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10. JURASSIC AND EARLY CRETACEOUS RADIOLARIANS FROM LEG 129, SITES 800 AND 801, WESTERN PACIFIC OCEAN[1]

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ABSTRACT

Rich radiolarian faunas were obtained continuously from Middle Jurassic to Lower Cretaceous radiolarite sequences at Sites 800 and 801, drilled during Ocean Drilling Program Leg 129 in the western Pacific. Occurrences of 90 taxa are presented in tables for these sites. Seven radiolarian zones, *Dibolachras tytthopora, Cecrops septemporatus, Pseudodictyomitra carpatica, Pseudodictyomitra primitiva, Cinguloturris carpatica, Stylocapsa*(?) *spiralis,* and *Tricolocapsa conexa* in descending order, were recognized in this interval. The radiolarite sequences of Sites 800 and 801 encompass approximately the Berriasian to Hauterivian (or to Barremian) and the Bathonian/Callovian to Valanginian ages, respectively. At Site 801, a hiatus of early Oxfordian was identified.

INTRODUCTION

Abundant radiolarians were recovered from Mesozoic sedimentary sections in the western Pacific deep basins during Ocean Drilling Program (ODP) Leg 129. Sites 800 and 801 were drilled in the Pigafetta Basin (Fig. 1). At both sites, thick volcaniclastic turbidite units of middle Cretaceous age overlie radiolarite sequences. Radiolarians are the only fossil group that can give precise ages for the Jurassic to Lower Cretaceous interval because these radiolarites contain very few calcareous nannofossils and are barren of foraminifers and palynomorphs (Lancelot, Larson, et al., 1990).

Many studies of Jurassic and Lower Cretaceous radiolarian biostratigraphy have been accomplished during the last decade. These studies were based mainly on land sections of accreted oceanic and continental margin sequences. Tectonic disturbances, such as faulting and folding, have sometimes made it difficult to establish a biostratigraphic framework in the land sections. Continuous radiolarite deposits recovered in the western Pacific allow us to establish a reliable radiolarian zonation. In addition, these radiolarian assemblages recovered from the western Pacific can be regarded as representative of low-latitude faunas, because paleomagnetic data indicate that the drilling sites were in low-latitudes during the Jurassic and Cretaceous (Lancelot, Larson, et al., 1990).

The present study focuses on the Middle Jurassic to Early Cretaceous radiolarian biostratigraphy of Sites 800 and 801. I document, with illustrations, the occurrences of zone-diagnostic and other selected radiolarian species and show a biostratigraphic zonation for low-latitude radiolarians. Detailed taxonomic studies, including description of new taxa, will be done in the future.

The oldest (latest Bathonian or earliest Callovian) radiolarian faunas from the basal sedimentary strata at Site 801 are reported, with illustrations, in another paper (Matsuoka, 1991, and included in this volume).

METHODS

Rock samples were examined from each core catcher and from other stratigraphic intervals. They were disaggregated using 5% hydrofluoric acid for 12–24 hr. The time of treatment varied depending on the degree of induration of the sediments. The samples were sieved, and the >46-μm fraction was examined. The residues which included radiolarian tests were mounted in Entellan New. Identification of radiolarian species was based mainly on light microscope observation. Scanning electron microscope observation was carried out for one or two samples from every radiolarian zone. Radiolarian occurrences, including 90 taxa from Sites 800 and 801, are presented in Tables 1 and 2, respectively. These tables do not report quantitative abundance, but indicate the presence or absence of taxa only. Abundance is denoted as follows: A = abundant (>1000 radiolarians per slide), C = common (101–1000 radiolarians per slide), F = few (11–100 radiolarians per slide), and R = rare (1–10 radiolarians per slide). The preservation of radiolarian assemblage is classified as poor (P), poor-moderate (PM), moderate (M), and moderate-good (MG), according to the degree of dissolution and breakage of the radiolarian tests. No assemblage was assigned to good (G) because radiolarian tests always more or less dissolved.

RADIOLARIAN ZONES

Figure 2 shows the radiolarian zonation scheme adopted during Leg 129 for the Middle Jurassic to Cretaceous sediments. The zonation of Sanfilippo and Riedel (1985) was used for Cretaceous sediments younger than early Valanginian. For the Middle Jurassic to early Valanginian interval, the radiolarian zonation of Matsuoka and Yao (1985, 1986) was used with modifications.

Age assignments of zones are tentative because Mesozoic radiolarian zones are not sufficiently dated by other age-diagnostic fossils. For the Cretaceous, ages of zones are based on Sanfilippo and Riedel's (1985) assignments. For Middle Jurassic to early Valanginian interval, age assignments depend largely on correlation of Matsuoka and Yao's zonation with Baumgartner's (1984) zonation. Baumgartner's zonation was based primarily on his research in Atlantic and Mediterranean Tethys regions, where radiolarian-bearing sequences sometimes contain other age-diagnostic fossils. This zone correlation, however, is not sufficient because zone definitions differ; our zonation is categorized to interval zones, whereas Baumgartner's zonation is regarded as concurrent range zones. In addition, key species used to define our zones are not always treated in Baumgartner's work. The age calibration of Baumgartner's zonation was slightly modified by Baumgartner (1987), and subsequently by O'Dogherty et al. (1989). The correlation of Matsuoka and Yao's zones with geological stages was made through a zonal correlation to Baumgartner's zones, using the stage assignments by O'Dogherty et al. (1989) for the Jurassic. The resulting age calibration of Matsuoka and Yao's zones is concor-

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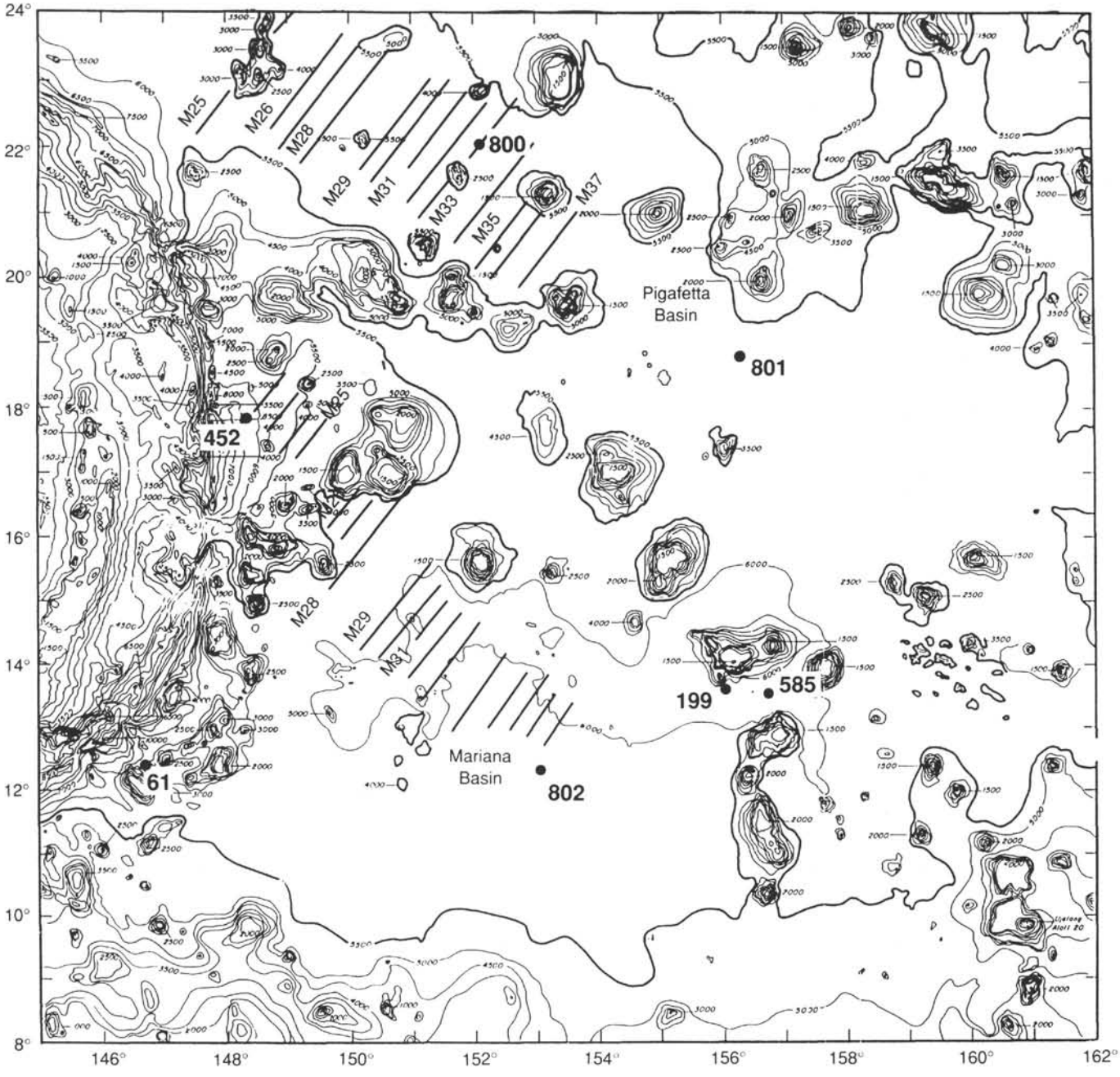

Figure 1. Location map of Sites 800–802, drilled during Leg 129, and Deep Sea Drilling Project (DSDP) Sites 61, 199, 452, and 585 (after Lancelot, Larson, et al., 1990). Bathymetry in meters. Diagonal lines show magnetic anomalies M25-M37.

dant with the rare ammonites and calcareous nannofossils obtained from the vicinity of radiolarian localities in Japan (Yao, 1986).

An independent radiolarian zonation for the Jurassic has been proposed by Pessagno (1977a), Pessagno et al. (1984), and Pessagno et al. (1987a) through their biostratigraphic studies in western North America and east central Mexico. Although a correlation of Matsuoka and Yao's zones with zones of Pessagno et al. (1984, 1987a) was possible, based on comparison of stratigraphic ranges of a limited number of common species, age assignments did not agree well with each other except for the latest Jurassic (Yao, 1986). Therefore, the Jurassic radiolarian zonation established in North America was not used in this work.

The radiolarian zones recognized in this study are presented below in descending order.

Dibolachras tytthopora Zone

Author. Schaaf (1981).

Top. Not defined. See remarks.

Base. First appearance biohorizon of *Dibolachras tytthopora.*

Remarks. The top of this zone was originally defined by the first appearance of *Crolanium pythiae* (Schaaf, 1981). *C. pythiae,* however, was found from the horizon lower than the first occurrence biohorizon of *D. tytthopora* at Site 800. *C. pythiae* seems to make its first appearance earlier than Schaaf's observation (for further discussion, see the section of radiolarians at each site,

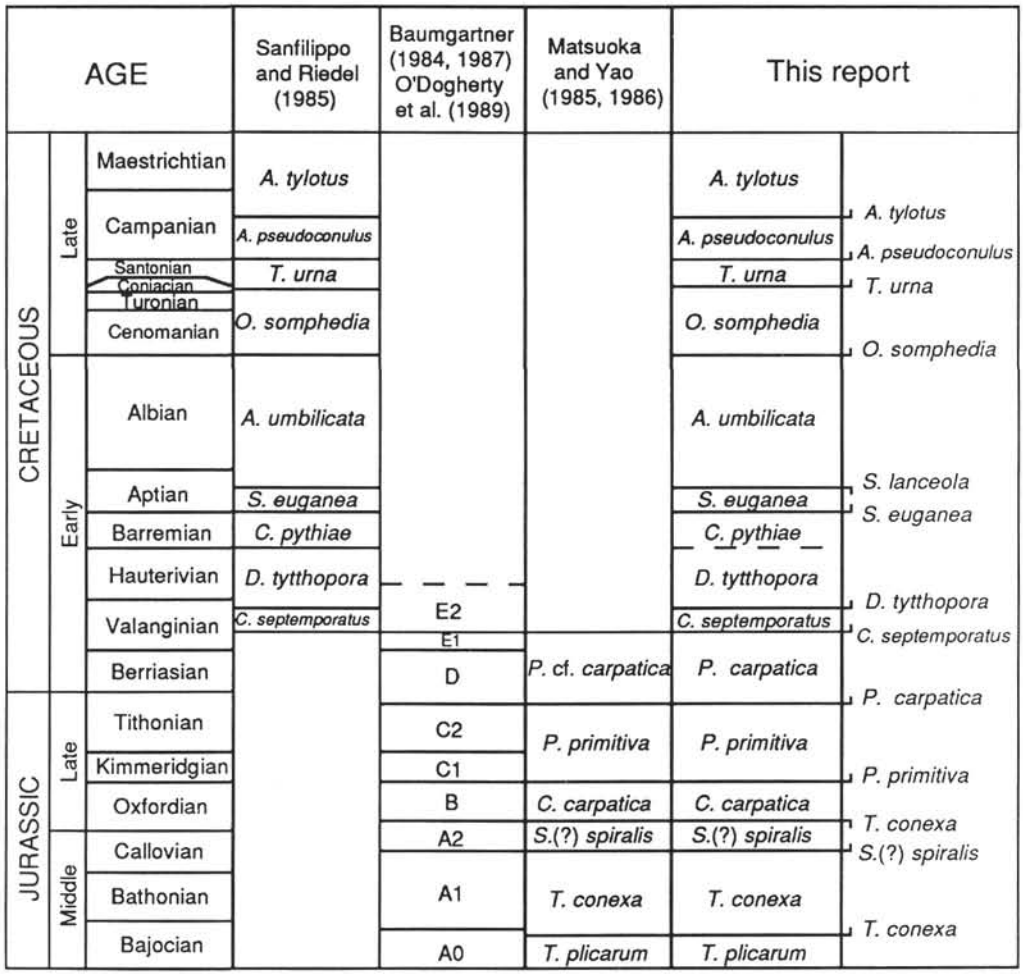

Figure 2. Middle Jurassic–Cretaceous radiolarian zonation and age assignment. The zonation of Matsuoka and Yao (1985, 1986) was not originally assigned to stages.

Site 800). Therefore, this zone may include partly or entirely the *Crolanium pythiae* Zone of Sanfilippo and Riedel (1985).

Age. Late Valanginian–Hauterivian (or to Barremian).

Cecrops septemporatus Zone

Author. Riedel and Sanfilippo (1974). (= *Staurosphaera septemporata* Zone).

Top. First appearance biohorizon of *Dibolachras tytthopora.*

Base. First appearance biohorizon of *Cecrops septemporatus.*

Remarks. *Cecrops septemporatus* can be evolved from *Sphaerostylus lanceola* or its related forms. The first appearance biohorizon of *C. septemporatus* is one of the most reliable among Early Cretaceous radiolarian events.

This zone is partly correlated to the Zone E2 of Baumgartner (1984) because *C. septemporatus* is one of diagnostic species of the Zone E2.

Age. Valanginian.

Pseudodictyomitra carpatica Zone

Author. Matsuoka, herein.

Top. First appearance biohorizon of *Cecrops septemporatus.*

Base. Evolutionary first appearance biohorizon of *Pseudodictyomitra carpatica.*

Remarks. Matsuoka and Yao (1985) reported *Pseudodictyomitra* cf. *carpatica* Assemblage Zone for the lowermost Cretaceous radiolarian zone. *P.* cf. *carpatica* of Matsuoka and Yao (1985) is considered to be identical to *P. carpatica.* Matsuoka (1986b) pointed out the phylogenetic relationship between *Pseudodictyomitra primitive* and *P. carpatica* (= *P.* cf. *carpatica*). At Site 801, the vertical distribution of these two species suggest an evolutionary lineage from *P. primitiva* to *P. carpatica.* The *P. carpatica* Zone is herein redefined as an interval zone.

This zone is correlated to the Zone E1 and Zone D of Baumgartner (1984). *P. carpatica* first appears in the latest Tithonian in the Mediterranean Tethys regions (Baumgartner, 1984).

Age. Latest Tithonian-early Valanginian.

Pseudodictyomitra primitiva Zone

Author. Matsuoka and Yao (1986).

Top. Evolutionary first appearance biohorizon of *Pseudodictyomitra carpatica.* The top is defined herein.

Base. First appearance biohorizon of *Pseudodictyomitra primitiva.*

Remarks. The top of this zone was not defined by Matsuoka and Yao (1986). This zone is correlated to the Zone C2 and Zone C1 of Baumgartner (1984).

Age. Kimmeridgian-latest Tithonian.

Cinguloturris carpatica Zone

Author. Matsuoka and Yao (1986).

Top. First appearance biohorizon of *Pseudodictyomitra primitiva.*

Base. Last appearance biohorizon of *Tricolocapsa conexa.*

Remarks. This zone is correlated to the Zone B of Baumgartner (1984).

Age. Oxfordian.

Stylocapsa(?) *spiralis* Zone

Author. Matsuoka (1983).

Table 1. Occurrence of Early Cretaceous radiolarians from Site 800.

Radiolarian zonation	Sample (cm)	Abundance	Preservation	*Pseudodictyomitra carpatica*	*Cecrops septemporatus*	*Dibolachras tytthopora*	*Acaeniotyle diagonophona*	*Foremanella diamphidia*	*Mirifusus mediodilatatus* s.l.	*Sethocapsa uterculus*	*Sethocapsa cetia*	*Archaeodictyomitra excellens*	*Archaeodictyomitra apiarium*	*Archaeodictyomitra pseudoscalaris*	*Archaeodictyomitra brouweri* var. α	*Thanarla pulchra*	*Parvicingula cosmoconica*	*Parvicingula boesii*	*Xitus spicularius*	*Podobursa triacantha*	*Acanthocircus trizonalis*	*Acanthocircus dicranacanthos*	*Alievium helenae*
	129-800A-			·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Dibolachras tytthopora	51R-1, 30–31	C	P	P	·	·	·	·	·	·	·	·	·	·	P	P	·	·	·	·	P	·	·
	51R-CC	A	M	·	P	·	·	·	·	P	·	·	·	P	P	P	·	·	P	·	P	·	P
	52R-1, 57–59	A	P	P	·	P	·	·	·	·	·	P	·	·	P	P	·	·	·	·	P	·	P
	52R-2, 49–51	A	PM	·	P	P	·	P	·	P	·	P	·	P	P	P	·	P	P	·	·	P	P
	52R-CC	A	PM	·	P	·	P	·	·	P	·	P	·	·	P	·	·	P	P	·	·	P	P
	53R-1, 53–55	A	M	·	P	·	·	·	·	P	·	P	·	·	P	P	·	·	P	P	P	P	P
	53R-2, 17–19	A	PM	·	P	·	·	·	·	·	·	P	·	P	P	P	·	P	P	·	P	·	P
Cecrops septemporatus	53R-CC	A	M	P	P	·	P	P	P	P	·	P	·	P	P	P	·	P	P	·	P	P	P
	54R-1, 54–56	A	PM	P	P	·	P	·	P	P	·	P	·	P	P	P	·	P	P	·	P	P	P
	54R-1, 140–142	A	PM	P	P	·	P	P	P	P	P	P	·	P	P	P	·	·	P	P	P	P	P
	54R-2, 50–52	A	PM	P	P	·	P	P	P	P	·	P	P	P	P	P	·	·	P	·	P	P	P
	54R-2, 98–100	A	PM	P	·	·	P	·	·	·	·	·	·	P	P	P	·	P	P	P	P	P	P
	54R-CC	A	M	P	·	·	P	P	P	P	·	P	·	P	P	P	P	P	P	P	P	P	P
	55R-1, 70–72	A	PM	P	·	·	·	·	·	P	·	P	P	P	P	P	·	P	P	P	·	P	P
Pseudodictyomitra carpatica	55R-1, 137–139	A	M	P	·	·	P	·	·	·	·	P	·	P	P	P	·	P	P	P	P	P	P
	55R-2, 44–46	A	PM	P	·	·	·	·	·	P	P	P	P	P	P	P	·	P	P	P	P	P	P
	55R-2, 133–135	A	M	P	·	·	·	·	·	·	·	P	P	P	P	P	·	P	P	·	P	P	·
	55R-CC	A	M	P	·	·	P	P	·	P	·	P	P	P	P	P	P	P	P	P	P	P	P

Notes: Zone-diagnostic species are presented at left. Abundance: A = abundant and C = common. Preservation: P = poor, PM = poor to moderate, and M = moderate.

Top. Last appearance biohorizon of *Tricolocapsa conexa.*

Base. Evolutionary first appearance biohorizon of *Stylocapsa*(?) *spiralis.*

Remarks. *S.*(?) *spiralis* first occurs near the horizon of the base of the Zone A2 of Baumgartner (1984) at Site 534 of DSDP Leg 76, Blake Bahama Basin (P. Baumgartner, pers. comm., 1990). This zone is correlated to the Zone A2 of Baumgartner (1984).

Age. Late Callovian–early Oxfordian.

Tricolocapsa conexa Zone

Author. Matsuoka (1983).

Top. Evolutionary first appearance biohorizon of *Stylocapsa*(?) *spiralis.*

Base. Evolutionary first appearance biohorizon of *Tricolocapsa conexa.*

Remarks. This zone is correlated to the Zone A1 and upper Zone A0 of Baumgartner (1984). The basal sedimentary strata at Site 801 are assigned to the middle part of this zone, corresponding to latest Bathonian or earliest Callovian. For further discussion, see the section of radiolarians at each site, Site 801.

Age. Late Bajocian–early Callovian.

RADIOLARIANS AT EACH SITE

This section summarizes the radiolarian observations for each site. Tables 1 and 2 display the occurrences of all zone-diagnostic species and other selected taxa for Sites 800 and 801, respectively. Selected specimens presented in Plates 1 to 5 are from the *Cecrops septemporatus, Pseudodictyomitra carpatica, Pseudodictyomitra primitiva, Cinguloturris carpatica,* and *Stylocapsa*(?) *spiralis* zones, respectively. Radiolarian faunas of the *Tricolocapsa conexa* Zone are illustrated in Matsuoka (1991, and included in this volume).

Site 800

Site 800 is located in the northern Pigafetta Basin (21°55.38′N, 152°19.32′E) at a water depth of 5686 m (Fig. 1). This site is situated on magnetic lineation anomaly M33.

Radiolarians were investigated in alternating clay and radiolarite strata (Core 129-800A-51R through 129-800A-55R). This unit is overlain by Aptian volcaniclastic turbidites. Core recovery within the studied interval ranged from 18.2% to 55.7%. Radiolarian preservation within this interval is poor (P) to moderate (M).

Samples 129-800A-51R-1, 30–31 cm, through 129-800A-52R-2, 49–51 cm, contain radiolarians diagnostic of the *Dibolachras tytthopora* Zone of late Valanginian–Hauterivian (or to Barremian) age. Characteristic taxa include *Acanthocircus carinatus, Archaeodictyomitra lacrimula, D. tytthopora,* and *Eucyrtis tenuis.*

Samples 129-800A-52R-CC through 129-800A-54R-2, 50–52 cm, contain radiolarians diagnostic of the *Cecrops septemporatus* Zone of Valanginian age. Characteristic species include *C. septemporatus, Eucyrtis hanni, Mirifusus chenodes, Dictyomitrella*(?) *columna,* and *Pseudodictyomitra lilyae. Mirifusus mediodilatatus* s.l. makes its final appearance in this zone. *Crolanium pythiae* was found from Sample 129-800A-53R-CC together with *M. mediodilatatus* s.l. *C. pythiae* is regarded as the diagnostic species, of which the first appearance biohorizon defines the boundary between the *Dibolachras tytthopora* Zone and the next younger *C. pythiae* Zone (Schaaf, 1981). Co-occurrence of *C. pythiae* with s.l. *M. mediodilatatus* was not reported by Schaaf (1985). The first appearance biohorizon of *C. pythiae* seems to be earlier than has been reported previously.

Samples 129-800A-54R-2, 98–100 cm, through 129-800A-55R-CC contain radiolarians diagnostic of the *Pseudodictyomitra carpatica* Zone. This zone is characterized by abundant occurrences of *Archaeodictyomitra apiarium, Parvicingula boesii,* and *P. carpatica.* On the basis of comparison concerning faunal succession of the *P. carpatica* Zone between Sites 800 and 801, this interval is assigned to the upper part of *C. carpatica* Zone. Consequently, this interval possibly does not include the latest Tithonian, although the entire *P. carpatica* Zone covers from latest Tithonian to early Valanginian.

Table 1 (continued).

Radiolarian zonation	Sample (cm)	Abundance	Preservation	*Syringocapsa agolarium*	*Acaeniotyle umbilicata*	*Hemicryptocapsa capita*	*Podobursa tricola*	*Syringocapsa limatum*	*Eucyrtis hanni*	*Crolanium pythiae*	*Stichocapsa cribata*	*Mirifusus chenodes*	*Pseudodictyomitra lilyae*	*Pseudodictyomitra nuda*	*Dictyomitrella(?) columna*	*Thanarla elegantissima*	*Dictyomitrella(?) puga*	*Archaeodictyomitra lacrimula*	*Acanthocircus carinatus*	*Eucyrtis tenuis*
Dibolachras tytthopora	129-800A-51R-1, 30–31	C	P	·	·	·	·	·	·	·	·	·	·	·	·	·	·	P	P	·
	51R-CC	A	M	·	P	·	·	·	·	·	·	·	P	·	·	·	P	P	P	P
	52R-1, 57–59	A	P	·	P	·	·	·	·	·	·	·	·	·	·	·	·	P	P	·
	52R-2, 49–51	A	PM	·	P	·	·	·	·	·	·	·	P	P	·	·	·	·	P	P
Cecrops septemporatus	52R-CC	A	PM	·	·	P	·	·	·	·	·	·	P	P	·	·	·	·	·	·
	53R-1, 53–55	A	M	P	·	·	·	P	P	·	·	·	P	P	·	·	P	·	·	·
	53R-2, 17–19	A	PM	P	P	P	·	P	P	·	·	P	P	·	·	·	P	·	·	·
	53R-CC	A	M	P	P	P	P	P	P	P	P	P	P	P	P	P	P	·	·	·
	54R-1, 54–56	A	PM	·	·	P	·	P	·	·	P	·	·	·	·	·	P	·	·	·
	54R-1, 140–142	A	PM	·	P	P	P	P	·	·	·	P	·	P	P	·	P	·	·	·
	54R-2, 50–52	A	PM	·	P	P	P	P	P	·	·	·	·	P	P	·	P	·	·	·
Pseudodictyomitra carpatica	54R-2, 98–100	A	PM	·	·	P	·	P	·	·	·	·	·	P	·	·	P	·	·	·
	54R-CC	A	M	·	·	P	·	P	·	·	·	·	·	P	·	·	P	·	·	·
	55R-1, 70-72	A	PM	·	·	P	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	55R-1, 137–139	A	M	·	P	P	·	·	·	·	·	·	·	·	·	·	P	·	·	·
	55R-2, 44–46	A	PM	·	·	P	·	P	·	·	·	·	·	·	·	·	·	·	·	·
	55R-2, 133–135	A	M	P	·	P	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	55R-CC	A	M	P	P	·	·	P	·	·	·	·	·	P	·	·	P	·	·	·

Sample 129-800A-56R-1, 5–7 cm, contains *C. septemporatus, Acanthocircus trizonalis, A. dicranacanthos, Alievium helenae,* and *Foremanella diamphidia.* This faunal composition indicates the *C. septemporatus* Zone. The zone assignment is younger than that of samples in Core 129-800A-55R. In addition, the sampled rock piece is quite different in lithology from other rock fragments in Core 129-800A-56R. These facts indicate that the sample is the result of downhole contamination, therefore is not included in Table 1.

Site 801

Site 801 is located in the central Pigafetta Basin (18°38.54′N, 156°21.58′E) at a water depth of 5682 m (Fig. 1). The site is situated on a magnetic quiet zone southeast of the M25–M37 magnetic lineation sequence.

The radiolarians investigated were taken from brown radiolarite (Core 129-801B-14R through 129-801B-32R), alternating red radiolarite and claystone beds (Core 129-801B-33R through 129-801B-37R), and siliceous claystone interbedded within basaltic layers (Core 129-801B-39R). Core recovery of the studied interval ranged from 0.8% to 74.5%. Radiolarian preservation within this interval is poor (P) to moderate-good (MG).

Sample 129-801B-14R-CC contains radiolarians diagnostic of the *Cecrops septemporatus* Zone of Valanginian age. Faunal composition of this sample is similar to that of the several samples below it except for the presence of *C. septemporatus.*

Samples 129-801B-15R-1, 23–25 cm, through 129-801B-20R-CC contain radiolarians diagnostic of the *Pseudodictyomitra carpatica* Zone of latest Tithonian–early Valanginian age. Characteristic species include *Acanthocircus dicranacanthos, Acanthocircus trizonalis, Alievium helenae, Archaeodictyomitra brouweri* var. α, *Archaeodictyomitra pseudoscalaris, Archaeodictyomitra excellens, Pseudodictyomitra carpatica, Sethocapsa uterculus,* and *Xitus spicularius.*

Samples 129-801B-21R-1, 1–3 cm, through 129-801B-28R-CC contain radiolarians diagnostic of the *Pseudodictyomitra primitiva* Zone of Kimmeridgian–latest Tithonian age. Characteristic species include *Mesovallupus guadalupensis, Protovallupus* spp., *Pseudodictyomitra primitiva,* and *Vallupus hopsoni. Cinguloturris carpatica* and *Perispyridium ordinarium* make their final appearance in this zone.

Samples 129-801B-29R-1, 16–17 cm, through 129-801B-32R-CC contain radiolarians diagnostic of the *Cinguloturris carpatica* Zone of Oxfordian age. Characteristic species include *Crucella theokaftensis, Gongylothorax* sp. aff. *G. favosus, Haliodictya*(?) *hojnosi,* and *Tricolocapsa yaoi. Solenotryma*(?) *ichikawai* makes its first appearance in this zone. The lower part of the *C. carpatica* Zone may be absent due to a hiatus mentioned below.

Samples 129-801B-33R-1, 8–10 cm, through 129-801B-34R-1, 15–17 cm, contain radiolarians diagnostic of the *Stylocapsa*(?) *spiralis* Zone. The samples of this interval generally contain abundant specimens of *S.*(?) *spiralis, Stichocapsa robusta,* and *Tricolocapsa conexa.* The dominance of these species, combined with the absence of *Stichocapsa naradaniensis,* typical of the upper part of the *S.*(?) *spiralis* Zone, suggests that only the lower half of the zone is present. This implies that a hiatus may be present at the lithologic boundary between the brown radiolarite and the underlying unit of alternating red radiolarite and claystone. This interval (Sample 129-801B-33R-1, 8–10 cm, through 129-801B-34R-1, 15–17 cm) is therefore assigned to the late Callovian.

Samples 129-801B-34R-CC through 129-801B-39R-1, 16–18 cm, contain radiolarians diagnostic of the *Tricolocapsa conexa* Zone. Characteristic species include *Dicolocapsa conoformis, Guexella nudata, Stylocapsa oblongula, Stylocapsa tecta, Theocapsomma cordis,* and *Tricolocapsa conexa.* Samples 129-801B-34R-CC to 129-801B-36R-CC yield *T. conexa, S. tecta,* and *S. oblongula,* which in the absence of *S.*(?) *spiralis* is characteristic of the upper part of the *T. conexa* Zone. In Sample 129-801B-37R-1, 16–20 cm, *T. conexa* and *Guexella nudata* occur, whereas *S. tecta* does not, indicating the middle part of the *T. conexa* Zone. From Core 129-801B-39R, five samples (129-801B-39R-1, 7–9 cm, 16–18 cm, 20–21 cm, 26–28 cm, and 129-801B-39R-CC) yielded common to abundant, very poorly preserved radiolarian assemblages. Of these five samples, the assemblage from Sample 129-801B-39R-1, 16–18 cm, is better preserved

and contains *G. nudata,* indicating the middle *T. conexa* Zone. The basal sedimentary strata of Site 801 are assigned to the latest Bathonian or earliest Callovian.

SUMMARY

Continuous radiolarite sequences of Middle Jurassic to Early Cretaceous age were recovered from the western Pacific. Tables 1 and 2 are range charts of zone-diagnostic and other selected species. Seven successive radiolarian zones, the boundary of which are defined by the first or last appearance biohorizons, were recognized. The oldest sedimentary strata of Sites 800 and 801 are assigned to the Berriasian and to the latest Bathonian or earliest Callovian age, respectively. A hiatus of the early Oxfordian was identified at Site 801.

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APPENDIX

Species List

The list presents all taxa included Tables 1 and 2 and Plates 1–5, together with a few references of the original and, if necessary, the recent publications. Radiolarian genera and species within a genus are listed in alphabetical order.

Acaeniotyle diagorophona Foreman (Pl. 3, Fig. 12)
Acaeniotyle diagorophona Foreman, 1973, p. 258, pl. 2, figs. 2–5; Sanfilippo and Riedel, 1985, p. 586, figs. 4 (1a–b).
Acaeniotyle diagorophona Foreman *variate* Ozvoldova (Pl. 5., Fig. 10)
Acaeniotyle diagorophona Foreman *variata* Ozvoldova, 1979, p. 251, pl. 1, fig. 2.
Acaeniotyle umbilicata (Rüst)
Xiphosphaera umbilicata Rüst, 1898, p. 7, pl. 1, fig. 9.
Acaeniotyle umbilicata (Rüst)—Foreman, 1973, p. 258, pl. 1, figs. 12–14, 16; Sanfilippo and Riedel, 1985, p. 587, figs. 4 (2a–d).
Acanthocircus carinatus Foreman
Acanthocircus carinatus Foreman, 1973, p. 260, pl. 5, figs. 1–2.
Acanthocircus dicranacanthos (Squinabol)
Saturnalis dicranacanthos Squinabol, 1914, p. 289, text-fig. 1, pl. 22, figs. 4–7, pl. 23, fig. 8.
Acanthocircus dicranacanthos (Squinabol)—Foreman, 1975, P. 610, pl. 2D, figs. 5–6; Sanfilippo and Riedel, 1985, p. 591, figs. 5 (2a–c).
Acanthocircus suboblongus (Yao)
Spongosatunalis(?) *suboblongus* Yao, 1972, p. 29, pl. 3, figs. 1–6, pl. 10, figs. 3a–c.
Acanthocircus suboblongus (Yao)—Baumgartner, 1984, p. 755, pl. 1, fig. 6.
Acanthocircus trizonalis (Rüst)
Saturnulus trizonalis Rüst, 1898, p. 9, pl. 2, fig. 4.
Acanthocircus trizonalis (Rüst)—Foreman, 1973, p. 261, pl. 4, figs. 6–8; Sanfilippo and Riedel, 1985, p. 592, figs. 5 (1a–d).
Alievium helenae Schaaf (Pl. 1. Fig. 2)
Alievium helenae Schaaf, 1981, p. 431, pl. 7, fig. 9, pl. 10, figs. 2a–b.
Andromeda sp. M (Pl. 5, Fig. 8)
Angulobracchia sp. (Pl. 5, Fig. 9)
Archaeodictyomitra(?) *amabilis* Aita
Archaeodictyomitra(?) *amabilis* Aita, 1987, p. 70, pl. 1, figs. 13a–b, pl. 9, fig. 6.
Archaeodictyomitra apiarium (Rüst)
Lithocampe apiarium Rüst, 1885, p. 314, pl. 39, fig. 8.
Archaeodictyomitra apiarium (Rüst)—Schaaf, 1984, p. 92–93, figs. 1, 3a–b, 5a–b, non figs. 2, 4a–b.
Archaeodictyomitra brouweri var. α (Tan Sin Hok)
Eucyrtidium brouweri var. α Tan Sin Hok, 1927, p. 58, pl. 11, fig. 93.
Archaeodictyomitra brouweri var. α (Tan Sin Hok)—Schaaf, 1981, p. 432, pl. 19, figs. 3a–b.
Archaeodictyomitra excellens (Tan Sin Hok) (Pl. 1, Fig. 7)
Lithomitra excellence Tan Sin Hok, 1927, p. 56, pl. 11, fig. 85.
Archaeodictyomitra excellens (Tan Sin Hok) Baumgartner, 1984, p. 758, pl. 2, figs. 7–8.
Archaeodictyomitra lacrimula (Foreman)
Dictyomita(?) *lacrimula* Foreman, 1973, p. 263, pl. 10, fig. 11.
Archaeodictyomitra lacrimula (Foreman)—Schaaf, 1981, p. 432, pl. 22, figs. 3a–b; Sanfilippo and Riedel, 1985, p. 598, figs. 7 (3a–c).
Archaeodictyomitra pseudoscalaris (Tan Sin Hok) (Pl. 1, Fig. 8)
Stichomitra pseudoscalaris Tan Sin Hok, 1927, p. 56, pl. 11, fig. 84.
Archaeodictyomitra pseudoscalaris (Tan Sin Hok)—Schaaf, 1981, p. 432, pl. 4, fig. 5, pl. 21, figs. 13a–b.
Cecrops septemporatus (Parona) (Pl. 1, Fig. 1)
Staurosphaera septemporata Parona, 1890, p. 151, pl. 2, figs. 4–5.
Cecrops septemporatus (Parona)—Pessagno, 1977b, p. 33, pl. 3, fig. 11.
Cinguloturris carpatica Dumitrică (Pl. 3, Fig. 2; Pl. 4, Fig. 1)
Cinguloturris carpatica Dumitrică—Dumitrică and Mello, 1982, p. 23, pl. 4, figs. 7–11.
Crolanium pythiae Schaaf (Pl. 1, Fig. 9)
Crolanium pythiae Schaaf, 1981, p. 432, pl. 20, figs. 5a–c; Sanfilippo and Riedel, 1985, p. 616, figs. 13 (1a–e).
Crucella theokaftensis Baumgartner
Crucella theokaftensis Baumgartner, 1980, p. 308, pl. 8, figs. 19–22, pl. 12, fig. 1.
Cryptamphorella sp. (Pl. 2, Fig. 10)
Cyrtocapsa sp. A
Cyrtocapsa sp. A, Matsuoka, 1984, p. 146, pl. 1, figs. 14–17, pl. 2, figs. 13–16.
Dibolachras tytthopora Foreman
Dibolachras tytthopora Foreman, 1973, p. 265, pl. 11, fig. 4, pl. 16, fig. 15; Sanfilippo and Riedel, 1985, p. 609, figs. 11 (4a–b).
Dicolocapsa conoformis Matsuoka
Dicolocapsa conoformis Matsuoka, 1983, p. 13, pl. 1, figs. 1–3, pl. 5, figs. 1–6, pl. 6, figs. 1–4.
Dictyomitrella(?) *columna* (Rüst)
Lithocampe columna Rüst, 1898, p. 63, pl. 18, fig. 5.
Dictyomitrella(?) *kamoensis* Mizutani and Kido (Pl. 4, Fig. 3)
Dictyomitrella(?) *kamoensis* Mizutani and Kido, 1983, p. 258, pl. 53, figs. 2–4.
Dictyomitrella(?) *puga* (Schaaf) (Pl. 2, Fig. 1)
Archaeodictyomitra puga Schaaf, 1981, P. 432, pl. 3, fig. 7, pl. 21, figs. 11a–b.
Emiluvia chica Foreman (Pl. 5, Fig. 11)
Emiluvia chica Foreman, 1973, p. 262, pl. 8, fig. 7.
Emiluvia hopsoni Pessagno (Pl. 4, Fig. 11)
Emiluvia hopsoni Pessagno, 1977a, p. 76, pl. 4, figs. 14–16, pl. 5, figs. 1–7, pl. 12, figs. 15–16.
Eucyrtidiellum nodosum Wakita (Pl. 4, Fig. 10)
Eucyrtidiellum nodosum Wakita, 1988, p. 408, pl. 4, fig. 29, pl. 5, fig. 16.
Eucyrtidiellum ptyctum (Riedel and Sanfilippo) (Pl. 4, Fig. 9)
Eucyrtidium(?) *ptyctum* Riedel and Sanfilippo, 1974, p. 778, pl. 5, fig. 7, pl. 12, fig. 14, non fig. 15.
Eucyrtidiellum ptyctum (Riedel and Sanfilippo) -Baumgartner, 1984, p. 764, pl. 4, figs. 1–3.
Eucyrtidiellum sp. P (Pl. 3, Fig. 7)
Eucyrtidiellum unumaense (Yao)
Eucyrtidium unumaensis Yao, 1979, p. 39, pl. 9, figs. 1–11.
Eucyrtidiellum unumaensis (Yao)—Baumgartner, 1984, p. 765, pl. 4, fig. 6.
Eucyrtidiellum unumaense (Yao)—Nagai and Mizutani, 1990, p. 597, figs. 4 (6–7).

Eucyrtis hanni (Tan Sin Hok)
Lithocampe hanni Tan Sin Hok, 1927, p. 64, pl. 13, fig. 109.
Eucyrtis hanni (Tan Sin Hok), Riedel and Sanfilippo, 1974, p. 779, pl. 5, figs. 11–13, pl. 12, fig. 18, non 16, 17; Sanfilippo and Riedel, 1985, p. 618, fig. 13 (7).
Eucyrtis tenuis (Rüst)
Stichocapsa tenuis Rüst, 1885, p. 318, pl. 41, figs. 13–14.
Eucyrtis tenuis (Rüst)—Foreman, 1975, p. 615, pl. 2I, figs. 7–9; Sanfilippo and Riedel, 1985, p. 619, fig. 13 (5).
Foremanella diamphidia (Foreman) (Pl. 2, Fig. 11)
Paronaella(?) *diamphidia* Foreman, 1973, p. 262, pl. 8, figs. 3–4.
Foremanella diamphidia (Foreman)—Baumgartner, 1984, p. 765, pl. 6, fig. 18; Sanfilippo and Riedel, 1985, p. 593, figs. 5 (4a–b).
Gongylothorax sakawaensis Matsuoka (Pl. 5, Fig. 2)
Gongylothorax sakawaensis Matsuoka, 1982, p. 74, pl. 1, figs. 1–10.
Gongylothorax sp. aff. *G. favosus* Dumitrică (Pl. 4, Fig. 5)
aff. *Gongylothorax favosus* Dumitrică, 1970, p. 56, pl. 1, figs. 1a–c, 2.
Gongylothorax sp. aff. *G. favosus* Dumitrică—Matsuoka, 1986a, pl. 2, fig. 5, pl. 3, fig. 9.
Guexella nudata (Kocher)
Lithocampe nudata Kocher—Baumgartner et al., 1980, p. 55, pl. 6, fig. 3.
Guexella nudata (Kocher)—Baumgartner, 1984, P. 766, pl. 5, figs. 5–7.
Haliodictya(?) *hojnosi* Riedel and Sanfilippo (Pl. 3, Fig. 11)
Haliodictya(?) *hojnosi* Riedel and Sanfilippo, 1974, p. 779, pl. 2, fig. 6, pl. 12, fig. 2, non fig. 3.
Hemicryptocapsa capita Tan Sin Hok (Pl. 1, Fig. 3)
Hemicryptocapsa capita Tan Sin Hok, 1927, p. 50, pl. 9, fig. 67; Kito, 1987, pl. 2, fig. 7.
Hsuum brevicostatum (Ozvoldova) (Pl. 5, Fig. 7)
Lithostrobus brevicostatus Ozvoldova, 1975, p. 84, pl. 102, fig. 1.
Hsuum brevicostatum (Ozvoldova)—Baumgartner, 1984, p. 769, pl. 5, figs. 1–2.
Hsuum maxwelli Pessagno group (Pl. 4, Fig. 4)
Hsuum maxwelli Pessagno, 1977a, p. 81, pl. 7, figs. 14–16.
Hsuum maxwelli Pessagno group—Baumgartner, 1984, p. 769, pl. 5, figs. 3–4.
Mesovallupus guadalupensis Pessagno and MacLeod (Pl. 3, Fig. 10)
Mesovallupus guadalupensis Pessagno and MacLeod, Pessagno et al., 1987b, p. 28, pl. 3, figs. 6–7, pl. 7, fig. 12.
Mirifusus chenodes (Renz) (Pl. 1, Fig. 6)
Lithocampe chenodes Renz, 1974, p. 793, pl. 7, fig. 30, pl. 12, figs. 14a–d.
Mirifusus chenodes (Renz)—Baumgartner, 1984, p. 770, pl. 5, figs. 9, 15.
Mirifusus fragilis Baumgartner (Pl. 4, Fig. 2; Pl. 5, Fig. 5)
Mirifusus fragilis Baumgartner, 1984, p. 770, pl. 5, figs. 12, 16–17, 20–21.
Mirifusus guadalupensis Pessagno
Mirifusus guadalupensis Pessagno, 1977a, p. 83, pl. 10, figs. 9–14; Baumgartner, 1984, p. 771, pl. 5, figs. 8, 22.
Mirifusus mediodilatatus (Rüst) s.l. (Pl. 1, Fig. 5; Pl. 2, Fig. 5)
Lithocampe mediodilatata Rüst, 1885, p. 316, pl. 40, fig. 9.
Mirifusus mediodilatatus (Rüst) s.l.—Baumgartner, 1984, p. 711, pl. 5, figs. 10–11, 13–14, 18–19.
Napora pyramidalis Baumgartner
Napora pyramidalis Baumgartner, 1984, p. 775, pl. 6, figs. 11–12.
Paronaella mulleri Pessagno
Paronaella mulleri Pessagno, 1977a, p. 71, pl. 2, figs. 2–3.
Parvicingula boesii (Parona) (Pl. 1. Fig. 11; Pl. 2, Fig. 4)
Dictyomitra boesii Parona, 1890, p. 41, pl. 6, fig. 9.
Ristola boesii (Parona)—Kito, 1987, pl. 3, fig. 9.
Parvicingula cosmoconica (Foreman) (Pl. 2, Fig. 8)
Dictyomitra cosmoconica Foreman, 1973, p. 263, pl. 9, fig. 11, pl. 16, fig. 3.
Parvicingula cosmoconica (Foreman)—Baumgartner et al., 1980, p. 58, pl. 5, fig. 16, pl. 6, fig. 7.
Parvicingula dhimenaensis Baumgartner
Parvicingula dhimenaensis Baumgartner, 1984, p. 778, pl. 7, figs. 2–4.
Perispyridium ordinarium (Pessagno) (Pl. 3, Fig. 8; Pl. 4, Fig. 12)
Trilonche(?) *ordinaria* Pessagno, 1977a, p. 79, pl. 6, fig. 14.
Perispyridium ordinarium (Pessagno)—Dumitrică, 1978, p. 35, pl. 3, figs. 1–2, 5, pl. 4, fig. 9; Baumgartner, 1984, p. 779, pl. 7, figs. 5–6.
Podobursa helvetica (Rüst) (Pl. 5, Fig. 4)
Theosyringium helveticum Rüst, 1885, p. 309, pl. 27, fig. 14.
Podobursa helvetica (Rüst)—Baumgartner et al., 1980, p. 60, pl. 3, fig. 11, pl. 6, fig. 5.
Podobursa triacantha (Fischli)
Theosyringium triacanthus Fischli, 1916, fig. 38.
Podobursa triacantha (Fischli)—Foreman, 1973, p. 266, pl. 13, figs. 1–7; Sanfilippo and Riedel, 1985, p. 611, figs. 11 (1a–b).
Podobursa tricola Foreman
Podobursa tricola Foreman, 1973, p. 267, pl. 13, fig. 9, pl. 16, fig. 12; Sanfilippo and Riedel, 1985, p. 611, figs. 11 (3a–b).
Podocapsa amphitreptera Foreman (Pl. 2. Fig. 6)
Podocapsa amphitreptera Foreman, 1973, p. 267, pl. 13, fig. 11; Baumgartner, 1984, p. 780, pl. 7, figs. 9–10.
Protovallupus spp.
Protovallupus Pessagno and MacLeod—Pessagno et al., 1987b, p. 28.
Protunuma japonicus Matsuoka and Yao (Pl. 3, Fig. 5)
Protunuma japonicus Matsuoka and Yao, 1985, p. 130, pl. 1, figs. 11–15, pl. 3, figs. 6–9.
Protunuma turbo Matsuoka
Protunuma turbo Matsuoka, 1983, p. 24, pl. 4, figs. 4–7, pl. 8, figs. 16–18, pl. 9, figs. 1–2.
Pseudodictyomitra carpatica (Lozynyak) (Pl. 2, Figs. 2–3)
Dictyomitra carpatica Lozynyak, 1969, p. 38, pl. 2, figs. 11–13.
Pseudodictyomitra carpatica (Lozynyak)—Schaaf, 1981, p. 436, pl. 3, figs. 1a–c, pl. 20, figs. 4a–b.
Pseudodictyomitra lilyae (Tan Sin Hok) (Pl. 1, Fig. 10)
Dictyomitra lilyae Tan Sin Hok, 1927, p. 55, pl. 10, fig. 83.
Pseudodictyomitra lilyae (Tan Sin Hok)—Schaaf, 1981, p. 437, pl. 3, fig. 8, pl. 18, figs. 5a–b.
Pseudodictyomitra nuda (Schaaf)
Archaeodictyomitra nuda Schaaf, 1981, p. 432, pl. 3, fig. 6.
Pseudodictyomitra primitiva Matsuoka and Yao (Pl. 3, Fig. 1)
Pseudodictyomitra primitiva Matsuoka and Yao, 1985, p. 131, pl. 1, figs. 1–6, pl. 3, figs. 1–4.
Pseudodictyomitra(?) sp. D
Pseudodictyomitra(?) sp. D, Matsuoka and Yao, 1985, pl. 2, figs. 6–7.
Ristola altissima (Rüst) (Pl. 5, Fig. 6)
Lithocampe altissima Rüst, 1885, p. 315, pl. 40, fig. 2.
Parvicingula altissima (Rüst)—Pessagno, 1977a, p. 85, pl. 8, figs. 9–10.
Ristola altissima (Rüst)—Baumgartner, 1984, p. 783, pl. 8, figs. 3–4, 9.
Sethocapsa cetia Foreman
Sethocapsa cetia Foreman, 1973, p. 267, pl. 12, fig. 1, pl. 16, fig. 19; Sanfilippo and Riedel, 1985, p. 612, fig. 10 (5).
Sethocapsa uterculus (Parona) (Pl. 1, Fig. 4; Pl. 2, Fig. 9)
Theocapsa uterculus Parona, 1890, p. 168, pl. 5, fig. 17.
Sethocapsa uterculus (Parona)—Schaaf, 1981, p. 437, pl. 5, figs. 8a–b, pl. 26, figs. 5a–b, Sanfilippo and Riedel, 1985, p. 613, figs. 10 (6a–e).
Solenotryma(?) *ichikawai* Matsuoka and Yao (Pl. 3, Fig. 6)
Solenotryma(?) *ichikawai* Matsuoka and Yao, 1985, p. 133, pl. 1, figs. 7–10, pl. 3, figs. 5, 10–13.
Sphaerostylus lanceola (Parona) (Pl. 2, Fig. 12)
Stylosphaera lanceola Parona, 1890, p. 150, pl. 1, fig. 19.
Sphaerostylus lanceola (Parona), Riedel and Sanfilippo, 1974, p. 780, pl. 1, figs. 1–3; Sanfilippo and Riedel, 1985, p. 588, figs. 4 (4a–e).
Sphaerostylus oligoporus (Vinassa) (Pl. 3, Fig. 4)
Ellipsoxiphus oligoporus Vinassa, 1899, p. 228, pl. 17, fig. 44.
Sphaerostylus oligoporus (Vinassa), Sanfilippo and Riedel, 1985, p. 590, fig. 4 (5).
Spongocapsula palmerae Pessagno
Spongocapsula palmerae Pessagno, 1977a, p. 88, pl. 11, figs. 12–14, 16; Baumgartner, 1984, p. 785, pl. 8, fig. 16.
Spongocapsula sp. A
Spongocapsula sp. A, Matsuoka and Yao, 1985, pl. 2, fig. 3.
Stichocapsa cribata Hinde
Stichocapsa cribata Hinde, 1900, P. 43, pl. 4, fig. 39; Schaaf, 1981, p. 439, pl. 6, fig. 4, pl. 25, fig. 6.
Stichocapsa doryspheroides Neviani
Stichocapsa doryspheroides Neviani, 1900; Schaaf, 1984, p. 155, figs. 6a–b.
Stichocapsa robusta Matsuoka (Pl. 5, Fig. 3)
Stichocapsa robusta Matsuoka, 1984, p. 146, pl. 1, figs. 6–13, pl. 2, figs. 7–12.
Stichocapsa sp. P
Stichocapsa sp.—Matsuoka, 1991, pl. 2, fig. 11.
Stylocapsa catenarum Matsuoka
Stylocapsa catenarum Matsuoka, 1982, p. 75, pl. 2, figs. 1—11.

Stylocapsa oblongula Kocher
Stylocapsa oblongula Kocher—Baumgartner et al., 1980, p. 62, pl. 6, fig. 1; Baumgartner, 1984, p. 786, pl. 9, figs. 1–2.
Stylocapsa(?) *spiralis* Matsuoka (Pl. 5, Fig. 1)
Stylocapsa(?) *spiralis* Matsuoka, 1982, p. 77, pl. 3, figs. 1–8.
Stylocapsa tecta Matsuoka
Stylocapsa tecta Matsuoka, 1983, p. 14, pl. 1, figs. 5–11, pl. 5, figs. 8–14.
Syringocapsa agolarium Foreman
Syringocapsa agolarium Foreman, 1973, p. 286, pl. 1, fig. 5, pl. 16, fig. 17; Baumgartner, 1984, p. 786, pl. 9, figs. 3–4.
Syringocapsa limatum Foreman
Syringocapsa limatum Foreman, 1975, p. 617, pl. 2K, fig. 7.
Tetratrabs zealis (Ozvoldova) (Pl. 5, Fig. 12)
Crucella zealis Ozvoldova, 1979, p. 34, pl. 2, fig. 1.
Tetratrabs zealis (Ozvoldova)—Baumgartner, 1984, p. 788, pl. 9, fig. 10.
Thanarla elegantissima (Cita)
Lithocampe elegantissima Cita, 1964, p. 148, pl. 12, figs. 2–3.
Thanarla elegantissima (Cita)—Pessagno, 1977b, p. 46, pl. 7, fig. 10; Sanfilippo and Riedel, 1985, p. 600, figs. 8 (1a–e).
Thanarla pulchra (Squinabol) (Pl. 1, Fig. 12)
Sethamphora pulchra Squinabol, 1904, p. 213, pl. 5, fig. 8.
Thanarla pulchra (Squinabol)—Pessagno, 1977b, p. 46, pl. 7, figs. 7, 21, 26; Sanfilippo and Riedel, 1985, p. 600, figs. 8 (2a–e).
Theocapsomma cordis Kocher
Theocapsomma cordis Kocher, 1981, p. 100, pl. 17, figs. 2–4; Baumgartner, 1984, p. 789, pl. 8, figs. 16–17.
Tricolocapsa conexa Matsuoka
Tricolocapsa conexa Matsuoka, 1983, p. 20, pl. 3, figs. 37, pl. 7, figs. 11–14.
Tricolocapsa sp. aff. *T.*(?) *fusiformis* Yao
aff. *Tricolocapsa*(?)*fusiformis* Yao, 1979, p. 33, pl. 4, figs. 12–18, pl. 5. figs. 1–4.
Tricolocapsa sp. aff. *T.*(?) *fusiformis* Yao—Matsuoka, 1983, p. 20, pl. 2, figs. 12–13, pl. 8. figs. 2–3.
Tricolocapsa yaoi Matsuoka (Pl. 4, Fig. 6)
Tricolocapsa yaoi Matsuoka, 1986a, p. 106, pl. 2, figs. 1–4, pl. 3, figs. 1–8.
Vallupus hopsoni Pessagno and Blome (Pl. 3, Fig. 9)
Vallupus hopsoni Pessagno and Blome—Pessagno et al., 1984, p. 23, pl. 1, figs. 14–16, 18–19, 21, pl. 5, fig. 1.
Williriedellum sp. A group (Pl. 4. Fig. 7)
Williriedellum sp. A group, Matsuoka, 1983, p. 23, pl. 4, figs. 1–3, pl. 8, figs. 11–15.
Xitus spicularius (Aliev) (Pl. 2. Fig. 7)
Dictyomitra spicularia Aliev, 1961, p. 34, pl. 2, figs. 1–2.
Xitus spicularius (Aliev)—Pessagno, 1977b, p. 56, pl. 9, fig. 7, pl. 10, fig. 5; Schaaf, 1981, p. 440, pl. 4, fig. 11, pl. 5, figs. 12a–b, pl. 19, figs. 2a–b.
Zhamoidellum mikamense Aita (Pl. 3, Fig. 3; Pl. 4, Fig. 8)
Zhamoidellum mikamense Aita, 1987, p. 74, pl. 4. figs. 9a–b, pl. 10, figs. 10–11.

Table 2. Occurrence of Middle Jurassic–Early Cretaceous radiolarians from Site 801.

Radiolarian zonation	Sample	Abundance	Preservation	*Tricolocapsa conexa*	*Stylocapsa(?) spiralis*	*Pseudodictyomitra primitiva*	*Pseudodictyomitra carpatiaca*	*Cecrops septemporatus*	*Tricolocapsa* aff. *fusiformis*	*Stichocapsa robusta*	*Protunuma turbo*	*Guexella nudata*	*Hsuum maxwelli* gr.	*Hsuum brevicostatum*	*Archaeodictyomitra(?) amabilis*	*Parvicingula dhimenaensis*	*Dictyomitrella(?) kamoensis*	*Ristola altissima*	*Eucyrtidiellum unumaense*	*Acanthocircus suboblongus*	*Haliodictya(?) hojnosi*	*Stylocapsa tecta*	*Stylocapsa catenarium*
Cecrops septemporatus	129-801B-14R-CC	A	PM	.	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pseudodictyomitra carpatica	15R-1, 23–25	A	P	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	16R-1, 9–11	A	P	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	16R-1, 32–34	A	PM	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	16R-1, 37–39	A	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	16R-CC	A	PM	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	17R-1, 22–25	A	PM	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	17R-CC	C	PM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	18R-1, 7–9	A	PM	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	18R-1, 34–36	A	PM	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	18R-CC	A	MG	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	19R-CC	A	PM	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	20R-1, 7–9	A	M	.	.	P	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	20R-1, 16–18	C	PM	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	20R-CC	C	PM	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pseudodictyomitra primitiva	21R-1, 1–3	C	PM	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	21R-1, 13–15	C	PM	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	21R-CC	C	M	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	22R-CC, 0–2	C	M	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	22R-CC	A	PM	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	23R-CC, 7–9	A	M	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	23R-CC, 14–16	A	M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	23R-CC	C	PM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	24R-1, 22–23	A	M	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	24R-1, 66–68	A	PM	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	24R-CC	A	PM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	25R-1, 10–12	A	PM	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	25R-1, 32-35	A	PM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	25R-1, 65–68	A	M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	25R-CC	A	PM	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	26R-CC, 11–13	C	PM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	26R-CC	C	PM	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	27R-1, 99–101	C	PM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	27R-CC	C	PM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	28R-1, 6–7	F	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.
	28R-CC	C	MG	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.
Cinguloturris carpatica	29R-1, 16–17	A	PM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.
	29R-CC	A	M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	30R-1, 1–2	A	M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.
	30R-1, 12-14	F	M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.
	30R-CC	A	MG	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	P	.	.
	31R-1, 1–3	A	M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.
	31R-1, 21–22	C	PM	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	P	.	.
	31R-CC	A	P	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	P	.	.
	32R-CC	A	PM	.	.	.	.	.	.	.	.	.	P	P	.	.	P	.	.	P	.	.	.
Stylocapsa(?) spiralis	33R-1, 8–10	A	PM	P	.	.	.	.	.	P	.	.	.	P	.	.	.	.	.	.	.	.	.
	33R-1, 131–133	A	PM	P	P	.	.	.	.	P	.	.	P	.	.	.	.	.	.	.	.	.	P
	33R-2, 14–17	A	PM	P	P	.	.	.	.	P	.	.	P	P	.	.	.	.	.	.	.	.	P
	33R-CC	A	PM	P	P	.	.	.	.	P	.	.	P	P	.	.	.	P	.	P	.	.	.
	34R-1, 15–17	C	PM	P	P	.	.	.	.	P	.	.	.	.	.	.	.	.	P	.	.	P	P
Tricolocapsa conexa	34R-CC	C	PM	P	.	.	.	.	.	P	.	P	.	P	.	.	.	.	P	.	.	P	P
	35R-1, 43–45	A	PM	P	.	.	.	.	.	P	.	P	P	P	.	.	.	.	.	.	.	P	.
	35R-1, 76–80	A	PM	P	.	.	.	.	.	P	.	P	.	P	.	.	.	.	P	.	.	P	.
	35R-2, 95–98	A	PM	P	.	.	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-2, 138–140	A	P	P	.	.	.	.	.	P	.	P	.	.	.	.	.	.	P	.	.	.	.
	35R-3, 24–26	A	M	P	.	.	.	.	.	P	.	P	P	P	.	.	P	.	P	.	P	P	P
	35R-CC	A	P	P	.	.	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	P	.
	36R-CC	R	P	P	.	.	.	.	.	.	.	.	P	.	.	.	P	.	.	.	.	P	.
	37R-1, 16–20	A	PM	P	.	.	.	.	P	P	P	P	P	P	P	P	P	P	P	P	P	.	.
	39R-1, 16–18	A	P	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.

Table 2 (continued).

Radiolarian zonation	Sample	*Stylocapsa oblongula*	*Theocapsomma cordis*	*Stichocapsa* sp. P	*Eucyrtidiellum nodosum*	*Mirifusus fragilis*	*Paronaella mulleri*	*Gongylothorax sakawaensis*	*Stichocapsa dorysphereoides*	*Podobursa helvetica*	*Mirifusus guadalupensis*	*Tetratrabs zealis*	*Andromeda* sp. M	*Emiluvia chica*	*Williriedellum* sp. A gr.	*Tricolocapsa yaoi*	*Zhamoidellum mikamense*	*Gongylothorax* aff. *favosus*	*Cingulotturris carpatiaca*	*Eucyrtidiellum ptyctum*	*Perispyridium ordinarium*	*Emiluvia hopsoni*	*Solenotryma*(?) *ichikawai*
Cecrops septemporatus	129-801B-14R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pseudodictyomitra carpatica	15R-1, 23–25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	16R-1, 9–11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	16R-1, 32–34	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	16R-1, 37–39	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	16R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	17R-1, 22–25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	17R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	18R-1, 7–9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	18R-1, 34–36	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	18R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	19R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	20R-1, 7–9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P
	20R-1, 16–18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	P
	20R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	P
Pseudodictyomitra primitiva	21R-1, 1–3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	P
	21R-1, 13–15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P
	21R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	.	.	P
	22R-CC, 0–2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	P
	22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	P
	23R-CC, 7–9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	.	.	P
	23R-CC, 14–16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	.	.	P
	23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	.	.	P
	24R-1, 22–23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	.	.	P
	24R-1, 66–68	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	P	P	.	.
	24R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	P	.	P
	25R-1, 10–12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	P	.	P
	25R-1, 32–35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	P	.	P
	25R-1, 65-68	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	P	.	P
	25R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P
	26R-CC, 11–13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P
	26R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	P
	27R-1, 99–101	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	.	.	P
	27R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	P	.	.
	28R-1, 6–7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P
	28R-CC	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	P	P	P	.	P	.	P
Cinguloturris carpatica	29R-1, 16–17	.	.	.	.	.	.	.	.	.	.	.	.	.	P	P	P	P	.	.	.	.	P
	29R-CC	.	.	.	P	.	.	.	.	.	.	.	.	.	P	.	P	.	P	P	P	.	P
	30R-1, 1–2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	P	.	P
	30R-1, 12–14	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	.	.	.	.	P
	30R-CC	.	.	.	.	.	.	.	.	.	P	.	.	P	.	P	P	P	P	P	P	.	P
	31R-1, 1–3	.	.	.	P	.	.	.	.	.	.	.	.	P	.	.	.	P	P	.	P	.	P
	31R-1, 21–22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.	P
	31R-CC	.	.	.	P	.	.	.	.	.	.	.	.	.	.	P	P	.	P	P	.	.	.
	32R-CC	.	.	.	P	P	.	.	P	.	.	.	.	P	P	P	P	P	P	P	P	P	.
Stylocapsa(?) *spiralis*	33R-1, 8–10	.	.	.	P	.	.	.	.	P	.	.	.	P	P	.	.	.	.	P	.	.	.
	33R-1, 131–133	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	33R-2, 14–17	.	.	.	.	.	.	.	.	P	.	.	.	P	P	.	P	.	.	P	.	.	.
	33R-CC	.	.	.	.	P	.	P	P	P	.	P	P	P	.	.	.	.	.	.	.	.	.
	34R-1, 15–17	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	.	.
Tricolocapsa conexa	34R-CC	P	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	.
	35R-1, 43–45	.	P	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	.	.
	35R-1, 76–80	.	.	P	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	.	.
	35R-2, 95–98	P	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-2, 138–140	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-3, 24–26	P	P	P	P	P	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-CC	P	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	36R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	37R-1, 16–20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	39R-1, 16–18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 2 (continued).

Radiolarian zonation	Sample	*Protunuma japonicus*	*Acaeniotyle diagoronhona*	*Dicolocapsa conoformis*	*Cyrtocapsa* sp. A	*Spongocapsula palmerae*	*Pseudodictyomitra* sp. D	*Crucella theokaftensis*	*Eucyrtidiellum* sp. P	*Formanella diamphidia*	*Vallupus hopsoni*	*Mesovallupus guadalupensis*	*Mirifusus mediodilatatus* s.l.	*Napora pyramidalis*	*Spongocapsula* sp. A	*Protovallupus* spp.	*Sethocapsa uterculus*	*Sethocapsa cetia*	*Archaeodictyomitra excellens*	*Archaeodictyomitra apiarium*	*Archaeodictyomitra pseudoscalaris*	*Archaeodictyomitra brouweri* var. α	*Thanarla pulchra*
Cecrops septemporatus	129-801B-14R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	P	P
Pseudodictyomitra carpatica	15R-1, 23–25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	P	.	P	P
	16R-1, 9–11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	P	P
	16R-1, 32–34	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	.
	16R-1, 37–39	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.
	16R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.
	17R-1, 22–25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	P	P	.	P
	17R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	P	
	18R-1, 7-9	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	P	.	P	.	P	P	P
	18R-1, 34–36	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	P	.	P	P	.
	18R-CC	.	.	.	.	.	.	.	.	P	.	.	P	.	.	.	P	P	P	.	P	.	P
	19R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	20R-1, 7–9	.	.	.	.	.	.	.	P	.	.	.	.	P	P	.	.	.	.	P	.	.	.
	20R-1, 16–18	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	P	.	.	.	.	.	.
	20R-CC	.	P	.	.	.	.	.	P	.	P	.	P	P	.	.	.	.	.	P	.	.	.
Pseudodictyomitra primitiva	21R-1, 1–3	.	.	.	.	.	.	.	P	.	P	.	.	.	P	.	.	.	.	.	.	.	.
	21R-1, 13–15	.	.	.	.	.	.	.	P	.	P	.	.	.	P	.	.	.	.	.	.	.	.
	21R-CC	.	.	.	.	.	P	.	P	.	.	.	.	.	P	.	.	.	.	.	.	.	.
	22R-CC, 0–2	.	.	.	.	.	.	.	P	.	P	.	P	P	P	.	.	.	.	.	.	.	.
	22R-CC	.	.	.	.	.	.	.	.	P	P	.	.	.	.	.	.	.	.	.	.	.	.
	23R-CC, 7–9	.	P	.	.	.	P	.	P	.	P	P	P	P	P	.	.	.	.	.	.	.	.
	23R-CC, 14–16	.	.	.	.	.	P	.	P	P	P	P	.	.	P	.	.	.	.	.	.	.	.
	23R-CC	.	.	.	.	.	P	.	P	P	.	.	.	.	P	.	.	.	.	.	.	.	
	24R-1, 22-23	.	P	.	.	.	P	.	P	P	P	P	.	P	P	P	.	.	.	.	.	.	.
	24R-1, 66–68	.	.	.	.	.	P	.	P	.	.	.	P	P	.	P	.	.	.	.	.	.	.
	24R-CC	.	.	.	.	.	P	.	P	.	.	P	P	P	.	P	.	.	.	.	.	.	.
	25R-1, 10–12	.	.	.	.	.	.	.	P	.	.	P	.	.	.	P	.	.	.	.	.	.	.
	25R-1, 32–35	P	P	.	.	.	.	.	P	.	.	P	.	P	.	P	.	.	.	.	.	.	.
	25R-1, 65–68	.	P	.	.	.	P	.	P	.	P	P	P	P	P	.	.	.	.	.	.	.	.
	25R-CC	.	.	.	.	.	P	.	.	.	.	P	.	P	P	P	.	.	.	.	.	.	.
	26R-CC, 11–13	.	.	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	.	.
	26R-CC	.	.	.	.	.	.	.	P	.	.	.	.	P	.	P	.	.	.	.	.	.	.
	27R-1, 99–101	.	P	.	.	.	.	.	.	.	.	.	.	P	.	.	.	.	.	.	.	.	.
	27R-CC	.	.	.	.	.	.	.	P	P	.	.	.	.	.	.	.	.	.	.	.	.	.
	28R-1, 6–7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	28R-CC	P	P	.	.	.	P	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cinguloturris carpatica	29R-1, 16–17	.	.	.	.	.	P	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	29R-CC	P	.	.	.	P	P	P	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	30R-1, 1–2	.	P	.	.	.	P	P	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	30R-1, 12–14	.	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	30R-CC	.	P	.	.	P	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	31R-1, 1–3	.	P	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	31R-1, 21–22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	31R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	32R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stylocapsa(?) *spiralis*	33R-1, 8–10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	33R-1, 131–133	.	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	33R-2, 14–17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	33R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	34R-1, 15–17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tricolocapsa conexa	34R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-1, 43–45	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-1, 76–80	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-2, 95–98	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-2, 138–140	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-3, 24–26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	35R-CC	.	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	36R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	37R-1, 16–20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	39R-1, 16–18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 2 (continued).

Radiolarian zonation	Sample	*Parvicingula cosmoconica*	*Parvicingula boesii*	*Xitus spicularius*	*Podobursa triacantha*	*Podocapsa amphitreptera*	*Acanthocircus trizonalis*	*Acanthocircus dicranacanthos*	*Alievium helenae*	*Syringocapsa agolarium*	*Acaeniotyle umbilicata*
Cecrops septemporatus	129-801B-14R-CC	.	.	.	P	.	.	.	P	.	.
Pseudodictyomitra carpatica	15R-1, 23–25	.	P	.	.	.	P	P	.	.	.
	16R-1, 9–11	.	.	P	.	.	P	P	.	.	.
	16R-1, 32–34	.	.	P	.	.	.	P	P	.	.
	16R-1, 37–39	.	.	.	P	.	.	P	.	.	.
	16R-CC	.	.	.	.	.	.	P	P	.	P
	17R-1, 22–25	.	.	.	.	.	P	P	P	P	.
	17R-CC	.	.	.	.	.	.	P	.	.	.
	18R-1, 7–9	.	P	.	.	.	P	P	P	.	.
	18R-1, 34–36	.	.	.	.	.	.	.	.	.	.
	18R-CC	P	P	P	P	P	P	.	P	.	.
	19R-CC	.	.	.	.	.	.	.	.	.	.
	20R-1, 7–9	.	.	.	.	.	.	.	.	.	.
	20R-1, 16–18	.	.	.	.	.	.	.	.	.	.
	20R-CC	.	P	.	.	.	.	.	.	.	.
Pseudodictyomitra primitiva	21R-1, 1–3	.	.	.	.	.	.	.	.	.	.
	21R-1, 13–15	.	.	.	.	.	.	.	.	.	.
	21R-CC	.	.	.	.	.	.	.	.	.	.
	22R-CC, 0–2	.	.	.	.	.	.	.	.	.	.
	22R-CC	.	.	.	.	.	.	.	.	.	.
	23R-CC, 7–9	.	.	.	.	.	.	.	.	.	.
	23R-CC, 14–16	.	.	.	.	.	.	.	.	.	.
	23R-CC	.	.	.	.	.	.	.	.	.	.
	24R-1, 22–23	.	.	.	.	.	.	.	.	.	.
	24R-1, 66–68	.	.	.	.	.	.	.	.	.	.
	24R-CC	.	.	.	.	.	.	.	.	.	.
	25R-1, 10-12	.	.	.	.	.	.	.	.	.	.
	25R-1, 32–35	.	.	.	.	.	.	.	.	.	.
	25R-1, 65–68	.	.	.	.	.	.	.	.	.	.
	25R-CC	.	.	.	.	.	.	.	.	.	.
	26R-CC, 11–13	.	.	.	.	.	.	.	.	.	.
	26R-CC	.	.	.	.	.	.	.	.	.	.
	27R-1, 99–101	.	.	.	.	.	.	.	.	.	.
	27R-CC	.	.	.	.	.	.	.	.	.	.
	28R-1, 6–7	.	.	.	.	.	.	.	.	.	.
	28R-CC	.	.	.	.	.	.	.	.	.	.
Cinguloturris carpatica	29R-1, 16–17	.	.	.	.	.	.	.	.	.	.
	29R-CC	.	.	.	.	.	.	.	.	.	.
	30R-1, 1–2	.	.	.	.	.	.	.	.	.	
	30R-1, 12-14	.	.	.	.	.	.	.	.	.	.
	30R-CC	.	.	.	.	.	.	.	.	.	.
	31R-1, 1–3	.	.	.	.	.	.	.	.	.	.
	31R-1, 21–22	.	.	.	.	.	.	.	.	.	.
	31R-CC	.	.	.	.	.	.	.	.	.	.
	32R-CC	.	.	.	.	.	.	.	.	.	.
Stylocapsa(?) *spiralis*	33R-1, 8–10	.	.	.	.	.	.	.	.	.	.
	33R-1, 131–133	.	.	.	.	.	.	.	.	.	.
	33R-2, 14–17	.	.	.	.	.	.	.	.	.	.
	33R-CC	.	.	.	.	.	.	.	.	.	.
	34R-1, 15–17	.	.	.	.	.	.	.	.	.	.
Tricolocapsa conexa	34R-CC	.	.	.	.	.	.	.	.	.	.
	35R-1, 43–45	.	.	.	.	.	.	.	.	.	.
	35R-1, 76–80	.	.	.	.	.	.	.	.	.	.
	35R-2, 95–98	.	.	.	.	.	.	.	.	.	.
	35R-2, 138–140	.	.	.	.	.	.	.	.	.	.
	35R-3, 24–26	.	.	.	.	.	.	.	.	.	.
	35R-CC	.	.	.	.	.	.	.	.	.	.
	36R-CC	.	.	.	.	.	.	.	.	.	.
	37R-1, 16–20	.	.	.	.	.	.	.	.	.	.
	39R-1, 16–18	.	.	.	.	.	.	.	.	.	.

Notes: Zone-diagnostic species are presented at left. Abundance: A = abundant, C = common, F = few, and R = rare. Preservation: P = poor, PM = poor to moderate, M = moderate, and MG = moderate to good.

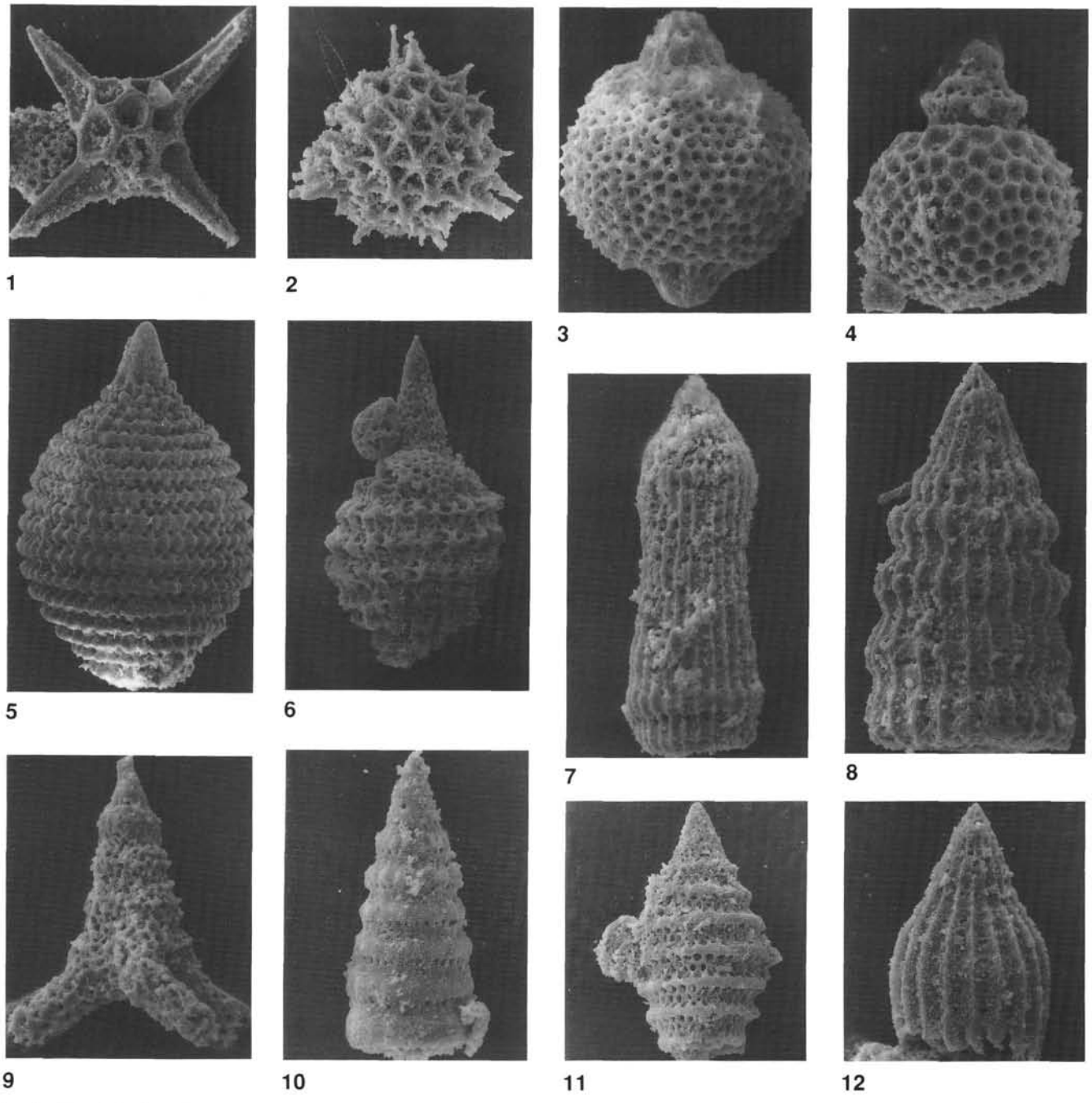

Plate 1. Radiolarian fauna in the *Cecrops septemporatus* Zone. All specimens are taken from Sample 129-800A-53R-CC. **1.** *Cecrops septemporatus* (Parona), ×180. **2.** *Alievium helenae* Schaaf, ×250. **3.** *Hemicryptocapsa capita* Tan Sin Hok, ×250. **4.** *Sethocapsa uterculus* (Parona), ×250. **5.** *Mirifusus mediodilatatus* (Rüst), ×100. **6.** *Mirifusus chenodes* (Renz), ×180. **7.** *Archaeodictyomitra excellens* (Tan Sin Hok), ×250. **8.** *Archaeodictyomitra pseudoscalaris* (Tan Sin Hok), ×250. **9.** *Crolanium pythiae* Schaaf, ×250. **10.** *Pseudodictyomitra lilyae* (Tan Sin Hok), ×250. **11.** *Parvicingula boesii* (Parona), ×180. **12.** *Thanarla pulchra* (Squinabol), ×250.

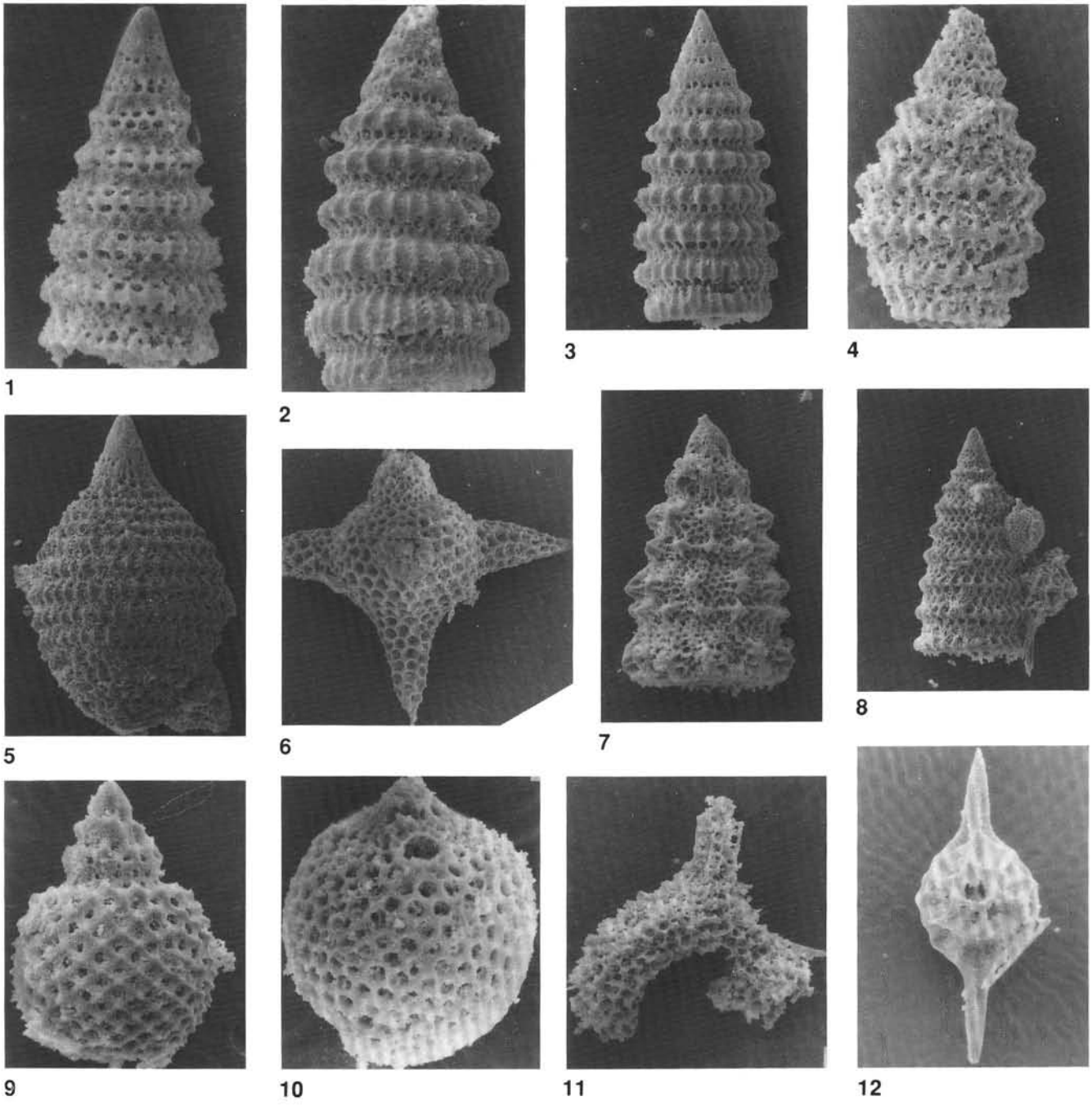

Plate 2. Radiolarian fauna in the *Pseudodictyomitra carpatica* Zone. All specimens are taken from Sample 129-800A-55R-CC. **1.** *Dictyomitrella*(?) *puga* (Schaaf), ×250. **2.** *Pseudodictyomitra carpatica* (Lozynyzk), ×250. **3.** *Pseudodictyomitra carpatica* (Lozynyzk), ×180. **4.** *Parvicingula boesii* (Parona), ×250. **5.** *Mirifusus mediodilatatus* (Rüst), ×100. **6.** *Podocapsa amphitreptera* Foreman, ×100. **7.** *Xitus spicularius* (Aliev), ×180. **8.** *Parvicingula cosmoconica* (Foreman), ×100. **9.** *Sethocapsa uterculus* (Parona), ×250. **10.** *Cryptamphorella* sp., ×380. **11.** *Foremanella diamphidia* (Foreman), ×180. **12.** *Sphaerostylus lanceola* (Parona), ×180.

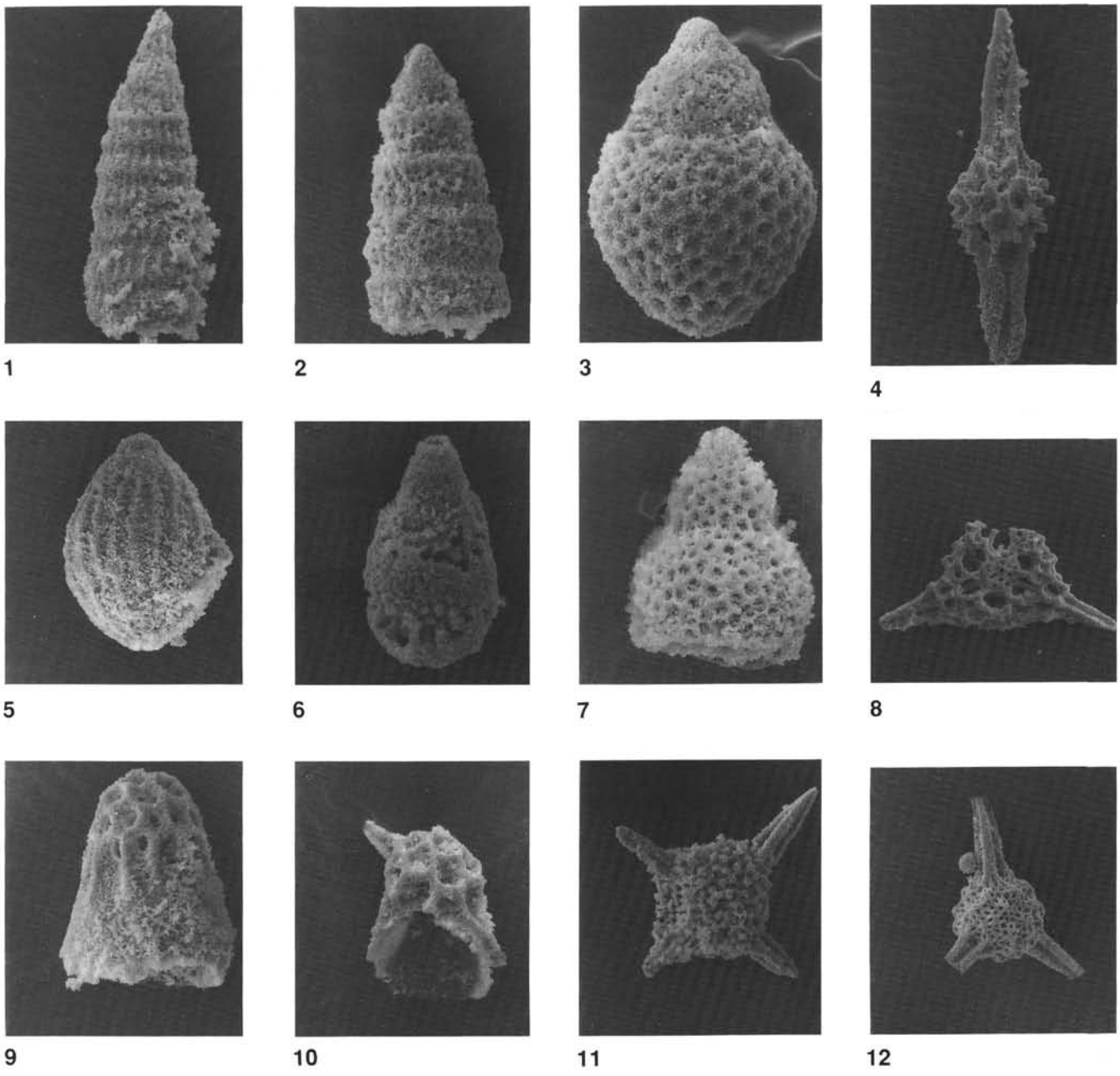

Plate 3. Radiolarian fauna in the *Pseudodictyomitra primitiva* Zone. Some specimens (Figs. 1, 3, 4, 7, 9, and 10) are from Sample 129-801B-23R-CC, 7–9 cm, and the others (Figs. 2, 5, 6, 8, 11, and 12) from Sample 129-801B-28R-CC. **1.** *Pseudodictyomitra primitiva* Matsuoka and Yao, ×250. **2.** *Cinguloturris carpatica* Dumitrică, ×250. **3.** *Zhamoidellum mikamense* Aita ×380. **4.** *Sphaerostylus oligoporus* (Vinassa), ×180. **5.** *Protunuma japonicus* Matsuoka and Yao, ×250. **6.** *Solenotryma*(?) *ichikawai* Matsuoka and Yao, ×250. **7.** *Eucyrtidiellum* sp. P, ×380. **8.** *Perispyridium ordinarium* (Pessagno), ×100. **9.** *Vallupus hopsoni* Pessagno and Blome, ×250. **10.** *Mesovallupus guadalupensis* Pessagno and MacLeod, ×250. **11.** *Haliodictya*(?) *hojnosi* Riedel and Sanfilippo, ×180. **12.** *Acaeniotyle diagorophona* Foreman, ×100.

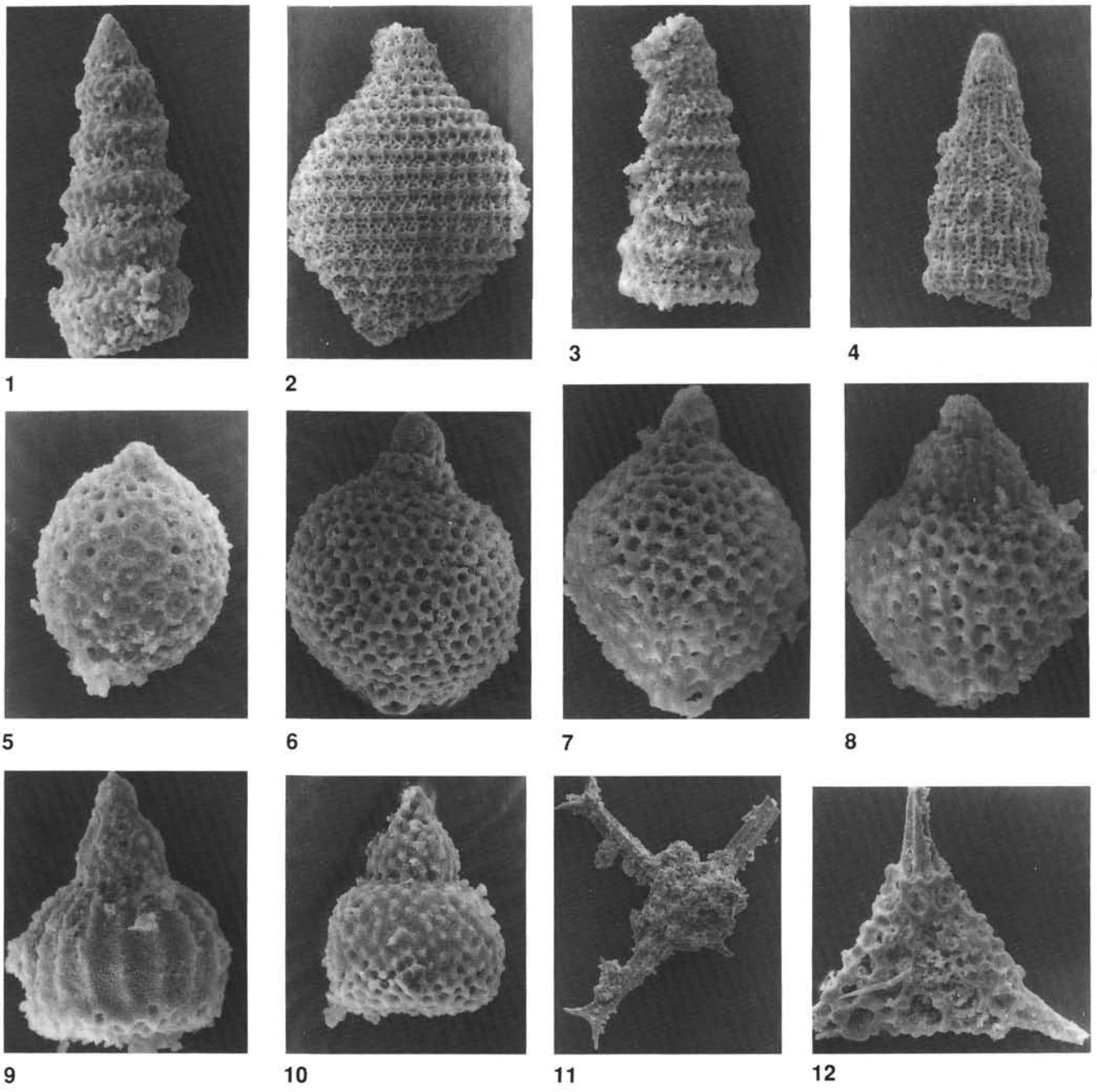

Plate 4. Radiolarian fauna in the *Cinguloturris carpatica* Zone. All specimens are taken from Sample 129-801B-32R-CC. **1.** *Cinguloturris carpatica* Dumitrică, ×250. **2.** *Mirifusus fragilis* Baumgartner, ×100. **3.** *Dictyomitrella*(?) *kamoensis* Mizutani and Kido, ×250. **4.** *Hsuum maxwelli* Pessagno, ×180. **5.** *Gongylothorax* sp. aff. *G. favosus* Dumitrică, ×380. **6.** *Tricolocapsa yaoi* Matsuoka, ×380. **7.** *Williriedellum* sp. A., ×380. **8.** *Zhamoidellum mikamense* Aita, ×380. **9.** *Eucyrtidiellum ptyctum* Riedel and Sanfilippo, ×380. **10.** Eucyrtidiellum nodosum Wakita, ×380. **11.** *Emiluvia hopsoni* Pessagno, ×100. **12.** *Perispyridium ordinarium* (Pessagno), ×180.

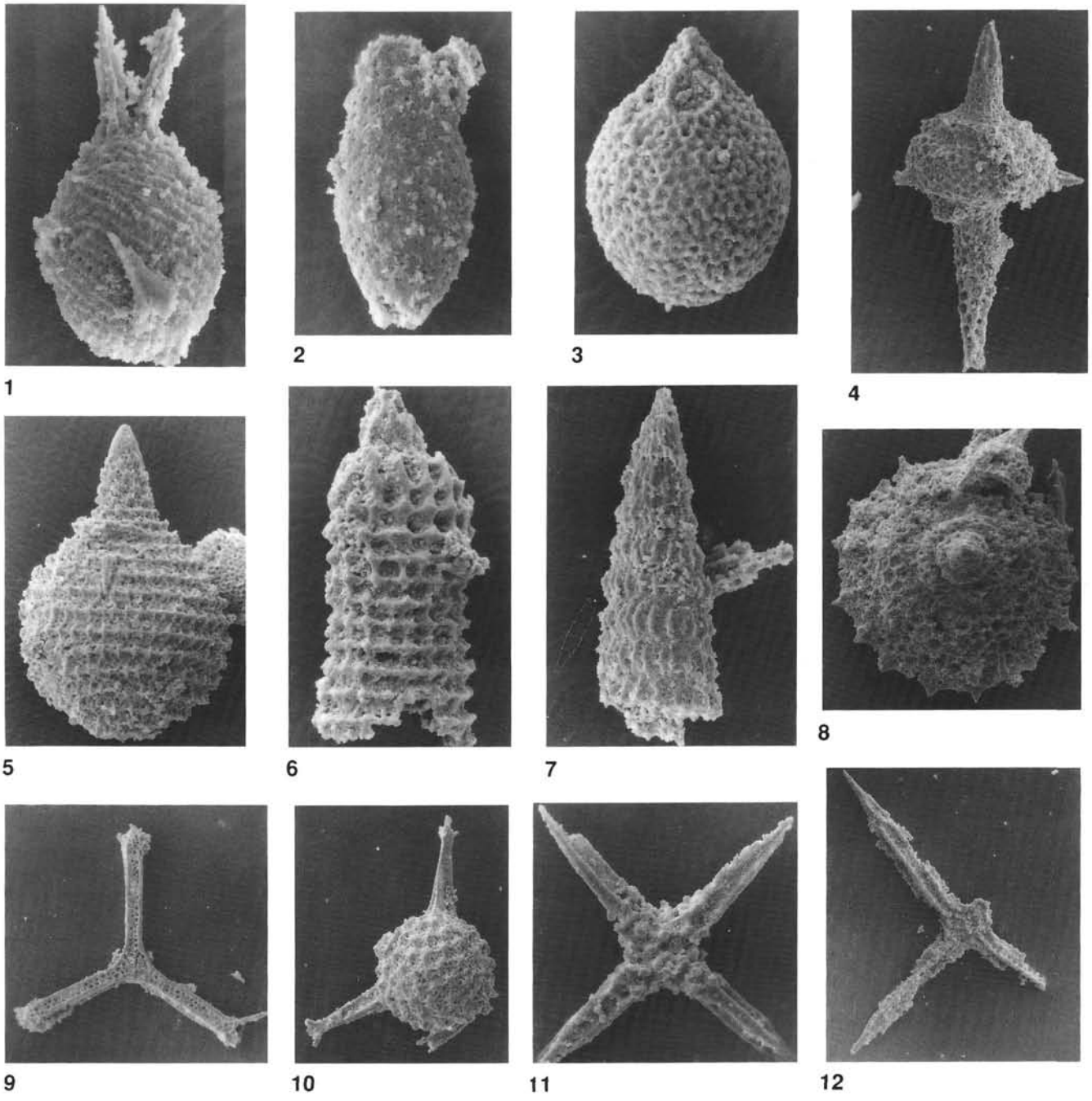

Plate 5. Radiolarian fauna in the *Stylocapsa*(?) *spiralis* Zone. All specimens are taken from Sample 129-801B-33R-CC. **1.** *Stylocapsa*(?) *spiralis* Matsuoka, ×250. **2.** *Gongylothorax sakawaensis* Matsuoka, ×250. **3.** *Stichocapsa robusta* Matsuoka, ×250. **4.** *Podobursa helvetica* (Rüst), ×100. **5.** *Mirifusus fragilis* Baumgartner, ×100. **6.** *Ristola altissima* (Rüst), ×180. **7.** *Hsuum brevicostatum* (Ozvoldova), ×180. **8.** *Andromeda* sp. M, ×100. **9.** *Angulobracchia* sp., ×75. **10.** *Acaeniotyle diagorophona* Foreman *variata* Ozvoldova, ×75. **11.** *Emiluvia chica* Foreman, ×180. **12.** *Tetratrabs zealis* (Ozvoldova), ×75.