

6. CENOZOIC RADIOLARIANS FROM DSDP SITE 98, NORTHWEST PROVIDENCE CHANNEL, BAHAMAS: CORRELATION WITH ODP SITE 634¹

Amanda A. Palmer²

INTRODUCTION

Site 634, drilled during ODP Leg 101, was essentially a reoccupation of Site 98, drilled during DSDP Leg 11 (Hollister, Ewing, et al., 1972; Table 1, Fig. 1). At Site 634, the upper 144 m of sediment was washed in an attempt to reach the Upper Cretaceous target horizon in the time remaining for the cruise (Austin, Schlager, et al., 1986). Figure 2 illustrates the spatial relationship of Site 98 (2750 m water depth) and Site 634 (2835 m water depth), 0.2 nmi to the northwest. Radiolarians were observed in Site 98 samples from 100 to 240 meters below seafloor (mbsf) during Leg 11, but no detailed biostratigraphic analyses were conducted. Thus, Site 98 presented us an opportunity to sample material correlating with the washed section at Site 634.

Samples were taken from Cores 101-634A-2R through 101-634A-4R to study radiolarians, but all proved barren, nor were radiolarians observed in shipboard smear slides. A correlation between Sites 98 and 634 (Fig. 2) suggests that these cores represent the same interval as that recovered in Cores 11-98-10 and 11-98-11, which were also barren.

These results are presented separately from other Leg 101 radiolarian studies (Palmer, this volume) because the Site 98 fauna was predominantly Eocene, while other radiolarian assemblages studied were Oligocene and Miocene.

METHODS OF INVESTIGATION

Samples (10 cm³) were selected from the same intervals in which siliceous microfossils were reported by Hollister, Ewing, et al. (1972). Conventional radiolarian preparation procedures were followed (Riedel and Sanfilippo, 1977), including disaggregation of the sample in hydrogen peroxide solution, treatment with hydrochloric acid to remove calcium carbonate, and sieving through a 63- μ m mesh screen.

Strewn slides of the residue were made for each sample and were scanned at 250 \times for diagnostic taxa. Zones were identified using the standard low-latitude radiolarian zonation of Riedel and Sanfilippo (1978). Biostratigraphically important species are listed in the Appendix (Taxonomic List).

RESULTS

Fourteen of the samples obtained from Site 98 contain radiolarians (Table 1). The first appearance of *Stichocorys delmontensis* (in Sample 11-98-5-1, 116–118 cm) and the last appearance of *Thyrsoyrtis annosa* (in Sample 11-98-5-2, 118–120 cm) suggest that the boundary between the *Cyrtocapsella tetrapera* and *Stichocorys delmontensis* zones (early Miocene age) may occur between the samples (Table 1). Unfortunately, no other biostratigraphically important species are present.

Core 11-98-6 contains species that indicate the *Calocyclas bandyca* and *Carpocanistrum azyx* zones (late Eocene age). Core 11-98-7 contains fragments of tan chert, but no radiolarians. Cores 11-98-8 through 11-98-9 contain radiolarians from the

Bekoma bidartensis Zone (early Eocene to late Paleocene age; Table 1).

SUMMARY

Recovery from the Cenozoic section in the Northwest Providence Channel, Bahamas, was poor because of spot coring and washing. Nevertheless, radiolarians were found in 14 samples from Site 98; two samples were Miocene in age, and the remaining 12 were Eocene (or latest Paleocene, in some cases). This suggests a long record of Paleogene and lower Neogene biosiliceous sedimentation at the location of Sites 98 and 634; such a record was noted in numerous studies of the Caribbean region. Continuous coring of the Northwest Providence Channel section would allow further study of this depositional episode.

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² Ocean Drilling Program, Texas A&M University, College Station, TX 77843.

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- APPENDIX**
Taxonomic List
- Bekoma bidartensis* Riedel and Sanfilippo
Bekoma bidartensis Riedel and Sanfilippo, 1971, p. 1592, Pl. 7, Figs. 1-7.
Bekoma bidartensis Riedel and Sanfilippo, 1978, p. 65, Pl. 3, Fig. 3.
- Buryella tetradica* Foreman
Buryella tetradica Foreman, 1973, p. 433, Pl. 8, Figs. 4 and 5; Pl. 9, Figs. 13 and 14.
- Calocyclus hispida* (Ehrenberg)
Anthrocyrtis hispida Ehrenberg, 1873, p. 216; 1875, Pl. 8, Fig. 2.
Calocyclus hispida (Ehrenberg) Foreman, 1973, p. 434, Pl. 1, Figs. 12-15; Pl. 9, Fig. 18.
- Calocyclus turris* Ehrenberg
Calocyclus turris Ehrenberg, 1873, p. 218; 1875, Pl. 18, Fig. 7. Riedel and Sanfilippo, 1978, p. 65, Pl. 3, Figs. 7 and 8.
- Calocycloma castum* (Haeckel)
Calocyclus casta Haeckel, 1887, p. 1384, Pl. 73, Fig. 10.
Calocycloma castum (Haeckel) Foreman, 1973, p. 434, Pl. 1, Figs. 7, 9, and 10.
- Ceratospyrus articulata* Ehrenberg
Ceratospyrus articulata Ehrenberg, 1873, p. 218. Sanfilippo and Riedel, 1973, p. 526, Pl. 15, Figs. 1-3; Pl. 31, Figs. 8 and 9.
- Cyrtocapsella cornuta* (Haeckel)
Cyrtocapsa (*Cyrtocapsella*) *cornuta* Haeckel, 1887, p. 1513, Pl. 78, Fig. 9.
Cyrtocapsella cornuta (Haeckel) Sanfilippo and Riedel, 1970, p. 453, Pl. 1, Figs. 19 and 20.
- Dictyoprora mongolfieri* (Ehrenberg)
Eucyrtidium mongolfieri Ehrenberg, 1854, Pl. 36, Fig. 18, B lower; 1873, p. 230.
- Dictyoprora mongolfieri* (Ehrenberg), Nigrini 1977, p. 250, Pl. 4, Fig. 7.
- Dictyoprora urceolus* (Haeckel)
Dictyocephalus urceolus Haeckel, 1887, p. 1305.
Dictyoprora urceolus (Haeckel), Nigrini, 1977, p. 251, Pl. 4, Figs. 9 and 10.
- Dorcadospyrus simplex* (Riedel)
Brachiospyrus simplex Riedel, 1959, p. 293, Pl. 1, Fig. 10.
Dorcadospyrus simplex (Riedel), Riedel and Sanfilippo, 1970, Pl. 15, Fig. 6. Moore, 1971, p. 740, Pl. 10, Figs. 3 and 4.
- Eusyringium fistuligerum* (Ehrenberg)
Eusyringium fistuligerum Ehrenberg, 1873, p. 229; 1875, Pl. 9, Fig. 3.
Eusyringium fistuligerum (Ehrenberg), Riedel and Sanfilippo, 1970, p. 527, Pl. 8, Figs. 8 and 9.
- Lamptonium fabaeforme chaunothorax* Riedel and Sanfilippo
Lamptonium (?) *fabaeforme* (?) *chaunothorax* Riedel and Sanfilippo 1970, p. 524, Pl. 5, Figs. 8 and 9.
- Lamptonium fabaeforme fabaeforme* (Krashenninnikov)
Cyrtocalpis fabaeformis Krashenninnikov, 1960, p. 296, Pl. 3, Fig. 11.
Lamptonium fabaeforme fabaeforme (Krashenninnikov), Foreman, 1973, p. 436, Pl. 6, Figs. 6-9.
- Lamptonium sanfilippooae* Foreman
Lamptonium sanfilippooae Foreman, 1973, p. 436, Pl. 6, Figs. 15 and 16; Pl. 11, Figs. 16 and 17.
- Lychnocanoma amphitrite* Foreman
Lychnocanoma amphitrite Foreman, 1973, p. 437, Pl. 11, Fig. 10.
- Phormocyrtis striata exquisita* (Kozlova)
Podocyrtis exquisita Kozlova in Kozlova and Gorbovets, 1966, p. 106, Pl. 17, Fig. 2.
Phormocyrtis striata exquisita (Kozlova), Foreman, 1973, p. 438, Pl. 7, Figs. 1-4, 7 and 8; Pl. 12, Fig. 5.
- Phormocyrtis striata striata* Brandt
Phormocyrtis striata Brandt, 1935, p. 55, Pl. 9, Fig. 12.
Phormocyrtis striata striata Brandt, Foreman, 1973, p. 438, Pl. 7, Figs. 5, 6, and 9.
- Podocyrtis* (*Lampterium*) *chalara* Riedel and Sanfilippo
Podocyrtis (*Lampterium*) *chalara* Riedel and Sanfilippo, 1970, p. 535, Pl. 12, Figs. 2 and 3.
- Stichocorys delmontense* (Campbell and Clark)
Eucyrtidium delmontense Campbell and Clark, 1944, p. 56, Pl. 7, Figs. 19 and 20.
Stichocorys delmontense (Campbell and Clark), Sanfilippo and Riedel 1970, p. 451, Pl. 1, Fig. 9.
- Theocotyle cryptocephala* (Ehrenberg)
Eucyrtidium cryptocephalum Ehrenberg 1873, p. 227; 1875, Pl. 11, Fig. 11.
Theocotyle cryptocephala (Ehrenberg), Sanfilippo and Riedel, 1982, p. 178, Pl. 2, Figs. 4-7.
- Theocotyle nigrinae* (Riedel and Sanfilippo)
Theocorys sp. Nigrini in Cita et al., 1970, Pl. 2, Fig. L.
Theocotyle cryptocephala (?) *nigrinae* Riedel and Sanfilippo, 1970, p. 525, Pl. 6, Figs. 5 and 6.
Theocotyle nigrinae (Riedel and Sanfilippo), Sanfilippo and Riedel, 1982, p. 178, Pl. 2, Figs. 1-3.
- Theocyrtis annosa* (Riedel)
Phormocyrtis annosa Riedel, 1959, p. 295, Pl. 2, Fig. 7.
Thyrsoyrtis annosa (Riedel) Riedel and Sanfilippo, 1970, p. 535, Pl. 15, Fig. 9.
- Theocotylissa alpha* Foreman
Theocotyle (*Theocotylissa*) *alpha* Foreman, 1973, p. 441, Pl. 4, Figs. 13 and 15; Pl. 12, Fig. 16.
Theocotylissa alpha Foreman, Sanfilippo and Riedel, 1982, p. 179-180, Pl. 2, Figs. 16 and 17.
- Thyrsoyrtis* (*Thyrsoyrtis*) *bromia* Ehrenberg
Thyrsoyrtis bromia Ehrenberg, 1873, p. 260; 1875, Pl. 12, Fig. 2.
Thyrsoyrtis (*Thyrsoyrtis*) *bromia* Ehrenberg, Sanfilippo and Riedel, 1982, p. 172-173, Pl. 1, Figs. 17-20.
- Thyrsoyrtis* (*Thyrsoyrtis*) *hirsuta* (Krashenninnikov)
Podocyrtis hirsutus Krashenninnikov, 1960, p. 300, Pl. 3, Fig. 16.
Thyrsoyrtis (*Thyrsoyrtis*) *hirsuta* (Krashenninnikov), Sanfilippo and Riedel, 1982, p. 173, Pl. 1, Figs. 3 and 4.
- Thyrsoyrtis* (*Thyrsoyrtis*) *rhizodon* Ehrenberg
Thyrsoyrtis rhizodon Ehrenberg, 1873, p. 262; 1875, Pl. 12, Fig. 1.
Thyrsoyrtis (*Thyrsoyrtis*) *rhizodon* Ehrenberg, Sanfilippo and Riedel, 1982, pp. 173-174, Pl. 1, Figs. 14-16; Pl. 3, Figs. 12-17.
- Thyrsoyrtis* (*Pentalacorys*) *tetracantha* (Ehrenberg)
Podocyrtis tetracantha Ehrenberg, 1873, p. 254; 1875, Pl. 13, Fig. 2.
Thyrsoyrtis (*Pentalacorys*) *tetracantha* (Ehrenberg), Sanfilippo and Riedel, 1982, p. 176, Pl. 1, Figs. 11 and 12; Pl. 3, Fig. 10.
- Tristylospyrus tricerus* (Ehrenberg)
Ceratospyrus tricerus Ehrenberg, 1873, p. 220; 1875, Pl. 21, Fig. 5.
Tristylospyrus tricerus (Ehrenberg), Haeckel, 1887, p. 1033.

Table 1. Occurrences of radiolarians at Site 98 (25°22.95' N, 77°18.68' W, 2750 m water depth).

Sample (cm)	<i>Phormocyrtis striata exquisita</i>	<i>Thyrsocyrtis (Thyrsocyrtis) hirsuta</i>	<i>Theocotylissa alpha</i>	<i>Ceratospyrus articulata</i>	<i>Lamptonium fabaeforme chaunothorax</i>	<i>Bekoma bidartensis</i>	<i>Buryella tetradica</i>	<i>Calocyclus castum</i>	<i>Theocotyle nigrinae</i>	<i>Lamptonium fabaeforme fabaeforme</i>	<i>Phormocyrtis striata striata</i>	<i>Lamptonium sanfilippoae</i>	<i>Dictyoprora urceolus</i>	<i>Theocotyle cryptocephala</i>	<i>Dictyoprora mongolfieri</i>	<i>Thyrsocyrtis (Thyrsocyrtis) bromia</i>	<i>Lychnocanoma amphitrite</i>	<i>Podocyrtis chalara</i>	<i>Calocyclus hispida</i>	<i>Thyrsocyrtis (Thyrsocyrtis) rhizodon</i>	<i>Eusyringium fistuligerum</i>	<i>Calocyclus turris</i>	<i>Thyrsocyrtis (Pentalacorys) tetracantha</i>	<i>Dorcadospyrus simplex</i>	<i>Trisyllospyrus triceros</i>	<i>Theocytis annosa</i>	<i>Cyrtocapsella cornuta</i>	<i>Stichocorys delmontensis</i>	Zone		
98-5-1, 116-118	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	upper <i>C. tetrapera</i> Zone
98-5-2, 118-120	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	to lower <i>S. delmontensis</i> Zone	
98-6-1, 116-118	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	F	F	---	---	---	R	r	---	---	---	---	---	---	---	<i>Carpocanistrum azyx</i> to <i>Calocyclus bandyca</i> Zone	
98-6-2, 116-118	---	---	---	---	---	---	---	---	---	---	---	---	F	---	R	R	---	---	---	---	---	F	R	---	---	---	---	---	---		
98-6-4, 113-115	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	F	R	r	---	---	R	F	R	---	---	---	---	---	---		
98-6-5, 116-118	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	F	R	F	---	---	---	F	---	---	---	---	---	---	---		
98-6-6, 116-118	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	R	F	R	R	---	---	r	---	---	---	---	---	---	---	---	
98-8-1, 116-118	R	R	r	F	---	R	F	r	---	---	R	R	---	r	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<i>Bekoma bidartensis</i> Zone	
98-8-2, 114-116	F	R	R	---	---	R	R	R	F	---	F	R	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		---
98-8-3, 116-118	R	R	F	---	---	---	F	R	R	F	---	R	R	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		---
98-8, CC	---	r	F	---	---	r	R	F	---	F	---	r	R	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		---
98-9-1, 120-122	F	R	F	---	---	---	r	R	---	F	---	R	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		---
98-9-2, 97-99	F	r	F	---	---	R	---	---	r	R	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		---
98-9, CC	F	r	F	r	R	R	r	r	r	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		---

Note: Relative abundance of individual species: C = common (>100 specimens/slide), F = frequent (11-100/slide), R = rare (3-10/slide), r = very rare (1-2/slide).

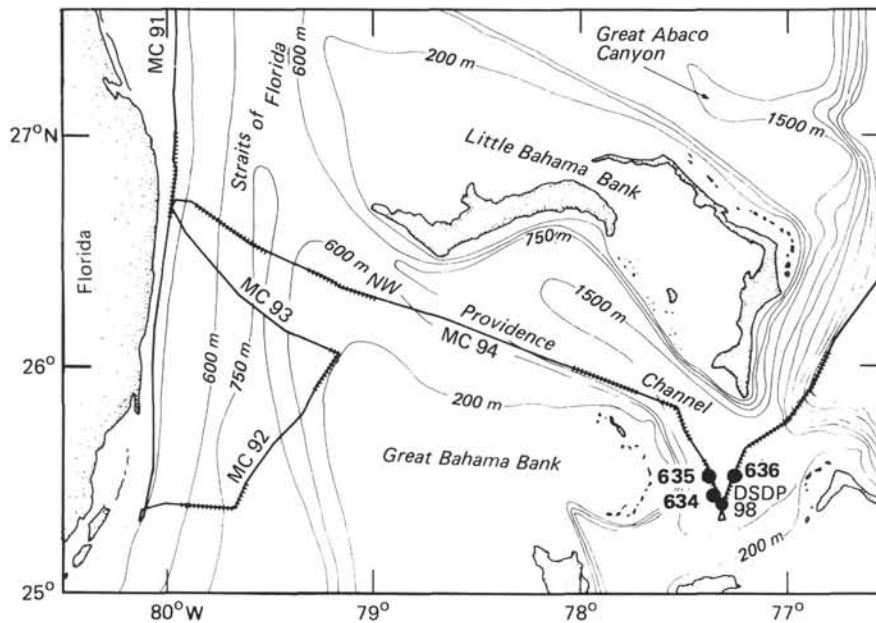


Figure 1. Map showing location of Sites 98 and 634.

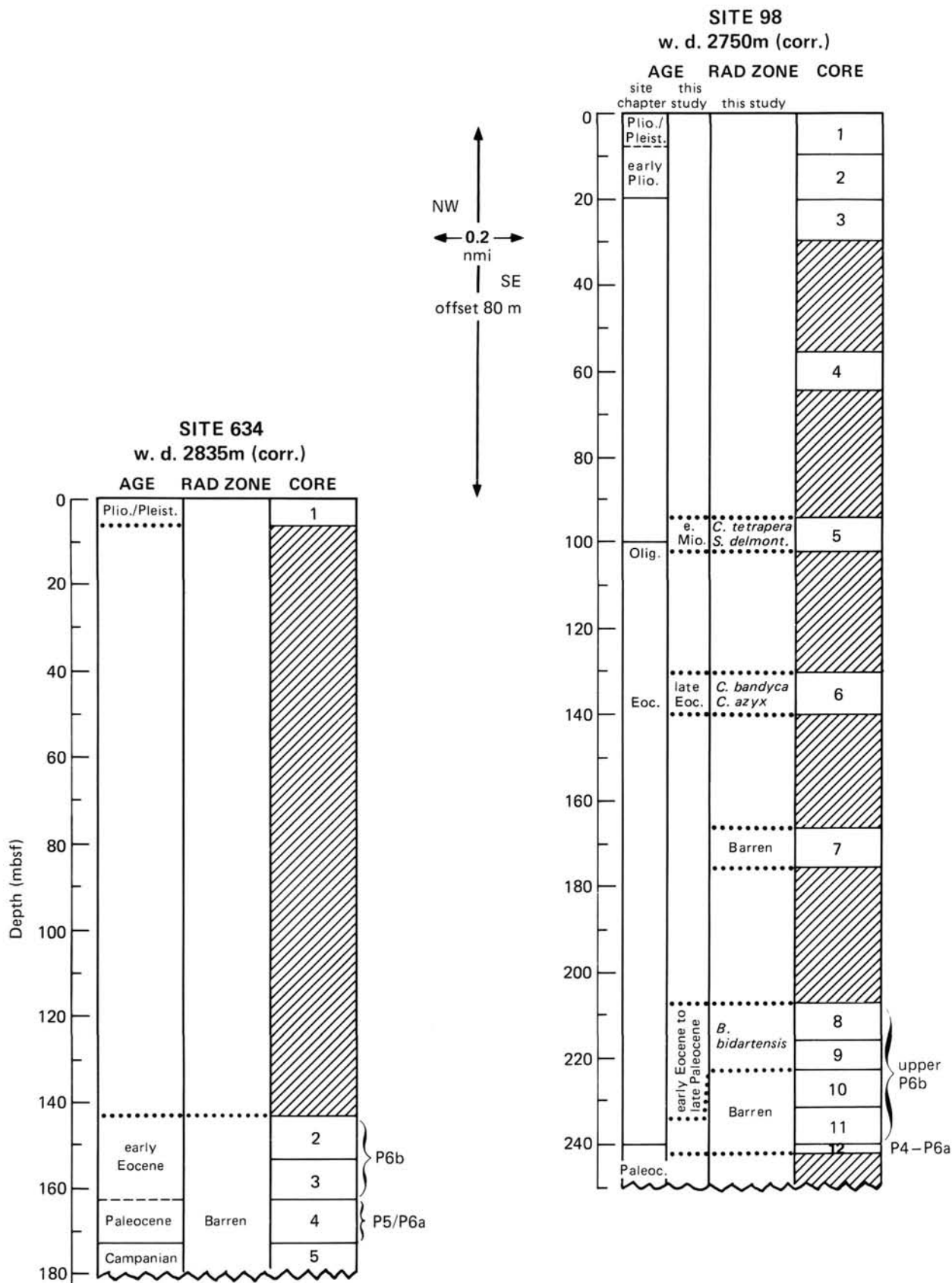


Figure 2. Correlation of Site 634 with Site 98, based on actual relative position with respect to sea level; the sites are offset 0.2 nmi horizontally and 85 m vertically. Occurrence of radiolarian zones is based on this study; foraminifer ages indicated for the lower part of each section are from Hollister, Ewing, et al. (1972) (Site 98) and Austin, Schlager, et al. (1986) (Site 634). w.d. = water depth.