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37. RADIOLARIANS FROM LEG 122, EXMOUTH AND WOMBAT PLATEAUS, INDIAN OCEAN[1]

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ABSTRACT

Sites 759 through 764 were drilled during Ocean Drilling Program Leg 122 on the Exmouth and Wombat plateaus off northwest Australia, eastern Indian Ocean. Radiolarian recovery was generally poor due to unsuitable lithofacies. A few Quaternary radiolarian faunas were recovered from most of the sites. Rare and poorly preserved Oligocene and Eocene radiolarian faunas were recovered from Holes 760A, 761B, 761C, and 762B. Poorly preserved Cretaceous radiolarians occur in samples from Holes 761B, 762C, 763B, and 763C. Chert intervals from Cores 122-761B-28X, 122-761C-5R, and 122-761C-6R contain moderately well-preserved Cretaceous radiolarian faunas (upper Albian, mid- to upper Cenomanian, and mid-Albian, respectively). Rare fragments of Upper Triassic radiolarians were recovered from sections in Holes 759B, 760B, and 764A.

The only well-preserved pre-Quaternary radiolarians are in lower and upper Paleocene faunas (*Bekoma campechensis* Zone) recovered from Site 761, Sections 122-761B-16X-1 to 122-761C-19X-CC. The composition of these faunas differs somewhat from that of isolated coeval Paleocene faunas from Deep Sea Drilling Project sites in the Atlantic, Gulf of Mexico, tropical Pacific, eastern Indian Ocean, and near Spain and North Africa, as well as from several on-land sites in North America, Cuba, and the USSR.

INTRODUCTION

The Exmouth Plateau is part of one of the oldest continental margins in the world. It consists of rifted and deeply subsided continental crust covered by a 10-km-thick Phanerozoic sedimentary sequence. Seismic-reflector data compiled prior to Ocean Drilling Program (ODP) Leg 122 (Exon et al., 1982) indicate that the Exmouth Plateau stratigraphy includes Holocene to Miocene pelagic ooze, Eocene chalk, and Upper Cretaceous carbonates and marls (mature ocean depositional environment) overlying middle to Lower Cretaceous (?Upper Jurassic) shallow marine shales (juvenile ocean mud environment). Jurassic coal measures and shelf carbonates (rifting paralic sedimentation) and Middle and Upper Triassic shallow marine and fluviodeltaic sediments (intracratonic environment) were deposited prior to breakup in both the northern and southern parts of the plateau.

The major objectives of Leg 122 were

1. To determine the Late Triassic and Jurassic prerift and synrift history and rift-drift transition in a starved passive continental margin setting;
2. To study the Cretaceous to Cenozoic postbreakup development of sedimentation and paleoenvironment from a juvenile to mature ocean;
3. To study the distribution of Jurassic, Cretaceous, and Tertiary depositional sequences in a relatively undisturbed passive margin setting and test the latest eustatic sea-level curve models (Haq et al., 1987, 1988);
4. To refine the Mesozoic geologic time scale;
5. To investigate the middle Cretaceous anoxic sedimentation in terrigenous, shallow-marine, and deep-marine environments; and
6. To document the Cretaceous/Tertiary boundary event (Haq, von Rad, O'Connell, et al., 1990, pp. 12–13).

Even though the depositional environments and lithologies drilled during Leg 122 were unsuitable for the recovery of radiolarian faunas, some of the lithologic types, such as the cherty intervals, could not have been dated without radiolarian biostratigraphy. Radiolarian faunas were recovered from holes drilled at Sites 759 through 764.

Well-preserved Quaternary radiolarian faunas were recovered from the first few sections at each hole. However, pre-Quaternary faunas were rare due to dissolution. A few poorly preserved Cretaceous radiolarians and questionable Triassic forms were recovered from Hole 759B. Samples from Hole 760A contained a few Eocene to Miocene forms, and poorly preserved lower Mesozoic forms were found in Hole 760B.

Of particular interest are the well-preserved Paleocene faunas from Hole 761B. Many of the Paleocene radiolarian taxa in Cores 122-761B-16X to 122-761B-18X are previously unreported; new forms are discussed and illustrated, and a brief systematic section is included.

Poorly preserved Paleogene and Cretaceous faunas were scattered throughout the samples recovered from the Site 761 mudstones.

Chert and siliceous mudstone fragments were found in Holes 761B, 761C, and 762C, but only one sample from Hole 761B and two samples from Hole 761C contained moderately well-preserved middle and Upper Cretaceous faunas. Brief lithologic descriptions of the cherts are included, and some of the chert samples are illustrated in thin section.

The radiolarian faunas from Sites 762, 763, and 764 are all poorly preserved. Several Paleogene and Cretaceous faunas were recovered from Holes 762B and 762C, respectively. Middle and Lower Cretaceous faunas were found in Holes 763B and 763C, and questionable Upper Triassic radiolarian fragments were found in a few samples from Holes 764A and 764B.

METHODS OF INVESTIGATION

SAMPLE PREPARATION

Most of the radiolarian faunas were studied after the sample was boiled in hydrogen peroxide (50%) for 3 to 5 min,

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sieved with 40-, 80-, and 230-mesh (420, 177, and 62 μm) stainless-steel sieves, and treated with hot hydrochloric acid (HCl; approximately 50% solution) until the calcareous component was reduced as much as possible. If the sediment did not fully disaggregate, the procedure was repeated. Ultrasound was used when chemical processing did not completely remove the clay component.

The Mesozoic chert samples were processed at the shore-based laboratory using a modification of the hydrofluoric acid (HF) technique of Pessagno and Newport (1972). A small piece (average 4–5 cm in length) of each sample was normally saved for making thin sections. Each sample was first etched with HCl to determine the calcium carbonate content and then broken (if large) and placed in a Nalgene beaker. Any $CaCO_3$ was then removed by adding approximately 200 mL of 30% HCl to the sample. The sample was washed thoroughly with water, covered with 200–400 mL of 10% HF solution, and allowed to stand for approximately 24 hr. After 24 hr, the solution was diluted and poured through 40-, 80-, and 230-mesh sieves. The chert pieces that remained on the 40-mesh sieve were processed two more times using the same technique. The fine residues were dried in filter paper at low heat and stored in static-free vials.

The Cenozoic residues were stored in water. A small part of the 177- or 62-μm residue was transferred to a glass slide by means of a pipette so as to cover the required area at appropriate density. The preparation was then dried, and a few drops of xylene were added to expel air from the specimens. Slide preparation was completed by the addition of Piccolyte and a glass cover slip.

Quaternary and Cenozoic samples were examined by standard transmitted-light techniques. A reflected-light microscope is customarily used to study Mesozoic faunas because the skeletons are composed of quartz.

Abundance and Preservation

Determination of relative abundances and state of preservation was attempted only for the Paleocene faunas from Sections 122-761B-16X-1 to 122-761B-19X-CC. Table 1 shows the distribution of Paleocene radiolarian taxa for each sample collected. Abundance is indicated by

R (rare) = 1–49 specimens/strewn slide;
F (few) = 50–99 specimens/strewn slide;
C (common) = 100–200 specimens/strewn slide;
A (abundant) = >200 specimens/strewn slide.

Preservation is indicated by
P (poor) = most specimens are broken or corroded;
M (moderate) = surficial structures of some specimens are unclear or broken;
G (good) = most specimens are well preserved.

In the columns showing the occurrence of species, the same abundance symbols are used to indicate the abundance of a given species in the sample's total fauna. Estimates of species abundance were attempted only with strewn slides of normal density in which the radiolarians were not diluted by sedimentary components. The abundance of each species in such a sample is indicated by

R = 1–9 specimens;
F = 10–19;
C = 20–30;
A = >30.

A blank indicates that the species was not found. Sanfilippo and Riedel (1973) suggested that the term "abundant" not be used because it represents an unusually high proportion of a species in an assemblage. However, use of the term abundant is appropriate in this study because certain Paleocene taxa, such as *Buryella tetradica*, predominate in many of the samples from Cores 122-761B-16X through 122-761B-18X.

BIOSTRATIGRAPHY

All radiolarian-bearing samples and their respective faunas are discussed for each site. The Leg 122 chert lithology and radiolarian faunas are discussed in another section.

Previous Paleocene Studies

Few occurrences of Paleocene radiolarian faunas have been reported. Paleocene radiolarian-bearing samples have been recovered from Deep Sea Drilling Project (DSDP) legs at isolated sites in the eastern Atlantic (Nishimura, 1987; Sanfilippo and Riedel, 1979), Gulf of Mexico (Foreman, 1973; Sanfilippo and Riedel, 1973), tropical Pacific (Riedel and Sanfilippo, 1971), off Spain and North Africa (Westberg et al., 1980), and the eastern Indian Ocean (Dumitrică, 1973).

Paleocene radiolarians have been reported from on-land sequences in North America from Missouri (Frizzell and Middour, 1951) and California (Foreman, 1968). Some of the taxa described by Campbell and Clark (1944b) from the Upper Cretaceous of California and by Clark and Campbell (1945) from the Oligocene and Eocene Kreyenhagen Formation also range into the Paleocene. Sanfilippo and Riedel (1976) recorded an occurrence in Cuba. Paleocene radiolarians have also been reported from the USSR by Borisenko (1958, 1960), Lipman (1972), and Tochilina (1975).

Radiolarian Biozones

The Leg 122 Quaternary and rare Tertiary radiolarian faunas were assigned to the detailed biozones proposed by Riedel and Sanfilippo (1978) and later modified by Sanfilippo et al. (1985). These zonal schemes include biozones for the Quaternary Period and Pliocene to Eocene Epochs.

Paleocene

The Paleocene radiolarians recovered from Site 761 are assignable to the *Bekoma campechensis* Zone of Nishimura (1987). This zone lies immediately below the *Bekoma bidartensis* Zone of Foreman (1973) and was considered the "unnamed zone" by Foreman (1973), Sanfilippo and Riedel (1973), and Riedel and Sanfilippo (1978).

The base of the *Bekoma campechensis* Zone was defined by Nishimura (1987) as the first appearance of *Bekoma campechensis* Foreman, which is approximately synchronous with the first occurrence of *Stylosphaera goruna* Sanfilippo and Riedel. The interval from Sample 122-761B-16X-1, 67–69 cm, through Section 122-761B-19X-CC is assigned to this zone. The *Bekoma campechensis* Zone was tentatively divided by Nishimura (1988) into an upper *Peritiviator*? sp. A–*Diplophlegma sophum* Subzone and a lower *Pterocodon* sp. A–*Stylotrochus nitidus* Subzone. These subzones are defined by the co-occurrences of these taxa. However, other taxa included within his subzones are not mentioned in Nishimura's abstract. *Peritiviator*? sp. A, *Diplophlegma sophum*, and *Pterocodon* sp. A do not occur in the Hole 761B Paleocene faunas, and *Stylotrochus nitidus* is rare (Table 1). Individual Hole 761B Paleocene taxa are discussed in "Site 761," as well as "Paleocene Radiolarian Taxonomy."

Cretaceous

No single radiolarian zonal scheme could be used for the Cretaceous radiolarian faunas from the Leg 122 samples. The Cretaceous biozonation proposed by Sanfilippo and Riedel (1985) was based largely on their studies of DSDP and

ODP material. Upper Cretaceous biozonal data were taken from on-land studies by Pessagno (1976), Taketani (1982), and Yamasaki (1987). Biozonal data for the Leg 122 Lower Cretaceous samples were taken from Schaaf (1981, 1984), Baumgartner (1984), and Aita (1987). No attempt was made to zone the fragmental and scarce pre-Cretaceous radiolarians.

Site 759

Hole 759B

Samples from Hole 759B (16°57.25′S, 115°33.61′E, water depth 2103.0 m) on the southeast flank of the Wombat Plateau contain few radiolarians. Sample 122-759B-3R-2, 119–121 cm, contains an undifferentiated Quaternary radiolarian fauna, including *Anthocyrtidium angulare*, *Didymocyrtis tetrathalamus*, *Stylacontarium acquilonium*, and *Theocorythium trachelium*. Only rare and broken specimens of these taxa occur in Core 122-759B-3R. Section 122-759B-4R-CC is barren of radiolarians. A poorly sorted sandstone in Section 122-759B-5R-CC contains reworked Quaternary radiolarians assignable to *Stylacontarium acquilonium* and broken, poorly preserved collosphaerids.

Radiolarians are absent in Cores 122-759B-6R through 122-759B-29R. Section 122-759B-30R-CC contains poorly preserved radiolarians assigned to ?*Capnodoce* Pessagno; this genus makes its first appearance in Upper Triassic (lower Carnian Stage) sequences. A fragment of the outer ring of *Acanthocircus* sp. was observed in a strewn slide from Section 122-759B-30R-3. This genus makes its first appearance in Middle Triassic (Ladinian) sequences. Sections 122-759B-31R-CC to 122-759B-39R-CC are totally barren of radiolarians.

A dark brown, reworked chert fragment in Sample 122-759B-30R-1, 3–4 cm, contains a single radiolarian, assignable to *Thanarla* sp., and a Cretaceous foraminifer. The genus *Thanarla* Pessagno is restricted to the Cretaceous.

Site 760

Hole 760A

Only a few radiolarians were extracted from Hole 760A (16°55.32′S, 115°32.48′E, water depth 1969.7 m), at the top of the Wombat Plateau. Section 122-760A-1H-CC contains rare but fairly well-preserved Quaternary radiolarians assignable to either the *Amphirhopalum ypsilon* Zone or the *Anthrocyrtidium angulare* Zone of Sanfilippo et al. (1985). Characteristic taxa include *Axoprunum angelinum*, *Collosphaera huxleyi*, *Lamprocyrtis nigriniae*, *Phormostichoartus marylandicus*, spyrids (gen. et sp. indet.), *Stylacontarium acquilonium*, and *Stylatractus* sp. The faunal composition remains nearly unchanged down to Sample 122-760A-2H-5, 88–90 cm.

Radiolarians are sporadic from Sections 122-760A-2H-CC to 122-760A-6H-CC. Fragments of *Dorcadospyris* spp. were recovered in Section 122-760A-7H-CC, which indicates an age range of middle Miocene to early Oligocene. Rare specimens of *Podocyrtis trachoides* were found in Sample 122-760A-8H-7, 29–31 cm, and *Spongatractus pachystylus* occurs in Section 122-760A-8H-CC; both taxa indicate a middle to late Eocene age. No radiolarians were recovered from Sections 122-760A-9H-CC to 122-760A-37X-CC.

Hole 760B

The sediments from Hole 760B (16°55.32′S, 115°32.48′E, water depth 1969.7 m) at the top of Wombat Plateau are nearly devoid of radiolarians. Section 122-760B-2R-CC is barren, but Section 122-760B-3R-CC contains twisted radiolarian spines, as well as poorly preserved, three- and four-rayed forms with outlines similar to those of the Jurassic genera *Pseudocrucella* Baumgartner and *Homeoparonaella* Baumgartner. Three- and four-rayed forms also occur in Upper Triassic (Norian) rocks in western North America (Blome, 1984), but are abundant only in uppermost Triassic (upper Norian) and Lower Jurassic strata. This suggests that Section 122-760B-3R-CC may be as young as Jurassic. Radiolarians are absent from Sections 122-760B-4R-CC to 122-760B-29R-CC.

Site 761

Site 761 has a Quaternary to upper Oligocene section (Subunit IA, Figs. 1 and 2) that yields sporadic but well-preserved Quaternary faunas, as well as a Paleocene section (Subunit ID, Fig. 1) that contains well-preserved faunas. The individual Paleocene taxa from Hole 761B are listed in Tables 1 and 2, systematically treated in the "Paleocene Radiolarian Taxonomy" section, and illustrated in Plates 1–4 in this paper.

Subunit IA occurs only in Hole 761B. Subunit ID occurs in both Holes 761B and 761C and is represented by Sections 122-761B-16X through 122-761B-20X and 122-761C-2R (Fig. 1). The cherts recovered from Holes 761B and 761C (Subunits IC, ID, IIB, and IIC, Figs. 2 and 3) are discussed in a later section. A few samples from Subunit IIB to Unit III contain poorly preserved Cretaceous faunas.

Hole 761A

Hole 761A is at 16°44.23′S, 115°32.10′E, in a water depth of 2188.8 m on the central Wombat Plateau.

Section 122-761A-1H-CC contains well-preserved middle to late Quaternary radiolarians, including *Acrosphaera spinosa*, *Anthrocyrtidium ophirense*, *Axoprunum stauraxonium*, *Didymocyrtis tetrathalamus*, *Euchitonia elegans*, *Giraffospyris angulata*, *Lamprocyrtis nigriniae*, *Lamprocyclas* spp., and *Stylacontarium acquilonium*.

Hole 761B

Hole 761B is at 16°44.23′S, 115°32.10′E, in a water depth of 2167.9 m on the central Wombat Plateau.

Radiolarian faunas assignable to either the upper Quaternary *Buccinosphaera invaginita* Zone or the *Collosphaera tuberosa* Zone of Sanfilippo et al. (1985) were extracted from Section 122-761B-1H-CC to Sample 122-761B-2H-4, 138–142 cm. Samples 122-761B-2H-4, 138–142 cm, 122-761B-2H-5, 23–27 cm, 122-761B-2H-CC, and 122-761B-3H-5, 81–83 cm, contain *Anthrocyrtidium angulare*, *Didymocyrtis tetrathalamus*, and *Theocorythium trachelium*, all of which belong within the lower Quaternary *Amphirhopalum ypsilon* or *Anthrocyrtidium angulare* Zones of Sanfilippo et al. (1985). Radiolarians are rare and preserved as fragments in Sections 122-761B-6H-CC and 122-761B-7H-CC.

A poorly preserved middle Eocene fauna (*Theocotyle cryptocephala* to *Podocyrtis ampla* Zones of Sanfilippo et al., 1985), including *Podocyrtis sinuosa* and *Podocyrtis* spp., was recovered from Section 122-761B-8H-CC. Core-catcher samples from Cores 122-761B-9H through 122-761B-11X and 122-761B-14X are barren.

Samples 122-761B-16X-1, 67–69 cm, through Section 122-761B-19X-CC (Fig. 2) contain moderately to well-preserved lower to upper Paleocene radiolarian taxa (Table 2). Some of these taxa were first described by Foreman (1973) and Sanfilippo and Riedel (1973; see "Paleocene Radiolarian Taxonomy") in their studies of radiolarians from DSDP Leg 10 (Gulf of Mexico). However, nearly one-third of the taxa in the Leg 122 Paleocene radiolarian faunas have not previously been illustrated or discussed.

The radiolarian faunas from Samples 122-761B-16X-1, 67–69 cm, to 122-761B-16X-4, 134–136 cm, are tentatively correlated with the upper Paleocene nannofossil Zone NP9

Table 1. Estimated abundance and preservation of radiolarian faunas from Sections 122-761B-16X-1 to 122-761B-19X-CC.

Core-Section	Interval (cm)	Abundance/ Preservation	*Amphisphaera minor*	*Amphitemis* cf. *?Stichomitra alamedaensis*	*Amphymenium splendiarmatum*	Astrosphaerin sp. E	Astrosphaerin sp. F	*Bathropyramis* sp. cf. *B. woodringi*	*Bekoma campechensis*	*Bekoma* sp. aff. *B. campechensis*	*Bekoma divaricata*	*Buryella* sp. cf. *B. clinata*	*Buryella pentadica*	*Buryella tetradica*	*Buryella* sp. A	*Ceratospyris* sp. aff. *C. articulata*	*Clathrocycloma parcum*	*Clathrocycloma* sp. A	*Cornutella californica*	*Dictyomitra andersoni*	*Dictyoceras caia*	*Dorcadospyris* sp. cf. *D. platyacantha*	*Dorcadospyris* sp. A	*Dorcadospyris* sp. B	*Entapium chaenapium*	*Entapium regulare*	*Entapium* sp. A	*Heliostylus* sp.	*?Lithochytris* sp. A
16X-01	67-69	R/M												R									R						
16X-02	67-69	R/M												R									R						
16X-03	67-69	R/M											R	R									R						
16X-04	67-69	R/M	R					R				R	R	R								R	R						
16X-04	97-100	R/M											R	R															
16X-CC		A/G	F	F		F	F	F	F	F		C	F	C		F	F	F	F			F	C	F	F	C	F		F
17X-01	67-69	A/G	F		F		F	C	F	F	F	C	C	C	F	F	F	F	F			C	C	F	F	C	F		F
17X-01	133-136	A/G	C		C	F	F	C	C	C	F	C	C	C	F		F	C	C			C	C	F	F	C	F		F
17X-02	67-69	A/G	C	F	F		C	F	F	F		C	C	C			F	C	F			C	C	F	F	C	C	F	F
17X-02	133-136	A/G	F		F		F	F	F	F		C	C	A		F	F	C	F		F	C	C	F	F	F	F	F	F
17X-03	67-69	C/M	F		F	F	F	C				C	C	C	F			C	F	R	F	C	C	F	F	C	F	F	C
17X-03	133-136	C/M	F		F	F	F	F	R			C	C	C	F			C	F		F	C	C	F	F	F	F	F	C
17X-04	67-69	C/M	F	R	F	F	C	C				C	C	C	F			F	F		F	C	C	F	F	F	F	F	C
17X-05	67-69	C/M	F	R	C	F	F	F				C	C	C	F			F	C			C	C	F	F	C	F		C
17X-06	67-69	C/M	F	R	F	C	C	R				C	F	C	R			F	C	R		F	C		F	F	F		C
17X-06	133-136	C/M	R		F	C	F	R				C	C	A	F		R	R	F			F	C		F	C	R		F
17X-CC		C/M	F		F	C	F	F				C	C	A	F		R	F	C	R		F	C		F	C	R		C
18X-01	67-69	C/M	R		F	C	R	R				C	F	C			F	R	F			C	C	R	F	C	R		C
18X-02	67-69	C/M	R		F	F	R	R	R			C	C	C	R	R		R	F			C	C		F	C	R		C
18X-03	67-69	C/M	R	R	F	F	R		R			C	F	C	F		R	F	F			F	C	R	F	F	R		F
18X-04	67-69	A/G	C	R	C	F	C	F	C	C		A	A	A	C	F	A	C	C			C	A	R	C	C	F		C
18X-05	67-69	A/G	C	F	C	C	F	F	F	C	R	C	C	A	C	R	A	F	F			C	C		F	C	F		C
18X-06	67-69	A/G	F	R	F	C	C	C	R	R		C	C	A	F		A	F	F			C	C		F	C	F		C
18X-CC		A/G	F	R	F	C	C	C	R	R		C	C	C			A	F	F			C	C		F	C	F		F
19X-01	74-79	C/G	F			F	F	R	F			F	F	C			C		R			F	F			R	F		
19X-01	134-136	R/M				R	R	R	F				R	F			R					F	F		R	R			
19X-02	72-74	R/M				R	R					R	R	R			R					R	R						
19X-CC		R/P																					R			R			

Note: Letter codes explained in text.

(zones of Martini, 1971; Table 2); samples from the interval from Section 122-761B-16X-CC to Sample 122-761B-17X-1, 133–136 cm, are correlated with Zones NP7-8; Samples 122-761B-17X-2, 134–136 cm, to 122-761B-17X-5, 134–136 cm, are correlated with Zone NP6; and Samples 122-761B-17X-6, 134–136 cm, to 122-761B-19X-3, 134–136 cm, are correlated with Zone NP5 (Table 2; also Siesser and Bralower, this volume). The faunas from Samples 122-761B-19X-4, 134–136 cm, to 122-761B-21X-2, 134–136 cm, are tentatively correlated with the lower Paleocene nannofossil Zone NP3-4 (Shipboard Scientific Party, 1990, p. 180). However, the exact position of the transition between nannofossil zones in each section is not clear in the Leg 122 *Initial Reports* volume. Furthermore, Core 122-761B-16X consists of only four sections and a core catcher in the detailed barrel sheets, yet five sections are indicated in the text (Shipboard Scientific Party, 1990, cf. p. 498, and p. 181, fig. 23).

Nannofossil Zones NP9 to NP4 can be tentatively correlated with the concurrent ranges of Paleocene taxa from Hole 761B (Table 2). The abrupt appearance (downhole) of 22 Paleocene taxa in Section 122-761B-16X-CC may be the result of the difference in preservation between Sample 122-761B-

Table 1 (continued).

Core-Section	Interval (cm)	Abundance/ Preservation	*Lithomespilus mendosa*	*Lithomitra docilis*	*Lychnocanoma* sp. A	*Lychnocanoma* sp. B	*Lychnocanoma* sp. C	*Lychnocanoma* sp. D	*Lychnocanoma* sp. E	?*Lychnocanoma* sp. F	*Periphaena decora*	*Phormocyrtis striata exquisita*	*Phormocyrtis striata striata*	*Pterocodon* (?) *ampla*	*Saturnulus* sp. A	*Siphocampe* sp. aff. *S. arachnea*	*Spongodiscus* sp. A	*Spongurus (Spongurantha) quadratus*	*Stylosphaera coronata coronata*	*Stylosphaera goruna*	*Stylosphaera* sp. A	*Stylosphaera* sp. B	*Stylotrochus alveatus*	*Stylotrochus nitidus*	*Theocorys phyzella*	*Theocorys* sp. cf. *T. phyzella*	*Thecosphaerella ptomatus*	*Velicucullus* sp.	*Xiphospira circularis*
16X-01	67-69	R/M			R																R				R		R		R
16X-02	67-69	R/M			R														R		R								
16X-03	67-69	R/M			R			R											R	R	R		R						R
16X-04	67-69	R/M			R	R														R	R								R
16X-04	97-100	R/M																	R		R								
16X-CC		A/G		F	F	A	C	F				C	F		R		R	F	C	F	C	F	F		F	C			
17X-01	67-69	A/G	F	F	C	A	C	F		F	F	F			R	F	F	C	C	C	F	F	F	F	F	C	F	R	F
17X-01	133-136	A/G		C	F	C	C	F	F	F	F	F	F		R	C	F	C	C	C	F		F		C	F		R	C
17X-02	67-69	A/G		C	F	C	C	F	F		F	F			R	F	C	F	C	C	F	F	F		C	C	C	R	C
17X-02	133-136	A/G	F	C	C	F	C	F	F		F	F			R	F	F	C	C	C	F		F		F	F	C	R	F
17X-03	67-69	C/M	F	C		F	C	F			F	C				F	C	C	C	C			C			C	C	R	F
17X-03	133-136	C/M	F	C		F	C	F			F	C			R	F	C	C	C	C			C			C	F		C
17X-04	67-69	C/M	F	C	F	F	A	F	F	R	F	C			R		C	F	C	C			C		F	C	F		C
17X-05	67-69	C/M	F	F			C	F	F		F	F		R			F	F	C	C	F	F	F			F	F		F
17X-06	67-69	C/M	R	F			C	F	F			F		F			C	F	C	C	F	F	C			C	C		F
17X-06	133-136	C/M	F	R			C		R		R	F		F			C	F	C	C		F	C			F	C		C
17X-CC		C/M	F	R			C	R	F		R	C		C	R	R	C	C	C	C		F	C			F	C		C
18X-01	67-69	C/M	F				C	F	F		F	C		F		R	C	C	C	F		F	C			C	F		C
18X-02	67-69	C/M	F				C	R	F		C	C		F	R		F	F	C	C	F	F	F			C	C		F
18X-03	67-69	C/M		F			C		F			F		F	R	R		F	F	F		R				F	F		C
18X-04	67-69	A/G	F	C			A	R	F			F		F	F	C	A	C	C	C	C	F	C	F		C	C	R	C
18X-05	67-69	A/G	F	F			A		F			C			F	C	C	C	A	C	C	F	C			C	C		C
18X-06	67-69	A/G	F	F			C	F	C			C			R	F	C	C	A	C	F	C	C			C	C		C
18X-CC		A/G	F	F			C	F	F			C			R	F	C	C	A	C	F	C	F			C	C		F
19X-01	74-79	C/G	F	F	F			R	F		F						F	F	C	C	C						R		R
19X-01	134-136	R/M	F						R			F							C	F	F	R							R
19X-02	72-74	R/M	R														R	R	R			R							
19X-CC		R/P	R														R		R										

16X-4, 97–100 cm, a sample containing rare and fragmental forms, and Section 122-761B-16X-CC, which contains abundant and well-preserved forms. This appearance also occurs near the boundary between nannofossil Zones NP9 and NP7-8. *Phormocyrtis striata striata* appears to be restricted to the interval defined by nannofossil Zones NP7-8. The taxa that make their first and final appearances downhole in the interval correlated with nannofossil Zone NP6 include *Dictyoceras caia* and *Heliostylus* sp. (Table 2). The sample data show that *Pterocodon* (?) *ampla* makes its first appearance in Section 122-761B-17X-5 and that *Theocorys phyzella* makes its final appearance in Sample 122-761B-17X-4, 67–69 cm; both of these samples are correlated with the main body of nannofossil Zone NP6.

Forty-eight of 54 Paleocene taxa studied make their last appearance (downhole) in Sample 122-761B-19X-2, 67–69 cm, which is correlated with the lowest part of nannofossil Zone NP5. This abrupt disappearance below Sample 122-761B-19X-2, 72–74 cm, is probably the result of the change in preservation between Sample 122-761B-19X-2, 72–74 cm, and Section 122-761B-19X-CC (Table 1).

No radiolarians were recovered from Cores 122-761B-20X to 122-761B-24X. Fragments of *Dictyomitra* spp. and *Phaseliforma* spp. were recovered in Section 122-761B-25X-CC;

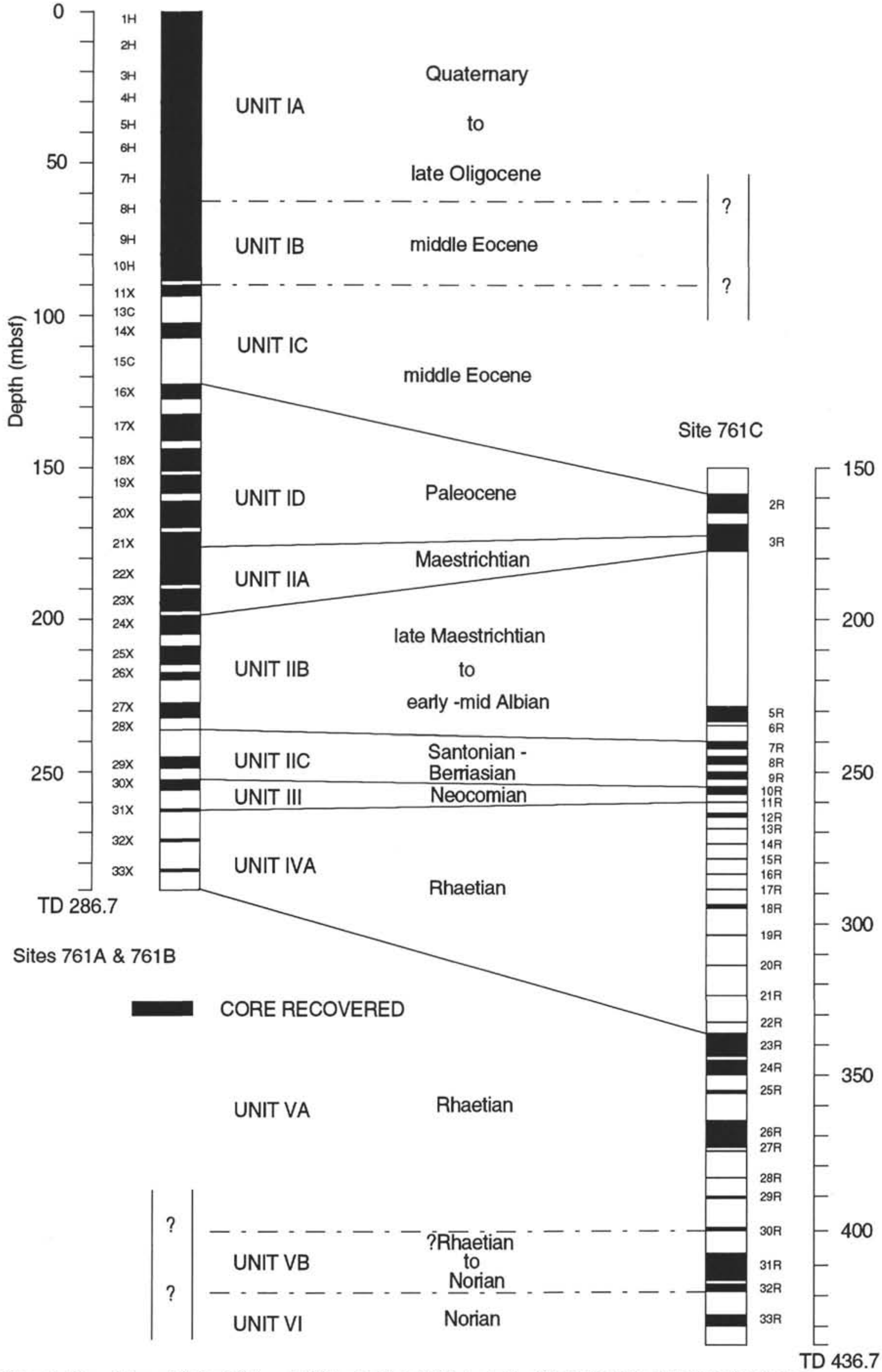


Figure 1. Correlation of Holes 761A and 761B with Hole 761C, including lithologic units and approximate ages.

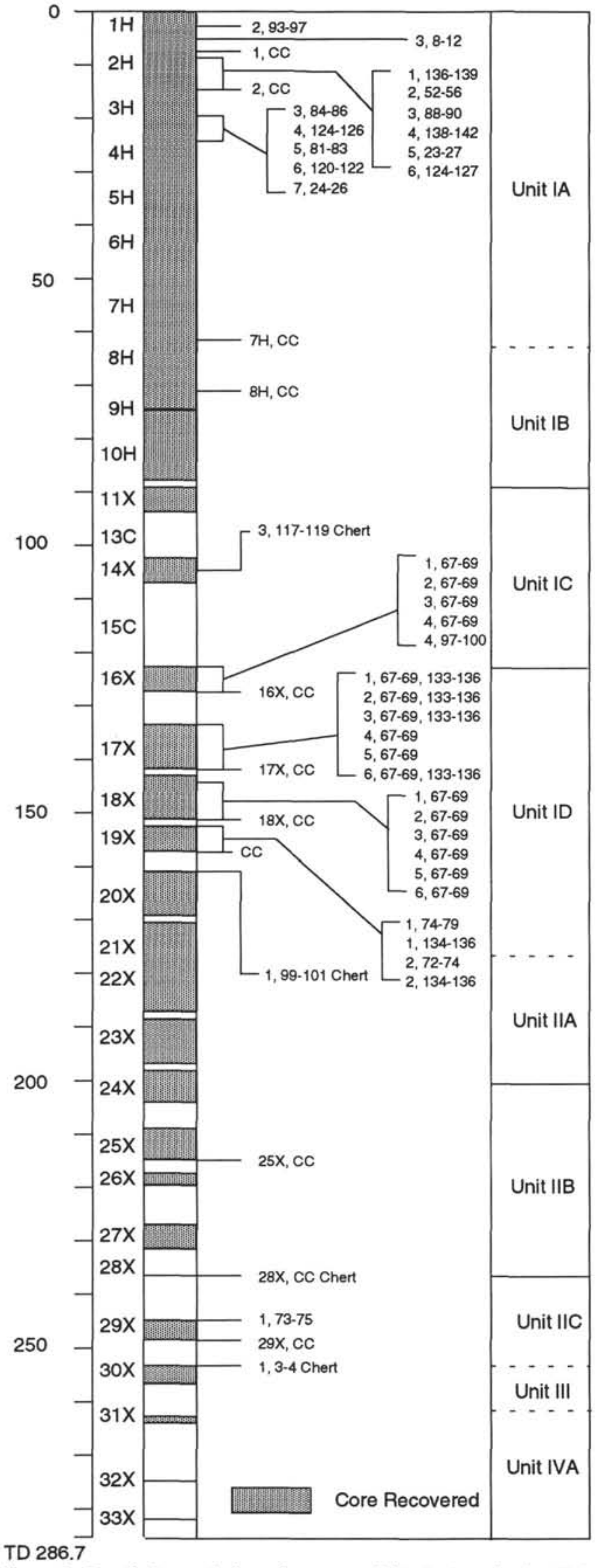


Figure 2. Detailed correlation of cores and lithologic units for Hole 761B, including radiolarian-bearing samples and chert intervals.

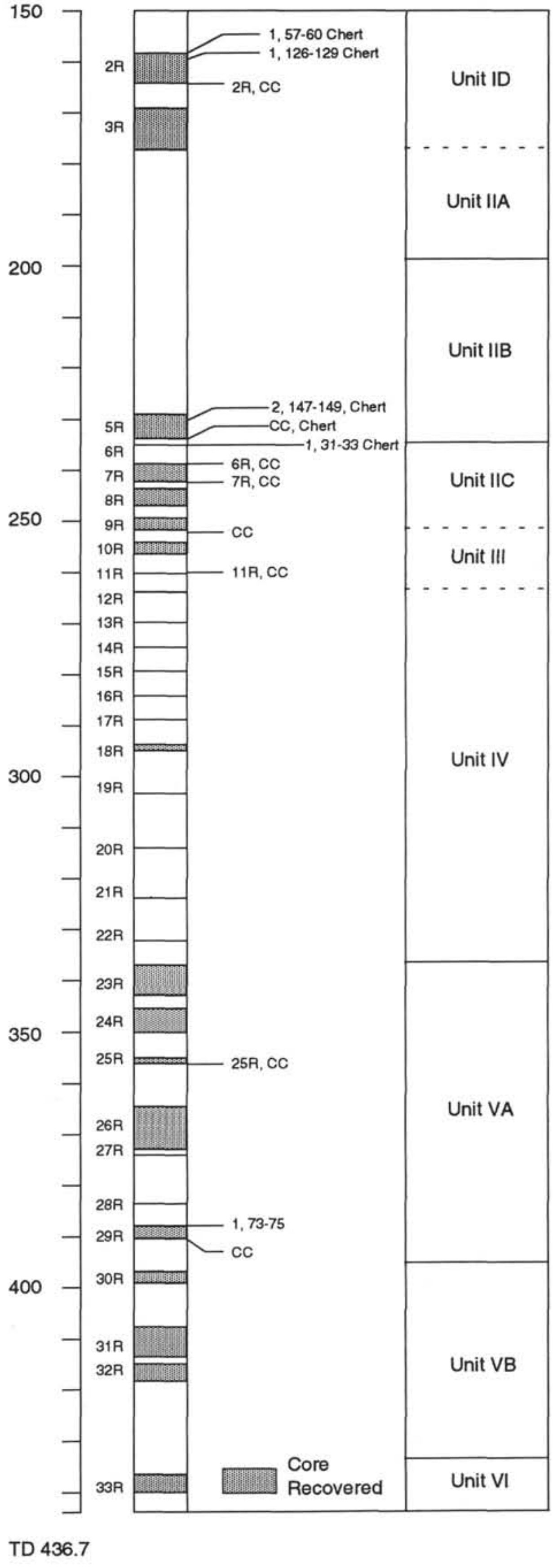
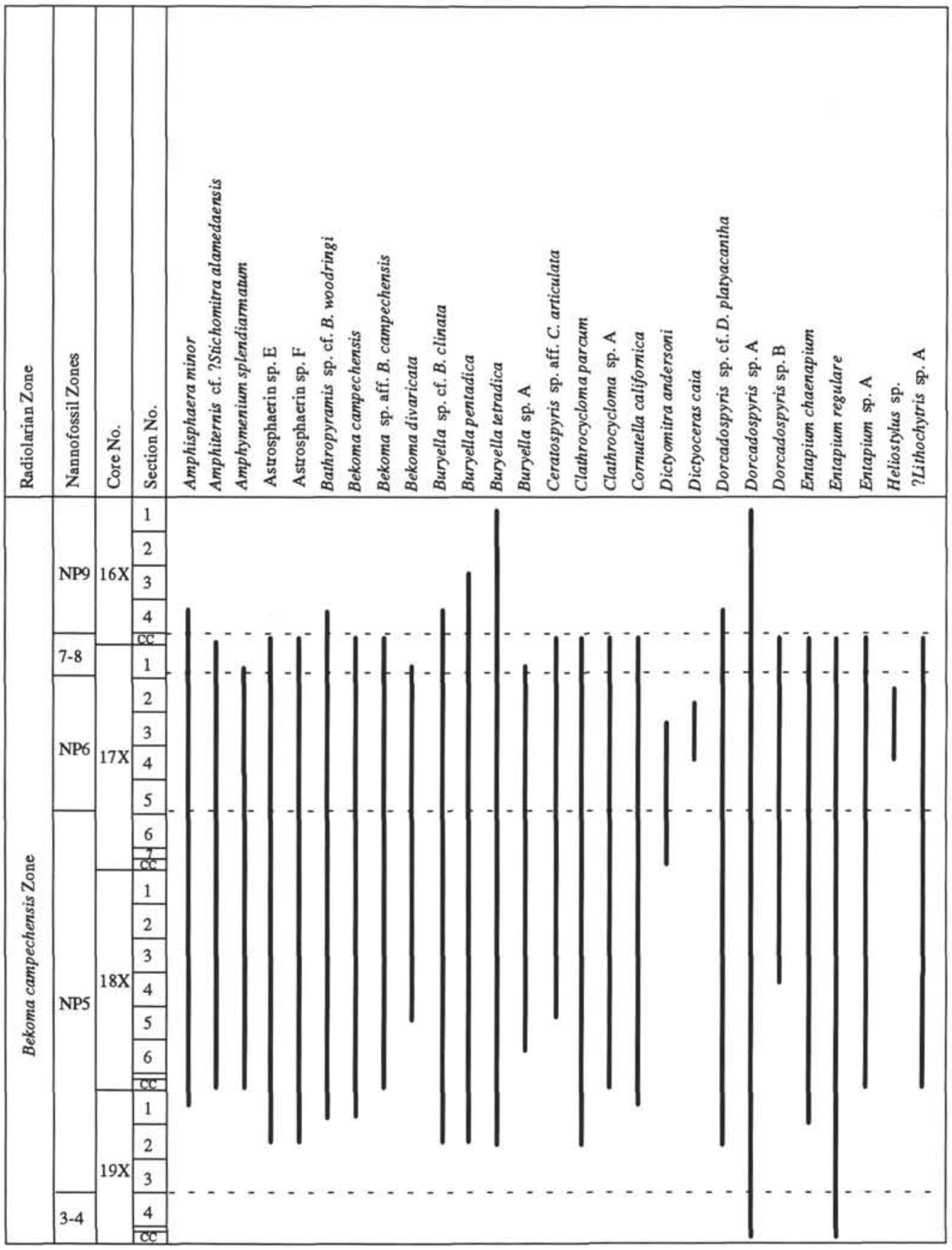


Figure 3. Detailed correlation of cores and lithologic units for Hole 761C, including radiolarian-bearing samples and chert intervals.

Table 2. Correlation of the relative ranges of radiolarian taxa from Sections 122-761B-16X-1 to 122-761B-19X-CC to nannofossil Zones NP9 to NP3–4.



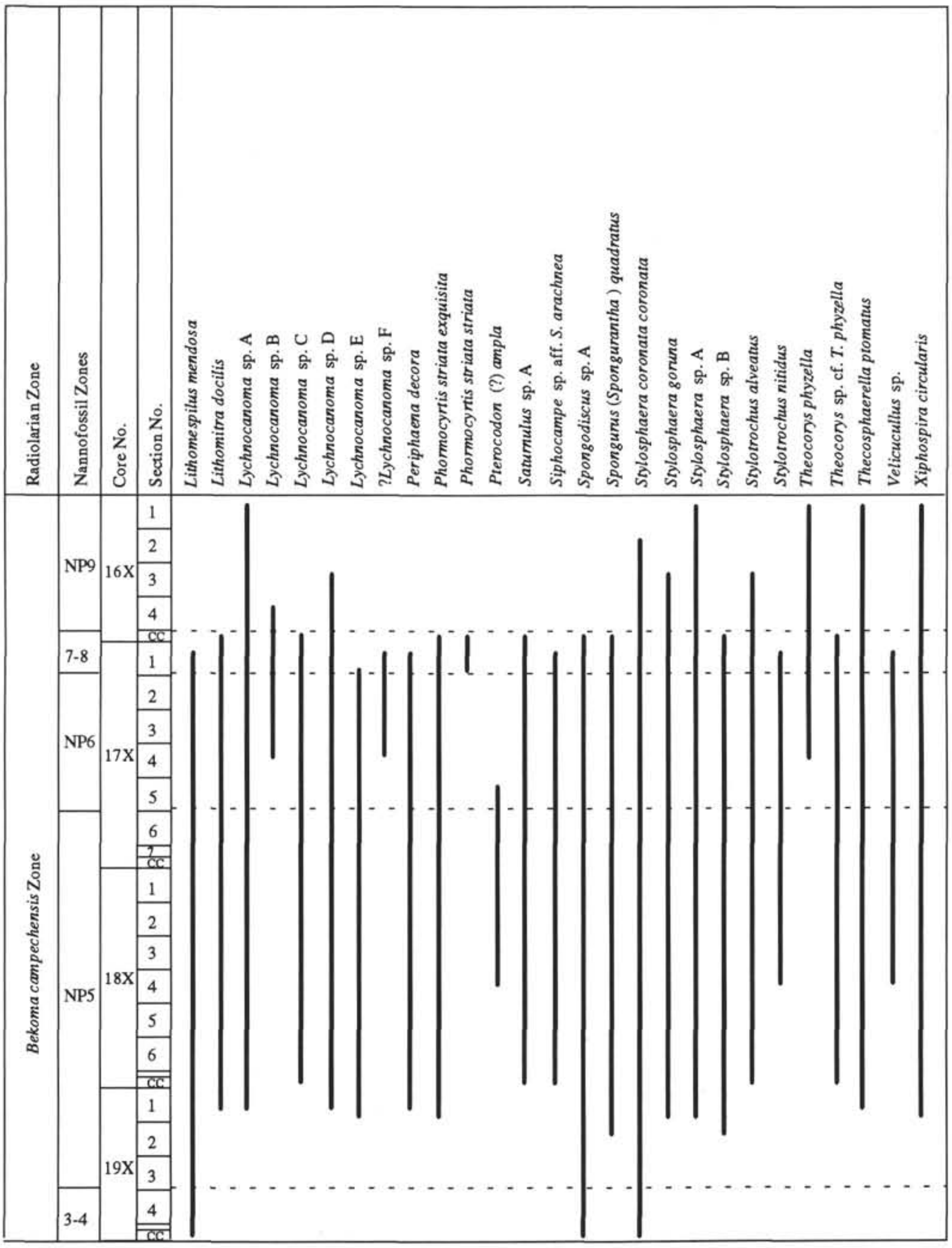
these indicate a Late Cretaceous (Campanian?) age. Cores 122-761B-26X and 122-761B-27X are barren.

Sample 122-761B-29X-1, 73–75 cm, contains a poorly preserved lower to middle Aptian fauna assignable to either the *Stichomitra euganea* Zone or the lowermost part of the *Acaeniotyle umbilicata* Zone of Sanfilippo and Riedel (1985). Age-diagnostic taxa include *Eucyrtis micropora*, *Pseudodictyomitra carpatica*, *P. lodogaensis*, *Sethocapsa trachyostraca*, *Stichomitra* spp., *Theocorys antiqua*, and *Xitus alievi*. Section 122-761B-29X-CC contains mostly casts, but it also includes poorly preserved forms belonging to *Praeconocaryomma* Pessagno, *Pseudodictyomitra* Pessagno, *Stichomitra* Cayeux, and *Thanarla* Pessagno. The concurrent ranges of these genera indicate an undifferentiated late Early Cretaceous age. Sections 122-761B-30X-CC to 122-761B-33X-CC are barren.

Hole 761C

With the exception of Section 122-761C-2R-CC (Fig. 3), most of the sediments contain poorly preserved faunas in Hole 761C (16°44.23′S, 115°32.10′E, water depth 2167.9 m) on the central Wombat Plateau. However, this section contains rare but moderately preserved upper Paleocene radiolarians nearly identical to those from Sections 122-761B-16X and 122-761B-17X. Sections 122-761C-3R-CC and 122-761C-9R-CC are barren.

Table 2 (continued).



Chert Samples 122-761C-5R-2, 147–149 cm, and 122-761C-6R-1, 31–33 cm, (Fig. 3) contain identifiable radiolarian faunas, both of which are discussed in a separate section.

Nearly all the radiolarians from Section 122-761C-7R-CC are preserved as casts; few or no external structures remain. However, several forms could be identified as *Mita* sp. cf. *M. magnifica* and *Xitus* sp. cf. *X. spicularius*, both of which indicate an undifferentiated late Early Cretaceous (Aptian-Albian) age. Section 122-761C-11R-CC contains a poorly preserved fauna containing ?*Holocryptocanium* sp. and ?*Obesacapsula* sp., which suggest an undifferentiated Early Cretaceous age. Cores 122-761C-23R-23R to 122-761C-30R are barren.

Site 762

Hole 762A

One faunal assemblage was recovered from Hole 762A (19°53.23′S, 112°15.24′E, water depth 1359.9 m) on the western part of central Exmouth Plateau. Section 122-762A-1H-CC contains rare, well-preserved radiolarians of undifferentiated Quaternary age, including *Acrosphaera spinosa*, *Didymocyrtis prismatica*, *Lamprocyclas maritalis*, *Lamprocyrtis* sp. cf. *L. nigriniae*, and *Theocorythium trachelium*.

Hole 762B

Quaternary radiolarian faunas are well represented in Hole 762B (19°53.24′S, 112°15.24′E, water depth 1360.0 m) on the western part of central Exmouth Plateau. Samples 122-762B-1H-1, 90–92 cm, to 122-762B-1H-3, 90–92 cm, all contain radiolarians assignable to the upper Quaternary *Buccinosphaera invaginita* Zone of Sanfilippo et al. (1985). The biostratigraphically diagnostic taxa include *Buccinosphaera invaginita*, *Didymocyrtis tetrathalamus*, *Lamprocyrtis nigriniae*, and *Stylacontarium acquilonium*. Section 122-762B-1H-CC contains moderately preserved radiolarians assignable to either the upper Quaternary *Buccinosphaera invaginita* Zone or the *Collosphaera tuberosa* Zone (Sanfilippo et al., 1985). Key marker taxa include *Acrosphaera spinosa*, *Collosphaera tuberosa*, *Lamprocyrtis nigriniae*, *Stylacontarium acquilonium*, and *Theocorythium trachelium*. The interval from Sample 122-762B-2H-1, 76–78 cm, to Section 122-762B-2H-CC contains undifferentiated mid-Quaternary radiolarians, including *Axoprunum angelinum*, *Anthrocyrtidium* spp., *Phormostichoartus doliolum*, and *Theocorythium trachelium*. Radiolarians assignable to the lower Quaternary *Amphirhopalum ypsilon* or *Anthrocyrtidium angulare* Zones of Sanfilippo et al. (1985) were extracted from Samples 122-762B-3H-1, 74–76 cm, to 122-762B-3H-5, 74–76 cm. Sections 122-762B-3H-CC to 122-762B-17H-CC are barren of radiolarians.

Hole 762C

Hole 762C is also on the western part of central Exmouth Plateau, at 19°53.23′S, 112°15.24′E, in a water depth of 1360.0 m.

Sections 122-762C-2X-CC and 122-762C-3X-CC are barren of radiolarians. Sample 122-762C-4X-3, 75–77 cm, contains the lower Oligocene marker taxon *Theocyrtis tuberosa*. Section 122-762C-4X-CC contains a relatively well-preserved fauna assignable to the upper Eocene *Thyrsocyrtis bromia* Zone of Sanfilippo et al. (1985). The key marker taxa include *Carpocanistrum azyx*, *Dictyopora pirum*, and *Theocyrtis tuberosa*, as well as undescribed species of *Axoprunum* and *Theocotyle*. Sections 122-762C-5X-CC to 122-762C-19X-CC are barren. Sample 122-762C-20X-3, 74–76 cm, and Section 122-762C-20X-CC contain poorly preserved lower Eocene radiolarians assignable to the *Buryella clinata* Zone of Sanfilippo et al. (1985), including undescribed *Axoprunum* species, *Buryella clinata*, *B. tetradica*, *Calocycloma castrum*, *Podocyrtis papalis*, and *Spongatractus* sp. cf. *S. balbis*.

Although Sections 122-762C-21X-CC to 122-762C-42X-CC contain fragments of siliceous microfossils, they are too poorly preserved to be biostratigraphically useful. Sections 122-762C-43X-CC and 122-762C-45X-CC yielded poorly preserved Maestrichtian or Campanian radiolarians, including *Dictyomitra* sp. cf. *D. densicostata* and specimens of *Phaseliforma* Pessagno. Sections 122-762C-46X-CC, 122-762C-47X-CC, 122-762C-58X-CC, and 122-762C-64X-CC all contain poorly preserved forms identifiable as undifferentiated Late Cretaceous age. Section 122-762C-44X-CC and most sections from 122-762C-48X-CC to 122-762C-63X-CC not mentioned previously are barren. An undifferentiated Early Cretaceous age was assigned to Section 122-762C-66X-CC on the basis of forms belonging to *Pseudodictyomitra* Pessagno. With the exception of Section 122-762C-79X-CC, which contains forms assignable only to *Pseudodictyomitra* Pessagno and *Stichomitra* Cayeux of undifferentiated Early Cretaceous age, the remaining sections from Core 122-762C-67X to Section 122-762C-89X-CC are barren.

Site 763

Hole 763A

Radiolarian recovery was generally poor and most of the faunas are of low abundance at Hole 763A (20°35.20′S, 112°12.50′E, water depth 1367.5 m) on the western part of central Exmouth Plateau. Samples 122-763A-2H-2, 60–62 cm, and 122-763A-2H-5, 60–62 cm, and Section 122-763A-2H-CC all contain common and well-preserved upper Quaternary radiolarians assignable to the *Collosphaera tuberosa* Zone of Sanfilippo et al. (1985). Individual taxa include *Acrosphaera spinosa*, *Anthrocyrtidium* spp., *Collosphaera tuberosa*, *Didymocyrtis tetrathalamus*, *Lamprocyrtis nigriniae*, *Phormostichoartus corbula*, *P. marylandicus*, and *Stylacontarium acquilonium*. Sample 122-763A-3H-2, 60–62 cm, yielded a sparse, mixed middle Quaternary fauna that includes taxa indicating the *Collosphaera tuberosa* and *Amphirhopalum ypsilon* Zones of Sanfilippo et al. (1985). Sections 122-763A-3H-CC through 122-763A-21H-CC are barren.

Hole 763B

Many of the samples from Hole 763B (20°35.19′S, 112°12.52′E, water depth 1367.5 m) on the western part of central Exmouth Plateau contain unidentifiable radiolarians that are preserved as clear, silica-infilled balls and cones with little or no exterior meshwork remaining. Sections 122-763B-2X-CC through 122-763B-9X-CC are barren. The uppermost occurrence of Cretaceous taxa is in Section 122-763B-10X-CC, which contains forms identifiable only to the generic level; these include *Artostrobium* sp. and *Phaseliforma* sp. Sections 122-763B-11X-CC through 122-763B-21X-CC are barren.

Most of the radiolarian samples from Hole 763B are Cretaceous in age. Poorly preserved middle Cretaceous forms assignable only to the genera *Dictyomitra* Zittel and *Stichomitra* Cayeux were recovered from Sample 122-763B-22X-1, 60–62 cm. Section 122-763B-22X-CC contains common but poorly preserved radiolarians assignable to the upper Cenomanian–lower Turonian part of the *Obesacapsula somphedia* Zone of Sanfilippo and Riedel (1985); identifiable forms include *Alievium* spp., *Pseudoaulophacus* spp., *Pseudodictyomitra pseudomacrocephala*, *Stichomitra communis*, *Stichomitra* spp., and *Thanarla veneta*. The fauna from Sample 122-763B-23X-1, 60–62 cm, is sparse but it does possess *Thanarla veneta* of Cenomanian or Turonian age. Sections 122-763B-24X-CC through 122-763B-30X-CC are barren. The presence of *Thanarla* sp. in Section 122-763B-31X-CC indicates an undifferentiated Valanginian to Cenomanian age. Sections 122-763B-32X-CC through 122-763B-36X-CC are all barren.

Section 122-763B-37X-CC contains moderately preserved Lower Cretaceous (Albian) radiolarians assignable to the lower part of the *Acaeniotyle umbilicata* Zone of Sanfilippo and Riedel (1985). The biostratigraphically diagnostic taxa include *Archaeodictyomitra simplex* and *Thanarla pulchra*. Sections 122-763B-38X-CC, 122-763B-41X-CC, and 122-763B-42X-CC all contain poorly preserved forms belonging to the long-ranging Cretaceous radiolarian genera *Cryptoamphorella* Dumitrică, *Pantanellium* Pessagno, *Pseudodictyomitra* Pessagno, *Stichomitra* Cayeux, and *Thanarla* Pessagno. Forms assignable to *Acaeniotyle diaphorogona* and *Thanarla* sp. were recovered from Sample 122-763B-39X-1, 60–62 cm. *Acaeniotyle diaphorogona* has an age range of Berriasian to middle Albian. Sections 122-763B-39X-CC and 122-763B-43X-CC to 122-763B-54X-CC are all barren, with the exception of Section 122-763B-47X-CC and Sample 122-763B-

48X-1, 60–62 cm, which both contain poorly preserved upper Valanginian to Aptian radiolarians identifiable as *Cryptoamphorella* sp., *Pseudodictyomitra* sp. aff. *P. leptoconica*, and *Thanarla* (?) *conica*. Sample 122-763B-48X-5, 60–62 cm, contains *? Obesacapsula* sp., *Pseudodictyomitra leptoconica*, *Syringocapsa* sp., and *Thanarla* sp., all of which indicate a probable Valanginian age.

Hole 763C

Only two samples yielded radiolarians from Hole 763C (20°35.21′S, 112°12.51′E, water depth 1367.5 m) on the western part of central Exmouth Plateau. Sections 122-763C-2R-CC through 122-763C-46R-CC are all barren, with two exceptions. Section 122-763C-22R-CC contains poorly preserved forms (*Archaeodictyomitra apiara* and *Thanarla* (?) *conica*) that indicate an undifferentiated Berriasian to late Valanginian age. The fauna in Section 122-763C-35R-CC is completely replaced by pyrite, and most of the radiolarians are preserved as casts and molds. Identifiable taxa include ?*Mirifusus* sp., *Parvicingula* (?) *jonesi*, and *Parvicingula* sp., which suggest either an Early Cretaceous (Berriasian) or Late Jurassic (Tithonian) age.

Site 764

Hole 764A

Radiolarians were recovered from only three samples from Hole 764A (16°33.96′S, 115°27.43′E, water depth 2698.6 m) on the northeast part of the Wombat Plateau. Sample 122-764A-1R-4, 140–142 cm, contains sparse late Quaternary age radiolarians assignable to either the *Buccinosphaera invaginita* Zone or the *Collosphaera tuberosa* Zone of Sanfilippo et al. (1985). Section 122-764A-7R-CC contains pyritized casts of partial tests, as well as fragments of radiolarian spines questionably identified as *Ferresium* Blome. This genus has been reported from Upper Triassic (upper Norian and Rhaetian) sequences in western North America, Japan, and New Zealand (Blome, 1984).

Hole 764B

Hole 764B is at 16°33.96′S, 115°27.43′E, in a water depth of 2698.6 m on the northeast part of the Wombat Plateau. Section 122-764B-20R-CC contains fragments questionably assigned to *Ferresium*.

Cherts

Chert is sporadically present in Holes 761B, 761C, and 762C. Of the 10 chert samples examined for radiolarians, only three (Samples 122-761B-28X-CC, 14–16 cm; 122-761C-5R-2, 147–149 cm; and 122-761C-6R-1, 31–33 cm; Figs. 2 and 3) contain identifiable radiolarian faunas, all of which are Cretaceous in age. The other samples (122-761B-14X-3, 117–119 cm; 122-761B-20X-1, 99–101 cm; 122-761C-2R-1, 126–129 cm; 122-762C-7X-3, 34–36 cm; 122-762C-5X-CC; 122-762C-8X-3, 65–67 cm; and 122-762C-21X-1, 118–120 cm) contain mostly foraminifers. Many of the radiolarians observed in thin section are partly calcified. Many of the cherty samples are actually silicified mudstones (Pl. 5, Figs. 1–5), whereas the radiolarian-producing samples are cherty (Pl. 5, Fig. 6).

The chert interval in Sample 122-761B-28X-CC, 14–16 cm, contains abundant, small spherules questionably identified as pisolites (Pl. 5, Fig. 1). This sample contains upper Lower Cretaceous (upper Albian) radiolarians assignable to the *Petasiforma foremanae* Zone of Pessagno (1977; equivalent to the upper part of the *Acaeniotyle umbilicata* Zone of Sanfilippo and Riedel, 1985). Taxa present include *Acaeniotyle diaphorogona*, *Alievium* spp., *Archaeodictyomitra simplex*, *Mita gracilis*, *Thanarla pulchra*, *Spongocapsula zamoraensis*, *Stichomitra* (?) *communis*, and *Zifondium lassenensis*.

The chert interval in Sample 122-761C-5R-2, 147–149 cm, contains a lower Upper Cretaceous (middle to upper Cenomanian) fauna assignable to the *Rotaforma hessi* Zone of Pessagno (1976; equivalent to the lower part of the *Obesacapsula somphedia* Zone of Sanfilippo and Riedel, 1985). Age-diagnostic taxa include *Archaeodictyomitra sliteri*, *A.* (?) *turris*, *Halesium sexangulum*, *Mita gracilis*, *Pseudodictyomitra pseudomacrocephala* (i.e., large nassellarian illustrated in Pl. 5, Fig. 2), *Novixitus mclaughlini*, *Novixitus* spp., *Patulibracchium inaequalum*, *Stichomitra communis*, *S.* (?) *euganae*, *S.* (?) *zamoraensis*, and *Thanarla elegantissima*. Silicified foraminifers are abundant (Pl. 5, Fig. 2), and partial calcium carbonate replacement of the radiolarian tests is common (Pl. 5, Fig. 3).

The chert interval in Sample 122-761C-6R-1, 31–33 cm, contains lower Upper Cretaceous (middle Albian) taxa with concurrent ranges near the boundary separating the *Kozurium zingulai* and *Petasiforma foremanae* Zones of Pessagno (1977; equivalent to the upper part of the *Acaeniotyle umbilicata* Zone of Sanfilippo and Riedel, 1985). Diagnostic taxa include *Acaeniotyle diaphorogona*, *A. umbilicata*, *Acanthocircus dendrocanthus*, *Archaeodictyomitra squinaboli*, *Mita magnifica*, *Pseudodictyomitra carpatica*, *Xitus spicularius*, *X. spineus*, and *Zifondium lassenensis*. This fauna is the best preserved of all the chert radiolarian faunas; most of the radiolarians are infilled with silica (large nassellarian in Pl. 5, Fig. 5) and not partially replaced by carbonate.

PALEOCENE RADIOLARIAN TAXONOMY

A short systematic section is included because many of the Leg 122 Paleocene taxa have had little or no systematic treatment. Only genera and species are discussed, listed in alphabetical order. The brief synonomies include only the origin of the specific names.

Genus *AMPHISPHAERA* Haeckel, 1881
Amphisphaera minor (Clark and Campbell)
(Pl. 3, Fig. 23)

Stylosphaera minor Clark and Campbell, 1942, p. 27, pl. 5, figs. 1, 2, 12.
Amphisphaera minor (Campbell and Clark) *in* Sanfilippo and Riedel, 1973, p. 486, pl. 1, figs. 1–5; pl. 22, fig. 4.

Genus *AMPHIPTERNIS* Foreman, 1973
Amphipternis sp. cf. ?*Stichomitra alamedaensis* (Campbell and Clark)
(Pl. 2, Fig. 5)

cf. *Phormocampe* (*Cyrtocorys*) *alamedaensis* Campbell and Clark, 1944b, p. 37, pl. 7, fig. 41.
cf. *Phormocampe* (*Cyrtocorys*) *alamedaensis* var. *tenuis* Campbell and Clark, 1944b, p. 37, pl. 7, figs. 35–36.
cf. ?*Stichomitra alamedaensis* (Campbell and Clark) *in* Foreman, 1968, p. 77, pl. 8, fig. 4.
Amphipternis sp. cf. ?*Stichomitra alamedaensis* (Campbell and Clark) *in* Foreman, 1973, p. 430, pl. 7, fig. 18; pl. 9, fig. 1.

Genus *AMPHYMENIUM* Haeckel, 1881
Amphymenium splendiarmatum Campbell and Clark
(Pl. 2, Fig. 10)

Amphymenium splendiarmatum Campbell and Clark, 1942, p. 46, pl. 1, figs. 12, 14. Sanfilippo and Riedel, 1973, p. 524, pl. 11, figs. 6–8; pl. 28, figs. 6–8.

Remarks. All of the Leg 122 two-armed spongdiscids possess chambered arms with spongy terminations that are conical or flatly expanded.

ASTROSPHAERINS
(cf. Sanfilippo and Riedel, 1973)

Remarks. According to Foreman (1973), little is known about astrosphaerins and whether they should be included as a subfamily of the Actinommidae Haeckel (in the sense of Riedel, 1967).

Astrosphaerin sp. E
(Pl. 4, Fig. 11)

Sanfilippo and Riedel, 1973, p. 488, pl. 6, figs. 3–6; pl. 23, fig. 1.

Remarks. Astrosphaerin sp. E differs from sp. F by having two curved and one straight projections.

Astrosphaerin sp. F
(Pl. 4, Fig. 12)

Sanfilippo and Riedel, 1973, p. 488, pl. 6, figs. 7–8; pl. 23, fig. 2.

Genus *BATHROPYRAMIS* Haeckel, 1881
Bathropyramis (*Acropyramis*) sp. cf. *B. woodringi* Campbell and Clark, 1944a
(Pl. 4, Fig. 6)

Bathropyramis (*Acropyramis*) *woodringi* Campbell and Clark, 1944a, p. 39, pl. 5, figs. 21–22.

Remarks. This form differs from *B. woodringi* by having a larger number and thinner radial beams with offsetting horizontal bars.

Genus *BEKOMA* Riedel and Sanfilippo, 1971
Bekoma campechensis Foreman
(Pl. 4, Figs. 15, 17)

Foreman, 1973, p. 432, pl. 3, fig. 24; pl. 10, figs. 1–2; p. 444, fig. 4.

Bekoma sp. aff. *B. campechensis* Foreman
(Pl. 4, Fig. 7)

Remarks. *Bekoma* sp. aff. *B. campechensis* differs from *B. campechensis* by having shorter, less robust, and slightly curved feet.

Bekoma divaricata Foreman
(Pl. 4, Fig. 13)

Foreman, 1973, p. 433, pl. 3, fig. 23; pl. 10, figs. 3–4.

Genus *BURYELLA* Foreman, 1973
Buryella sp. cf. *B. clinata* Foreman
(Pl. 1, Fig. 3)

Buryella clinata Foreman, 1973, p. 433, pl. 8, figs. 1–3; pl. 9, fig. 19.

Buryella pentadica Foreman
(Pl. 3, Figs. 4, 5)

Foreman, 1973, p. 433, pl. 8, fig. 8; pl. 9, figs. 15–16.

Buryella tetradica Foreman
(Pl. 1, Figs. 7, 8)

Foreman, 1973, p. 433, pl. 8, figs. 4–5; pl. 9, figs. 13–14.

Remarks. This species has been found in Paleocene and lower Eocene assemblages from tropical localities in all three major oceans (Sanfilippo et al., 1985).

Buryella sp. A
(Pl. 1, Figs. 1, 2)

Remarks. *Buryella* sp. A differs from others species of *Buryella* in this report by possessing a less curved test and a prominent cephalis.

Genus *CERATOSPYRIS* Ehrenberg, 1847
Ceratospyris sp. aff. *C. articulata* Ehrenberg
(Pl. 2, Figs. 12, 13)

Ceratospyris articulata Ehrenberg, 1873, p. 218, pl. 20, fig. 4.

Genus *CLATHROCYCLOMA* Haeckel, 1887
Clathrocycloma parcum Foreman
(Pl. 4, Figs. 1, 2)

Foreman, 1973, pp. 434–435, pl. 2, fig. 13; pl. 11, fig. 12.

Clathrocycloma sp. A
(Pl. 2, Fig. 18)

Clathrocycloma spp., Foreman, 1973, pl. 2, fig. 12.

Remarks. This form differs from *C. parcum* by possessing a broad skirt and finer pore frames.

Genus *CORNUTELLA* Ehrenberg, 1838, emend. Nigrini, 1967
Cornutella californica Campbell and Clark, emend. Foreman, 1968
(Pl. 3, Figs. 13, 24)

Campbell and Clark, 1944b, pp. 22–23, pl. 7, figs. 33–34, 42–43; emend. Foreman, 1968, pp. 21–22, pl. 3, figs. 1a–1c.

Genus *DICTYOCERAS* Haeckel, 1862
Dictyoceras caia Foreman
(Pl. 3, Fig. 12)

Foreman, 1973, p. 435, pl. 2, fig. 7; pl. 9, fig. 21.

Genus *DICTYOMITRA* Zittel, 1876
Dictyomitra andersoni (Campbell and Clark), emend. Foreman, 1968
(Pl. 1, Fig. 12)

Lithocampe (*Lithocampanula*) *andersoni* Campbell and Clark, 1944b, p. 42, pl. 8, fig. 25.
Dictyomitra (*Dictyomitroma*) *multicostata* Zittel *in* Campbell and Clark, 1944b, p. 39, pl. 8, figs. 22–24, 29, 35.
Lithomitra (*Lithomitrissa*) *regina* var. *subconica* Campbell and Clark, 1944b, p. 41, pl. 8, fig. 28.
Dictyomitra (*Dictyomitroma*) *tiara* Campbell and Clark, 1944b, p. 40, pl. 8, figs. 1–4, 12.
Dictyomitra andersoni (Campbell and Clark) *in* Foreman, 1968, p. 68, pl. 7, figs. 6a–6d.

Genus *DORCADOSPYRIS* Haeckel, 1881
Dorcadospyris sp. cf. *D. platyacantha* (Ehrenberg)
(Pl. 2, Figs. 2–4)

Petalospyris platyacantha Ehrenberg, 1873, p. 247; 1875, pl. 22, fig. 8.
Dorcadospyris confluens (Ehrenberg) *in* Goll, 1969, p. 337, pl. 58, figs. 9–12.
Dorcadospyris platyacantha (Ehrenberg) *in* Sanfilippo and Riedel, 1973, p. 528, pl. 17, figs. 11–15; pl. 33, fig. 2.

Remarks. These forms differ from *D. platyacantha* by possessing more divergent and less flattened feet.

Dorcadospyris sp. A
(Pl. 1, Figs. 9, 10)

Remarks. This form differs from *D. platyacantha* by lacking an apical spine and possessing a smaller, thinner sagittal ring with thinner sagittal spines.

Dorcadospyris sp. B
(Pl. 2, Fig. 19)

Remarks. This form differs from *D. platyacantha* by having a larger inflated cephalis.

Genus *ENTAPIUM* Sanfilippo and Riedel, 1973
Entapium chaenapium Sanfilippo and Riedel
(Pl. 4, Fig. 5)

Sanfilippo and Riedel, 1973, pp. 491–492, pl. 1, fig. 3; pl. 23, figs. 9–12.

Entapium regulare Sanfilippo and Riedel
(Pl. 3, Fig. 20)

Sanfilippo and Riedel, 1973, p. 492, pl. 2, figs. 10–19; pl. 24, figs. 1–3.

Entapium sp. A
(Pl. 3, Fig. 22)

Remarks. This undescribed form differs from *E. regulare* Sanfilippo and Riedel in possessing a smaller cortical shell with longer, more massive bladed spines and differs from *E. chaenapium* Sanfilippo and Riedel by having six or more bladed primary spines.

Genus *HELIOSTYLUS* Haeckel, 1881
Heliostylus sp.
(Pl. 4, Fig. 10)

Heliostylus spp. *in* Sanfilippo and Riedel, 1973, p. 522, pl. 8, figs. 1–2; pl. 27, fig. 1.

Remarks. Sanfilippo and Riedel (1973) applied this generic name to all phacodiscids in which two opposite bars connect the cortical and outer medullary shells.

Genus *LITHOCHYTRIS* Ehrenberg, 1847
?*Lithochytris* sp. A
(Pl. 3, Figs. 8, 9)

Remarks. This form differs from other taxa belonging to this genus (cf. Foreman, 1973, p. 436) by having thinner walls with larger pores and spines projecting from the large thorax vs. the abdomen.

Genus *LITHOMESPILUS* Haeckel, 1881
Lithomespilus mendosa (Krasheninnikov)
(Pl. 2, Figs. 16, 17)

Ellipsidium (?) *mendosum* Krasheninnikov, 1960, p. 281, pl. 1, fig. 14.
Ellipsidium cultum Borisenko, 1960, p. 224, pl. 3, fig. 4.
Lithomespilus mendosa (Krasheninnikov) *in* Riedel and Sanfilippo, 1973, pp. 517–518, pl. 4, figs. 6–7; pl. 24, figs. 10–11.

Genus *LITHOMITRA* Bütschli, 1882
Lithomitra docilis Foreman
(Pl. 1, Fig. 4)

Foreman, 1973, p. 431, pl. 8, figs. 20–22; pl. 9, figs. 3–5.

Remarks. This taxon first appears in the lowermost Paleocene and ranges into the lower Oligocene. It also differs from forms placed by Nigrini (1977) into the *Siphocampe lineata* group in possessing an upward-directed tube and differently arranged pores.

Genus *LYCHNOCANOMA* Haeckel, 1887
Lychnocanoma sp. A
(Pl. 3, Figs. 1, 17)

Lamptonium pennatum Foreman *in* Sanfilippo and Riedel, 1979, p. 504, pl. 1, figs. 3–4.

Remarks. This form is similar to the forms assigned to *L. pennatum* by Sanfilippo and Riedel (1979) but differs in possessing a less rounded thorax.

Lychnocanoma sp. B
(Pl. 2, Figs. 7, 11)

Remarks. This distinct form differs from sp. A by possessing a tapering thorax and an incomplete abdomen with a ragged termination. It also has more slender feet.

Lychnocanoma sp. C
(Pl. 3, Figs. 11, 16)

Remarks. This form differs from the species of *Lychnocanoma* discussed previously by possessing a large, bladed horn and long bladed feet.

Lychnocanoma sp. D
(Pl. 3, Figs. 14, 21)

Lychnocanoma sp. *in* Westberg et al., 1980, pl. 1, fig. 12.

Remarks. This form differs from *L. anacolum*, *L. auxilla*, and other species of *Lychnocanoma* by possessing a small horn and an inflated thorax.

Lychnocanoma sp. E
(Pl. 3, Fig. 15)

?*Dictyophimus* spp. *in* Dumitrică, 1973, p. 788, pl. 7, figs. 5–6, 8–9.

Remarks. This form differs from sp. D by having feet that radiate out from the test at a relatively high angle and a long, tubular third segment.

?*Lychnocanoma* sp. F
(Pl. 2, Fig. 1)

Remarks. This form is questionably assigned to *Lychnocanoma* because it lacks a definable third segment. It also differs from sp. A and sp. B by possessing a larger cephalis and curved feet.

Genus *PERIPHAENA* Ehrenberg, 1873
Periphaena decora Ehrenberg
(Pl. 4, Fig. 14)

Periphaena decora Ehrenberg, 1873, p. 246; 1875, pl. 28, fig. 6. Riedel, 1957, p. 258, pl. 62, fig. 1. Sanfilippo and Riedel, 1973, p. 523, pl. 8, figs. 8–10; pl. 27, figs. 2–5.
Haliomma humboldti Ehrenberg, 1854, pl. 36, fig. 27; 1875, pl. 27, fig. 3.
Heliodiscus humboldti (Ehrenberg) *in* Haeckel, 1887, p. 449. Riedel, 1957, p. 258, pl. 62, fig. 2.
Heliodiscus cingillum Haeckel, 1887, p. 448, pl. 33, fig. 7.
Periphaena cincta Haeckel, 1887, p. 426, pl. 33, fig. 4.
Perizona scutella Haeckel, 1887, p. 427, pl. 32, fig. 7.

Remarks. This species differs from *Periphaena heliasteriscus* (Clark and Campbell) by having a girdle of varying width (Leg 122 forms have a narrow girdle), with or without spines.

Genus *PHORMOCYRTIS* Haeckel, 1887
Phormocyrtis striata exquisita (Kozlova)
(Pl. 3, Figs. 6, 7)

Pododcyrtis exquisita Kozlova *in* Kozlova and Gorbovets, 1966, p. 106, pl. 17, fig. 2.
Phormocyrtis striata Brandt *in* Riedel and Sanfilippo, 1971, pl. 8, fig. 4.
Phormocyrtis striata exquisita (Kozlova) *in* Foreman, 1973, p. 438, pl. 7, figs. 1–4, 7–8; pl. 12, fig. 5.

Phormocyrtis striata striata Brandt
(Pl. 2, Fig. 6)

Phormocyrtis striata Brandt *in* Wetzel, 1935, p. 55, pl. 9, fig. 12. Riedel and Sanfilippo, 1970, p. 532, pl. 10, fig. 7.
Phormocyrtis striata striata Brandt *in* Foreman, 1973, p. 438, pl. 7, figs. 5–6, 9.

Genus *PTEROCODON* Ehrenberg, 1847
Pterocodon (?) *ampla* (Brandt)
(Pl. 2, Figs. 14, 15)

?*Theocyrtis ampla* Brandt *in* Wetzel, 1935, p. 56, pl. 9, figs. 13–15.
?*Theocorys unicum* Lipman *in* Lipman et al., 1960, p. 97, pl. 12, fig. 11. Kozlova *in* Kozlova and Gorbovets, 1966, p. 109, pl. 17, fig. 5.
Pterocodon (?) *ampla* (Brandt) *in* Foreman, 1973, pp. 438–439, pl. 5, figs. 3–5.

Remarks. There is considerable variation in test wall thickness, shape of the apical spine and thorax, and arrangement of pores in both the Leg 122 morphotypes and those illustrated by Foreman (1973).

This species ranges across the Paleocene/Eocene boundary and has been recovered from northern Europe, the tropical Pacific, Gulf of Mexico, and the Caribbean (Sanfilippo et al., 1985).

Genus *SATURNULUS* Haeckel, 1881, emend. Nigrini, 1967
Saturnulus sp. A
(Pl. 4, Fig. 9)

?*Saturnulus* sp. cf. *planetes* Haeckel *in* Dumitrică, 1973, p. 787, pl. 1, fig. 8.

Genus *SIPHOCAMPE* Haeckel, 1881, emend. Nigrini, 1977
Siphocampe sp. aff. *S. arachnea* (Ehrenberg) group
(Pl. 1, Figs. 5, 6)

Lithocampe lineata Ehrenberg, 1838, p. 130.
Eucyrtidium lineata (Ehrenberg) *in* Ehrenberg, 1854, pl. 22, fig. 26; pl. 36, fig. 16C.
Lithomitra lineata (Ehrenberg) group Riedel and Sanfilippo, 1971, p. 1600, pl. 11, figs. 1–11; pl. 21, figs. 14–16; pl. 3E, fig. 14. Foreman, 1973, p. 431, pl. 8, fig. 19.
Siphocampe arachnea (Ehrenberg) group Nigrini, 1977, p. 255, pl. 3, figs. 7–8.

Remarks. The Leg 122 forms differ from *S. arachnea* by possessing post-thoracic segmentations with more pronounced constrictions both proximally and distally between pore rows. The morphotype illustrated by Foreman (1973) as belonging to the *Lithomitra lineata* (Ehrenberg) group is similar to forms figured in this report.

Genus *SPONGODISCUS* Ehrenberg, 1854
Spongodiscus sp. A
(Pl. 4, Fig. 16)

Spongodiscus sp. *in* Sanfilippo and Riedel, 1973, pl. 11, figs. 18–19.

Genus *SPONGURUS* Haeckel, 1887
Spongurus (*Spongurantha*) *quadratus* Campbell and Clark
(Pl. 3, Fig. 19)

Campbell and Clark, 1944b, p. 13, pl. 5, fig. 9.
Spongurus spp. *in* Dumitrică, 1973, p. 788, pl. 5, figs. 1–3.

Remarks. This species, illustrated in a line drawing in Campbell and Clark (1944b), is similar to the Leg 122 forms.

Genus *STYLOSPHAERA* Ehrenberg, 1847
Stylosphaera coronata coronata Ehrenberg
(Pl. 1, Figs. 11, 15)

Stylosphaera coronata Ehrenberg, 1873, p. 258; 1875, pl. 25, fig. 4.
Druppatractus trichopterus Clark and Campbell, 1942, p. 34, pl. 5, fig. 4.
?*Lothatractus hederae* Clark and Campbell, 1942, p. 33, pl. 5, fig. 3.
?*Druppatractus polycentrus* Clark and Campbell, 1942, p. 35, pl. 5, fig. 19.
?*Druppatractus parasagittatus* Middour *in* Frizzell and Middour, 1951, p. 21, pl. 2, figs. 11–12.
Stylosphaera coronata coronata Ehrenberg *in* Sanfilippo and Riedel, 1973, p. 520, pl. 1, figs. 13–17; pl. 25, fig. 4.

Stylosphaera goruna Sanfilippo and Riedel
(Pl. 1, Figs. 17–20)

Sanfilippo and Riedel, 1973, p. 521, pl. 1, fig. 19; pl. 25, figs. 5–6.

Stylosphaera sp. A
(Pl. 1, Figs. 13, 14)

Remarks. This form differs from *S. coronata coronata* by possessing shorter three-bladed spines of equal or nearly equal length.

Stylosphaera sp. B
(Pl. 1, Fig. 16)

Remarks. This form differs from species of *Stylosphaera* discussed previously by possessing two long-bladed spines of equal or nearly equal length.

Genus *STYLOTROCHUS* Haeckel, 1862
Stylotrochus alveatus Sanfilippo and Riedel
(Pl. 4, Fig. 8)

Sanfilippo and Riedel, 1973, p. 525, pl. 13, figs. 4–5; pl. 30, figs. 3–4.

Stylotrochus nitidus Sanfilippo and Riedel
(Pl. 3, Fig. 10)

Sanfilippo and Riedel, 1973, p. 525, pl. 13, figs. 9–14; pl. 30, figs. 7–10.

Genus *THEOCORYS* Haeckel, 1881
Theocorys phyzella Foreman
(Pl. 2, Figs. 8, 9)

Foreman, 1973, p. 440, pl. 5, fig. 8; pl. 12, fig. 1.

Theocorys sp. cf. *T. phyzella* Foreman
(Pl. 3, Figs. 2, 3)

Remarks. This form differs from *T. phyzella* by having a greater stricture between the cephalis and abdomen and a more inflated abdomen.

Genus *THECOSPHAERELLA* Haeckel, 1887
Thecosphaerella ptomatus Sanfilippo and Riedel
(Pl. 3, Fig. 18)

Sanfilippo and Riedel, 1973, pp. 521–522, pl. 3, figs. 14–18; pl. 26, fig. 2.

Genus *VELICUCULLUS* Riedel and Campbell, 1952
Velicucullus sp.
(Pl. 4, Fig. 3)

Velicucullus sp. *in* Sanfilippo and Riedel, 1973, p. 530, pl. 20, fig. 5.

Genus *XIPHOSPIRA* Haeckel, 1887
Xiphospira circularis (Clark and Campbell)
(Pl. 4, Fig. 4)

Porodiscus circularis Clark and Campbell, 1942, p. 42, pl. 2, figs. 2, 6, 10.
Xiphodictya amphixiphos Clark and Campbell, 1942, p. 43, pl. 2, fig. 4.
Xiphospira circularis (Clark and Campbell) 1942 *in* Sanfilippo and Riedel, 1973, p. 526, pl. 14, figs. 5–12; pl. 31, figs. 4–7.

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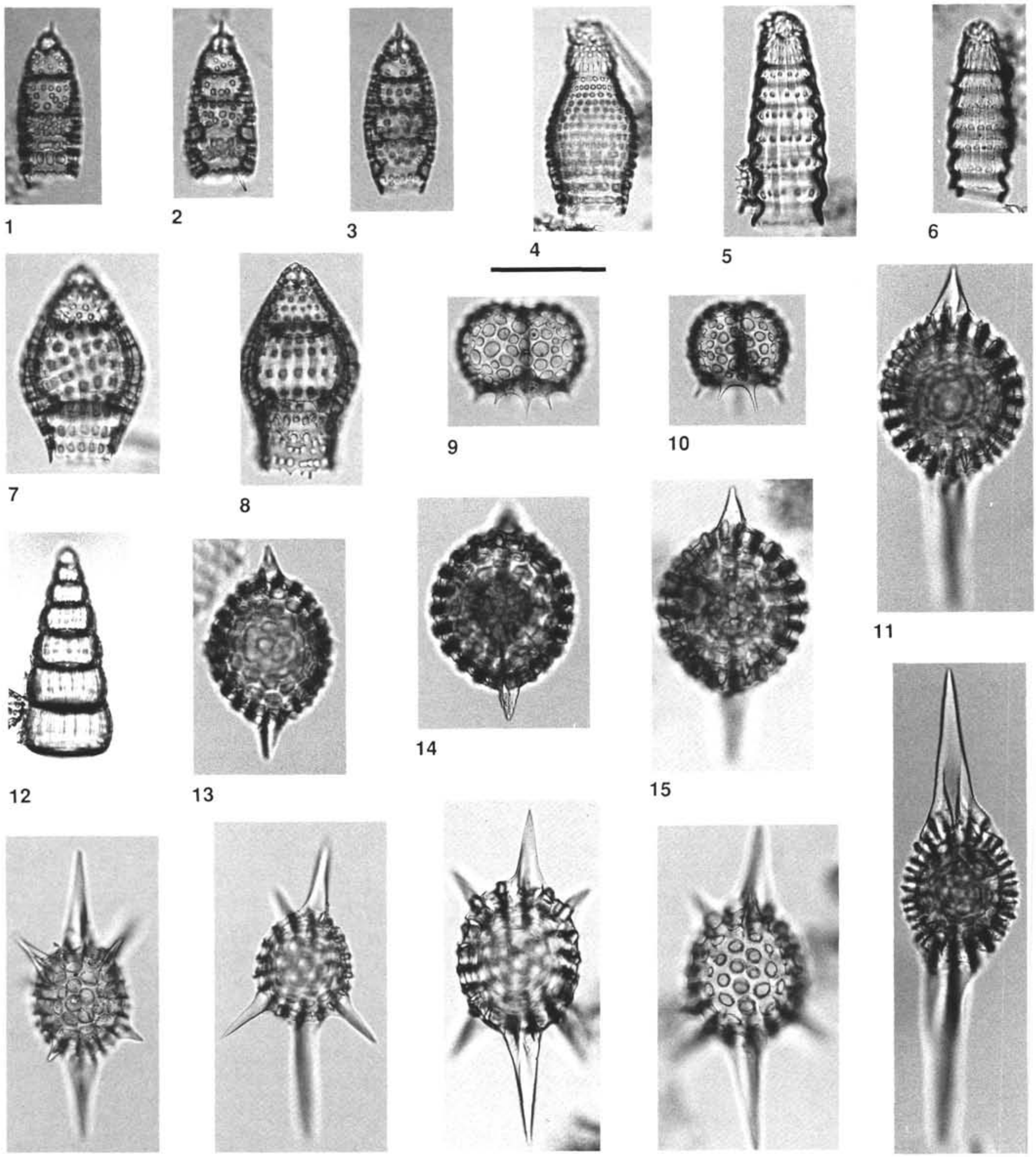

Plate 1. Scale bar = 80 μm. **1, 2.** *Buryella* sp. A; Sample 122-761B-17X-4, 67–69 cm. **3.** *Buryella* sp. cf. *B. clinata*; Sample 122-761B-17X-3, 67–69 cm. **4.** *Lithomitra docilis*; Sample 122-761B-17X-1, 133–136 cm. **5, 6.** *Siphocampe* sp. aff. *S. arachnea*; (5) Sample 122-761B-18X-4, 67–69 cm, (6) Sample 122-761B-17X-3, 133–136 cm. **7, 8.** *Buryella tetradica*; Section 122-761B-16X-CC. **9, 10.** *Dorcadospyris* sp. A; Sample 122-761B-17X-3, 67–69 cm. **11, 15.** *Stylosphaera coronata coronata*; Sample 122-761B-17X-1, 133–136 cm. **12.** *Dictyomitra andersoni*; Sample 122-761B-18X-1, 67–69 cm. **13, 14.** *Stylosphaera* sp. A; Sample 122-761B-17X-5, 67–69 cm. **16.** *Stylosphaera* sp. B; Sample 122-761B-18X-2, 67–69 cm. **17–20.** *Stylosphaera goruna*; (17–19) Section 122-761B-16X-CC, (20) Sample 122-761B-17X-3, 133–136 cm.

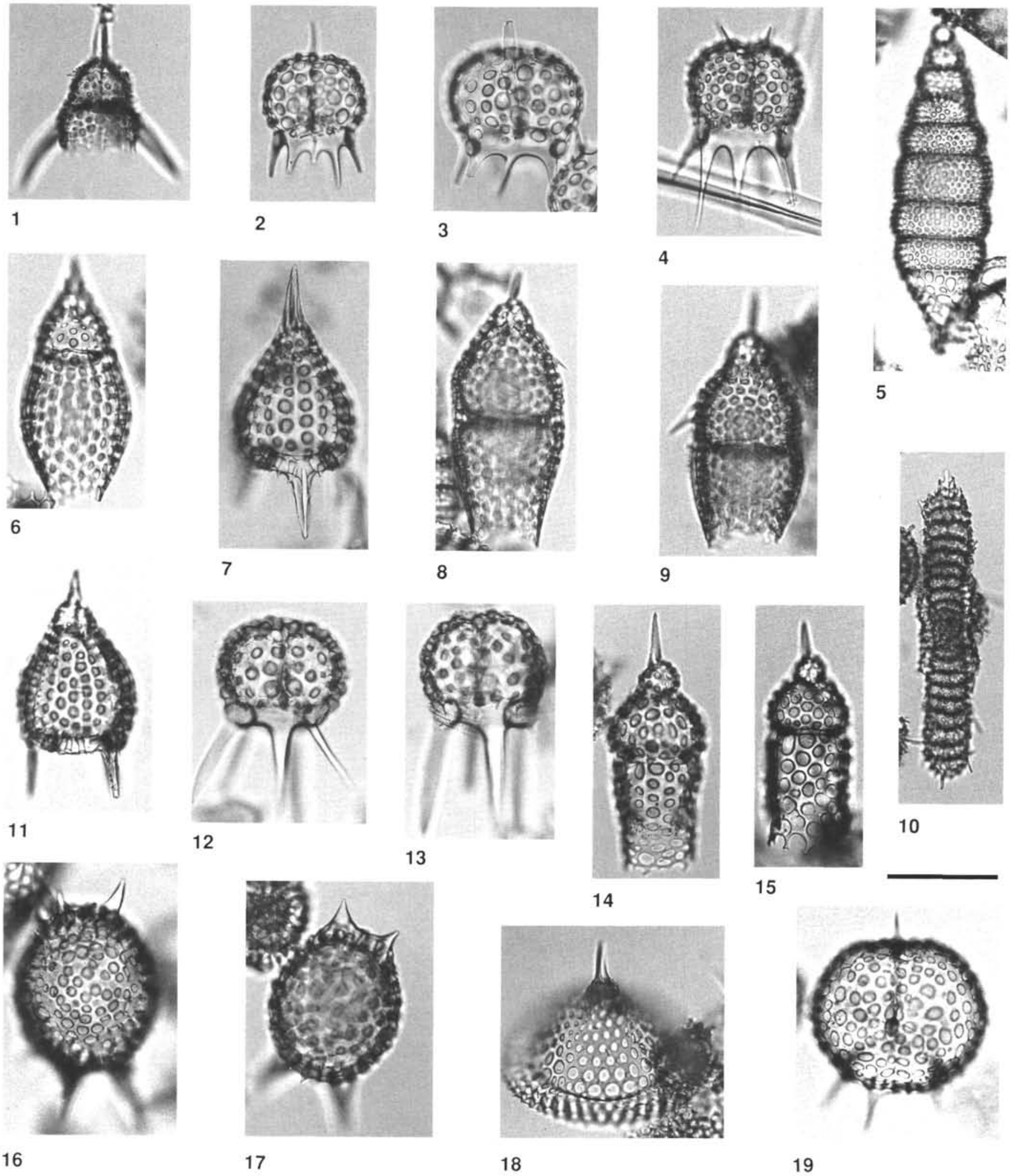

Plate 2. Scale bar = 80 μm. **1.** *?Lychnocanoma* sp. F; Sample 122-761B-17X-4, 67–69 cm. **2–4.** *Dorcadospyris* sp. cf. *D. platyacantha*; (2, 4) Sample 122-761B-17X-4, 67–69 cm, (3) Section 122-761B-16X-CC. **5.** *Amphipternis* sp. cf. *?Stichomitra alamedaensis*; Sample 122-761B-17X-2, 67–69 cm. **6.** *Phormocyrtis striata striata*; Section 122-761B-16X-CC. **7, 11.** *Lychnocanoma* sp. B; Section 122-761B-16X-CC. **8, 9.** *Theocorys phyzella*; (8) Sample 122-761B-17X-5, 67–69 cm, (9) Sample 122-761B-17X-1, 133–136 cm. **10.** *Amphymenium splendiarmatum*; Sample 122-761B-17X-2, 67–69 cm. **12, 13.** *Ceratospyris* sp. aff. *C. articulata*; Sample 122-761B-17X-1, 133–136 cm. **14, 15.** *Pterocodon* (?) *ampla*; (14) Sample 122-761B-18X-2, 67–69 cm, (15) Section 122-761B-17X-CC. **16, 17.** *Lithomespilus mendosa*; (16) Sample 122-761B-17X-1, 133–136 cm, (17) Sample 122-761B-18X-2, 67–69 cm. **18.** *Clathrocycloma* sp. A; Sample 122-761B-17X-3, 67–69 cm. **19.** *Dorcadospyris* sp. B; Section 122-761B-16X-CC.

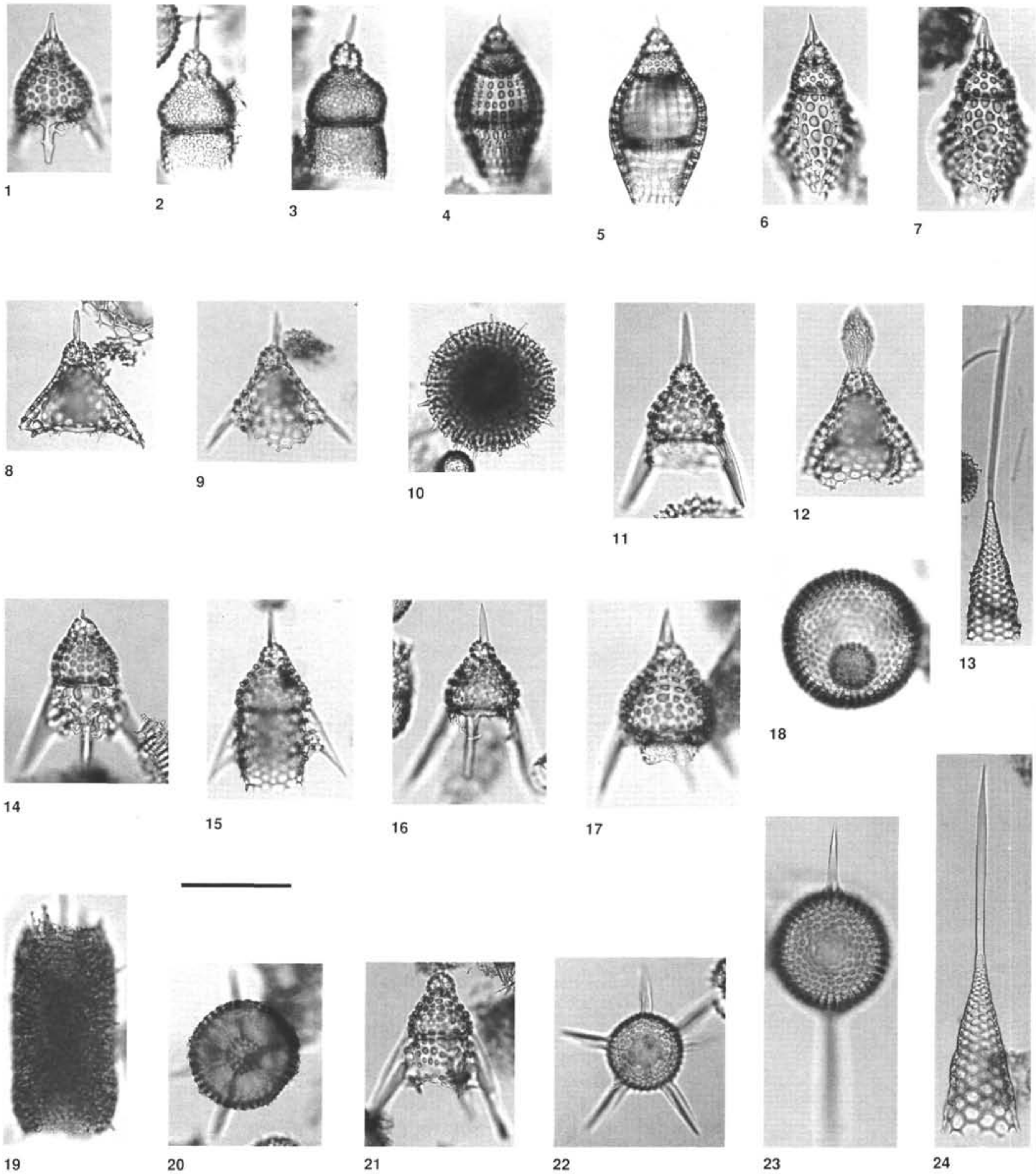

Plate 3. Scale bar = 60 μm. **1, 17.** *Lychnocanoma* sp. A; Sample 122-761B-17X-2, 67–69 cm. **2, 3.** *Theocorys* sp. cf. *T. phyzella*; (2) Sample 122-761B-18X-4, 67–69 cm, (3) Sample 122-761B-17X-2, 67–69 cm. **4, 5.** *Buryella pentadica*; (4) Sample 122-761B-17X-3, 133–136 cm, (5) Section 122-761B-17X-CC. **6, 7.** *Phormocyrtis striata exquisita*; (6) Sample 122-761B-17X-3, 67–69 cm, (7) Sample 122-761B-17X-2, 67–69 cm. **8, 9.** ?*Lithochytris* sp. A; Sample 122-761B-17X-6, 67–69 cm. **10.** *Stylotrochus nitidus*; Sample 122-761B-17X-1, 67–69 cm. **11, 16.** *Lychnocanoma* sp. C; Sample 122-761B-17X-4, 67–69 cm. **12.** *Dictyoceras caia*; Sample 122-761B-17X-3, 67–69 cm. **13, 24.** *Cornutella californica*; (13) Sample 122-761B-17X-2, 133–136 cm, (24) Sample 122-761B-18X-6, 67–69 cm. **14, 21.** *Lychnocanoma* sp. D; (14) Sample 122-761B-18X-1, 74–79 cm, (21) Sample 122-761B-17X-2, 67–69 cm. **15.** *Lychnocanoma* sp. E; Section 122-761B-17X-CC. **18.** *Thecosphaerella ptomatus*; Section 122-761B-18X-CC. **19.** *Spongurus* (*Spongurantha*) *quadratus*; Section 122-761B-18X-CC. **20.** *Entapium regulare*; Sample 122-761B-17X-1, 133–136 cm. **22.** *Entapium* sp. A; Sample 122-761B-18X-3, 67–69 cm. **23.** *Amphisphaera minor*; Sample 122-761B-17X-3, 67–69 cm.

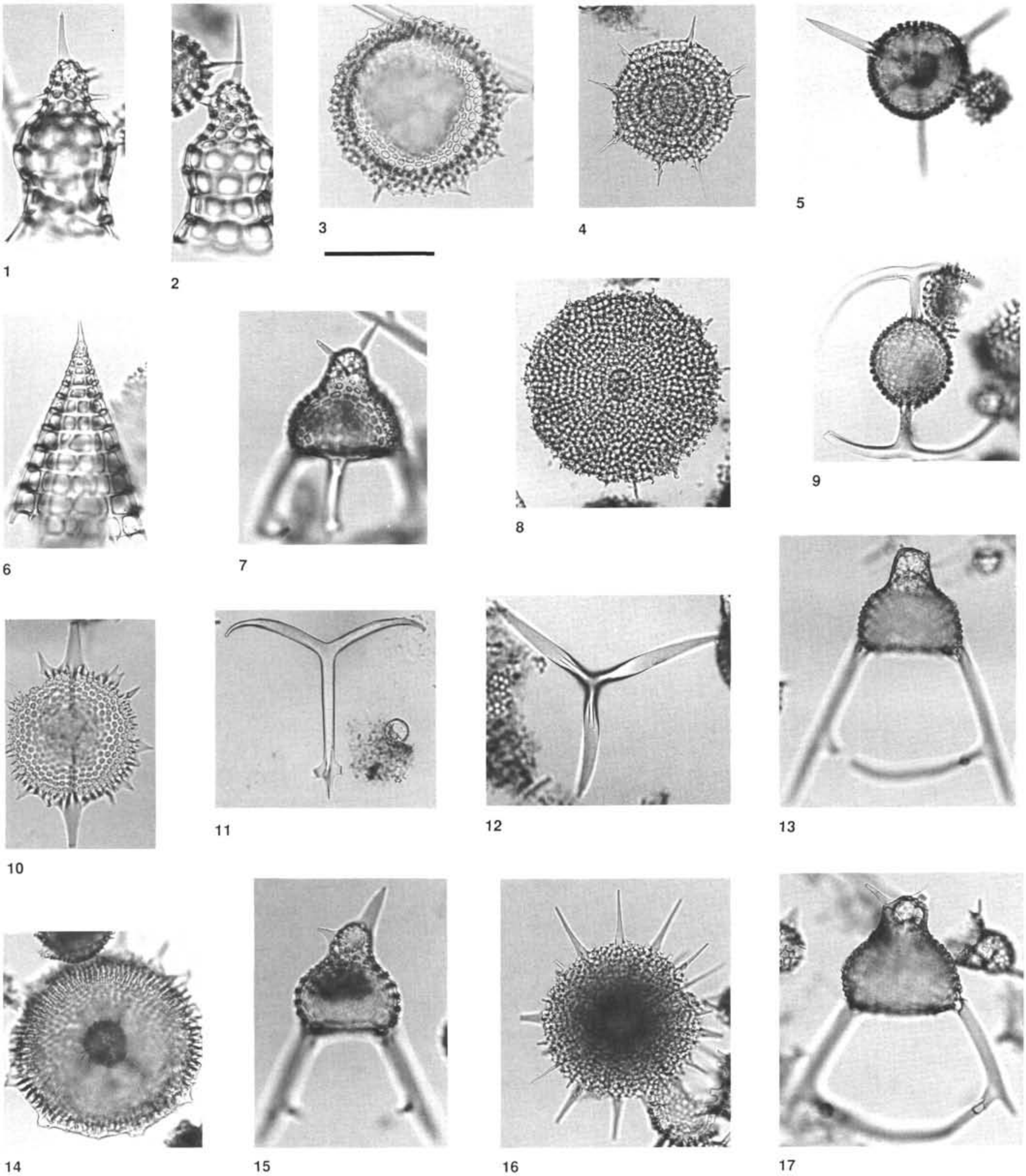

Plate 4. Scale bar = 60 μm. **1, 2.** *Clathrocycloma parcum*; Sample 122-761B-17X-2, 67–69 cm. **3.** *Velicucullus* sp.; Sample 122-761B-18X-4, 67–69 cm. **4.** *Xiphospira circularis*; Sample 122-761B-18X-5, 67–69 cm. **5.** *Entapium chaenapium*; Section 122-761B-17X-CC. **6.** *Bathropyramis (Acropyramis)* sp. cf. *B. woodringi*; Sample 122-761B-17X-2, 133–136 cm. **7.** *Bekoma* sp. aff. *B. campechensis*; Sample 122-761B-17X-1, 133–136 cm. **8.** *Stylotrochus alveatus*; Section 122-761B-17X-CC. **9.** *Saturnulus* sp. A; Sample 122-761B-18X-5, 67–69 cm. **10.** *Heliostylus* sp.; Sample 122-761B-18X-5, 67–69 cm. **11.** Astrosphaerin sp. E; Section 122-761B-17X-CC. **12.** Astrosphaerin sp. F; Sample 122-761B-17X-6, 133–136 cm. **13.** *Bekoma divaricata*; Sample 122-761B-17X-1, 67–69 cm. **14.** *Periphaena decora*; Sample 122-761B-17X-2, 67–69 cm. **15, 17.** *Bekoma campechensis*; (15) Sample 122-761B-19X-1, 74–79 cm, (17) Sample 122-761B-17X-1, 133–136 cm. **16.** *Spongodiscus* sp. A; Sample 122-761B-18X-4, 67–69 cm.

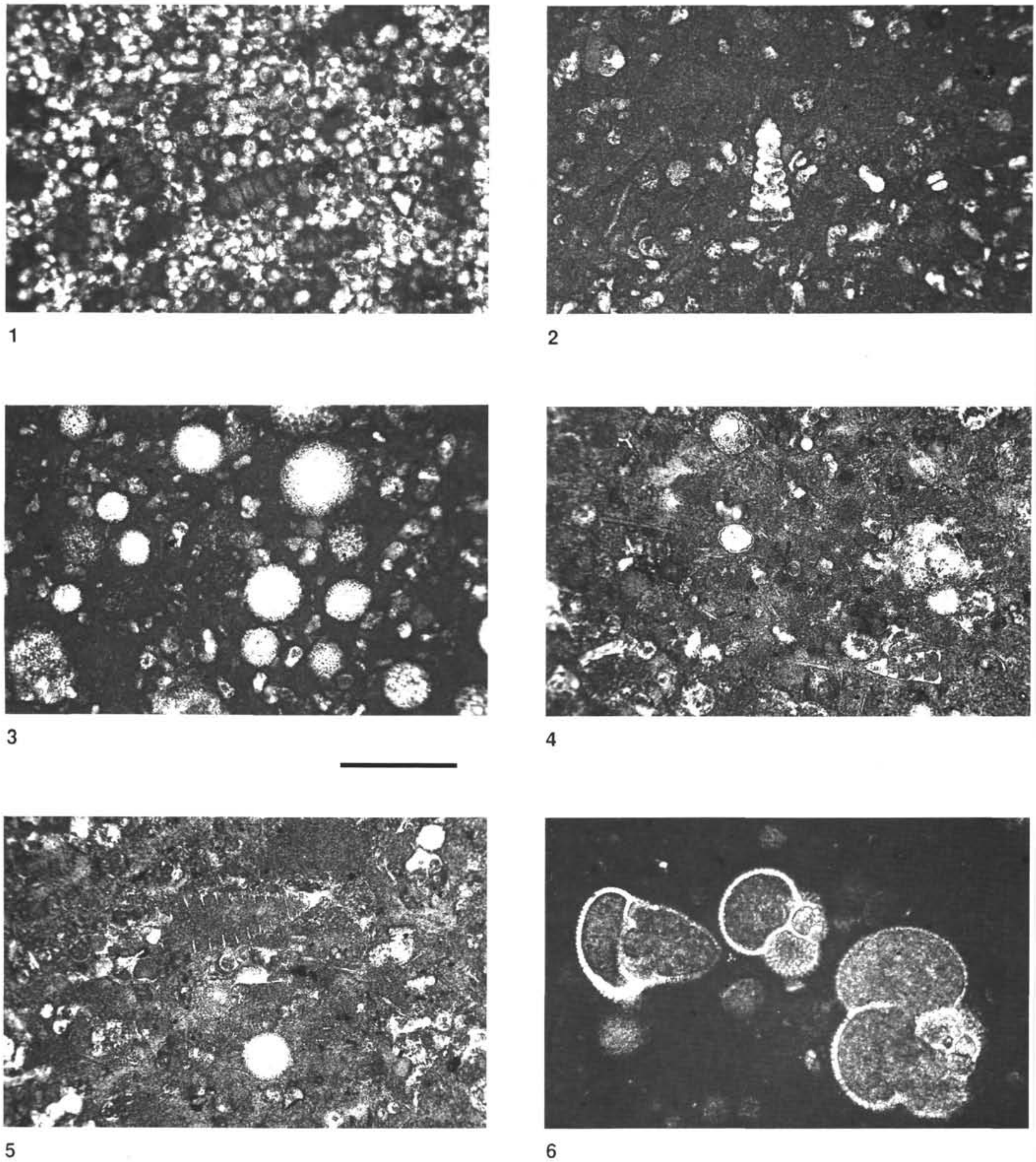

Plate 5. Scale bar = 800 μm. Transmitted-light photomicrographs of chert thin sections, all in plain light. **1.** Sample 122-761B-28X-CC, 14–16 cm. **2, 3.** Sample 122-761C-5R-2, 147–149 cm; note the age-diagnostic (Cenomanian–early Turonian) form, *Pseudodictyomitra pseudomacrocephala*, in Fig. 2. **4, 5.** Sample 122-761C-6R-1, 31–33 cm; note calcium carbonate replacement of the radiolarian tests in Fig. 4. **6.** Sample 122-762C-8X-3, 65–67 cm.