14. MESOZOIC CALCAREOUS NANNOPLANKTON OF THE EASTERN NORTH ATLANTIC, LEG 41

Pavel Čepek, Federal Institute for Geosciences and Natural Resources
(Bundesanstalt für Geowissenschaften und Rohstoffe), Hannover, Fed. Rep. of Germany

INTRODUCTION

Cretaceous sediments were recovered in all five sites drilled during Leg 41. Jurassic sediments were only found at Site 367. Figure 1 shows the site locations and Figures 2 and 3 show site ages and correlations. Two of the sites were in deep basins (367 and 370), two were on rises (366 and 368), and one was on the continental slope (369). Calcareous nannoplankton assemblages range from Oxfordian to Maestrichtian age in the samples studied.

The determination of the calcareous nannoplankton (Table 1) was mainly made with light microscopy on smear slides prepared from samples which were treated with an ultrasonic apparatus. Some selected well-preserved samples were also studied with the scanning electron microscope. Nannofossil abundance and preservation were estimated for all samples studied. Species abundance was determined for about half of the samples. The estimation method was modified from the one used by Hay (1970) and Gartner (1972). According to this technique, the abundance of a species is estimated with the light microscope at a magnification of 1560× as being present as: 1-10 specimens per field (A); 1 specimen in 10 fields (C); 1 specimen in 50 fields (F); 1 specimen in 200 fields (R). The abundance of species was expressed with abundant (A), common (C), few (F), and rare (R).

The samples are listed in the tables according to site number, section, and interval. For each sample the depth has also been given in meters below sea floor. All scanning electron microscope prints were taken by E. Knickrehm with the Autoscan microscope of the Federal Institute for Geosciences and Natural Resources, Hannover, Germany.

CALCAREOUS NANNOFOSSIL BIOSTRATIGRAPHY AND ZONATION

Jurassic

Numerous studies about Jurassic coccoliths have been published and several zonations—Stradner (1963), Prins (1969), Worsley (1971), and Rood et al. (1973)—have been proposed. For this study the zonation of Barnard and Hay (1974) was used.

Jurassic sediments were encountered only at Site 367. The lowest section of this site (Sample 367-38-1, 139-140 cm, to Sample 367-32-5, 11-12 cm) remains unzoned; its age ranges from Oxfordian to Kimmeridgian.

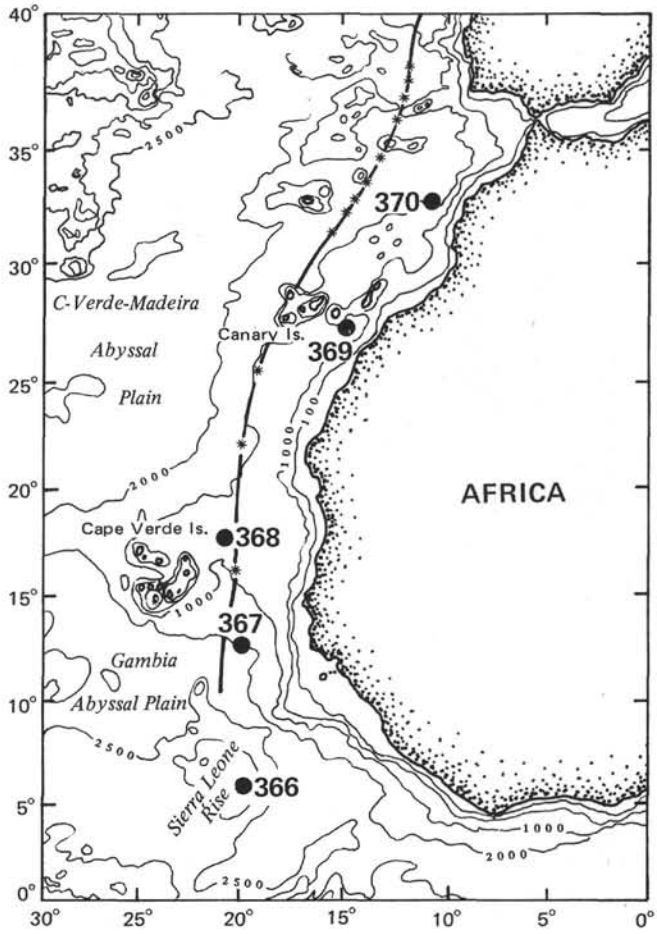

Figure 1. *Location of sites drilled on DSDP Leg 41.*

Parhabdolithus embergeri Zone

This zone is defined as the interval from the first occurrence of *Parhabdolithus embergeri* (Noel) to the first occurrence of *Nannoconus colomi* (de Lapparent).

Important common species: *Parhabdolithus embergeri* (Noel).

Age: Tithonian (late Kimmeridgian to Portlandian).

Remarks: This youngest Jurassic zone is present at Site 367, from 367-32-5, 7-8 cm, to 367-32-4, 136-138 cm.

Cretaceous

A number of calcareous nannofossil zonations have been proposed for the Cretaceous system. For the Early Cretaceous: Worsley (1971) and Thierstein (1971, 1973,

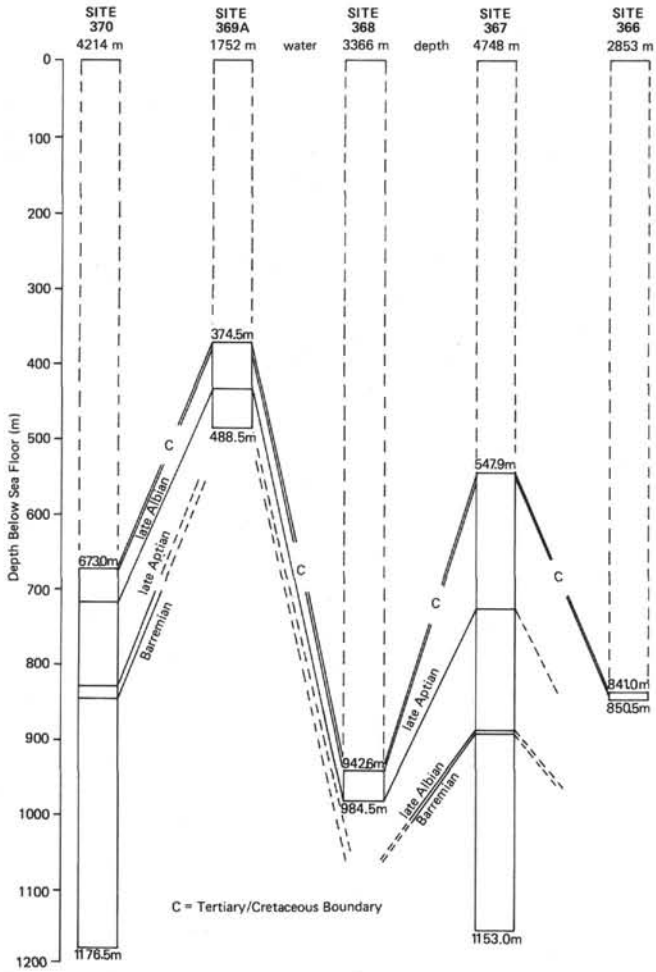

Figure 2. *Sites drilled on Leg 41 of the Deep Sea Drilling Project and comparison with some determined Cretaceous stages based on nannoplankton assemblages.*

1974, in press) and for the Late Cretaceous: Cepek and Hay (1969), Bukry and Bramlette (1970), Manivit (1971), Roth (1973), Bukry (1974), and Thierstein (1974). For this report the zonation according to van Hinte (1976) as given in Figure 4 was used. It is based on the zonation of Bukry (1974), Roth (1973), and Thierstein (1973) and is correlated with the zonations or biohorizons of radiolarians, benthonic foraminifers, planktonic foraminifers, calpionellids, and pelagic macrofossils.

Other nannofossils were used besides the marker species to determine the age of part of the sections. Some zones were not recognized.

Nannoconus colomi Zone

This zone is defined as the interval from the first occurrence of *Nannoconus colomi* (de Lapparent) to the first occurrence of *Cretarhabdus crenulatus* Bramlette and Martini.

Important common species: *Nannoconus colomi* (de Lapparent), *Lithraphidites carniolensis* Deflandre, *Cruciellipsis cuvillieri* (Manivit), and *Rucinolithus wisei* Thierstein.

Age: Berriasian.

Remarks: This zone was determined only at Site 367. The boundary to the overlying zone is not clear, because in the younger sediments it was not possible to identify any zone. Only the chronostratigraphic ages could be determined.

This zone is present from Samples 367-32-3, 58-59 cm, to 367-30-2, 57-58 cm.

Cretarhabdus crenulatus Zone

This zone is defined as the interval from the first occurrence of *Cretarhabdus crenulatus* Bramlette and Martini to the first occurrence of *Calcicalathina oblongata* (Worsley).

Important common species: *Cretarhabdus crenulatus* Bramlette and Martini, *Vagalapilla stradneri* (Rood et al.), *Zygodiscus diplogrammus* (Deflandre and Fert), and *Podorhabdus dietzmanni* (Reinhardt).

Age: Early Valanginian.

Remarks: This zone was determined only in the basal section of Site 370 (Samples 51, CC to 50-2, 134-135 cm).

Calcicalathina oblongata Zone

This zone is defined as the interval from the first occurrence of *Calcicalathina oblongata* (Worsley) to the first occurrence of *Lithraphidites bollii* (Thierstein).

Important common species: *Calcicalathina oblongata* (Worsley) and *Tubodiscus verenae* Thierstein.

Age: Late Valanginian to early Hauterivian.

Remarks: This zone is present only in Site 370 (Samples 50-1, 94-95 cm to 38, CC). The exact top of this zone is difficult to identify because the species *Lithraphidites bollii* (Thierstein) was not observed.

Lithraphidites bollii Zone

This zone was not determined at the studied sites.

Micrantholithus hoschulzi Zone

This zone is defined as the interval from the last occurrence of *Cruciellipsis cuvillieri* (Manivit) to the last occurrence of *Nannoconus colomi* (de Lapparent).

Important common species: *Nannoconus colomi* (de Lapparent).

Age: Barremian.

Remarks: This zone was determined at Sites 367 and 370. In both sites the *Lithraphidites bollii* Zone is missing. For this reason it is difficult to determine the lower boundary of this zone. In this paper the species *Cruciellipsis cuvillieri* (Manivit) was used for ascertaining the lower boundary of this zone. Thierstein (1973) used the last occurrence of *Calcicalathina oblongata* (Worsley) for the lower boundary of the *Micrantholithus hoschulzi* Zone. This zone is present in Samples 367-26, CC to 367-25-4, 135-136 cm and 370-34, CC to 370-33, CC.

Chiastozygus litterarius Zone

This zone is defined as the interval from the last occurrence of *Nannoconus colomi* (de Lapparent) to the first occurrence of *Lithastrinus floralis* Stradner.

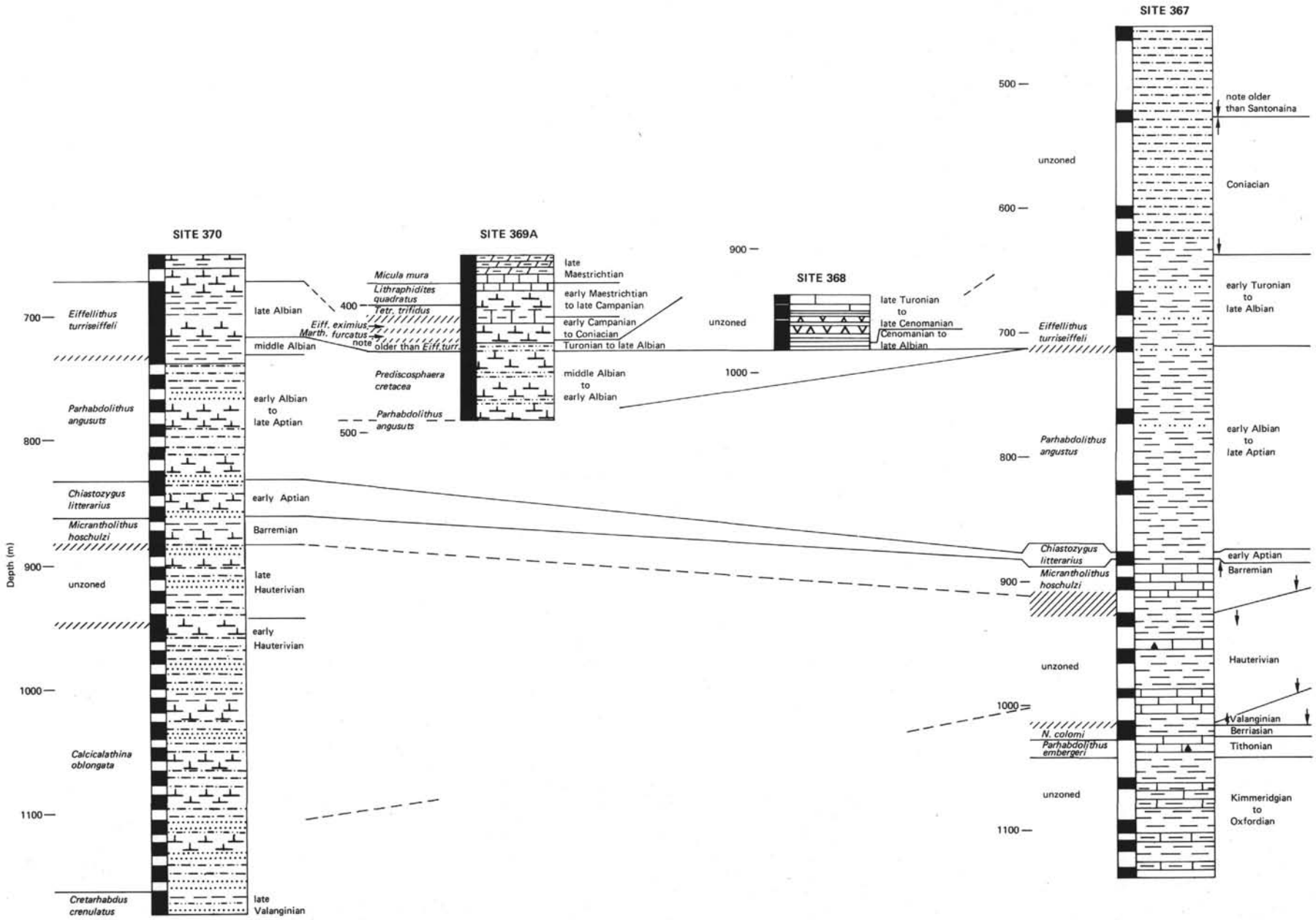

Figure 3. *Comparison of calcareous nannofossil zones at Sites 367 to 370.*

TABLE 1
Nannofossil Species Considered in This Report

Tetralithus aculeus (Stradner)
Corollithion achylosum (Stover)
Braarudosphaera africana Stradner
Hayesites albiensis Manivit
Chiastozygus amphipons (Bramlette and Martini)
Parhabdolithus angustus (Stradner)
Parhabdolithus asper (Stradner)
Watznaueria barnesae (Black)
Microrhabdulus belgicus Hay and Towe
Flabellites biforaminis Thierstein
Watznaueria biporta Bukry
Nannoconus bucheri Bronnimann
Lithraphidites carniolensis Deflandre
Lucianorhabdus cayeuxi Deflandre
Nannoconus colomi (de La Parent)
Cretarhabdus conicus Bramlette and Martini
Biscutum constans (Gorka)
Cretarhabdus coronadventis Reinhardt
Cretarhabdus crenulatus Bramlette and Martini
Prediscosphaera cretacea (Arkhangelsky)
Chiastozygus cuneatus (Lyuleva)
Cruciellipsis cuvillieri (Manivit)
Arkhangelskiella cymbiformis Vekshina
Microrhabdulus decoratus Deflandre
Micula decusata Vekshina
Octopodorhabdus decussatus (Manivit)
Podorhabdus dietzmanni (Reinhardt)
Zygodiscus diplogrammus (Deflandre and Fert)
Cribrosphaerella ehrenbergi (Arkhangelsky)
Zygodiscus elegans Gartner
Parhabdolithus embergeri (Noel)
Broinsonia enormis (Shumenko)
Zygodiscus erectus (Deflandre)
Eiffellithus eximius (Stover)
Tranolithus exiguus Stover
Lithastrinus floralis Stradner
Scapholithus fossilis Deflandre and Fert
Marthasterites furcatus Deflandre
Tranolithus gabalus Stover
Sollasites horticus (Stradner, Adamiker, and Maresch)
Micrantholithus hoschulzi (Reinhardt)
Discorhabdus ignotus (Gorka)
Discolithus incohatus Stover
Marthasterites inconspicuus Deflandre
Parhabdolithus infinitus (Worsley)
Rucinolithus irregularis Thierstein
Stephanolithion laffittei Noel
Broinsonia lata (Noel)
Diazomatolithus lehmani Noel
Chiastozygus litterarius (Gorka)
Kamptnerius magnificus Deflandre
Cyclagelosphaera margereli Noel
Watznaueria martelae (Noel)
Vagalapilla matalosa (Stover)
Micula mura (Martini)
Gatnerago obliquus (Stradner)
Calcicalathina oblongata (Worsley)
Tetralithus obscurus Deflandre
Micrantholithus obtusus Stradner
Ahmuellerella octoradiata (Gorka)
Podorhabdus orbiculofenestrus (Gartner)
Broinsonia parca (Stradner)
Manivitella pemmatoidea (Deflandre ex Manivit)
Tranolithus phacelosus Stover
Tetralithus pyramidus Gardet
Diadorhombus rectus Worsley
Cretaturbella rothii Thierstein
Discorhabdus rotatorius (Bukry)
Lithraphidites quadratus Bramlette and Martini
Cretarhabdus schizobrachiatus (Gartner)
Corollithion signum Stradner
Parhabdolithus splendens (Deflandre)
Micula staurophora (Gardet)
Microrhabdulus stradneri Bramlette and Martini
Vagalapilla stradneri (Rood, Hay, and Barnard)
Ericsonia subpertusa Hay and Mohler
Cretarhabdus surirellus (Deflandre)
Biscutum supracretaceum (Reinhardt)
Eiffellithus trabeculatus (Gorka)
Tetralithus trifidus Stradner
Eiffellithus turriseiffeli (Deflandre and Fert)
Tubodiscus verenae Thierstein
Rucinolithus wisei Thierstein
Zygolithus sp.

TABLE 1 – *Continued*

Important common species: *Micrantholithus hoschulzi* (Reinhardt).

Age: Early Aptian.

Remarks: In addition to the occurrence of *Nannoconus colomi* (de Lapparent) Thierstein (1973) used the first occurrence of *Chiastozygus litterarius* (Gorka) to determine the lower boundary of this zone. At Site 367 the first occurrence of the latter species coincides with the first occurrence of *Lithastrinus floralis* Stradner or begins even later at Site 370. Thus, *Chiastozygus litterarius* occurs at those sites in the *Parhabdolithus angustus* Zone.

This zone is present in Samples 367-25-3, 38-39 cm, to 367-25-1, 16-17 cm and 370-32, CC to 32-2, 110-111 cm.

Parhabdolithus angustus Zone

This zone is defined as the interval from the first occurrence of *Lithastrinus floralis* Stradner and/or *Parhabdolithus angustus* (Stradner) to the first occurrence of *Prediscosphaera cretacea* (Arkhangelsky).

Important common species: *Parhabdolithus angustus* (Stradner) and *Lithastrinus floralis* Stradner.

Age: Late Aptian to early Albian.

Remarks: This zone is present at Sites 367 and 370. The *Prediscosphaera cretacea* Zone was not found in these two sites. Consequently, at these sites the upper boundary of this zone is limited by the *Eiffellithus turriseiffeli* Zone.

This zone is present in Samples 367-32-5, 7-8 cm, to 367-32-4, 136-138 cm and 370-31-3, 149-150 cm, to 370-26-4, 70-71 cm.

Prediscosphaera cretacea Zone

This zone is defined as the interval from the first occurrence of *Prediscosphaera cretacea* (Arkhangelsky) to the first occurrence of *Eiffellithus turriseiffeli* (Deflandre and Fert).

Important common species: *Prediscosphaera cretacea* (Arkhangelsky), *Vagalapilla matalosa* (Stover), *Broinsonia lata* (Noel), *Cretarhabdus coronadventis* Reinhardt, and *Podorhabdus orbiculofenestrus* (Gartner).

Age: Early to middle Albian.

Remarks: This zone was determined only at Hole 369A from Samples 43-3, 70-71 cm, to 47, CC. Thus it is missing at Sites 367 and 370.

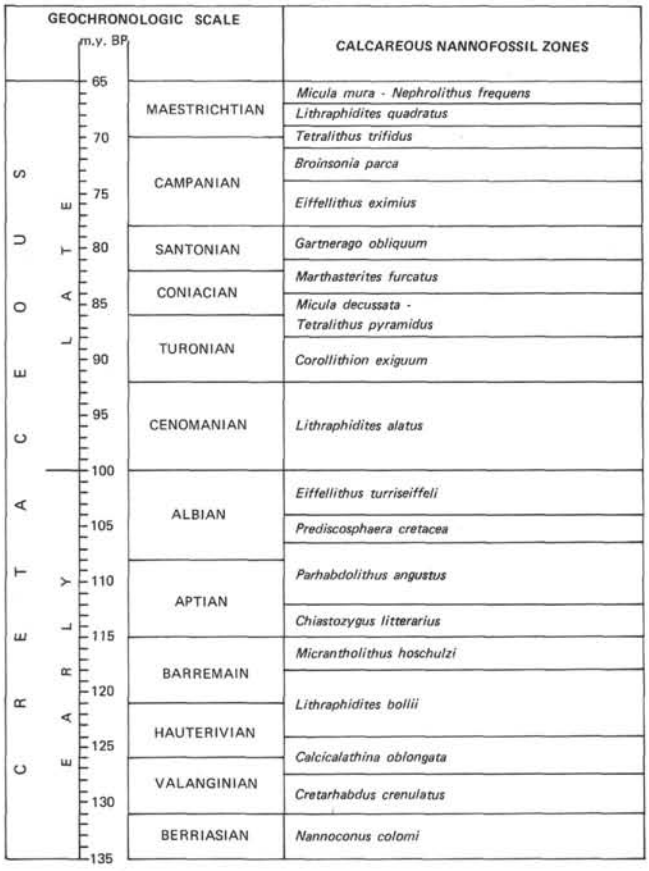

Figure 4. *Correlation of Cretaceous nannoplankton zones used in this report with the geochronological scale of van. Hinte (in press).*

Eiffellithus turriseiffeli Zone

This zone is defined as the interval from the first occurrence of *Eiffellithus turriseiffeli* (Deflandre and Fert) to the first occurrence of *Lithraphidites alatus* Thierstein.

Important common species: *Eiffellithus turriseiffeli* (Deflandre and Fert) and *Cribrosphaerella ehrenbergi* (Arkhangelsky).

Age: Late Albian.

Remarks: The upper boundary of this zone is that determined by Roth (1971); according to Van Hinte (1976), it is located in the early Cenomanian. At Site 370 this zone represents the youngest Cretaceous zone recognized (from 370-26-3, 80-81 cm, to 370-20-1, 70-71 cm). As the marker species of younger zones are missing, it was difficult to define the top of this zone at Site 367 and Hole 369A (the basis of the zone occurs in Samples 367-22-5, 78-79 cm and 369A-42-2, 80-81 cm, to 369A-41, CC). Moreover, the assemblage of nannofossils is comparatively poor and not well preserved at Site 367.

The three following zones were not recognized in the sites: *Lithraphidites alatus* Zone, *Corollithion exiguum* Zone, *Micula decussata-Tetralithus pyramidus* Zone.

According to literature these zones cover the range from the Cenomanian to the lower Coniacian.

Marthasterites furcatus Zone

This zone is defined as the interval from the first to the last occurrence of *Marthasterites furcatus* Deflandre.

Important common species: *Marthasterites furcatus* Deflandre and *Microrhabdulus decoratus* Deflandre.

Age: Late Coniacian to early Santonian.

Remarks: This zone was determined only at Hole 369A in the interval from 369A-41-2, 70-71 cm, to 369A-40-3, 85-86 cm.

Gartnerago obliquus Zone

This zone was not recognized in the samples studied.

Eiffellithus eximius Zone

This zone is defined as the interval from the first occurrence of *Broinsonia parca* (Stradner) to the last occurrence of *Eiffellithus eximius* (Stover).

Important common species: *Eiffellithus eximius* (Stover) and *Broinsonia parca* (Stradner).

Age: Early Campanian.

Remarks: This zone is present only in Hole 369A in Sample 369A-39, CC.

Broinsonia parca Zone

This zone was not recognized in the samples studied.

Tetralithus trifidus Zone

This zone is defined as the interval from the first to the last occurrence of *Tetralithus trifidus* Stradner.

Important common species: *Tetralithus trifidus* Stradner, *Arkhangelskiella cymbiformis* Vekshina, and *Tetralithus aculeus* (Stradner).

Age: Late Campanian to early Maestrichtian.

Remarks: This zone is present in Hole 369A (369A-39-3, 70-71 cm, to 369A-38, CC).

Lithraphidites quadratus Zone

This zone is defined as the interval from the last occurrence of *Tetralithus trifidus* Stradner to the first occurrence of *Micula mura* (Martini).

Important common species: *Lithraphidites quadratus* Bramlette and Martini, *Cretarhabdus coronadventis* Reinhardt, *Tetralithus aculeus* (Stradner), and *Gartnerago obliquum* (Stradner).

Age: Early Maestrichtian.

Remarks: The boundary between this zone and the *Tetralithus trifidus* Zone is present only in Hole 369A, but *Lithraphidites quadratus* Bramlette and Martini is present only in the upper part of this zone which was recognized in: 366-55, CC and 369A-38-3, 60-61 cm, to 369A-36, CC.

Micula mura Zone

This zone is defined as the interval from the first to the last occurrence of *Micula mura* (Martini).

Important common species: *Micula mura* (Martini).

Age: Late Maestrichtian.

Remarks: This zone is present only in Hole 369A from Sample 369A-35-5, 128-129 cm, to 369A-36-3, 20-21 cm.

DISTRIBUTION OF CALCAREOUS NANNOFOSSILS

SITE 366
(latitude 05°40.7'N, longitude 19°51.1'W, water depth 2853 m)

Site 366 (Table 5) was drilled on the Sierra Leone Rise and was continuously cored down to 850.5 meters. The hole bottomed in sediments of upper Maestrichtian marlstone. These Upper Cretaceous sediments occurred only in Sample 55, CC. The poorly to moderately preserved assemblage belongs to the *Lithraphidites quadratus* Zone, with abundant *Micula staurophora* (Gardet) and common *Watznaueria barnesae* (Black).

SITE 367
(latitude 12°29.2'N, longitude 20°02.8'W, water depth 4748 m)

Site 367 is located in the Cape Verde Basin, southeast of the Cape Verde Islands (Tables 2 and 6). The total depth drilled was 1152 meters. The first Cretaceous sediments with one specimen of *Tetralithus obscurus* (Deflandre) appear in Sample 16-5, 37-38 cm; they are not older than Santonian. They are represented by silty clay which is very poor in coccoliths. Sample 16-6, 50-51 cm, which is practically barren of coccoliths, is of the same type of sediment. Core catcher 16 and Core 17 are barren of nannofossils. The black shales rich in organic matter in Core 18 through Sample 22-5, 78-79 cm, represent the Albian to Coniacian ages. The coccolith assemblages are mainly poor and it is therefore very difficult to determine the biostratigraphic and zonal value. Sample 18-1, 100-101 cm, to 18, CC recovered Coniacian sediment. *Lucianorhabdus cayeuxi* Deflandre, which first occurred in the Coniacian, was found. Samples 19-3, 85-86 cm, to 22-5, 78-79 cm, (excluding 20, CC and 22-2, 22-23 cm, which are barren of coccoliths) yield assemblages including *Parhabdolithus asper* (Stradner), *Corollithion achylosum* (Stover), and *Eiffellithus turriseiffeli* (Deflandre and Fert). This assemblage indicates the late Albian to early Turonian interval. The base of this stratigraphic sequence belongs to the *Eiffellithus turriseiffeli* Zone. Sample 22-6, 105-106 cm, is barren of coccoliths. The oldest part of the black shales in Sample 22, CC contains *Parhabdolithus angustus* (Stradner) and *Lithastrinus floralis* Stradner, but *Eiffellithus turriseiffeli* (Deflandre and Fert) and *Prediscosphaera cretacea* (Arkhangelsky) are missing. This assemblage indicates the *Parhabdolithus angustus* Zone of late Aptian to early Albian age. The shale, clay, claystone, and limestone of Samples 23, CC to 25-1, 6-7 cm, are of the same age. The *Chiastozygus litterarius* Zone (early Aptian) was recognized in the limestone, Samples 25-1, 16-17 cm, to 25-3, 38-39 cm, with *Micrantholithus obtusus* (Stradner), but without *Parhabdolithus asper* (Stradner), *Lithastrinus floralis* Stradner, and *Nannoconus colomi* (de Lapparent). The limestone of Sample 25-4, 135-136 cm, and the gray limestone with an alternation of black marlstone of Core 26 contain *Nannoconus colomi* (de Lapparent) without *Cruciellipsis cuvillieri* (Manivit), which indicates Barremian age. This nannoplankton assemblage belongs to the *Micrantholithus hoschulzi* Zone. Samples 27-1, 131-132 cm, to 29-2, 88-89 cm, with *Cruciellipsis cuvillieri* (Manivit) and without *Rucinolithus wisei* Thierstein suggest assigning this gray limestone and black marlstone to the Hauterivian. Only in Sample 30-1, 44-45 cm, was a Valanginian assemblage with *Rucinolithus wisei* Thierstein and *Diadorhombus rectus* Worsley recovered. The *Nannoconus colomi* Zone of Berriasian age with *Nannoconus*

TABLE 2
Site 367 Samples in Which Calcareous Nannoplankton Were Not Found

16-1, 70-71
16-2, 40-41
16-3, 40-41
16-4, 40-41
16, CC
17-1, 130-131
17-2, 115-116
17-3, 80-81
17-6, 80-81
17, CC
18-3, 95-96
20, CC
22-2, 22-23
22-6, 105-106

TABLE 3
Site 368 Samples in Which Cretaceous Calcareous Nannoplankton Were Not Found

59-1, 70-71
59-2, 70-71
59-3, 80-81
59, CC
60-2, 27-28
60-3, 21-22
60-3, 84, 5
60-3, 114-115
60-4, 5-6
60-4, 144
60-5, 44-45
62-3, 130-131
62, CC
63-3, 72-73

TABLE 4
Site 370 Samples in Which Cretaceous Calcareous Nannoplankton Were Not Found

23-3, 70-71
26-1, 70-71
26, CC
27-1, 80-81
27-2, 80-81
28-1, 70-71
28-2, 60-61
28-3, 60-61
29, CC
30-3, 72-73
30, CC
31-1, 60-61
31-4, 139-140
31, CC
32-2, 100-101
32-3, 70-71

TABLE 5
Distribution of Nannofossils at Site 366

Sample	Depth Below Sea Floor (m)	Abundance	Preservation	*Watznaueria barnesae*	*Micula staurophora*	*Eiffellithus turriseiffeli*	*Parhabdolithus embergeri*	*Chiastozygus amphipons*	*Lithraphidites quadratus*	*Micula decusata*	*Cribrosphaerella ehrenbergi*	*Microrhabdulus decoratus*	*Ericsonia subpertusa*	Zone	Age
55, CC	850	F	P-M	C	A	F	R	R	R	R	R	R	R	*Lithraphidites quadratus*	Maestrichtian

colomi (de Lapparent), *Cruciellipsis cuvillieri* (Manivit), *Lithraphidites carniolensis* Deflandre, but without *Diadorhombus rectus* Worsley, was found in the gray limestone of Samples 30-2, 57-58 cm, to 32-3, 58-59 cm. This sediment forms the base of the Cretaceous.

The underlying zone, the *Parhabdolithus embergeri* Zone, which corresponds to the Tithonian, was recovered in Samples 32-4, 136-138 cm, and 32-5, 7-8 cm. In the limestone of Sample 32-5, 11-12 cm, the coccoliths are poorly preserved and represented only by *Watznaueria barnesae* (Black), *Watznaueria biporta* Bukry, *Watznaueria martelae* (Noel), and *Cyclagelosphaera margereli* Noel, but *Parhabdolithus embergeri* (Noel) is missing. This assemblage is indicative of the Oxfordian to Kimmeridgian ages.

SITE 368
(latitude 17°30.4′N, longitude 21°21.2′W, water depth 3366 m)

Site 368 represents a 984.5-meter section drilled on the Cape Verde Rise (Tables 3 and 7). Cretaceous sediments, consisting mainly of black shales, were recovered from Sample 59-3, 108-109 cm, to Core 63. The assemblage is poorly preserved and it is only possible to give an age determination since zones could not be defined. Cores 59 to 60 and Samples 62-3, 130-131 cm, 62, CC and 63-3, 72-73 cm are nearly barren of nannofossils. Between Section 60-5, and Section 62-3, olivine diabase was recovered. Black shales with more coccoliths than in Cores 59 and 60 were again recovered from Section 62-3, to the base of Site 368. It is possible to divide the Cretaceous sediments into two stratigraphical horizons: first, Samples 59-3, 108-109 cm to 63-3, 40-49 cm, and second, 63-4, 70-71 cm, to 63, CC. The nannoplankton assemblages of the first horizon with *Gartnerago obliquus* (Stradner) and *Parhabdolithus asper* (Stradner) are assigned to the late Cenomanian to late Turonian. The second horizon with *Eiffellithus turriseiffeli* (Deflandre and Fert), *Broinsonia lata* (Noel), and *Broinsonia enormis* (Shumenko), but without *Gartnerago obliquus* (Stradner), belongs to the late Albian to Cenomanian.

HOLE 369A
(latitude 26°35.5′N, longitude 14°59.9′W, water depth 1752 m)

Hole 369A is located on the continental slope off Cape Bojador, Spanish-Sahara (Table 8). Cretaceous sediments were found in Cores 35 through 47. Samples 35-5, 128-129 cm, to 36-3, 20-21 cm, were assigned to the *Micula mura* Zone (late Maestrichtian). This limestone is characterized by rich and moderately well preserved coccolith assemblages with *Micula mura* (Martini). The marlstone encountered from Samples 36, CC to 39-3, 70-71 cm, contains a nannoplankton assemblage of the *Lithraphidites quadratus* Zone—with zonal marker, but without *Micula mura* (Martini)—which may be assigned to the late Campanian to early Maestrichtian. The lower part of this interval belongs to the *Tetralithus trifidus* Zone as it contains the zonal marker together with *Arkhangelskiella cymbiformis* Vekshina and *Tetralithus aculeus* (Stradner). Coniacian to early Campanian chalk and marl were recognized in Samples 39, CC to 41-2, 70-71 cm. The upper part contains *Eiffelithus eximius* (Stover) and thus belongs to the *Eiffellithus eximius* Zone. A well-preserved and abundant assemblage including *Marthasterites furcatus* Deflandre was assigned to the lower part of this Coniacian to early Campanian section (*Marthasterites furcatus* Zone). Late Albian to Turonian marl and chalk were encountered from Samples 41, CC to 42-2, 80-81 cm; they contain *Eiffellithus turriseiffeli* (Deflandre and Fert) and *Parhabdolithus asper* (Stradner) and indicate the *Eiffellithus turriseiffeli* Zone. Early to middle Albian sediments were determined in Samples 42, CC to 47, CC containing common and moderately to well preserved nannofossils of the *Prediscosphaera cretacea* Zone. The marker species as well as *Vagalapilla matalosa* (Stover) and *Broinsonia lata* (Noel) are present, but *Eiffellithus turriseiffeli* (Deflandre and Fert) is missing.

SITE 370
(latitude 32°50.2′N, longitude 10°46.6′W, water depth 4214 m)

Site 370 was drilled (1200 m) in a deep basin off Morocco (Table 4 and Table 9). From Core 20 to the base of the site (Core 51) Cretaceous calcareous silty claystones, shales, and limestones, interbedded with siltstones, sandstones, and conglomerates were recovered. These sediments were divided into seven stratigraphical horizons from late Valanginian to late Albian.

From the top of the Cretaceous sediments, Sample 20-1, 70-71 cm, to 24-4, 70-71 cm (except Sample 23-3, 70-71 cm, which is barren of coccoliths), rich

TABLE 6
Distribution of Nannofossils at Site 367

Sample (Interval in cm)	Depth Below Sea Floor (m)	Abundance	Preservation	*Watznaueria martelae*	*Cyclagelosphaera margereli*	*Watznaueria barnesae*	*Watznaueria biporta*	*Parhabdolithus embergeri*	*Nannoconus colomi*	*Lithraphidites carniolensis*	*Cruciellipsis cuvillieri*	*Rucinolithus wisei*	*Diazomatolithus lehmani*	*Parhabdolithus asper*	*Diadorhombus rectus*	*Manivitella pemmatoidea*	*Vagalapilla stradneri*	*Zygodiscus diplogrammus*	*Parhabdolithus infinitus*	*Cretarhabdus crenulakis*	*Cretarhabdus conicus*	*Micrantholithus obtusus*	*Calcicalathina oblongata*	*Micrantholithus hoschulzi*	*Cretarhabdus surirellus*	*Nannoconus bucheri*	*Chiastozygus litterarius*	*Lithastrinus floralis*	*Biscutum supracretaceum*	*Stephanolithion laffittei*	*Parhabdolithus angustus*	*Zygodiscus erectus*
16-5, 37-38	546	R	–																													
16-6, 50-51	548	R	P																													
18-1, 100-101	637	C	P-M			•											•	•		•							•	•		•		•
18-4, 112-113	641	R	P			•											•	•		•							•	•				•
18-5, 15-16	642	R	P			•																										
18, CC	644	R	–																													
19-3, 85-86	648	F	P-M			•	•	•						•			•	•		•							•	•		cf.	•	•
19-4, 110-111	650	C	M			•	•	•									•	•							•			•				
19, CC	654	R-F	P			•		•										•										•				
20-4, 38, 5	689	C	P-M			•				•						•	•	•							•		•	•		•	•	
20-4, 40-41	689	A	G			•				•						•	•	•									•	•		•	•	
21-1, 85-86	692	R	P			•																										
21-2, 77-79	694	R	P			•																										
21-6, 107-108	700	A	M			•				•				•			•	•				•			•						•	
21, CC	701	R-F	P			•											•	•									•				•	
22-3, 7-8	723	R	P			•								•														•				
22-4, 80-81	725	R	P			•								•				•		•												•
22-5, 78-79	727	C	P			•								•		•	•	•							•		•	•				•
22, CC	730	F	P			•	•							•		•	•										•	•			•	•
23, CC	787	R	P			•												•										•				
24, CC	844	C	P-M			•		•		•				•															•	•		
25-1, 6-7	891	F-C	M	•		•		•		•			•	•			•	•		•						cf.	•	•				
25-1, 16-17	891	F	P			•				•				•			•			•												
25-2, 82-83	893	F	P			•		•						•			•			•			•									
25-3, 38-39	894	F	P			•	•	•						•			•	•		•			•									
25-4, 135-136	897	A	G		•	•		•	•	•			•	•			•	•			•				•	cf.						
26-4, 123-124	916	C-A	G					•	•	•				•			•			•	•		•	cf.	•	•						
26-4, 138-139	916	C	P-M			•		•		•				•							•											
26, CC	920	C	M			•		•	•	•				•				•		•	•	•	•									
27-1, 131-132	940	C	M			•				•	•		•	•																		
27-2, 109-110	941	C	G								•									•	•											
27-3, 86-87	942	F-C	P-M			•		•		•	•			•			•															
28-3, 60-61	971	F-C	P			•				•				•		•																
29-2, 88-89	998	R-F	P			•		•			•		•	•																		
30-1, 44-45	1024	C	M	•	•	•		•		•	•	•	•	•	•																	
30-2, 57-58	1026	F-C	P-M			•	•	•		•	•		•																			
30-2, 68-68	1026	R	P	•	•	•				•	•																					
31-2, 1-2	1054	F	P					•		•	•																					
31-2, 106-107	1055	F-C	P-M			•	•	•			•		•																			
31-2, 109-110	1055	R	P			•	•	•	•		•																					
31, CC	1062	C	M		•	•	•	•	•	•	•																					
32-2, 5-6	1083	C-A	M		•	•		•	•	•	•	•																				
32-3, 58-59	1085	C	M			•		•	•	•	•																					
32-4, 136-138	1087	C	M		•		•	•		cf.																						
32-5, 7-8	1087	A	P-M	•	•	•	•	•																								
32-5, 11-12	1087	C	P	•	•	•	•																									
32-5, 57-58	1088	F-C	P	•	•	•	•																									
32-5, 111-112	1088	F	M	•	•	•	•																									
32, CC	1091	R-F	P	•	•	•																										
33-3, 75-76	1109	R	P		•	•																										
34-2, 55-56	1113	R	P	•	•	•	•																									
35-5, 109-110	1126	R	P	•	•	•																										
36-3, 8-9	1130	R	P	•	•	•	•																									
37-1, 66-67	1135	F	P	•		•																										
38-1, 127-128	1143	R	M	•	•	•	•																									
38-1, 139-140	1143	R-F	P	•	•	•	•																									

TABLE 6 – *Continued*

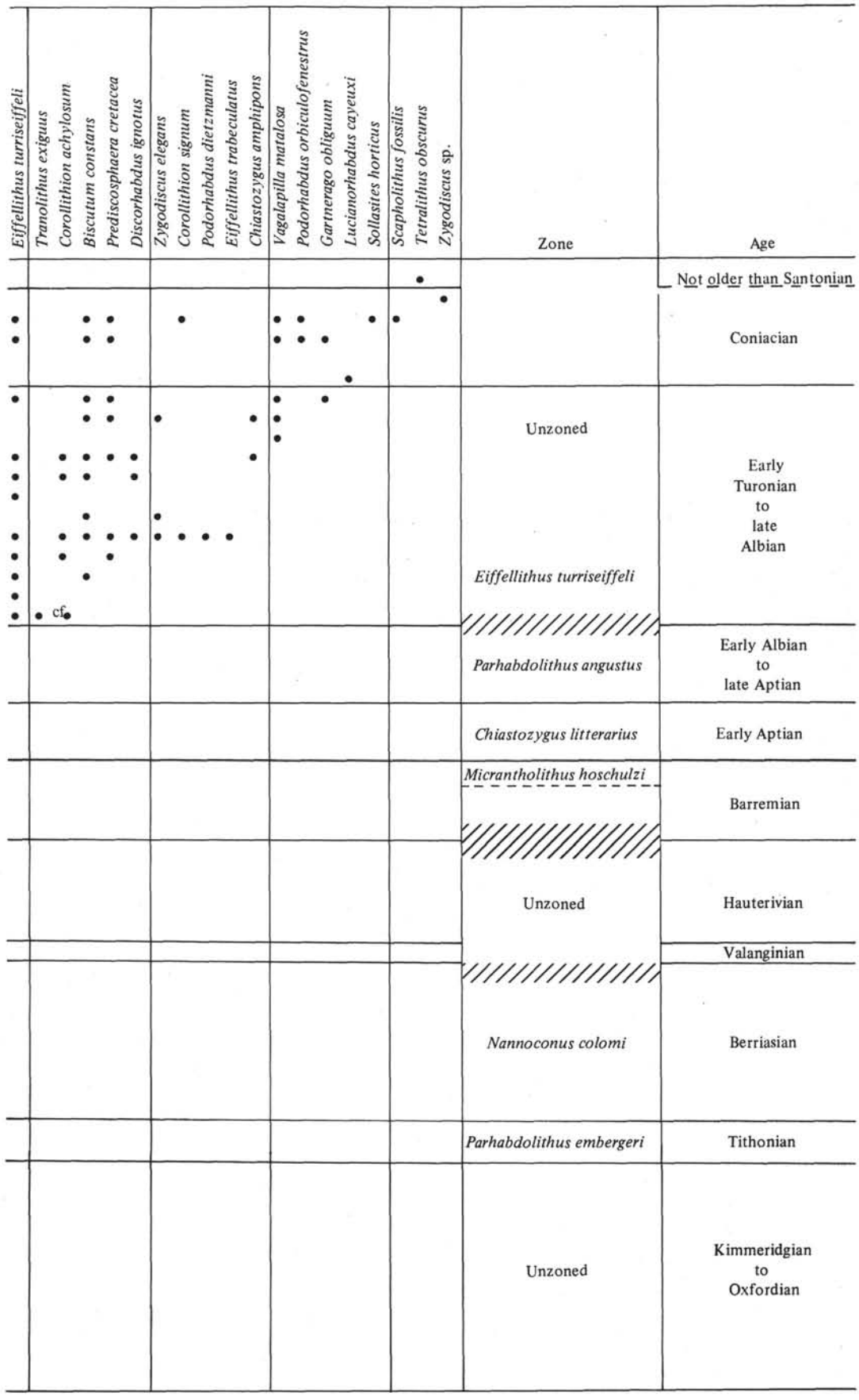

TABLE 7
Distribution of Nannofossils at Site 368

Sample (Interval in cm)	Depth Below Sea Floor (m)	Abundance	Preservation	*Watznaueria barnesae*	*Prediscosphaera cretacea*	*Zygodiscus diplogrammus*	*Lithastrinus floralis*	*Chiastozygus litterarius*	*Cribrosphaerella ehrenbergi*	*Broinsonia lata*	*Manivitella pemmatoidea*	*Eiffellithus turriseiffeli*	*Zygodiscus elegans*	*Watznaueria biporta*	*Biscutum constans*	*Gartnerago obliguum*	*Parhabdolithus angustus*	*Vagalapilla matalosa*	*Parhabdolithus embergeri*	*Zygodiscus* sp.	*Broinsonia enormis*	*Parhabdolithus* cf. *asper*	*Discorhabdus ignotus*	*Podorhabdus orbiculofenestrus*	*Tranolithus* cf. *phacelosus*	*Micula staurophora*	*Kamptnerius magnificus*	Zone	Age
59-3, 108-109	942	R	P																								R		
60-2, 117-119	952	R	P	R																									
62-4, 62-63	973	R-F	P	C		F	C			F	R									F		F			F	F			Late
62-4, 80-81	973	R	P	R			R					R		R						R									Turonian
62-4, 84-85	973	R	P	R																								Unzoned	to
63-1, 76-77	975	R-F	P-M	C	F	F	C			F		cf F		F	F					F			R	R					late
63-1, 84-85	975	R-F	P	•	•	•				•	•	•						cf •				•							Cenomanian
63-2, 53-54	977	R-F	P	C	F		A					F			F	C		F	R	F	R								
63-3, 40-43	978	R-F	P	C	R		A					R		F	R	R	R												
63-4, 70-71	980	R	P	C	R	F	F																						Cenomanian
63, CC	984	R	P	A	C	F	F	R	R	R	R	C	R							R									to late Albian

TABLE 8
Distribution of Nannofossils at Site 369A

Sample (Interval in cm)	Depth Below Sea Floor (m)	Abundance	Preservation	*Parhabdolithus asper*	*Watznaueria barnesae*	*Chiastozygus litterarius*	*Parhabdolithus angustus*	*Corollithion achylosum*	*Braarudosphaera africana*	*Parhabdolithus embergeri*	*Corollithion signum*	*Zygodiscus erectus*	*Lithraphidites carniolensis*	*Discorhabdus ignotus*	*Watznaueria martelae*	*Parhabdolithus splenden*	*Stephanolithion laffittei*	*Cretarhabdus coronadventis*	*Lithastrinus floralis*	*Vagalapilla stradneri*	*Manivitella pemmatoidea*	*Tranolithus gabalus*	*Zygodiscus elegans*	*Cretarhabdus conicus*	*Scepholithus fossilis*	*Biscutum constans*	*Zygodiscus diplogrammus*	*Vagalapilla matalosa*	*Hayesites albiensis*	*Cretarhabdus surirellus*	*Prediscosphaera cretacea*	*Podorhabdus orbiculofenestrus*	*Flabellites biforaminis*	*Octopodorhabdus decussatus*	*Watznaueria biporta*	*Cretarhabdus crenulatus*	*Parhabdolithus infinitus*
35-5, 128-129	372	A	M		A								C		F												R		R	C						
35, CC	374	A	M-G																																	
36-3, 20-21	377	A	M		C										R						R								C	A						
36, CC	384	A	M-G										•																					•		
37-3, 60-61	387	A	M-G		A					C			F		C					F				F					C	A						
37, CC	393	A	M-G							•			•																	•						
38-3, 60-61	397	A	M-G		C					C			C			R		F									R			C	A					
38, CC	403	A	P-M																																	
39-3, 70-71	406	C	M		C					F					F						F						C			C	C					
39, CC	412	A	M		•																										•					
40-3, 85-86	416	C	G		C			R		C	R					R		R	A		F						C		C					F	
40, CC	422	A	G			•		•			•		•																	•					
41-2, 70-71	424	A	G		A	C	C	C		F	C		F			F	C	R	C		F			F		C	C	R	C	C				F	
41, CC	431	R	M	•	•		•						•	•		•			•	•				•			•									
42-2, 80-81	433	C	M-G	C	A	C	C			F	C		C	C		F	C		C	F	C	C	F	R		A	C		A	C		F		F	
42, CC	441	C	G	•	•	•	•		•				•						•	•	•													•		
43-3, 60-61	444	F-C	M	F	A	C	C						C	C			F	R	C	C	F	C	R			C	F		F	F	C			C		
43, CC	450	C-A	M-G	•	•	•	•			•			•				•		•								•							•		
44-2, 50-51	452	C	M	C	A	F	C	C		F			A	R		R	C	R	F	C	F		C	R	R	A	F		R	C	C	R			R	
44, CC	460	F-C	M	•	•	•	•		•	•			•	•					•		•															
45-3, 70-71	463	C-A	G	C	A	F	F	F		F	F	R	F			F	C		C	C	F	R	C	F	F	A	F			F	C		F	R	C	
45-4, 60-61	465	C	G	C	A	C	C	R		F		C	F	A		F	C	R	C	C	F	F	C	F	C	A	C			C	R	F		R	C	
45, CC	469	C	M-G	•	•	•	•						•				•			•																	
46-4, 60-61	474	C	M-G	C	A		C	F		F		R	C			R	C	R	C		R		C	R		C	C	C		R	R			F	C	F
46, CC	479	C	M-G	•	•	•	•	•		•											•															
47-3, 70-71	482	A	G	C	A	F	C	F		C	C	C	C	C	C	C	C	C	C	C	F	F	F	F	F	C	F	R	R	R	R	R	R	R	R	
47, CC	488	A	M-G	C	A	C	C	F	R	C		C	C					R	R	F	C	F	C			C	F	R		F	R			F		

assemblages of nannofossils occur with *Octopodorhabdus decussatus* (Manivit), *Corollithion signum* Stradner, and *Eiffellithus turriseiffeli* (Deflandre and Fert). These assemblages suggest to this part of the profile the late Albian (*Eiffellithus turriseiffeli* Zone). The same zone, but of middle Albian age, is recovered in Samples 24, CC to 26-3, 80-81 cm. In this lower part of the *Eiffellithus turriseiffeli* Zone, *Corollithion signum* Stradner is missing, but the middle Albian species *Eiffellithus turriseiffeli* (Deflandre and Fert), *Vagalapilla matalosa* (Stover), *Eiffellithus trabeculatus* (Gorka), and *Podorhabdus orbiculofenestrus* (Gartner) are present. The *Parhabdolithus angustus* Zone (late Aptian to early Albian) was recovered from Sample 26-4, 70-71 cm, to 31-3, 149-150 cm. Coccoliths are generally rare in this zone. Several samples are barren of nannoplankton (Table 4), or contain poorly to moderately preserved assemblages which are characterized by the presence of *Parhabdolithus angustus* (Stradner) and *Lithastrinus floralis* Stradner. In the interval from 31-4, 139-140 cm, to 32-3, 70-71 cm, nannofossils are missing. Better preservation and abundance of nannoplankton, without *Nannoconus colomi* (de Lapparent), were observed in Core 32 of early Aptian age (*Chiastozygus litterarius* Zone). In Sample 33, CC the last occurrence of *Nannoconus colomi* (de Lapparent) indicated that the interval from this sample to Core 34 is not younger than Barremian (probably *Micrantholithus hoschulzi* Zone). In Samples 35-3, 70-71 cm, to 38-1, 91-92 cm, there are moderately to well preserved and common to abundant late Hauterivian coccolith assemblages with *Cruciellipsis cuvillieri* (Manivit) and *Parhabdolithus infinitus* (Worsley). The deepest stratigraphic horizon is of late Valanginian to early Hauterivian age. Samples 38, CC to 50-1, 94-95 cm, with *Calcicalathina oblongata* (Worsley) belong to the *Calcicalathina oblongata* Zone. Sample 50-2, 134-135 cm, and Core 51 did not yield *Calcicalathina oblongata* (Worsley), but they contained *Cretarhabdus crenulatus* Bramlette and Martini, *Podorhabdus dietzmanni* (Reinhardt), and *Zygodiscus diplogrammus* (Deflandre and Fert) and may thus be assigned to the *Cretarhabdus crenulatus* Zone.

REFERENCES

Arkhangelsky, A.D., 1912. Upper Cretaceous deposits of east European Russia: Mater. Geol. Russ., v. 25.

TABLE 8 – *Continued*

Podorhabdus dietzmanni	*Broinsonia lata*	*Tranolithus phacelosus*	*Eiffellithus turriseiffeli*	*Eiffellithus eximius*	*Cribrosphaerella ehrenbergi*	*Micula staurophora*	*Gartnerago obliquum*	*Kamptnerius magnificus*	*Chiastozygus cuneatus*	*Marthasterites furcatus*	*Eiffellithus trabeculatus*	*Microrhabdulus belgicus*	*Tetralithus pyramidus*	*Microrhabdulus decoratus*	*Chiastozygus amphipons*	*Microrhabdulus stradneri*	*Discolithus incohatus*	*Broinsonia parca*	*Tetralithus trifidus*	*Lucianorhabdus cayeuxi*	*Tetralithus aculeus*	*Arkhangelskiella cymbiformis*	*Cretarhabdus schizobrachiatus*	*Ahmuellerella octoradiata*	*Micula mura*	*Lithraphidites quadratus*	Zone	Age
			C • A		C • C	A • A		F • F					R	C • F	R • R	R • F	 • F					C • C		F • F	C • C	C • R	*Micula mura*	Late Maestrichtian
		R	• C • A		• C • A	• A • A		• F • R						• F • C	C • C	• C • F			R • R			• C • A		R • A		• • •	*Lithraphidites quadratus*	Early Maestrichtian to late Campanian
			 • C		• C			• F						 • F	 • F				• C	F			• C	R				*Tetralithus trifidus*	
			• A	• F		•	R	C	F	F	C					C	cf F	R										*Eiffellithus eximius*	Early Campanian to Coniacian
		F	• A	• F	• C		•	• C	• F	• F	• F	F	R	R	•													*Marthasterites furcatus*	
			• F		• F																						Not older than *Eiff. turriseiffeli*	Turonian to late Albian
F C F F	R	R F																									*Prediscosphaera cretacea*	Middle Albian to early Albian

TABLE 9
Distribution of Nannofossils at Site 370

Sample (Interval in cm)	Depth Below Sea Floor (m)	Abundance	Preservation	*Watznaueria barnesae*	*Watznaueria biporta*	*Watznaueria martelae*	*Parhabdolithus asper*	*Diazomatolithus lehmani*	*Cruciellipsis cuvillieri*	*Parhabdolithus embergeri*	*Lithraphidites carniolensis*	*Podorhabdus dietzmanni*	*Cretarhabdus crenulatus*	*Cretarhabdus surirellus*	*Manivitella pemmatoidea*	*Cretaturbella rothii*	*Nannoconus colomi*	*Vagalapilla stradneri*	*Biscutum constans*	*Cretarhabdus conicus*	*Stephanolithion laffittei*	*Zygodiscus diplogrammus*	*Zygodiscus erectus*	*Cyclagelosphaera margereli*	*Micrantholithus obtusus*	*Micrantholithus hoschulzi*	*Calcicalathina oblongata*	*Discorhabdus ignotus*	*Tubodiscus verenae*	*Zygodiscus elegans*	*Parhabdolithus infinitus*	*Discorhabdus rotatorius*	*Lithastrinus floralis*
20-1, 70-71	670	C-A	G	A	F		F			F	C		R	C	C			C	F	F	C	C	F				C					C
20-2, 100-101	675	R	G	•														•				•										
20, CC	682	C-A	G	•			•				•	•										•						•				•
21-2, 60-61	684	C	M-G	C	R	R	F			F	C			C	R			R	C	F	R	F								F		F
21, CC	692	C	M-G	•			•				•	•			•							•										
22-3, 60-61	695	C-A	M-G	C		C	F							C	R			F	C			F								R		F
22, CC	701	C-A	M-G				•					•			•													•				•
23-3, 70-71	705	R	P	R																												
23, CC	711	C	M	•			•					•			•													•				
24-4, 70-71	716	A	M-G	A	R		F			F	C		R	C	C			F	F			C	C							C		R
24, CC	720	C	G	•			•					•																				•
25-2, 50-51	722	R	P	R																		R										
25, CC	730	C	M	•			•					•										•						•				•
26-2, 70-71	732	R	P	R																												
26-3, 80-81	733	C	M	C	F		C				R			F	C				C	F	F	F	F					F		R		F
26-4, 70-71	735	R	P-M	F	F																									R		R
27-3, 40-41	752	R	P	R																												R
27, CC	758	R	P	R																												
28, CC	777	C	M-G	•			•				•				•						•							•				•
30-1, 84-85	806	C-A	G	•			•				•																					
31-1, 139-140	826	F	M	•			•			•																						•
31-2, 129-130	827	R	P	R																												
31-3, 149-150	829	F-C	M	•			•																									•
32-2, 110-111	837	R	–	R																												
32-4, 100-101	840	C	P-M	A	C	R	C			C	C		F	R	F		•	R		F		F								F		
32, CC	844	C-A	M-G	•			•				•		•							•												
33, CC	863	C-A	M-G	•			•			•	•				•		•					•										
34-3, 70-71	877	A	M	C	C	R	C			F	C		F	F	F		C	C	C	R	C	C			F							
34, CC	882	R	M	•			•										•															
35-3, 70-71	885	C	M	•			•		•	•	•				•			•				•										
35-5, 24-25	888	C	G	•	•		•			•	•		•		•																	•
35, CC	891	C-A	M	•			•		•		•				•	•										•						
36, CC	901	A	M-G	•			•		•		•				•	•	•															
37, CC	920	C-A	M-G	•			•		•	•	•		•			•	•			•						•						
38-1, 91-92	939	A	G	•			•		•	•	•	•	•	•		•		•		•										•		
38, CC	948	A	G				•	•	•	•	•		•					•		•												
39-3, 48-49	951	C-A	M-G	A	R	C	C			F	F	R	C	F	R	R	F	F		R	C	F			F		F	R		F		
39, CC	958	A	G	•			•			•	•	•	•				•	•		•					•	•						
40-3, 50-51	971	C-A	M	A	F		C			R	F		F	F	F			F		R	F											
40, CC	977	C-A	G	•			•	•	•	•	•		•					•														
41-3, 107-108	990	C	M	A	F		C		F		F	C		F	R			F	R	F	C	C		F	F		R	R		F		
41, CC	996	C	M	•			•		•	•								•														
42-3, 47-48	1008	C	M	A	F		C		C	F	F	F	F			F		F		F	F	F		R	R		F					
42, CC	1015	C	M	•			•		•	•	•		•																			
43-3, 104-105	1028	F-C	M	A	C		C		F	R	C	F	R					F	R	R	C	F					R					
43, CC	1034	C-A	M-G	•			•		•	•	•	•					•	•			•			•	•							
44, CC	1053	F-C	M-C	•			•		•		•					•		•														
45-3, 22-23	1065	F	P-M	A			C		C	R	F				R	F		F							F		F			R		
45-3, 40-41	1065	F	M	C	R	C	C			R	F	C				R	R	R		R	C	F					F					
45, CC	1072	F-C	M	•			•		•		•													•								
46-3, 99-100	1085	R	P	C			R		R	F	C	F								F		R										
46, CC	1091	R	P-M	•			•		•																							
47-1, 95-96	1101	F	M	C	F	R	F		R	R	F	F	R				R	F		F				F	F							
47-3, 52-53	1104	F-C	M	•			•		•	•	•																					
48-2, 34-35	1121	A	M	A	R	R	C		C	C	A	R	R		R	R		F	C	F	C			R			R	R				
48, CC	1129	F-C	M	•			•	•	•	•	•	•					•	•														
49-2, 68-69	1140	C	M	A			C		C	C	A	R						C		F	C							C	R			
49, CC	1148	F-C	M-G	•			•		•	•	•		•					•			•											
50-1, 94-95	1158	C	M	A		R	F		C	R		F	F		C	F	C	C			F	C			C	R	R					
50-2, 134-135	1160	C	M	•					•	•	•							•														
51-2, 68-69	1169	F-C	P	C	R	R	F	R	F	R	R	R	R	R	R			R		C	C	F	R	R								
51, CC	1176	C-A	M	•	•	•	•	•	•	•	•	cf. •	•	•	•	•	cf. •	•															

TABLE 9 – *Continued*

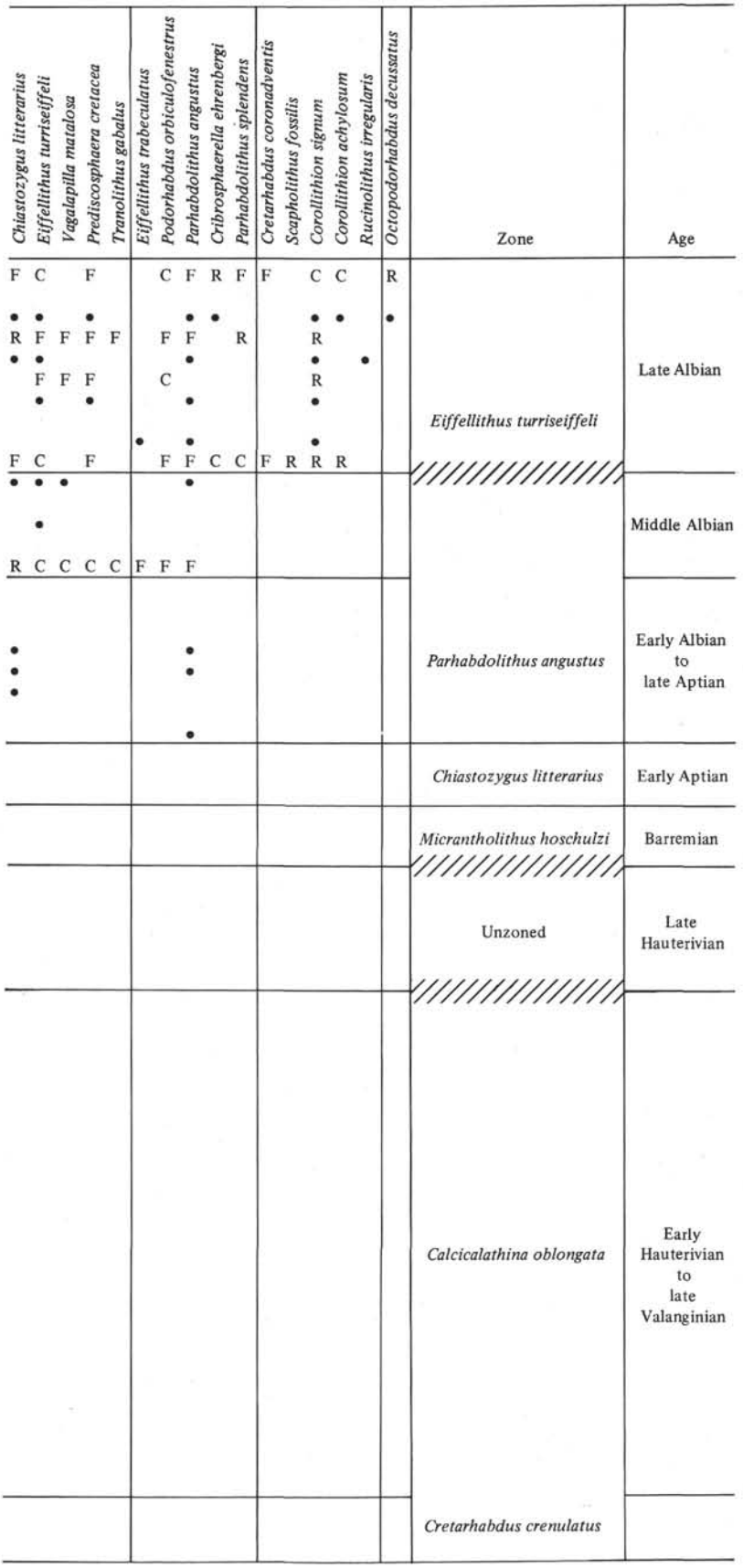

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PLATE 1

Figure 1 — *Lithraphidites quadratus* Bramlette and Martini, 1964.
369A-35, CC.
Scanning electron micrograph of the side view.

Figure 2 — *Arkhangelskiella cymbiformis* Vekshina, 1959.
369A-36, CC.
Scanning electron micrograph of the proximal side.

Figure 3 — *Kamptnerius magnificus* Deflandre, 1959.
369A-36, CC.
Scanning electron micrograph of the proximal side.

Figure 4 — *Cribrosphaerella ehrenbergi* (Arkhangelsky, 1912).
369A-36, CC.
Scanning electron micrograph of the distal side.

Figure 5 — *Cribrosphaerella ehrenbergi* (Arkhangelsky, 1912).
369A-37, CC.
Scanning electron micrograph of proximal side.

Figure 6 — *Micula staurophora* (Gardet, 1955).
369A-39, CC.
Scanning electron micrograph of the side view.

Figure 7 — *Tetralithus aculeus* (Stradner, 1961).
369A-39, CC.
Scanning electron micrograph of the plan view.

Figure 8 — *Marthasterites furcatus* Deflandre, 1954.
369A-40, CC.
Scanning electron micrograph.

Figure 9 — *Cylindralithus coronatus* Bukry, 1969.
369A-41-2, 70-71 cm.
Scanning electron micrograph of the distal side.

Figure 10 — *Eiffellithus eximius* (Stover, 1966).
369A-41-2, 70-71 cm.
Scanning electron micrograph of the distal side.

Figure 11 — *Eiffellithus eximius* (Stover, 1966).
369A-41-2, 70-71 cm.
Scanning electron micrograph of the distal side.

Figure 12 — *Eiffellithus turriseiffeli* (Deflandre, 1954).
369A-41-2, 70-71 cm.
Scanning electron micrograph of the distal side.

PLATE 1

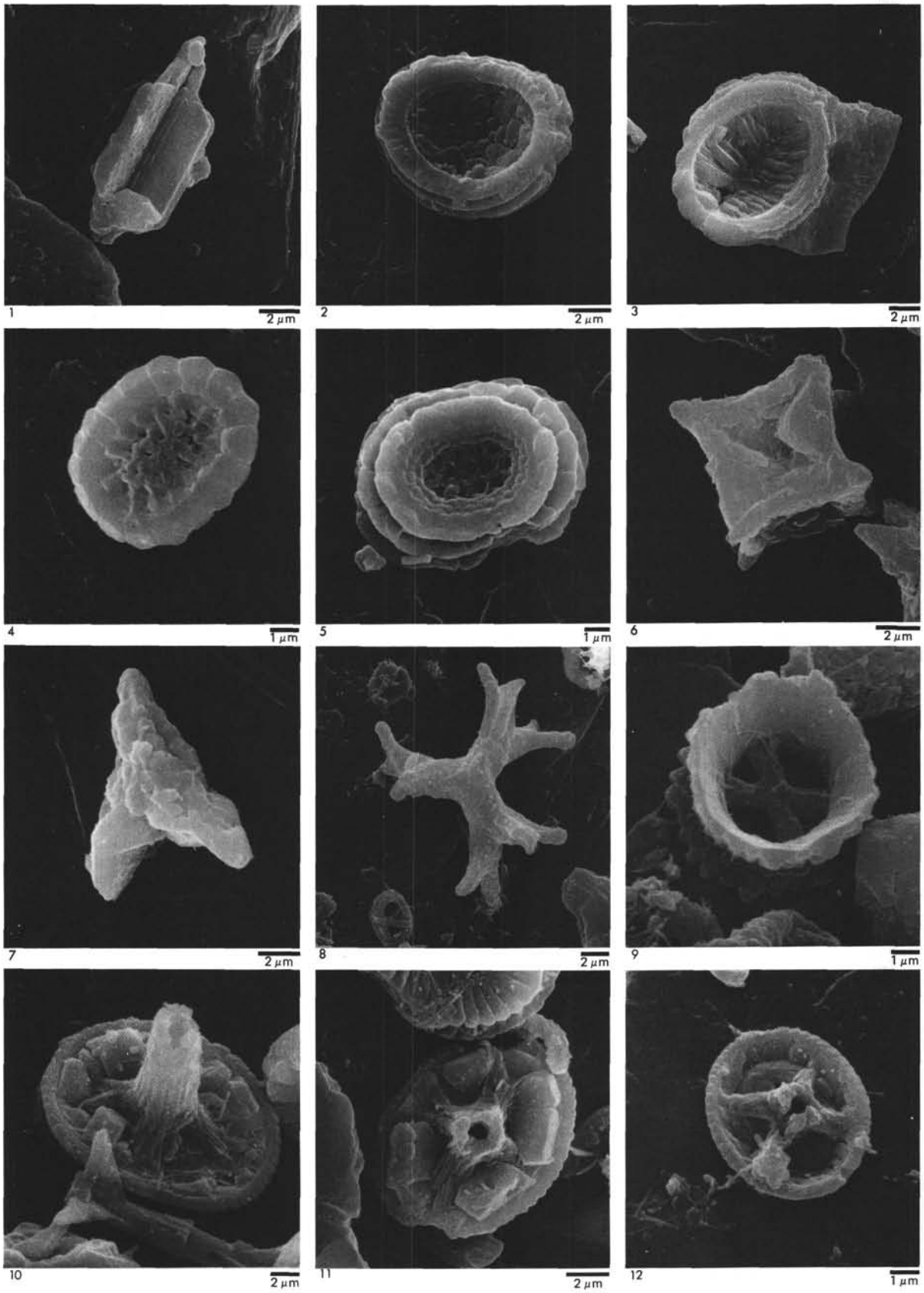
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PLATE 2

Figure 1 — *Watznaueria barnesae* (Black, 1959).
369A-41-2, 70-71 cm.
Scanning electron micrograph of the distal side.

Figure 2 — *Watznaueria barnesae* (Black, 1959).
369A-39, CC.
Scanning electron micrograph.

Figure 3 — *Prediscosphaera cretacea* (Arkhangelsky, 1912).
369A-41-2, 70-71 cm.
Scanning electron micrograph of the proximal side.

Figure 4 — *Watznaueria biporta* Bukry, 1969.
369A-36, CC.
Scanning electron micrograph of the distal side.

Figure 5 — *Watznaueria biporta* Bukry, 1969.
369A-43, CC.
Scanning electron micrograph of the distal side.

Figure 6 — *Chiastozygus cuneatus* (Lyuleva, 1967).
369A-41-2, 70-71 cm.
Scanning electron micrograph of the distal side.

Figure 7 — *Lithastrinus floralis* Stradner, 1962.
369A-41, CC.
Scanning electron micrograph.

Figure 8 — *Lithastrinus floralis* Stradner, 1962.
369A-41, CC.
Scanning electron micrograph.

Figure 9 — *Lithastrinus floralis* Stradner, 1962.
369A-43, CC.
Scanning electron micrograph.

Figure 10 — *Stephanolithion laffittei* Noel, 1957.
369A-41, CC.
Scanning electron micrograph of the distal side.

Figure 11 — *Stephanolithion laffittei* Noel, 1957.
369A-41, CC.
Scanning electron micrograph of the proximal side.

Figure 12 — *Stephanolithion laffittei* Noel, 1957.
369A-43, CC.
Scanning electron micrograph of the distal side.

PLATE 2

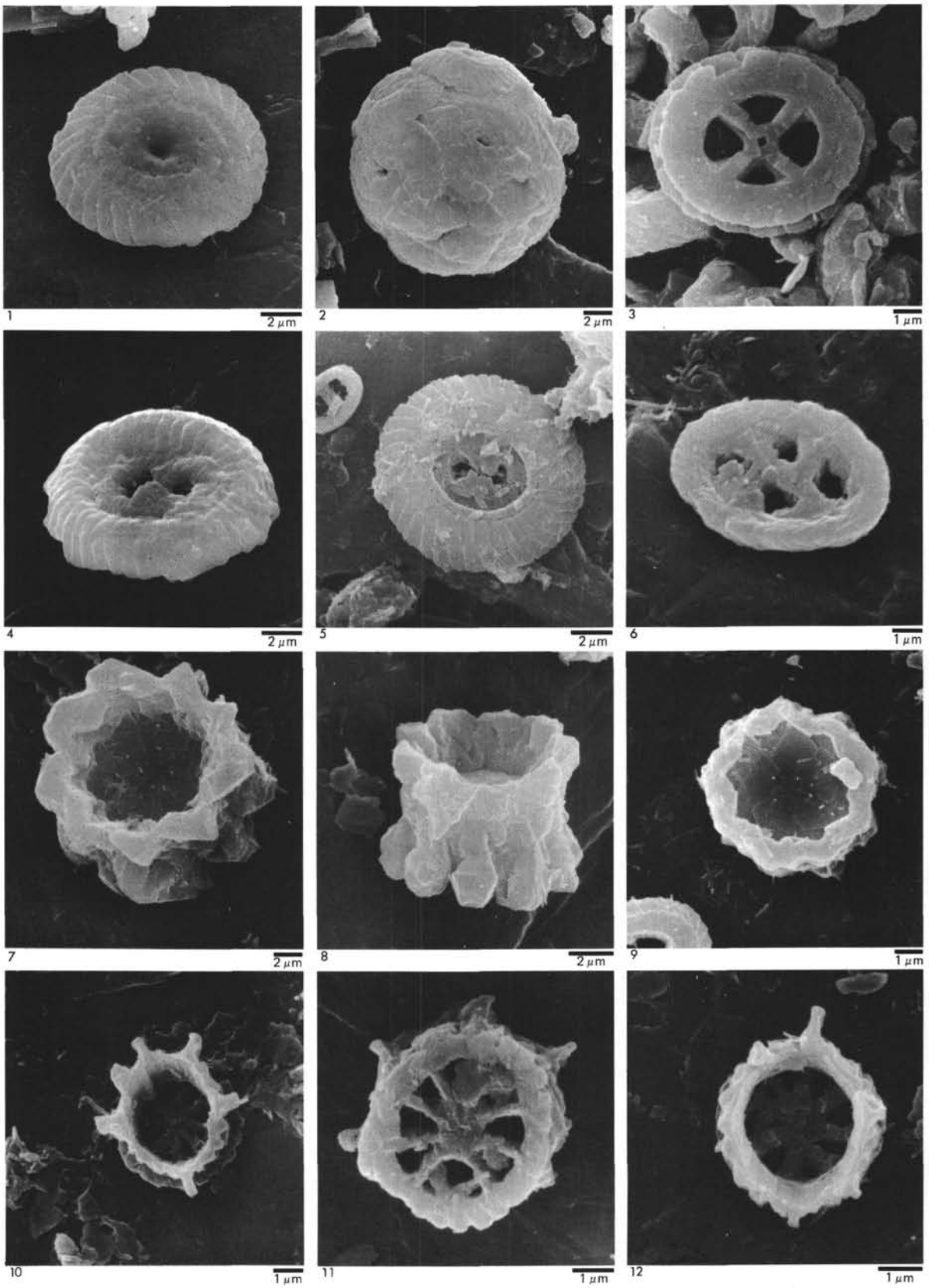
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PLATE 3

Figure 1 — *Parhabdolithus embergeri* (Noel, 1959).
369A-41-2, 70-71 cm.
Scanning electron micrograph of the distal side.

Figure 2 — *Parhabdolithus embergeri* (Noel, 1959).
367-26-4, 123-124 cm.
Scanning electron micrograph of the side view.

Figure 3 — *Corollithion signum* Stradner, 1963.
369A-40, CC.
Scanning electron micrograph of the distal side.

Figure 4 — *Parhabdolithus angustus* (Stradner, 1963).
369A-41, CC.
Scanning electron micrograph of the distal side.

Figure 5 — *Parhabdolithus angustus* (Stradner, 1963).
369A-41, CC.
Scanning electron micrograph of the proximal side.

Figure 6 — *Parhabdolithus angustus* (Stradner, 1963).
369A-43, CC.
Scanning electron micrograph of the distal side.

Figure 7 — *Cretarhabdus crenulatus* Bramlette and Martini, 1964.
367-27-2, 109-110 cm.
Scanning electron micrograph of the distal side.

Figure 8 — *Lithraphidites carniolensis* Deflandre, 1963.
369A-41, CC.
Scanning electron micrograph of the side view.

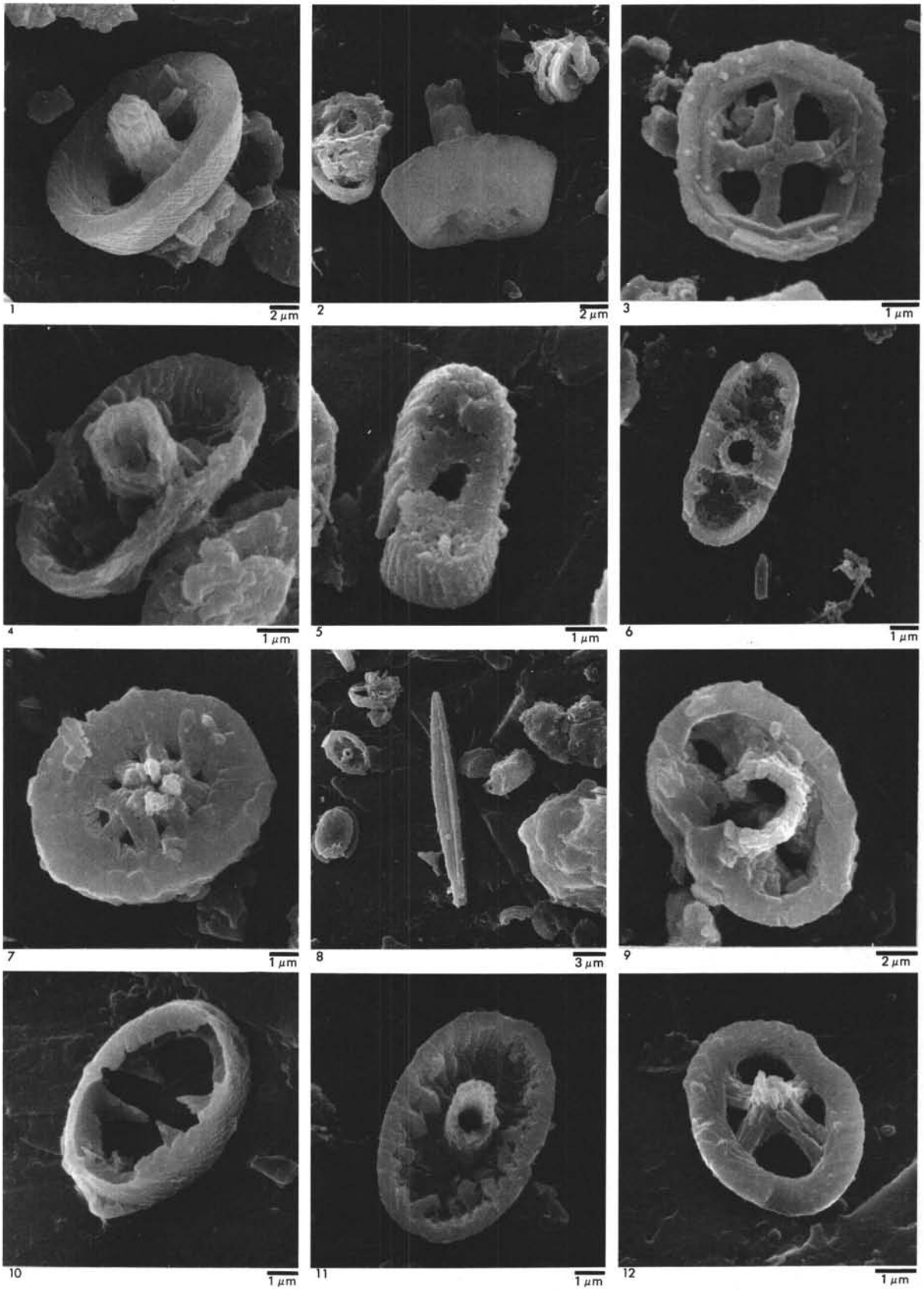
Figure 9 — *Parhabdolithus infinitus* (Worsley, 1971).
367-27-2, 109-110 cm.
Scanning electron micrograph of the distal side.

Figure 10 — *Zygodiscus diplogrammus* (Deflandre and Fert, 1954).
369A-41, CC.
Scanning electron micrograph of the proximal side.

Figure 11 — *Parhabdolithus asper* (Stradner, 1963).
369A-41, CC.
Scanning electron micrograph of the distal side.

Figure 12 — *Chiastozygus litterarius* (Gorka, 1957).
367-20-4, 40-41 cm.
Scanning electron micrograph of the distal side.

PLATE 3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