RADIOLARIA FROM MEDITERRANEAN SEDIMENTS, DSDP LEG 42A

Annika Sanfilippo, Scripps Institution of Oceanography, La Jolla, California
J.-P. Caulet, Laboratoire de Géologie du Muséum National d'Histoire Naturelle, Paris
and
W.R. Riedel, Scripps Institution of Oceanography, La Jolla, California

ABSTRACT

One radiolarian sample was obtained at each of Sites 376, 378, and 374 (this last not substantiated by all three authors), and a series of samples with less well preserved assemblages at Site 372. The sample from Core 376-1 is Quaternary, and that from 378-8 (upper Pliocene) is younger than late Pliocene radiolarian samples from Crete. Cores 372-32 to approximately 372-41 may be equivalent to Mallorcan localities and Monte Calvo and Casalino in northern Italy, and Cores 372-42 to 372-46 may be equivalent to many other northern Italian Miocene radiolarian localities, but poor preservation and sparse assemblages at Site 372 preclude more precise correlation.

INTRODUCTION

No radiolarian specialist was included in the shipboard party of Leg 42A, and none participated in the post-cruise meetings. Consequently, this investigation was based on samples selected by specialists in calcareous microfossils, and the radiolarian results are not yet closely integrated with those of other fossil groups.

The localities of the drilling sites at which radiolarians were found are as follows:

Site 372: 40°01.86’N, 04°47.79’E; water depth 2699 meters.
Site 374: 35°50.87’N, 18°11.78’E; water depth 4078 meters.
Site 376: 34°52.32’N, 31°48.45’E; water depth 2101 meters.
Site 378: 35°55.67’N, 25°06.97’E; water depth 1835 meters.

All of the radiolarian assemblages obtained are of Miocene and younger ages, and our principal objective during this preliminary study has been to place them in the developing framework of Mediterranean Neogene stratigraphy. This having been done, they can be used in later studies directed toward reconstructing paleoenvironmental conditions in the Mediterranean.

OCCURRENCES OF RADIOLARIANS

The radiolarian occurrences are described in the following paragraphs and Table 1. In the species lists and table, instead of using the uncalibrated terms “common”, “few” and “rare” as in previous radiolarian chapters, we have determined the percentage abundances of selected species, relative to the total radiolarian assemblage coarser than 63 µm and we present these numbers together with the total numbers of radiolarians on the slides examined. Thus these results can be evaluated quantitatively — which has obvious advantages as radiolarian stratigraphy progresses beyond its initial developmental and descriptive phase.

Site 372

One sample was examined from each of Cores 4 and 9 through 46 taken at this Site, but only those shown in Table 1 contained radiolarians. The assemblages were generally very sparse, and of moderate or poor preservation.

Site 374

Shipboard paleontologists found radiolarians in the catcher sample of Core 15, and forwarded them to one of us (J.-P.C), who identified the following species here — Druppatractus irregularis, Carposphaera modesta (formerly Thecosphaera grecoi), Cyrtocapsella cayexui (Vinassa), Eucyrtidium elongatum (Stöhr), Heliodiscus asteriscus, H. echiniscus, Hexaconitum sexaculeatum (formerly H. hootsi), Lithocampe eminens (Stöhr), L. jimbriata (Stöhr), L. radicula, Lychnocanoma grande, Ommatarus didymus, Stichocorys delmontensis, S. peregrina, Thecosphaera paroniana, and Trisulcus ?triloba.

There was too little time between the completion of arrangements for the writing of this chapter and the manuscript deadline, for the radiolarian slides to be sent from Paris to La Jolla. Therefore a new sample was obtained and examined (A.S. and W.R.) from Sample 374-15 CC. Although the sample was of several cubic centimeters, the only siliceous microfossil found in it was a single sponge spicule—no radiolarians nor diatoms were encountered.

Site 376

Only two samples from this Site were examined. That at 376-15-3, 146-148 cm, yielded no radiolarians,
while that at 376-1-4, 62-64 cm, contained well preserved, abundant radiolarians (approximately 5,400 specimens per slide), including the following species with approximate percentage representation indicated — Hexacontium sexaculeatum (0.7%), Druppatractus irregularis (0.2%), Peripanartium sp. (1%), Spongaster tetras (0.5%), Nephropsyris renilla (0.1%), Acanthodesmia vinculata (0.5%), Eucyrtidium acuminatum group (2%), E. anomalum (0.9%), E. punctatum group (0.4%), Siphocampe corbula (0.2%), Botryocyrtis spp. (0.3%), and Botryopyle dictyocephalus group (0.2%). No specimens were found of Tholaspyris rhombus, Pseudocubus vema, nor any species of Stichocorys.

**Site 378**

The only sample examined from this Site was Sample 8-1, 113-115 cm, where radiolarians are well preserved and common (approximately 2,800 specimens per slide). Species identified include the following, their approximate percentages of the total radiolarian assemblage being given in parentheses — Amphipsphaera spinosa (0.07%), Carposphaera modesta (0.6%), Hexacontium sexaculeatum (0.7%), Omnatetra didymus (0.2%), Tholaspyris rhombus (0.4%), Eucyrtidium acuminatum group (0.6%), Siphocampe corbula (0.07%), Botryocyrtis sp. (0.7%), Botryopyle dictyocephalus group (4.4%), Lithobotrys galea (0.7%), and Pseudocubus vema (3.3%). No specimens were found of Druppatractus irregularis, Peripanartium sp., Eucyrtidium punctatum, nor any species of Stichocorys.

**STRATIGRAPHIC CORRELATIONS**

Figure 1 shows the correlations between radiolarian assemblages described here, and those known from other Mediterranean localities (for further details of which the reader is referred to the papers cited). The sample from Core 376-1 is Quaternary, and that from Core 378-8 (upper Pliocene on the basis of calcareaous microfossils) is younger than late Pliocene radiolarian samples from Crete. Sample 374-15 CC has been examined by only one of us (J.-P.C.), and therefore its relationship to previously described Tabianian and Messinian assemblages is not yet firmly established. At Site 372, where the only long sequence of radiolarian samples was obtained, Cores 32 to approximately 41 seem to be equivalent to Mallorcan localities and Monte Calvo and Casalino in northern Italy, and Cores 42 to 46 may be equivalent to many other northern Italian Miocene radiolarian localities (including those described by earlier authors such as Vinassa, 1900; Carnevale, 1908; and Lucchese, 1927), but more precise correlation is not possible because of poor preservation and sparse assemblages in the drilled cores.

**SPECIES LIST**

The purpose of this list is to provide bibliographic references to the taxa mentioned in this chapter, and some comments on their records in earlier literature. Unless otherwise indicated, we have rather uncritically followed the generic assignments applied by earlier authors, since shortage of time has prevented our examining the relationships of type species of genera.
Campbell and Clark. Some specimens in our Sample phaera angelina become submerged as synonyms of species that synonym of this species.

Amphistylus pantanellii Principi (1909, p. 7, pi. 1, fig. 16) is a result of synonymy is that some familiar names such as Stylosphaera. Therefore we are led to conclude that Doryconthidium isoacanthos resulting inconvenience is that some familiar names such as Stylosphaera isoporata Carnevale (1908, p. 12, pi. 1, fig. 7) and unavoidable if the existing unsatisfactory situation is to be improved.

Figure 1. Correlations between Leg 42-A radiolarian samples and those from other Mediterranean Neogene localities. Most series and stage assignments are based on calcareous microfossils. Horizontal lines separate distinguishable assemblages.

There are also problems with many of the specific names, because several authors at the beginning of this century described Italian Neogene radiolarian assemblages, apparently directing more of their effort to the erection of new species than to critical comparisons with other described forms. Consequently, there are many synonyms in the literature. This is not the appropriate place to attempt to rectify the situation comprehensively, but we have clarified a few of the more obvious synonyms, on the basis of topotypic specimens available. A resulting inconvenience is that some familiar names such as Stylosphaera angulina become submerged as synonyms of species that themselves may be synonymized during later, more comprehensive work. However, such a period of confused nomenclature seems unavoidable if the existing unsatisfactory situation is to be improved.

Acanthodesmia vinctulata (Müller, 1857, p. 484) Synonyms and illustrations of this species are given by Dumitrica (1973) and Caulet (1974).

Amphiphaera spinosa Carnevale, 1908, p. 14, pl. 2, fig. 6. This is the species that we have previously recorded as Stylospheara angulina Campbell and Clark. Some specimens in our Sample WRE 67-100 (Sanfilippo, 1971) from Carnevale’s locality Bergonzano have a thorny surface and others do not, the maximum diameter of the cortical shell is usually between 120 and 135μ, and the two cylinod-conical polar spines vary in length and thickness. Therefore we are led to conclude that Dorycondium isocanthos Carnevale (1908, p. 12, pl. 1, fig. 7) and Stylospheara isoporata Carnevale (1908, p. 13, pl. 2, fig. 3) are also synonyms.

The form that Stöhr (1880, p. 88, pl. 1, fig. 12) recorded as Haliomma (Stylospheara) hispidum Ehrenberg is evidently different from the form described by Ehrenberg (1854, pl. 36, fig. C26), but is likely the same as Amphiphaera spinosa.

Topotypic material of the radiolarian assemblage described by Principi is not available to us, but it seems likely that his species Amphistybus pantanellii Principi (1909, p. 7, pl. 1, fig. 16) is a synonym of this species.

of the species described by Lucchesi, Amphistybus rariporatus Lucchesi (1927, p. 86, pl. 4, fig. 1) and Drupaceptus microstylus Lucchesi (1927, p. 93, pl. 5, fig. 9) have characters similar to Amphiphaera spinosa, but the dimensions given are much too large. However, the measurements given seem to be consistently too large (see Sanfilippo and Riedel, 1970, p. 452), and our examination of topotypic specimens from Sample WRE 67-107 (Sanfilippo, 1971) convinces us that these two species also are synonyms of the form under consideration.

In recent literature on Quaternary radiolarians, this species is commonly known as Stylatractus universus Hays (1970, p. 215, pl. 1, fig. 1)–as was pointed out by Kling (1973, p. 634).

Botryocystis Ehrenberg (1860) spp. Members of this genus have previously been recorded from Mediterranean Neogene localities by Sanfilippo et al. (1973). A lumbar stricture is commonly well developed in specimens from Cores 376-1 and 378-8.

Botryopyle dictyocephalus (Haeckel) group This group has previously been recorded from the Mediterranean Neogene by Sanfilippo et al. (1973).

Cannartus bassani (Carnevale, 1908, p. 21, pl. 3, fig. 12) The possible synonyms of this species have been determined by Sanfilippo et al. (1973, p. 216).

Cannartus iaticus Riedel, 1959, p. 291, pl. 1, fig. 5. This species has previously been recorded from the Mediterranean Neogene by Sanfilippo et al. (1973).

Cannartus violina Haeckel, 1887, p. 358, pl. 39, fig. 10. Other occurrences of this species in the Mediterranean Neogene are given by Sanfilippo et al. (1973).

Carpocanopsis cingulata Riedel and Sanfilippo, 1971, p. 1597, pl. 2G, fig. 17-21; pl. B, fig. 8. A possible synonym is Cyrtocalpis tubulosa Vinassa (1900, p. 580, pl. 2, fig. 25), but the original illustration is inadequate and we have been unable to examine topotypic material.

Carpophrea modesta (Stör, 1880, p. 86, pl. 1, fig. 5). This species, described in the genus Haliomma by Stöhr and transferred to Carpophrea by Haeckel (1887, p. 74), appears to be the same as that which we (Riedel et al. 1974, p. 707, pi. 56, fig. 3; pl. 62, fig. 2-4) have previously reported as Thecospheara greeci Vinassa (1900, p. 568, pl. 1, fig. 8). We have examined specimens from Messinian diatomites collected by M. N. Bramlette near Raddusa and Serradifalco, Sicily, and find no substantial difference from Vinassa’s species.

We have earlier synonymized Thecospheara leptococcus Carnevale (1908, p. 9, pl. 1, fig. 10) with this species. It also seems probable that Thecospheara saccoi Principi (1909, p. 4, pl. 1, fig. 6) is a synonym, but we have not topotypic material available to check this.

Another possible synonym is Thecospheara raripora Lucchesi (1927, p. 82, pl. 3, fig. 5), and in order to check this we have examined topotypic material from Ca’ Lombasini (Sample WRE 67-107, see Sanfilippo, 1971). However, we have not found any specimens corresponding to the original description in having well-separated pores and a single medullary shell, and thus the status of that species remains in doubt.

There is some similarity with the form from Catanissetta, Sicily, described by Ehrenberg (1844, p. 83; 1854, pl. 22, fig. 35) as Haliomma aequorea, but the dimensions given (diameter 68μ according to the description) are too small.

Cyclampterium leptetrum Sanfilippo and Riedel, 1970, p. 456, pl. 2, fig. 11, 12. This species has previously been recorded from Mediterranean localities by Sanfilippo et al. (1973).

Cyrtocapsella cornuta Haeckel, 1887, p. 1513, pl. 78, fig. 9. Synonyms of this species are listed by Sanfilippo and Riedel (1970).
Cyrtiocapsella tetrapera Haeckel, 1887, p. 1512, pl. 78, fig. 5.

The synonymy of this species is given by Sanfilippo and Riedel (1970).

Drupparectus irregularis Popofsky, 1912, p. 114, text-fig. 24-26.

The early literature on Italian Neogene radiolarians does not seem to include this form.

Eucyrtidium acuminatum (Ehrenberg, 1844, p. 84) group

We have previously recorded these forms (Sanfilippo et al., 1973) as the Eucyrtidium cienkowskii Haeckel group, but there seems to be no justification for excluding the species described earlier by Ehrenberg, the name of which therefore has priority. Another member of this group is Dicytomia calcanolitidae Dreyer (1890, p. 48, pl. 6, fig. 31)—specimens which we have found in samples from Serradifalco and Raddusa closely resemble Stöhr’s (1880, pl. 4, fig. 6) illustration of E. acuminatum. Specimens from older assemblages tend to have a pronounced structure and change in contour between the second and third segments, as in Dicytomia multistriata [sic] Lucchese (1827, p. 106, pl. 8, fig. 8). Eucyrtidium sp. (ex gr. E. cienkowskii) of Bachmann et al. (1963, p. 130, pl. 8, fig. 37), and possibly Stichocorys martelli Principi (1909, p. 16, pl. 1, fig. 51).

Eucyrtidium anomala (Haeckel, 1860, p. 839)

(Plate 1, Figures 1, 2)

Possible synonyms of this species are listed by Dumitrica (1973) and Caulet (1974). It is distinguished from the E. punctatum group by its larger size and the presence of distinct wings on the thorax.

Eucyrtidium diaphanum Sanfilippo and Riedel in Sanfilippo et al., 1973, p. 221, pl. 5, figs. 12-14.

The taxonomy of this species, which occurs rarely in Samples WRE 67-99 and 67-100 (Sanfilippo, 1971), was adjusted in Sanfilippo et al. (1973). The same form occurs in Sample WRE 67-107 from Ca’ Lombasini, which is the type locality for E. acuminatum. It is distinguished from the E. punctatum group by having a more elongated and apically pointed anteccephalic chamber, rather than the eucephalic chambers of approximately the same size, and a very small, indistinct postcephal chamber.

Core 378-8 contains in addition to members of the Botryopyge dicytocephalus group and Botryocyris sp., many specimens apparently assignable to L. galea some of which have a slightly enlarged and apically pointed anteccephal chamber.

Lithomitra lineata (Ehrenberg) group Riedel and Sanfilippo (1971, p. 1600) sensu lato

We here include in this group also those forms separated as Lithomitra sp. aff. L. lineata group by Riedel and Sanfilippo (1971, p. 1600, pl. 11, fig. 12; pl. 21, fig. 17; pl. 3E, fig. 15-19). Probable members of this group in the Mediterranean Neogene include Lithomitra embronialis Vinassa (1900, p. 586, pl. 3, fig. 21) and Lithomitra laevigata Principi (1909, p. 17, pl. 1, fig. 55).

Lithopera renzae Sanfilippo and Riedel, 1970, p. 454, pl. 1, figs. 21-23, 27.

This species has previously been recorded from Mallorca by Sanfilippo et al. (1973).

Lithopera thornburgi Sanfilippo and Riedel, 1970, p. 455, pl. 2, figs. 4-6.

Lychnocanoma elongata (Vinassa, 1900, p. 243, pl. 2, fig. 31).

The synonymy of this species has been clarified by Sanfilippo et al. (1973).

Lychnodictyum audax Riedel, 1953, p. 810, pl. 85, fig. 9.

This species occurs also in the late Pliocene of Crete (Sanfilippo and Riedel, 1975).

Nephrorpyrus renilla Haeckel, 1887, p. 1101, pl. 90, figs. 9, 10.

Ommatarrus didymus (Ehrenberg, 1844, p. 83).

Specimens occurring in DSDP core 378-8 rarely have caps better developed than in the original illustration of Ommatarrus triangula Stöhr (1880, p. 90, pl. 2, fig. 1), which species was synonymized with O. didymus by Sanfilippo et al. (1973, p. 216).

Peripanartium sp.

(Plate 1, Figure 6)

This form is the same as that recorded from late Pliocene sediments of Crete by Sanfilippo and Riedel (1975, p. 66, pl. 1, figs. 5-7). It may be significant that this form has not been recorded in more westerly Mediterranean localities.

Pseudocubus vema (Hays, 1965, p. 176, pl. 2, fig. 3, text-fig. A)

This species has previously been recorded from the Mediterranean Neogene by Dumitrica (1973) and Sanfilippo and Riedel (1975).

Siphocampe corbula (Harting, 1863, p. 12, pl. 1, fig. 21).

This species occurs in Cores 376-1 and 378-8, those in the latter core being well developed except for the lack of a peristome. Its precursor (Riedel and Sanfilippo, 1971, p. 1601, pl. 1H, fig. 28) occurs in Core 372-22.

Spionaster sp (p)

(Plate 1, Figures 7-9)

The assemblage in Core 376-1 contains specimens of Spionaster conforming morphologically to several different species (S. tetras, S. pentas and S. berminghianii), so that we have not been able to determine satisfactorily which species is present. The situation here is analogous to that described by Riedel and Sanfilippo (in press, fig. 2, and pl. 2) for the assemblages in DSDP Hole 77B prior to the establishment of S. berminghianii and between S. berminghianii and S. tetras.
A single specimen closely resembling *S. tetras* was found anomalously in the sample from Core 372-38 (see also Riedel and Sanfilippo, 1971, pl. 5, fig. 1, for a similar early Miocene record).

**Stauroxiphos communis** Carnevale, 1908, p. 15, pl. 2, fig. 9. (Plate 1, Figure 10)

Specimens from Site 372 agree well with the original description and illustration, except that they have more than three radial bars prolonged as short spines, and the medullary shell is pear-shaped. In order to check their identity with topotypic material, we have examined the radiolarian assemblage in Sample WRE 67-100 (Sanfilippo, 1971) and find that specimens there have the characters of those in the Leg 42 specimens.

It seems likely that *Stauroxiphos sexradiatus* Lucchese (1927, p. 86, pl. 4, fig. 3) is a synonym, despite the puzzling description of the pores of the cortical shell as less numerous. We have examined topotypic material of this species from Ca’ Lombasini (Sample WRE 67-107, Sanfilippo, 1971), and find that the pores of the cortical shell are similar to those of Carnevale’s species.

**Stichocorys armata** (Haeckel, 1887, p. 1460, pl. 78, fig. 17)

The possible synonymy of this species has been discussed by Sanfilippo et al. (1973).

**Stichocorys delmontensis** (Campbell and Clark, 1944, p. 56, pl. 7, figs. 19-21)

Possible synonyms of this species are indicated by Sanfilippo and Riedel (1970).

**Stichocorys peregrina** (Riedel, 1953, p. 812, pl. 85, fig. 2)

This species has been recorded also from the stratotype Zanclean (Riedel et al., 1974), and from the late Pliocene of Crete (Sanfilippo and Riedel, 1975).

**Stichocorys woffii** Haeckel, 1887, p. 1479, pl. 80, fig. 10

We have not previously found this species in the Mediterranean Neogene.

**Tholospyris rhombus** (Haeckel, 1887, p. 942, pl. 81, fig. 7)

This species, emended by Gol (1972), has been recorded by Sanfilippo and Riedel (1975) from the late Pliocene of Crete.

**Trigonastrum regulare** Haeckel, 1887, p. 539, pl. 43, fig. 16, (Plate 1, Figure 11)

This distinctive species, recorded by Dumitrica (1973) from DSDP Core 128-3, occurs also in Core 276-1, and in order to elucidate its occurrence we have searched through the other late Neogene samples from the Mediterranean region available to us. *T. regulare* was not found in any of them, and only one (Sample 767A from Pigi, Crete — see Sanfilippo and Riedel, 1975) contained rare specimens assignable to the species that Dumitrica (1973) identified as *Amphirkhopalum wirchowi* and that Nigrini (1971) recorded as *A. ypsilien*. This latter species occurs also in Cores 376-1 and 378-8.

**Xiphatracus brevispina** Carnevale, 1906, p. 20, pl. 3, fig. 11, (Plate 1, Figures 12, 13)

The Leg 42 specimens conform sufficiently well with Carnevale’s description and illustration to justify this identification, but some deviations need to be noted. Our specimens are not well enough preserved to determine whether the pores of the second shell are larger than those of the outer shell. Also, the original description indicates that the polar spines are short, and that only one is bladed. We have examined specimens of this species in topotypic material (Sample WRE 67-100, see Sanfilippo, 1971) and find that the polar spines there vary from being so short that distinction between bladed and conical form is uncertain, to both being longer than originally illustrated and distinctly bladed.

**ACKNOWLEDGMENTS**

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**SPECIES INDEX**

Although this paper is short, an index seems desirable because so many synonymies are suggested. Specific names are arranged alphabetically, with generic names secondary.

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ADDENDUM

Since this paper was completed, Sanfilippo and Riedel have been able to examine four of Caulet's slides of Sample 374-15, CC. On these slides they have encountered Carposphaera modesta (9 specimens); unidentified actinommids (8); Cannartus petterssoni.
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(one fragment, but unambiguously identifiable); *Peripanartium* sp. (1); phacodiscids (3); spongodiscids and porodiscids (34); pyloniids (5); litheliids (2); *Cyrtocapsella japonica*, which may be equivalent to *Theocapsa cayeuxi* Vinassa (1); *Eucyrtidium acuminatum* group (1); *Stichocorys delmontensis* (8); unidentified theoperids (5); incertae sedis (1); and two specimens evidently reworked from Cretaceous (one *Dictyomitra* sp. and one *Sethocapsa* sp.)—total of 81 specimens.

The presence of *Cannartus petterssoni* indicates the late middle Miocene *C. petterssoni* Zone, and presumably if *Stichocorys peregrina* morphotypes occur on other slides they are greatly subordinate to *S. delmontensis* morphotypes.

PLATE 1

(In the figure explanations, the sample numbers and slide designations in the form "Ph.2", "Sl.1", etc. indicate preparations in our collection, and designations in the form "R45/1" indicate England Finder positions of the illustrated specimens on the slides.)

Figures 1, 2  *Eucyrtidium anomalum.*
1. 376-1-4, 62-64 cm, Ph.2, O48/2, 280×.
2. Same slide, V30/4, 280×.

Figure 3  *Eucyrtidium punctatum* group.
376-1-4, 62-64 cm, Ph.2, Y26/0, 280×.

Figures 4, 5  *Lithobotrys galea.*
4. 372-22-2, 144-146 cm, Sl.1, F43/0, 280×.
5. 378-8-1, 113-115 cm, F.1, W41/4, 280×.

Figure 6  *Peripanartium* sp.
376-1-4, 62-64 cm, Cs.1, Z54/3, 280×.

Figures 7-9  *Spongaster* sp.
7. 376-1-4, 62-64 cm, Cs.1, J43/2, 190×.
8. Same slide, F41/0, 190×.
9. Same slide, J24/3, 190×.

Figure 10  *Stauroxiphos communis.*
372-22-2, 144-146 cm, Sl.2, D30/1, 280×.

Figure 11  *Trigonastrum regulare.*
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Figures 12, 13  *Xiphatractus brevispina.*
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13. Same slide, L22/4, 280×.

(see p. 760)