INTRODUCTION

I recovered well-preserved radiolarian assemblages from the Quaternary sediments drilled at all four sites at the mouth of the Gulf of California during Leg 65 (Fig. 1). The sites, with positions and water depths averaged for all hole locations per site, are:

- Site 482—22° 47.4'N, 107° 59.6'W; water depth, 3022 meters.
- Site 483—22° 53.0'N, 108° 44.8'W; water depth, 3070 meters.
- Site 484—23° 11.2'N, 108° 23.6'W; water depth, 2887 meters.
- Site 485—22° 44.9'N, 107° 54.2'W; water depth, 2981 meters.

The nearly 200 taxa I identified are listed alphabetically in the systematic reference list. The only reliable radiolarian biostratigraphic datum determined for the Quaternary sedimentary section is the highest occurrence of *Axoprunum angelinum* (Hays) at Sites 483, 484, and 485.

THE RADIOLARIAN ASSEMBLAGE

With some additions, the species identified from Leg 65 are the same I described in earlier studies of Holocene sediments from the Gulf of California (Benson, 1964, 1966). The major differences between the Holocene and older assemblages are in the relative abundances of individual species. I could not determine whether these differences in abundance reflect environmental conditions, preservation, or both.

Holocene Radiolarians from the Gulf of California

In an earlier study (Benson, 1966), I found radiolarians in the Recent sediments at 26 of 28 stations distributed throughout the Gulf of California (Fig. 2). At the time, I concluded that the Holocene assemblage was derived primarily from equatorial Pacific waters. From an examination of recent literature on the distribution of modern radiolarians, particularly in the eastern Pacific but also in high as well as intermediate and low latitudes (Riedel, 1958; Nigrini, 1967, 1968, 1970; Casey, 1971, 1977; Ling et al., 1971; Kling, 1973, 1977; Molina-Cruz, 1977; Nigrini and Moore, 1979), I conclude that the assemblage is primarily tropical to subtropical but with contributions of cooler water species from the California Current System.

Table 1 lists the dominant members of the Holocene assemblage in the Gulf, as determined by averaging the percentages for each species at each station. The quantitative methods used in my earlier research to obtain the percentages are as follows. I first scanned all sl measured from the HCl-insoluble, clay-free residues of sediments from the 28 sampling stations in order to determine the occurrence or nonoccurrence of each species. Next, I counted 500 tests for each station, preliminary counts of 1000 having shown no significant differences from the 500 count in relative frequencies of each species at a station. The slide with the greatest concentration of tests was chosen for purposes of counting. In order to include as many variations in test density as possible on the slide, I made a diagonal traverse across the 22 mm × 44 mm area under the cover glass. Six of the 28 stations yielded total populations of less than 500. The counts for each species at each station were converted into percentages.

Species that show cooler water affinities and that are probably, at least in part, from the California Current System include *Hexactinon enthacanthum*, *Stylochlamydium venustum*, *Lithomelissa hystric*, *Larocopyle butschlii*, *Liithelius minor*, *Pterocorys minythorax*, *Heliotholus histricosa* group, *Actinosphaera cristata* (?), and *Theocalyptida davisi*na s.l. The influence of the California Current System is evident in Bé's (1977) map of the major faunal provinces of living planktonic foraminifers. The current carries a higher latitude (Transition Zone) assemblage southward along the west coast of Baja California. The intrusion of the cool water current into subtropical and tropical waters causes three faunal provinces to converge at a point offshore from southern Baja California, namely, the Transition Zone, Subtropical Faunal Province, and Tropical Faunal Province. Likewise, the Holocene radiolarian assemblage within and at the mouth of the Gulf of California represents a mixing of species from similar latitudinally defined radiolarian provinces.

I did take into consideration the commingling in the sediments of tests of species occupying overlying water masses which are vertically separated or distinct from one another. For example, Kling (1977) attributes the decrease in abundance of *Theocalyptida davisi*na, which occupies the temperate and polar regions of most oceans, from common in a core from the Santa Monica Basin to rare in one from the Santa Barbara Basin, to the fact that this species is restricted to the subsill depths of the Santa Monica Basin. The sill depth of the Santa Barbara Basin is 260 meters shallower.
shevskaya and Björklund (1974) also note that this species (their Diplocyclas davisiana) is associated with deep water, being common in deep water and rare in shallow water sediments of the Norwegian-Greenland seas. In the Gulf of California, T. davisiana s.l. (mostly T. davisiana davisiana but also T. davisiana cornutoides in smaller numbers) is more abundant in the deeper water sediments. T. davisiana davisiana is also a quantitatively important member of the Quaternary assemblage at Leg 65 sites, which are in relatively deep water. Figure 3 illustrates the strong correlation ($r = 0.90$) between water depth and the relative percentage of this species in each Holocene sample from the gulf (Benson, 1966) and in presumably Holocene samples from Sites 482, 483, and 485. Theocalyptra davisiana s.l. is probably representative of faunas living in submerged, colder water masses that contribute to the overall assemblage in the sediments of the Gulf of California.

The Quaternary Assemblage at Leg 65 Sites

Tables 2 through 5 list the abundance and degree of preservation of radiolarians in samples examined from Leg 65 sites. Data are shown graphically in Figure 4.

The overall assemblage is approximately the same at all four sites, dominant species being among the spumellines Tetrapyle octacantha group, Phorticum pylo- nium group, Actinosphaera cristata(?), Hexagonium entancthum, Druppatractus variabilis, Thecosphaera spp., Lithellus minor, Lithellus (?) sp., and several spongodiscids; among the nassellines Theocalyptra davisiana davisiana, Botryostrobus auritus-australis group, B. aquilonaris, and Lamprocyclas maritalis maritalis. In samples with abundant radiolarians, more than 100 species are present. The number of nasselline species generally exceeds that of spumelline species, but the number of spumelline tests exceeds the number of nasselline tests.

In addition to those already noted, many other species are persistent and quantitatively important in the Quaternary section. Spumellines include Acrosphaera murrayana, Actinomma antarcticum, A. leptodermum, A. medianum, Hexagonium heteracanthum, Druppatractus irregularis, Amphisphaera cristata, Xiphactinus cronus, X. piato, Ommatartus tetrathalamus, Amphirhopalum ypsilon, Dictyocoryne profunda, D. truncatum, Euchitonina elegans, Euchitonina sp. cf. E. fucata, Hymeniostrum euclidis, Styloclamydon asteriscus group, and S. venustum group. Nassellines include Liriospyris reticulata, Lithomelissa monoceras, Dictyo- phimus crisiae, Carpocanistrum sp. A, C. petospyris group, Cornutella profunda, Lamprocyclas maritilis polypora, Anthocyrtidium ophirensis, Theocorythium trachellium trachellium, Lamprocyrtis nigriniae, L. (?) hannai, Pterocorys minythorax, Theocalyptra davisiana cornutoides, Eucyrtidium hexagonatum, Siphocampe lineata group, and Phormostichoartus corbula.

I found no significant changes in the assemblage with depth at any site. As in the case of the Holocene assemblage, the mouth of the Gulf of California was apparently a region where species from both lower and higher latitudes mixed during the Pleistocene. There was no domination by a strictly cold water assemblage, at least not for sufficient time to have left a record which could be detected with the sample spacing used in this study. Statistical analysis of data from more closely spaced samples at each site may reveal more subtle
Figure 2. Sample location map, Gulf of California (from Benson, 1966). Numbers refer to cores collected by G. A. Rusnak during the Vermilion Sea Expedition in 1959. (Depth contours in fathoms.)
Table 1. Relative abundances of dominant Holocene radiolarians in the Gulf of California (after Benson, 1966).

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Av. % Per Station (26 stations)</th>
<th>Stations Where Present (out of 26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrapyle octacantha group</td>
<td>6.8</td>
<td>26</td>
</tr>
<tr>
<td>Phorticium pylonium group</td>
<td>6.1</td>
<td>26</td>
</tr>
<tr>
<td>Druppatractus variabilis</td>
<td>4.6</td>
<td>25</td>
</tr>
<tr>
<td>Hexactonium entacanthum</td>
<td>3.9</td>
<td>25</td>
</tr>
<tr>
<td>Eucyrtidium hexagonatum</td>
<td>3.8</td>
<td>26</td>
</tr>
<tr>
<td>Stylochlamydium venustum/S. asteriscus</td>
<td>3.8</td>
<td>26</td>
</tr>
<tr>
<td>Lithomelissa hystrix</td>
<td>2.7</td>
<td>23</td>
</tr>
<tr>
<td>Spirocyrtis scalaris/S. subscalaris</td>
<td>2.4</td>
<td>25</td>
</tr>
<tr>
<td>Larcopyle butschlii</td>
<td>2.1</td>
<td>25</td>
</tr>
<tr>
<td>Helotholus histricosa group</td>
<td>2.1</td>
<td>26</td>
</tr>
<tr>
<td>Ommatartus tetralamatus</td>
<td>1.8</td>
<td>26</td>
</tr>
<tr>
<td>Pterocorys minytiorax/P. zancleus</td>
<td>1.7</td>
<td>21</td>
</tr>
<tr>
<td>Eucyrtionia sp. cf. E. furcata</td>
<td>1.6</td>
<td>26</td>
</tr>
<tr>
<td>Lithomelissa monoceras</td>
<td>1.5</td>
<td>25</td>
</tr>
<tr>
<td>Druppatractus irregularis</td>
<td>1.5</td>
<td>23</td>
</tr>
<tr>
<td>Pleacanthina okisikos</td>
<td>1.4</td>
<td>16</td>
</tr>
<tr>
<td>Helotholus histriscosa group</td>
<td>1.4</td>
<td>22</td>
</tr>
<tr>
<td>Pseudocubus obeliscus</td>
<td>1.4</td>
<td>23</td>
</tr>
<tr>
<td>Actinotheca cristata(?)</td>
<td>1.2</td>
<td>25</td>
</tr>
<tr>
<td>Pseudothea bicorne(?)</td>
<td>1.2</td>
<td>23</td>
</tr>
<tr>
<td>Theocalyptra davisiana s. l.</td>
<td>1.0</td>
<td>18</td>
</tr>
<tr>
<td>Spongiodiscus biconcavus</td>
<td>1.0</td>
<td>26</td>
</tr>
<tr>
<td>Theopilium tricostatum</td>
<td>1.0</td>
<td>23</td>
</tr>
<tr>
<td>Actinocyrtidium angulare</td>
<td>0.9</td>
<td>19</td>
</tr>
<tr>
<td>Hexactonium laevigatum</td>
<td>0.8</td>
<td>23</td>
</tr>
<tr>
<td>Plagiocyrtis(?) panarium</td>
<td>0.8</td>
<td>17</td>
</tr>
<tr>
<td>Anomalocyrtis dentata</td>
<td>0.7</td>
<td>20</td>
</tr>
</tbody>
</table>

changes related to fluctuations of sea surface temperature during the Pleistocene.

Throughout the Pleistocene section, the planktonic foraminiferal data show the same lack of domination by species from any one of the three major modern faunal provinces which converge at a point off southern Baja California (Bé, 1977). Using my shipboard identifications, I constructed Table 6, which shows that in those samples from Site 483 with common to abundant foraminifers, the dominant species represent all three provinces. Throughout the Pleistocene, the California Current System was active at least as far south as the mouth of the Gulf of California, transporting large populations of such higher latitude species as *Globigerina bulloides* and *Globoquadridina pachyderma* to a subtropical to tropical region dominated by *G. dutertrei*, *Globigerinoides ruber*, *G. sacculifer*, *Globorotalia menardii*, and *Pulleniatina obliquiloculata*.

### BIOSTRATIGRAPHY

#### Quaternary Radiolarian Zonations and Datum Levels

In the study of Leg 65 samples, I attempted to apply Quaternary radiolarian zonations and datum levels used in both equatorial (Nigrini, 1971; Dinkelman, 1973; Johnson and Knoll, 1975) and higher latitude studies (Hays, 1970; Kling, 1973). The absence or scarcity of the marker species *Pterocanium prismatium*, *Theocorythium vetulum*, *Anthocorytidium angulare*, *Collophera tuberosa*, and *Buccinosphaera invaginata* precluded use of Nigrini's (1971) fourfold zonation of the Quaternary in equatorial Pacific sediments. The highest occurrence of *Axoprunum angelinum* (= *Stylactractus universus*) is the only datum level I determined with any confidence. Sediments containing radiolarians above this level could be assigned to Kling's (1973) *Artostrobium miralestense* (= *Botryostrobus aquilonaris*) Zone and those below to his *Axoprunum angelinum* Zone (= *S. universus* Zone of Hays, 1970). Because of the absence of such marker species as *Eucyrtidium matuyamai* and *Lamprocyrtis heteroporo*, I could determine neither the base of the latter zone nor the presence of the underlying *E. matuyamai* Zone as defined by Hays (1970) or Kling (1973).

The need to determine rates of sediment accumulation at DSDP sites forces biostratigraphers to emphasize the importance of the ages in years of significant paleontological datum levels discovered in the sedimentary sections cored. Table 7 summarizes the estimated ages for several levels in the Quaternary. The reader should consult the references given in the table in order to assess the validity of the ages.

Data from Leg 65 support Hays and Shackleton's (1976) conclusion that the extinction level of *A. angelinum* (= *S. universus*) was globally synchronous at about 0.41 ± 0.005 Ma. At Sites 483, 484, and 485, this
Table 2. Radiolarians at Site 482.

<table>
<thead>
<tr>
<th>Sample (interval in cm)</th>
<th>Depth below Seafloor (m)</th>
<th>Abundance</th>
<th>preservation</th>
<th>Baculocystis volvox</th>
<th>Collophora rubra</th>
<th>Aspergiloides arenaceus</th>
<th>Anthracocrinus californiensis</th>
<th>Thecosomatae venusti</th>
</tr>
</thead>
<tbody>
<tr>
<td>482A-1, 80-82</td>
<td>3.81</td>
<td>C</td>
<td>F</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>482A-2, 80-82</td>
<td>3.81</td>
<td>C</td>
<td>F</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>482A-3, 80-82</td>
<td>3.81</td>
<td>C</td>
<td>F</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>482A-4, 80-82</td>
<td>3.81</td>
<td>C</td>
<td>F</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>482A-1, CC</td>
<td>3.81</td>
<td>C</td>
<td>F</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>482A-2, CC</td>
<td>3.81</td>
<td>C</td>
<td>F</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>482A-3, CC</td>
<td>3.81</td>
<td>C</td>
<td>F</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>482A-4, CC</td>
<td>3.81</td>
<td>C</td>
<td>F</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Abundances are indicated as: A (abundant), C (common), F (few), R (rare), and B (barren); blank space = species searched for but not found. Preservation is indicated as G (good), M (moderate), and P (poor).

The top of this zone (Pseudoemiliania lacunosa) has recently been dated at 0.44 Ma by Gartner (1977). Johnson and Knoll (1975) claim that the highest occurrence of A. angelinum may be diachronous (Table 7), since it is significantly younger in two cores from the equatorial Pacific than in the North Pacific sediments.
studied by Hays (1970). In rather weak support of Johnson and Knoll’s claim of diachrony, single specimens of *Collosphaera tuberosa* occur 3.6 and 7.3 meters below the highest occurrence of *A. angelinum* in Hole 483 (Table 3). According to them, the first occurrence of *C. tuberosa* is dated at 0.37 ± 0.01 Ma in the two cores they studied.

**Biolstratigraphy of Leg 65 Sites**

Tables 2–5 and Figure 4 summarize data from the Leg 65 holes for each site and are arranged according to subbottom depth. Marker species that I searched for are given in the tables. The datum for comparing all four sites in Figure 4 is the highest occurrence of *Axoprunum angelinum* at Sites 483, 484, and 485. All of the sedimentary section recovered at Site 482 was deposited above this datum.

One feature apparent in Figure 4 is that in the few meters or tens of meters of sediment immediately overlying the basement and in the sediments interbedded with the basalt layers at Sites 482, 483, and 485, radiolarians are generally absent or, if present, are rare but well preserved. Therefore, it does not appear that submarine volcanism had a direct effect on the preservation of radiolarian skeletons in these sediments.

In order to determine whether there is any pattern in the change in radiolarian abundance from rare or barren in the lower part to common and abundant in the upper part of the Pleistocene section in the region of the mouth of the Gulf of California, I have combined the data from Leg 65 with radiolarian data from Legs 63 and 64 in Table 8.

The faunal increase clearly occurred much earlier at sites northwest of the axis of the East Pacific Rise than at sites southeast of the axis (Fig. 1) and must have resulted, at least in part, from enhanced biological productivity in overlying waters. Perhaps upwelling or the influence of the California Current System was felt earlier at the northwestern sites during the opening of the Gulf than at the southeastern ones. Alternatively, more nearly oceanic conditions, but not necessarily upwelling, with concomitant increased contribution of radiolarian skeletons to the bottom sediments, would have prevailed earlier at the northwestern sites, which are farther from the Mexican mainland than the southeastern sites and were, therefore, less influenced by terrigenous sedimentation.

**Site 482**

None of the Quaternary-age radiolarian marker species (Table 7) was found in any of the samples from the drill holes at Site 482 (Table 2). All of the sediment at
Table 5. Radiolarians at Site 485.a

<table>
<thead>
<tr>
<th>Sample</th>
<th>Depth below Seafloor (m)</th>
<th>Abundance</th>
<th>Preservation</th>
<th>Taxa</th>
</tr>
</thead>
<tbody>
<tr>
<td>485-1-2, 80-82</td>
<td>2.31</td>
<td>C</td>
<td>M</td>
<td><em>Buccinosphaera invaginata</em></td>
</tr>
<tr>
<td>485-2,CC (7-9)</td>
<td>7.83</td>
<td>C</td>
<td>M/G</td>
<td><em>Stylacontarium acquilonium</em></td>
</tr>
<tr>
<td>485-3,CC (7-9)</td>
<td>22.07</td>
<td>R</td>
<td>M</td>
<td><em>Collosphaera tuberosa</em></td>
</tr>
<tr>
<td>485-4,CC (13-15)</td>
<td>25.84</td>
<td>A</td>
<td>G</td>
<td><em>Axoprunum angelinum</em></td>
</tr>
<tr>
<td>485-5-1, 80-82</td>
<td>32.31</td>
<td>R</td>
<td></td>
<td><em>Lamprocyrtis neoheteroporos</em></td>
</tr>
<tr>
<td>485-5-2, 80-82</td>
<td>33.81</td>
<td>R</td>
<td>G</td>
<td><em>Anthocyrtidium angulare</em></td>
</tr>
<tr>
<td>485-5-3, 80-82</td>
<td>35.31</td>
<td>R</td>
<td>G/R</td>
<td><em>Theocorythium vetulum</em></td>
</tr>
<tr>
<td>485-5-4, 80-82</td>
<td>36.81</td>
<td>R</td>
<td>B</td>
<td>cf.</td>
</tr>
<tr>
<td>485-5-5,CC (5-7)</td>
<td>37.77</td>
<td>C</td>
<td>G/R</td>
<td><em>R. cf.</em></td>
</tr>
<tr>
<td>485-5-6,CC (6-8)</td>
<td>50.58</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>485A-1,CC (11-13)</td>
<td>60.10</td>
<td>R</td>
<td>G</td>
<td><em>B. invaginata</em></td>
</tr>
<tr>
<td>485A-2,CC (19-21)</td>
<td>65.10</td>
<td>F</td>
<td>G/R</td>
<td><em>S. acquilonium</em></td>
</tr>
<tr>
<td>485A-3,CC (2-4)</td>
<td>73.22</td>
<td>A</td>
<td>G/R</td>
<td><em>C. tuberosa</em></td>
</tr>
<tr>
<td>485A-4,CC (3-4)</td>
<td>80.15</td>
<td>A</td>
<td>G/R</td>
<td><em>T. vetulum</em></td>
</tr>
<tr>
<td>485A-5,CC (5-7)</td>
<td>93.70</td>
<td>R</td>
<td></td>
<td><em>A. angelinum</em></td>
</tr>
<tr>
<td>485A-6,CC (6-8)</td>
<td>102.30</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>485A-7,CC (3-5)</td>
<td>109.70</td>
<td>R</td>
<td></td>
<td></td>
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<td>485A-8,CC (5-7)</td>
<td>120.24</td>
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<tr>
<td>485A-9,CC (15-17)</td>
<td>129.88</td>
<td>B</td>
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<td></td>
</tr>
<tr>
<td>485A-10,CC (9-11)</td>
<td>139.60</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>485A-11-2, 145-147</td>
<td>148.46</td>
<td>B</td>
<td></td>
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</tr>
<tr>
<td>485A-19-2, 10-12</td>
<td>189.61</td>
<td>R</td>
<td></td>
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<tr>
<td>485A-19-2, 114-116</td>
<td>190.65</td>
<td>R</td>
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</tr>
<tr>
<td>485A-20-2, 13-15</td>
<td>194.14</td>
<td>R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>485A-22,CC (12-16)</td>
<td>210.00</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>485A-26,CC</td>
<td>227.70</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>485A-27,CC (15-19)</td>
<td>231.97</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>485A-28,CC (15-19)</td>
<td>235.80</td>
<td>B</td>
<td></td>
<td></td>
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<td>485A-34-1, 9-11</td>
<td>277.10</td>
<td>R</td>
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<td>485A-34-1, 36-39</td>
<td>277.38</td>
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<td></td>
</tr>
<tr>
<td>485A-36-2, 130-150</td>
<td>297.90</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>485A-37,CC (11-12)</td>
<td>306.00</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>485A-38-1, 40-50</td>
<td>313.50</td>
<td>B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a See note, Table 2, for explanation of symbols.

the site must have been deposited above the radiolarian datum level denoted by the highest occurrence of *Axoprunum angelinum* (0.41 Ma; Fig. 4). This interpretation is supported by the absence of evidence for the existence at Site 482 of calcareous nannofossil Zone NN19, which ended 0.44 Ma (Gartner, 1977).

Radiolarian skeletons are well preserved throughout the sedimentary section. As mentioned, above the faunal increase at about 102 meters sub-bottom, radiolarians are present in all samples. Fluctuations in abundance are partly related to reduction of their numbers through dilution by fine sand, silt, and foraminifers transported to the site by turbidity currents or some other mechanism. With few exceptions, only the more pelagic sediments have common to abundant radiolarians.

Above 80 meters sub-bottom, well-preserved radiolarians are generally common to abundant at Site 483 (Table 3). Below this depth and in the sediments interlayered with the basalts, they are rare or absent but still well preserved. In the lowest sample with common radiolarians, Sample 483-9,CC (10-12 cm), the dominant forms are thick-walled actinomnids, including abundant *Axoprunum angelinum*, *Actinomma* spp., *Xiphatractus* spp., *Druppatractus* spp., and a few robust nasselline species, including *Theocalyptra davisianna davisianna*, *Botryostrobus aquilonaris*, *Carpocarrium papillosum*, *Plectopyramis dodecomma*, and *Coronella profunda*. Although there is little indication of chemical attack, this concentration of robust skeletons may have resulted from the dissolution of less solution-resistant skeletons from an originally more diverse assemblage typical of the overlying sediments.

The highest occurrence of *Axoprunum angelinum* is in Sample 483-5-3, 100-102 cm (33.51 m sub-bottom). At this level, as well as at its highest occurrences at Sites 484 and 485, I observed several specimens in which the two polar spines were reduced or absent (Plate 1, Figs. 3
**Table 6. Quaternary planktonic foraminifers at Site 483.**

<table>
<thead>
<tr>
<th>Sample (interval in cm)</th>
<th>Depth below Seafloor (m)</th>
<th>Species Assemblages (after Bé, 1977)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Tropical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtropical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transition</td>
</tr>
<tr>
<td>483-1,CC (13-15)</td>
<td>0.40</td>
<td>C R C F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A C R F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F/C C/A</td>
</tr>
<tr>
<td>483-2,CC (5-7)</td>
<td>5.60</td>
<td>R R R F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A C F R</td>
</tr>
<tr>
<td>483-3, 100-102</td>
<td>14.51</td>
<td>R R R C</td>
</tr>
<tr>
<td>483-3, 23-25</td>
<td>15.24</td>
<td>R R F</td>
</tr>
<tr>
<td>483-3-4, 100-102</td>
<td>16.01</td>
<td>R/R F</td>
</tr>
<tr>
<td>483-4-1, 100-102</td>
<td>21.01</td>
<td>R</td>
</tr>
<tr>
<td>483-4,CC (0-3)</td>
<td>24.45</td>
<td>A R R R</td>
</tr>
<tr>
<td>483-5-1, 100-102</td>
<td>30.51</td>
<td>A F R F C R</td>
</tr>
<tr>
<td>483-5-2, 100-102</td>
<td>32.01</td>
<td>A C F R R</td>
</tr>
<tr>
<td>483-5-3, 100-102</td>
<td>33.51</td>
<td>R C C/A R</td>
</tr>
<tr>
<td>483-5,CC (5-7)</td>
<td>37.10</td>
<td>F R F</td>
</tr>
<tr>
<td>483-6-2, 28-31</td>
<td>40.80</td>
<td>C R R</td>
</tr>
<tr>
<td>483-6,CC (16-18)</td>
<td>43.60</td>
<td>F</td>
</tr>
<tr>
<td>483-7,CC (5-7)</td>
<td>55.61</td>
<td>C R F</td>
</tr>
<tr>
<td>483-8,CC (11-13)</td>
<td>63.65</td>
<td>C F C</td>
</tr>
<tr>
<td>483-9,1-74-76</td>
<td>68.25</td>
<td>F</td>
</tr>
<tr>
<td>483-9,CC (10-12)</td>
<td>77.14</td>
<td>R</td>
</tr>
<tr>
<td>483-10,CC (19-21)</td>
<td>79.71</td>
<td>R</td>
</tr>
<tr>
<td>483C-2-1, 80-82</td>
<td>86.81</td>
<td>R</td>
</tr>
<tr>
<td>483-3,23, 80-82</td>
<td>88.81</td>
<td>R</td>
</tr>
<tr>
<td>483-11,CC (16-18)</td>
<td>93.70</td>
<td>R</td>
</tr>
<tr>
<td>483C-2-6, 80-82</td>
<td>94.31</td>
<td>C</td>
</tr>
<tr>
<td>483C-3-1, 80-82</td>
<td>96.31</td>
<td>R</td>
</tr>
<tr>
<td>483B-2-1, 70-72</td>
<td>101.70</td>
<td>R</td>
</tr>
<tr>
<td>483-12,CC (4-6)</td>
<td>105.64</td>
<td>F</td>
</tr>
<tr>
<td>483B-2-4, 70-72</td>
<td>106.21</td>
<td>F/C</td>
</tr>
<tr>
<td>483B-2-6, 81-83</td>
<td>109.32</td>
<td>R</td>
</tr>
<tr>
<td>483-13-3, 85-87</td>
<td>109.36</td>
<td>R</td>
</tr>
<tr>
<td>483-17-1, 10-13</td>
<td>142.12</td>
<td>R</td>
</tr>
<tr>
<td>483-18-2, 0-2</td>
<td>152.51</td>
<td>R</td>
</tr>
<tr>
<td>483-18-2, 46-48</td>
<td>152.97</td>
<td>R</td>
</tr>
<tr>
<td>483-18-2, 130-132</td>
<td>153.81</td>
<td>R</td>
</tr>
<tr>
<td>483-18-3, 99-101</td>
<td>155.01</td>
<td>R</td>
</tr>
<tr>
<td>483-18-3, 124-126</td>
<td>155.25</td>
<td>R</td>
</tr>
<tr>
<td>483-18-4, 70-72</td>
<td>156.21</td>
<td>R</td>
</tr>
<tr>
<td>483-20-2, 71-95</td>
<td>210.83</td>
<td>R</td>
</tr>
<tr>
<td>483-20-2, 120-130</td>
<td>211.25</td>
<td>R</td>
</tr>
</tbody>
</table>

a See note, Table 2, for explanation of symbols.

b High latitude species which may originate from the California Current System.

and 4). *A. angelinum* is present in every sample down to the section which is barren of radiolarians.

Other Quaternary marker species that I noted include: (1) single occurrences of *Collosphaera tuberosa* in Samples 483-5,CC (5-7 cm) (Plate 1, Figs. 5-6) and 483-6-2, 16-18 cm, the latter being a sample of a volcanic ash layer; (2) rare occurrences of *Lamprocyrtis neoherotropos* in Samples 483-8,CC (11-13 cm) (Plate 3, Figs. 4, 6) and 483-9-1, 74-76 cm; (3) one specimen identified as *Anthocyrtidium angulare* in Sample 483-9-1, 74-76 cm (Plate 3, Fig. 1), and (4) one specimen identified as *Theocorythium vetulum* in Sample 483-8,CC (11-13 cm) (Plate 3, Figs. 7-9). Because of the scarcity of these species, I did not assign any of the section at Site 483 to Nigrini’s (1971) fourfold zonation of the Quaternary.

**Site 484**

Well-preserved radiolarians are abundant in nearly all of the samples examined from Site 484 (Table 4). The
Table 7. Estimated ages of Quaternary radiolarian datum levels.

<table>
<thead>
<tr>
<th>Radiolarian Datum Level</th>
<th>Estimated Age (Ma)</th>
<th>References and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition: Clososphaera sp. A. to Bucinospinosa irrorata</td>
<td>0.21 ± 0.02</td>
<td>Johnson and Knoll (1975)</td>
</tr>
<tr>
<td>Top: Stelacocysta acutiformis</td>
<td>0.31</td>
<td>Hays (1979)</td>
</tr>
<tr>
<td>Top: Sagenophyllum acuminatum</td>
<td>0.41 ± 0.005</td>
<td>Hays and Shackleton (1975)</td>
</tr>
<tr>
<td>Base: Clososphaera tubera</td>
<td>0.54</td>
<td>Johnson and Knoll (1973)</td>
</tr>
<tr>
<td>Top: Axoprunum angei</td>
<td>0.76</td>
<td>Johnson and Knoll (1973)</td>
</tr>
<tr>
<td>Top: Lamprocyrtis neoheteroporos</td>
<td>0.80</td>
<td>Johnson and Knoll (1975) for tropical Pacific</td>
</tr>
<tr>
<td>Base: Clososphaera sp. A.</td>
<td>0.61</td>
<td>Johnson and Knoll (1975)</td>
</tr>
<tr>
<td>Top: Actinocythereis exigua</td>
<td>0.94</td>
<td>Johnson and Knoll (1973)</td>
</tr>
<tr>
<td>Top: Thecoctyclus vetulus</td>
<td>1.03</td>
<td>Johnson and Knoll (1975) for tropical Pacific</td>
</tr>
<tr>
<td>Top: Pterocanium prismatium</td>
<td>1.04</td>
<td>Johnson and Knoll (1975)</td>
</tr>
</tbody>
</table>

Table 8. Radiolarian abundance changes at DSDP sites in the mouth of the Gulf of California.

<table>
<thead>
<tr>
<th>Site</th>
<th>Depth to Basement (m)</th>
<th>Depth to Change from Raré to Barren Below to Common and Abundant Above (m)</th>
<th>Date of Faunal Increase (Ma)</th>
<th>Extrapolated from Estimated Rates of Sediment Accumulation (Ma)</th>
<th>References and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southeast of East Pacific Rise axis:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>473</td>
<td>287</td>
<td>29</td>
<td>0.5</td>
<td></td>
<td>Johnson and Knoll (1975) for tropical Pacific</td>
</tr>
<tr>
<td>482</td>
<td>137</td>
<td>110</td>
<td>&lt;0.41</td>
<td></td>
<td>Johnson and Knoll (1973) estimate based on King's (1973) data for DSDP Site 175</td>
</tr>
<tr>
<td>485</td>
<td>154</td>
<td>73-81</td>
<td>0.48-0.58</td>
<td></td>
<td>Johnson and Knoll (1973) estimate based on King's (1973) data for DSDP Site 173</td>
</tr>
<tr>
<td>Northwest of East Pacific Rise axis:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>474</td>
<td>563</td>
<td>320</td>
<td>1.3</td>
<td></td>
<td>Johnson and Knoll (1975) for tropical Pacific</td>
</tr>
<tr>
<td>475</td>
<td>n/a</td>
<td>45-53</td>
<td>0.85-1.3</td>
<td></td>
<td>Johnson and Knoll (1973) estimate based on King's (1973) data for DSDP Site 175</td>
</tr>
<tr>
<td>476</td>
<td>257</td>
<td>80</td>
<td>1.7</td>
<td></td>
<td>Johnson and Knoll (1975) for tropical Pacific</td>
</tr>
<tr>
<td>483</td>
<td>110</td>
<td>80</td>
<td>1.2</td>
<td></td>
<td>Johnson and Knoll (1975) for tropical Pacific</td>
</tr>
</tbody>
</table>

The purpose of this list is to provide recent bibliographic references plus notes, where applicable, to the radiolarian taxa present in Holocene sediments from the Gulf of California (Benson, 1964, 1966), and in Quaternary sediments recovered during Leg 65 at the mouth of the Gulf. Original references are generally not given. Most of the generic assignments are those of recent authors; otherwise, the original authors' genera or those of Campbell (1954) were used. Except for those taxa identified in the text as dominant members of the Pleistocene and Holocene assemblages, all of the taxa listed are generally rare. Nearly all (95% or more) of the taxa present are accounted for in the list.

**Acrobotrissa cibrosa Popofsky**

*Plate 9, Figs. 6-7*

*Cf. Acrobotrissa cibrosa* Haeckel, 1887, p. 1114, pl. 96, fig. 10.

**Acrobotys sp. cf. A. disolenus Haeckel**

*Plate 9, Figs. 6-7*

*Cf. Acrobotys disolenus* Haeckel, 1887, p. 1114, pl. 96, fig. 10.

**Acrosphaera murrayana Haeckel**

*Choeniosphaera murrayana* Haeckel, Benson, 1964, pl. 1, fig. 6; 1966, p. 120, pl. 2, fig. 3.

**Polyosolenia murrayana** (Haeckel), Nigrini, 1968, p. 52, pl. 1, figs. 1a-b.

**Remarks.** According to Johnson and Nigrini (1980), the correct generic name for collosphaerids with irregularly scattered spines is *Acrosphaera*, not *Polyosolenia*.

**Actinosphaera antarctica** (Haeckel)

*Diplotomma antarctica* Riedl, Benson, 1966, p. 134, pl. 2, fig. 14, pl. 3, figs. 2-3 (not fig. 1).

**Actinosphaera antarctica** (Haeckel), Nigrini, 1967, p. 26, pl. 2, figs. 1a-d.

**Actinosphaera arcadophorum Haeckel**

*Actinosphaera arcadophorum* Haeckel, Benson, 1964, p. 29, pl. 2, fig. 3; 1970, p. 167, pl. 1, fig. 11.

**Actinosphaera lepidoterrum (Jorgensen)**

*Actinosphaera sp., Benson, 1964, pl. 1, fig. 15; 1966, p. 164, pl. 5, fig. 6 (not fig. 5).

**Echiniosphaera lepidoterrum** Jorgensen, Kling, 1977, p. 215, pl. 2, fig. 16.

**Actinosphaera sp., Benson, 1964, pl. 1, fig. 16; 1966, p. 164, pl. 5, fig. 5.

**Actinosphaera cristata** (Haeckel)?

*Cenosphaera cristata* Haeckel, Riedl, 1958, p. 223, pl. 1, figs. 1-2; Kling, 1977, p. 215, pl. 2, fig. 4.

**Carpocosphera acanthophora** (Popofsky), Benson, 1964, pl. 1, fig. 3; 1966, p. 127, pl. 2, figs. 8-10.
Anthocyrtidium angulare
Nigrini, 1971, p. 445, pi. 34.1, figs. 3a-b; (Mast), Benson, 1966, p. 170, pi. 5, figs. 1-2.

Remarks. Nigrini (1972, p. 832) describes this species as having "a delicate primitive microsphere with large polygonal meshes which are connected to the cortical shell by a number of thread-like radial bars." Nigrini (1972) assigned two such species to the genus Anthocyrtina Holland and Enjmet, and I have followed this practice for Cenosphera cristata (Haeckel)?

Amphiplecta cylindrocephala Dumitrică
(Plate 8, Fig. 5)


Amphiplecta cylindrocephala Dumitrică, 1972, p. 836, pi. 24, figs. 4-5.

Amphiphopodum virchowii (Haeckel)
(Plate 2, Figs. 1-3)

Amphiphopodum virchowii (sic) (Haeckel), Dumitrică, 1972, p. 835, pi. 27-28; 1966, p. 221, pi. 11, figs. 3-6.

Amphiphopodum ypsilon Haeckel, Nigrini, 1967, p. 35, pi. 3, figs. 3a-d; 1970, p. 168, pi. 2, fig. 2; 1971, p. 447, pi. 34.1, figs. 7a-c.

Remarks. Although I did not make counts of specimens, tests found lower in the Quaternary sections at Leg 65 sites generally have fewer chambers (three or four) on the forked arm before bifurcation (Plate 2, Figs. 4-6) than those found higher in the section (Plate 2, Fig. 7), a trend first noted by Nigrini (1971).

Amphiplecta cristata Carnevale
(Plate 4, Fig. 5)

Amphiplecta cf. uranus Haeckel, Benson, 1964, pl. 1, fig. 7; 1966, p. 136, pl. 3, figs. 4-5.

Amphiplecta cristata Carnevale, Dumitrică, 1972, p. 833, pl. 20, fig. 10.

Amphitholus acanthotheora Haeckel

Amphitholus acanthotheora Haeckel, 1887, p. 667; Benson, 1964, pl. 1, fig. 60; 1966, p. 258, pl. 17, figs. 4-7.

Anomalacantha dentata (Mast)

Anomalacantha dentata (Mast), Benson, 1966, p. 170, pl. 5, figs. 10-11.

Heteracantha dentata Mast, Nigrini, 1970, p. 167, pl. 1, fig. 9.

Anthocyrtidium angulare Nigrini

(Plate 3, Fig. 1)

Anthocyrtidium angulare Nigrini, 1971, p. 441, pl. 34.1, figs. 3a-b; Dinkelman, 1973, p. 788, pl. 10, fig. 5; Johnson and Knoll, 1975, p. 107, pi. 1, fig. 3.

Remarks. The specimen illustrated in Plate 3, Figure 1 is the only one found in Leg 65 samples that has the dimensions and true biretta-shaped thorax described for this species by Nigrini (1971). It differs from Nigrini's (1971, pl. 34.1, figs. 3a-b) illustration of the species in the larger size of the thoracic pores, but Nigrini does not mention pore size as an identifying characteristic. Several somewhat larger specimens, having a cylindrical to slightly in-turned thorax beneath a sharp change in contour and herein designated Anthocyrtidium sp. cf. A. angulare (Plate 3, Figs. 2-3), were found at about the same level (Sample 483-9.1, 74-76 cm) as A. angulare or lower. These specimens may be variant forms of Anthocyrtidium ophiurense.

Anthocyrtidium ophiurense (Ehrenberg)

Anthocyrtidium cineraria Haeckel, Benson, 1964, pl. 2, figs. 28-29; 1966, p. 472, pl. 32, figs. 6-9.

Anthocyrtidium ophiurense (Ehrenberg), Nigrini, 1967, pi. 6, fig. 3; 1970, p. 171, pl. 4, fig. 7; Molina-Cruz, 1977, p. 337, pl. 6, fig. 10.

Anthocyrtidium zoomorphanum (Ehrenberg)

Anthocyrtidium oxycephalum (Haeckel), Benson, 1964, pl. 2, fig. 27; 1966, p. 468, pi. 32, figs. 3-5.

Anthocyrtidium zoomorphanum (Ehrenberg), Nigrini, 1967, p. 58, pl. 6, fig. 4; Molina-Cruz, 1977, p. 337, pl. 6, fig. 8.

Arachnocoris umbelliferia Haeckel

(Plate 8, Fig. 6)

Arachnocoris umbelliferia Haeckel, 1861, p. 837; 1862, p. 305, pl. 6, fig. 12; Benson, 1966, p. 375, pl. 24, figs. 20-21.

Astronurra angulare (Campbell and Clark)

(Plate 1, Figs. 1-4)

Stylactractus universus Hays, 1970, p. 215, pl. 1, figs. 1-2; Kling, 1971, p. 1086, pl. 1, fig. 7; Dinkelman, 1973, p. 765, pl. 10, figs. 6-7.

Astronurra angulare (Campbell and Clark), Kling, 1973, p. 634, pl. 1, figs. 13-16, pl. 6, figs. 14-18; Johnson and Knoll, 1975, p. 107, pl. 1, fig. 5.

Remarks. The highest occurrence of this species at Sites 483, 484, and 485 represents the only reliable radiolarian datum determined for Leg 65 drill holes. Many tests of this species at its highest occurrence in Leg 65 samples are characterized by the reduction (Plate 1, Fig. 3) or absence (Plate 1, Fig. 4) of the two polar spines.

Botryocystis quinaria Ehrenberg

Botryocystis cf. caput-serpentes Ehrenberg, Benson, 1966, p. 348, pl. 23, fig. 17, text-fig. 24.

Botryocystis quinaria Ehrenberg, Renz, 1974, p. 789, pl. 18, fig. 19.

Botryocystis scutum (Harting)

Botryopygyl sp., Benson, 1964, pl. 2, fig. 64; 1966, p. 345, pl. 23, fig. 16, text-fig. 23.

Botryocystis scutum (Harting), Nigrini, 1967, p. 52, pl. 6, figs. 1a-c; Molina-Cruz, 1977, p. 338, pl. 6, fig. 14.

Botryocystis sp., Casey, 1971, pl. 23.3, fig. 1.

Botryostrobus aquilonaris (Bailey)

Siphocampium erucosum (Haeckel), Benson, 1964, pl. 2, fig. 63; 1966, p. 527, pl. 35, figs. 18-20.

Botryostrobus aquilonaris (Bailey), Nigrini, 1977, p. 246, pl. 1, fig. 1; Kling, 1979, p. 309, pl. 2, fig. 18.

Botryostrobus auritus-australis (Ehrenberg) group

Siphocampium cerius (Haeckel), Benson, 1964, pl. 2, fig. 62; 1966, p. 521, pi. 35, figs. 12-13.

Botryostrobus auritus-australis (Ehrenberg) group, Nigrini, 1977, p. 246, pl. 1, figs. 2-5; Kling, 1979, p. 309, pl. 2, fig. 17.

Buccinosphaera invaginata Haeckel

Buccinosphaera invaginata Haeckel, Nigrini, 1971, p. 445, pl. 34.1, fig. 2; Dinkelman, 1973, p. 764, pl. 10, fig. 3; Johnson and Knoll, 1975, p. 107, pl. 1, fig. 2; Knoll and Johnson, 1975, p. 63, pl. 1, figs. 3-6.

Remarks. Although I did not find this species in Leg 65 samples, I did not find it.

Callimira emmae Haeckel

Callimira emmae Haeckel, 1887, p. 1218, pl. 63, figs. 3-4; Benson, 1966, p. 390, pl. 25, fig. 12.

Callimira sp., Renz, 1974, p. 789, pl. 18, fig. 5; 1976, p. 162, pl. 7, fig. 1.

Dictyocryphalus papillosus
Carpocanium
Ehrenberg, 1872a, p. 310, 1872b, pi. 7, Bailey.

Haeckel, 1887, p. 66, pi. 26, fig. 10.

Aff. canistrum.

or not forms with a more distinct cephalis are included in detailed morphological studies will be required to determine whether

Clathrocyclas monumentum
Clathrocyclas(l)

Eucoronis
Clathrocyclas perforata
Cenosphaera
Cenosphaera coronata
sp. A, Nigrini and Moore, 1979, p. 125, pi. 21, fig. 3.

Carpocanistrum sp.

Carpocanistrum sp., Riedel and Sanfilippo, 1971, p. 1599, pl. 11, figs. 18, 20-22-25, pl. 21, figs. 8, 9(7).

Carpocanistrum papillosum (Ehrenberg), Renz, 1974, p. 789, pl. 17, fig. 21; Nigrini and Moore, 1979, p. N27, pl. 21, fig. 3.

Carpocanistrum sp.

Carpocanistrum scaparius, Renz, 1974, p. 789, pl. 13, fig. 17; 1976, p. 101, pl. 2, fig. 5.

Carpocanistrum stelactites
Haeckel
(Plate 4, Fig. 4)

Carpocanistrum stelactites
Haeckel, 1887, p. 227, pl. 27, fig. 4; Benson, 1966, p. 173, pl. 6, figs. 2-3.

(?)(Carpocanistrum abietinus Haeckel, Renz, 1974, p. 789, pl. 13, fig. 18.

Cladosocenia(? sp. cf. C. (?) tricolpum (Haeckel)


Clastrocanium sp. cf. C. corona inum Popofsky
Cf. Clathrocanium corona inum Popofsky, 1913, p. 342, pl. 33, fig. 1.


(?)(Clastrocanium ornatum Popofsky, 1913, p. 343, pl. 33, fig. 2;

C. clathrocanium, Benson, 1971, pl. 23, fig. 3.

Clathrocannium sp., Renz, 1974, p. 789, pl. 18, fig. 3; 1976, p. 163, pl. 7, fig. 5.

Clathrocircus stapedius
Haeckel
(Plate 7, Figs. 5-7)

Clathrocircus stapedius Haeckel, 1887, p. 962, pl. 92, fig. 8; Benson, 1966, p. 307, pl. 21, figs. 11-13, pl. 22, fig. 1(?)(not fig. 2); Goll, 1972, p. 963, pl. 51, fig. 3.

(?)Triceraspyris damaecornis Haeckel, Nigrini, 1967, p. 46, pl. 5, fig. 5.

Remarks. Nigrini's (1967, pl. 5, fig. 5) illustration of Triceraspyris damaecornis resembles Benson's (1966, pl. 21, fig. 11) Clathrocircus stapedius more closely than it does Dendrospyris damaecornis (Benson, 1966, pl. 22, fig. 2).

Clathrocosry murrayi
Haeckel
Clathrocosry murrayi Haeckel, 1887, p. 1219, pl. 64, fig. 8; Benson, 1966, p. 391, pl. 25, figs. 13-15.

Clathrocosry sp., Renz, 1974, p. 789, pl. 18, fig. 4; 1976, p. 163, pl. 7, fig. 4.

Clathromitra pterophornis
Haeckel
(Plate 9, Fig. 8)

Clathromitra pterophornis Haeckel, 1887, p. 1219, pl. 57, fig. 8; Benson, 1966, p. 399, pl. 26, fig. 4.

Collosphaera(? sp.
(Plate 4, Fig. 3)


Collosphaera sp. A, Knoll and Johnson
Collosphaera sp. A, Knoll and Johnson, 1975, p. 63, pl. 1, figs. 1-2-7, pl. 2, figs. 4-6; Johnson and Knoll, 1975, p. 107, pl. 1, fig. 1.
Remarks. Although I searched for this species in Leg 65 samples, I did not find it.

Collophora tuberosa Haeckel
(Plate 1, Fig. 5-6)

Echinomma delicatum (Dogiel), Kling, 1977, p. 215, pi. 2, figs. 6-7.

Dicyocoryne truncatum (Ehrenberg)
(Plate 6, Fig. 1)

Dicyocoryne cf. truncatum (Ehrenberg), Benson, 1964, pl. 1, fig. 47; 1966, p. 235, pl. 15, fig. 1.

Dicyocoryne truncatum (Ehrenberg), Nigrini and Moore, p. 189 (partim.); pl. 12, fig. 2a (not 2b).

Remarks. In deference to Nigrini and Moore's (1979, pp. 189-190) opinion that Eucniona triangulum (Ehrenberg), as figured by them (op. cit., pl. 12, fig. 2a and Knoll and Anikouchine (1967, 1976, pp. 189 and 190), figs. 8–9), may belong to Dicyocoryne truncatum, I prefer to keep it as a separate species.

Dicyocoryne cf. truncatum (Haeckel)
(Plate 8, Fig. 7)

Dicyocoryne truncatum (Haeckel)
(Plate 6, Fig. 1)

Dicyocoryne profunda (Ehrenberg)
(Plate 8, Fig. 4)

Cf. Dictyocoryne profunda Haeckel, Benson, 1966, p. 307, pi. 22, fig. 2.

Dicyocoryne aff. D. binapteronis Goll

Patagospyris? sp., Benson, 1966, p. 326, pl. 22, fig. 22, pl. 23, figs. 2-1.

Dicyocoryne aff. D. binapteronis Goll, Rentz, 1974, p. 790, pi. 19, fig. 11.

Dicyocoryne profunda Ehrenberg
(Plate 6, Fig. 2)

Hymeniasa truncatum (Ehrenberg), Nigrini and Moore, p. 189 (partim.); pl. 12, fig. 2a (not 2b).

Dicyocoryne aff. D. binapteronis Goll, Rentz, 1974, p. 790, pi. 19, fig. 11.

Dicyocoryne cf. truncatum (Ehrenberg), Benson, 1964, pl. 1, fig. 47; 1966, p. 235, pl. 15, fig. 1.

Dicyocoryne truncatum (Ehrenberg), Nigrini and Moore, p. 189 (partim.), pl. 12, fig. 2a (not 2b).

Remarks. In deference to Nigrini and Moore's (1979, pp. 189-190) opinion that Eucniona triangulum (Ehrenberg), as figured by them (op. cit., pl. 12, fig. 2a and Knoll and Anikouchine (1967, 1976, pp. 189 and 190), figs. 8–9), may belong to Dicyocoryne truncatum, I prefer to keep it as a separate species.

Dicyocoryne cf. truncatum (Haeckel)
(Plate 8, Fig. 7)

Dicyocoryne truncatum (Haeckel)
(Plate 6, Fig. 1)

Dicyocoryne profunda (Ehrenberg)
(Plate 8, Fig. 4)

Cf. Dictyocoryne profunda Haeckel, Benson, 1966, p. 307, pi. 22, fig. 2.

Dicyocoryne aff. D. binapteronis Goll, Rentz, 1974, p. 790, pi. 19, fig. 11.

Dicyocoryne profunda Ehrenberg
(Plate 6, Fig. 2)

Hymeniasa truncatum (Ehrenberg), Nigrini and Moore, p. 189 (partim.); pl. 12, fig. 2a (not 2b).

Dicyocoryne aff. D. binapteronis Goll, Rentz, 1974, p. 790, pi. 19, fig. 11.

Dicyocoryne cf. truncatum (Haeckel)
(Plate 8, Fig. 7)

Dicyocoryne truncatum (Haeckel)
(Plate 6, Fig. 1)

Dicyocoryne profunda (Ehrenberg)
(Plate 8, Fig. 4)

Cf. Dictyocoryne profunda Haeckel, Benson, 1966, p. 307, pi. 22, fig. 2.

Dicyocoryne aff. D. binapteronis Goll, Rentz, 1974, p. 790, pi. 19, fig. 11.

Dicyocoryne profunda Ehrenberg
(Plate 6, Fig. 2)

Hymeniasa truncatum (Ehrenberg), Nigrini and Moore, p. 189 (partim.); pl. 12, fig. 2a (not 2b).

Dicyocoryne aff. D. binapteronis Goll, Rentz, 1974, p. 790, pi. 19, fig. 11.

Dicyocoryne cf. truncatum (Haeckel)
(Plate 8, Fig. 7)

Dicyocoryne truncatum (Haeckel)
(Plate 6, Fig. 1)

Dicyocoryne profunda (Ehrenberg)
(Plate 8, Fig. 4)

Cf. Dictyocoryne profunda Haeckel, Benson, 1966, p. 307, pi. 22, fig. 2.

Dicyocoryne aff. D. binapteronis Goll, Rentz, 1974, p. 790, pi. 19, fig. 11.

Dicyocoryne profunda Ehrenberg
(Plate 6, Fig. 2)

Hymeniasa truncatum (Ehrenberg), Nigrini and Moore, p. 189 (partim.); pl. 12, fig. 2a (not 2b).

Dicyocoryne aff. D. binapteronis Goll, Rentz, 1974, p. 790, pi. 19, fig. 11.
**Euchitonia elegans** (Ehrenberg), Benson, 1964, pl. 2, figs. 52-53; 1966, p. 447, pl. 30, figs. 3-5.

**Coroclypta curvispina** (Ehrenberg), Benson, 1964, pl. 2, figs. 52-53; 1966, p. 447, pl. 30, figs. 3-5.

**Coroclypta curvispina** (Ehrenberg), Renz, 1974, p. 790, pl. 16, fig. 22; 1976, p. 129, pl. 5, fig. 2.

**?Euchitonia elegans** (Ehrenberg), Benson, 1964, pi. 1, fig. 31(?) 1966, pi. 14, fig. 1, pl. 2, figs. 2(7); Nigrini, 1967, p. 39, pl. 4, figs. 2a-b; 1970, p. 169, pl. 2, fig. 6; Ling and Anikoukhine, 1967, p. 1486, pl. 189 and 190, figs. 3-4; Molina-Cruz, 1977, p. 334, pl. 2, fig. 8; Nigrini and Moore, 1979, p. 583, pl. 11, figs. 1a-b.

**Remarks.** Although Nigrini and Moore (1979, p. 583) indicate that Benson’s (1966) description (including dimensions) of this species is not consistent with theirs, *E. elegans*, along with *E. furcata*, is present in the Gulf of California and in Leg 65 samples. Benson’s (1966, pl. 14, fig. 1) illustration of *E. elegans* is similar to other published illustrations of this species.

**Euchitonia furcata Ehrenberg**

**Euchitonia furcata** Ehrenberg, Benson, 1964, pl. 1, fig. 31(?) 1966, pi. 14, fig. 1, pl. 2, figs. 7; Nigrini, 1967, p. 39, pl. 4, figs. 2a-b; 1970, p. 169, pl. 2, fig. 6; Ling and Anikoukhine, 1967, p. 1486, pl. 189 and 190, figs. 3-4; Molina-Cruz, 1977, p. 334, pl. 2, fig. 8; Nigrini and Moore, 1979, p. 583, pl. 11, figs. 1a-b.

**Euchitonia** sp. cf. *Euchitonia elegans* (Ehrenberg), Benson, 1964, pl. 1, fig. 31(?) 1966, pi. 14, fig. 1, pl. 2, figs. 2(7); Nigrini, 1967, p. 39, pl. 4, figs. 2a-b; 1970, p. 169, pl. 2, fig. 6; Ling and Anikoukhine, 1967, p. 1486, pl. 189 and 190, figs. 3-4; Molina-Cruz, 1977, p. 334, pl. 2, fig. 8; Nigrini and Moore, 1979, p. 583, pl. 11, figs. 1a-b.

**Remarks.** Although Nigrini and Moore (1979, p. 583) indicate that Benson’s (1966) description (including dimensions) of this species is not consistent with theirs, *E. elegans*, along with *E. furcata*, is present in the Gulf of California and in Leg 65 samples. Benson’s (1966, pl. 14, fig. 1) illustration of *E. elegans* is similar to other published illustrations of this species.

**Euchitonia sp.**

**Euchitonia sp.** Ehrenberg, Benson, 1964, pl. 1, fig. 30; 1966, p. 232, pl. 14, figs. 3-4.

**Remarks.** This species (?) is distinguished by its large size; its circular central structure consisting of five to seven concentric, latticed, discoidal shells; its two similar arms which do not bend toward one another; and in fully developed tests, a patagium with thickened margins, convex outward between the arms, presenting the appearance of a shield. It is clearly not the same as *E. multiplis* (= *E. furcata*) of Nigrini (1967); therefore, I have designated it as *Euchitonia sp.*

**Euchitonia sp. cf. E. furcata Ehrenberg**

**Euchitonia sp.** cf. *E. furcata* Ehrenberg, Benson, 1964, pl. 1, figs. 29, 33; 1966, p. 228, pl. 13, figs. 4-5.

**Remarks.** This species differs from *Euchitonia furcata* in having shorter arms that are broader and thicker in relation to their length, in having a patagium that is of similar thickness throughout its extent, and in having a central structure consisting of three to five concentric, discoidal, latticed shells with somewhat irregular outlines.

**Euchitonia sp. cf. E. triangulum** (Ehrenberg)

**Euchitonia sp.** cf. *echinata* Haeckel, Benson, 1966, p. 226, pl. 12, fig. 7, pl. 13, figs. 1-3.

**Euchitonia sp.** cf. *E. triangulum* (Ehrenberg), Ehrenberg, Renz, 1974, p. 791, pl. 16, fig. 20; 1976, p. 128, pl. 5, fig. 2.

**Remarks.** This species is characterized by Benson (1966, p. 227) as being distinctly bilateral and having a circular central region consisting of five to eight concentric discoidal shells and an internal arm structure consisting of distinct, equally spaced, latticed rings, traceable from arm to arm. These features clearly distinguish this species from *Dictyocoryne truncatum*.

**Eucoronis nephrophyta** Haeckel, Benson, 1964, pl. 2, fig. 6; 1966, p. 508, pl. 1, figs. 6-7; Casey, 1971, pl. 23.2, figs. 14-15.

**Eucecryphalus sp.** Benson, 1964, pi. 30, figs. 6-7; Casey, 1971, pl. 23.2, figs. 14-15.

**Eucecryphalus elegans** (Ehrenberg), Benson, 1964, pi. 1, fig. 31(?) 1966, pi. 14, fig. 1, pl. 2, figs. 2(7); Nigrini, 1967, p. 39, pl. 4, figs. 2a-b; 1970, p. 169, pl. 2, fig. 6; Ling and Anikoukhine, 1967, p. 1486, pl. 189 and 190, figs. 3-4; Molina-Cruz, 1977, p. 334, pl. 2, fig. 8; Nigrini and Moore, 1979, p. 583, pl. 11, figs. 1a-b.

**Remarks.** Although Nigrini and Moore (1979, p. 583) indicate that Benson’s (1966) description (including dimensions) of this species is not consistent with theirs, *E. elegans*, along with *E. furcata*, is present in the Gulf of California and in Leg 65 samples. Benson’s (1966, pl. 14, fig. 1) illustration of *E. elegans* is similar to other published illustrations of this species.

**Eucecryphalus sp.**

**Eucecryphalus sp.** Benson, 1966, pi. 450, pl. 30, figs. 6-7; Casey, 1971, pl. 23.2, figs. 14-15.

**Eucrypides elegans (Ehrenberg), Benson, 1964, pi. 1, fig. 31(?) 1966, pi. 14, fig. 1, pl. 2, figs. 2(7); Nigrini, 1967, p. 39, pl. 4, figs. 2a-b; 1970, p. 169, pl. 2, fig. 6; Ling and Anikoukhine, 1967, p. 1486, pl. 189 and 190, figs. 3-4; Molina-Cruz, 1977, p. 334, pl. 2, fig. 8; Nigrini and Moore, 1979, p. 583, pl. 11, figs. 1a-b.

**Remarks.** Although Nigrini and Moore (1979, p. 583) indicate that Benson’s (1966) description (including dimensions) of this species is not consistent with theirs, *E. elegans*, along with *E. furcata*, is present in the Gulf of California and in Leg 65 samples. Benson’s (1966, pl. 14, fig. 1) illustration of *E. elegans* is similar to other published illustrations of this species.

**Eucecryphalus sp.** Benson, 1966, pi. 450, figs. 6-7; Casey, 1971, pl. 23.2, figs. 14-15.

**Eucecryphalus sp.** Benson, 1966, pi. 30, figs. 6-7; Casey, 1971, pl. 23.2, figs. 14-15.

**Eucecryphalus sp.** Benson, 1966, pi. 30, figs. 6-7; Casey, 1971, pl. 23.2, figs. 14-15.
Hexapyle dodecantha (Haeckel), Goll, 1969, p. 331, pl. 59, figs. 4, 6-7; Renz, 1974, p. 792, pl. 19, fig. 10; 1976, p. 167, pl. 8, fig. 5; Molina-Cruz, 1977, p. 336, pl. 6, fig. 7.

**Heliodiscus aequalis** Haeckel
Heliodiscus aequalis Haeckel, Benson, 1964, pl. 1, fig. 26; 1966, p. 200, pl. 9, fig. 3 (not fig. 4); Nigrini, 1967, p. 32, pl. 3, figs. 1a-b; 1970, p. 168, pl. 2, fig. 1.

**Heliodiscus echiurus** Haeckel
Heliodiscus echiurus Haeckel, Benson, 1966, p. 200, pl. 9, fig. 4 (not fig. 3).

**Heliodiscus echiniscus** Haeckel

**Helotholus histricosa** Jörgensen group
(Plate 8, Figs. 1-3)
Helotholus histricosa Jörgensen, Benson, 1966, p. 459, pl. 31, figs. 4-8; Kling, 1977, p. 215, pl. 2, fig. 6.

**Remarks.** Specimens from the Gulf that were identified as Helotholus histricosa Jörgensen are of two general types: (1) tests with a partially hidden cephalis and a discernible, but not distinct, collar structure (Benson, 1966, pi. 31, figs. 4-5; this chapter, Plate 8, Fig. 2), and (2) tests with a completely hidden cephalis consisting of a broadly rounded cap-like structure with relatively large pores (Benson, 1966, pl. 31, figs. 6-8; this chapter, Plate 8, Figs. 1, 3).

**Hexactinaria echiurus** Jörgensen
Hexactinaria echiurus (sic) Jörgensen, Benson, 1966, pl. 1, fig. 12; 1966, p. 149, pl. 3, figs. 13-14, pl. 4, figs. 1-3; Kling, 1977, p. 215, pl. 2, fig. 15.

**Remarks.** This species is nearly identical to *H. heracliti* sp. cf. H. heracliti, the two may be conspecific. Because both species are undoubtedly cephaiders with a constant number of six mutually perpendicular radial beams extended as main spines, I do not agree with Björklund’s (1977) placement of them in synonymy with Actinoma haysi. However, it can be demonstrated that A. haysi is basically a cephalis but with a variable number of additional beams and spines.

**Hexactinaria leucogaster** Haeckel
Hexactinaria leucogaster Haeckel, Benson, 1964, pl. 1, figs. 9, 13; 1966, p. 153, pl. 4, figs. 4-5; Molina-Cruz, 1977, p. 333, pl. 2, fig. 7.

**Remarks.** See those under Hexactinaria heteractina.

**Hexactinaria heteractina** (Haeckel
Hexactinaria heteractina Haeckel, Benson, 1964, pl. 1, figs. 9, 13; 1966, p. 153, pl. 4, figs. 4-5; Molina-Cruz, 1977, p. 333, pl. 2, fig. 7.

**Remarks.** See those under Hexactinaria heteractina.

**Hexapyle dodecantha** Haeckel
Hexapyle dodecantha Haeckel, 1964, p. 271, pl. 18, figs. 11-13, text-fig. 19.

Hexapyle spp., Molina-Cruz, 1977, p. 335, pl. 2, figs. 9-10.

**Remarks.** Fully developed individuals with an outer ellipsoidal shell of smooth outline (Benson, 1966, pl. 16, figs. 12, 13, 16; this chapter, Plate 6, Fig. 6) may closely resemble fully developed individuals of *Phorbidium pyronium* and *Larcopyle butschlii*.

**Hexactinaria triaxonius** Haeckel
(Plate 4, Fig. 6)

Hexactinaria triaxonius Haeckel, 1887, p. 175, pl. 21, fig. 2; Benson, 1966, p. 139, pl. 3, figs. 6-7.

**Hymaniastrum euclidi** Haeckel
Hymaniastrum euclidi (Haeckel) Popofsky, Benson, 1964, pl. 1, fig. 45; 1966, p. 222, pl. 12, figs. 1-3.


**Lamprocyclas maritalis** Haeckel
Lamprocyclas maritalis Haeckel, Benson, 1964, pl. 2, figs. 41-42; 1966, p. 475, pl. 32, figs. 12, 33, fig. 17.

**Lamprocyclas maritalis** Nigrini, 1967, p. 7, fig. 3; 1970, p. 171, pl. 4, fig. 9; Molina-Cruz, 1977, p. 337, pl. 6, figs. 8-9.

**Lamprocyclas maritalis** was distinguished from *L. m. polypora* on the basis of having ten or fewer pores on the half equator of the abdomen, a thicker abdominal wall with pores set in polygonal frames, generally smaller abdominal dimensions, and, typically, a well-developed hyaline peristome with numerous tooth-like spines. Some specimens with very broad abdomens (Benson, 1966, pl. 33, fig. 1) may belong to *L. m. ventricosa* (Nigrini, 1968). *L. m. maritalis* is the dominant member of this group in the samples examined.

**Lamprocyclas maritalis** Haeckel polypora Nigrini
Lamprocyclas maritalis Haeckel, Benson, 1966, p. 475, pl. 32, figs. 10-11, pl. 33, fig. 17.

**Lamprocyclas maritalis** Haeckel maritalis Haeckel, 1967, p. 76, pl. 7, fig. 6; 1970, p. 171, pl. 4, fig. 8; Molina-Cruz, 1977, p. 337, pl. 6, fig. 6.

**Lamprocyclas hanna** (Campbell and Clark)
Lamprocyclas hanna (Campbell and Clark), Kling, 1973, p. 638, pl. 5, figs. 12-14, pl. 12, figs. 10-14.

**Lamprocyclas jenonis** Haeckel, Molina-Cruz, 1977, p. 337, pl. 7, fig. 10.

**Lamprocyclas neoheteroporosa** Kling
(Plate 3, Figs. 4-6)
Lamprocyclas neoheteroporosa Kling, 1973, p. 639, pl. 5, figs. 17-18, pl. 15, figs. 4-5; Johnson and Knoll, 1975, p. 109, pl. 1, fig. 9; Riedel and Sanfilippo, 1978, p. 69, pl. 5, fig. 10.

**Lamprocyclas nigritae** (Caulet)
Conarachnium sp., Benson, 1964, pl. 2, fig. 31; 1966, p. 479, pl. 33, figs. 2-3.

**Conarachnium? sp.,** Nigrini, 1968, p. 56, pl. 1, fig. 5a, 5b.

**Lamprocyclas haydi** Kling, 1973, p. 639, pl. 5, figs. 15-16, pl. 15, figs. 1-3; Molina-Cruz, 1977, p. 337, pl. 6, fig. 9.


**Lampromitra quadricuspis** Haeckel
(Plate 8, Fig. 8)
Lampromitra quadricuspis Haeckel, 1887, p. 1214, pl. 58, fig. 7; Benson, 1966, p. 455, pl. 30, fig. 11, pl. 31, fig. 1.

**Larcopyle butschlii** Dreyer group
Larcopyle butschlii Dreyer, 1889, p. 124, pl. 10, fig. 70; Benson, 1966, p. 280, pl. 19, figs. 3-5.
Larcoype buischii Dreyer, 1889(?), Kling, 1977, p. 217, pl. 1, fig. 11.
Remarks. This group of ellipsoidal tests with regular outline is identified on the basis of its internal pylonid structure and the presence of a cluster of spines at one pole of the test.

Larcoypira quadranula Haeckel
Larcoypira quadranula Haeckel, Benson, 1966, p. 266, pl. 18, figs. 7-8; Nigrini, 1970, p. 169, pl. 2, fig. 9; Casey, 1971, pl. 23.3, fig. 8; Kling, 1977, p. 217, pl. 2, fig. 18; Molina-Cruz, 1977, p. 335, pl. 3, fig. 3.

Lipmanella dicytoceras (Haeckel)
Dictyoeceras acanthicum Jörgensen, Benson, 1964, pl. 2, fig. 37; 1966, p. 241, pl. 28, figs. 8-10.
Dictyoeceras anconicum (Cleve), Dumitricà, 1972, p. 840, pl. 25, figs. 3-5.

Lipmanella tribranchiata Dumitricà, 1972, p. 840, pl. 25, figs. 3-5.
Lipmanella pyramidale cf. Dictyoeceras Popofsky, Renz, 1974, p. 794, pl. 18, fig. 6; 1976, p. 158, pl. 6, fig. 12.

Lithomelissa thoracites Haeckel
Lithomelissa thoracites Haeckel, Benson, 1966, p. 366, pl. 24, fig. 13 (not figs. 10-12).
Lithomelissa monoceras Popofsky, Casey, 1971, p. 23.2, fig. 16; Renz, 1974, p. 794, pl. 18, fig. 14; 1976, p. 158, pl. 6, fig. 12.

Lithomelissa laticeps Jörgensen
(Lithomelissa lateiceps Haeckel, 1905, p. 136, pl. 16, fig. 84; Benson, 1966, p. 369, pl. 24, figs. 14-15.

Lithomelissa laticeps Jörgensen (Plate 9, Fig. 3)

Lithomelissa mononemata Haeckel

Lithomelissa monoceras Popofsky

Lithomelissa laticeps Haeckel
Lithomelissa laticeps Haeckel, 1860, p. 836; 1862, p. 281, pi. 4, figs. 4-6. L. cf. Lithostrobus hexagonalis Haeckel.
Lithomelissa laticeps Haeckel, Benson, 1964, pl. 2, fig. 17; 1966, p. 366, pl. 24, figs. 10-12 (not fig. 13).

Lithophora bacca Ehrenberg
Lithophora bacca Ehrenberg, Benson, 1966, p. 489, pl. 33, figs. 10-11; Nigrini, 1967, p. 54, pl. 6, fig. 2.

Lithoscytus sp. cf. L. hexagonalis Haeckel
Cf. Lithoscytus hexagonalis Haeckel, p. 1475, pi. 79, fig. 20; Nigrini, 1968, p. 58, pl. 1, fig. 10.

Lithoscytus sp. cf. hexagonalis Haeckel, Benson, 1964, pl. 2, fig. 61; 1966, p. 508, pl. 35, figs. 1-2.

Lophocorys polyacantha Popofsky group
Lophocorys polyacantha Popofsky, 1913, p. 400, fig. 122; Benson, 1966, p. 494, pl. 34, figs. 1-3; Kling, 1979, p. 309, pl. 1, fig. 27. Lophocorys polyacantha Popofsky, 1913, p. 405, pl. 36, figs. 4-5; Renz, 1974, p. 788, pl. 16, fig. 13.
Lophocorys polyacantha Popofsky, 1913, p. 373, pi. 24, fig. 19.
Lophophaena cylindrica (Cleve)
Cf. Lophophaena cylindrica (Cleve), Benson, 1964, pl. 2, fig. 14; 1966, p. 373, pi. 24, fig. 19.
Lophophaena cylindrica (Cleve), Renz, 1974, p. 794, pl. 18, fig. 6; 1976, p. 159, pl. 6, fig. 21.

Lophophaenoma sp. aff. L. witjazii Petrushevskaya
Lophophaenoma sp. aff. L. witjazii Petrushevskaya, Benson, 1964, pl. 2, fig. 16; 1966, p. 379, pi. 24, figs. 16-17.
Lophophaenoma sp. aff. L. witjazii Renz, 1974, p. 794, pl. 18, fig. 13; 1976, p. 159, pl. 6, fig. 14.

Lophophaenoma sp. aff. L. witjazii Petrushevskaya, Benson, 1964, pl. 2, fig. 16; 1966, p. 379, pi. 24, figs. 22-23, pl. 25, fig. 1.
Lophophaenoma sp. aff. L. witjazii Petrushevskaya, Renz, 1974, p. 794, pl. 18, fig. 13; 1976, p. 159, pl. 6, fig. 14.

Lophophaenoma sp. aff. L. witjazii (Haeckel, 1860) hyperborea (Jörgensen)
Lophophaenoma sp. aff. L. hyperborea (Jörgensen), Goll, 1976, p. 400, pl. 14, figs. 4-6, 8-9, 11-12, pl. 15.

Lophophaenoma sp. aff. L. hyperborea (Jörgensen), Goll, 1976, p. 398, pl. 10, pl. 11, figs. 1-3, 5.
Lophospyris pentagona (Ehrenberg) quadriforis (Haeckel)


Lophospyris pentagona quadriforis (Haeckel), Goll, 1976, p. 398, pl. 13, figs. 1-7, 10, 13.

Neosemantis distephanus (Haeckel)

Semantis distephanus Haeckel, 1887, p. 957, pl. 83, fig. 3.

Neosemantis distephanus Popofsky, 1913, p. 299, pl. 29, fig. 2.

Neosemantis distephanus (Haeckel) Popofsky, Benson, 1966, p. 291, pl. 19, fig. 18, pl. 20, fig. 1.


Panartus tetrathalamus tetrathalamus (Haeckel), Benson, 1966, p. 302, pi. 21, fig. 5.

Nephrodictyum renilla (Haeckel, Benson, 1964, pi. 1, fig. 53; 1966, p. 251, pl. 16, figs. 3-4; Molina-Cruz, 1977, p. 355, pi. 5, figs. 1-3.

Ommatartus tetrahedra (Haeckel)

Ommatartus tetrahedra (Haeckel), Benson, 1964, p. 1, figs. 5-22-25; 1966, p. 193, pi. 8, figs. 8-13, pi. 9, figs. 1-2, text-fig. 10.

Panartus tetrahedra (Haeckel), Nigrini, 1967, p. 30, pl. 2, figs. 4a-d.

Panartus tetrahedra (Haeckel), Nigrini, 1970, p. 168, pl. 1, fig. 12.

Ommatartus tetrahedra (Haeckel), Riedel and Sanfilippo, 1971, p. 1588, pi. 1C, figs. 5-7; Kling, 1977, p. 217, pl. 2, fig. 11.

Peridium longispinum (Haeckel)

Peridium longispinum (Haeckel), Benson, 1964, p. 359, pi. 23, figs. 27, pl. 24, figs. 1-3.

Peridium spinipes (Haeckel)

Peridium spinipes Haeckel, Casey, 1971, pi. 23.2, figs. 17-18.

Psilomelissa calvata (Haeckel, Renz, 1974, p. 795, pl. 18, fig. 8; 1976, p. 160, pi. 6, fig. 15.

Peripryamyllus circumtexta (Haeckel)

Peripryamyllus circumtexta Haeckel, 1887, p. 1162, pi. 54, fig. 5; Riedel, 1958, p. 231, pl. 2, figs. 8-9; Benson, 1966, p. 426, pi. 29, fig. 4; Kling, 1973, p. 637, pi. 2, figs. 15-19, pi. 9, figs. 1-3; Kling, 1979, p. 309, pi. 1, fig. 20.

Pharmacantha hystrix (Jörgensen)

(Plate 7, Figs. 10-11)


Pharmacantha? panarium (Dumitrică)

(Plate 7, Figs. 1-2)


Plagiacantha? sp. cf. P. sphaerozoum (Haeckel)

(Plate 7, Figs. 15-16)


Plagiacantha? oikiskos (Jörgensen)

(Plate 7, Figs. 13-14)


Remarks. In the Gulf of California, this species(?) may represent tests of Lithomelissa hystrix with the thorax undeveloped.

Plectopyramis dodecomona (Haeckel)

Plectopyramis dodecomona Haeckel, 1887, p. 1588, pi. 18, fig. 12; 1966, p. 424, pi. 29, fig. 3.

Bathopryamyllus woodringi (Campbell and Clark, 1973, p. 635, pi. 2, figs. 20-23, pi. 9, figs. 4, 5, 7, 8).
Ehrenberg (?), Popofsky, 1908, p. 304, pi. 33, Haeckel, 1887, p. 1010, pi. 94, fig. 11; Benson, the transverse bars of the thoracic meshwork are not continuous but represent a different species for the following reasons: (1) the thorax

Dictyophimus infabricatus, Molina-Cruz, 1977, pi. 8, fig. 1.

sp., Benson, 1964, pi. 2, fig. 21; 1966, p. 401, pi. 26, figs. 2-3.

Pseudodictyophimus gracilipes (Bailey), Kling, 1977, p. 217, fig. 1.

Remarks. This species appears to be related to Lithomelissa sp. but lacks the well-developed lateral spines of this genus.

Pterocorys bicorne Haeckel (?)

Pterocorys sp. Benson, 1964, pi. 2, fig. 21; 1966, p. 401, pi. 26, figs. 5-6; Casey, 1971, pi. 23.3, fig. 1-2; Nigrini and Moore, 1979, p. N49, pi. 25, figs. 6a-b.

Remarks. The assignment of this species to Pterocorys bicorne is questionable in light of Nigrini and Moore’s (1979) reservations about applying Haeckel’s species name before examining topotypic material.

Pterocorys grandiporus Nigrini

Pterocorys grandiporus Nigrini, 1968, p. 57, pl. 1, fig 7; Benson, 1964, pl. 2, fig. 39; Molina-Cruz, 1977, p. 336, pl. 6, fig. 11.

Pterocorys korotnevi (Dogiel)

Pterocorys korotnevi (Dogiel), Benson, 1964, pi. 2, fig. 18; Nigrini, 1970, p. 170, pl. 3, figs. 1-5; Ling, Stadum, and Welch, 1971, p. 714, pi. 2, fig. 2, pi. 28, fig. 4; Kling, 1973, p. 638, pi. 4, figs. 1-4.

Pterocorys praetextum (Ehrenberg) euclopum Haeckel

Pterocorys praetextum (Ehrenberg), Benson, 1964, pi. 2, fig. 38(2); 1966, p. 405, pi. 27, figs. 3(?), 5 (not fig. 4).

Pterocorys praetextum (Ehrenberg) euclopum Haeckel, Nigrini, 1967, p. 70, pl. 7, fig. 2; 1970, p. 170, pl. 3, fig. 8; Kling, 1979, p. 311, pl. 2, figs. 14a-b, 15a-b, 16.

Pterocorys praetextum praetextum (Ehrenberg)

Pterocorys praetextum (Ehrenberg), Benson, 1964, pi. 2, fig. 22; 1966, p. 408, pl. 27, fig. 6, pl. 28, fig. 1.

Remarks. Because its test is “more cylindrical, very different from other hat-shaped Corocelitopsis” (Renz, 1976, p. 118), I have placed this species in the genus Pterocorys (cephalis, thorax, abdomen with three solid thoracic wings; without terminal feet, Campbell, 1954, p. 130).

Pterocorys minythorax (Nigrini)

Theococcus zancleus (Müller), Benson, 1964, pi. 2, figs. 50-51; 1966, p. 482, pi. 33, fig. 5 (not fig. 4); Casey, 1971, pi. 23.3, fig. 15. Theococcus minythorax Nigrini, 1968, p. 57, pl. 1, fig. 8; Kling, 1977, p. 217, pl. 1, fig. 8.

Pterocorys zancleus (Müller), Nigrini, 1979, p. 85, pl. 25, fig. 9.

Pterocorys killmari (Renz)

Pterocorys cf. columba Haeckel, Benson, 1964, pi. 2, fig. 35; 1966, p. 414, pi. 28, fig. 7.

Corocelitopsis killmari Renz, 1974, p. 790, pl. 17, fig. 10; 1976, p. 118, pi. 4, fig. 11.

Remarks. This useful stratigraphic marker for the top of the Pliocene was not found in sediments that may be of Pliocene age at Site 485.

Pterocorys sp. cf. P. elegans (Haeckel)

Cf. Artopilium elegans Haeckel, 1887, p. 1440, pl. 75, fig. 1.

Pterocorys cf. elegans (Haeckel), Benson, 1966, pi. 27, figs. 1-2.

Eucyrtidium hertwigii Haeckel

Pterocarys hertwigii Haeckel, Nigrini, 1976, p. 73, pi. 7, figs. 4a-b; Molina-Cruz, 1977, pi. 8, figs. 7-8.

Eucyrtidium hertwigii Haeckel, Casey, 1971, pl. 23.1, figs. 18-20.

Pterocarys hertwigii (Haeckel), Riedel and Sanfilippo, 1978, p. 72, pl. 9, fig. 2; Nigrini and Moore, 1979, p. 85, pl. 25, fig. 9.

Pterocarys killmari (Renz)

Pterocarys cf. columba Haeckel, Benson, 1964, pi. 2, fig. 35; 1966, p. 414, pi. 28, fig. 7.

Corocelitopsis killmari Renz, 1974, p. 790, pl. 17, fig. 10; 1976, p. 118, pi. 4, fig. 11.

Remarks. Because its test is “more cylindrical, very different from other hat-shaped Corocelitopsis” (Renz, 1976, p. 118), I have placed this species in the genus Pterocarys (cephalis, thorax, abdomen with three solid thoracic wings; without terminal feet, Campbell, 1954, p. 130).

Pterocarys minythorax (Nigrini)

Theococcus zancleus (Müller), Benson, 1964, pi. 2, figs. 50-51; 1966, p. 482, pi. 33, fig. 5 (not fig. 4); Casey, 1971, pl. 23.3, fig. 15. Theococcus minythorax Nigrini, 1968, p. 57, pl. 1, fig. 8; Kling, 1977, p. 217, pl. 1, fig. 8.

Pterocarys zancleus (Müller), Nigrini, 1979, p. 85, pl. 25, figs. 11a-b.

Pylonium sp.

Pylonium sp. Benson, 1966, p. 250, pl. 16, fig. 2.

Saturnalis circularis Haeckel

Saturnalis circularis Haeckel, Nigrini, 1967, p. 25, pl. 1, fig. 9; Kling, 1973, p. 635, pl. 1, figs. 21-25, pl. 7, figs. 1-5.

Sethococcus (?) dogieli Petrusheskaya

Sethococcus (?) dogieli Petrusheskaya, Dumitrić, 1972, p. 837, pl. 23, figs. 1-2.

Lipmanella (?) dogieli (Petrusheskaya), Petrusheskaya and Kozlova, 1972, p. 542, pl. 37, fig. 10.

Sethophorina pentalactis Haeckel

Lamprorina cf. coronata Haeckel, Benson, 1966, p. 452, pl. 30, fig. 8 (not figs. 9-10).
Siphocampium Haeckel, Benson, 1966, p. 523, pi. 35, cf. cornutella

Spirocyrtis scalaris Haeckel, Nigrini, 1967, p. 88, pi. 8, fig. 7, pi. 9, figs. 10-11.

Spirema sp., Benson, 1966, p. 268, pi. 18, figs. 9-10.

Siphocampium sp., Benson, 1964, pi. 2, fig. 47; 1966, p. 517, pi. 35, fig. 9.


Spongaster tetras Ehrenberg

Spongaster teitra Ehrenber, Benson, 1964, p. 220, pi. 2; Riedel and Sanfilippo, 1971, p. 72, figs. 6-8; Kling, 1973, p. 634, pi. 1, figs. 5-10, pi. 13, figs. 6-8. (*) Prunopyle antarctica Dreyer, 1889, p. 24, pi. 5, fig. 75; Riedel, 1958, p. 225, pi. 1, figs. 7-8.

Spirema sp.

(Plate 6, Figs. 3-4)

Spirema sp., Benson, 1966, p. 268, pi. 18, figs. 9-10.

Spongaster tetras Ehrenberg

Spongaster tetras Ehrenberg, Benson, 1964, p. 2; Riedel and Sanfilippo, 1971, p. 158, pi. 1D, figs. 5-7; Casey, 1971, pi. 23.3, figs. 18-19.

Spongaster tetras Ehrenberg, Nigrini, 1967, p. 41, pi. 5, figs. 1a-b; 1970, p. 169, pi. 2, fig. 7.

Spongaster pseudosphenocystis Haeckel, Benson, 1964, pi. 1, fig. 46; 1966, p. 238, pi. 15, fig. 2; Riedel and Sanfilippo, 1971, p. 158, pi. 1D, figs. 5-7; Casey, 1971, pi. 23.3, figs. 18-19.

Spongaster pseudosphenocystis Haeckel, Nigrini, 1967, p. 41, pi. 5, figs. 1a-b; 1970, p. 169, pi. 2, fig. 7.

Spongaster pseudosphenocystis Haeckel, Benson, 1964, pi. 1, figs. 21, 43, 44; 1966, p. 187, pi. 8, figs. 1-3; Nigrini, 1970, p. 188, pi. 2, fig. 3; Casey, 1971, pi. 23.3, fig. 20; Kling, 1977, pi. 2, fig. 12.

Spongaster pseudosphenocystis Haeckel, Benson, 1964, pi. 1, figs. 8, 11; 1966, p. 141, pi. 3, figs. 8-11.

Spongaster pseudosphenocystis Haeckel, Benson, 1964, pi. 1, figs. 8, 11; 1966, p. 141, pi. 3, figs. 8-11.

Spongaster pseudosphenocystis Haeckel, Benson, 1964, pi. 1, fig. 46; 1966, p. 238, pi. 15, fig. 2; Riedel and Sanfilippo, 1971, p. 158, pi. 1D, figs. 5-7; Casey, 1971, pi. 23.3, figs. 18-19.

Spongaster pseudosphenocystis Haeckel, Nigrini, 1967, p. 41, pi. 5, figs. 1a-b; 1970, p. 169, pi. 2, fig. 7.

Spongaster pseudosphenocystis Haeckel, Benson, 1964, pi. 1, figs. 21, 43, 44; 1966, p. 187, pi. 8, figs. 1-3; Nigrini, 1970, p. 188, pi. 2, fig. 3; Casey, 1971, pi. 23.3, fig. 20; Kling, 1977, pi. 2, fig. 12.

Spongaster pseudosphenocystis Haeckel, Benson, 1964, pi. 1, figs. 8, 11; 1966, p. 141, pi. 3, figs. 8-11.
Remarks. Benson (1966) characterized this species as a cubic-sphere and having a cortical shell with a subcubic outline and compressed in one of the dimensions. It differs from Poppo's species in having three-bladed rather than conical main spines and a thorny rather than smooth cortical shell. The latter characteristics agree well with Klings (1973, p. 15, figs. 13-14) illustrations of thin-walled specimens of S. bipunctatum.

**Stylochlamydid asteriscus Haeckel group**

*Ommatodiscus sp.*, Benson, 1964, pl. 1, fig. 35; 1966, p. 210, pl. 10, figs. 3, 5(7).

*Stylochlamydid sp. aff. S. venustum* (Bailey), Renz, 1974, p. 798, pl. 15, fig. 17.

*Stylochlamydid asteriscus* Haeckel, Molina-Cruz, 1977, p. 335, pl. 4, fig. 6; Nigrini and Moore, 1979, pl. 113, fig. 14, fig. 5.

Remarks. This group includes specimens with an opaque, biconvex central region (concentric discoidal shells), surrounded in a single plane by numerous concentric, equally spaced, regular, latticed rings covered by a porose sieve plate and with or without marginal spines. Nigrini and Moore (1979, p. 107) designate an incompletely developed test of *S. asteriscus* illustrated by Benson (1966, pl. 10, fig. 3) as Porodiscus sp. A.

*Stylochlamydid venustum (Bailey) group*

*Ommatodiscus sp.*, Benson, 1964, pl. 1, fig. 40, fig. 36(?); 1966, p. 210, pl. 10, figs. 2, 4, 5(7).

*Stylochlamydid venustum* (Bailey), Kring, 1977, p. 217, pl. 1, fig. 5.

*Stylochlamydid sp. aff. S. multispina* Haeckel, Renz, 1974, p. 798, pl. 15, fig. 12.

Remarks. This group includes specimens with an opaque, biconvex central region (concentric discoidal shells), surrounded in a single plane by generally irregular concentric rings which may be broken into concave outward segments near the periphery of the test. A porose sieve plate covers the rings on both sides of the test. Nigrini and Moore (1979, p. 107) identify an incompletely developed specimen of *S. venustum* illustrated by Benson (1966, pl. 10, fig. 4) as Porodiscus sp. B.

*Stylochlamydid validispina Jorgensen*

*Stylochlamydid validispina* Jorgensen, Benson, 1964, pl. 1, fig. 35; 1966, p. 203, pl. 9, figs. 5-6; text-fig. 11; Kring, 1977, pl. 217, pl. 2, fig. 1.

*Xiphospora sp. aff. X. circularis* (Clark and Campbell), Kring, 1973, p. 635, pl. 2, figs. 1-3, pl. 7, figs. 11-14 (not figs. 15-17).

*Stylochlamydid multispina* Haeckel, Renz, 1976, p. 111, pl. 3, fig. 13.

**Tessaraurastra straussi Haeckel**

*Tessaraurastra straussi* Haeckel, Renz, 1974, p. 798, pl. 15, fig. 15; 1976, p. 112, pl. 3, fig. 7.

*Amphirhophalum* cf. *Tessaraurastra straussi* Haeckel, Johnson and Nigrini, 1980, p. 148, pl. 2, fig. 4(?), pl. 5, fig. 1, 2(7).

Remarks. The rarey occurring tests of this species in Leg 65 samples show no indication of cross arms (as illustrated by Johnson and Nigrini, 1980, pl. 5, fig. 1). Renz (1974, p. 798) noted that the cross arms were either rudimentary or lacking. Johnson and Nigrini (1980) suggest that the lateral arms are taxonomically unimportant; therefore, the species might be more properly placed in the genus *Amphispyris*.

**Tetrapyle octacantha Müller group**

*Tetrapyle octacantha* Müller, 1858, pl. 33, pl. 2, figs. 12-13, pl. 3, figs. 1-12; Benson, 1964, pl. 1, figs. 48-52, 54-59; 1966, p. 245, pl. 15, figs. 3-10, pl. 16, fig. 1, text-fig. 18; Molina-Cruz, 1977, pl. 335, pl. 5, figs. 5-7.


Remarks. This group differs from the *Porocorythium pylonium* group in (1) the presence of few, if any, radial beams, which are generally confined to the regions of the dimenive axes of the tests, and (2) the presence in fully developed individuals of no more than three systems of girdles, the third being irregular and joined to the second system by numerous short bars arising from the surface of the latter (Benson, 1964, pl. 1, fig. 48; 1966, pl. 16, fig. 1).
**ACKNOWLEDGMENTS**

I thank Cathy Nigrini, La Habra Heights, California, and Ted Moore, Jr., University of Rhode Island, for their reviews of the original manuscript.

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Huang, 1967, p. 285, pl. 19, figs. 9-11.

Huang, 1974, p. 19, figs. 9-11.

Huang, 1976, p. 78, pl. 17, figs. 1-6. *Hataina ovata* Huang

Spumellina incertae sedis, Forma A, Benson, 1966, p. 283, pl. 19, figs. 6-8.

Hataina ovata Huang, 1967, p. 178, pl. 17, figs. 1-6, pl. 18, figs. 1-4, pl. 19, figs. 1-6.

**REFERENCES**


Benson, R. N., 1966. Recent Radiolaria from the Gulf of California [Ph. D. dissert.]. University of Minnesota, Minneapolis.


Hataina ovata Huang, 1967, p. 178, pl. 17, figs. 1-6, pl. 18, figs. 1-4, pl. 19, figs. 1-6.

**ACKNOWLEDGMENTS**

I thank Cathy Nigrini, La Habra Heights, California, and Ted Moore, Jr., University of Rhode Island, for their reviews of the original manuscript.


APPENDIX
Radiolarian Names

Acanthocorys variabilis
Acanthosphaera elliptica
Aerobotysa cribosa (Plate 9, Fig. 5)
Aerobryta disolenia
A. sp. cf. A. disolenia (Plate 9, Fig. 6-7)
Aerosphaera murrayana
Actinomma antarctium
A. arcadophorum
A. hayi
A. hypsithrix
A. leptoedrura
A. mediumium
A. sp.
Actinosphaera cristata
 Amphicapsulsum wyvilleanum
Amphipieta acrostoma
A. cylindrocephala (Plate 8, Fig. 5)
Amphirhopalum
A. virchowii (Plate 2, Figs. 1-3)
A. ypsiion (Plate 2, Figs. 4-7)
Amphipspherea cristata (Plate 4, Fig. 5)
A. cronos
A. pluto
A. uranus
Amphispyris costata
A. costata-thorax
A. reiciulata
A. subquadrata
A. toxarium
A. zonarius
Amphitholus acanthometra
Anomalacantha dentata
Anthocyrtidium angulare (Plate 3, Fig. 1)
A. cineraria
A. ophirese
A. sp. cf. A. angulare (Plate 3, Figs. 2-3)
A. zonguebaricum
A. oxycephale
Arachnocorys pentacantha
A. umbilicifera (Plate 8, Fig. 6)
Artogypisum elegans
A. undulatum
Axoprunum angelinum (Plate 1, Figs. 1-4)
Bathropyramis woodringi
Botryocystis caput-serpentis
B. quinaria
B. scutum
B. sp.
Botryoxyle sp.
Botryostrobus aquilonaria
B. auritus-austalis
Buccinosphaera invaginata
Cainomatima emmae
C. sp.
Calocyclas amicae
C. monumentum
Carpocanarium papillosum
C. sp.
Carpocanistrum sp. A
C. sp.
C. (?) sp.
Carpocanarium petalospyris
C. sp.
Carpophora acaenthoaphora
Cenosphera acanthophora
C. cristata
C. perforata
C. sp.
C. (?) sp. aff. C. perforata (Plate 4, Fig 4)
Ceratospyris borealis
C. pentagona
C. polygona
Choeneocapsulsum murrayana
Cincfopiramidum infundibulum
Circosphaera microporus
Cladococcus abelites
C. cervicornis (Plate 4, Fig. 1)
C. scoparius
C. stalaritic (Plate 4, Fig. 2)
Cladoscycumon triculorum
Clathrocynanum coronatum
C. ornatum
C. sp.
Clathrocystis stapelius (Plate 7, Figs. 5-7)
Clathrocyrdis murrayi
C. sp.
Clathrocycla? sp.
Clathrocyclum davisona
Clathromanita picrohormis (Pl. 9, Fig. 8)
Collosphaera sp. A
C. tuberosa (Plate 1, Figs. 5-6)
C. (?) sp. (Plate 4, Fig 3)
Conarachnium sp.
Cornutella profunda
Corypelecyra
C. cervus
C. killmari
C. kruegeri
Cubotholus octoceras
C. regularis
Cycladophora davisona
Cypasita irregularis
Cyrtopera laguncula
Dendrosyris bipaneritanis
D. damascensis
Desmospyris anthocyrtoides
Dicytecephalus mediterraneus
D. papillosum
Dicytocularcahnetica
D. pyramidale
Dicytocyrocyne profundus
D. sp. (Plate 6, Fig. 2)
D. truncatum (Plate 6, Fig. 1)
Dictyocryptophora papillosum
Dictyophirusensis
D. gracilipes
D. inflabracius
D. platycephala (Plate 8, Fig. 7)
D. sp. cf. D. tripus (Plate 8, Fig. 4)
D. tetracanthis
D. tripus
Diopiloegma baxare
Dicocystis (?) sp.
Disolenia quadrata
D. variabilis
Doryconthidium hexactis
D. (?) sp.
Druppatractus acquilonius
D. irregularis
D. pyriformis
D. variabilis
D. (?) sp.
Echinonema delicatulum
E. delicatatum
E. leptoedrura
Elaphococcus cervicornis
Eucryphalus cervus
E. (?) sp. (Plate 9, Fig. 4)
Euchitonia echinata
E. elegans
E. functiva
E. mulleri
E. sp.
E. sp. cf. E. triangulum (Plate 5, Figs. 4-5)
E. triangulum
Eucoronis nephrospyris
E. (?) sp.
<table>
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<th>QUATERNARY RADIOLARIANS</th>
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<td>Eucyrtidium</td>
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<td>Hexactinum arachnoidale</td>
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<td><em>L. tribranchiata</em> (Plate 9, Fig. 1)</td>
</tr>
<tr>
<td><em>L.(?) dogieli</em></td>
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<tr>
<td>Liriopysris reticulata</td>
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<tr>
<td><em>L. sp.</em></td>
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<td><em>L. sp. 2</em></td>
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<tr>
<td><em>L. toxarium</em></td>
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<tr>
<td><em>L.(?) toxarium A</em></td>
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<tr>
<td>Litharachnium tentorium</td>
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<tr>
<td>Lithelius minor</td>
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<tr>
<td><em>L.(?) sp.</em></td>
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<tr>
<td>Lithocampe anomalata</td>
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<tr>
<td>Lithomelissa galeata</td>
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<tr>
<td><em>L. hystrix</em></td>
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<tr>
<td><em>L. laticeps</em> (Plate 9, Fig. 3)</td>
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<tr>
<td><em>L. monocrates</em></td>
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<tr>
<td><em>L. spp.</em></td>
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<tr>
<td><em>L. thoracites</em> (Plate 9, Fig. 2)</td>
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<tr>
<td>Lithomitra infundibulum</td>
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<tr>
<td><em>L. lineata</em></td>
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<tr>
<td>Lithopera bacca</td>
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<tr>
<td>Lithopilum sphaerocephatum</td>
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<tr>
<td>Lithostrobus hexagonalis</td>
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<tr>
<td><em>L. hexastichus</em></td>
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<tr>
<td>Lophocorys polyacantha</td>
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<tr>
<td>Lophophaena capito</td>
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<tr>
<td><em>L. cylindrica</em></td>
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<tr>
<td>Lophophaenoma witjazii</td>
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| Lophospyris pentagona hyperborea |
| L. pentagona pentagona           |
| L. pentagona quadriforis        |
| Lychnodictyum challengeri       |
| Neosemantis distephanus         |
| Nephrodictyum renilia           |
| Nephrospyris renilia            |
| Oboleiscus pseudoeuropolis      |
| Octopyle stenozona              |
| Ommatartus tetrathalamus        |
| Ommatodiscus pantanellii       |
| O. sp.                          |
| Panartus tetrathalamus          |
| *P. tetrathalamus tetrathalamus*|
| Patagospyr(t?) sp.              |
| Peridium longispinun            |
| P. sp.                          |
| P. spinipes                     |
| Peropyrusis circumtexta         |
| Petalespyris ophirensis         |
| Phormacantha hystrix (Plate 7, Fig. 12) |
| Phormocyrtis fastuosa           |
| Phormospyris scaphipes          |
| *P. stabilis capoi*            |
| *P. stabilis scaphipes*         |
| *P. stabilis stabilis*          |
| P. tricosata                    |
| Phormostichoarctus corbula      |
| Phorctica pylonium (Plate 7, Figs. 15-16) |
| Plagiacantha(? panarium (Plate 7, Figs. 10-11) |
| Plagionium sp. cf. P. sphaerozoum (Plate 7, Figs. 1-2) |
| P. sphaerozoum                   |
| Plectacantha aikiskos (Plate 7, Figs. 13-14) |
| P. (?) sp.                      |
| Plectophora triaxanth             |
| Plectopyranus dodecomma          |
| Polysolenia murrayana            |
| P. (?) sp.                      |
| Porodiscus microporus            |
| P. (?) sp. B                     |
| Prunopyle anarctica              |
| Pseudocubus obeliscus (Pl. 7, Figs. 8-9) |
| Pseudodictyophimus gracilipes   |
| Psilomelissa calvata             |
| P. galeata                       |
| Pterocanium bicorne              |
| P. elegans                       |
| P. grandiporus                   |
| P. koroinevi                     |
| P. praetextum                    |
| P. praetextum euclupum           |
| P. praetextum praetextum         |
| P. pristium                      |
| P. prosperinae                   |
| P. sp.                           |
| P. trilobum                      |
| Pterocorys                       |
| P. clausus                       |
| P. columba                       |
| P. hertwigi                      |
| P. hirundo                       |
| P. killmari                      |
| P. minytorux                     |
| P.(?) sp.                        |
| P. caniceps                      |
| Pylonium sp. (Plate 6, Fig. 5)   |
| Rhodospyris sp.                  |
| Saturnalis circularis            |
| Semantis distephanus             |
| Sethoconus(t) dogieli            |
| Sethophormis pentalactis        |
| Siphocampe arachnea              |
| S. corbula                       |
| S. lineata                       |
| S. nodosaria                      |
Siphonosphaera polysiphonia
S. socialis
Sphaeropyle langii
Spirema sp. (Plate 6, Figs. 3-4)
Spirocyrtis gyroscalaris
S. scalaris
Spongaster disymmetricus
S. tetraz
S. tetraz tetraz
e Spongocore diplocylindrica
S. puela
Spongodiscus biconcavus
S. sp. 3
Spongoliva ellipsoides
Spongopyle osculosa
Spongosphera streptacantha
Spongotrechus glacialis
S. sp. cf. S. glacialis (Plate 5, Fig. 3)
Spongurus elliptica
S. sp.
Stichopera pectinata
Stichoplum bicorne
S. annulatum
S. anocor
Stichopterygium anomalum
Stylocampe chrysalidium
S. bispiculum (Plate 1, Figs. 7-10)
Stylotractus spp.
S. universus
Stylochlamydium asteriscus
S. venustum
Stylodictya multispina
S. validispina
Stylosophera lithatractus
Tessarastrium sternesi
Tetrastyle octacantha
Thecosphaera spp.
Theocorythium trachelium trachelium
T. davisiana davisiana
t T. sp
Theoconus hertwigii
T. minythorax
T. zancleus
Theocorys veneris
Theocorythium trachelium trachelium
T. vetulum (Plate 3, Figs. 7-9)
Theropilum triscostatum
Tholospyris devexa
T. kantuana
T. procura
T. scaphipes
Trematodiscus microporus
Triceraspysris damaecornis
Tricolympysris kantuana
Tristylopyris scaphipes
Verteclitata hexacantha
Xiphactinus circularis
X. cronos (Plate 4, Fig. 8)
X. pluto (Plate 5, Figs. 1-2)
Xiphosyras circularis
Zygocampe chrysalidium
Zygocircus capulosus
Z. productus
Z. sp. (Plate 7, Figs. 3-4)
Plate 1. Radiolarians of Quaternary age from Leg 65 samples. (Scale bar equals 100 μm.) 1-4. Axoprunum angelinum (Campbell and Clark). 1. Sample 483-6.CC (16–18 cm), E43/2. 2. Sample 483-9.CC (10–12 cm), slide a, V13/4. 3, 4. Tests with polar spines reduced or lacking, typical of species at highest occurrence in Leg 65 samples, (3) Sample 484A-5.CC (5–7 cm), J20/2, (4) Sample 484A-5.CC (5–7 cm), X7/2. 5, 6. Collosphaera tuberosa Haeckel. Sample 483-5.CC (5–7 cm), slide a, Z24/4, (5) focus on upper surface, (6) focus on periphery. 7-10. Stylacontarium bispiculum Popofsky. Tests closely resembling Stylacontarium acquilonium (= Druppairactus acquilonius Hays) but having a spherical outer medullary shell rather than an elliptical shell protruding at the connecting bars, (7, 8) Sample 483-9.CC (10–11 cm), slide a, X12/1, focus on medullary shell and on surface of cortical shell, respectively, (9, 10) Sample 482A-1.CC, H26/0, focus on medullary shell and on surface of cortical shell, respectively. Note: Species shown in Plates 1-3 are either biostratigraphic marker species, are related to these, or have potential utility in Quaternary radiolarian biostratigraphy. (Slide numbers are followed by England Finder coordinates.)
Plate 2. Radiolarians of Quaternary age from Leg 65 samples. (Scale bar equals 100 µm.) 1-3. *Amphirhopalum virchowii* (Haeckel), (1) Sample 483-6, CC (16-18 cm), R18/0, (2) Sample 482B-3, CC (5-7 cm), Y26/0, (3) Sample 485A-3, CC (2-4 cm), O35/1. 4-6. *Amphirhopalum ypsilon* Haeckel. Low occurrence forms showing three chambers on the forked arm before bifurcation, (4) Sample 482B-2, CC (4-6 cm), R7/3 (60.73 m sub-bottom), (5) Sample 485A-3, CC (2-4 cm), G17/0 (73.22 m sub-bottom). (6) Sample 485A-3, CC (2-4 cm), N19/4 (73.22 m sub-bottom). 7. *Amphirhopalum ypsilon* Haeckel. High occurrence form showing five chambers on the forked arm before bifurcation, Sample 482A-1, CC, H26/0 (4.00 m sub-bottom).

See Note, Plate 1. (Slide numbers are followed by England Finder coordinates.)
Plate 3. Radiolarians of Quaternary age from Leg 65 samples. (Scale bars equal 100 µm for Figs. 1-6, 8 and 20 µm for Figs. 7, 9.)

1. Anthocytidium angulare Haeckel. Sample 483-9-1, 74-76 cm, slide a, D17/2.
2-3. Anthocytidium sp. cf. A. angulare Haeckel, (2) Sample 483-9-1, 74-76 cm, slide b, O44/0, (3) Sample 483-9-1, 74-76 cm, slide b, M34/0.
4-6. Lamprocyrtis neoheteroporos Kling, (4) Sample 483-8, CC (11-13 cm), D40/1, (5) Sample 485A-3, CC (2-4 cm), T5/0, (6) Sample 483-8, CC (11-13 cm), E36/0.
7-9. Theocorythium vetulum Nigrini, all of same specimen, Sample 483-8, CC (11-13 cm), E32/0. Figures 7 and 9 illustrate the paired cephalic lobes directly beneath the larger unpaired lobe, a characteristic of the genus Theocorythium.

See Note, Plate 1. (Slide numbers are followed by England Finder coordinates.)
Plate 4. Radiolarians from Holocene sediments in the Gulf of California. (Scale bars equal 100 µm.) 1. Cladococcus cervicornis Haeckel. VS-R-133b, 1-3 cm, V17/2. Benson, 1966, pl. 6, fig. 1. 2. Cladococcus stoliczkanis Haeckel. VS-R-136a, 1-3 cm, M6/3. Benson, 1966, pl. 6, fig. 2. 3. Collosphaera (?) sp. VS-R-60a, 3-5 cm, K12/1. Benson, 1966, pl. 2, fig. 1. 4. Cenosphaera (?) sp. aff. C. perforata Haeckel. VS-R-60a, 3-5 cm, S15/4. Benson, 1966, pl. 2, fig. 6. 5. Amphisphaera cristata Carnevale. VS-R-46a, 1-3 cm, M32/1. Benson, 1966, pl. 3, fig. 5. 6. Hexastylus triaxonia Haeckel. VS-R-71a, 1-3 cm, E32/3. Benson, 1966, pl. 3, fig. 6. 7. Hexacontium sp. cf. H. heracliti (Haeckel). VS-R-71a, 1-3 cm, J6/0. Benson, 1966, pl. 4, fig. 8. 8. Xiphatractus cronos (Haeckel). VS-R-56a, 1-3 cm, J55/1. Benson, 1966, pl. 7, fig. 12. Note: Plates 4 through 9 illustrate species from Holocene sediments in the Gulf of California that are part of the Quaternary-age assemblages from Leg 65 and that have not been illustrated previously by Benson (1964) or other contemporary radiolarian workers. The photographs are from Benson's (1966) plates. (Slide numbers are followed by England Finder coordinates. The numbers preceded by VS-R refer to sampling stations in the Gulf of California [this chapter, Fig. 2].)
Plate 5. Radiolarians from Holocene sediments in the Gulf of California. (Scale bars equal 100 µm.) 1-2. *Xiphatractus pluto* (Haeckel), (1) VS-R-27b, 1-3 cm, D15/0. Benson, 1966, pl. 7, fig. 17, (2) VS-R-27b, 1-3 cm, D15/0. Focus on surface of cortical shell. Benson, 1966, pl. 7, fig. 16. 3. *Spongatrochus* sp. cf. *S. glacialis* Popofsky. VS-R-81a, 1-3 cm, S41/2. Benson, 1966, pl. 11, fig. 4. 4-5. *Euchitonia* sp. cf. *E. triangulatum* (Ehrenberg), (4) VS-R-71a, 1-3 cm, J38/0. Benson, 1966, pl. 13, fig. 1, (5) VS-R-34a, 3-5 cm, S30/3. Benson, 1966, pl. 13, fig. 3. See Note, Plate 4.
Plate 6. Radiolarians from Holocene sediments in the Gulf of California. (Scale bar equals 100 μm.)

1. Dictyocoryne truncatum (Ehrenberg). VS-R-56a, 1-3 cm, Q20/0. Benson, 1966, pl. 15, fig. 1.

2. Dictyocoryne sp. VS-R-27b, 1-3 cm, Z52/4. Benson, 1966, pl. 12, fig. 4, 3-4.

3. Spirema sp., (3) VS-R-27b, 1-3 cm, K19/2. Benson, 1966, pl. 18, fig. 9, (4) VS-R-27b, 1-3 cm, R50/2. Benson, 1966, pl. 18, fig. 10.

4. Pylonium sp. VS-R-81a, 1-3 cm, X38/4. Benson, 1966, pl. 16, fig. 2.

5. Hexapyle dodecantha Haeckel group, (6) VS-R-184b, 1-3 cm, Y17/4. Benson, 1966, pl. 18, fig. 13, (7) VS-R-81a, 1-3 cm, Y51/2. Benson, 1966, pl. 18, fig. 15.

See Note, Plate 4.

See Note, Plate 4.

See Note, Plate 4.
Plate 9. Radiolarians from Holocene sediments in the Gulf of California. (Scale bars equal 100 µm.) 1. Lipmanella tribranchiata Dumitrică. VS-R-81a, 1-3 cm, G41/1. Doroso-right lateral view. Benson, 1966, pl. 28, fig. 11. 2. Lithomelissa thoracites Haeckel. VS-R-92b, 1-3 cm, E23/0. Ventro-right lateral view. Benson, 1966, pl. 24, fig. 11. 3. Lithomelissa laticeps Jorgensen. VS-R-93b, 1-3 cm, Z46/0. Right lateral view. Benson, 1966, pl. 24, fig. 14. 4. Eucuscryphalus (?) sp. VS-R-192b, 1-3 cm, U34/2. Left lateral view. Benson, 1966, pl. 30, fig. 6. 5. Acrobotissa cribosa Popofsky. VS-R-60a, 3-5 cm, O39/4. Right lateral view. Benson, 1966, pl. 23, fig. 15. 6-7. Acrobotrys sp. cf. A. disotelia Haeckel. (6) VS-R-81a, 1-3 cm, G29/0. Right lateral view. Benson, 1966, pl. 23, fig. 14, (7) VS-R-93b, 1-3 cm, D46/2. Left lateral view. Benson, 1966, pl. 23, fig. 13. 8. Clathromitra pierophormis Haeckel. VS-R-56a, 1-3 cm, E19/2. Left lateral view from below, focus on basal tripodium. Benson, 1966, pl. 26, fig. 4. Figure 9-11. Eucrytidium (?) heaxastichum (Haeckel) group, (9) VS-R-92a, 1-3 cm, D20/0. Benson, 1966, pl. 34, fig. 16, (10) VS-R-60b, 3-5 cm, N45/0. Benson, 1966, pl. 34, fig. 13, (11) VS-R-60b, 3-5 cm, F43/1. Benson, 1966, pl. 34, fig. 15. See Note, Plate 4.