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Biological, Physical, And Chemical Data From Gulf of Mexico Core PE0305-GC1

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Introduction

This paper presents benthic foraminiferal census data, and magnetic susceptibility, ^{210}Pb , radiocarbon, and geochemical measurements from gravity core PE0305-GC1 (=GC1). Core GC1 was collected from the Louisiana continental shelf as part of an initiative to investigate the geographic and temporal extent of hypoxia, low-oxygen water, in the Gulf of Mexico. Hypoxia (<1.4 ml/l or <2 ppm oxygen concentration) in Gulf of Mexico waters can eventually lead to death of marine species (Malakoff, 1998). The development of hypoxia off the Mississippi delta has increased steadily since routine and systematic measurements were begun in 1985 and has been linked to the use of fertilizer in the Mississippi basin (Rabalais, 2002). Benthic foraminifers provide a proxy to track the development of hypoxia prior to 1985 (Blackwelder et al., 1996; Sen Gupta et al., 1996). Previous work (Osterman, 2003) determined that the relative occurrence of three low-oxygen-tolerant species is highest in the hypoxia zone (Fig. 1). The cumulative percentage of these three species (% *Pseudononion atlanticum* + % *Epistominella vitrea,* + % *Buliminella morgani* = PEB index of hypoxia) was used to investigate fluctuation in paleohypoxia in four cores, including the upper 60 cm of GC1 (Osterman et al., 2005). In this report, we compile all available data from GC1 as the basis for further publications.

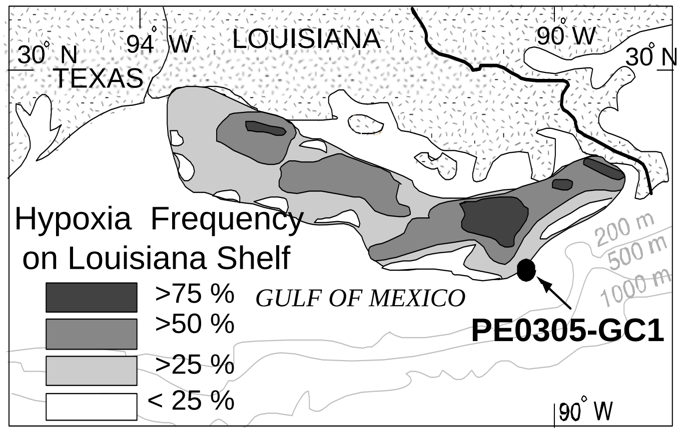

Figure 1. Location map of gravity core GC1 showing the frequency of hypoxia measured at a grid of stations since 1985 by N. Rabalais; taken from CENR (2000).

Methods and Results

Gravity core GC1 was collected at 47 mwd (meters water depth) on the Louisiana continental shelf during R/V *Pelican* cruise PE-03-05 (July 2002). The core was sectioned (at 60 and 120 cm), refrigerated, and transported to Reston, VA. X-radiographs were obtained on the whole core at the Maryland Geological Survey in Baltimore, MD. Digital scans of the x-radiographs are found in Appendix 1.

Whole-core magnetic susceptibility (MS) was measured on GC1 using the Bartington system with an 8-cm loop diameter. The meter was set on cgs (centimeters/gram/second), 0.1 (7 seconds/measurement) scale and later converted to SI (Systeme Internationale). Background measurements were taken before and after the measurement of each of the three core sections. Because of unreliable measurements near the ends of the core sections, the values from the top and bottom 4 cm of each section were discarded. The MS values are reported in Table 1.

Table 1. Measurement of magnetic susceptibility in Gravity core PE0305-GC1.

depth (cm)	MS value		depth (cm)	MS value
4	203.575		80	316.673
5	213.628		81	327.982
6	218.655		82	331.752
7	222.425		83	334.265
8	221.168		84	335.522
9	219.911		85	344.319
10	218.655		86	363.168
11	216.142		87	382.018
12	214.885		88	388.301
13	211.115		89	387.044
14	209.858		90	376.991
15	207.345		91	371.965
16	208.602		92	368.195
17	212.372		93	368.195
18	214.885		94	374.478
19	217.398		95	389.557
20	218.655		96	431.027
21	218.655		97	466.212
22	218.655		98	443.593
23	219.911		99	382.018
24	221.168		100	346.832
25	213.628		101	327.982
26	224.938		102	319.186
27	224.938		103	311.646
28	224.938		104	314.159
29	222.425		105	319.186
30	224.938		106	324.212
31	228.708		107	326.726
32	233.734		108	326.726
33	237.504		109	327.982
34	241.274		110	329.239
35	242.531		111	330.496
36	242.531		112	330.496
37	241.274		113	327.982
38	242.531		114	325.469
39	251.327		115	324.212
40	262.637		116	319.186
41	267.664		117	311.646
42	256.354		124	304.106
43	246.301		125	314.159
44	241.274		126	317.929
45	242.531		127	321.699
46	245.044		128	327.982
47	251.327		129	334.265
48	256.354		130	349.345
49	261.381		131	376.991
50	267.664		132	407.150
51	266.407		133	437.310
52	257.611		134	448.619
53	241.274		135	412.177
54	237.504		136	370.708
55	234.991		137	348.088
56	231.221		138	336.779
62	234.991		139	330.496
63	247.558		140	317.929
64	248.814		141	309.133
65	248.814		142	299.080
66	246.301		143	296.566
67	247.558		144	295.310
68	248.814		145	295.310
69	252.584		146	294.053
70	256.354		147	292.796
71	262.637		148	290.283
72	270.177		149	287.770
73	272.690		150	285.257
74	277.717		151	285.257
75	282.743		152	281.487
76	286.513		153	277.717
77	290.283		154	276.460
78	295.310		155	277.717
79	306.619		156	280.230
			157	281.487
			158	281.487
			159	282.743
			160	284.000
			161	281.487
			162	272.690

The core was split in half longitudinally. One half was sampled and processed for foraminifers in the U.S. Geological Survey (USGS) Foraminiferal Research Laboratory in Reston, VA, in the fall of 2002. The samples for faunal analyses were soaked in a dilute calgon solution and agitated for 30 minutes to assist in disaggregation, then wet sieved at 63 µm. The washed residue was oven dried at $\leq 50°$ C, then dry sieved at 125 µm. The samples were not dried prior to the wet-sieving process; the calculated dry weights were obtained by measuring the moisture content in a small subsample of each sample and are presented in Table 2.

Samples contained few to abundant benthic foraminifera (3 to 603 foraminifers/gram). When necessary, a representative subsample of approximately 300 specimens was obtained for faunal analysis with a microsplitter (Table 2). Benthic foraminifers were hand picked from the >125-µm faunal split and placed on standard 60-square micropaleontological slides to be sorted by species. Identification of the benthic foraminifer species was made using standard literature, including the taxonomy of Loeblich and Tappan (1988, 1994), Phleger and Parker (1951), Parker (1954), Bandy (1954), Anderson (1961), Murray (1971, 2000), Bock et al. (1971), Poag (1981), and Morkhoven et al. (1986).

Table 2 records the number of specimens that were counted in each sample. Most specimens were identified to the species level. However, rare species may be grouped with other foraminifers of the same taxonomic level; by family (e.g., Nodosariidae spp.), or by genera (e.g., *Pyrgo* spp.). See Appendix 2 for more information on all identified species and on the groups of rare species. In addition, the number of planktonic foraminifers, ostracods, the *Ammonia Elphidium* (AE) Index (Sen Gupta et al., 1996), and the PEB Index (Osterman, 2003) are also reported in Table 2.

TABLE 2 BENTHIC FORAMINIFERAL COUNTS OF PE0305-GC1

sample depth	dry sample wt.	% sample examined	Total Calc. & Agglut.	Total Agglutinated	Total species in split	Planktonics in split	Ostracods in split	N of foraminifers per gram	AE INDEX	PEB INDEX	Ammotium salsum	Bigeneria irregularis	Haplophragmoides bradyi	Lagenammina difflugiformis	Miliammina horrida	Pseudoclavulina mexicana	Reophax ovicilus	Reophanus scorpiurus	Reophax spp.	Textularia candeina	Textularia mayori	Ammonia parkinsoniana	Amphicoryne hirsuta	Bolivina subspinensis	Brizalina barbata	Brizalina striatula f. spinata	B. subaeariensis v. mexicana	Brizalina transluscens	Buccella hanni	Bulimina marginata	Buliminella morgani	Cancris auriculus
0	13	6.25	478	76	31	39	8	603.2	46.03	36.19	3	14		50		1			1		7	29		2				2		6	6	16
0.5	8	18.75	611	133	31	53	4	435.7	41.25	29.95	3	36		64							20	33		1			1	3		7	5	24
1.5	8	12.5	425	96	31	23	2	438.1	42.59	28.24	8	27	1	53							7	23		1				2		1	3	7
2.5	9	25	454	113	30	27	9	209.2	32.84	23.79	3	31		56				4			9	22		2						3	7	15
3.5	9	12.5	408	101	30	49	4	353.2	33.93	29.17	1	28		51	2			1			8	19						1		2	8	19
4.5	8	12.5	394	89	27	27	7	374.3	31.88	29.19	1	34		35	1						8	22						1		1	5	10
5.5	7	12.5	353	100	30	40	2	381.6	55.56	19.26	3	27	1	57	2			2			8	25		1	1	2		1			6	20
6.5	6	12.5	423	135	30	36	5	543.2	58.93	22.46	5	27	1	82				2			18	33		1						1	3	8
7.5	7	12.5	403	98	34	37	5	467.9	51.02	22.58	8	17		62	1						10	25		1	1	1				3	3	16
8.5	7	12.5	364	94	28	29	5	404.4	38.89	21.15	4	25		52	3			2			8	21		1				1		2	1	12
9.5	10	12.5	584	130	37	67	6	458.5	42.42	24.49	6	36		71	1			3			13	28	1	1				3		7	8	32
10.5	7	12.5	276	64	32	25	3	307.5	21.43	23.19	5	22		25	1			1			10	6	1			2		3			7	15
11.2	9	25	562	143	38	89	13	251.2	33.33	17.08	7	42	1	71	1						21	24				2	1			2	2	31
12.5	6	37.5	403	115	26	57	3	182.8	27.42	17.37	8	37	2	46	3			2			17	17								2		13
13.5	10	12.5	444	130	37	86	6	343.9	32.08	14.41	8	38		59	1					1	23	17	1	2		3				3	1	13
14.5	10	25	292	74	38	33	3	117	24.00	9.25	3	39		21			1	1	1		8	12		1				2	1	5		
15.5	8	25	476	117	35	67	6	228.6	33.33	14.71	6	39		49	3		2				18	22							1	2	1	26
16.5	7	12.5	380	99	33	72	2	409.7	35.71	12.63	4	32		50							13	15	1	1	1					4		28
17.5	8	25	629	180	38	##	10	298.8	23.23	13.04	9	58		71	10		2			1	29	23	1	2	1	2	1		2	2	4	29
18.5	8	12.5	407	103	38	69	6	411.6	32.86	9.83	9	47		20	4	1	2	1			19	23	1	1						3	1	19
19.5	8	12.5	595	167	42	83	12	564.7	21.69	16.30	6	58	1	71	5		1	7			18	18		2			1	3	2	4	6	25
20.5	7	12.5	322	90	30	50	6	362.3	23.08	15.53	5	28		45	1						11	12		1		1	1			4	1	13
21.5	9	12.5	406	91	30	65	11	375.1	26.67	14.04	7	38	1	33	1						11	20						1		2		20
22.5	7	12.5	508	122	33	43	12	625.2	34.92	18.50	3	42		37	1			2			27	22	1	1							3	27
23.5	8	12.5	328	88	29	47	2	349.4	46.43	14.33	2	39		30	2						15	26				1			1	2		11
24.5	8	12.5	296	83	26	31	12	292	21.05	16.22	6	33		28	2			1			13	8			1			1		4		13
25.5	7	25	345	97	30	41	5	209.1	27.59	14.20	6	33	1	32	3			4			18	16		1			1			4		12
26.5	10	25	557	153	37	##	5	221.7	33.75	9.16	6	73		37	4	1		3		1	28	27		4				3		3		36
27.5	11	12.5	373	95	35	53	6	278.4	29.85	10.72	5	37		25	4			1			23	20			1	1					1	17
28.5	10	25	308	81	31	51	7	125.7	27.66	11.04	4	32		22	3						20	13		1	1					2		24
29.5	6	50	435	111	35	74	13	140.3	22.78	5.52	1	59		20	4	1				1	25	18	1						1	2		35
30.5	10	100	459	153	40	83	7	47.7	28.13	6.10	6	58	1	43	7	4					34	18		2	1			1		2		16
31.5	7	100	680	187	40	8	32	92.8	37.27	9.26	5	86		58	2			3			33	41	1	1	1	4		1	1	1	1	31
32.5	5	100	490	144	33	11	32	91.8	37.18	10.20	6	75		40				1		3	19	29		1		1		1			2	28
33.5	ND	75	424	124	33	31	10	ND	40.00	8.96	9	52		41	2	1					19	22			1			2			1	16
34.5	ND	50	410	98	28	9	15	ND	51.65	18.29	1	44		41		1					11	47		1			1			4	2	16
35.5	11	50	363	66	28	34	15	68.4	54.29	19.01		42		10	4						10	38							1		1	30
36.5	8	100	68	19	21	7	2	8.5	30.00	10.29	3	8		3	1						4	3								1		4
37.5	10	100	137	33	22	17	5	14.2	27.27	8.03	1	12	1	6						1	12	6										8
38.5	11	100	518	116	39	96	26	47.1	25.61	8.30	2	67		15	6	1	1			2	22	21		1	1		1			2		47
39.5	8	75	409	122	30	70	13	72.3	38.36	5.62	10	64		15	1					2	30	28		1						2		18
40.5	5	100	233	49	23	24	4	15.5	25.64	6.31		23		14	3					1	8	10										25
41.5	11	100	523	89	34	42	36	46.6	33.33	13.77		57		3	4					7	18	29			1			3			1	70
42.5	9	100	523	112	29	58	27	56.5	47.54	13.77	1	60		7	4					8	32	29						2				64
43.5	11	100	500	113	27	58	19	47.3	36.78	14.80	5	70		1	7					2	28	32										56
44.5	8	100	496	105	31	50	30	63.5	46.99	10.28	1	75		2	6					3	18	39								1	1	58
45.5	13	50	355	76	29	30	21	52.9	46.67	13.24	1	51		1	5					2	16	21										43
46.5	12	75	485	111	29	33	27	54.8	49.18	9.48		68		8	4						31	30										57
47.5	14	75	596	131	30	64	37	58.3	42.35	13.76	2	91		4	4					1	29	36			1			6				64
48.5	10	75	464	98	29	44	26	63.7	52.08	15.73		65		3	9					1	20	25										70
49.5	11	75	599	119	31	81	43	70.3	53.33	13.36		76		6	8					1	28	32		1				1		1		90
50.5	9	50	556	69	36	59	93	126.4	54.29	18.88		43	1	4	4					1	16	19			1	2			1		3	##
51.5	13	25	640	89	35	56	55	204.3	50.79	19.69		53		6	3						27	32		1				6			3	85
52.5	16	50	678	176	35	49	48	83.3	53.85	11.95	5	85		18	3					5	60	35						2				53
53.5	10	100	689	152	34	70	37	70.3	48.11	12.34	5	64		33	18					6	26	51			2	1		1		1		52
54.5	12	100	494	127	37	66	29	40.9	51.79	10.53		65	1	20	14					2	25	29		1		1		1		2		41
55.5	11	100	549	110	36	61	53	50.8	48.33	15.48	1	66		10	9						24	29		2		2					2	49
56.5	8	100	478	94	37	50	30	62.2	61.82	13.81	1	55		12	4						22	34				1			1			52
57.5	8	100	348	79	29	40	19	45	44.12	13.51	1	44		7	4				1	5	17	15				1						32
58.5	13	100	436	79	30	29	42	34.4	57.14	12.84		42		7	6						24	36										39
59.5	15	100	612	125	32	47	70	41.5	34.78	18.95		71		6	3					3	42	24		2	1	1		5			1	64
60.5	13	100	394	75	27	24	17	30.1	35.19	13.20		42		5	6						22	19		1				3	1		1	31
61.5	12	100	296	50	30	44	18	24.7	95.00	10.14		30			3						17	19		2				5		1	1	24
62.5	9	100	529	122	29	54	33	57.4	46.58	15.50	2	64		12	4						40	34						2		1	6	41
63.5	11	100	406	102	27	47	20	38.3	42.86	8.37	2	51		7	10						32	27						1				30
64.5	11	100	405	118	30	45	15	37.4	54.17	7.16		71	1	10	3					5	28	26						3				33
65.5	11	100	398	107	31	36	30	36.2	57.78	6.78	1	58	1	7	8					6	26	26						2				34
66.5	9	100	337	91	27	27	16	36.1	57.45	5.64	3	51		5	9					1	22	27								1		23
67.5	8	100	236	72	22	26	14	28	43.75	7.63		54			3					1	14	21										22
68.5	11	100	226	57	18	28	5	21.2	39.58	8.41		35									22	19			1			3				10
69.5	11	100	255	62	19	20	18	24.1	53.19	8.63		39		1	4						18	25		1				2				18
70.5	10	100	230	72	24	21	4	23.1	39.02	5.22	1	45			7						19	16						1				12
71.5	13	100	184	40	17	19	3	14.1	41.86	8.70		26			4						10	18										5
72.5	14	100	346	114	24	28	13	24.4	39.76	7.80		71		1	7						35	33						2				16
73.5	9	100	216	49	23	22	4	24.9	36.67	12.96		30			5						14	22						1				16
74.5	11	100	264	52	25	22	11	24	28.36	14.77		30			5						17	19						2		1		12
75.5	9	100	190	47	16	24	8	20.7	24.00	11.58		23			5						19	12									1	6
76.5	9	100	290	93	25	29	15	30.7	36.07	11.03		60			5						28	22						1			1	11
77.5	12	100	334	95	19	31	11	27.7	44.09	9.88		58			9						28	41						2				16
78.5	12	100	365	109	22	31	8	30.1	32.67	7.40		67			6						36	33						1		1		17
79.5	9	100	370	125	19	27	22	40.2	45.10	6.76		85		1	8					1	30	46										21
80.5	12	50	560	156	21	26	13	97.1	24.27	3.93		80			12					6	58	50						1				18
81.5	10	50	443	132	17	18	7	87.2	23.95	4.06		69			15						48	40										6

sample depth	Cassidulina curvata	Cassidulina reniforme	Cibicidoides mundulus	Cibicidoides pachyderma	Cornuspira planorbis	Dentalina spp.	Elphidium discoidale	Elphidium spp.	Epistominella vitrea	Eponides antillarium	Fursenkoina pontoni	Fursenkoina spp.	Gavelinopsis translucens	Glandulina laevigata	Globocassidulina subglobosa	Hanzawai concentrica	Lenticulina calcur	Marginulina spp.	Miliolinella fichteliana	Neolenticulina peregrina	Nodosaria spp.	Nodosariidae spp.	Orodorsalis umbonatus	Other Calcareous	Other milliolids
0						1	34		18		6					55	2	2			1	6			
0.5							47		21	1	11			1		80	3				3	10			
1.5				1			31	1	21		11					50					2	7		1	
2.5		2		3		3	45		16	1	6					54	2				1	4			
3.5		1		1			37		15		7					38	2					5			
4.5						1	47		18		10	2				36				1		8			
5.5				4		2	20		3		4					44	4	1				4			
6.5		1		4		2	23		10	1	4					57	1					3			
7.5			1				24		13	4	9					53	1			1		3	1		1
8.5						1	33		8		4					53	1	1				4			
9.5				1		1	38		21	2	19		1			63	1					9	1	2	
10.5		1		1		2	22	3	10		15		1			27				1		4			
11.2		3	1	4			48	1	5		8	1	2			84	2	1				7			
12.5				5			45		2		4				1	60	2					3			
13.5		1		2		2	36		11	1	10		1			78	3	1			1	5			
14.5		1	1	9		3	38		2	1	2		1			49	2					6		1	
15.5			1	2		2	44		5	2	12		11			63	4					3			
16.5				5		3	27	1	3	1	12		4			45	3					2			
17.5				3		3	76		7	3	11					108	2			3		3		2	
18.5				5		1	47	1	4	1	10		1			71	2					2	1		
19.5		1	1	5		3	65		8	3	18		2			84	1			1	1	4	1		
20.5				2		1	40		4	2	4					49						3		1	
21.5			1	5		1	55		2		11					66	1					1	2		
22.5			3	4		3	41	2	10	1	7				1	87		2				3			
23.5			1				30		1	1	5		2			62	2			1		2			
24.5			1				30		2	1	4					55						1			
25.5						2	42	1	3		5					48		2				1			
26.5			2	3		5	53	3	3	1	7		2			107	3					3	1		
27.5				4			47	1	3	2	5		1			61				1		5	1	2	
28.5			1	2		1	34		3	1	6		1			54	4					2			
29.5				7		1	61		2	1	7		1	1		68	4	1				2			
30.5				3		1	46		3	2	11	1	1			64	2	1			1	3			
31.5				9		4	69	1	1	2	13		1			101	3			1		6	1		
32.5				4		2	49		3	1	11		4			78						2			
33.5				2		1	33		1	5	9		1			84	4	1	1			1			
34.5							44		17	3	14		1			39						2			
35.5				2			32	1	17		13		2			32	1	1				2			
36.5						1	7			1	3					10									
37.5				4		1	16		2							32	1								
38.5		1		12		1	61		2	1	14		1			90	2	1				1	1	1	
39.5				10		4	45		1	3	3					74	4	2			2				
40.5						2	29		3	4	3		2			39						2		1	
41.5						2	58		4		12		7			91				3		6			1
42.5						2	32		6		9		8		1	91						2	1		
43.5						1	55		1		4		1		1	85				1		5			
44.5						1	44		4		10		2			86					1	4			
45.5					1	2	24		2		7		6			49				1		1	1	1	
46.5	1					1	31			1	11		3			93						5		2	1
47.5		1					49	1	11		16		9			72				1		5		1	
48.5				1			23		5		7		1	1		69				1		1			
49.5						4	28		9	1	15		9			92				1					2
50.5		1				4	16	1	11		15		16			47				4		7		3	1
51.5					1	2	31		17		21		9	1		74				3		4		3	1
52.5		2				5	30	1	6		16		10			144			1	3		5	1		1
53.5		2		2		9	55		1	2	9		3			150	3					2		1	
54.5					1		27	1	3		15		6		1	93						4			
55.5						2	31	2	6		8		11			123			1			2			1
56.5						2	21		4	1	20		1			92	1		2	3		5		1	1
57.5							19		1	4	9		7			61						6			
58.5				1		2	27	2	4		17		1			97				1		3		1	2
59.5							45	2	11		18					117	1					12			
60.5						1	35		10		14	1				83						5			
61.5		4				4	1	1	9		6					77	1					3		5	
62.5				3			39		13		3		5			105									
63.5				2		2	36		5				3	1		88	1	1				5			
64.5				2		3	22		10				3			89	1	1	2	1		3			
65.5				1		3	19	1	2		1		2			96		1				4			
66.5						1	20						2			65		2				2			1
67.5						1	27		2		2		1			39			2						
68.5		2				2	29		6		1					47									
69.5						2	22		7							57									
70.5		1		1		1	25	1	4		1					49									
71.5						1	25				1					49	1								1
72.5		1				1	50	1	4		1					57	1					1			
73.5							38	2	13		1					36				2		1			
74.5		4					48		25		3		1			40	2		2			1			
75.5		1				1	38		8							44									
76.5					1	2	39	2	9		3		2			41						2			
77.5						2	52	4	9							45			1						
78.5						1	68		6		1	1	1			55		1		1		2			
79.5		1					56						9			39									
80.5						1	156		1				1			94	1	1							
81.5						1	127				2		1			59	1								

sample depth	Planulina spp.	Pseudononion atlanticum	Pseudonosaria comatula	Pyrgo nasutus	Pyrgo murrhina	Pyrgo williamsoni	Quinqueloculina bicarinata	Quinqueloculina compta	Quinqueloculina dimidiata	Rectobolivina advena	Reussella spinulosa	Rosalina suezensis	Saracenaria spp.	Siphonina pulchra	Spirolaccamina spp.	Trifarina bella	Triloculina tegminus	Uvigerina peregrina	Valvulina laevigata
0		149		1			2	1		4	36			1		5		17	
0.5		157					1	1		4	28			1		13	1	21	
1.5		96					4			5	38					10	1	13	
2.5		85		1			6			9	33			1	1	9		10	
3.5		96	1		1		4			3	23			1		6		17	
4.5		92		2			3			7	27		1			4		7	
5.5		59					4			4	22	1				13		8	
6.5	1	82		1			5				25	1	2			11	1	7	
7.5	1	75		1			3		1	1	35					15	1	11	
8.5	1	68		1			3			4	29			1		9		11	
9.5	3	114		5			8		2	6	46					16		15	
10.5		47		1			3	1	1	4	20					7		7	
11.2	5	89		3			7		4	3	53		1	1		10		14	
12.5	2	68		1			6			6	34					10		7	
13.5	3	52		2			7			3	28		1	1		11		14	
14.5	4	25		1			6				29	1	2	1		5	1	6	
15.5	3	64		1			8	3		5	46	1	2	2		8		15	
16.5	5	45	1	3			4	1		6	33					10	1	16	
17.5	8	71			1		13			1	37			1		12		17	
18.5	2	35		2		1	10			2	40			1		4		12	1
19.5	8	83		4			7			6	40	2				8		11	
20.5	2	45					4	1			26	1		2		7		5	
21.5	4	55	1				6	1		2	45			3		4		6	
22.5	5	81		4			5			2	51			2		6		12	
23.5	6	46		2			4			2	21					2		9	
24.5	6	46					6		1	2	19					5		7	
25.5	4	46					5	1		1	25	2		1		7		18	
26.5	4	48		1			12		2		36	2	2			8		23	
27.5	3	36		1		1	11			4	27	2		3		5		12	
28.5		31	1	2			7	1		1	21	2				2		9	
29.5	5	22		2			16	1		5	32	4				6	1	17	
30.5	3	25	3	1		2	34		1	2	24	7	1			5	1	18	
31.5	4	61		3			25			4	36	7				8	1	48	1
32.5		45				2	16	2	1	2	26	10	1			5		20	
33.5	3	36		1			14			3	26	5		1		7		19	
34.5	3	56		1			5	6			13	9				6	2	20	
35.5		51		2			22		3		10	5		2		3		26	
36.5	1	7					1				3	1		1			1	4	
37.5		9		1	1	8					9	2	1					3	
38.5	2	41		4			16	2		2	39	2				9	1	22	
39.5	3	22		3			12			1	27		1			7	3	11	
40.5	2	35				1	4				7	2				1	2	10	
41.5		67		9		9	28	1		5	4	2		3		2	5	11	
42.5		66		10		4	35			6	9	15	1	2			6	10	
43.5		73		1	2		37			3	8	2	1	2				16	
44.5		46		9	1	3	40	6		5	10	8		2			4	6	
45.5		45		6		3	30		5	4	11	3	1					12	
46.5		46		7		6	37		7	6	10	6		2		1		10	
47.5		71		14		10	32	7	6	11	14	8		1				18	
48.5		68		12	1	4	27	2	6	7	5	6	2			1		21	
49.5		71		13	2	8	34		6	7	9	5	3					36	
50.5		91		26		13	24	7		4	4	11		2				30	
51.5		106		23		23	43	2	3	6	9	8	5			2		27	
52.5	1	75		11		8	46	1		6	9	3	2	1		3	2	19	
53.5		84		9		1	37	1		6	18	4	1			2	2	25	
54.5		49		9	1	4	23	6		6	13	5	1		1	1	3	19	
55.5		77		11	2	8	33	5		2	7	1	2			2	1	17	
56.5		62		6	1		22	7		9	12	5	2			3	3	10	
57.5		46		7			27	4		7	3		4			3	6	7	
58.5		52		7			25	4		7	4	5	3				2	15	
59.5	1	104		4	1		21	4		3	9	10				3	3	20	
60.5		41		8		3	46				1					2	1	12	
61.5		20		3			38	3	4			3				2	3	7	
62.5	1	63		5		4	53		2	2	12	4		1		1		7	
63.5		29		5			29			3	6	4				1		25	
64.5		19		1			38	2	2	4	1	2		2				17	
65.5		25		2		1	42			1	3	7		2			6	10	
66.5		19		2	1		43	1		1	3	11				2	2	17	
67.5		16		1	2	1	16			1	1					1		8	
68.5		13		1			22			2	1	1						9	
69.5		15		1			26	1	1		3	7						5	
70.5		8		2		2	22				2			1			2	6	
71.5		16					14	3			5					1		4	
72.5		23		4			16			1	2	2					1	15	
73.5		15		1			8	1			2	4					1	3	
74.5		14					15		1	1	3	7		1				10	
75.5		13					12				4	1						2	
76.5		22		2	1		15	1		3	2	11						4	
77.5		24		2			27			1	4	2						7	
78.5		21					23			2	6	5						10	
79.5		25		2	1	6	25				5	2						7	
80.5		21		1			45			3	8	1						1	
81.5		18				1	47			1	6							1	

TABLE 2 CONTINUED. BENTHIC FORAMINIFERAL COUNTS OF PE03

sample depth	dry sample wt.	% sample examined	Total Calc. & Agglut.	Total Agglutinated	Total species in split	Planktonics in split	Ostracods in split	N of foraminifers per gram	AE INDEX	PEB INDEX	Ammotium salsum	Bigeneria irregularis	Haplophragmoides bradyi	Lagenammina difflugiformis	Milliamina horrida	Pseudoclavulina mexicana	Reophax ovicullus	Reophanus scorpiurus	Reophax spp.	Textularia candeina	Textularia mayori
82.5	10	100	384	108	17	36	7	38.3	25.23	6.77		65			12						31
83.5	12	100	297	61	24	27	10	24.6	27.50	17.17		41			4						16
95.5	9	100	90	24	27	7	16	10.2	60.00	17.78		10			2					1	11
96.5	17	100	209	66	22	21	17	12.4	37.50	22.97		29			15						22
97.5	9	100	146	54	17	4	12	17.1	20.45	6.85		33			2					2	17
98.5	8	100	54	12	17	5	8	6.6	50.00	7.41	1	8		2							1
99.5	12	100	37	10	14	10	6	3.1	33.33	10.81		4			3						3
100.5	10	100	37	10	15	3	5	3.8	60.00	10.81		8		1							1
101.5	11	100	62	15	15	2	14	5.7	44.44	29.03		7			1						7
102.5	9	100	67	8	14	4	14	7.2	44.44	29.85		4									4
103.5	10	50	292	31	24	68	35	57.4	52.94	21.92		29									2
104.5	10	100	876	58	24	56	28	37.2	35.48	17.55		28			9						21
105.5	12	100	661	106	30	46	36	53.7	21.43	32.38		65			9					2	30
106.5	11	100	425	110	28	34	30	38.1	26.56	8.71		49			9					3	49
107.5	11	100	385	118	24	23	14	35	27.66	10.91		56			12						50
108.5	10	100	394	117	23	35	19	40.5	29.69	7.11		54			13					1	49
109.5	10	100	240	70	19	28	14	23.6	28.57	4.58		18			7						45
110.5	12	100	280	89	20	24	13	23.7	32.61	8.21		47			10						32
111.5	10	100	220	69	22	19	14	22.6	44.44	4.55		27			3						39
112.5	12	100	177	73	19	21	12	14.8	41.67	2.82		26			5					1	41
113.5	12	100	202	55	19	10	6	17.3	30.77	2.48		24			8						23
114.5	10	100	179	53	21	17	11	17.3	33.33	6.15		27			11					1	14
115.5	9	100	117	30	17	11	7	12.8	31.58	4.27		10		2	6						12
116.5	11	100	196	65	19	17	22	18.1	37.93	5.61	1	34			12						18
117.5	13	100	196	55	16	13	28	15.1	45.83	5.61		22			10						23
118.5	13	100	237	73	20	25	23	17.6	37.04	5.91		44			10						19
119.5	10	100	118	28	13	13	14	11.4	28.57	2.54		17			1						10
120.5	14	100	526	160	27	41	43	38.4	22.22	11.98	4	79		25	5					1	46
121.5	12	50	257	71	29	18	18	42	24.39	6.23	2	38	1	10						1	19
122.5	13	100	552	145	29	40	52	44.3	16.25	11.59		72	2	34	9					1	27
123.5	10	100	411	116	31	22	29	40.1	24.66	5.11	4	58		13	5					3	33
124.5	12	100	365	84	27	24	8	30	25.00	10.96	3	23		5	13					1	39
125.5	11	100	315	73	22	20	12	28.7	22.62	11.43	1	26		1	12						33
126.5	10	100	345	92	25	16	12	35.9	12.26	6.38		30			11						51
127.5	15	100	366	80	25	19	25	25.2	10.71	11.48		24		2	15						39
128.5	11	100	278	66	23	11	18	24.6	4.90	6.47		19		2	16					1	28
129.5	14	100	234	4	19	3	12	17.3	46.67	58.55		1									3
130.5	13	100	100	9	15		9	7.7	18.18	62.00		9									
131.5	12	100	310	46	24	1	43	26.2	18.18	13.87		37		2							7
132.5	15	100	298	117	27	3	20	19.3	36.14	7.72		77		1	33					1	5
133.5	12	100	296	86	24	21	11	25.3	8.20	10.47		50		3	16						17
134.5	10	100	225	53	22	15	11	21.7	24.39	7.56		33			6						14
135.5	11	100	219	46	21	17	13	20.6	13.95	10.50		24		1	6						15
136.5	12	100	100	31	17	2	15	8.2	8.00	4.00		12		3	1						15
137.5	10	100	409	116	34	29	25	39.8	48.44	13.94	1	49		8	13					2	43
138.5	6	50	497	117	30	27	20	63.9	30.67	14.29	1	55		3	15					2	41
139.5	11	100	506	120	36	22	29	48.3	49.43	16.40	3	52		20	9						36
140.5	3	50	316	85	33	12	17	48.5	32.50	15.82	1	40		12	8						24
141.5	6	50	515	109	35	20	23	65.6	41.57	21.55	3	52		18	2						34
142.5	3	50	437	90	34	29	36	69.2	46.77	25.63	2	31		22	9						26
143.5	4	25	356	53	36	18	16	104.3	6.36	28.93		18		5	6					2	22
144.5	3	25	451	94	34	20	19	141.3	9.51	22.17	4	28		29	7					1	25
145.5	2	25	281	64	35	19	17	90.5	55.56	21.35	5	22			16					2	19
146.5	3	25	392	80	34	15	44	125.3	8.98	25.26	4	20		24	9					1	22
162.5	3	50	423	159	28	11	65	66.5	30.26	11.11		65		32	10			2		2	37
163.5	6	25	340	117	31	28	22	83.9	20.00	18.24	7	38		24	5				1	4	38

sample depth	Ammonia parkinsoniana	Amphicoryne hirsuta	Bolivina subspinensis	Brizalina barbata	Brizalina striatula f. spinata	B. subaeraensis v. mexicana	Brizalina transluscens	Buccella hannai	Bulimina marginata	Buliminella morgani	Cancris auriculus	Cassidulina curvata	Cassidulina reniforme	Cibicidoides mundulus	Cibicidoides pachyderma	Cornuspira planorbis	Dentalina spp.	Elphidium discoidale	Elphidium spp.	Epistominella vitrea	Eponides antillarium	Fursenkoina pontoni	Fursenkoina spp.	Gavelinopsis translucens	Glandulina laevigata	Globocassidulina subglobosa
82.5	28										11							83		1		2				
83.5	11		1				8			1	22		8				1	29		26		3		2		
95.5	6									1	4		1				1	4		2		2		2		
96.5	9						5			2	9							15	1	25						
97.5	9										3						1	35		1		1				
98.5	7										1							7								
99.5	1									1	2							2								
100.5	3										2							2		1						
101.5	4										3							5		2						
102.5	4										6							5						2		
103.5	9				1						53		1				1	8		3		2		10		
104.5	11									1	87							20		1		1		4		
105.5	12		4	1	1		39			21	29		20				1	44	10	122		13		5		
106.5	17									1	29						1	47		2		2		6		
107.5	13								1		19						1	34	2	2		2		2		
108.5	19						1		1		25						1	45		1		2		1		
109.5	12			1							7							30				1			1	
110.5	15										14						1	31		1				1		
111.5	16			1		1					7		2					20		2						
112.5	5										2		1					7						2		
113.5	8										10		1				1	18						1		
114.5	7										9						1	14				1		3		
115.5	6						1				14							13				1				
116.5	11										14						1	18				2		2		
117.5	11										12							13						3		
118.5	10										15		1				1	17		1				4		
119.5	8										6							20						1		
120.5	14		1		1		4			3	20		2			3	2	49		25		2		10		
121.5	10		1				2		2	2	22						1	31		6		2		10		
122.5	13			1			1			2	26		4					67		15		7		14		
123.5	18										19						3	55		7		9		10		
124.5	24								3	4	8						1	72		8		1		1		
125.5	19										20							65		5		1		2		
126.5	13						3		2		10						1	93		6		4		6		
127.5	12						2		3	2	6							100	2	16		4		9		
128.5	5									1	2							97		6				6		
129.5	7						22			54	1							8	23	55				1		
130.5	2						6				16							9	1	33						
131.5	10				18		3			1	15	6						45		16		1				
132.5	30				1		1	1	1	1	2		1					53		12		1		1		
133.5	5									6	10						1	56		8		1		1		
134.5	10		1								7						1	31		3		3		1		
135.5	6						1			2	6				1			37		5				2		
136.5	2							1			2						1	23								
137.5	31								1	2	17		1				1	33		5		4		5		
138.5	23				1		2			5	13						1	52		20		2		5		
139.5	43		2		2		2			5	19		1				5	44	1	15		2	2	7		
140.5	13									1	20		1		1		2	27		12		4	1	3		
141.5	37				2			3	1	9	13		3					52		20		6	2	5		
142.5	29		1		2					20	19						2	33	2	29		3	1	1	1	
143.5	20		1		2		4			6	12		3		1		3	35	1	40		7	1	4		
144.5	32		1		1		10			5	21		8		2			49		43		4	1	10		
145.5	20				1	1	6		1	5	9		2				3	16	3	25				4		
146.5	23		1		1		11		2	9	18		1					36	7	39		3	1	2		
162.5	23						4		1	1	16						2	53		12		4	1	1		
163.5	11		1				1				14		1				1	44	3	16		1		1		

sample depth	Hanzawai concentrica	Lenticulina calcur	Marginulina spp.	Miliolinella fichteliana	Neolenticulina peregrina	Nodosaria spp.	Nodosariidae spp.	Orodorsalis umbonatus	Other Calcareous	Other miliolids	Planulina spp.	Pseudononion atlanticum	Pseudonosaria comatula	Pyrgo nasutus	Pyrgo murrhina	Pyrgo williamsoni	Quinqueloculina bicarinata	Quinqueloculina compta	Quinqueloculina dimidiata	Rectobolivina advena	Reussella spinulosa	Rosalina suezensis	Saracenaria spp.	Siphonina pulchra	Spirolaccamina spp.	Trifarina bella	Triloculina tegminus	Uvigerina peregrina	Valvulina laevigata
82.5	70	3										25		2			35				7	2					2	5	
83.5	46											24		3			20	3			8	8		1			1	10	
95.5	2	1	1				1					13		5		1	6	2	1	1	1	3						5	
96.5	25						2					21		2		1	11		1	1	3	3						7	
97.5	11											9		1		1	14				5	1							
98.5	8						1			1		4		1			6	1			1	2						2	
99.5	4											3		6			2					1					2	3	
100.5	1						1					3		1			7				1						4	1	
101.5	2						1					16		1			5					2					5	1	
102.5	3											20		2		1	10				1	1						4	
103.5	13		3				2					61		7		12	12		3		9	12				1	16	22	
104.5	35	1					1		1			64		3	1	17	22				7	10				1	10	20	
105.5	57		3		2							71		6			47	5	2	6	5	4						25	
106.5	86	2		1			3			1	1	34		5		2	47	9	3		2	4				1		9	
107.5	71		1		2		3					40		5		1	48	2			2	4						12	
108.5	78	1					1					27		6			40	1			6	8						13	
109.5	54						1					11		4			30	2	1		3	2						10	
110.5	68									2		22		7		1	4				5	4				1	5	9	
111.5	35				1					2		8	1	5		1	30				1	7						10	1
112.5	39						1					5		3			15	3		1		13					1	6	
113.5	49											5		2			32	1		1	2	8					3	5	
114.5	31						1			1		11		4		1	23				1	7					1	10	
115.5	26											5		1		1	8					2				1		8	
116.5	26									1		11		4		1	14	3				9						14	
117.5	42						1					11		5		1	20				1	10						11	
118.5	37		1				2					13		10			17	3			2	17						13	
119.5	25											3		4			16					3						4	
120.5	75											35		14		3	33	3				50						17	
121.5	31						3		1			8		1			19	2	1		1	13					7	10	
122.5	77						2			1		47		7		7	35			1	2	56	2				7	13	
123.5	60	1			3		3			1		14		7		8	34	3			1	31				1	4	3	
124.5	52	2			1							28		7		3	24					31	1			1	1	8	
125.5	53	1										31		9		2	6				2	20	2					3	1
126.5	42	1					1			1		16		10		2	16	2	1			13	4					6	
127.5	35	3					1			2		24		5		2	12	8				25	1					12	
128.5	23	3			1							12		3			11	1			1	16	1				7	16	
129.5							3		2			28					6	4				5					7	1	3
130.5	3								1	2		13														1	1	2	1
131.5	20						1					12		2			79	6	2	1		10					9	3	4
132.5	14						1					10		3		3	24		3			10						5	3
133.5	33						1					17		4			12	1	2	1	1	38					11	1	
134.5	34											14		1		1	8			1	3	42				1		7	3
135.5	28				1		2					16		2		2	2					45						15	
136.5	8											4		4			3					14	1					2	4
137.5	54						7					50		4		2	16	5		1	3	24	1			3	2	15	6
138.5	80						1		2			46		5		1	44				4	38	2			4	3	19	7
139.5	77				1		7		1			63		7		2	31	4			8	13	1				4	13	4
140.5	56								2			37		2		1	23	1	1		3	7	1			1		8	3
141.5	68						6				4	82		4		3	20	3	1	7	15	20	1			3		15	1
142.5	53				1		3		2			63		8		3	27				3	12	13	1		1	1	13	
143.5	36				1		1		3			57		7			20	4	1	1	5	10				4	1	12	
144.5	32				2		2		8			52		7		2	15	9		1	12	12	1			1		14	
145.5	34						3		1			30		5			13	1		2	12	8	1			4	1	6	
146.5	37	1					4		1			51		4		1	19	1				9	13					6	11
162.5	64		2									34				1	16	3	2			10						11	3
163.5	45						1					46		2		1	14	2		2	1	9				1		4	1

Samples for ^{210}Pb were collected from the upper 20 cm of the remaining core half in November 2003. Sediment geochronology of GC1 was derived using multiple radioactive tracers, including excess ^{210}Pb, ^{137}Cs, and $^{239, 240}$Pu isotopes (Table 3, Fig. 2). A detailed description of the methods utilized in developing a geochronological framework for the core can be found in Swarzenski et al. (2005). Very briefly, ^{210}Pb activities were determined either by alpha counting of its granddaughter, ^{210}Po (half life, $t_{½}$ = 138 days) (Flynn, 1968), or by gamma-ray spectrometry. Polonium-210 reaches secular equilibrium with ^{210}Pb after approximately two years. Five-gram aliquots of dried and pulverized sediment were leached in a warm H_2O_2/HCl solution, and a known amount of ^{209}Po was added to the pulverized sample as a yield tracer prior to digestion. Polonium was spontaneously electrodeposited onto silver planchets overnight on a warm stirring plate. The overall chemical yield was 83 - 95%, based on an introduced ^{209}Po yield tracer. The Ag planchets were subsequently counted under vacuum on a Si surface-barrier detector (300 mm^2) with an alpha-energy resolution of about 20 keV full-width-at-half maximum (FWHM). The average efficiency for the 5.3 MeV alpha-line of ^{210}Po was estimated at ~ 20%. Supported ^{210}Pb activity was estimated from the mean ^{210}Pb activity within a deeper region of the cores, where total ^{210}Pb activity was relatively constant and assumed to be in secular equilibrium with ^{226}Ra. The mean value was subtracted from the total ^{210}Pb activities at each level to calculate excess ^{210}Pb activity. Supported ^{210}Pb activities for a subset of samples were also compared with ^{226}Ra activities determined by gamma-ray counting ^{214}Bi on a Ge well detector and were found to be within 10% of the sample values. For ^{239,240}Pu analyses, ~10 g of dried, powdered sample were leached repeatedly with hot 6 M HC, and the combined leachates were processed for Pu after the addition of a ^{242}Pu yield tracer. Pu was separated and purified using standard ion-exchange techniques (Baskaran et al., 1996). About 10-15 g of dried, powdered sediment sample were placed in a gamma-counting vial, and specific concentrations of ^{226}Ra were determined using the 351 keV (^{214}Pb) and 609 keV (^{214}Bi) gamma lines for ^{226}Ra and the 661.6 keV line for ^{137}Cs. Either NIST radioactive spikes and material or radioactive standards that are calibrated with NIST standards were used for calibrating the counting equipment. Precision in the activities of ^{210}Pb, ^{239,240}Pu, and ^{226}Ra was typically better than 5%.

Table 3. Lead-210 measurements.

Core ID	Depth (cm)	Mean Depth (cm)	Water Content	Loss On Ignition (% Dry Wt.)	Total Pb-210 Activity (dpm/g)	Total Pb-210 Activity Error (+/-)	ln Pb-210 xs (dpm/g)
PE03-05 GC-1	0-1	0.5	45.50	5.72	6.79	0.147	1.915881574
PE03-05 GC-1	1-2	1.5	46.44	5.97	6.22	0.128	1.827083617
PE03-05 GC-1	2-3	2.5	47.16	6.15	5.78	0.119	1.753927176
PE03-05 GC-1	3-4	3.5	46.93	5.83	5.78	0.127	1.755193036
PE03-05 GC-1	4-5	4.5	45.59	6.08	5.44	0.118	1.694164883
PE03-05 GC-1	5-6	5.5	45.52	6.09	5.94	0.127	1.782404
PE03-05 GC-1	6-7	6.5	45.24	5.95	4.92	0.125	1.592310586
PE03-05 GC-1	7-8	7.5	45.91	5.88	4.66	0.107	1.539364112
PE03-05 GC-1	8-9	8.5	45.88	5.60	4.61	0.103	1.527772096
PE03-05 GC-1	9-10	9.5	45.32	5.81	5.40	0.127	1.686187744
PE03-05 GC-1	10-11A	10.5	44.91	5.00	4.51	0.137	1.506789032
PE03-05 GC-1	10-11B	10.5	--	4.00	4.61	0.141	1.527978766
PE03-05 GC-1	10-11C	10.5	--	4.00	4.58	0.146	1.520694639
PE03-05 GC-1	11-12	11.5	45.37	4.40	2.90	0.071	1.065067487
PE03-05 GC-1	12-13	12.5	42.84	4.80	2.01	0.050	0.697804123
PE03-05 GC-1	13-14	13.5	47.81	5.07	1.92	0.053	0.653985353
PE03-05 GC-1	14-15	14.5	48.62	5.60	1.53	0.046	0.423845728
PE03-05 GC-1	15-16	15.5	45.85	5.00	1.71	0.044	0.535763038
PE03-05 GC-1	16-17	16.5	45.81	5.79	2.05	0.057	0.718325104
PE03-05 GC-1	17-18	17.5	46.81	5.50	3.25	0.077	1.178146698
PE03-05 GC-1	18-19	18.5	46.00	5.00	3.39	0.080	1.221843186
PE03-05 GC-1	19-20	19.5	46.49	5.20	3.82	0.094	1.341429152

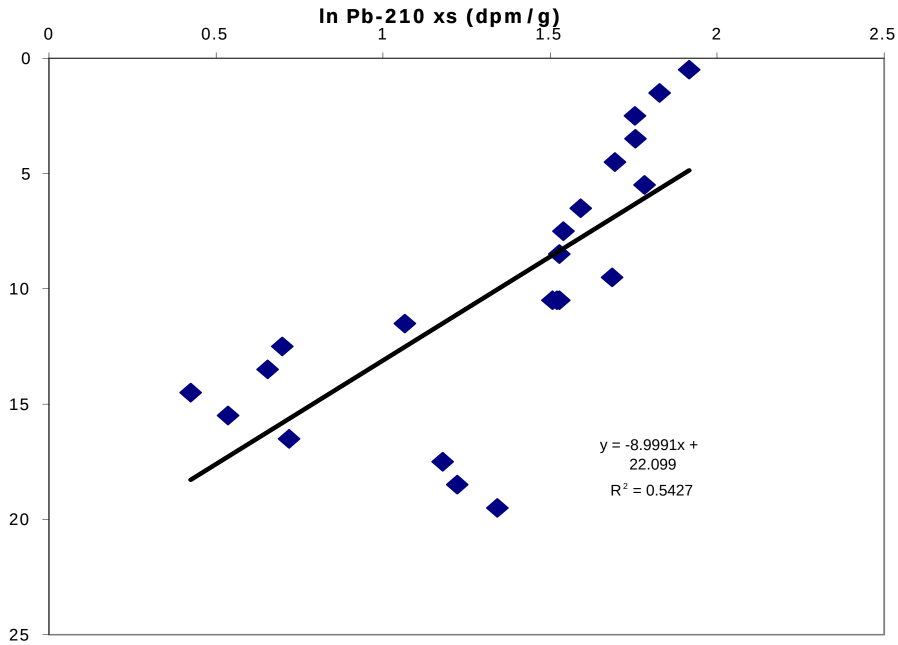

Figure 2. Lead-210 chronology for Gravity core PE0305-GC1.

A separate set of samples was taken in February 2005 from the remaining core half for geochemical analyses. Concentrations of total carbon and total inorganic carbon (IC) were determined using a UIC carbon coulometer (Table 4). A known quantity of each sediment sample (approximately 40 mg) was weighed and placed in a porcelain boat into the carbon-coulometer oven, which combusted the sample at 970ºC in the presence of excess oxygen. All of the carbon was oxidized into carbon dioxide to determine the total carbon concentration. A known quantity of each sediment sample was weighed, placed into a glass flask, and acidified in a heated reaction vessel to measure, using 5 mL of 2 M perchloric acid to release all the inorganic carbon. Total organic carbon (TOC) was determined by calculating the difference between the total carbon (released by combustion) minus the total inorganic carbon (generated by acidification). Calcium-carbonate ($CaCO_3$, wt. %) concentrations were determined by dividing the inorganic carbon by the total weight of the sediment sample,and multiplying by a factor of 8.33 to account for carbonate stoichiometry.

Sediment samples for organic carbon and nitrogen stable-isotope analyses were dried at 50°C, powdered, and stored frozen. Powder sediments were acidified in 0.1N HCl to remove carbonate for analysis of the stable isotopic composition of organic carbon ($\delta^{13}C$) and organic nitrogen ($\delta^{13}N$). Small samples (>70 µg[micrograms] organic nitrogen) were loaded into tin boats using a microbalance capable of 1-µg resolution. Samples were combusted at 1050°C using a Carlo Erba 2500 series I Elemental Analyzer. The isotopic ratio of the combustion product, CO_2 and N_2 gases, was measured sequentially using a continuous-flow inlet system on a Finnigan Mat Delta Plus XL stable-isotope mass spectrometer. Carbon and nitrogen isotopic values are reported in conventional per mil (‰) notation relative to the VPDB and Air international standards, respectively. All carbon and nitrogen isotopic analyses were run in duplicate or triplicate, and the instrument was calibrated using multiple internal standards including urea, bovine liver, and/or spinach. Standard deviation of the isotopic measurements for organic carbon and nitrogen were better than 0.2‰ and 0.3‰, respectively (Table 4).

A single AMS ^{14}C date of 4195 +/- 35 years on mixed benthic foraminifers was obtained in the lower part of the core (152-157 cm). The graphite target for the date was processed at the ^{14}C laboratory of the (USGS) in Reston, VA, and the ^{14}C age was determined at the Center for Accelerator Mass Spectrometry (CAMS), Lawrence Livermore National Laboratory in Livermore, CA. The quoted age is in radiocarbon years (BP) using the Libby half-life of 5568 years, and no correction has been applied.

Table 4. Geochemical analyses

Sample	% Total C	Inorg, C, wt. %	CaCO3, Wt. %	Org C, wt. %	d 15N, ‰ Air	d 13C, ‰PDB
3-4	1.27	0.29	2.40	0.98	4.66	-23.24
4-5	1.20	0.34	2.81	0.87	4.13	-25.88
5-6	1.13	0.30	2.51	0.83	-0.98	-21.95
6-7	1.20	0.32	2.64	0.88	3.83	-25.23
7-8	1.13	0.32	2.69	0.81	3.72	-22.04
8-9	1.18	0.33	2.78	0.84	3.46	-22.77
9-10	1.22	0.34	2.79	0.89	0.27	-27.30
10-11	1.14	0.34	2.82	0.80	3.55	-25.55
11-42	1.11	0.28	2.36	0.82	-1.64	-28.92
12-13	1.11	0.27	2.26	0.84	2.84	-23.82
13-14	1.06	0.26	2.18	0.80	-4.96	-23.99
14-15	1.09	0.37	3.12	0.71	3.11	-24.11
15-16	1.24	0.28	2.33	0.96	3.85	-22.49
16-17	1.06	0.29	2.40	0.77	3.76	-26.10
17-18	1.11	0.34	2.85	0.77	4.11	-24.95
18-19	1.22	0.41	3.39	0.81	-2.31	-27.16
19-20	1.03	0.32	2.68	0.71	-2.36	-24.50
20-21	1.07	0.35	2.88	0.73	-5.41	-27.64
21-22	1.59	0.79	6.55	0.80	4.26	-23.84
22-23	1.30	0.55	4.55	0.76	4.69	-25.82
23-24	3.37	0.36	3.02	3.01	3.46	-26.21
24-25	2.29	0.54	4.52	1.74	-5.94	-30.66
25-26	0.99	0.23	1.92	0.76	3.69	-31.98
26-27	0.95	0.26	2.21	0.68	3.77	-24.10
27-28	0.90	0.22	1.86	0.68	3.60	-26.36
28-29	0.89	0.27	2.25	0.62	-3.80	-24.04
29-30	0.96	0.25	2.10	0.71	-0.97	-26.91
30-31	0.92	0.24	1.99	0.68	3.60	-25.48
31-32	0.87	0.27	2.21	0.60	3.82	-24.70
32-33	0.87	0.22	1.81	0.65	3.80	-23.77
33-34	0.83	0.21	1.79	0.62	2.80	-29.08
34-35	0.91	0.20	1.65	0.71	3.37	-28.03
35-36	0.82	0.22	1.87	0.60	3.52	-24.98
36-37	0.78	0.19	1.61	0.59	3.19	-31.20
37-38	0.87	0.25	2.09	0.62	3.81	-24.22
38-39	0.94	0.19	1.58	0.75	-1.72	-24.93
39-40	0.94	0.20	1.69	0.73	3.24	-22.90
40-41	0.83	0.22	1.79	0.61	0.42	-25.24
41-42	0.82	0.22	1.81	0.60	-2.41	-24.64
42-43	0.82	0.21	1.77	0.61	3.57	-27.37
43-44	0.86	0.19	1.61	0.67	3.03	-35.39
44-45	0.81	0.22	1.82	0.59	2.50	-31.17
45-46	0.86	0.19	1.61	0.66	3.62	-23.66
46-47	0.83	0.23	1.89	0.61	3.00	-25.31
47-48	0.88	0.21	1.77	0.67	-2.94	-24.57
48-49	0.88	0.19	1.60	0.68	2.66	-28.41
49-50	0.88	0.21	1.76	0.67	3.08	-29.69
50-51	0.79	0.21	1.72	0.58	0.45	-37.74
51-52	0.78	0.19	1.62	0.59	3.15	-27.05
52-53	0.88	0.18	1.49	0.70	3.59	-27.70
53-54	0.82	0.17	1.45	0.64	2.44	-27.97
54-55	0.87	0.19	1.60	0.68	3.36	-25.31
55-56	0.86	0.18	1.54	0.68	-2.56	-25.40
56-57	0.84	0.22	1.85	0.62	-3.37	-22.44
57-58	1.56	0.19	1.62	1.37	3.34	-30.30
58-59	0.85	0.24	2.01	0.61	3.89	-24.60
59-60	0.82	0.19	1.58	0.63		
60-61	0.84	0.21	1.78	0.63	2.97	-36.83
61-62	0.87	0.23	1.95	0.64	2.73	-25.52
62-63	0.87	0.22	1.87	0.64		
63-64	0.84	0.20	1.65	0.64	3.62	-25.25
64-65	0.90	0.24	1.97	0.66	-1.73	-28.17
65-66	0.85	0.23	1.93	0.61	0.31	-27.32
66-67	0.90	0.22	1.85	0.68	3.45	-24.70
67-68	0.86	0.22	1.86	0.63	-1.78	-26.38
68-69	0.82	0.21	1.75	0.61	3.24	-29.69
69-70	0.89	0.23	1.96	0.65	3.63	-28.16
70-71	0.91	0.22	1.84	0.69	3.63	-24.20
71-72	0.85	0.25	2.07	0.61	3.74	-23.29
72-73	0.86	0.25	2.07	0.61	3.73	-24.16
73-74	0.89	0.28	2.32	0.61	4.02	-23.58
74-75	0.91	0.26	2.15	0.65	2.50	-27.92

Table 4 continued. Geochemical analyses

Sample	% Total C	Inorg, C, wt. %	CaCO3, Wt. %	Org C, wt. %	d 15N, ‰ Air	d 13C, ‰PDB
75-76	0.89	0.25	2.07	0.64	3.50	-27.97
76-77	0.87	0.25	2.11	0.62	3.18	-26.19
77-78	0.87	0.25	2.06	0.63	3.42	-25.24
78-79	0.85	0.26	2.14	0.60	3.80	-24.62
79-80	0.90	0.23	1.94	0.66	3.28	-26.10
80-81	0.90	0.26	2.20	0.63	2.93	-33.58
81-82	0.91	0.25	2.07	0.67	3.44	-29.10
82-83	0.87	0.23	1.91	0.64	3.84	-23.32
83-84	0.83	0.23	1.88	0.60	-1.01	-25.31
84-85	0.82	0.23	1.95	0.58	1.47	-31.97
85-86	0.85	0.23	1.92	0.62	3.86	-36.46
86-87	0.79	0.20	1.69	0.59	1.95	-30.76
87-88	0.79	0.20	1.69	0.59	3.11	-27.00
88-89	0.83	0.20	1.67	0.63	2.86	-24.95
89-90	0.90	0.20	1.69	0.70		
90-91	0.87	0.21	1.79	0.66		
91-92	0.93	0.18	1.47	0.75	3.58	-25.30
92-93	0.97	0.19	1.61	0.77	3.51	-29.27
93-94	0.98	0.22	1.81	0.76	4.11	-24.05
94-95	0.99	0.26	2.20	0.73	2.51	-28.46
95-96	0.98	0.22	1.84	0.76	4.16	-26.07
96-97	1.05	0.21	1.74	0.84	3.35	-34.64
97-98	0.74	0.22	1.81	0.52	3.71	-25.06
98-99	0.86	0.20	1.63	0.67	3.67	-26.94
99-100	0.87	0.20	1.71	0.67	2.21	-26.55
100-101	0.93	0.20	1.66	0.73	2.86	-23.89
101-102	0.93	0.19	1.58	0.74	3.80	-26.42
102-103	0.87	0.20	1.65	0.67	2.11	-27.33
103-104	0.86	0.21	1.77	0.65	3.74	-23.46
104-105	0.88	0.21	1.74	0.67	3.54	-23.83
105-106	0.91	0.26	2.17	0.65	4.40	-28.46
106-107	0.90	0.28	2.32	0.63	3.66	-22.68
107-108	0.98	0.27	2.26	0.71	2.47	-25.29
108-109	0.94	0.29	2.41	0.65	3.96	-24.01
109-110	0.97	0.23	1.94	0.73	3.34	-24.52
110-111	1.01	0.31	2.54	0.70	3.57	-22.60
111-112	1.06	0.36	2.98	0.70	2.25	-22.71
112-113	0.97	0.40	3.32	0.57	3.60	-26.63
113-114	1.06	0.35	2.89	0.71	4.00	-23.28
114-115	1.06	0.38	3.17	0.68	4.24	-24.84
115-116	1.07	0.39	3.23	0.69	3.65	-24.92
116-117	1.04	0.40	3.30	0.65	4.19	-23.28
117-118	1.02	0.36	3.03	0.66	4.06	-21.53
118-119	1.07	0.41	3.44	0.66	2.74	-21.45
119-120	1.08	0.38	3.14	0.71	4.42	-22.14
120-121	1.05	0.42	3.47	0.64	-1.54	-26.89
121-122	1.10	0.39	3.29	0.70	3.60	-28.05
122-123	1.10	0.39	3.22	0.71	4.07	-23.72
123-124	1.08	0.37	3.06	0.71	5.47	-24.83
124-125	1.06	0.35	2.89	0.71		
125-126	1.05	0.38	3.18	0.67	3.96	-23.31
126-127	1.05	0.34	2.85	0.71	3.33	-26.98
127-128	1.14	0.38	3.20	0.75		
128-129	1.18	0.35	2.90	0.84	3.25	-23.62
129-130	1.28	0.40	3.36	0.87	2.95	-29.84
130-131	1.42	0.39	3.22	1.03	3.64	-22.89
131-132	1.17	0.36	2.98	0.81	2.40	-30.02
132-133	1.00	0.36	3.01	0.64	3.94	-31.03
133-134	0.93	0.33	2.74	0.60		
134-135	1.03	0.35	2.94	0.68	4.09	-23.67
135-136	1.04	0.34	2.87	0.70	2.31	-24.20
136-137	1.14	0.37	3.06	0.77	1.99	-25.56
137-138	1.07	0.26	2.18	0.81	3.75	-23.97
138-139	0.99	0.31	2.54	0.68	2.45	-24.20
139-140	0.96	0.31	2.56	0.65	2.93	-28.42
140-141	1.00	0.29	2.38	0.71	3.09	-24.84
141-142	0.97	0.24	2.02	0.73	4.10	-26.91
142-143	0.94	0.24	2.01	0.70		
143-144	1.04	0.25	2.05	0.79		

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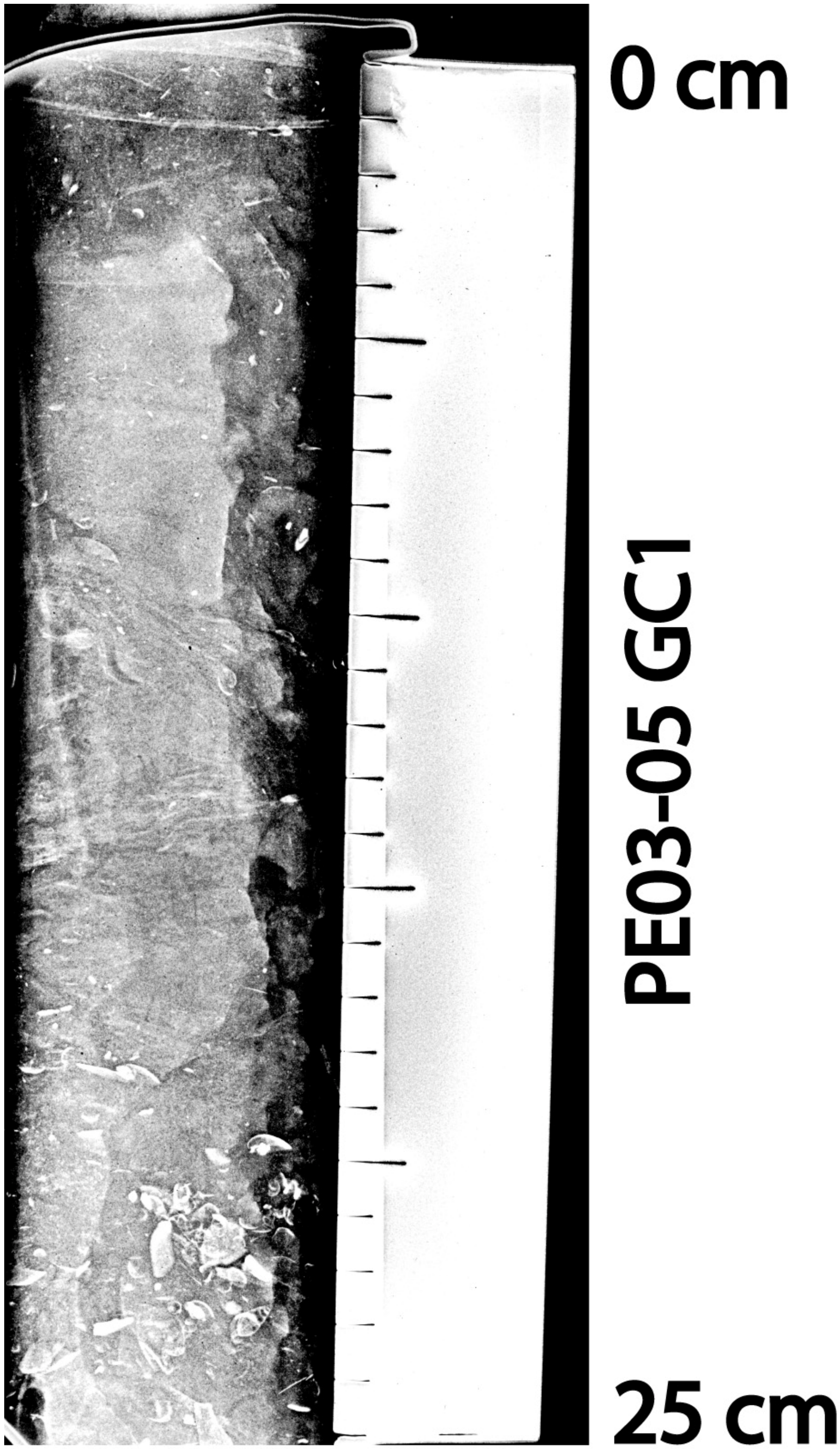
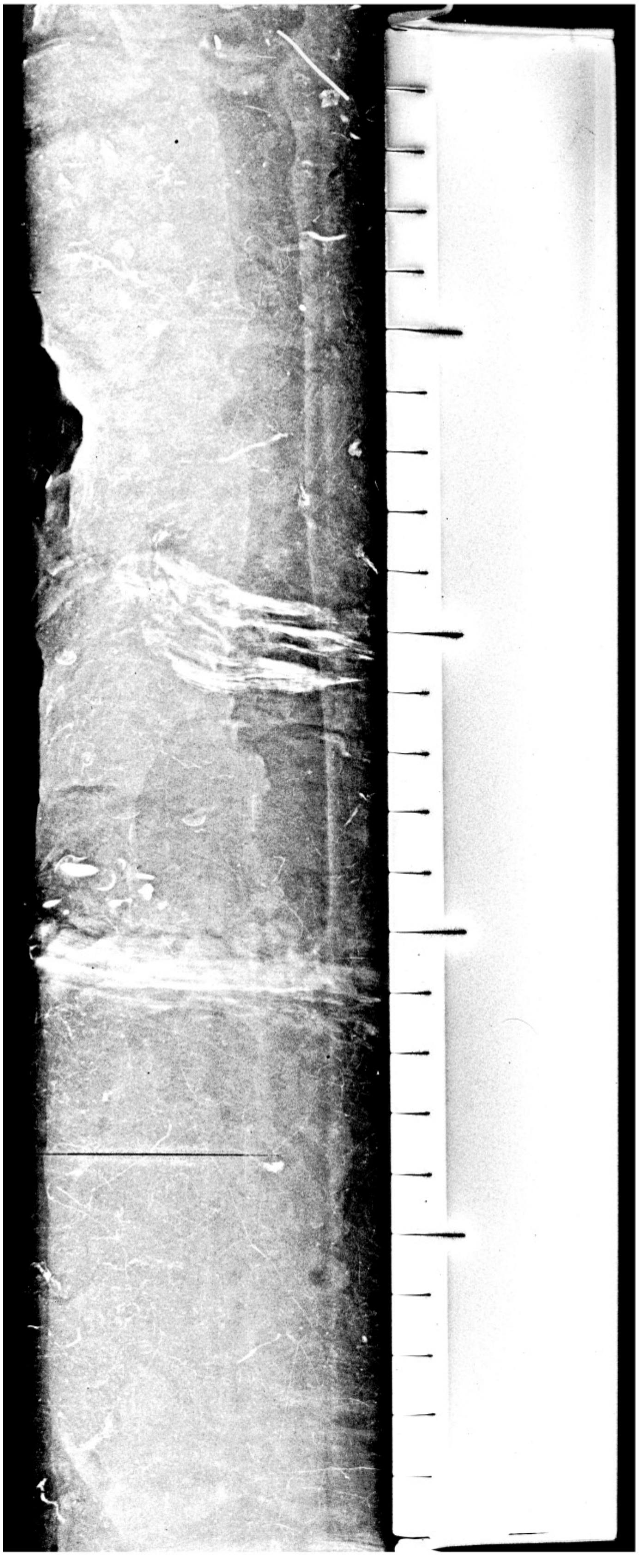
Appendix 1

Core PE0305-GC1 X-rays

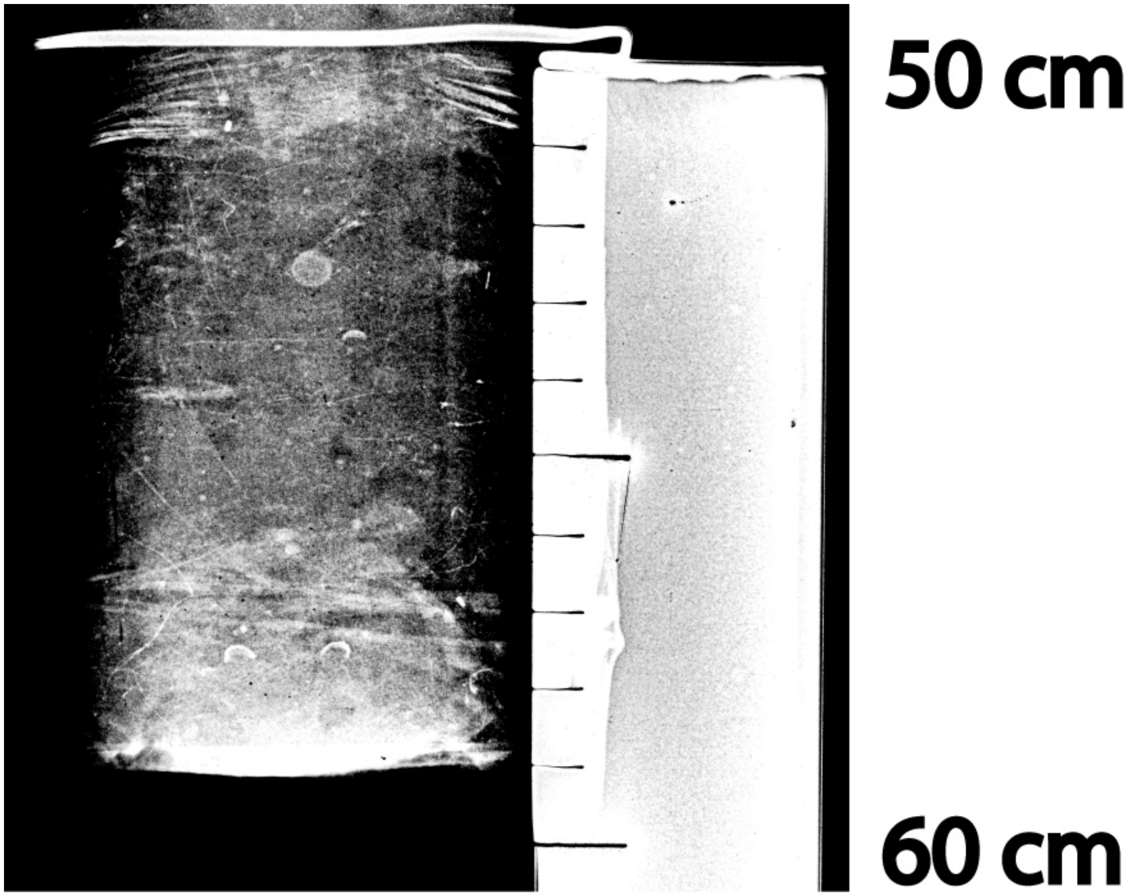

0 cm
PE03-05 GC1
25 cm

25 cm



PE03-05 GC1

50 cm

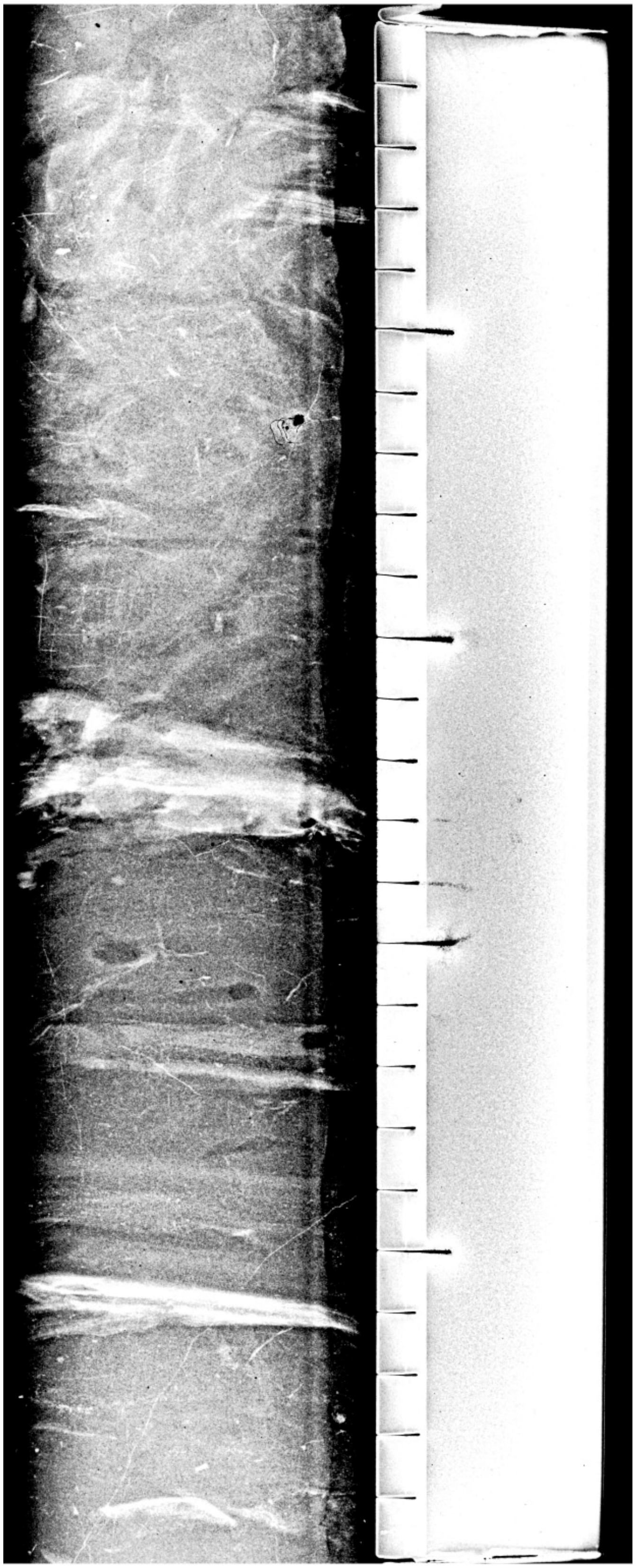


PE03-05 GC1

60 cm

PE03-05 GC1

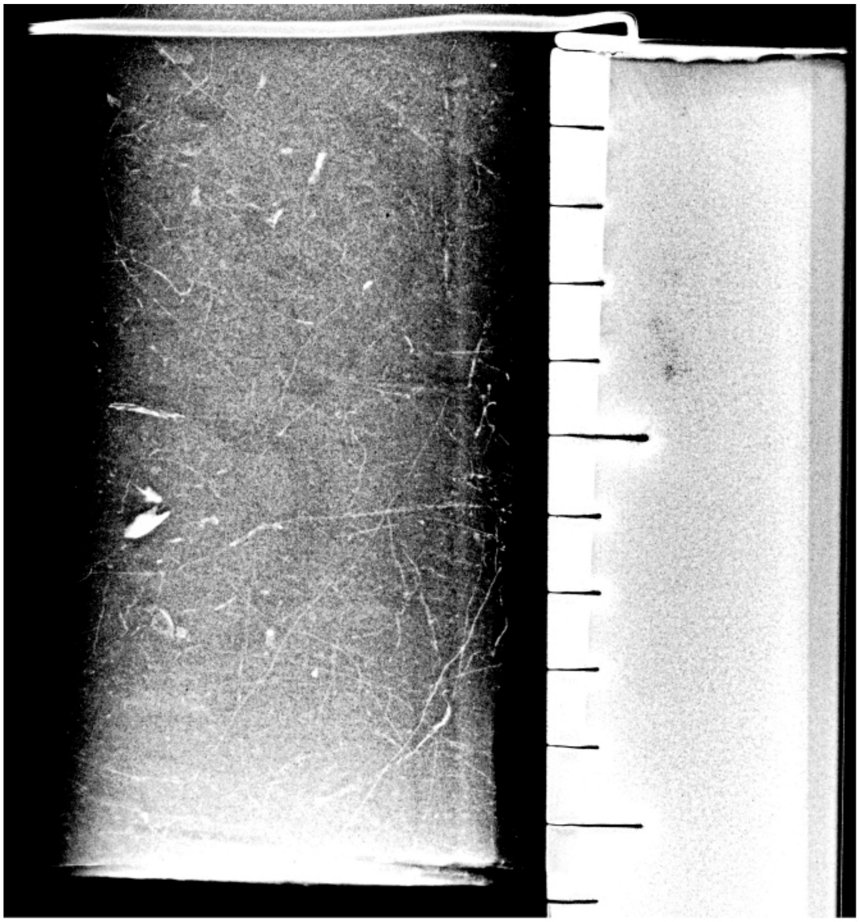
85 cm



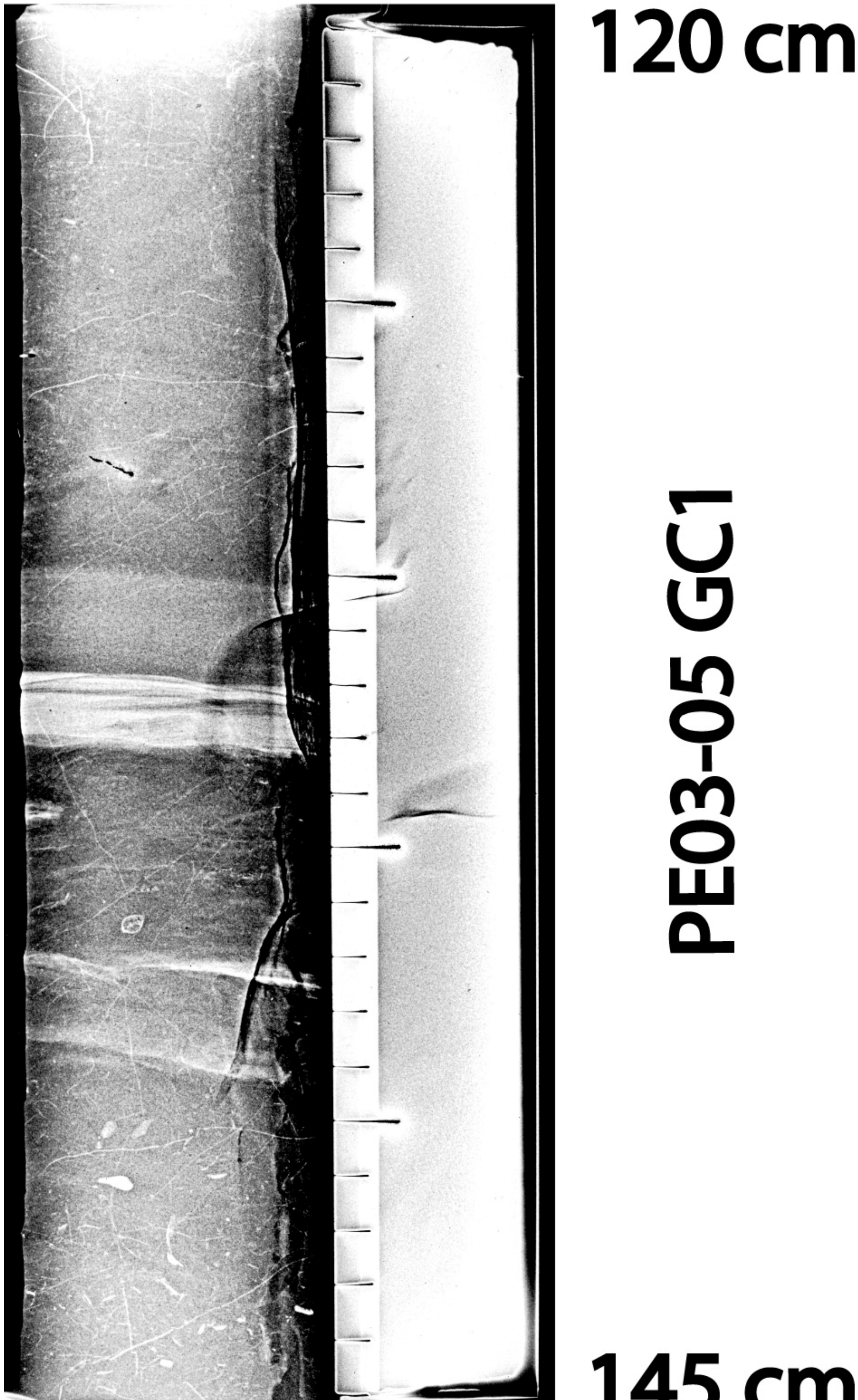
85 cm

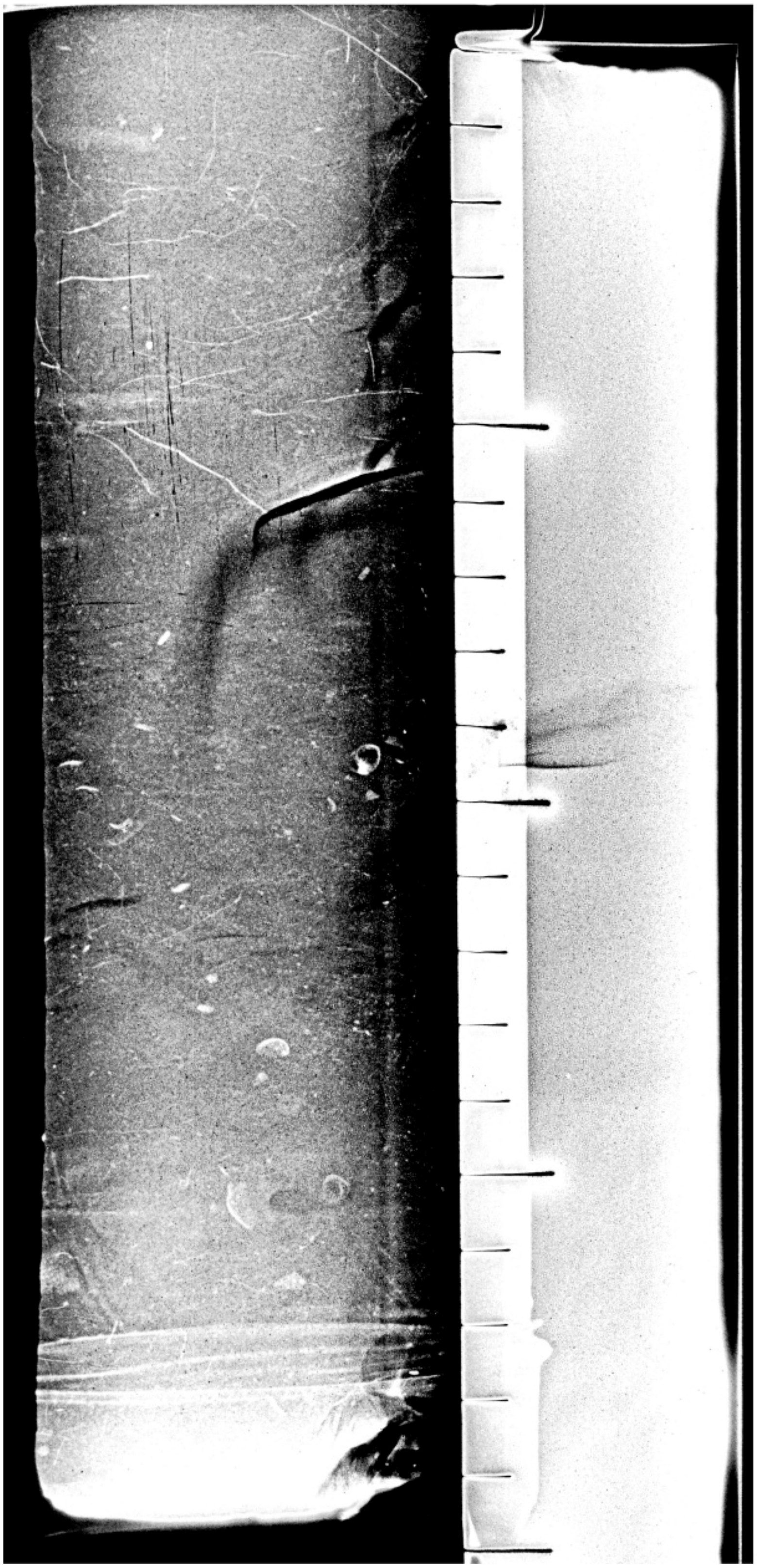
PE03-05 GC1

110 cm



PE03-05 GC1


120 cm
PE03-05 GC1
145 cm



145 cm

PE03-05 GC1

164 cm

APPENDIX 2
GULF OF MEXICO FORAMINIFERS

AGGLUTINATED SPECIES

Ammotium salsum Cushman and Brönniman, 1948, Cush. Found. Foram. Res. Contr., v. 24, pt. 2, p. 39, pl. 7, fig. 9.
Bigeneria irregularis Phleger and Parker, 1951, Geol. Soc. Amer. Mem. no. 46, pt. II, p. 4, pl. 1. figs. 16-21.
Haplophragmoides bradyi (Robertson) = *Trochammina bradyi* Robertson, 1897, Ann. Mag Nat. His., ser. 6, v. 7 p. 388. fine-grained troccamminid.
Lagenammina difflugiformis (Brady) = *Reophax difflugiformis* Brady, 1879, Notes on some of the Reticularian Rhizopoda of the *Challenger* Expedition: Quarterly J. of Micro. Sci., new series, v. 19, p. 51, pl. 4, figs. 3a,b.
Milliamina horrida (Cushman)= *Quinqueloculina horrida* Cushman, 1947, Contr. Cush. Lab. Foram. Res., v. 23, pt. 88, pl. 19, fig. 1.
Pseudoclavulina mexicana (Cushman) = *Clavulina humilis* Brady var. *mexicana* Cushman, 1922, Bull. 104, U.S. National Museum, pt. 3, p. 83, pl. 16, figs. 1-3. Note: initial part triserial with latter chambers uniserial, often fine grained
Reophanus ovicilus (Brady) = *Reophax ovicula* Brady, 1879, Quarterly J. of Micro. Sci., new series, v. 19, p. 20-62.
Reophanus scorpiurus (*Montfort) = Reophax scorpiurus* Brady, 1884, Rept. Voy. *Challenger,* Zool., v. 9, p. 62, pl. 30, figs. 12, 14-17. Note coarse-to-medium grained multichambered.
***Reophax* spp. =** other unidentified, rare forms.
Textularia candeina d'Orbigny, 1839, in Ramone de la Sagra, Hist. Fis. Pol. Nat. Cuba "Foraminiferes," p. 143, pl. 1, figs. 25-27. Note round form with typical textularia aperature
Textularia mayori Cushman, 1922, Pub. 311 Carnegie Inst. Washington, v. 17, p. 23, pl. 2, fig. 3. Note: spikey form found in shallow water.

CALCAREOUS SPECIES

Ammonia parkinsoniana (d'Orbigny) **=** *Rosalina parkensoniana* d'Orbigny, 1939, in Ramone de la Sagra, Hist. Fis. Pol. Nat. Cuba "Foraminiferes," p. 99, pl. 4, figs. 25-27.
Amphicoryne hirsute (d'Orbigny) = *Nodosaria hirsute* d'Orbigny, 1826, Ann. Sci. Nat., v. 7, p. 252, n. 7.
Bolivina subspinensis Cushman, 1922, Bull. 104, U.S. National Museum, pt. 3, p. 48, pl. 7, fig. 5.
Brizalina barbata (Phleger and Parker) = *Bolivina barbata* Phleger and Parker, 1951, Geol. Soc. Amer. Mem., no. 46, pt. II, p. 13, pl. 6, figs. 12-13.
Brizalina striatula Cushman **var. *spinata*** Cushman = *Bolivina striatula* Cushman var. *spinata* Cushman, 1936, Spec. Pub. no. 6, Cush. Lab. Foram. Res., p. 59, pl. 8, figs. 9a,b.
Brizalina subaenariensis Cushman **var. *mexicana*** Cushman = *Bolivina subaenariensis* Cushman var. *mexicana* Cushman, 1922 Bull. 104, U.S. National Museum, pt. 3, pt. 47, pl. 8. fig. 1

Brizalina transluscens (Phleger and Parker) = *Bolivina transluscens* Phleger and Parker, 1951, Geol. Soc. Amer. Mem. no. 46, pt. II, p. 15, pl. 7, figs. 13, 14a,b.
Buccella hanni (Phleger and Parker) = *Eponides hanni* Phleger and Parker, 1951, Geol. Soc. Amer. Mem. no. 46, pt. 2, p. 21, pl. 11, figs. 1a,b, 2a,b.
Bulimina marginata d'Orbigny, 1826, Ann. Sci. Nat., v. 7, p. 269, no. 4, pl. 12, figs. 10-12.
Buliminella morgani Anderson, 1961, LA Geol. Bull no. 35, pt. II, p. 87, pl. 19, fig. 10.
Cancris auriculus (Fichtel and Moll) = *Nautilus auricula* var. β Fichtel and Moll, 1798, p. 108, pl. 20, figs. a-c. NOTE: this is the *Cancris sagra* (d'Orbigny) of Anderson, 1961.
Cassidulina curvata Phleger and Parker, 1951, Geol. Soc. Amer. Mem. no. 46, pt. II, p. 26, pl. 14, figs. 5a,b.
Cassidulina reniforme (Nørvang) = *Cassidulina crassa* d' Orbigny var. *reinforme* Nørvang, 1945, The zoology of Iceland. *Foraminifera*, v. 2, no. 2
Chilostomella oolina Schwager, 1878, Bol. Com. Geol, Ital., v. 9, p. 527, pl. 1, fig. 16. NOTE: included in other calcareous species.
***Cibicides* spp**. included in other calcareous species.
Cibicidoides mundulus (Brady, Parker, and Jones) = *Truncatulina mundula*, Brady, Parker, and Jones, 1888, Zool. Soc. London, Trans. v. 12, pt. 7, no. 1, p. 228, pl. 45, figs. 25a-c.
Cibicidoides pachyderma (Rzehak) = *Truncatulina pachyderma* Rzehak, 1886, Naturf. Ver. Brünn, Verh., Brünn, Bd. 24 (1885), p. 87, pl. 1, fig. 5a-c. (see Morkoven et al., 1986, p. 68-71). NOTE: *Planulina floridana* (Cushman) = *Truncatulina floridana* Cushman, 1919. U.S. Geol. Sur. Bull. 676, p. 62, pl. 19, fig.2. (see Loeblich and Tappan 1994, p. 149, pl. 312, figs. 9-14)/ *Planulina floridana* (sublittoral) Poag 1981/ *Cibicides pseudoungerianus* (Cushman)/ *Cibicides cicatricosus* (Schwager) in Bock et al., 1971/ *Cibicides umbonatus* (Phleger and Parker, 1951. pl. 17, figs. 7a,b, 8a,b.)
Cornuspira planorbis Schultze, 1854, Organismus Polythal., p. 40, pl. 2, fig. 21.
Dentalina communis d'Orbigny in Brady, 1884, Rept. Voy. *Challenger,* Zool., v. 9, p. 130, pl. 62, figs. 21, 22. Note: most common species included in *Dentalina* spp.
Elphidium discoidale (d'Orbigny) = *Polystomella discoidalis* d'Orbigny, 1839, in Ramone de la Sagra, Hist. Fis. Pol. Nat. Cuba "Foraminiferes," p. 56, pl. 6, figs. 23, 24.
***Elphidium excavatum* (Terquem)** = *Polystomella excavata* Terquem, 1876, Societé Dunquerquoise, Memoires, v. 19 (1874-75), p. 429. NOTE: included in other *Elphidium* spp.
Elphidium poeyanum (d'Orbigny) = *Polystomella poeyana* d'Orbigny, 1839, in Ramone de la Sagra, Hist. Fis. Pol. Nat. Cuba "Foraminiferes," p. 55, pl. 6, figs. 25, 26. NOTE: included in other *Elphidium* spp.
Epistominella vitrea Parker, in Phleger, Parker, and Peirson, 1953, Cush. Found. Sp. Pub. no. 2, p. 9, pl. 4, figs. 34-36, 40, 41.
Eponides antillarium (d'Orbigny) = *Rotalina antillarum* d'Orbigny, 1839, in Ramone de la Sagra, Hist. Fis. Pol. Nat. Cuba "Foraminiferes," p. 75, pl. 5, figs. 4-6. NOTE: round.
Fursenkoina pontoni (Cushman) = *Virgulina pontoni* Cushman, 1932, Contr. Cush. Lab. Foram. Res., v. 8, pt. 1, p. 17, pl. 3, fig. 7.
***Fursenkoina* spp.** other unidentified *Fursenkoina*.
Gavelinopsis translucens (Phleger and Parker) = *"Rotalia" transluscens* Phleger and Parker, 1951, Geol. Soc. Amer. Mem. no. 46, pt. 2, p. 24, pl. 12, figs. 11a,b, 12a,b.
Glandulina laevigata (d'Orbigny) = *Nodosaria laevigata* d' Orbigny, 1826, Ann. Sci. Nat., ser. 1, v. 7, p. 252, pl. 10, figs. 1-3.
Globocassidulina subglobosa (Brady) = *Cassidulina subglobosa* Brady, 1881, Quart. J. Micr. Sci., v. 21, pl. 30 fig. 60.

Hanzawaia concentrica (Cushman) = *Truncatulina concentrica* Cushman, 1918, U.S. Geological Sur. Bull. 676, p. 64, pl. 21, fig. 3.
Lenticulina calcur (Linné) = *Nautilus calcur* Linné, 1767, Syst. Nat., 12th ed., p. 1162, no. 272 Note: most common species included in *Lenticulina* spp.
Marginulina marginulinoides (Göes) = *Çristellaria aculeata* var. *marginulinoides* Göes, 1896, Bull. Mus. Comp. Zool., v. 29, p. 56, pl. 5, figs. 15, 16. Note: most common form, included in *Marginulopsis* spp.
Miliolinella fichteliana (d'Orbigny) = *Triloculina fichteliana* d'Orbigny, 1839, in Ramone de la Sagra, Hist. Fis. Pol. Nat. Cuba "Foraminiferes," p. 171, pl. 9, figs. 8-10.
Neolenticulina peregrina (Schwager) = ***Cristellaria peregrina*** Schwager, 1866, *Novara* Expedition, Geol. Thiel, v. 2, p. 245, pl. 7, fig. 89. Note: more commonly referred to as *Lenticulina perigrina*.
Nodosaria albatrossi Cushman = *Nodosaria vertabralis* (Batsch), var. *albatrossi* Cushman, 1923, Bull. 104, U.S. National Mus., pt. 4, p. 87, pl. 15, fig. 1. NOTE: included in *Nodosaria* spp.
Nodosaria pyrula d'Orbigny, 1826, Ann. Sci. Nat., v. 7, no. 13, p. 253,. Note: included in *Nodosaria* spp.
***Nodosariidae* spp.** includes assorted species of the genera *Lagena*, *Fissurina* and *Oolina*.
Nonion depressulum (Walker and Jacob) **var. *matagordanum*** Kornfeld, 1931, Stanford Univ., Dept. Geol., Contr., v. 1, no. 3, p. 87, pl. 13, figs. 2a,b.
Nonionella opima Cushman, 1947, Cont. Cush. Lab. Foram Res., v. 23, pt. 4, p. 90, pl. 20, figs. 1-3. NOTE: occurs rarely and included with *P. atlanticum*.
Oridorsalis umbonatus (Reuss) = *Rotalina umbonatus* Reuss, 1851, Zeitschrift der Deutschen Geoligischen Gesellschaft, Berlin, v. 3, p. 75, pl. 5, figs. 35a-c. Note: *O. umbonatus* includes individuals identified as *Eponides tener* by other authors.
Other calcareous other unidentified and rare species.
Other milliolids other unidentified and rare species.
Planulina foveolata (Brady) = *Anomolina foveolata* Brady, 1884, Rept. Voy. *Challenger,* Zool., v. 9, p. 676, pl. 94, figs. 1a-c. NOTE: included with *Planulina* spp.
Pseudononion atlanticum (Cushman) = *Nonionella atlantica* Cushman, 1947, Cont. Cush. Lab. Foram. Res., v. 23, pt. 4, p. 11, pl. 5, figs. 21-23.
Pseudonosaria comatula (Cushman) = *Nodosaria comatula* Cushman, 1923, Bull. 104, U.S. Nat. Museum, pt. 4, p. 83, pl. 14, fig. 5.
Pyrgo nasutus Cushman, 1935, Smithsonian Misc. Coll., v. 91, no. 21, p. 7, pl. 3, figs. 1-4.
Pyrgo murrhina (Schwager) = *Biloculina murrhina* Schwager 1866**,** *Novara* Expedition, Geol. Thiel, v. 2, p. 203, pl. 4, figs. 15a-c.
Pyrgo williamsoni (Silvestri) = *Biloculina williamsoni* Silvestri, 1923, Atti Accad. Pont. Romana Nuovi Lincei, v. 76 (1922–23), p. 73, pl. 6, figs. 169–170.
Quinqueloculina bicarinata d'Orbigny, 1826, Ann. Sci. Nat. v. 7, p. 302. NOTE: this is the triangular-shaped form with no striations.
Quinqueloculina compta Cushman, 1947, Contr. Cush. Lab. Foram. Res., v. 23, pt. 4, p. 87, pl. 19, fig. 2. Note: elongated form.
Quinqueloculina dimidiata Terquem, 1876, Essai sur le classement des animaux que vivent sur la plage et dans le environs le Dunkerque, p. 81, pl. 4, figs. 5a-c.
Rectobolivina advena (Cushman) = *Siphogenerina advena* Cushman, 1922, Carnegie Inst., Washington, Pub. 311, p. 35, pl. 5, fig. 2.

Reussella spinulosa *(Reuss)* = *Verneuilina spinulosa* Reuss, 1850, Denkschriften Kaiser. Akad. Der Wissensch. Math. - Natur. Classe. 1, 374. NOTE checked *Reussella spinulose* (Reuss) var. *atlantica* Cushman, 1947, Cont. Cush. Lab. Foram. Res., v. 23, pt. 4, p. 91, pl. 20, figs. 6-7, but I believe it to be the same.
Rosalina suezensis* = *Rosalina bahamensis Todd and Low, 1971, U.S. Geol. Sur., Prof. Paper 683-C, p. C14, pl. 3, fig. 2.
Saracenaria spp. assorted species of this genera.
Siphonina pulchra Cushman, 1919, Publ. 291, Carnegie Inst. Washington, p. 42, pl. 14, figs. 7a-c.
Spirolaccamina spp. assorted species of the genera.
Trifarina bella (Phleger and Parker) = *Angulogerina bella* Phleger and Parker, 1951, Geol. Soc. Amer. Mem. no. 46, pt. 2, p. 12, pl. 6, figs. 7, 8.
Triloculinella tegminis (Loeblich and Tappan) = *Scutuloris tegminus* Loeblich and Tappan, 1953, Studies of Arctic Foraminifera, Smithsonian Misc. Coll., v. 121, no. 7, p. 41, pl. 6, fig. 10; includes *Miliolinella chukchiensis* (Loeblich and Tappan) 1953, pl. 7, fig. 7 *Quinqueloculina subrotunda* (Montague) Todd and Low, 1967; and *Quinqueloculina subrotunda* (Montague?) Cushman, 1948.
Uvigerina peregrina Cushman, 1923, Bull. 104, U.S. Nat. Museum, pt. 4, p. 166, pl. 42, figs. 7-10.
Valvulina laevigata Phleger and Parker, 1951, Geol. Soc. Amer. Mem. no. 46, pt. 2, p. 25, pl. 13, figs. 11a,b, 12a,b.