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Diatom Taphocoenoses in the Coastal Upwelling Areas off Western South America

by

G. Schuette

H. Schrader

Reference 79-8

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Diatom floral analysis of 116 sediment surface samples obtained off Peru reveals a boundary in the sediments between coastal upwelling influenced sediments and sediments outside the highly productive realm. Sinuous patterns of relative abundance for meroplanktic species (Actinocyclus octonarius, Actinoptychus senarius, and Cyclotella striata/stylorum) may preserve the meander-like patterns of surface water parameters off Peru. The occurrence of loci of high abundance of diatom valves per gram of dry sediment, and the limited occurrence of Skeletonema costatum and of a species of the genus

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DIATOM TAPHOCOENOSES IN THE COASTAL UPWELLING AREA OFF WESTERN SOUTH AMERICA

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Table I

A	B	C	D	E	F	G	H	I
1	W7706-78	RB	3°29.0'S	81°17.2'W	539	0		
2	W7706-79	K	3°29.0'S	81°17.2'W	538	0		
3	W7706-76	RB	3°34.7'S	81°00.1'W	365	2		
4	W7706-77	K	3°35.0'S	81°02.5'W	366	0		
5	W7706-74	RB	3°45.4'S	81°24.3'W	713	3		∿1
6	W7706-73	K	3°29.4'S	81°29.0'W	2116	16		
7	W7706-72	K	3°31.2'S	81°38.5'W	3601	10		
8	W7706-71	G	3°40.9'S	82°30.3'W	3600	4		
9	W7706-69	RB	4°12.0'S	85°20.4'W	3537	5		
10	W7706-70	G	4°12.9'S	85°19.7'W	3453	14		
11	Y71-9-84	MG	5°00.0'S	85°57.2'W	4010	9		
12	W7706-68	G	4°49.1'S	88°30.7'W	3903	13		
13	Y71-9-87	MG	5°03.25'S	93°04.8'W	3858	37		
14	Y71-9-88	MG	5°00.3'S	99°26.5'W	3650	6		
15	Y71-9-89	MG	5°58.6'S	101°01.5'W	3990	10		
16	Y71-7-35	MG	9°57.09'S	97°56.3'W	4010	5		
17	Y71-7-33	MG	10°00.0'S	92°40.0'W	4093	4		
18	Y71-7-30	MG	10°03.1'S	88°40.6'W	4237	2		
19	W7706-66	RB	10°00.7'S	87°58.6'W	4305	0		
20	W7706-67	G	10°01.4'S	87°57.9'W	4351	0		
21	W7706-65	G	10°11.8'S	84°44.8'W	4500	0		
22	W7706-64	K	8°49.0'S	81°56.6'W	4404	12		
23	Y71-8-76	MG	8°07.0'S	81°36.0'W	5122	32		∿1
24	Y71-8-83	MG	7°40.1'S	81°02.6'W	3103	71		<1
25	W7706-62	K	8°13.0'S	80°47.7'W	2670	5		
26	W7706-63	K	8°16.9'S	80°55.4'W	4513	30		<1
27	W7706-61	K	8°03.7'S	80°25.9'W	838	4	+Late Miocene	∿1
28	W7706-60	RB	8°03.7'S	80°25.9'W	830	0		
29	W7706-58	RB	8°03.4'S	80°24.3'W	486	0		
30	W7706-57	RB	7°55.7'S	80°10.9'W	192	1		
31	W7706-51	RB	9°44.6'S	79°24.3'W	259	0		
32	W7706-53	RB	9°47.0'S	79°26.5'W	414	0		
33	W7706-40	K	11°15.3'S	77°57.8'W	186	29		
34	W7706-39	RB	11°15.1'S	77°57.4'W	186	120		
35	W7706-41	K	11°20.6'S	78°07.0'W	411	11		
36	W7706-42	RB	11°20.6'S	78°07.0'W	411	15		
37	W7706-43	RB	11°24.6'S	78°13.8'W	584	2		
38	W7706-44	K	11°24.6'S	78°13.8'W	580	1		
39	W7706-45	RB	11°26.6'S	78°17.2'W	810	2		
40	W7706-47	RB	11°40.2'S	78°25.8'W	1500	4	+unidentified older	∿1
41	W7706-49	K	11°16.6'S	79°05.9'W	3970	5	+Late Miocene	<1
42	Y71-8-58	FF	11°37.6'S	79°14.2'W	6189	31	+Pleistocene &Late Miocene	<1
43	Y71-8-56	FF	11°38.4'S	79°14.2'W	6256	34	+Late Miocene	<1
44	Y71-8-55	FF	11°38.5'S	79°14.8'W	6309	34	+Early Pliocene	<1
45	W7706-50	K	11°40.7'S	79°57.9'W	4902	7		<1
46	Y73-7-98	MG	12°22.0'S	77°28.0'W	300	0		
47	Y71-6-3	SS	12°28.2'S	77°02.7'W	130			
48	W7706-2	RB	12°53.2'S	76°52.0'W	161	43		
49	W7706-1	RB	12°54.0'S	76°51.0'W	148	2		
50	W7706-3	RB	12°58.3'S	76°57.4'W	304	6		
51	W7706-4	K	12°58.9'S	76°58.0'W	325	8		
102	Y71-6-22	MG	16°48.6'S	74°03.4'W	5301	119	+Late Miocene	<1
103	FD75-3-14	P	16°57.0'S	74°33.0'W	6390	15		
104	FD75-3-15	MG	17°11.0'S	74°52.0'W	4690	25		∿1
105	Y71-6-14	MG	17°40.2'S	75°47.3'W	4625	1	+?Oligocene	
106	W7706-19	K	22°14.3'S	79°30.7'W	4479	0		
107	W7706-20	K	23°01.9'S	73°44.7'W	3717	5		
108	W7706-21	K	23°14.7'S	71°48.7'W	4400	3		
109	FD75-3-9	MG	23°15.0'S	71°24.0'W	7597	0		
110	W7706-22	K	23°18.7'S	71°20.0'W	8080	0		
111	W7706-24	K	23°19.2'S	71°08.7'W	5107	8		<1
112	W7706-28	RB	23°00.0'S	70°41.0'W	764	0		
113	Y73-6-86	MG	24°58.0'S	70°58.0'W	2925	8		<1
114	Y73-6-87	FF	25°01.0'S	71°26.0'W	3992	0		
115	Y73-6-82	MG	27°19.4'S	71°20.0'W	3063	0		
116	Y73-6-81	MG	27°34.4'S	71°51.2'W	6118	0		

A	B	C	D	E	F	G	H	I
52	W7706-5	K	13°02.4'S	77°04.9'W	625	0		
53	W7706-6	K	13°02.4'S	77°04.9'W	701	0		
54	W7706-11	K	13°09.0'S	77°14.0'W	1380	11	+Late Miocene	<1
55	W7706-9	G	13°01.0'S	77°19.0'W	1335	12		
56	W7706-10	K	13°09.0'S	77°15.0'W	1380	14		<1
57	W7706-38	K	13°12.0'S	77°15.1'W	1414	12		<1
58	W7706-8	G	13°08.4'S	77°32.6'W	2067	40	Pleistocene/ Pliocene	<1
59	W7706-12	G	13°13.0'S	77°20.0'W	1285	7		∿1
60	W7706-7	G	13°16.0'S	77°27.6'W	1774	21		
61	W7706-14	K	13°27.3'S	77°42.9'W	3621	67	+Pliocene/ Miocene(?)	
62	W7706-13	G	13°26.0'S	77°40.0'W	3470	67	+?Oligocene	<1
63	Y71-6-5	MG	13°30.2'S	77°19.9'W	2286	54		
64	W7706-35	RB	13°39.2'S	76°53.4'W	592	3		<1
65	W7706-36	RB	13°37.3'S	76°50.5'W	370	12		
66	W7706-37	K	13°37.8'S	76°50.9'W	370	32		10
67	Y73-7-96	FF	13°47.0'S	76°18.0'W	18	22		>20
68	Y71-6-6	P	13°37.0'S	77°34.2'W	3801	43	Pleistocene	
69	Y71-6-7	MG	13°45.7'S	77°45.9'W	5374	41	+Pliocene/ Pleistocene	
70	Y71-6-8	FF	13°45.1'S	77°42.8'W	5273	30	+Pleistocene	∿1
71	Y71-6-9	FF	13°45.7'S	77°43.2'W	5371	57	+Pleistocene	∿1
72	Y71-6-10	FF	13°45.7'S	77°43.7'W	5508	45		
73	Y71-6-11	FF	13°46.2'S	77°44.4'W	5594	52		
74	Y73-7-97	MG	13°57.0'S	78°05.0'W	4620	34		
75	FD75-3-16	MG	13°57.0'S	78°05.0'W	4653	28		
76	W7706-15	K	13°48.4'S	78°18.3'W	4581	21		∿2
77	Y71-6-4	MG	14°36.6'S	79°06.9'W	4518	28	+Pliocene/ Miocene	
78	W7706-16	K	15°38.2'S	81°14.8'W	4521	0		
79	Y73-3-23	MG	15°31.7'S	96°58.2'W	3656			
80	W7706-17	RB	17°29.2'S	84°18.0'W	4573	0		
81	W7706-18	K	17°29.6'S	84°17.8'W	4462	0		
82	Y71-6-12	MG	16°26.6'S	77°33.8'W	2734			
83	W7706-33	K	15°43.6'S	76°47.8'W	2967	6		<1
84	W7706-34	K	15°19.2'S	76°51.0'W	3316	24		<1
85	Y71-6-23	MG	15°11.9'S	76°14.7'W	3930			
86	Y71-6-24	MG	15°16.0'S	76°18.8'W	4899	16	+Late Miocene	∿1
87	Y71-6-25	P	15°15.5'S	76°18.9'W	4614			
88	Y71-6-26	MG	15°16.1'S	76°22.4'W	4813			
89	W7706-32	K	16°17.4'S	75°53.9'W	645	6		<1
90	W7706-31	RB	16°17.6'S	73°53.6'W	645	4		<1
91	Y73-7-95	G	16°25.0'S	74°14.0'W	2720	39		
92	W7706-30	RB	16°42.0'S	73°24.2'W	2154	0		∿20
93	Y73-6-93	G	16°46.1'S	74°34.6'W	6250	23	+?Oligocene	∿2
94	Y73-7-94	MG	16°51.0'S	74°33.0'W	5920	15		∿1
95	Y71-6-15	FF	16°55.5'S	74°21.8'W	7406	12	+?Oligocene	∿1
96	Y71-6-16	FF	16°54.5'S	74°20.7'W	6761	23		
97	Y71-6-17	FF	16°53.3'S	74°20.0'W	6485	23		∿3
98	Y71-6-18	MG	16°56.7'S	74°21.3'W	7280	13		∿2
99	Y71-6-19	MG	17°03.0'S	74°24.5'W	5791	32		∿1
100	Y71-6-20	FF	16°57.9'S	74°20.8'W	7293	11		∿1
101	Y71-6-21	MG	16°50.8'S	74°21.7'W	6505	25		∿2

A = Number this paper

B = OSU core number

C = Type of Sampler

D = Latitude

E = Longitude

F = Water Depth

G = Abundance x 10^6 of diatoms per gram dry sediment

H = Age of reworked older diatoms

I = % displaced shallow water benthic diatoms

Table II. Relative abundance of 43 species at 49 stations.

Station #	Species #* 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
111	0.00	1.02	0.00	0.00	.68	2.73	0.00	.68	0.00	0.00	77.47	0.00	1.02	0.00	0.00	1.71	0.00	0.00	0.00	2.39	0.00	0.00	0.00	0.00	0.00	0.00	1.37	0.00	3.41	0.00	0.00	0.00	.34	0.00	.34	1.37	0.00	0.00	0.00	0.00	1.37	0.00	4.10
113	0.00	.74	0.00	0.00	0.00	.74	0.00	0.00	0.00	0.00	85.61	0.00	1.48	0.00	0.00	5.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.37	0.00	0.00	0.00	0.00	2.58	0.00	0.00	0.00	.37	0.00	0.00	.74	0.00	0.00	0.00	0.00	1.48	0.00	.74
4	0.00	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.78	0.00	0.00	0.00	0.00	4.69	0.00	0.00	0.00	3.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.13	.78	.78	.78	2.34	0.00	0.00	19.53	10.16	0.00	0.00	0.00	0.00	0.00	1.56
5	0.00	0.00	0.00	0.00	1.65	22.31	0.00	0.00	0.00	0.00	48.35	0.00	0.00	0.00	0.00	.41	.41	0.00	.41	0.00	0.00	.41	0.00	0.00	0.00	0.00	1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.13	3.31	1.24	2.07	2.89	0.00	9.09	0.00	1.65
8	0.00	0.00	0.00	.61	1.82	.30	0.00	0.00	0.00	0.00	34.55	0.00	.30	0.00	0.00	15.76	0.00	0.00	0.00	2.73	0.00	1.52	0.00	0.00	0.00	0.00	0.00	0.00	2.42	.61	4.85	0.00	.30	0.00	0.00	16.97	8.18	0.00	.30	.30	1.52	0.00	6.97
20	0.00	.45	0.00	0.00	0.00	0.00	1.79	0.00	0.00	0.00	3.14	0.00	2.24	0.00	0.00	37.67	0.00	0.00	0.00	0.00	.45	0.00	0.00	0.00	.90	0.00	0.00	0.00	14.35	0.00	4.93	0.00	1.35	0.00	0.00	11.21	17.94	.45	0.00	0.00	.45	0.00	2.69
21	0.00	0.00	0.00	.52	.52	.52	1.55	0.00	0.00	0.00	4.66	0.00	.52	0.00	0.00	61.14	0.00	0.00	0.00	1.55	1.04	0.00	0.00	0.00	.52	0.00	0.00	0.00	5.70	0.00	2.59	0.00	.52	0.00	0.00	11.40	4.66	0.00	0.00	0.00	1.04	0.00	1.55
22	0.00	0.00	0.00	0.00	0.00	4.08	0.00	0.00	0.00	0.00	14.97	0.00	0.00	0.00	0.00	24.49	0.00	0.00	0.00	35.03	2.38	0.00	0.00	0.00	0.00	0.00	1.02	0.00	1.70	0.00	0.00	.34	0.00	0.00	0.00	9.18	2.04	0.00	0.00	0.00	0.00	0.00	4.76
23	0.00	0.00	0.00	0.00	1.76	7.62	0.00	0.00	0.00	0.00	56.30	0.00	0.00	.59	0.00	2.93	0.00	0.00	0.00	8.80	3.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	1.17	0.00	0.00	9.97	2.05	0.00	1.47	0.00	1.17	0.00	1.17
24	1.26	3.46	0.00	0.00	1.57	1.89	0.00	0.00	0.00	0.00	56.31	0.00	.31	0.00	0.00	1.57	.31	0.00	.31	11.64	.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.63	2.83	0.00	.94	0.00	1.26	0.00	0.00	16.04	2.83	0.00	.31	0.00	.31	0.00	1.57
25	0.00	2.54	.42	0.00	1.27	13.14	.42	0.00	0.00	0.00	29.24	0.00	1.27	0.00	0.00	15.68	1.27	0.00	1.69	17.37	.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.54	0.00	.42	0.00	.42	0.00	.42	8.47	.85	0.00	0.00	0.00	0.00	0.00	1.69
26	0.00	1.26	0.00	0.00	.96	8.33	0.00	0.00	0.00	0.00	38.78	0.00	.64	0.00	0.00	9.29	.64	0.00	0.00	16.35	1.92	0.00	0.00	0.00	0.00	0.00	0.00	.32	0.00	1.60	0.00	.64	0.00	1.28	0.00	.96	11.86	1.28	0.00	0.00	0.00	.96	0.00	2.88
28	0.00	12.92	0.00	0.00	1.25	16.25	0.00	0.00	0.00	0.00	10.00	0.00	1.25	0.00	0.00	10.00	2.92	0.00	0.00	22.08	1.25	0.00	0.00	0.00	0.00	0.00	1.25	0.00	1.25	0.00	0.00	0.00	.42	.42	.42	14.58	.83	0.00	.42	0.00	1.25	0.00	1.25
30	.27	23.84	0.00	0.00	2.19	5.75	0.00	0.00	0.00	.27	18.63	0.00	.27	0.00	0.00	4.66	.55	0.00	0.00	18.08	.82	0.00	0.00	0.00	0.00	0.00	0.00	.27	1.10	.27	.55	0.00	1.92	0.00	0.00	18.63	.55	0.00	.82	0.00	.27	0.00	.27
41	0.00	9.87	0.00	0.00	1.56	7.53	0.00	0.00	0.00	0.00	34.03	0.00	.26	0.00	0.00	11.43	.26	0.00	0.00	10.39	1.04	.78	0.00	0.00	0.00	0.00	1.04	0.00	.26	0.00	.52	0.00	.26	.52	.26	14.81	2.60	0.00	.52	0.00	.52	0.00	1.56
45	0.00	0.00	0.00	0.00	.80	2.65	0.00	0.00	0.00	0.00	39.79	.27	1.33	0.00	0.00	18.57	0.00	0.00	.53	6.10	.80	1.06	0.00	0.00	0.00	0.00	0.00	0.00	3.45	0.00	1.86	.53	.80	0.00	0.00	13.53	5.04	0.00	.53	0.00	1.06	0.00	1.33
46	5.67	.26	0.00	0.00	1.03	15.21	0.00	.77	0.00	0.00	33.51	.52	2.84	0.00	0.00	10.57	0.00	0.00	.52	11.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.26	4.38	0.00	.52	.26	.77	0.00	0.00	9.28	.26	0.00	.77	0.00	.26	0.00	1.29
55	0.00	.34	0.00	0.00	3.10	10.34	0.00	0.00	0.00	0.00	34.83	0.00	.34	0.00	0.00	18.97	.34	0.00	0.00	17.93	0.00	.34	0.00	0.00	0.00	0.00	0.00	0.00	.34	0.00	0.00	.34	1.38	.69	0.00	4.83	0.00	.34	2.76	0.00	1.38	0.00	1.38
59	0.00	8.76	0.00	0.00	2.82	12.99	0.00	0.00	0.00	.28	34.46	0.00	.56	0.00	0.00	9.32	0.00	0.00	0.00	9.60	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.98	0.00	.56	0.00	1.13	0.00	1.69	8.47	0.00	0.00	4.52	0.00	0.00	0.00	1.13
60	0.00	1.01	0.00	0.00	1.68	25.50	0.00	0.00	0.00	0.00	24.50	0.00	0.00	0.00	0.00	.67	0.00	0.00	0.00	2.01	2.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.34	0.00	0.00	0.00	0.00	0.00	6.38	3.02	0.00	0.00	26.51	0.00	3.69	0.00	2.01
62	0.00	.28	0.00	0.00	.28	5.11	0.00	0.00	0.00	0.00	77.84	0.00	0.00	0.00	0.00	.85	0.00	0.00	0.00	1.70	1.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.28	.28	0.00	0.00	.57	0.00	5.97	0.00	0.00	3.98	0.00	0.00	.28	1.14
63	2.60	0.00	0.00	0.00	.52	9.11	.52	0.00	0.00	0.00	36.20	0.00	.78	0.00	0.00	5.21	0.00	0.00	0.00	12.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.91	2.34	1.56	.78	2.60	0.00	.52	11.72	1.82	0.00	.26	0.00	.78	0.00	6.51
74	.58	0.00	0.00	0.00	1.15	3.75	0.00	0.00	0.00	0.00	58.50	0.00	.58	0.00	0.00	15.56	0.00	0.00	.29	4.32	.58	0.00	0.00	0.00	0.00	0.00	0.00	.58	1.44	0.00	0.00	.58	1.44	0.00	0.00	6.92	.29	0.00	2.31	0.00	0.00	0.00	1.15
75	.99	0.00	0.00	0.00	0.00	.66	0.00	0.00	0.00	0.00	75.83	0.00	.99	0.00	0.00	6.62	0.00	0.00	0.00	1.66	.33	0.00	0.00	0.00	0.00	0.00	0.00	.99	1.66	0.00	.66	0.00	0.00	.99	.33	4.64	.33	0.00	.99	0.00	.66	0.00	1.66
76	0.00	.28	0.00	.28	3.06	7.50	.28	.28	0.00	0.00	35.83	0.00	.83	0.00	0.00	16.11	.28	0.00	.56	7.78	.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.94	0.00	1.11	.83	1.11	0.00	.28	12.78	2.78	.83	.83	0.00	.28	0.00	3.89
77	0.00	0.00	0.00	0.00	.79	3.17	.79	.40	0.00	0.00	30.95	0.00	0.00	0.00	0.00	18.65	0.00	0.00	1.19	9.92	.79	.79	0.00	0.00	0.00	0.00	0.00	0.00	5.95	0.00	1.59	1.19	1.59	0.00	0.00	13.10	4.76	.40	.40	0.00	.79	0.00	2.78
82	0.00	5.86	0.00	0.00	.93	4.01	.31	0.00	0.00	.31	25.00	.62	1.54	0.00	0.00	9.88	0.00	1.23	0.00	11.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.31	10.80	.31	.31	.62	6.17	0.00	0.00	10.80	1.85	0.00	2.47	0.00	.93	0.00	4.32
83	0.00	0.00	0.00	0.00	5.74	4.31	0.00	.48	.48	0.00	35.89	.96	.96	0.00	0.00	14.83	.48	0.00	.48	1.91	.48	.48	0.00	0.00	0.00	0.00	.96	0.00	2.39	1.44	1.44	1.91	1.44	0.00	0.00	11.48	5.26	0.00	1.91	.96	.96	0.00	2.39
84	1.12	2.61	0.00	0.00	2.24	7.09	0.00	.37	0.00	0.00	46.64	1.49	.75	0.00	0.00	11.19	.37	0.00	0.00	7.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.22	0.00	.37	0.00	2.24	1.87	0.00	4.48	1.12	0.00	.37	0.00	0.00	0.00	2.61
91	.30	4.78	0.00	0.00	0.00	3.58	0.00	.30	0.00	.30	70.15	0.00	.60	0.00	0.00	1.79	0.00	0.00	.30	3.58	.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.19	0.00	.90	0.00	1.19	0.00	0.00	7.16	0.00	0.00	1.19	0.00	.90	0.00	1.49
92	0.00	30.73	0.00	0.00	0.00	4.47	0.00	0.00	0.00	0.00	26.82	0.00	0.00	0.00	0.00	1.12	0.00	0.00	0.00	5.59	0.00	0.00	0.00	0.00	0.00	0.00	7.82	0.00	3.35	0.00	0.00	0.00	0.00	0.00	1.12	10.06	0.00	0.00	8.94	0.00	0.00	0.00	0.00
104	.26	3.37	0.00	0.00	1.81	4.40	0.00	.78	0.00	.26	52.33	.52	2.33	0.00	0.00	6.99	0.00	0.00	0.00	8.03	.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.37	.26	0.00	0.00	4.15	0.00	0.00	6.99	.52	0.00	.26	.26	.52	.26	2.07
105	0.00	1.18	0.00	0.00	.59	1.18	0.00	0.00	0.00	0.00	55.62	0.00	1.18	0.00	0.00	8.28	0.00	0.00	.59	5.33	0.00	0.00	0.00	0.00	0.00	0.00	2.96	0.00	2.37	0.00	2.96	.59	1.78	0.00	.59	8.88	1.78	0.00	0.00	0.00	0.00	0.00	4.14
33+34	0.00	6.02	1.70	0.00	.79	2.75	.79	0.00	0.00	.13	60.86	0.00	1.05	0.00	0.00	1.31	0.00	0.00	0.00	4.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.65	.79	.13	1.18	2.36	2.36	0.00	7.20	.79	0.00	1.83	0.00	2.49	.13	.65
35+36	1.46	6.55	.12	0.00	2.79	10.19	0.00	.12	0.00	0.00	31.55	0.00	.73	0.00	0.00	22.21	.12	0.00	0.00	7.28	.12	.49	0.00	0.00	0.00	0.00	0.00	.85	.12	.73	.12	1.21	0.00	1.58	0.00	0.00	8.37	1.09	0.00	0.00	0.00	0.00	0.00	2.18
37+38	.82	26.06	0.00	0.00	1.77	2.73	0.00	0.00	0.00	0.00	28.79	0.00	.27	0.00	0.00	3.96	0.00	0.00	0.00	11.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.95	1.23	0.00	.68	0.00	2.18	0.00	1.23	14.05	0.00	0.00	1.91	0.00	0.00	.27	1.50
39+40	.13	15.00	0.00	0.00	2.68	7.52	0.00	.13	0.00	.64	25.99	0.00	.51	0.00	0.00	8.92	0.00	0.00	.13	14.01	.51	.25	0.00	0.00	.13	0.00	.38	.25	2.04	.13	.25	0.00	1.27	.13	3.31	10.83	.38	0.00	1.53	0.00	1.02	0.00	1.15
43+44	0.00	1.47	.15	0.00	1.18	9.00	0.00	0.00	0.00	.15	38.64	0.00	1.33	.15	0.00	10.32	0.00	.15	.74	5.46	1.62	.29	0.00	0.00	0.00	.15	.29	0.00	2.95	.29	1.33	.44	2.51	.29	1.33	12.83	1.62	0.00	1.77	0.00	1.18	0.00	2.36
48+49	0.00	9.64	0.00	0.00	.23	6.43	0.00	.11	0.00	.92	58.09	0.00	.23	0.00	0.00	.80	.23	0.00	0.00	5.28	.34	0.00	0.00	0.00	0.00	0.00	.69	0.00	.11	0.00	0.00	0.00	0.00	0.00	.11	14.70	.46	0.00	.92	0.00	.46	0.00	.23
50+51	1.02	0.00	.15	0.00	2.20	16.54	0.00	.73	.15	0.00	41.14	0.00	.44	0.00	0.00	12.74	0.00	0.00	.44	13.18	.15	0.00	0.00	0.00	0.00	0.00	1.32	0.00	.73	0.00	.44	.44	1.61	.15	0.00	4.83	0.00	.59	.29	0.00	0.00	0.00	.73
54+56+57	.91	7.11	0.00	0.00	.91	8.43	0.00	0.00	0.00	.10	35.03	.10	1.32	0.00	0.00	14.82	0.00	0.00	.41	9.04	.41	0.00	0.00	0.00	0.00	0.00	.61	0.00	1.32	0.00	.71	0.00	.81	0.00	.61	13.10	.71	0.00	1.93	0.00	.51	0.00	1.12
64+65+66	.74	5.89	.11	0.00	2.52	8.10	0.00	.42	0.00	1.37	39.75	.21	.63	0.00	0.00	5.99	.32	0.00	.21	11.45	.84	0.00	0.00	0.00	0.00	0.00	.32	0.00	2.21	.11	0.00	.42	2.21	0.00	.84	6.20	6.20	0.00	.84	0.00	.32	.11	1.68
85-86	0.00	2.33	0.00	0.00	1.24	7.47	0.00	.16	0.00	.70	57.00	.08	.62	.08	.08	4.59	.31	0.00	.16	7.15	.62	0.00	0.00	0.00	.08	.08	0.00	.08	1.79	.23	.62	.16	.93	.23	.62	7.08	.93	0.00	2.49	0.00	.93	.08	1.09
95-101+103	.55	4.87	0.00	0.00	1.36	4.15	0.00	.08	.04	.04	60.36	.04	.97	0.00	0.00	2.96	.21	0.00	.04	6.90	.59	.04	0.00	0.00	0.00	0.00	.17	.55	.13	2.03	.17	.34	.47	1.57	.25	.08	5.25	1.23	0.00	2.88	.08	.47	.04	1.06
89+90	0.00	30.83	0.00	0.00	.58	4.82	0.00	0.00	0.00	.58	38.15	0.00	.19	0.00	0.00	1.93	.39	0.00	0.00	3.08	.58	0.00	0.00	0.00	0.00	0.00	.77	0.00	1.73	.19	.19	0.00	.19	.19	0.00	11.56	0.00	0.00	1.93	.77	.58	0.00	.77
93+94	.14	.71	0.00	0.00	1.70	2.98	0.00	.43	0.00	0.00	67.33	0.00	.99	0.00	0.00	1.56	0.00	0.00	.14	6.25	.57	0.00	0.00	.43	0.00	0.00	0.00	0.00	2.98	.14	.28	.14	1.99	1.28	0.00	6.11	.43	0.00	1.56	0.00	0.00	0.00	1.85
9+10	0.00	0.00	0.00	.32	.81	0.00	.49	0.00	0.00	0.00	3.40	0.00	1.29	0.00	0.00	48.71	0.00	0.00	0.00	.97	.16	1.13	0.00	.16	.32	0.00	0.00	0.00	6.80	0.00	1.94	1.13	1.29	0.00	0.00	13.27	5.18	0.00	.16	.16	2.43	0.00	9.87
6+7	0.00	0.00	0.00	.32	.79	.16	0.00	.32	0.00	0.00	35.55	0.00	.32	0.00	0.00	7.42	.16	0.00	0.00	4.90	0.00	.32	1.11	.32	.47	.16	.63	0.00	4.11	0.00	2.84	1.11	.47	0.00	0.00	24.80	6.64	0.00	.47	.16	1.26	0.00	5.21
69+72	.48	2.72	0.00	0.00	1.76	6.09	0.00	.16	0.00	0.00	42.15	.16	.96	0.00	0.00	5.93	.48	0.00	.32	12.50	.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.17	0.00	2.08	0.00	1.92	.16	.48	9.62	2.72	0.00	2.08	.16	.48	.16	1.44

*Species names corresponding to these column headings are given in Table IV

Table III. Varimax Factor Matrix (Q-mode)

Station #	Communality	Factors 1	2	3	4	5
111	.987	.961	.025	.203	.094	.119
113	.984	.965	.056	.187	.062	.110
4	.961	.889	.197	.336	.135	-.016
5	.955	.830	.012	.206	.165	.443
8	.955	.781	.484	.277	.184	-.004
20	.930	.067	.954	.077	.094	-.029
21	.963	.045	.966	.031	.157	.050
22	.949	.233	.452	.215	.802	-.020
23	.995	.914	.070	.263	.250	.149
24	.989	.878	.085	.365	.279	.016
25	.991	.619	.349	.316	.575	.237
26	.997	.780	.209	.323	.474	.127
28	.979	.119	.256	.605	.697	.219
30	.994	.299	.146	.841	.419	.007
41	.990	.709	.302	.512	.342	.129
45	.995	.810	.449	.261	.253	.071
46	.965	.731	.257	.276	.448	.295
55	.973	.682	.354	.234	.520	.241
59	.996	.717	.218	.460	.342	.325
60	.916	.446	.017	.230	.162	.799
62	.996	.956	.019	.219	.097	.155
63	.968	.805	.172	.303	.423	.142
74	.988	.910	.250	.215	.173	.147
75	.991	.961	.092	.201	.091	.103
76	.991	.779	.411	.280	.336	.156
77	.992	.715	.517	.274	.368	.051
82	.910	.642	.362	.451	.398	.077
83	.978	.824	.423	.256	.184	.141
84	.982	.873	.223	.268	.261	.175
91	.996	.942	.037	.284	.114	.117
92	.968	.433	.054	.051	.031	.187
104	.991	.905	.137	.295	.229	.116
105	.994	.929	.174	.259	.172	.069
33+34	.993	.929	.036	.318	.119	.115
35+36	.971	.655	.506	.353	.324	.236
37+38	.991	.512	.117	.815	.222	.039
39+40	.989	.548	.235	.665	.406	.161
43+44	.986	.830	.285	.318	.274	.199
48+49	.993	.883	.046	.416	.158	.117
50+51	.983	.772	.218	.232	.436	.309
54+56+57	.992	.728	.360	.433	.332	.187
64+65+66	.978	.820	.152	.376	.334	.170
85-88	.999	.916	.085	.278	.210	.177
95-101+103	.993	.923	.053	.300	.167	.140
89+90	.984	.607	.066	.773	.028	.118
93+94	.996	.950	.035	.237	.159	.108
9+10	.979	.049	.974	.057	.158	.018
6+7	.885	.777	.323	.353	.221	-.065
69+72	.993	.845	.156	.338	.351	.128
Variance		57.188	11.781	14.927	9.984	3.903
Cum. Var.		57.188	68.968	83.895	93.879	97.782

Table IV. Varimax Factor Score Matrix (Q-mode).

pecies # and name	Factors 1	2	3	4	5
1 *Actinocyclus curvatulus/ Coscinodiscus rothii*	.004	-.005	-.008	.029	.016
2 *Actinocyclus octonarius*	-.190	-.024	.887	-.204	.017
3 *Actinocyclus divisus*	.002	-.001	-.001	.001	.001
4 *Actinocyclus ellipticus*	.001	.006	-.000	-.003	-.002
5 *Actinoptychus splendens*	.005	.020	.020	.026	.050
6 *Actinoptychus senarius*	-.076	-.040	.042	.295	.761
7 *Asteromphalus* spp.	-.001	.022	-.001	-.007	.001
8 *Asteromphalus arachne*	.004	.000	-.004	.004	.002
9 *Asteromphalus pettersonii*	.000	.001	-.000	-.001	.001
10 *Biddulphia aurita*	.000	-.002	.009	-.000	-.000
11 *Chaetoceros* resting spore group	.970	-.007	.178	.053	.100
12 *Coscinodiscus* #1	.003	.002	-.002	.001	.001
13 *Coscinoduscus africanus/ C. tabularis*	.008	.023	-.002	.015	.008
14 *Coscinodiscus lineatus*	.001	-.000	-.001	.000	.000
15 *Coscinodiscus lineatus v. plicata*	.000	-.000	-.000	-.000	.000
16 *Coscinodiscus nodulifer/ C. radiatus*	-.038	.916	-.059	.115	.097
17 *Coscinodiscus obscurus/ C. perforatus*	-.009	-.007	.010	.033	.006
18 *Coscinodiscus oculus-iridis*	-.000	.001	.002	.002	-.003
19 *Coscinodiscus symbolophorus*	.003	.003	-.007	.012	.004
20 *Cyclotella striata/stylorum*	-.084	-.123	.148	.896	-.155
21 *Delphineis* spp.	-.004	.001	.001	.036	.039
22 *Hemidiscus cuneiformis*	.003	.015	.000	-.006	-.003
23 *Nitzschia bicapitata*	.001	.001	.001	-.000	-.005
24 *Nitzschia interrupta*	.001	.001	-.000	-.001	-.002
25 *Nitzschia marina*	-.001	.010	.001	-.006	-.001
26 *Nitzschia seriata*	.000	.000	-.000	-.000	-.001
27 *Paralia sulcata*	-.011	.005	.065	-.034	.028
28 *Pleurosigma* spp.	-.001	-.001	.008	.000	-.004
29 *Pseudoeunotia doliolus*	.019	.170	.039	-.023	-.045
30 *Rhizosolenia alata*	.005	.001	.000	.002	-.007
31 *Rhizosolenia bergonii*	.016	.074	.005	-.030	-.032
32 *Rhizosolenia styliformis*	.008	.013	-.006	.002	-.010
33 *Roperia tesselata*	.018	.017	.021	.031	-.031
34 *Skeletonema costatum*	.006	-.003	-.001	.002	.001
35 *Stephanopyxis palmeriana/ S. turris*	-.018	-.001	.026	-.018	.146
36 *Thalassionema nitzschioides*	.038	.236	.370	.134	-.238
37 *Thalassionema nitzschioides v. parva*	.038	.205	.004	-.070	-.100
38 *Thalassiosira* A & B	.001	.003	-.005	-.000	.015
39 *Thalassiosira eccentrica* group	-.053	.021	.094	-.137	.517
40 *Thalassiosira lineata*	.001	.004	.004	-.007	-.001
41 *Thalassiosira oestrupii*	.003	.022	-.004	-.019	.109
42 *Thalassiosira plicata*	.001	-.001	.001	-.000	-.001
43 *Thalassiothrix* spp.	.027	.094	-.015	.046	-.032

Table V. Rotated Factor Matrix (R-Mode)

Species	Factors 1	2	3	4	5	6	7	8	9	10
Actinocyclus curvatulus/ Coscinodiscus rothii	-.106	-.085	-.075	.070	.537	-.076	-.108	-.060	.013	.169
Actinocyclus octonarius	-.127	-.117	.012	-.003	-.508	-.119	-.185	-.535	.232	.484
Actinocyclus divisus	.002	.003	.018	.040	-.088	-.028	.787	-.039	.051	.056
Actinocyclus ellipticus	.329	-.078	.012	-.125	-.161	.209	-.133	.523	-.106	.080
Actinoptychus splendens	-.184	.146	.604	.009	.181	-.069	-.078	.022	.168	-.049
Actinoptychus senarius	-.276	.751	-.027	-.104	.261	-.139	-.067	-.137	.392	-.114
Asteromphalus spp.	.860	-.017	-.114	.043	-.021	-.155	.285	.135	-.013	.006
Asteromphalus arachne	-.061	-.055	.323	-.036	.712	.184	-.045	-.146	-.061	.088
Asteromphalus petersonii	.012	.007	.905	-.090	.128	-.044	-.001	.016	.030	-.030
Biddulphia aurita	-.097	-.036	.033	.069	-.063	-.000	-.058	-.329	-.044	.030
Chaetoceros resting spore group	-.566	-.121	-.052	-.144	.153	.096	.321	-.207	-.620	-.142
Coscinodiscus #1	.020	-.051	.447	.286	.411	-.061	.024	-.127	-.039	.042
Coscinodiscus africanus/ C. tabularis	.329	-.132	.018	.254	.568	-.030	.076	-.044	.026	.094
Coscinodiscus lineatus	.077	-.029	-.027	-.009	-.103	.022	-.038	-.048	-.050	-.554
Coscinodiscus lineatus v. plicata	-.037	.007	-.022	-.032	.015	.080	.003	-.140	-.106	-.100
Coscinodiscus nodulifer/ C. radiatus	.678	-.122	-.023	-.071	.079	-.157	-.088	.422	.135	-.038
Coscinodiscus obscurus/ C. perforatus	-.068	.029	.052	-.139	.001	-.018	.056	-.057	.578	.033
Coscinodiscus oculus-iridis	.055	.034	-.011	.742	-.024	-.009	-.041	-.027	.012	.008
Coscinodiscus symbolophorus	-.034	.053	.058	-.093	.302	-.078	.040	.180	.156	-.025
Cyclotella striata/ stylorum	-.250	-.212	-.167	.116	.093	-.105	-.074	-.037	.715	-.126
Delphineis spp.	-.035	.120	-.073	-.126	-.250	-.080	-.146	-.140	.226	-.900
Hemidiscus cuneiformis	.064	.009	.188	-.084	-.131	.023	-.129	.658	-.096	.097
Nitzschia bicapitata	.083	-.027	.009	-.051	-.058	.921	-.056	.084	.051	.080
Nitzschia interrupta	.049	-.062	-.024	-.024	.048	.594	.062	.118	-.080	.026
Nitzschia marina	.922	.001	-.108	-.098	-.038	.298	-.061	.024	-.072	.030
Nitzschia seriata	-.011	-.013	.002	.022	-.025	.572	-.002	-.020	-.073	-.110
Paralia sulcata	-.074	.102	.009	-.184	-.204	-.022	-.093	-.153	.045	.270
Pleurosigma spp.	-.145	-.150	-.116	.255	-.030	-.078	-.197	-.172	.018	.192
Pseudoeunotia doliolus	.778	-.119	.035	.469	.174	.049	-.106	.073	-.090	.063
Rhizosolenia alata	-.047	-.096	.427	.227	-.056	-.037	.192	.169	-.110	.048
Rhizosolenia bergonii	.593	-.182	.047	-.062	-.039	.139	-.173	.489	-.222	.099
Rhizosolenia styliformis	.076	-.087	.538	.205	.051	.258	.271	.372	-.032	.032
Roperia tesselata	.018	-.176	.126	.858	.206	-.025	.138	-.092	-.086	.011
Skeletonema costatum	-.099	-.050	-.013	-.011	.065	.031	.717	-.150	-.093	.028
Stephanopyxis palmeriana/ S. turris	-.106	.844	-.061	-.001	-.194	-.041	-.170	-.136	-.000	-.045
Thalassionema nitzschioides	.142	-.407	.041	.057	-.347	.366	-.268	.292	.208	.167
Thalassionema nitzschioides v. parva	.672	-.141	.112	.015	-.068	.119	-.090	.319	-.149	-.012
Thalassiosira A&B	.021	.559	-.043	-.140	.130	-.069	.061	.233	-.024	.162
Thalassiosira eccentrica group	-.086	.602	.023	.005	-.234	-.018	-.115	-.264	-.090	-.145
Thalassiosira lineata	.042	-.095	.785	-.089	-.110	.046	-.102	.018	-.077	.107
Thalassiosira oestrupii	-.019	.776	.002	-.034	-.127	.038	.152	.283	-.079	.060
Thalassiosira plicata	-.124	-.118	-.011	.090	.022	-.043	.134	-.284	-.199	.038
Thalassiothrix spp.	.213	-.053	.059	.275	-.024	.200	-.116	.676	-.056	.009
Variance (% of that explained by the 10 factors)	25.0	14.4	11.6	10.1	8.9	6.8	6.5	6.2	5.5	5.0
Cumulative Variance	25.0	39.4	51.0	61.0	69.9	76.7	83.3	89.5	95.0	100.0

Table VI. Factor Score Matrix (R-Mode).

	Factors									
Station #	1	2	3	4	5	6	7	8	9	10
4	56.0	16.7	28.3	24.8	-12.5	-9.5	-32.3	53.0	99.0	17.7
5	9.4	7.6	4.5	3.4	-1.9	-2.1	-5.5	11.0	22.9	4.1
8	16.9	5.0	9.1	6.7	-4.1	-3.2	-10.8	19.2	38.3	5.8
20	7.6	0.7	0.5	0.4	0.0	-0.7	-1.5	1.5	5.0	0.8
21	8.3	1.5	2.0	1.4	-1.8	-1.8	-2.7	5.3	11.8	0.7
22	6.2	1.4	2.0	1.2	-1.1	-2.0	-4.9	8.5	18.4	1.4
23	-8.5	-2.7	-4.0	-3.5	0.8	1.2	4.5	-8.0	-18.6	-5.6
24	-38.0	-12.6	-19.6	-15.5	8.2	6.2	21.0	-34.6	-86.1	-12.0
25	62.9	18.6	31.3	26.6	-13.1	-10.5	-34.3	57.6	99.0	18.0
26	34.6	9.0	18.8	17.5	-9.8	-5.5	-18.3	30.0	77.2	5.6
28	-30.6	-8.2	-16.1	-14.4	7.3	4.8	16.8	-27.4	-64.6	-7.6
30	99.0	29.4	55.1	47.6	-26.3	-17.0	-62.0	97.6	99.0	29.6
41	-99.0	-30.7	-54.7	-47.7	22.4	17.6	61.3	-99.0	-99.0	-30.8
45	1.4	-1.9	1.4	1.4	-1.7	-0.3	-1.1	1.1	1.6	-1.3
46	57.0	17.6	27.7	23.6	-8.5	-9.5	-33.0	52.1	99.0	17.1
55	62.4	19.7	31.2	26.8	-12.3	-10.2	-34.4	59.0	99.0	18.9
59	42.9	16.4	21.2	18.0	-7.0	-7.5	-26.1	41.8	99.0	13.3
60	13.1	7.2	7.0	5.9	-4.3	-2.2	-8.0	11.2	29.0	2.0
62	25.4	6.7	11.7	9.4	-6.2	-3.8	-14.1	21.3	54.4	4.9
63	-41.8	-12.7	-20.9	-16.2	9.0	6.8	24.0	-37.6	-94.2	-11.9
74	-57.3	-16.7	-29.8	-25.0	13.5	9.8	31.7	-52.8	-99.0	-17.4
75	86.6	24.5	45.0	38.4	-19.6	-13.8	-49.3	81.6	99.0	24.9
77	13.9	4.2	6.9	6.1	-2.2	-2.9	-7.3	14.7	31.4	4.2
82	-3.4	-1.0	-1.9	3.3	0.6	0.5	2.0	-3.9	-8.7	-0.8
83	8.1	2.5	9.6	2.5	-1.2	-1.7	-4.7	8.1	18.3	2.4
84	-7.5	-2.5	-3.6	-2.7	3.1	1.0	5.1	-7.9	-17.5	-1.9
91	-99.0	-29.0	-52.7	-46.2	22.9	16.6	55.8	-93.3	-99.0	-25.8
92	-8.0	-2.2	-4.5	-3.9	0.3	1.2	3.7	-9.2	-18.4	-0.6
104	40.3	11.6	20.8	18.5	-6.4	-6.4	23.0	37.1	91.4	11.6
105	59.4	17.7	29.3	25.2	-12.9	-10.1	-33.0	55.5	99.0	16.7
33+34	-16.7	-4.8	-8.4	-6.9	2.7	2.6	14.7	-15.7	-38.0	-4.2
35+36	35.3	8.9	17.4	14.5	-7.8	-7.4	-21.1	34.8	80.5	11.3
37+38	22.0	6.9	12.0	10.6	-5.9	-4.8	-13.8	21.4	53.8	9.6
39+40	-34.4	-9.9	-18.3	-15.2	6.7	6.0	18.8	-34.9	-80.8	-9.1
43+44	31.4	10.0	15.2	13.7	-5.9	-4.4	-18.8	30.5	72.2	7.3
48+49	80.3	23.6	40.3	33.5	-16.4	-14.6	-45.5	76.4	99.0	24.5
50+51	-18.2	-5.5	-6.9	-6.9	5.2	3.4	10.4	-18.2	-40.6	-6.1
54+56+57	-99.0	-57.6	-98.1	-83.7	41.7	31.5	99.0	-99.0	-99.0	-54.1
64+65+66	-37.7	-11.4	-17.9	-15.0	7.6	6.5	21.3	-35.7	-84.4	-12.2
85-88	-0.2	0.0	-0.1	-0.2	0.1	0.5	0.0	-0.9	-0.7	-0.7
95-101+103	-28.2	-8.8	-13.4	-11.4	5.3	4.1	16.9	-27.2	-64.5	-7.8
89+90	-5.8	-2.7	-1.6	-2.8	-1.1	0.8	3.0	-7.7	-13.8	-1.3
93+94	-0.3	-0.3	-0.3	-0.3	0.8	0.3	0.8	0.1	-0.0	-0.3
9+10	0.8	-0.2	0.1	0.9	-0.4	0.4	0.1	1.2	-2.4	0.3
6+7	0.6	-0.2	0.1	-0.3	-0.4	6.2	-0.4	0.6	0.3	0.5
69+72	-99.0	-30.8	-52.1	-43.5	22.8	16.3	57.3	-95.1	-99.0	-28.7