

Early Middle Miocene Radiolaria from Nicobar Islands, Northeast Indian Ocean

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ABSTRACT: In the tropical Northeast Indian Ocean, Neogene sediments of the Andaman and Nicobar Islands belong to a deep water marine facies rich in Radiolaria. Within the Nicobar group of islands, moderately rich radiolarian assemblages from Nancowry and Kamorta islands have been studied. One-hundred-twenty species belonging to the *Dorcadospyris alata* Zone (~15-13 Ma) are herein reported and illustrated. This is the first detailed record of Early Middle Miocene radiolarian taxa from land-based sections of Andaman-Nicobar Islands and it is hoped that it will provide a database for comparative studies between the tropical radiolarian faunas of the Pacific and Indian oceans.

INTRODUCTION

In the Northeast Indian Ocean, sediments from the Andaman and Nicobar Islands represent uplifted sea floors of Late Cretaceous to subrecent age. The Neogene sediments on these islands contain rich, well preserved microfaunas of Radiolaria, foraminifera, diatoms and calcareous nannoplankton and are comparable to those from deep sea cores. Because of their soft lithology, microfossil recovery is good.

Although work on Radiolaria from these islands, in the form of preliminary reports, has been available since 1952 (Jacob and Shrivastava 1952; Singh and Vimal 1973), detailed studies on Neogene Radiolaria only began in the 1980s (Srinivasan et al. 1983; Sharma 1988; Sharma and Sharma 1988, 1989; Singh 1991; Rawal 1993; Sharma and Singh 1993; Mahapatra 1993; Sharma et al. 1993; Mahapatra and Sharma 1994; Sharma and Singh, in press).

Early Middle Miocene sequences from the Nancowry and Kamorta islands, which belong to the Nicobar group of islands (text-fig. 1), yielded a moderately rich and well preserved radiolarian fauna. The purpose of this paper is to present taxonomic notes and to illustrate taxa from sections found on these islands. We hope that this documentation will be useful for comparing fauna from different sites of the tropical Indian and Pacific region, including both land based sections and deep sea cores.

MATERIAL AND METHODS

One section from Nancowry Island and three from Kamorta Island have been examined (text-fig. 2). Samples from the North Coast section (Nancowry Island) and from the West Coast section (Kamorta Island) were provided by M. S. Srinivasan of the Department of Geology, Banaras Hindu University. Samples from the Southeast Coast sections (A) and (B) were collected by one of us (SS).

The slides were prepared by standard procedures (Sanfilippo et al. 1985) using a 63µm sieve. Depending upon the abundance of Radiolaria, one to six slides were prepared for each sample. Occurrences of radiolarian species are shown in Table 1.

RADIOLARIAN ASSEMBLAGE AND BIOSTRATIGRAPHY

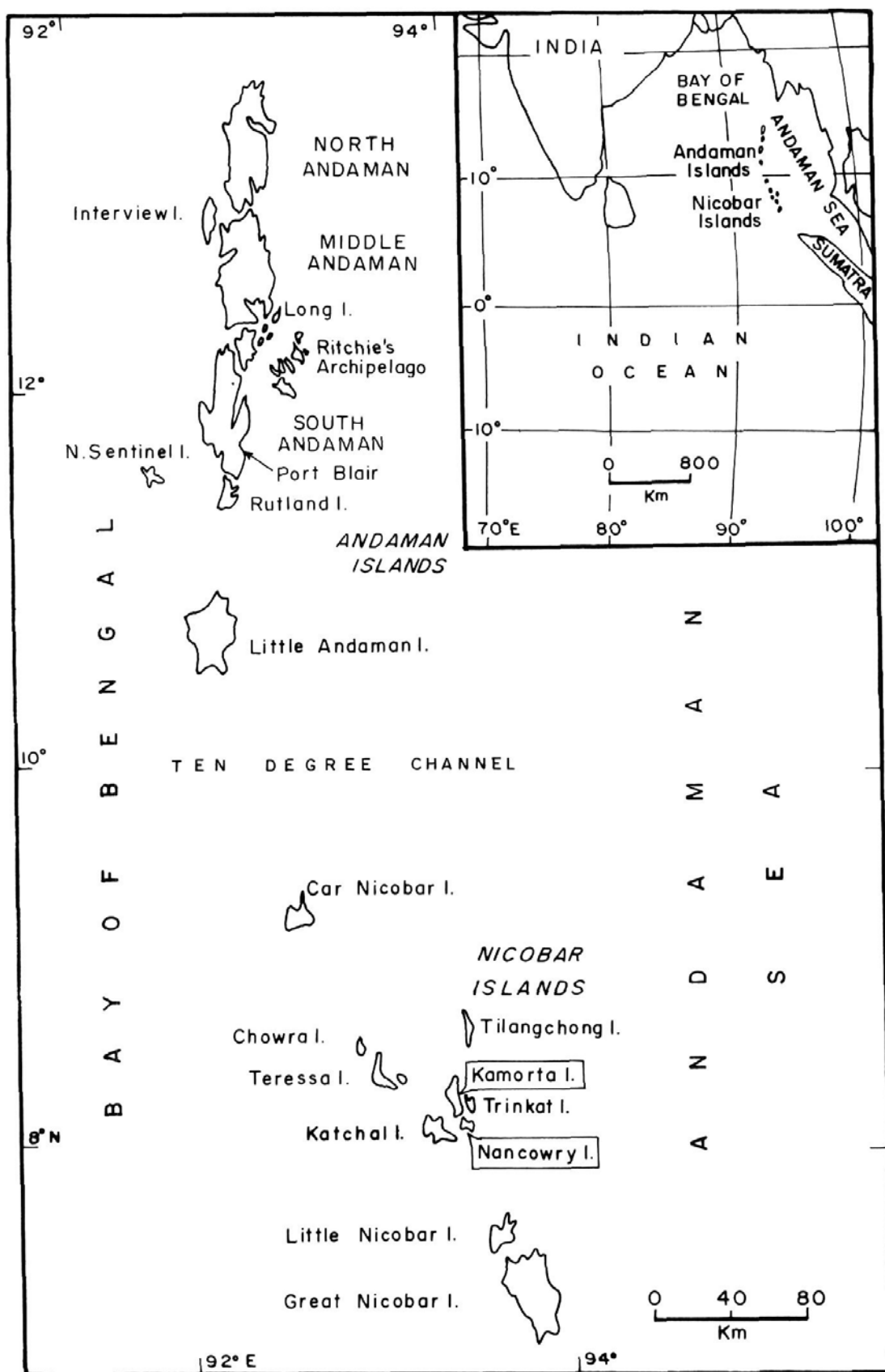
Moderately good preservation is found in all the sections. Rapid deposition of coarse sediments observed in the North Coast and Southeast Coast sections is possibly responsible for parts of the sections being barren of Radiolaria or showing poor abundance. The West Coast section with homogenous lithology of calcareous mudstone contains abundant Radiolaria.

The radiolarian assemblage consists of 128 taxa including 8 reworked forms. Dominant species include *Lophophaena* spp., *Porodiscus* sp. A, *Stylochlamyidium asteriscus*, *Spongostochus glacialis* group and *Didymocyrtis laticonus*. *Larcopyle bütschlii*, *Calocycletta caepa* and *Stylodictya validispina* are common in the North Coast section. *Eucyrtidium hexagonatum*, *Stichocorys delmontensis* and *Tholospyrus anthophora* are well represented in the West Coast section.

A mild reworking of radiolarian species is observed, which resulted in bringing a few older forms into the assemblage. In the West Coast section reworking seems to be slightly more pronounced than in the other sections (Table 1).

Due to the absence of zonal marker events in the sections, the radiolarian zone was identified on the presence of stratigraphically useful species. Radiolarian assemblages of the examined sections show close faunal similarity in them, and consequently, all the four sections are considered together for biozonation. *Didymocyrtis laticonus* occurs in all the sections. Its first appearance is recorded in the upper part of *Dorcadospyris alata* Zone and ranges through the overlying *Diartus petterssoni* Zone (Sanfilippo et al. 1985; Nigrini 1985). The presence of *Didymocyrtis laticonus* in all the sections and the absence of *Diartus petterssoni*, whose first appearance defines the top of *Dorcadospyris alata* Zone, show that the sections are referable to the upper part of *Dorcadospyris alata* Zone (text-fig. 3).

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TEXT-FIGURE 1

Location of Andaman-Nicobar Islands in the Indian Ocean (inset). Areas of study are shown within the boxes.

Cyrtocapsella japonica, *Lithopera bacca* and *Didymocyrtis antepenultima* are present in the studied sections (Table 1). In the tropical central Pacific, these species first appear in the overlying *Diartus petterssoni* Zone (Nigrini 1985), whose lower boundary is defined by the first appearance of *Diartus petterssoni*. Their presence in the *Dorcadospyrus alata* Zone in the area of study is due to the late appearance of *Diartus petterssoni* in the tropical Indian Ocean (at 10.6-10.8 Ma). In the central equatorial Pacific the first appearance of *Diartus petterssoni* is found much earlier (at 12.5-12.7 Ma) (Johnson and Nigrini 1985).

Based on Radiolaria, the precise time of deposition of the studied sequences is difficult to determine as no reliable radiolarian event could be identified. Srinivasan and Dave (1985) identified planktic foraminiferal zones and datum levels in the same sections. Age estimation of these datum levels (e.g. Saito 1977; Keller 1980; Berggren et al. 1985) suggest that their deposition was between about 15 Ma and 13 Ma.

SYSTEMATICS

This section deals with the systematics of 120 species, excluding the reworked species which are listed separately at the end of this section. The classification followed here is largely based on the scheme presented in Nigrini and Moore (1979) and Nigrini and Lombardi (1984). Species within a genus and genera within a family are treated alphabetically. Distinguishing morphological features are provided for the unidentified species.

Subclass RADIOLARIA Müller 1858

Order POLYCYSTINA Ehrenberg 1838, emend. Riedel 1967b

Suborder SPUMELLARIA Ehrenberg 1875

Family COLLOSPHAERIDAE Müller 1858

Genus *Acrosphaera* Haeckel 1881

Acrosphaera spinosa echinoides Haeckel

Plate 1 figures 1, 2

Acrosphaera echinoides HAECKEL 1887, p. 100, pl. 8, fig. 1.

Acrosphaera spinosa echinoides Haeckel. - BJORKLUND and GOLL 1979, p. 1311, pl. 1, figs. 7, 10-13; pl. 4, figs. 1-4, 7, 8.

Genus *Collosphaera* Müller 1855, emend. Bjorklund and Goll 1979

Collosphaera macropora Popofsky

Plate 1, figure 8

Collosphaera macropora POPOFSKY 1917, p. 247, pl. 14, figs. 2a-c. - JOHNSON and NIGRINI 1980, p. 147, pl. 1, fig. 7; pl. 4, fig. 15.

Genus *Trisolenia* Ehrenberg 1860b

Trisolenia megalactis megalactis Ehrenberg

Plate 1, figures 3-5

Trisolenia megalactis EHRENBURG 1860b, p. 833; 1872a, p. 321, pl. 8, fig. 19; 1872b, p. 301.

Trisolenia megalactis megalactis Ehrenberg. - BJORKLUND and GOLL 1979, p. 1321, pl. 5, figs. 1-21.

Family ACTINOMMIDAE Haeckel 1862, emend. Sanfilippo and Riedel 1980

Genus *Actinomma* Haeckel 1860, emend. Nigrini 1967, emend. Bjorklund 1976

Actinomma leptodermum (Jörgensen)

Plate 1, figure 7

Echinomma leptodermum JÖRGENSEN 1900, p. 56; 1905, p. 116, pl. 8, figs. 33a-c.

Actinomma leptodermum (Jörgensen). - NIGRINI and MOORE 1979, p. 535, pl. 3, fig. 7.

Genus *Carposphaera* Haeckel 1881

Carposphaera nodosa Haeckel

Plate 1, figure 13

Carposphaera nodosa HAECKEL 1887, p. 76, pl. 28, figs. 2, 2a. - BLUEFORD 1982, p. 198, pl. 5, figs. 7-8.

Genus *Cladococcus* Müller 1857

Cladococcus sp. A

Plate 1, figure 20

Shell single, thick; pores circular to subcircular, equidimensional, hexagonally framed, about 6 on half equator, interpore space about 3/4 of the pore diameter; spines long, bladed, more than 10 in number, about 2.5 times the shell diameter, branched near the distal end; shell surface with small thorn-like projections.

Cladococcus sp. B

Plate 1, figure 10

Shell small, single; pores circular to subcircular, closely packed, polygonally framed, many long bladed spines on the surface, their length almost equal to or slightly larger than the shell diameter, branched near the distal end; thin bispines present all over the surface of the shell.

Genus *Hexastylus* Haeckel 1881

Hexastylus dimensivus Haeckel

Plate 1, figure 18

Hexastylus dimensivus HAECKEL 1887, p. 175, pl. 21, fig. 6. - BLUEFORD 1982, p. 197, pl. 4, fig. 6.

Hexastylus favulosus Blueford

Plate 1, figures 16, 17

Hexastylus favulosus BLUEFORD 1982, p. 197, pl. 4, figs. 1-4.

Genus *Hexacontium* Haeckel 1881

Hexacontium hexactis (Stöhr)

Plate 1, figures 6-11

Actinomma hexactis STÖHR 1880, p. 91, pl. 2, fig. 7.

Hexacontium hexactis HAECKEL 1887, p. 192. - BLUEFORD 1982, p. 197, pl. 4, figs. 7-8.

Hexacontium cf. *H. hexactis* (Stöhr)

Plate 1, figure 12

Actinomma hexactis STÖHR 1880, p. 91, pl. 2, fig. 7.

Hexacontium hexactis HAECKEL 1887, pl. 192. - BLUEFORD 1982, p. 197, pl. 4, figs. 7-8.

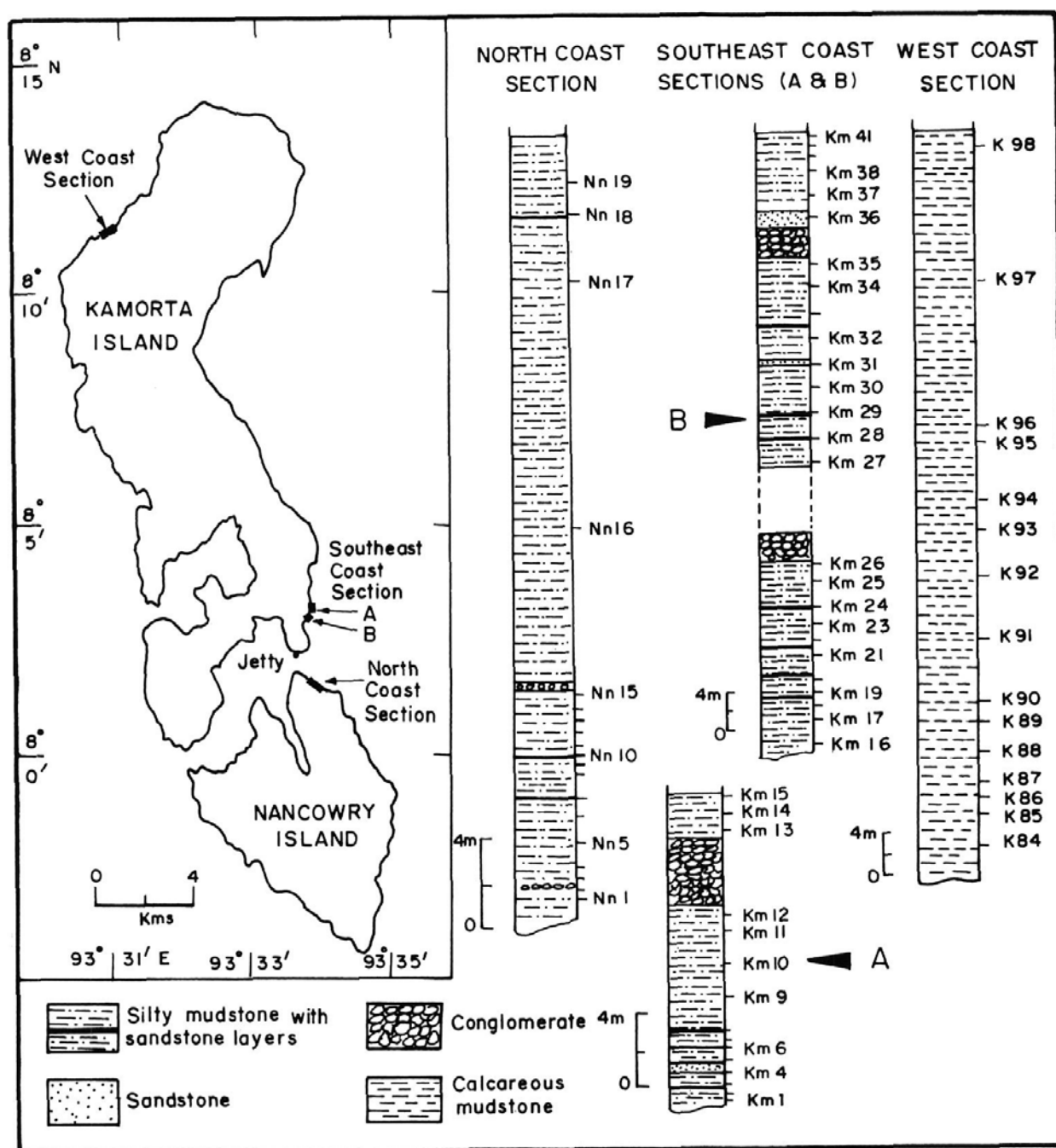
Remarks: The forms belonging to this species are very similar to *Hexacontium hexactis* but differ in having a larger number of spines than on *Hexacontium hexactis*, which has 6-8 spines.

Genus *Sphaerostylus* Haeckel 1881

Sphaerostylus cristatus Blueford

Plate 1, figures 19, 24

Sphaerostylus cristatus BLUEFORD 1982, p. 199, pl. 5, figs. 9, 10.



TEXT-FIGURE 2
Location of the studied sections, their lithologs and stratigraphic position of samples.

Sphaerostylus nicholasi Blueford
Plate 1, figure 23

Sphaerostylus nicholasi BLUEFORD 1982, p. 200, pl. 6, figs. 5-6.

Sphaerostylus rosetta Blueford
Plate 2, figure 7

Sphaerostylus rosetta BLUEFORD 1982, p. 202, pl. 7, figs. 1, 2.

Genus *Druppattractus* Haeckel 1887

Druppattractus acquilonius Hays
Plate 1, figure 22

Druppattractus acquilonius HAYS 1970, p. 214, pl. 1, figs. 4, 5. -
NIGRINI and LOMBARI 1984, p. S23, pl. 4, figs. 1a,b.

Stylacantharium acquilonium (Hays). - KLING 1973, p. 634, pl.1, figs.
17-20; pl. 14, figs. 1-4.

***Druppatractus hastatus* Blueford**

Plate 2, figures 3, 4

Druppatractus hastatus BLUEFORD 1982, p. 206, pl. 6, figs. 3, 4.

***Druppatractus irregularis* Popofsky**

Plate 2, figure 6

Druppatractus irregularis POPOFSKY 1912, p. 114, text-figs. 24-26. - BLUEFORD 1982, p. 204, pl. 6, figs. 7a, b.

***Druppatractus nanus* Blueford**

Plate 2, figures 1, 2

Druppatractus nanus BLUEFORD 1982, p. 204, pl. 7, figs. 3a-4.

***Druppatractus* sp. A**

Plate 1, figure 15

Cortical shell thick, slightly ellipsoidal, surface rough, pores rosette shaped; two unequal, bladed polar spines, larger spine thick, 3-4 times the smaller one, distal end of larger spine with serrated edges (broken in the present figure); small, robust bladed spines on one-half of cortical shell proximal to smaller polar spine; medullary shell spherical with diameter nearly half that of the cortical shell, pores of medullary shell circular, hexagonally framed.

***Druppatractus* sp. B**

Plate 2, figure 5

Cortical shell elongated, shorter diameter of cortical shell about two times that of medullary shell; surface rough, bears closely spaced large circular pores with raised polygonal borders; one pole bears a long conical spine which is weakly bladed at the base, other pole bears one or two small, nearly equal conical spines, weakly bladed at the base; medullary shell spherical having circular pores with hexagonal framework.

Genus *Stylatractus* Haeckel 1887

***Stylatractus* spp.**

Plate 1, figure 21

Stylatractus spp. NIGRINI and MOORE 1979, p. S55, pl. 7, figs. 1a, b.

Family SPONGURIDAE Haeckel 1862, emend. Petrushevskaya 1975

Genus *Spongurus* Haeckel 1860

***Spongurus* spp.**

Plate 1, figures 9, 14

Shell ellipsoidal, composed of spongy meshwork with numerous small pores, shell length about 1.8 times its breadth; surface relatively smooth, but small thorn-like projections present near the pylome, internally well developed concentric ellipsoids present, distance between ellipsoids gradually increases towards the periphery along the longer axis.

Genus *Spongocore* Haeckel 1887

***Spongocore puella* Haeckel**

Plate 2, figure 14

Spongocore puella HAECKEL 1887, p. 347, pl. 48, fig. 6. - NIGRINI and MOORE 1979, p. S69, pl. 8, figs. 5a-c.

Family PHACODISCIDAE Haeckel 1881

Genus *Heliodiscus* Haeckel 1862, emend. Nigrini 1967

***Heliodiscus asteriscus* Haeckel**

Plate 2, figure 15

Heliodiscus asteriscus HAECKEL 1887, p. 445, pl. 33, fig. 8. - NIGRINI and LOMBARI 1984, p. S39, pl. 5, fig. 4.

Genus *Phacodiscus* Haeckel 1881

***Phacodiscus* sp.**

Plate 2, figure 24

Cortical shell lenticular, diameter nearly three times that of medullary shell, pores numerous, small, rounded to subrounded, almost regularly distributed, surface smooth, periphery with no girdle or spines. One medullary shell distinct, with large subrounded, irregularly arranged pores.

Family COCCODISCIDAE Haeckel 1862, emend. Sanfilippo and Riedel 1980

Subfamily ARTISCINAE Haeckel 1881, emend. Riedel 1967b

Genus *Didymocyrtis* Haeckel 1860

***Didymocyrtis antepenultima* (Riedel and Sanfilippo)**

Plate 2, figure 9

Ommatartus antepenultimus RIEDEL and SANFILIPPO 1970, p. 521, pl. 14, fig. 4.

Didymocyrtis antepenultima (Riedel and Sanfilippo). - SANFILIPPO and RIEDEL 1980, p. 1010. - NIGRINI and LOMBARI 1984, p. S55, pl. 7, figs. 2a, b.

***Didymocyrtis laticonus* (Riedel)**

Plate 2, figure 10

Cannartus laticonus RIEDEL 1959, p. 291, pl. 1, fig. 5.

Didymocyrtis laticonus (Riedel). - SANFILIPPO and RIEDEL 1980, p. 1010. - NIGRINI and LOMBARI 1984, p. S53, pl. 7, figs. 1a-c.

Genus *Diartus* Sanfilippo and Riedel 1980

***Diartus didymus* (Ehrenberg)**

Plate 2, figures 12, 13

Haliomma didymus EHRENBURG 1844, p. 83.

Ommatartus didymus (Ehrenberg). - SANFILIPPO et al. 1973, p. 216, pl. 2, figs. 1, 2.

Diartus didymus (Ehrenberg). - SANFILIPPO and RIEDEL 1980, p. 1010.

Family SPONGODISCIDAE Haeckel 1862, emend. Riedel 1967b

Genus *Dictyocoryne* Ehrenberg 1860b

***Dictyocoryne profunda* Ehrenberg**

Plate 3, figure 1

Dictyocoryne profunda EHRENBURG 1860a, p. 767; 1872a, p. 307; 1872b, p. 288, pl. 7, fig. 23. - NIGRINI and MOORE 1979, p. S87, pl. 12, fig. 1.

***Dictyocoryne truncatum* (Ehrenberg)**

Plate 2, figure 36

Rhopalodictyum truncatum EHRENBURG 1861, p. 301. - HAECKEL 1887, p. 589.

Dictyocoryne truncatum (Ehrenberg). - NIGRINI and MOORE 1979, p. S89, pl. 12, figs. 2a, b.

Genus *Euchitonia* Ehrenberg 1860b, emend. Nigrini 1967

Euchitonia furcata Ehrenberg

Plate 2, figure 34

Euchitonia furcata EHRENBURG 1872a, p. 308; 1872b, p. 289, pl. IV (iii), fig. 6. - NIGRINI and LOMBARI 1984, p. S59, pl. 8, fig. 1

Genus *Hymeniastrum* Ehrenberg 1847

Hymeniastrum spp. Nigrini and Lombardi

Plate 2, figure 35; plate 3, figure 2

Hymeniastrum spp. NIGRINI and LOMBARDI 1984, p. S61, pl. 8, figs. 2a, b.

Genus *Stylochlamydidium* Haeckel 1881

Stylochlamydidium asteriscus Haeckel

Plate 2, figure 16

Stylochlamydidium asteriscus HAECKEL 1887, p. 514, pl. 41, fig. 1. - NIGRINI and MOORE 1979, p. S113, pl. 14, fig. 5.

Genus *Stylodictya* Ehrenberg 1847, emend. Kozlova 1972 (In: Petrushevskaya and Kozlova 1972)

Stylodictya aculeata Jörgensen

Plate 2, figures 17, 29

Stylodictya aculeata JÖRGENSEN 1905, p. 119, pl. 10, fig. 41. - NIGRINI and LOMBARDI 1984, p. S69, pl. 10, figs. 1a, b.

Stylodictya validispina Jörgensen

Plate 2, figure 19

Stylodictya validispina JÖRGENSEN 1905, p. 119, pl. 10, fig. 40. - NIGRINI and LOMBARDI 1984, p. S71, pl. 10, fig. 2.

Genus *Circodiscus* Kozlova 1972 (In: Petrushevskaya and Kozlova 1972)

Circodiscus microporus (Stöhr) group

Plate 2, figure 28

Trematodiscus microporus STÖHR 1880, p. 108, pl. 4, fig. 17.
Circodiscus microporus (Stöhr). - PETRUSHEVSKAYA and KOZLOVA 1972, p. 526, pl. 19, figs. 1-7.
Circodiscus microporus (Stöhr) group NIGRINI and LOMBARDI 1984, p. S73, pl. 10, fig. 3.

Circodiscus sp.

Plate 2, figure 18

Shell circular to slightly oval in outline; central chamber large, around which are two or more elliptical rings of approximately equal width; pores rounded to subrounded, variable in size, 3-4 in each ring across width, outer margin bears thorn like small spines.

Genus *Porodiscus* Haeckel 1881, emend. Kozlova 1972 (In: Petrushevskaya and Kozlova 1972)

Porodiscus sp. A

Plate 2, figure 21

Porodiscus sp. A NIGRINI and MOORE 1979, p. S107, pl. 14, figs. 1, 2a, b.

Porodiscus (?) sp

Plate 2, figures 22, 23

Central structure large, dense and covered with spongy meshwork; chambers very irregular and discontinuous; pores numer-

ous, irregular in shape and size becoming larger towards the shell margin.

Remarks: This species is similar to *Porodiscus* (?) sp. B described and illustrated by Nigrini and Moore (1979), but differs in having much larger central opaque structure and in pores becoming larger towards the shell margin.

Genus *Spongopyle* Dreyer 1889

Spongopyle osculosa Dreyer

Plate 2, figures 25, 26

Spongopyle osculosa DREYER 1889, p. 42, pl. 11, figs. 99, 100. - NIGRINI and LOMBARDI 1984, p. S77, pl. 11, figs. 1a, b.

Genus *Spongotrochus* Haeckel 1860

Spongotrochus glacialis Popofsky group

Plate 2, figure 8

Spongotrochus glacialis POPOFSKY 1908, p. 228, pl. 26, fig. 8, pl. 27, fig. 1; pl. 28, fig. 2.

Spongotrochus glacialis Popofsky group NIGRINI and LOMBARDI 1984, p. S79, pl. 11, fig. 2.

Spongotrochus (?) *venustum* (Bailey)

Plate 2, figure 20

Perichlamydidium venustum BAILEY 1856, p. 5, pl. 1, figs. 16, 17.

Stylochlamydidium venustum (Bailey) HAECKEL 1887, p. 515.

Spongotrochus (?) *venustum* (Bailey) NIGRINI and LOMBARDI 1984, p. S81, pl. 11, fig. 3.

Family PYLONIIDAE Haeckel 1881

Genus *Hexapyle* Haeckel 1881

Hexapyle spp.

Plate 3, figure 6

Hexapyle spp. NIGRINI and MOORE 1979, p. S121, pl. 16, figs. 1a-c.

Genus *Phorticium* Haeckel 1881

Phorticium polycladum Tan and Tchang

Plate 3, figure 7

Phorticium polycladum TAN and TCHANG 1976, p. 267, text fig. 39a, b. - NIGRINI and LOMBARDI 1984, p. S83, pl. 12, figs. 1a, b.

Phorticium pylonium Haeckel

Plate 3, figure 8

Phorticium pylonium HAECKEL 1887, p. 709, pl. 49, figure 10. - NIGRINI and LOMBARDI 1984, p. S85, pl. 12, figs. 2a, b.

Genus *Prunopyle* Dreyer 1889

Prunopyle tetrapila Hays

Plate 2, figures 32, 33

Prunopyle tetrapila HAYS 1965, p. 172, pl. 11, fig. 5.

Genus *Tetrapyle* Müller 1858

Tetrapyle octacantha Müller

Plate 3, figure 9

Tetrapyle octacantha MÜLLER 1858, p. 33, pl. 2, figs. 12, 13; pl. 3, figs. 1-12. - NIGRINI and LOMBARDI 1984, p. S87, pl. 12, figs. 3a, b.

TABLE 1

Occurrence of Radiolaria in the samples of the examined sections.

Occurrence/Abundance: A = abundant, C = Common, F = few, R = rare, + = extremely rare (1-2 specimens). Occurrence of a taxon in samples showing extremely low abundance (< 10 specimens) is indicated by the letter 'P'. Samples barren of Radiolaria are not included in the table. Preservation: G = good, M = moderate, * = reworked species

ZONE		Dorcadospyris alata Zone																											
SECTIONS		NORTH COAST SECTION													SOUTHEAST COAST SECTION A														
SAMPLES		Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	
SPECIES		1	3	4	5	6	8	12	13	14	16	17	19		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Acrobotrys sp.		.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2. Acrocubus octopylus		.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3. Acrosphaera spinosa echinoides		+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	+	.
4. Actinomma leptodemum		+	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5. Albatrossidium sp. A		.	+	.	+	.	.	.	.	.	+	.	.	.	+	.	F	.	.	R	R	.	R	R	.	F	R	.	.
6. Albatrossidium sp. B		R	+	R	.	R	.	R	.	R	R	.	.	.	R	.	R	.	R	R	.	R	.	.	.	R	R	R	.
7. Anthocyrtidium ehrenbergi		.	.	R	R	.	.	R	.	.	.	.	P	.	R	.	R	.	.	R	.	R	.	.	R	.	.	.	.
8. Botryocyrtis spp.		.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
9. Botryostrobos miralestensis		+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
10. Calocyrtella caepa		F	+	.	R	R	.	F	.	F	F	.	.	.	R	.	R	.	.	R	R	.	R	R	.	F	.	.	.
* 11. Calocyrtella costata		.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
* 12. Calocyrtella virginis		+	+	.	+	+	.	+	+	+	R	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	R
13. Carpodanarium sp.		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.
14. Carpodanistrum spp.		+	.	.	.	R	.	+	.	.	R	.	.	.	+	.	+	.	.	.	.	.	.	+	.	.	.	.	.
* 15. Carpodanopsis bramlettei		.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16. ?Carpocanopsis cristata		+	.	.	.	+	.	+	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
* 17. Carpodanopsis favosa		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18. Carposphaera nodosa		.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	+	.	+	.	.	.
19. Cinclopyramis sp.		+	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
20. Circodiscus microporus group		R	R	R	.	R	.	R	.	.	R	P	.	.	R	P	R	.	.	.	R	.	R	R	.	R	R	R	.
21. Circodiscus sp.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
22. Cladococcus sp. A		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.
23. Cladococcus sp. B		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24. Clethrocanium sphaerocephalum		+	+	+	.	+	.	+	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	+	.
25. Collosphaera macropora		.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
26. Comutella profunda		+	.	+	+	.	.	+	.	.	+	.	.	.	.	R	.	.	+	+	.	R	R	.	+	R	R	+	.
27. Cubotholus sp.		.	.	.	.	+	.	+	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	+	.
28. Cyrtocapsella comula		.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	+	.	+	.	+	.
29. Cyrtocapsella japonica		.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.
30. Cyrtocapsella tetrapera		.	.	.	.	+	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31. Dendrosphyris binapertonis		+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32. Dendrosphyris bursa		+	.	+	+	.	.	+	.	.	+	.	.	.	+	.	+	.	.	R	.	.	R	.	.	+	+	+	.
33. Dendrosphyris damaecornis		+	.	.	+	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
34. Dendrosphyris pododendros		+	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35. Diartus didymus		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	+	+	.
36. Dictyocoryne profunda		.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37. Dictyocoryne truncatum		R	R	R	.	R	.	R	.	R	R	.	.	.	+	.	+	.	.	.	.	.	.	.	.	+	.	+	.
38. Dictyophimus hirundo		.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39. Didymocyrtis antepenultima		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	+	+	.	+	+	.	.
40. Didymocyrtis laticornis		C	F	C	C	C	.	C	.	C	C	P	P	.	R	P	R	.	P	R	R	P	.	R	P	R	.	R	R
* 41. Didymocyrtis violina		.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
42. Dorcadospyris alata		.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
43. Dorcadospyris forcipata		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44. Druppactractus acquilonius		.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	+	.	.	.	+	+	.	R	.	.
45. Druppactractus hastatus		+	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46. Druppactractus irregularis		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
47. Druppactractus nanus		.	.	+	+	.	.	+	.	+	+	.	P	.	.	.	R	.	.	.	.	.	.	R	.	R	R	R	R
48. Druppactractus sp. A		.	.	.	R	.	.	.	.	.	+	.	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49. Druppactractus sp. B		R	R	.	R	.	R	.	R	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50. Euchitonina furcata		.	R	R	R	.	.	R	.	R	R	P	P	.	.	.	.	.	.	.	.	.	.	.	R	.	R	R	.
51. Eucyrtidium cf. E. acuminatum		.	R	.	R	R	.	.	.	R	R	P	.	.	R	.	R	.	.	.	.	.	R	R	.	R	.	R	.
52. Eucyrtidium hexagonatum		R	R	F	.	R	.	.	.	R	R	.	.	.	R	P	R	.	.	.	.	R	R	.	.	R	F	.	.
53. Giraffospyris angulata		.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
54. Giraffospyris circumflexa		+	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	R
55. Giraffospyris toxaria		.	+	.	+	+	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56. Gorgospyris perizostrea		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.
57. Helioliscus asteriscus		.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58. Hexacotium hexactis		+	+	.	.	+	.	+	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	+	.	+	.	.	.
59. Hexacotium cf. H. hexactis		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60. Hexapyle spp.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
61. Hexastylus dimensivus		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	+	.	.
62. Hexastylus favulosus		.	+	+	.	.	.	.	.	+	+	.	.	.	+	.	.	.	+	.	.	.	.	.	.	+	+	+	.
63. Hymenialstrum spp.		R	R	R	R	+	.	R	.	R	R	.	.	.	.	.	R	.	.	R	.	R	R	.	R	.	R	R	R
64. Lamprocyclas maritilis group		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	+	.
65. Lamprocyclas (?) hanna		.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE 1
Continued.

ZONE		Dorcadospyris alata Zone																											
SECTIONS		NORTH COAST SECTION														SOUTHEAST COAST SECTION A													
SAMPLES		Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Nn	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	
SPECIES		1	3	4	5	6	8	12	13	14	16	17	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
66.	<i>Larcopyle bütschlii</i>	R	R	R	R	F		F		R	F			+									+						
67.	<i>Larcospira moschkovskii</i>	+		+	+	+		+		R	R					R				R			R		R	R		R	
68.	<i>Liriospyris elevata</i>	R		+	+	+		+	+	+	+					+							+			+		+	
69.	<i>Liriospyris geniculosa</i>	+	+	+				+		+	+					+				+					+				
70.	<i>Liriospyris mutuarie</i>	+	R			+		+		+	+								+			+		+		+	+	+	
*71.	<i>Liriospyris parkerae</i>										R		+																
*72.	<i>Liriospyris stauropora</i>	R	+	+							R																		
73.	<i>Liriospyris</i> sp. "L2"	F	R		R					R															+				
74.	<i>Lithellus minor</i>	R	+	R	R	F		R	P	R	R			R		R			F	R		R	R		R	R		R	
75.	<i>Lithellus nautiloides</i>	+	+	+	+	R		R	P	+	+	P	P	R		R			R	R		R	R		R	R	R	R	
76.	<i>Lithopora bacca</i>																												
77.	<i>Lithopora neotera</i>																												
78.	<i>Lithopora renzae</i>					+		+		+				+															
79.	<i>Lithopora thornburgi</i>																								+				
80.	<i>Lophophaena</i> spp.	+	+		+	R		R		+	R			F		R			R	F		C	F		+	+	+	+	
81.	<i>Lophospyris pentagona hyperborea</i>			+	+	R		+																					
82.	<i>Lophospyris pentagona pentagona</i>	+		+		+				+	+			+					+						+	+	+		
*83.	<i>Lychnocanomma elongata</i>					+																+	+						
84.	<i>Lychnoditium audax</i>																			+		+							
85.	<i>Peridium</i> spp.							R		R				C		C			R	A		C	F		R	R	R	R	
86.	<i>Phacodiscus</i> sp.				+	+		+		+	+	P	P	+											+				
87.	<i>Phormospyris stabilis antarctica</i>	R		R	R	+		+		+				+	+							+							
88.	<i>Phormospyris stabilis capoi</i>																												
89.	<i>Phormospyris stabilis scaphipese</i>	+	+	+	+					+												+			R				
90.	<i>Phormospyris stabilis stabilis</i>	+		+		+		+		+		+		R		+						R	R			R			
91.	<i>Phormospyris corbula</i>																										+		
92.	<i>Phormostichoartus fistula</i>			+																									
93.	<i>Phormostichoartus marylandicus</i>				+	+		+		+	+			+											+	+	+	+	
94.	<i>Phortidium polycladum</i>	+	+	+	+	+		+	P	+	+	P	P			R			R		P	R			R	R	R	R	
95.	<i>Phortidium pylonium</i>					+				+				+	+			+	+	+	+	+	+	+	+	+	+	+	
96.	<i>Porodiscus</i> sp.	F	R	F	R	R	P	R	P	F	R	P	P	R	P	F			R				R		R	R		R	
97.	<i>Porodiscus</i> (?) sp.	R	R	R	R	R		F	P	R	R	P	P	F		F						R	R		R	R	R	F	
98.	<i>Prunopyle tetrapila</i>																								+				
99.	<i>Pterocanium trilobum</i>	+	+		+	+		+		+	+								+										
100.	? <i>Pylospira</i> octopyle	+		+	+			+		+															+				
101.	<i>Siphocampe arachnea</i> group																					+							
102.	<i>Siphostichartus corona</i>	+			+	+								+						+									
103.	<i>Sphaerostylus cristatus</i>	+		+	+	+	+			+	+			R		R							R		R	R		R	
104.	<i>Sphaerostylus nicholasi</i>					+				+	+	P		+	+	P			+	+	+	+	R		R				
105.	<i>Sphaerostylus rosetta</i>															+													
106.	<i>Spirocylis subscalaris</i>																												
107.	<i>Spongocore puella</i>			+		+		+		+				R								R	R		R	R			
108.	<i>Spogopyle osculosa</i>	R		R	R	R		R		R	R					+				+						+			
109.	<i>Spongostrochus glacialis</i> group	R	F	F	R	F		F		F	F	P	P	F	P	F	P		R	R		R	R		R	R	R	F	
110.	<i>Spongostrochus</i> (?) <i>venustum</i>	F	R	F	F	C		F	P	F	F	P		F		F			F	F		F	R		F	R	R	R	
111.	<i>Spongurus</i> spp.	R	R	R	R	R		F		R	F	P	P	R		R			R	F		F	R		F	R	R	R	
112.	<i>Stichocorys armata</i>			+						+				+	+														
113.	<i>Stichocorys delmontensis</i>	R		R	R	R				R				R		F			R	R	P	R	R		R	R	R	R	
114.	<i>Stichocorys diploconus</i>	+		+	+	+				+				+					+				+		+	+			
115.	<i>Stichocorys wolffii</i>	+		+					P	+	+												R	+	R		+		
116.	<i>Stylatractus</i> spp.					+		+		+				+									+		+				
117.	<i>Stylochlamydidium asteriscus</i>	R	R	R	R	F		F		R	F		P	R		R			R	R		R	R		F	F	R	F	
118.	<i>Stylodictya aculeata</i>	+	+	+	+	+		+		R	R			R		R							R		R	R	R	R	
119.	<i>Stylodictya validispina</i>	R	R	R	R	F		F		R	R	P		R		R	P	P	R	R	P		R	P	R	R	R	R	
120.	<i>Tetrapyle octacantha</i>	+		+	+	+		+		+				+	+							+							
121.	<i>Theocorys</i> sp.	R	+		+	+		R		R	R			R					R	R		R	R			R	+		
122.	<i>Tholospyris anthophora</i>	+	+			+		+	P		+	P	P	+		R			+										
123.	<i>Tholospyris infericosta</i>	+				+		+		+													+						
124.	<i>Tholospyris kantiana</i>	+	+	+	+	+				+				+										+					
125.	<i>Tholospyris mammillaris</i>							+		+	+			+								+							
126.	<i>Trisolenia megalactis megalactis</i>	R		R	R	R		R		R	R																		
127.	<i>Tympanomma binotatum</i>	+		+		+		+		R	+																		
128.	<i>Zygocircus productus abnormis</i>																						+						
ABUNDANCE		F	F	C	F	A	R	A	R	C	A	R	R	C	R	C	R	R	C	F	R	F	F	R	C	F	F	C	
PRESERVATION		G	G	G	G	G	M	G	G	G	G	G	M	G	M	G	M	M	G	M	M	M	G	M	G	M	G	G	

TABLE 1
Continued.

ZONE		Dorcadospyris alata Zone																																							
SECTIONS		SOUTHEAST COAST SECTION B																				WEST COAST SECTION																			
SAMPLES		Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	Km	K	K	K	K	K	K	K	K	K	K	K	K	K	K				
SPECIES		16	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	40	41	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98			
1. Acrobotrys sp.			
2. Acrocubus octopylus		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3. Acrosphaera spinosa echinoides		.	.	*	.	.	*	.	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*	.	.	.	.	.	.	.	.	.	.	.
4. Actinomma leptodermum		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5. Albatrossidium sp. A		.	.	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				
6. Albatrossidium sp. B		.	.	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				
7. Anthocyrtidium ehrenbergi		.	.	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				
8. Botryocytis spp.		.	.	.	.	.	*	.	*	.	*	*	.	.	.	*	*	.	.	.	*	.	.	.	R	R	R	R	R	R	.	.	R	R	R	R	R	R
9. Botryostrobos miralestensis		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
10. Calocyctella caepa		.	.	R	R	R	.	.	R	R	F	R	.	R	.	.	R	R	R	R	R	R	+	R	R	+	R	+	R	+	R	R	+	R	R	R	+				
*11. Calocyctella costata		R	R	.	R	R	R	R	R	R	R	R	R	.	R		
*12. Calocyctella virginis		.	.	.	.	.	*	.	.	.	.	.	.	.	.	*	.	.	.	.	.	.	+	+	.	+	.	R	+	R	R	R	.	R	R	.	R	
13. Carpodanarium sp.		.	.	.	.	*	.	.	.	.	.	*	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	*	.	+
14. Carpodanistrum spp.		.	.	.	.	.	.	.	.	*	.	.	.	.	.	.	+	+	+	.	.	.	*	.	R	.	*	.	*	.	.	.	.	.	*	.	.	+
*15. Carpodanopsis bramlettei		.	.	.	.	.	.	*	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	*	.	+
16. ?Carpodanopsis cristata		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+
*17. Carpodanopsis favosa		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18. Carposphaera nodosa		.	.	.	.	*	+	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	+	.	.	.	+	+	+	+	.	.	.	.	+	.	.	.
19. Cinclopyramis sp.		.	.	.	.	.	*	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+
20. Circodiscus microporus group		.	.	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				
21. Circodiscus sp.		.	.	.	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22. Cladococcus sp. A		.	.	.	.	*	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.
23. Cladococcus sp. B		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+
24. Clathrocanium sphaerocephalum		.	.	.	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+
25. Collosphaera macropora		.	.	.	.	.	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+
26. Cornutella profunda		.	.	+	+	.	*	R	+	.	R	+	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	+	+	+	+	+	+	+	+	+	+
27. Cubotholus sp.		.	.	.	.	.	.	.	.	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
28. Cyrtocapsella cornuta		.	.	.	.	.	.	*	.	.	.	.	.	.	.	.	.	+	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	+	+	.
29. Cyrtocapsella japonica		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.
30. Cyrtocapsella tetrapera		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
31. Dendrosphyris binapertensis		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
32. Dendrosphyris bursa		.	.	+	+	.	R	.	+	R	+	R	.	+	+	+	+	+	+	+	+	+	+	+	+	R	+	R	R	.	R	
33. Dendrosphyris damaecornis		*	+	.	.		
34. Dendrosphyris pododendros		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35. Diartus didymus		.	.	+	+	R	+	.	.	.	.	.	.	.	.	.	+	+	.	R	.	.	+	+	R	+	+	+	+	+	+	+	+	+	+	+	+	+
36. Dictyocoryne profunda		R	R	.	R	.	R	R	.	R	R	.	R	.	.		
37. Dictyocoryne truncatum		*	R	+	*	.	+	+	+	+	+	+	+	R	R	R	R	R	.	R		
38. Dictyophimus hirundo		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
39. Didymocyrtis antepenultima		R	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
40. Didymocyrtis laticonus		P	R	R	R	R	R	F	R	F	F	.	R	.	R	R	F	R	R	R	R	R	F	R	R	R	R	R	R	F	R	F	R	F	R	F	R	F			
*41. Didymocyrtis violina		.	.	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42. Dorcadospyris alata		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43. Dorcadospyris forcipata		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44. Druppactractus acqulloni		.	.	.	.	+	+	.	+	R	R	R	R	R	.	R	.	R	.	.	.	+	+	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+
45. Druppactractus hastatus		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46. Druppactractus irregularis		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
47. Druppactractus nanus		.	.	.	.	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
48. Druppactractus sp. A		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49. Druppactractus sp. B		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50. Euchttonia furcata		.	.	.	.	R	.	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
51. Eucyrtidium cf. E. acuminatum		.	.	.	.	R	.	R	.	.	R	R	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52. Eucyrtidium hexagonatum		.	.	.	.	.	.	R	R	.	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	+	+	+	R	R	
53. Giraffospyris angulata		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
54. Giraffospyris circumflexa		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
55. Giraffospyris toxaria		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
56. Gorgospyris perizostea		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
57. Heliolodiscus asteriscus		R	R	R		
58. Hexacotium hexactis		*																				

TABLE 1
Continued.[illegible]

Family LITHELIIDAE Haeckel 1862

Genus *Larcopyle* Dreyer 1889

Larcopyle bütschlii Dreyer

Plate 3, figure 3

Larcopyle bütschlii DREYER 1889, p. 124, p. 10, fig. 70. - NIGRINI and LOMBARI 1984, p. S89, pl. 13, figs. 1a,b.

Genus *Larcospira* Haeckel 1887

Larcospira moschkovskii Kruglikova

Plate 3, figure 10

Larcospira sp. KRUGLIKOVA 1974, pl. 2, figs. 15, 16.

Larcospira moschkovskii KRUGLIKOVA 1978, p. 88, pl. 27, figs. 3-6. - NIGRINI and LOMBARI 1984, p. S91, pl. 13, figs. 2a,b.

Genus *Lithelius* Haeckel 1860

Lithelius minor Jörgensen

Plate 3, figure 4

Lithelius minor JÖRGENSEN 1899, p. 65, pl. 5, fig. 24. - NIGRINI and MOORE 1979, p. S135, pl. 17, figs. 3, 4a,b.

Lithelius nautiloides Popofsky

Plate 3, figure 5

Lithelius nautiloides POPOFSKY 1908, p. 230, pl. 27, fig. 4(only). - NIGRINI and LOMBARI 1984, p. S97, pl. 14, figs. 2a,b.

Genus *Pylospira* Haeckel 1887

?*Pylospira octopyle* Haeckel

Plate 2, figure 27

?*Pylospira octopyle* HAECKEL 1887, p. 698, pl. 49, fig. 4. - NIGRINI and LOMBARI 1984, p. S101, pl. 14, fig. 4.

Family THOLONIIDAE Haeckel 1887

Genus *Cubotholus* Haeckel 1887

Cubotholus sp.

Plate 2, figures 30, 31

Cortical shell thick, made of six simple cupolas in the direction of three axes, surface rough but without spines, pores large, subrounded and of equal size; single medullary shell with indistinct pores.

Suborder NASSELLARIA Ehrenberg 1875

Family PLAGIACANTHIDAE Hertwig 1879, emend. Goll 1979

Genus *Lophophaena* Ehrenberg 1847

Lophophaena spp.

Plate 3, figures 11-13

Shell thick; cephalis with rounded to subrounded pores of variable size and with well developed spines; thorax separated from cephalis by a prominent constriction, thoracic pores circular to subcircular and similar to those on cephalis.

Family PLAGONIIDAE Haeckel 1887 emend. Riedel 1967b

Genus *Peridium* Haeckel 1887

Peridium spp.

Plate 3, figure 21

Cephalis smooth, nearly oval in outline, with numerous small pores and with single bladed apical horn; shell mouth open; three basal feet with meshwork.

Family TRISSOCYCLIDAE Haeckel 1881, emend. Goll 1968 (= Acanthodesmiidae Haeckel 1862, in Riedel 1971)

Genus *Dendrosphyris* Haeckel 1881, emend. Goll 1969

Dendrosphyris binapertonis Goll

Plate 3, figure 14

Dendrosphyris binapertonis GOLL 1968, p. 1420, pl. 173, figs. 5, 6, 10, text fig. 8. - MAHAPATRA and SHARMA 1994, p. 159, pl. 1, fig. 1.

Dendrosphyris bursa Sanfilippo and Riedel

Plate 4, figure 2

Theocampe ? sp. a, NAKASEKO 1963, p. 183, pl. 2, figs. 8a,b.

Dendrosphyris bursa Sanfilippo and Riedel. - SANFILIPPO et al. 1973, p. 217, pl. 2, figs. 9-13. - NIGRINI and LOMBARI 1984, p. N19, pl. 16, figs. 1a-f. - MAHAPATRA and SHARMA 1994, p. 159, pl. 1, fig. 5.

Dendrosphyris damaecornis (Haeckel)

Plate 3, figure 16

Triceraspyris damaecornis HAECKEL 1887, p. 1032.

Dendrosphyris damaecornis (Haeckel). - GOLL 1968, p. 1420, pl. 173, figs. 1-4, text fig. 8. - NIGRINI and LOMBARI 1984, p. N21, pl. 16, fig. 2. - MAHAPATRA and SHARMA 1994, p. 159, pl. 1, fig. 2.

Dendrosphyris pododendros (Carnevale)

Plate 3, figure 15

Tessarospyris pododendros CARNEVALE 1908, p. 28, pl. 3, fig. 18.

Dendrosphyris pododendros (Carnevale). - GOLL 1968, p. 1422, pl. 174, figs. 1-4, text fig. 8. - NIGRINI and LOMBARI 1984, p. N23, pl. 16, figs. 3a,b. - MAHAPATRA and SHARMA 1994, p. 159, pl. 1, fig. 2.

Genus *Dorcadospyris* Haeckel 1881, emend. Goll 1969

Dorcadospyris alata (Riedel)

Plate 3, figures 40, 41

Brachiospyris alata RIEDEL 1959, p. 293, pl. 1, figs. 11, 12.

Dorcadospyris alata (Riedel). - RIEDEL and SANFILIPPO 1970, p. 523, pl. 14, fig. 5.

Dorcadospyris forcipata (Haeckel)

Plate 4, figure 1

Dipospyris forcipata HAECKEL 1887, p. 1037, pl. 85, fig. 1.

Dipodospyris forcipata Haeckel. - RIEDEL 1957, p. 79, pl. 1, fig. 3.

Dorcadospyris forcipata (Haeckel). - RIEDEL and SANFILIPPO 1970, p. 523, pl. 15, fig. 7. - NIGRINI and LOMBARI 1984, p. N31, pl. 17, fig. 3. - MAHAPATRA and SHARMA 1994, p. 159, pl. 1, fig. 12.

Genus *Giraffospyris* Haeckel 1881, emend. Goll 1969

Giraffospyris angulata (Haeckel)

Plate 3, figure 34

Eucoronis angulata HAECKEL 1887, p. 978, pl. 82, fig. 3.

Giraffospyris angulata (Haeckel). - GOLL 1969, p. 331, pl. 59, figs. 4,6,7,9. - NIGRINI and LOMBARI 1984, p. N41, pl. 19, fig. 1.

Giraffospyris circumflexa Goll

Plate 3, figure 35

Giraffospyris circumflexa GOLL 1969, p. 332, pl. 60, figs. 1-4, text fig. 2. - NIGRINI and LOMBARI 1984, p. N43, pl. 19, fig. 2. - MAHAPATRA and SHARMA 1994, p. 159, pl. 1, figs. 6, 7.

***Giraffospyris toxaria* (Haeckel)**

Plate 3, figures 36, 37

Podocoronis toxarium HAECKEL 1887, p. 980, pl. 83, fig. 7.*Giraffospyris toxaria* (Haeckel). - GOLL 1969, p. 335, pl. 56, figs. 1, 2, 4, 7, text fig. 2. - MAHAPATRA and SHARMA 1994, p. 160, pl. 2, fig. 1.Genus *Gorgospyris* Haeckel 1881***Gorgospyris perizostra* Sanfilippo and Riedel**

Plate 3, figure 17

Gorgospyris perizostra SANFILIPPO and RIEDEL 1973, p. 218, pl. 3, figs. 4, 5. - MAHAPATRA and SHARMA 1994, p. 160, pl. 2, fig. 3.Genus *Liriospyris* Haeckel 1881, emend. Goll 1968***Liriospyris elevata* Goll**

Plate 3, figures 24, 26

Liriospyris elevata GOLL 1968, p. 1426, pl. 175, figs. 4, 5, 8, 9, text fig. 9; MAHAPATRA and SHARMA 1994, p. 160, pl. 2, fig. 5.***Liriospyris geniculosa* Goll**

Plate 3, figure 30

Liriospyris geniculosa GOLL 1968, p. 1427, pl. 175, figs. 21-24. - NIGRINI and LOMBARI 1984, p. N47, pl. 19, fig. 3. - MAHAPATRA and SHARMA 1994, p. 160, pl. 2, fig. 6.***Liriospyris mutuaris* Goll**

Plate 3, figure 20

Liriospyris mutuaris GOLL 1968, p. 1428, pl. 175, figs. 6, 10, 11, 14, text fig. 9. - NIGRINI and LOMBARI 1984, p. N49, pl. 19, fig. 4. - MAHAPATRA and SHARMA 1994, p. 160, pl. 2, fig. 8.***Liriospyris* sp. "L2" Goll**

Plate 3, figures 27, 28

Liriospyris sp. "L2" GOLL 1968, p. 1424, text fig. 9. - MAHAPATRA and SHARMA 1994, p. 160, pl. 2, fig. 13.Genus *Lophospyris* Haeckel 1881, emend. Goll 1976***Lophospyris pentagona pentagona* (Ehrenberg)**

Plate 3, figure 38

Ceratospyris pentagona EHRENBERG 1872a, p. 303; 1872b, pl. 15, fig. 15.*Lophospyris pentagona pentagona* (Ehrenberg). - GOLL 1976, p. 398, pl. 10, figs. 1-7; pl. 11, figs. 1-3, 5. - NIGRINI and LOMBARI 1984, p. N55, pl. 19, figs. 6a-c. - MAHAPATRA and SHARMA 1994, p. 161, pl. 2, figs. 15, 16.***Lophospyris pentagona hyperborea* (Jørgensen)**

Plate 3, figure 39

Ceratospyris hyperborea JØRGENSEN 1905, pp. 130-131, pl. 13, fig. 49.*Lophospyris pentagona hyperborea* (Jørgensen). - GOLL 1976, p. 400, pl. 14, figs. 4-6, 8, 9, 11, 12; pl. 15, figs. 1-12.Genus *Acrocubus* Haeckel 1881***Acrocubus octopylus* Haeckel**

Plate 3, figure 29

Acrocubus octopylus HAECKEL 1887, p. 993, pl. 82, fig. 9. - GOLL 1972, p. 961, pl. 37, figs. 1-3. - SANFILIPPO et al. 1985, p. 664, fig. 11.5.Genus *Phormospyris* Haeckel 1881, emend. Goll 1976***Phormospyris stabilis antarctica* (Haeckel)**

Plate 3, figure 18

Triceraspyris antarctica (Haeckel). - RIEDEL 1958, p. 230-231, text fig. 3-5, pl. 2, figs. 6, 7.*Phormospyris stabilis antarctica* (Haeckel). - GOLL 1976, p. 394, pl. 3, figs. 1-6; pl. 4, figs. 1-9; pl. 5, figs. 3-6. - NIGRINI and MOORE 1979, p. N17, pl. 20, figs. 1a-d.***Phormospyris stabilis capoi* Goll**

Plate 3, figure 31

Ceratospyris sp. PETRUSHEVSKAYA 1971, pl. 127, figs. 2-4.*Phormospyris stabilis capoi* GOLL 1976, p. 392, pl. 5, figs. 1, 2; pl. 6, figs. 1-13; pl. 7, figs. 1-9.***Phormospyris stabilis scaphipes* (Haeckel)**

Plate 3, figure 33

Tristyluspyris scaphipes HAECKEL 1887, p. 1033, pl. 84, fig. 13.*Tholospyris scaphipes* (Haeckel) GOLL 1969, p. 328, pl. 58, figs. 1-6. - GOLL 1972, p. 969, pl. 82, figs. 1-4; pl. 83, fig. 1.*Phormospyris stabilis scaphipes* (Haeckel). - GOLL 1976, p. 394, pl. 8, figs. 1-15; pl. 9, figs. 1-5. - NIGRINI and MOORE 1979, p. N19, pl. 20, figs. 2 a-d.***Phormospyris stabilis stabilis* (Goll)**

Plate 3, figure 32

Dendrosyris stabilis GOLL 1968, p. 1422, pl. 173, figs. 16-18, 20.*Phormospyris stabilis stabilis* (Goll). - GOLL 1976, p. 390, pl. 1, figs. 1-13; pl. 2, figs. 7-14. - NIGRINI and LOMBARI 1984, p. N59, pl. 19, fig. 7. - MAHAPATRA and SHARMA 1994, p. 162, pl. 3, fig. 5.Genus *Tholospyris* Haeckel 1881, emend. Goll 1969***Tholospyris anthophora* (Haeckel)**

Plate 4, figures 3, 4

Dictyospyris anthophora HAECKEL 1887, p. 1076, pl. 89, fig. 8.*Tholospyris anthophora* (Haeckel). - GOLL 1969, p. 324, pl. 55, figs. 1-4, text fig. 1.***Tholospyris infericosta* Goll**

Plate 4, figure 9

Tholospyris infericosta GOLL 1969, p. 326, pl. 55, figs. 7, 10-12, text fig. 1.***Tholospyris kantiana* (Haeckel)**

Plate 4, figures 7, 8

Tricolospyris kantiana HAECKEL 1887, p. 1098, pl. 88, fig. 10.*Tholospyris kantiana* (Haeckel). - GOLL 1969, p. 327, pl. 58, figs. 17-19, 23, text fig. 1. - NIGRINI and LOMBARI 1984, p. N71, pl. 20, figs. 2a-c. - MAHAPATRA and SHARMA 1994, p. 162, pl. 3, fig. 8.***Tholospyris mammillaris* (Haeckel)**

Plate 4, figures 5, 6

Dictyospyris mammillaris HAECKEL 1887, p. 1076, pl. 89, figs. 9, 10.*Tholospyris mammillaris* (Haeckel) GOLL 1969, p. 327, pl. 55, figs. 5, 6, 8, 9, text fig. 1. - NIGRINI and LOMBARI 1984, p. N73, pl. 20, figs. 3a,b. - MAHAPATRA and SHARMA 1994, p. 162, pl. 3, figs. 10, 11.Genus *Tympanomma* Haeckel 1887***Tympanomma binotatum* (Haeckel)**

Plate 3, figure 19

Tympanidium binocionum HAECKEL 1887, p. 1004, pl. 94, fig. 18.
Tympanomma binocionum (Haeckel) PETRUSHEVSKAYA and KOZLOVA 1972, p. 533, pl. 39, figs. 23, 24. - NIGRINI and LOMBARI 1984, p. N77, pl. 20, fig. 4. - MAHAPATRA and SHARMA 1994, p. 164, pl. 3, fig. 17.

Genus *Zygocircus* Bütschli 1882, emend. Goll 1979

Zygocircus productus abnormis Goll

Plate 4, figure 18

Zygocircus productus abnormis GOLL 1979, p. 381, pl. 1, figs. 3, 4.

Family CARPOCANIIDAE Haeckel 1881, emend. Riedel 1967b

Genus *Carpocanarium* Haeckel 1887

Carpocanarium sp.

Plate 4, figure 25

This species is similar to that described and illustrated by Nigrini and Lombari, (1984, p. N83, pl. 21, fig. 2) but differs in having 4-5 pores per longitudinal row in thorax as compared to 8-10 pores in the form described by them.

Genus *Carpocanistrum* Haeckel 1887

Carpocanistrum spp.

Plate 4, figure 26

Carpocanum spp. NIGRINI 1970, p. 171, pl. 4, figs. 4, 5.
Carpocanistrum spp. RIEDEL and SANFILIPPO 1971, p. 1596, pl. 1G, figs. 1-6, 8-13; pl. 2F, figs. 5, 6; pl. 3D, figs. 1, 2, 6, 7, 9. - NIGRINI and MOORE 1979, p. N23, pl. 21, figs. 1a-c.

Genus *Carpocanopsis* Riedel and Sanfilippo 1971

? *Carpocanopsis cristata* (Carnevale)

Plate 4, figures 21, 24

?*Sethocorys cristata* CARNEVALE 1908, p. 31, pl. 4, fig. 18.

?*Sethocorys cristata* var. CARNEVALE 1908, p. 32, pl. 4, fig. 19.

Carpocanopsis cristatum (Carnevale). - RIEDEL and SANFILIPPO 1971, p. 1597, pl. 1G, fig. 16; pl. 2G, figs. 1-7.

?*Carpocanopsis cristata* (Carnevale). - NIGRINI and LOMBARI 1984, p. N89, pl. 21, fig. 5.

Family THEOPERIDAE Haeckel 1881, emend. Riedel 1967b

Genus *Cinclopyramis* Haeckel 1879

Cinclopyramis sp.

Plate 4, figure 20

Cephalis small, usually broken; throat conical, consisting principally of ten longitudinal rods joined by transverse bars which are continuous around the circumference, node-like structure present at the junction, thoracic pores are thus quadrangular, increasing in size distally, covered with meshwork which are visible particularly in the proximal part.

Genus *Cornutella* Ehrenberg 1838, emend. Nigrini 1967

Cornutella profunda Ehrenberg

Plate 4, figure 10

Cornutella clathrata β *profunda* EHRENBURG 1854, p. 241.

Cornutella profunda Ehrenberg. - RIEDEL 1958, p. 232, pl. 3, figs. 12. - NIGRINI and LOMBARI 1984, p. N93, pl. 22, fig. 1.

Genus *Clathrocanium* Ehrenberg 1860b

Clathrocanium sphaerocephalum Haeckel

Plate 3, figure 42

Clathrocanium sphaerocephalum HAECKEL 1887, p. 1211, pl. 64, fig. 1. - SANFILIPPO et al. 1973, p. 220, pl. 4, fig. 9.

Genus *Cyrtocapsella* Haeckel 1887

Cyrtocapsella cornuta (Haeckel)

Plate 4, figure 13

Cyrtocapsa cornuta HAECKEL 1887, p. 1513, pl. 78, fig. 9.

PLATE 1 All figures X180

12 *Acrosphaera spinosa echinoides* Haeckel, 1, K 92; 2, K 93.

3-5 *Trisolenia megalactis megalactis* (Ehrenberg), 3, K 93; 4, K 84; 5, K 95.

6,11 *Hexacantium hexactis* (Stöhr), Km 40; 6, focussed on surface pores; 11, focussed on periphery.

7 *Actinomma leptodermum* (Jörgensen), Nn 6.

8 *Collosphaera macropora* Popofsky, K 83.

9,14 *Spongurus* spp., 9, K 85; 14, K 91.

10 *Cladococcus* sp. B, K 88.

12 *Hexacantium* cf. *H. hexactis* (Stöhr), Km 23.

13 *Carposphaera nodosa* Haeckel, Nn 16.

15 *Druppatractus* sp. A, K 91.

16,17 *Hexastylus favulosus* Blueford, 16, K 95; 17, K 98.

18 *Hexastylus dimensivus* Haeckel, K 93.

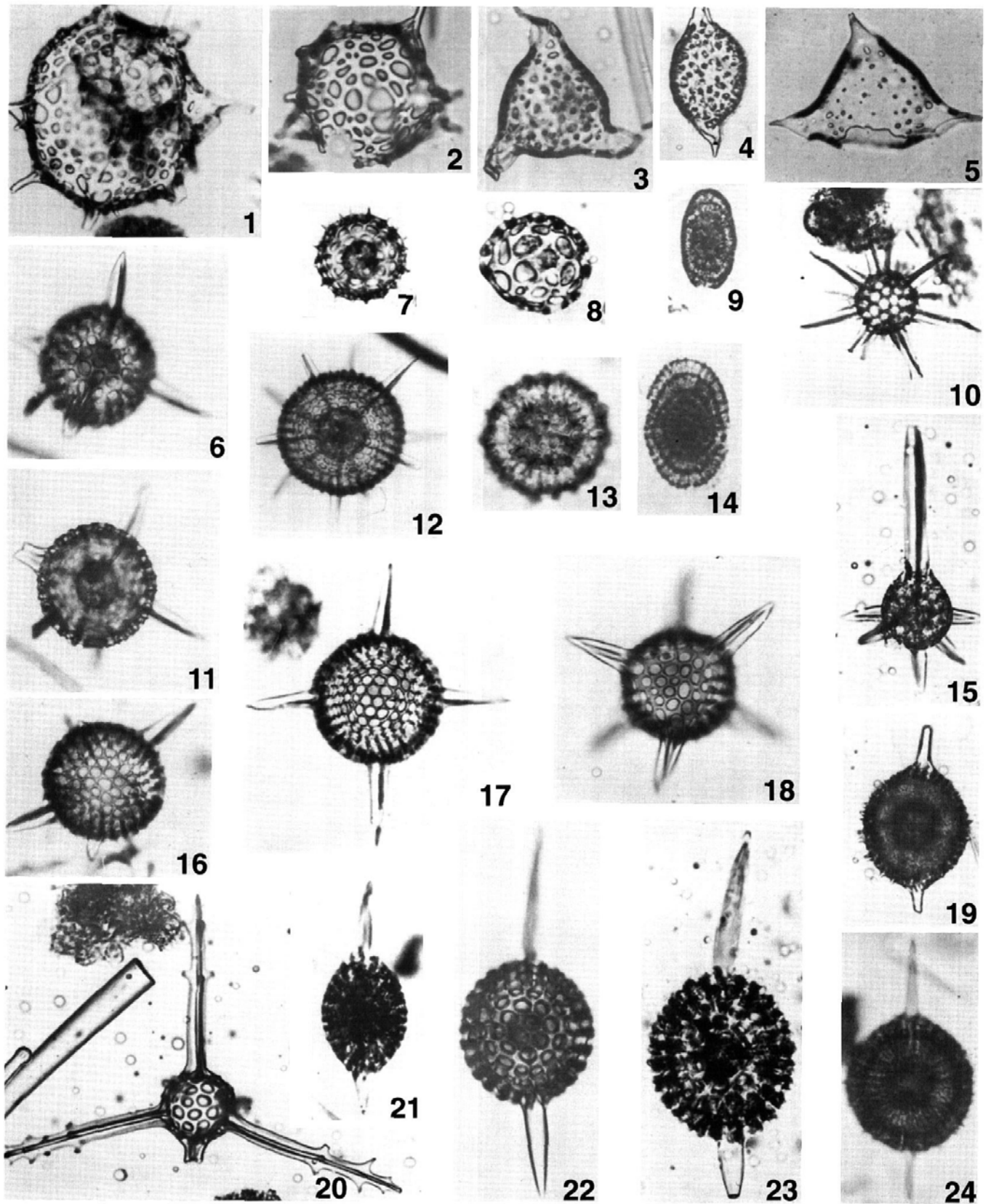
19,24 *Sphaerostylus cristatus* Blueford, 19, focussed on periphery, Nn 6; 24, focussed on surface pores, Nn 12.

20 *Cladococcus* sp. A, K 93.

21 *Stylatractus* spp., Km 33.

22 *Druppatractus acquilonius* Hays, Km 33.

23 *Sphaerostylus nicholasi* Blueford, K 95.



Cyrtocapsella cornuta Haeckel. - SANFILIPPO and RIEDEL 1970, p. 453, pl. 1, figs. 19, 20.
Cyrtocapsella cornuta (Haeckel). - NIGRINI and LOMBARI 1984, p. N101, pl. 23, fig. 1.

***Cyrtocapsella japonica* (Nakaseko)**

Plate 4, figure 15

Eusyringium japonicum NAKASEKO 1963, p. 193, text-figs. 20, 21; pl. 4, figs. 1-3.
Cyrtocapsella japonica (Nakaseko). - SANFILIPPO and RIEDEL 1970, p. 452, pl. 1, figs. 13-15. - NIGRINI and LOMBARI 1984, p. N107, pl. 23, figs. 4a-c.

***Cyrtocapsella tetrapera* (Haeckel)**

Plate 4, figure 14

Cyrtocapsa tetrapera HAECKEL 1887, p. 1512, pl. 78, fig. 5.
Cyrtocapsella tetrapera Haeckel. - SANFILIPPO and RIEDEL 1970, p. 453, pl. 1, figs. 16-18.
Cyrtocapsella tetrapera (Haeckel). - NIGRINI and LOMBARI 1984, p. N109, pl. 23, fig. 5.

Genus *Dictyophimus* Ehrenberg 1847, emend. Nigrini 1968

***Dictyophimus hirundo* (Haeckel) group**

Plate 4, figure 28

Pterocorys hirundo HAECKEL 1887, p. 1318, pl. 71, fig. 4.
Dictyophimus hirundo (Haeckel) group. - PETRUSHEVSKAYA 1975, p. 583. - NIGRINI and MOORE 1979, p. N35, pl. 22, figs. 2, 3a,b, 4.

Genus *Eucyrtidium* Ehrenberg 1847, emend. Nigrini 1967

***Eucyrtidium* cf. *E. acuminatum* (Ehrenberg)**

Plate 4, figure 27

Lithocampe acuminatum EHRENBURG 1844, p. 84.
Eucyrtidium acuminatum (Ehrenberg). - NIGRINI 1967, p. 81, pl. 8, figs. 3a,b. - NIGRINI and MOORE 1979, p. N61, pl. 24, figs. 3a,b.

Remarks: The forms belonging to this species are very similar to *Eucyrtidium acuminatum* but differ in having a larger thorax.

***Eucyrtidium hexagonatum* Haeckel**

Plate 4, figure 23

Eucyrtidium hexagonatum HAECKEL 1887, p. 1489, pl. 80, fig. 11. - NIGRINI and LOMBARI 1984, p. N115, pl. 23, figure 8.

Genus *Lithopera* Ehrenberg 1847

***Lithopera* (*Lithopera*) *bacca* Ehrenberg**

Plate 4, figure 17

Lithopera bacca EHRENBURG 1872a, p. 314.
Lithopera (*Lithopera*) *bacca* Ehrenberg. - SANFILIPPO and RIEDEL 1970, p. 455, pl. 1, fig. 29.
Lithopera bacca Ehrenberg. - SANFILIPPO et al. 1985, p. 675, figs. 16.6a,b.

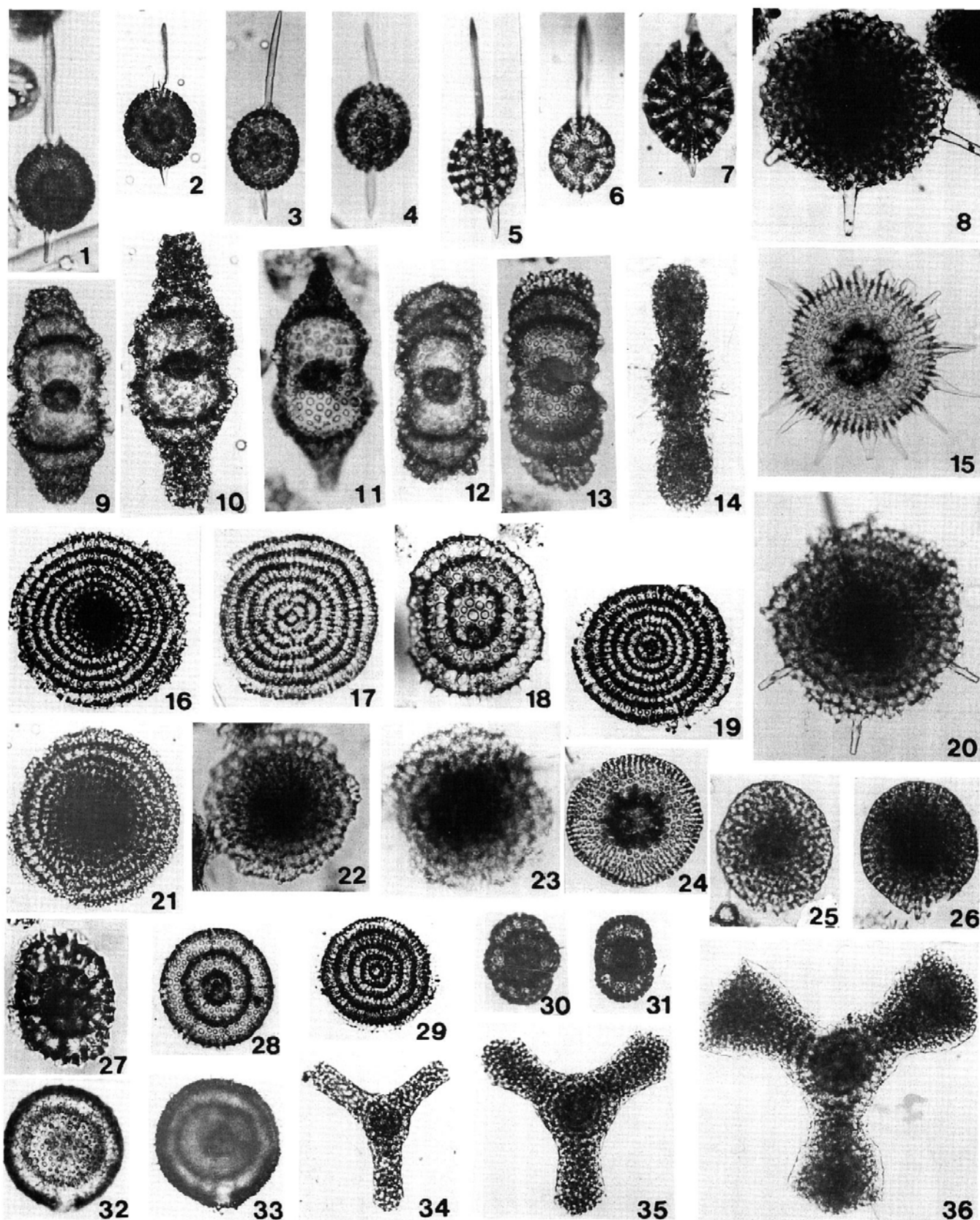
***Lithopera* (*Lithopoera*) *neotera* Sanfilippo and Riedel**

Plate 4, figure 16

Lithopera (*Lithopera*) *neotera* SANFILIPPO and RIEDEL 1970, p. 454, pl. 1, figs. 24-26, 28.
Lithopera neotera Sanfilippo and Riedel. - SANFILIPPO et al. 1985, p. 675, figs. 16.5a,b.

PLATE 2
 All figures X180

- | | |
|---|--|
| 12 <i>Druppatractus nanus</i> Blueford, 1, K 95; 2, K 89. | 18 <i>Circodiscus</i> sp., K 95. |
| 34 <i>Druppatractus hastatus</i> Blueford, 3, K 97; 4, K 91. | 19 <i>Stylodictya validispina</i> Jörgensen, K 93. |
| 5 <i>Druppatractus</i> sp. B., K 91. | 20 <i>Spongotrochus</i> (?) <i>venustum</i> (Bailey), K 96. |
| 6 <i>Druppatractus irregularis</i> Popofsky, K 89. | 21 <i>Porodiscus</i> sp. A, Nn 6. |
| 7 <i>Sphaerostylus rosetta</i> Blueford, K 89. | 22,23 <i>Porodiscus</i> (?) sp., 22, K 87; 23, K 92. |
| 8 <i>Spongotrochus glacialis</i> Popofsky group, K 95. | 24 <i>Phacodiscus</i> sp., Nn 6. |
| 9 <i>Didymocyrtis antepenultima</i> Riedel and Sanfilippo, Km 10. | 25,26 <i>Spongopyle osculosa</i> Dreyer, K 97. |
| 10 <i>Didymocyrtis laticonus</i> Riedel, K 91. | 27 ? <i>Pylospira octopyle</i> Haeckel, K 90. |
| 11 <i>Didymocyrtis violina</i> (Haeckel), Km 7. | 28 <i>Circodiscus microporus</i> (Stöhr) group, K 95. |
| 12,13 <i>Diartus didymus</i> (Ehrenberg), 12, Km 21; 13, Km 9. | 30,31 <i>Cubotholus</i> sp., 30, K 92; 31, Nn 6. |
| 14 <i>Spongocore puella</i> Haeckel, K 91. | 32,33 <i>Prunopyle tetrapyla</i> Hays, K 94; 32, focussed on surface pores; 33, focussed on periphery. |
| 15 <i>Heliodiscus asteriscus</i> Haeckel, K 95. | 34 <i>Euchitonia furcata</i> Ehrenberg, K 98. |
| 16 <i>Stylochlamyidium asteriscus</i> Haeckel, K 93. | 35 <i>Hymeniastrum</i> spp., K 98. |
| 17,29 <i>Stylodictya aculeata</i> Jörgensen, Nn 6. | 36 <i>Dictyocoryne truncatum</i> (Ehrenberg), K 95. |



Lithopera (Lithopera) renzae Sanfilippo and Riedel
Plate 4, figure 22

Lithopera (Lithopera) renzae SANFILIPPO and RIEDEL 1970, p. 454, pl. 1, figs. 21-23, 27.

Lithopera renzae Sanfilippo and Riedel. - SANFILIPPO et al. 1985, p. 675, pl. 16.4a-c.

Lithopera (Glomaria) thornburgi Sanfilippo and Riedel
Plate 4, figure 19

Lithopera (Glomaria) thornburgi SANFILIPPO and RIEDEL 1970, p. 455, pl. 2, figs. 4-6.

Lithopera thornburgi Sanfilippo and Riedel. - SANFILIPPO et al. 1985, p. 676, figs. 16.3a,b.

Genus *Lychnodictyum* Haeckel 1881

Lychnodictyum audax Riedel
Plate 4, figure 29

Lychnodictyum audax RIEDEL 1953, p. 810, pl. 85, fig. 9. - NIGRINI and LOMBARI 1984, p. N123, pl. 25, fig. 1.

Genus *Pterocanium* Ehrenberg 1847

Pterocanium trilobum (Haeckel)
Plate 4, figure 30

Dictypodium trilobum HAECKEL 1860, p. 839.

Pterocanium trilobum (Haeckel). - NIGRINI 1967, p. 71, pl. 7, figs. 3a,b. - NIGRINI and LOMBARI 1984, p. N127, pl. 25, fig. 3.

Genus *Stichocorys* Haeckel 1881

Stichocorys armata (Haeckel)
Plate 5, figure 3

Cyrtophormis armata HAECKEL 1887, p. 1460, pl. 78, fig. 17.

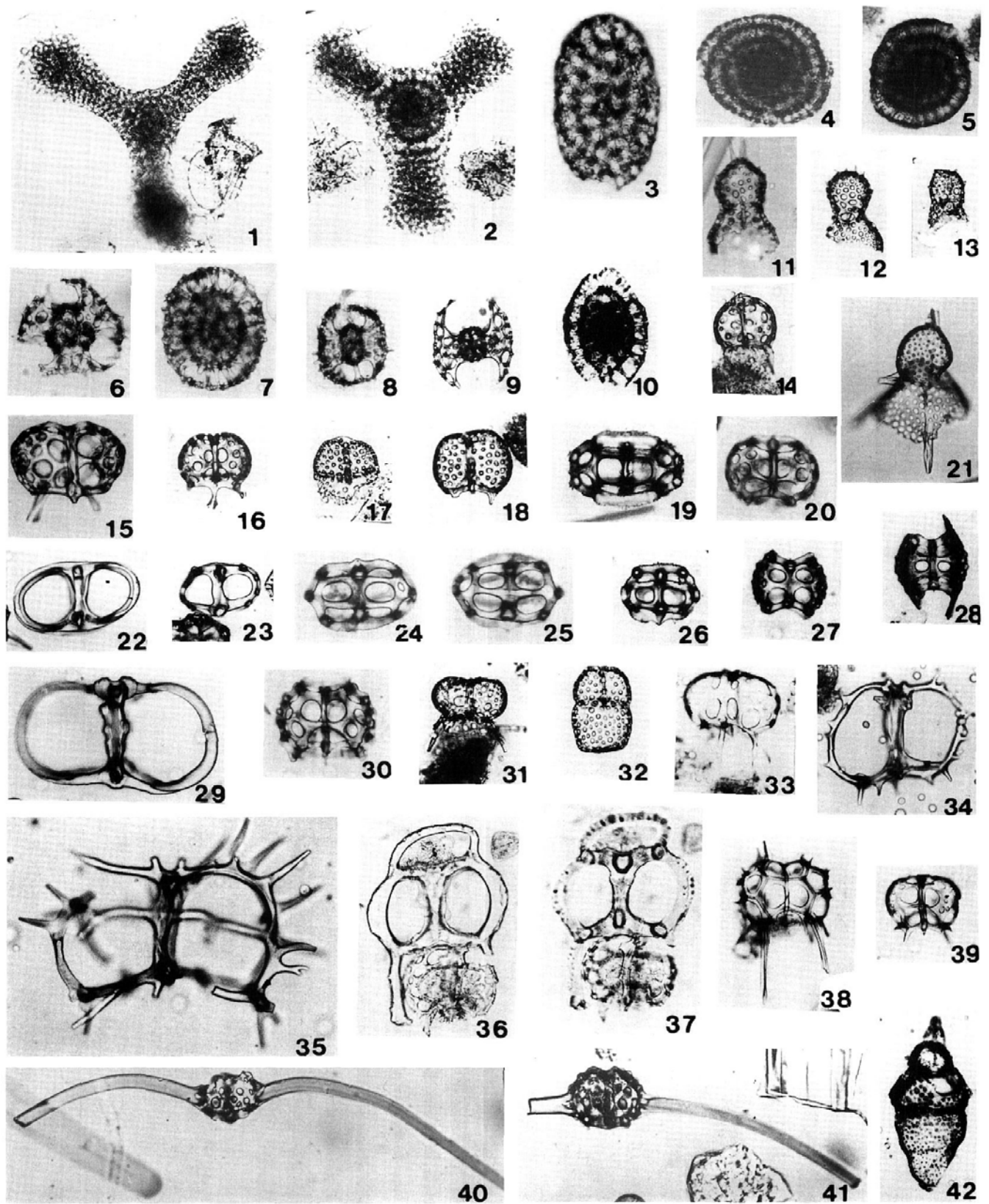
Stichocorys armata (Haeckel). - RIEDEL and SANFILIPPO 1971, p. 1595, pl. 2E, figs. 13-15. - SANFILIPPO et al. 1973, p. 222, pl. 6, figs. 1,2.

Stichocorys delmontensis (Campbell and Clark)
Plate 5, figure 1

Eucyrtidium delmontense CAMPBELL and CLARK 1944, p. 56, pl. 7, figs. 19, 20.

PLATE 3
All figures X180

- 1 *Dictyocoryne profunda* Ehrenberg, Nn 12.
- 2 *Hymeniastrum* spp., Nn 6.
- 3 *Larcopyle bütschlii* Dreyer, Km 33.
- 4 *Lithelius minor* Jörgensen, K 91.
- 5 *Lithelius nautiloides* Popofsky, K 94.
- 6 *Hexapyle* spp., Km 23.
- 7 *Phorticium polycladum* Tan and Chang, Nn 12.
- 8 *Phorticium pylonium* Haeckel, Km 32.
- 9 *Tetrapyle octacantha* Müller, Nn 16.
- 10 *Larcospira moschkovskii* Kruglikova, Km 40.
- 11-13 *Lophophaena* spp., 11, Km 20; 12, K 95; 13, K 86.
- 14 *Dendrospyris binapertonis* Goll, Km 32.
- 15 *Dendrospyris pododendros* (Carnevale), K 91.
- 16 *Dendrospyris damaecornis* (Haeckel), Nn 5.
- 17 *Gorgospyris perizostra* Sanfilippo and Riedel, Km 6.
- 18 *Phormospyris stabilis antarctica* (Haecker), Nn 6.
- 19 *Tympanomma binocionum* (Haeckel), Nn 12.
- 20 *Liriospyris mutuaria* Goll, K 95.
- 21 *Peridium* spp., K 96.
- 22 *Liriospyris parkerae* Riedel and Sanfilippo, K 96.
- 23 *Liriospyris stauropora* (Haeckel), K 96.
- 24-26 *Liriospyris elevata* Goll, 24,25, Nn 16; 26, Nn 5.
- 27,28 *Liriospyris* sp. "L2" Goll, 27, Km 20; 28, Nn 1.
- 29 *Acrocubus octopylus* Haeckel, Nn 16.
- 30 *Liriospyris geniculosa* Goll, K 98.
- 31 *Phormospyris stabilis capoi* Goll, K 98.
- 32 *Phormospyris stabilis stabilis* (Goll), Nn 20.
- 33 *Phormospyris stabilis scaphipes* (Haeckel), Km 22.
- 34 *Giraffospyris angulata* (Haeckel), K 87.
- 35 *Giraffospyris circumflexa* Goll, K 90.
- 36,37 *Giraffospyris toxaria* (Haeckel), K 88.
- 38 *Lophospyris pentagona pentagona* (Ehrenberg), K 95.
- 39 *Lophospyris pentagona hyperborea* (Jörgensen), Km 20.
- 40,41 *Dorcadospyris alata* (Riedel), Nn 12.
- 42 *Clathrocanium sphaerocephalum* Haeckel, Km 21.



Stichocorys delmontensis (Campbell and Clark), SANFILIPPO and RIEDEL 1970, p. 451, pl. 1, fig. 9. - NIGRINI and LOMBARI 1984, p. N129, pl. 25, fig. 4.

***Stichocorys diploconus* (Haeckel)**

Plate 5, figure 4

Cyrtocapsa diploconus HAECKEL 1887, p. 1513, pl. 78, fig. 6.
Stichocorys diploconus (Haeckel). - SANFILIPPO and RIEDEL 1970, p. 451, pl. 1, figs. 31, 32. - NIGRINI and LOMBARI 1984, p. N131, Plate 25, figs. 5a,b.

***Stichocorys wolffii* Haeckel**

Plate 5, figure 2

Stichocorys wolffii HAECKEL 1887, p. 1479, pl. 80, fig. 10. - NIGRINI and LOMBARI 1984, p. N135, pl. 25, fig. 7.

Genus *Theocorys* Haeckel 1881

***Theocorys* sp.**

Plate 5, figure 7

Cephalis spherical with a few small pores and a small horn, collar stricture distinct; thorax thick-walled, nearly hemispherical, rough with circular pores sunken in hexagonally framed pits, arranged in about 8 longitudinal rows on a half equator; lumbar stricture distinct, wall of abdomen thin, abdomen width nearly 1.5 times that of thorax, slightly curved inward at the distal end, pores circular to elliptical, irregular in size, larger pores near the proximal part of the abdomen, termination not clear.

Family PTEROCORYTHIDAE Haeckel 1881 emend. Riedel 1967b, emend. Moore 1972

Genus *Albatrossidium* Sanfilippo and Riedel 1992

***Albatrossidium* sp. A**

Plate 5, figures 5, 6

Shell three segmented, rather thin; cephalis elongate, conical, bulging at the base, pores small, sparsely distributed, apical horn small, bladed; collar stricture distinct, thorax campanulate with moderately large, rounded to subrounded pores, arranged in more or less longitudinal rows; abdomen cylindrical, with pores similar to those on thorax and arranged in longitudinal rows; distal part ragged.

***Albatrossidium* sp. B**

Plate 5, figures 12, 13

Remarks: This species looks very close to *Albatrossidium* sp. A but differs in having feebly developed costae between longitudinal rows of pores.

Genus *Anthocyrtidium* Haeckel 1881

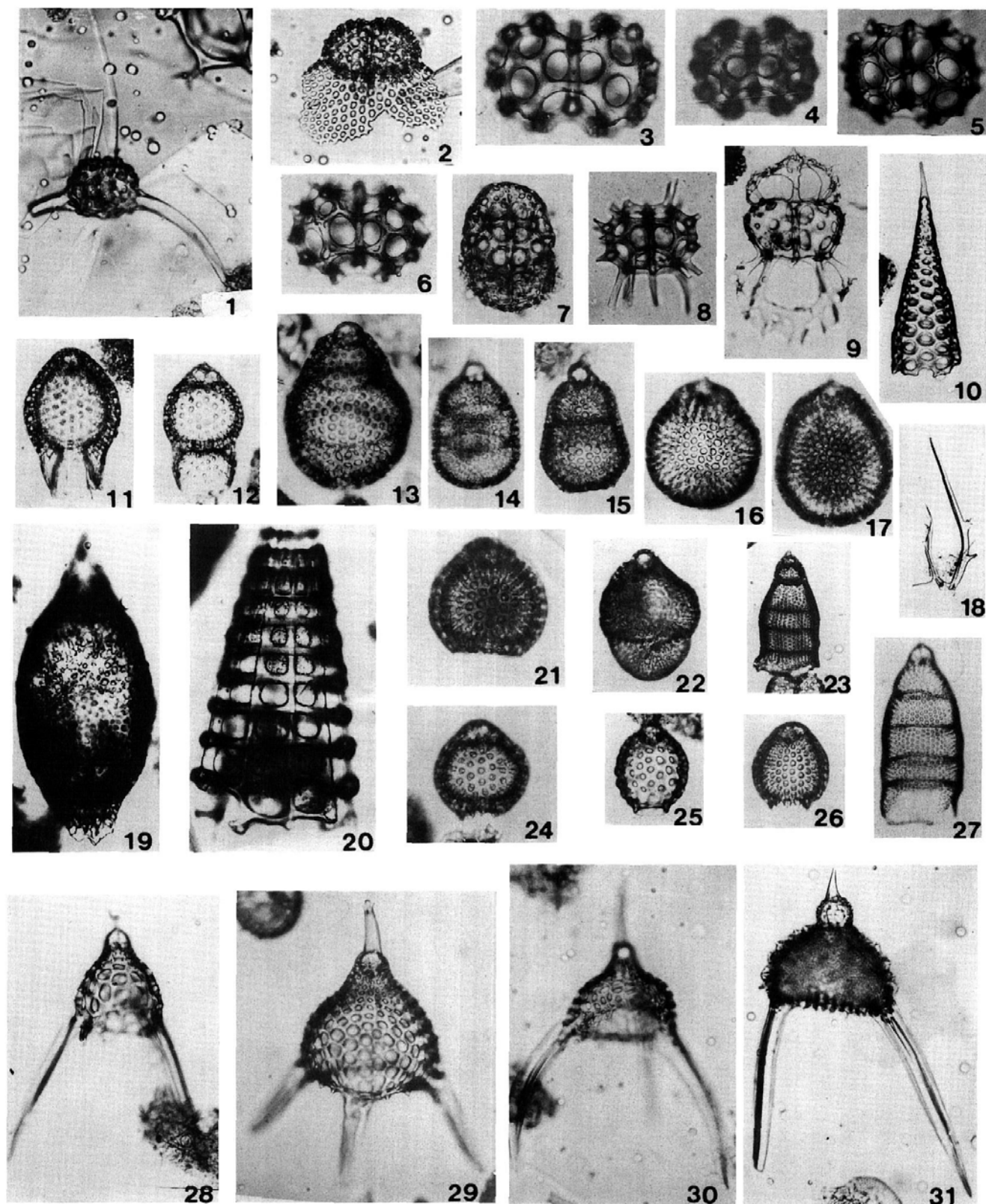
***Anthocyrtidium ehrenbergi* (Stöhr)**

Plate 5, figure 26

Anthocyrtis ehrenbergi STÖHR 1880, p. 100, pl. 3, figs. 21a,b.
Anthocyrtidium ehrenbergi ehrenbergi (Stöhr). - RIEDEL 1957, p. 83, pl.2, figs.1-3.
Anthocyrtidium ehrenbergi ehrenbergi (Stöhr). - NIGRINI and LOMBARI 1984, p. N147, pl. 27, fig. 1.

PLATE 4
All figures X180

- 1 *Dorcadospyris forcipata* (Haeckel), K 95.
- 2 *Dendrospyris bursa* Sanfilippo and Riedel, Km 12.
- 3,4 *Tholospyris anthophora* (Haeckel), 3, K 95; 4, K 91.
- 5,6 *Tholospyris mammillaris* (Haeckel), K 95.
- 7,8 *Tholospyris kantiana* (Haeckel), K 95.
- 9 *Tholospyris infericosta* Goll, K 87.
- 10 *Cornutella profunda* Ehrenberg, Nn 1.
- 11 *Carpocanopsis favosa* (Haeckel), Km 35.
- 12 *Carpocanopsis bramlettei* Riedel and Sanfilippo, Km 23.
- 13 *Cyrtocapsella cornuta* (Haeckel), K 95.
- 14 *Cyrtocapsella tetrapera* (Haeckel), K 91.
- 15 *Cyrtocapsella japonica* (Nakaseko), Km 14.
- 16 *Lithopera (Lithopera) neotera* Sanfilippo and Riedel, Km 32.
- 17 *Lithopera (Lithopera) bacca* Ehrenberg, Km 35.
- 18 *Zygocircus productus abnormis* Goll, K 98.
- 19 *Lithopera (Glomaria) thornburgi* Sanfilippo and Riedel, Km 40.
- 20 *Cinclopyramis* sp., Km 23.
- 21,24 *?Carpocanopsis cristata* (Carnevale), 21, Nn 16; 24, Nn 6.
- 22 *Lithopera (Lithopera) renzae* Sanfilippo and Riedel, Nn 12.
- 23 *Eucyrtidium hexagonatum* Haeckel, K 98.
- 25 *Carpocanarium* sp., K 90.
- 26 *Carpocanistrum* spp., K 86.
- 27 *Eucyrtidium* cf. *E. acuminatum* (Ehrenberg), K 91.
- 28 *Dictyophimus hirundo* (Haeckel) group, K 87.
- 29 *Lychnodictyum audax* Riedel, K 93.
- 30 *Pterocanium trilobum* (Haeckel), K 93.
- 31 *Lychnocanomma elongata* (Vinassa de Regny), K 87.



Anthocyrtidium ehrenbergi (Stöhr). - NIGRINI and CAULET 1988, p. 345, pl. 1, figs. 3, 4.

Genus *Calocycletta* Haeckel 1887, *sensu* Moore 1972

Calocycletta (Calocyclior) caepa Moore

Plate 5, figures 10, 11

Calocycletta caepa Moore 1972, p. 150, pl. 2, figs. 4-7. - NIGRINI and LOMBARI 1984, p. N153, pl. 28, figs. 1a-d.

Calocycletta (Calocyclior) caepa SANFILIPPO and RIEDEL 1992, p. 31, pl. 2, fig. 11.

Genus *Lamprocyclas* Haeckel 1881

Lamprocyclas maritalis Haeckel group

Plate 5, figure 24

Lamprocyclas maritalis HAECKEL 1887, p. 1390, pl. 74, figs. 13, 14.

Lamprocyclas maritalis Haeckel group. - NIGRINI and LOMBARI 1984, p. N163, pl. 30, fig. 1a, b.

Genus *Lamprocyrtilis* Kling 1973

Lamprocyrtilis (?) hannai (Campbell and Clark)

Plate 5, figure 25

Calocyclas hannai CAMPBELL and CLARK 1944, p. 48, pl. 69, figs. 21, 22.

Lamprocyrtilis (?) hannai (Campbell and Clark). - KLING 1973, p. 638, pl. 5, figs. 12-14; pl. 12, figs. 10-14. - NIGRINI and LOMBARI 1984, p. N165, pl. 30, figs. 2a, b.

Lamprocyclas hannai (Campbell and Clark). - CAULET 1986, p. 852.

Family ARTOSTROBIIDAE Riedel 1967a, emend. Foreman 1973

Genus *Botryostrobus* Haeckel 1887, emend., Nigrini 1977

Botryostrobus miralestensis (Campbell and Clark)

Plate 5, figure 17

Dictyocephalus miralestensis CAMPBELL and CLARK 1944, p. 45, pl. 6, figs. 12-14.

Artostrobium miralestensis (Campbell and Clark). - RIEDEL and SANFILIPPO 1971, p. 1599, pl. 1H, figs. 14-17; pl. 21, figs. 9, 10.

Botryostrobus miralestensis (Campbell and Clark). - NIGRINI 1977, p. 249, pl. 1, fig. 9.

Genus *Phormostichoartus* Campbell 1951, emend. NIGRINI 1977

Phormostichoartus corbula (Harting)

Plate 5, figure 20

Lithocampe corbula HARTING 1863, p. 12, pl. 1, fig. 21.

Phormostichoartus corbula (Harting). - NIGRINI 1977, p. 252, pl. 1, fig. 10.

Phormostichoartus fistula Nigrini

Plate 5, figure 21

Phormostichoartus fistula NIGRINI 1977, p. 253, pl. 1, figs. 11-13.

Phormostichoartus marylandicus (Martin)

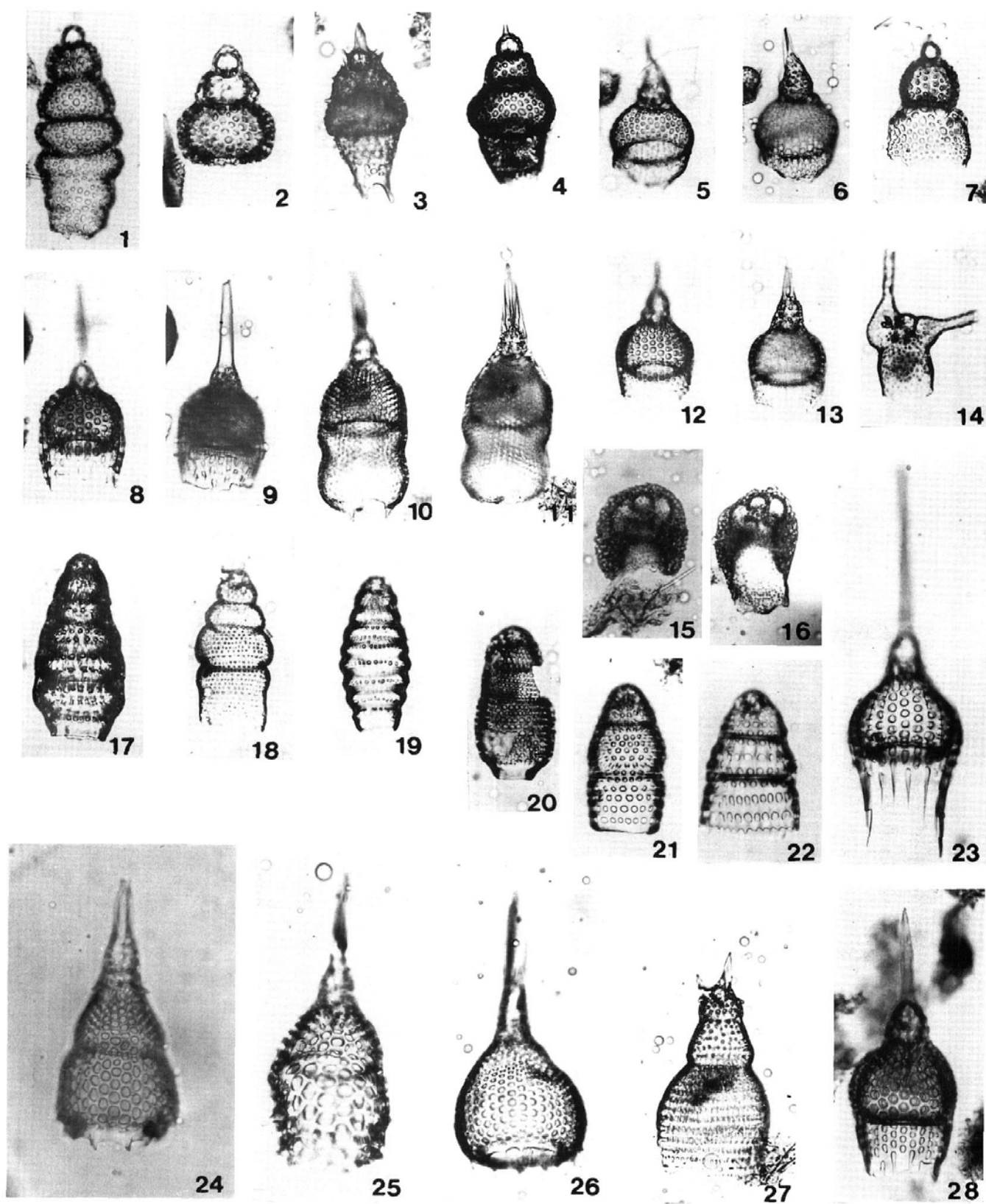
Plate 5, figure 22

Lithocampe marylandica MARTIN 1904, p. 450 pl. 130, fig. 4.

Phormostichoartus marylandicus (Martin). - NIGRINI 1977, p. 253, pl. 2, figs. 1-4.

PLATE 5 All figures X180

- 1 *Stichocorys delmontensis* (Campbell and Clark), K 94.
- 2 *Stichocorys wolffii* Haeckel, Km 13.
- 3 *Stichocorys armata* (Haeckel), K 89.
- 4 *Stichocorys diploconus* (Haeckel), Nn 1.
- 5,6 *Albatrossidium* sp. A, 5, 6, K 85; 5, focussed on pores; 6, focussed on apical horn and periphery.
- 7 *Theocorys* sp., K 91.
- 8,9,28 *Calocycletta (Calocycletta) virginis* Haeckel, 8,9, K 93; 28, K 89; 8, 28, focussed on pores; 9, focussed on apical horn and periphery.
- 10,11 *Calocycletta (Calocyclior) caepa* Moore, K 85; 10, focussed on pores; 11, focussed on apical horn and periphery.
- 12,13 *Albatrossidium* sp. B, Km 26; 12, focussed on pores; 13, focussed on apical horn and periphery.
- 14 *Acrobotrys* sp., K 86.
- 15,16 *Botryocyrtilis* spp. 15, Km 23; 16, K 88.
- 17 *Botryostrobus miralestensis* (Campbell and Clark), Nn 14.
- 18 *Spirocyrtilis subscalaris* Nigrini, K 86.
- 19 *Siphocampe arachnea* (Ehrenberg) group, K 89.
- 20 *Phormostichoartus corbula* (Harting), Km 33.
- 21 *Phormostichoartus fistula* Nigrini, Nn 4.
- 22 *Phormostichoartus marylandicus* (Martin), K 95.
- 23 *Calocycletta (Calocyclissima) costata* (Riedel), K 86.
- 24 *Lamprocyclas maritalis* Haeckel group, Km 25.
- 25 *Lamprocyrtilis (?) hannai* (Campbell and Clark), K 88.
- 26 *Anthocyrtidium ehrenbergi* (Stöhr), K 86.
- 27 *Siphostichartus corona* (Haeckel), K 88.



Genus *Siphocampe* Haeckel 1881, emend. Nigrini 1977

Siphocampe arachnea (Ehrenberg) group

Plate 5, figure 19

Lithocampe lineata EHRENBURG 1838, p. 130 (partim.)

Eucyrtidium lineatum arachneum EHRENBURG 1861, p. 299 (partim.)

Siphocampe arachnea (Ehrenberg) group, NIGRINI 1977, p. 255, pl. 3, figs. 7, 8. - NIGRINI and LOMBARI 1984, p. N186, pl. 32, figs. 1a, b.

Genus *Siphostichartus* Nigrini 1977

Siphostichartus corona (Haeckel)

Plate 5, figure 27

Cyrtophormis (Acanthocyrtis) corona HAECKEL 1887, p. 1462, pl. 77, fig. 15.

Phormostichoartus corona (Haeckel). - RIEDEL and SANFILIPPO 1971, p. 1600, pl. 11, figs. 13-15; pl. 2J, figs. 1-5

Siphostichartus corona (Haeckel). - NIGRINI 1977, p. 257, pl. 2, figs. 5, 6. - NIGRINI and LOMBARI 1984, p. N193, pl. 32, figs. 4a-d.

Genus *Spirocyrtis* Haeckel 1881 emend. Nigrini 1977

Spirocyrtis subscalaris Nigrini

Plate 5, figure 18

Spirocyrtis subscalaris NIGRINI 1977, p. 259, pl. 3, figs. 1, 2.

Family CANNOBOTRYIDAE Haeckel 1881, emend. Riedel 1967b

Genus *Botryocyrtis* Ehrenberg 1860b

Botryocyrtis spp.

Plate 5, figures 15, 16

Botryocyrtis spp. RIEDEL and SANFILIPPO 1971, p. 1602, pl. 1J, figs. 1-11; pl. 2J, figs. 10-12; pl. 3F, fig. 7.

Genus *Acrobotrys* Haeckel 1881

Acrobotrys sp.

Plate 5, figure 14

Cephalis trilobate, with large subglobular occipital lobe, smaller middle lobe, and inflated-conical frontal lobe; occipital and frontal lobes bear slender cylindrical tubes approximately at right angles; thorax cylindrical; shell surface smooth, perforated by numerous small circular to subcircular pores.

Remarks: Riedel and Sanfilippo (1971) illustrated a number of forms under *Acrobotrys* spp. Our specimen closely resembles the form illustrated by them on plate 1J, figure 15.

REWORKED SPECIES

Calocyclus (Calocyclus) costata (Riedel)

Plate 5, figure 23

Calocyclus virginis Haeckel, RIEDEL 1957, p. 90, pl. 1, fig. 5

Calocyclus costata RIEDEL 1959, p. 296, pl. 2, fig. 9

Calocyclus costata (Riedel). - RIEDEL and SANFILIPPO 1970, p. 535, pl. 14, fig. 12. - NIGRINI and LOMBARI 1984, p. N155, pl. 28, fig. 2;

Calocyclus (Calocyclus) costata (Riedel). - SANFILIPPO and RIEDEL 1992, p. 30, pl. 5, fig. 1.

Calocyclus (Calocyclus) virginis Haeckel

Plate 5, figures 8, 9, 28

Calocyclus (Calocyclus) virginis HAECKEL 1887, p. 1381, pl. 74, fig. 4. - RIEDEL 1959, p. 295, pl. 2, fig. 8

Calocyclus virginis Haeckel. - RIEDEL and SANFILIPPO 1970, p. 535, pl. 14, fig. 10. - NIGRINI and LOMBARI 1984, p. N161, pl. 29, fig. 2

Calocyclus (Calocyclus) virginis Haeckel. - SANFILIPPO and RIEDEL 1992, p. 36.

Carpocanopsis bramlettei Riedel and Sanfilippo

Plate 4, figure 12

Carpocanopsis bramlettei RIEDEL and SANFILIPPO 1971, p. 1597, pl. 2G; figs. 8-14; pl. 8, fig. 7. - NIGRINI and LOMBARI 1984, p. N85, pl. 21, fig. 3.

Carpocanopsis favosa (Haeckel)

Plate 4, figure 11

Cycladophora favosa HAECKEL 1887, p. 1380, pl. 62, figs. 5, 6

Carpocanopsis favosum (Haeckel). - RIEDEL and SANFILIPPO 1971, p. 1597, pl. 2G, figs. 15, 16; pl. 8, figs. 9-10

Carpocanopsis favosa (Haeckel). - NIGRINI and LOMBARI 1984, p. N91, pl. 21, figs. 6a-c.

Didymocyrtis violina (Haeckel)

Plate 2, figure 11

Cannartus violina HAECKEL 1887, p. 358, pl. 39, fig. 10

Didymocyrtis violina (Haeckel). SANFILIPPO and RIEDEL 1980, p. 1010. - NIGRINI and LOMBARI 1984, p. S49, pl. 6, fig. 5.

Liriospyris parkerae Riedel and Sanfilippo

Plate 3, figure 22

Liriospyris parkerae RIEDEL and SANFILIPPO 1971, p. 1590, pl. 2c, fig. 15; pl. 5, fig. 4. - MAHAPATRA and SHARMA 1994, p. 160, pl. 2, fig. 11.

Liriospyris stauropora (Haeckel)

Plate 3, figure 23

Trissocyclus stauropora HAECKEL 1887, p. 987, pl. 83, fig. 5

Liriospyris stauropora (Haeckel). - GOLL 1968, p. 1431, pl. 175, figs. 1-3, 7, text fig. 9. - NIGRINI and LOMBARI 1984, p. N51, pl. 19, fig. 5. - MAHAPATRA and SHARMA 1994, p. 160, pl. 2, fig. 14.

Lychnocanoma elongata (Vinassa de Regny)

Plate 4, figure 31

Tetrahedrina elongata VINASSA DE REGNY 1900, p. 243, pl. 2, fig. 31

Lychnocanoma elongata (Vinassa de Regny). - SANFILIPPO et al. 1973, p. 221, pl. 5, figs. 19, 20. - NIGRINI and LOMBARI 1984, p. N119, pl. 24, figs. 2a, b.

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