

## 12. CALCAREOUS NANNOPLANKTON RANGES, DEEP SEA DRILLING PROJECT

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Following are distribution charts of selected taxa of calcareous nannoplankton for the Leg 11 Sites (Figure 1). On each chart is shown, where possible, the correlative planktonic foraminiferal zones of Blow (1969). No zonal names for the Mesozoic interval are included; except Site 105, only the designation of early Cretaceous or late Jurassic is shown. The use of stage names in that interval is included in a separate chapter on early Cretaceous-late Jurassic nannoplankton (Wilcoxon, this volume).

The chart symbols represent only occurrence of the included taxa and do not indicate abundance. The indicated ranges are only for the particular sites and may or may not reflect the total range of any particular species. All age determinations are based on light microscope examination.

A distribution chart for Site 107 is omitted as both cores taken at that site contain highly mixed nannoplankton assemblages and an accurate age determination is not possible.

Zonations by Bramlette and Wilcoxon (1967), Gartner (1969, and in press), Martini and Worsley (1970), and Milow (in press) have been incorporated into the age assignments indicated on the various site charts.

### REFERENCES

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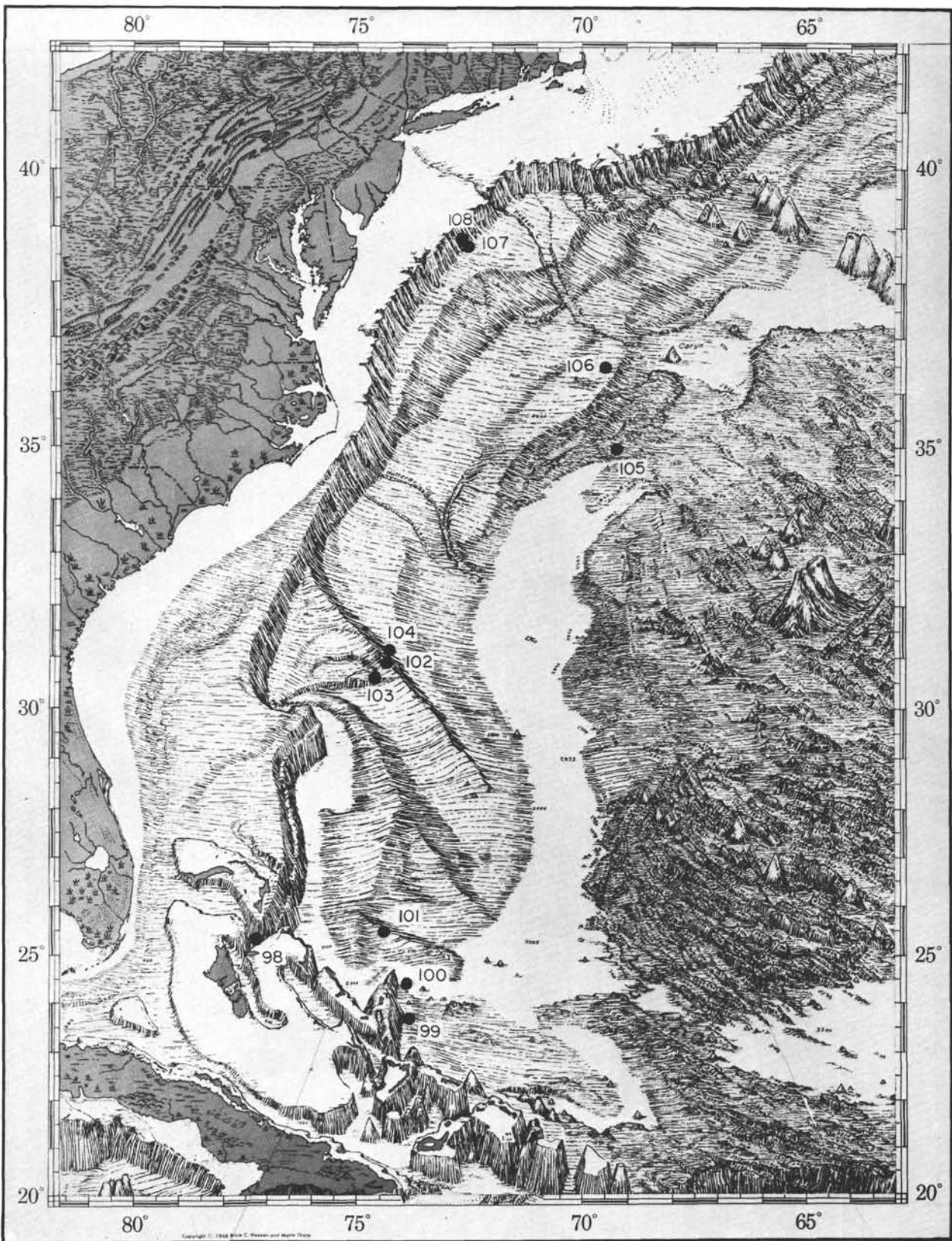


Figure 1. Site locations, Leg 11



SITE  
98



SITE  
99A

AGE	QUATERNARY			PLIOCENE	EARLY CRETACEOUS	LATE JURASSIC
	NANNOPLANKTON ZONES	EMILIANIA HUXLEYI	PSEUDOEMILIANIA LACUNOSA			
PLANKTONIC FORAM ZONES	N23	N22	N20			
<i>Emiliania huxleyi</i>	●					
<i>Cyclococcolithina leptopora</i>	●	● ●				
<i>Unbicospaera mirabilis</i>	●	●				
<i>Syracosphera pulchra</i>	●	● ●				
<i>Helicopontosphaera kampfneri</i>	●	● ●	● ●			
<i>Coccolithus pelagicus</i>	●	● ●	● ●			
<i>Rhabdosphaera stylifera</i>	●	● ●	●			
<i>Scapholithus fossilis</i>	●					
<i>Cyclolithella annula</i>	●	●				
<i>Gephyrocapsa oceanica</i>	●	● ●				
<i>Pseudoemiliana lacunosa</i>		● ●	●			
<i>Ceratolithus cristatus</i>		● ●				
<i>Discoster brouweri</i>		● ●	● ●			
<i>D. surculus</i>						
<i>D. asymmetricus</i>						
<i>D. pentradiatus</i>						
<i>Cyclococcolithina macintyreai</i>						
<i>Ceratolithus rugosus</i>						
<i>Reticulofenestra pseudounibilia</i>						
<i>Sphenolithus abies</i>						
<i>Microrhabdulus decoratus</i>				●		
<i>Eiffellithus eximus</i>				●		
<i>Watznaueria barnesi</i>				● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
<i>Micrantholithus obtusus</i>				●		
<i>Apertapetra gronosa</i>				●		
<i>Parhabdolithus embergeri</i>				● ● ● ●	● ● ● ●	● ● ● ●
<i>Braarudosphaera discula</i>				● ●		
<i>Lithastrinus septentrionalis</i>				●		
<i>Nannoconus steinmanni</i>				● ● ● ●	● ● ● ●	● ● ● ●
<i>N. bucheri</i>				● ●		
<i>N. colomi</i>				●		
<i>N. globus</i>				●		
<i>N. dolomiticus</i>				● ●		
<i>Ahmuellerella asper</i>				● ●		
<i>Stephanolithion laffitei</i>				● ●		
<i>Coccolithus cuvillieri</i>				● ●		
<i>C. deflandrei</i>				● ●		
<i>Lithraphidites carniolensis</i>				● ●		
<i>Diazomatolithus lehmani</i>				● ●		
<i>Cyclagelosphaera margereli</i>				● ●		
<i>Watznaueria britannica</i>				● ●		
<i>Parhabdolithus iasicus</i>				● ●		
<i>Rucinolithus hayii</i>				● ●		
<i>Zygodiscus salilum</i>				● ●		
<i>Z. busoni</i>				● ●		
<i>Z. erectus</i>				● ●		
<i>Stephanolithion bigoti</i>				● ●		

SITE  
100

SITE 101-101A		CORES DEPTH IN CM.				
			101	1-1; 14-15	2-1; 102-103	1-4; 88-89
				2-cc	2-4; 16-17	1-cc
					101A	
					1-3; 88-89	1-cc
					2-1; 88-89	2-cc
					3-2; 32-33	3-cc
					4-1; 117-118	4-cc
					5-1; 38-39	5-cc
					9-1; 27-30	9-cc
					10-1; 84-86	10-cc
AGE		PLIOCENE	LATE MIocene	LATE MIocene	EARLY CRETACEOUS	
NANOPLANKTON ZONES		RETICULOFENESTRA PSEUDOUNIBILICA	DISCOASTER QUINQUERAMUS	DISCOASTER VARIABILIS	DISCOASTER EXILIS SUB ZONE	
PLANKTONIC FORAM ZONES		N19/20	N.18	N.16	N.13/14	
Reticulofenestra pseudounibilica		● ● ●	● ● ●	● ● ●	● ●	
Ceratolithus rugosus		● ● ●	● ●			
Cyclococcolithina macintyreui		● ● ●				
Coccilithus pelagicus		● ● ●	● ●		● ●	
Helicopontosphaera kamptneri		● ● ●	● ● ●	●		
Discoaster brouweri		● ● ●	● ● ●	●	● ●	
D. surculus		● ● ●	● ●			
D. pentaradiatus		● ● ●	● ● ●		● ●	
D. asymmetricus		● ● ●				
D. perplexus		● ● ●				
D. variabilis		● ● ●	● ● ●	● ●	● ●	
Pseudodelmilia lacunosa		● ● ●				
Helicopontosphaera sellii		● ●				
Ceratolithus cristatus		● ●				
Scyphosphaera pulcherrima		● ●				
Rhabdosphaera stylifera		● ●				
Sphenolithus abies		● ●	● ● ●	● ● ●	●	
Ceratolithus tricorniculatus		● ● ●	● ● ●	● ●		
Discoaster quinqueramus		● ● ●	● ● ●	● ●	● ●	
D. exilis		● ● ●	● ● ●	● ●		
D. kugleri		● ● ●	● ●	● ●		
D. calcaris		● ● ●	● ●	●		
D. challengerii		● ●	● ●			
D. trinidadensis						
Parhabdolithus embergeri						
Zygolithus ponticus						
Watnaueria barnesae						
W. actinosa						
Deflandrius intercisor						
Arkhangelskiella striata						
A. erratica						
Apertapetra gronosi						
Zygodiscus erectus						
Eiffelithus turriselliferi						
Glaukolithus diplogrammus						
Ahmuellerella asper						
Parhabdolithus angustus						
Craterhabdus splendens						
C. crenulatus						
Stephanolithion crenulatum						
Nannoconus colomi						
N. steinmanni						
N. globulus						
N. dolomiticus						
Coccilithus deflandrei						
Stephanolithion cf. S. latifitei						
Braarudosphaera discus						
Ahmuellerella splendens						
Micrantholithus obtusus						
Parhabdolithus llaasicus						
Lithraphidites carnoiolensis						
Podorhabdus grassei						
Cyclagelosphaera margareti						
Coccilithus cuvillieri						
Diazomatolithus lehmanni						

SITE  
102

SITE 103		CORES DEPTH IN CM.	1-2; 70-71 1-cc	2-2; 19-20 2-cc	3-2; 20-21 3-cc	4-2; 20-21 4-cc	5-1; 130-131 5-cc	6-1; 97-98 6-cc
AGE		PLIOCENE	LATE MIOCENE				MID MIOCENE	
NANNOPLANKTON ZONES		CERATOLITHUS RUGOSUS	CERATOLITHUS TRICORNICULATUS			DISCOASTER QUINQUERAMUS	DISCOASTER VARIABILIS	
SPECIES	PLANKTONIC FORAM ZONES	N.19	N.17			N.15/16	N.11/14	
Reticulofenestra pseudoumbilica		● ●	● ● ● ● ● ●			● ●	● ●	
Sphenolithus abies		● ●	● ● ● ● ● ●			● ●		
Ceratolithus rugosus		● ●						
C. tricorniculatus		● ●	● ● ● ●					
Helicopontosphaera kampfneri		● ●	● ● ● ● ● ●			● ●	● ●	
Cyclococcolithina macintyreai		● ●	● ● ● ●					
Coccolithus pelagicus		● ●	● ● ● ●			● ●	● ●	
Discoaster brouweri		● ●	● ● ● ●			● ●		
D. pentaradiatus		● ●	● ● ● ●			● ●		
D. variabilis		● ●	● ● ● ●					
D. surculus		● ●	● ●			● ●		
D. asymmetricus		● ●						
D. quinqueramus			● ● ● ●					
D. exilis			● ● ● ●			● ●		
D. challengerii			● ● ● ●			● ●		
D. kugleri			● ●			● ●		
Helicopontosphaera intermedia						● ●		
Discoaster hamatus						● ●		
D. bollii						● ●		
Catinaster cf. C. coalitus						● ●		
Scyphosphaera amphora						● ●		

SITE  
104

SITE 105		CORES DEPTH IN CM.													
AGE	QUAT.	PLIOCENE			EARLY CRETACEOUS										
NANOPLANKTON ZONES		GEOPHYROCAPSA OCEANICA		DISCOASTER ASYMMETRICUS											
PLANKTONIC FORAM SPECIES	ZONES	N22/23	NI9/20	NI9	LATE ALBIAN		APTIAN		BARREMIAN		HAUTERIVIAN		HAUTERIVIAN-VALANGINIAN		
Gephyrocapsa oceanica		●		● ●											
Ceratolithus cristatus		●													
Thracosphaera imperforata		●		● ●											
Helicopontiosphaera kampferi		●		● ● ●											
Coccolithus pelagicus		●		● ● ●											
Umbilicosphaera mirabilis		●		●											
Cyclococcolithina leptopora															
Scapholithus fossilis															
Rhabdosphaera stylifera															
Syracosphera pulchra		●													
Reticulofenestra pseudoumbilica															
Discaster brouwersi															
D. pentaradiatus															
D. variabilis															
D. asymmetricus															
D. challengerii															
D. surculus															
Ceratolithus tricorniculatus															
C. rugosus															
Scyphosphphaera apsteinii															
Cyclococcolithina macintyreana		●	●	●	●	●									
Sphenolithus abies		●	●	●	●	●									
Apertapetra gronosa															
Lithraphidites carnolensis															
Eiffelithus turrentifeli															
Cretababdus decorus															
C. splendens															
Parhabdolithus embergeri															
P. angustus															
Prediscosphphaera columnatus															
Glaukolithus diplogrammus															
Deltandrus intericus															
Stephanolithion crenulatum															
Arkhangelskiella striata															
Ahmuelleria aspera															
Cretababdus crenulatus															
Watnaueria barnesae															
W. actinosa															
Zygodiscus erectus															
Stephanolithion laffittei															
Nannoconus kamptneri															
Brauridiosphaera discula															
Cycloeglosphaera margaretae															
Diazomolithus lehmanni															
Watnaueria britannica															
Parhabdolithus elongatus															
Nannoconus dolomiticus															
Crepidolithus crassus															
Stephanolithion sp.															
Cruciplacolithus cuvilli															
Nannoconus steinmanni															
Corallolithion sp.															
Zygodiscus silium															
Parhabdolithus mariae															
Loxolithus armilla															
Stephanolithion bigoti															
Hexapodohabdus curvilliferi															
Stauroolithites quadriarcultus															
Calloolithus martae															

LATE JURASSIC

TITHONIAN

OXFORDIAN ?

	23-2;	134-135
23-cc		
24-1;	70-71	
24-cc		
25-3;	43-44	
25-cc		
26-2;	130-131	
26-cc		
27-3;	85-86	
27-cc		
28-2;	100-101	
28-cc		
29-3;	5-6	
29-cc		
30-2;	79-80	
30-cc		
31-2;	91-92	
31-cc		
32-2;	115-116	
32-cc		
33-4;	23-24	
33-cc		
34-2;	17-18	
34-cc		
35-3;	92-93	
35-cc		
36-2;	111-112	
36-cc		
37-4;	78-79	
37-cc		
38-2;	99-100	
38-cc		
39-2;	46-47	
39-cc		
40-5;		
40-100		
BASALT		

SITE 106/106B		CORES DEPTH IN CM.	106	1-2; 70-71 1-cc	2-1; 134-135 2-cc	3-2; 139-140 3-cc	4-cc	5-2; 56-57 5-cc	6-1; 40-41 6-cc	106 B	1-2; 94-95 1-cc	2-3; 83-84 2-cc	3-1; 98-99 3-cc	4-2; 100-101 4-cc	5-2; 80-81 5-cc	6-1; 81-82 6-cc	7-cc	8-cc
AGE	QUATERNARY																	
NANOPLANKTON ZONES	GEPHY. OCEANICA	PSEUDOEMILIANA LACUNOSA	DISCOASTER BROUWERI	RETICULO. PSEUDOUNIBILICA	DISCOASTER QUINQUERAMUS	SPHENOLITHUS HETEROMORPHUS ?	?											
PLANKTONIC FORAM ZONES	N.22/23	N.22	N.21	N.19	N.17	N.9/10												
Gephyrocapsa oceanica	● ●	● ● ● ● ● ● ●																
Emiliania huxleyi	●																	
Coccolithus pelagicus	● ●	● ● ● ● ● ● ●	● ●	● ●	● ●	● ● ● ●	●											
Cyclococcolithina leptopora	● ●	● ● ● ● ● ● ●	● ●															
Rhabdosphaera stylifera	● ●	● ● ● ● ● ● ●	● ●															
Syracosphaera pulchra	● ●	● ● ● ● ● ● ●																
Umbilicosphaera mirabilis	● ●	● ● ● ● ● ● ●	● ●															
Helicopontosphaera kampfneri	● ●	● ● ● ● ● ● ●	● ●	● ●	● ●	● ● ● ●												
Scapholithus fossilis	● ●	●																
Discolithina japonica	● ●	● ● ● ● ● ● ●																
Ceratolithus cristatus	● ●	● ● ● ● ● ● ●	●															
Cyclolithella annula	●																	
Thoracosphaera imperforata	● ●	● ● ● ● ● ● ●																
Pseudoemiliania lacunosa		● ● ● ● ● ● ●	● ●															
Discoaster brouweri			● ●															
D. pentaradiatus			● ●															
Cyclococcolithina macintyreai			● ●															
Helicopontosphaera sellii			● ●															
Ceratolithus rugosus			● ●															
Scyphosphaera apsteinii			● ●															
Discoaster surculus			● ●															
D. variabilis			●															
D. asymmetricus			●															
Sphenolithus abies			●															
Reticulofenestra pseudounibilica			●															
Discoaster quinqueramus			●															
D. exilis			●															
Ceratolithus tricorniculatus			●															
Sphenolithus heteromorphus			●															
Cyclococcolithina nengammation			●															
Discoaster bollii			●															
D. kugleri			●															
Catinaster coalitus			●															
Coccolithus eopelagicus			●															

SITE  
108CORES  
DEPTH IN CM.

1-2; 82-83

1-cc

2-1; 106-107

2-cc

AGE	MIDDLE EOCENE		
NANNOPLANKTON ZONES	CHIASMOLITHUS GRANDIS/ BRAMLETTEIUS SERRACULOIDES		RETICULOFENESTRA UMBILICA
SPECIES	PI3/14		PII/12
<i>Chiasmolithus gigas</i>	●	●	●
<i>C. grandis</i>	●	●	● ●
<i>C. expansus</i>	●	●	●
<i>Reticulofenestra umbilica</i>		●	● ●
<i>Sphenolithus abies</i>	●	●	● ●
<i>S. radians</i>		●	● ●
<i>Zygrablithus bijugatus</i>	●	●	● ●
<i>Cyclococcolithina lusitanica</i>	●	●	● ●
<i>Discoaster barbadiensis</i>	●	●	● ●
<i>Rhabdosphaera tenuis</i>	●	●	
<i>R. spinula</i>	●	●	●
<i>Campylosphaera dela</i>	●	●	●
<i>Braarudosphaera bigelowi</i>	●	●	
<i>Helicoponlosphaera seminulum lophota</i>		●	● ●
<i>H. seminulum</i>	●	●	
<i>Lophodolithus reniformis</i>		●	● ●
<i>Discolithina panarium</i>		●	● ●
<i>D. ocellatus</i>	●	●	
<i>Coccolithus eopelagicus</i>	●	●	● ●
<i>Transversopontis obliquipons</i>	●	●	● ●
<i>Discolithina distinctus</i>			●
<i>D. pulchra</i>		●	● ●
<i>Discoaster diastypus</i>			● ●
<i>D. distinctus</i>			●
<i>D. deflandrei</i>			●