16. RADIOLARIA: LEG 14, DEEP SEA DRILLING PROJECT

M. G. Petrushevskaya, Zoological Institute of the Academy of Sciences of the USSR, Leningrad, USSR
and
G. E. Kozlova, All-Union Oil Institute (VNIGRI), Leningrad, USSR

CONTENTS

INTRODUCTION

DSDP material was sent by D. E. Hayes and by A. C. Pimm (Co-chief Scientists of the Leg 14 team) for investigation of the radiolarians. They were in the form of prepared slides, made by Lillian F. Musich (Scripps Institution of Oceanography).

In these materials, radiolarians were used for the determination of ages of Cenomanian, Early Campanian, Maestrichtian, Lower(?) Eocene, Middle and Upper Eocene, Oligocene, Lower and Middle Miocene and Pliocene deposits.

Neogene occurrences were studied by M. G. Petrushevskaya. Oligocene and Latest Eocene occurrences were studied jointly by both authors. Eocene and Cretaceous occurrences were studied by G. E. Kozlova.

As it was indicated by Riedel and Sanfilippo (1970), stratigraphic correlation by means of radiolarians is not as routine a matter as it is with foraminifera and calcareous nannoplankton. Therefore it is impossible to provide simple lists of well-known species to substantiate age-determinations. Even for the best known radiolarian species, used in previous DSDP volumes as zone-indicators (*Calocycletta virginis, Theocyrtis tuberosa,* etc.), generic and specific identifications are doubtful. That is why M. G. Petrushevskaya wrote most of the Systematics Section—some parts of it (concerning discoids) were prepared by G. E. Kozlova.

CRETACEOUS OCCURRENCES

Cretaceous rocks with radiolarian remains have been recovered by drilling at Sites 136, 137, 138, 140 and 144. As a rule, these remains are poorly preserved, especially in the lower part of the Cretaceous section: they are corroded, filled with consolidated sediment, recrystallized, or impregnated with iron oxides. However, in a series of instances, specimens did preserve a sufficient number of the species characteristics essential for their identification.

Cretaceous radiolarians have not yet been thoroughly studied, neither in the Atlantic nor on the continents. As yet there is no zonation for this group of fauna. The Leg 14 material is also insufficient for this type of study; therefore, in this work we will limit ourselves to the age definition only when the material permits.

Of interest for stratigraphic correlation, in our opinion, are three complexes, each of which is found at various points and each having a sufficient composition of species.

Cenomanian Complex

Deposits containing the Cenomanian complex were discovered near the western coast of Africa from Site 136 (271 to 280 meters below the sea floor), and Site 137 (256 to 265 meters) and Site 138 (425 to 431 meters). The containing rocks are: coccolith marl, calcareous clays, marly clays and siliceous argillites. The most complete composition of the complex is: *Cryptamphorella* sp., *Holocryptocanium barbui* Dumitrica, *Holocryptocapsa* sp. aff. *hindei* (Tan Sin Hok), *Squinabollum* sp. aff., *S. fossilis* (Squinabol), **Dictyomitra pseudomacrocephala* Squinabol, **D. costata* (Squinabol), **D. veneta* (Squinabol), *D. tiara* (Holmes), **D. multicostata* Zittel group, *D. crassispina* (Squinabol), **Stichocapsa* sp. aff. **S. ferosia* (Kh. Aliev), *S. disparlita* (Kh. Aliev), *S.* sp. aff., **Lithostrobus elegans* Squinabol, **Eusyringium* sp. aff. **Theocampe subtilis* Squinabol, **Conosphaera sphaeroconus* Rüst, *Conosphaera*? *fossilis* Squinabol, ?*Hexapyramis* sp., *Pseudoaulophacus superbus* (Squinabol), **Pseudoaulophacidae* gen. et sp. indet. (The most numerous specimens are marked with an asterisk.)

Its great similarity to the Cenomanian complex of the northeastern Caucasus speaks for the Cenomanian age of this complex (besides the data on the foraminifera and nannoplankton analysis): many of the above-mentioned species were found by Aliev (Kh. Aliev, 1965; at this point a group of them was assigned new synonymous names); *Holocryptocanium barbui* and *Holocryptocapsa* cf. *hindei* (Dumitrica, 1970) were described from the Cenomanian deposits of the Carpathian Mountains. However, it should be noted that almost all the species in the above list (with the exception of *Cryptamphorella* sp., *Holocryptocapsa hindei* and *Holocryptocanium barbui*) have a broader vertical distribution in the Atlantic region as well as on the European mainland; they were found in Caucasian Albian rocks (Kh. Aliev, 1965), in the Upper Cretaceous rocks of Italy (Squinabol 1903, 1904, 1914), in the Upper Cretaceous (Lower Turonian) rocks of the Rumanian Platform (P. Dumitrica collection); some species were encountered by Pessagno in the Lower Albian of the Atlantic (Pessagno 1970, Leg 1, Hole 5A, Core 3). Apparently the above-mentioned species in general are characteristic for both the Lower Cretaceous and lower horizons of the Upper Cretaceous of the Alpine Zone and the Atlantic region.

Radiolarian skeletons from the Cenomanian rocks are almost without exception poorly preserved; they usually occur as light transparent nuclei. In order to reveal the still-preserved sculpture we had to remove the skeletons from the balsam medium, into the vinegar-formaldehyde medium commonly used by diatomists.

The Early Campanian Complex

Deposits of this age were also discovered near the African coast from Site 137, Cores 6 and 5 (209 to 225 meters below sea floor level) and from Site 138, Core 5 (332 to 341 meters). The containing rocks are brown zeolitic clays. The most complete composition of the complex is: *Dictyomitra duodecimcostata* Squinabol, *D. regina* (Campbell and Clark), *D.* sp. aff. *Stichocapsa tecta* Rüst, *D. multicostata* Zittel group, *Cryptamphorella* sp. aff., *C. conara* (Foreman), *Cryptamphorella sphaerica* (White), *Myllocercion* sp. aff., *M. minima* Dumitrica, **Pseudoaulophacus superbus* (Squinabol), *P.* sp. aff. *P. parqueroensis* Pessagno, **Patellula planoconvexa* (Pessagno), **P. verteroensis* (Pessagno), *P.* sp., *Dactyliosphaera* sp. aff., *Lithocyclia justa* Rüst, *Histiastrum*? *valanginica* Kh. Aliev, ?*Hexapyramis* sp., **Porodiscus cretaceus* Campbell and Clark, **Lithelidae* gen. B, *Lithelidae* gen. A.

The specific character of this complex is determined by the predominance of large Discoidea, the majority of which have a pseudoaulophacid structure. A very similar fauna, almost identical in its species composition, was found by Pessagno (1963) in the Cariblanco Formation and in the limestones of the Parguera, Puerto Rico (Lower Campanian). On the basis of this similarity it is possible to stipulate the Early Campanian age of the complex with pseudoaulophacidae.

Maestrichtian Complex

Found in the equatorial part of the western and eastern Atlantic, Site 137, Core 4 (165 to 173 meters below sea floor level), Site 140, Core 8 (645 to 651 meters), Hole 144, Core 3 (162 to 166 meters) and Hole 144A, Core 4 (171 to 180 meters). The containing rocks are nannofossil-foraminiferal marls, and oozy zeolitic clays with interlayers of quartzy sandstones.

Incomplete list of the species: *Dictyomitra multicostata* Zittel group, *D. ornata* Kh. Aliev, *D.* sp. aff., *D. regina* (Campbell and Clark), *D. tiara* (Holmes), *D. striata* Lipman, *Amphipyndax enessefi* Foreman, *A. stocki* (Campbell and Clark), *A. plousious* Foreman, *Stichocapsa asymbatos* (Foreman), *S. cingulata* (Squinabol), *S.* sp. aff. *producta* (Kh. aliev), *Gongylothorax* sp. aff., *G. verbeeki* (Tan Sin Hok), *Theocapsomma* sp. aff. *T. comys* Foreman, *Theocampe*? *bassillis* Foreman, *Theocampe* ? *daseia* Foreman, *Rhopalosyringium* sp. aff. *R. magnificum* Campbell and Clark, *R. colpodes* Foreman, *Theocampe* sp. P. *myllocercion* sp. C. *Diacanthocapsa ovoidea* Dumitrica, *Bathropyramis sanjoaquinensis* Campbell and Clark, *Petassiforma speciosa* (Squinabol), *Tripodiscium*? sp. aff. *Lithomelissa hoplites* Foreman, *Porodiscus cretaceus* Campbell and Clark, *P. delicatulus* (Lipman), *Spongotrochus polygonatus* (Campbell and Clark), *Spongotripus morenoensis* Campbell and Clark, *Pseudoaulophacus gallowayi* (White), *P. superbus* (Squinabol), *Cenosphaera* sp. aff. *C. euganea* Squinabol, *Spongosaturnalis* (M) sp. aff. *S. latuformis* Campbell and Clark, *Cenosphaera sphaeroconus* Rüst, *Stylatractus* (?) sp., *Spongoprunum* (?) sp. aff. *Cyphantus probus* Rüst, *Lithelidae* gen. A and others.

The majority of these species, according to the data of Foreman (1968, Table 1) are distributed from the Late Campanian to the Late Maestrichtian. However, on the whole, the given association, in its species composition, appears to be closest to the Late Maestrichtian complex of California described and depicted in the above-mentioned work. Only in the Maestrichtian were found small Tricyrtida: *Rhopalosyringium colpodes, Theocampe bassilis, Theocapsomma comys.* Complexes from Sample 24A-11 (Atlantic, Leg 4; Riedel and Sanfilippo, 1970) and Sample 59-2-5-CC (Pacific, Leg 6; Kling, 1970) seem somewhat older due to the absence of this particular group of species; species of the genus *Amphibrachium* also tend to give it an ancient aspect.

Site 136 (34° 10.13'N, 16° 18.19'W; water depth 4169 meters)

At a depth of 269? to 271 meters below the sea floor, in Sample 6-1, and also in Samples 6-CC, very poorly preserved radiolarians were found, mainly nuclei. The presence of *Lithelidae* gen.A can attest to the post-Turonian (Senonian) age of the containing rocks. At a depth of approximately 280 meters in Core 7, only unidentifiable nuclei were encountered. In Core 8, at a depth of 288? to 289 meters (Sections 8-1, 5-7 cm and 8-1, 80-82 cm) a small number of very poorly preserved radiolarians was found; among them several species could successfully be identified; these pointed to a possible Cenomanian age of Core 8. In Sections 8-6 and 8-CC only fragments of Pseudoaulophacidae were found. See Table 1.

Site 137 (25° 55.53′N, 27° 03.64′W; water depth 5361 meters)

Cores 1, 2 and 3 contain no radiolarians. At a depth of 165 to 173 meters in Core 4 (Sections 4-1, 4-2 and 4-CC) there are numerous radiolarians of moderately poor preservation; the composition of the complex indicates the possibility of a Maestrichtian age.

At a depth of 219? to 225 meters, in Core 6 (Section 6-1) and also in Sections 5-CC and 6-CC, species of the Early Campanian complex were found. In the interval from 256 to 265 meters (Cores 7 and 8) are a great number of poorly preserved skeletons, presumably of Cenomanian age. See Table 2.

Site 138 (25° 55.37′N, 25° 33.79′W; water depth 5288 meters)

At a depth of 332 to 341 meters (Section 5-CC) below sea floor, a small number of Early Campanian radiolarians were encountered; their state of preservation was satisfactory. A small number of species of the Cenomanian complex were found in samples taken at a depth of 425 to 431 meters (Core 6, Sections 6-2, 6-3 and 6-CC). The remains are very poorly preserved: these are predominantly nuclei, filled with transparent silica. See Table 3.

Site 140 (21° 44.97′N, 21° 47.52′W; water depth 4483 meters)

At a depth of 645 to 641 meters (Core 8, Sections 1, 2 and CC) below the sea floor were found a great number of poorly preserved radiolarians, partially dissolved, impregnated with iron oxides, sometimes pyritized. The age of the complex is probably Maestrichtian. See Table 4.

Site 144 (09° 27.23′N, 54° 20.52′W; water depth 2939 meters)

At a depth of 162 to 166 meters below the sea floor (Core 3, Sections 3-1 and 3-2), species of the Maestrichtian complex were found; this is the richest of all Cretaceous finds of Leg 14 in terms of species and specimen numbers; the preservation of the remains is relatively poor. Exactly the same complex was discovered in Sections 144-3-CC and 144A-4-CC. See Table 5.

CENOZOIC ZONATION

The age assignments were made on the basis of the Cenozoic zonation proposed by Riedel and Sanfilippo (1970, 1971), and modified by J. Hays and others (1969) and by T. Moore (in press); see Table 6.

In Leg 14 the samples with radiolarians apparently belong to the following zones.

TABLE 1
Site 136

Site 136 / Samples	Age	*Holocryptocanium barbui*	*Cryptamphorella* sp.	*Pseudoaulophacus* sp. indet.	*Stichocapsa* sp. indet.	*Conosphaera fossilis (?)*	*Porodiscidae* gen. indet.	*Cryptamphorella sphaerica (?)*	*Lithelidae* gen. A spp.	Preservation
6-1, 5-7 cm	Senonian?						R	R	F	E.P.
6-CC							R		F	E.P.
7-4, 140-148 cm	?	Undefinable fragments								E.P.
7-CC				R						E.P.
8-1, 5-7 cm	Cenomanian				R					E.P.
8-1, 80-82 cm		R	R	R	C	R				E.P.
8-6, 44-46 cm	?					R				E.P.
8-6, 125-127 cm				R						E.P.
8-CC				R						E.P.

Lampterium chalara (= *Podocyrtis chalara*) Zone. Some samples from Site 144 (Table 2) seem to belong in this zone because the main species–indicators of this zone, defined by Riedel and Sanfilippo (1970, 1971), were observed in them. *Lithochytris* sp. O, *Lithochytris* sp. T, *Lithochytris* sp. aff. *L. ventricosa*, *Anthocyrtella spatiosa* group and *Stylatractus coronatus* are also characteristic for the assemblage.

Lampterium goetheana (= *Podocyrtis goetheana*) Zone. Samples from Site 140 and Site 144 seem to belong in this zone (see Tables 10 and 12). The assemblage is the same as defined by T. Moore (in press): nearly the same species as in the *Lampterium chalara* Zone, but the appearance of *Lampterium goetheana* and *Lampterium* sp. aff. *L. goetheana* and also of *Lophocyrtis jacchia* are the distinguishing features.

Thyrsocyrtis bromia Zone (apparently the uppermost part). Some samples from Site 140 seem to belong in this zone (Table 10). For the uppermost part of the *Thyrsocyrtis bromia* Zone, as defined by Riedel and Sanfilippo (1970, 1971) and Moore (in press), the following peculiarities of the assemblage are characteristic: 1) the earliest appearance of *Calocycletta tuberosa* and *Cyrtophormis gracilis*, 2) the absence (as a rule) of *Thyrsocyrtis bromia*, 3) occurrence of *Lithochytris* sp. aff. *L. tripodium* (*babylonis*), *Lophocyrtis jacchia*, *Cycladophora*? *turris*. The

TABLE 2
Site 137

Site 137 / Samples	Zone	Preservation	*Pseudoaulophacidae* gen. sp. indet.	*Eucyrtidium* ? sp. aff. *Theocampe subtilis*	*Hagiastrum* ? sp.	*Dictyomitra multicostata* group	*Spongodiscidae* gen. sp. indet.	*Dictyomitra albiensis* Kh. Aliev	*Dictyomitra costata*	*Dictyomitra tiara*	*Dictyomitra* sp. aff. *Lithostrobus elegans*	*Dictyomitra pseudomacrocephala*	*Conosphaera fossilis*	*Diacanthocapsa* ? sp.	*Gongylothorax* ? sp. indet.	*Dictyomitra veneta*	*Hexapyramis* ? sp.	*Eucyrtidium* ? sp. C.	*Conosphaera sphaeroconus*	*Dictyomitra crassispina*	*Cenosphaera* sp. aff. *C. euganea*	*Discoidea* gen. sp. indet.	*Dictyomitra duodecimcostata*	*Cryptamphorella* sp. aff. *C. conara*	*Cryptamphorella sphaerica*	*Pseudoaulophacus superbus*	*Patellula planoconvexa*	*Patellula verteroensis*	*Pseudoaulophacus* sp.	*Dactyliosphaera* sp. aff. *Lithocyclia justa*	*Spongotrochus* sp.	*Lithelidae* gen. B	*Conosphaera* sp.	*Pseudoaulophacus gallowayi*	*Gongylothorax* sp. aff. *G. verbeeki*	*Stichocapsa cechena* ?	*Dictyomitra* sp. aff. *D. regina*	*Theocapsomma* sp.	*Stichocapsa asymbatos*	*Cryptamphorella macropora*
4-1, 143-147 cm	Maestrichtian	P		Undefinable fragments																																				
4-2, 6-10 cm		P		Undefinable fragments																																				
4-2, 80-84 cm		P	R		R	A										C	R	R	C		C												C	R	A	A	A	R	R	F
4-CC		P	R		R	A										C					C												C	R	A	A	R			
5-CC	Early Campanian	P					R																F	F	F	F	F	F	F	F	R	F								
6-1, 16-18 cm		P		Undefinable fragments																				F																
6-1, 82-84 cm		P																						R																
6-CC	?	P		Undefinable fragments																																				
7-1, 139-141 cm		P																	R																					
7-CC	Cenomanian	P	C	C	C	C			C	F	F	C	R	A	A	C	C		C	F	R	C	C																	
8-2, 80-82 cm		P	C	C	C	C				F	F	C	R	A	A	F	R		R																					
8-CC		P	C	C	C	R		R	F	F	F	R	R	A	A	F	R	R	R																					
10-3, 6-8 cm	Albian ?	P	R	C	R																																			
10-3, 73-75 cm		P	R	C	R	R																																		
10-CC		P	R	R	R	R	R																																	
11-2, 80-82 cm		P	R	R	R	R	R																																	
11-3, 6-8 cm		P	R	R	R	R																																		

TABLE 3
Site 138

Site 138 Samples	Age	Holocryptocapsa sp. aff. H. hindei	Holocryptocanium barbui	Cryptamphorella sp.	Dictyomitra pseudomacrocephala	Dictyomitra multicostata group	Eusyringium ? sp. aff. Theocampe subtilis	Stichocapsa sp. aff. Lithostrobus elegans	Lithelidae gen. B	Dictyomitra (?) sp. aff. Stichocapsa tecta	Dictyomitra duodecimcostata	Dictyomitra sp. aff. D. regina	Cryptamphorella sp. aff. C. conara	Cryptamphorella sphaerica	Myllocercion sp. aff. M. minima	Eucyrtidium sp. C	Pseudoaulophacus superbus	Pseudoaulophacus sp. aff. P. pargueraensis	Patellula planoconvexa	Patellula verteroensis	Pseudoaulophacus sp.	Dactylosphaera sp. aff. Lithocyclia jusia	Spongotrochus sp.	Histiastrum valanginica	Hexapyramis (?) sp.	Porodiscus cretaceus	
5-CC	Early Campanian				R	F			A	R	F	F	F	F	R	R	C	F	C	C	C	F	F	R	F	C	
6-2, 5-7 cm	Cenomanian			F	R	F																					
6-CC	Cenomanian	R	R		A	R	R	R																			Preservation poor

present authors can indicate abundant *Calocycletta virginis* typ., abundant *Coccodiscinae* and *Phacodiscinae*, common *Theocapsomma* sp. aff., *T. ornata* and *Lithamphora sacculifera quadrata* typ.

Calocycletta tuberosa (=*Theocyrtis tuberosa*) Zone. Samples from Sites 138, 140 and 144 (Tables 8, 10, 12, 13) seem to belong in this zone. The assemblage is abundant in *Cyrtophormis gracilis* and *Calocyclas asperum; Trigonactinium*? *angustum* is frequent; *Calocycletta tuberosa* is represented by three forms (subspecies ?); *Periphaena*? *dupla, Cyclampterium milowi, Desmospyris* sp. aff. *D. anthocyrtoides* and *Liriospyris* sp. B are also characteristic for the assemblage of this zone.

Upper and lower parts of the *Calocycletta tuberosa* Zone are likely to be distinguished. In the lower part *Eucyrtidium* sp. aff. *E. montiparum, Lithamphora sacculifera quadrata* typ., *Petalospyris* sp. E, and *Calocycletta tuberosa* forms A occur. They are absent or rare in the upper part of the zone. *Calocycletta acanthcephala* is abundant, and

TABLE 4
Site 140

Site 140 Samples	Age	Tholodiscus sp.	Porodiscus cretaceus	Spongotrochus sp.	Spongoprunum (?) sp. aff. Cyphantus probus	Spongotripus morenoensis	Lithelidae gen. A	Diacanthocapsa minima ?	Diacanthocapsa sp. aff. D. ancus	Rhopalosyringium sp. aff. R. colpodes	Theocapsomma sp. aff. T. comys	Dictyomitra multicostata group	Stichocapsa asymbatos	Pseudoaulophacus superbus	Pseudoaulophacus gallowayi	Amphipyndax plousios
8-1, 60-62 cm	Maestrichtian		C				C					F				
8-2, 70-72 cm	Maestrichtian	F	F				F			R		C	R	R	R	
8-CC	Maestrichtian	R	R	C	R	R	R	R	A		R	C	F			F

Dorcadospyris ? *ateuchus, Astractinium* sp. C, *Lithocampe subligata, Eucyrtidiidae* gen. sp. "rocket", *Botryocella multicellaris* gr., *Orosphaeridae* genn. and *Lamprocyclas rhinoceras* become more frequent in the upper part than they are in the lower part.

Calocycletta veneris (= *Calocycletta virginis*) Zone. Samples from Sites 138, 139, 140 and 142 seem to belong in this zone. Though some species indicated by Riedel and Sanfilippo (1970, 1971) do not occur in the samples, the definition of the zone is the same as given by Riedel and Sanfilippo.

The presence of *Calocycletta veneris, Cannartus violina, Lithocampe* (*Cyrtocapsella*) *tetrapera* and *Stichocorys wolfii* and the absence of *Calocycletta costata* are characteristic for the assemblage of the zone.

The upper and lower parts of the *Calocycletta veneris* Zone are likely to be distinguished. Only two samples (138-1-CC and 139-7-CC) seem to belong in the lower part of the *Calocycletta veneris* Zone. In this assemblage *Lychnocanium bipes* and *Calocycletta annosa* are frequent, and many species characteristic for the upper part of the zone are absent (see Tables 8, 9). The samples which apparently belong in the upper part of the zone are more numerous (Tables 9, 10, 11). The assemblage from the upper part of the zone may be characterized 1) by the absence of *Lychnocanium bipes, Calocycletta annosa* and some other species going from the Oligocene, and 2) by the presence of a number of species (absent in the lower part), some of these species (*Dorcadospyris dentata, Cyrtophormis armata* and *Trissocyclus stauropora*) have been indicated by Riedel and Sanfilippo as characteristic for the upper part of the zone.

Calocycletta costata Zone. Some samples from Sites 139, 140 and 142 (Tables 9, 10, 11) seem to belong in this zone. It is the appearance of *Calocycletta costata* (indicated by Riedel and Sanfilippo, 1970, as defining the base of the zone) that permits the identification of the zone in the

TABLE 5
Site 144

Site 144 Samples	Age	*Cenosphaera* sp. aff. *C. euganea*	*Conosphaera sphaeroconus*	*Stylatractus* (?) sp.	*Spongosaturnalis* (?) sp. aff. *S. latuformis*	*Porodiscus cretaceus*	*Porodiscus delicatulus*	*Spongotrochus polygonatus*	*Spongotrochus* sp.	*Spongotripus morenoensis*	*Lithelidae* gen. A.	*Pseudoaulophacus gallowayi*	*Gongylothorax* sp. aff. *G. verbeeki*	*Diacanthocapsa* sp. aff. *D. ancus*	*Cryptamphorella* sp. aff. *C. conara*	*Theocapsomma* sp. aff. *T. comys*	*Theocampe ? bassilis*	*Theocampe ? dasela*	*Diacanthocapsa* sp. A	*Rhopalosyringium* sp. aff. *R. magnificum*	*Amphipyndax enessefi*	*Amphipyndax stocki*	*Amphipyndax plousios*	*Dictyomitra multicostata* group	*Dictyomitra tiara*	*Dictyomitra striata*	*Dictyomitra ornata*	*Dictyomitra* sp. aff. *D. regina*	*Stichocapsa asymbatos*	*Stichocapsa cingulata*	*Stichocapsa* sp. aff *S. producta*	*Pseudoaulophacus superbus*	*Theocampe* sp. P	*Diacanthocapsa* sp. B	*Myllocercion* sp. aff. *M. minima*	*Spongodiscus* sp. aff. *S. multus*	*Spongopyle insolita*	*Diacanthocapsa ovoidea*	*Tholodiscus fresnoensis*	*Spongoprunum* (?) sp. aff. *Cyphantus probus*	*Bathropyramis sanjoaquinensis*	*Petassiforma speciosa*	*Amphipyndax* sp. A.	*Tripodiscium* ? sp. aff. *Lithomelissa hoplites*	*Rhopalosyringium* sp. aff. *R. colpodes*	*Tholodiscus* sp.
3-1	Maestrichtian	F	A	F	R	A		F	F	F	A	F		R			C	A		F	F	F		A					F				R	A						F		R		R	R	
3-2, 85-88 cm		F	A	F	R	A	F	F	F	F	A	F					A	A		F	F	F		A	F			R	A					A	F	R	R	F		F	R			R	R	R
3-CC		F	A	R	R	A	F	R	C	R	A	F		R			F	A		F	R	A	F	A		F		R	F			F	R	A	R	R	R	R	R	R					R	C
H.A 4CC		F	A	F	R	A		R	F	R	A	F	R	R	R	F	F	A	F	F	A	F	R	A	F	F	F	F	A	R	R			A						R			F			C

Preservation poor

mentioned sites. The assemblage occurring in these samples is not quite the same as defined in the previous volumes. *Cannartus mammiferus*, for example, appears not at the base of the *Calocycletta costata* Zone, but low in the *Calocycletta veneris* Zone. *Cannartus violina* does not become extinct in the lower part of the *Calocycletta costata* Zone, but became even more numerous in this zone than in the upper part of the *Calocycletta veneris* Zone.

Dorcadospyris alata Zone. Only some samples from Site 140 (Table 10) seem likely to belong in this zone. The assemblage of this zone is characterized (as was indicated by Riedel and Sanfilippo, 1970, 1971) by the presence of *Dorcadospyris alata, Dorcadospyris dentata, Lithocampe (Cyrtocapsella) cornuta, Cannartus mammiferus, Calocycletta veneris* and *Stichocorys delmontensis.*

Pterocanium prismatium Zone. Samples from Site 139 (Table 9) might belong in this zone.

This zone, established for tropical sediments, is characterized (by Riedel and Sanfilippo, 1970) by the extinction of *Spongaster pentas* and the presence of *Pterocanium prismatium*. Though Site 139 is situated in the tropics, there are neither *Spongaster pentas* nor *Pterocanium prismatium* in the samples determined, on the base of foraminiferal and some other data, as middle Pliocene. Some other species widely-distributed in tropical warm water (according to data of Nigrini, 1967, and Petrushevskaya, 1969b), (such as *Pterocorys campanula hertwigii, Centrobotrys thermophila, Callimitra* spp., *Rhizosphaera arcadoporum*) are also absent here, though they occur in the tropics in the *Pterocanium prismatium* Zone (Petrushevskaya, 1970, 1971b). This might be explained by the near-shore position of Site 139. It seems significant that some species described by Nigrini (1968) for East Pacific tropical sediments [*Lithostrobus hexagonalis* Hck., *Pterocorys minithorax* (Nigrini), *Conarchidium*? sp. A Nigrini, *Carpocanium* sp. A Nigrini] are present in these East Atlantic near-shore sediments. Moreover, many species typical for transitional regions of the North and South Atlantic (Hays, 1965; Petrushevskaya, 1967, 1969a), occur in the samples in question [*Botryostrobus tumidulus* (Bailey), *Spongodiscus resurgens osculosa, Archipilium* sp. aff. *A. macropus* (Hck.), *Lamprocyclas aegles* (Ehr.), *Hexacontium arachnoidale* group, *Haliometta miocenica* group, *Stylatractus neptunus, Tricolocapsa papillosa, Dictyophimus hirundo* group, *Lamprotripus mawsoni, Diplocyclas bicorona* group, *Pseudodictyophimus gracilipes, Lipmanella xiphephorum* group, *Lipmanella dogieli* group, etc.]

Of the species present, those useful for age-assignment are: (1) tropical *Anthocyrtidium ophirense* Hck. and *Ommatartus* sp. aff. *O. ceratospyris* (= *O. tetrathalamus*), Pliocene to Recent; (2) Antaractic transitional *Lamprocyclas heteroporus* Hays, known to extend no higher than Pliocene zones Υ or Φ, (Hays 1965, see plate 6); (3) transitional tropical *Cromyechinus tetrapyla* (Hays), which occur up to the χ zone. Thus the set of species age indicators in these samples, as well as the whole assemblage is mixed: both high and low latitude species are present. The species typical for Miocene and Low Pliocene zones (*Prunopyle titan, Astromma hughesi, Stichocorys peregrinus* and *Ommatartus penultimus*) are absent in these sediments. Their absence and the presence of the four species mentioned as age-indicators, indicate the radiolarian assemblage to be of Middle Pliocene age. It may be referred to the *Pterocanium prismatium* Zone as well as zone Φ of

TABLE 6
Cenozoic Radiolarian Zonation

Riedel and Sanfilippo, 1970, Leg 4			Riedel and Sanfilippo, 1971, Leg 7	T. Moore, 1971, Leg 8	Hays, Saito, Opdyke and Burckle, 1969	
Q					X	Q
Pliocene		Pterocanium prismatium		Pterocanium prismatium	Φ	Pliocene
Pliocene		Spongaster pentas		Spongaster pentas	Y	Pliocene
Miocene	Upper	Stichocorys peregrina		Stichocorys peregrina	T	Miocene
Miocene	Upper	Ommatartus penultimus	Ommatartus penultimus	Ommatartus penultimus		Miocene
Miocene	Upper	Ommatartus antepenultimus	Ommatartus antepenultimus	Ommatartus antepenultimus		Miocene
Miocene	middle	Cannartus petterssoni	Cannartus petterssoni	Cannartus ? petterssoni		Miocene
Miocene	middle	Cannartus laticonus	Dorcadospyris alata	Cannartus laticonus		Miocene
Miocene	middle	Dorcadospyris alata	Dorcadospyris alata	Dorcadospyris alata		Miocene
Miocene	lower	Calocycletta costata	Calocycletta costata	Calocycletta costata		Miocene
Miocene	lower	Calocycletta virginis	Calocycletta virginis	Calocycletta virginis		Miocene
Miocene	lower	Lychnocanium bipes	Lychnocanium bipes	Lychnocanium bipes		Miocene
Oligocene		Theocyrtis tuberosa	Dorcadospyris ateuchus	Dorcadospyris papilio		Miocene
Oligocene		Theocyrtis tuberosa		Theocyrtis annosa		Miocene
Oligocene		Theocyrtis tuberosa	Theocyrtis tuberosa	Theocyrtis tuberosa		Miocene
Eocene	Upper	Thyrsocyrtis bromia		Thyrsocyrtis bromia		Miocene
Eocene	Upper	Thyrsocyrtis tetracantha		Thyrsocyrtis tetracantha		Miocene
Eocene	Middle	Un-zoned interval		Podocyrtis goetheana		Miocene
Eocene	Middle	Podocyrtis chalara		Podocyrtis chalara		Miocene
Eocene	Middle	Podocyrtis mitra		Podocyrtis mitra		Miocene
Eocene	Middle	Podocyrtis ampla		Podocyrtis ampla		Miocene
Eocene	Middle	Thyrsocyrtis triacantha		Thyrsocyrtis triacantha		Miocene
Eocene	Middle	Theocampe mongolfieri		Theocampe mongolfieri		Miocene

Hays, and yet the assemblage is atypical for both high-latitude sediments of that age and for tropical sediments of that age.

Table 7 gives the ranges of the species taken into account for the age-assignment of the Leg 14 samples. It is based on the samples mentioned above. It is incomplete, because there were no complete Cenozoic sequences, but single samples, and there were no radiolarians from the Low Eocene, Upper Oligocene and Upper Miocene.

CENOZOIC RADIOLARIANS AT EACH SITE

Tables 8 through 13 show the occurrences of radiolarians in Cenozoic samples from Leg 14. The list of the species taken into account for these tables may be seen in Table 7. If a species was searched for, but not found, that species is not named in Tables 8-13. The letters "a", "c", "f" and "r" indicate that a species is abundant, common, few or rare in relation to the total number of the

TABLE 7
Radiolarian Ranges and Zones for Leg 14

Age	Paleocene	low/mid. Eocene	Middle Eocene		Upper Eocene	Oligocene	Lower Miocene		Middle Miocene	Pliocene	
Zone		Unzoned interval	Lampterium chalara	Lampterium goetheana	Thyrsocyrtis bromia (upper part)	Calocycletta tuberosa	Calocycletta veneris	Calocycletta costata	Dorcadospyris alata	Pterocanium prismatium	
	—										*Lithocampium* sp. A
	—										*Lithochytris* sp. A
	—										*Desmospyris* sp. aff. *D. lata*
	—										*Pterocanium* ? *satelles*
	—										*Plectodiscus circularis*
	—										*Eusyringium striata*
	—										*Becoma bidarfensis*
		—									*Thyrsocyrtis argulus*
		—									*Podocyrtis mitra* group
		—									*Theocotyle venezuelensis*
		—	—	—	—						*Lithochytris* sp. aff. *L tripodium*
		—	—	—	—						*Podocyrtis papalis*
		—	—	—	—	– – –					*Theocampe mongolfieri*
		—	—	—							*Spongosphaera pachystyla*
		—	—	—							*Ratagospyris pentas* group
		—	—	—	—	—					*Periphaena decora*
			—	—							*Dendrospyris didiceros* group
			—	—	?	• •					*Eusyringium fistuligerum* group
			—	—		• •					*Calocycloma ampulla*
			—	—		•					*Lampterium chalara*
			—	—							*Lychnocanium bellum*
			—	—							*Anthocyrtella spatiosa*
			—	—							*Stylatractus coronatus*
			—		?						*Heliodiscus hexasteriscus*
			—		?						*Heliodiscus pentasteriscus*
			—	—							*Porodiscus concentricus*
			—	—	—						*Lithochytris* sp. O
			—	—	—	?					*Lithochytris* sp. T
			—	—	—						*Lithochytris* sp. aff. *L. ventricosa*
			—		?	• •					*Astractinium aristotelis*
			—	•	?	• •					*Trigonactinium pithagore*
			—	—	—	• • •					*Tholodiscus splendens*
			—	—	—	– –					*Thyrsocyrtis triacantha*
			—	—	—	• • —					*Lophophaena capito* group
			—	—	—	• •					*Lithocyclia ocellus* sens. str.

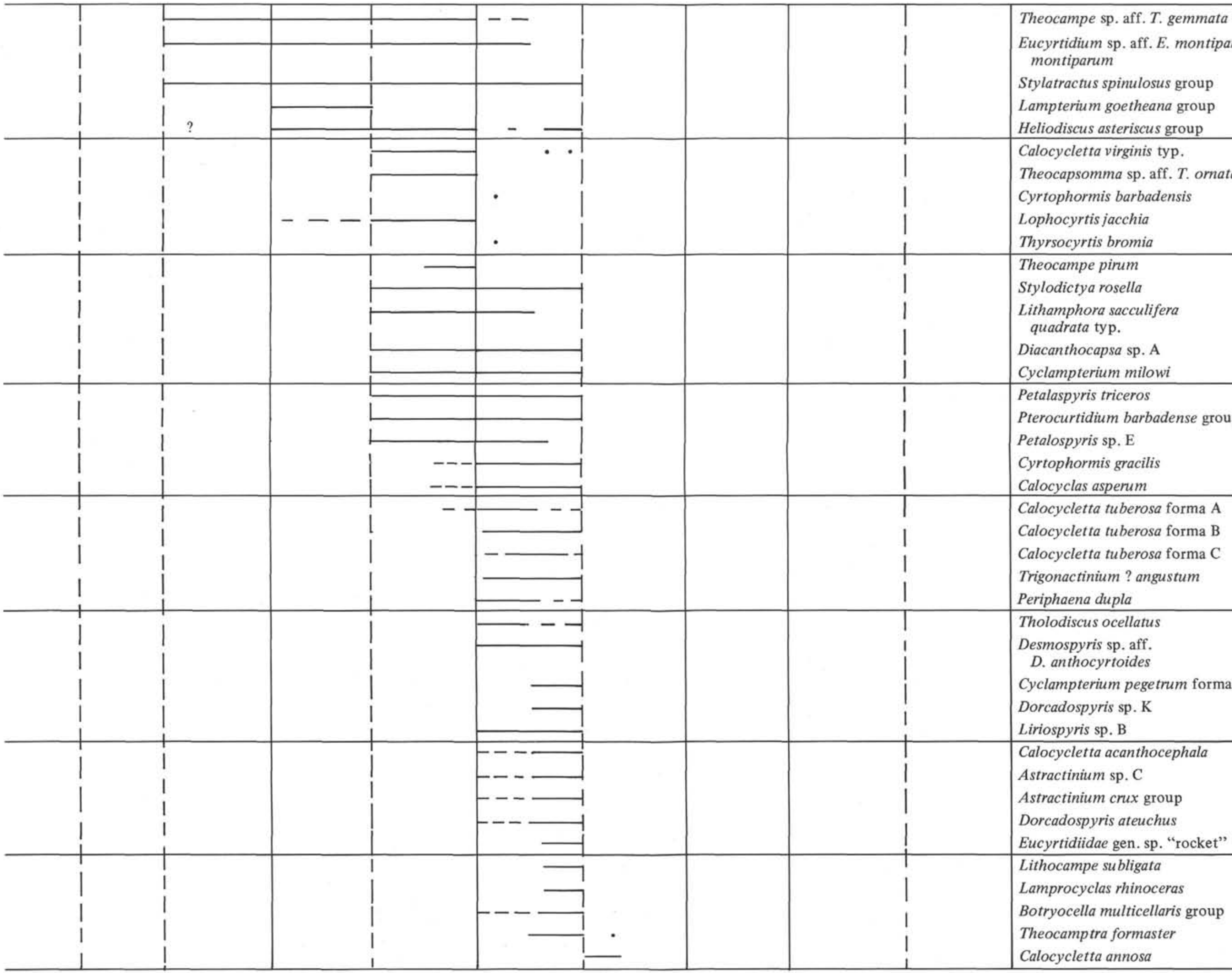

?
Theocampe sp. aff. T. gemmata
Eucyrtidium sp. aff. E. montiparu montiparum
Stylatractus spinulosus group
Lampterium goetheana group
Heliodiscus asteriscus group
Calocycletta virginis typ.
Theocapsomma sp. aff. T. ornata
Cyrtophormis barbadensis
Lophocyrtis jacchia
Thyrsocyrtis bromia
Theocampe pirum
Stylodictya rosella
Lithamphora sacculifera quadrata typ.
Diacanthocapsa sp. A
Cyclampterium milowi
Petalaspyris triceros
Pterocurtidium barbadense group
Petalospyris sp. E
Cyrtophormis gracilis
Calocyclas asperum
Calocycletta tuberosa forma A
Calocycletta tuberosa forma B
Calocycletta tuberosa forma C
Trigonactinium ? angustum
Periphaena dupla
Tholodiscus ocellatus
Desmospyris sp. aff. D. anthocyrtoides
Cyclampterium pegetrum forma I
Dorcadospyris sp. K
Liriospyris sp. B
Calocycletta acanthocephala
Astractinium sp. C
Astractinium crux group
Dorcadospyris ateuchus
Eucyrtidiidae gen. sp. "rocket"
Lithocampe subligata
Lamprocyclas rhinoceras
Botryocella multicellaris group
Theocamptra formaster
Calocycletta annosa

TABLE 7 – *Continued*

Paleocene	low/mid. Eocene	Middle Eocene		Upper Eocene	Oligocene	Lower Miocene		Middle Miocene	Pliocene	Age
	Unzoned interval	Lampterium chalara	Lampterium goetheana	Thyrsocyrtis bromia (upper part)	Calocycletta tuberosa	Calocycletta veneris	Calocycletta costata	Dorcadospyris alata	Pterocanium prismatium	Zone
										Cannartus prismaticus
						?				*Myllocercion* sp. C
										Lychnocanium bipes
										Theocamptra collaris
							?			*Stichopodium martellii conicum*
										Acrobotrys sp. aff. *A. disolenia*
										Cannartus tubarius
							?			*Stichopodium martellii* typ.
										Stichopodium cienkowskii
										Botryocyrtis quinaria group
										Stichocorys delmontensis group
										Lithocampium sp. B
										Rhodospyris De I group
										Calocycletta veneris sensu str.
										Carpocanopsis favosum group
										Lithocampe (Cyrtocapsella) tetrapera
										Spongasteriscus sp.
										Cyrtophormis armata
										Eucyrtidiidae gen. sp. W
										Theocamptra marylandica group
										Stichocorys wolffii
										Cannartus violina
										Theocamptra corona
										Calocycletta costata
										Desmospyris sp. A
										Lithocampe (Cyrtocapsella) cornuta
										Cannartus mammiferus
										Dendrospyris pododendros group
										Rhodospyris sp. aff. *R. tricornis*
										Cyrtophormis sp.
										Lithotympanium tuberosum
										Lipmanella sp. O
										Tympanomma binoctonum
										Dicolocapsa microcephala

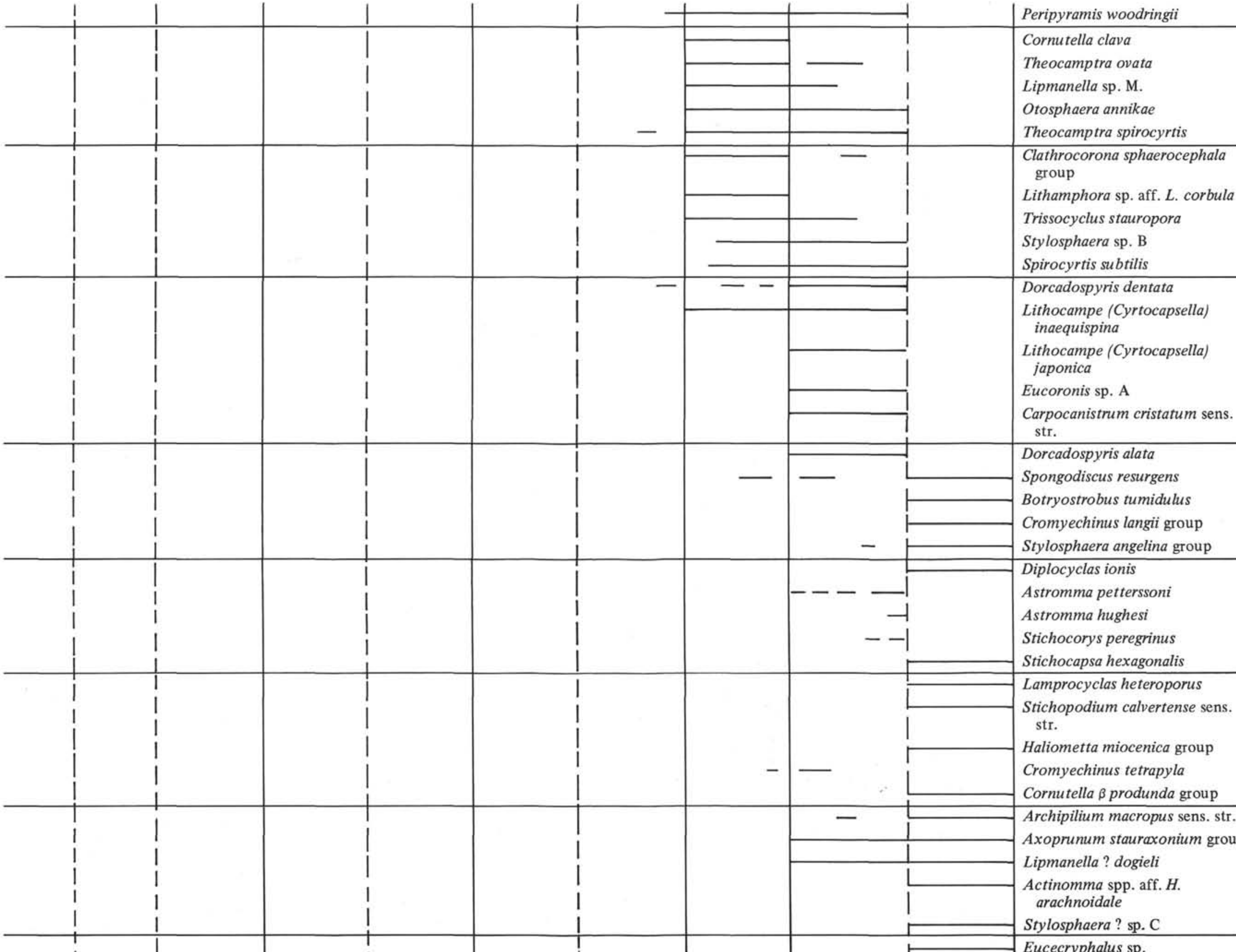

Peripyramis woodringii
Cornutella clava
Theocamptra ovata
Lipmanella sp. M.
Otosphaera annikae
Theocamptra spirocyrtis
Clathrocorona sphaerocephala group
Lithamphora sp. aff. L. corbula
Trissocyclus stauropora
Stylosphaera sp. B
Spirocyrtis subtilis
Dorcadospyris dentata
Lithocampe (Cyrtocapsella) inaequispina
Lithocampe (Cyrtocapsella) japonica
Eucoronis sp. A
Carpocanistrum cristatum sens. str.
Dorcadospyris alata
Spongodiscus resurgens
Botryostrobus tumidulus
Cromyechinus langii group
Stylosphaera angelina group
Diplocyclas ionis
Astromma petterssoni
Astromma hughesi
Stichocorys peregrinus
Stichocapsa hexagonalis
Lamprocyclas heteroporus
Stichopodium calvertense sens. str.
Haliometta miocenica group
Cromyechinus tetrapyla
Cornutella β produnda group
Archipilium macropus sens. str.
Axoprunum stauraxonium group
Lipmanella ? dogieli
Actinomma spp. aff. H. arachnoidale
Stylosphaera ? sp. C
Eucecryphalus sp.

TABLE 7 – *Continued*

Age / Zone	Paleocene	low/mid. Eocene: Unzoned interval	Middle Eocene: Lampterium chalara	Middle Eocene: Lampterium goetheana	Upper Eocene: Thyrsocyrtis bromia (upper part)	Oligocene: Calocycletta tuberosa	Lower Miocene: Calocycletta veneris	Lower Miocene: Calocycletta costata	Middle Miocene: Dorcadospyris alata	Pliocene: Pterocanium prismatium
Ommatartus spp. aff. *O. ceratospyris*										|
Zygocircus productus typ.										|
Anthocyrtidium ovata										|
Lychnocanium korotnevi										|
Stylatractus neptunus sens. str.										|
Stylatractus fragilis										|
Tricolocapsa papillosa										|
Lipmanella sp. aff. *L. xiphephorum*										|
Lamprocyclas junonis group										|
Lamprocyclas aegles sens. str.										|
Anthocyrtidium ophirense										|
Spirocyrtis cornutella										|
Pterocorys sabae										|

radiolarian assemblage in a sample. For the characterization of the total assemblage, the same letters "a", "c", "f" and "r" are applied. The preservation of the skeletons is classified as "good - g" (all specimens are preserved), "moderate - m" (some specimens are destroyed, in fragments, nassellarians without heads) and "poor - p" (nearly all specimens are destroyed or dissolved).

Site 138 (25° 55.37'N, 25° 33.70'W; water depth 5288 meters)

Rare radiolarians occur at about 52 to 61 meters below the sea floor (1-CC); they apparently belong in the *Calocycletta veneris* Zone. Frequent radiolarians of moderate preservation occur from 110 to 113 meters below the sea floor (Core 2). Radiolarians from the upper part of this core seem to belong in the upper part of the *Calocycletta tuberosa* Zone. The lower part of Core 2 seems to belong in the lower part of the *Calocycletta tuberosa* Zone. Paleocene? radiolarians from Core 4 were not studied. Lower than 332 meters below the sea floor, Cretaceous radiolarians of poor preservation occur (see "Cretaceous Occurrences").

Site 139 (23° 31.14'N, 18° 42.26'W; water depth 3047 meters)

Radiolarians, if present, were of good preservation, and the assemblages are rich in species and in individuals.

Radiolarians are common and even abundant from 114 to 123 meters below the sea floor (Core 1). These samples seem to belong no lower than the *Pterocanium prismatium* Zone.

Radiolarians are frequent and even common from 345 to 576 meters below the sea floor (Core 3). Sample 3-CC contains a Middle Miocene assemblage. It is difficult to determine the zone it belongs in, but it may be in the lowest *Cannartus petterssoni* Zone. Samples 4-CC, 5-CC and 139-SW1 seem to belong in the *Calocycletta costata* Zone. Core 7 (576 to 665 meters below the sea floor) is poor in radiolarians; it apparently belongs in the *Calocycletta veneris* Zone. Sample 7-CC is abundant in radiolarians; it belongs in the lowest part of the *Calocycletta veneris* Zone.

Site 140 (21° 44.97'N, 21° 47.52'W; water depth 4483 meters)

Hole 140

Well-preserved radiolarians are common from about 201 meters below the sea floor (Core 2). The samples from the upper part of this core seem to belong in the lower part of the *Dorcadospyris alata* Zone. The middle part of this core (Section 2 and 4) appear to belong in the *Calocycletta costata* Zone. The lower part of Core 2 and Sample 2-CC apparently belong in the *Calocycletta veneris* Zone, but the slide marked as 2-CC contains an abundance of well-preserved Late Eocene radiolarians. It apparently belongs in the upper part of the *Thyrsocyrtis bromia* Zone.

Well-preserved (but many fragmented) radiolarians are common in Core 3 (311 to 318 meters below the sea floor). These samples seem to belong in the *Lampterium goetheana* Zone.

Poorly preserved skeletons (infilled with silt) are abundant in Core 4 (368 to 374 meters below the sea floor). Apparently it belongs in the Low Eocene (similar to the samples described by C. Nigrini, 1970).

TABLE 8
Radiolarians in Site 138

Sample	Abundance	Preservation	*Theocampe mongolfieri*	*Astractinium aristotelis*	*Trigonactinium pythagorae*	*Eucyrtidium* sp. aff. *E. montiparum*	*Stylatractus spinulosus*	*Theocampe pirum*	*Lithamphora sacculifera quadrata*	*Lophophaena capito* group	*Cyclampterium milowi*	*Petalospyris* sp. E	*Cyrtophormis gracilis*	*Calocyclas asperum*	*Calocycletta tuberosa* forma A	*Calocycletta tuberosa* forma B	*Trigonactinium* ? *angustum* sens. str.	fragments of Orosphaeridae genn. spp.	*Desmospyris* sp. aff. *D. anthocyrtoides*	*Dorcadospyris* sp. K	*Liriospyris* sp. B	*Calocycletta acanthocephala*	*Astractinium* ? sp. C	*Astractinium crux* group	*Dorcadospyris* ? *ateuchus*	Eucyrtidiidae gen. sp. "rocket"	*Lithocampe subligata*	*Lamprocyclas rhinoceras*	*Botryocella multicellaris* group	*Theocamptra formaster*	*Calocycletta annosa*	*Cannartus prismaticus*	*Lychnocanium bipes*	*Stichopodium martellii conicum*	*Cannartus tubarius*	*Botryocyrtis quinaria* group	*Stichocorys delmontensis*	*Calocycletta veneris* sens. str.	*Spongasteriscus* sp.	*Tympanomma binoctonum*	*Theocamptra ovata*	*Clathrocorona sphaerocephala* group	*Spongodiscus resurgens osculosus*	Zone
1-1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	?
1-3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
1-6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
1-CC	r	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	–	F	F	F	R	F	–	F	–	Calocycletta veneris Zone
2-1, 5-7 cm	a	m	R	R	–	–	–	R	F	F	–	–	C	C	R	A	R	C	F	–	F	R	R	–	–	–	F	C	–	–	–	–	–	–	–	–	C	–	–	–	F	–	–	?
2-2, 5-7 cm	f	m	–	R	?	–	R	–	R	R	–	–	R	R	–	R	R	A	–	–	R	–	–	V	R	–	–	–	–	–	–	?	–	R	–	–	–	–	–	–	R	–	R	
2-2, 80-81 cm	f	p	–	–	–	–	R	–	F	R	–	–	A	A	–	A	F	A	F	–	F	–	–	F	R	–	R	–	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Calocycletta tuberosa Zone
2-3, 5-7 cm	a	m	–	–	–	–	F	R	–	–	–	F	C	C	F	C	–	C	–	–	R	–	–	–	–	–	R	–	F	F	–	–	–	–	–	–	–	–	–	–	–	–	–	
2-4, 5-7 cm	a	m	–	R	–	–	F	–	F	R	–	F	C	C	F	C	R	–	R	–	?	F	–	–	–	?	R	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
2-5, 7-8 cm	a	m	–	–	–	–	F	–	–	–	R	F	A	A	A	F	–	F	–	R	–	C	–	–	–	?	R	F	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
2-6, 5-7 cm	a	m	–	R	–	–	F	–	–	–	–	F	C	C	F	F	R	–	–	R	–	C	R	C	R	R	R	?	F	–	–	?	–	–	–	–	–	–	–	–	–	–	–	

TABLE 9
Radiolarians in Site 139

Sample	Abundance	Preservation	*Dorcadospyris ? ateuchus*	Eucyrtidiidae gen. sp. "rocket"	*Lithocampe subligata*	*Lamprocyclas rhinoceras*	*Botryocella multicellaris* group	*Theocamptra formaster*	*Calocycletta annosa*	*Cannartus prismaticus*	*Myllocercion* sp. C	*Lychnocanium bipes*	*Theocamptra collaris*	*Stichopodium martellii conicus*	*Acrobotrys* sp. aff. *A. disolenia*	*Cannartus tubarius*	*Stichopodium martellii* typ.	*Stichopodium cienkowskii*	*Botryocyrtis quinaria* group	*Stichocorys delmontensis* group	*Lithocampium* sp. B	*Rhodospyris* De 1 group	*Calocycletta veneris* sens. str.	*Carpocanopsis favosum* group	*Lithocampe (Cyrtocapsella) tetrapera*	*Spongasteriscus* sp.	*Cyrtophormis armata*	Eucyrtidiidae gen. sp. W	*Theocamptra marylandica* group	*Stichocorys wolffii*	*Cannartus violina*	*Theocamptra corona*	*Calocycletta costata*	*Desmospyris* sp. A
1-1, 80-82 cm	a	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1-2, 5-7 cm	a	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1-CC	a	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2-1, 5-7 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2-3, 80-82 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2-4, 5-7 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3-CC	f	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	–	–	–		–	–	–	–	–
4-CC	c	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	–	R	A	–	–	F	–	C	–	–	–	–	R	–	R	F	–
5-CC	a	g	–	–	–	–	–	–	–	–	–	–	–	–	F	–	F	F	C	A	C	–	–	–	C	–	C	–	C	C	F	C	C	C
7-3, 80-82 cm	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7-4, 80-82 cm	r	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	–	–	–	–	R	R	–	–	–	R	R	–	–	–
7-5, 5-7 cm	r	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	–	–	–	–	–	R	–	–	–	–	–	–	–	–
7-5, 8-10 cm	r	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	–	–	–	–	–	–	–	–
7-6, 80-82 cm	r	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	–	–	–	R	–	–	–	–
7-CC	a	g	R	–	–	R	R	–	R	R	R	R	–	–	R	R	C	–	C	A	–	–	–	C	A	F	–	–	–	–	–	–	–	–

TABLE 9 – *Continued*

Lithocampe (Cyrtocapsella) cornuta	*Cannartus mammiferus*	*Dendrospyris pododendros* group	*Rhodospyris* sp. aff. *R. tricornis*	*Cyrtophormis* sp.	*Lithotympanium tuberosum*	*Lipmanella* sp. O	*Tympanomma binoctonum*	*Dicolocapsa microcephala*	*Peripyramis woodringii*	*Cornutella clava*	*Theocamptra ovata*	*Lipmanella* sp. M	*Otosphaera annikae*	*Theocamptra pirocyrtis*	*Clathrocorona sphaerocephala* group	*Lithamphora* sp. aff. *L. corbula*	*Trissocy stauropora*	*Stylosphaera* sp. B	*Spirocyrtis subtilis*	*Dorcadospyris dentata*	*Lithocampe (Cyrtocapsella) inaequispina*	*Lithocampe (Cyrtocapsella) japonica*	*Eucoronis* sp. A	*Carpocanistrum cristatum* sens. str.	*Dorcadospyris alata*	*Spongodiscus resurgens*	*Botryostrobus tumidulus*	*Cromyechinus langii* group	*Stylosphaera angelina* group	*Diplocyclas ionis*	*Astromma petterssoni*	*Astromma hughesi*	*Stichocorys peregrinus*	*Stichocapsa hexagonalis*	*Lamprocyclas heteroporus*	*Stichopodium calvertense* sens. str.	*Haliometta miocenica* group	Zone
–	–	–	–	–	–	–	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	A	C	R	C	F	–	–	–	–	?	R	C	Pterocanium
–	–	–	–	–	–	–	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	A	C	R	C	F	–	–	–	–	F	F	C	prismatium
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	A	C	–	C	–	–	–	–	F	–	–	C	Zone (?)
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	?
–	–	–	–	–	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	F	–	–	–	C	–	–	–	–	F	F	C	–	–	–	R	
F	F	F	–	–	C	–	F	–	–	–	R	–	F	–	–	F	–	F	–	–	C	C	C	–	–	C	–	R	C	–	F	–		–	–	–	–	
F	–	C	F	F	–	–	–	R	F	F	F	F	–	C	A	F	–	F	C	–	–	–	–	–	–	A	–	R	F	F	–	–	–	–	–	–	–	Calocycletta costata Zone
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Calocycletta
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	veneris
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Zone
C	–	–	F	F	–	F	?	R	–	–	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	C	–	R	–	–	–	–	–	–	–	–	–	

TABLE 9 – *Continued*

Sample	Abundance	Preservation	*Cromyechinus tetrapyla*	*Cornutella profunda* group	*Archipilium macropus* sens. str.	*Axoprunum stauraxonium* group	*Lipmanella ? dogieli*	*Actinomma* spp. aff. *H. arachnoidale*	*Stylosphaera ?* sp. C	*Eucecryphalus* sp.	*Ommatartus* spp. aff. *O. ceratospyris*	*Zygocircus productus* typ.	*Anthocyrtidium ovatum*	*Lychnocanium korotnevi*	*Stylatractus neptunus* sens. str.	*Stylatractus fragilis*	*Triocolocapsa papillosa*	*Lipmanella xiphephorum*	*Lamprocyclas junonis* group	*Lamprocyclas aegles* sens. str.	*Anthocyrtidium ophirense*	*Spirocyrtis cornutella*	*Pterocorys sabae*	Zone
1-1, 80-82 cm	a	g	–	C	–	A	C	A	C	–	F	F	C	F	C	F	C	F	C	A	R	F	R	Pterocanium
1-2, 5-7 cm	a	g	–	C	–	C	C	C	C	F	F	F	C	C	C	C	F	F	C	A	F	R	F	prismatium
1-CC	a	g	–	–	–	C	F	C	F	F	F	R	F	F	C	F	C	–	–	–	–	–	–	Zone (?)
2-1, 5-7 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
2-3, 80-82 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
2-4, 5-7 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	?
3-CC	f	g	–	–	–	F	F	F	–	–	–	–	–	–	–	–	R	–	–	–	–	–	–	
4-CC	c	g	–	–	C	F	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
5-CC	a	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Calocycletta costata Zone
7-3, 80-82 cm	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
7-4, 80-82 cm	r	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Calocycletta
7-5, 5-7 cm	r	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	veneris
7-5, 8-10 cm	r	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Zone
7-6, 80-82 cm	r	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
7-CC	a	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	

TABLE 10A
Radiolarians in Site 140 (Neogene)

Sample	Abundance	Preservation	*Myllocercion* sp. C	*Theocamptra collaris*	*Stichopodium martellii conicum*	*Cannartus tubarius*	*Stichopodium cienkowskii*	*Botryocyrtis quinaria* group	*Theocamptra formaster*	*Stichocorys delmontensis*	*Lithocampium* ? sp. B	*Rhodospyris* sp. De 1 group	*Lithocampe (Cyrtocapsella) tetrapera*	*Calocycletta veneris*	*Carpocanopsis favosum* group	*Cyrtophormis armata*	Eucyrtidiidae gen. sp. W	*Stichocorys wolffii*	*Theocamptra marylandica*	*Cannartus violina*	*Theocamptra corona*	*Calocycletta costata*	*Desmospyris* sp. A	*Lithocampe (Cyrtocapsella) cornuta*	*Cannartus mammiferus*	*Dendrospyris pododendros*	*Rhodospyris* sp. aff. *R. tricornis*	*Cyrtophormis* sp.	*Lithotympanium tuberosum*	*Lipmanella* sp. O	*Dicolocapsa microcephala*	*Peripyramis woodringi*	*Theocamptra ovata*	*Lipmanella*? sp. M	*Theocamptra spirocyrtis*	*Clathrocorona sphaerocephala* group	*Tympanomma binoctonum*	*Trissocyclus stauropora*	*Stylosphaera* sp. B	*Theocamptra* sp. aff. *T. marylandica*	*Spirocyrtis subtilis*	*Lithocampe (Cyrtocapsella) inaequispina*	*Lithocampe (Cyrtocapsella) japonica*	*Dorcadospyris dentata*	*Carpocanistrum cristatum*	*Dorcadospyris alata*	*Cornutella β profunda* group	Zone
1-1, 80-82 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
1-5, 5-7 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
2-1, 5-7 cm	c	g	–	–	–	–	–	R	–	C	–	R	–	R	F	–	R	F	F	R	R	R	R	R	R	R	R	R	R	F	R	R	C	R	R	R	–		–	F	R	R	–	C	R	R	F	Dorcadospyris
2-1, 80-82 cm	c	g	–	–	–	–	–	R	–	C	–	R	–	R	–	–	R	F	F	C	R	R	R	R	F	R	R	R	F	R	R	R	F	R	R	R	–	F		F	R	R	R	F	R	R	–	alata Zone ?.
2-2, 5-7 cm	f	g	–	–	–	–	–	R	–	C	–	R	–	F	–	–	F	F	F	C	R	F	–	–	C	F	F	F	F	R	–	F	F	R	R	R	–	F	R	F	R	R	–	F	–	–	–	
2-2, 80-82 cm	c	g	F	–	–	–	–	C	–	C	–	F	–	C	–	F	R	F	F	C	R	C	–	–	C	F	R	R	R	F	–	R	F	R	R	R	–	F	R	F	R	R	–	–	–	–	–	Calocycletta
2-3, 5-7 cm	a	g	–	F	–	–	R	C	R	C	–	–	–	C	–	R	R	F	F	C	R	F	R	–	C	R	F	R	F	F	–	R	F	R	R	F	F	F	R	F	R	R	–	–	–	–	–	costata
2-3, 80-82 cm	c	g	–	F	–	–	F	F	–	C	–	F	F	C	–	R	R	C	F	C	R	R	R	–	C	F	–	F	F	R	–	R	R	R	R	F	–	R	–	F	R	R	–	–	–	–	–	Zone
2-4, 5-7 cm	c	g	–	F	F	R	R	R	–	C	–	R	R	C	–	F	F	C	F	F	R	–	R	–	C	R	–	R	R	F	–	R	–	R	R	F	–	–	–	F	R	R	–	–	–	–	–	
2-4, 80-82 cm	f	m	–	F	F	–	F	F	–	C	–	R	R	C	–	R	R	C	R	F	R	–	R	–	C	–	–	–	–	–	–	–	–	R	–	–	–	–	–	R	–	–	–	–	–	–	–	Calocycletta
2-6, 80-82 cm	a	g	–	F	F	–	R	R	–	C	F	–	F	F	–	F	R	F	–	F	–	–	R	–	F	–	–	–	–	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	veneris
"5-CC" (or 2-CC) ? ?	f	g	–	–	F	–	R	R	R	C	–	–	R	F	–	R	–	F	–	F	–	–	–	–	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Zone

TABLE 10B
(Paleogene) Radiolarians in Site 140 Holes 140 and 140A

	Abundance	Preservation	*Theocampe mongolfieri*	*Podocyrtis sinuosa*	*Podocyrtis papalis*	*Dendrospyris didiceros* group	*Patagospyris pentas*	*Theocotyle venezuelensis*	*Thyrsocyrtis argulus*	*Spongosphaera pachystyla*	*Periphaena decore*	*Lampterium chalara*	*Lampterium goetheana*	*Lampterium* sp. aff. *L. goetheana*	*Thyrsocyrtis triacantha*	*Eusyringium fistuligerum*	*Theocampe excellens*	*Stichopilidium sphinx*	*Lithochytris* sp. T	*Lithochytris* sp. O	*Lithochytris* sp. aff. *L. ventricosa*	*Eucyrtidium* sp. aff. *E. montiparum*	*Calocyclomma ampulla*	*Stylatractus coronatus*	*Stylatractus spinulosus* group	*Lithocyclia ocellus* group	*Heliodiscus asteriscus* sens. str.	*Calocycletta virginis* typ.	*Theocampe* sp. aff. *T. gemmata*	*Stylodictya rosella*	*Heliodiscus hexasteriscus*	*Heliodiscus pentasteriscus*	*Astractinium aristotelis* group	*Trigonactinium pythagore*
2A-1, 80-82 cm		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2A-3, 5-7 cm		m	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2A-3, 80-82 cm		p	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	R	R	–	–	–	–	–	R	R
2A-4, 80-82 cm		m	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	R	–	–	–	F	–	–	R	–
2A-5, 5-7 cm		m	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	R	–	–	–	F	–	–	R	R
2A-6, 8-10 cm		p	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	–	–	–	–	–	–	–	–	–
2A-6, 80-82 cm		m	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	A	F	F	–	–	F	–	–	F	F
2A-CC		m	C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	C	–	–	C	C	F	–	–	C	C
2-CC		g	R	–	–	–	–	–	–	–	A	–	–	–	R	–	–	F	F	F	F	A	–	–	A	F	F	A	F	F	F	F	A	C
3-2, 10-12 cm		g	C	–	–	–	–	–	–	–	–	–	–	C	C	–	–	–	F	C	F	–	F	–	A	F	F	–	–	–	–	–	–	–
3-2, 80-82 cm		g	A	–	–	–	R	–	–	–	–	–	–	C	–	R	F	R	F	C	F	R	F	C	A	F	F	–	–	–	–	–	–	–
3-3, 5-7 cm		g	C	–	R	–	–	–	–	–	–	C	C	R	C	C	F	R	R	C	F	R	–	A	F	C	–	–	–	–	–	–	–	–
3-CC		g	C	–	R	F	F	–	–	–	–	–	C	–	F	–	–	–	–	–	–	–	F	C	–	–	–	–	–	–	–	–	–	–
4-1, 10-12		p	C	–	–	–	–	C	R	R	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4-e, 85-87 cm		m	A	–	–	R	C	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4-CC		p	A	R	R	C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

TABLE 10B – *Continued*

Lithapium ? mitra	*Diacanthocapsa* sp. A	*Sethochytris babylonis* group	*Lithamphora sacculifera quadrata*	*Lophocyrtis jacchia*	*Lychnocanium bellum*	*Arthophormis barbadensis*	*Lophophaena capito* group	*Lithomitra imbricata*	*Petalospyris* sp. E	*Pterocyrtidium barbadense*	*Cyclampterium milowi*	*Petalospyris triceros*	*Calocycletta tuberosa* forma A	*Calocycletta tuberosa* forma B	*Cyrtophormis gracilis*	*Calocyclas asperum*	*Periphaena dupla*	*Trigonactinium ? angustum*	*Dorcadospyris ? ateuchus*	*Dorcadospyris* sp.	*Calocycletta tuberosa* forma C	*Calocycletta acanthocephala*	*Orosphaeridae gen.* sp. indet.	Zone
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	A	Calocycletta tuberosa
–	–	–	–	–	–	–	–	–	–	–	–	F	–	F	–	–	–	–	R	R	–	–	A	
–	–	–	–	–	–	–	–	–	R	–	C	F	–	C	R	A	F	–	–	–	–	F	A	
–	–	–	–	–	–	–	F	F	F	–	R	F	A	A	A	A	F	–	–	–	A	F	–	
–	–	–	–	–	–	–	F	–	F	–	–	F	A	R	A	A	F	?	R	–	A	F	A	
–	–	–	–	–	–	A	–	–	–	–	–	–	F	–	–	–	–	–	–	–	–	–	A	
–	–	–	–	F	–	–	F	A	F	A	R	C	–	–	R	C	–	–	–	–	–	–	–	Thyrsocyrtis bromia (upper part)
R	C	C	–	F	–	–	F	R	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	
R	C	R	R	R	R	–	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Lampterium goetheana
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Unzoned interval (Middle or Lower Eocene)
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	

TABLE 11
Radiolarians in Site 142

Sample	Abundance	Preservation	*Cannartus tubarius*	*Stichocorys delmontensis*	*Lithocampe (Cyrtocapsella) tetrapera*	*Calocycletta veneris*	*Stylatractus santaennae*	*Cyrtophormis armata*	*Stichocorys wolfii*	*Cannartus violina*	*Theocamptra corona*	*Calocycletta costata*	*Lithocampe cornuta*	*Cannartus mammiferus*	*Dendrospyris pododendros* group	*Rhodospyris* sp. aff. *tricornis*	*Lithotympanium tuberosum*	*Otosphaera annikae*	*Tympanomma binoctonum*	*Trissocyclus stauropora*	*Theocamptra* sp. aff. *T. marylandica*	*Dorcadospyris dentata*	*Eucornis* sp. A	*Carpocanistrum cristatum*	*Cromyechinus tetrapyla*	Zone
1-1, 80-82 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
1-2, 80-82 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
1-3, 80-82 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
2-2, 88-90 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
4-2, 88-90 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
5-1, 80-82 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
5-1, 138-140 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
8-2, 106-108 cm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
9-1, 98-100 cm	f	m	–	F	F	C	–	–	F	F	F	–	F	–	R	F	C	R	–	C	R	–	F	F	–	?
9-2, 58-60 cm	a	m	–	–	–	C	F	R	F	F	F	F	F	R	–	–	F	–	–	F	R	C	–	–	R	Calocycletta costata Zone
9-3, 90-92 cm	c	m	–	–	–	F	–	–	R	–	–	–	R	–	–	–	–	–	R	R	–	R	–	–	–	Calocycletta
9-CC	c	m	–	–	F	R	–	–	A	–	R	–	R	R	–	–	R	R	R	R	–	R	–	–	–	veneris
CB	r	m	R	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–	Zone

From 641 to 645 meters below the sea floor (Core 8), poorly preserved (dissolved, pyritized and so on) skeletons of Cretaceous radiolarians occur.

Hole 140A

From 235 to 244 meters below the sea floor (Core 2, Sections 3, 4, 5 and 6, 8-10 cm) rare fragments of radiolarians which seem to belong in the *Calocycletta tuberosa* Zone, occur. The lower part of Core 2 (samples 6, 80-82 cm and 140A12-CC) contains nearly the same assemblage as on the slide marked as 140-2-CC; it seems to belong in the upper part of the *Thyrsocyrtis bromia* Zone. This part of that zone was observed by T. Moore (1970, see Leg 8, Site 69, Sections 9-1, 9-3).

Site 141 (19° 25.16'N, 23° 59.91'W; water depth 4148 meters)

Only in Sample 2-CC occur well preserved, rare Miocene radiolarians.

Site 142 (03° 22.11'N, 42° 23.51'W; water depth 4350 meters

Radiolarians are common only from 575 to 581 meters below the sea floor (Core 9).The skeletons are moderately preserved: many specimens are destroyed; nasellarians without heads were found. The assemblage is poor in species. The lower part of Core 9 appears to belong in the *Calocycletta veneris* Zone, and the upper part in the *Calocycletta costata* Zone.

Site 144 (09° 27.23'N, 54° 20.52'W; water depth 2939 meters

Hole 144

Radiolarians of good preservation are very abundant from 57 to 61 meters (Core 1). They seem to belong in the *Lampterium goetheana* Zone. The samples from 61 to 63 meters below the sea floor (samples from 1-6, 1-CC) are also abundant in radiolarians. The skeletons are of good preservation. They seem to belong in the *Lampterium chalara* Zone.

The samples from Core 2 (about 104 to 112 meters below the sea floor) are abundant in radiolarian skeletons. The skeletons are of various preservation: some are of good preservation, others are either destroyed, or dissolved, or infilled with silt, some representing only "ghosts" of the skeletons. As to the stratigraphic position of these samples, they are placed in the Paleocene because of the foraminifera and other data. Radiolarian assemblages were not homogeneous in this core. Sample 2-1-Top seems to belong in the *Calocycletta tuberosa* Zone (it contains an assemblage similar to that of the samples from 144A-2). The next sample, 2-1, contains an assemblage abundant in species; *Eusyringium striata, Lithocampium* sp. A, *Bekoma bidarfensis, Pterocanium satelles*, and *Desmosphris* sp. aff. *D. lata* being common in the assemblage. There are also rare specimens of Eocene and Oligocene species of the same assemblage as that listed for the *Calocycletta tuberosa* Zone (see Tables 10, 12). Sample 2-2-Top seems to be in the *Calocycletta tuberosa* Zone. Samples 2-2-Bottom and 2-3-Top contain nearly the same assemblage as 2-1. Sample 2-CC is abundant in moderately and poorly preserved radiolarian skeletons. The assemblage is very much the same as in Samples 2-1, 2-2-Bottom and 2-3-Top, but there are no Eocene or Oligocene species mentioned. An assemblage similar to that in the sample in question (144-2-CC) was described by Riedel and Sanfilippo (in press, 1971) from Site 67 (1-2-CC) as Upper Paleocene.

Hole 144A

Radiolarians of good preservation (though many in fragments) are abundant from 20 to 29 meters below the sea floor (Core 1). These samples seem to belong in the upper part of the *Calocycletta tuberosa* Zone. The samples from Core 2 (from 38 to 47 meters below the sea floor) seem to belong in the lower part of the *Calocycletta tuberosa* Zone.

Hole 144B

Radiolarians of good preservation (though many in fragments) are abundant in Core 2 (from 10 to 19 meters below the sea floor). These samples apparently belong in the *Calocycletta tuberosa* Zone. The samples from Core 3 (3-3, 3-4 and 3-5) contain rare, poorly preserved radiolarians; only fragments of orosphaerids are numerous. It is difficult to judge the age of these samples without special investigation of the Orosphaeridae.

SYSTEMATICS

The taxonomy applied here is a new one, combined from the "polycystine systematics" proposed by W. R. Riedel (Riedel, 1967a, b; Riedel and Sanfilippo, 1970, 1971) and the polycystine classification discussed by M. G. Petrushevskaya (1969c, 1971a, 1971b). In the future, some of the genera mentioned here might be united. But before this can be done, these old genera of Haeckel and Ehrenberg must be investigated and discussed. Unfortunately, the system of polycystine radiolarians still remains far from complete. In the Leg 14 material a number of species, important for stratigraphy, were found which could not be studied exhaustively. They are included in the present "Systematic Section", but their taxonomic position remains doubtful.

Genera within families, and species within genera, are disposed not in alphabetical order, but with a hint of their phylogeny.

Type specimens and other figured specimens are deposited in the Zoological Institute of the Academy of Sciences of the USSR, and VNIGRI Institution (Leningrad, USSR).

SPUMELLARIA

Family COLLOSPHAERIDAE Müller

Genus OTOSPHAERA Haeckel emend. Nigrini

Otosphaera Haeckel, 1887, p. 116; Campbell, 1954, p. 52; Nigrini, 1967, p. 27. Type species *Otosphaera polymorpha* Haeckel, 1887, pl. 7, fig. 6.

Otosphaera annikae sp. nov.
(Plate 9, Figure 1)

Solenosphaera sp. Riedel and Sanfilippo, in press, pl. 1A, fig. 21, part.

Description based on 24 specimens from 139-3-CC, 139-4-CC, 140-2-2, 142-9-1, 88-100 cm.

The smooth wall is perforated by rounded pores. The diameter of the pores is equal to or less than the interval between them. The rounded shell (about 120-140μ in diameter) is very much the same as in the type species of the genus. It differs from *O. polymorpha* by having two (instead of three) tubes. The tubes are disposed (as in *O. auriculata*, described by C. Nigrini, 1967, pl. 1, fig. 7) on the opposite poles of the shell. The wall of the tube is perforated on the proximal end and stretched into a long needle on the distal end. In *O. auriculata* (Plate 9, Figure 2) there are no such needles on the ends of the tubes.

O. annikae is characteristic of the early *Dorcadospyris alata* Zone. The species is named for Annika Sanfilippo, who, together with W. R. Riedel, first illustrated this species.

Family ACTINOMMIDAE Haeckel

Actinommidae Haeckel, 1862, emend. Riedel, 1967b.
Sphaeroidea Haeckel, *sensu* Hollande and Enjumet, 1960.

Subfamily ACTINOMMINAE Haeckel, emend.

Actinommatidae Haeckel, 1862, p. 440; 1887, p. 251; Riedel, 1967b, p. 294, part.

Thecosphaeridae Haeckel, 1881, p. 449, 1887, p. 78; emend. Hollande and Enjumet, 1960, p. 110.

Actinommidae with the axoplast situated in the center of the nucleus and axopodial threads going through the nucleus. Sometimes there is a bunch of axopodial threads and thus the central capsule becomes bipolar. The innermost (first) skeletal shell, called since Haeckel the "medullary" shell, is latticed. It is about 15-35μ in diameter—of "microsphaera-type". The second and the third shells have porous walls.

Genus ACTINOMMA Haeckel

Actinomma Haeckel, 1862, p. 440; 1881, p. 453; 1887, p. 251; Campbell, 1954, p. 64; Hollande and Enjumet, 1960, p. 110; *not* Nigrini, 1967, p. 26. *Actinommetta* Haeckel, 1887, p. 253; Campbell, 1954, p. 64. Type-species *Haliomma trinacrium* Haeckel, 1860 (Haeckel, 1862, pl. 24, figs. 6-8).

The test consists of three shells. The innermost (first) shell is about 20μ in diameter. The third shell is spherical, with a small number of large irregular pores. Radial spines three-edged; they run through the second and third shells and form external spines. There are numerous small additional spines on the surface of the third shell.

Actinomma sp. group aff. Hexaconthium arachnoidale Hollande and Enjumet
(Plate 9, Figures 4-7)

?*Hexaconthium arachnoidale* Hollande and Enjumet, 1960, p. 110, pl. 53, fig. 1.

Echinommaa leptodermum Jörgensen in Hays, 1965, p. 169, p. 1, fig. 2 (*non* Jörgensen, 1905, p. 116, fig. 33).

About 7 pores on the half equator of the third shell. About 5 to 11 main radial spines.

The species differs from *Actinomma trinacrium* in the shape and number of the pores. The species differs from *Hexaconthium arachnoidale* in having a variable number of main spines, not always

TABLE 12
Radiolarians at Holes 144 and 144A

Sample	Abundance	Preservation	*Lithochytris* sp. A	*Desmospyris* sp. aff. *D. lata*	*Pterocanium* ? *satelles*	*Plectodiscus circularis*	*Eusyringium striata*	*Lithocampium* sp. A	*Becoma bidarfensis*	*Podocyrtis argulus*	*Podocyrtis papalis*	*Theocampe mongolfieri*	*Periphaena decora*	*Dendrospyris didiceros* group	*Eusyringium fistuligerum*	*Calocycloma ampulla*	*Lampterium chalara*	*Anthocyrtella spatiosa group*	*Stylatractus coronatus*	*Heliodiscus hexasteriscus*	*Heliodiscus pentasteriscus*	*Porodiscus concentricus*	*Lithochytris* sp. O	*Lithochytris* sp. T	*Astractinium aristotelis*	*Trigonactinium pithagorae*	*Tholodiscus splendens*	*Lophophaena capito* group	*Lithocyclia ocellus* sens. str.	*Thyrsocyrtis triacantha*	*Theocampe* sp. aff. *T. gemmata*	*Eucyrtidium* sp. aff. *E. montiparum*
1A-2, 12-14 cm	–	g	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	R	–	C	F	F	–	–	–
1A-2, 78-80 cm	–	m	–	–	–	–	–	–	–	–	–	R	–	–	F	–	–	–	–	–	–	–	–	–	–	R	–	F	–	R	–	–
1A-3, 5-7 cm	–	m	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	–	–	–	–
1A-3, 76-78 cm	–	m	–	–	–	–	–	–	–	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	F	–	–	r	–	–	–	–
1A-4, 5-7 cm	–	m	–	–	–	–	–	–	–	–	–	R	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	r	–	R	–	–
1A-4, 80-82 cm	–	p	–	–	–	–	–	–	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	–	–	–	–
1A-5, 5-7 cm	–	m	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1A-CC	–	m	–	–	–	–	–	–	–	–	–	–	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2A-4, 5-7 cm	–	m	–	–	–	–	–	–	–	–	R	F	F	–	R	R	–	–	–	–	–	–	–	–	F	–	R	R	–	C	–	–
2A-5, 5-7 cm	–	m	–	–	–	–	–	–	–	–	R	F	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	R	–	R
2A-5, 80-82 cm	–	m	–	–	–	–	–	–	–	–	R	–	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	R	R	R
2A-6, 2-4 cm	–	m	–	–	–	–	–	–	–	–	R	F	R	–	R	R	–	–	–	–	–	–	–	–	R	R	R	R	R	R	R	R
1-2, MID	–	g	–	–	–	–	–	–	–	–	C	A	C	C	C	F	A	C	F	–	–	R	C	C	–	–	C	R	C	C	F	C
1-3, 80-85 cm	–	g	–	–	–	–	–	–	–	–	C	A	C	C	C	F	A	C	F	–	–	R	C	C	–	–	C	R	C	C	F	C
1-4	–	g	–	–	–	–	–	–	–	–	C	A	C	C	C	F	A	C	F	–	–	R	C	C	–	–	C	R	C	C	F	C
1-5, 80-85 cm	–	g	–	–	–	–	–	–	–	–	C	A	C	C	C	F	A	C	F	–	–	R	C	C	–	–	C	R	C	C	F	C
1-6, 80-85 cm	–	g	–	–	–	–	–	–	–	–	C	A	C	–	A	F	A	C	F	–	–	R	C	C	–	–	C	R	C	C	C	A
1-CC	–	g	–	–	–	–	–	–	–	–	–	C	A	–	F	C	A	A	F	C	C	R	C	C	A	–	C	–	A	A	–	A
2-1, TOP	–	p/g	–	–	–	–	–	–	–	–	–	R	R	R	R	F	R	–	–	–	–	–	–	–	R	–	–	R	–	–	–	–
2-1	–	m/g	R	R	F	C	C	C	R	R	R	R	R	R	R	F	–	–	–	–	–	–	–	–	R	A	–	r	R	F	–	–
2-2, TOP	–	p/m	–	–	–	–	–	–	–	–	–	R	–	–	R	–	?	–	F	–	–	–	–	–	–	–	R	R	–	R	–	F
2-3	–	p/g	R	R	F	A	C	C	F	–	?	R	R	–	R	F	–	–	–	–	–	–	R	R	–	–	F	r	–	F	–	–
2-CC	–	p/m	–	–	–	F	F	C	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		–		–	–

six. It differs from *Echinomma leptodermum* in shape and number of the pores, in the number of spines, and in the dimensions of the third shell.

From the *Cannartus petterssoni* Zone till Recent. Earlier forms of that very type existed, but they differ from the species in question by having a thicker, heavier third shell with smaller pores.

Genus HALIOMETTA Haeckel, emend.

Haliometta Haeckel, 1887, p. 233; Campbell, 1954, p. 62. Type species *Haliomma circumtextum* (Haeckel, 1887, pl. 28, fig. 7).

The test consists of three (rarely four) shells. The first is irregular, about 20 μ in diameter. The first and second (so-called

Stylatractus spinulosus group	*Lampterium goetheana*	*Heliodiscus asteriscus* group	*Theocapsomma* sp. aff. *T. ornata*	*Thyrsocyrtis bromia*	*Stylodictya rosella*	*Lithamphora sacculifera quadrata*	*Diacanthocapsa* sp. A	*Cyclampterium milowi*	*Petalospyris triceros*	*Pterocyoticlius barbadense*	*Petalospyris* sp. E	*Cyrtophormis gracilis*	*Calocycletta tuberosa* forma A	*Calocycletta tuberosa* forma B	*Calocycletta tuberosa* forma C	*Calocyclas asperum*	*Trigonactinium ? angustum*	*Periphaena dupla*	*Tholodiscus ocellatus*	*Liriospyris* sp. B	*Desmospyris* spp. aff. *D. anthocyrtoides*	*Calocycletta acanthocephala*	*Astractinium ?* sp. C	*Astractinium crux* group	*Dorcadospyris ateuchus*	Eucyrtidiidae gen. sp. "rocket"	*Botryocella multicellaris* group	*Lithocampe subligata*	*Lamprocyclas rhinoceras*	*Theocamptra formaster*	Orosphaeridae genn. spp. fragments	Zone
C	–	C	–	–	–	–	C	F	F	F	–	A	–	A	–	C	C	F	R	F	F	F	F	R	F	F	F	F	R	R	A	
C	–	–	–	–	–	R	F	F	F	–	–	A	–	A	–	C	F	–	–	R	F	–	R	R	–	–	–	F	R	–	A	
C	–	–	–	–	–	–	C	F	C	–	–	C	–	C	–	C	R	–	–	F	F	R	–	F	–	–	R	F	R	–	A	
F	–	–	–	–	–	–	C	C	C	–	–	A	–	A	–	C	R	–	–	–	–	–	R	–	F	–	–	–	–	–	A	
–	–	–	–	–	–	R	–	C	C	C	F	A	–	A	R	C	R	–	–	–	–	R	–	–	F	–	R	F	–	–	F	
F	–	–	–	–	–	–	–	–	–	–	–	A	–	A	–	C	R	–	–	–	F	R	–	–	F	R?	R	F	–	–	F	Calocycletta
–	–	–	–	–	–	–	–	–	R	–	–	R	–	–	–	–	–	–	–	–	R	–	–	–	–	–	–	–	–	–	F	tuberosa
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	F	
–	–	–	–	R	–	R	C	R	F	–	–	–	A	F	F	C	R	–	–	R	–	–	–	–	–	–	–	–	–	–	–	
R	–	–	–	–	–	–	R	–	F	–	R	A	–	–	A	A	R	F	–	R	A	–	–	–	–	–	–	–	–	–	–	
–	–	–	–	–	–	–	A	–	A	C	–	C	R	F	A	A	C	F	–	–	–	–	–	–	–	–	–	–	–	–	–	
R	–	R	–	R	–	F	A	R	F	A	R	–	R	F	C	A	F	C	R	–	–	R	–	–	–	–	–	–	–	–	–	
C	C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
C	C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Lampterium
C	C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	goetheana
C	C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Lampterium
C	–	C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	chalara
F	R	–	F	–	–	–	R	R	–	C	–	F	F	–	C	C	R	R	–	–	–	–	–	–	R	–	–	–	–	–	–	
R	R	–	–	–	–	–	–	R	–	–	–	–	R	–	–	R	–	–	R	–	–	R	–	–	–	–	–	–	–	–	–	Interval with
–	–	–	–	–	–	–	–	–	F	F	–	R	F	–	C	C	R	F	–	R	–	F	–	–	–	–	–	–	–	–	–	mixed
–	R?	–	–	–	–	–	–	R	–	–	?	–	?	–	–	–	–	–	R	–	–	–	–	–	–	–	–	–	–	–	–	assemblages
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	

"medullary") shells are very often destroyed. The pores on the third shell are of equal size.

The radial spines do not run through the third shell, but there are rods uniting the second and third shells, which do not extend outside. At the points where these rods touch the third shell, there are little funnels, and the third shell does not represent by itself the regular sphere, but has convex and concave sections. The main external radial spines are not connected with the mentioned inner rods, as is usual. As a rule they arise on the convex parts of the third sphere. Small additional spines are present on the third shell (may be broken off).

Haliommetta miocenica (Campbell and Clark) group
(Plate 9, Figures 8, 9)

Heliosphaera miocenica Campbell and Clark, 1944A, p. 16, pl.2, figs. 10-14.

TABLE 13
Radiolarians in Hole 144B

Sample	Abundance	Preservation	*Periphaena dupla*	*Lithochytris* spp. aff. *L. tripodium*	*Thyrsocyrtis argulus*	*Podocyrtis papalis*	*Theocampe mongolfieri*	*Eusyringium fistuligerum*	*Astractinium aristotelis*	*Lophophaena capito* group	*Eucyrtidium* sp. aff. *E. montiparum*	*Stylatractus spinulosus* group	*Calocycletta virginis* typ.	*Theocapsomma* sp. aff. *T. ornata*	*Lithamphora sacculifera quadrata*	*Diacanthocapsa* sp. A. ("Tertiary")	*Cyclampterium milowi*	*Petalospyris* sp. E	*Pterocyrtidium barbadense* group	*Cyrtophormis gracilis*	*Calocyclas asperum*	*Calocycletta tuberosa* forma A	*Calocycletta tuberosa* forma B	*Calocycletta tuberosa* forma C	*Trigonactinium* ? *angustum* sens. str.	*Desmospyris* sp. aff. *D. anthocyrtoides*	*Cyclampterium pegetrum* forma 1	*Dorcadospyris* sp. K	*Liriospyris* sp. B	*Calocycletta acanthocephala*	*Astractinium* sp. C	*Astractinium crux* group	*Dorcadospyris* ? *ateuchus*	*Eucyrtidiidae* gen. sp. "rocket"	*Lithocampe subligata*	*Lamprocyclas rhinoceras*	*Botryocella multicellaris*	*Theocamptra formaster*	*Orosphaeridae* genn. spp. fragments	Zone
1-3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
1-4, 80-82 cm	r	p	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
2-1, 80-82 cm	c	g	–	R	–	R	–	–	–	–	–	R	–	–	–	–	C	–	–	A	C	F	A	F	R	R	–	R	F	R	–	–	R	–	F	R	–	–	R	
2-2, TOP	f	m	–	–	R	R	F	R	–	R	–	–	R	–	–	–	F	–	R	F	F	F	C	F	F	F	–	–	F	R	–	–	F	–	R	R	–	–	–	
2-2, 5-7 cm		g	–	–	–	R	F	–	–	R	–	–	–	–	–	–	A	R	R	A	A	F	A	R	F	C	R	?	F	F	–	–	F	–	R	R	–	–	?	
2-3		g	–	–	–	F	F	–	R	F	–	–	F	–	–	A	F	–	F	A	A	F	?	C	?	R	–	–	F	A	–	–	R	–	F	–	R	–	–	Calocycletta tuberosa Zone
2-3, 5-7 cm		m	A	–	–	–	F	R	–	F	–	–	–	–	–	–	A	–	F	A	A	R	F	–	R	F	–	R	F	C	–	R	R	–	F	–	R	–	R	
2-4, TOP		m	A	–	–	–	–	R	–	–	–	–	–	–	–	–	F	–	–	A	A	–	C	–	–	?	–	–	–	R	R	–	R	–	R	–	–	R	–	
2-5, TOP		g	–	R	–	–	–	–	–	F	–	–	–	R	?	–	F	–	F	A	C	?	C	–	R	F	–	–	F	F	–	–	R	?	R	R	F	–	–	
2-6, TOP		m	–	R	–	–	R	–	–	F	–	F	–	–	–	–	F	R	F	A	C	–	C	R	R	F	?	F	–	R	R	F	?	?	R	R	F	R	F	
3-3, 5-7 cm		p	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	R	R	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
3-4, 85-87 cm		p	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	?	–	–	–	–	
3-4, 80-82 cm		p	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	?	–	–	–	–	–	–	–	–	–	–	
3-5, TOP		p	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	

Acanthosphaera sp. Hays, 1965, p. 169, p. 2, fig. 8.
Echinomma popofskii Petrushevskaya, 1967, p. 23, pl. 12, figs. 1-3.
Echinomma quadrisphaera Dogiel in Petrushevskaya, 1969b, p. 138, fig. 1(4).

Diameter of the third shell 90-130μ. Main external radial spines three-edged.

Very likely there are two main forms (subspecies?) of this species. One of them–typical *H. miocenica* and recent cold water *Haliometta*, described as *Echinomma popofskii*–is characterized by a smaller number of pores (about 12) on the half equator of the third shell. The other group–*Acanthosphaera* sp. Hays and *Haliometta* described as *Echinomma quadrispina*–has more pores (about 18) on the half equator of the third shell.

The Eocene species of this group (Plate 9, Figure 10) is characterized by greater dimensions. Some of its external radial spines *are* connected with the second shell.

All these forms are similar to *Haliomma circumtextum* in the characters of the third shell.

These species differ sharply from *Heliosphaera echinoides* Haeckel, 1862, pl. 9, fig. 4 (the type species of *Heliosphaera*) in the construction of the nucleo-axopodial complex, and they cannot be in the genus *Heliosphaera*.

Genus THECOSPHAERA Haeckel

Thecosphaera Haeckel, 1881, p. 452; 1887, p. 78; Campbell, 1954, p. 50; emend. by Hollande and Enjumet, 1960, p. 111. Type species *Thecosphaera tripodictyon* Haeckel, 1887, unfigured.
Thecosphaerella Haeckel, 1887, p. 80; Campbell, 1954, p. 50. Type species *Haliomma inerme* Haeckel, 1860 (Haeckel, 1862, pl. 24, fig. 5).

Very much the same as *Haliometta*, but as a rule without external main radial spines.

Thecosphaera sp. A
(Plate 9, Figure 17)

?*Haliomma aequorea* Ehrenberg, 1844a, p. 83; 1854, pl. 22, fig. 35.
?*Carposphaera melitomma* Haeckel, 1887, p. 73, pl. 20, fig. 4.
?*Haliomma lirianthus* Haeckel, 1887, p. 232, pl. 28, fig. 1.

Dimensions. Diameter of the second shell 60μ, of the third 150μ.

Eocene. The Recent species *Thecosphaera radians* Hollande and Enjumet is very similar to the form in question, but has more pores on the third shell.

Thecosphaera ? sp. B
(Plate 9, Figure 18)

This species is distinguished from *Thecosphaera* sp. A by the greater number of pores (about 11, instead of 8 in *Thecosphaera* sp. A) on the half equator of the third shell, and by the presence of thin external radial spines. The dimensions of the test and the festooned outline of the pores on the third shell are the same in both species.

Eocene to Early Oligocene ?

Thecosphaera ? sp. C
(Plate 9, Figure 19)

Has strong radial spines.

Eocene.

Genus ACTINOMMURA Haeckel

Actinommura Haeckel, 1887, p. 255; Campbell, 1954, p. 66. Type species *Actinomma capillaceum* Haeckel, 1887, pl. 29, fig. 6.

The test consists of three shells, the first about 18μ in diameter, the second about 60μ, the third 150-200μ. They relate as 1 : 3 : 9. Numerous rounded, nearly equal pores on the spherical third shell. Numerous radial spines are usually present, going from the second shell, through the third shell, to the outside.

Actinommura sp. A
(Plate 9, Figure 13)

?*Haliomma medusa* Ehrenberg, 1844a, p. 83; 1854, pl. 22, fig. 33.
?*Acanthosphaera setosa* Ehrenberg, 1872a, p. 301; 1872b, pl. 9, fig. 11.

Eocene.

Actinommura sp. B
(Plate 9, Figure 14)

Differs from *Actinommura* sp. A in greater size of the third shell, and in greater diameter of the pores on the third shell.

Eocene.

Actinommura ? sp. aff. californica
(Plate 9, Figure 15)

?*Thecosphaera californica* Clark and Campbell, 1945, p. 22, pl. 4, fig. 7.
?*Thecosphaera scabra* Kozlova in Kozlova and Gorbovetz, 1966, p. 52, pl. 7, figs. 5, 6.

The radial spines were not observed. Besides, the number of pores on the half equator of the third shell is more–about 20–instead of 15 in *Actinommura* sp. B. The dimensions of the test are similar for both species.

Eocene–Oligocene.

Genus CROMYECHINUS Haeckel

Cromyechinus Haeckel, 1881, p. 454; 1887, p. 263; Campbell, 1954, p. 66. Type species *Cromyechinus icosacanthus* Haeckel, 1887, pl. 30, fig. 1.
Chromyechinus Jörgensen, 1905, p. 117.
Sphaeropyle Dreyer, 1899, p. 89; Campbell, 1954, p. 66. Type species *Sphaeropyle langii* Dreyer, 1899, fig. 54.

The first shell about 15-20μ in diameter, the second about 30-50μ. The diameter, as well as the shape and the number of the pores of the third shell, is variable. It is always spherical. Radial spines numerous; they go from the second shell through the third. The difference from *Actinomma* lies mainly in the nearly obligate presence of a delicate fourth shell in *Cromyechinus*. Very often the fourth shell has a pylome at one pole.

Cromyechinus langii (Dreyer) group
(Plate 9, Figure 12)

Sphaeropyle langii Dreyer, 1899, p. 89, fig. 54; Hülsemann, 1963, p. 17, fig. 9.
Cromyechinus borealis (Cleve, 1899) Jörgensen, 1905, p. 117, pl. 9, fig. 35-37; Petrushevskaya, 1967, p. 25-30, pl. 13, figs. 5-9; Petrushevskaya, 1969a, p. 124, pl. 1, fig. 1.
Cromyechinus antaractica (Dryer) Petrushevskaya 1967, pl. 14, figs. 4, 5, 7, part.
Cromyechinus sp. Petrushevskaya 1969b, pl. 10, figs. 1, 5-8.

The fourth shell is more removed from the third than in *C. antarctica.*

Miocene-Recent.

Cromyechinus tetrapyla (Hays)
(Plate 9, Figure 11)

Prunopyle tetrapyla Hays, 1965, p. 172, pl. 2, fig. 5.

Miocene-Quaternary. Antarctic, transitional and tropical regions.

Genus STYLATRACTUS Haeckel

Stylatractus Haeckel, 1887, p. 328; Campbell, 1954, p. 73. *Stylatractura* Haeckel, 1887, p. 328. Type species *Amphistylus neptunus* Haeckel, 1878, Atlas, pl. 17, fig. 6.

The first shell about 35μ in diameter, the second ellipsoidal or pear-shaped, major axis about 40-70μ. The second and third shells are joined by numerous rods going in various directions. Some of them form external radial spines. Two of these spines, situated on opposite poles of the test, are much stouter than the others. The third shell is usually very thick-walled, ellipsoidal. It has 8 to 10 pores on the half equator. The pores of the third shell may be overgrown by the delicate rods of the fourth shell.

Stylatractus spinulosus (Ehrenberg) group
(Plate 11, Figures 2-4)

Stylosphaera spinulosa Ehrenberg, 1873, p. 259; 1875, pl. 15, fig. 8.
?*Xiphatractus trochilus* Haeckel, 1887, p. 129, pl. 13, fig. 10.

Besides two polar spines, there are 5 to 8 stout additional radial spines of various length.

Eocene-Oligocene.

Stylatractus ostracion (Haeckel)
(Plate 11, Figure 1)

Druppatractus ostracion Haeckel, 1887, p. 326, pl. 16, figs. 8, 9.

The length of the major axis of the third shell is about 160μ, of the minor axis about 120μ. Only two external spines. About seven pores on the half equator of the third shell.

Eocene-Oligocene.

Stylatractus radiosus (Ehrenberg)

Stylosphaera radiosa Ehrenberg, 1854, p. 256; 1875, pl. 24, fig. 5.

Two polar spines only. Dimensions of the third shell variable. About nine pores on the half equator of the third shell.

Eocene.

Stylatractus neptunus Haeckel
(Plate 11, Figure 11)

Stylatractus neptunus Haeckel, 1887, p. 328, pl. 17, fig. 6; Riedel, 1958, p. 266, pl. 1, fig. 9.

Xiphatractus radiosus (Ehrenberg) Haecker, 1908, p. 442, pl. 84, fig. 588, text-fig. 81.

Stylatractus sp. Petrushevskaya, 1967, p. 30, pl. 15, fig. 3, part.

The length of the major axis of the second shell is about 75μ, of the third about 140μ; of the minor axis of the second shell 60μ, of the third about 110μ. Eight or nine pores on the half of the equator of the third shell; they are usually overgrown by the rods of the fourth shell. Two three-edged polar spines.

Quaternary.

Stylatractus santaennae (Campbell and Clark)
(Plate 11, Figure 10)

Lithatractus santaennae Campbell and Clark, 1949a, p. 19, pl. 2, figs. 20-22.

Differs from *S. neptunus* by the thicker-walled third shell.

Middle and Late Miocene.

Stylatractus fragilis (Haeckel)
(Plate 11, Figure 12)

Lithatractus fragilis Haeckel, 1887, p. 319, pl. 16, fig. 3.

?*Amphisphaera cronos* Haeckel, 1887, p. 117, pl. 17, fig. 5.

Thin-walled third shell. Two weak cylindrical polar spines.

Quaternary. In the Miocene thicker-walled forms of that type existed, somewhat similar to *S. santaennae*.

Stylatractus sp. aff. Stylosphaera sulcata Ehrenberg
(Plate 11, Figures 13, 14)

?*Stylosphaera sulcata* Ehrenberg, 1873, p. 259; 1875, pl. 24, fig. 6.

About ten festooned pores on the half diameter of the third shell.

Eocene.

Stylatractus coronatus (Ehrenberg)
(Plate 11, Figure 9)

Stylosphaera coronata Ehrenberg, 1873, p. 258; 1875, pl. 25, fig. 4.

Xiphostylus plasianus Haeckel, 1887, pl. 127, pl. 13, fig. 9.

Differs from *S. sulcata* by the characteristic shape of one of the polar spines.

Eocene.

Genus STYLOSPHAERA Ehrenberg

Stylosphaera Ehrenberg, 1847b, p. 54; Haeckel, 1881, p. 451; 1887, p. 133; Campbell, 1954, p. 53. *Stylosphaerella* Haeckel, 1887, p. 135; Campbell, 1954, p. 53. Type species *Stylosphaera hispida* Ehrenberg, 1854, pl. 36, fig. 26.

The construction of the inner part of the skeleton of the type species is as yet unknown. Very probably there are two "medullary" shells of the same type as characteristic for Actinomminae. The second shell is very likely joined to the third shell by numerous radial spines. Two of the latter, disposed on opposite poles of the skeleton, are much stouter than the other. The third shell of irregular shape has 18 to 20 small pores on the half equator.

Stylosphaera minor Clark and Campbell typ.
(Plate 10, Figure 9)

Stylosphaera minor Clark and Campbell, 1942, pl. 16, pl. 1, figs. 13, 14.

Major axis of the third shell about 100-150μ, shorter axis about 90-140μ. About 15 pores on the half equator of the third shell. Two long polar spines.

Eocene-Oligocene.

Stylosphaera sp. A
(Plate 10, Figure 8)

?*Amphisphaera spinosa* Carnevale, 1908, p. 14, pl. 2, fig. 6.

?*Doryconthidium maximum* Carnevale, 1908, p. 11, pl. 2, fig. 1.

Stylosphaera angelina Campbell and Clark, 1944a, p. 12, pl. 1, figs. 17, 18, part.

Third shell thick-walled, about 120μ in diameter. About 20 pores on the half equator of the third shell. Two long polar spines and some small additional spines, going in various directions.

Lower Miocene.

Stylosphaera sp. B
(Plate 10, Figure 7)

Skeleton of the same construction as in *Stylosphaera* sp. A, but one polar spine is much shorter than the other. The third shell is only about 100μ in diameter.

Middle Miocene.

Stylosphaera angelina Campbell and Clark group
(Plate 11, Figures 15-19)

Stylosphaera angelina Campbell and Clark, 1944a, p. 12, pl. 1, figs. 15 and 20, (part).

Stylatractus universus Hays in Kling, in press, pl. 1, fig. 1.

Because of the convex-concave shape of the third shell it looks, in optical section, as if festooned—very much the same as in *Haliometta miocenica* (Plate 9, Figures 8, 9; Plate 11, Figures 15, 18). This feature distinguishes this species from the *Stylosphaera* species mentioned above. The surface of the third shell with irregularly disposed pores (about eighteen on the half of the equator) and with small additional spines. Sometimes the surface of the third shell is spongy (Plate 11, Figure 17).

This species differs from the Antaractic species *Stylatractus* sp. Hays (1965, pl. 1, fig. 6) by having thinner polar spines.

Calocycletta costata Zone to Quaternary.

Stylosphaera ? sp. C
(Plate 11, Figures 5-7)

Resembles *Stylosphaera angelina* in having the third shell of the same festooned shape, with very similar small numerous pores, and having two polar spines of the same type. But it differs from *S. angelina* in the dimensions: the first shell about 10μ, the second 25-35μ, the third, major axis 60-80μ, minor axis 50-65μ. A distinguishing character of the species is also the pear-shaped second shell (as in *Stylatractus neptunus*). Sometimes a delicate fourth shell is developed (Plate 11, Figure 7).

Calocycletta virginis Zone to Quaternary.

Stylosphaera ? laevis Ehrenberg
(Plate 11, Figure 8)

Stylosphaera laevis Ehrenberg, 1873, p. 259; 1875, pl. 25, fig. 6.

Having the "cortical" (third?) shell of nearly the same size as in *Stylosphaera* ? sp. C, it differs from that species in the shape (rosette) of the pores on the "cortical" shell and in the number of these pores. The disposition of the trabeculae joining the "cortical" and the "medullary" shells is also different. In the species in question they are disposed in the equatorial plane as in *Axoprunum* species, while in the species described here as *Stylosphaera* such rods go in various directions.

Eocene.

Genus AXOPRUNUM Haeckel

Axoprunum Haeckel, 1887, p. 298; Campbell, 1954, p. 68; Hays, 1965, p. 170. Type species *Axoprunum stauraxonium* Haeckel, 1887, pl. 48, fig. 4.

The first shell about 10μ in diameter, the second about 30-40μ and slightly ellipsoidal, the third shell nearly ellipsoidal abut with equatorial intake. The second and third shells are joined by rods (about 6) disposed in the equatorial plane, and by two rods going to the opposite poles of the shell. These two rods go through the third shell and form two strong polar spines. The other rods never protrude outside the third shell, but at the points where they touch the third shell little pits exist.

Axoprunum stauraxonium Haeckel
(Plate 10, Figure 10)

Axoprunum stauraxonium Haeckel, 1887, p. 298, pl. 48, fig. 4; Hays, 1965, p. 170, pl. 1, fig. 3.

The major axis of the third shell about 150μ, the minor axis about 120μ. Polar spines cylindrical.

Upper Miocene to Recent.

Axoprunum polycentrum (Clark and Campbell)
(Plate 10, Figures 11, 12)

Druppatractus polycentrus Clark and Campbell, 1942, p. 35, pl. 5, fig. 19.

The major axis of the third shell is about 120-130μ, the minor axis about 110-120μ. As in *A. stauraxonium* there are about nine large pores on the half equator of the third shell. The polar spines are three-edged. "Equatorial" rods uniting the second and third shells are disposed irregularly: some of them somewhat higher than the equatorial plane, others somewhat lower.

Remark: The species (Plate 10, Figure 9) figured by Riedel and Sanfilippo (in press, pl. 2C, fig. 14) as *Cannartus* sp. aff. *Cannartus prismaticus* has the same construction and dimensions. The difference between it and *A. polycentrum* is only in the number of pores: it has about twelve pores on the half equator of the third shell. It cannot be placed into *Cannartus* because it has inner rods connected with polar spines.

Eocene-Oligocene.

Axoprunum liostylum (Ehrenberg) group
(Plate 10, Figure 3)

Stylosphaera liostylus Ehrenberg, 1873, p. 259; 1875, pl. 25, fig. 2.

The major axis of the third shell about 150-170μ, the minor axis about 140μ. About twelve pores on the half equator of the third shell. The polar spines cylindrical, very long.

Upper-Eocene?-Oligocene.

Remark: In the Miocene and Pliocene, forms with very similar third shells exist but they have short, often curved polar spines.

Axoprunum carduum (Ehrenberg)
(Plate 10, Figure 1)

Stylosphaera carduus Ehrenberg, 1873, p. 258; 1875, pl. 25, fig. 7.

The major axis of the third shell about 200μ, the minor axis about 160μ.

Eocene.

Genus SPONGOSPHAERA Ehrenberg

Spongosphaera Ehrenberg, 1847b, p. 54; Campbell, 1954, p. 74 (*non Spongosphaera* Haeckel, 1887, p. 282). *Spongatractus* Haeckel, 1887, p. 282. Type species *Spongosphaera pachystyla* Ehrenberg.

Spongosphaera pachystyla Ehrenberg
(Plate 10, Figure 5)

Spongosphaera pachystyla Ehrenberg, 1873, p. 256; 1875, pl. 26, fig. 3.

Spongotractus pachystylus Ehr., Riedel and Sanfilippo, 1970, pl. 4, fig. 1.

The inner construction is very likely the same as in *Axoprunum* species, but the surface of the third shell is spongy.

Eocene.

Cretaceous Actinommidae[1]

More or less regular spheres, some of them even flattened to become lenticular. All of them have double cortical shells. The external shell has larger pores, the internal one smaller pores. The pores of the internal shall may be seen through large pores of the external shell. The latter are not rounded, but festooned, and look like rosettes. Specimens similar to the discussed actinommids were described by Kh., Aliev, 1965, pl. 2, figs. 5, 6. The internal construction is unknown, and thus only conventional generic identification is possible.

Conosphaera fossilis Parona
(Plate 1, Figure 8)

Conosphaera fossilis Parona, 1890, p. 148, pl. 1, fig. 9.

Cenomanian.

Conosphaera sphaeroconus Rüst
(Plate 4, Figure 2)

Conosphaera sphaeroconus Rüst, 1898, p. 13, pl. 4, fig. 8.

Albian-Maestrichtian.

Cenosphaera? sp. aff. Cenosphaera euganea Squinabol
(Plate 1, Figure 10; Plate 4, Figure 1)

?*Cenosphaera euganea* Squinabol, 1904, p. 109, pl. 8, fig. 1.

It has smaller dimensions of the test and of the pores, than Squinabol's species.

Cenomanian-Maestrichtian.

Subfamily SATURNALINAE Deflandre

Saturnalidae Deflandre, 1953, p. 419; Riedel and Sanfilippo, 1970, p. 504.

The subfamily was treated only in Cretaceous occurrences, though in the late Tertiary and Early Quaternary fragments of saturnalin rings were frequent.

Spongosaturnalis? sp. aff. Spongosaturnalis latuformis Campbell and Clark
(Plate 4, Figure 5)

?*Spongosaturnalis latuformis* Campbell and Clark, 1944b, p. 8, pl. 3, figs. 2, 4, 7, 8, 11, 12.

Cretaceous (Maestrichtian).

Subfamily ARTISCINAE Haeckel

Haeckel, 1881, p. 462; Riedel, 1967b, p. 294.

Actinommidae which very likely have the same nucleo-axoplast complex as Actinomminae.

The innermost (first) skeletal shell latticed, about 15μ in diameter. The second shell is *flattened* along the main axis of the skeleton: its dimension along that axis is no more than 40μ, while the diameter of the second shell measured in the equatorial plane is as a rule about 50μ. The second shell is joined with the third by means of numerous rods situated exactly in the equatorial plane or near it. Unlike *Axoprunum*, there are no inner polar rods. The third shell is elongated along the main axis of the skeleton, constricted in the equatorial plane. It may be surrounded on all sides, or only on the poles, by irregular chambered shells or by spongy meshwork. The most ancient representative of the subfamily seems to be like the specimen illustrated on Plate 12, Figure 1.

Genus CANNARTUS Haeckel

Cannartus Haeckel, 1881, p. 462; 1887, p. 358; Campbell, 1954, p. 74; Riedel and Sanfilippo, 1970, p. 520.

Artiscinae with spongy polar columns, without distinct polar caps. The diameter of the columns is less than the equatorial diameter of the third shell.

Cannartus prismaticus Haeckel

See Riedel and Sanfilippo, 1970, p. 520, pl. 15, fig. 1.

Cannartus tubarius (Haeckel)

Pipettaria tubaria Haeckel, 1887, p. 339, pl. 39, fig. 15; Riedel, 1959b, p. 289, pl. 1, fig. 2.

Cannartus tubarius (Haeckel), Riedel and Sanfilippo, 1970, p. 520, pl. 15, fig. 2; Kling (1971), pl. 3, fig. 3; Riedel and Sanfilippo, in press, pl. 2C, figs. 8-10.

Miocene.

Cannartus mammiferus (Haeckel)
(Plate 12, Figure 3)

Cannartidium mammiferum Haeckel, 1887, p. 375, pl. 39, fig. 16.

Cannartus mammiferus (Haeckel), Riedel, 1959a, p. 291, pl. 1, fig. 4; Riedel and Sanfilippo, 1970, p. 520, pl. 14, fig. 1; Riedel and

[1] This group was studied only by G. E. Kozlova.

Sanfilippo, in press, pl. 2C, figs. 1-3; Kling, 1971, pl. 3E; Moore, in press, pl. 12, fig. 5.
Miocene.

Cannartus violina Haeckel
(Plate 12, Figure 9, 10)

Cannartus violina Haeckel, 1887, p. 358, pl. 39, fig. 10; Riedel, 1959a, p. 290, pl. 1, fig. 3; Kling, 1971, pl. 3, fig. D; Riedel and Sanfilippo, in press, pl. 2C, figs. 4-7; Moore, in press, pl. 12, fig. 4.

Pores on the third shell 5-12μ in diameter.

Miocene.

Cannartus sp. A.
(Plate 12, Figures 11-14)

?*Cannartus haeckelianus* Vinassa, 1900, p. 547, pl. 1, fig. 44.

Cannartus sp. Riedel and Sanfilippo, in press, pl. 2B, fig. 10, only.

Differs from *C. violina* by more delicate wall of the third shell, without mammiferous papillae. The number of pores on the half circumference of the third shell is about fourteen, the diameter of the pores 3-7μ. The third shell more elongate than in *C. violina*, and it is inclined to malformations (Plate 12, Figures 13, 14). One or two irregular envelopes, extending from the equator to the polar tubes, may surround the third shell.

Having delicate, irregular (nearly spongy) surface of the main shell, and being inclined to malformations, the species in question is somewhat similar to the form of *Trigonactinium angustum* (Plate 17, Figure 3). Maybe they are both terminal stages (species, or forms) of a genus. Rare, mainly in 139-5-CC.

Miocene.

Genus ASTROMMA Ehrenberg

Astromma Ehrenberg, 1847b, p. 54; Campbell, 1954, p. 74. Type species *Astromma enthomocora* Ehrenberg, 1847 (Ehrenberg, 1854, pl. 22, fig. 32).

Cypassis Haeckel, 1887, p. 366; Campbell, 1954, p. 74 . = *Didymocyrtis* Haeckel, 1881, p. 445; Campbell, 1954, p. 74. Type species *Cypassis palliata* Haeckel (1887, pl. 40, fig. 5).

Artiscinae (Plate 12, Figure 6) with the polar caps pressed closely to the third shell. The distance between the polar cap and the pole of the third shell is less than one-quarter of the third shell's long axis.

The polar columns are initially of the same breadth of even broader than the third shell.

Astromma petterssoni (Riedel)
(Plate 12, Figure 5)

Cannartus (?) *petterssoni* in Riedel and Sanfilippo, 1970, p. 520, pl. 14, fig. 3; Moore, in press, pl. 12, fig. 7.

The walls of the third shell have mammiferous papillae. Polar columns are spongy; only one cap may be distinguished in them.

Miocene.

Astromma hughesi (Campbell and Clark)
(Plate 12, Figure 4)

Ommatocampe hughesi Campbell and Clark, 1944a, p. 23, pl. 3, fig. 12.

Ommatartus hughesi (Campbell and Clark), Riedel and Sanfilippo, 1970, p. 520; Moore, in press, pl. 12, fig. 8. *non*? *Ommatocampe hughesi* Bandy, Casey and Wright, 1971, pl. 1, fig. 3.

Differs from *A. petterssoni* by more elongate shape of the third shell and by chambered (not spongy) polar columns.

Miocene.

Genus OMMATARTUS Haeckel

Ommatartus Haeckel, 1881, p. 463; 1887, p. 395; Campbell, 1954, p. 76; Riedel and Sanfilippo, 1970, p. 521. Type species *Ommatartus amphicanna* Haeckel, 1887, aff. pl. 40, fig. 12.

?*Artiscus* Haeckel, 1881, p. 462; 1887, p. 355; Campbell, 1954, p. 74. = *Artiscium* Haeckel, 1887, p. 355; Campbell, 1954, p. 74. Type species *Artiscus paniscus* Haeckel, 1887, like pl. 40, fig. 1.

Panaronium Haeckel, 1887, p. 389; Campbell, 1954, p. 76. Type species *Panarium tubularium* Haeckel, 1887, pl. 40, fig. 9.

The third shell delicate, without any mammiferous papillae or other thickenings. There are distinct polar caps. The distance between a cap and a pole of the third shell is more than a quarter of the third shell's major axis. Therefore the caps are elongated further from the third shell than in *Astromma*. Spongy columns, if present, are as narrow as in *Cannartus*.

Ommatartus spp. aff. O. ceratospyris (Haeckel)
(Plate 12, Figure 15-17)

?*Haliomma didymocyrtis* Haeckel, 1860, p. 816. = *Didymocyrtis ceratospyris* Haeckel, 1862, p. 445, pl. 22, figs. 14-16. = *Cyphonium ceratospyris* Haeckel, 1887, p. 366.

Panartus tetrathalamus Haeckel in Nigrini, 1967, pl. 2, fig. 4b, part.

Ommatartus tetrathalamus (Haeckel), Moore, in press, pl. 12, fig. 12.

The third shell rather short, long axis about 100-150μ, minor axis (not in the equatorial plane) 80-100μ. The shape of the third shell is variable, 6-8 pores on the half circumference (not at the equator) of the third shell.

Pleistocene-Recent.

Family COCCODISCIDAE Haeckel[2]

Haeckel, 1862, p. 485; Riedel, 1967b, p. 294.

The so-called "medullary" shell is double. The first shell is about 18-30μ in diameter, and the second shell about 30-50μ in diameter. The construction is very much the same as in Artiscinae, with the exception that the second shell is joined with the third shell by means of numerous rods situated in the equatorial plane of the skeleton, but along the main axis of the skeleton. The third shell is flattened along the main skeletal axis, and has the shape of a lens.

Subfamily PHACODISCINAE Haeckel

Phacodiscidae Haeckel, 1881, p. 456; Riedel, 1967b, p. 294.

The lens of the third shell is about 130-260μ in diameter. The third shell may be armed with spines, but not with chambered or spongy arms or rings.

Genus SETHOSTYLUS Haeckel

Sethostylus Haeckel, 1881, p. 457; 1887, p. 420; Campbell, 1954, p. 81. Type species *Sethostylus distyliscus* Haeckel, 1887, pl. 31, fig. 9.

Phacostylus Haeckel, 1881, p. 457; Haeckel, 1887, p. 430; Campbell, 1954, p. 80. Type species *Phacostylus amphistylus* Haeckel (1887, pl. 31, fig. 12).

Phacodiscinae with two main spines in the equatorial plane, going from the second shell through the third shell.

Sethostylus sp. aff. Phacostylus amphistylus Haeckel
(Plate 13, Figure 1)

?*Phacostylus amphistylus* Haeckel, 1887, p. 430, pl. 31, fig. 12.

Eocene.

Genus HELIOSESTILLA Haeckel

Heliosestilla Haeckel, 1887, p. 440; Campbell, 1954, p. 78. Type species *Heliosestrum octonum* Haeckel, 1887, pl. 34, fig. 3.

Phacodiscinae with eight main spines on the margin of the lenticular third shell. The spines are situated in the equatorial plane.

Heliosestilla spicata (Haeckel)
(Plate 13, Figure 10)

?*Sethostylus spicatus* Haeckel, 1887, p. 430.

Marginal spines of variable length. This species differs from the type species of the genus by possessing unequal spines, two of them being longer than the others. The number, size and shape of pores are similar in both species.

Eocene-Oligocene.

Genus TRIACTIS Haeckel

Triactis Haeckel, 1881, p. 457; *non* Campbell, 1954, p. 81; Riedel and Sanfilippo, 1970, p. 521. *Triactiscus* Haeckel, 1887, p. 432; *non* Campbell, 1954, p. 81; but Strelkov, Chabakov and Lipman,

[2]This group was studied mainly by G. E. Kozlova.

1959, p. 433. Type species *Triactiscus tripyramis* Haeckel (1887, pl. 33, fig. 6).

Phacotriactis Sutton 1896a, p. 61; Riedel and Sanfilippo, 1970, p. 521. Type species *Phacotriactis triangula* Sutton (1896a, pl. 61, fig. 3).

Phacodiscinae with three main spines.

Triactis triactis (Ehrenberg)
(Plate 13, Figure 2)

Haliomma triactis Ehrenberg, 1873, p. 236; 1875, pl. 28, fig. 4.

Differs from *T. tripyramis tripyramis*, described by Riedel and Sanfilippo, (1970, pl. 4, fig. 8) and by Moore (in press, pl. 1, fig. 8) by the smaller number of pores on the third shell.

Eocene.

Genus HELIODISCUS Haeckel

Heliodiscus Haeckel, 1862, p. 436; 1887, p. 444; *non* Campbell, 1954, p. 82, but Nigrini, 1967, p. 32. Type species *Heliodiscus asteriscus* Haeckel (1887, pl. 33, fig. 8).

Phacodiscinae with undetermined number of spines (5-20 and more) on the margin of the third shell.

Heliodiscus asteriscus Haeckel group
(Plate 13, Figure 3)

?*Heliodiscus asteriscus* Haeckel, 1887, p. 445, pl. 33, fig. 8; Hays 1965, p. 171, pl. 3, fig. 7; Nigrini, 1967, p. 32, pl. 3, fig. 1.

Eocene?-Recent.

Heliodiscus hexasteriscus Clark and Campbell
(Plate 13, Figure 4)

Heliodiscus hexasteriscus Clark and Campbell, 1942, p. 40, pl. 3, figs. 14, 15.

Having the pores of the same character as in *H. asteriscus*, but differing in the size of the third shell.

Eocene.

Heliodiscus sp.
(Plate 13, Figure 9)

Similar to *Asteriscus echiniscus* Haeckel (1887, p. 448, pl. 34, fig. 5) in the structure of the surface, and differs in a larger dimension (to 500μ) of outermost shell.

Eocene-Oligocene.

Heliodiscus saturnalis Clark and Campbell
(Plate 13, Figure 8)

Heliodiscus saturnalis Clark and Campbell, 1942, p. 41, pl. 3, figs. 9, 9a.

Similar to *Periphaena decora* in the character of the pores on the third shell. Differs in the size of the third shell and the absence of a hyaline girdle.

Eocene.

Heliodiscus pentasteriscus Clark and Campbell
(Plate 13, Figure 6, 7)

Heliodiscus pentasteriscus Clark and Campbell, 1942, p. 39, pl. 3, fig. 8.

Eocene.

Genus PERIPHAENA Ehrenberg

Periphaena Ehrenberg, 1873, p. 246; Haeckel, 1887, p. 426; Campbell, 1954, p. 78. Type species *Periphaena decora* Ehrenberg (1875, pl. 28, fig. 6).

Perizona Haeckel, 1881, p. 457; 1887, p. 427; Campbell, 1954, p. 78. Type species *Perizona scutella* Haeckel, 1887, pl. 32, fig. 7.

Heliodiscomma Haeckel, 1887, p. 448; Campbell, 1954, p. 82. Type species *Heliodiscus cingulatum* Haeckel (1887, pl. 37, fig. 7).

The margin of the lens has a girdle. The latter may be festooned, but there are no real needles.

Periphaena decora Ehrenberg
(Plate 14, Figures 1, 2)

Periphaena decora Ehrenberg, 1873, p. 246; 1875, pl. 28, fig. 6.

Eocene-Oligocene.

Periphaena? dupla (Kozlova)
(Plate 14, Figure 3)

?*Astrophacus duplus* Koslova, in Kozlova and Gorbovetz, 1966, p. 74, pl. 12, figs. 2, 3.

Differs from *P. decora* in the character of the pores on the third shell; they are less in number, less regular, and of greater size.

Oligocene.

Periphaena sp.
(Plate 14, Figures 4, 5)

Similar to *P. decora* in the structure of the third shell, but has 6 to 10 spines of different size. The diameter of the third shell is less than in *P. decora.*

Eocene-Oligocene.

Subfamily COCCODISCINAE Haeckel

Coccodiscidae Haeckel, 1862, p. 485; Riedel, 1967b, p. 294.

Coccodiscidae with the lens of the third shell surrounded by chambered or spongy rings, arms or spines, situated in the equatorial plane of the skeleton.

Genus LITHOCYCLIA Ehrenberg sens. str.

Lithocyclia Ehrenberg, 1847a, p. 385; Haeckel, 1887, p. 459; Campbell, 1954, p. 82; Riedel and Sanfilippo, 1970, p. 522, part. Type species *Lithocyclia ocellus* Ehrenberg, 1854, pl. 36, fig. 30.

Coccodiscinae with rings, but without arms or spines.

Lithocyclia ocellus Ehrenberg sens. str.
(Plate 15, Figures 1, 2)

Lithocyclia ocellus Ehrenberg, 1854, pl. 36, fig. 30; 1873, p. 240; 1875, pl. 29, fig. 3; Riedel and Sanfilippo, in press, pl. 3A, fig. 6; Moore, in press, pl. 4, fig. 1.

Most of the specimens have a thick spongy equatorial zone surrounding the third shell (as in *L. stella* Ehrenberg, 1875, pl. 29, fig. 2). But in some specimens the outer zone consists of distinct concentric (or spiral) chambered rings (as in *L. ocellus* Ehrenberg, 1875, pl. 29, fig. 3). These two forms may be considered as variations of a single species: very often one can see intermediate specimens possessing a spongy ring, concentrically zoned.

Diameter of the first shell 15-18μ, of the second 40-45μ, of the third 90-100μ. Diameter of the pores on the third shell about 3-4μ.

Eocene-Oligocene.

Lithocyclia sp. aff. L. lenticula Haeckel
(Plate 15, Figure 3)

?*Lithocyclia lenticula* Haeckel, 1887, p. 459, pl. 36, fig. 3.

This form differs from *L. lenticula* in the character of the pores on the third shell; they are more numerous (18 to 20 on the diameter) and of smaller size. The outer zone consists of only two porous rings. It is more delicate in structure and less regular than the third shell. The margin has a number of small spines. Diameter of the first shell 15-18μ, of the second shell 45-50μ, of the third shell 135-140μ; diameter of the shell with rings 210-220μ. Diameter of the cortical pores 5-6μ.

Eocene.

Genus STYLOCYCLIA Ehrenberg

Stylocyclia Ehrenberg, 1847, p. 54; Haeckel, 1887, p. 462; Campbell, 1954, p. 82. Type species *Stylodictya dimidiata* Ehrenberg.

Coccodiscinae with two spines.

Stylocyclia dimidiata Ehrenberg
(Plate 15, Figure 4)

Stylocyclia dimidiata Ehrenberg, 1873, p. 256; 1875, pl. 29, fig. 4.

Diameter of the second shell 50-60μ, of the third shell 110-120μ; diameter of the test with the outer zone 230-250μ. Length of the spines 180-250μ.

Eocene.

Genus TRIGONOCYCLIA Haeckel

Trigonocyclia Haeckel, 1881, p. 458; 1887, p. 464; Campbell, 1954, p. 82. Type species *Trigonocyclia triangularis* Haeckel (1887, pl. 37, fig. 5).

Coccodiscinae with three spines.

Trigonocyclia prima Kozlova sp. n.
(Plate 15, Figure 6)

Medullary shell double. Phacoid cortical shell without a secondary spongy layer, with circular to subcircular pores, 14 to 18 on the diameter. Cortical shell surrounded by a single wide porous ring, the porous structure of which is less regular than that of the cortical shell. The spines three-bladed, short, acute, originating within the cortical shell, do not form a regular triangle. Diameter of the inner medullary shell 15-18μ, of the second shell 40-50μ, of the third (cortical) shell 120-130μ, of the shell with porous ring 190-200μ. Diameter of the pores on the cortical shell 6-10μ. Length of the spines 50-80μ.

Eocene.

Trigonocyclia (?) sp. A
(Plate 15, Figure 5)

The first and second shells constitute a so-called double medullary shell. The phacoid cortical shell (the third) has distinct circular to subcircular pores, 8 to 9 pores on the diameter. The outer zone consists of four concentric porous rings, the outermost being covered by secondary spongy layers. The spines are short, three-edged. They form a regular triangle. Diameter of the second shell about 50μ, of the third shell about 90μ; diameter of the skeleton with the outer zone about 220μ. Diameter of the cortical pores 5-9μ. Length of the spines up to 50μ.

Remarks: This species differs from typical Coccodiscinae in the ratio of the diameters of the second and third shells. As a rule the diameter of the third shell is three times greater than the diameter of the second shell. But in *Trigonocyclia* (?) sp.A this ratio is less, the diameter of the third shell being only twice that of the second shell. A species with this ratio was described by S. Tochilina (1970) as a new genus *Hexacyclia*. A more detailed study may result in the assignment of *Trigonocyclia*(?) sp.A to *Hexacyclia*.

Eocene.

Genus TRIGONACTINIUM Haeckel

Trigonactinium Haeckel, 1887, p. 472; Campbell, 1954, p. 84. Type species *Trigonactura triacantha* Haeckel (1887, pl. 38, figs. 6, 7).

Coccodiscinae with three chambered or spongy arms extending from the third shell.

Trigonactinium pythagorae (Ehrenberg)
(Plate 17, Figure 1)

Astromma pythagorae Ehrenberg, 1873, p. 217; 1875, pl. 30, fig. 2.
Hymeniastrum pythagorae Ehrenberg, 1854, pl. 36, fig. 31; 1873, pl. 237; 1875, pl. 30, fig. 5.
Lithocyclia aristotelis group Riedel and Sanfilippo, 1970, p. 522, part.; Riedel and Sanfilippo, in press, pl. 3A, fig. 5, part.; Moore, in press, pl. 4, fig. 4, part.

Eocene-Oligocene.

Trigonactinium (?) angustum (Riedel) sens. str.
(Plate 17, Figure 3)

Trigonactura angusta Riedel, 1959a, p. 292, pl. 1, fig. 6.
Lithocyclia angustum (Riedel) Riedel and Sanfilippo, 1970, p. 522, pl. 13, figs. 1, 2? Riedel and Sanfilippo, in press, pl. 3A, fig. 5, part.

Differs from the typical *Trigonactinium* in having very narrow arms. The irregular pores and even spongy surface of the third shell are also characteristic.

Oligocene.

Genus ASTRACTINIUM Haeckel

Astractinium Haeckel, 1887, p. 476; Campbell, 1954, p. 83. Type species *Astromma aristotelis* Ehrenberg

Coccodiscinae with four chambered or spongy arms, arising from the third shell.

Astractinium aristotelis group
(Plate 16, Figures 1-5)

Astromma aristotelis Ehrenberg, 1847b, p. 55, fig. 10; 1873, p. 217; 1875, pl. 30, figs. 3, 4.
Astromma pentactis Ehrenberg, 1873, p. 217; 1875, pl. 30, fig. 1.
Lithocyclia aristotelis group Riedel and Sanfilippo, in press, pl. 3A, figs. 2, 4, part; Moore, in press, pl. 4, fig. 5, part.

The diameter of the third shell about 110μ, pores on it about 4-5μ. There are various forms (subspecies or even species?) in this group.

Eocene-Oligocene.

Astractinium spp. aff. Lithocyclia crux Moore
(Plate 16, Figures 8, 9)

Lithocyclia crus Moore, in press, pl. 6, fig. 4.

Oligocene.

Astractinium (?) sp. C
(Plate 16, Figure 10)

This form is similar to *Trigohactinium*(?) *angustum* in having very narrow arms and irregular (nearly spongy) surface of the third shell. It differs from *T.* (?) *angustum* in the rounded outline of the main shell, and in possessing four (instead of three) arms.

Oligocene.

Genus ASTROCYCLIA Haeckel

Astrocyclia Haeckel, 1881, p. 458; 1887, p. 466; Campbell, 1954, p. 82. Type species *Astrocyclia solaster* Haeckel (1887, p. 36, fig. 7).

Coccodiscinae with numerous radial spines.

Astrocyclia sp.
(Plate 15, Figure 7)

Lithocyclia ocellus group Riedel and Sanfilippo, 1970, p. 522, pl. 5, fig. 2, part.

The cortical shell (the third) rounded-polygonal, with circular to subcircular pores, occasionally very small, about 16 to 20 on the diameter of the shell. There are 6 to 8 outer spines. The outer zone consists of concentric porous rings, all of them covered by a thick spongy layer.

The spines three-edged, acute, originating within the cortical shell. Diameter of the second shell 40-50μ, of the third shell 100-110μ, of the skeleton with the outer zone 210-230μ. Diameter of the cortical pores 3-6μ. The spines are about 100μ in length.

Eocene.

Family PORODISCIDAE Haeckel emend. Kozlova

Haeckel, 1887, p. 481; Riedel, 1967b, p. 296; Kozlova, 1967a, p. 1171.

For some time, this group has been studied by one author, G. E. Kozlova. She believes some porodiscids belong to a new genera. Though M. G. Petrushevskaya had studied some species and genera, and had discussed these data and drawn some conclusions, she is not the author of these genera, therefore, the genera are signed by one name.

Emended diagnosis: The central shell is latticed, spherical or ellipsoidal, about 12-20μ in diameter. It is surrounded by a system of three bands–frontal, sagittal and equatorial, very much the same as in *Larcoidea* (see Jörgensen, 1905, pl. 10, fig. 42). Each band consists of two curved porous plates or wings, which may even form cupolas. The wings of the three bands surrounding the central shell come into contact and form the first chambered system. It is about 30-50μ in diameter.

The first system of porous bands is surrounded by the second system, the third, etc. The flattening of the skeleton results because in the second and following systems the frontal and the sagittal bands are constricted along the main axis (Plate 19, Figures 5, 6, 11). They do not enclose the whole preceding system, but the growth of each following system begins from the margin of the preceding system. The difference from Larcoidea is that in Larcoidea the subsequent systems enclose one another entirely.

In Porodiscidae there are no gates, of the type characteristic for Larcoidea.

In Porodiscidae, incomplete frontal and sagittal bands of the following systems are on the surface, and form the outside walls of the flattened skeleton. The equatorial bands are complete. They are usually seen as rings, spirals or more complicated figures characteristic for Porodiscidae.

There are four main radial spines, lying in the equatorial plane of the disk, going from the central shell in two perpendicular directions. There are some additional spines, lying in the same plane, going from second and subsequent systems. There are also secondary spines inclined to the equatorial plane. They are joined from inside with the outside walls of the skeleton, and they are rarely seen.

Genus Porodiscus Haeckel, 1881, emend. Kozlova

Flustrella Ehrenberg, 1838, p. 122; *Porodiscus* Haeckel, 1887, p. 491 (part.); *Flustrella* Campbell, 1954, p. 89, (part); *Stylodictya* Campbell, 1954, p. 92 (part.) Type species *Porodiscus concentrica* (Ehrenberg) 1838, p. 132.

The skeleton is flat or slightly concave in its center, has a rounded outline and is composed of annular equatorial rings (the rest is not developed); first system is of the *Archidistcus* type (central chamber and one ring), d ≈ 30μ, very rarely submerged in the skeleton; distance between the annular rings is less than or equal to the diameter of the initial chamber. Main spines are indistinct and as a rule cannot be distinguished from the secondary spines, the number of which in the latter systems exceeds fifty. The rim of the skeleton is either smooth or covered by numerous spines.

Remarks: Rings in *Porodiscus* sometimes merge into a spiral.

Differs from the genus *Stylodictya* by the absence of cupola-shaped chambers in the first system and by the more or less constant width of the rings.

Early Cretaceous-Recent.

Porodiscus cretaceus Campbell and Clark
(Plate 5, Figure 6, 7)

Porodiscus cretaceus Campbell and Clark, 1944, p. 15, pl. VI, fig. 7.

Disc diameter 90-210μ, width of ring 10-13μ; diameter of pores 2-5μ.

Campanian-Maestrichtian.

Porodiscus delicatulus Lipman
(Plate 5, Figures 8, 9)

Stylodictya delicatula Lipman, 1954, p. 33, pl. 1, figs. 19-20.

Specimens from the Atlantic have a smaller number of rings; its central part is covered by spongy tissue; in some specimens rings are joined in a spiral (Figure 9).

Diameter of disc 110-170μ, width of rings 10-13μ.

Campanian-Maestrichtian.

Porodiscus concentricus (Ehrenberg)
(Plate 18, Figure 11)

Flustrella concentrica Ehrenberg, 1838, p. 132; 1854, pl. 19, fig. 61; 1875, p. 72, pl. 22, fig. 13.

Trematodiscus concentricus (Ehrenberg) Haeckel, 1862, p. 493; *Trematodiscus concentricus* (Ehrenberg) Stöhr, 1880, p. 108; *Porodiscus concentricus* (Ehrenberg) Haeckel, 1887, p. 492.

Eocene-Oligocene.

Genus THOLODISCUS Kozlova, new genus

Stylodictya Ehrenberg, 1838 (part.); *Porodiscus* Haeckel, 1881, p. 491 (part.), *Staurodictya* Haeckel, 1881, p. 506 (part.). Type species *Stylodictya ocellata* Ehrenberg (1875, p. 84, pl. 23, fig. 7).

Skeleton is flat or slightly concave, rounded-multiangular or rounded-quadrangular in outline. Consists of equatorial and sagittal rings (frontal ring is not developed); wings of the rings are displaced at 45° in relation to the main axis, and have a cupola-like structure, quite clearly expressed in the first systems and less distinct in the subsequent ones, where the wings are elongated in the direction of the periphery of the disc. At the point of their merging, the wings become overlapped by each other and form four zig-zag lines in the direction of the main axes.

First system of the *Tholostaurus* type (*in sensu* Haeckel), diameter ≈ 40-50μ, is not submerged into the skeleton; the distance between systems (width of cupolas) is larger than or equal to the diameter of the central chamber, four main radial spines going from the central shell; four additional–from the tops of the cupolas of the first system; both often are transformed into the outside spines.

Tholodiscus differs from the related genus *Stylodictya* by the type of wings–cupola connection, which forms four zig-zag radial lines, and also by the multiangular outline of its disc.

The name is derived from Greek "Tholos" (dome) and "Discos" (disk), masculine.

Tholodiscus fresnoensis (Foreman)
(Plate 5, Figure 1)

Staurodictya(?) sp. Koslova and Gorbovets, 1967, pl. 4, fig. 2.
Staurodictya(?) *fresnoensis* Foreman, 1968, p. 14, pl. 11, fig. 2.

Campanian-Maestrichtian.

Tholodiscus sp.
(Plate 5, Figure 5)

Nine to ten concentric systems of the same width; shell is thin-walled, with two pores on a ring; rim is devoid of spines, the middle is overgrown by spongy tissue.

Disc diameter 200-240μ width of a ring 12-13μ, diameter of pores 2-3μ.

Campanian-Maestrichtian.

Tholodiscus ocellatus (Ehrenberg)
(Plate 18, Figures 1, 2)

Stylodictya ocellata Ehrenberg, 1875, p. 84, pl. 23, fig. 7.
Staurodictya ocellata (Ehrenberg), Haeckel, 1887, p. 508.

Skeleton is irregularly quadrangular, consisting of 3-4 systems; width of the cupolas is relatively large, especially in the last systems; zig-zag radial lines are clearly expressed, pores are round. On the first system pores are half the size of most on the others; there are 3-4 pores on the width of a cupola. Four rather thick and long, three-bladed spines are arranged at right angles.

Disc diameter 140-170μ, width of cupolas 12μ (first system), 40μ (fourth system); pore diameter 7-8μ, in the first system 3μ; length of spines exceeds 100μ.

Oligocene.

Tholodiscus splendens (Ehrenberg)
(Plate 18, Figures 3-5)

Stylodictya splendens Ehrenberg, 1875, p. 84, pl. 23, fig. 9.
Stylodictya clavata Ehrenberg, 1875, p. 84, pl. 23, fig. 2.
Staurodictya splendens (Ehrenberg) Haeckel, 1887, p. 508.
Stylodictya clavata Ehrenberg, Haeckel, 1881, p. 513.

Skeleton is rounded-quadrangular, consisting of 6-10 systems of almost the same width; porous shell has two, or seldom three, round pores on a ring; radial spines are thick, their number varies from 4 to 8; small, numerous inner radial spines lend a "chamber-like" appearance to the rings.

Disc diameter 200-270μ, width of rings 15μ, diameter of pores 4-5μ, length of external spines 60-170μ.

Eocene-Oligocene.

Genus STYLODICTYA Ehrenberg 1847, emend. Kozlova

Stylodictya Ehrenberg, 1847, p. 54, (part.); *Porodiscus* Haeckel, 1881, p. 491 (part.); *Staurodictya* Haeckel 1881, p. 506 (part.); *Stylodictya* Haeckel, 1881, p. 509 (part.) Type species *Stylodictya gracilis* Ehrenberg, 1854, p. 246.

Skeleton is flat or slightly concave with round outline; consists of equatorial and sagittal girdles (frontal girdle is not developed), wings of the rings are displaced at 45° in relation to the main axes; at their merging point they do not envelope each other and thus form girdles of regular round or scalloped form, especially distinctive in the first systems. The first system is close to *Tholostaurus* (cupolas do not overlap each other), diameter ≈ 30-40μ, not submerged into the skeleton; the distance between systems is greater than or equal to the diameter of the central chamber.

The main and additional spines are well developed and often extend as external spines. Rim of the disc is smooth with 4, 8, or more spines.

Differs from *Tholodiscus* new gen. by the annular character of the wing connection, by the absence of the zig-zag radial lines in the plane of the disc, and by its more regular round outline.

Eocene-Recent.

Stylodictya inaequalispina Clark and Campbell
(Plate 18, Figure 8)

Stylodictya inaequalispina Clark and Campbell, 1942, p. 45, pl. 3, fig. 5.

Disc diameter 150-190μ; width of rings 12μ, pore diameter 4-6μ (in center 2μ), length of spines up to 50μ.

Eocene-Oligocene.

Stylodictya rosella, Kozlova sp. n.
(Plate 18, Figure 9)

Stylodictya sp. Clark and Campbell, 1945, p. 24, pl. 3, fig. 19.

Central chamber is surrounded by 9-11 slightly curved (scalloped) annular systems, each system doubling in size beginning in the center to the edge of the disc; pores are found, 2 or 3 on each ring, approximately of the same size; there are up to twenty-four inner spines of uniform thickness; at the rim of the disc they appear either as thin spicules or as massive flat teeth.

Disc is very thin in its central part and becomes very thick at the rim (the last 5 to 6 rings).

Disc diameter 250-270μ, width of rings 7-16μ, pore diameter 3-4μ; diameter of the first system 24μ.

It differs from *S. targaeformis* (see below) by larger dimensions, the thickness along its rim, and by a greater number of spines.

Eocene-Oligocene.

Stylodictya targaeformis (Clark and Campbell)
(Plate 18, Figure 10)

Staurodictya targaeformis Clark and Campbell, 1942, p. 43, pl. 3, fig. 6.

Specimens from Atlantic have eight external spines.

Disc diameter 170-200μ; width of rings 5-10μ; pore diameter 2-5μ, length of spines 40μ; diameter of the first system 30μ.

Eocene-Oligocene.

Stylodictya orbiculata (Haeckel)
(Plate 18, Figure 7)

Trematodiscus orbiculatus Haeckel, 1862, pl. 28, fig. 2.
Porodiscus orbiculatus Haeckel, 1887, p. 492.

Disc diameter 125-140μ, width of rings 7-15μ; pore diameter 5μ.

Eocene-Oligocene.

Stylodictya aculeata (Jörgensen)
(Plate 18, Figure 6)

Stylodictya aculeata Jörgensen, 1905, p. 119, pl. 10, fig. 41; Petrushevskaya, 1967, p. 35, pl. 11, figs. 1-3.

Quaternary.

CIRCODISCUS Kozlova, new genus

Porodiscus Haeckel, 1881, p. 491, (part.); *Ommatodiscus* Stöhr, 1880, p. 115 (part.); *Flustrella* Campbell, 1954, p. 89 (part.) Type species *Trematodiscus microporus* Stöhr, 1880, p. 108, pl. 4, fig. 17.

Slightly convex skeleton with round or oval outline. Consists of frontal, sagittal and equatorial girdles, their wings connected to form regular round or oval rings.

First system is of the *Trizonium* type (*in sensu* Haeckel), its dimension ≈ 30-40μ, with fully developed girdles; in the rest of them, only the equatorial girdle is fully developed; saggital and frontal girdles terminate at the point of the junction with the ring of the previous system; distance between (width of rings) is considerably larger than the diameter of the central chamber. Spines (four main and four secondary) pass inside of the skeleton. Rim is smooth.

It differs from *Plectodiscus* gen. nov., by the character of the connection of its wings and accordingly by the structure of the first system.

The name is derived from Greek "Circos" (circle) and "Discos" (disk), masculine.

Eocene-Recent.

Circodiscus microporus (Stöhr)
(Plate 19, Figure 1-7)

Trematodiscus microporus Stöhr, 1880, p. 108, pl. 4, fig. 17.
Porodiscus microporus Stöhr, Haeckel, 1887, p. 493.

Skeleton is oval, flat, consisting of 3 or 4 comparatively wide, oval, annular girdles; pores are even, circular, 5 or 6 on each ring. Inner spines (8?) do not extend outside; rim of the disc seldom has a smooth, clearly outlined tapered edge; more often it is "torn" and disconnected.

Disc diameter with four systems 180-200μ width of rings 25-35μ, pore diameter 5-8μ.

Miocene-Quaternary.

Circodiscus sp.
(Plate 19, Figure 8)

From *C. microporus* it differs by having wider rings and smaller pores.

Disc diameter (with three systems) 160μ, width of rings 30-40μ, pore diameter 3-4μ.

Miocene.

Genus PLECTODISCUS Kozlova, new genus

Discospira Haeckel, 1862 (part.); *Porodiscus* Haeckel, 1882, p. 492 (part.); *Flustrella* Campbell 1954, p. 89 (part.). Type species *Porodiscus circularis* Clark and Campbell, 1945, p. 42, pl. 11, figs. 2, 6, 10.

Thin, biconvex skeleton, with oval, less frequently circular outline, consisting of frontal, equatorial and sagittal girdles. The closed-spiral structure of girdles is of the *Spironium* type: wings of the same type of girdle form a one-half turn of the spiral, and at the point of their juncture overlap each other. First system has fully developed girdles, its dimensions are 40 × 50μ; in the rest of the girdles, only the equatorial girdle is fully developed, both saggital and frontal girdles terminating at the point of their junction with the previous system. Distance between rings is greater than is the diameter of the central chamber. Inner spines are indistinct; rim of the disc is smooth or is covered by numerous short spines.

Depending on the degree of inclination of the plane of the girdles in relation to the main axes of the skeleton, the equatorial girdles appear from the surface (rest of girdles in corresponding cross-section) in the form of rings, as a single or double spiral, or in the form of rings connected by zigzag radial lines.

The name is derived from Greek "plecta" (interlacing) and "Discos" (disk), masculine.

Paleocene-Oligocene.

Plectodiscus circularis (Clark and Campbell)
(Plate 19, Figures 9-12)

Porodiscus circularis Clark and Campbell, 1942, p. 42, pl. 11, figs. 2, 6, 10.
Porodiscus uralicus Lipman, 1960, p. 86, pl. XI, figs. 9-11; *Porodiscus durus* Moksyakova, p. 146, pl. 2, fig. 8.

Skeleton is oval, less frequently circular in outline, consisting of 4 to 6 systems, the width of which increases slightly from the center toward the rim of the disc; all possible varieties of the outer forms of the girdle are represented here: the enclosed-spiral (Plate-Figure 12), annular (Plate-Figures 9, 10) and spiral; pores are round and of uniform size, four or five on the width of each system; disc rim is tapered; main and secondary radial spines are of uniform thickness and appear at the rim of the disc in the form of (16?) tiny spicules.

Disc diameter 120-250μ, distance between systems 20-35μ, pore diameter 6-9μ.

Paleocene?-Eocene. Paleocene forms have a coarser and larger skeleton.

Plectodiscus bergontianus (Carnevale)
(Plate 19, Figure 13)

Porodiscus bergontianus Carnevale, 1908, p. 23, pl. 4, fig. 2.
Porodiscus squinaboli Carnevale, 1908, p. 23, pl. 4, fig. 3.

Disc diameter 230-240μ, width of rings 15-20μ, pore diameter 5-7μ.

This form differs from *P. circularis* by the greater number of systems and their smaller width.

Eocene.

Genus OMMATOCAMPE Ehrenberg

Ommatocampe Ehrenberg, 1860, p. 852; Haeckel, 1887, p. 392; Campbell, 1954 p. 76. Type species *Ommatocampe polyarthra* Ehrenberg, 1872b, pl. 6, fig. 9.

Amphymenium Haeckel, 1881, p. 460; 1887, p. 519; Campbell, 1954, p. 86. Type species *Amphymenium zygartus* Haeckel, 1887, pl. 44, fig. 7.
Ommathymenium Haeckel, 1887, p. 520; Campbell, 1954, p. 88. Type species *Amphymenium amphistylium* Haeckel, 1887, pl. 44, fig. 9.

Porodiscidae with two chambered arms. Very often with patagium.

Ommatocampe spp. aff. Amphymenium amphistylium Hck.
(Plate 20, Figures 1, 2)

?*Amphymenium amphistylium* Haeckel, 1887, p. 520, pl. 44, fig. 9.

Central chamber about 18μ in diameter.

Paleogene.

Genus TRIGONASTRUM Haeckel

Trigonastrum Haeckel, 1887, p. 538; Campbell, 1954, p. 88. Type species *Trigonastrum regulare* Haeckel, 1887, pl. 43, fig. 16.
?*Chitonastrum* Haeckel, 1881, p. 460; 1887, p. 536; Campbell, 1954, p. 86. Type species *Chitonastrum triglochin* Haeckel, 1887, unfigured.

Porodiscidae with three chambered arms, rarely with patagium.

Trigonastrum sp. aff. Chitonastrum lyra Haeckel
(Plate 20, Figure 3)

?*Chitonastrum lyra* Haeckel, 1887, p. 538, pl. 43, fig. 15.

Differs from *C. lyra* by shorter and unforked arms. Although it has the same outline as *Euchitonia elegans* (see Nigrini, 1967, pl. 4, fig. 2), *Trigonastrum* sp. differs from it in having chambered, not spongy, arms.

Pliocene-Quaternary.

Trigonastrum sp. aff. Euchitonia muelleri Haeckel
(Plate 20, Figure 4)

In *Euchitonia muelleri* (=*E. furcata*, type species of genus *Euchitonia*, described by C. Nigrini, 1967, p. 37) the arms are spongy. In the species in question they are chambered. The other characters are nearly the same in both species.

Pliocene-Quaternary.

Genus STEPHANASTRUM Ehrenberg

Stephanastrum Ehrenberg, 1847, p. 54; Haeckel, 1887, p. 548; Campbell, 1954, p. 88. *Stephanastromma* Haeckel, 1887, p. 549; Campbell, 1954, p. 88. Type species *Stephanastrum rhombus* Ehrenberg, 1854, pl. 25, fig. 1.

Four-armed Porodiscidae with the central disc having 2 or 3 systems of chambered elongated rings.

Stephanastrum sp. aff. S. rhopaloporum Haeckel
(Plate 20, Figures 10, 11)

?*Stauralastrum rhopaloporum* Haeckel, 1887, p. 541, pl. 45, fig. 1.
?*Histiastrum boseanum* Haeckel, 1887, p. 546, pl. 45, fig. 1.

The ends of the arms are widened (often broken). Rare five-armed malformations exist.

The species differs from *S. rhombus* only in the absence of the rhombic patagium.

Eocene-Oligocene.

Family PSEUDOAULOPHACIDAE Riedel[3]

Pseudoaulophacidae Riedel, 1967a, p. 148.

Genus PSEUDOAULOPHACUS Pessagno

Pseudoaulophacus Pessagno, 1963, p. 200. Type species *Pseudoaulophacus florensis* Pessagno, 1963, pl. 2, figs. 2, 5.

Biconvex lens, circular, irregular or nearly triangular from above. Spines on the equatorial margin of the test.

Pseudoaulophacus superbus (Squinabol)
(Plate 3, Figures 1-3)

Theodiscus superbus Squinabol, 1914, p. 271, pl. 10, fig. 4.

Cretaceous (Albian-Maestrichtian).

[3]This group was studied by G. E. Kozlova.

Pseudoaulophacus gallowayi (White)
(Plate 6, Figure 1)

Baculogypsina? *gallowayi* White, 1928, p. 305, pl. 41, figs. 9-10.
Pseudoaulophacus gallowayi (White) Pessagno, 1963, p. 202, pl. 2, figs. 1, 3, 6; pl. 4, figs. 2, 5, 7; pl. 7, figs. 2, 4.

Differs from *P. superbus* in 1) the greater dimensions of the disc, 2) the more delicate pseudoaulophacid meshwork, the triangular frames being larger, and 3) its longer spines.

Cretaceous (Cenomanian-Maestrichtian).

Pseudoaulophacus sp. aff. P. pargueraensis Pessagno
(Plate 3, Figures 10-12)

?*Pseudoaulophacus pargueraensis* Pessagno, 1963, p. 204, pl. 2, figs. 4, 7.

Differs from *P. pargueraensis* by the absence of spines on the equatorial margin, but this may be because of unsatisfactory preservation.

Cretaceous (Early Campanian).

PATELLULA Kozlova, new genus

Type species *Stylospongia planoconvexa* Pessagno, 1963, pl. 3, figs. 4-6.

Includes a discoids with skeletons, planoconvex in cross section and subcircular in outline, consisting throughout of pseudoaulophacid meshwork. There are spines on the equatorial margin. On the plane surface a pit or a funnel may be present.

Remarks: This genus differs from *Pseudoaulophacus* in the shape of the skeleton. It differs from *Stylospongia* Haeckel, 1860 (type species *Stylospongia hexleyi* Haeckel, 1862, pl. 28, fig. 7) in the type of meshwork: this genus is characterized by pseudoaulophacid structure, and *Stylospongia* by spongy structure

Species belonging to this genus were described by Squinabol from Euganean Cretaceous deposits: *Stylotrochus helios* Squinabol, 1903, pl. 10, fig. 23; *Dactylodiscus cayeuxi* Squinabol, 1903, pl. 9, fig. 18 and discoid gen. sp. indet. Squinabol, 1903, pl. 9, fig. 21.

The name is derived from Greek, "Patella" (saucer), feminine.

Campanian.

Patellula planoconvexa (Pessagno)
(Plate 3, Figure 13)

Stylospongia planoconvexa Pessagno, 1963, p. 199, pl. 3, figs. 4-6; pl. 6, fig. 1.

Cretaceous (Early Campanian).

Patellula verteroensis (Pessagno)
(Plate 3, Figures 8, 9)

Stylospongia verteroensis Pessagno, 1963, p. 199, pl. 3, figs. 1-3; pl. 6, figs. 2, 3; pl. 7, figs. 3-6.

Cretaceous (Early Campanian).

Genus HAGIASTRUM Haeckel, emend.

Hagiastrum Haeckel, 1881, p. 460; 1887, p. 542; Campbell, 1954, p. 94. Type species *Hagiastrum plenum* Rüst, 1885, pl. 23, fig. 10.
X-astrum Neviani, 1900, p. 657.

Skeleton very much the same as in *Spongasteriscus* and in *Stephanastrum*. It consists of a central solid disc or sphere provided with four arms (often armed by spines), the arms being of the same solid structure as the central part. The difference is that in *Hagiastrum* this structure is pseudoaulophacoid, while in *Spongasteriscus* it is spongy and in *Stephanastrum* porodiscoid.

Hagiastrum sp. aff. Stauralastrum euganea Squinabol
(Plate 6, Figures 4, 5)

Stauralastrum euganea Squinabol, 1903, p. 123, pl. 9, fig. 19.
Pseudoaulophacid gen. sp. Riedel and Sanfilippo, 1970, pl. 2, fig. 7.

Specimens in our material have the arms shorter than those in Squinabol's material.

Albian-Maestrichtian.

Subfamily DACTYLIOSPHAERIDAE Squinabol
Genus DACTYLIOSPHAERA Squinabol, emend. Kozlova

Dactyliosphaera Squinabol, 1904, p. 196; Campbell, 1954, p. 68. Type species *Dactyliosphaera silvae* Squinabol, 1904, pl. 9, fig. 21.

Emended diagnosis. Skeleton is a biconvex lens. Central part represents by itself a sphere (hollow??). Sphere is surrounded in its equatorial plane by a thick ring composed of a dense pseudo-aulophacoid meshwork.

Dactyliosphaera sp. aff. Lithocyclia jüsta
(Plate 3, Figure 16)

?*Lithocyclia jüsta* Rüst, 1888, p. 197, pl. 24, fig. 6.

Diameter of the whole skeleton about 150μ, of the central sphere 65-70μ. This species differs from typical *L. jüsta* Rüst by the ratio of the dimensions of the sphere and ring.

Cretaceous (Early Campanian).

Family SPONGODISCIDAE Haeckel

Spongodiscidae Haeckel, 1862, p. 452; Riedel, 1967b, p. 295.

The skeleton, flattened along the main axis, consists of so-called spongy substance. It represents by itself small chambers. They are disposed irregularly or in a dense spiral, or in closely disposed spheres. The central chamber is usually not visible.

Genus SPONGODISCUS Ehrenberg

Spongodiscus Ehrenberg, 1854, p. 237; Haeckel, 1881, p. 461; 1887, p. 567; Campbell, 1954, p. 93. *Spongodisculus* Haeckel, 1887, p. 576; Campbell, 1954, p. 93. Type species *Spongodiscus resurgens* Ehrenberg.

Spongodiscidae with discoid (lenticular) skeleton without arms or any other subdivisions. On the surface, a plate with small pores ("gown") may be present. Very often there is a pylome. No strong outside radial spines.

Spongodiscus resurgens Ehrenberg typ.
(Plate 21, Figure 5)

Spongodiscus resurgens Ehrenberg, 1854, pl. 35B, F, Fig. 16.

Delicate spongy disc without gown, about 100μ in diameter. Pylome tube is indistinct.

Pliocene-Quaternary.

Spongodiscus resurgens Ehrenberg osculosa (Dreyer)
(Plate 21, Figure 4)

Spongopyle osculosa Dreyer, 1899, p. 42, figs. 99, 100; Riedel, 1958, p. 226, pl. 1, fig. 12.

Disc of the same delicate spongy structure as in *S. resurgens* typ., 190-270μ in diameter, very often with "gown". Pylome tube distinct.

Middle Miocene-Recent (in Antaractic).

In the Paleogene, *Spongodiscus* species existed with rougher, spongy, even lithelid, structure (Plate 21, Figures 1, 3).

Genus SPONGOTROCHUS Haeckel

Spongotrochus Haeckel, 1860, p. 844; 1887, p. 585; Campbell, 1954, p. 94. = *Spongotrochiscus* Haeckel, 1862, p. 463; 1887, p. 585; Campbell, 1954, p. 94. Type species *Spongotrochus brevispinus* Haeckel, 1862, pl. 27, figs. 4-5.

Spongodiscidae with the flattened skeletal lens provided with numerous spines.

Spongotrochus? spp.
(Plate 3, Figure 4; Plate 5, Figures 11, 12)

Cretaceous (Maestrichtian).

Spongotrochus? polygonatus Clark and Campbell
(Plate 4, Figures 9, 10)

Spongotrochus polygonatus Clark and Campbell, 1944b, p. 19, pl. 5, figs. 2, 10, 11

Cretaceous (Campanian-Maestrichtian).

Spongotrochus longispinus Haeckel
(Plate 21, Figure 15)

Spongotrochus longispinus Haeckel, 1887, p. 463, pl. 27, figs. 2, 3.

Diameter of the disc about 200μ.

Miocene-Quaternary.

Genus SPONGOTRIPUS Haeckel

Spongotripus Haeckel, 1881, p. 461; 1887, p. 580; Campbell, 1954, p. 94. Type species *Spongotripus regularis* Haeckel, 1887, unfigured.

Spongodiscidae with discoidal skeleton provided with three main spines.

Cretaceous-Paleogene.

Spongotripus morenoensis Campbell and Clark
(Plate 6, Figures 2, 3)

Spongotripus morenoensis Campbell and Clark, 1944b, p. 19, pl. 5, fig. 1.

Our specimens have somewhat greater dimensions than do specimens from Campbell and Clark's material.

Cretaceous (Maestrichtian).

Spongotripus sp.
(Plate 21, Figure 2)

This species is somewhat similar to *Tripodictya triacantha* Haeckel (1887, pl. 42, fig. 7), but it has a spongy skeleton, while in *T. triacantha* chambered rings are distinct.

Eocene-Oligocene.

Genus SPONGASTER Ehrenberg

Spongaster Ehrenberg, 1860, p. 833; Haeckel, 1881, p. 462; 1887, p. 596; Campbell, 1954, p. 94; Riedel and Sanfilippo, 1970, p. 522. *Spongastrella* Haeckel, 1887, p. 597; Campbell, 1954, p. 94. Type species *Spongaster tetras* Ehrenberg.

Schizodiscus Dogiel and Reshetnjak, 1952, p. 8. Type species *Schizodiscus disymmetricus* Dogiel (see pl. 21, fig. 14.).

Spongodiscidae with discoidal skeleton without arms or spines. The spongy disc may be subdivided into one central and 4-6 peripheral thick masses separated by thinner (more transparent) spongy bands (a kind of patagium?).

Spongaster sp.
(Plate 21, Figure 13)

Elongated, nearly ellipsoidal *Spongaster*, somewhat similar to *Spongurus* sp. in Kruglikova, 1969, pl. 4, Fig. 33.

Miocene.

Genus OMMATOGRAMMA Ehrenberg

Ommatogramma Ehrenberg, 1860; Haeckel, 1887, p. 519; Campbell, 1954, p. 88. Type species *Ommatogramma naviculare* Ehrenberg, 1872b, pl. 6, fig 7.

Spongurus Haeckel, 1862, p. 465; 1881, p. 461; 1887, p. 343; Campbell, 1954, p. 74. Type species *Spongurus cylindricus* Haeckel, 1862, pl. 27, fig. 1.

Spongocore Haeckel, 1887, p. 345; Campbell, 1954, p. 74. = *Spongocorina* Haeckel, 1887, p. 345; Campbell, 1954, p. 74. Type species *Spongocore velata* Haeckel, 1887, not illustrated.

Spongocorisca Haeckel, 1887, p. 345; Campbell, 1954, p. 74. Type species *Spongocore puella* Haeckel, 1887, pl. 48, fig. 6.

Spongodiscidae with nearly cylindrical (constricted) skeleton, often surrounded by a patagium.

Ommatogramma sp. aff. Amphibrachium robustum Vinassa
(Plate 21, Figure 10)

?*Amphibrachium robustum* Vinassa, 1900, p. 577, pl. 2, fig. 11.

Differs from *O. puella* (Hck.) in greater dimensions, and stronger spines extending from the middle part of the skeleton.

Miocene-Quaternary.

Genus RHOPALASTRUM Ehrenberg

Rhopalastrum Ehrenberg, 1847b, p. 54; Haeckel, 1887, p. 526; Campbell, 1954, p. 88. = *Rhopalastrella* Haeckel, 1887, p. 526; Campbell, p. 88. Type species *Rhopalastrum lagenosum* Ehrenberg, 1847, in 1854, pl. 22, fig. 22.

Rhopalodictyum Ehrenberg 1860, p. 830; Haeckel, 1887, p. 589; Campbell, 1954, p. 94. Type species *Rhopalodictyum abyssorum* Ehrenberg, 1872b, pl. 8, fig. 17.

Dictyocoryne Ehrenberg, 1860, p. 830; Haeckel, 1887, p. 592; Campbell, 1954, p. 94. Type species *Dictyocoryne profunda* Ehrenberg, 1872b, pl. 7, fig. 23.

Dictyastrum Ehrenberg 1860, p. 830; Haeckel, 1887, p. 524; Campbell, 1954, p. 86. = *Dictyastrella* Haeckel, 1887, p. 524; Campbell, 1954, p. 86. Type species *Dictyastrum angulatum* Ehrenberg, 1872b, pl. 8, fig. 18.

Euchitonia Ehrenberg, 1860, p. 831; Haeckel, 1887, p. 532; Campbell, 1954, p. 86. = *Stylactis* Ehrenberg, 1872, p. 320; Campbell, 1954, p. 86. Type species *Euchitonia furcata* Ehrenberg, 1872b, pl. 8, fig. 6.

Pteractis Ehrenberg, 1872, p. 320; Campbell, 1954, p. 86. Type species *Pteractis elegans* Ehrenberg, 1872b, pl. 8, fig. 3.

Spongodiscidae with thin spongy central disc (where chambered rings may be sometimes seen), with three spongy arms and patagium between them.

Rhopalastrum sp. aff. Dictyocoryne pentagona Stöhr
(Plate 21, Figure 12)

?*Dictyocoryne pentagona* Stöhr, 1880, p. 118, pl. 7, fig. 2.

Having the same central disc, our form differs from typical *pentagona* by smaller dimensions. The species is closely related to *Spongaster pentas* Riedel and Sanfilippo, 1970: they both have indistinct arms and patagium. The difference between the two species is in the structure of the central disc.

Early Miocene.

Rhopalastrum profunda (Ehrenberg) group
(Plate 17, Figure 4-6; Plate 20, Figure 8)

?*Rhopalastrum lagenosum* Ehrenberg, 1854, pl. 22, fig. 22.

Dictyocoryne profunda Ehrenberg, 1861a, p. 767; 1872a, p. 307; 1872b, pl. 7, fig. 23; Ling and Anikouchine, 1967, p. 1489, pls. 191, 192, fig. 6.

The arms and the patagium consist of different spongy meshwork. As in *Rhopalastrum* sp. aff. *pentagona*, the chambered rings are about 7-10μ high. The difference from *R. mülleri* (Hck.) (=*Euchitonia furcata* Ehr.) described by C. Nigrini (1967, p. 37) is in the outline of the arms: in the*R. profunda* group they are broader toward the end, while in *R. furcata* they are of nearly the same breadth from the base to the end.

Early Miocene-Recent.

Rhopalastrum angulatum (Ehrenberg) group
(Plate 17, Figures 7, 8)

Dictyastrum angulatum Ehrenberg, 1872a, p. 289; 1872b, pl. 8, fig. 18; Haeckel, 1887, p. 524.

The arms and the patagium consist of different spongy substance. In Recent forms the chambers are about 4-5μ high, while Tertiary forms have larger meshes—about 7-10μ (the same as in the *R. profunda* group). The species is distinguished by the angular (not rounded) outline of the arms.

Early Miocene-Recent.

Genus SPONGASTERISCUS Haeckel

Spongasteriscus Haeckel, 1862, p. 474; 1887, p. 594; Campbell, 1954, p. 94. = *Spongasteriscinum* Haeckel, 1887, p. 594; Campbell, 1954, p. 94. Type species *Spongasteriscus ovatus* Haeckel, 1887, unfigured.

Spongodiscidae with central spongy sphere provided with four spongy cylindical arms.

Spongasteriscus spp.
(Plate 20, Figure 12; Plate 21, Figures, 6, 7)

?*Histiastrum martinianum* Carnevale 1908, pl. 26, pl. 4, fig. 11.

?*Spongasteriscus marylandicus* Martin, 1904, p. 435, pl. 130, fig. 10.

Middle Miocene.

In the Oligocene, forms of *Spongasteriscus* with inflated ends of the arms existed.

Cretaceous Spongodiscid
(Plate 5, Figure 13)

The central part of the skeleton is spiral, the distal part spongy. It resembles *Spongocyclia* Haeckel, 1862, p. 469 (type species *Spongocyclia cycloides* Haeckel, 1862, pl. 28, fig. 1). It is very likely that some specimens described in Haeckel's monograph of 1862 are of great age.

Maestrichtian.

Spongoprunum sp. aff. Cyphantus probus Rüst
(Plate 4, Figures 6, 7)

?*Cyphinus probus* Rüst, 1888, p. 196, pl. 24, fig. 4.

Spongodiscid gen. sp. Riedel and Sanfilippo, 1970, pl. 1, fig. 8.

This species differs from Rüst's species in the longer spongy part of the skeleton. The central construction of the skeleton in this form is less distinct than in typical *S. probus.*

Cretaceous (Maestrichtian).

Family LITHELIDAE

While numerous in Tertiary and Quaternary deposits, this family was examined by G. E. Kozlova only for the Cretaceous, because of the stratigraphic importance of some Cretaceous species.

Cretaceous Lithelid Genus A

Includes species with a spiral skeleton (spiral is double?). They are somewhat elogated along one main axis. They cannot be included in any known genus.

Cretaceous Lithelid Genus A sp. indet.
(Plate 5, Figures 14, 15)

Cromyodruppa sp. Lipman, 1954, pl. 24, figs. 15, 16.

Cretaceous (Campanian-Maestrichtian).

Cretaceous Lithelid Genus B

Includes species very much the same as those referred to "Cretaceous genus *A*". This genus is distinguished by its pseudo-aulophacoid surface, while "Cretaceous lithelid genus *A*" is characterized by a porous surface of the skeleton.

Cretaceous Lithelid Genus B sp. indet.
(Plate 3, Figure 17)

Cretaceous (Campanian).

NASSELLARIA[4]

SPYRIDA Ehrenberg emend. Petrushevskaya

Spyridina Ehrenberg, 1847b, p. 53; Petroshevskaya 1971a, p. 990; 1971b, p. 240.

Acanthodesmiidae Haeckel, 1862 sens. Riedel, 1967b, p. 296.

Nassellarians possessing a sagittal ring, or nassellarians arising from such species.

We do not give here any account of the evolution of the group, and we do not propose here any new classification of the Spyrida. Here illustrated are the species (found in Leg 14 material) closely related to the type species of some of Haeckel's genera.

Family TRIOSPYRIDAE Haeckel emend. Petrushevskaya

Haeckel, 1881, p. 441; 1887, p. 1025; Petrushevskaya, 1971a, p. 990; 1971b, p. 243.

Zygocyrtida Haeckel, 1862, p. 291, part.

Spyroidea Haeckel, 1887, p. 1015, part.

Spyrida with the cephalis very much the same as in many cyrtoids, especially in dicyrtids. The internal rods *Lr* and *Ll* are strong and produce the basal or lateral feet of the skeleton. The internal spines *A* and *Vert* (the greater part of the sagittal ring) are often situated *in* the test. In such cases the sagittal ring is joined with the walls of the cephalis by means of some internal additional rods. The ring may be seen through some pores of the test (the pores named by Goll, 1968, as "vertical", "sternal" and "frontal" pores). The other pores are small, numerous and they are disposed without any symmetry about the sagittal plane. In the other cases, if the sagittal ring is included in the wall of the test, the number of the pores is less and they are disposed symmetrically about the sagittal plane.

Genus HEXASPYRIS Haeckel

Hexaspyris Haeckel, 1887, p. 1046; Riedel, 1959, p. 15 (not Campbell, 1954, p. 113). = *Hexaspyridium* Haeckel, 1887, p.

[4]Species identification of Cretaceous nassellarians was made by G. E. Kozlova.

TABLE 14
Subdivisions of the Nassellaria Proposed and Used by W. R. Riedel and Subdivisions Proposed and Used by M. G. Petrushevskaya

Riedel, 1967b	Petrushevskaya, 1971				Nassellarian taxonomy applied here	
Acanthodesmiidae	Spyrida	Triospyrididae				Family Triospyrididae
		Acanthodesmiidae				Family Acanthodesmiidae
Plagoniidae	Cyrtida	Sethophormididae			Superfamily Plagiacanthoidea	Family Sethophormididae
		Plagiacanthoidea	Plagiacanthidae			Family Lampromitridae
				Lophophaeninae		Family Lophophaenidae
				Sethoperinae		Family Sethoperidae
				Plagiacanthinae		Family Plagiacanthidae
Carpocaniidae		Eucyrtidioidea	Carpocaniidae		Superfamily Eucyrtidioidea	Family Carpocaniidae sub fam. Carpocaniinae
						subfam. group C
Artostrobiidae			Eucyrtidiidae	Artostrobiinae		Family Artostrobiidae subfam. group A
						subfam. Artostrobiinae
Theoperidae				Eucyrtidiinae		Family Neosciadiocapsidae
						Cryptocephalic dicyrtid group
						Family Williriedelidae
						Family group N
						? subfam. group E
Pterocoryidae				Pterocoryinae		Family Pterocoryidae
Amphipyndacidae				Amphipyndacinae		Family Amphipyndacidae
Theoperidae				Eucyrtidiinae		Family Eucyrtidiidae
				Plectopyramidinae		Family Plectopyramididae
				Eucyrtidiinae		Family Lychnocaniidae
Cannobotryidae		Cannobotryoidea			Superfamily Cannobotryoidea	

1047. Type species *Ceratospyris setigera* Ehrenberg, 1873; 1875, pl. 20, fig. 11.

Thick-walled cephalis with numerous, irregularly disposed pores. Sagittal ring is enclosed *in* the cephalis. No thorax. Mouth of the cephalis constricted. About 6 feet. The feet are cylindrical, weak, They go from the margin of the cephalis downwards. Horns, if present, are weak (see Plate 39, Figure 13).

Genus LIRIOSPYRIS Haeckel sens. str.

Liriospyris Haeckel, 1881, p. 443; 1887, p. 1049; Campbell, 1954, p. 114; Goll, 1968, p. 1423, part. Type species *Liriospyris hexapoda* Haeckel, 1887, pl. 86, Fig. 7.

Thin-walled cephalis with definite number of large pores. The saggital ring is included in the walls. The mouth of the shell is constricted, and there is no thorax. Undetermined number of cylindrical feet. As a rule the feet are short and weak. Horns, if present, weak.

Liriospyris sp. aff. L. clathrata
(Plate 39, Figure 15)

On the frontal side of the cephalis, three pairs of large pores beside the sagittal ring are seen without turning the shell. On the lateral sides of the cephalis the wall is very thin (often damaged), pores irregular. No sagittal construction. Feet as little horns. The species is somewhat similar to *Dictyospyris clathrata* Ehrenberg (Plate 39, Figure 14).

Eocene.

Liriospyris sp. B. group
(Plate 39, Figures 17-20)

Two pairs of large pores may be seen beside the sagittal ring. The upper (alongside the arch of the sagittal ring) pores, scarcely visible, are the largest. The lateral sides of the test are well developed. The sagittal constriction is distinct. Feet as small horns from the margin of the mouth.

Oligocene.

Genus THAMNOSPYRIS Haeckel

Thamnospyris Haeckel, 1881, p. 443; 1887, p. 1071; Campbell, 1954, p. 114; Petrushevskaya 1971b, p. 248.

Type species *Gorgospyris shizopodia* Haeckel, 1887, pl. 87, fig. 4.

?*Archiphatha* Haeckel, 1881, p. 422; Campbell, 1954, p. 119. = *Coronophatna* Haeckel, 1881, p. 429. = *Archiphaena* Haeckel, 1887, p. 1177. = *Coronophaena* Haeckel, 1887, p. 1178. Type species *Archiphaena gorgospyris* Haeckel, 1887, p. 1178, pl. 98. fig. 10.

Thick-walled cephalis with small irregularly disposed pores. Pores are few. The sagittal ring is enclosed *in* the cephalis. Walls of cephalis are prolonged into a peristome–a kind of thorax, but pore-less. The margin of the peristome has a crown of flat chisel-shaped springs. They cannot be named "feet", as they are not connected with the internal spines *D, L, I*. No horns (apical, vertical, etc.).

Thamnospyris sp. aff. T. schizopodia
(Plate 38, Figure 3)

?*Gorgospyris schizopodia* Haeckel, 1887, p. 1071, pl. 87, fig. A.

Differs from typical *T. schizopodia* in the greater length of the peristomial teeth, and in the outline of the test.

Early Miocene.

Genus RHODOSPYRIS Haeckel

Rhodospyris Haeckel, 1881, p. 443; 1887, p. 1088; Campbell, 1954; Petrushevskaya, 1971b, p. 248. Type species *Rhodospyris tricornis* Haeckel, 1887, pl. 83, fig. 13.

Thick-walled test consists of two segments: cephalis and thorax, the cephalis being broader than the thorax. The sagittal ring may be enclosed in the cephalis and connected with the wall from the inside. Pores on the cephalis are small, irregularly disposed. There are no real feet going from the margin of the cephalis. The margin of the thorax may be armed with flat teeth or sprigs. As a rule, apical and some additional horns are present on the cephalis.

Remarks: Two trends in the change of the morphology may be indicated. The first is the overgrowing of the thorax (from *Rhodospyris* sp. aff. *R. tricornis* to *Rhodospyris* sp. De 1). The second is diminution of the thorax (from *Rhodospyris* sp. A to *Rhodospyris* sp. aff. *R. Anthocyrtis*). Maybe they indicate the existence of two subgenera.

Rhodospyris sp. aff. R. tricornis
(Plate 38, Figures 7-10)

?*Rhodospyris tricornis* Haeckel, 1887, p. 1089, pl. 83, fig. 13.

Differs from the typical *R. tricornis* in the smaller number of pores on the cephalis, and their more regular disposition. In *R. tricornis* typ. The thorax is longer and armed with terminal teeth, which is not the case in the species in question.

Miocene.

Rhodospyris sp. A
(Plate 38, Figure 11)

The species is distinguished by having a short closed thorax with irregular pores.

Early Miocene.

Rhodospyris? spp. De 1 group
(Plate 38, Figures 15,16)

Dendrospyris sp. 1 Goll, 1968, p. 1417, text-fig. 8.

Cephalis is very much the same as in *Rhodospyris* sp. aff. *tricornis*–the same wall, the same pores–only the dimensions are a little less. The thorax, on the contrary, is different from that of *R. tricornis*. It is twice as broad as the cephalis. The pores on it are very small and numerous: about 20 longitudinal rows of pores on the half equator of the thorax.

Oligocene?–Early Miocene.

Rhodospyris sp. aff R. anthocyrtis
(Plate 38, Figure 14)

Patagospyris anthocyrtis Haeckel, 1887, p. 1088, pl. 95, fig. 19.

Multipored cephalis, the sagittal ring included in the wall of the cephalis. The thorax is of the same breadth as the cephalis. Cephalis and thorax are separated by a distinct constriction of the test. The mouth of the thorax has some teeth.

Middle Miocene. In the Oligocene a very similar species existed (Plate 38, Figures 18, 19). They are distinguished by the arrangement of the pores.

Genus DESMOSPYRIS Haeckel

Desmospyris Haeckel, 1881, p. 443; 1887, p. 1089; Campbell, 1954, p. 116; Petrushevskaya, 1971b, p. 248. Type species *Desmospyris mammilata* Haeckel, 1887, pl. 83, fig. 14.

Diagnosis. The test consists of two segments, the thorax being narrower than the cephalis. The sagittal ring is 1) enclosed in the cephalis or 2) included in the cephalic wall. In the first case the wall has numerous irregular pores and may even be spongy. In the second case the wall of the cephalis has rather large pores, symmetrically disposed on the sides of the sagittal ring. No real feet, only teeth on the thoracic margin. As a rule no horns.

Desmospyris sp. A
(Plate 38, Figures 12, 13)

?*Dictyocephalus obtusus* Bütschli, 1882, p. 535, fig. 20.

Differs from *D. obtusus* and from *D. mamillata* (Plate 38, Figure 6) by its larger pores.

Middle Miocene.

Desmospyris spp. aff. D. anthocyrtoides (Bütschli)
(Plate 40, Figure 3)

?*Petalospyris anthocyrtoides* Bütschli, 1881, Fig. 19.

Dendrospyris anthocyrtoides (Bütschli), Goll, 1968, p. 1469, pl. 175, figs. 9, 11-14, part.; Riedel and Sanfilippo, in press, pl. 5, fig. 5, part.

The sagittal ring is entirely within the test. This species differs from the species described by Bütschli in the greater number of the pores, and by the sagittal ring being "deeper" in the test. Thorax very short, with practically no teeth.

Oligocene.

Desmospyris sp. aff. D. lata
(Plate 38, Figure 1)

?*Dendrospyris acutis* Goll 1968, p. 1419, pl. 173, figs. 7-9, 12.
Giraffospyris lata Goll, 1969, p. 334, pl. 58. figs. 22, 24-26.

In our specimens the number of pores was the same as in *D. lata*, but the entire outline of the test was more similar to that of *D. acutis* (though in some specimens the outline of the shell was intermediate between *D. lata* and *D. acutis*). Maybe this Paleocene species was ancestral to the two Eocene species described by Goll.
Paleocene.

Genus DENDROSPYRIS Haeckel, sens. str.

Dendrospyris Haeckel, 1881, p. 441; 1887, p. 1038; Campbell, 1954, p. 112; Goll, 1968, p. 1417, part. Type species *Ceratospyris stylophora* Ehrenberg, 1873 (1875, pl. 20, fig. 10).
Giraffospyris Haeckel, 1881, p. 442; 1887, p. 1056; Campbell, 1954, p. 114; Goll, 1969, p. 329, part. Type species *Ceratospyris heptaceros* Ehrenberg, 1873; 1875, pl. 20, fig. 2.
Aegospyris Haeckel, 1881, p. 442; 1887, p. 1053; *non* Campbell, 1954, p. 112; Riedel, 1959b, p. 6. Type species *Aegospyrys aegoceras* Haeckel, 1887, pl. 95, fig. 10.
Triospyrium Haeckel, 1887, p. 1030; Campbell, p. 112. Type species *Ceratospyris furcata* Ehrenberg, 1873; 1875, pl. 20, fig. 8.

Diagnosis. Test consists of one segment, a thick-walled cephalis. Large pores situated symmetrically on both sides of the sagittal ring. (Plate 39, Figure 22). The latter is connected with or included in the cephalic wall. The mouth constricted. Six feet are directed downwards, two of them being stronger than the others. Several horns on the cephalis.

Dendrospyris didiceros group
(Plate 40, Figure 12)

Ceratospyris didiceros Ehrenberg, 1873, p. 228; 1875, pl. 21, fig. 6.
Ceratospyris longibarba Ehrenberg, 1873, p. 219; 1875, pl. 21, fig. 2.
Ceratospyris heptaceros Ehrenberg, 1873, p. 219; 1875, pl. 20, fig. 2.
Giraffospyris didiceros (Ehrenberg) Goll, 1969, p. 332, pl. 60, figs. 5-7, 9, part; Riedel and Sanfilippo, 1970, pl. 5, fig. 5, part.
Eocene-Oligocene?

Dendrospyris pododendros (Carnevale) group
(Plate 39, Figures 26-28)

Tessarospyris pododendros Carnevale, 1908, p. 28, pl. 3, fig. 18.
Dendrospyris pododendros (Carnevale) Goll, 1968, p. 1422, pl. 174, figs. 1-4.
Early and Middle Miocene.

Genus PETALOSPYRIS Ehrenberg

Petalospyris Ehrenberg, 1847, p. 54; Haeckel, 1881, p. 443; 1887, p. 1059; Bütschli, 1882, p. 510; Campbell, 1954, p. 114; Petrushevskaya, 1971b, p. 249. Type species *Petalospyris foveolata* Ehrenberg, 1854, pl. 36, fig. 14.

This genus is very closely related to *Dendrospyris*. The difference lies in the wide-open mouth of the test, the legs going first laterally, and only then they may be curved and directed downwards. The legs, about six in number, are more or less strong, cylindrical.

Petalospyris triceros (Ehrenberg) group
(Plate 40, Figure 9)

Ceratospyris triceros Ehrenberg, 1873, p. 220; 1875, pl. 21, fig. 5.
Tristylospyris triceros Ehrenberg) Riedel, 1959a, p. 292, pl. 1, figs. 7, 8; Riedel and Sanfilippo, in press, pl. 3A, figs. 11, 12; Moore, in press, pl. 6, figs. 1-3.
Six divergent feet, three of them being stronger than the others.
Eocene-Oligocene.

Petalospyris sp. E
(Plate 40, figure 1)

All of the feet are weak.
Oligocene.

Dorcadospyris(?) or Petalospyris(?) ateuchus (Ehrenberg)

Ceratospyris ateuchus Ehrenberg, 1873, p. 218.
Cantharospyris ateuchus (Ehrenberg) Riedel, 1959, p. 294, pl. 22, fig. 3, 4.
Dorcadospyris ateuchus (Ehrenberg) Riedel and Sanfilippo, 1970, p. 253, pl. 15, fig. 4; Moore, in press, pl. 8, figs. 1, 2.

Two of the feet are stronger than the others as in *Dorcadospyris*, but all feet are divergent as in *Petalospyris*, and they are not inclined to form any ring.
Oligocene.

Genus DORCADOSPYRIS Haeckel

Dorcadospyris Haeckel, 1881, p. 441; 1887, p. 1040; Campbell, 1954, p. 112; Goll, 1969, p. 335, part. Type species *Dorcadospyris dentata* Haeckel, 1887, pl. 85, fig. 6.
Gamospyris Haeckel, 1881, p. 441; 1887, p. 1042; Campbell, 1954, p. 112. Type species *Gamospyris circularis* Haeckel, 1887, pl. 83, fig. 19.
Stephanospyris Haeckel, 1881, p. 441; 1887, p. 1042; Campbell, 1954, p. 112. Type species *Stephanospyris cordata* Haeckel, 1887, pl. 85, fig. 10.
?*Brachiospyris* Haeckel, 1881, p. 441; 1887, p. 1037; Campbell, 1954, p. 112. Type species *Ceratospyris ocellata* Ehrenberg, 1873; 1875, pl. 20, fig. 5.

This genus is closely related to *Petalospyris*. The only difference lies in the development of the feet. In *Dorcadospyris* two of the feet are stronger than the other four, and these two legs are inclined to be joined to form a ring.

Dorcadospyris sp. K
(Plate 40, Figure 5)

Two feet form a complete ring. The four other feet are rather strong and long. It is very much the same as in *D. spinosa* Moore (in press, pl. 7, figs. 2-5), but the feet are smooth, without horns.
Oligocene.

Dorcadospyris simplex (Riedel)
(Plate 40, Figure 11)

See Riedel and Sanfilippo, 1970, p. 523, pl. 15, fig. 6.
Miocene.

Dorcadospyris dentata Haeckel

See Goll, 1969, p. 338, pl. 60, figs. 8, 10-13.
Miocene.

Dorcadospyris alata (Riedel)

See Riedel and Sanfilippo, 1970, p. 523, pl. 14, fig. 5.
Miocene.

Genus PATAGOSPYRIS Haeckel

Patagospyris Haeckel, 1881, p. 443; 1887, p. 1087; Campbell, 1954, P. 116; Petrushevskaya, 1971b, p. 248. = *Petalospyrella* Haeckel, 1887, p. 1060; Campbell, 1954, p. 114. Type species, *Petalospyris confluens* Ehrenberg, 1873; 1875, pl. 22, fig. 5.

All features are nearly the same as in *Petalospyris*, but the feet are more numerous and flat (not cylindrical).

Patagospyris argisca (Ehrenberg)
(Plate 40, Figure 8)

Petalospyris argiscus Ehrenberg, 1873, p. 246; 1875, pl. 22, fig. 1.
Dorcadospyris argisca (Ehrenberg) Goll, 1969, p. 336, part.

The specimen illustrated by Goll has no sagittal constriction, while the sagittal constriction is distinct in the specimens from Ehrenberg's and from our material.
Eocene.

Patagospyris pentas (Ehrenberg)
(Plate 39, Figures 32, 33)

Petalospyris pentas Ehrenberg, 1873, p. 247; 1875, pl. 22, fig. 11.
Eocene.

Family ACANTHODESMIIDAE Haeckel

Haeckel, 1862, p. 265; Hertwig, 1879, p. 68; Bütschli, 1882, p. 495; Riedel 1967b, p. 296, part; Petrushevskaya, 1971a, p. 990; 1971b, p. 260.
Stephoidea Haeckel, 1887, p. 931.

Spyrida without cephalis similar to that of cyrtoids, the sagittal ring and some arches connected with it being the basic elements of the skeleton.

Genus TRICOLOSPYRIS Haeckel

Tricolospyris Haeckel, 1881, p. 44; 1887, p. 1078; Campbell, 1954, p. 114; Petrushevskaya, 1971b, p. 246. Type species *Tricolospyris kantiana* Haeckel, 1887, pl. 88, fig. 10.
Tholospyris Haeckel, in Goll, 1969, p. 322, part.

Thick-walled cephalis with a sagittal ring in its walls, and a small number of large pores. The pores are disposed symmetrically with respect to the sagittal plane. A galea and thorax are also present—they have a delicate wall with numerous small pores. Sometimes the cephalis is surrounded by a delicate envelope not only above (galea) and below (thorax) but all around.

Tricolospyris leibnitziana group
(Plate 38, Figures 26, 29)

Tricolospyris leibnitziana Haeckel, 1887, p. 1098, pl. 88, fig. 9.

Differs from *T. kantiana* Haeckel in the thickness of the cephalic walls.

Miocene.

Genus TYMPANOMMA Haeckel

Tympanomma Haeckel, 1887, p. 100; Campbell, 1954, p. 109; Petrushevskaya, 1971b, p. 260. Type species *Tympanidium binoctonum* Haeckel, 1887, pl. 94, fig. 18.

Six pairs of main rods arise from the sagittal ring. The test consists of a thick-walled cephalis having a small number of large pores.

Tympanomma binoctonum (Haeckel)
(Plate 39, Figures 23, 24)

Tympanidium binoctonum Haeckel, 1887, p. 100, pl. 94, fig. 18; Riedel, 1957, p. 78, pl. 1, fig. 2.

Miocene.

Genus TRISSOCYCLUS Haeckel

Trissocyclus Haeckel, 1881, p. 446; 1887, p. 986; Campbell 1954, p. 108, Petrushevskaya, 1971b, p. 260. = *Tricyclarium* Haeckel, 1887, p. 987; Campbell, 1954, p. 108. Type species *Trissocyclus stauropora* Haeckel, 1887, pl. 83, fig. 5.
Trissocircus Haeckel, 1881, p. 446; 1887, p. 985; Campbell, 1954, p. 108. = *Tricircarium* Haeckel, 1887, p. 985; Campbell 1954, p.108. Type species *Trissocircus lentellipsis* Haeckel, 1887, pl. 93, fig. 10.
Zygostephanium Haeckel, 1887, p. 972; Campbell, 1954, p. 108. Type species *Zygostephanium dizonium* Haeckel, 1887, pl. 93, fig. 3.
Liriospyris Haeckel in sens. Gol. 1, 1968, p. 1423, part.

The skeleton consists of the frontal and sagittal rings, the frontal ring being porous.

Trissocyclus stauropora Haeckel
(Plate 39, Figures 29-31)

Trissocyclus stauropora Haeckel, 1887, p. 987, pl. 83, fig. 5.
Zygostephanus dissocircus Haeckel, 1887, p. 971, pl. 93, fig. 1.
Zygostephanium dizonium Haeckel, 1887, p. 973, pl. 93, fig. 3.
Liriospyris stauropora (Haeckel) Goll, 1968, p. 1431, pl. 175, figs. 1-3, 7.

Miocene.

Trissocyclus elevata (Goll)
(Plate 39, Figure 25)

Liriospyris elevata Goll, 1968, p. 1426, pl. 175, figs. 4, 5, 8, 9.

Early Miocene.

Genus LITHOTYMPANIUM Haeckel emend. Petrushevskaya

Lithotympanium Haeckel, 1887, p. 447; 1887, p. 1006; Campbell, 1954, p. 109. Type species *Lithotympanium tuberosum* Haeckel, 1887, pl. 83, fig. 1.

Eight pairs of thick rods originate from the sagittal ring. The lateral walls are as two large plates.

Lithotympanium tuberosum Haeckel
(Plate 38, Figures 22-24)

Lithotympanium tuberosum Haeckel, 1887, p. 1006, pl. 83, fig. 1; Petrushevskaya, 1971b, pl. 131, figs. 18, 19.
Liriospyris sp. 2, Goll, 1968, text-fig. 9.

Miocene.

Genus EUCORONIS Haeckel

Eucoronis Haeckel, 1881, p. 445; 1887, p. 976; Campbell, 1954, p. 108; Petrushevskaya, 1971b, p. 267. = *Acrocoronis* Haeckel, 1881, p. 445; 1887, p. 977; Campbell, 1954, p. 108. Type species *Eucoronis perspecillum* Haeckel, 1887, pl. 82, fig. 6.
Acrocubus Haeckel, 1887, p. 447; 1887, p. 992; Campbell, 1954, p. 108. = *Apocubus* Haeckel, 1887, p. 992; Campbell, 1954, p. 108. Type species *Acrocubus octopylus* Haeckel, 1887, pl. 82, fig. 9.
Coronidium Haeckel, 1887, p. 973; Campbell, 1954, p. 108. Type species *Coronidium dyostephanus* Haeckel, 1887, pl. 82, fig. 6.

Four pairs of rods, arising from the sagittal ring, form two arches of the frontal ring. (Plate 41, Figures 13, 14).

Eucoronis sp. A
(Plate 41, Figures 1, 2)

The arches of the frontal ring are without horns.

Miocene.

Eucoronis hertwigii group
(Plate 41, Figures 15-17)

Acanthodesmia hertwigii Bütschli, 1882, pl. 32, fig. 9; Petrushevskaya, 1971b, p. 967, pl. 141, figs. 1-3.

The arches of the frontal ring have an irregular outline and they are thorny.

Eocene-Oligocene.

Genus PODOCORONIS Haeckel

Podocoronis Haeckel, 1881, p. 445; 1887, p. 980; *non* Campbell, 1954, p. 108; Riedel, 1959b, p. 19. = *Dipocoronis* Haeckel, 1881, p. 445; 1887, p. 980; *non* Campbell, 1954, p. 108; Riedel, 1959b, p. 19. Type species *Podocoronis toxarium* Haeckel, 1887, pl. 83, fig. 7.
Dipocubus Haeckel, 1887, p. 993; Campbell, 1954, p. 108. Type species *Acrocubus arcuatus* Haeckel, 1887, pl. 93, fig. 15.
Tripocubus Haeckel, 1887, p. 994; Campbell, 1954, p. 108. Type species *Acrocubus cortina* Haeckel, 1887, pl. 93, fig. 16.
Tetracubus Haeckel, 1887, p. 994; *non* Campbell 1954, p. 108; Riedel, 1959b, p. 25. Type species *Acrocubus amphithectus* Haeckel, 1887, pl. 93, fig. 17.
Toxidium Haeckel, 1887, p. 996; Campbell, 1954, p. 109. Type species *Toxarium cordatum* Haeckel, 1887, pl. 93, fig. 19.
Giraffospyris Haeckel, sens. Goll, 1969, p. 329, part.

Four pairs of rods, arising from the sagittal ring, form the frontal ring as in *Eucoronis*. The difference is in the presence 1) of the apical horn with two galear arches and 2) of two basal feet.

Podocoronis toxarium Haeckel
(Plate 41, Figure 3)

Podocoronis toxarium Haeckel, 1887, p. 980, pl. 83, fig. 7.
Acrocubus arcuatus Haeckel, 1887, p. 993, pl. 93, fig. 5.
Giraffospyris toxaria (Haeckel) Goll, 1969, p. 335, pl. 56, figs. 1, 2, 4, 7.

Miocene

Genus ZYGOCIRCUS Bütschli, emend. Petrushevskaya

Zygocircus Bütschli, 1882, p. 496; Haeckel, 1887, p. 945; Campbell, 1954, p. 108; Petrushevskaya, 1971b, p. 279. Type species *Lithocircus productus* Hertwig, 1879, pl. 7, fig. 4.

Sagittal ring with basal spines D, L_r and l_l.

Zygocircus productus (Hertwig)
(Plate 41, Figure 4)

Lithocircus productus Hertwig, 1879, p. 69, pl. 7, fig. 4.
Zygocircus productus (Hertwig) Bütschli, 1882, p. 496; Haeckel, 1887, p. 946; Petrushevskaya, 1971b, p. 281, pl. 145, figs. 10, 11.

The feet are very weak.

Quaternary.

Zygocircus bütschlii Haeckel
(Plate 41, Figure 4)

Zygocircus bütschlii Haeckel, 1887, p. 948.

The feet are distinct. The horns on the ring are numerous. The sagittal ring is three-edged as in *Z. productus.*

Oligocene.

Zygocircus sp.
(Plate 41, Figures 8-11)

?*Semantis triangularis* Clark and Campbell, 1945, p. 29, pl. 5, fig. 7.

The edges on the rings are not so distinct as in *Z. butschlii.* number of horns on the arch of the sagittal ring is less than in *Z. butschlii* and than in typical *Z. triangulatis* (Campbell and Clark).

Eocene.

Zygocircus cimelium sp. nov. Petrushevskaya
(Plate 41, Figures 5, 6)

The skeleton is very much the same as in *Z. productus,* but the length of the ring is three to four times greater. The arch of the sagittal ring is without horns and without edges.

The name of the species derived from a Greek noun (neuter), meaning "treasure." Description based on 5 specimens from 140-5-3, 5-7 cm.

Eocene.

CYRTIDA

Cyrtida Haeckel, 1862, p. 280, part.; Petrushevskaya, 1971a, p. 984; 1971b, p. 56

Cyrtiden Hertwig, 1879, p. 74, part.

Cyrtellaria Haeckel, 1887, p. 1015, part.

Nassellarians without sagittal ring, but with arches *aj* and *ap* in the cephalis.

Superfamily PLAGIACANTHOIDEA Hertwig, emend, Petrushevskaya

Plagiacanthiden Hertwig, 1879, p. 72; Petrushevskaya, 1971a, p. 989; 1971b, p. 57.

Plagoniidae Haeckel, Riedel, 1967b, p. 295.

Crytida with large cephalis, compared with the whole skeleton. Thorax may or may not be developed.

Family LAMPROMITRIDAE Haeckel, emend. Petrushevskaya

Lampromitrida Haeckel, 1881, p. 431.

Lophophaeninae group II, Petrushevskaya, 1971a, p. 989.

The thorax is well developed. It may be even larger than the cephalis. The cephalis has a low eucephalic part, nearly hidden in the skeleton.

Genus TRIPODISCIUM Haeckel, emend. Petrushevskaya

Tripodiscium Haeckel, 1881, p. 428; 1887, p. 1143; Campbell, 1954, p. 117; Petrushevskaya, 1971b, p. 70. = *Tripodiscinus* Haeckel, 1887, p. 1143; Campbell, 1954, p. 117. Type species *Tripodiscium tristylospyris* Haeckel, 1887, unfigured.

The spine *A* goes as a columella in the cephalis, and forms a stout apical horn. The spine *Vert* forms an occipital horn or tube. The spines *D, Lr* and *Ll* form stout lateral feet, all three being disposed nearly in the horizontal plane. The cephalis has a large antecephalic lobe ("dorsal" lobe in the report of Foreman, 1968). The cephalis is widely open towards the thorax. The thorax may be more or less long (Plate 37, Figures 16, 17).

Cretaceous-Eocene.

Remark: This genus is not typical for the Lampromitridae.

Tripodiscium? sp. aff. Lithomelissa hoplites
(Plate 7, Figure 2)

?*Lithomelissa* (?) *hoplites* Foreman, 1968, p. 26, pl. 3, fig. 2.

The thorax is very long, and the test resembles the skeleton of three-segmented nassellarians.

The species is not typical for *Tripodiscium*, but it cannot be placed in the genus *Lithomelissa*. For *Lithomelissa*, species like *L. microptera* Ehr. and *L. macroptera* Ehrenberg, 1873, 1875, (with collar constriction) seem to be typical.

Cretaceous (Maestrichtian).

Tripodiscium sp. A
(Plate 37, Figure 17)

Lithomelissa sp. Clark and Campbell, 1945, p. 38, pl. 6, fig. 1.

Typical *Tripodiscium* with short thorax.

Eocene.

Genus CERATOCYRTIS Bütschli

Ceratocyrtis Bütschli, 1882, p. 536; *non* Haeckel, 1887, p. 1290, *non* Campbell 1954, p. 128; but Petrushevskaya, 1971b, p. 98. Type species *Cornutella cucullaris* Ehrenberg, 1873, 1875, pl. 2, fig. 7.

Helotholus Jörgensen, 1905, p. 137; Campbell, 1954, p. 128. Type species *Helotholus histricosa* Jörgensen, 1905, pl. 16, figs. 86-88.

Bathrocalpis Clark and Campbell, 1942, p. 64; Campbell, 1954, p. 118. Type species *Bathrocalpis campanula* Clark and Campbell, 1942, pl. 9, fig. 27.

Very much like *Tripodiscium*, but without large feet or horns.

Ceratocyrtis sp. aff. C. Cucullaris (Ehrenberg)
(Plate 37, Figure 12)

Cornutella cucullaris Ehrenberg, 1873, p. 221; 1875, pl. 2, fig. 7.

Ceratocyrtis cucullaris (Ehrenberg) Bütschli, 1882, p. 536, fig. 36; Petrushevskaya, 1971b, pl. 52, fig. 1.

Paleogene.

Genus LAMPROTRIPUS Haeckel emend Petrushevskaya

Lamprotripus Haeckel, 1881, p. 432; 1887, p. 1199; *non* Campbell, 1954, p. 122; but Petrushevskaya, 1971b, p. 95. Type species *Lamprotripus squarrosus* Haeckel, 1881 (1887, pl. 60, fig. 1).

Somewhat like *Ceratocyrtis*, but with long feet, included proximally in the thoracic wall. The feet are terminal, not lateral as in *Tripodiscium*

Lamprotripus mawsoni (Riedel)

Dictyophimus mawsoni Riedel, 1958, p. 234, pl. 3, figs. 6, 7; Petrushevskaya, 1967, p. 76, fig. 430.

Quaternary.

Genus PSEUDODICTYOPHIMUS Petrushevskaya

Pseudodictyophimus Petrushevskaya, 1971b, p. 91.

Dictyophimus Ehrenberg, Petrushevskaya, 1967a, p. 67-74. Type species *Dictyophimus gracilipes* Bailey (1856, fig. 8).

Very much the same as *Tripodiscium*, but the antecephalic lobe of the cephalis is small and is confused with the thorax (compare Figures 17 and 18 on Plate 37).

Pseudodictyophimus gracilipes (Bailey) group
(Plate 37, Figure 21)

Dictyophimus gracilipes Bailey 1856, see Petrushevskaya, 1967a, p. 67, figs. 38, 39.

Quaternary.

Pseudodictyophimus sp. A
(Plate 37, Figures 19, 20)

Miocene.

Family LOPHOPHAENIDAE Haeckel, emend, Petrushevskaya

Lophophaenida Haeckel, 1881, p. 430; Campbell, 1954, p. 123; Petrushevskaya, 1971a, p. 989, group III, part; 1971b, p. 86, part.

The cephalis is large, egg-shaped, with distinct collar constriction. The spine *A* is inclined so as to be included in the cephalic wall.

Genera: *Lithomelissa* Ehr., 1847b (type species *L. microptera* Ehr., 1856); *Lophophaena* Ehr., 1847b (*Loph. galea orci* Ehr., 1854) and *Lophophaenoma* Hck., 1887 (*Lophophaena radians* Ehr., 1875).

Genus LOPHOPHAENA Ehrenberg, emend. Petrushevskaya

Lophophaena Ehrenberg, 1847b, p. 54; Haeckel, 1887, p. 1303; Campbell, 1954, p. 128; Petrushevskaya, 1971b, p. 105. = *Lophophaenula* Haeckel, 1887, p. 1303; Campbell, 1954, p. 128. Type species *Lophophaena galea orci* Ehrenberg, 1854. = *L. apicata* Ehrenberg, 1873 (1875, pl. 8, fig. 11).

Lophophaena? capito Ehrenberg group
(Plate 33, Figures 20-23)

?*Lophophaena capito* Ehrenberg, 1873, p. 242; 1875, pl. 8, fig. 6.
Lophophaenoma sp. G. Petrushevskaya, 1971b, pl. 56, figs. 16, 17.

Our species differs from the typical *L. capito* by its greater dimensions. From typical *Lophophaena* species (*L. apicata* Ehr.), this species group differs in its ball-shaped cephalis and narrow "neck".

Eocene-Oligocene.

Family SETHOPERIDAE Haeckel, emend. Petrushevskaya

Sethoperida Haeckel, 1881, p. 433; 1887, p. 1232; Haecker, 1908, p. 448; Petrushevskaya, 1971a, p. 989; 1971b, p. 76.

The cephalis is surrounded by latticed plates. Spine *A* forms a columella; its branches *a* extend in the cavity of the cephalis. The spine *Vert* is weak.

Genus CLATHROCORONA Haeckel

Clathrocorona Haeckel, 1881, p. 431; 1887, p. 1212; Campbell, 1954, p. 122. Type species *Clathrocanium* (*Clathrocorona*) *diodema* Haeckel (1887, pl. 64, fig. 2).

The latticed plates surrounding the cephalis are practically undeveloped. The lower three plates form the walls of a distinct thorax; the lateral three plates are represented only by 1) the edges on the apical horn and 2) the edges of the feet, included in the thoracic wall.

Clathrocorona sphaerocephala (Haeckel) group
(Plate 37, Figures 27-30)

?*Clathrocanium sphaerocephalum* Haeckel, 1887, p. 1211, pl. 64, fig. 1; Petrushevskaya, 1971b, pl. 39, figs. 5-7.

Thorax has three gates, sometimes overgrown with very thin threads. The pores on the thorax are small and numerous.

Miocene.

Superfamily EUCYRTIDIOIDEA Ehrenberg

Eucyrtidina Ehrenberg, 1847, p. 53; Petrushevskaya, 1971a, p. 985; 1971b, p. 166.
Cyrtoidea Haeckel, 1887, p. 1126, part.

As a rule the cephalis is small compared with the whole skeleton. It is separated from the thorax by some distinct arches. After the thorax comes the abdomen, and as a rule some other segments.

Family CARPOCANIIDAE Haeckel

Carpocanida Haeckel, 1881, p. 427; Riedel, 1967b, p. 296; Petrushevskaya, 1971a, p. 988; 1971b, p. 238.

Eucyrtidioidea with the small eucephalic chamber merged within the thorax. Thorax with round pores. Abdomen may be in the form of a peristome.

Subfamily CARPOCANIINAE Haeckel

Carpocanida Haeckel, 1881, p. 427; Riedel, 1967b, p. 296; Petrushevskaya, 1971a, p. 988.

Carpocaniidae with ovate or nearly cylindrical thorax, the pores being disposed in longitudinal rows on it. Abdomen very often without pores (in the form of a peristome) or with pores, smaller than those of the thorax.

Genus MYLLOCERCION Foreman

Myllocercion Foreman, 1968, p. 37. Type species *Myllocercion acineton* Foreman, 1968, pl. 5, fig. 11.

The wall of the thorax is very thick. Thorax is separated from abdomen by internal wall (ring or shelf) with a small opening. Abdomen with pores much smaller than the thoracic pores.

Myllocercion sp. aff. M. minima (Dumitrica)
(Plate 2, Figures 19, 20; Plate 7, Figure 3)

?*Diacanthocapsa minima* Dumitrica, 1970, p. 62, pl. 15, figs. 92, 93, 95.

The species in question differs from typical *M. minima* by its longer thorax.

Specimens from the Campanian (Plate 2, Figures 19, 20) are somewhat distinguished from the Maestrichtian specimens (Plate 7, Figure 3) by the outline of the test.

Early Campanian–Maestrichtian.

Myllocercion sp. C
(Plate 22, Figures 13, 14)

?*Carpocanopsis cingulatum* Riedel and Sanfilippo, in press, pl. 2G, figs. 17-19, part.

This species differs from the type species of *Myllocercion* (*M. acineton*) only in its narrower thorax.

Early and middle Miocene.

Genus THEOCAPSOMMA Haeckel, emend. Foreman

Theocapsomma Haeckel, Foreman, 1968, p. 29, part.

The species, indicated by Campbell (1954, p. 136) as type species for the genus *Theocapsomma* Haeckel, 1887, p. 1429, (*Theocapsa linneai* Haeckel, 1887, pl. 66, fig. 13) has a different cephalis with distinct apical horn and a different disposition of pores, than in Carpocaninae. A species, typical for *Theocapsomma* in our definition, is *Theocapsomma comys* Foreman, 1968, pl. 4, fig. 2.

The pores on the thorax are the same as on the abdomen. They are situated in longitudinal furrows. The abdomen is rather long.

Theocapsomma sp. aff. T. comys Foreman
(Plate 7, Figure 6)

?*Theocapsomma comys* Foreman, 1968, p. 29, pl. 4, fig. 2c. part;

Not only longitudinal, but also horizontal rows of pores are distinct.

Cretaceous (Maestrichtian).

Theocapsomma sp. F group
(Plate 22, Figure 3)

?*Theocapsomma comys* Foreman, 1968, p. 29, pl. 4, fig. 2a, part.

The abdomen is very long, often destroyed. This group of species differs from typical *T. comys* by the greater number of longitudinal rows of pores.

Eocene.

Theocapsomma ornata (Ehrenberg)
(Plate 22, Figure 1)

Cryptoprora ornata Ehrenberg, 1873, p. 222; 1875, pl. 5, fig. 8; Riedel and Sanfilippo, in press, pl. 30, fig. 10, part.

Differs from *T. comys* by its higher cephalis. The number of pores in a longitudinal row of the thorax is smaller than in *Theocapsomma* sp. F. Typical *T. ornata* was rare in Leg 14 material. Common was *Theocapsomma* sp. aff. *T. ornata* (Plate 22, Figure 2), first figured by Riedel and Sanfilippo (pl. 3D, fig. 10).

Paleocene-Eocene.

Genus CARPOCANOPSIS Riedel and Sanfilippo

Carpocanopsis Riedel and Sanfilippo, in press. Type species *Carpocanopsis cingulatum* Riedel and Sanfilippo, in press, pl. 8, fig. 8.

Carpocanopsis favosum (Haeckel) group
(Plate 22, Figure 24)

Cycladophora favosa Haeckel, 1887, p. 1380, pl. 62, figs. 5, 6; Riedel, 1954, p. 172, pl. 1, fig. 2, part.
Carpocanopsis favosum (Haeckel) Riedel and Sanfilippo, in press, pl. 2G, figs. 15, 16, pl. 8, figs. 9-11.

There are various forms of this group, differing in the width of the thoracic mouth, in the size of the thorax and in the size of the pores on the thorax. Characteristic for all of them is the outline of the cephalo-thorax, and little irregularity of the longitudinal rows of pores on the thorax. Abdomen as a peristome.

Miocene.

Genus CARPOCANISTRUM Haeckel

Carpocanistrum Haeckel, 1887, p. 1170; Riedel and Sanfilippo, in press (*not* Campbell, 1954, p. 119). Type species *Carpocanistrum evacuatum* Haeckel 1887, pl. 52, fig. 11.
Cystophormis Haeckel, 1887, p. 1165; Campbell, 1954, p. 118. Type species *Cystophormis pyla* Haeckel, 1887, pl. 52, fig. 1.
Sethamphorus Burma, 1959, p. 327. Type species *Sethamphora favosa* Haeckel, 1887, pl. 57, fig. 4.

Thorax is thick-walled.

Carpocanistrum sp. O
(Plate 22, Figures 28, 30)

Carpocanistrum sp. Riedel and Sanfilippo, in press, pl. 2F, figs. 5-7, part.

Test about 70-90μ long and 65-75μ broad. About eight to nine longitudinal rows or pores on the half equator of the thorax. About seven or eight pores in one row. Mouth as a short tube.

Oligocene-Miocene.

Carpocanistrum sp. aff. C. pulchrum
(Plate 22, Figures 19, 20)

Carpocanistrum sp. Riedel and Sanfilippo, in press, pl. 3D, figs, 3, 5, part.

?*Carpocanium pulchrum* Carnevale, 1908, p. 30, pl. 4, fig. 15.

Test about 70-100μ long and 70-90μ broad. About six to eight longitudinal rows of pores on the half equator of the thorax. About six pores in one row. Rows are separated by longitudinal ridges. Mouth as a short tube.

Upper Oligocene-Miocene.

Carpocanistrum cristatum Carnevale

Sethocorys cristata Carnevale, 1908, p. 31, pl. 4, fig. 18.

Carpocanopsis cristatum (Carnevale) Riedel and Sanfilippo, in press, pl. 1G, fig. 16, pl. 2G, figs. 1, 2, part.

The description as in Riedel and Sanfilippo. But only about nine or ten pores on the half equator of the thorax. Cephalis plus thorax are about 75-80μ long.

Miocene.

Genus CARPOCANIUM Ehrenberg sens. str.

Carpocanium Ehrenberg, 1847b, p. 54; Haeckel 1887, 1279; Campbell, 1954, pl. 127; Petrushevskaya, 1971b, p. 239, part. = *Carpocanidium* Haeckel, 1887, p. 1280; Campbell, 1954, p. 127. Type species *Lithocampe solitaria* Ehrenberg 1844 (1854, pl. 22, fig. 28).

Cyrtocalpis Haeckel, 1860, p. 835; 1887, p. 1185; Campbell, 1954, p. 121. Type species *Cyrtocalpis amphora* Haeckel (1862, pl. 5, fig. 2).

Very much the same as *Carpocanistrum*, but the thoracic wall is thinner. The thorax is ovate, nearly cylindrical.

Carpocanium sp. aff. C. coronatum Ehrenberg
(Plate 22, Figures 25, 26)

?*Carpocanium coronatum* Ehrenberg, 1858, p. 30; 1875, pl. 5, fig. 7.

?*Carpocanistrum* sp. Riedel and Sanfilippo, in press, pl. 3D, fig. 8, part.

Test about 70-80μ long and 60-70μ broad. About eleven longitudinal rows of the pores on the half equator of the thorax. About nine to ten pores in a row. Mouth as a short tube.

Oligocene.

Genus CARPOCANOBIUM Haeckel

Carpocanobium Haeckel, 1887, p. 1282; Campbell, 1854, p. 127. Type species *Carpocanium trepanium* Haeckel, 1887, pl. 52, fig. 18.

Asecta Popofsky, 1903, p. 373; Campbell, 1954, p. 128. Type species *Asecta prunoides* Popofsky, 1913, text-fig. 89.

The thoracic wall is thin. The thorax is broader in its distal part than near the cephalis.

Carpocanobium sp. aff. C. setosa (Ehrenberg)
(Plate 22, Figures 27, 28)

?*Halicalyptra setosa* Ehrenberg, 1875, pl. 2, fig. 12.

Carpocanium hexagonale Haeckel, 1887, p. 1282, pl. 52, fig. 15.

Carpocanistrum sp Riedel and Sanfilippo, in press, pl. 3D, figs. 7, 9.

Test about 80-100μ long and up to 70-85μ broad. Longitudinal rows or pores are uncertain. There are about twelve pores on the half equator of the thorax, and about eight or nine pores on the length of the thorax. Mouth as a broad tube (very short).

Oligocene.

Subfamily Group C

Includes Carpocaniidae with pores arranged irregularly or in checker-board order. Abdomen is rather large. Pores on the abdomen are similar to those on the thorax.

This group was described by P. Dumitrica (1970, p. 53-54) as "Cryprocephalic tricyrtid group". But here this group is accepted in a narrower sense than was suggested by P. Dumitrica. The species which are distinguished by longitudinal arrangement of pores (*Diacanthocapsa comys, Diacanthocapsa* sp. Dumitrica 1970, pl. 20, figs. 129-130) are included in the present paper as real Carpocaniidae. As can be seen on Figure 43, Plate 7 in Dumitrica's report, the species mentioned above not only have a spherical eucephalic part (chamber) of the cephalis, but also the surrounding parts (lobes) of the cephalis. One of these parts, the lateral lobe, is even figured by P. Dumitrica on Figure 43. It is the same lobe as figured by M. Petrushevskaya (1968d, fig. 9). All these Carpocaniids are not included in the cryptocephalic group in question. By the way, the eucephalic chamber in this latter group is not so deeply hidden in the skeleton as is typical for real Carpocaniinae, and the subfamily group in question is very similar to many Eucyrtidiidae (*Lithocampe, Theocotyle*).

Genus DIACANTHOCAPSA Squinabol

Diacanthocapsa Squinabol, 1903, p. 133; Campbell, 1954, p. 129; Dumitrica, 1970, p. 61. Type species *Diacanthocapsa euganea* Squinabol (1903, pl. 8, fig. 26).

Diacanthocapsa sp. A group
(Plate 7, Figure 11; Plate 22, Figures 4, 6)

?*Theocapsa* (*Theocapsomma*) *amphora* Campbell and Clark, 1944b, p. 35, pl. 7, figs. 30, 31.

?*Theocapsomma amphora* (Campbell and Clark) Foreman, 1968, p. 31, pl. 4, figs. 9a-c.

Our Cretaceous specimens (Plate 7, Figure 11) differ from the Tertiary specimens in the outline of the abdomen (Plate 22, Figures 4, 6).

Cretaceous-Tertiary.

Diacanthocapsa sp. B
(Plate 7, Figures 4, 5)

Theocapsomma sp. Riedel and Sanfilippo, 1970, pl. 3, fig. 1.

Differs from *Diacanthocapsa* sp. A group by its more pronounced cephalis.

Cretaceous (Maestrichtian).

Family ARTOSTROBIIDAE Riedel

Artostrobiidae Riedel, 1967a, p. 149; 1967b, p. 296; Petrushevskaya, 1971a, p. 985; 1971b, p. 235.

Cephalis originally widely open to the thorax. It consists of a eucephalic lobe and antecephalic lobe. The latter has only a "dorsal" (*sens.* H. Foreman, 1968) part, without the apical-dorsal. As a rule, there is a distinct tube connected with the spine *Vert*—see Petrushevskaya, 1968b, fig. 6.

Subfamily Group A

Includes three-segmented genera having the pores disposed irregularly or in distinct longitudinal rows.

Genus RHOPALOSYRINGIUM Campbell and Clark, emend. Foremen

Rhopalosyringium Campbell and Clark, 1944b, p. 30; Campbell, 1954, p. 130; Foreman, 1968, p. 54. Type species *Rhopalosyringium magnificum* Campbell and Clark (1944b, pl. 7, figs. 16, 17).

Rhopalosyringium sp. aff. R. magnificum
(Plate 7, Figures 14-17)

?*Rhopalosyringium magnificum* Campbell and Clark, 1944b, p. 30, pl. 7, figs. 16, 17; Foreman, 1968, p. 55, pl. 6, figs. 7, a, b.

?*Theoperid* gen. sp. indet. Riedel and Sanfilippo, 1970, pl. 3, fig. 4.

Cretaceous (Campanian-Maestrichtian).

Rhopalosyringium sp. aff. R. colpodes Foreman
(Plate 7, Figure 12)

Rhopalosyringium colpodes Foreman, 1968, p. 57, pl. 6, fig. 6.

This species is distinguished not only by the outline of the test, but also by the regular disposition of pores–longitudinal as well as horizontal rows may be seen.

Cretaceous (Campanian-Maestrichtian).

Genus PHORMOCYRTIS Haeckel

Phormocyrtis Haeckel, 1887, p. 1368; Campbell, 1954, p. 134. Type species *Theocorys longicornis* Haeckel, 1887, pl. 69, fig. 15.

Cephalic lobes are indistinct. The pores are disposed in longitudinal rows.

Phormocyrtis sp. E

?*Phormocyrtis proxima* Clark and Campbell, 1942a, p. 82, pl. 7, figs. 24, 25.

Differs from the typical *P. proxima* in the shape of its thorax (more bulbiform) and in the shape of its abdomen (more cylindrical). These features are very similar to those of *Rhopalosyringium* species.

Paleocene.

Phormocyrtis embolum (Ehrenberg) group
(Plate 22, Figures 8, 9)

Eucyrtidium embolum Ehrenberg, 1873, p. 228; 1875, pl. 10, fig. 5.

Our specimens somewhat differ from the typical *P. embolum* in the shape of the abdomen.

Eocene.

Phormocyrtis sp. A
(Plate 22, Figure 7)

This form is distinguished from *Phormocyrtis* [=*Theocorys*] *longicornis* (Hck.) in the outline of the abdomen. It differs from *Phormocyrtis proxima* Clark and Campbell in the dimensions of its abdomen (broader than the thorax) and in the shape of the thorax (more slender).

Oligocene, rare.

Genus TRICOLOCAPSA Haeckel

Tricolocapsa Haeckel, 1881, p. 436; 1887, p. 1431; Campbell, 1954, p. 136. = *Tricolocapsula* Haeckel, 1887, p. 1432; Campbell, 1954, p. 136.; Petrushevskaya, 1971b, p. 198. Type species *Tricolosapsa theophrasti* Haeckel, 1887, pl. 66, fig. 1.

Carpocanarium Haeckel, 1887, p. 1279; Campbell, 1954, p. 127; Riedel and Sanfilippo, in press. Type species *Carpocanium calocyclothes* Stöhr, 1880, pl. 3, fig. 8.

Abdomen is more or less reduced.

Tricolocapsa papillosa (Ehrenberg) group
(Plate 22, Figure 31)

Eucyrtidium papillosum Ehrenberg, 1872a, p. 310; 1872b, pl. 7, fig. 10.

Dictyocephalus papillosus (Ehrenberg) Haeckel, 1887, p. 1307; Riedel, 1958, p. 236, pl. 3, fig. 10; Petrushevskaya, 1967, p. 114, fig. 66; 1969c, pl. 8, figs. 7-13.

Dictyocryphalus papillosus (Ehrenberg) Nigrini, 1967, p. 63, pl. 6, fig. 6.

Carpocanium calocyclothes Stöhr, 1880, p. 96, pl. 3, fig. 8.

Dictyocephalus bergontianus Carnevale, 1908, p. 32, pl. 4, fig. 20.

Carpocanarium sp. Riedel and Sanfilippo, in press, pl. 11, figs. 17-20, 21-25 (*not* 21), pl. 2J, figs. 8, 9.

Tube may be distinct or not.

Miocene-Recent.

Tricolocapsa (?) sp.
(Plate 22, Figures 33, 34)

Description is based on twelve specimens from 140A-2-6, 80-82 cm, and from 140-2-CC (? 5-CC).

The thorax is flattened laterally. The pores are rare, and disposed irregularly or in checker-board order. The length of the test is about 80-90 μ, the breadth up to 75μ.

Eocene.

Remarks: The species is similar to *Dicolocapsa microcephala* (Plate 22, Figure 32) in the construction of its thorax (and this feature distinguishes it from all *Tricolocapsa* species), but the cephalic structures in our species and in *Dicolocapsa* are different.

Genus THEOCAMPE Haeckel

Theocampe Haeckel, 1887, p. 1422; Campbell, 1954, p. 134; Riedel, 1958, p. 26; Burma, 1959, p. 325; Foreman, 1968, p. 48. = *Theocampana* Haeckel, 1887, p. 1422. = *Theocampula* Campbell, 1954, p. 134. Type species *Dictyomitra ehrenbergii* Zittel, 1876, pl. 2, fig. 5.

Tricolocampe Haeckel, 1881, p. 434, 1887, p. 1411; *non* Campbell, 1954, p. 134; Petrushevskaya, 1971b, p. 198. = *Tricolocampium* Haeckel, 1887, p. 1412. Type species *Tricolocampe cylindrica* Haeckel (1887, pl. 66, fig. 21).

The genus may be subdivided into subgenera.

Subgenus I (or even genus)

Proposed by H. Foreman (1968, p. 48) for *Theocampe daseia* Foreman and *T. bassilis* Foreman (*not* for *T. lispa* Foreman). This group is distinguished by the well developed shelf between thorax and abdomen. This shelf is also characteristic for *Myllocercion, Rhopalosyringium, Eribotrys* and other Cretaceous tricyrtids and stichocyrtids.

This group differs from typical *Theocampe* by the abdomen being, in its upper part, as a rule, narrower than the thorax. The abdomen is slender, nearly cylindrical. Mouth indefinite.

Theocampe ? sp. aff. T. daseia Foreman
(Plate 7, Figures 8-10)

Theocampe daseia Foreman, 1968, p. 48, pl. 6, figs. 9, as, b.

Abdomen becomes narrower distally. Not only horizontal, but also longitudinal rows of the pores are distinct on the abdomen.

Cretaceous (Maestrichtian).

This species seems to be closely related to some *Rhopalosyringium* species.

Theocampe? bassilis Foreman
(Plate 7, Figure 7)

Theocampe bassilis Foreman, 1968, p. 50, pl. 6, fig. 10.

The abdomen is cylindrical or even becomes broader in its middle part. The pores on the abdomen are situated in transverse rows.

Cretaceous (Maestrichtian).

Subgenus THEOCAMPE Haeckel sens. str.

Theocampe Haeckel, 1887, p. 1422; Campbell, 1954, p. 134, part.

Type species *Dictyomitra ehrenbergii* Zittel, 1876, pl. 2, fig. 5.

The shelf between thorax and abdomen is more or less pronounced. Abdomen in its lower (or middle) part is much broader than the thorax. The mouth is constricted and forms a short tube. The pores on the abdomen are disposed in longitudinal rows, but sometimes horizontal rows are very distinct. Abdomen is flattened laterally (oval in cross section).

Theocampe sp. P
(Plate 7, Figure 1)

This species differs from *T. vanderhofi* Campbell and Clark (see Foreman, 1968, pl. 6, fig. 12) in the outline of the abdomen, in the more constricted mouth and in the disposition of the pores.

Cretaceous (Maestrichtian).

Theocampe pirum (Ehrenberg)
(Plate 23, Figure 11)

Eucyrtidium pirum Ehrenberg, 1873, p. 232; 1875, pl. 10, fig. 14.

Theocampe pirum (Ehrenberg) Haeckel, 1887, p. 1423; Riedel and Sanfilippo, in press, pl. 3E, figs. 10, 11.

?*Dictyocephalus pulcherrimus curtis* Clark and Campbell, 1942, p. 97, pl. 8, figs. 3, 6, 7.

Very much the same as *Theocampe* sp. P, but differing somewhat in the ratio between thorax and abdomen.

Eocene.

Theocampe mongolfieri (Ehrenberg) group
(Plate 23, Figures 3-5)

Eucyrtidium mongolfieri Ehrenberg, 1854, pl. 36, fig. 18B; 1873, p. 230; 1875, pl. 10, fig. 3.
Theocampe mongolfieri (Ehrenberg), Burma 1959, p. 239; Riedel and Sanfilippo, p. 536; Riedel and Sanfilippo, in press, pl. 3E, fig. 13.
?*Sethamphora costata* Haeckel, 1887, p. 1251, pl. 62, fig. 3.
?*Dictyocephalus pulcherrimus* typ. Clark and Campbell, 1942, p. 78, pl. 8, fig. 2.
Eocene.

Theocampe excellens (Ehrenberg)
(Plate 23, Figure 7)

Eucyrtidium exellens Ehrenberg, 1873, p. 228; 1875, pl. 10, fig. 12.
Differs from *T. mongolfieri* by its smaller pores on the abdomen. These pores are not disposed in distinct longitudinal rows.
Oligocene.

Subgenus TRICOLOCAMPE Haeckel

Tricolocampe Haeckel, 1881, p. 434; 1887, p. 1411; *non* Campbell, 1954, p. 134; Petrushevskaya, 1971b, p. 198. = *Tricolocampium* Haeckel, p. 1412. Type species *Tricolocampe cylindrica* Haeckel (1887, pl. 66, fig. 21).

The shelf between thorax and abdomen may be more or less pronounced. Abdomen is slender, ovate. It is somewhat broader than the thorax in its upper part. In fully developed specimens the mouth is constricted and even elongated into a short tube, but very often the skeleton is incomplete. Abdomen is flattened laterally. The pores on the abdomen are disposed in horizontal (transverse) rows–as in typical artostrobiids.

Cretaceous-Recent.

The species *T. vanderhoofi* Campbell and Clark, *Theocampe lispa* Foreman, *T. altamonensis* (Campbell and Clark) and *T. dactylica* Foreman (described by H. Foreman (1968) seem to belong in this group.

This group is more closely related to *Theocampe* subgenus I than to typical *Theocampe*.

Theocampe sp. aff. T. gemmata (Ehrenberg)
(Plate 23 Figure 10)

?*Eucyrtidium gemmatum* Ehrenberg, 1873, p. 229; 1875, pl. 10, fig. 6.

This species differs from *T. gemmata* by the outline of the test. It is somewhat similar to the species described as *Theocorys ovata* Haeckel, 1887, pl. 69, fig. 16, but differs from it by the smaller number of the pores in a horizontal row and by the deeper constriction between thorax and abdomen.

Eocene.

Theocampe callimorphos (Clark and Campbell)
(Plate 23, Figure 8)

Dictyocephalis callimorphos Clark and Campbell, 1945, p. 42, pl. 6, fig. 7.
Lithomitra sp. aff. *Lithomitra lineata* (Ehr.) Riedel and Sanfilippo, in press, pl. 3E, figs. 17, 18, part.

This form has longitudinal furrows between the pores of a horizontal row.

Eocene.

Theocampe eos (Clark and Campbell)
(Plate 23, Figure 9)

Dictyocephalus eos Clark and Campbell, 1945, p. 42, pl. 6, fig. 8.

Very much the same as *T. callimorphos*, but without longitudinal furrows.

Eocene.

Subfamily ARTOSTROBIINAE Riedel

Artostrobiidae Riedel, 1967a, p. 149; 1967b, p. 296; Petrushevskaya, 1971a, p. 985; 1971b, p. 235.

Four- or multi-segmented Artostrobiidae. Pores are disposed on the abdomen in distinct transverse (horizontal) rows.

Genus THEOCAMPTRA Haeckel, emend, Petrushevskaya

Theocamptra Haeckel, 1887, p. 1424; Campbell, 1954, p. 134. Type species *Theocampe collaris* Haeckel, 1887, pl. 66, fig. 18.

After the cephalis, which is united with thorax, the third segment (distinctly separated from the other part of the skeleton) is distinguished. The third segment is rather short, nearly of the same length as the thorax. The lower part of the test is very much like the abdomen of *Theocampe* species, and the third segment seems to be inserted between thorax and abdomen. This is the only difference between *Theocamptra* and *Theocampe* (*Tricolocampe*).

Paleogene-Neogene.

Theocamptra marylandica (Martin)
(Plate 23, Figures 20, 21)

Lithocampe marylandica Martin, 1904, p. 450, pl. 130, fig. 4.

Three transverse rows of pores on the third segment. The fourth segment up to 90-100μ broad.

Miocene.

Theocamptra sp. aff. T. marylandica
(Plate 23, Figures 22, 23)

?*Lithocampe marylandica* Martin, 1904, p. 450.
Artostrobium sp. aff. *A. doliolum* Riedel and Sanfilippo, in press, pl. 21, fig. 4.

Differs from the typical *T. marylandica* by its smaller dimensions; the fourth segment up to 60-70μ broad.

Miocene.

Remark: Both species are very similar to *Theocampe callimorphos* (Clark and Campbell) (Pl. 23, fig. 8). The difference lies in the segmentation of the test.

Theocamptra ovata (Haeckel)
(Plate 23, Figures 17-19)

Lithocampe ovata Haeckel, 1887, p. 1504, p. 77, fig. 1.

Two transverse rows of pores on the third segment. No furrows near the pores on the fourth segment.

Miocene.

Theocamptra sp. aff. Theocamptra ovata (Haeckel)
(Plate 23, Figures 15, 16; Plate 24, Figure 6)

Very much the same as typical *T. ovata*, but has longitudinal furrows between the pores. This feature makes this species similar to *Theocamptra* aff. *marylandica* and to *Theocampe callimorphus*.

Oligocene.

Theocamptra collaris (Haeckel)

Theocampe collaris Haeckel, 1887, p. 1425, pl. 66, fig. 18.
Artostrobium sp. aff. *A. doliolum* Riedel and Sanfilippo, in press, pl. 21, figs. 1, 3, 5, part.

One transverse row of pores on the third segment. The fourth segment is 1.5 times broader than the third (the same as in *T. marylandica* group and in *T. ovata* group).

Miocene.

Theocamptra corona (Haeckel) group
(Plate 23, Figures 24, 25)

Cyrtophormis corona Haeckel, 1887, p. 1462, pl. 77, fig. 15.
Phormostichoartus corona (Haeckel) Riedel and Sanfilippo, in press, pl. 2J, figs. 1-5.

Four transverse rows of pores on the third segment. It is distinguished from *T. collaris, T. marylandica* and *T. ovata* also by the comparative breadth of the fourth segment. In *T. corona* the fourth segment is 2 to 2.5 times broader than the third segment.

Miocene.

Theocamptra spirocyrtis Petrushevskaya sp. nov.
(Plate 23, Figures 28-30)

The description is based on 21 specimens from 139-5-CC; 140-2-1, 5-7 cm and 80-82 cm; 140-2-3, 80-84 cm and 140-2-4, 5-7 cm and 80-82 cm.

Seven to nine transverse rows of pores on the third segment, which is about 60μ long. It is broader in its lower part (about 60-80μ) than in its upper part. The fourth segment 2 to 2.5 times as broad as the third. Very often the large and thin-walled fourth segment is damaged.

Miocene.

Remark:, Some specimens have irregular strictures in the middle part of the third segment. They resemble representatives of the genus *Spyrocyrtis*.

Theocamptra formaster Petrushevskaya sp. nov.
(Plate 23, Figures 26, 27)

Phormostichoartus sp. aff. *P. corona* (Haeckel) Riedel and Sanfilippo, in press, pl. 2J, fig. 7, pl. 3F, figs. 4, 5, part.

The third segment is small, even narrower than the thorax. There are 2 to 3 transverse rows of pores on the third segment. The fourth segment is large, nearly three times broader than the third segment. The pores on the fourth segment are larger in size and more numerous than in all *Theocamptra* species mentioned above. Not only horizontal rows of the pores, but also longitudinal rows may be seen on the fourth segment. This character is similar to *Theocampe* species. There is a fifth segment. This feature is uncommon for *Theocamptra* species.

"Formaster"–latin nominative, meaning "imitator".

Oligocene.

The description is based on eighteen specimens from 144B-2-5, Top, 144B-2-6, Top and 138-2-3, 5-7 cm.

Genus LITHAMPHORA Popofsky, emend. Petrushevskaya

Lithamphora Popofsky, 1908, p. 294; Campbell, 1954, p. 140; Petrushevskaya, 1971b, p. 198. Type species *Lithamphora furcaspiculata* Popofsky, 1908, pl. 36, figs. 6-8.

There is no shelf between thorax and abdomen, as in *Theocampe* species, and the mouth of the test is not constricted as in those species. There is no distinct division into third and fourth segments, as in characteristic for *Theocamptra* species.

The most ancient known representative of the genus seems to be Artostrobiid gen. sp. Riedel and Sanfilippo, 1970, pl. 3, fig. 13 (see also Plate 30, Figure 1).

Lithamphora sacculifera (Clark and Campbell) quadrata subsp. nov.
(Plate 30, Figures 4-6)

?*Lithomitra sacculifera* Clark and Campbell, 1945, p. 50, pl. 7, fig. 18.

Differs from *L. sacculifera* typ. (Plate 30, Figure 3) by greater dimensions. Test is up to 200 μ long and up to 80-100μ broad. The pores are nearly quadrangular and hence the name "quadrata".

The description is based on fourteen specimens from the slide marked in our Leg 14 material as 140-2-CC.

Eocene.

Lithamphora sp.
(Plate 30, Figure 2)

This form is very much like *L. sacculifera quadrata* but only about 120μ long and up to 65-70μ broad. Only six or seven pores in a half of a transverse row of the abdomen, instead of ten pores as in *L. sacculifera quadrata*.

Eocene-Oligocene.

Lithamphora sp. aff. Lithocampe corbula Harting
(Plate 30, Figure 7)

?*Lithocampe corbula* Harting, 1863, p. 12, pl. 1, fig. 21.
?*Tricolocampe polyzona* Haeckel, 1887, p. 1412, pl. 66, fig. 19.
Tricolocampe amphizona Haeckel, 1887, p. 1412, pl. 66, fig. 20.
Siphocampe corbula (Harting) Nigrini, 1967, p. 85, pl. 8, fig. 5.
S. sp. aff. *S. corbula* (Harting) Riedel and Sanfilippo, in press, pl. 2I, figs. 11, 12.

Miocene.

Genus LITHOMITRA Bütschli

Lithomitra Bütschli, 1882, p. 528; Haeckel, 1887, p. 1483; Campbell, 1954, p. 141. = *Lithomitrella* Haeckel, 1887, p. 1483; Campbell, 1954, p. 141. Type species *Eucyrtidium pachyderma* Ehrenberg, 1873; 1875, pl. 11, fig. 21.

The post-thoracic part of the skeleton is subdivided into numerous segments. Each of these segments has one row (rarely two rows) of pores. The surface "striate", very much as in some *Theocampe* (*Tricolocampe*) species (Plate 24, Figure 1).

Lithomitra imbricata group
(Plate 24, Figure 2-5)

Eucyrtidium imbricatus Ehrenberg, 1873, p. 229; 1875, pl. 11, fig. 22.
Lithomitra lineata (Ehrenberg) Riedel and Sanfilippo, in press, pl. 2I, fig. 16, part.

The test spindle-shaped. The broadest segment is the sixth or the seventh (cephalis being the first). The pores numerous, rather small.

Eocene-Oligocene.

Lithomitra nodosaria group
(Plate 24, Figures 29, 30)

Lithomitra nodosaria Haeckel, 1887, p. 1484, pl. 79, fig. 1; Petrushevskaya, 1967, pl. 83, figs. 8, 9; Kruglikova, 1969, pl. 4, fig. 3.
?*Lithomitra altamiraensis* Campbell and Clark, 1944a, p. 53, pl. 7, fig. 9.

The test robust, nearly cylindrical. The broadest segment is the fourth or the fifth (cephalis being the first). Pores are greater in size and less numerous than in *L. imbricata*.

Oligocene-Quaternary.

Remark: The Oligocene specimens have more segments (and longer test) than Quaternary ones.

Lithomitra eruca Haeckel
(Plate 24, Figures 32, 33)

Lithomitra eruca Haeckel, 1887, p. 1485, pl. 79, fig. 3; Petrushevskaya, 1971b, pl. 122, fig. 6.

The distance between segments is less than in *L. nodosaria* and in *L. imbricata*, and the number of pores in a row is greater.

Neogene.

Genus BOTRYOSTROBUS Haeckel

Botryostrobus Haeckel, 1887, p. 1475; Campbell, 1954, p. 141. Type species *Lithostrobus botryocyrtis* Haeckel, 1887, pl. 79, fig. 18.
Artostrobium Haeckel, 1887, p. 1482; Campbell, 1954, p. 140; Petrushevskaya, 1971b, p. 171. Type species *Lithocampe aurita* Ehrenberg, 1844; 1854, pl. 22, fig. 25.

Fully developed test consists of about 10 segments. Each segment has 2 to 8 horizontal rows of pores. Segments (except cephalis and thorax) are separated by distinct constrictions of test wall. The most ancient *Botryostrobus* seems to be *Botryostrobus* sp. P (Plate 24, Figures 8-11).

Botryostrobus miralestensis (Campbell and Clark)
(Plate 24, Figure 31)

?*Dictyomitra costata* Stöhr, 1880, p. 101, pl. 3, fig. 23.
Dictyocephalus miralestensis Campbell and Clark, 1944, p. 45, pl. 6, figs. 12-14.
Artostrobium miralestense (Campbell and Clark) Riedel and Sanfilippo, in press, pl. 1H, figs. 14-17, pl. 2I, figs. 9, 10, pl. 3E, fig. 12, part.

Differs from *Botryostrobus* (=*Eucyrtidium*) *tumidulus* (Bailey, 1856) 1) by greater dimensions of the test, 2) by smaller number of pores: only one or two rows on a segment (instead of 3 to 6 in *B. tumidulus*, see Plate 24, Figures 20, 21)

Oligocene-Miocene.

Botryostrobus auritus (Ehrenberg) group
(Plate 24, Figures 15-18)

Lithocampe aurita Ehrenberg, 1844a, p. 84.
Eucyrtidium auritum (Ehr.) Ehrenberg, 1854, pl. 22, fig. 25.
Lithostrobus seriatus Haeckel, 1887, p. 1474, pl. 79, fig. 17; Petrushevskaya, 1967, p. 145, pl. 82, figs. 1-4, 1971b, pl. 124, figs. 6-8.
Artostrobium auritum (Ehrenberg) group, Riedel and Sanfilippo, in press, pl. 1H, fig. 7, part.

The broadest segment is the fifth or the sixth.

Pliocene-Quaternary.

Remark: Differs from closely related *Botryostrobus* (=*Lithostrobys*) *lithobotrys* (Haeckel, 1887), see Plate 24, Figure 19, by more narrow (up to 60μ, instead of 80μ in *B. lithobotrys*), more slender, elongated skeleton.

Botryostrobus australis (Ehrenberg) group
(Plate 24, Figures 12-14)

Lithocampe australe Ehrenberg, 1844b, p. 187.
Eucyrtidium austral (Ehrenberg) Ehrenberg, 1854, pl. 35a, 21, fig. 18.

?*Eucyrtidium euporum* Ehrenberg, 1872a, p. 291; 1872b, pl. 4, fig. 20; Petrushevskaya, 1967, p. 141, pl. 80, figs. 1-4.
Dictyomitra drigalskii Popofsky, 1908, p. 293, pl. 36, fig. 4.
?*Lithomitra bramlettei* Clark and Campbell, 1944, p. 53, pl. 7, fig. 11, part.
Artostrobium auritum (Ehrenberg) group, Riedel and Sanfilippo, in press, pl. 1H, fig. 8, part.

The broadest segment is the fourth (cephalis being the first). The greatest breadth of the fourth segment is up to 60-70μ.

Differs from the closely related *Botryostrobus* (=*Lithostrobus*) *botryocyrtis* (Haeckel, 1887), see Riedel and Sanfilippo, in press, pl. 1H, fig. 6, by more slender, elongated skeleton.

Miocene-Recent.

Genus SPIROCYRTIS Haeckel

Spirocyrtis Haeckel, 1887, p. 1508; Campbell, 1954, p. 142, Petrushevskaya, 1971b, p. 236. = *Spirocyrtidium* Haeckel, 1887, p. 1509. Type species *Spirocyrtis scalaris* Haeckel (1887, pl. 76, fig. 14).

Very much the same as *Botryostrobus*. Differs by the difference in the thickness of the thoracic wall and that of the post-thoracic segments, pores being smaller on them than on the thorax. The length of the post-thoracic segments is not so definite as it is in *Botryostrobus* species.

Neogene-Recent.

Spirocyrtis subtilis Petrushevskaya sp. nov.
(Plate 24, Figures 22-24)

Spirocyrtis sp. aff. *S. scalaris*, Riedel and Sanfilippo, in press, pl. 1G, fig. 24; pl. 2H, figs. 15, 17, 18, pl. 3E, fig. 2, part.
Artostrobium sp. B, Petrushevskaya, 1971b, pl. 124, figs. 4-5.

The narrowest post-thoracic segment—the third—is about 45μ broad. The broadest segment—the seventh or the eighth—about 70-80μ broad. The outline of the test is variable. The length of a post-thoracic segment is variable also. Very often there is a tube, connected with the spine *A*.

Description is based on thirteen specimens from 139-5-CC, 140-2-1, 5-7 cm and 140-2-4, 80-82 cm.

'Subtilis' —Latin adjective meaning "slender".

Miocene.

Spirocyrtis sp.
(Plate 24, Figures 27, 28)

The species is distinguished from *S. scalaris* by its rounded, not angular segments—the outline of the test is festooned, not step-like as it is in *S. scalaris*.

This species differs from the *Botryostrobus* species referred to by Riedel and Sanfilippo as *Spirocyrtis* sp. aff. *S. scalaris* (in press, pl. 1G, figs. 19, 20, 22) by the skeleton being broader distally, and having more segments.

Quaternary.

Spirocyrtis cornutella Haeckel
(Plate 24, Figure 26)

Spirocyrtis cornutella Haeckel, 1887, p. 1509, pl. 76, fig. 13; Petrushevskaya, 1971c.
Spirocyrtis scalaris Hck., Riedel and Sanfilippo, in press, pl. 1G, fig. 26, part.

This species is distinguished from *S. scalaris* by the irregular outline and narrower skeleton. It is similar in these features to *S. subtilis* but in *S. cornutella* the skeleton is shorter, and there is no tube connected with the spine *A*.

Pliocene?-Quaternary.

Family NEOSCIADIOCAPSIDAE Pessagno

Neosciadiocapsidae Pessagno, 1969, p. 392.

Spines *A, D, Vert, Axial,* two *L* and two *l* are going from *MB* in the same way as in all typical *Eucyrtidioidea*. Cephalis hemispherical to conical, imperforate or perforate, with or without horns. The eucephalic part of the cephalis is confused with the other parts, and there exists one cavity of the cephalis unseparated into lobes. Arches *ap* go in the upper part of the cephalic wall (the same as in *Eribotrys* described by Foreman, 1968)—see Petrushevskaya (1968a, fig. 5 IV-IX). Tube ("cephalopyle", Pessagno, 1969) may be present, connected with the spine *Vert*. Poorly developed or pronounced collar stricture. Thorax conical to cylindrical in shape proximally, flaring to form a narrow to broad thoracic shirt (a velum) distally. Thoracic pores variable in size are situated in transverse (concentric) rows. Mouth may be closed by planiform to conical plate.

Cretaceous-Recent.

Genus PETASSIFORMA Pessagno

Petassiforma Pessagno, 1969, p. 411. Type species *Petassiforma foremanae* Pessagno, 1969, pl. 23, figs. 6-10, pl. 24, fig. 2.

Petassiforma speciosa (Squinabol)
(Plate 7, Figure 21)

Sethoconus speciosus Squinabol, 1904, p. 131, pl. 8, fig. 16.

The dimensions of the skeleton are nearly the same as in *P. formanae Pessagno.*

Cretaceous (Maestrichtian).

Genus EUCECRYPHALUS Haeckel

Eucecryphalus Haeckel, 1860, p. 836; 1881, p. 431; 1887, p. 1220; Campbell, 1954, p. 122; Petrushevskaya, 1972b, p. 222, part. = *Eucecryphalium* Haeckel, 1887, p. 1221; Campbell, 1954, p. 122. Type species *Eucecryphalus gegenbauri* Haeckel, 1862, pl. 5, figs. 12-15.

Eucecryphalus sp.
(Plate 33, Figures 6, 7, 8)

Two divergent horns on the cephalis. The upper part (about 20-30μ long) of the thorax has small pores. Then, after a constriction, comes the middle part—conical, with larger pores. It is about 70μ long and up to 100-110μ broad. The thoracic velum has 3 to 4 rows of pores. The latter are smaller than the pores on the middle part of the thorax. This species is very similar to *Cassideus yoloensis* Pessagno 1969, pl. 26, figs. 1-3, in the outline of the shell. It differs from *C. yoloensis* by its smaller pores on the thorax and by its smaller velum.

Quaternary.

Genus CLATHROCYCLAS Haeckel

Clathrocyclas Haeckel, 1888, p. 434; 1887, p. 1385; Campbell, 1954, p. 132; Foreman, 1968, p. 46. Type species *Clathrocyclas principessa* Haeckel, 1887, pl. 74, fig. 7.

Characteristic for this genus is the roomy, bulbous thorax, nearly cylindrical in its lower part. In *Petassiforma* and in *Eucecryphalus* it is slender, high-conical. In *Clathrocyclas*, pores on the thorax are rather large, not numerous. The cephalis is up to 28-38μ broad. Vertical spines form tube or horn (Petrushevskaya, 1971b, pl. 115, fig. 2).

Cretaceous-Recent.

Clathrocyclas bicornis (Popofsky)
(Plate 33, Figures 11, 12)

Pterocorys bicornis Popofsky, 1908, p. 228, pl. 34, figs. 7, 8.
Theocalyptra bicornis (Popofsky) Riedel, 1958, p. 240, pl. 4, fig. 4; Petrushevskaya, 1967, p. 126, pl. 71, figs. 2, 7, part. *non Clathrocyclas bicornis* Hays, 1965.

The latter species must have another name, "bicornis" being preoccupied in this genus. If J. Hays has nothing against it, as a name for his species "antebicornis" may be suggested.

Pliocene-Recent-*C. bicornis*.

Miocene-Pliocene—*C. antebicornis*.

Genus DIPLOCYCLAS Haeckel

Diplocyclas Haeckel, 1881, p. 434; 1887, p. 1392; Campbell, 1954, p. 132. Type species *Diplocyclas bicorona* Haeckel, 1887, pl. 59, fig. 8.

Thorax high, conical, nearly cylindrical, often irregular in outline. As a rule, the test is smaller than in *Clathrocyclas*. Pores on the thorax rather large, not numerous. The species *Theocalyptra davisiana* (Ehrenberg). described by Riedel, 1958, p. 239, pl. 4, figs. 2, 3 and by Petrushevskaya, 1967, p. 122, pl. 69, figs. 1-7, seems to belong in this genus.

Diplocyclas sp. aff. D. bicorona Haeckel
(Plate 33, Figures 17, 18)

?*Diplocyclas bicorona* Haeckel, 1887, pl. 59, fig. 8.

The upper corona of apophyses is not so distinct as illustrated by E. Haeckel.

Pliocene-Quaternary.

Diplocyclas ionis (Haeckel) group
(Plate 33, Figure 19)

Clathrocyclas ionis Haeckel, 1887, p. 1389, pl. 59, fig. 9.

Differs from the *D. bicorona* group by the shell being broader distally.

Pliocene-Quaternary.

Diplocyclas sp. A group
(Plate 33, Figures 14-16)

Stout apical horn. Nearly cylindrical upper part of the thorax. Lower part of the thorax with very large, irregular pores.

Oligocene.

Genus ANTHOCYRTELLA Haeckel

Anthocyrtis Ehrenberg, 1847, p. 54; Haeckel, 1887, p. 1269; Loeblich and Tappan, 1961, p. 228 (the name is preoccupied). *Anthocyrtella* Haeckel, 1887, p. 1269; *non* Campbell, 1954; Loeblich and Tappan, 1961, p. 228. Type species *Anthocyrtis mespilis* Ehrenberg, 1854, pl. 36, fig. 13.

Differs from *Diplocyclas* by the regular outline of the thorax. There is a distinct shelf separating the velum. The thorax in *Anthocyrtella* is very much like that in *Clathrocyclas* but the dimensions in *Anthocyrtella* are less, and the number of pores is greater. The pores themselves are smaller than in *Clathrocyclas*. The distinguishing character of *Anthocyrtella* is the large and very regular velum with longitudinal rods, more pronounced than the transverse rods. In this characteristic, species of *Anthocyrtella* are similar to *Sciadiocapsa* (?) *petasus* Foreman, 1968, pl. 7, figs. 1, a, b.

Anthocyrtella spatiosa (Ehrenberg) group
(Plate 33, Figures 1-3)

Cycladophora spatiosa Ehrenberg, 1873, p. 222; 1875, pl. 18, figs. 5, 6.

?*Clathrocyclas universa grandis* Clark and Campbell, 1942, p. 88, pl. 7, fig. 18.

There are two subspecies (or species) described by Ehrenberg under that name: 1) with porous velum (Plate 33, Figures 1, 2), and 2) with checkerboard meshwork instead of velum (Plate 33, Figure 3).

Eocene.

Cryptocephalic dicyrtid group

Described by Dumitrica (1970, p. 52). This group is characterized by "simple" or "theoperid" cephalis–a thick-walled sphere not divided into lobes.

Genus GONGYLOTHORAX Foreman

Gongylothorax Foreman, 1968, p. 19; Dumitrica, 1970, p. 56. Type species *Dicolocapsa verbeeki* Tan Sin Hok (1927, pl. 8, figs. 40, 41).

Gongylothorax sp. aff. G. verbeeki (Tan Sin Hok)
(Plate 7, Figures 18, 19)

Dicolocapsa verbeeki, Tan Sin Hok, 1927, p. 44, pl. 8, figs. 40, 41.

Gongylothorax verbeeki (Tan Sin Hok) Foreman, 1968, p. 20, pl. 2, figs. 8, a-c; Dumitrica, 1970, p. 57, pl. 1, fig. 6, pl. 2, figs. 7-10.

Because of poor preservation, no sutural pore was seen.

Cretaceous (Maestrichtian).

Family WILLIRIEDELLIDAE Dumitrica

Cryptothoracic nassellaria with simple cephalis, described by P. Dumitrica (1970, p. 68).

Genus CRYPTAMPHORELLA Dumitrica

Cryptamphorella Dumitrica, 1970, p. 80. Type species *Hemicryptocapsa conara* Foreman (1968, pl. 4, figs. 11a-b).

Cretaceous.

Cryptamphorella sp. aff. C. conara (Foreman)
(Plate 2, Figure 17)

?*Hemicryptocapsa conara* Foreman, 1968, p. 35, pl. 4, figs. 11 a-b.

?*Cryptamphorella conara* (Foreman) Dumitrica, 1970, p. 80, pl. 11, figs. 66 a-c.

The wall of the test is thicker than in the specimens figured by H. Foreman and by P. Dumitirca. The sutural pores and modes on the surface are not seen because of poor preservation.

Cretaceous (E. Campanian).

Cryptamphorella sphaerica (White)
(Plate 2, Figures 15, 16)

?*Baculogyspina sphaerica* White, 1928, p. 306, pl. 41, figs. 12-13.

Holocryptocapsa (?) *sphaerica* (White) Pessagno, 1963, p. 206, pl. 1, fig. 3, pl. 5, figs. 1-2, text-fig. 4.

Cryptamphorella sphaerica (White) Dumitrica, 1970, p. 82, pl. 12, figs. 73-77, pl. 20, figs. 133 a-b.

Cretaceous (E. Campanian).

Genus HOLOCRYPTOCAPSA Tan Sin Hok

Holocryptocapsa Tan Sin Hok, 1927, p. 51; Campbell, 1954, p. 136; Dumitrica, 1970, p. 74. Type species *Holocryptocapsa fallax* Tan Sin Hok (1927, pl. 10, figs. 73, 74).

Holocryptocapsa sp. aff. H. hindei Tan Sin Hok
(Plate 1, Figure 1)

?*Holocryptocapsa hindei* Tan Sin Hok, 1927, p. 53, pl. 10, fig.75; Dumitrica 1970, p. 74, pl. 15, figs. 100 a-d.

Our specimens are somewhat larger than the specimens in Dumitrica's material.

Cretaceous (Albian?-Cenomanian).

Family Group N

To include di- or tri-segmented Nassellaria Eucyrtidioidea with large terminal segment, this segment with or without aperture. If present, the aperture as a tube is small. Cephalis seems to be divided into two chambers by a transverse annular shelf. The shelf is formed by arches *ap* (see Petrushevskaya, 1968a, figs. 5, 10-12). Part of these arches were described by P. Dumitirca as arches *mp*. The spine referred to as the spine *V* (Dumitrica 1970, text-fig. 4) is the normal spine *A*, going from a very short *MB* and forming the apical horn. Vertical spine in *Squinabollum* is absent. Thus this kind of cephalis cannot be regarded as an aberrant type. This type of cephalis is very much the same as in Pterocoryidae and in Amphipyndacinae. These two families and the family in question cannot be united into one family, not because of the difference in their cephalic structure, but because of the different segmentation of their tests.

Cretaceous-Tertiary.

Genus SQUINABOLLUM Dumitrica

Squinabollum Dumitrica, 1970, p. 83. Type species *Clistophaena fossilis* Squinabol (1903, pl. 10, fig. 11).

Clistophaena armche (Plate 28, Figure 19). Type species of *Clistophaena* is quite different from this genus.

Cretaceous.

Squinabollum sp. aff. S. fossilis (Squinabol)
(Plate 1, Figure 4)

?*Squinabollum fossilis* (Squinabol) Dumitrica, 1970, p. 83, pl. 19, figs. 118-122.

The outline of the test, the strong spines on the lower half of the abdomen and the characteristics of the porous wall are the same as in typical *Squinabollum*. The preservation is too poor to identify the species.

Cretaceous (Cenomanian).

Genus DICOLOCAPSA Haeckel

Dicolocapsa Haeckel, 1881, p. 433; 1887, p. 1312; *non* Campbell, 1954, p. 129; Riedel, 1959b, p. 11. Type species, as indicated by Riedel, *Dicolocapsa microcephala* Haeckel (1887, pl. 57, fig. 1).

Tertiary.

Dicolocapsa microcephala Haeckel
(Plate 22, Figure 32)

Dicolocapsa microcephala Haeckel, 1887, p. 1312, pl. 57, fig. 1; Sanfilippo and Riedel, 1970, pl. 1, fig. F.

Miocene.

Genus LIPMANELLA Loeblich and Tappan, emend. Petruskevskaya

Lipmanella Loeblich and Tappan, 1961, p. 119. = *Dictyoceras* Haeckel, 1860, p. 333; 1887, p. 1324; Campbell, 1954, p. 130; Petrushevskaya, 1971b, pp. 198, 220. Type species *Lithornithium dictyoceras* Haeckel (Haeckel, 1862, pl. 8, figs. 1-5).

The cephalis thick-walled, divided (as a rule) into upper and lower parts by means of the arches *ap*, as in *Squinabollum* and in *Dicolocapsa*. The thorax is larger than the cephalis. The abdomen may be separated distinctly from the thorax or it may be united with the thorax in a single segment. The spines *D, Ll* and *Lr* form external feet, which are rather weak. They go laterally from the thorax. In the upper walls of the thorax are three ribs formed by these spines. The spine *A* forms the apical horn. The mouth of the shell is very often open.

Cretaceous?-Quaternary.

Remark: The taxonomical position of the genus is doubtful–maybe it is really pterocoryid.

Lipmanella (?) sp. aff. Lithomelissa? amazon Foreman
(Plate 37, Figure 1)

?*Lithomelissa amazon* Foreman, 1968, p. 26, pl. 4, fig. 1.

The division of the cephalis into lower and upper parts is not developed. In typical *Lithomelissa amazon,* the cephalis is smoother.

Paleogene.

Lipmanella (?) sp. M
(Plate 37, Figure 2)

The thorax, the spines and the pores are very much the same as in *Lipmanella* (?) sp. aff. *Lithomelissa amazon*. The difference is in the smaller dimensions and in the cephalis being constricted at its base, with pronounced subdivision into upper and lower parts.

Miocene.

Lipmanella sp. O
(Plate 37, Figures 4, 5)

Differs from *Lipmanella* (?) sp. M by the distinct subdivision of the skeleton into thorax and abdomen.

This species is somewhat similar to *Dictyoceras insectum* Haeckel (1887, pl. 71, fig. 6), and there is no doubt in the generic identification of this species (*Dictyoceras = Lipmanella*). It is also somewhat similar to *Pterocorys columbo* Haeckel (1887, pl. 71, fig. 2), but differs in the construction of the cephalis. Some specimens are similar to *Pterocyrtidius barbadense* (Ehrenberg) (see Plate 27, Figure 18, 19) in the proportions of the test.

Miocene.

Lipmanella (?) dogieli (Petrushevskaya)
(Plate 37, Figure 10)

Sethoconus (?) *dogieli* Petrushevskaya, 1967, p. 95, pl. 53, figs. 1, 2; 1971b, pl. 110, fig. 2.

The number of pores is less than in *Lipmanella* sp. C–only about 7 pores on a half equator. Pores are irregular and of different sizes. There is no subdivision into thorax and abdomen.

Pliocene-Quaternary.

Remark: This species is very similar also to the Miocene species described as *Lithomelissa campanulaeformis* by Campbell and Clark (1945, p. 44, pl. 6, fig. 1), see Plate 37, Figure 11 in the present report. *Lipmanella* (?) *dogieli* differs from *L. campanulaeformis* by smaller dimensions. Perhaps it represents by itself only Quaternary subgenus of the Miocene species *L. campanulaeformis.*

Subfamily Group E

To include genera without a wide velum (characteristic for Neosciadiocapsidae). In place of the velum there is a long, nearly cylindrical abdomen. Abdominal pores are much larger than thoracic pores, and therefore the thorax and abdomen seem to be built of different kinds of skeletal meshwork. Cephalis of the same kind as in Neosciadiocapsidae, with the arches *ap* going in the upper walls. Cephalis conical, wide at the base. The apex gradually turns into a conical apical horn. *Lampterium* is the most typical genus of the group. Whether this group should be placed among Pterocoryidae or among Neosciadiocapsidae is questionable.

Genus THYRSOCYRTIS Ehrenberg

Thyrsocyrtis Ehrenberg, 1847b, p. 54; Haeckel, 1887, p. 1350; Campbell, 1954, p. 130; Riedel and Sanfilippo, 1970, p. 525. Type species *Thyrsocyrtis rhizodon* Ehrenberg, 1873 (1875, pl. 12, fig. 1).

Podocyrtarium Haeckel, 1887, p. 1337; Campbell, 1954, p. 130. Type species *Podocyrtis tripodiscus* Haeckel, (1887, pl. 72, fig. 4).

Podocyrtonium Haeckel, 1887, p. 1347, Campbell, 1954, p. 130. *Podocyrtis pedicellaria* Haeckel (1887, pl. 72, fig. 8).

Differs from *Lampterium* by distinct longitudinal rows of pores not only on the thorax, but also on the abdomen. Differs from *Podocyrtis* 1) by the abdomen being larger than the thorax, and 2) by the difference in the size between thoracic and abdominal pores.

Tertiary.

Thyrsocyrtis rhizodon Ehrenberg

Thyrsocyrtis rhizodon Ehrenberg, 1873, p. 262; 1875, pl. 12, fig. 1; Riedel and Sanfilippo, in press, pl. 3C, fig. 6.

Eocene.

Thyrsocyrtis tetracantha (Ehrenberg)

Podocyrtis tetracantha Ehrenberg, 1873, p. 254; 1875, pl. 13, fig. 2.
Thyrsocyrtis tetracantha (Ehrenberg) Riedel and Sanfilippo, 1970, p. 527.

Eocene.

Thyrsocyrtis triacantha (Ehrenberg)
(Plate 32, Figure 9; Plate 34, Figure 6)

Podocyrtis triacantha Ehrenberg, 1873, p. 254; 1875, pl. 13, fig. 4.
Thyrsocyrtis triacantha (Ehrenberg) Riedel and Sanfilippo, 1970, p. 526, pl. 8, figs. 2, 3; Moore, pl. 4, fig. 2.

Eocene-Oligocene?

Thyrsocyrtis argulus (Ehrenberg)
(Plate 32, Figure 8)

Podocyrtis argulus Ehrenberg, 1873, p. 248; 1875, pl. 16, fig. 2.
Thyrsocyrtis hirsuta hirsuta (Krasheninnikov) Riedel and Sanfilippo, 1970, p. 7, figs. 8, 9.

Eocene.

Thyrsocyrtis sp. E
(Plate 32, Figure 11)

?*Podocyrtis pedicellaria* Haeckel, 1887, p. 1347, pl. 72, fig. 8.
?*Podocyrtis sinuosa* (?) in Riedel and Sanfilippo, 1970, p. 534, pl. 11, figs. 3, 4.

Eocene.

Podocyrtis (?) or Thyrsocyrtis (?) mitra (Ehrenberg)

Podocyrtis mitra Ehrenberg, 1854, pl. 36, fig. B 20; 1873, p. 251; *non* Ehrenberg, 1875, pl. 15, fig. 4.
Podocyrtis (Lampterium) mitra (Ehrenberg) Riedel and Sanfilippo, 1970, p. 534, pl. 11, figs. 5, 6; Moore, in press, pl. 3, fig. 4.

Eocene.

Thyrsocyrtis ? bromia Ehrenberg

Thyrsocyrtis bromia Ehrenberg, 1873, p. 260; 1875, pl. 12, fig. 2; Riedel and Sanfilippo, 1970, p. 526; Riedel and Sanfilippo, in press, pl. 8, fig. 6, Moore, in press, pl. 5, figs. 1-3.

Cephalis and thorax very similar to *Cyclampterium* species, but abdomen is smaller.

Eocene.

Genus LOPHOCYRTIS Haeckel

Lophocyrtis Haeckel, 1887, p. 1410; Campbell, 1954, p. 134; Riedel and Sanfilippo, 1970, p. 529. Type species *Eucyrtidium stephanophorum* Ehrenberg (1873, p. 223; 1875, pl. 8, fig. 14).

Differs from *Thyrsocyrtis* mainly by the abdomen being narrower.

Lophocyrtis? jacchia (Ehrenberg) group
(Plate 28, Figure 21)

Thyrsocyrtis jacchia Ehrenberg, 1873, p. 261; 1875, pl. 12, fig. 7.
Thyrsocyrtis dionisia Ehrenberg, 1873, p. 260; 1875, pl. 12, fig. 5.

Lophocyrtis? *jacchia* (Ehrenberg) Riedel and Sanfilippo, 1970, p. 530; Riedel and Sanfilippo, in press, pl. 3C, fig. 4 (*non* fig. 5); Moore, in press, pl. 5, figs. 4, 7.
Eocene.

Genus THEOCOTYLE Riedel and Sanfilippo

Theocotyle Riedel and Sanfilippo, 1970, p. 524. Type species *Theocotyle venezuelensis* Riedel and Sanfilippo (1970, pl. 6, fig. 10).

The two upper segments, cephalis and thorax, very similar to these segments of *Stichocorys* and *Cyrtophormis* (in *Theocotyle* they are only larger).The abdomen and the proportions of the whole test are nearly the same as in *Thyrsocyrtis*. The difference between *Theocotyle cryptocephala* and *Thyrsocyrtis argulus* lies mainly in the length of the peristomial teeth. *Theocotyle venezuelensis* (type species of *Theocotyle*) differs from *Thyrsocyrtis* more obviously, but the existence of species like *Theocotyle cryptocephala* indicates a relationship between the two genera.

Eocene.

Theocotyle venezuelensis Riedel and Sanfilippo

Theocotyle venezuelensis Riedel and Sanfilippo, 1970, p. 525, pl. 6, figs. 9-10, pl. 7, figs. 1-2.
Eocene.

Genus LAMPTERIUM Haeckel emend.

Lampterium Haeckel, 1881, p. 434; 1887, p. 1376; Campbell, 1954, p. 132; Riedel and Sanfilippo, 1970, p. 534, partim. Type species *Cycladophora goetheana* Haeckel (1887, pl. 65, fig. 5).

Tetralocorys Haeckel, 1881, p. 436; 1887, p. 1370; Campbell, 1954, p. 132; Riedel and Sanfilippo, 1970, p. 534. Type species *Alacorys litheri* Haeckel (1887, pl. 65, fig. 4).

Lamptidium Haeckel, 1887, p. 1377; Campbell, 1954, p. 132; Riedel and Sanfilippo, 1970. Type species *Cycladophora hexapleura* Haeckel, (1887, = *Lanterna chinensis* Bury (pl. 13, fig. 7).

The difference between *Lampterium goetheana* and species of *Anthocyrtella*, especially *A. spatiosa* forma 2 (Plate 33, Figure 3), is less than the difference between *L. goetheanum* and *Podocyrtis papalis* (type species of *Podocyrtis*). That is the reason for *Lampterium* to be not a subgenus of *Podocyrtis*, but an independent genus. The cephalis in *Lampterium* has not the pronounced lateral lobes characteristic for Pterocoryidae. The arches *ap* are situated in the *Lampterium cephalis* as high as they are in the species of *Ectonocorys* Foreman. The cephalis itself is wide towards the thorax. The thorax in *Lampterium* is very much the same as in *Anthocyrtella* species, but the longitudinal disposition of the pores is more pronounced. The abdomen is not so wide as the velum of Neosciadiocapsidae. Abdominal wall has less pores (they are enormous) and less rods, even than in *Anthocyretella spatiosa* forma 2. Very likely this genus must be placed among Pterocoryidae, as has been done by Riedel and Sanfilippo (1970), but there are some uncertainties about its evolution from *Podocyrtis* species. It may as well have evolved from *Thyrsocyrtis* species (see Plate 32, Figure 11).

Lampterium chalara (Riedel and Sanfilippo)
(Plate 32, Figure 12)

?*Podocyrtis* (?) sp. Bury, 1862, pl. 12, fig. 2.

Podocyrtis chalara Riedel and Sanfilippo, 1970, p. 535, pl. 12, figs. 2, 3; Moore, in press, pl. 3, fig. 5.
Eocene.

Lampterium goetheanum (Haeckel)

Cycladophora goetheana Haeckel, 1887, p. 1376; pl. 65, fig. 5.

Podocyrtis goetheana (Haeckel) Riedel and Sanfilippo, 1970, pl. 535; Riedel and Sanfilippo, in press, pl. 8, fig. 13; Moore, in press, pl. 3, figs. 7, 8.

There do exist varieties of *L. goetheanum* (Plate 32, Figures 13, 14) differing from the typical *L. goetheanum* in the disposition of pores on the abdomen.

Eocene.

Genus CALOCYCLOMA Haeckel

Calocycloma Haeckel, 1887, p. 1384; Campbell, 1954, p. 132; Riedel and Sanfilippo, 1970, p. 524. Type species *Calocyclas casta* Haeckel (1887, pl. 73, fig. 10).
Eocene.

Calocycloma ampulla Ehrenberg
(Plate 34, Figure 4)

Eucyrtidium ampulla Ehrenberg, 1854, pl. 36, fig. 15; 1875, pl. 10, figs. 11, 12.

Sethamphora ampulla (Ehrenberg) Haeckel, 1887, p. 1251.

Calocycloma ampulla (Ehrenberg) Riedel and Sanfilippo, 1970, p. 524, pl. 6, fig. 1; Riedel and Sanfilippo, in press, pl. 3B, fig. 4.
Eocene.

Family PTEROCORYIDAE Haeckel, emend, Riedel

Pterocorida Haeckel, 1881, p. 435.

Lamptrocycladidae Haecker, 1908, p. 452.

Pterocoryidae Haeckel, Riedel, 1967b, p. 296; Petrushevskaya, 1971a, p. 986; 1971b, p. 230.

Eucyrtidioidea with cephalis and thorax, and usually also with abdomen. Cephalis consists of eucephalic lobe and two lateral lobes. The lateral lobes are separated from above by the arches *ap* and from below by the archs *lp*. The cephalis is constricted up to its lower margin. It is a high cone or nearly a cylinder in outline. Apical horn stout. The feet corresponding to the spines *D* and *L* are weak. The pores on the thorax and abdomen are disposed in checkerboard order, or they form longitudinal rows.

Genus PODOCYRTIS Ehrenberg

Podocyrtis Ehrenberg, 1847, p. 54; Haeckel, 1881, p. 436; 1887, p. 1337; Campbell, 1954, p. 130; Riedel and Sanfilippo, 1970, p. 533, part. = *Podocyrtidium* Haeckel, 1887, p. 1344; Campbell, 1954, p. 130. Type species *Podocyrtis papalis* Ehrenberg (1854, pl. 36, fig. 23).

Atypically for Pterocoryidae, the cephalis is often wider towards its lower margin. Abdomen funnel-shaped, conical, narrower than the thorax, and as a rule it is shorter than the thorax. The mouth of the shell is festooned. Festoons are poreless.

Paleogene.

Podocyrtis papalis Ehrenberg
(Plate 35, Figure 1)

Podocyrtis papalis Ehrenberg, 1847b, fig. 2; 1854, pl. 36, fig. 23; 1873, p. 251; Riedel and Sanfilippo, 1970, p. 533, pl. 11, fig. 1; Riedel and Sanfilippo, in press, pl. 3E, fig. 1.

Podocyrtis mitrella Ehrenberg, 1873, p. 351; 1875, pl. 15, fig. 3.

?*Podocyrtis fasciata* Clark and Campbell, 1942, p. 80, pl. 7, figs. 29, 33.

Thorax up to 100-80μ long and about 120μ broad.

Eocene.

Podocyrtis coronatus (Ehrenberg)
(Plate 35, Figure 3)

Eucyrtidium coronatum Ehrenberg, 1873, p. 227; 1875, pl. 10, fig. 9.

Cephalis nearly cylindrical, often curved. Thorax up to 65-75μ long and up to 70-80μ broad.

Eocene.

Genus CALOCYCLETTA Haeckel

Calocycletta Haeckel, 1887, p. 1381; Campbell, 1954, p. 132; Riedel and Sanfilippo, 1970, p. 535. Type species *Calocyclas veneris* Haeckel (1887, pl. 74, fig. 5).

?*Anthocyrtonium* Haeckel, 1887, p. 1274; Campbell, 1954, p. 125. Type species *Anthocyrtium campanula* Haeckel (1887, pl. 62, fig. 17).

Cephalis is typical for Pterocoryidae, thick-walled. Abdomen cylindrical, of the same breadth as the thorax or somewhat narrower. The mouth of the shell is as a rule armed with long flat teeth.

Tertiary.

Calocycletta acanthocephala (Ehrenberg)
(Plate 35, Figures 5-7)

Eucyrtidium acanthocephalum Ehrenberg, 1873, p. 225, 1875, pl. 9, fig. 8.

Cephalic horns, very similar to those in *C. tuberosa* forma A, are present. About 9 to 11 pores on half of the thoracic equator.

Oligocene.

Calocycletta virginis Haeckel sens. str.
(Plate 35, Figures 8-10)

Calocycletta virginis Haeckel, 1887, p. 1381, pl. 74, fig. 4; Riedel and Sanfilippo, 1970, p. 535, part. (*non* fig. 14, pl. 10) Riedel and Sanfilippo, in press, pl. 2H, figs. 8-11 (*non* figs. 5-9), part.

?*Theocyrtis tuberosa* (Riedel) Moore, in press, pl. 5, fig. 5, part.

About 12 to 15 pores on half of the thoracic equator. The external constriction between thorax and abdomen is distinct. The teeth of the abdomen may be undeveloped.

Eocene, *not* Miocene.

Calocycletta veneris Haeckel sens. str.
(Plate 5, Figure 16)

Calocycletta veneris Haeckel, 1887, p. 1381, pl. 74, fig. 5.

Calocycletta virginis Haeckel, Riedel and Sanfilippo, 1970, p. 535, pl. 14, fig. 10; Riedel and Sanfilippo, in press, pl. 2H, figs. 5-7, part; Moore, in press, pl. 10, fig. 7.

About 10 pores on half of the thoracic equator. No external constriction between thorax and abdomen, only an inner shelf. Abdominal teeth are distinct (if not broken). Riedel and Sanfilippo indicate the evolution of this species from forms similar to *C. virginis* (Riedel and Sanfilippo, in press, pl. 2H, figs. 8-11).

Miocene. Characteristic for the zone called the "*Calocycletta virginis* Zone"; therefore (because typical *C. virginis* is absent in this zone) this zone must be named the "*Calocycletta veneris* Zone".

Calocycletta costata (Riedel)
(Plate 35, Figure 17)

Calocyclas costata Riedel, 1959, p. 296, pl. 2, fig. 9.

Calocycletta costata (Riedel) Riedel and Sanfilippo, 1970, p. 535, pl. 14, fig. 12; Moore, in press, pl. 10, fig. 8.

?*Anthocyrtium flosculus* Haeckel, 1887, p. 1277, pl. 62, fig. 19.

About 11 to 13 longitudinal rows of pores on half of the thoracic equator; they are separated by ridges. Teeth of the abdomen are very well developed.

Miocene.

Calocycletta tuberosa (Riedel)
(Plate 35, Figures 11-14)

Theocyrtis tuberosa Riedel 1959a, p. 298, pl. 2, figs. 10, 11; Riedel and Sanfilippo, 1970, p. 535, pl. 13, figs. 8-10; Moore, in press, pl. 5, fig. 6, part.

About 15 to 18 pores on half of the thoracic equator. The surface of the thorax has small tuberculae. The teeth of the mouth are not developed.

There are several forms (subspecies?) of this species.

Calocycletta tuberosa forma A (Plate 35, Figures 11, 12), see Riedel and Sanfilippo (1970, pl. 13, fig. 9), has less pores on the thorax. The cephalis has the same horns that are characteristic for *C. acanthocephala*. *C. tuberosa* forma A and *C. acanthocephala* seem to be closely related and originate from one and the same ancestor. *C. tuberosa* forma A is restricted to Early Oligocene.

Calocycletta tuberosa forma B (Plate 35, Figures 13, 14). Typical *C. tuberosa*. It is distinguished from *C. tuberosa* forma A, 1) by a greater number of pores, 2) by more pronounced tuberculae, and 3) by the narrower cephalis without the additional horns.

Restricted to Oligocene.

Remark: The generic identification is emended for the following reasons. *C. tuberosa* resembles *Eucyrticium barbadense* Ehrenberg (1875, pl. 9, fig. 7, the type species of *Theocyrtis*, which is somewhat similar in the upper two segments of the skeleton to *Calocycletta costata*) no more than it resembles *Calocycletta veneris* (the type species of *Calocycletta*). Taking into account the relation between *C. veneris* and *C. virginis* on the one hand, and the relation between *C. virginis* and *C. tuberosa* on the other, it seems likely that there existed two lines from one and the same ancestor. Both lines may be included in one and the same genus *Calocycletta*.

Calocycletta tuberosa forma C was figured by Riedel and Sanfilippo (in press, pl. 3D, figs. 16 and 18) as *Theocyrtis* sp. aff. *T. tuberosa*. It has tuberculae only on the upper part of the thorax. On the lower part of the thorax there are longitudinal ribs, as characteristic for *C. annosa*. *Calocycletta tuberosa* forma C is very similar to *C. virginis* in the shape and size of the test, and also in the number and disposition of the pores.

Late Eocene-Early Oligocene.

Calocycletta annosa (Riedel)

Phormocyrtis annosa Riedel, 1959a, p. 295, pl. 2, fig. 7.

Theocyrtis annosa Riedel and Sanfilippo, 1970, p. 535, pl. 15, fig. 9; Moore, in press, pl. 7, fig. 7.

Seems to originate from *Calocycletta tuberosa* forma C.

Oligocene-Miocene.

Genus LAMPROCYCLAS Haeckel

Lamprocyclas Haeckel, 1881, p. 434; 1887, p. 1390; Campbell, 1954, p. 132. = *Lamprocyclia* Haeckel, 1887, p. 1390; Campbell, 1954, p. 132; Nigrini, 1967, p. 74; Petrushevskaya, 1971b, p. 232. Type species *Lamprocyclas nuptialis* Haeckel (1887, pl. 74, fig. 15).

Theocorbis Haeckel, 1887, p. 1401; Campbell 1954, p. 134. Type species *Theoconus jovis* Haeckel (1887, pl. 69, fig. 4).

Craterocyclas Haecker, 1908, p. 454; Campbell, 1954, p. 127. Type species *Craterocyclas robustissima* Haecker (1908, p. 85, fig. 596).

Hexalodus Haecker, 1908, p. 456; Campbell, 1954, p. 134. Type species *Hexalodus dendroporus* Haecker (1908, p. 85, fig. 593).

Cephalis is as a rule nearly cylindrical, but sometimes conical (wide at its base). Abdomen as a rule is longer and broader than thorax [In *Theocorythium* (Plate 36, Figure 15) it is smaller]. The mouth of the abdomen is somewhat constricted. As a rule, margin is poreless. It may be elongated into a peristome. Peristome may have festoons or teeth. The walls of the abdomen very often have horns (teeth?). The peristomial and abdominal teeth may constitute a "double corona".

Paleogene-Recent.

Lamprocyclas rhinoceros (Haeckel)
(Plate 36, Figure 1-3)

Lophoconus rhinoceros Haeckel, 1887, p. 1405, pl. 69, fig. 2.

Cephalis has a tube, which is more or less developed in various specimens.

Oligocene.

Lamprocyclas sp. A
(Plate 36, Figure 4)

?*Calocyclas parthenia* Haeckel, 1887, p. 1385, pl. 74, fig. 1.

?*Calocyclas hannai* Campbell and Clark, 1944a, p. 48, pl. 6, figs. 21, 22.

Abdomen (without peristome) 100-120μ long and 130-150μ broad. About 12 longitudinal rows or pores on the half equator of the abdomen.

Miocene.

Lamprocyclas aegles (Ehrenberg) group
(Plate 36, Figure 13)

Podocyrtis aegles Ehrenberg, 1854, pl. 35, B IV, fig. 18; Petrushevskaya, 1971b, pl. 116, fig. 1.

?*Phormocampe lamprocyclas* Haeckel, 1887, p. 1457, pl. 77, fig. 16.

?*Lamprocyclas maritalis antiqua* Riedel, 1953, p. 811, pl. 85, fig. 8.

Abdomen 50-70μ broad. About 11 or 12 longitudinal rows of pores on the half equator of the abdomen.

Miocene-Quaternary.

Lamprocyclas maritalis Haeckel
(Plate 36, Figure 14)

Lamprocyclas maritalis Haeckel, 1887, p. 1390, pl. 74, figs. 13, 14; Nigrini, 1967, p. 74, pl. 7, fig. 5.

Differs from *Lamprocyclas* sp. A by the length of the abdomen–it is about 70-80μ long (without peristome). About 14 or 15 longitudinal rows of pores on the half equator of the abdomen.

Pliocene-Quaternary.

Lamprocyclas heteroporus Hays
(Plate 36, Figures 6, 7)

Lamprocyclas heteroporus Hays, 1965, p. 179, pl. 3, fig. 1; Petrushevskaya, 1971b, pl. 117, figs. 4, 5.

Somewhat similar to *Androcyclas gamphonychos* Jörgensen (1905, pl. 18, figs. 92-97) on the one hand, and it is somewhat similar to *Thyrsocyrtis bromia* (see Riedel and Sanfilippo, in press, pl. 8, fig. 6).

Pliocene.

Lamprocyclas junonis (Haeckel) group
(Plate 36, Figure 8)

Theoconus junonis Haeckel, 1887, p. 1401, pl. 69, fig. 7; Kruglikova, 1969, pl. 4, fig. 38.

Cephalis may be open from above. Abdomen 60-75μ long, 75-90μ broad. About 6-8 longitudinal rows of pores on the half equator of the abdomen.

Pliocene-Quaternary.

Genus PTEROCORYS Haeckel

Pterocorys Haeckel, 1881, p. 435; 1887, p. 1316; *non* Campbell, 1954, p. 130; Petrushevskaya, 1971b, p. 232. Type species *Pterocorys campanula* Haeckel, 1887, pl. 71, fig. 3.

Theoconus Haeckel, 1887, p. 1399; Campbell, p. 134. Type species *Eucyrtidium zancleum* Müller (1858, pl. 6, figs. 1-3).

Lithopilium Popofsky, 1913, p. 377; Campbell, 1954, p. 130. Type species *Lithopilium macroceras* Popofsky (1913, pl. 38, fig. 2, text-fig. 95).

Cephalis cylindrical or conical. Abdomen longer and broader than thorax (if fully developed). The margin of the abdomen without any teeth, or horns. No peristome. The mouth of the shell may be closed as a sack.

Tertiary-Recent.

Pterocorys sabae (Ehrenberg)
(Plate 36, Figure 19)

Pterocanium sabae Ehrenberg, 1872, pl. 7, fig. 17.

Cephalis cylindrical. About thirteen pores on the half equator of the abdomen.

Pliocene-Quaternary.

Pterocorys clausus group (Popofsky)
(Plate 36, Figures 16-18)

Lithornithium clausum Popofsky, 1913, p. 393, text-fig. 116.

Cephalis more conical than in *P. campanula*. All dimensions are less: thorax 60-70μ broad, 30-40μ long; abdomen 60-75μ broad, up to 80μ long. About 12 to 14 longitudinal rows of pores on a half equator of the abdomen.

Pliocene-Quaternary

Genus ANTHOCYRTIDIUM Haeckel emend. Petrushevskaya

Anthocyrtidium Haeckel, 1881, p. 431; 1887, p. 1278; Campbell, 1954, p. 125; Nigrini, 1967, p. 56. Type species *Anthocyrtidium cineraria* Haeckel (1887, pl. 62, fig. 16).

?*Conarachnium* Haeckel, 1881, p. 430; 1887, p. 1290; Campbell, 1954, p. 128. Type species *Eucyrtidium trochus* Ehrenberg (1872b, pl. 7, fig. 17).

Anthocyrtissa Haeckel, 1887, p. 1270; Campbell, 1954, p. 126. Type species *Anthocyrtis ophirensis* Ehrenberg (1872b, pl. 9, fig. 13).

Sethoconus Haeckel, 1887, p. 1290; Campbell, 1954, p. 128. Type species *Eucyrtidium trochus* Ehrenberg (1872b, pl. 7, fig. 17).

Sethocyrtis Haeckel, 1887, p. 1298; Campbell 1954, p. 128. Type species *Sethochytris oxycephalus* Haeckel (1887, pl. 62, fig. 9).

?*Phormocampe* Haeckel, 1887, p. 1456; Campbell 1954, p. 139. Type species *Phormocampe campanula* Haeckel (1887, pl. 77, fig. 13).

Pterocoryidae without abdomen. Cephalis nearly cylindrical.

Pliocene-Quaternary.

Anthocyrtidium ophirense (Ehrenberg)
(Plate 36, Figure 11)

Anthocyrtis ophirensis Ehrenberg 1872a, p. 301; 1872b, pl. 9, fig. 13.

Anthocyrtidium cineraria Haeckel, 1887, p. 1278, pl. 62, fig. 16.

Anthocyrtidium ophirense (Ehrenberg), Nigrini, 1969, p. 56, pl. 6, fig. 3.

Pliocene-Quaternary.

Anthocyrtidium ovata (Haeckel)
(Plate 36, Figure 10)

Anthocyrtis ovata Haeckel, 1887, p. 1272, pl. 62, fig. 13.

?*Anthocyrtidium zanguebaricum* (Ehrenberg). Nigrini, 1969, p. 58, pl. 6, fig. 4.

Pliocene-Quaternary.

Family AMPHIPYNDACIDAE Riedel

Amphipyndacidae Riedel, 1967a, p. 149; 1967b, p. 296; Petrushevskaya, 1971a, p. 985.

The shell consists of numerous segments, and is high-conical in shape. Round pores are disposed on all segments (except cephalis) in checkerboard order. Cephalis thick-walled, consisting of eucephalic lobe, subdivided into upper and lower parts by means of low-disposed arches *aj* (=*VB* of Foreman, 1966).

Genus AMPHIPYNDAX Foreman

Amphipyndax Foreman, 1966, p. 355. Type species *Amphipyndax enessefi* Foreman (1966, text-figs. 10, 11).

Amphipyndax enessefi Foreman
(Plate 8, Figure 15)

Amphipyndax enessefi Foreman, 1966, p. 356, text-figs. 10, 11 a, b.

Cretaceous (Campanian-Maestrichtian).

Amphipyndax stocki (Campbell and Clark)
(Plate 8, Figures 16, 17)

Stichocapsa stocki Campbell and Clark, 1944b, p. 44, pl. 8, figs. 31-33.

Stichocapsa megalocephala Campbell and Clark, 1944b, p. 44, pl. 8, figs. 26, 34.

?*Dictyomitra uralica* Gorbovetz in Kozlova and Gorbovetz, p. 116, pl. 6, figs. 6, 7; Petrushevskaya, 1971b, pl. 88, figs. 2-3.

Amphipyndax stocki (Campbell and Clark), Foreman, 1968, p. 78, pl. 8, fig. 12.

Cretaceous (Santonian-Maestrichtian).

Amphipyndax sp. A
(Plate 8, Figure 18)

Similar to *A. enessefi* in the number of pores on a segment, but there are no nodes. The walls are thicker on the boundaries between segments. It is similar to the species described as *Lithostrobus punctulatus* Pessagno (1963, pl. 5, fig. 5) in the pores on the segments.

Cretaceous (Maestrichtian).

Family EUCYRTIDIIDAE Ehrenberg, emend. Petrushevskaya

Eucyrtidina Ehrenberg, 1847, p. 53.

Eucyrtidiidae Ehrenberg, Petrushevskaya, 1971a, p. 985; 1971b, p. 215.

Theoperidae Haeckel, Riedel 1967b, p. 296, part.

Cephalis is small, often spherical. Post-thoracic segments may be numerous, but may be reduced, or be represented by the abdomen only. The pores are disposed in checkerboard order.

Genus STICHOCAPSA Haeckel

Stichocapsa Haeckel, 1881, p. 439; 1887, p. 1515; Campbell, 1954, p. 143. Type species *Stichocapsa jaspidea* Rüst (1885, pl. 41, fig. 6).

The segments are numerous, and the distalmost ones may be narrower than the middle ones. The segments are separated by distinct external constrictions of the test. H. Foreman (1968) named this genus *Stichomitra*, but *Stichomitra*, as was indicated by Campbell, is a synonym of *Dictyomitra*.

Cretaceous-Tertiary.

Stichocapsa sp. aff. S. ferosia (Kh. Aliev)
(Plate 2, Figure 6)

?*Dictyomitra ferosia* Kh. Aliev, 1961, p. 55, pl. 1, figs. 5, 6.

This form differs from Kh. Aliev's specimens by the smaller longitudinal dimension of a segment.

Cretaceous (Albian-Cenomanian).

Stichocapsa asymbatos (Foreman)
(Plate 8, Figures 1-3)

Stichomitra asymbatos Foreman, 1968, p. 73, pl. 8, fig. 10.
?*Stichocapsa oblongula* Rüst, 1885, pl. 41, fig. 9.
Cretaceous (Campanian-Maestrichtian).

Stichocapsa sp. aff. S. producta (Kh. Aliev)
(Plate 8, Figures 4-5)

?*Dictyomitra producta* Kh. Aliev, 1961, p. 58, pl. 11, fig. 1; 1965, p. 44, pl. 7, fig. 7.
Typical specimens are larger than this species.
Cretaceous (Albian-Maestrichtian).

Stichocapsa cingulata (Squinabol)
(Plate 8, Figure 19)

Stichomitra cingulata Squinabol, 1914, p. 281, pl. 20, fig. 11.
Cretaceous (Maestrichtian).

Stichocapsa sp. aff. L. elegans Squinabol
(Plate 2, Figure 7)

?*Lithostrobus elegans* Squinabol, 1903, p. 138, pl. 9, fig. 22.
Dictyomitra clivosa Kh. Aliev, 1961, p. 54, pl. 1, figs. 1, 2; 1965, p. 38, pl. 6, figs. 7, 8.
There are numerous papillae or beads of the same type as described for *Lithostrobus pseudoconulus* Pessagno (1963, p. 210, pl. 1, fig. 8, pl. 5, figs. 6, 8).
Cretaceous (Cenomanian).

Stichocapsa hexagonalis (Haeckel)
(Plate 25, Figure 1)

Lithostrobus hexagonalis Haeckel, 1887, p. 1475, pl. 79, fig. 20; Nigrini, 1968, p. 58, pl. 1, fig. 10.
The walls are thinner than in Cretaceous species, and there is no inner shelf separating the segments.
Pliocene-Quaternary.

Genus LITHOSTROBUS Bütschli

Lithostrobus Bütschli, 1882, p. 529; Haeckel, 1887, p. 1469; Campbell, 1954, p. 141; =*Cyrtostrobus* Haeckel, 1887, p. 1471. Type species *Eucyrtidium argus* Ehrenberg (1875, pl. 9, fig. 1).
As in *Stichocapsa*, the segments are numerous. They are separated from one another by distinct external constrictions. The distinguishing characteristic is the increasing breadth of the subsequent segments, the thorax and abdomen being very narrow (Plate 25, Figure 2). The genus is closely related to *Cyrtopera laguncula* (Haeckel, 1887, pl. 75, fig. 10) and some other species on this plate.
Cretaceous-Quaternary.

Genus LITHOCAMPE Ehrenberg

Lithocampe Ehrenberg, 1838, p. 128; Haeckel, 1887, p. 1501; Campbell, 1954, p. 140. = *Lithocampula* Haeckel, 1887, p. 1502; Campbell, 1954, p. 140. Type species *Lithocampe radicula* Ehrenberg, 1838 (1854, pl. 22, fig. 23a).
Eusyringoma Haeckel, 1887, p. 1498; Frizzell and Middour, 1951, p. 35; Campbell, 1954, p. 140. Type species *Eucyrtidium lagenoides* Stöhr (1880, pl. 4, fig. 8).
Cyrtocapsella Haeckel, 1887, p. 1512; Campbell, 1954, p. 143; Sanfilippo and Riedel, 1970, p. 451; Riedel and Sanfilippo, 1970, p. 530. Type species *Cyrtocapsa tetrapera* Haeckel (1887, pl. 78, fig. 5).
Syringium Principi 1909, p. 19; Riedel and Sanfilippo, 1970, p. 530. Type species *Syringium vinassai* Principi (1909, pl. 1, fig. 60).
Diabolocampe Burma 1959, p. 329. Type species *Theocampe stenostoma* Haeckel (1887, pl. 66, fig. 23).
The number of segments is 3 to 8. The terminal segment is funnel- or sack-shaped, closed or nearly closed. Its walls are thinner than the walls of the other segments. Thorax, abdomen and the other segments are separated by external constrictions of the shell and by internal rings or shelves. The diameter of the openings, especially that of the preterminal segment, may be comparatively very small. A. Sanfilippo and W. Riedel (1970) believe the 3-4 segmented species belongs in the separate genus *Cyrtocapsella*. Their specimens have three or four segments plus a terminal segment. The latter is more or less developed (or broken), but it must be counted. A. Sanfilippo and W. Riedel indicate the important tendency in the Lithocampids to "throw off" the distal segments, resulting in the genus *Cyrtocapsella*. Nevertheless it is difficult to find the boundary between the specimens on Figures 8 and 14 of Plate 25, and to place them into different genera. I believe *Cyrtocapsella* to be no more than a subgenus of the genus *Lithocampe*.
The character of *Lithocampe* species is that their thorax is 35-60μ long and 50-95μ broad. This genus is most closely related to *Stichocorys*.
Tertiary.

Lithocampe subligata Stöhr group
(Plate 25, Figures 7-10)

Lithocampe subligata Stöhr, 1880, p. 102, pl. 4, fig. 1.
Lithocampe sp. cf. *L. radicula* Ehrenberg, in Petrushevskaya, 1971b, pl. 90, fig. 5.
Oligocene-Miocene.

Lithocampe tetrapera (Haeckel)
(Plate 25, Figure 14)

Cryptocapsa tetrapera Haeckel, 1887, p. 1512, pl. 78, fig. 5.
Cryptocapsella tetrapera (Haeckel) Riedel and Sanfilippo, 1970, p. 530, pl. 14, fig. 7.
Miocene.

Lithocampe cornuta (Haeckel)
(Plate 25, Figures 15, 16)

Cyrtocapsa cornuta Haeckel, 1887, p. 1513, pl. 78, fig. 9.
Cyrtocapsella cornuta (Haeckel) Riedel and Sanfilippo, 1970, p. 531, pl. 14, fig. 8.
Miocene.

Lithocampe compacta (Haeckel)
(Plate 25, Figure 17)

Cyrtocapsa compacta Haeckel, 1887, p. 1512, pl. 77, fig. 8.
Cyrtocapsella tetrapera (Haeckel), Riedel and Sanfilippo, in press, pl. 2E, fig. 6, part.
Miocene.

Lithocampe inaequispina (Principi)

Cyrtocapsa inaequispina Principi, 1909, p. 19, pl. 1, fig. 62.
?*Cyrtocapsa subconica* Nakaseko, 1963, p. 120, pl. 4, fig. 9.
Miocene.

Lithocampe japonica (Nakaseko)
(Plate 25, Figure 18)

Eusyringium japonicum Nakaseko, 1963, p. 193, pl. 4, figs. 1-3, text-figs. 20, 21.
Cyrtocapsella japonica (Nakaseko), Riedel and Sanfilippo, 1970, p. 532, pl. 14, fig. 9).
Miocene.

Genus STICHOCORYS Haeckel

Stichocorys Haeckel, 1881, p. 438; 1887, p. 1479; Campbell, 1954, p. 140; Sanfilippo and Riedel, 1970, p. 530; Riedel and Sanfilippo, 1970, p. 530. Type species *Stichocorys wolfii* Haeckel (1887, pl. 80, fig. 10).
?*Cyrtocapsa* Haeckel, 1881, p. 439; 1887, p. 1512; *non* Campbell, 1954, p. 143; Riedel, 1959b, p. 11. Type species to be not *Cyrtocapsa ovalis* Rüst, 1885, but *Cyrtocapsa chrysalidium* Haeckel (1887, pl. 76, fig. 9).
Very much the same as *Lithocampe*, but the thorax is a little smaller (25-40μ long and 50-60μ broad). The fourth segment is narrower than the third or of the same breadth. The fifth segment is narrower than the fourth.
Miocene-Pliocene.

Stichocorys delmontensis (Campbell and Clark)
(Plate 25, Figures 11, 12)

See Riedel and Sanfilippo, 1970, p. 530.
Miocene.

Stichocorys wolffii Haeckel
(Plate 25, Figure 22)

Stichocorys wolffii Haeckel, 1887, p. 1479, pl. 80, fig. 10, Riedel, 1957a, p. 92, pl. 4, figs. 6, 7; Riedel and Sanfilippo, 1970, p. 530; Riedel and Sanfilippo, in press, pl. 2E, figs. 8, 9.

Stichocorys baerii Haeckel, 1887, p. 1479, pl. 80, fig. 8.
?*Stichocorys huschkei* Haeckel, 1887, p. 1480, pl. 80, fig. 3.
Miocene.

Stichocorys coronata (Carnevale)
(Plate 25, Figures 23, 24)

Calocyclas coronata Carnevale, 1908, p. 33, pl. 4, fig. 24.

Abdomen is joined to the thorax only by sparse and thin meshwork. The thorax is somewhat larger than in *St. wolffii*.

Miocene.

Stichocorys peregrina (Riedel)
(Plate 25, Figure 25)

Eucyrtidium elongatum peregrinum Riedel, 1953, p. 812, pl. 85, fig. 2; Riedel, 1957a, p. 94.
Stichocorys peregrina (Riedel), Riedel and Sanfilippo, 1970, p. 530.
?*Cyrtocapsa chrysalidium* Haeckel, 1887, p. 1515, pl. 76, fig. 9.
??*Stichocorys okenii* Haeckel, 1887, p. 1480, pl. 80, fig. 5.
Miocene-Pliocene.

Genus CYRTOPHORMIS Haeckel

Cyrtophormis Haeckel, 1887, p. 1459; Campbell 1954, p. 139 (*non Cyrtophormis* Haeckel, 1887, p. 1165). = *Cyrtophormiscus* Haeckel, 1887, p. 1460; Campbell, 1954, p. 139. Type species *Cyrtophormis armata* (Haeckel, 1887, pl. 78, fig. 17).
Cyrtophormidium Haeckel, 1887, p. 1460; Campbell, 1954, p. 139. Type species *Cyrtophormis cingulata* Haeckel (1887, pl. 78, fig. 18).

Cyrtophormis is distinguished from *Stichocorys* as a rule by larger thorax (30-60μ long and 50-95μ broad) and by the fourth segment being terminal. This genus differs from *Lithocampe* by the larger abdomen (about 60-90μ long). The distinguishing character is the cephalis which is often not thick-walled and ball-shaped, but possesses postcephalic lobe and tube, with additional horns.

Eocene-Miocene.

Cyrtophormis sp. Ch
(Plate 26, Figure 1)

The fourth segment with small regular pores. Abdomen about 110-120μ broad, 75-85μ long.

Eocene-Oligocene.

Cyrtophormis dominasinensis (Ehrenberg)
(Plate 28, Figure 11)

Podocyrtis dominasinensis Ehrenberg, 1873, p. 250; 1875, pl. 14, fig. 4.
Artophormis dominasinensis (Ehrenberg) Riedel and Sanfilippo, 1970, p. 532; Riedel and Sanfilippo, in press, pl. 6, fig. 6.

The fourth segment is constricted; its pores are irregular, but nearly of the same size. It differs from *Cyrtophormis* sp. Ch only by somewhat smaller dimensions (abdomen about 95μ broad and about 70μ long) and in the number of pores on the abdomen (about 13 pores on half of the thoracic equator, instead of about 15 as in *Cyrtophormis* sp. Ch).

Oligocene.

Cyrtophormis barbadensis (Ehrenberg)
(Plate 28, Figure 12)

Calocyclas barbadensis Ehrenberg, 1873, p. 217, 1875, pl. 18, fig. 8.
Artophormis barbadensis (Ehrenberg), Riedel and Sanfilippo, 1970, p. 532, pl. 13, fig. 5; Moore, in press, pl. 5, fig. 9.

Our specimens have the fourth segment widely open, and its pores are of various sizes. Longitudinal rods or ribs are pronounced on the fourth segment; its walls are thinner than the walls of the whole test. The abdomen is shorter than in *C. dominasinensis*, and has a larger number of smaller pores. These specimens differ from the specimens described by Riedel and Sanfilippo.

Oligocene.

Cyrtophormis gracilis (Riedel)
(Plate 28, Figures 13-15)

Artophormis gracilis Riedel, 1959c, p. 300, pl. 2, figs. 12, 13; Riedel and Sanfilippo, 1970, p. 532, pl. 13, figs. 6, 7; Riedel and Sanfilippo, in press, pl. 3B, figs. 5-7.
Artophormis barbadensis (Ehrenberg), Riedel and Sanfilippo, in press, pl. 3B, fig. 8, part; Moore, in press, pl. 5, figs. 10, 11.

The fourth segment is cylindrical with large irregular meshes. Abdomen rather short (about 50-70μ) barrel-shaped. The ring separating abdomen and the fourth segment is pronounced. About ten longitudinal rows of pores on a half equator of the abdomen.

Eocene-Oligocene.

Cyrtophormis armata Haeckel
(Plate 25, Figures 19, 20)

Cyrtophormis armata Haeckel, 1887, p. 1460, pl. 78, fig. 17.
Lithocampe compressa Stöhr, 1880, p. 103, pl. 4, fig. 5.
Stichocorys armata (Haeckel), Sanfilippo and Riedel, 1970, pl. 1, figs. 30, 31, part; Riedel and Sanfilippo, in press, pl. 2E, figs. 13 and 15 only.
Oligocene?-Miocene.

Cyrtophormis sp
(Plate 25, Figure 21)

?*Cyrtophormis cingulata* Haeckel, 1887, p. 1460, pl. 78, fig. 18.
Eusyringium cf. *vicentense* Campbell and Clark, Nakaseko, 1955, p. 113, pl. 10, fig. 7.
Stichocorys diploconus (Haeckel), Sanfilippo and Riedel, 1970, pl. 1, fig. 32, only; Riedel and Sanfilippo, in press, pl. 2E, fig. 16.
Stichocorys armata (Haeckel), Riedel and Sanfilippo, in press, pl. 2E, fig. 14, only.
Miocene.

EUCYRTIDIIDAE Genus

To include species with confused post-thoracic segments. Cephalis and thorax are very much the same as in *Stichocorys*, and nearly of the same dimensions. Thorax is separated from the post-thoracic part by a distinct constriction and an inner ring. The abdomen is cylindrical or conical. It is not separated from the fourth segment, but rather they are united in the last segment of the skeleton. As a rule it is widely open to the mouth. The wall of the post-thoracic part of the skeleton is thinner than the wall of the thorax.

Oligocene-Miocene.

EUCYRTIDIIDAE gen. sp. "rocket"
(Plate 28, Figures 2, 3)

The post-thoracic part is proximally cylindrical, then it becomes nearly discoidal, and distally again nearly cylindrical. It is more than 100μ long. In the cylindrical part it is about 50μ broad, in its broader part it is about 75-100μ broad. About 9 to 11 longitudinal rows of pores on the cylindrical post-thoracic part of the skeleton.

Oligocene.

EUCYRTIDIIDAE Gen. sp. W
(Plate 28, Figures 6, 7)

?*Artophormis gracilis* Riedel, Riedel and Sanfilippo, in press, pl. 6, fig. 7, part.

Thorax is somewhat bigger than in Eucyrtidiidae gen. sp. "rocket", and the pores on the post-thoracic part are of greater size (the number of longitudinal rows being the same). It is distinguished from the specimen illustrated by Riedel and Sanfilippo by the regular disposition of pores on the post-thoracic part of the skeleton.

Miocene.

Genus CALOCYCLAS Ehrenberg

Calocyclas Ehrenberg, 1847b, p. 54; Haeckel, 1887, p. 1381; Campbell, 1954, p. 132. Type species *Calocyclas turris* Ehrenberg (1875, pl. 18, fig. 2).

The test consists of cephalis, thorax and abdomen. Abdomen is smaller than thorax. They are separated by a distinct constriction and by a well-developed ring. Thorax 70-110μ broad and of the same length; it is nearly spherical in outline. Pores on abdomen are of the same size as the thoracic pores.

Paleogene.

Calocyclas asperum (Ehrenberg)
(Plate 28, Figures 16-18)

Eucyrtidium asperum Ehrenberg, 1873, p. 226; 1875, pl. 8, fig. 15.

About 10 to 13 longitudinal rows of pores on a half of the thoracic equator.

Eocene-Oligocene.

Genus CYCLAMPTERIUM Haeckel

Cyclampterium Haeckel, 1887, p. 1379; Campbell, 1954, p. 132. Type species *Cycladophora pantheon* Haeckel (1887, pl. 68, fig. 3).

The test consists of cephalis, thorax and abdomen. Abdomen is larger than thorax. They are separated by an inner ring. Thorax 100-180μ long and about 200μ broad. Pores on the abdomen are much larger than thoracic pores. *Cyclampterium* is similar to *Lampterium* in the construction of the shell. They differ by the characters of their cephalises. In *Cyclampterium* it is ball-like, "theoperid", simple. In *Lampterium* it is conical with a pyramidal horn, of "Ectonocorys-type".

Tertiary.

Cyclampterium milowi Riedel and Sanfilippo

Cyclampterium milowi Riedel and Sanfilippo, in press, pl. 3B, fig. 3, pl. 7, fig. 8, 9.

Abdomen long, subcylindrical or expanding distally, often destroyed. Pores large, irregular. Thorax hemispherical, constricted at the boundary between thorax and abdomen.

Oligocene.

Cyclampterium pegetrum Sanfilippo and Riedel
(Plate 34, Figures 7, 8)

Cyclampterium? *pegetrum* Sanfilippo and Riedel, 1970, p. 456, pl. 2, figs. 8-10.

There are several forms (subspecies?) of this species. One (Riedel and Sanfilippo, in press, pl. 2D, figs. 12 and 14, only) is characterized by a high (about 140-150μ) thorax, having about 14 longitudinal rows of pores on a half of its equator. Thorax is sack-shaped with irregularly disposed pores. See Plate 34, Figure 8. This form is here named "f.II".

Low Miocene.

C. pegetrum f.I (Plate 34, Figure 7) is characterized by a flat thorax (about 100μ long). It has about 11 longitudinal rows of pores on a half of its equator. Thorax conical or cylindrical. Its pores are of nearly equal size, and are disposed regularly. It is illustrated by Riedel and Sanfilippo, in press (pl. 3B, fig. 1, 2).

Restricted to "*D. ateuchus* Zone", Oligocene.

Genus EUCYRTIDIUM Ehrenberg

Eucyrtidium Ehrenberg, 1847a, p. 54; Haeckel, 1887, p. 1487; Campbell, 1954, p. 140; Petrushevskaya, 1971b, p. 215, part. = *Eucyrtis* Haeckel, 1881, p. 438; 1887, p. 1488. Type species *Lithocampe acuminata* Ehrenberg, 1844 (1854, pl. 22, fig. 27).

Very similar to *Lithocampe*. It has multisegmented skeleton, constricted distally. It is distinguished by less pronounced external constrictions between the segments. In many species the pores are disposed not in checkerboard order but in distinct longitudinal rows. Cephalis and thorax are united to form a compound cephalo-thorax. The upper part of the skeleton is conical, because of that union and because of the conical apical horn. The horn, as a rule is broad at its base. In *Lithocampe* the apical horn is thin, often broken.

Eucyrtidium? sp. C
(Plate 2, Figure 13)

The pores are disposed in checkerboard order. It is somewhat similar to *Stichomitra cechena* Foreman (1968, p. 8, fig. 1), but the cephalis has not apical horn and it is submerged into thorax, and the wall of the skeleton is much thicker than in Foreman's species.

Cretaceous (E. Campanian).

Eucyrtidium? cubense Riedel and Sanfilippo

Eucyrtidium cubense Riedel and Sanfilippo, in press, pl. 7, figs. 10, 11.

Thick-walled test. Post-abdominal part not separated into segments. Pores on this part irregular. Somewhat similar to *Eusyringium* and *Lithocampium* species, but post-abdominal part of the skeleton is not constricted.

Eocene.

Eucyrtidium sp. aff. E. montiparum Ehrenberg
(Plate 26, Figures 2-4)

?*Eucyrtidium montiparum* Ehrenberg, 1873, p. 230; 1875, pl. 9, fig. 11.

Similar to *E. montiparum* in the proportions of the test and in the number and disposition of pores. But for *E. montiparum* more distinct constrictions between segments are typical. The species in question differs from *E.*? *cubense* by the presence of distinct inner rings separating the segments of the post-abdominal part.

Eocene.

Eucyrtidium acuminatum (Ehrenberg) group
(Plate 26, Figure 17)

Lithocampe acuminata Ehrenberg, 1844, p. 84.

Eucyrtidium acuminatum (Ehrenberg) Ehrenberg, 1854, pl. 22, fig. 27; Stöhr, 1880, p. 104, pl. 4, fig. 6, *non* Bandy, Casey and Wright, 1971, pl. 2, fig. 5.

Miocene-Quaternary.

Genus STICHOPODIUM Haeckel

Stichopodium Haeckel, 1881, p. 439; 1887, p. 1447; Campbell, 1954, p. 136. Type species *Stichopodium dictyopodium* Haeckel, (1887, pl. 75, fig. 6).

In all features very similar to *Eucyrtidium*. Nevertheless it is distinguished by deep outer constriction and by pronounced inner shelf separating cephalo-thorax from post-thoracic part of the skeleton. Abdomen and other segments are united into one unit. The walls of the latter may be thinner than the walls of the cephalo-thorax. The post-thoracic segments are separated from one another only by rings in the wall. These rings may have a variable position and even form a spiral. As a rule there are not more than four post-thoracic segments in the "unit".

Stichopodium ? microporum (Ehrenberg)
(Plate 25, Figures 4-6)

Eucyrtidium microporum Ehrenberg, 1873, p. 230; 1875, pl. 9, fig. 20.

Lithostrobus cornutus Haeckel, 1887, p. 1474, pl. 77, fig. 6.

Eocene-Oligocene.

Stichopodium cienkowskii (Haeckel)
(Plate 26, Figures 18, 19)

Eucyrtidium cienkowskii Haeckel, 1887, p. 1493, pl. 80, fig. 9.

?*Eusyringium cannostoma* Haeckel, 1887, p. 1499, pl. 80, fig. 13.

The first post-thoracic segment (abdomen?) is about 30-40μ long. The broadest part of the test is not in this segment, but in the second or in the third post-thoracic segment. On the post-thoracic segments there are about 17 to 19 longitudinal rows of pores on the half equator.

Miocene.

Stichopodium martellii (Principi)
(Plate 26, Figures 9, 10)

Stichocorys martellii Principi, 1909, p. 16, pl. 1, fig. 52.

The first post-thoracic segment (abdomen?) is about 60μ long. The broadest part of the test is in the lower part of this segment. About 13 longitudinal rows of pores on the half equator of the post-thoracic part.

Low Miocene.

Stichopodium martellii conicum Petrushevskaya subsp. nov.

The description is based on 28 specimens from Site 140, Core 2. Differs from typical *St. martellii* by shorter first post-thoracic segment (about 40-50μ). This segment has somewhat different outline.

Miocene.

Stichopodium calvertense (Martin)
(Plate 28, Figure 13)

Eucytidium calvertense Martin, 1904, p. 450, pl. 130, fig. 5; Kling, in press, pl. 1, fig. C. (*Non Eucyrtidium calvertense* Martin, Hays 1965, *non E. calvertense* in Bandy, Casey and Wright, 1971, pl. 9, fig. 1.
?*Spirocyrtis elegans* Nakaseko, 1963, p. 196, pl. 3, fig. 12, part.

Very similar to *S. cienkowskii*, but differs by narrower shell (the broadest place being about 80μ instead of 90-100μ), by a smaller number of segemnts, and by a smaller number of longitudinal rows of pores (about 11 instead of 17 on the half equator of the second post-thoracic segment).

Miocene-Pliocene.

Remark: This species differs from Antaractic Miocene-Pliocene specimens by the thinner wall of post-thoracic part, by a narrower shell (about 80μ instead of about 90-110μ), and by a smaller number of pores (about 11 longitudinal rows on half of the second post-thoracic segment, instead of 15).

Stichopodium ? sp. aff. Eucyrtidium matuyamai Hays
(Plate 26, Figures 5, 6, 15, 16)

Eucyrtidium matuyamai Hays, Kling, 1971, pl. 1, fig. D.
?*Eucyrtidium lagena* Haeckel, 1862, pl. 4, fig. 11.

The broadest part of the shell is about 70-90μ. There are about 10 to 12 longitudinal rows of pores on the second post-thoracic segment. The pores are large and somewhat irregularly disposed. The post-thoracic part is very long, nearly cylindrical. The first post-thoracic segment is about 70μ long.

Pliocene.

Stichopodium ? spp.
(Plate 26, Figures 21, 22)

They differ from *Stichopodium*? sp. aff. *E. matuyamai* by the ovate outline of the shell, and by greater number of pores (about 12 to 14 longitudinal rows on the second post-thoracic segment). It is very much the same as *S. martellii coincum* but the first post-thoracic segment is longer or it may be of variable length.

Stichopodium sp. T
(Plate 26, Figure 14)

Similar to *Eucyrtidium teuscheri*, Haeckel, 1887 (see Petrushevskaya, 1967, p. 121, pl. 68, figs. 1, 2), but differing from typical *E. teuscheri* by broader shell and greater number of pores.

Quaternary.

Genus ARTOCYRTIS Haeckel

Artocyrtis Haeckel, 1887, pl. 1490; Campbell, 1954, p. 140. Type species *Eucyrtidium profundissimum* Ehrenberg (1872b, pl. 7, fig. 12).

Very similar to *Eucyrtidium* in compact outline of the shell. Differs by larger thorax (about 50-70μ long and 70-100μ broad), and by irregular or sometimes transverse disposition of pores on abdomen and post-abdominal segments (see Plate 26, Figure 11).

Genus EUSYRINGIUM Haeckel

Eusyringium Haeckel, 1881, p. 437; 1887, p. 1496; Frizzell and Middour, 1951, p. 35; Campbell, 1954, p. 140; Riedel and Sanfilippo, 1970, p. 527. = *Eusyringartus* Haeckel, 1887, p. 1496; Campbell, 1954, p. 140. Type species *Eusyringium conosiphon* Haeckel (1887, pl. 78, fig. 10).

Very similar to *Stichopodium* in the construction and dimensions of cephalis and thorax. Differs from *Stichopodium* by its post-thoracic part not being subdivided into any segments (very much as in Eucyrtidiidae genus, described above). Differs from mentioned Eucyrtidiidae genus by the funnel-shaped outline of that part. The pores on it are situated in longitudinal rows. These pores are of the same type as those on the thorax. The thorax is smaller than in *Thyrsocyrtis* and *Lampterium*. In other features *Eusyringium* is similar to these two genera. The taxonomic position of this genus is doubtful. The existence of such species as *E. striata* and *Lithocampium*? sp. B, very similar to *Thyrsocyrtis* sp. E (Plate 32, Figure 11) in all features except the size of abdominal pores, indicates the possibility of *Eusyringium* and *Thyrsocyrtis* being closely related; *Thyrsocyrtis* a descendant of *Eusyringium*. This possibility is no more questionable than the possibility (indicated by Riedel and Sanfilippo, 1970) that *Podocyrtis* and the species referred to here as *Thyrsocyrtis* are closely related. What is more, the construction of the cephalis in *Eusyringium* species and in the representatives of *Thyrsocyrtis* is practically the same.

Cretaceous-Tertiary.

Eusyringium striata (Brandt)
(Plate 32, Figures 1, 2)

Phormocyrtis striata Brandt, 1935 in Wetzel, 1935, p. 55, pl. 9, fig. 12; Riedel and Sanfilippo, 1970, p. 532, pl. 10, fig. 7; Riedel and Sanfilippo, in press, pl. 8, fig. 4.

Early Tertiary.

Eusyringium ? sp. aff. Theocampe subtilis (Squinabol)
(Plate 1, Figure 1)

?*Theocampe subtilis* Squinabol, 1904, p. 135, pl. 8, fig. 43.

Differs from *E. striata* in the proportions of the test.

The preservation of the specimens is too poor to permit any certain conclusions about species identification. The indication of the similarity with *Theocampe* species is appropriate for the Cretaceous forms of *Eusyringium*.

Cretaceous (Albian-Cenomanian).

Eusyringium fistuligerum (Ehrenberg)
(Plate 32, Figure 3)

Eucyrtidium fistuligerum Ehrenberg, 1873, p. 229; 1875, pl. 9, fig. 3.
Eucyrtidium sipho Ehrenberg, 1873, p. 233; 1875, pl. 9, fig. 2.
Eusyringium fistuligerum (Ehrenberg) Haeckel, 1887, p. 1497; Riedel and Sanfilippo, 1970, p. 527, part.; Riedel and Sanfilippo, in press, pl. 3B, fig. 14; Moore, in press, pl. 4, fig. 10, part.

Abdomen (without siphon) more than 120μ long and no less than 120μ broad.

Eocene.

Eusyringium tubulus (Ehrenberg)
(Plate 32, Figures 4, 5)

Eucyrtidium tubulus Ehrenberg, 1854, pl. 36, fig. 19; 1873, p. 233; 1875, pl. 9, fig. 6.
Eusyringium fistuligerum (Ehrenberg) Moore, in press, pl. 4, fig. 11, part.

Abdomen up to 100μ long (without siphon) and up to 90μ broad.

Eocene.

In the Early Oligocene a small, aberrant form of this species existed (Plate 32, Figure 5).

Genus LITHOCAMPIUM Haeckel

Lithocampium Haeckel, 1881, p. 437; 1887, p. 1504; *non* Campbell, 1954, p. 141, but Riedel, 1959b, p. 16. Type species *Lithocampe diploconus* Haeckel (1887, pl. 77, fig. 3).

The type species of this genus (Plate 26, Figure 12) is similar to the genus *Artocyrtis* Haeckel (Plate 26, Figure 11) in the proportions of the test. But *Artocyrtis* has no longitudinal ribs on the surface that separate the rows of pores. In the other species (*Lithocampium* sp. A) the thorax is smaller. These species are similar to *Eusyringium striata*. The difference between *Lithocampium* and *Eusyringium* lies in the segmentation of the post-thoracic part of the test.

Lithocampium sp. A

Lithocampium sp. A, Riedel and Sanfilippo, in press, pl. 7, fig. 12.

Paleocene.

Lithocampium (?) sp. B
(Plate 32, Figures 6, 7)

This species is similar to *Eusyringium striata* in the ratio of the segments, and in the size and disposition of the pores. The difference is in the presence of an internal ring (or shelf) dividing the abdomen into two parts (or separating the abdomen from a short fourth segment). This segment is very much like the siphon of typical *Eusyringium*. This species differs from *Lithocampium* sp. A by the greater number of pores and by the distinct longitudinal disposition of the pores.

Miocene.

Lithocampium diploconus (Haeckel) group
(Plate 26, Figure 12)

Lithocampe diploconus Haeckel, 1887, p. 1505, pl. 77, fig. 3.

About 13 to 15 longitudinal rows of pores on the thorax, sometimes continuing on the surface of the first post-thoracic segment and even on the second post-thoracic segment. The first post-thoracic segment is about 40-50μ long. It may be a little broader than the thorax, convex, as a very short, flattened waterbarrel, or it may be nearly cylindrical and even narrower than the thorax.

Oligocene-Low Miocene.

Genus DICTYOMITRA Zittel

Dictyomitra Zittel, 1876, p. 80; Haeckel, 1887, p. 1476; Campbell, 1954, p. 140; Foreman, 1968, p. 63. = *Dictyomitroma* Haeckel, 1887, p. 1478; Campbell, 1954, p. 140. Type species *Dictyomitra multicostata* Zittel (1876, pl. 11, figs. 2-4).

Stichomitra Cayeux 1897, p. 204; Campbell, 1954, p. 140. Type species *Stichomitra costata* Cayeux (1897, pl. 8, fig. 68).

Diplostrobus Squinabol, 1904, p. 140; Campbell 1954, p. 140. Type species *Diplostrobus crassispina* Squinabol (1904, pl. 8, fig. 37).

Longitudinal ribs on the shell surface.

Cretaceous.

Dictyomitra crassispina (Squinabol)
(Plate 2, Figure 4)

Diplostrobus crassispina Squinabol, 1904, p. 140, pl. 8, fig. 37.

Cretaceous (Albian ?-Cenomanian).

Dictyomitra costata (Squinabol)
(Plate 2, Figure 3)

Stichophormis costata Squinabol, 1904, p. 136, pl. 8, fig. 41.

Cretaceous (Albian?-Cenomanian).

Dictyomitra (?) disparlita Kh. Aliev

Dictyomitra ? *disparlita* Kh. Aliev, 1961, p. 59, pl. 2, fig. 2; 1963, p. 46, pl. 8, fig. 2, pl. 14, fig. 8.

Cretaceous (Albian-Cenomanian).

Dictyomitra veneta (Squinabol)
(Plate 2, Figure 2)

Phormocyrtis veneta Squinabol, 1904, p. 134, pl. 9, fig. 30.

Cretaceous (Albian?-Maestrichtian).

Dictyomitra pseudomacrocephala Squinabol
(Plate 2, Figure 5)

Dictyomitra pseudomacrocephala Squinabol, 1904, p. 139, pl. 10, fig. 2.

Dictyomitra sagitafera Kh. Aliev, 1961, p. 25, pl. 1, figs. 1-3; 1965, p. 55, pl. 10, figs. 2-4.

Cretaceous (Albian?-E. Campanian).

Dictyomitra sp. A
(Plate 2, Figure 12)

Similar to *Dictyomitra duodecimcostatas* Squinabol, but differs by the broader shell. The fourth, or the fifth, or the sixth segment may be inflated.

Cretaceous (Maestrichtian).

Dictyomitra duodecimcostata Squinabol group
(Plate 2, Figures 10, 11)

Lithostrobus duodecimcostatus Squinabol, 1904, p. 138, pl. 10, fig. 21.

Cretaceous (Lower Campanian).

Dictyomitra striata Lipman
(Plate 8, Figures 12, 13)

Dictyomitra striata Lipman, 1953, p. 41, pl. 3, figs. 12-14; Kh. Aliev, 1965, pl. 10, fig. 6; Kozlova and Gorbovetz, 1966, p. 116, pl. 6, figs. 2-5.

?*Dictyomitra lamellicostata* Foreman, 1968, p. 65, pl. 7, figs. 8, a, b.

The absence of apertural teeth and proximal costal lamellae in *D. striata* seem to be the result of poor preservation of the specimens described as *D. lamellicostata*.

Cretaceous (Campanian-Maestrichtian).

Dictyomitra multicostata Zittel
(Plate 8, Figures 9, 10)

Dictyomitra multicostata Zittel, 1876, p. 81, pl. 2, figs. 2-4; Campbell and Clark, 1944b, p. 39, pl. 8, fig. 42, part.; Foreman, 1968, p. 63, pl. 7, figs. 9, a, b.

Cretaceous (Albian-Maestrichtian).

Dictyomitra ornata Kh. Aliev
(Plate 8, Figure 8)

Dictyomitra ornata Kh. Aliev, 1961, p. 29, pl. 1, figs. 6, 7, 1965, p. 53, pl. 9, figs. 9, 10.

There are several pores (instead of one as in *D. multicostata*) in a longitudinal furrow on a segment.

Cretaceous (Albian-Maestrichtian).

Dictyomitra ? sp. aff. D. regina (Campbell and Clark)
(Plate 8, Figure 11)

?*Lithomitra regina* Campbell and Clark, 1944b, p. 41, pl. 8, figs. 30, 38, 40.

?*Dictyomitra regina* (Campbell and Clark), Foreman, 1968, p. 68, pl. 8, figs. 5 a-c.

?*Dictyomitra crebrisulcata* Squinabol, 1904, p. 231, pl. 10, fig. 11.

There are several pores on a segment in a longitudinal row, as in *D. ornata*. What is more, there are no distinct external constrictions separating the segments, and the outline of the test is very much as in *Eucyrtidium* species.

Cretaceous (Campanian-Maestrichtian).

Dictyomitra ? sp. aff. Stichocapsa tecta Rüst
(Plate 2, Figure 14)

?*Stichocapsa tecta* Rüst, 1885, p. 318, pl. 41, fig. 11.

The difference from typical *Dictyomitra* is the same as is mentioned for *Dictyomitra* sp. aff. *D. regina*. It differs from *Stichocapsa* species by the disposition of pores and the outline of the test. It differs from Rüst's specimens by the number of segments and the smaller pores.

Cretaceous (E. Campanian).

Dictyomitra tiara Holmes
(Plate 2, Figure 8)

Dictyomitra tiara Holmes 1900, p. 702, pl. 38, fig. 4.

Dictyomitra ordinaria Kh. Aliev, 1965, p. 51, pl. 9, fig. 4.

Dictyomitra carpatica Lozynyak, 1969, p. 38, pl. 2, figs. 11-13.

This species is distinguished by the ribs, which do not extend from segment to segment, but are interrupted.

Cretaceous (Albian-Cenomanian).

Family PLECTOPYRAMIDIDAE Haecker, emend. Petrushevskaya

Plectopyramidae Haecker, 1908, p. 457; Petrushevskaya, 1971a, p. 986; 1971b, p. 225.

Small dome-shaped cephalis and a vast thorax. Pores are disposed on the thorax in distinct longitudinal rows. Internal spines nearly reduced.

Remark: It is very likely that such species as *Lithapium* (?) *mitra* (?) Riedel and Sanfilippo, 1970, pl. 4, figs. 6, 7 belong in the Plectopyramidinae.

Genus CORNUTELLA Ehrenberg, emend. Petrushevskaya

Cornutella Ehrenberg, 1838, p. 128; Haeckel, 1881, p. 427; 1887, p. 1180 (*non* Campbell, 1954, p. 121); Petrushevskaya, 1971b, p. 212. = *Cornutissa* Haeckel, 1881, p. 427; 1887, p. 1181; Campbell, 1954, p. 121. Type species *Cornutella clathrata* Ehrenberg, 1838; 1854, pl. 22, fig. 39.

Cornutanna Haeckel, 1881, p. 427; 1887, p. 1183; Campbell, 1954, p. 121. Type species *Cornutanna ortoconus* Haeckel (1887, unfigured).

Cornutosa Haeckel, 1881, p. 427; Campbell, 1954, p. 121. Type species *Cornutura spiralis* Haeckel, 1881, unfigured.

Cornutellium Haeckel, 1881, p. 430; 1887, p. 1293; Campbell, 1954, p. 121. = *Ceratarachnium* Haeckel 1887, p. 1293. Type species *Cornutella trochus* Ehrenberg (1872b, pl. 9, fig. 14).

Cornutellium Haeckel, 1887, p. 1180 (*non* Campbell 1954, p. 121, but Riedel, 1959b, p. 10. Type species *Cornutella hexagona* Haeckel, 1887, pl. 54, fig. 9.

Ortocornutana Clark and Campbell, 1945; Campbell, 1954, p. 121. Type species *Cornutanna orthoconus* Haeckel, 1887, unfigured. Cretaceous-Recent.

Cornutella sp. aff. C. californica Campbell and Clark
(Plate 30, Figure 10)

?*Cornutella californica* Campbell and Clark, 1944b, p. 22, pl. 7, figs. 33, 34, 42, 43; Foreman, 1968, p. 21, pl. 3, fig. 1b, part.

Long, narrow skeleton somewhat irregular in outline (up to 300μ long and up to 70μ broad without a horn). Up to six pores on the half equator of the shell.

Eocene-Oligocene.

Cornutella clava Petrushevskaya, sp. nov.
(Plate 30, Figures 11, 16)

Somewhat similar to *Cornutella* sp. aff. *C. californica*, but broader (up to 100μ broad). It is distinguished 1) by the strange shape of its apical horn, resembling a mace, and 2) by a ridge (may be a foot produced by spine *D*) on the surface of the shell.

The description is based on five specimens from 139-5-CC and 140A, 2-6 cm, 80-82 cm.

"Clava" is a Latin noun, feminine, meaning "a mace".

Oligocene.

Cornutella stiligera Ehrenberg group
(Plate 30, Figures 14, 15)

Cornutella stiligera Ehrenberg, 1854, pl. 36, fig. 1; 1875, pl. 3, fig. 3.

It is distinguished by its straight outline. Up to 220μ long (without a horn), and up to 70μ broad.

Oligocene.

Cornutella bimarginata (Haeckel) group
(Plate 30, Figures 13)

Sethoconus bimarginatus Haeckel, 1887, p. 1295, pl. 57, fig. 12; Petrushevskaya, 1967, p. 106, pl. 59, fig. 4.
Sethoconus subtilis Carnevale, 1908, pl. 4, fig. 16.
Sethoconus woodfordi Campbell and Clark, 1944, p. 44, pl. 6, fig. 8; Nakaseko, 1963, p. 174, text-fig. 7, pl. 7, fig. 8.

Miocene-Recent.

Cornutella clathrata Ehrenberg
(Plate 30, Figures 16, 17)

Cornutella clathrata Ehrenberg, 1844a, p. 77, 1854, pl. 22, fig. 39, part.

Pores are disposed somewhat irregularly, and the outline of the shell is irregular. The test may be curved. Up to 200μ long (without a horn), and up to 60-70μ broad.

Oligocene.

Cornutella profunda Ehrenberg
(Plate 30, Figures 18, 19)

Cornutella clathrata β profunda Ehrenberg, 1854, pl. 35B, IV, fig. 24.
Cornutella verrucosa Ehrenberg, 1872a, p. 287; 1872b, pl. 9, fig. 16; Petrushevskaya, 1967, p. 109, pl. 61, figs. 1-4.

It is distinguished by having the smallest dimensions, by the weak apical horn, and by the number and disposition of pores.

Miocene-Recent.

Cornutella longisetta Ehrenberg
(Plate 30, Figure 8)

Cornutella longisetta Ehrenberg, 1872a, p. 287; 1872b, pl. 9, fig. 15; Petrushevskaya, 1967, p. 110, pl. 62, figs. 1, 2.

Distinguished by its large cephalis.

Oligocene?-Recent.

Genus PERIPYRAMIS Haeckel

Peripyramis Haeckel, 1881, p. 428; 1887, p. 1162; Campbell, 1954, p. 119; Riedel, 1958, p. 231. Type species *Peripyramis circumtexta* Haeckel, 1887, pl. 54, fig. 5.
??*Spongopyramis* Haeckel, 1887, p. 1260; Campbell, 1954, p. 128. Type species *Plectopyramis spongiosa* Haeckel, 1881 (1887, pl. 56, fig. 10).

Quadrangular pores are disposed in longitudinal, but *not in transverse*, rows.

Peripyramis magnifica (Clark and Campbell)
(Plate 31, Figure 3)

Sethopyramis magnifica Clark and Campbell, 1942, p. 72, pl. 8, figs. 1, 5, 9.

Somewhat similar to *Bathropyramis quadrata* Haeckel, and at the same time to *Lithapium* (?) *mitra* (?) Riedel and Sanfilippo, 1970 (Plate 34, Figure 3). The difference lies in the disposition and outline of the pores.

Eocene.

Peripyramis woodringi (Campbell and Clark)
(Plate 31, Figure 10)

Bathropyramis woodringii Campbell and Clark, 1944a, p. 39, pl. 5, figs. 21, 22; Riedel, 1953, p. 810, pl. 85, fig. 6.
?*Cinclopyramis infundibulum* Haeckel, 1887, p. 1161, pl. 54, fig. 7.

The ribs of the thorax are divergent for up to 200μ of their length.

Miocene.

Peripyramis circumtexta Haeckel
(Plate 31, Figure 4)

Peripyramis circumtexta Haeckel, 1887, p. 1162, pl. 54, fig. 5; Riedel, 1958, p. 231, pl. 2, figs. 8, 9; Petrushevskaya, 1967, p. 113, pl. 64, figs. 1, 2.
?*Bathropyramis ramosa* Haeckel, 1887, p. 1161, pl. 54, fig. 4.
?*Bathropyramis reticulata* Vinassa, 1900, p. 579, pl. 2, fig. 22.

The ribs of the thorax are divergent for only up to 100-150μ of their length, they then become parallel and even convergent.

Miocene-Quaternary.

Genus BATHROPYRAMIS Haeckel

Bathropyramis Haeckel, 1881, p. 428; 1887, p. 1159; Campbell, 1954, p. 118. = *Acropyramis* Haeckel, 1887, p. 1159; Campbell, 1954, Type species *not Bathropyramis acephala* Haeckel, 1887, unfigured, but *Bathropyramis quadrata* Haeckel, 1887, pl. 54, fig. 1.
Cephalopyramis Haeckel, 1881, p. 432; 1887, 1253; Campbell, 1954, p. 127. Type species *Cephalopyramis enneactis* Haeckel, 1881 (1887, pl. 56, fig. 7).
Sethopyramis Haeckel, 1887, p. 1253; Campbell, 1954, p. 127. Type species *Cornutella scalaris* Ehrenberg, 1873 (1875, pl. 2, fig. 1).

Not only longitudinal, but also transverse rows or pores are distinct. The inner rings separating the transverse rows of pores are somewhat like the "shelves" in *Dictyomitra* species.

Cretaceous-Recent.

?Bathropyramis sanjoaquinensis Campbell and Clark
(Plate 7, Figure 20)

?*Bathropyramis sanjoaquinensis* Campbell and Clark, 1942, p. 22, pl. 7, fig. 2.

Cretaceous (Campanian-Maestrichtian).

Bathropyramis sp. aff. B. spongiosa (Haeckel)
(Plate 31, Figure 8)

?*Plectopyramis spongiosa* Haeckel, 1881; Prodromus, 1887, p. 1261, pl. 56, fig. 10.

If this form is really *Plectopyramis spongiosa*—type species of the genus *Spongopyramis*—the latter must be regarded as a synonym of *Bathropyramis*, not of *Peripyramis*. "Spongy" envelope is characteristic for both *Peripyramis* and *Bathropyramis* species.

Oligocene.

Bathropyramis scalaris (Ehrenberg)
(Plate 31, Figure 6)

Cornutella scalaris Ehrenberg, 1873, p. 221; 1875, pl. 2, fig. 1.
?*Sethopyramis pulcherrima* Clark and Campbell, 1945, p. 39, pl. 6, fig. 3.

Eocene.

Bathropyramis aeshna Petrushevskaya sp. nov.
(Plate 31, Figures 1, 2)

Description is based on four specimens from 138-2-2, 80-81 cm and 2-4 cm, 5-7 cm.

Similar to *B. sclaris* in nearly all features except for the armature of the cephalis: it is not "spongy", but there are two long horns, directed as two wings. That is why the species name means "beam".

Oligocene.

Family LYNCHNOCANIIDAE Haeckel, emend. Petrushevskaya

Lychnocanida Haeckel, 1881, p. 432; Petrushevskaya, 1971b, p. 227.

Eucyrtidioidea with usually three-segmented shell. As a rule the apical horn is stout. Three feet or legs, produced by the inner spines *D, L1* and *Lr*. This group seems very likely to have evolved from Eucyrtidiidae, but is probably polyphyletic.

Genus STICHOPILIDIUM Haeckel

Stichopilidium Haeckel, 1887, p. 1438; Campbell, 1954, p. 136; Foreman, 1968, p. 70. Type species *Stichopilium macropterum* Haeckel, 1887. = ?*Rhopalocanium* sp. Bury, 1862, pl. 17, fig. 7.

Four- or multi-segmented skeleton, similar to that of *Stichocapsa, Lithocampe* or *Stichocorys*. The difference lies in the presence of three feet going from abdomen or from the second post-thoracic segment.

Cretaceous-Paleocene.

Stichopilidium sphinx (Ehrenberg)
(Plate 27, Figure 1)

Pterocanium ? *sphinx* Ehrenberg, 1873, p. 255; 1875, pl. 17, fig. 5.

Eocene.

Genus LITHOCHYTRIS Ehrenberg

Lithochytris Ehrenberg, 1847b, p. 54; Haeckel, 1887, p. 1362; Campbell, 1954, p. 132. = *Lithocytridium* Haeckel, 1887, p. 1363; Campbell, 1954, p. 132. Type species *Lithochytris vespertilio* Ehrenberg (1875, pl. 4, fig. 10).

As a rule two segments only, the second being enormously large.

Subgenus LITHOCHYTRODES Haeckel

Lithochytrodes Haeckel, 1887, p. 1362; Campbell, 1954, p. 132. Type species *Lithochytris pyriformis* Haeckel (1887, pl. 61, fig. 11).

?*Sethochytris* Haeckel, 1881, p. 433; 1887, p. 1239; Campbell, 1954, p. 124. Type species *Sethochytris triconiscus* Haeckel (1887, pl. 57, fig. 13).

In contrast to the nominative subgenus, in the subgenus *Lithochytrodes* the feet are solid spines, more or less pronounced, sometimes absent. The thorax is pear-shaped. It seems to be composed of thorax plus abdomen.

Paleogene.

Lithochytris (Lithochytrodes) sp. A
(Plate 27, Figure 2)

The second segment has a rather wide opening. A delicate third segment, short and cylindrical in shape, may be developed.

Paleogene.

Lithochytris (Lithochytrodes) sp. T
(Plate 27, Figure 6)

Theoperid gen. sp. indet. Riedel and Sanfilippo, 1970, pl. 8, fig. 10.

Similar to *Lithochytris* sp. A, but the opening of the second segment is less. About fifteen pores on a half equator of the second segment.

Eocene.

Lithochytris (Lithochytrodes) turgidulum (Ehrenberg)
(Plate 27, Figures 8, 9)

Lychnocanium turgidulum Ehrenberg, 1873, p. 245; 1875, pl. 7, fig. 6.

?*Lychnocanium pyriforme* Haeckel, 1887, p. 1225, pl. 61, fig. 11.

Similar to *Lithochytris* sp. T, but the number of pores is less and the feet are shorter.

Eocene.

Lithochytris (Lithochytrodes) sp. aff. L. ventricosa (Ehrenberg)
(Plate 27, Figures 3, 4)

?*Anthocyrtis ventricosa* Ehrenberg, 1873, p. 217; 1875, pl. 8, fig. 1.

Similar to *Lithochytris* sp. T, but the feet are reduced. About 17 pores on the half equator of the second segment.

Eocene-Oligocene.

Lithochytris (Lithochytrodes) sp. O
(Plate 27, Figure 7)

Very much the same as *Lithochytris* sp. aff. *L. ventricosa*, but there is no opening, the second segment being closed.

Eocene.

Lithochytris (Lithochytrodes) sp. aff. L. tripodium Ehrenberg
(Plate 27, Figure 5)

?*Lithochytris tripodium* Ehrenberg, 1873, p. 239; 1875, pl. 4, fig. 11.

?*Dictyophimus babylonis* Clark and Campbell, 1942, p. 67, pl. 9, figs. 32, 36.

Sethochytris babylonis (Clark and Campbell) group, Riedel and Sanfilippo, 1970, p. 528, pl. 9, figs. 1-3,; Moore, in press, pl. 3, figs. 9, 10.

Eocene-Oligocene.

Genus PTEROCYRTIDIUM Bütschli

Pterocyrtidium Bütschli, 1882, p. 531; *non* Haeckel, 1887, p. 1316; *non* Campbell, 1954, p. 136. Type species *Pterocanium barbadense* Ehrenberg (1875, pl. 17, fig. 6).

Small cephalis, and nearly spherical thorax separated from abdomen. Abdomen cylindrical, of equal breadth or narrower than thorax. Feet originate from the lower part of the thorax.

Paleogene.

Pterocyrtidium barbadense (Ehrenberg) group
(Plate 27, Figures 18, 19)

Pterocanium barbadense Ehrenberg, 1873, p. 254; 1875, pl. 17, fig. 6.

Eocene-Oligocene.

Genus RHOPALOCANIUM Ehrenberg

Rhopalocanium Ehrenberg, 1847b, p. 54; Haeckel, 1887, p. 1359; Campbell, 1954, p. 132. Type species *Rhopalocanium ornatum* Ehrenberg (1854, pl. 34, fig. 9).

Similar to *Pterocyrtidium*, but the feet originate from the abdomen.

Paleogene.

Rhopalocanium ornatum Ehrenberg
(Plate 27, Figures 13, 14)

Rhopalocanium ornatum Ehrenberg, 1854, pl. 36, fig. 9; 1875, pl. 17, fig. 8.

Eocene.

Genus PTEROCANIUM Ehrenberg

Pterocanium Ehrenberg, 1847b, p. 54; Haeckel 1881, p. 436; 1887, p. 1328; Campbell, 1954, p. 130; Petrushevskaya, 1971b, p. 228. = *Pterocanarium* Haeckel, 1887, p. 1329; Campbell, 1954, p. 130. Type species *Pterocanium proserpinae* Ehrenberg (1872b, pl. 11, fig. 220.

Similar to *Pterocyrtidium* and *Rhopalocanium* in the proportions of the shell. The feet originate from the lower part of the thorax, but they are included in the abdominal walls. The difference from *Pterocyrtidium* and *Rhopalocanium* lies in the character of the walls of the thorax and abdomen. The thorax in *Pterocanium* has thick walls with rather large pores. The abdomen has thin walls with irregular pores of various sizes. The abdomen may be nearly reduced; sometimes it is broken.

Neogene-Recent.

Pterocanium (?) satelles (Kozlova)

?*Pterocanium pyramis* Haeckel, 1887, p. 1330, pl. 68, fig. 7.

?*Theopodium satelles* Kozlova in Kozlova and Gorbovetz, 1966, p. 105, pl. 16, fig. 8.

Differs from the type species of *Theopodium* Haeckel 1881 (*T. tricostatum* Haeckel, 1887, pl. 97, fig. 14, indicated by Campbell 1954, fig. 67-5) by smaller pores on the abdomen. Siberian specimens have fewer and larger pores than Leg 14 specimens.
Paleocene-Eocene.

Pterocanium (?) sp. aff. prismatium
(Plate 27, Figures 10, 11)

Having a similar outline and nearly the same size as *Pterocanium prismatium* Riedel, this species seems to be an ancestor of that well-known species. Abdomen undeveloped.
Oligocene-Miocene, rare.

Genus DICTYOPHIMUS Ehrenberg

Dictyophimus Ehrenberg, 1847b, p. 53; Haeckel, 1881, p. 432; 1887, p. 1195; *non* Campbell, 1954, p. 122; but Nigrini, 1967, p. 66. = *Dictyophimium* Haeckel, 1887, p. 1195. Type species *Dictyophimus crisae* Ehrenberg, = *D. arabicus* Ehrenberg (1872b, pl. 10, fig. 3).

Differs from *Pterocyrtidium* and *Rhopalocanium* by the conical shape of the test (instead of cylindrical or ellipsoidal). Differs from *Pterocanium* by the smaller number of pores on the thorax. Thorax may not be distinctly separated from abdomen (without inner shelf or ring).
Eocene-Recent.

Dictyophimus pocillum Ehrenberg
(Plate 29, Figure 5)

Dictyophimus pocillum Ehrenberg, 1873, p. 223; 1875, pl. 5, fig. 6.
Eocene-Oligocene.

Dictyophimus sp. aff. D. hirundo Haeckel
(Plate 27, Figures 16, 17)

?*Pterocorys hirundo* Haeckel, 1887, p. 1318, pl. 71, fig. 4; Riedel, 1958, p. 238, pl. 3, fig. 11: pl. 4, fig. 1; Petrushevskaya, 1967, p. 115, pl. 67, figs. 1-5; 1971b, pl. 111, figs. 4-5.
?*Dictyophimus triserratus* Haeckel 1887, p. 1200, pl. 61, fig. 17; Petrushevskaya, 1971b, pl. 111, figs. 2-3.

Differs from the Antarctic specimens by the weak apical horn.
Pliocene-Quaternary.

Genus ARCHIPILIUM Haeckel

Archipilium Haeckel, 1881, p. 427; 1887, p. 1139; Campbell, 1954, p. 117. Type species *Archipilium orthopterum* Haeckel, 1887, pl. 98, fig. 7.

Similar to *Dictyophimus* in all characteristics, but there is no apical horn.
Tertiary.

Archipilium sp. aff. A. macropus (Haeckel)
(Plate 29, Figure 14)

?*Sethopilium macropus* Haeckel, 1887, p. 1203, pl. 97, fig. 9.
Pliocene.

Remark: Specimens similar to this species occur in the Oligocene (Plate 29, Figure 13).

Genus PTEROPILIUM Haeckel

Pteropilium Haeckel, 1881, p. 435; 1887, p. 1326; Campbell, 1954, p. 130. Type species *Pteropilium stratiotes* Haeckel, 1887, pl. 70, fig. 9.

Being multi-segmented, this genus is similar to *Stichopilidium*. It differs from *Stichopilidium* in the dimensions of the shell, primarily in the dimensions of the thorax and abdomen (up to 70-100μ broad, instead of about 120μ). The distinguishing characteristic is the construction of the feet. They arise from the thorax, and may be solid or hollow. There may be framework plates between the apical horn and feet—very much the same as in Sethoperidae. The feet are directed laterally.
Tertiary.

Pteropilium sp. B
(Plate 29, Figure 12)

Somewhat similar to *Lychnocanium tridentatum* Ehrenberg, (1875, pl. 7, fig. 4), but the feet are hollow at their base. The "sethoperid" plates are distinct.
Miocene.

Pteropilium (?) sp. group aff. Pterocanium continguum Ehrenberg
(Plate 29, Figures 8-10)

?*Pterocanium continguum* Ehrenberg, 1873, p. 255; 1875, pl. 17, fig. 7.

The specimens are similar to *P. continguum* (Plate 29, Figure 11) in the two upper segments (they are somewhat smaller and have fewer pores). They are distinguished by the abdominal and post-thoracic part of the test, which is very much the same as in Eucyrtidiidae gen. sp. "rocket" (Plate 28, Figures 2, 3).
Oligocene.

Genus LYCHNOCANIUM Ehrenberg

Lychnocanium Ehrenberg, 1847b, p. 54; Haeckel, 1881, p. 432; 1887, p. 1224; Campbell, 1954, p. 124; Riedel and Sanfilippo, 1970, p. 529, part. = *Lychnocanissa* Haeckel, 1887, p. 1226; Campbell, 1954, p. 124. Type species *Lychnocanium falciferum* Ehrenberg (1854, pl. 36, fig. 7).
Fenestracantha Bertolini, 1935; Campbell, 1954, p. 124. Type species

Three segments, thorax being separated from abdomen by an external constriction and an inner ring. The thorax and the abdomen have different walls, as in *Pterocanium*. The difference from *Pterocanium* is in the position of the feet. As in *Pteropilium*, they originate from the thorax and are not included into the walls of the abdomen.
Eocene-Quaternary.

Lychnocanium bellum Clark and Campbell
(Plate 29, Figure 1)

Lychnocanium bellum Clark and Campbell, 1942, p. 72, pl. 9, figs. 35, 39; Riedel and Sanfilippo, 1970, p. 529.
Eocene.

Lychnocanium tripodium Ehrenberg
(Plate 29, Figure 2)

Lychnocanium tripodium Ehrenberg, 1873, p. 245; 1875, pl. 7, fig. 2.
Eocene.

Lychnocanium hirundo Ehrenberg
(Plate 29, Figure 3)

Lychnocanium hirundo Ehrenberg, 1856, pl. 36, fig. 6; 1875, pl. 7, fig. 8.

Thorax about 70-80μ long and 90-100μ broad. About 7 to 9 pores on the thorax between two feet. Feet three-edged, very long, curved.
Eocene-Oligocene.

Lychnocanium sp.
(Plate 29, Figure 7)

Very much the same as *L. hirundo*, but smaller in all dimensions.
Eocene-Early Oligocene.

Lychnocanium bipes Riedel

Lychnocanium bipes Riedel, 1959, p. 294, pl. 2, figs. 5, 6; Riedel and Sanfilippo, 1970, p. 529, pl. 15, fig. 8.
Oligocene.

Lychnocanium grande Campbell and Clark
(Plate 29, Figure 6)

Lychnocanium grande Campbell and Clark, 1944a, p. 42, pl. 6, figs. 3-6.

Cephalic wall without pores. About 8 to 9 pores on the thorax between feet. Feet three-edged, nearly straight.
Oligocene-Miocene.

Lychnocanium korotnevi (Dogiel)
(Plate 29, Figure 16)

Pterocorys korotnevi Dogiel in Dogiel and Reshetnyak, 1952, p. 17, fig. 11; Petrushevskaya, 1962, p. 338, fig. 8; 1971b, pl. 111, fig. 1.

Thorax 40-55μ long and about 80μ broad. Cephalis poreless.
Pliocene-Quaternary.

Genus BEKOMA Riedel and Sanfilippo

Bekoma Riedel and Sanfilippo, in press. Type species *Bekoma bidarfensis* Riedel and Sanfilippo, in press, pl. 7, figs. 1-7.

Similar in many features to *Lychnocanium*, but the construction of the collar region is somewhat different.

Paleogene.

Bekoma bidarfensis Riedel and Sanfilippo

Bekoma bidarfensis Riedel and Sanfilippo, in press, pl. 7, figs. 1-7.

Paleocene.

Superfamily CANNOBOTRYOIDEA Haeckel

Cannobotryidae Haeckel, 1881; Riedel, 1967b, p. 296; Petrushevskaya, 1971a, p. 988; 1971b, p. 154.

Polycyrtida Haeckel, 1862, p. 341.

Botrida Haeckel, 1881, p. 439.

Botryodea Haeckel, 1887, p. 1105; Strelkov, Khabakov and Lipman, 1959, p. 444; Petrushevskaya, 1965, p. 79.

Cyrtida with the skeleton consisting of cephalis and thorax; other segments are very rare. Cephalis rather large comparted with the whole skeleton (up to one half its size). Cephalis consists of eucephalic and many additional lobes. Lobes are separated by internal walls. The arches *ap* and *al* are included into these walls. Ante-cephalic lobe has two parts, named by H. Foreman (1968) "apical-dorsal" and "dorsal". The cephalis is separated from the thorax by a basal plate.

Genus BOTRYOCELLA Haeckel

Botryocella Haeckel, 1881, p. 440; 1887, p. 1116: Campbell, 1954, p. 144: *non* Petrushevskaya, 1965, p. 110; but Petrushevskaya, 1971b, p. 161.*Type species Lithobotrys nucula* Ehrenberg (1875, pl. 3, fig. 16).

Eucephalic lobe is nearly hidden, submerged into the ante-cephalic lobe. Post-cephalic part is smaller than ante-cephalic. Tubes of ante-cephalic lobe and of post-cephalic lobe, if present, are situated on the level of the basal plate.

Differs from *Centrobotrys* by the thickness of the test, by the pronounced separation into thorax and cephalis, and by the tubes near the basal plate. *Centrobotrys* seems very likely to originate from *Botryocella*.

Paleogene.

Botryocella multicellaris Haeckel group
(Plate 39, Figures 8, 10)

Botryocella multicellaris Haeckel, 1887, p. 1117, pl. 96, fig. 12.

Botryocella sp. O, Petrushevskaya, 1971b, pl. 82, figs. 4-6.

Botryopyle dictyocephalus group Riedel and Sanfilippo, in press, pl. 2J, fig. 18; pl. 3F, fig. 12, part.

Botryopyle sp. A, Riedel and Sanfilippo, in press, pl. 2J, figs. 20, 21, pl. 3F, fig. 13.

Centrobotrys ? sp. A, Riedel and Sanfilippo, in press, pl. 3F, figs. 15, 16.

The walls are thick, and the pores rather large. The apex of ante-cephalic lobe ovate in outline. Abdomen narrow, cylindrical.

Oligocene.

Botryocella spp. aff. B. cribrosa (Ehrenberg) group
(Plate 39, Figures 4-6)

?*Lithobotrys cribrosa* Ehrenberg, 1873, p. 237; 1875, pl. 3, fig. 20.

Botryopyle dictyocephalus group Riedel and Sanfilippo, in press, pl. 2J, fig. 17; pl. 3F, fig. 10, part.

The pores as a rule are smaller than in the *B. multicellularis* group. The apex of the ante-cephalic lobe is conical, even with a small tube. Abdomen in its upper part is nearly of the same breadth as the cephalis.

Oligocene-Early Miocene.

Genus ACROBOTRYS Haeckel

Acrobotrys Haeckel, 1881, p. 440; 1887, p. 1114; *non* Campbell, 1954, p. 106; Petrushevskaya, 1965, p. 106. Type species *Acrobotrys disolenia* Haeckel (1887, pl. 96, fig. 10).

The upper part of the eucephalic lobe is on the surface of the skeleton. It is of nearly the same size as the ante- and post-cephalic lobes. Ante- and post-cephalic lobes have tubes situated higher than in *Botryocella*, that is, higher than the basal plate.

Oligocene-Pliocene.

Acrobotrys sp. aff. A. disolenia Haeckel
(Plate 39, Figures 3, 9)

?*Acrobotrys disolenia* Haeckel, 1887, p. 1114, pl. 96, fig. 10.

Late Oligocene-Early Miocene.

Acrobotrys sp. aff. A sphaerothorax Haeckel
(Plate 39, Figures 1, 2)

?*Lithobotrys sphaerothorax* Haeckel, 1887, p. 1119, pl. 96, fig. 15.

Distinguished by two symmetrical pairs of tubes, on ante-cephalic and post-cephalic lobes.

Early Miocene.

Genus BOTRYOCYRTIS Ehrenberg

Botryocyrtis Ehrenberg, 1860, p. 829; Haeckel, 1881, p. 440; 1887, p. 1120; Campbell, 1954; Petrushevskaya, 1965, p. 101. Type species *Botryocyrtis caputserpentis* Ehrenberg (1872b, pl. 10, fig. 21).

Acanthobotrys Popofsky, 1913, p. 314; Campbell, 1954, p. 143. Type species *Acanthobotrys multispina* Popofsky (1913, pl. 29, figs. 10, 11; pl. 30, fig. 5).

Monotubus Popofsky, 1913, p. 322; Campbell, 1954, p. 144; Petrushevskaya, 1965, p. 99. Type species *Monotubus microporus* Popofsky (1913, text-fig. 20).

Eucephalic, ante-cephalic and post-cephalic lobes of nearly the same size and shape. Thorax (and sometimes abdomen) are comparatively large. The surface of the skeleton is spongy.

Neogene-Quaternary.

Botryocyrtis quinaria Ehrenberg group
(Plate 39, Figure 7)

Botryocyrtis quinaria Ehrenberg, 1872a, p. 287; 1872b, pl. 10, fig. 16; Petrushevskaya, 1965, p. 104, figs. 14, 15.

Botryocyrtis spp. Riedel and Sanfilippo, in press, pl. 1J, fig. 8, 11; pl. 2J, figs. 10, 11; pl 3F, fig. 7.

There is no separation into thorax and abdomen. The skeleton somwhat larger than in *B. microporus* (Popofsky).

Miocene.

REFERENCES

Aliev, Kh. Sh., 1961. Novye vidy semeistva Porodiscidae iz otlozhenii valanzhina severo-vostochnogo Azerbaidzhana. *Dokl. AN Azerb. SSSR. t. 17, No. 7.*

________ 1965. Radiolarii nizhnemelovykh otlozhenii severovostochnogo Azerbaidzhana i ikh stratigraficheskoe znachenie. *Izd. AN Azerb. SSSR, Baku.*

Bailey, J. W., 1856. Notice of microscopic forms found in the soundings of the sea of Kamtschatka. *Am. J. Sci. Arts.* ser. 2, **XXII**.

Bandy, O. L., Casey, R. E. and Wright, R. C., 1971. Late Neogene planktonic zonation, magnetic reversals and radiometric dates, Antarctic to the Tropics. *Antarctic Research Series.* (Biology, Antarctic Seas, IV), **15**, Washington, pp. 1-26.

Burma, B. H., 1959. On the status of *Theocampe* Haeckel, and certain similar genera. *Micropaleontology*. **5** (3).

Bury, M., 1862. Polycystins, figures of remarkable forms in the Barbados chalk deposits. *Atlas.* London.

Bütschli, O., 1882. Beitrage zur Kenntnis der Radiolarienskelette, insbesondere der der Cyrtida. *Zeitschr. Wiss. Zool.* **36**, pp. 485-540, pls. 31-33.

Campbell, A. S., 1954. Radiolaria. **In:** *Treatise on Invertebrate Paleontology* R. C. Moore. (Ed.) (Univ. Kansas Press and Geol. Soc Am.) Pt. D, Protista 3, pp. 11-163.

________ and Clark, B. L., 1944a. Miocene radiolarian faunas from Southern California. *Geol. Soc. Am. Spec. Paper.* (51), pp. i-vii and 1-76, pls. 1-7.

_______ 1944b. Radiolaria from Upper Cretaceous of Middle California. *Geol. Soc. Am. Spec. Paper.* (57), pp. i-viii and 1-61, pls. 1-8.

Carnevale, P., 1908. Radiolarie e Silicoflagellati di Bergonzano (Reggio Emilia). *Mem. R. Ist. Veneto Sci. Lett. Arti.* 28 (3), pp. 1-46, pls. 1-4.

Clark, B. L. and Campbell, A. S., 1942. Eocene radiolarian faunas from the Mt. Diablo area, California. *Geol. Soc. Am. Spec. Paper.* (39).

_______ 1945. Radiolaria from the Kreyenhagen Formation near Los Banos, California. *Mem. Geol. Soc. Am.* **10**, pp. i-vii and 1-66, pls. 1-7.

Deflandre, G., 1953. Radiolaires fossiles. In *Traité de Zoologie*. P.-P. Grassé (Ed.). Paris (Masson), 1, pt. 2, pp. 389-436.

Dogel, V. A. and Reshetnyak, V. V., 1952. Materialy po radiolariyam severo-zapadnoi chasti Tikhogo okeana. *Issled. dalnevostochnykh morei SSSR*. t. III.

Dreyer, F., 1889. Morphologische Radiolarienstudien. 1. Die Pylombildungen in vergleichend-anatomischer und entwicklungsgeschichtlicher Beziehung bei Radiolarien und bei Protisten überhaupt, nebst System und Beschreibung neuer und der bis jetzt bekannten pylomatischen Spumellarien. *Jena. Zeitschr. Naturw.* **23**, new ser. vol. 16, pp. 1-138, pls. 1-6.

Dumitrica, P., 1970. Cryptocephalic and cryptothoracic Nassellaria in some Mesozoic deposits of Romania. *Rev. Roum. Geol., Geophys. et Geogr. Ser. Geol.* **14** (1).

Ehrenberg, C. G., 1838. Über die Bildung der Kreidefelsen und des Kreidemergels durch unsichtbare Organismen. *Abhandl. Preuss. Akad. Wiss.* Jahrg. 1838.

_______ 1844a. Über 2 neue Lager von Gebirgsmassen aus Infusorien als Meeres-Absatz in Nord-Amerika und eine Vergleichung derselben mit den organischen Kreide-Gebilden in Europa und Afrika. *Monatsber, Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1844, pp. 57-97.

_______ 1844b. Einige vorlaufige Resultate seiner Untersuchungen der ihm von der Sudpolreise des Capitain Ross, so wie von den Herren Schayer und Darwin zugekommenen Materialien über das Verhalten des kleinsten Lebens in den Oceanen und den grössten bisher zugänglichen Tiefen des Weltmeeres. *Monatsber. Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1844, pp. 182-207.

Ehrenberg, C. G., 1847a. Über eine halibiolithische, von Herrn R. Schomburgk entdeckte, vorherrschend aus mikroskopischen Polycystinen gebildete, Gebirgsmasse von Barbados. *Monatsber. Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1846, pp. 382-385.

_______ 1847b. Über die mikroskopischen kieselschaligen Polycystinen als mächtige Gebirgsmasse von Barbados und über das Verhältnis der aus mehr als 300 neuen Arten bestehenden ganz eigenthümlichen Formengruppe jener Felsmasse zu den lebenden Thieren und zur Kreidebildung. Eine neue Anregung zur Erforschung des Erdlebens. *Monatsber. Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1847, pp. 40-60, 1 pl.

_______ 1854. *Mikrogeologie*. Leipzig (Fortsetzung, (1856).

_______ 1858. Kurze Characteristik der 9 neuen Genera und der 105 neuen Species des ägäischen Meeres und des Tiefgrundes des Mittelmeeres. *Monatsber. Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1858.

_______ 1860a. Über die organischen und unorganischen Mischungsverhältnisse des Meeresgrundes in 19,800 Fuss Tiefe nach Lieut. Brookes Messung. *Monatsber. Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1860.

_______ 1860b. Über den Tiefgrund des stillen Ozeans zwischen Californien und den Sandwich–Inseln aus bis 15,600 Fuss Tiefe nach Lieut. Brookes. *Monatsber. Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1860, pp. 819-833.

_______ 1872a. Mikrogeologischen Studien als Zusammenfassung seiner Beobachtungen des kleinsten Lebens der Meeres-Tiefgründe aller Zonen und dessen geologischen Einfluss. *Monatsber. Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1872, pp. 265-322.

_______ 1872b. Mikrogeologischen Studien über das kleinste Leben der Meeres-Tiefgrunde aller Zonen und dessen geologischen Einfluss. *Abhandl. Kgl. Akad. Wiss. Berlin.* Jahrg. 1872, pp. 131-399, pls. 1-12, 1 chart.

_______ 1973. Grössere Felsproben des Polycystinen-Mergens von Barbados mit weiteren Erlauterungen. Monatsber. Kgl. Preuss. Akad. Wiss. Berlin. Jahrg. 1873, pp. 213-263.

_______ 1875. Fortsetzund der mikrogeologischen Studien als Gesammt-übersicht der mikroskopischen Paläontologie gleichartig analysirter Gebirgsarten der Erde, mit specieller Rücksicht auf den Polycystinen-Mergel von Barbados. *Abhandl. Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1875, pp. 1-226, pls. 1-30.

Foreman, H. P., 1966. Two Cretaceous radiolarian genera. *Micropaleontology*. 12 (3), pp. 355-359.

_______ 1968. Upper Maestrichtian Radiolaria of California. *Spec. Pap. Palaeontol.* (Palaeontol. Ass., London), no. 3, 82 pp., 8 pls.

Frizzel, D. L. and Middour, E. S., 1951. Paleocene Radiolaria from Southeastern Missouri. *Bull, Univ. Missouri School Mines Metall.* Tech. ser. no. 77, pp. 1-41, pls. 1-3.

Goll, R. M., 1968. Classification and phylogeny of Cenozoic Trissocyclidae (Radiolaria) in the Pacific and Caribbean basins. Pt. I. *J. Paleontol.* **42** (6), pp. 1409-1432, pls. 173-176, 9 text-figs.

_______ 1969. Classification and phylogeny of Cenozoic Trissocyclidae (Radiolaria) in the Pacific and Caribbean basins. Pt. II. *J. Paleontol.* **43** (2), pp. 322-339, 6 pls. 2 text-figs.

Haeckel, E., 1860. Abbildungen und Diagnosen neuer Gattungen und Arten von lebenden Radiolarien des Mittelmeeres. *Monatsber. Kgl. Preuss. Akad. Wiss. Berlin.* Jahrg. 1860, pp. 835-845.

_______ 1862. *Die Radiolarien (Rhizopoda Radiaria).* Eine Monographie. Berlin (Reimer), xiv + 572 pp., 35 pls.

_______ 1881. Prodromus Systematic Radiolarium. Entwurf eines Radiolarien-Systems auf Grund von Studien der Challenger-Radiolarien. *Jena. Zeitschr. Naturw.* **15** (new ser., vol. 8), no. 3, pp. 418-472.

_______ 1887. Report on the Radiolaria collected by H.M.S. *Challenger* during the years 1873-1876. *Rep. Sci. Res. Voy. Challenger*. 1873-1876, Edinburgh, Zool., t. XVIII, Pt. I, II.

Haecker, V., 1908. Tiefsee-Radiolarien. *Wiss. Ergebn. d. Deutschen Tiefsee-Exped. Valdivia.* **14**, pp. 477-706, pls. 86-87, 2 charts.

Harting, P., 1863. Bijdrage tot de kennis der mikroskopische faune en flora van de Banda-Zee. *Verh. Konkinkl. Akad. Wetensch. Amsterdam* **10**, pp. 1-34, pls. 1-3.

Hays, J., 1965. Radiolaria and Late Tertiary and Quaternary history of Antaractic seas. *Antarctic Research Series*. (Biol. Antarc. Seas, vol. 2) (A. Geophys. Union), 5, pp. 125-184.

_______, Saito, T., Opdyke, N. D. and L. H. Burckle, 1969. Pliocene- Pleistocene sediments of the equatorial Pacific: their paleomagnetic biostratigraphic and climatic record. *Bull. Geol. Soc. A.* **80** (8), pp. 1481-1514.

Hertwig, R., 1879. *Der Organismus der Radiolarien.* Jena G. Fischer, iv + 149 pp., 10 pls.

Hollande, A. and Enjumet, M., 1960. Cytologie, évolution et systematique des Sphaeroïdés (Radiolaires). *Arch. Mus. Natn. Hist. Nat. Paris.*Ser. 7, 7, pp. 1-134, pls. 1-64.

Holmes, W. M., 1900. On Radiolaria from the Upper Chalk at Coulsdon (Surrey). *Quart. J. Geol. Soc., London.* **56.**

Hülsemann, K., 1963. Radiolaria in plankton from the Arctic Drifting Station T-3, including the description of three new species. *Arctic Inst. N. Am.., Tech. Pap. Arct.* No. 13, pp. 1-52.

Jörgensen, E., 1905. The protist plankton and the diatoms in bottom samples. *Bergens Mus. Skr.* pp. 49-151, 195 -225, pls. 6-18.

Kling, S. A., 1970. Radiolaria. In *Initial Reports of the Deep Sea Drilling Project, Volume VI.* Washington D. C., U. S. Government Printing Office, pp. 1069-1092.

Kozlova, G. E., 1967a. Tipy stroeniya radiolarii iz sem. Porodiscidae. *Zool. Zhurn.* t. 46, vyp. 8.

_______ 1967b. O filogeneticheskoi svyazi podotryadov Discoidea i Larcoidea (Radiolaria, Spumellaria). *Zool Zhurn.* t. 46, vyp. 9.

_______ i Gorbovets, A. N. 1966. Radiolarii verkhnemelovykh i verkhne-eozenovykh otlozhenii Zapadno-Sibirskoi nizmennosti, nedra. *Vses. Neft. Nauchno-issled. Geol.-Razu Inst.* No. 248, pp. 159, pls. 17.

Kruglikova, S. B., 1969. Radiolarii v kolonke St. 4066 (severnaya chast Tikhogo okeana). V sb. Osnovnye problemy mikropaleonotologii i organo-gennogo osadkonakopleniya v okeanakh i moryarch. *M., Nauka Moscow.* pp. 48-72.

Ling, H. Y. and Anikouchine, W. A., 1967. Some Spumellarian Radiolaria from the Java, Philippine and Mariana Trenches. *J. Paleontol.* **41** (6), pp. 1481-1491, pls. 189-192, 5 text-figs.

Lipman, R. Kh. 1952. Materialy k monograficheskomu izucheniyu radiolyarii verkhnemelovykh otlozhenii Russkoi platformy. *Tr. VSEGEI, Paleontologiya i stratigrafiya.* pp. 24-51, 3 pls.

_______ 1953. Novye dannye o radiolyariyakh Dalnego Vostoka. *Tr. VSEGEI, Paleontologiya i stratigrafiya.* pp. 126-146, 1 pl.

Loeblich, A. R. Jr. and Tappan, H., 1961. Remarks on the systematics of the Sarkodina (Protozoa), renamed homonyms and new and validated genera. *Proc. Biol. Soc. Washington.* **74**, pp. 213-214.

Lozynyak, P. Yu., 1969. Radiolyarii nizhnemelovykh otlozhenii Ukrainskikh Karpat. V kn. Iskopaemye i sovremennye radiolarii. *Ukrainian NIGRI Lvov.* pp. 29-40, pls. 2.

Martin, G. C., 1904. Radiolaria. *Maryland Geol. Surv. Gen. Ser., Baltimore.* pp. 447-459.

Moore, T. G., 1971. Radiolaria. In *Initial Reports of the Deep Sea Drilling Project Volume VIII.*Washington D.C. (U.S. Government Printing Office) pp. 391-411.

Müller, J., 1858. Über die Thalassicollen, Polycystinen und Acanthometren des Mittelmeeres. *Abhandl. Kgl. Preuss. Acad. Wiss. Berlin.* Jahrg. 1858, pp. 1-62, pls. 1-11.

Nakaseko, K., 1955. Miocene radiolarian fossil assemblage from the Southern Toyama Prefecture in Japan. *Sci. Repts., Osaka Univ.* No. 4, pp. 65-127, pls. 1-11.

_______ 1963. Neogene Cyrtoidea (Radiolaria) from the Isozaki Formation in Ibaraki Prefecture, Japan. *Sci Repts., Osaka Univ.,* 12 (2), pp. 165-198, pls. 1-4.

Nigrini, C., 1967. Radiolaria in pelagic sediments from the Indian and Atlantic Oceans. *Bull. Scripps Inst. Oceanog.* **11**

_______ 1968. Radiolaria from eastern tropical Pacific sediments. *Micropaleontology.* **14** (1), pp. 51-63, pl. 1.

_______ 1970. Biostratigraphy. In *Inital Reports of the Deep Sea Drilling Project, Volume II.* Washington, D. C. (U. S. Government Printing Office) pp. 391-411.

Parona, C. F., 1890. Radiolarie nei noduli selciosi del calcare giurese di Cittiglio presso Laveno. *Boll. Soc. Geol. Ital.* **9**, pt. 1, pp. 1-46, pls. 1-6.

Pessagno, E. A., 1963. Upper Cretaceous Radiolaria from Puerto Rico. *Micropaleontology.* **9** (2), pp. 197-214, pls. 1-7.

_______ 1969a. The Neosciadiocapsidae, a new family of upper Cretaceous Radiolaria. *Bull. Am. Paleontol.* **56** (253).

_______ 1969b. Mesozoic planktonic foraminifera and Radiolaria. In *Initial Reports of the Deep Sea Drilling Project, Volume I.* Washington, D. C. (U. S. Government Printing Office).

Petrushevskaya, M. G., 1962. Znachenie rosta skeleta radiolyarii dlya ikh sistematiki. *Zool. Zhurn.* t. XII, vyp. 3, pp. 331-341.

_______ 1965. Osobennosti konstruktsii skeleta radiolarii Botryoidae (otryad Nassellaria). *Tr. Zool. In-ta AN SSSR,* t. XXXV.

_______ 1967. Radiolarii otryadov Spumellaria i Nassellaria Antarkticheskoi oblasti (po materialam Sovetskoi Antarkticheskoi ekspeditsii). Issled. fauny morei, t. IV (XII). Resultaty biol. issled. *Sovetskoi Antarkticheskoi Ekspeditsii (1950-1958).* vyp. 3, pp. 5-186.

_______ 1968a. Gomologii v skeletakh radiolarii Nassellaria. 1. Osnovnye dugi v semeistve Cyrtoidae. *Zool. Zhurn.* t. 47, vyp. 9.

_______ 1968b. Gomologii v skeletakh radiolarii Nassellaria. 2. Osnovnye dugi slozhnoustroennykh tsefalisov Cyrtoidae i Botryoidae. *Zool. Zhurn.* t. 47, vyp. 12.

_______ 1969a. Raspredelenie skeletov radiolarii v osadkakh severnoi Atlantiki. Sb. "Drevnie i sovremennye radiolarii". *Izd. Lvovsk. Gos un-ta, Lvov.*

_______ 1969b. Spumelline and Nasselline Radiolarians in Bottom Sediments as Water-masses Indicators. In Micropaleontology and Organogenous sedimentation in the oceans. *Nauka, Moscow.* pp. 127-150.

_______ 1970. Prodolzhitelnost zhizni vidov radiolarii. Otchetnaya nauchnaya sessiya. *Zool. Inst. AN SSSR, Leningrad.* Str. 6-7.

_______ 1971a. On the nautral system of Polycystine Radiolaria. *Proc. II Planktonic Conference, Rome.*

_______ 1971b. Radiolarii Nassellaria v planktone Mirovogo Okeana. *Issled. fauny morey, Leningrad.*

Popofsky, A., 1908. Die Radiolarien der Antarktis. *Deutsche Südpolar Expedition 1901-1903, Berlin.* **10**, (Zool. vol. 2), no. 3, pp. 183-305, 1 table, pls. 20-36.

_______ 1913. Die Nassellarien des Warmwassergebietes. *Deutsche Südpolar Expedition 1901-1903, Berlin.* **14**, Zool., vol. VI, no. 11.

Principi, P., 1909. Contributo allo studio dei Radiolari Miocenici Italiani. *Boll. Soc. Geol. Ital.* **28**, pp. 1-22, pl. 1.

Riedel, W. R., 1957. Radiolaria: a preliminary stratigraphy. *Rep. Swed. Deep-Sea Exped.* **6** (3), pp. 59-96, pls. 1-4.

________1958. Radiolaria in Antarctic sediments. *Rep. B.A.N.Z. Antarct. Res. Exped.* Ser. B, **6**, pt. 10, pp. 217-255.

________1959a. Oligocene and Lower Miocene Radiolaria in tropical Pacific sediments. *Micropaleontology*. **5** (3), pp. 285-302.

Riedel, W. R. 1959b. Preliminary draft of a petition to be submitted to the International Commission on Zoological Nomenclature. Scripps Institution of Oceanog. La Jolla, California.

________1967a. Some new families of Radiolaria. *Proc. Geol. Soc. London*. No. 1640.

________1967b. Class Actinopoda. In *The Fossil Record.* London (Geol. Soc. London).

________ and Sanfilippo, A., 1970. Radiolaria. In *Initial Reports of the Deep Sea Drilling Project, Volume IV.* Washington, D. C. (U. S. Government Printing Office) pp. 503-575, 15 pl.

________ and Sanfilippo, 1971. Radiolaria. In *Initial Reports of the Deep Sea Drilling Project, Volume VII.* Washington, D. C. (U. S. Government Printing Office) pp. 1529-1672, 8 pls.

Rüst, D., 1898. Neue Beiträge zur Kenntniss der fossilen Radiolarien aus Gesteinen des Jura und der Kreide. *Palaeontographica*. **45**, pp. 1-67, pls. 1-19.

Sanfilippo, A. and Riedel, W. R., 1970. Post-Eocene "closed theoperid" radiolarians. *Micropaleontology*. **16** (4), pp. 446-462, 2 pls.

Seguenza, G., 1880. Le formazioni terziarie nella provincia di Reggio (Calabria) Formazione Pliocenica. *Atti R. Accad. Lincei, 1879-1880.* Ser. 3, Mem. cl. sci. fis. mat. nat., vol. 6, pp. 1-446, pls. 1-17.

Squinabol, S., 1903. Le Radiolarie dei Noduli selciosi nella Scaglia degli Euganei. *Riv. Ital. Paleont.* **9**, pp. 105-150, pls. 8-10.

________1904. Radiolarie cretacee degli Euganei. *Atti Memorie R. Accad. Sci. Lett. Arti Padova*. New ser., vol. 20, pp. 171-244, pls. 1-10.

________1914. Contributo alla conoscenza dei Radiolarii fossili del Veneto. *Mem. 1st. R. Univ. Padova*. **2**, pp. 249-306, pls. 20-24.

Stöhr, E., 1880. Die Radiolarienfauna der Tripoli von Grotte, Provinz Girgenti in Sicilien. *Palaeontographica*. **26**, (ser. 3, vol. 2), pp. 69-124, pls. 17-23 (1-7).

Strelkov, A. A., Khabakov, A. V., Lipman, R. Kh., 1959. Radiolarii. V kn. "Osnovy paleontologii", t. 1, *Izd. AN SSSR, M.*

Sutton, H. J., 1896. Radiolaria; a new genus from Barbados. *Am. Month. Micros. J.* **17**, pp. 61-62.

Tan Sin Hok, 1927. Over de samenstelling en het onstaan van krijt-en mergelgesteenten van de Molukken. *Jaarb. Mijnw. Ned.-Vost-Indië, jaarg. 1926, Verhand.* Pt. 3, pp. 5-165, pls. 1-16.

Tochilina, S. V., 1970. Hexacyclia - novyi rod Spumellaria iz otlozhenii verkhnego eotsena Voronezhskoi anteklizy. *Tr. Voronezh. Universiteta.*

Vinassa de Regny, P. E., 1900. Radiolari Miocenici Italiani. *Mem. R. Accad. Sci. 1st Bologna*. Ser. 5, **8**, pp. 565-595, pls. 1-3.

Wetzel, O., 1935. Die Micropaleontologie des Heiligenhafener Kieseltones (Ober-Eozän). *Niedersaechs. Geol. Verhandl., Jahresber.* 27.

White, M. P., 1928. Some index foraminifer of the Tampico Embayment area of Mexico. Pt. II. *J. Paleontol.* **2** (4).

Zittel, K., 1876. Über fossile Radiolarien der oberen Kreide. *Zeitschr. Deutsch. Geol. Gesellsch.* **28**.

EXPLANATION OF PLATES

The numbers following the identification of each figure indicate the locality of the illustrated specimen: number of the site, core, section,[5] and sometimes the interval within a section in centimeters. In most cases, the authors have included the text-page of the systematic section, where the references and the description may be found.

On the following plates, figures are at a magnification of 200X. Whether these photographs are of good or of poor quality, this magnification is not sufficient for most nassellarians, especially Neogene ones. Therefore, the representatives of different species and even genera may look alike to the investigator unacquainted with these species, if the specimens are examined under that magnification.

On the first eight plates are the assemblages of Cretaceous radiolarians. On the other plates (Plates 9 through 41) are Cenozoic radiolarians, more or less in systematic order.

[5] The sample 140-2-CC is marked by * because this section is Miocene, but the slide marked as "2-CC" contains Eocene radiolarians.

Plate 1
Magnification 200X

Figure 1	*Holocryptocapsa hindei* 138-6-2, 5-7 cm.	p. 541
Figure 2	*Cryptamphorella* sp. 138-6-3, 77-79 cm.	
Figure 3	*Holocryptocanium barbui* 138-6-2, 5-7 cm.	
Figure 4	*Squinabollum* sp. aff. *fossilis* 137-7-CC.	p. 541
Figure 5	*Diacanthocapsa* ? sp. 137-7-CC.	
Figure 6	*Gongylothorax* (?) sp. indet. 137-7-CC.	p. 541
Figure 7	Sphaeroidea gen. sp. indet. 137-7-CC.	
Figure 8	*Conosphaera fossilis* 137-7-CC.	p. 521
Figure 9	Pseudoaulophacidae gen. et sp. indet. 137-7-CC.	
Figure 10	*Cenosphaera* sp. aff. *C. euganea* 137-7-CC.	p. 521
Figure 11-13	Discoidea gen. et sp. indet. 137-7-CC.	

PLATE 1

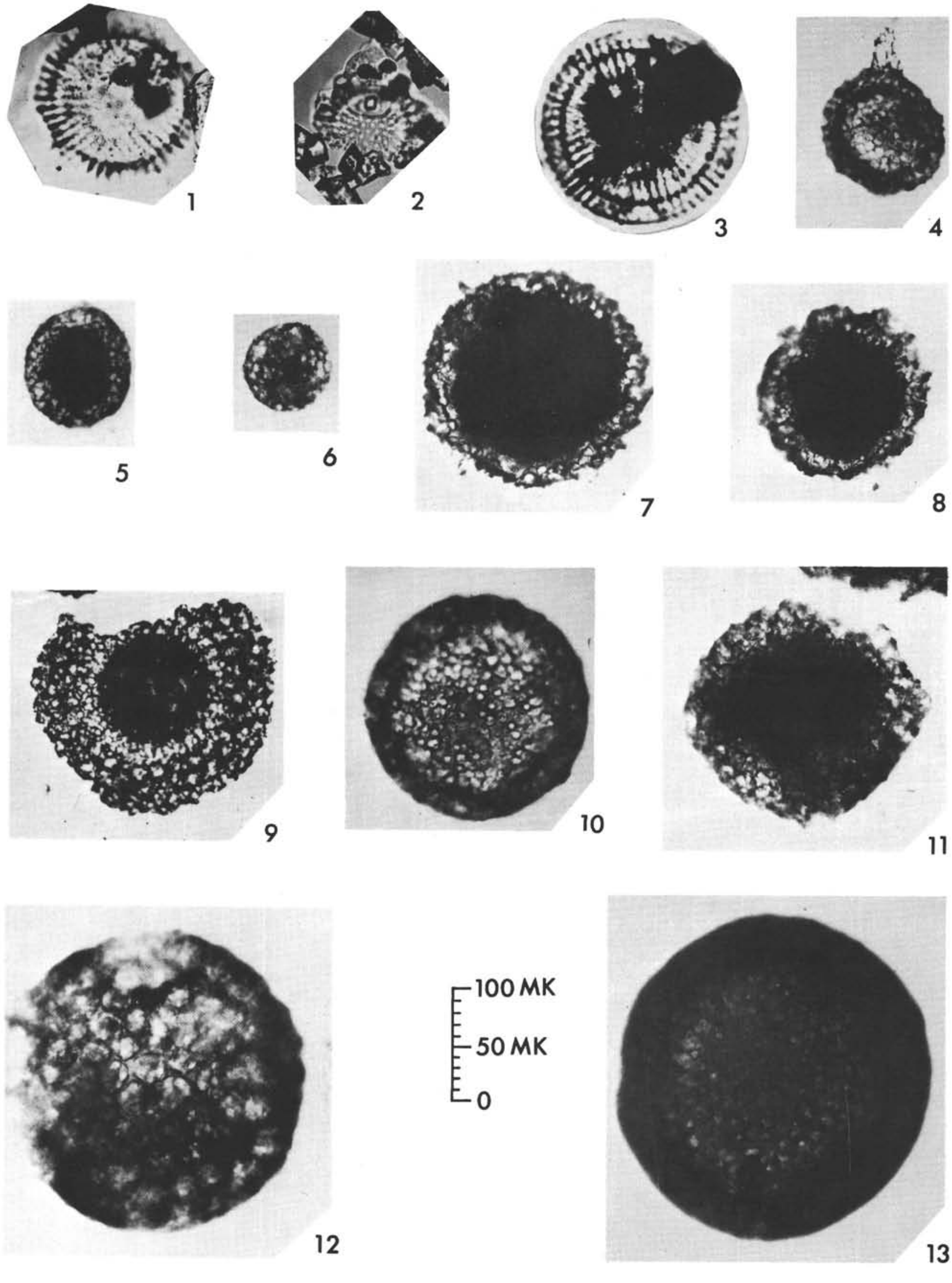


Plate 2
Magnification 200X

Figure 1	*Eusyringium* ? sp. aff. *Theocampe subtilis* 137-7-CC.	p. 549
Figure 2	*Dictyomitra veneta* 137-7-CC.	p. 550
Figure 3	*Dictyomitra costata* 137-7-CC.	p. 550
Figure 4	*Cistyomitra crassispina* 137-7-CC.	p. 550
Figure 5	*Dictyomitra pseudomacrocephala* 138-5-CC.	p. 550
Figure 6	*Stichocapsa* sp. aff. *S. ferosia* 137-7-CC.	p. 545
Figure 7	*Stichocapsa* sp. aff. *L. elegans* 137-7-CC.	p. 546
Figure 8	*Dictyomitra tiara* 137-7-CC.	p. 550
Figure 9	*Eucyrtidioidea* gen. sp. 138-5-CC.	
Figure 10, 11	*Dictyomitra duodecimcostata* group 138-5-CC.	p. 550
Figure 12	*Dictyomitra* sp. A 144-3-2, 85-88 cm.	p. 550
Figure 13	*Eucyrtidium* ? sp. C 138-5-CC.	p. 548
Figure 14	*Dictyomitra* ? sp. aff. *Stichocapsa tecta* 138-5-CC.	p. 550
Figures 15, 16	*Cryptamphorella sphaerica* 138-5-CC.	p. 541
Figure 17	*Cryptamphorella* sp. aff. *conara* 138-5-CC.	p. 541
Figure 18	*Gongylothorax* ? sp. 138-5-CC.	
Figures 19, 20	*Myllocercion* sp. aff. *M. minima* 138-5-CC.	p. 535

PLATE 2

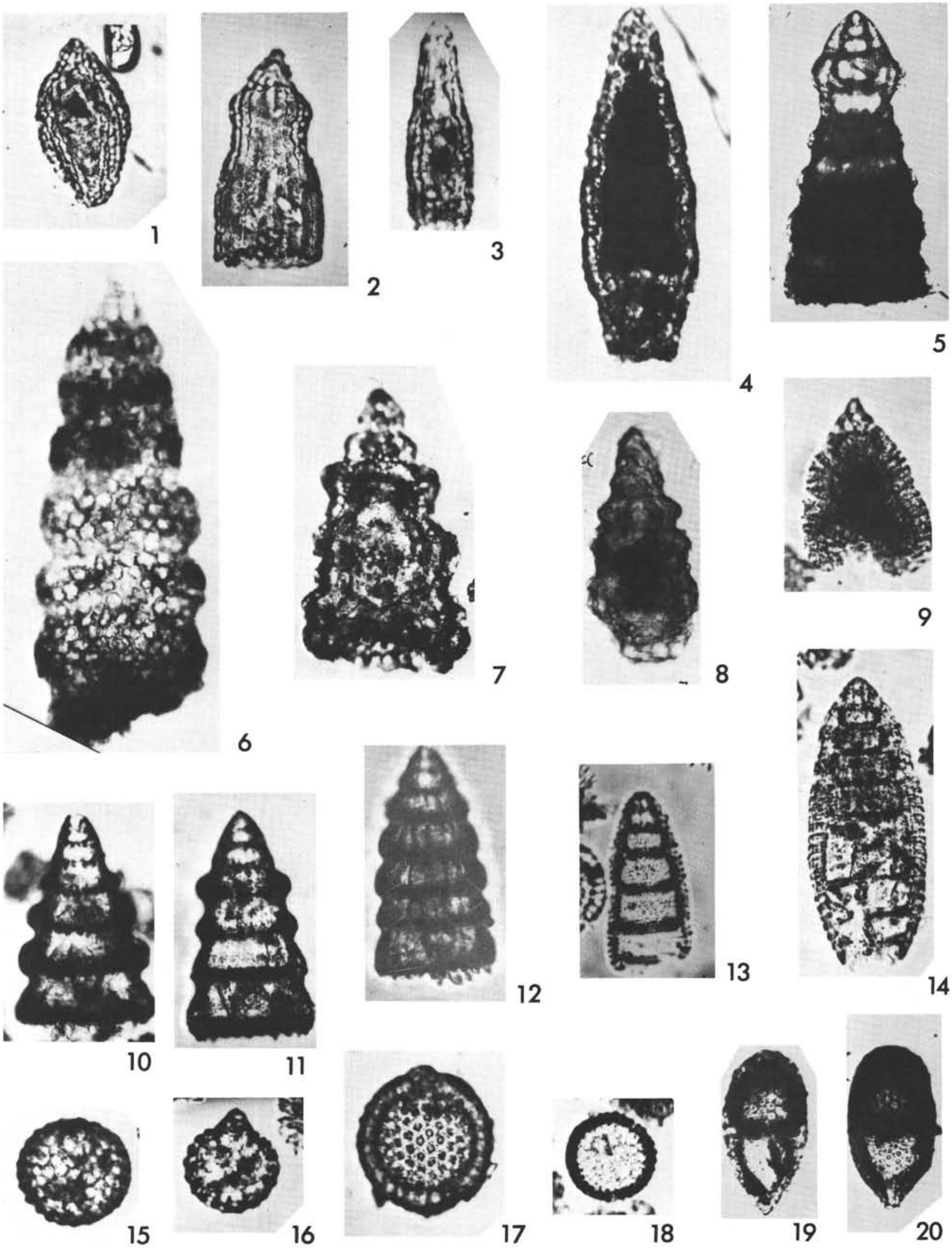


Plate 3
Magnification 200X

Figure 1-3	*Pseudoaulophacus superbus* 138-5-CC. 3: Transverse section.	p. 527
Figure 4	*Spongotrochus* sp. 138-5-CC.	
Figures 5-7	*Pseudoaulophacus* sp. 138-5-CC.	
Figures 8, 9	*Patellula verteroensis* 138-5-CC.	p. 527
Figures 10-12	*Pseudoaulophacus* sp. aff. *P. pargueranensis* 138-5-CC.	p. 527
Figure 13	*Patellula planoconvexa* 138-5-CC.	p. 527
Figures 14, 15	*Spongodiscidae* gen. sp. indet. 138-5-CC.	
Figure 16	*Dactyliosphaera* sp. aff. *Lithocyclia justa* 138-5-CC.	p. 528
Figure 17	*Lithelidae* gen. B sp. 138-5-CC.	p. 529
Figure 18, 19	*Lithelidae* gen. sp. 138-5-CC.	

PLATE 3

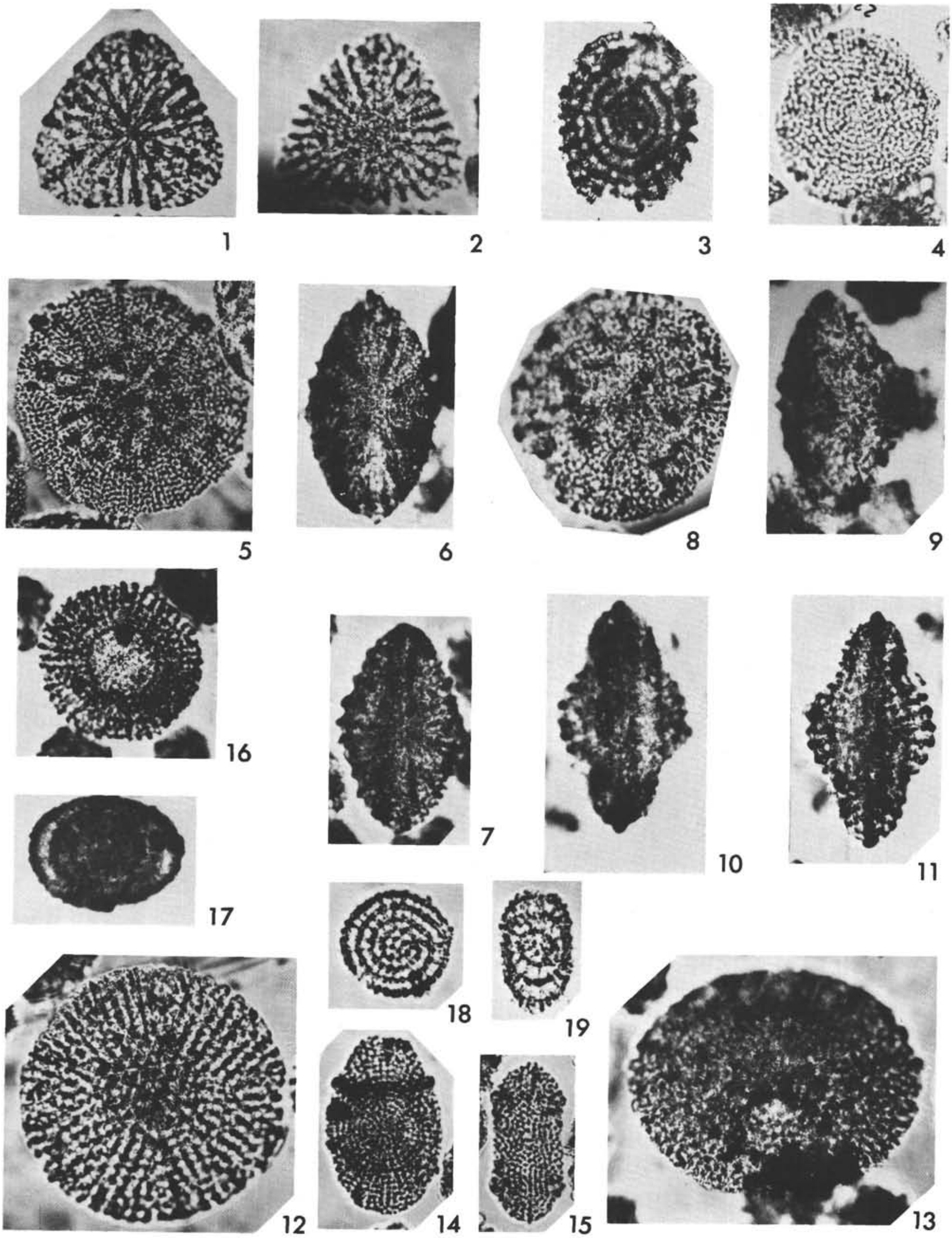


Plate 4
Magnification 200X

Figure 1	*Cenosphaera* sp. aff. *C. euganea* 137-4-2, 80-84 cm.	p. 521
Figure 2	*Conosphaera* ? *sphaeroconus* 137-4-2, 80-84 cm.	p. 521
Figures 3, 4	*Stylatractus* (?) sp. 3: 144-4-CC. 4: 144-3-CC.	
Figure 5	*Spongosaturnalis* (?) sp. aff. *S. latuformis* 144-3-CC.	p. 521
Figure 6,7	*Spongoprunum* (?) sp. aff. *Cyphantus probus* 6: 144-3-2, 85-88 cm. 7: 144-3-CC.	p. 529
Figure 8	*Spongodiscidae* ? gen. et sp. indet. 144-3-2, 85-88 cm.	
Figures 9, 10	*Spongotrochus* ? *polygonatus* 9: 144-3-CC. 10: 144-3-2, 85-88 cm.	p. 528

PLATE 4

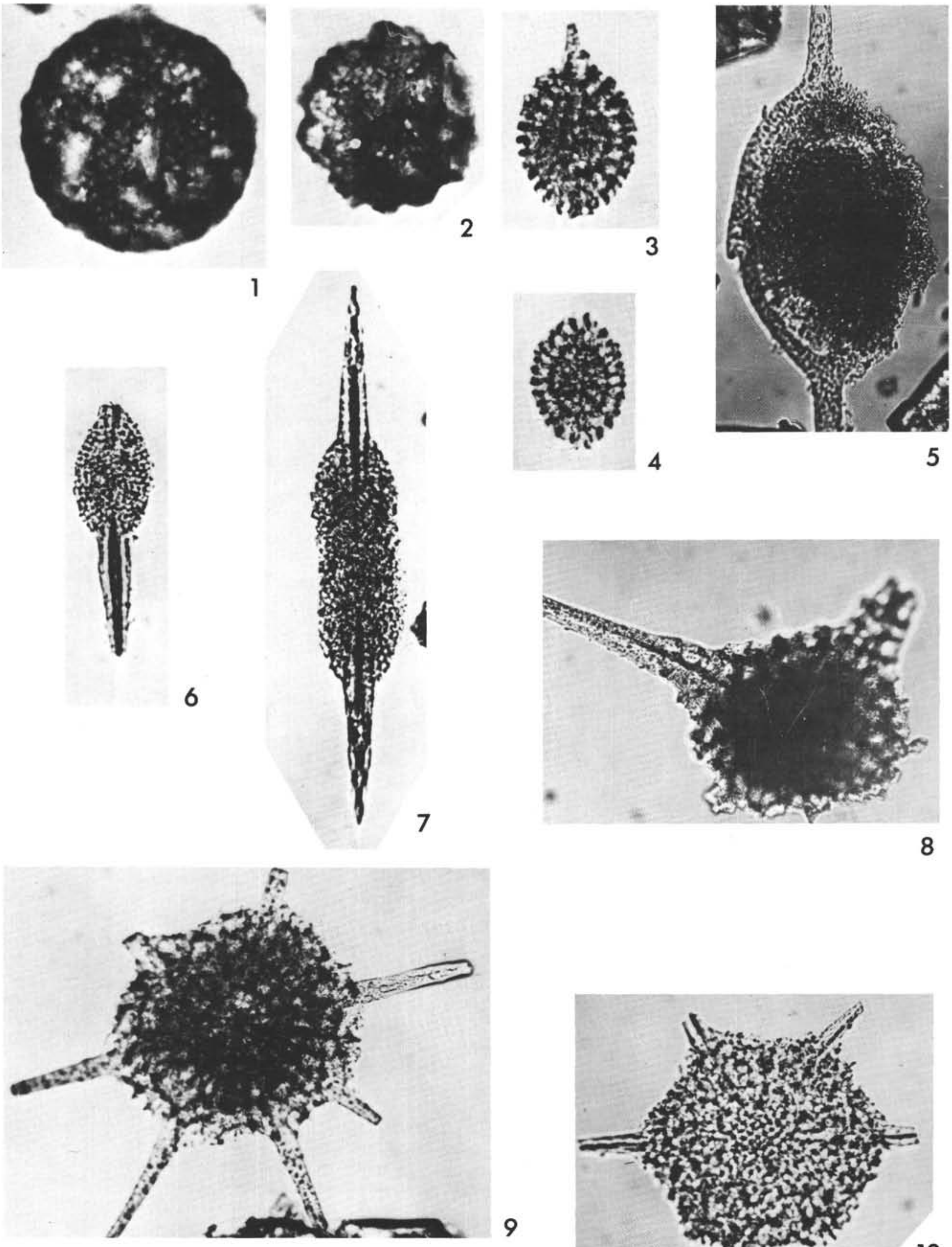


Plate 5
Magnification 200X

Figure 1	*Tholodiscus fresnoensis* 144-3-CC.	p. 525
Figure 2-4	*Porodiscidae* genn. et spp. indet. 2, 3: 144-3-CC. 4: 144-3-1.	p. 525
Figure 5	*Tholodiscus* sp. 144-3-CC.	p. 525
Figures 6, 7	*Porodiscus cretaceus* 144-3-CC.	p. 525
Figures 8, 9	*Porodiscus delicatulus* 144-3-CC.	p. 525
Figure 10	*Spongopyle insolita* 144-3-CC.	
Figure 11, 12	*Spongotrochus* (?) sp. 144-3-CC.	p. 528
Figure 13	*Spongodiscidae* ? gen. et sp. indet. 144-3-CC.	p. 529
Figures 14, 15	*Lithelidae* gen. A sp. aff. *Cromyodruppa* sp. Lipman 144-3-CC.	p. 529

PLATE 5

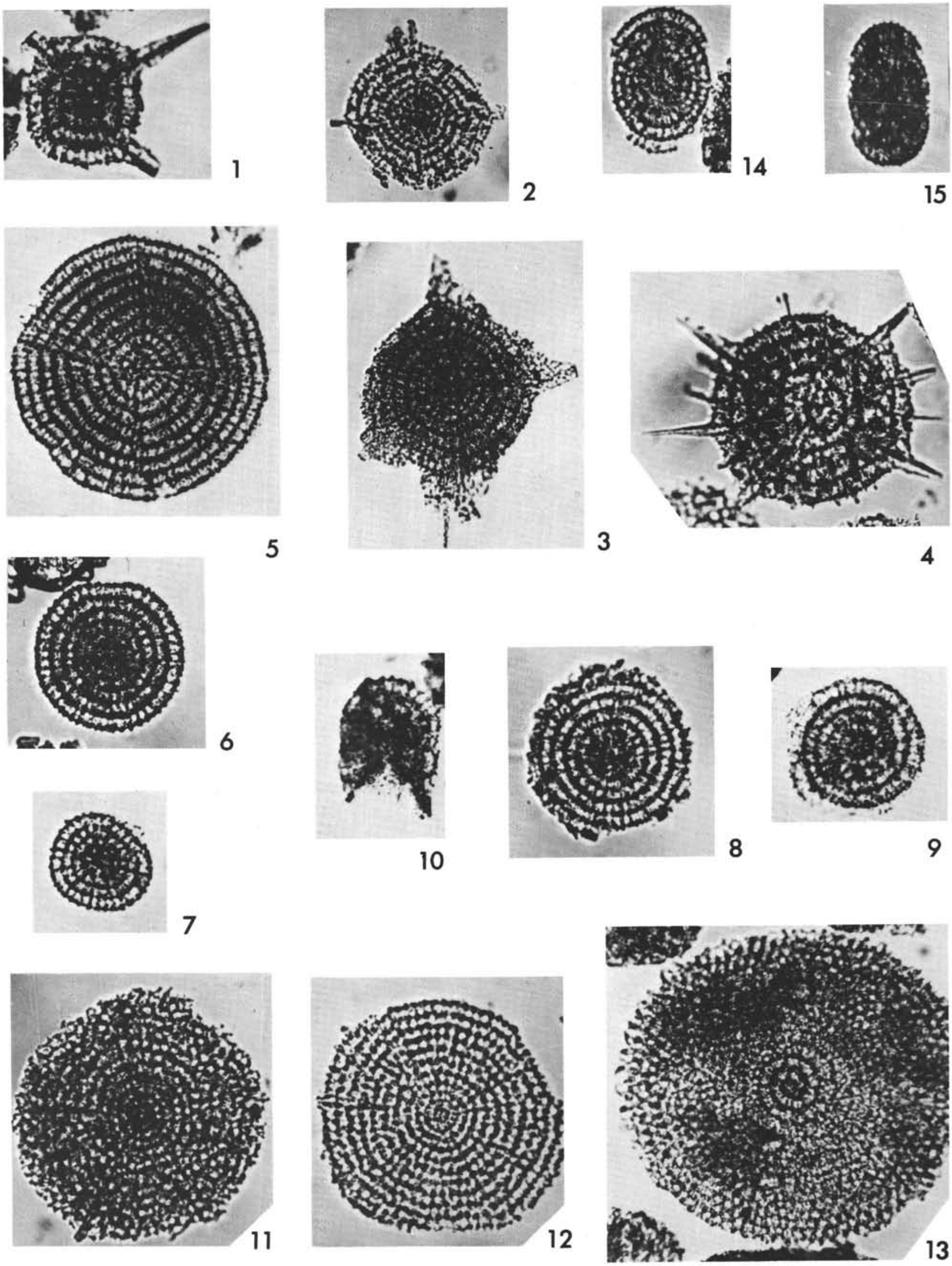
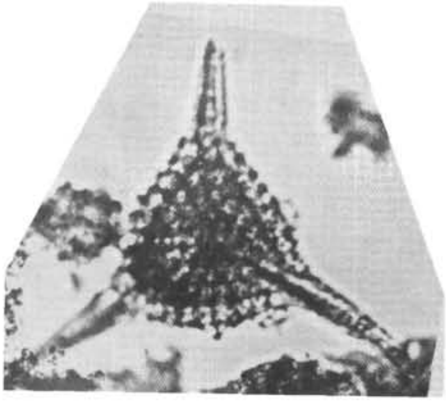


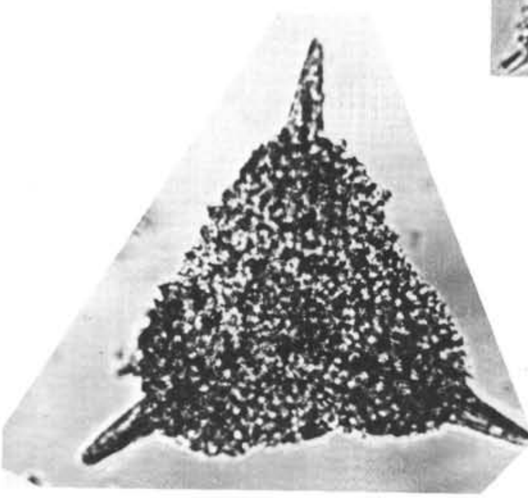
Plate 6
Magnification 200X

Figure 1	*Pseudoaulophacus gallowayi* (?) 144-3-1.	p. 527
Figures 2, 3	*Spongotripus morenoensis* 2: 144-3-2, 85-88 cm. 3: 144-3-1.	p. 528
Figures 4-7	Pseudoaulophacidae	
	4: *Hagiastrum* sp. aff. *Stauralastrum euganea* 144-3-2, 85-88 cm.	p. 527
	5: *Hagiastrum* sp. aff. *Stauralastrum euganea* 144-3-CC.	p. 527
	6, 7: Genn. et spp. indet. 144-3-2, 85-88 cm.	p. 527

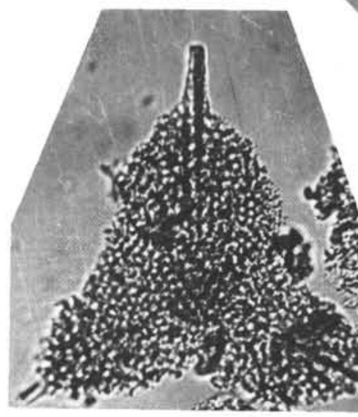
PLATE 6



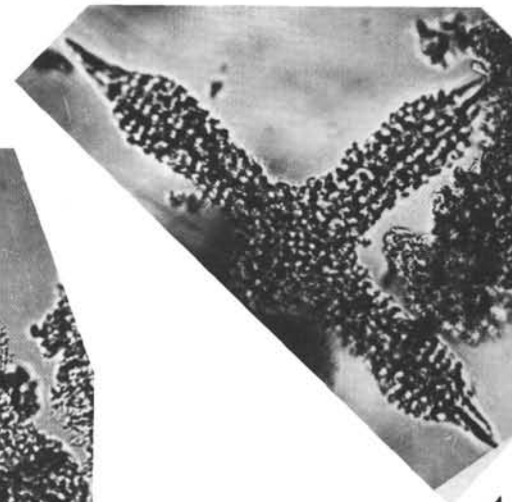
1



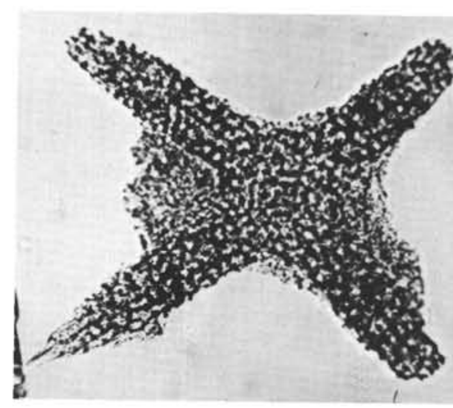
2



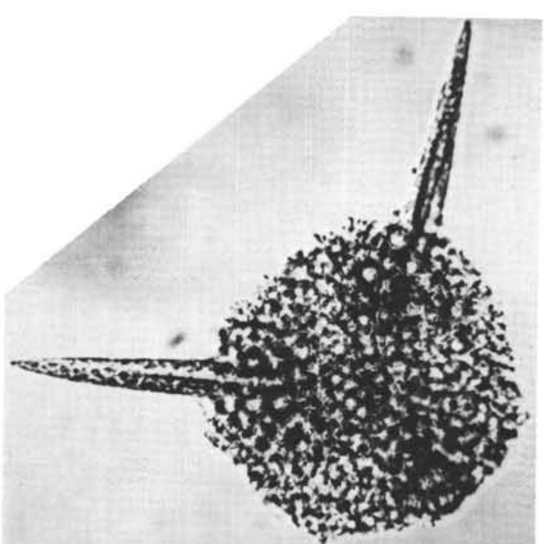
3



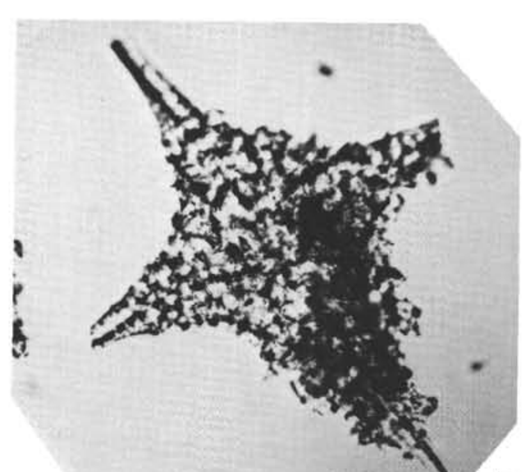
4



5



6



7

Plate 7
Magnification 200X

Figure 1	*Theocampe* sp. P 144-3-CC.	p. 537
Figure 2	*Tripodiscium* ? sp. aff. *Lithomelissa hoplites* 144-3-2, 85-88 cm.	p. 534
Figure 3	*Myllocercion* sp., aff. *M. minima* 144-3-2, 85-88 cm.	p. 535
Figures 4, 5	*Diacanthocapsa* sp. B 4: 144-3-2, 85-88 cm. 5: 144A-4-CC.	p. 536
Figure 6	*Theocapsomma* sp. aff. *T. comys* 144-3-CC.	p. 535
Figure 7	*Theocampe* ? *bassilis* 144-3-CC.	p. 537
Figures 8-10	*Theocampe* ? sp. aff. *T. daseia* 8, 9: 144-3-2, 85-88 cm. 10: 144-3-CC.	p. 537
Figure 11	*Diacanthocapsa* sp. A 144-3-CC.	p. 536
Figure 12	*Rhopalosyringium* sp. aff. *R. colpodes* 144-3-CC.	p. 537
Figures 14-17	*Rhopalosyringium* sp. aff. *R. magnificum* 144-3-2, 85-88 cm.	p. 537
Figures 18, 19	*Gongylothorax* sp. aff. *G. verbeeki* 144A-4-CC.	p. 541
Figure 20	?*Bathropyramis sanjoaquinensis* 144-3-2, 85-88 cm.	p. 551
Figure 21	*Petassiforma speciosa* 144-3-1.	p. 540

PLATE 7

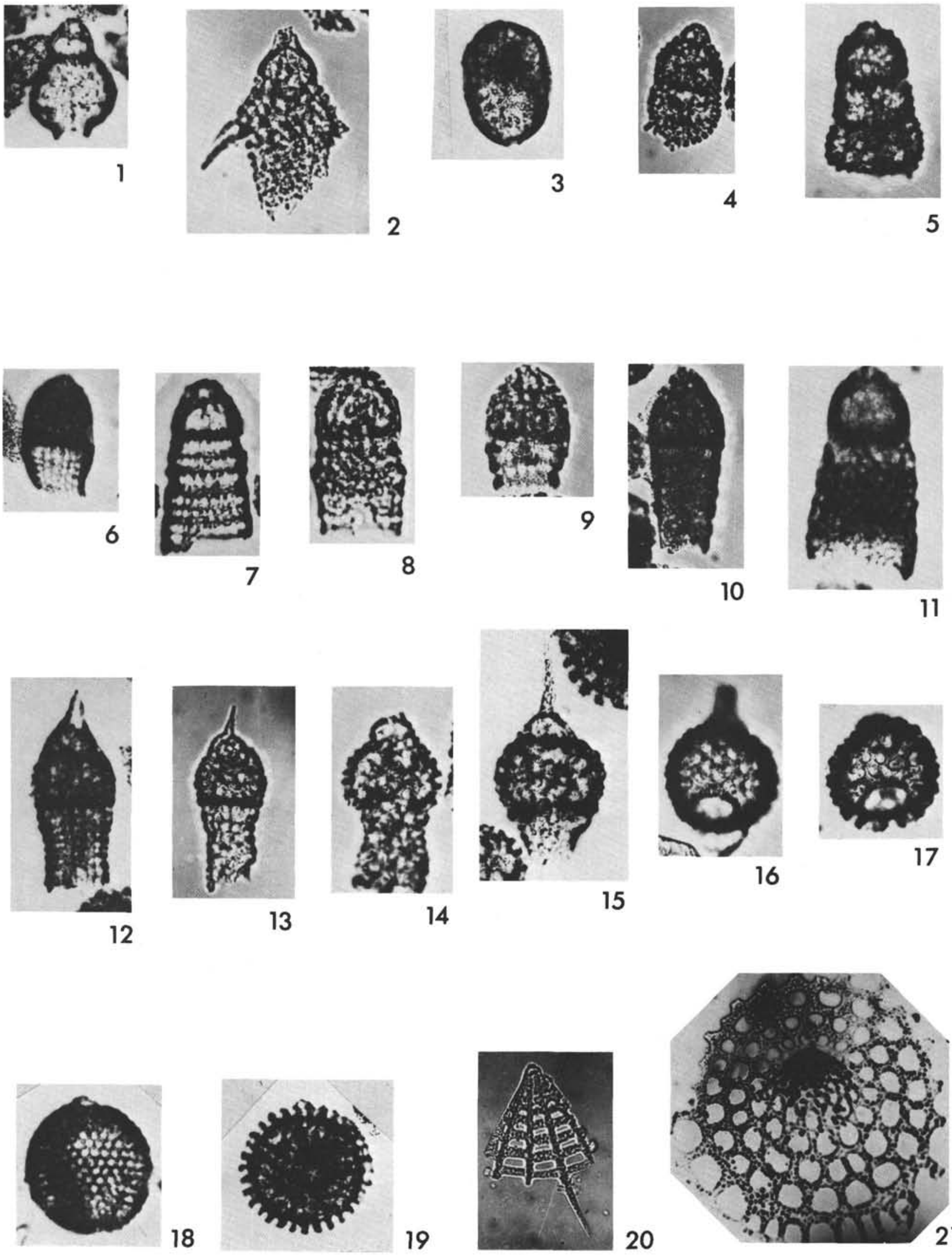


Plate 8
Magnification 200X

Figure 1-3	*Stichocapsa asymbatos* 1, 2: 144-3-2, 85-88 cm. 3: 144A-4-CC.	p. 546
Figures 4, 5	*Stichocapsa* sp. aff. *S. producta* 4: 144A-4-CC. 5: 137-4-2, 80-84 cm.	p. 546
Figures 6, 7	*Stichocapsa* sp. 144-3-2, 85-88 cm.	
Figure 8	*Dictyomitra ornata* 144A-4-CC.	p. 550
Figures 9, 10	*Dictyomitra multicostata* 9: 144-3-2, 85-88 cm. 10: 144-3-CC.	p. 550
Figure 11	*Dictyomitra* aff. *regina* 144A-4-CC.	p. 550
Figures 12, 13	*Dictyomitra striata* 12: 144A-4-CC. 13: 144-3-CC.	p. 550
Figure 14	*Amphipyndax* sp. aff. *A. enessefi* 144-3-2, 85-88 cm.	
Figure 15	*Amphipyndax enessefi* 144-3-CC.	p. 545
Figures 16, 17	*Amphipyndax stocki* 16: 144-3-CC. 17: 144-3-2, 85-88 cm.	p. 545
Figure 18	*Amphipyndax* sp. 144-3-CC.	p. 545
Figure 19	*Stichocapsa cingulata* 144-3-CC.	p. 546

PLATE 8

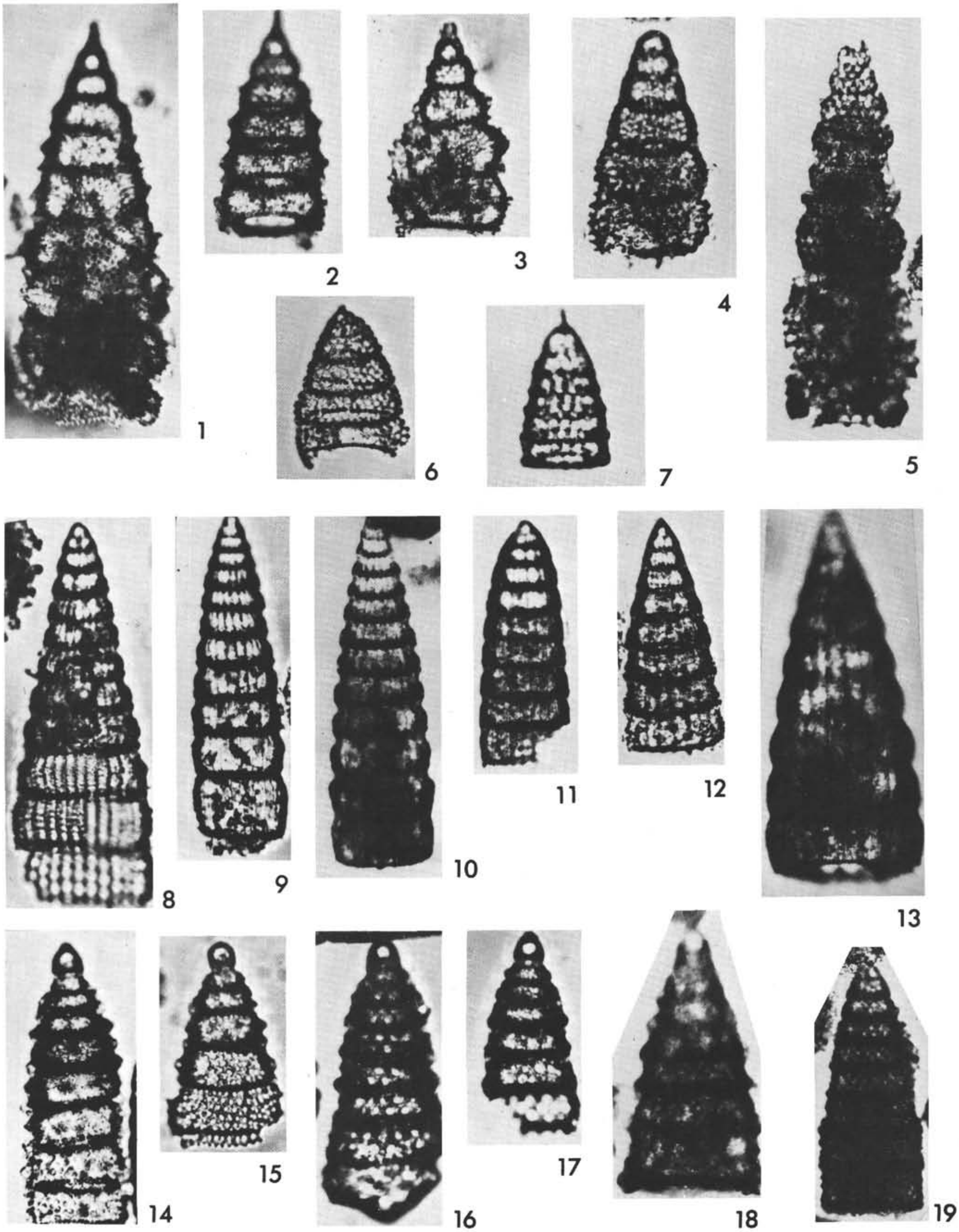


Plate 9
Magnification 200X

Figure 1	*Otosphaera annikae* holotype 139-3-CC.	p. 515
Figure 2	*Otosphaera auriculata* 139-4-CC.	p. 515
Figure 3	Collosphaeridae gen. et sp. indet. 139-1-1.	
Figures 4-7	*Actinomma* sp. aff. *Hexacontium arachnoidale* 139-1-1, 80-82 cm.	
Figures 8, 9	*Haliometta miocenica* 139-1-1, 80-82 cm.	
Figure 10	*Haliometta* sp. 140A-2-4, 80-82 cm.	
Figure 11	*Cromyechinus tetrapila* 142-9-2, 58-60 cm.	p. 519
Figure 12	*Cromyechineu langii* 139-7-4, 80-82 cm.	p. 519
Figure 13	*Actinommura* sp. A 140A-2-5, 5-7 cm.	p. 519
Figure 14	*Actinommura* sp. B, the rods connecting medullary and cortical shells are boken. 140A-2-6, 80-82 cm.	p. 519
Figure 15	*Actinommura* sp. C 140-2-CC *	
Figure 16	*Acanthosphaera* ? *haliformis* 140A-2-5, 5-7 cm.	
Figure 17	*Thecosphaera* sp. A 140-2-CC *.	
Figure 18	*Thecosphaera* (?) sp. B 140-2-CC *.	p. 519
Figure 19	*Thecosphaera* ? sp. C 144-1-CC.	p. 519

PLATE 9

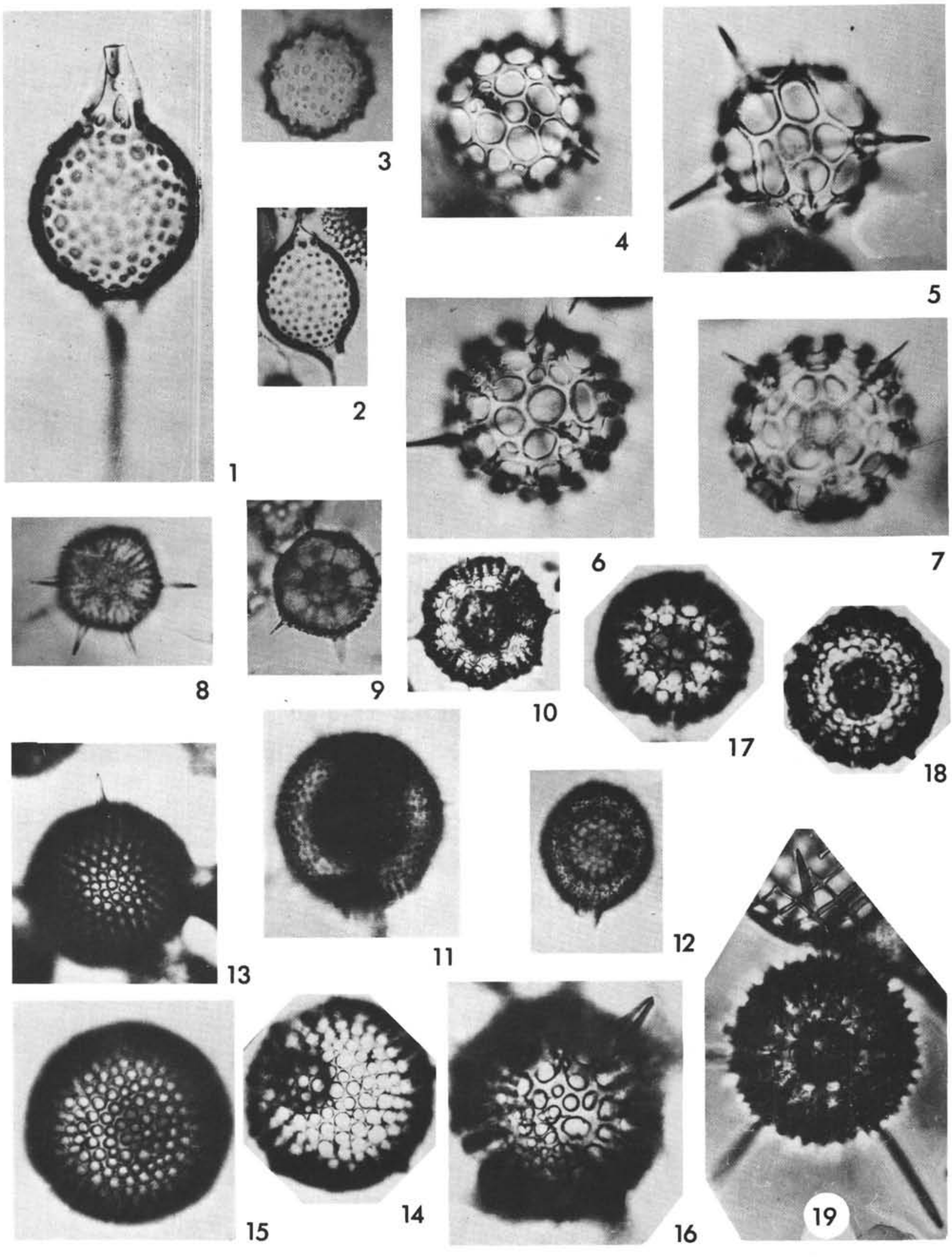


Plate 10
Magnification 200X

Figure 1	*Axoprunum carduum* 140A-2-3, 80-82 cm.	p. 521
Figure 2	*Axophrunum* sp. 140-2-CC *.	p. 521
Figure 3	*Axoprunum liostylum*	p. 521
Figure 4	*Stylosphaera minor* 140-2-CC *.	p. 520
Figure 5	*Spongosphaera pachystyla* 144-1-4, 80-82 cm.	p. 521
Figure 6	*Saturnalinae* gen. indet. 144-2-3.	p. 521
Figure 7	*Stylosphaera* sp. B 139-5-CC.	p. 520
Figure 8	*Stylosphaera* sp. A 139-7-CC.	p. 520
Figure 9	*Cannartus* sp. aff. *C. prismaticus* 140-2-CC *.	p. 521
Figure 10	*Axoprunum stauraxonium* 139-1-2, 5-7 cm.	p. 521
Figures 11, 12	*Axoprunum polycentrum* 11: 140A-2-6, 80-82 cm. 12: 138-2.	p. 521

PLATE 10

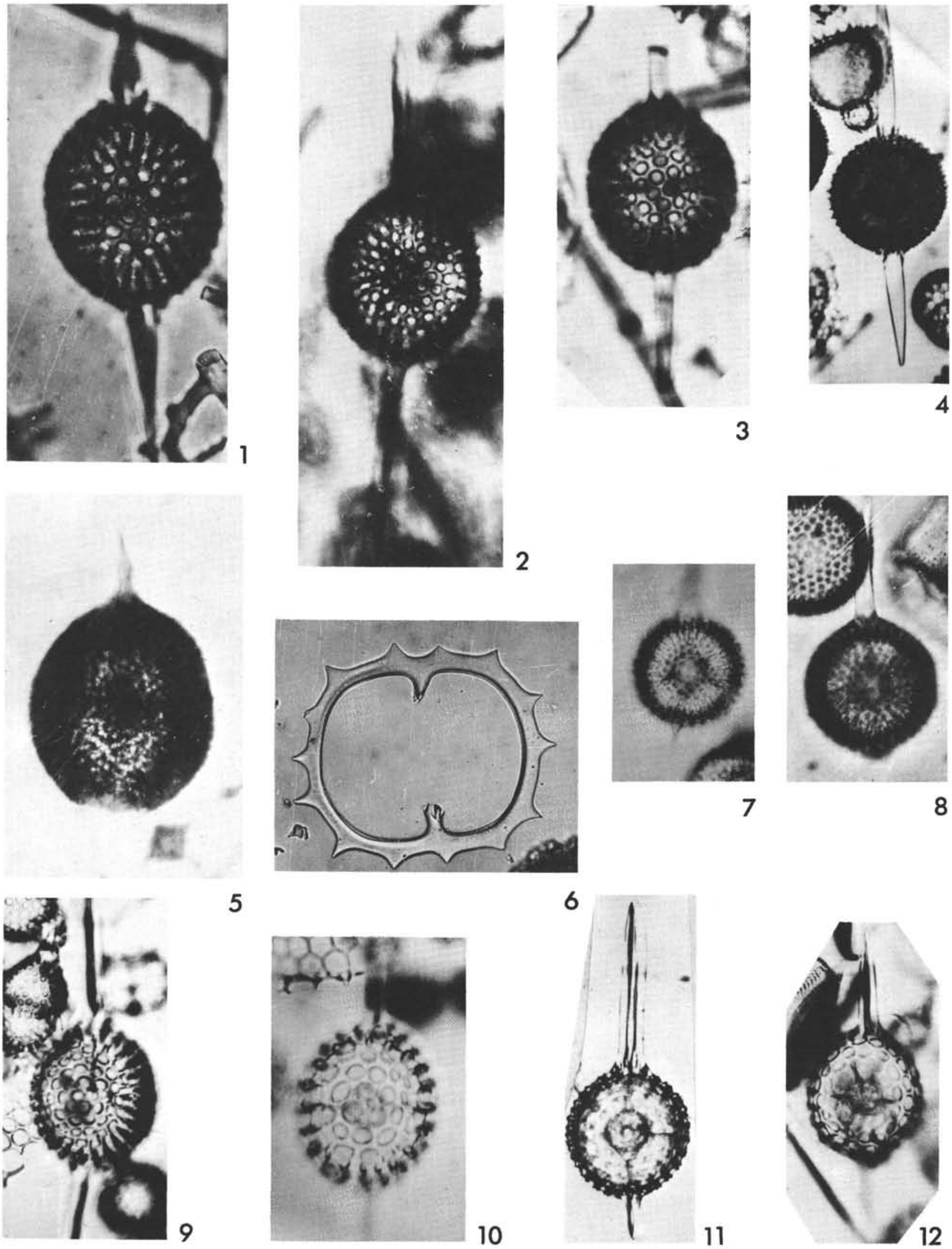


Plate 11
Magnification 200X

Figure 1	*Stylatractus ostacion* 140A-2-5, 5-7 cm.	p. 520
Figures 2-4	*Stylatractus spinulosus* group 2: 140A-2-6, 80-82 cm. 3: 140-2-CC*. 4: 138-2-3, 5-7 cm.	p. 519
Figures 5-7	*Stylosphaera* sp. C 5: 139-1-1, 80-82 cm. 6: 139-1-CC. 7: 139-1-2, 5-7 cm.	p. 520
Figure 8	*Stylosphaera* (?) *laevis* 144-1-4, 80-85 cm.	p. 520
Figure 9	*Stylatractus coronatus* 144-1-4, 80-85 cm.	p. 520
Figure 10	*Stylatractus santaennae* 139-4-CC.	p. 520
Figure 11	*Stylatractus neptunus* 138-1-1.	p. 520
Figure 12	*Stylatractus fragilis* 139-1-1, 80-82 cm.	p. 520
Figures 13, 14	*Stylosphaera* sp. aff. *sulcata* 144-1-5, 80-85 cm.	p. 520
Figures 15-19	*Stylosphaera angelina* group 15: California. 16, 18, 19: 139-1-2, 5-7 cm. 17: 139-1-CC.	p. 520

PLATE 11

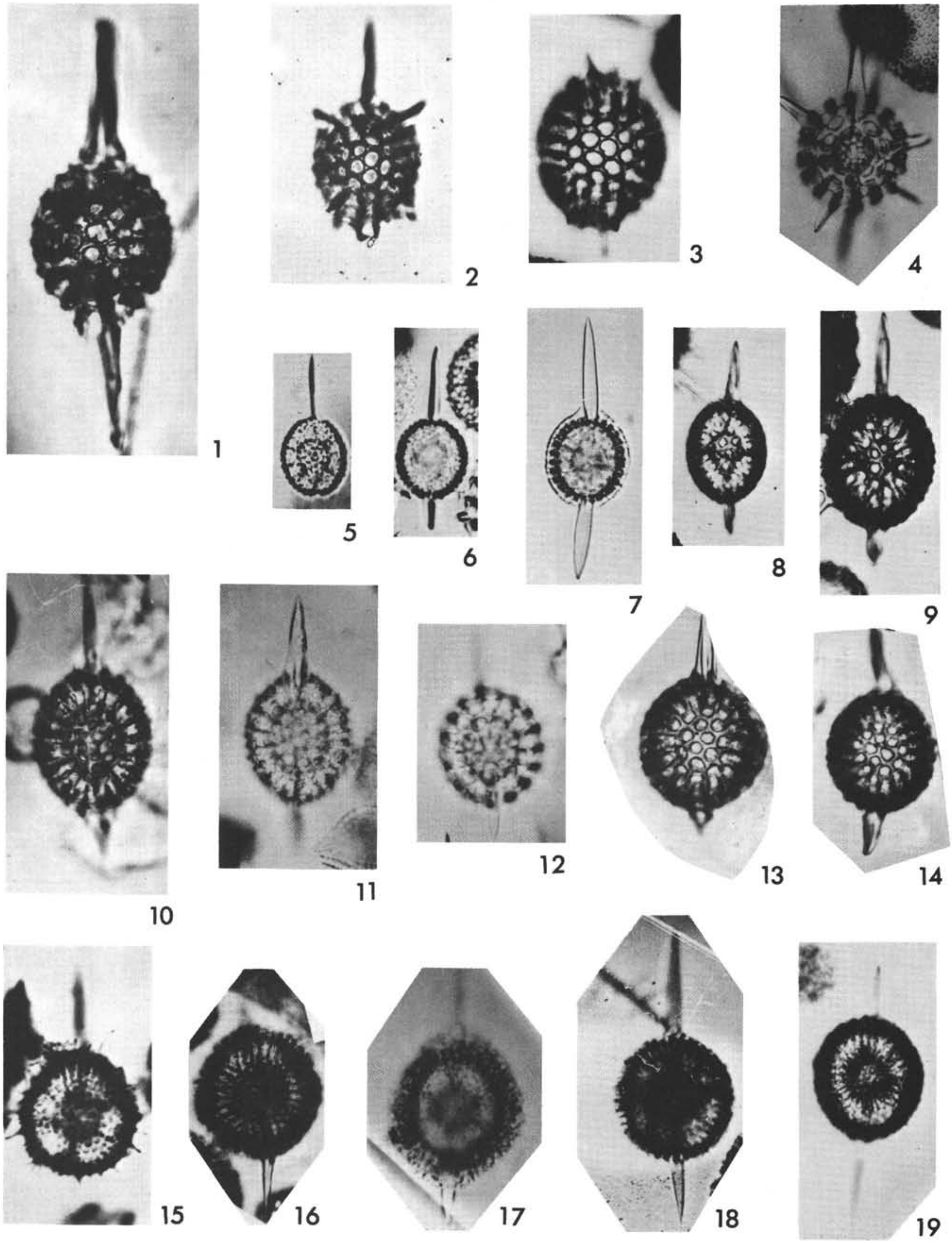


Plate 12
Magnification 200X

Figure 1	*Artiscinae* gen. sp. with hollow polar columns. 140-4-1, 10-12 cm.	p. 522
Figure 2	*Cannartus* sp. 138-2-2, 5-7 cm.	p. 521
Figure 3	*Cannartus mammiferus* 140-2-Bumper	p. 521
Figure 4	*Astromma hughesi* 139-3-CC.	p. 522
Figure 5	*Astromma petterssoni* 139-3-CC.	p. 522
Figure 6	*Astromma enthomocora* 139-3-CC.	p. 522
Figures 7, 8	*Astromma* ? supp. 7: 139-4-CC 8: 142-9-1, 98-100 cm	p. 522
Figures 9, 10	*Cannartus violina* 9: 140-2-1, 80-82 cm 10: 140-2-1, 5-7 cm	p. 522
Figures 11-14	*Cannartus* sp. A 11: 139-5-CC 12: 140-2-3, 5-7 cm 13, 14: 139-5-CC	p. 522
Figures 15-17	*Ommatartus* spp. aff. *O. ceratosphyris* 15, 17: 139-1-CC 16: 139-1-1, 80-82 cm	p. 522

PLATE 12

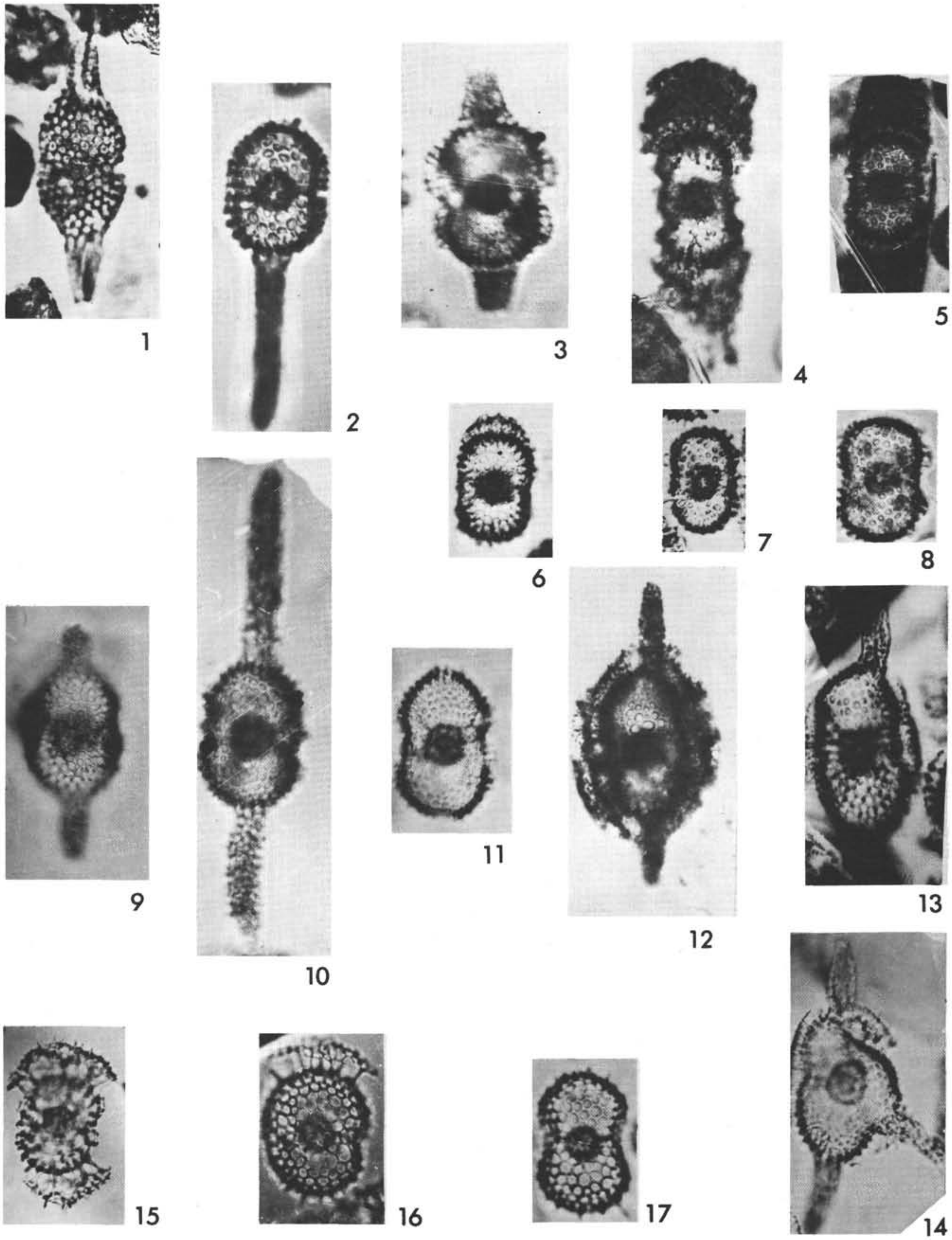


Plate 13
Magnification 200X

Figure 1	*Sethostylus* sp. aff. *Phacostylus amphistylus* 140-2-CC*.	p. 522
Figure 2	*Triactis triactis* 140-2-CC*.	p. 523
Figure 3	*Heliodiscus asteriscus* grp. 144-1-3, 80-85 cm.	p. 523
Figure 4	*Heliodiscus hexasteriscus* 144-1-CC.	p. 523
Figure 5	*Heliodiscus* sp. aff. *H. saturnalis* 144-1-6, 80-85 cm.	p. 523
Figure 6, 7	*Heliodiscus pentasteriscus* 144-1-5, 80-85 cm.	p. 523
Figure 8	*Heliodiscus saturnalis* 144-1-CC.	p. 523
Figure 9	*Heliodiscus* sp. aff. *H. echiniscus* 144A-2-6, 2-4 cm.	p. 523
Figure 10	*Heliosestilla spicata* 140A-2-5, 5-7 cm.	p. 522

PLATE 13

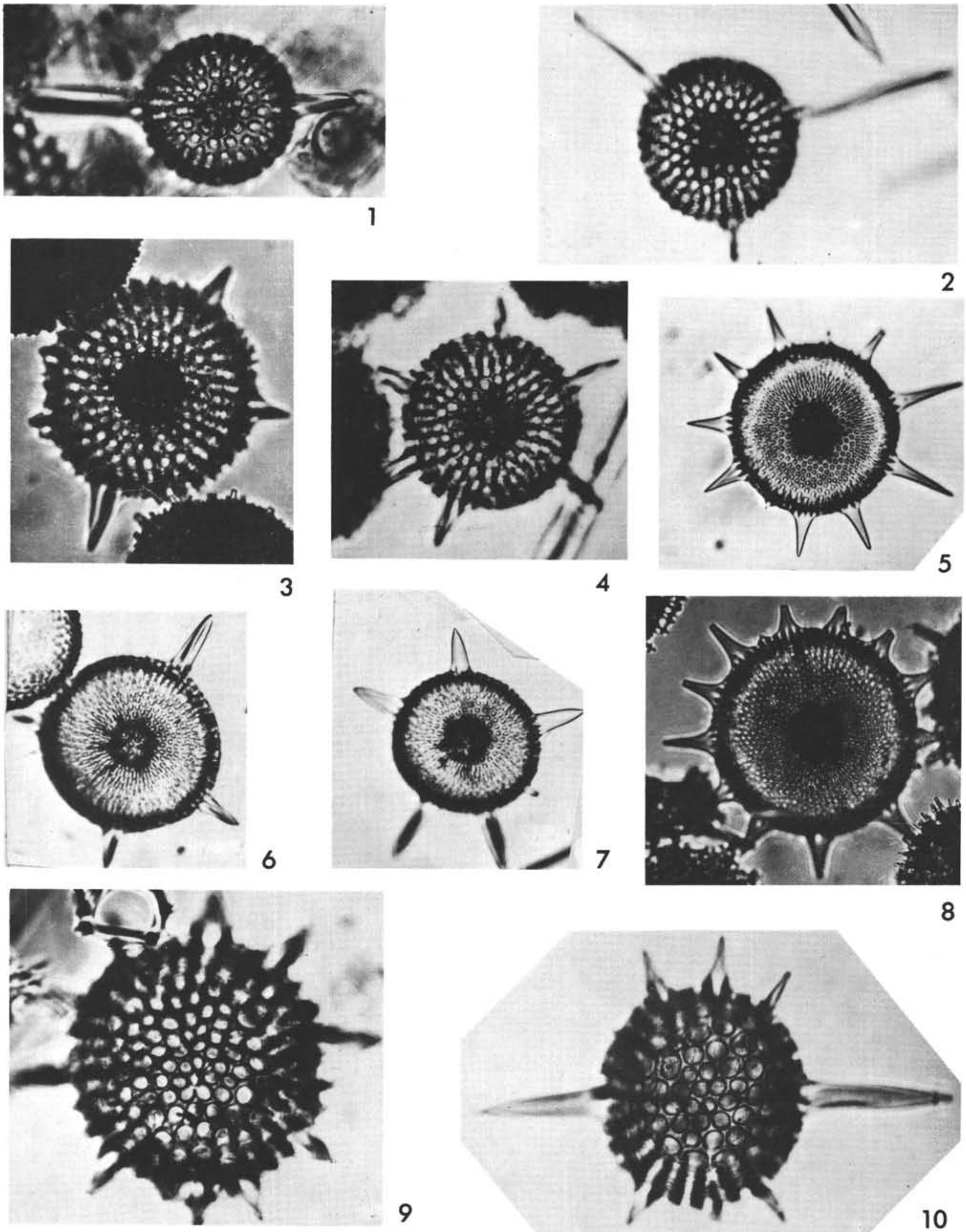
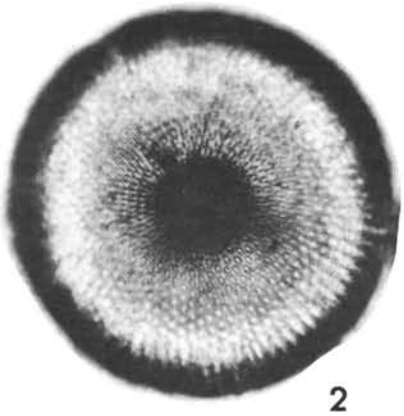


Plate 14
Magnification 200X

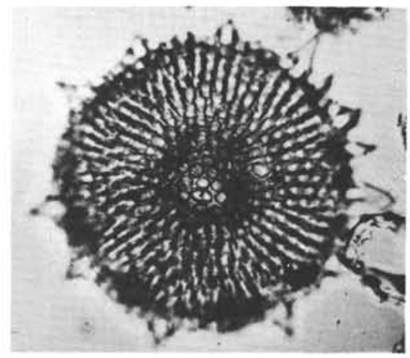
Figure 1, 2	*Periphaena decora* 1: 140-2-CC*. 2: 144-1-5, 80-85 cm.	p. 523
Figure 3	*Periphaena dupla* 144A-2-6, 2-4 cm.	p. 523
Figures 4, 5	*Periphaena* sp. 144-1-CC.	p. 523
Figure 6	*Stylocyclia* ? sp. 144-1-CC.	p. 523
Figure 7	*Lithocyclia* ? sp. 144-1-CC.	p. 523

PLATE 14

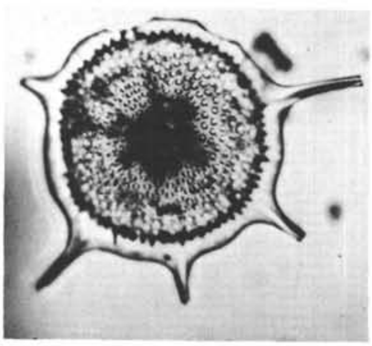
1



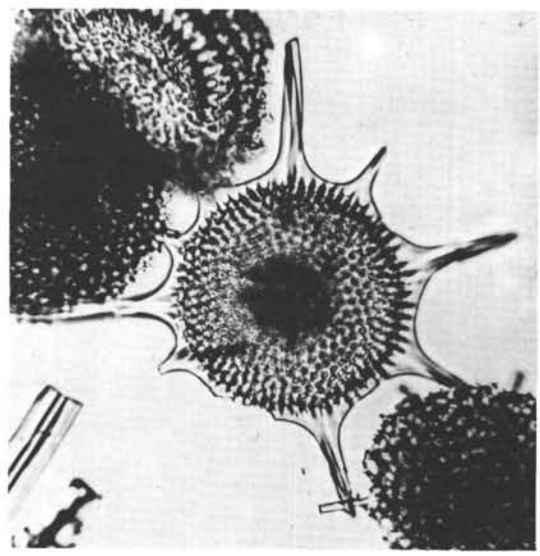
2



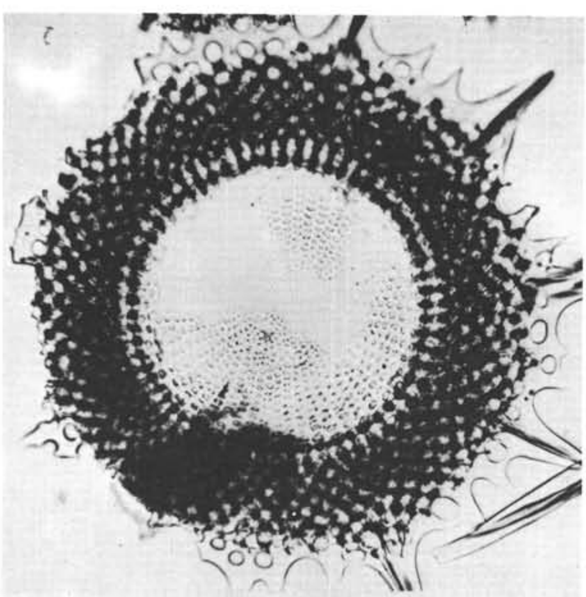
3



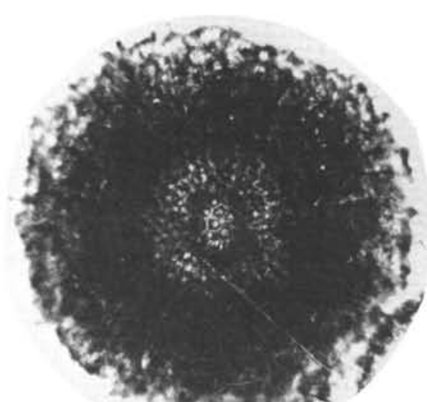
4



5



6

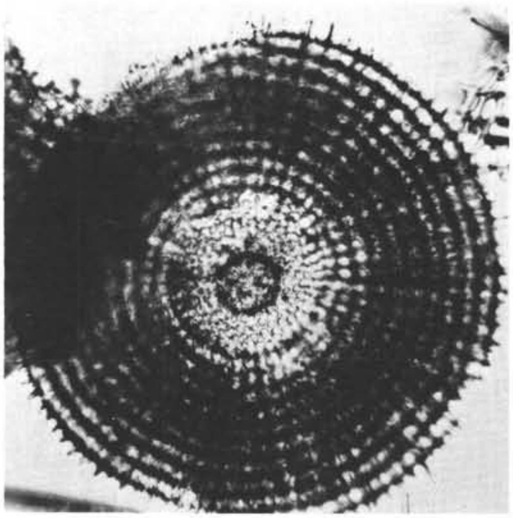


7

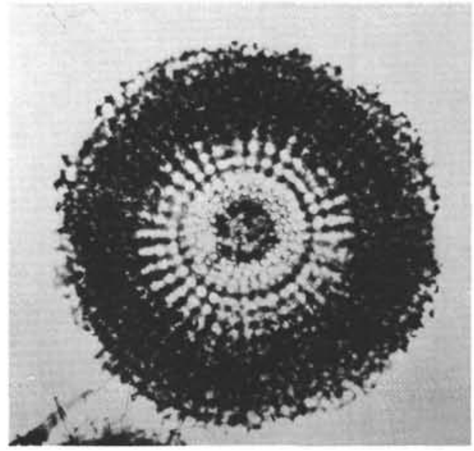
Plate 15
Magnification 200X

Figures 1, 2	*Lithocyclia ocellus* 144-1-CC.	p. 523
Figure 3	*Lithocyclia* sp. aff. *L. Lenticula* 144-1-CC.	p. 523
Figure 4	*Stylocyclia dimidiata* 144-1-6, 80-85 cm.	p. 523
Figure 5	*Trigonocyclia* sp. A 144-1-5, 80-85 cm.	p. 524
Figure 6	*Trigonocyclia prima* holotype 144-1-CC.	p. 524
Figure 7	*Astrocyclia* sp. 144-1-CC.	p. 524

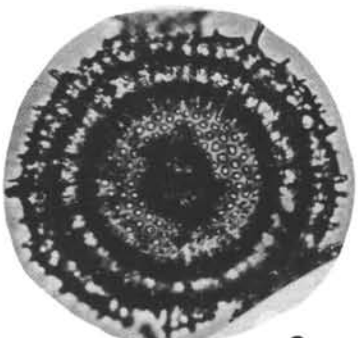
PLATE 15



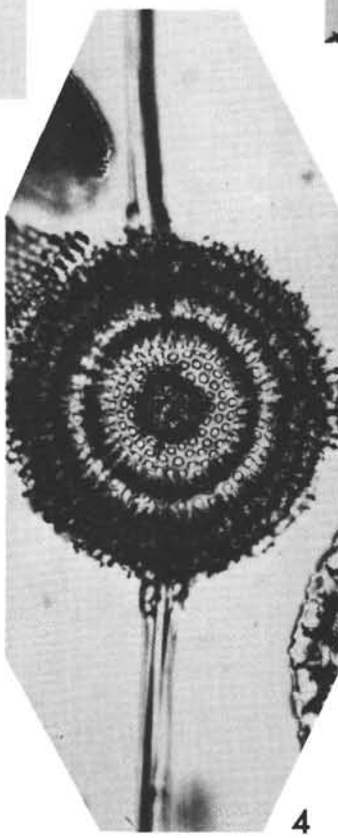
1



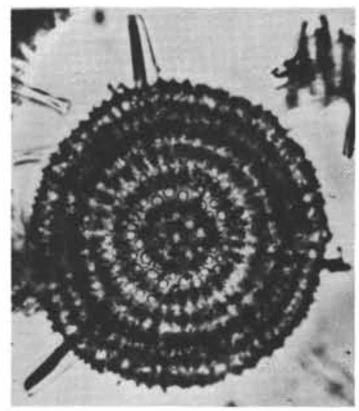
2



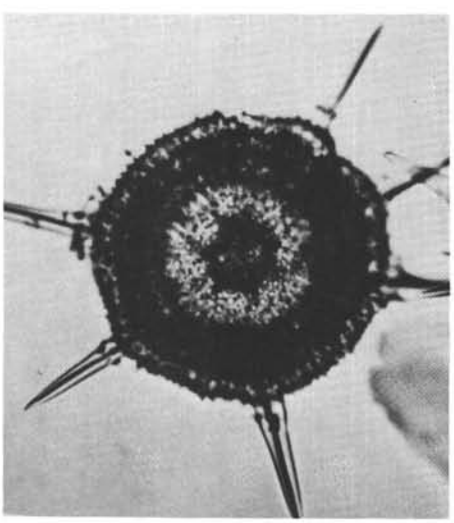
3



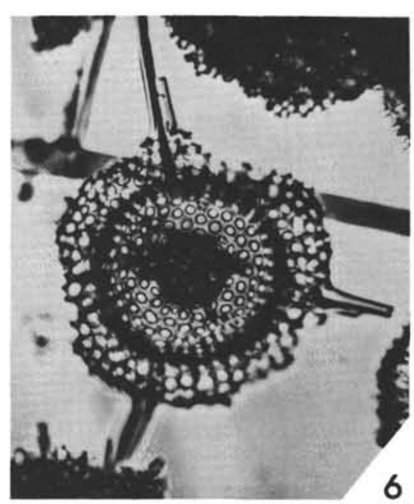
4



5



7



6

Plate 16
Magnification 200X

Figures 1-5	*Astractinium aristotelis* group 140-2-CC*.	p. 524
Figure 6	*Astractinium* sp. A 140-2-CC*.	
Figure 7	*Astractinium* sp. B 140-2-CC*.	
Figures 8, 9	*Astractinium* spp. aff. *Lithocyclia crux* 8: 144B-2-6, Top. 9: 138-2-6, 5-7 cm.	p. 524
Figure 10	*Astractinium* sp. C 144B-2-5, Top.	p. 524

PLATE 16

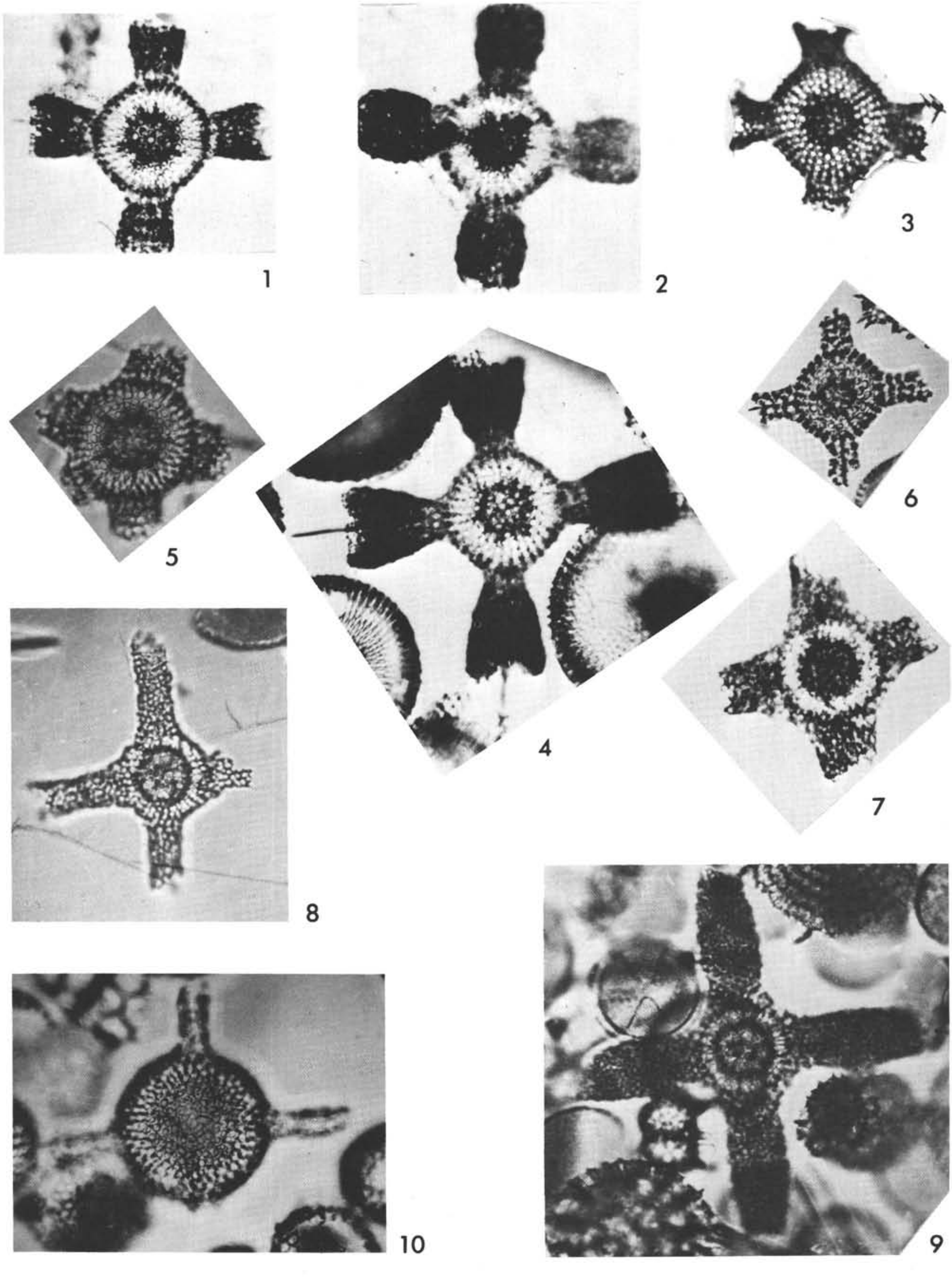
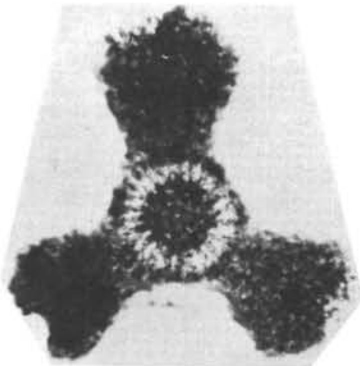
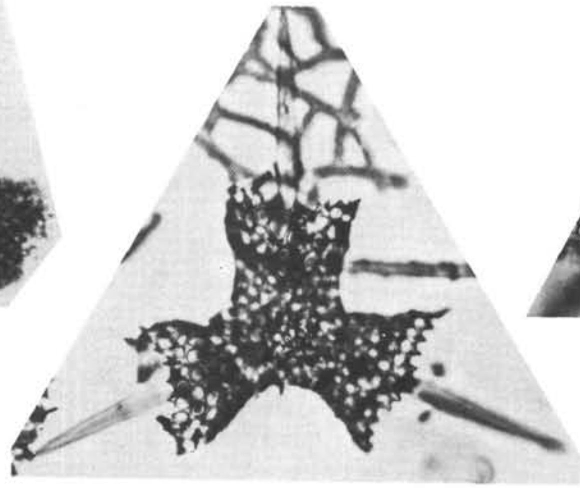


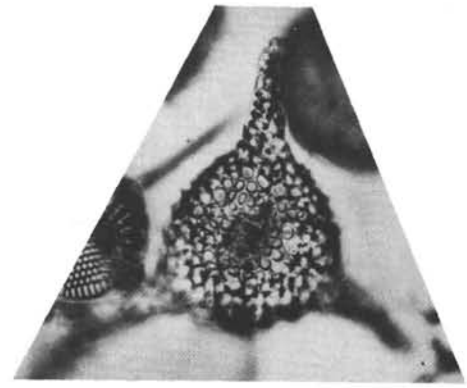
Plate 17
Magnification 200X

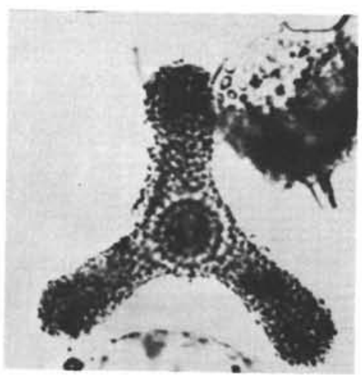
Figure 1	*Trigonactinium pithagore* 140-2-CC*.	p. 524
Figure 2	*Trigonactinium* sp. 140A-2-5, 5-7 cm.	p. 524
Figure 3	*Trigonactinium ? angustum* 138-2-6, 5-7 cm.	p. 524
Figures 4-6	*Rhopalastrum profundum group* 4: 140-2-6, 80-85 cm. 5: 139-1-2, 5-7 cm. 6: 140-2-1, 5-7 cm.	p. 529
Figures 7, 8	*Rhopalastrum angulatum* group 7: 139-1-2, 5-7 cm. 8: 139-5-CC.	p. 529

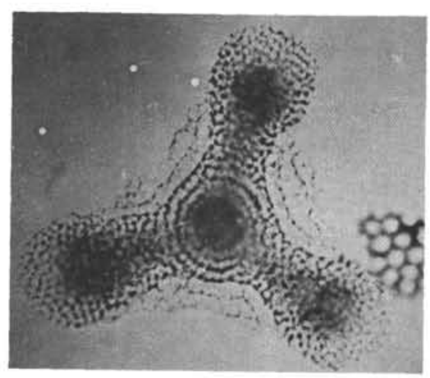
PLATE 17

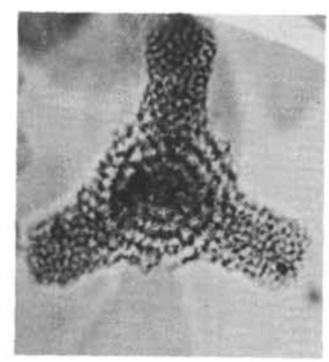

1

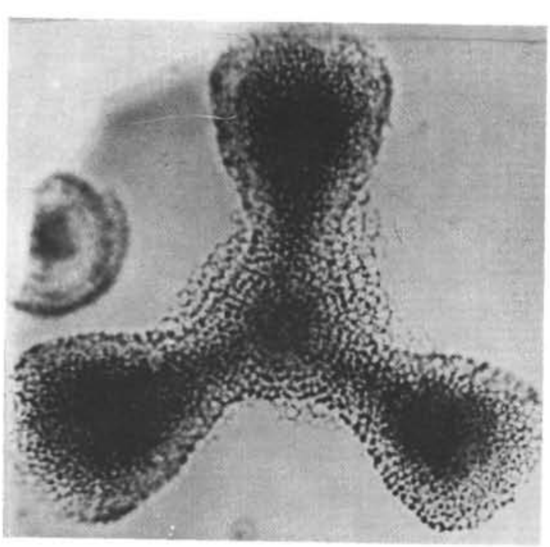

2


3


4


5


6


7

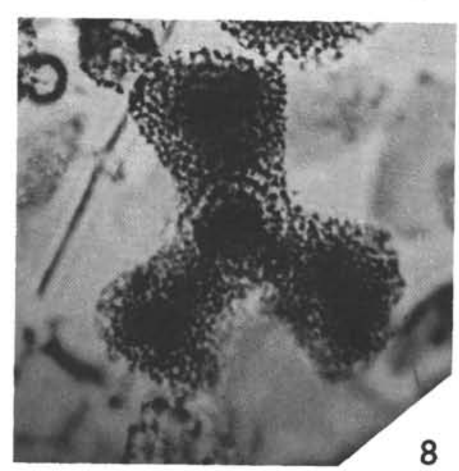

8

Plate 18
Magnification 200X

Figures 1, 2	*Tholodiscus ocellatus* 1: 144-1-4, 80-85 cm. 2: 144A-2-6, 2-4 cm.	p. 525
Figures 3-5	*Tholodiscus splendens* 3: 144-1-5, 80-85 cm. 4, 5: 140-2-CC*.	p. 525
Figure 6	*Stylodictya aculeata* 139-1-2, 5-7 cm.	p. 526
Figure 7	*Stylodictya orbiculata* 144A-2-6, 2-4 cm.	p. 526
Figure 8	*Stylodictya inaequalispina* 144-1-6, 80-85 cm.	p. 526
Figure 9	*Stylodictya rosella* holotype 140-2-CC*.	p. 526
Figure 10	*Stylodictya targaeformis* 144-1-CC*.	p. 526
Figure 11	*Porodiscus concentricus* 144-1-6, 80-85 cm.	p. 525

PLATE 18

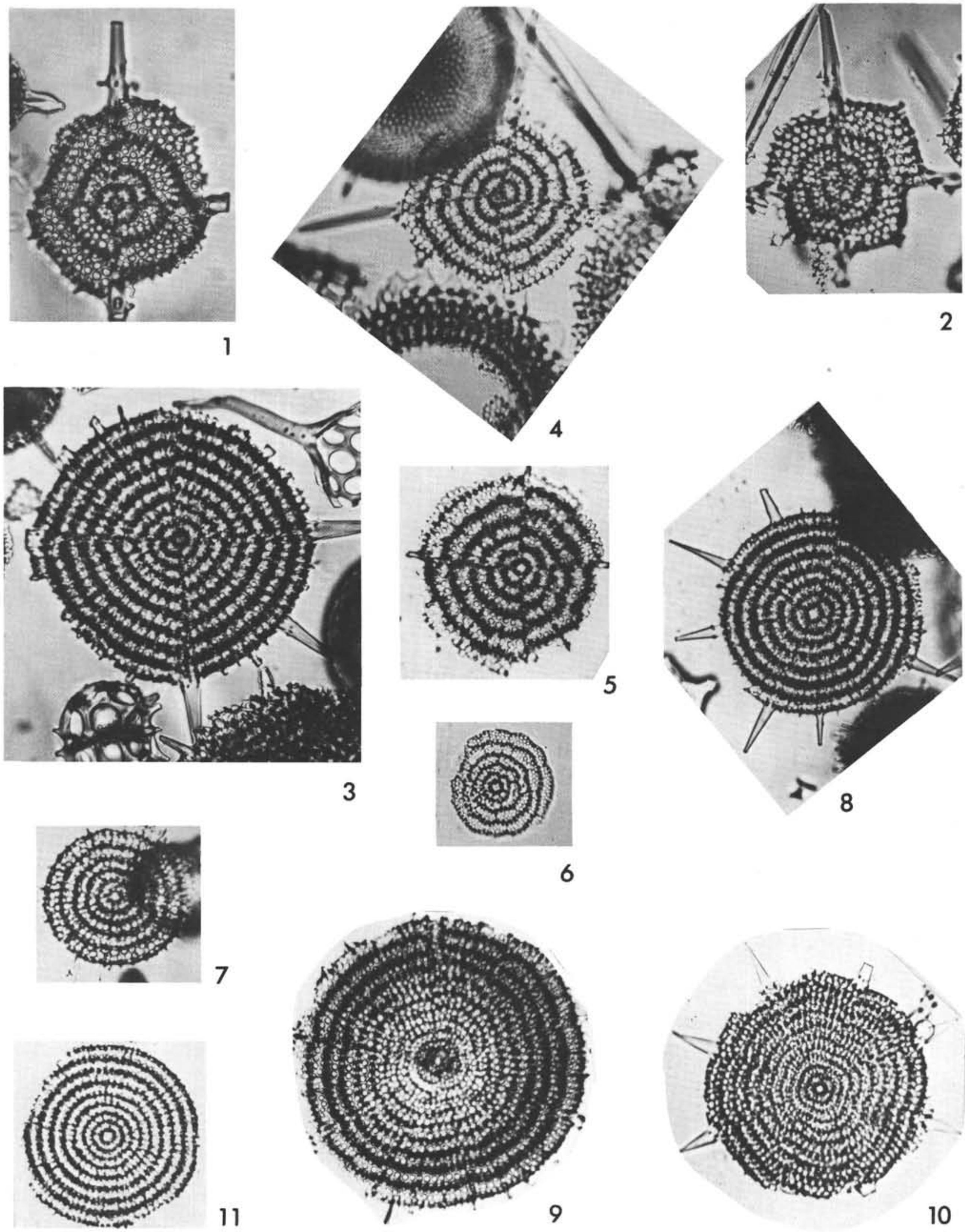


Plate 19
Magnification 200X
(except Figure 6)

Figures 1-6	*Circodiscus microporus* Indian Ocean, St. 4550 "VITYAZ" 4: Equatorial section. 5: Sagittal section. 6: Frontal section - 400X.	p. 526
Figure 7	*Circodiscus microporus* 139-1-CC.	p. 526
Figure 8	*Circodiscus* sp. 139-3-CC.	p. 526
Figures 9-12	*Plectodiscus circularis* 9-11: California, Kellogg Shale (11 – sagittal section). 12: 144-2-3.	p. 526
Figure 13	*Plectodiscus bergontianus* 144-1-CC.	p. 526
Figure 14	*Plectodiscus* sp. 148A-2-6, 80-82 cm.	
Figure 15	Phacodiscidae ? gen indet. 140-2-6, 80-82 cm.	

PLATE 19

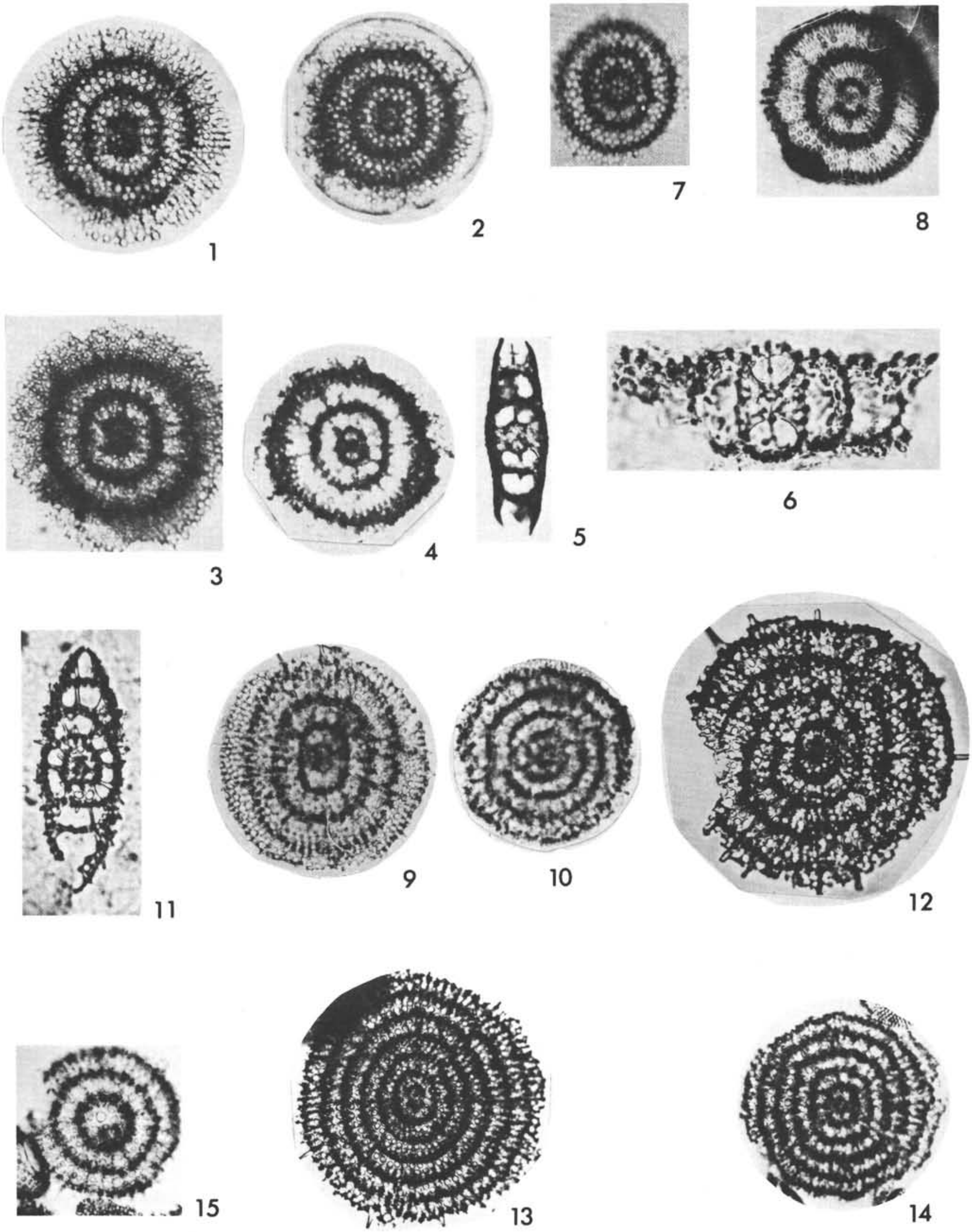


Plate 20
Magnification 200X

Figures 1-2	*Ommatocampe* spp. aff. *O. amphistylium* 1: 144-1-CC. 2: 139-7-CC.	p. 527
Figures 3	*Trigonastrum* sp. aff. *Chitonastrum lyra* 139-1-1, 80-82 cm.	p. 527
Figure 4	*Trigonastrum* sp. aff. *Euchitonia mulleri* 139-1-1, 80-82 cm.	p. 527
Figure 5	*Trigonastrum* sp. 139-1-1, 80-82 cm.	p. 527
Figure 6	Spongodiscidae ? gen indet. (=*Porodiscus fortii*) 144-1-CC.	
Figure 7	Porodiscidae gen. indet. (=*Porodiscus ellipticus*?)	
Figure 8	*Rhopalastrum profunda* group 140-2-CC*.	p. 529
Figures 9-11	*Stephanastrum* sp. aff. *S. rhopaloporum* 9: 140A-2-6, 80-82 cm. 10: 140-2-CC*. 11: 144B-2-5, Top. Five-armed malformation.	p. 527
Figure 12	*Spongasteriscus* sp. 139-7-CC.	p. 529

PLATE 20

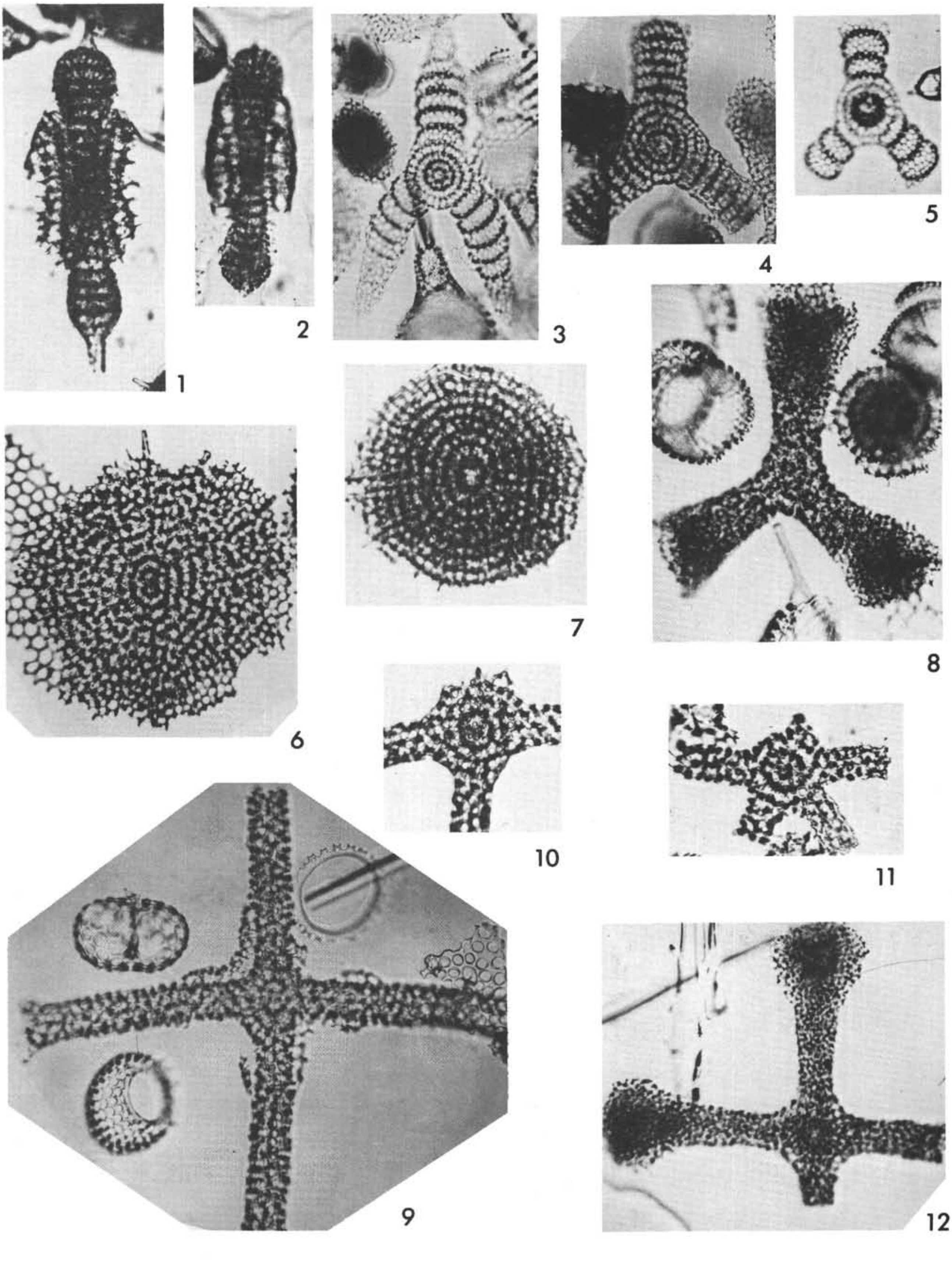


Plate 21
Magnification 200X
(except Figure 14)

Figure 1	*Spongodiscus* ? sp. 140-2-1, 5-7 cm.	p. 528
Figure 2	*Spongotripus* sp. 140-2-CC*.	p. 528
Figure 3	*Spongodiscus* ? sp. Malaga Mudstone, California.	p. 528
Figure 4	*Spongodiscus resurgens osculosa* 139-1-1, 80-82 cm.	p. 528
Figure 5	*Spongodiscus resurgens resurgens* 139-1-1, 80-82 cm.	p. 528
Figures 6-7	*Spongasteriscus* spp. 6: 140-2-1, 5-7 cm. 7: 140-2-3, 5-7 cm.	p. 529
Figure 8	*Ommatogramma* sp. A 140-2-1, 5-7 cm.	
Figure 9	*Ommatogramma* sp. B 139-5-CC.	
Figure 10	*Ommatogramma* sp. aff. *Amphibrachium robustum* 139-1-2, 5-7 cm.	p. 528
Figure 11	*Ommatogramma* sp. 140-2-CC*.	
Figure 12	*Rhopalastrum* sp. aff. *Dictyocoryna pentagona* 139-5-CC.	p. 529
Figure 13	*Spongaster* sp. 140-2-1, 5-7 cm.	p. 528
Figure 14	*Spongaster disimmetricus* Northwestern Pacific. Dogiel's collection, S1. 124; 100X.	
Figure 15	*Spongotrochus longispinus* 140-2-1, 5-7 cm.	p. 528

PLATE 21

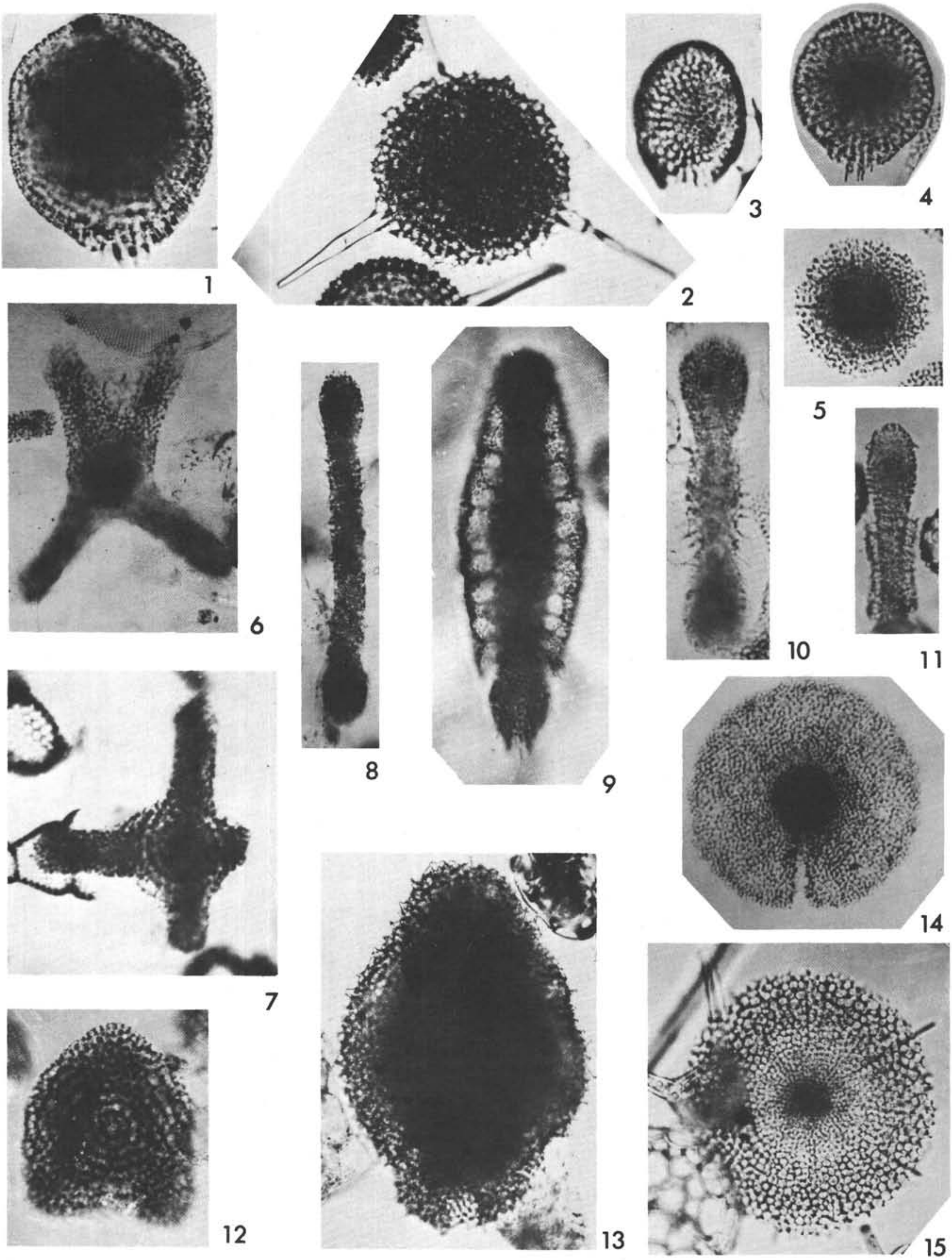


Plate 22
Magnification 200X

Figure 1	*Theocapsomma ornata* 144-1-CC.	p. 535
Figure 2	*Theocapsomma* sp. aff. *T. ornata* 140-2-CC*.	p. 535
Figure 3	*Theocapsomma* sp. F group 140-2-CC*.	p. 535
Figure 4	*Diacanthocapsa* sp. A group 140-2-CC*.	p. 536
Figure 5	*Theocapsomma* ? sp. 140-2-CC*.	p. 535
Figure 6	*Diacanthocapsa* sp. A group 144B-2-5, Top.	p. 536
Figure 7	*Phormocyrtis* sp. A 144B-2-6, Top.	p. 537
Figures 8, 9	*Phormocyrtis embolum* group 140-3-3, 5-7 cm.	p. 537
Figure 10	Eucyrtidiidae gen. sp. aff. *Pterocyrtidius barbadense* 144B-2-6, Top.	p. 552
Figures 11, 12	Eucyrtidiidae gen. sp. aff. *Lithomitra elizabethae* Clark et Campbell 11: Western Ural, Ladvinka, Core 28. 12: 144B-2-6, Top.	
Figures 13, 14	*Myllocercion* sp. C 13: 139-7-CC. 14: 140-2-2, 83-84 cm.	p. 535
Figure 15	*Carpocanopsis* ? *bramlettei* 139-7-CC.	
Figure 16	*Carpocanistrum* sp. aff. *Sethocorys odysseus* 142-9-1, 98-100 cm.	
Figures 17, 22	*Carpocanistrum* sp. 17: 139-7-6, 80-82 cm. 22: 139-5-CC.	p. 535
Figure 18	*Carpocanopsis* sp. aff. *C. favosum* 142-9-1, 98-100 cm.	p. 535
Figures 19, 20	*Carpocanistrum* sp. aff. *C. pulchrum* 19: 140-2-1, 80-84 cm. 20: 140-2-1, 5-7 cm.	p. 536
Figures 21, 23	*Carpocanistrum* sp. C 139-4-CC.	
Figure 24	*Carpocanopsis favosum* group 140-2-1, 5-7 cm.	p. 535
Figures 25, 26	*Carpocanium* sp. aff. *C. coronatum* 25: 144B-2-6, Top. 26: 138-2-3, 5-7 cm.	p. 536
Figures 27, 28	*Carpocanobium* sp. aff. *C. setosa* 27: 138-2-4, 5-7 cm. 28: 144B-2-5, Top.	p. 536
Figures 29, 30	*Carpocanistrum* sp. 0 29: 140-2-3, 84-85 cm. 30: 140-2-1, 5-7 cm.	p. 536
Figure 31	*Tricolocapsa papillosa* group 139-1-1, 80-82 cm.	
Figure 32	*Dicolocapsa microcephala* 139-5-CC.	p. 542
Figures 33, 34	*Tricolocapsa* ? sp. 33: 140-2-CC*. 34: 140A-2-6, 80-82 cm.	
Figure 35	*Carpocanopsis* sp. indet. 138-2-2, 80-81 cm.	
Figure 36	*Carpocanobium* sp. indet. 144B-2-5, Top.	

PLATE 22

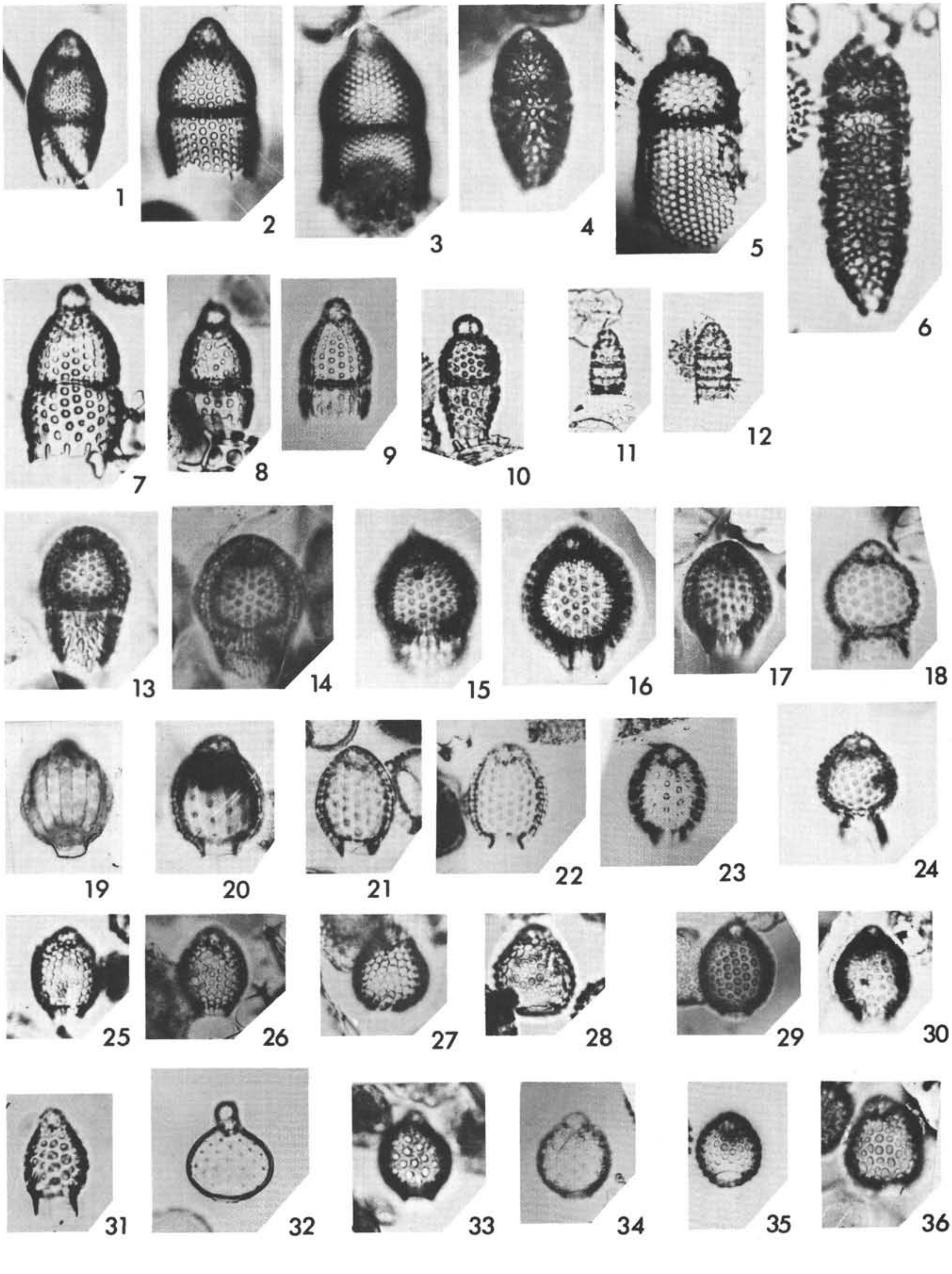


Plate 23
Magnification 200X

Figures 1, 2	*Theocampe* aff. *mongolfieri* 140-2-CC*.	p. 538
Figures 3-5	*Theocampe mongolfieri* 140-3-3, 5-7 cm.	p. 538
Figure 6	*Theocampe* sp. 144B-2-6, Top.	p. 537
Figure 7	*Theocampe excellens* 140-2-CC*.	p. 538
Figure 8	*Theocampe calimorphos* 140-3-3, 5-7 cm.	p. 538
Figure 9	*Theocampe eos* 140-2-CC*.	p. 538
Figure 10	*Theocampe* sp. aff. *gemmata* 140-2-CC*.	p. 538
Figure 11	*Theocampe pirum* 138-2-3, 5-7 cm.	p. 537
Figure 12	*Theocampe* sp. 140-2-CC*.	p. 537
Figures 13, 14	*Theocamptra* spp. 13: 140-2-1, 5-7 cm. 14: JYN V-16P, 235-237 cm.	
Figures 15, 16	*Theocamptra* sp. aff. *ovata* 144B-2-6, Top	p. 538
Figures 17-19	*Theocamptra ovata* 17, 18: 140-2-1, 5-7 cm. 19: 139-7-CC.	p. 538
Figures 20, 21	*Theocamptra marylandica* 20: 140-2-3, 84-85 cm. 21: 140-2-1, 80-82 cm.	p. 538
Figures 22, 23	*Theocamptra* sp. aff. *marylandica* 22: 140-2-1, 5-7 cm, lateral view. 23: 140-2-1, 5-7 cm, frontal view.	p. 538
Figures 24, 25	*Theocamptra corona* group 140-2-1, 5-7 cm, one and the same specimen.	p. 538
Figures 26, 27	*Theocamptra formaster* 26: 144B-2-6, Top, holotype. 27: 144B-2-6, Top.	p. 539
Figures 28-30	*Theocamptra* sp. *rocyrtis* 28: 140-2-4, 80-82 cm, holotype, lateral view. 29: 140-2-1, 5-7 cm, frontal view. 30: 140-2-1, 80-82 cm.	p. 538

PLATE 23

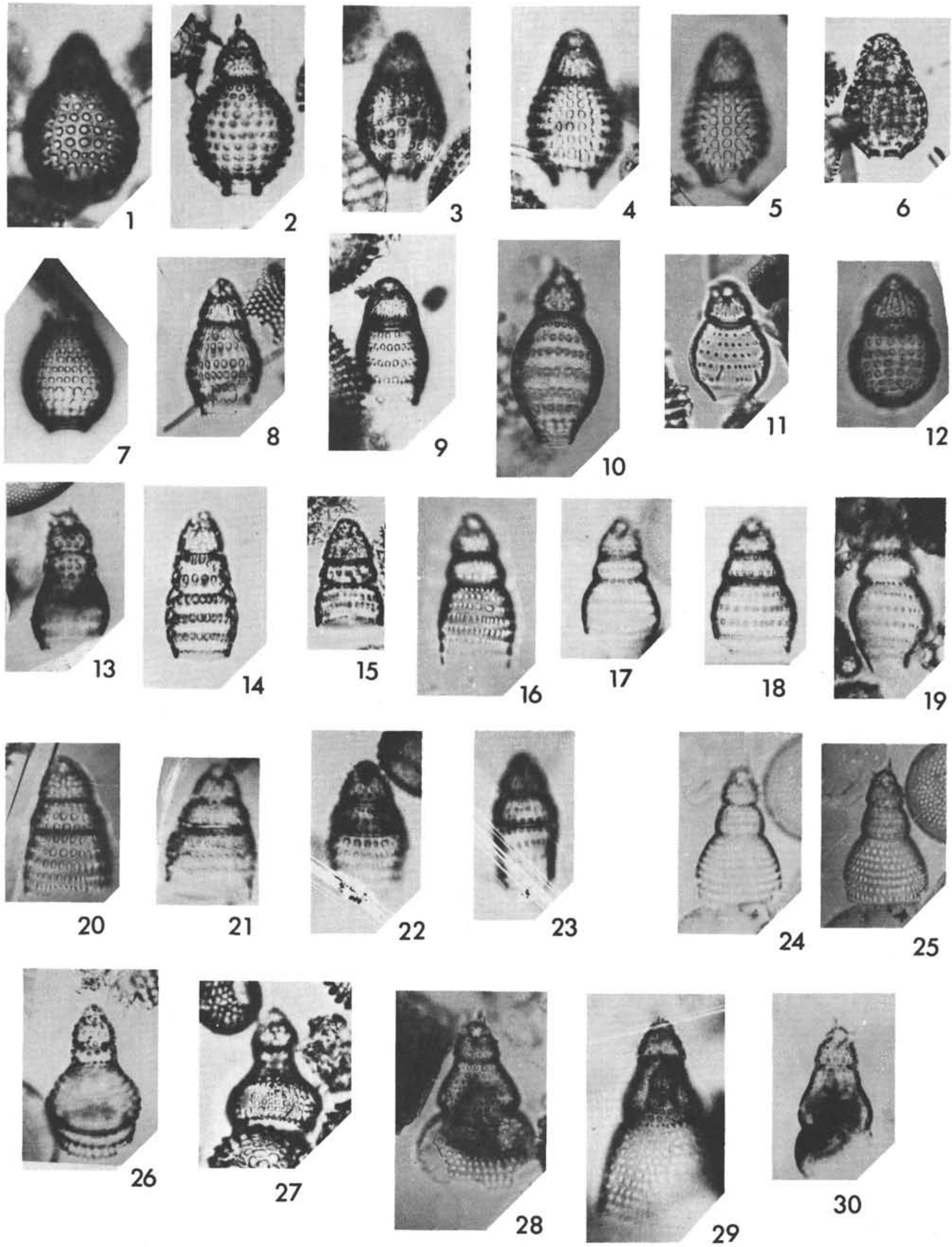

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

Plate 24
Magnification 200X

Figure 1	*Lithomitra* ? sp. aff. *L. lineata* 138-2-3, 5-7 cm.	p. 539
Figures 2-5	*Lithomitra imbricata* group 2, 5: 138-2-2, 80-81 cm. 3: 139-5-CC 4: 139-7-CC.	p. 539
Figure 6	*Theocamptra* sp. aff. *ovata* 144B-2-5, Top.	p. 538
Figure 7	*Lithamphora* ? sp. 140-2-CC*.	
Figures 8-11	*Botryostrobus* sp. P 8, 9: 138-2-6, 5-7 cm. 10: 138-2-3, 5-7 cm. 11: 140-2-6, 82-84 cm.	p. 539
Figures 12-14	*Botryostrobus australis* group 12: 139-1-2, 5-7 cm. 13, 14: 139-1-1, 80-82 cm.	p. 539
Figures 15-18	*Botryostrobus auritus* group 15, 16, 18: 139-1-2, 5-7 cm. 17: 139-1-1, 80-82 cm.	p. 539
Figure 19	*Botryostrobus lithobotrys* 139-1-CC.	p. 539
Figures 20, 21	*Botryostrobus tumidulus* 139-1-CC.	p. 539
Figures 22-24	*Spirocyrtis subtilis* 22: 139-5-CC, holotype. 23: Malaga Mudstone, California. 24: 139-5-CC.	p. 540
Figure 25	*Spirocyrtis* sp. aff. *S. cornutella* 139-1-2, 5-7 cm.	p. 540
Figure 26	*Spirocyrtis cornutella* 139-1-1, 80-82 cm.	p. 541
Figures 27, 28	*Spirocyrtis* sp. 27: 139-1-1, 5-7 cm. 28: 139-1-1, 80-82 cm.	p. 540
Figures 29, 30	*Lithomitra nodosaria* group 29: 139-7-CC. 30: 140-2-CC.	p. 539
Figure 31	*Botryostrobus miralestense* 139-3-CC.	p. 539
Figures 32, 33	*Lithomitra eruca* group 32: 139-5-CC. 33: 138-2-4, 5-7 cm.	p. 539

PLATE 24

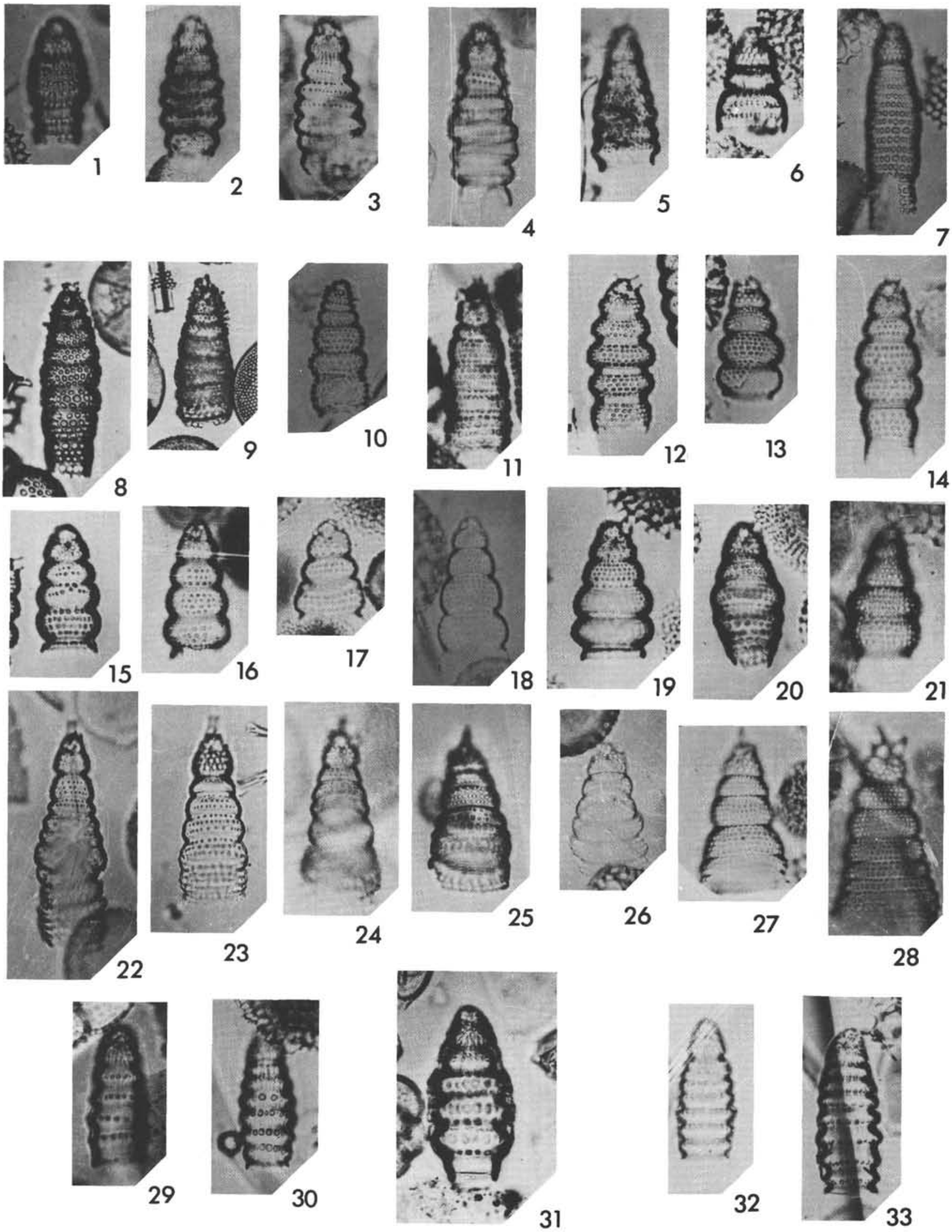


Plate 25
Magnification 200X

Figure 1	*Stichocapsa hexagonalis* 139-1-CC.	p. 546
Figure 2	*Lithostrobus* sp. 138-2-6, 5-7 cm.	p. 546
Figure 3	*Eucyrtidioidea* gen. sp. 140-2-1, 5-7 cm.	p. 547
Figures 4-6	*Stichopodium ? microproum* 4, 6: 140-2-CC*. 5: 138-2-4, 5-7 cm.	p. 548
Figures 7-10	*Lithocampe subligata* group 7, 8: 139-7-CC. 9: 144B-2-6, Top. 10: 144B-2-5, Top.	p. 546
Figures 11, 12	*Stichocorys delmontense* 11: 140-2-1, 5-7 cm. 12: Delmont. Miocene California.	p. 546
Figure 13	*Lithocampe* sp. 139-7-CC.	
Figure 14	*Lithocampe tetrapera* 139-7-6, 80-82 cm.	p. 546
Figures 15, 16	*Lithocampe cornuta* 15: 142-CB. 15: 142-9-1, 98-100 cm.	p. 546
Figure 17	*Lithocampe compacta* 139-5-CC.	p. 546
Figure 18	*Lithocampe japonica* 139-4-CC.	p. 546
Figures 19, 20	*Cyrtophormis armata* 19: 140A-2-5, 5-7 cm. 20: 139-5-CC.	p. 547
Figure 21	*Cyrtophormis* sp. 140-2-1, 5-7 cm.	p. 547
Figure 22	*Stichocorys wolfii* 140-2-1, 5-7 cm.	p. 546
Figures 23, 24	*Stichocorys coronatus* 139-5-CC.	p. 547
Figure 25	*Stichocorys peregrinus* 139-4-CC.	p. 547

PLATE 25

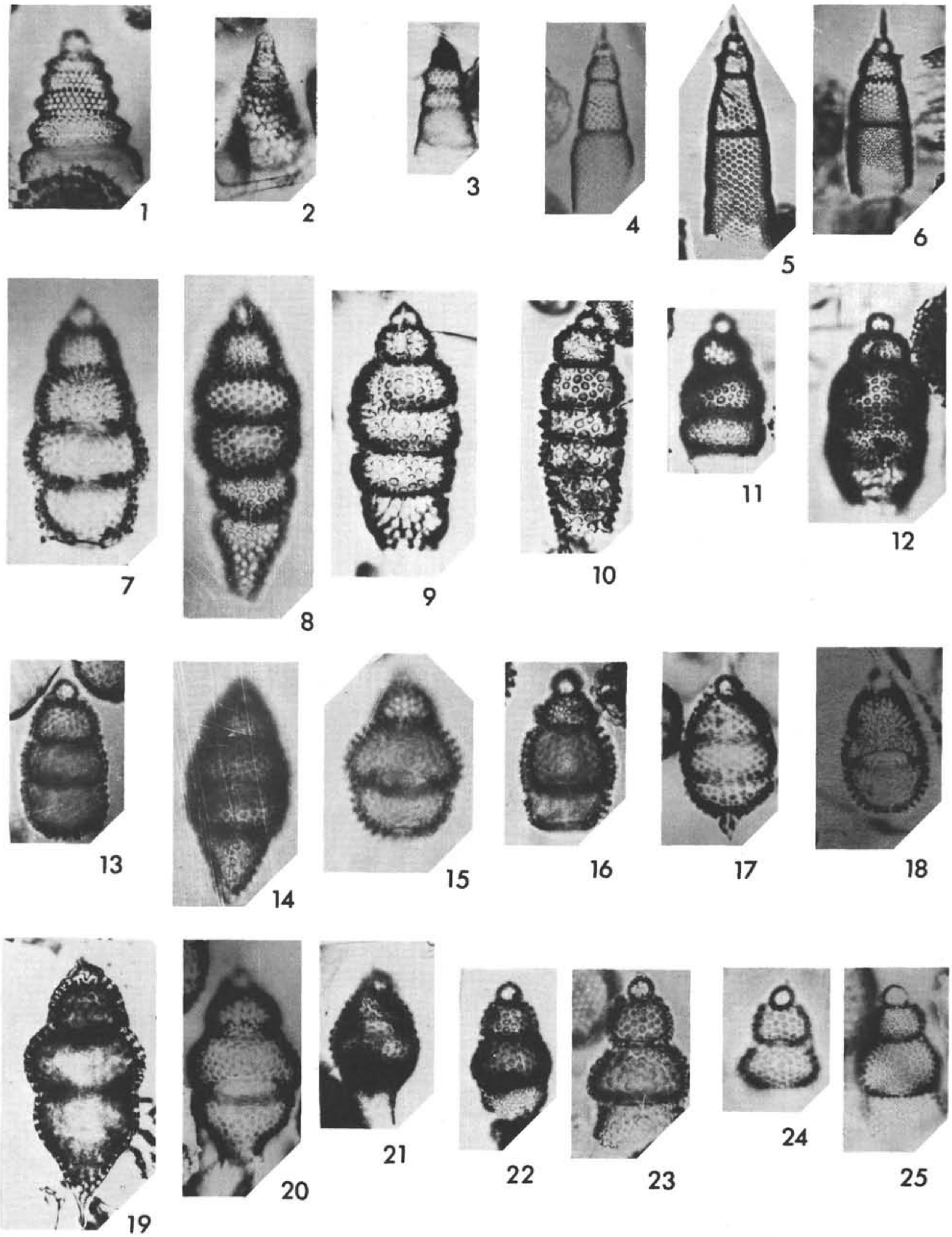


Plate 26
Magnification 200X

Figure 1	*Cyrtophormis* sp. Ch 144B-2-6, Top.	p. 547
Figures 2-4	*Eucyrtidium* sp. aff. *E. montiparum* 2, 3: 144-1-5, 80-85 cm. 4: 140-3-3, 5-7 cm.	p. 548
Figures 5, 6	*Stichopodium* (?) sp. group aff. *Eucyrtidium matuyamai* 5: 139-1-1, 80-82 cm. 6: 139-1-2, 5-7 cm.	p. 549
Figure 7	*Lithocampium* sp. aff. *L. diploconus* JYN V-20P, 457-459 cm.	
Figure 8	*Lithocampium* ? sp. 139-7-CC.	
Figures 9, 10	*Stichopodium martellii* 9: JYN V-16P, 235-237 cm. 10: 139-7-CC.	p. 548
Figure 11	*Artocyrtis* sp. 139-1-2, 5-7 cm.	p. 549
Figure 12	*Lithocampium diploconus* 140-2-2, 83-84 cm.	p. 550
Figure 13	*Stichopodium calvertense* 139-1-2, 5-7 cm.	p. 549
Figure 14	*Stichopodium* ? sp. T. 139-1-CC.	p. 549
Figures 15, 16	*Stichopodium* sp. aff. *S. matujamai* 15: 139-1-1, 80-82 cm. 16: 139-1-2, 5-7 cm.	p. 549
Figure 17	*Eucyrtidium acuminatum* 139-4-CC.	p. 548
Figures 18, 19	*Stichopodium cienkowskii* 18: 140-2-1, 80-84 cm. 19: 139-5-CC.	p. 548
Figure 20	*Stichopodium martellii conicum*, holotype 140-2-3, 84-85 cm.	p. 548
Figures 21, 22	*Stichopodium* ? spp. 139-1-1, 80-82 cm.	p. 549

PLATE 26

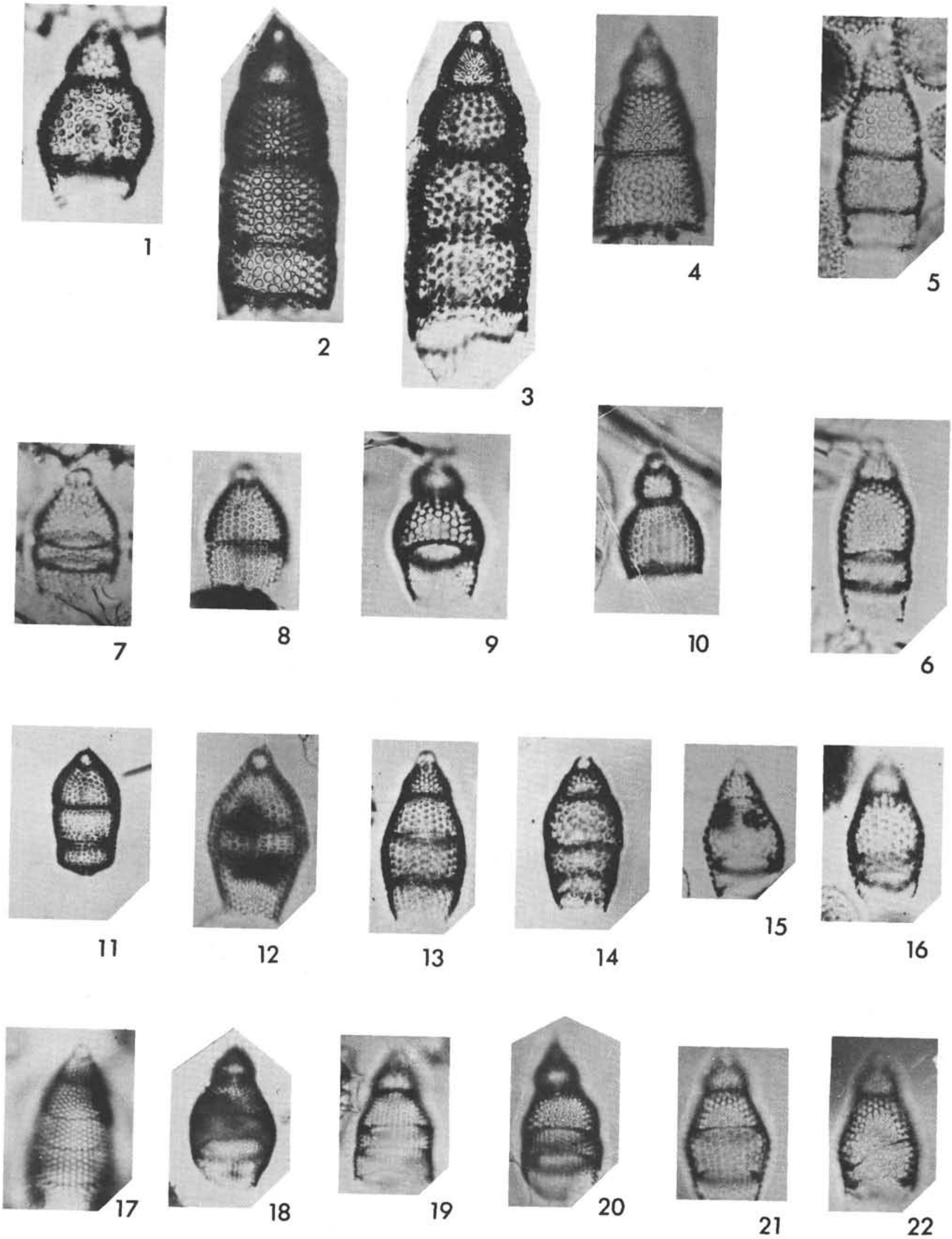


Plate 27
Magnification 200X

Figure 1	*Stichopilidium sphinx* 144-1-5, 80-85 cm.	p. 552
Figure 2	*Lithochytris* sp. A 144-2-3.	p. 552
Figures 3, 4	*Lithochytris* sp. aff. *L. ventricosa* 144B-2-6, Top.	p. 552
Figure 5	*Lithochytris* sp. aff. *L. tripodium* 144B-2-6, Top.	p. 552
Figure 6	*Lithochytris* sp. T. 144-1-5, 80-85 cm.	p. 552
Figure 7	*Lithochytris* sp. 0 140-2-CC*.	p. 552
Figures 8, 9	*Lithochytris turgidulum* 140-3-CC.	p. 552
Figures 10. 11	*Pterocanium* (?) sp. aff. *P. prismatium* 10: 140A-2-6, 80-82 cm. 11: JYN V-20P, 455-457 cm.	p. 553
Figure 12	*Lithochytris* sp. 138-2-4, 5-7 cm.	p. 552
Figures 13, 14	*Rhopalocanium ornatum* 13: 144-1-6, 80-85 cm. 14: 140A-2-6, broken specimen.	p. 552
Figure 15	*Pterocyritidium* sp. 140-2-CC*.	p. 552
Figures 16, 17	*Dictyophimus* sp. aff. *D. hirundo* 16: 139-1-1, 80-82 cm. 17: 139-1-2, 5-7 cm.	p. 553
Figures 18, 19	*Pterocyritidium barbadense* group 140-2-CC*.	p. 552

PLATE 27

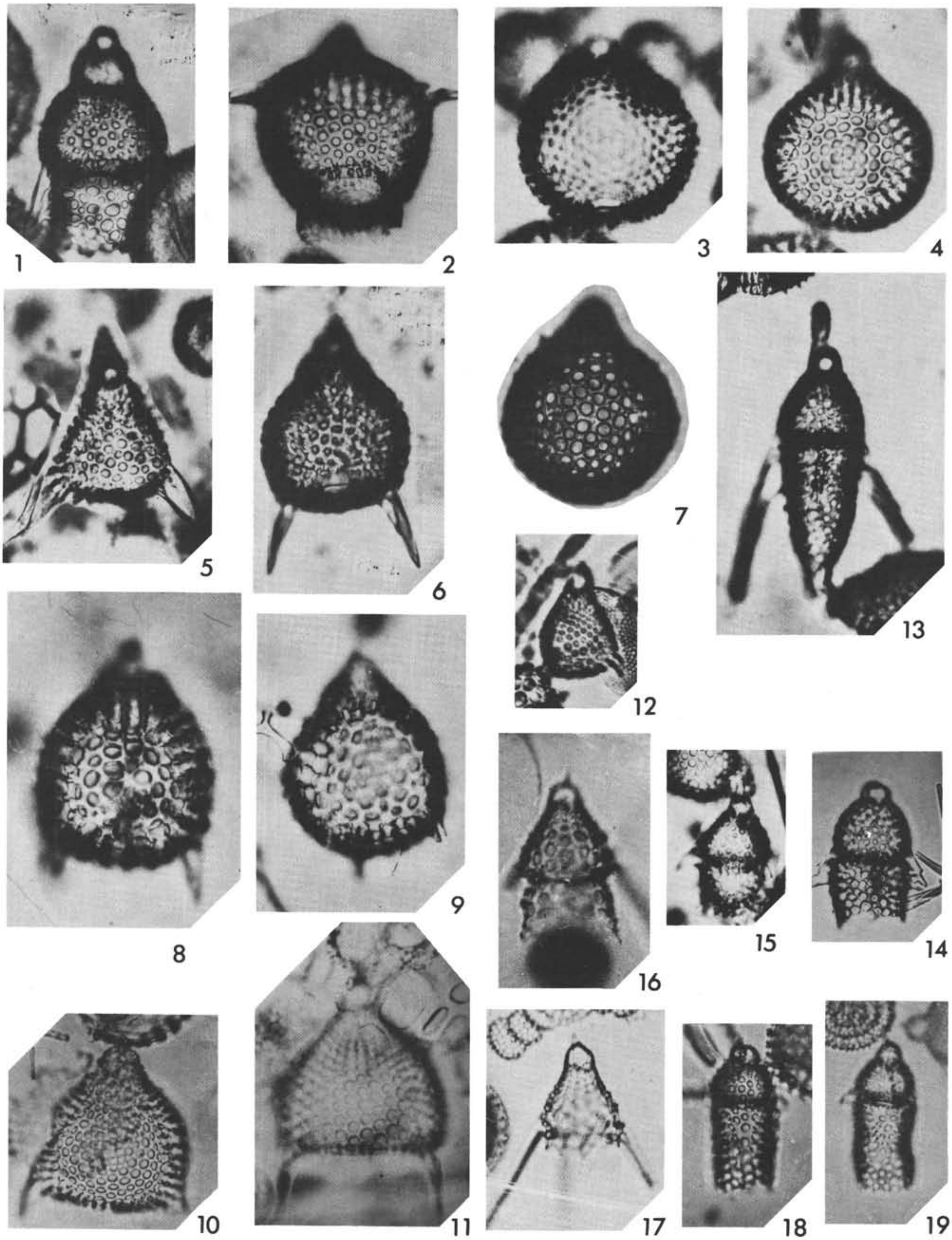


Plate 28
Magnification 200X

Figure 1	*Cyrtophormis* (?) sp. 139-5-CC.	
Figures 2, 3	*Eucyrtidiidae* gen. sp. "rocket" 2: 138-2-3, 5-7 cm. 3: 144B-2-6, Top.	p. 547
Figures 4, 5	Species, similar to Eucyrtidiidae gen. sp. "rocket" 4: 144B-2-5, Top. 5: 138-2-6, 5-7 cm.	p. 547
Figures 6, 7	Eucyrtidiidae gen. sp. W. 6: 140-2-1, 5-7 cm. 7: 140-1-2, 5-7 cm.	
Figure 8	Eucyrtidiidae gen. sp. indet 138-2-6, 5-7 cm.	
Figures 9, 10	*Theocorys* ? spp. indet 9: 140-2-1, 5-7 cm. 10: JYN V-16, 235-237 cm.	
Figure 11	*Cyrtophormis dominasinensis* 138-2-4, 5-7 cm.	p. 547
Figure 12	*Cyrtophormis barbadensis* 144-1-4, 80-85 cm.	p. 547
Figures 13-15	*Cyrtophormis gracilis* 13: 144A-2-6, 2-4 cm. 14: 144B-2-5, Top. 15: JYN V-16P, 235-237 cm.	p. 547
Figures 16-18	*Calocyclas asperum* 16: 138-2-2, 80-81 cm. 17: 140A-2-5, 5-7 cm. 18: 144B-2-6, Top.	p. 547
Figure 19	*Clistophaena* sp. aff. *C. armata* 138-2-6, 5-7 cm.	p. 541
Figure 20	*Clistophaena* sp. 140A-2-4, 80-82 cm.	
Figure 21	*Lophocyrtis* ? *jacchia* group 140A-2-6.	p. 542

PLATE 28

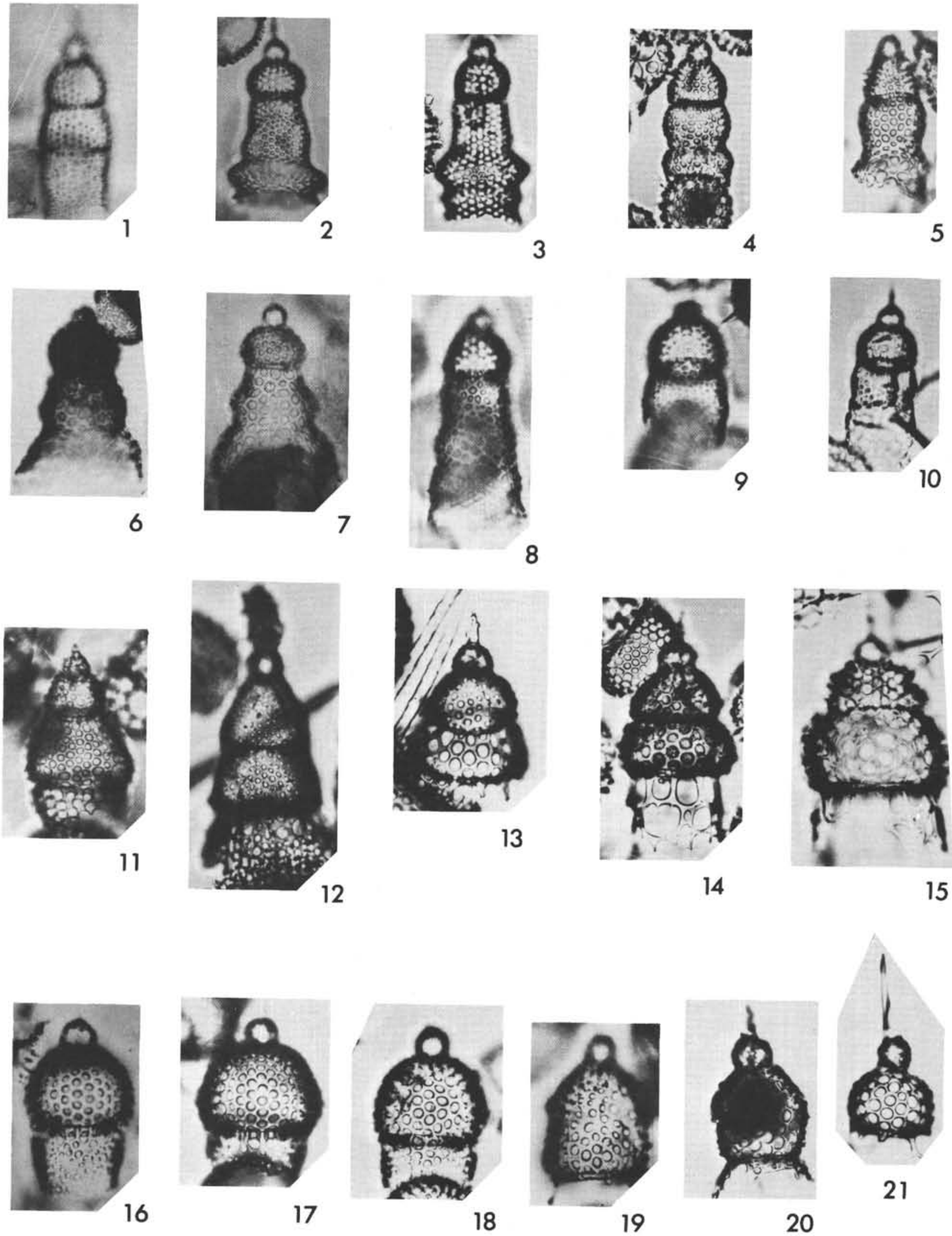


Plate 29
Magnification 200X

Figure 1	*Lychnocanium bellum* 140-2-CC*.	p. 553
Figure 2	*Lychnocanium tripodium* 144-1-CC.	p. 553
Figure 3	*Lychnocanium hirundo* 144A-2-6, 2-4 cm.	p. 553
Figure 4	*Pteropilium* (?) sp. 144-1-6, 80-85 cm.	p. 553
Figure 5	*Dictyophimus pocillum* 140A-2-6, 80-82 cm.	p. 553
Figure 6	*Lychnocanium grande* 138-2-2, 80-82 cm.	p. 553
Figure 7	*Lychnocanium* sp. 144B-2-6, Top.	p. 553
Figures 8-10	*Pteropilium* ? sp. aff. *Pterocanium contiguum* group 8: 138-2-6, 5-7 cm. 9. 138-2-2, 80-81 cm. 10: 140A-2-6, 80-82 cm.	p. 553
Figure 11	*Pterocanium ? contiguum* 138-2-6, 5-7 cm.	p. 553
Figure 12	*Pteropilium* sp. B. 140-2-3, 84-85 cm.	p. 553
Figures 13, 14	*Archipilium* spp. aff. *A. macropus* 13: 138-2-2, 80-81 cm. 14: 139-1-1, 80-82 cm.	p. 553
Figure 15	*Lamprotripus mawsoni* 139-1-1, 80-82 cm.	p. 534
Figure 16	*Lychnocanium korotnevi* 139-1-1, 80-82 cm.	p. 553

PLATE 29

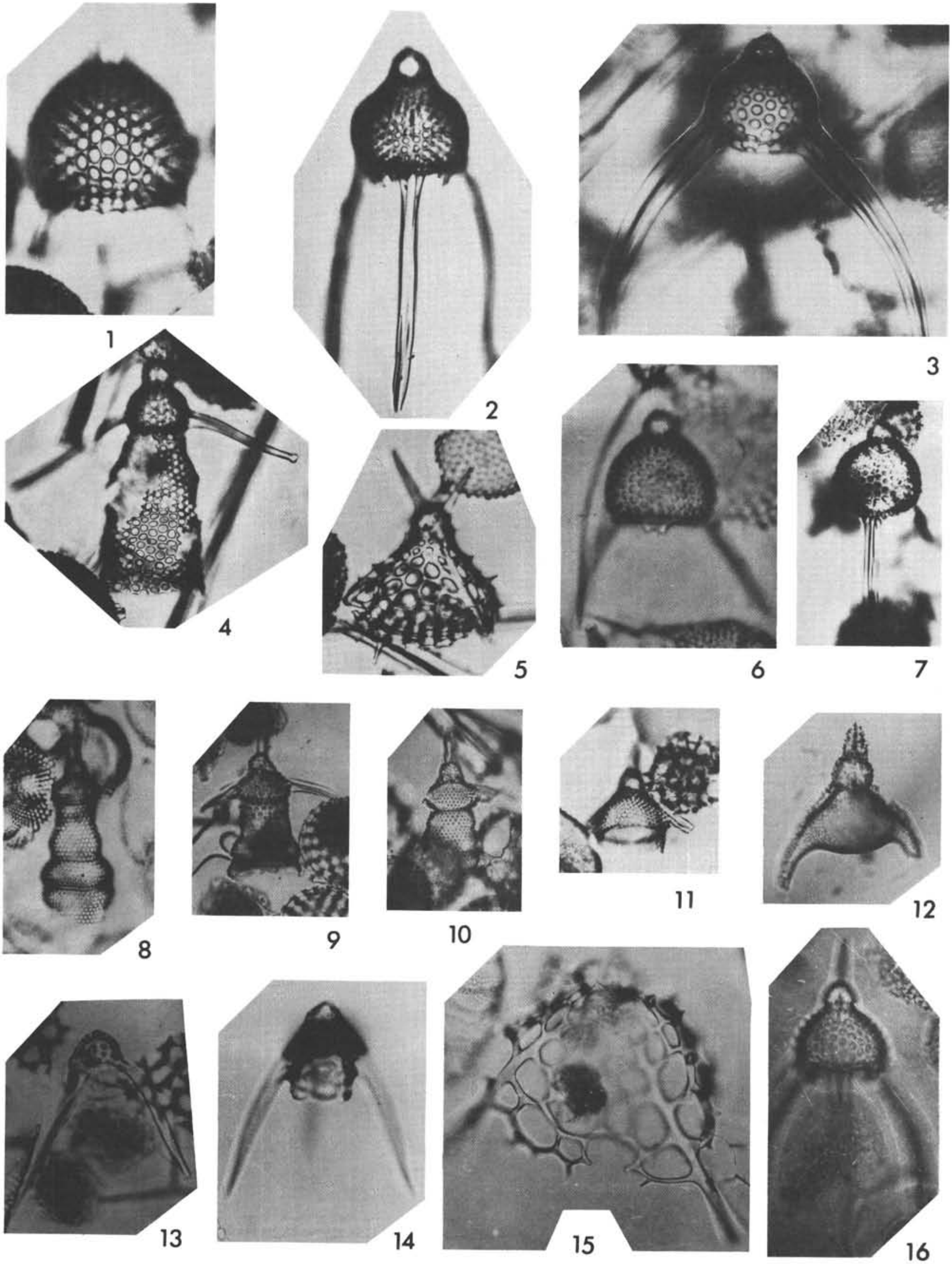


Plate 30
Magnification 200X

Figure 1	*Lithamphora* ? sp. 144B-2-6, Top.	p. 539
Figure 2	*Lithamphora* sp. 140-2-CC*.	p. 539
Figure 3	*Lithamphora sacculifera* Eocene, California, No. 1795	p. 539
Figures 4-6	*Lithamphora sacculifera quadrata* 140-2-CC* (4: holotype).	p. 539
Figure 7	*Lithamphora* sp. aff. *L. corbula* 139-5-CC.	p. 539
Figures 8, 9	*Cornutella longiseta* group 8: 139-1-2, 5-7 cm. 9; 138-2-4, 5-7 cm.	p. 551
Figure 10	*Cornutella* sp. aff. *C. californica* 138-2-6, 5-7 cm.	p. 551
Figures 11, 12	*Cornutella clava* 11: 139-5-CC, holotype. 12: 140A-2-6, 80-82 cm.	p. 551
Figure 13	*Cornutella bimarginata* group 139-1-CC.	p. 551
Figures 14, 15	*Cornutella stiligera* group 14: 138-2-6, 5-7 cm. 15: 140A-2-4, 80-82 cm.	p. 551
Figures 16, 17	*Cornutella clathrata* 139-5-CC.	p. 551
Figures 18-20	*Cornutella* β *profunda* group 18: 138-2-4, 5-7 cm. 19, 20: 139-1-2, 5-7 cm.	p. 551

PLATE 30

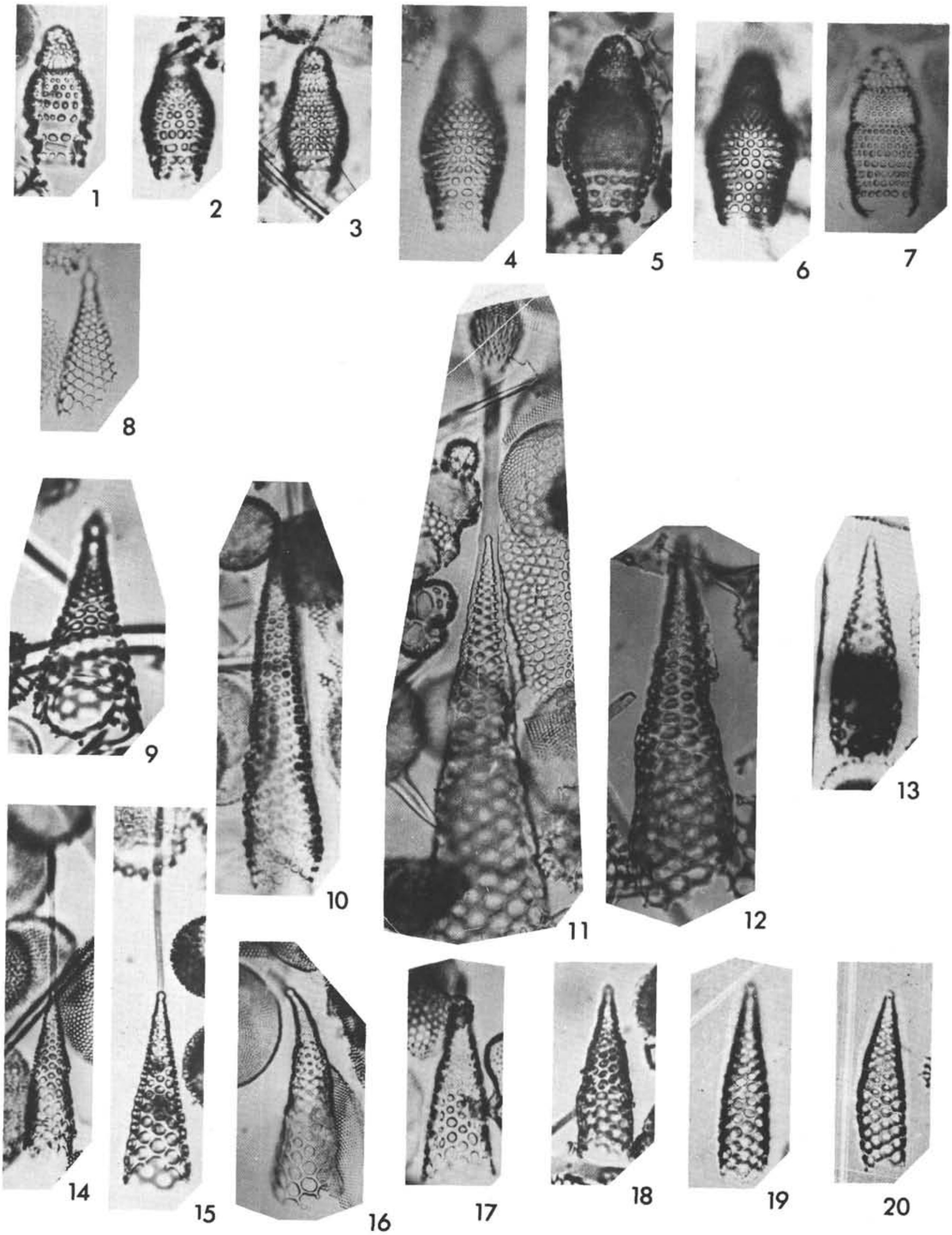


Plate 31
Magnification 200X

Figures 1, 2	*Bathropyramis aeshna* 1: 138-2-4, 5-7 cm, holotype. 2: 138-2-2, 80-81 cm.	p. 552
Figure 3	*Peripyramis magnifica* 140A-2-4, 80-82 cm.	p. 551
Figure 4	*Peripyramis circumtexta* 140-2-CC*.	p. 551
Figure 5	*Peripyramis* sp. A. 139-5-CC.	
Figure 6	*Bathropyramis scalaris* 140A-2-6, 80-82 cm.	p. 551
Figure 7	*Bathropyramis* sp. 139-1-1, 80-82 cm.	
Figure 8	*Bathropyramis* sp. aff. *B. spongiosa* 139-1-CC.	p. 551
Figure 9	*Peripyramis* sp. B. 140A-2-6, 80-82 cm.	
Figure 10	*Peripyramis woodringii* 140-2-1, 5-7 cm.	p. 551

PLATE 31

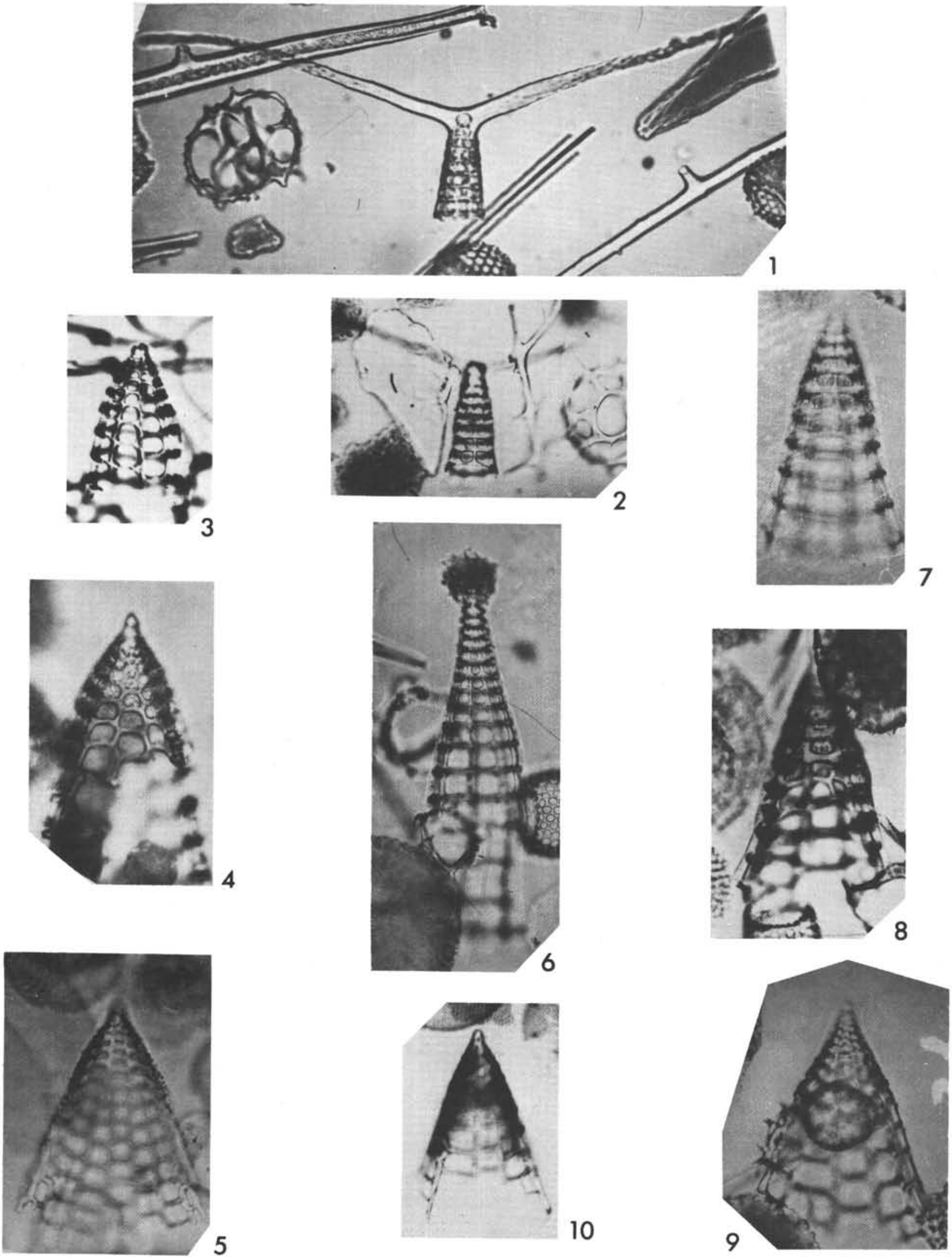


Plate 32
Magnification 200X

Figures 1, 2	*Eusyringium striata* 1· 144B-2-5, Top. 2: Western Siberia, Eocene.	p. 549
Figure 3	*Eusyringium fistuligerum* 144-1-5, 80-85 cm.	p. 549
Figures 4, 5	*Eusyringium tubulus* 4: 144-1-5, 80-85 cm. 5: 138-2-1, 5-7 cm.	p. 549
Figures 6, 7	*Lithocamnium* ? sp. B 6: 139-5-CC. 7: 140-2-6, 80-82 cm.	p. 550
Figure 8	*Thyrsocyrtis argulus* 144-1-5, 80-85 cm.	p. 542
Figure 9	*Thyrsocyrtis triacantha* 144-1-5, 80-85 cm.	p. 542
Figure 10	*Lampterium* sp. G 140-3-3, 5-7 cm.	
Figure 11	*Thyrsocyrtis* sp. E 144B-2-6, Top.	p. 542
Figure 12	*Lampterium chalara* 144-1-5, 80-85 cm.	p. 543
Figures 13, 14	*Lampterium* sp. aff. *L. goetheana* 13: 144-1-CC. 14: 144-1-4, 80-85 cm.	p. 543
Figure 15	*Lampterium* sp. 140-3-3, 5-7 cm.	

PLATE 32

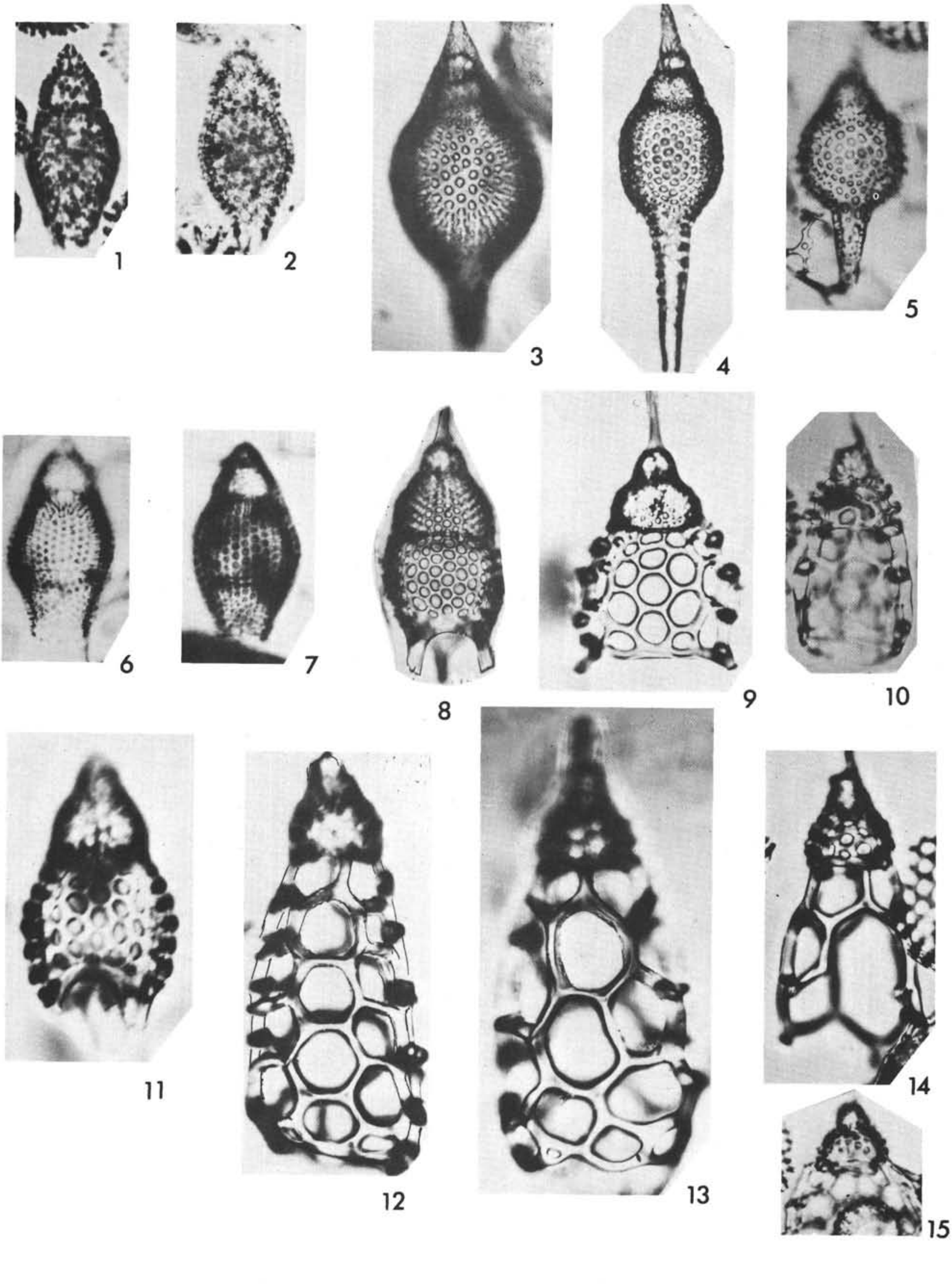


Plate 33
Magnification 200X

Figures 1-3	*Anthocyrtella spatiosa* group 1, 2: 144-1-5, 80-85 cm. 3: 144-1-CC.	p. 541
Figures 4, 5	*Anthocyrtella* sp. M 4: 140-3-3, 5-7 cm. 5: Western Siberia Eocene.	
Figures 6-8	*Eucecryphalus* sp. 6, 8: 139-1-CC. 7: 139-1-2, 5-7 cm.	p. 540
Figure 9	*Clathrocyclas universa undella* (?) group California, Malaga Mudstone.	
Figure 10	*Anthocyrtella* sp. 140-3-3, 5-7 cm.	
Figures 11, 12	*Clathrocyclas bicornis* 11: 139-1-1, 80-82 cm. 12: 139-1-2, 5-7 cm.	p. 540
Figure 13	Eucyrtidioidea gen. sp. (= *Anthocyrtella hispida* Ehrenberg) 140-2-CC*.	
Figures 14-16	*Diplocyclas* sp. A group 14: 140-2-CC*. 15: 138-2-6, 5-7 cm. 16: 140A-2-4, 80-82 cm.	p. 541
Figures 17, 18	*Diplocyclas* sp. aff. *D. bicorona* 139-1-2, 5-7 cm.	p. 540
Figure 19	*Diplocyclas ionis* group 140-2-1, 5-7 cm.	p. 541
Figures 20-23	*Lophophaena* ? *capito* group 20, 23: 144B-2-6, Top. 21: 140-2-CC*. 22: 140A-2-6, 80-82 cm.	p. 535

PLATE 33

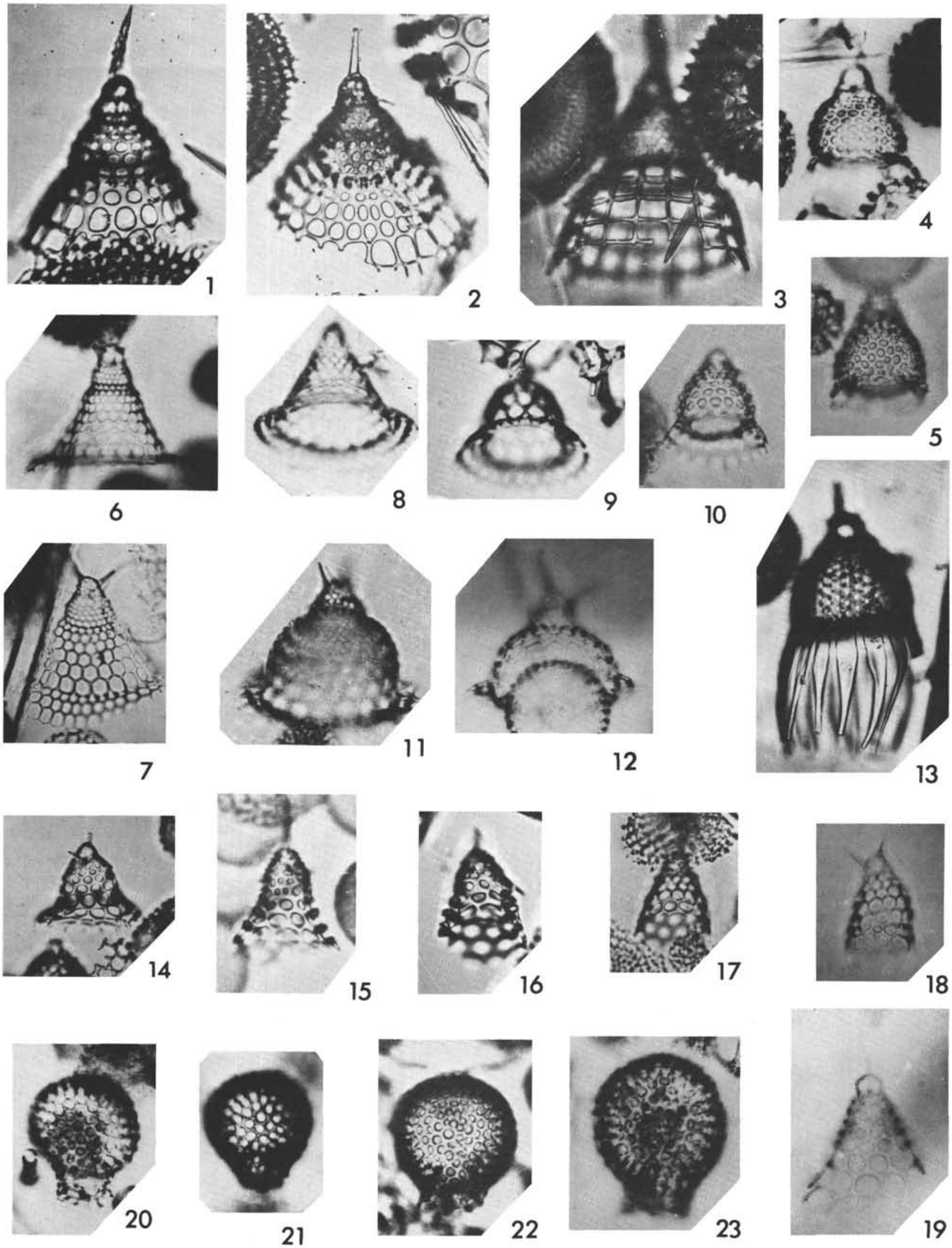


Plate 34
Magnification 200X

Figures 1, 2	*Anthocyrtoma* sp. Riedel and Sandfillipo or *Cycladophora* ? *erinaceus,* Ehrenberg same specimen. 144-1-CC.	
Figure 3	*Lithapium* ? *mitia* (?) 140A-2-3, 80-82 cm.	p. 551
Figure 4	*Calocycloma ampulla* 144-1-5, 80-85 cm.	p. 543
Figure 5	*Thyrsocyrtis* sp. 144-1-6, 80-85 cm.	
Figure 6	*Thyrsocyrtis triacantha* 144-1-4, 80-85 cm.	p. 542
Figure 7	*Cyclampterium pegetrum,* forma I 144B-2-5, Top.	p. 548
Figure 8	*Cyclampterium pegetrum,* forma II 139-5-CC.	p. 548

PLATE 34

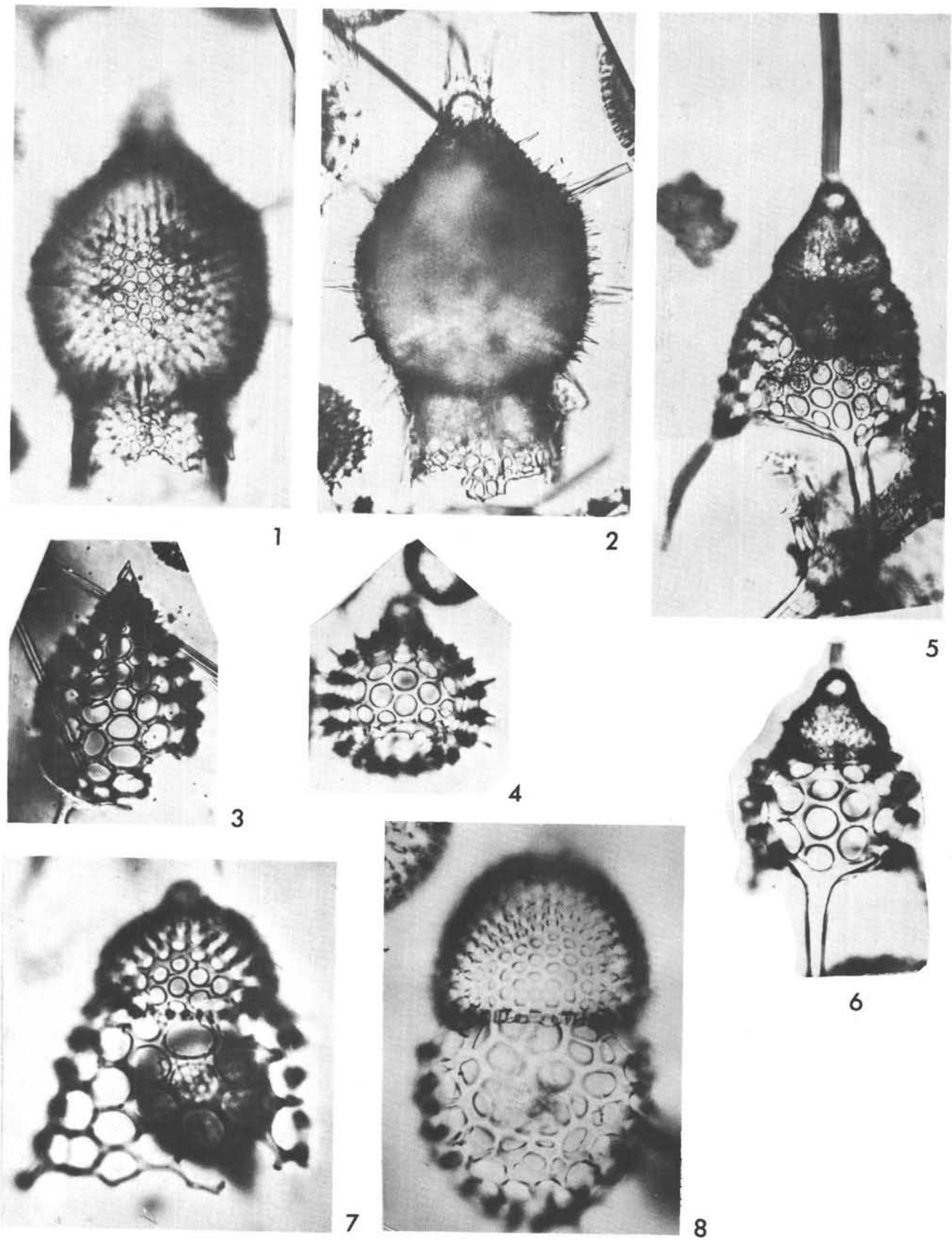


Plate 35
Magnification 200X

Figure 1	*Podocyrtis papalis* 144-1-5, 80-85 cm.	p. 544
Figure 2	*Podocyrtis* sp. 140-3-3, 5-7 cm.	p. 543
Figure 3	*Podocyrtis coronatus* 140-2-CC*.	p. 543
Figure 4	*Podocyrtis* sp. aff. *P. coronatus* 140-2-CC*.	
Figures 5-7	*Calocycletta acanthocephala* 5, 6: same specimen, 138-2-4, 5-7 cm. 7: 140-2-CC*.	p. 543
Figures 8-10	*Calocycletta virginis* 140-2-CC*.	p. 544
Figures 11, 12	*Calocycletta tuberosa* forma A 138-2-1, 5-7 cm.	p. 544
Figures 13, 14	*Calocycletta tuberosa* forma B 13: 140A-2-6, 80-82 cm. 14: 144B-2-6, Top.	p. 544
Figure 15	*Calocycletta* sp. aff. *C. virginis* 139-7-CC.	p. 544
Figure 16	*Calocycletta veneris* 142-9-2, 58-60 cm.	p. 544
Figure 17	*Calocycletta costata* 140-2-2, 5-7 cm.	p. 544

PLATE 35

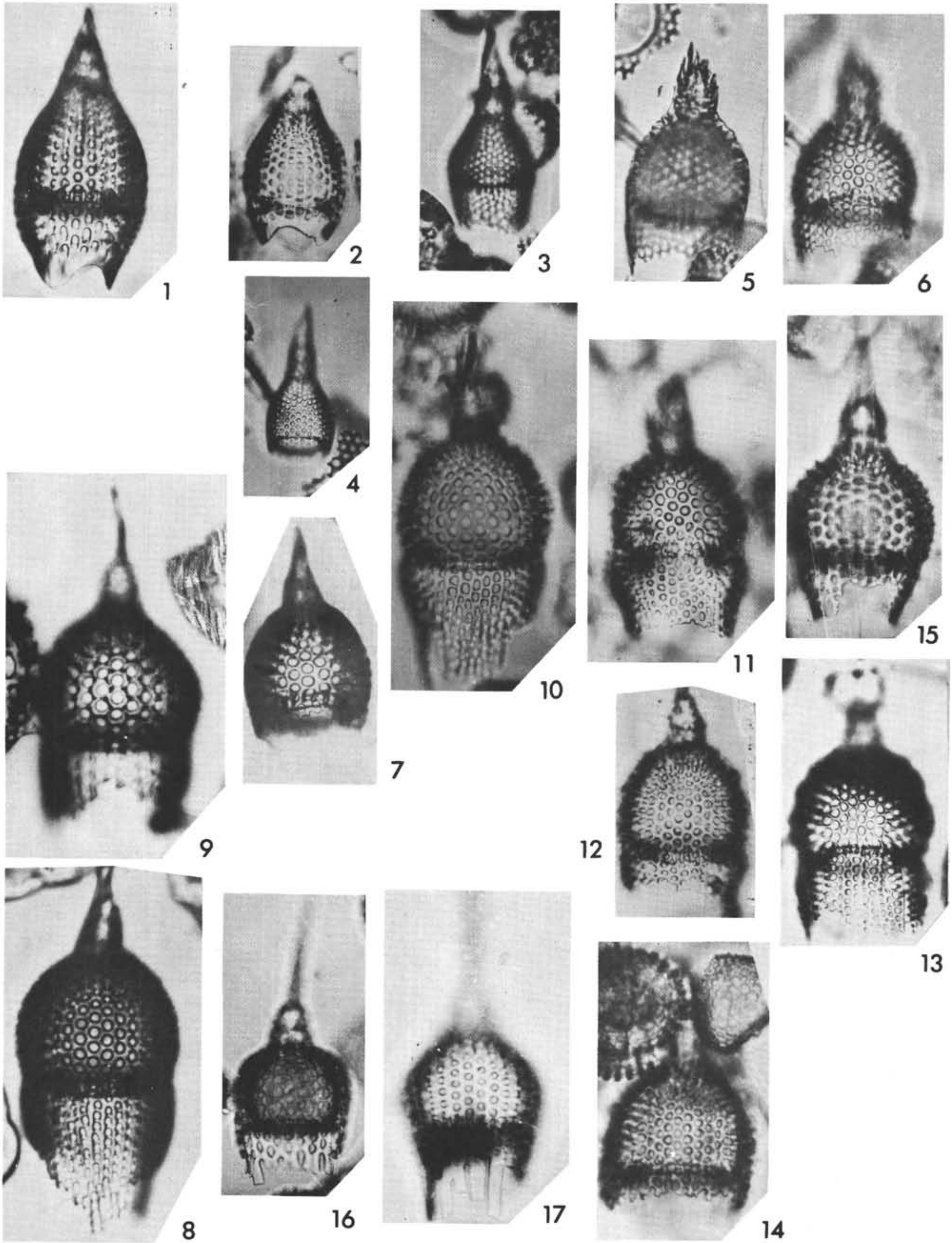


Plate 36
Magnification 200X

Figures 1-3	*Lamprocyclas rhinoceros* 1: 144B-2-6, Top. 2, 3: 138-2-1, 5-7 cm.	p. 544
Figure 4	*Lamprocyclas* sp. A 139-4-CC.	p. 544
Figure 5	*Lamprocyclas* sp. indet. 138-2-2, 80-81 cm.	p. 545
Figures 6, 7	*Lamprocyclas heteroporus* 6: 139-1-CC. 7: 139-1-2, 5-7 cm.	p. 545
Figure 8	*Lamprocyclas junonis* group 139-1-1, 80-82 cm.	p. 545
Figure 9	*Lamprocyclas* sp. 139-1-2, 5-7 cm.	
Figure 10	*Anthocyrtidium ovata* 139-1-2, 5-7 cm.	p. 545
Figure 11	*Anthocyrtidium ophirense* 139-1-2, 5-7 cm.	p. 545
Figure 12	*Lamprocyclas* aff. *L. heteroporus* 139-1-2, 5-7 cm.	
Figure 13	*Lamprocyclas aegles* group 139-2-1, 5-7 cm.	p. 544
Figure 14	*Lamprocyclas maritalis* group 139-1-CC.	p. 545
Figure 15	*Theocorythium* sp. 139-1-1, 80-82 cm.	p. 544
Figures 16-18	*Pterocorys clausus* group 16, 18: 139-1-2, 5-7 cm. 17: 139-1-CC.	p. 545
Figure 19	*Pterocorys sabae* 139-1-1, 80-82 cm.	p. 545

PLATE 36

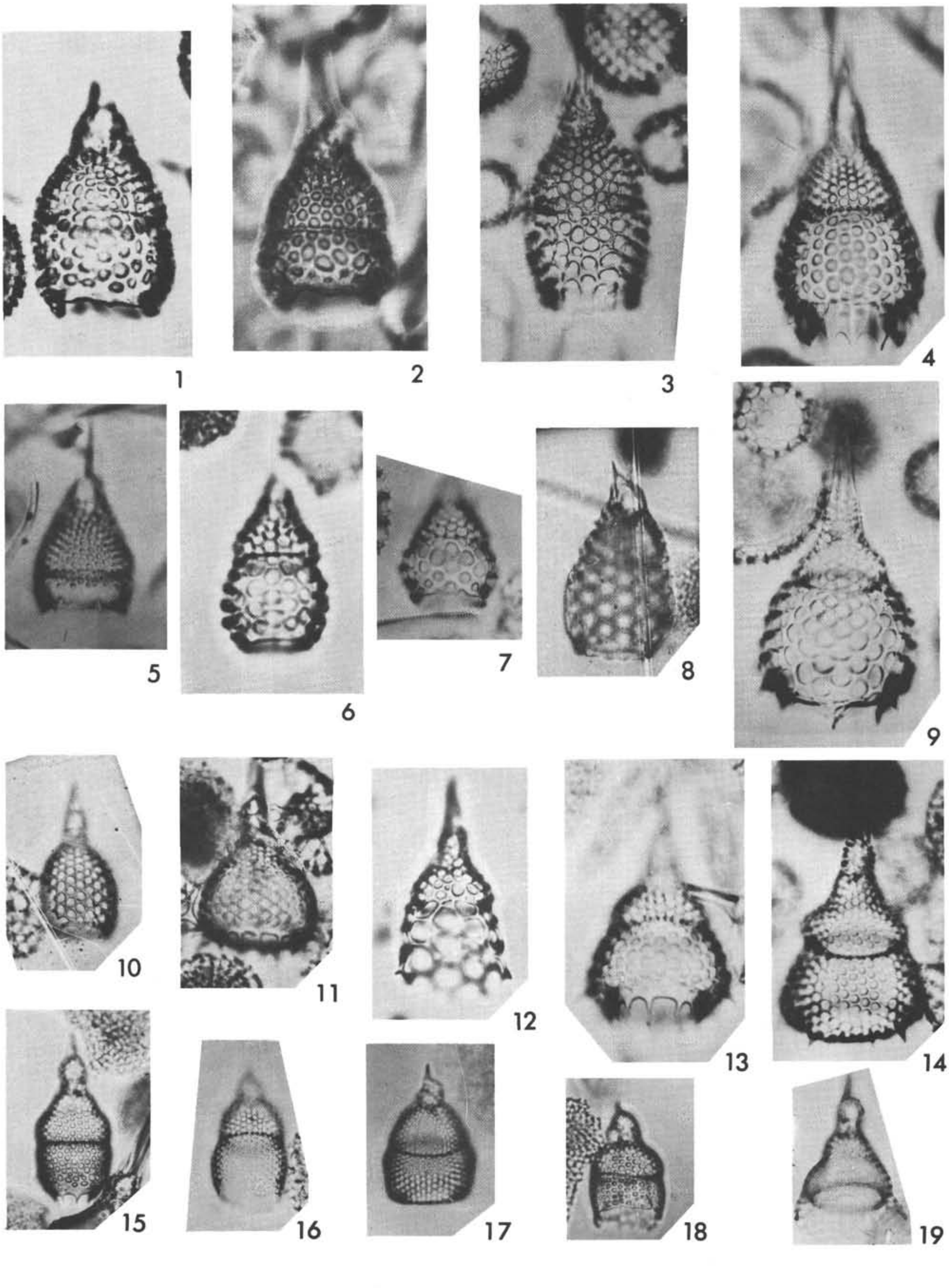


Plate 37
Magnification 200X

Figure 1	*Lipmanella* ? sp. aff. *Lithomelissa amazon* 138-2-6, 5-7 cm	p. 542
Figures 2, 3	*Lipmanella* (?) sp. M 2: 139-5-CC. 3: 140-2-1, 5-7 cm.	p. 542
Figures 4, 5	*Lipmanella* sp. 0 group 140-2-1, 5-7 cm.	p. 542
Figure 6	*Ceratocyrtis* sp. 140-2-1, 80-82 cm.	p. 534
Figures 7-9	*Lipmanella* sp. C group 7, 8: 139-5-CC. 9: 139-SW1.	p. 542
Figure 10	*Lipmanella* ? *dogieli* Ob 29 Same specimen as on Figure 53, I in Petrushevskaya 1967.	p. 542
Figure 11	*Lithomelissa* (?) *campanulaeformis* 139-1-CC	p. 542
Figure 12	*Ceratocyrtis* sp. aff. *C. cucullaris* 139-5-CC.	p. 534
Figures 13, 14	*Lipmanella* sp. aff. *L. xiphephorum* 13: 139-5-CC. 14: 139-1-CC.	p. 542
Figure 15	*Lipmanella xiphephorum* 139-1-2, 5-7 cm.	p. 542
Figure 16	*Tripodiscium* sp. 138-2-3, 5-7 cm.	p. 534
Figure 17	*Tripodiscium* sp. A 138-2-6, 5-7 cm.	p. 534
Figure 18	*Pseudodictyophimus* sp. 139-4-CC.	p. 534
Figures 19, 20	*Pseudodictyophimus* sp. A 140-2-1, 5-7 cm.	p. 534
Figure 21	*Pseudodictyophimus gracilipes* 139-1-CC.	p. 534
Figure 22	*Pseudodictyophimus* ? sp. indet. 139-1-CC.	
Figure 23	*Ceratocyrtis* sp. indet. 139-5-CC.	
Figure 24	*Pseudodictyophimus* sp. B 140-2-CC*.	
Figures 25, 26	*Clathrocorona* ? sp. 142-9-1, 98-100 cm.	p. 535
Figures 27-30	*Clathrocorona sphaerocephala* group 27: 142-9-1, 98-100 cm. 28: 140-2-1, 80-84 cm. 29: 140-2-1, 5-7 cm. 30: 139-5-CC.	p. 535
Figure 31	*Clathrocanium* ? sp. 138-2-3, 5-7 cm.	

PLATE 37

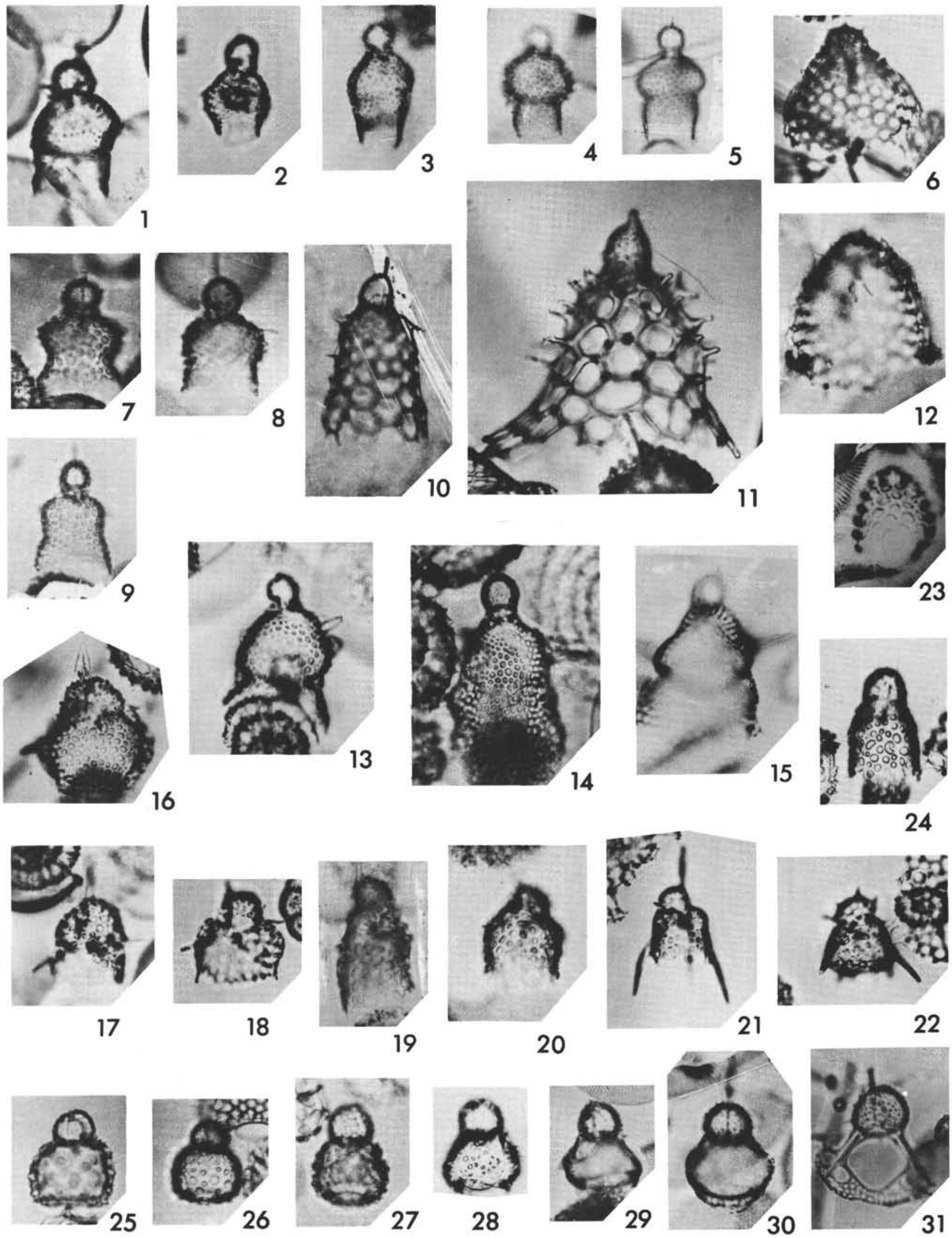


Plate 38
Magnification 200X

Figure 1	*Desmospyris* sp. aff. *D. lata* 140A-2-3.	p. 532
Figure 2	*Thamnospyris schizopodia* 140-2-3, 5-7 cm.	p. 531
Figure 3	*Thamnospyris* sp. aff. *T. schizopodia* 140-2-3, 5-7 cm.	p. 531
Figures 4, 5	*Thamnospyris* spp. 140-2-1, 80-84 cm.	
Figure 6	*Desmospyris* sp. aff. *D. mamillata* 140-3-3, 5-7 cm.	p. 531
Figures 7-10	*Rhodospyris* sp. aff. *R. tricornis* 7, 8: 142-9-1, 98-100 cm. 9: 140-2-1, 5-7 cm. 10: 139-7-CC.	p. 531
Figure 11	*Rhodospyris* sp. A 139-7-CC.	p. 531
Figure 12, 13	*Desmospyris* sp. A 12: 140-2-1, 5-7 cm. 13: 140-2-3, 80-85 cm.	p. 532
Figure 14	*Rhodospyris* sp. aff. *R. anthocyrtis* 140-2-1, 5-7 cm.	p. 531
Figures 15, 16	*Rhodospyris* sp. De I group, thorax incomplete. 15: JYN V-16P, 235-237 cm. 16: 139-7-CC.	p. 531
Figure 17	*Desmospyris* (?) *pannosa* JYN V-16P, 235-237 cm.	
Figures 18, 19	*Rhodospyris* spp. indet 18: 140A-2-6, 80-82 cm. 19: 144B-2-5, Top.	p. 531
Figures 20, 21	Spyrida gen. et spp. indet 20: 139-5-CC. 21: 139-7-CC.	
Figures 22-24	*Lithotympanium tuberosum* 142-9-1, 98-100 cm.	p. 533
Figure 25	*Desmospyris* sp. 140-2-1, 5-7 cm.	
Figures 26, 29	*Tricolospyris leibnitziana* group 26: 140-2-3, 84-85 cm. 29: 139-5-CC.	p. 533
Figures 27, 28	*Tricolospyris* spp. aff. *T. leibnitziana* 27: 139-5-CC. 28: 140-2-1, 5-7 cm.	
Figure 30	Spyrida gen. et sp. indet. 140-2-1, 5-7 cm.	

PLATE 38

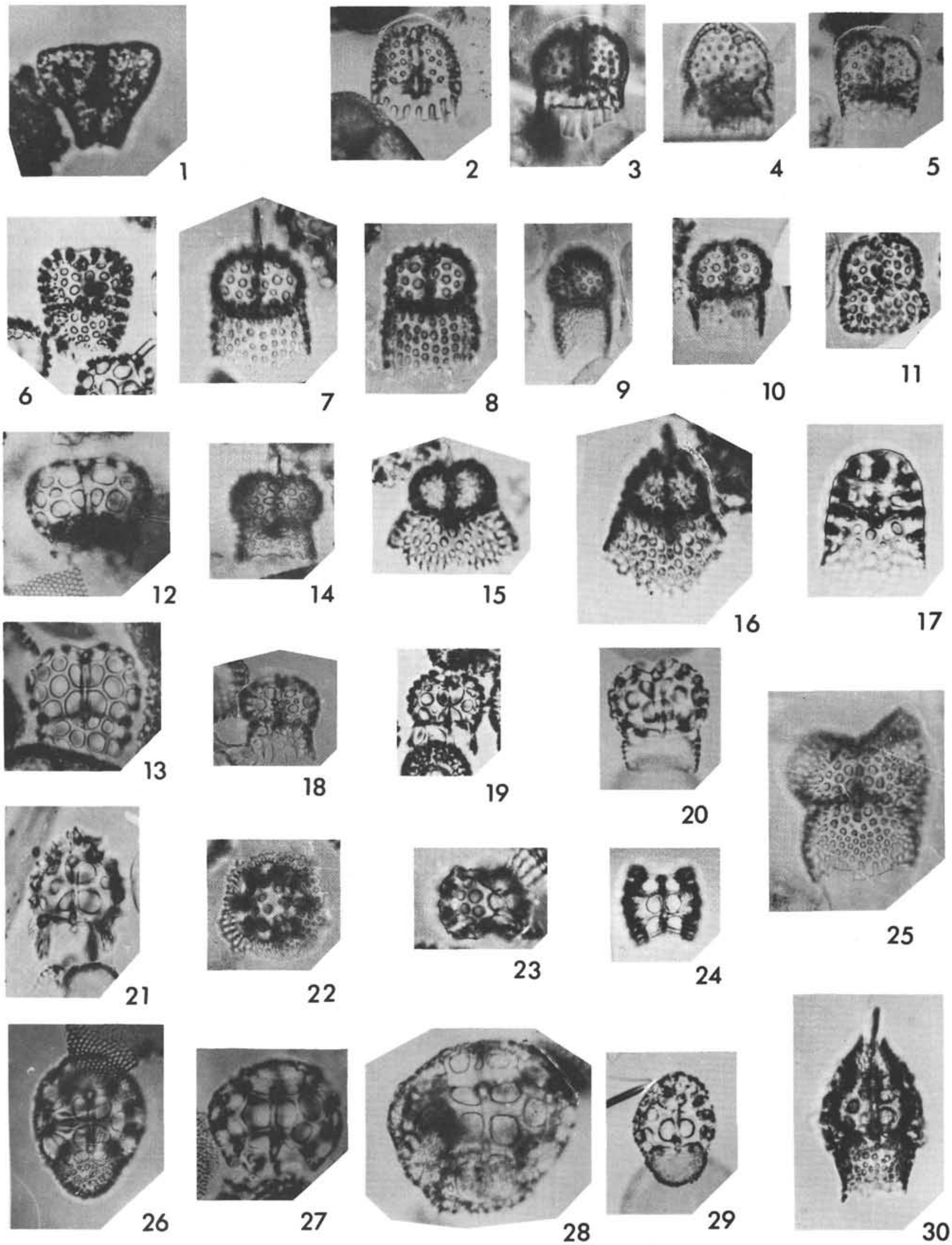


Plate 39
Magnification 200X

Figures 1, 2	*Acrobotrys* sp. aff. *A. sphaerothorax* 1: 139-7-CC, Ph. 2: 139-5-CC, Ph2.	p. 554
Figure 3	*Acrobotrys* sp. aff. *A. disolenia* 139-5-CC, Ph2.	p. 554
Figures 4-6	*Botryocella* spp. aff. *B. cribrosa* group 4: 138-2-3, 5-7 cm, Ph. 5: 138-2-1, 5-7 cm SLI. 6: 144B-2-6, TOP, SLI.	p. 554
Figure 7	*Botryocyrtis quinaria* group 140-2-1, 80-84 cm.	p. 554
Figures 8, 10	*Botryocella multicellaris* 8: 138-2-3, 5-7 cm. 10: 139-7-CC.	p. 554
Figure 9	*Acrobotrys* sp. aff. *A. disolenia* group 139-7-CC.	p. 554
Figure 11	*Centrobotrys* sp. 144B-2-5, Top.	p. 554
Figure 12	*Botryocella* sp. 140-2-1, 5-7 cm, Ph1.	
Figure 13	*Hexaspyris* sp. 139-5-CC.	p. 529
Figure 14	*Dictyospyris ? clathrata* 144-1-5, 80-82 cm.	p. 531
Figure 15	*Liriospyris* sp. aff. *D. clathrata* 140-3-CC, SL2.	p. 531
Figure 16	*Liriospyris* sp..A 140A-2-6, 80-82 cm, SL1.	
Figures 17-20	*Liriospyris* sp. B group 17, 18, 20 : 144B-2-5, Top. 19: 138-2-3, 5-7 cm.	p. 531
Figure 21	*Liriospyris* sp. aff. *L. hexapoda* 139-7-CC.	p. 531
Figure 22	*Dendrospyris* sp. aff. *Theospyris felis* 139-7-CC.	p. 532
Figures 23, 24	*Tympanomma binoctonum* 142-9-3, 90-92 cm.	p. 533
Figure 25	*Trissocyclus elevata* 140-2-1, 80-82 cm.	p. 533
Figures 26-28	*Dendrospyris pododendros* group 26, 27: 139-7-CC. 28: 139-5-CC.	p. 532
Figures 29-31	*Trissocyclus stauropora* 29: From the median bar, 142 Bumper. 30: 142 Bumper. 31: From the apex, 142-9-1, 98-100 cm.	p. 533
Figures 32, 33	*Patagospyris pentas* 140-3-CC.	p. 532

PLATE 39

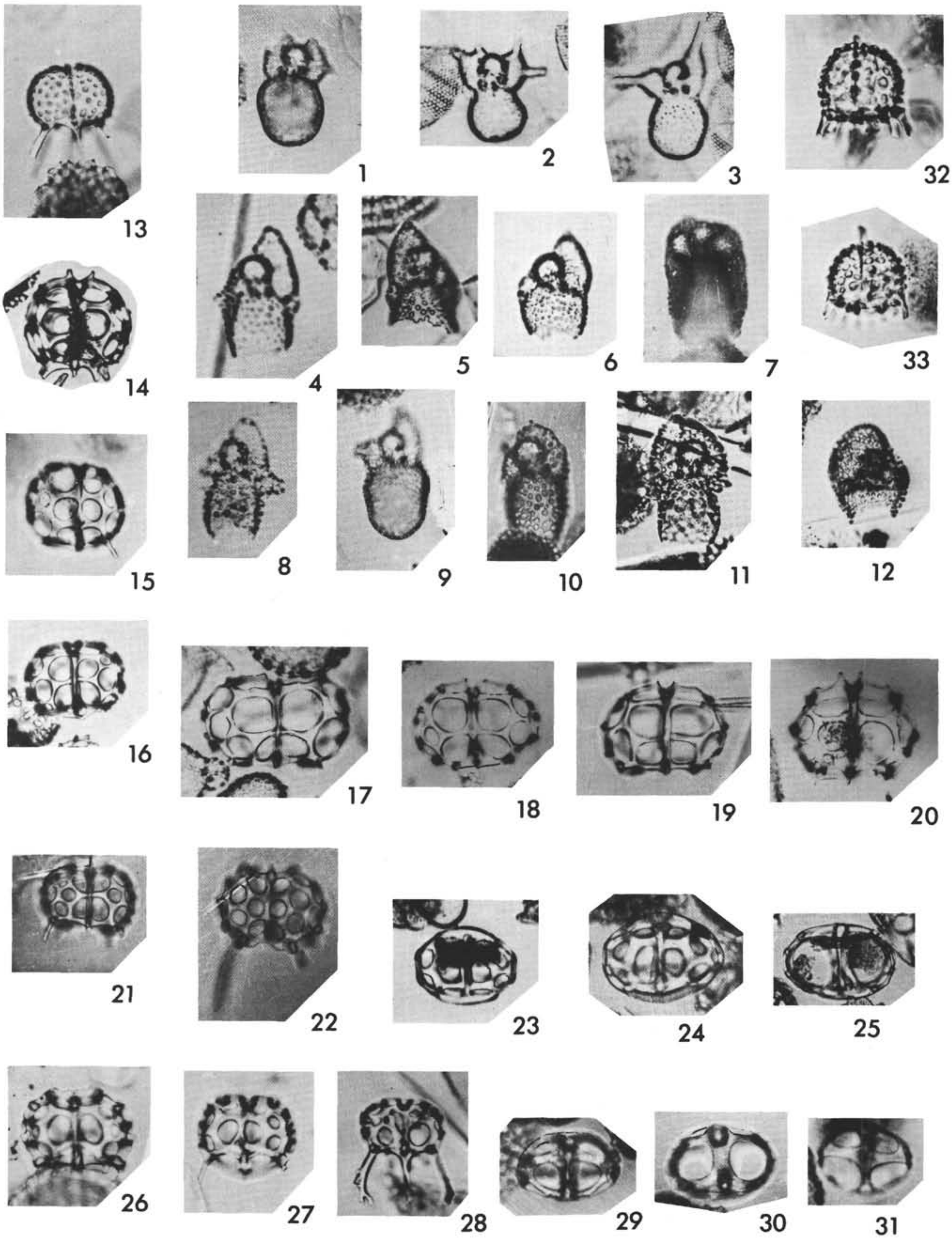


Plate 40
Magnification 200X

Figure 1	*Petalospyris* sp. E 140A-2-4.	p. 532
Figure 2	*Desmospyris* sp. aff. *D. anthocyrtoides* 140A-2-5.	p. 532
Figure 3	*Desmospyris* sp. aff. *D. anthocyrtoides* forma 2 144B-2-6, Top, SL 1.	p. 532
Figure 4	*Desmospyris anthocyrtoides* 144B-2-6, Top, SL 1.	p. 532
Figure 5	*Dorcadospyris* sp. K 144B-2-6, Top, CSE 1.	p. 532
Figure 6	*Hexaspyris* sp. 140-2-CC*.	p. 529
Figure 7	*Dorcadospyris* sp. 138-2-6, 5-7 cm Ph.	
Figure 8	*Patagospyris argisca* 144-1-6.	p. 532
Figures 9, 10	*Petalospyris triceros* group 144B-2-5, Top, SL 1.	p. 532
Figure 11	*Dorcadospyris simplex* 139-7-CC.	p. 532
Figure 12	*Dendrospyris didiceros* group 140-3-3, 5-7 cm, SL 2.	p. 532
Figure 13	*Dorcadospyris* sp. aff. *D. alata* 140-2-1, 5-7 cm.	p. 532

PLATE 40

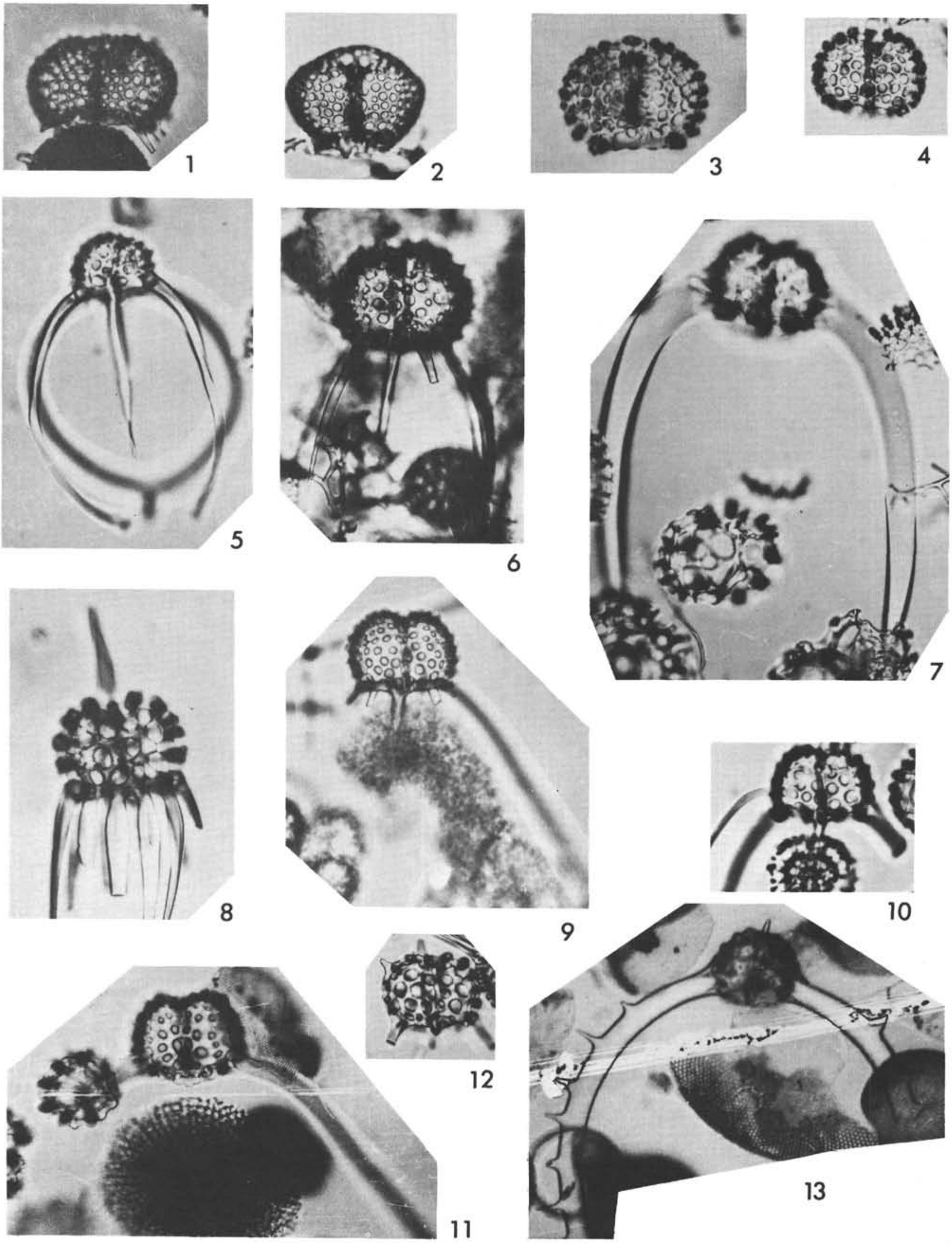
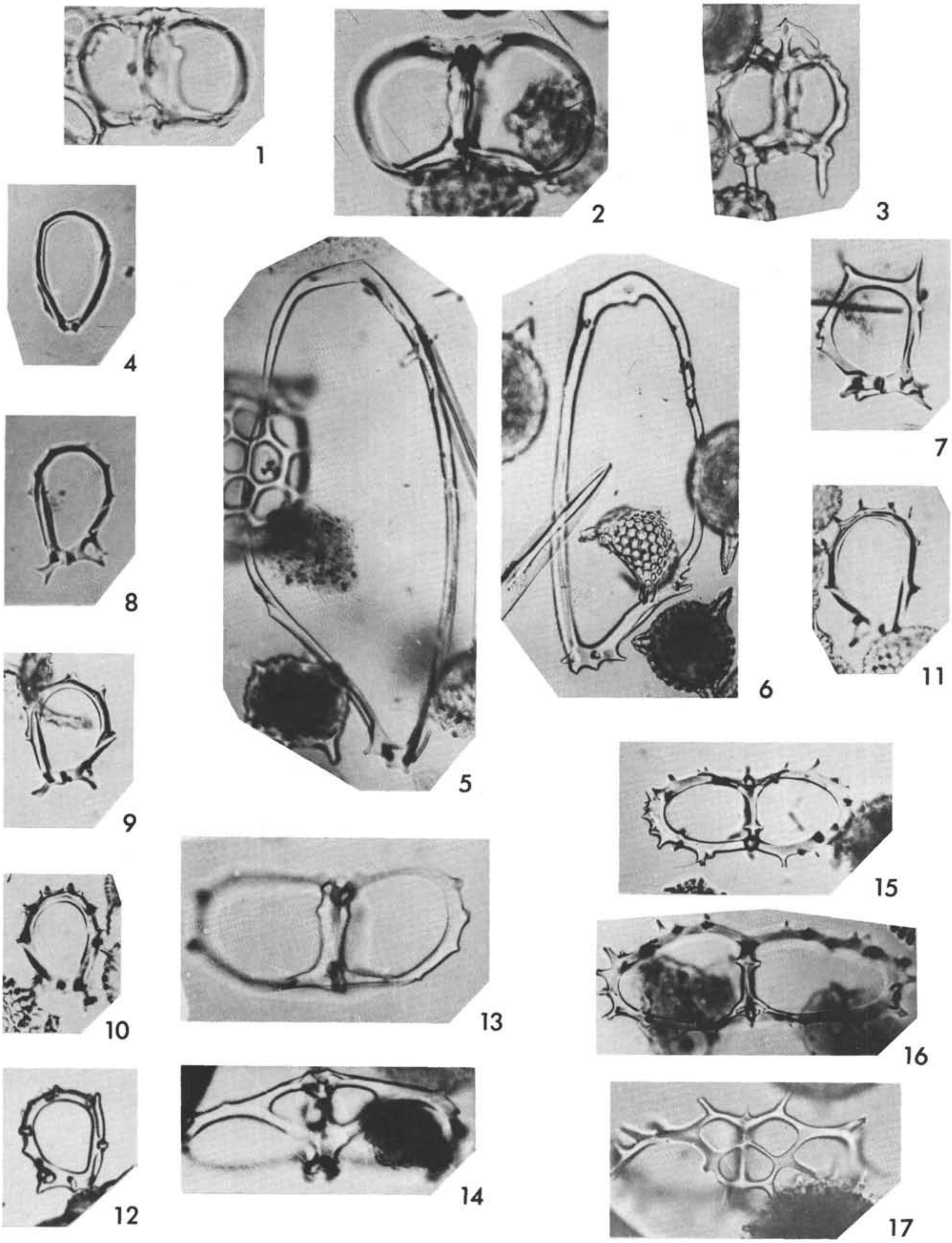


Plate 41
Magnification 200X

Figures 1, 2	*Eucoronis* sp. A 1: 142-9-1, 98-100 cm. 2: 139-4-CC.	p. 533
Figure 3	*Podocoronis toxarium* 142-9-2, 58-60 cm.	p. 533
Figure 4	*Zygocircus productus* 139-1-2, 5-7 cm.	p. 533
Figures 5, 6	*Zygocircus cimelium* 5: Holotype, 140-3-3, 5-7, Y45/0. 6: 140-3-3, 5-7 cm, M45/0.	p. 534
Figure 7	*Zygocircus* sp. 140-3-CC.	p. 534
Figures 8-11	*Zygocircus butschli* 8: 140-3-3, 5-7 cm. 9: 144B-2-6, Top. 10, 11: 144B-2-5, Top.	p. 534
Figure 12	*Zygocircus* (?) sp. indet 140-2-6.	
Figures 13, 14	*Eucoronis* sp. B. 13: 142-9-1, 98-100 cm. 14: 142-9-3, 90-92 cm.	p. 533
Figures 15-17	*Eucoronis hertwigii* group 15: 144B-2-6, Top. 16: 140-3-3, 5-7 cm. 17: 144B-2-5, Top.	p. 533

PLATE 41



INDEX OF RADIOLARIAN NAMES