

41. COCCOLITH STRATIGRAPHY, ARABIAN AND RED SEAS, DEEP SEA DRILLING PROJECT LEG 23¹

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INTRODUCTION

Leg 23 of the Deep Sea Drilling Project, March to May 1972, which began at Colombo, Ceylon and ended at Djibouti, French Territory of the Afars and the Issas, investigated the Arabian and Red Seas, recovering 311 cores at 12 drilling sites (Figure 1; Table 1). Light-microscope

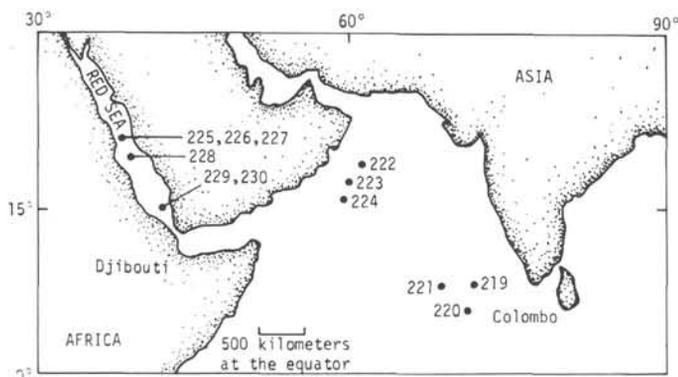


Figure 1. Location of sites cored during DSDP Leg 23.

TABLE 1
Location, Water Depth, Penetration, and Number of Cores Cut at DSDP Sites in the Arabian and Red Seas

Site	Latitude (N)	Longitude (E)	Water Depth (m)	Penetration (m)	Cores
Arabian Sea					
219	09°01.75'	72°52.67'	1764	411	42
220	06°30.97'	70°59.02'	4036	350	21
221	07°58.18'	68°24.37'	4650	270	19
222	20°05.49'	61°30.56'	3546	1300	36
223	18°44.98'	60°07.78'	3633	740	41
224	16°32.51'	59°42.10'	2500	792	11
Red Sea					
225	21°18.58'	38°15.11'	1228	240	29
226	21°20.51'	38°04.93'	2169	14	2
227	21°19.86'	38°07.97'	1795	359	45
228	19°05.16'	39°00.20'	1038	325	40
229	14°46.09'	42°11.47'	852	212	23
230	15°19.00'	41°50.05'	832	19	2

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techniques were used to study the coccoliths of 289 samples from these cores. The zonation employed in zonal assignments of core samples (summarized in Figures 2 and 3) is based on Bukry (1971, in press).

INDO-PACIFIC CORRELATION WITH DISCOASTER FORMOSUS

The calcareous nannofossil *Discoaster formosus* was first described from Deep Sea Drilling Project (DSDP) Sites 62 and 63 in the western equatorial Pacific north of New Guinea (Martini and Worsley, 1971); the species has since gone unrecorded. Its type level, the middle Miocene *Sphenolithus heteromorphus* Zone, has been cored repeatedly in all the major oceans. Abundant *D. formosus* populations have now been found 87° to the east in the same zone at DSDP Site 223 in the Arabian Sea, south of Oman. The species composition of the new and type assemblages is practically identical, and an analysis of the ray number in the star-shaped *D. formosus* specimens shows a remarkably similar distribution. Three to eight rays are developed in this species. Populations from DSDP 63.1-12-2, 80-81 cm (167 m) and DSDP 223-23-2, 50-51 cm (452 m) have the following percents, respectively, based on counts of 300 specimens: three-rayed, 2% and 3%; five-rayed, 12% and 14%; six-rayed, 79% and 77%; seven-rayed, 7% and 5%; eight-rayed, 0% and <1%. Identical age and paleoecology within the *S. heteromorphus* Zone are indicated at these two widely separated areas. The lack of occurrences of *D. formosus* at other Indo-Pacific sites indicates that the species is extremely restricted in stratigraphic range or ecologic tolerance and could prove to be a diagnostic fossil when found at other localities.

REFERENCES

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- Martini, E. and Worsley, T., 1971. Tertiary calcareous nannoplankton from the western equatorial Pacific: In Winterer, E. L., Riedel, W. R., et al., Initial Reports of the Deep Sea Drilling Project, Volume VII: Washington (U. S. Government Printing Office), p. 1500.

Series or Subseries	Zone or Subzone	Arabian Sea Sites						Red Sea Sites							
		219	220	221	222	223	224	225	226	227	228	229	230		
Holocene or Pleistocene	<i>E. huxleyi</i>	1-1	1-1												
	<i>G. oceanica</i>	2-1	2-2/2-3	5-2/10-5	1-1	1-3/2-5		1-3	?1-4	1-1	1-4/10-2	1-1/1-3	1-1/4-2 3A-2/18A-3 1A-1/2A-2	1-3	1-1
	<i>G. caribbeanica</i>	2-5/4-2			2-1	3-1		3-3/8-3		2-1	11-2				
	<i>E. annula</i>	4-4		?11-2/15-3				9-2			12-2/16-5				
Pliocene	Upper	<i>C. macintyreii</i>				3-2		10-2			18-2/19-2				
		<i>D. pentaradiatus</i>	4-6/5-3			4-1/21-2	4-5		11-2/11-5		3-1	21-3/27-3			
		<i>D. tamalis</i>	6-2			nondiag-	5-5		12-1/14-3			28-3/29-3			
	Lower	<i>D. asymmetricus</i>	6-5/7-2												
		<i>S. neoabies</i>					6-5		15-2/19-3 poor pres-		5-2/10-2 poor pres-	30-3/31-3			
		<i>C. rugosus</i>	7-5						20-2		12-2/14-1	32-3			
		<i>C. acutus</i>	8-2							?22-2					
Miocene	Upper	<i>T. rugosus</i>													
		<i>C. primus</i>	9-2/12-2	4-1/4-4		22-2/35-5					17-1/31-1				
		<i>D. berggrenii</i>		5-2			7-5/13-3								
	<i>D. neorectus</i>		5-5			14-5/17-5									
	<i>D. bellus</i>														
Middle	<i>D. hamatus</i>					18-5/19-5									
	<i>C. coalitus</i>					20-2									
	<i>D. kugleri</i>					21-1/23-1									
Lower	<i>C. miopelagicus</i>														
	<i>S. heteromorphus</i>	13-2/14-2				23-2/27-2									
	<i>H. ampliaperta</i>	14-5/14-6					4-1								
	<i>S. belemnos</i>						5-2/8-5								
	<i>D. druggii</i>						rare, non-								
<i>D. deflandrei</i>						diagnostic									

Figure 2. *Coccolith* zonation of Neogene sediment from the Arabian and Red Seas, DSDP Leg 23. The numbers assigned to zonal intervals are core and section numbers of samples examined. A core is typically 9 meters long, and a section is a sixth part of a core, 1.5 meters, both numbered from the top. Where a zone or subzone is represented in samples from two or more core sections, the highest and lowest sections are listed.

Series or Subseries	Zone or Subzone	Arabian Sea Sites					
		219	220	221	223	224	
Oligocene	Upper	<i>C. abisectus</i>					9-1
		<i>S. ciperoensis</i>		6-2/8-5	16-5/17-2	28-5	
		<i>S. distentus</i>				29-5	
		<i>S. predistentus</i>	15-2/15-5	9-2/10-2		30-5/31-1	
	Lower	<i>R. hillae</i>	?16-2				
		<i>C. formosa</i>	16-4			31-3	
<i>C. subdistichus</i>							
Eocene	Upper	<i>R. reticulata</i>	17-2/17-5	11-1		32-1	
		<i>D. tani</i>	18-2				
	Middle	<i>D. saipanensis</i>	19-2/19-5		18-3	32-3/33-2	10-2
		<i>D. bifax</i>			?18-6		
		<i>C. staurion</i>	20-2/21-2	12-2/12-5			
		<i>C. gigas</i>		13-2/14-1			
		<i>D. strictus</i>		?14-2/?14-3			
		<i>R. inflata</i>		15-2/15-5			11-1
	Lower	<i>D. kuepperi</i>		15-6/16-2			
		<i>D. lodoensis</i>		17-1			
<i>T. orthostylus</i>			18-2/18-3				
<i>D. diastypus</i>							
Paleocene	Upper	<i>D. multiradiatus</i>					
		<i>D. nobilis</i>	?12A-2/12A-5				
		<i>D. mohleri</i>					

Figure 3. Coccolith zonation of Paleogene sediment recovered from the Arabian Sea, DSDP Leg 23.