34. DATA REPORT: CENOZOIC RADIOLARIANS FROM LEG 143, HOLE 869A, EQUATORIAL PACIFIC OCEAN

Jonathan C. Aitchison and Peter G. Flood

ABSTRACT

Cenozoic (lower Eocene to lower Miocene) radiolarians are abundant and exceptionally well-preserved in cores from Leg 143 Hole 869A. The Eocene/Oligocene boundary sequence appears conformable, whereas erosional hiatuses are present between the early Oligocene and early Miocene and between the middle and late Eocene. These hiatuses may represent periods of emergence.

INTRODUCTION

Hole 869A (Leg 143), located at 11°0.009'N, 164°44.696'W, is situated 45 nmi (83 km) southwest of the atoll-guyot pair of Pikini (formerly Bikini) Atoll and Wodedejebato (formerly Sylvania) Guyot in the equatorial Pacific Ocean. Hole 869A was an APC/XCB-cored hole that had 100% recovery in the APC-cored section. The hole was drilled in a water depth of 4826.7 m and penetrated 166.5 m of radiolarian ooze.

The area examined has long been known as one in which well-preserved radiolarian faunas are present. Riedel and Sanfilippo (1971) presented an extensive report on Cenozoic tropical radiolarians from the western Pacific Ocean in the Initial Reports volume of Deep Sea Drilling Project (DSDP) Leg 7. Abundant and exceptionally well-preserved radiolarians were recovered from cores throughout Hole 869A (Table 1). The primary purpose of this paper is to provide radiolarian age constraints on sediments recovered from this section.

METHODS

Samples were taken at least one per core, and most core-catcher samples were examined. More detailed examinations were conducted in the vicinity of particular sedimentological or radiolarian events. To obtain clean radiolarian concentrates for microscopic examination, sediments were disaggregated and sieved to remove the clay-silt fraction. A 5-cm³ sample was placed in a 400-cm³ beaker that contained 150 mL of a 10% solution of hydrogen peroxide and a small amount of Calgon (to aid in disaggregating the sediment). If calcareous components were evident, they were dissolved by adding hydrochloric acid. The residue was sieved through a 63-µm sieve, and the remaining siliceous microfossils were pipetted evenly onto labeled glass slides. The accompanying water then was evaporated under a heat lamp, after which the remaining residue was mounted using Norland Optical Adhesive and covered with a 22 × 50 mm cover slip. Two slides were prepared and examined for each sample. Qualitative assessments of the radiolarians in each slide were not recorded for abundance and preservation as, in all cases, radiolarians were abundant and well preserved. Radiolarians were profusely abundant in some samples, and complete faunal lists are not presented herein but are the topic of ongoing study to be presented later (Aitchison and Flood, unpubl. data).

BIOSTRATIGRAPHIC FRAMEWORK

The Cenozoic radiolarian zonation of Sanfilippo et al. (1985), derived for the tropical equatorial Pacific, was used at all sites. Sanfilippo et al. (1985) summarized the taxonomy and evolutionary lineages of all stratigraphically important radiolarian taxa commonly found in low-latitude regions of this zonation. When suggesting tentative “absolute” ages for radiolarian datum levels and zonal boundaries, the schemes of Nigrini (1985) and Barron et al. (1985), established on the basis of DSDP Leg 85 sites in the equatorial Pacific, were followed. Although much of the material obtained during Leg 85 could not be directly dated paleomagnetically, sufficient duplicate sites were available in which all major microfossil events could be identified, some of which had been correlated to the polarity time scale in nearby piston cores. Thus, the ages of Pacific radiolarian events, estimated by Foreman (1981), Nigrini (1985), and Barron et al. (1985), are considered to provide a satisfactory working model. Tentative correlation with calcareous nannofossil stratigraphy has been based on correlation charts of Haq et al. (1987).

LITHOSTRATIGRAPHY

Two lithostratigraphic units were identified in Hole 869A: (Unit I) cyclically bedded very pale brown to yellow-brown to dark reddish brown nannofossil ooze, radiolarian nannofossil ooze, and clayey nannofossil ooze; and (Unit II) cyclically bedded white to very pale brown to dark yellowish-brown clayey nannofossil ooze to nannofossil radiolarian ooze containing porcellanite and chert.

Unit I (0–88.20 mbsf, lower Miocene to upper Eocene)

The dominant sedimentary theme of Unit I is one of cycles, on various scales, which are characterized by regular changes in color and composition. The principal sedimentary components are nannofossils, radiolarians, sponge spicules, and clay; the colors vary from very pale brown to yellow-brown to dark reddish-brown, and the compositions range from nannofossils ooze through radiolarian nannofossil ooze to clayey nannofossil ooze. Thicknesses of different lithologies are on the scale of tens of centimeters, although some thinner bands do exist. Subunit IA is separated from Subunit IB by a stratigraphic hiatus. There is some reworking of Subunit IA into the basal bed of Subunit IA.

Unit II (88.2–166.5 mbsf, upper Eocene to middle Eocene)

As in Unit I, the dominant sedimentary theme of Unit II is one of cycles on various scales, characterized by regular changes in color and composition. In Core 143-869A-10X, the first porcellanite appears that is associated with clayey nannofossil ooze. Porcellanites and cherts appear intermittently at first, but increase in percentage

2 Department of Geology and Geophysics, University of Sydney, Sydney, New South Wales, 2006, Australia.
3 Department of Geology and Geophysics, University of New England, Armidale, New South Wales, 2351, Australia.
Table 1. Age-diagnostic radiolarians present in samples from Hole 869A.

<table>
<thead>
<tr>
<th>Epoch</th>
<th>Radiolarian zone</th>
<th>Core, section, interval (cm)</th>
<th>Dictyonema urceolata</th>
<th>Dicryphalus decorus</th>
<th>Dictyocrypha eucapitana</th>
<th>Dictyocrypha gracilis</th>
<th>Dictyocrypha obtusa</th>
<th>Dictyocrypha sp.</th>
<th>Dictyocrypha sp.</th>
<th>Dictyocrypha sp.</th>
<th>Dictychocystites farringtoni</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
<th>Dictyacystites hirsuta</th>
</tr>
</thead>
<tbody>
<tr>
<td>early Eocene</td>
<td>Podocyrtis ampla</td>
<td>13X-CC</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Oligocene</td>
<td>Theocytis tuberosa</td>
<td>9H-1, 90-92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>late Oligo-</td>
<td>T. bromia</td>
<td>9H-1, 100-102</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>middle Eoc-</td>
<td>P. ampla</td>
<td>13X-CC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>P. ampla</td>
<td>13X-CC</td>
<td>14X-1, 112-114</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Theocytis</td>
<td>triacantha</td>
<td>14X-2, 95-97</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Dictyopora</td>
<td>mongolfieri</td>
<td>15X-CC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

No hiatus was detected at the Oligocene/Eocene boundary, which lies between Samples 143-869A-9H-1, 100-102 cm, and -9H-CC, with the latter containing a latest Eocene assemblage that includes Thyrsocyrtis terracantha, Thyrsocyrtis triacantha, Podocyrtis charlata, Lichnocoma bradyca, Eusyringium fuscigerum, Calocycles lurris, and Lithocyrtis vesperilus. This assemblage was assigned to the Thyrsocyrtis bromia Zone of Sanfilippo et al. (1985). Reworking of middle Eocene radiolarians is evident in Samples 143-869A-10X-1, 55-56 cm, and -10X-1, 100-102 cm. These samples are latest Eocene in age, but contain elements of a middle Eocene fauna that includes Podocyrtis mitra and Podocyrtis trachodes, which are characteristic of the Podocyrtis mitra Zone of Sanfilippo et al. (1985), together with a latest Eocene fauna identical to that found in Sample 143-869A-9H-CC.

The remainder of the section is an apparently conformable middle Eocene succession. Sample 143-869A-13X-CC contains Podocyrtis ampla and Podocyrtis sinuosa and was assigned to the Podocyrtis ampla Zone of Sanfilippo et al. (1985). Samples 143-869A-14X-1, 112-114 cm, through -14X-CC contain Thyrsocyrtis triacantha, but not Podocyrtis ampla, suggesting that they belong to the Thyrsocyrtis triacantha Zone of Sanfilippo et al. (1985). Thyrsocyrtis triacantha is absent from Samples 143-869A-15X-1, 114-116 cm through 143-869A-15X-CC, but Dictyopora mongolfieri is present in great abundance together with Thyrsocyrtis hirsuta, indicating that these samples are from the middle Eocene Dictyopora mongolfieri Zone of Sanfilippo et al. (1985).

CONCLUSIONS

Exceptionally well-preserved, abundant middle Eocene to lower Miocene radiolarians in cores from Leg 143 Hole 869A permit refinement of shipboard age assignments on the basis of calcareous nanoplancton. Radiolarian data indicate that the Eocene/Oligocene boundary sequence appears conformable, whereas significant erosional hiatuses are present between the early Oligocene and early Miocene and between the middle and late Eocene.
SPECIES LIST

Detailed original descriptions of the biotaxonomically significant radiolarian species, identified in samples from Leg 143, have already been presented. Therefore, the following list simply provides a bibliographic reference for the species mentioned here. In most cases, only the reference containing the original description is presented, except where this description differs from present consensus or has been revised. These species are listed in alphabetical order.

Podocyrtis (Podocyrtoges) ampla Ehrenberg
Artophormis gracilis Riedel
Artophormis gracilis Riedel, 1959, p. 300, pl. 2, figs. 12, 13.
Calocyclus bandyeza (Mato and Theyer)
Lychnocanoma bandyeza Mato and Theyer, 1980, p. 225, pl. 1, figs. 1–6.
Calocyclus bandyeza (Mato and Theyer), Sanfilippo and Riedel in Saunders et al., 1985, p. 411, pl. 5, figs. 1–5.
Calocyclus turris Ehrenberg
Calocyclus turris Ehrenberg, 1973, p. 218; 1875, pl. 18, fig. 7.

Centrobryus thermophila
Centrobryus thermophila Petrushevskaya, 1965, p. 115, text-fig. 20.

Lychnocanoma elongata
Lychnocanoma elongata Riedel, 1959, p. 294, pl. 2, figs. 5–6.

Lychnocanium bipes
Lychnocanium bipes Riedel, 1959, p. 294, pl. 2, figs. 5–6.

Lithochytris vespertilio
Lithochytris vespertilio Ehrenberg, 1875, pi. 36, fig. B20; 1873, p. 240.

Podocyrtis (Podocyrtoges) ampla fasciolata
Podocyrtis (Podocyrtoges) ampla fasciolata (Ehrenberg) Sanfilippo and Riedel, 1970, p. 533, pl. 12, figs. 5, 7, 8.

Podocyrtis (Podocyrtoges) ampla Ehrenberg
Podocyrtis (Podocyrtoges) ampla (Ehrenberg) Sanfilippo and Riedel, 1992, p. 14, pl. 5, fig. 4.

Podocyrtis (Lampterium) chalara Riedel and Sanfilippo
Podocyrtis (Lampterium) chalara Riedel and Sanfilippo, 1970, p. 535, pl. 12, figs. 2, 3.

Podocyrtis (Lampterium) chalara Ehrenberg
Podocyrtis (Lampterium) chalara Riedel and Sanfilippo, 1978, p. 71, pl. 8, fig. 3, text fig. 3.

Podocyrtis (Podocyrtoges) diamesa Riedel and Sanfilippo
Podocyrtis (Podocyrtoges) diamesa Riedel and Sanfilippo, 1970, p. 533 (partim), pl. 12, figs. 4, non figs. 5, 6.

Podocyrtis (Podocyrtoges) diamesa Riedel and Sanfilippo, 1973, p. 531, pl. 20, figs. 9, 10, pl. 35, figs. 10, 11.


Podocyrtis (Lampterium) fasciolata (Nigrini)
Podocyrtis (Podocyrtoges) fasciolata Nigrini, 1974, p. 1069, pl. 1K, figs. 1–2, pl. 4, figs. 2, 3.

Podocyrtis (Lampterium) fasciolata (Nigrini) Sanfilippo et al., 1985, p. 697, fig. 30.7.

Podocyrtis (Lampterium) heleneae Nigrini
Podocyrtis (Lampterium) heleneae Nigrini, 1974, p. 1070, pl. 1L, figs. 9–11, pl. 4, figs. 4, 5.

Podocyrtis (Lampterium) mitra Ehrenberg
Podocyrtis (Lampterium) mitra Ehrenberg, 1854, pl. 36, fig. B20; 1873, p. 251; non Ehrenberg, 1875, pl. 15, fig. 4.

Podocyrtis (Lampterium) mitra (Ehrenberg) Riedel and Sanfilippo, 1970, p. 534; 1978, text-fig. 3.

Podocyrtis (Lampterium) sinuosa Ehrenberg
Podocyrtis (Lampterium) sinuosa Ehrenberg, 1873, p. 253; 1875, pl. 15, fig. 5; Riedel and Sanfilippo, 1970, p. 534, pl. 11, figs. 3, 4; 1978, text-fig. 3.

Podocyrtis (Lampterium) trichodes Riedel and Sanfilippo
Podocyrtis (Lampterium) trichodes Riedel and Sanfilippo, 1970, p. 535, pl. 11, fig. 7, pl. 12, fig. 1.

Sechthocyrtis tronciscus
Sechthocyrtis tronciscus Haeckel, 1887, p. 1239, pl. 57, fig. 13.
Spongatractus pachystylus (Ehrenberg)
Spongatractus pachystylus Ehrenberg, 1873, p. 256; 1875, pl. 26, fig. 3.
Spongatractus pachystylus (Ehrenberg) Sanfilippo and Riedel, 1973, p. 519, pl. 2, figs. 4–6, pl. 25, fig. 3.

Stichocorys delmontensis (Campbell and Clark)
Eucyrtidium delmontensis, Campbell and Clark, 1944, p. 56, pl. 7, figs. 19, 20.

Stichocorys delmontensis (Campbell and Clark) Sanfilippo and Riedel, 1970, p. 451, pl. 1, fig. 9.

Theocotyle venezuelensis Riedel and Sanfilippo
Theocotyle venezuelensis Riedel and Sanfilippo, 1970, 525, pl. 6, figs. 9, 10, 7, figs. 1, 2.

Theocotyle tuberosa Riedel emend. Sanfilippo et al.
Theocotyle tuberosa Riedel, 1959, p. 298, pl. 2, figs. 10, 11; Sanfilippo et al., 1985, p. 701, figs. 32, 1a–1d.

Thysocyrtis (Thysocyrtis) hisutus (Kraheinimnikov)
Thysocyrtis (Thysocyrtis) hisutus (Kraheinimnikov), 1960, p. 300, pl. 3, fig. 16.
Thysocyrtis (Thysocyrtis) hisutus (Kraheinimnikov) Sanfilippo and Riedel, 1982, p. 173, pl. 1, figs. 3, 4.

Thysocyrtis (Thysocyrtis) rhizodon Ehrenberg
Thysocyrtis (Thysocyrtis) rhizodon Ehrenberg, 1873, p. 262; 1875, p. 94, pl. 12, fig. 1; Sanfilippo and Riedel, 1982, p. 173, pl. 1, figs. 14–16, pl. 3, figs. 12–17.

Thysocyrtis (Thysocyrtis) robustus Riedel and Sanfilippo
Thysocyrtis hisutus robustus Riedel and Sanfilippo, 1970, p. 526, pl. 8, fig. 1.

Thysocyrtis (Thysocyrtis) robustus (Riedel) Sanfilippo and Riedel, 1982, p. 174, pl. 1, fig. 5.

Thysocyrtis (Pentacorys) tenax Foreman
Thysocyrtis tenax Foreman, 1973, p. 442, pl. 3, figs. 13–16, pl. 12, fig. 8.

Thysocyrtis (Pentacorys) tetracanthus (Ehrenberg)
Thysocyrtis tetracanthus (Ehrenberg), 1873, p. 254; 1875, pl. 13, fig. 2.
Thysocyrtis (Pentacorys) tetracanthus (Ehrenberg) Sanfilippo and Riedel, 1982, p. 176, pl. 1, figs. 8–10, pl. 3, figs. 3, 4. 573
**References**


---


---


---


---


---


---