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### 30. TROPICAL ATLANTIC SILICOFLAGELLATES FROM LEG 108 CORES OFF AFRICA<sup>1</sup>

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The occurrence of Cenozoic silicoflagellates at three Ocean Drilling Program (ODP) Holes (660A, 662A, and 667A) was investigated to determine biostratigraphic and relative paleotemperature relations in the tropical Atlantic Ocean. This report presents the data obtained (Tables 1–4) from a study of 37 samples and some preliminary comments on the data. The age of the single sparse assemblage at Hole 660A is late middle Eocene or late Eocene (*Dictyocha hexacantha* Zone); the sparse to common assemblages of Hole 667A are Oligocene and early Miocene and the common to abundant assemblages of Hole 662A are early Pliocene to Quaternary. Dissolution thinning of silicoflagellates is noted in most samples, even in Hole 662A, which is under the present productive Benguela Current.

Relative paleotemperature values (Bukry, 1981b, 1983) calculated for the samples show very warm conditions, generally, with cooler conditions occurring only in some parts of the Quaternary *Bachmannocena quadrangula* Zone of Hole 662A, the lower Pliocene upper *Dictyocha fibula* Zone of Hole 662A, and the lower Miocene lower *Naviculopsis lata* Zone of Hole 667A. These relative paleotemperature results correlate with values determined from low-latitude sites in the eastern Pacific Ocean (Bukry, 1982a, 1982b, 1983, 1985).

Most of the taxonomy used in the tables is documented in previous publications of the *Initial Reports of the Deep Sea Drilling Project* (see my chapters in DSDP Volumes 16, 35, 37, 40, 44, 49, 54, 67, 68, 69, 81, and 95). Other taxa appear in Barron et al. (1984). Silicoflagellate samples were prepared as acid residues (Bukry, 1983) for light-microscope study. Counting techniques followed those previously described in DSDP reports, and totals are presented as percentages (Bukry, 1985).

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**Table 1. Occurrence of silicoflagellates in samples from Hole 660A, shown as percents.**

Age	late middle Eocene or late Eocene
Zone	<i>Dictyocha hexacantha</i>
Depth (m)	118
Core, section	14H-2
Sample interval (cm)	100
<i>Corbisema hastata globulata</i>	1
<i>C. hastata hastata</i>	11
<i>C. hastata incohata</i>	56
<i>C. regina</i>	1
<i>C. spp.</i>	15
<i>Dictyocha hexacantha</i>	4
<i>D. spinosa</i>	3
<i>Distephanus quinquangellus</i> (frenguelloid)	1
<i>D. speculum speculum</i> (cannopilean)	3
<i>Macrora barbadensis</i>	4
Total specimens	73
Relative paleotemperature value	95

Note: Percents are rounded off and may not total 100 percent. Hole 660A is at 10°00.809'N, 19°14.738'W, and water depth is 4327.8 m. Biostratigraphic assignment is from Bukry (1981a); relative paleotemperature value is also given.

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Table 2. Occurrence of silicoflagellates in Quaternary samples from Hole 662A, shown as percents.

Age Zone	<i>D. acul. acul.</i>			Quaternary <i>B. quadrangula</i>								<i>D. stap. stap.</i>			
	15 3H-2	18 3H-5	24 4H-2	34 5H-2	38 5H-5	43 6H-2	48 6H-5	53 7H-2	56 7H-4	72 9H-2	81 10H-2	91 11H-2	100 12H-2	110 13H-2	119 14H-2
Depth (m)															
Core, section															
Sample interval (cm)	70	70	70	69	69	69	69	69	120	68	70	70	70	68	69
<i>Bachmannocena quadrangula</i>				4	X	40	1	24	18	73	39				
<i>B. sp. aff. B. circulus</i> (polar)							7								
<i>Dictyocha aculeata aculeata</i>	15	24	33	26	X	2	16								
<i>D. aculeata aculeata</i> s. ampl.	3		6			2	6		8		3	1			
<i>D. calida ampliata</i>				10		1	1	2			<1				
<i>D. calida calida</i>			<1	17	X	17	13	7	1	1	2	2	3	2	1
<i>D. sp. cf. D. hessii</i>				1	X	1									
<i>D. lingii</i>				2		4			<1						
<i>D. longispina</i>			1												5
<i>D. perfecta</i>														1	
<i>D. perlaevis</i>					X	2	1	9	47	<1	1	36	3	38	19
<i>D. stapedia aspinosa</i>	2	1	3	1		6	14	2		2	3	6	13		
<i>D. stapedia stapedia</i>	71	67	48	34	X	22	33	33	23	21	47	45	71	48	44
<i>D. subaculeata</i>		2						8				5	1	3	
<i>D. vexativa</i>													1		
<i>D. sp. (asperoid)</i>												2			
<i>D. spp. (tilt, etc.)</i>	7	6	9	2	⊗	2	8	15	<1	<1	3	2	8	1	11
<i>Distephanus boliviensis</i> s. ampl.									<1		1				1
<i>D. crux</i> s. ampl.												3		5	11
<i>D. quinquangellus</i>													1		
<i>D. speculum speculum</i>				2		<1			1	1				1	4
<i>D. sp. A of Bukry</i> (1979)				1		1					<1		1		
<i>Octactis pulchra</i>	2		<1	<1				1		1	<1	1		1	3
Total specimens	100	300	221	300	20	300	300	105	300	300	300	300	200	300	300
Relative paleotemperature value	98	100	100	95	—	79	96	87	89	64	79	97	98	95	86

Note: Biostratigraphic assignment (Bukry, 1981a) and relative paleotemperature values (Bukry, 1983) are also shown. Occurrence in sparse samples shown by X, with the dominant taxon circled. Hole 662A is at 1°23.41'S, 11°44.35'W, and water depth is 3821.3 m.

Table 3. Occurrence of silicoflagellates in Pliocene samples from Hole 662A, shown as percents.

Age Zone	late Pliocene <i>D. stap. stap.</i>						early Pliocene <i>D. fibula</i>						
	129 15H-2	133 15H-5	138 16H-2	148 17H-2	152 17H-5	157 18H-2	162 18H-5	167 19H-2	176 20H-2	186 21H-2	190 21H-5	195 22H-2	200 22H-5
Depth (m)													
Core, section													
Sample interval (cm)	68	68	67	70	70	70	70	70	70	70	70	70	70
<i>Dictyocha aegea</i>								1		<1			
<i>D. angulata</i>								1					2
<i>D. arbutusensis</i>									1			10	1
<i>D. brevispina</i>									1				
<i>D. sp. cf. D. concinna</i>			1							<1			
<i>D. calida ampliata</i>	2												
<i>S. calida calida</i>	1							1	2	2			
<i>D. sp. cf. calida calida</i>		17	21								3		
<i>D. sp. cf. D. concavata</i>													
<i>D. delicata</i> var. <i>bisecta</i>									4				
<i>D. fibula</i> s. ampl.			24	1	4	1		34	39	37	34	46	38
<i>D. flexatella</i>	1		1	4	2	3		1					
<i>D. ornata africana</i>	10		1					25					
<i>D. longa</i>								14	8	16	2	6	15
<i>D. sp. aff. D. longa</i>				8									
<i>D. longa</i> var. <i>paxilla</i>										6	18		3
<i>D. perfecta</i>					1				2	2	5		17
<i>D. perlaevis</i>	5	11	4			3	1	1	6	10	1	2	4
<i>D. pulchella</i>			2							<1		2	1
<i>D. stapedia aspinosa</i>		3	1	29	5	1	1			1			
<i>D. stapedia stapedia</i>	67	55	28	51	58	2?				1?			
<i>D. vexativa</i>										1			
<i>D. sp. A</i>					3	81	54		4		9	32	
<i>D. spp. (tilt, etc.)</i>	2	6	17	6	11	7	11		10	3	7		8
<i>Distephanus boliviensis</i>					5		3	1					1
<i>D. crux</i> s. ampl.	3	3			1							2	
<i>D. quinquangellus</i>		1	2	1	6			1		1	3		
<i>D. speculum speculum</i>	3	4	1	1	4	2	30	23	24	20	21		10
<i>D. sp. A of Bukry</i> (1979)	6												
Total specimens	100	100	200	200	100	100	100	200	100	300	200	50	100
Relative paleotemperature value	89	93	97	98	84	98	67	75	76	79	76	99?	89

Note: Biostratigraphic assignment and relative paleotemperature values are also shown (Bukry, 1981a, 1981b).

Table 4. Occurrence of silicoflagellates in samples from Hole 667A, shown as percents.

Age Zone	<i>N. pont.</i>		early Miocene			<i>N. lata</i>		Oligocene <i>N. biap.</i>	
	230.4 26X-1	232.8 26X-3	240.0 27X-1	249.0 28X-1	252.4 28X-3	261.6 29X-3	337.2 37X-3	338.0 37X-3	
Depth (m)									
Core, section									
Sample interval (cm)	110	47	115	70	115	75	40	115	
<i>Corbisema triacantha</i>							73	75	
<i>C. sp.</i>			2						
<i>Bachmannocena apiculata apiculata</i>					3	6	12	7	
<i>B. apiculata curvata</i>								2	
<i>B. apiculata evexa</i>					1		1	4	
<i>B. apiculata glabra</i>							1		
<i>B. elliptica</i>	7		5						
<i>B. elliptica</i> var. <i>rhomboidea</i>	6	X							
<i>Dictyocha brevispina</i>			11	4		2			
<i>D. sp. aff. D. brevispina</i> (navicular)			25						
<i>Distephanus crux crux</i>	8		12	8	20				
<i>D. crux darwinii</i>				4					
<i>D. crux parvus</i>	2				1				
<i>D. crux scutulatus</i>	6	X	4	4	4				
<i>D. hannai</i>					5	32			
<i>D. sp. aff. D. hannai</i>					7	25			
<i>D. longispinus</i>					37				
<i>D. quinquangellus</i>							7		
<i>D. sp. cf. D. schauinslandii</i>		X							
<i>D. speculum patulus</i>			2		2	5	1		
<i>D. speculum speculum</i>				2					
<i>D. staurodon</i>	2	X			1				
<i>D. stradneri</i> var. <i>grandis</i>					2	3			
<i>D. sp. cf. D. stradneri</i> (asperoid)					1				
<i>D. sp. cf. D. stradneri</i> (fibuloid)					1				
<i>D. spp.</i>				2					
<i>Naviculopsis sp. cf. N. biapiculata</i>							4	7	
<i>N. constricta</i>				2					
<i>N. eobiapiculata</i>							3	5	
<i>N. lata</i> s. ampl.			32	74	16	6			
<i>N. navicula</i>	2								
<i>N. obtusarca</i>	24								
<i>N. obtusarca</i> var. <i>acicula</i>	26								
<i>N. pacifica pacifica</i>						16			
<i>N. ponticula ponticula</i>	22								
<i>N. quadrata</i>			4			1			
<i>N. spp.</i> (fragments)	1		5						
Total specimens	200	14	57	50	200	63	200	57	
Relative paleotemperature value	91	—	90	88	55	55	80	87	

Note: Occurrence in sparse sample shown by X. Biostratigraphic assignment is from Bukry (1981a, p. 439); relative paleotemperature values are also given. Zones identified include *Naviculopsis biapiculata* Zone (*N. biap.*), *Naviculopsis lata* Zone (*N. lata*), *Naviculopsis quadrata* Zone (*N. q.*), and *Naviculopsis ponticula* Zone (*N. pont.*). Hole 667A is at 4°34.15'N, 21°54.68'W, and water depth is 3529.3 m.