an independent taxon, the subspecies name is, as a homonym, invalid, and will have to be changed. It is preoccupied by *Ammodiscus rugosus* Terquen, 1886.

The variety was described by Schijfsma from the Upper Cretaceous of the Netherlands. The specimens from the Upper Cretaceous abyssal sediments of the Indian Ocean are two to five times smaller.

**Stratigraphic range:** Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

**Family SACCAMMINIDAE Brady, 1884**

Genus SACCAMMINA Sars, in Carpenter, 1869

***Saccamina complanata* (Franke)**  
(Plate 7, Figures 10a, b)

1912. *Pelosina complanata* Franke (K. Preuss. Geol. Lander. Anst. 76, Bd. 32 [1911], p. 107, pl. 3, fig. 1.)

**Original:** N 4013/66, Sample 260-6-1, 139-141 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** The test is small to medium-size, spherical or subspherical. The aperture is small, rounded, arranged terminally at the end of a short neck. The wall is agglutinated, fine grained, smooth, or slightly rough.

**Dimensions:** Diameter 0.15-0.37 mm.

This cosmopolitan species was described from the Upper Cretaceous of many countries.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*, and upper assemblage with *Praecystammina globigerinaeformis*.

Genus PILULINA Carpenter, 1870

This genus is similar to *Saccamina* but differs in having an elongate slit-like aperture. Some species of *Pilulina* were described from the Quaternary. The recording of *Pilulina* in the Upper Cretaceous considerably widens the stratigraphic range of the genus.

***Pilulina antiqua* sp. nov.**  
(Plate 7, Figures 11a, b)

**Holotype:** N 4013/67, Sample 260-6-1, 139-141 cm; Upper Cretaceous; Indian Ocean.

**Description:** The single-chambered test is small, spherical, hardly noticeably compressed. The aperture is a long oval slit, arranged terminally, sometimes on a low rise (Plate 7, Figure 11a), slightly detached from the other part of the test. The wall is agglutinated, fine-grained, and smooth.

**Dimensions:** Largest diameter 0.15-0.31 mm. The difference between largest and smallest diameters (i.e., the degree of compression) is 0.015-0.030 mm.

**Comparison:** The Recent representatives of *Pilulina* differ from the described species in the shape of the test and the aperture; in *P. jefreysii* Carpenter the aperture has an S-shaped curvature; in *P. ovata* Cushman the test is broadly elliptical with the aperture irregular in shape and situated in an oval depression; in *P. arenacea* Earland the test is oval, the aperture is slit-like with more or less wrinkled edges, conspicuous, and projecting.

**Stratigraphic range:** Upper Cretaceous (not older than upper Turonian-Coniacian) of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the upper assemblage of agglutinated foraminifera with *Praecystammina globigerinaeformis*.

**Family HORMOSINIDAE Haekel, 1894**

Genus HORMOSINA Brady, 1879

***Hormosina ovulum* (Grzybowski)**  
(Plate 7, Figure 12)

1896. *Reophax ovulum* Grzybowski, (Rozpr. Akad. Um. Krakow, t. 30, str. 276, tabl. 8, fig. 19-21.)

**Original:** N 4013/68, Sample 261-7, CC; Upper Cretaceous; Indian Ocean.

**Remarks:** The test is small to medium size, inflated, drop shaped, wide at the base and tapering towards the aperture. The aperture is terminal, rounded, on a narrow neck. The wall is agglutinated, fine grained, smooth, or slightly rough.

A second rounded opening on a short neck is situated at the base of the test; this is the likely place of connection with the previous chamber. However, multichambered *H. ovulum* are absent in our material; this can be due to destruction of the fragile tests. It can also be assumed that the species is to be attributed to the monochambered genus *Pelosina*.

**Dimensions:** Length 0.35-0.50 mm, width 0.32-0.42 mm.

*Hormosina ovulum* has been described from the Upper Cretaceous of many parts of the world.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Site 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii*.

**Family ASTRORHIZIDAE Brady, 1881**

Genus HYPERAMMINA Brady, 1878

***Hyperammina* ex gr. *elongata* Brady**  
(Plate 7, Figures 13, 14)

**Originals:** N 4013/69 and N 4013/70; Sample 260-6-1, 71-73 cm; Upper Cretaceous; Indian Ocean.

**Remarks:** The tests are small to medium-size, drop shaped, inflated at the base, tubular in the apertural part. The aperture is an open end of the tube. The wall is agglutinated, fine grained, and rough.

**Dimensions:** Length 0.20-0.54 mm.

Similar representatives of *Hyperammina* are widely distributed in deposits of various age and determined as *H. elongata* Brady.

**Stratigraphic range:** Upper Cretaceous of the northeastern part of the Indian Ocean (Sites 260 and 261); occurs in the lower assemblage of agglutinated foraminifera with *Haplophragmium lueckeii* and upper assemblage with *Praecystammina globigerinaeformis*.

**REFERENCES**

- Cushman, J. A. and Hedberg, H. D., 1941. Upper Cretaceous foraminifera from Santander del Norte, Colombia, S.A.: Contrib. Cushman Lab. Foram. Res., v. 17, pt. 4.  
Cushman, J. A. and Renz, H. H., 1946. The foraminiferal fauna of the Lizard Springs Formation of Trinidad, British West Indies: Cushman Lab. Foram. Res., Spec. Publ., 18.  
Foreman, H. P., 1973. Cretaceous Radiolaria. Leg 20, DSDP. In Heezen, B. C., MacGregor, I., et al., Initial Reports of the Deep Sea Drilling Project, Volume 20: Washington (U.S. Government Printing Office), p. 249.  
Geroch, S., 1957. Uvigerinamina jankoi Majzon (Foraminifera) we fliszu Karpat: Roczn. Pol. Tow. Geol., v. 25, p. 3.



- . 1960. Microfaunal assemblages from the Cretaceous and Paleogene Silesian unit in the Beskid Slaski Mountains: *Inst. Geol., Bull.*, v. 153.
- . 1962. Thalmannamina and Plectorecurvoidea (Foraminifera) in the Lower Cretaceous of the Flysch Carpathians: *Ann. Soc. Geol. Pologne*, v. 32, no. 1-2.
- . 1966. Lower Cretaceous small foraminifera of the Silesian Series, Polish Carpathians: *Ann. Soc. Geol. Pologne*, v. 36, no. 4.
- Hanzlikova, E., 1969. The foraminifera of the Frýdex Formation (Senonian): *Sborn. Geol. Věd, R. P.*, v. 11.
- . 1972. Carpathian Upper Cretaceous foraminiferids of Moravia (Turonian-Maastrichtian): *Rozpr. U.U.G.*, sv. 39.
- . 1973. Foraminifera of the Variegated Godula Member in Moravia (Cenomanian-Turonian): *Sborn. Geol. Ved, Paleont.*, Rada P, sv. 15.
- Krashennikov, V. A., 1973. Cretaceous benthonic foraminifera, Leg 20 of *Glomar Challenger*. In Heezen, B. C., MacGregor, I., et al., *Initial Reports of the Deep Sea Drilling Project, Volume 20*, Washington (U.S. Government Printing Office), p. 205.
- Loeblich, A. R. and Tappan, H., 1964. Treatise on invertebrate Paleontology; Sarcodina, chiefly "Thecamoebians" and Foraminiferida: *Protista 2, C.*, New York (Geol. Soc. Am.).
- Majzon, L., 1943. Beiträge zur Kenntnis einiger Flysch-Schichten des Karpatenvorlandes mit Rücksicht auf die Globotruncanen: *Evk. Magyar áll. Eötvös Loránd geofiz. Intéz.*, v. 37, no. 1.
- Martin, L., 1964. Upper Cretaceous and lower Tertiary foraminifera from Fresno County, California: *Jb. Geol. Bundesanst., Sonderbd.*, 9.
- Myatliuk, E. V., 1966. On the foraminifera with a siliceous skeleton: *Questions of Micropaleontology*, no. 10 (in Russian).
- . 1970. Foraminifera of the flysch sediments of the Eastern Carpathians: *Trans. VNIGRI*, v. 282 (in Russian).
- Neagu, T., 1962. *Stud. Cerc. Geol. Geophys. Geogr., Ser. Geol.*, v. 7.
- . 1968. Biostratigraphy of Upper Cretaceous deposits in the southern Eastern Carpathians near Brasov: *Micropaleontology*, v. 14.
- . 1970. Micropaleontological and stratigraphical study of the Upper Cretaceous deposits between the upper valleys of the Buzau and Riul rivers (Eastern Carpathians): *Inst. Geol., Mem.*, v. 12.
- Noth, R., 1951. Foraminiferen aus Unter- und Oberkreide des Österreichischen Anteils an Flysch, Helvetikum und Vorlandvorkommen: *Jb. Geol. Bundesanst. (Wien), Sonderb.* 3.
- . 1952. Plectorecurvoidea, eine neue foraminiferengattung: *Verhandl. Geol. Bundesanst.*, no. 3.
- Orlov, Yu. A. (Chief Ed.), Rauser-Chernousova, D. M., Fursenko, A. V. (Eds.), 1959. *Treatise on paleontology: v. 1, Moscow (Protozoa)* (in Russian).
- Scheibnerova, V., 1961. Microfauna strednej a vrchnej kriedy bradloveho pasma zapad Karpat na Slovensku: *Acta Geol. Geogr. Univ. Comen.*, v. 5.
- . 1968. Middle and Upper Cretaceous microbiostratigraphy of the Klippen Belt (West Carpathians): *Acta Geol. Geogr. Univ. Comen.*, v. 17.
- Sliter, W. V., 1968. Upper Cretaceous foraminifera from Southern California and Northwestern Baja California, Mexico: *Univ. Kansas Paleont. Contrib.*, Ser. 49.
- Soliman, H. A., 1972. New Upper Cretaceous foraminifera from the Soviet Carpathians (USSR): *Rev. Micropaleont.*, v. 15, no. 1.
- Vasicek, M., 1947. Poznamky k mikrobiostratigrafii magurského flyse na Morave: *Věstr. Stat. Ust. Geol. CSR*, v. 22.
- Wickenden, R. T., 1932. New species of foraminifera from the Upper Cretaceous of the Prairie Provinces: *Roy. Soc. Canada, Proc. Trans.*, Ser. 3, v. 26.

TABLE 1  
Distribution of Agglutinated Foraminifera in the Upper Cretaceous (Not Older Than Upper Turonian-Coniacian) Sediments of Site 260

Upper Cretaceous		Age	Species	
			Samples (Interval in cm)	
Upper Assemblage of Foraminifera with <i>Praecystammmina globigerinaeformis</i>	6-1, 71-73	f	f	<i>Haplophragmoides fraudulentus</i> Krash.
	6-1, 85-87	c	-	<i>H. constrictus</i> Krash.
	6-1, 106-108	f	f	<i>H. multimerus</i> Krash.
	6-1, 136-138	f	c	<i>H. perexplicatus</i> Krash.
	6-1, 139-141	c	c	<i>H. decussatus</i> Krash.
	6-1, 145-147	c	f	<i>H. linki</i> Nauss
	6, CC	f	f	<i>H. bulloides</i> (Beissel)
		f	f	<i>H. multiformis</i> sp. nov.
		f	f	<i>H. meniensis</i> sp. nov.
		f	f	<i>Labrospira pacifica</i> Krash.
		f	f	<i>Paratrochamminoides vitreus</i> Krash.
		f	f	<i>P. intricatus</i> Krash.
		f	f	<i>Recurvoidea pseudosymmetricus</i> sp. nov.
	f	f	<i>R. pentameratus</i> sp. nov.	
	f	f	<i>R. ex gr. deflexiformis</i> (Noth)	
	f	f	<i>Pseudobolivina munda</i> Krash.	
	f	f	<i>P. lagenaria</i> sp. nov.	
	f	f	<i>Bolivinaopsis parvissimus</i> Krash.	
	f	f	<i>Plectrocurvoides parvus</i> Krash.	
	f	f	<i>Praecystammmina globigerinaeformis</i> Krash.	
	f	f	<i>Trochammina gyroideaformis</i> sp. nov.	
	f	f	<i>T. globigeriniiformis altiiformis</i> Cushman and Renz	
	f	f	<i>T. lobulata</i> sp. nov.	
	f	f	<i>T. pseudovesicularis</i> sp. nov.	
	f	f	<i>Uvigerinamina jankoi</i> Majzon	
	f	f	<i>Venerulina cretacea</i> Karer	
	f	f	<i>Dorothy oxycona</i> (Reuss)	
	f	f	<i>Plectina aff. conversa</i> (Grzyb.)	
	f	f	<i>Glomospira corona</i> Cushman and Jarv.	
	f	f	<i>Glomospirella gaultina</i> (Berth.)	
	f	f	<i>Ammodiscus cretaceus</i> (Reuss)	
	f	f	<i>A. cretaceus rugosa</i> Schijfsma	
	f	f	<i>Saccamina complanata</i> (Franke)	
	f	f	<i>Pilulina antiqua</i> sp. nov.	
	f	f	<i>Hyperammina ex gr. elongata</i> Brady	

Note: f = frequent, c = common, r = rare.





PLATE 1

Indian Ocean, Upper Cretaceous;

a—lateral view, b—peripheral view; all magnifications  $\times 150$ .

- Figures 1a, 1b, 2a *Haplophragmoides fraudulentus* Krasheninnikov.  
1a, 1b. Original, N 4013/1; Sample 260-6-1, 71-73 cm.  
Delete 1a, 1b.  
1a, 1b. Original, N 4013/1; Sample 260-6-1, 71-73 cm.  
2a. Original, N 4013/2; Sample 260-6-1, 136-138 cm.
- Figures 3a, 3b *Haplophragmoides constrictus* Krasheninnikov;  
Original, N 4013/3; Sample 260-6-1, 71-73 cm.
- Figures 4a, 4b *Haplophragmoides multicamerus* Krasheninnikov;  
Original, N 4013/4; Sample 260-6-1, 71-73 cm.
- Figures 5a, 5b *Haplophragmoides perexplicatus* Krasheninnikov;  
Original, 4013/5; Sample 260-6-1, 85-87 cm.
- Figures 6a, 6b *Haplophragmoides decussatus* Krasheninnikov;  
Original, N 4013/6; Sample 260-6-1, 145-147 cm.
- Figures 7a, 7b *Haplophragmoides linki* Nauss;  
Original, N 4013/7; Sample 260-6-1, 71-73 cm.
- Figures 8a, 8b *Haplophragmoides pseudokirki* sp. nov.;  
Holotype, N 4013/8; Sample 261-5, CC.
- Figures 9a, 9b, 10b, 11b *Haplophragmoides bulloides* (Beissel).  
9a, 9b. Original, N 4013/9; Sample 260-6-1, 145-147 cm.  
10b. Original, N 4013/10; Sample 260-6-1, 145-147 cm.  
11b. Original, N 4013/11; Sample 261-8-3, 42-44 cm.

PLATE 1

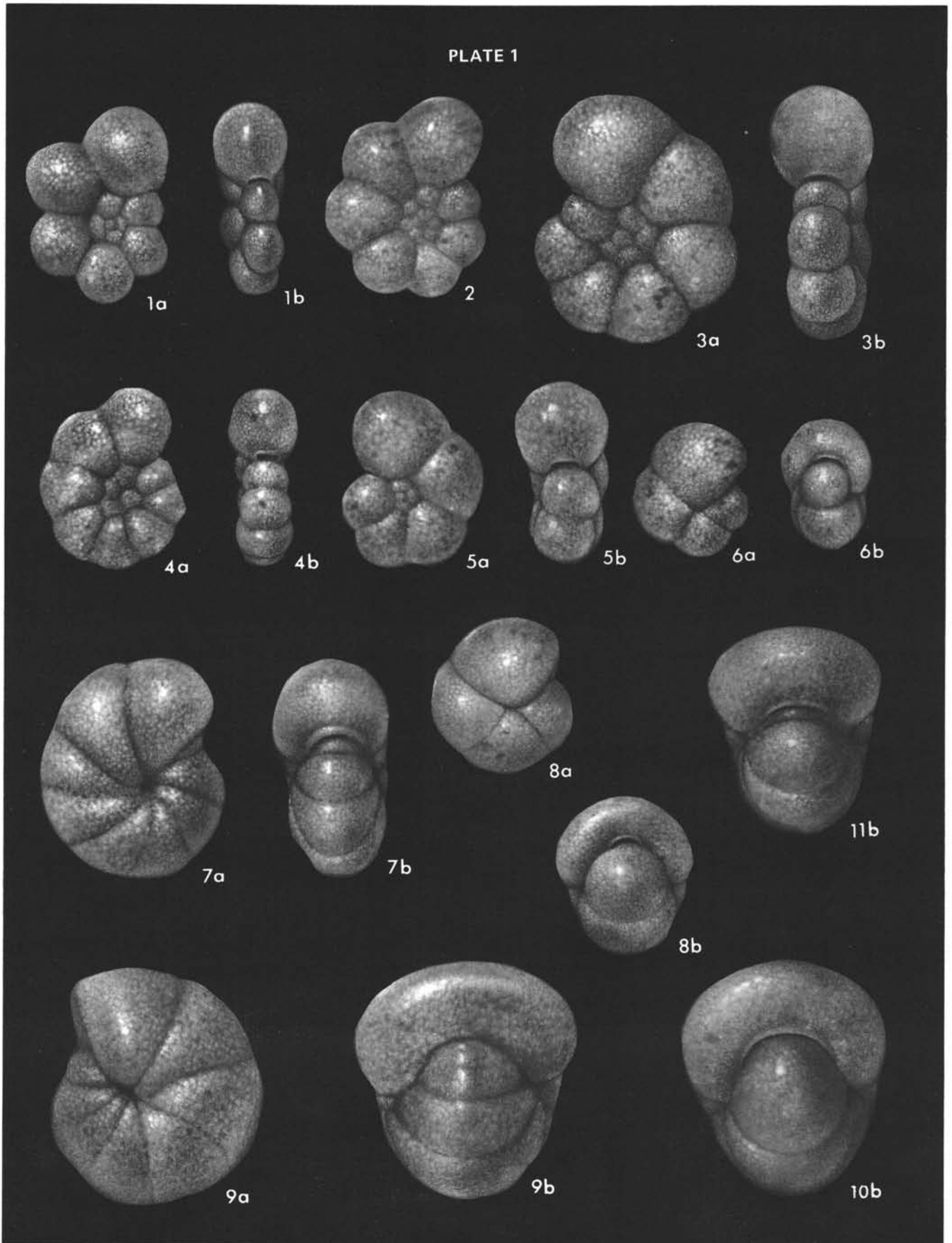


PLATE 2

Indian Ocean, Upper Cretaceous;

Figures 1-4, 6, and 7: a—lateral view, b—peripheral view;  
all magnifications  $\times 150$ .

Figure 5: a, b—lateral view, c—peripheral view;  
magnification  $\times 100$ .

- Figures 1a, 1b, *Haplophragmoides multiformis* sp. nov.  
2a, 2b 1a, 1b. Holotype, N 4013/12; Sample 260-6-1,  
106-108 cm.  
2a, 2b. Paratype, N 4013/13; Sample 261-7-1, 82-  
84 cm.
- Figures 3a, 3b, *Haplophragmoides menitens* sp. nov.  
4a, 4b 3a, 3b. Holotype, N 4013/14; Sample 260-6-1;  
136-138 cm.  
4a, 4b. Paratype, N 4013/15; Sample 260-6-1,  
139-141 cm.
- Figures 5a, 5b, *Haplophragmoides incredibilis* sp. nov.  
5c Holotype, N 4013/16; Sample 261-7-2, 80-82 cm.
- Figures 6a, 6b, *Labrospira inflata* sp. nov.  
7b 6a, 6b. Holotype, N 4013/17; Sample 261-7, CC.  
7b. Paratype, N 4013/18; Sample 261-7-2, 80-  
82 cm.



PLATE 2

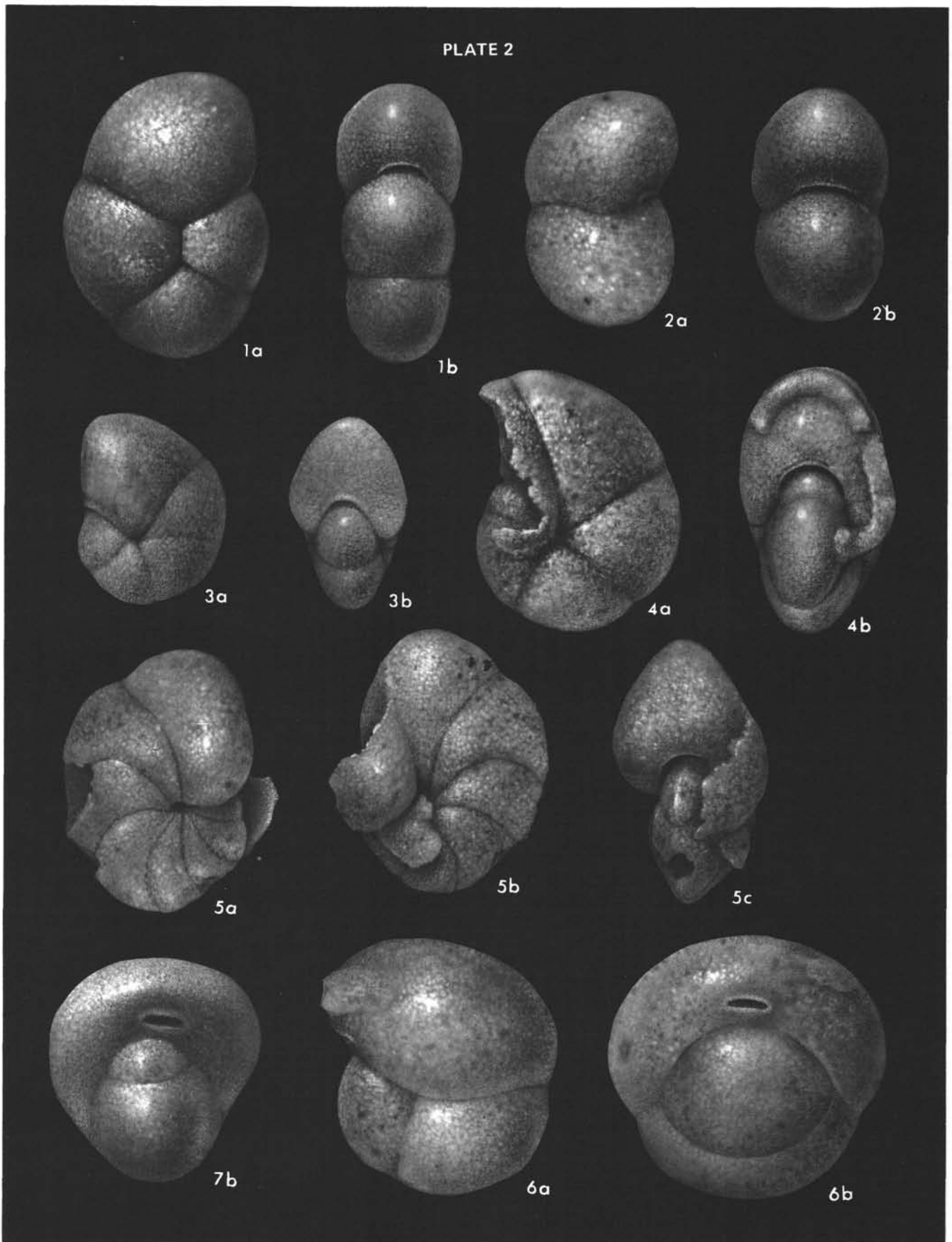


PLATE 3

Indian Ocean, Upper Cretaceous;

Figures 1, 2, 5: a—lateral view, b—peripheral view;  
all magnifications  $\times 150$ .

Figures 3 (magnification  $\times 100$ ), 4, and 6 (magnifications  $\times 150$ ):  
a, b—lateral view, c—peripheral view.

- Figures 1a, 1b, *Labrospira pacifica* Krasheninnikov.  
2a, 2b 1a, 1b. Original, N 4013/19; Sample 260-6-1, 71-73 cm.  
2a, 2b. Original, N 4013/20; Sample 260-6-1, 85-87.
- Figures 3a, 3b, *Recurvoides pseudosymmetricus* sp. nov.;  
3c Holotype, N 4013/23; Sample 260-6-1, 139-141 cm.
- Figures 4a, 4b, *Recurvoides* ex gr. *deflexiformis* (Noth).  
4c, 5a, 5c 4a-4c. Original, N 4013/25; Sample 260-6-1, 106-108 cm.  
5a, 5c. Original, N 4013/26; Sample 261-5-1, 80-82 cm.
- Figures 6a, 6b, *Recurvoides pentacameratus* sp. nov.;  
6c Holotype, N 4013/24, Sample 260-6-1, 136-138 cm.

PLATE 3



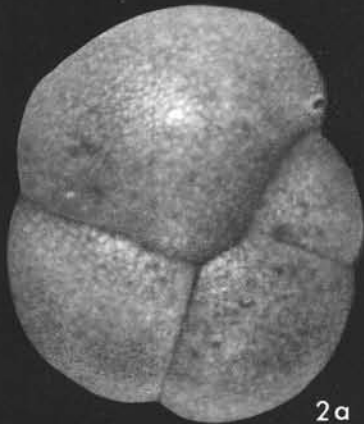
1a



1b



3a



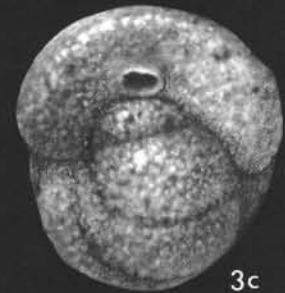
2a



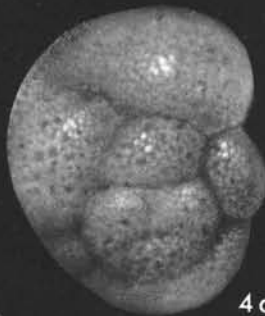
2b



3b



3c



4a



4b



4c



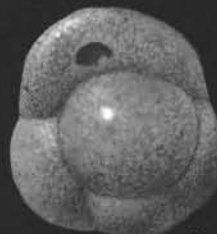
5a



6a



6b



6c



5c



PLATE 4

Indian Ocean, Upper Cretaceous;

Figures 1 and 2: a, b—lateral view, c—peripheral view;

Figures 3-13: a—lateral view, b—peripheral view;  
magnification of Figures 1, 3-13 (×150), Figure 2 (×100).

- Figures 1a, 1b, 1c *Paratrochamminoides vitreus* Krasheninnikov;  
Original, N 4013/21; Sample 260-6-1, 85-87 cm.
- Figures 2a, 2b, 2c *Paratrochamminoides intricatus* Krasheninnikov;  
Original, N 4013/22; Sample 260-6-1, 71-73 cm.
- Figures 3a, 3b, 4a, 5a *Haplophragmium lueckei* (Cushman and Hedberg).  
3a, 3b. Original, N 4013/27; Sample 261-7-3, 105-107 cm.  
4a. Original, N 4013/28; Sample 261-7-3, 105-107 cm.  
5a. Original, N 4013/29; Sample 261-7-3, 105-107 cm.
- Figures 6a, 6b, 7a *Pseudobolivina munda* Krasheninnikov.  
6a, 6b. Original, N 4013/30; Sample 260-6-1, 106-108 cm.  
7a. Original, N 4013/31; Sample 260-6-1, 145-147 cm.
- Figures 8a, 8b, 9a *Pseudobolivina cuneata* sp. nov.  
8a, 8b. Holotype, N 4013/32; Sample 261-8-4, 49-51 cm.  
9a. Paratype, N 4013/33; Sample 261-8-3, 42-44 cm.
- Figures 10a, 10b *Pseudobolivina normalis* sp. nov.  
Holotype, N 4013/36; Sample 261-7-2, 80-82 cm.
- Figure 11a *Bolivinopsis parvissimus* Krasheninnikov.  
Original, N 4013/37; Sample 260-6-1, 139-141 cm.
- Figures 12a, 13a *Bolivinopsis abyssalis* sp. nov.  
12a. Holotype, N 4013/38; Sample 261-7-1, 82-84 cm.  
13a. Paratype, N 4013/39; Sample 261-8-4, 49-51 cm.

PLATE 4

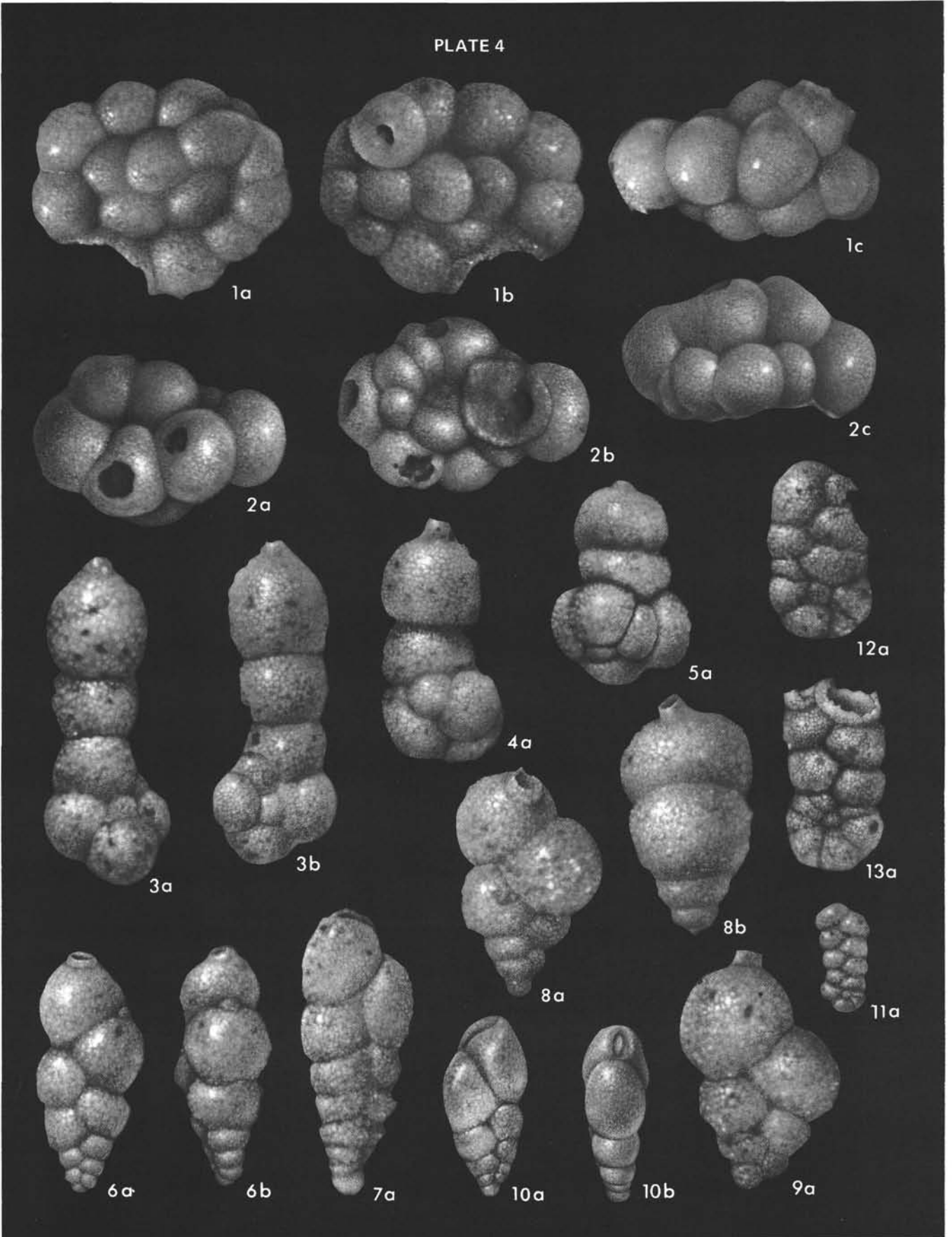


PLATE 5  
Indian Ocean, Upper Cretaceous.

Figures 1a, 1b, *Pseudobolivina lagenaria* sp. nov.

2a a—lateral view, b—peripheral view; magnification  $\times 150$ .

1a, 1b. Holotype, N 4013/34; Sample 260-6-1, 145-147 cm.

2a. Paratype, N 4013/35; Sample 260-6-1, 71-73 cm.

Figures 3a, 3b, *Plectorecurvoides parvus* Krasheninnikov;

3c a, b—lateral view, c—peripheral view; magnification  $\times 150$ . Original, N 4013/40; Sample 260-6-1, 106-108 cm.

Figures 4a, 4b *Plectorecurvoides rotundus* sp. nov.

4c, 5c, 6c a, b—lateral view, c—peripheral view; Figures 4 and 6—apertural view, Figure 5—opposite apertural side. Magnifications: Figures 4 and 6 ( $\times 100$ ), Figure 5 ( $\times 150$ ).

4a-4c. Holotype, N 4013/41; Sample 261-8-3, 42-44 cm.

5c. Paratype, N 4013/42; Sample 261-7-3, 105-107 cm.

6c. Paratype, N 4013/43; Sample 261-8-5, 49-51 cm.

Figures 7a, 7b, *Trochammina gyroidinaeformis* sp. nov.

7c, 8a, 8b, a—spiral view, b—umbilical view, c—peripheral view; magnifications  $\times 150$ .

8c, 9c 7a-7c. Holotype, N 4013/47; Sample 261-8-3, 42-44 cm.

8a-8c. Paratype, N 4013/48; Sample 261-6-5, 58-60 cm.

9c. Paratype, N 4013/49; Sample 260-6-1, 106-108 cm.



PLATE 5

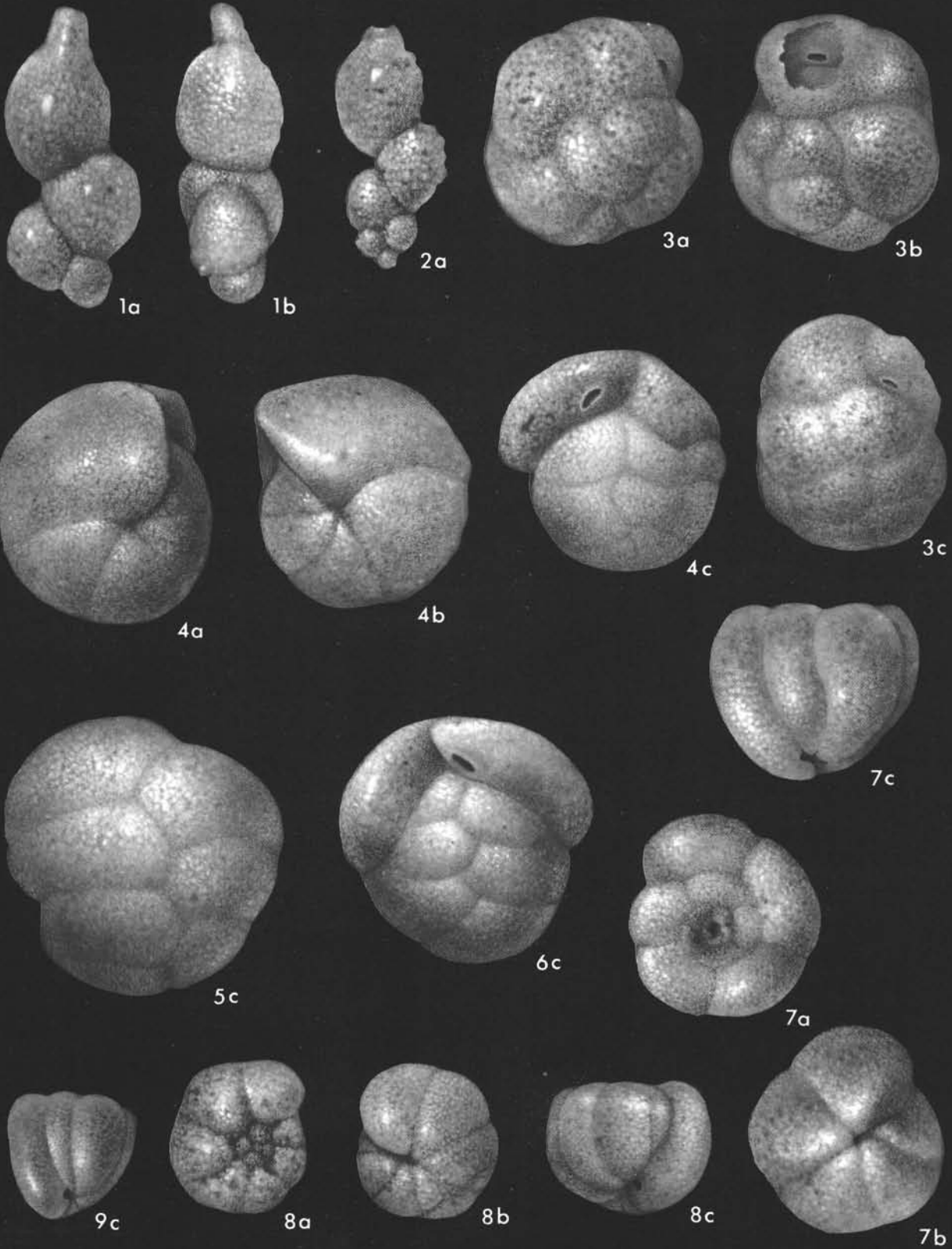
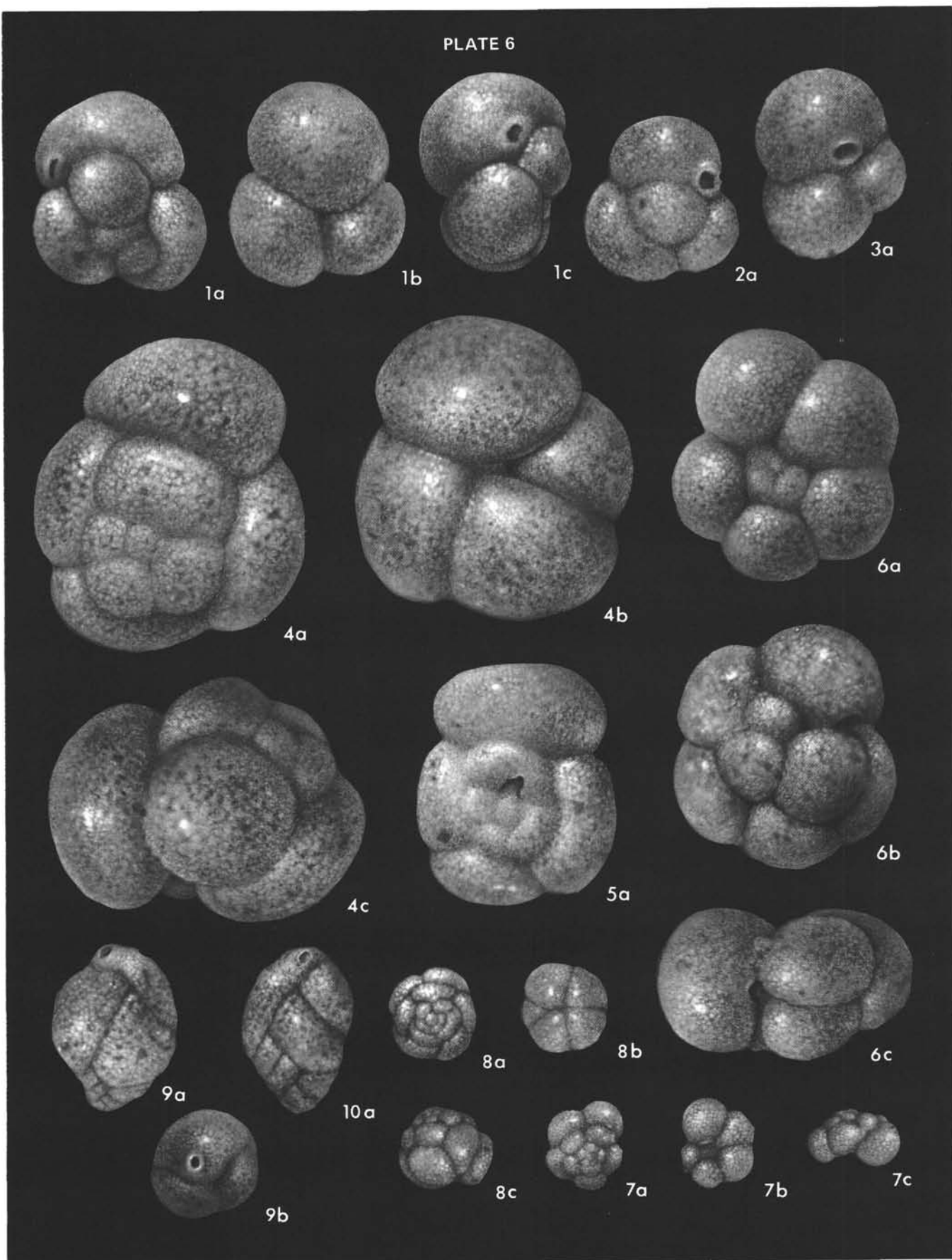


PLATE 6

Indian Ocean, Upper Cretaceous.

- Figures 1a, 1b, 1c, 2a, 3a, *Praecystamina globigerinaeformis* Krasheninikov.  
a, b—lateral view, c—peripheral view, all magnifications  $\times 150$ .  
1a-1c. Original, N 4013/44; Sample 260-6-1, 71-73 cm.  
2a. Original, N 4013/45; Sample 260-6-1, 145-147 cm.  
3a. Original, N 4013/46; Sample 261-6-5, 58-60 cm.
- Figures 4a, 4b, 4c, 5a, *Trochammina globigeriniformis altiformis* Cushman and Renz.  
a—spiral view, b—umbilical view, c—peripheral view; all magnifications  $\times 100$ .  
4a-4c. Original, N 4013/50; Sample 261-8-3, 42-44 cm.  
5a. Original, N 4013/51; Sample 261-8-5, 49-51 cm.
- Figures 6a, 6b, 6c, *Trochammina insueta*, sp. nov.  
a—spiral view, b—umbilical view, c—peripheral view; magnification  $\times 150$ .  
Holotype, N 4013/52; Sample 261-7-1, 80-84 cm.
- Figures 7a, 7b, 7c, *Trochammina lobulata* sp. nov.  
a—spiral view, b—umbilical view, c—peripheral view; magnification  $\times 150$ .  
Holotype, N 4013/53; Sample 260-6-1, 145-147 cm.
- Figures 8a, 8b, 8c, *Trochammina pseudovesicularis* sp. nov.  
a—spiral view, b—umbilical view, c—peripheral view; magnification  $\times 150$ .  
Holotype, N 4013/54; Sample 260-6-1, 145-147 cm.
- Figures 9a, 9b, 10a, *Uvigerinammina jankoi* Majzon.  
a—side view, b—apertural view; magnification  $\times 100$ .  
9a-9b. Original, N 4013/55; Sample 260-6-1, 85-87 cm.  
10a. Original, N 4013/56; Sample 260-6-1, 85-87 cm.

PLATE 6





## PLATE 7

Indian Ocean, Upper Cretaceous.

- Figures 1a, 1b, 1c *Verneuilina cretacea* Karrer.  
a—side view, b—peripheral view, c—apertural view; magnification  $\times 100$ .  
Original, N 4013/57; Sample 260-6-1, 71-73 cm.
- Figures 2a, 2b *Dorothia oxycona* (Reuss).  
a—side view, b—apertural view; magnification  $\times 150$ .  
Original, N 4013/58; Sample 260-6-1, 71-73 cm.
- Figures 3a, 3b, 4a *Plectina* aff. *conversa* (Grzybowski).  
a—side view, b—peripheral view; magnifications  $\times 100$ .  
3a-3b. Original, N 4013/59; Sample 260-6-1, 106-108 cm.  
4a. Original, N 4013/60; Sample 260-6-1, 71-73 cm.
- Figures 5a, 5b *Glomospira corona* Cushman and Jarvis.  
a—spiral view, b—side view; magnifications  $\times 150$ .  
Original, N 4013/61; Sample 260-6-1, 106-108 cm.
- Figures 6, 7 *Glomospirella gaultina* (Berthelin).  
6. Original, N 4013/62; Sample 260-6-1, 85-87 cm. Magnification  $\times 150$ .  
7. Original, N 4013/63; Sample 260-6-1, 85-87 cm. Magnification  $\times 100$ .
- Figure 8 *Ammodiscus cretaceus* (Reuss).  
Original, N 4013/64; Sample 260-6-1, 139-141 cm. Magnification  $\times 150$ .
- Figure 9 *Ammodiscus cretaceus rugosa* Schijfsma.  
Original, N 4013/65; Sample 260-6-1, 139-141 cm. Magnification  $\times 100$ .
- Figures 10a, 10b *Saccamina complanata* (Franke).  
a—side view, b—apertural view; magnifications  $\times 100$ .  
Original, N 4013/66; Sample 260-6-1, 139-141 cm.
- Figures 11a, 11b *Pilulina antiqua* sp. nov.  
a—side view, b—apertural view; magnifications  $\times 150$ .  
Holotype, N 4013/67; Sample 260-6-1, 139-141 cm.
- Figure 12 *Hormosina ovulum* (Grzybowski).  
Original, N 4013/68; Sample 261-7, CC. Magnification  $\times 100$ .
- Figures 13, 14 *Hyperamina* ex gr. *elongata* Brady.  
13. Original, N 4013/69; Sample 260-6-1, 71-73 cm.  
14. Original, N 4013/70; Sample 260-6-1, 71-73 cm.

PLATE 7

