8. SITE 929¹

Shipboard Scientific Party²

HOLE 929A

Date occupied: 10 March 1994
Date departed: 12 March 1994
Time on hole: 1 day, 15 hr
Position: 5°58.573'N, 43°44.396'W
Bottom felt (drill-pipe measurement from rig floor, m): 4369.0
Distance between rig floor and sea level (m): 11.4
Water depth (drill-pipe measurement from sea level, m): 4357.6
Total depth (from rig floor, m): 4896.5
Penetration (m): 527.5
Number of cores (including cores having no recovery): 56
Total length of cored section (m): 527.5
Total core recovered (m): 470.96
Core recovery (%): 89.3
Oldest sediment cored:
Depth (mbsf): 527.5
Nature: nannofossil claystone
Age: late Eocene
Measured velocity (km/s): 2.2–2.3

HOLE 929B

Date occupied: 13 March 1994
Date departed: 13 March 1994
Time on hole: 23 hr, 30 min
Position: 5°58.578'N, 43°44.385'W
Bottom felt (drill-pipe measurement from rig floor, m): 4367.0
Distance between rig floor and sea level (m): 11.4
Water depth (drill-pipe measurement from sea level, m): 4355.6
Total depth (from rig floor, m): 4596.0
Penetration (m): 229.0
Number of cores (including cores having no recovery): 24
Total length of cored section (m): 229.0
Total core recovered (m): 212.59
Core recovery (%): 92.8
Oldest sediment cored:
Depth (mbsf): 229.0
Nature: claystone with iron oxides, claystone with nannofossils, and nannofossil chalk with clay
Age: middle Miocene
Measured velocity (km/s): 1.6

HOLE 929C

Date occupied: 13 March 1994
Date departed: 14 March 1994
Time on hole: 15 hr, 30 min
Position: 5°58.563'N, 43°44.386'W
Bottom felt (drill-pipe measurement from rig floor, m): 4367.0
Distance between rig floor and sea level (m): 11.4
Water depth (drill-pipe measurement from sea level, m): 4355.6
Total depth (from rig floor, m): 4522.2
Penetration (m): 155.2
Number of cores (including cores having no recovery): 16
Total length of cored section (m): 152.2
Total core recovered (m): 144.22
Core recovery (%): 94.8
Oldest sediment cored:
Depth (mbsf): 155.2
Nature: clayey nannofossil ooze and nannofossil clay
Age: late Miocene
Comments: Drilled from 0.0 to 3.0 mbsf

HOLE 929D

Date occupied: 14 March 1994
Date departed: 15 March 1994
Time on hole: 16 hr, 30 min
Position: 5°58.566'N, 43°44.394'W
Bottom felt (drill-pipe measurement from rig floor, m): 4367.5
Distance between rig floor and sea level (m): 11.4
Water depth (drill-pipe measurement from sea level, m): 4356.1
Total depth (from rig floor, m): 4422.0
Penetration (m): 54.5
Number of cores (including cores having no recovery): 6
Total length of cored section (m): 54.5
Total core recovered (m): 54.39
Core recovery (%): 99.8
Oldest sediment cored:
Depth (mbsf): 54.5
Nature: clay with nannofossils and clayey nannofossil mixed sediment
Age: Quaternary

HOLE 929E

Date occupied: 15 March 1994
Date departed: 21 March 1994

¹ Curry, W.B., Shackleton, N.J., Richter, C., et al., 1995. *Proc. ODP, Init. Repts.*, 154: College Station, TX (Ocean Drilling Program).

² Shipboard Scientific Party is as given in the list of participants preceding the contents.

Time on hole: 6 days, 5 hr, 15 min

Position: 5°58.568'N, 43°44.402'W

Bottom felt (drill-pipe measurement from rig floor, m): 4367.5

Distance between rig floor and sea level (m): 11.4

Water depth (drill-pipe measurement from sea level, m): 4356.1

Total depth (from rig floor, m): 5176.4

Penetration (m): 808.9

Number of cores (including cores having no recovery): 35

Total length of cored section (m): 337.4

Total core recovered (m): 246.65

Core recovery (%): 73.1

Oldest sediment cored:

Depth (mbsf): 808.9

Nature: clayey nannofossil limestone and clayey nannofossil limestone with foraminifers

Age: late Paleocene

Measured velocity (km/s): 2.4–2.5

Comments: Drilled from 0.0 to 471.5 mbsf

Principal results: Site 929 is the deepest of the depth transect of sites on the Ceara Rise, and one of the three on the northern flank of the rise. The site is located beneath warm surface waters having a mean temperature around 27°C. The seafloor at a depth of 4356 m is in the mixing zone between today's North Atlantic Deep Water (NADW) and Antarctic Bottom Water (AABW), below today's carbonate lysocline but close to the carbonate compensation depth (CCD) as recently as the last glaciation. The site was chosen to provide material for investigating the geological history of surface- and deep-water properties in the region, and especially to provide a deep-water end-member with a good record of carbonate dissolution while still preserving sufficient carbonate to provide for paleochemical studies as well as biostratigraphic age control.

Five holes were drilled at Site 929. Hole 929A was cored with the APC to 138.18 mbsf and with the XCB to 527.5 mbsf. Hole 929B was cored with the APC to 123.58 mbsf and extended with the XCB to 229.05 mbsf. Hole 929C was cored with the APC to 126.87 mbsf and extended with the XCB to 155.2 mbsf. Hole 929D was cored with the APC to 54.5 mbsf. Hole 929E was drilled to 471.5 mbsf and then deepened with the RCB to 808.9 mbsf. Detailed comparisons between the magnetic susceptibility and natural gamma records generated on the MST, as well as high-resolution color reflectance generated using a handheld Minolta spectrophotometer, demonstrated that the sedimentary sequence to 240 mbsf had been completely recovered, although some ambiguity is present in the composite depth section at 130 mbsf. Overlap between holes can also be demonstrated for the interval from 470 to 520 mbsf between the deepest XCB section of Hole 929A and the section cored with the RCB in Hole 929E.

The recovered sedimentary sequence at Site 929 spans the interval from the Paleocene to the Holocene. Almost the entire sequence is characterized by rhythmic sedimentary cycles, and preliminary evaluation suggests that these are chiefly related to the orbital precession cycle, but with some intervals more influenced by the obliquity cycle. These sedimentary cycles were well recorded by magnetic susceptibility, color, and natural gamma emission. All three parameters are sensitive to, and thus record, variations in the ratio of terrigenous material to biogenic carbonate in the sediments, although at the lower carbonate values observed at Site 929 magnetic susceptibility and color become less reliable predictors of carbonate. Because of the pervasive magnetic overprint that has been observed at all sites on the Ceara Rise, it proved impossible to obtain any magnetostratigraphic data for the site.

Biostratigraphic age control was provided by calcareous nannofossils and foraminifers throughout. In both these fossil groups, the rich assemblages that have characterized this tropical region are severely reduced by carbonate dissolution in some intervals, but good time control was provided for most of the sequence. Close sampling (generally 1.5 m or better,

corresponding to 0.05 to 0.1 m.y.) in both fossil groups gives little indication of breaks in the stratigraphic record, although a 1-m.y. hiatus may be present at the base of the late Miocene. Mass wasting in the middle and late Miocene interrupts the continuity of the pelagic deposition. The disturbed sections appear to correlate with other events shallower on the rise, suggesting that widespread mass wasting occurred at this time.

Sedimentation rates were more variable at Site 929 than at the shallower Ceara Rise sites because of the additional impact of variable carbonate dissolution on the overall rates. For the Oligocene and much of the Eocene, the rate was almost 20 m/m.y., although there are two intervals in the Eocene in which the rate dropped to about 5 m/m.y. The sedimentation rate dropped progressively to a minimum value of about 3 m/m.y. in the middle and late Miocene. After 5 Ma the rate recovered, rising to as high as 40 m/m.y. in the Pleistocene. These represent the values for pelagic sedimentation; the actual sedimentation rate for the late Miocene is amplified to over 20 m/m.y. by the addition of redeposited material.

BACKGROUND AND OBJECTIVES

Site 929 was the deepest of a transect of sites drilled on the Ceara Rise (see "Introduction" chapter, fig. 2, this volume). The site is in an area with gently sloping relief toward the northeast; hydrosweep bathymetry coverage shows an increase in depth of about 40 m over several kilometers in this direction (Fig. 1). A small, V-shaped depression occurs about 1 nmi to the east of Site 929. The site itself is located on a local plateau at 4356 mbsl. The seismic section (Fig. 2) contains the same seismic units observed elsewhere on the rise: an upper layered sequence down to about 0.23 s TWT (170 m); a middle, more seismically incoherent unit between about 0.23 and 0.80 s TWT (170–700 m); a unit with some parallel reflectors between 0.80 and 0.90 s TWT (700–820 m); and a fairly prominent reflector at around 0.90 s TWT (830 m) that appears to represent the base of the pelagic section. The deepest objective of drilling, time permitting, was the base of the Cenozoic section. Planning was based on the premise that the chief objective at the site was to complete the sampling for high-resolution investigation of the late Neogene and into the Paleogene ocean history through the whole depth range available at the Ceara Rise. Drilling beyond the stratigraphic range attained at Site 925 (late middle Eocene) would provide an additional bonus. We were particularly concerned about obtaining a truly complete section, with abundant material available for high-resolution sampling of the uppermost part of the sediment column. We aimed to sample this upper section in triplicate with the APC to provide the means for high-resolution investigation of the whole of the upper Neogene section; in the event the XCB proved more suitable for recovering clays (like those found in the lowermost Pliocene and upper Miocene of Site 928), overlapping XCB cores would be recovered.

Oceanographic conditions in this region have probably been directly affected by the closure of the Panama Isthmus and uplift of the Andes during this time, as well as by the globally pervasive effect of increased glaciation. In addition, the sediments were expected to have preserved a detailed history of the transport of terrigenous matter to the Atlantic Ocean by the Amazon River and provide a history of the fluctuating influence of AABW over the depths of the western north Atlantic Ocean. Finally, the site was expected to provide a long record of the evolution of tropical calcareous nannofossils and planktonic foraminifers for most of the Cenozoic.

OPERATIONS

Site 929

The final drill site of Leg 154 lay on the lower northeast flank of the Ceara Rise only 32 nmi north of Site 928. *JOIDES Resolution* navigated to the geographic coordinates of proposed Site CR-5, and a positioning beacon was launched at 0500 hr (local time) on 10 March.

Hole 929A

Hole 929A began with a “mud-line” APC core that determined seafloor depth to be 4358 m. Coring with the APC then continued, with core orientation beginning on Core 154-929A-3H (Table 1). Sediments were more clay rich than at the sites higher on the Ceara Rise; consequently, they were less amenable to APC coring. Good results were obtained through Core 154-929A-13H, but a catastrophic liner failure on Core 154-929A-14H caused severe damage to the core, and incomplete APC stroke on Core 154-929A-15H resulted in several meters of flow-in material.

The XCB system produced good core quality and a high ROP, so coring continued through the drillable nannofossil clay and chalk section. Below 500 mbsf, the ROP fell sharply and core began to jam the XCB. When Cores 154-929A-55X and -56X recovered a total of only 1.5 m, the drilling party considered it to be XCB refusal. Coring was terminated at 527.5 mbsf and the bit was pulled above the seafloor.

Hole 929B

After a 20-m offset to the east, the APC coring system was deployed and the first core was “shot” with the bit 3 m deeper than for Core 154-929A-1H, and found the seafloor at 4356 m. Continuous oriented APC cores were taken to 123.5 mbsf (Table 1). The coring mode was switched to the XCB to avoid a serious liner failure such as occurred on Core 154-929A-14H, which apparently was induced by the lithology.

Coring continued until 11 XCB cores completed penetration to the scientific objective at 229 mbsf. Unfortunately, most of Cores 154-929B-15X and -16X were lost when sticky clay held the core-catcher mechanisms open. Again, the BHA was withdrawn from the hole for a resud.

Hole 929C

The vessel was offset 20 m south of Hole 929B for the third member of the triple-APC set. The initial core was started at 3 m below the depth of Core 154-929B-1H to maintain stratigraphic overlap.

Oriented APC cores were taken to 126.5 mbsf, where coring again shifted to the XCB mode to avoid problems with the stiff, marly clay. The initial XCB core (Core 154-929C-14X) again was lost through the core catchers, but nearly full recovery was achieved on Cores 154-929C-15X and -16X to complete the coring objective (Table 1).

Hole 929D

The final APC penetration of the voyage was a scheduled 50-m hole to be dedicated to geochemical studies in the same manner as Hole 925E. After the seafloor had been cleared, the ship was offset 20 m west so that undisturbed sediment would be cored.

An oriented mud-line core shot from 1 m shallower than Core 154-929A-1H recovered nearly 7 m of core, so seafloor depth was set at 4356 m. An additional five oriented APC cores reached total depth at 54.5 mbsf (Table 1).

A round trip of the drill string was required for the installation of an RCB BHA for Hole 929E. While the BHA was being converted, it was given its once-per-leg electromagnetic inspection to check for cracks and faults in the connections. The bit arrived on deck at 0330 hr on 15 March.

Hole 929E

With a roller-cone bit and standard RCB BHA installed, the drill string was tripped to the seafloor. Hole 929E was spudded with no change in ASK offsets from Hole 929D; the hole was drilled to 471.5 mbsf with no cores taken. The clay-rich interval from about 130 to 230 mbsf caused some problems with low ROP, high torque, and high circulating pressure. These problems were attributed to a “clay ball”

Figure 1. High-resolution swath bathymetry in the region of Site 929. The data were obtained during Cruise Ew9209 using the hydrosweep swath-mapping system. There is a gentle regional slope toward the northeast that is incised by a small, V-shaped depression about 1 nmi east of Site 929. The site is located on a small, flat feature at 4356 mbsl.

on the BHA and eventually disappeared as drilling continued in the chalk interval.

High torque persisted through Core 154-929A-9R, and Cores 154-929A-7R and -9R had anomalously low ROP. A short trip was considered necessary to “clean up” the hole. The short trip was effective, as all parameters were normal and ROP, core recovery, and core quality all were favorable in clayey nannofossil limestone. The penetration rate began to increase below 700 mbsf on the final day of coring as the clay content of the nannofossil chalk decreased. The sediment became so soft near the total depth of 809 mbsf that core recovery became sporadic and average recovery fell sharply. The time allotted for coring expired at 0400 hr on 19 March and preparations began for the logging program.

Logging Operations at Hole 929E

The wiper trip to 76 mbsf found a “tight spot” at 413 mbsf and the downtrip encountered bridges at 105 and 711 mbsf. The latter bridge was substantial and required several minutes of drilling with the top drive to clear. When the hole had been reamed to total depth and flushed with drilling mud, wireline runs were made with the rotary shifting tool (RST) to release the bit and to shift the mechanical bit release (MBR) sleeve into position. When the open-ended pipe had been pulled to 86 mbsf, the side-entry sub (SES) and logging sheaves were rigged.

The first logging tool to be run was the Quad combination string with the neutron porosity tool removed. The drill string was lowered into the hole while the logging tool was run down the pipe. Solid resistance was met at 712 mbsf, and the pipe could be advanced no farther with the application of weight and circulation only. A log was recorded up from 692 mbsf as the drill string preceded the tool up the hole. In addition to many washed-out intervals, the caliper log revealed hole restrictions at all depths where drilling and tripping problems had been experienced. The restrictions, attributed to swelling clay, were especially numerous above 220 mbsf.

When the quad combination tool had been rigged down, time remained for only a short logging run with the geochemical combination tool. The SES again was used to place the logging tool below the

Table 1. Coring summary, Site 929.

Core no.	Date (Mar. 1994)	Time (UTC)	Depth (mbsf)	Length cored (m)	Length recovered (m)	Recovery (%)
154-929A-						
1H	10	1645	0.0-4.5	4.5	4.59	102.0
2H	10	1735	4.5-14.0	9.5	9.33	98.2
3H	10	1840	14.0-23.5	9.5	9.81	103.0
4H	10	1925	23.5-33.0	9.5	9.49	99.9
5H	10	2020	33.0-42.5	9.5	9.96	105.0
6H	10	2100	42.5-52.0	9.5	9.50	100.0
7H	10	2145	52.0-61.5	9.5	9.97	105.0
8H	10	2235	61.5-71.0	9.5	9.45	99.5
9H	10	2320	71.0-80.5	9.5	9.90	104.0
10H	11	0010	80.5-90.0	9.5	9.44	99.3
11H	11	0100	90.0-99.5	9.5	10.04	105.7
12H	11	0200	99.5-109.0	9.5	9.74	102.0
13H	11	0300	109.0-118.5	9.5	9.15	96.3
14H	11	0345	118.5-128.0	9.5	8.86	93.2
15H	11	0430	128.0-137.5	9.5	10.18	107.1
16X	11	0545	137.5-147.1	9.6	5.32	55.4
17X	11	0640	147.1-156.8	9.7	8.42	86.8
18X	11	0745	156.8-166.4	9.6	8.28	86.2
19X	11	0850	166.4-176.1	9.7	6.47	66.7
20X	11	0950	176.1-185.7	9.6	9.75	101.0
21X	11	1050	185.7-195.4	9.7	9.24	95.2
22X	11	1135	195.4-205.1	9.7	9.68	99.8
23X	11	1225	205.1-214.4	9.3	9.99	107.0
24X	11	1305	214.4-224.0	9.6	9.81	102.0
25X	11	1350	224.0-233.6	9.6	9.64	100.0
26X	11	1440	233.6-243.4	9.8	8.82	90.0
27X	11	1520	243.4-253.0	9.6	8.89	92.6
28X	11	1620	253.0-262.2	9.2	6.90	75.0
29X	11	1710	262.2-271.9	9.7	9.74	100.0
30X	11	1800	271.9-281.6	9.7	9.82	101.0
31X	11	1855	281.6-291.3	9.7	9.45	97.4
32X	11	1955	291.3-301.0	9.7	9.05	93.3
33X	11	2045	301.0-310.7	9.7	9.59	98.8
34X	11	2130	310.7-320.4	9.7	9.79	101.0
35X	11	2225	320.4-330.0	9.6	9.69	101.0
36X	11	2320	330.0-339.7	9.7	9.72	100.0
37X	12	0020	339.7-349.4	9.7	9.81	101.0
38X	12	0115	349.4-359.0	9.6	8.82	91.9
39X	12	0220	359.0-368.5	9.5	8.98	94.5
40X	12	0325	368.5-378.1	9.6	8.56	89.1
41X	12	0420	378.1-387.7	9.6	6.62	68.9
42X	12	0515	387.7-397.4	9.7	0.58	6.0
43X	12	0605	397.4-407.1	9.7	7.91	81.5
44X	12	0715	407.1-416.7	9.6	9.86	103.0
45X	12	0815	416.7-426.4	9.7	7.16	73.8
46X	12	0920	426.4-436.1	9.7	4.31	44.4
47X	12	1020	436.1-445.7	9.6	9.93	103.0
48X	12	1110	445.7-455.3	9.6	9.36	97.5
48X	12	1110	445.7-455.3	9.6	9.36	97.5
49X	12	1200	455.3-465.0	9.7	9.93	102.0
50X	12	1250	465.0-474.6	9.6	9.83	102.0
51X	12	1340	474.6-484.2	9.6	9.82	102.0
52X	12	1425	484.2-493.5	9.3	8.94	96.1
53X	12	1535	493.5-503.2	9.7	4.92	50.7
54X	12	1730	503.2-507.8	4.6	6.65	144.0
55X	12	1930	507.8-517.8	10.0	0.78	7.8
56X	12	2200	517.8-527.5	9.7	0.72	7.4
Coring totals				527.5	470.96	89.3
154-929B-						
1H	13	0135	0.0-9.5	9.5	9.54	100.0
2H	13	0225	9.5-19.0	9.5	9.76	103.0
3H	13	0315	19.0-28.5	9.5	9.60	101.0
4H	13	0405	28.5-38.0	9.5	9.75	102.0
5H	13	0455	38.0-47.5	9.5	9.46	99.6
6H	13	0540	47.5-57.0	9.5	9.76	103.0
7H	13	0635	57.0-66.5	9.5	9.59	101.0
8H	13	0725	66.5-76.0	9.5	9.90	104.0
9H	13	0810	76.0-85.5	9.5	9.41	99.0
10H	13	0900	85.5-95.0	9.5	9.82	103.0
11H	13	1000	95.0-104.5	9.5	9.74	102.0
12H	13	1050	104.5-114.0	9.5	9.86	104.0
13H	13	1140	114.0-123.5	9.5	9.58	101.0
14X	13	1240	123.5-133.1	9.6	8.05	83.8
15X	13	1330	133.1-142.6	9.5	3.99	42.0
16X	13	1430	142.6-152.2	9.6	0.19	2.0
17X	13	1525	152.2-161.8	9.6	9.72	101.0
18X	13	1615	161.8-171.4	9.6	9.55	99.5
19X	13	1710	171.4-181.0	9.6	9.54	99.4
154-929C-						
1H	14	0220	3.0-12.5	9.5		9.83
2H	14	0315	12.5-22.0	9.5		9.49
3H	14	0400	22.0-31.5	9.5		9.76
4H	14	0445	31.5-41.0	9.5		9.58
5H	14	0525	41.0-50.5	9.5		9.78
6H	14	0605	50.5-60.0	9.5		9.62
7H	14	0650	60.0-69.5	9.5		9.83
8H	14	0735	69.5-79.0	9.5		9.54
9H	14	0820	79.0-88.5	9.5		9.73
10H	14	0900	88.5-98.0	9.5		9.63
11H	14	0950	98.0-107.5	9.5		9.79
12H	14	1040	107.5-117.0	9.5		9.52
13H	14	1130	117.0-126.5	9.5		9.87
14X	14	1220	126.5-136.1	9.6		0.33
15X	14	1310	136.1-145.6	9.5		9.96
16X	14	1410	145.6-155.2	9.6		7.96
Coring totals				152.2	144.22	94.8
Drilled				3.0		
Total				155.2		
154-929D-						
1H	14	1600	0.0-7.0	7.0		6.64
2H	14	1645	7.0-16.5	9.5		9.52
3H	14	1730	16.5-26.0	9.5		9.38
4H	14	1815	26.0-35.5	9.5		9.66
5H	14	1915	35.5-45.0	9.5		9.52
6H	14	2015	45.0-54.5	9.5		9.67
Coring totals				54.5	54.39	99.8
154-929E-						
1R	16	0530	471.5-481.3	9.8		9.88
2R	16	0625	481.3-491.0	9.7		8.70
3R	16	0750	491.0-500.8	9.8		4.88
4R	16	0930	500.8-510.4	9.6		5.52
5R	16	1110	510.4-520.0	9.6		5.85
6R	16	1330	520.0-529.3	9.3		7.75
7R	16	1630	529.3-539.0	9.7		4.99
8R	16	2000	539.0-548.6	9.6		5.75
9R	16	2350	548.6-558.3	9.7		7.10
10R	17	1000	558.3-567.9	9.6		9.10
11R	17	1140	567.9-577.5	9.6		7.95
12R	17	1345	577.5-587.2	9.7		9.53
13R	17	1545	587.2-596.9	9.7		8.31
14R	17	1745	596.9-606.5	9.6		9.68
15R	17	2000	606.5-616.1	9.6		9.59
16R	17	2215	616.1-625.8	9.7		9.37
17R	18	0030	625.8-635.3	9.5		9.24
18R	18	0220	635.3-645.0	9.7		7.65
19R	18	0450	645.0-654.7	9.7		9.85
20R	18	0650	654.7-664.3	9.6		9.05
21R	18	0900	664.3-673.9	9.6		7.35
22R	18	1115	673.9-683.2	9.3		7.61
23R	18	1345	683.2-692.8	9.6		4.15
24R	18	1550	692.8-702.5	9.7		7.56
25R	18	1745	702.5-712.2	9.7		9.82
26R	18	1915	712.2-721.9	9.7		6.98
27R	18	2125	721.9-731.6	9.7		5.46
28R	18	2320	731.6-741.2	9.6		7.06
29R	19	0100	741.2-750.9	9.7		6.93
30R	19	0220	750.9-760.6	9.7		2.60
31R	19	0330	760.6-770.2	9.6		9.87
32R	19	0425	770.2-779.9	9.7		0.00
33R	19	0530	779.9-789.5	9.6		9.28
34R	19	0625	789.5-799.2	9.7		0.03
35R	19	0750	799.2-808.9	9.7		2.21
Coring totals				337.4	246.65	73.1
Drilled				471.5		
Total				808.9

Figure 2. High-resolution, single-channel seismic record (Cruise Ew9209 Line 9) for Site 929. The data were obtained using an air-gun array (1350 cm³, tuned to minimize the bubble pulse) during the Ew9209 site survey cruise (see "Site Survey" chapter, this volume).

upper restricted intervals and the section from 580 to 108 mbsf was logged before it was necessary to recover the tool and rig down.

With the SES removed from the string, the pipe was pulled clear of the seafloor. At that point, the trip was interrupted to replace the upper guide horn assembly and to perform the required slip-and-cut operation on the drilling line. The drill string and positioning beacons then were recovered and the BHA was disassembled for transit. *JOIDES Resolution* departed Site 929 for Barbados at 0900 hr on 21 March.

LITHOSTRATIGRAPHY

Introduction

The 809-m sequence of sediment recovered from five holes drilled at Site 929 is predominantly clay, claystone, ooze, and chalk composed of clay minerals, calcareous nannofossils, and foraminifers. Minor, ubiquitous components include iron sulfide and oxides and oxyhydroxides of iron. The main component of lithologic variability occurs at decimeter to meter scales throughout most of the section in the form of distinct cyclic changes in color that are related to changes in the proportions of biogenic carbonate, detrital clay minerals, and to a lesser extent, the oxides and sulfides.

Site 929 is the deep-water end-member of the Ceara Rise depth transect and consequently, on average, contains less carbonate than the other sites. Despite this overall difference, many of the same lithologic changes used to characterize the primary lithostratigraphic units in the shallower sites were also observed at Site 929. Thus, three units have been defined (Fig. 3). Unit I (0–128 mbsf) is Holocene to early Pliocene in age and consists of alternating clays and clayey mixed sediments with varying amounts of nannofossils and foraminifers. Unit II (128–230 mbsf) is early Pliocene to early Miocene in age and consists of alternating oozes and clays (claystones) with varying amounts of nannofossils, foraminifers, and clay. Finally, Unit III (230–809 mbsf) is early Miocene to late Paleocene in age and consists of alternating clayey nannofossil chalks and limestones with nanno-

fossil claystones and nannofossil clayey mixed sedimentary rock. Each lithostratigraphic unit, along with their component subunits, is described in the following section.

Description of Lithostratigraphic Units

Lithologic Unit I

Intervals: Cores 154-929A-1H through -14H, Cores 154-929B-1H through -14X, Cores 154-929C-1H through -13H, and Cores 154-929D-1H through -6H

Age: Holocene to early Pliocene

Depth: 0–128 mbsf

Unit I sediments are dominated by clay with variable amounts of calcareous nannofossils and foraminifers. The unit can be divided into two subunits: Subunit IA (0–45 mbsf) is a gray (10YR 6/1) clay with nannofossils alternating with gray (10YR 5/1) nannofossil clay with foraminifers. Subunit IB (45–128 mbsf) is a light gray (10YR 7/1) clayey nannofossil ooze with varying amounts of foraminifers and a gray (10YR 6/1) nannofossil clayey mixed sediment. Clay content steadily increases toward the top of the subunit. The contact between the subunits is best observed as a shift in average carbonate content from 24% in the upper subunit to 39% in the lower subunit (Fig. 3). The change in carbonate content is associated with a down-core decrease in the average magnetic susceptibility of the sediments.

Unique to Subunit IA at Site 929, compared with the shallower sites, is the occurrence of no less than ten 1- to 3-cm-thick, silt-rich turbidites within the darker, more clay-rich glacial intervals. They contain abundant quartz with feldspar, mica, chlorite, and iron oxide. As in the shallower sites, Subunit IA contains numerous yellowish brown iron-oxide layers that tend to be concentrated in the gradational intervals between color changes. In addition, frequent dark gray, iron sulfide-rich horizons including pyrite staining in thin horizontal bands and/or sparsely disseminated fine-grained pyrite occur in both subunits.

Figure 3. Core recovery, lithostratigraphy, age, biozones, percentage of color reflectance (550 nm), magnetic susceptibility, carbonate content, bulk density, and natural gamma of sediments recovered at Holes 929A through 929E. Locations of slump (S), turbidite (T), and grain-flow (G) deposits are shown in the column adjacent to the generalized lithostratigraphy. Percentage of reflectance and magnetic susceptibility data down to 500 mbsf are from Hole 929A; below 500 mbsf, they are from Hole 929E.

Lithologic Unit II

Intervals: Cores 154-929A-15H through -25X, Cores 154-929B-14X through -24X, and Cores 154-929C-14X through -16X

Age: early Pliocene to early Miocene

Depth: 128–230 mbsf

Unit II (128–230 mbsf) consists mostly of clay and claystone with varying amounts of nannofossils and, to a lesser extent, foraminifers.

It can be distinguished from Unit I not so much by its somewhat higher average carbonate content (39% in Unit II compared with 33% in Unit I) as by its very high-amplitude carbonate variability. These changes are accompanied by a distinct color change from gray to brown hues and an increase in the red/blue (700/400 nm) ratio in percent reflectance data (Fig. 4D) as well as an increase in the amplitude of variability in magnetic susceptibility data. Also within Unit II are three intervals identified as the products of mass-wasting events,

Figure 3 (continued).

probably slumping or sliding (Figs. 3 and 4). Finally, as at Site 928, the ooze/chalk transition occurs within Unit II, at around 205 mbsf.

As with Sites 927 and 928, Unit II at Site 929 is divided into two subunits. Subunit IIA (128–164 mbsf) consists of light brownish gray (10YR 6/2) clayey nannofossil ooze with foraminifers and brown (10YR 5/2) nannofossil clay. Its mean carbonate content (43%) is similar to the lower part of Subunit IB above, but Subunit IIA exhibits more variability in carbonate content, expressed visually by “light/dark” color changes that are much more distinct than in Unit I. Subunit IIB (164–230 mbsf) consists of light brownish gray (10YR 6/2) clay or claystone and pinkish gray (7.5YR 6/2) clay with nanno-

fossils or claystone with nannofossils. Its boundary with Subunit IIA is marked by an abrupt drop in carbonate content to values less than 10%. Carbonate content remains low, averaging below 20%, in that part of the subunit not associated with mass wasting. The in situ sediment with low carbonate concentrations is interrupted by an interval of much more carbonate-rich, “slumped” sediments occurring between 176 and 205 mbsf (Figs. 3 and 4). The occurrence of this slump along with two other smaller slumps within Unit II (Fig. 4) is recognized also at Sites 925, 927, and 928 and marks a time interval of regional mass-wasting processes at the Ceara Rise (see also “Synthesis” chapter, this volume).

Figure 3 (continued).

Lithologic Unit III

Intervals: Cores 154-929A-25X through -56X and Cores 154-929E-1R through -35R

Age: early Miocene to late Paleocene

Depth: 230–809 mbsf

Unit III, as at Site 925, is the thickest lithostratigraphic unit recognized at Site 929, extending from 230 mbsf to the bottom of the section at 809 mbsf. It consists of early Miocene to late Paleocene nannofossil claystone, nannofossil clayey mixed sedimentary rock,

and clayey nannofossil chalk and limestone. The carbonate content is relatively high, except for one interval averaging 55% (Fig. 3). As at the shallower sites, most of the unit is characterized by decimeter- to meter-scale light to dark changes in color that mainly reflect cyclic changes in carbonate content. In general, Unit III also exhibits relatively high variability in percent reflectance, and low variability in magnetic susceptibility. The top of the unit is marked by a distinct increase in carbonate content and percentage reflectance, and a decrease in magnetic susceptibility (Fig. 3). Unlike the other sites, the red/blue (700/400 nm) percentage reflectance ratio does not decrease

Figure 3 (continued).

at the Unit II/III boundary in Site 929 (Fig. 4). Instead, this change occurs within the upper part of Unit III, around 20 m below all the other changes mentioned above that define the top of the unit.

As at Site 926, the presence of trace to moderate amounts of biosiliceous material is the main criterion used to subdivide the upper 450 m of Unit III at this site (Fig. 5). Four subunits are recognized on this basis. The remainder of the section (650–809 mbsf) is divided into two additional subunits, mainly on the basis of the significant

change in average carbonate content that occurs over one interval within the lower section of Unit III (see below).

Subunit IIIA (230–334 mbsf) consists of gray (5GY 6/1) claystone alternating with light greenish gray (5GY 7/1) nannofossil clayey mixed sedimentary rock and clayey nannofossil chalk. All lithologies contain trace to moderate amounts of fragmented radiolarians, diatoms, and siliceous sponge spicules (in one short interval around 290 mbsf, the biosiliceous component reaches around 20%; see Fig. 5). Its

Figure 4. Ratio of percentage of reflectance at 700 nm (red) to 400 nm (blue) vs. depth in Hole 929A. Iron-oxide and oxyhydroxide layers are emphasized by this ratio, particularly in Unit II. Note that, unlike at the shallower sites, the increase in this ratio occurs within Unit III rather than at the Unit II/III transition (almost 3 m.y. earlier).

average carbonate content is 59%. In addition, Subunit IIIA contains eight turbidites, 6–150 cm in thickness, within its upper 30 m (230–260 mbsf). Subunit IIIB (334–440 mbsf) consists of light greenish gray (5GY 7/1) clayey nannofossil chalk alternating with gray (5GY 6/1) nannofossil claystone. Its average carbonate content (67%) is nearly 10% higher than in the relatively silica-rich Subunits IIIA and IIIC above and below. Subunit IIIC (440–520 mbsf) consists of light greenish gray (5GY 7/1) nannofossil chalk and gray (5GY 6/1) clayey nannofossil mixed sedimentary rock and has an average carbonate content of 58%. As with Subunit IIIA, all lithologies contain trace to moderate amounts of biosiliceous material, mostly fragmented radiolarians, diatoms, and siliceous sponge spicules. Diatoms, however, are somewhat more abundant in this interval than in Subunit IIIA, representing between 10% and 20% of the sediment for much of the interval between 450 and 490 mbsf (Fig. 5). The interval between 470 and 495 mbsf contains six small turbidites. The base of Subunit IIIC is marked by the transition from chalk to limestone. Little or no biosiliceous material is found below the base of Subunit IIIC.

Subunit IIID (520–670 mbsf) consists of light greenish gray (5GY 7/1) clayey nannofossil limestone and greenish gray (5GY 6/1) clayey nannofossil mixed sedimentary rock with an average carbonate content of 56%. The base of this subunit is marked by a significant shift to lower carbonate content and percent reflectance and a small but distinct increase in magnetic susceptibility. Subunit IIIE (670–735 mbsf) is a low carbonate interval within Unit III (average carbonate content 28%). It consists of greenish gray (5GY 6/1) nannofossil claystone and claystone with nannofossils. Finally, Subunit IIIF (735–809 mbsf) is mainly gray (10Y 6/1, 5Y 5/1) clayey nannofossil mixed sedimentary rock with calcareous fragments and, to a lesser extent, light gray (5Y 7/1) clayey nannofossil limestone. Average carbonate content returns to levels above 50%. Throughout the bottom of Subunit IIID (below 640 mbsf) and most of Subunits IIIE and IIIF, small but significant numbers of millimeter-size recrystallized and spar-filled foraminifers are observed.

Figure 5. Relative abundance of biosiliceous fragments (radiolarians and diatoms) at Site 929 vs. depth in relative percent, based on smear-slide estimates. The division of Unit III into Subunits IIIA, IIIB, and IIIC was based on the pattern of occurrence of biosiliceous fragments.

Interpretation

The deep water depth of Site 929 (4356 m) makes it particularly sensitive to Holocene to early Paleogene paleoceanographic changes in the western equatorial Atlantic. Today, Site 929 is positioned about 200 m below the lysocline, within the mixing zone between NADW and AABW. Thus, its depositional history should be very sensitive to changes in deep-water circulation, alkalinity, and biogenic opal preservation. A comparison with the shallowest site along the Ceara Rise depth transect (Site 925, 3041 m water depth) shows that over significant portions of the last 43 m.y. carbonate concentrations are, on average, only around 7% lower. However, noticeably larger differences in average carbonate content between these two sites occur during two time intervals, the late Pliocene to Holocene (last 5 m.y.; lithologic Unit I) and late to middle Miocene (7–15 Ma; Site 929 lithologic Subunit IIIB). Over the last 5 m.y., the average carbonate content is only 33% at Site 929 compared to 53% at Site 925. Although some of this difference may be related to slightly less terrigenous influx from the Amazon Cone at Site 925, a significant portion of this difference is caused by an overall stronger dissolution gradient related to deep-water circulation. The occurrence of a clay-rich interval (average carbonate <20% for nonslump sediments from this interval) in the late and middle Miocene at Site 929 suggests deposition just above a CCD that must not have been much deeper than around 4400 m. The carbonate content at Site 925 is very high, averaging 72% over the same time interval. Another clay-rich interval occurs in the early Eocene (around 48–53 Ma) and may indicate that Site 929 was much closer to the CCD at this time as well, and that the lysocline was shallower. Unfortunately, none of the other sites recovered sediment as old as these Site 929 carbonate-poor claystones.

Changes in surface- and deep-water circulation and chemistry are also indicated by the occurrence and bathymetric distribution pattern of biogenic opal. Two intervals of biosiliceous sedimentation occur within Unit III at Site 929: one in the early Miocene (around 15–24

Ma), and the other in the early Oligocene (around 30–34 Ma). Little or no biosiliceous sediment is found at Site 925 within sediments representing these time intervals. The enhanced preservation of biosiliceous material during these time intervals indicates that (1) productivity was higher and/or (2) bottom waters less corrosive to silica were bathing the deeper parts of the Ceara Rise. Thus, the biogenic silica preservation events during the early Oligocene and early Miocene record information relating to the large-scale adjustments between northern and southern deep-water sources (see “Synthesis” chapter, this volume).

One feature unique to Site 929 is the occurrence of numerous thin turbidites within Unit I. As previously mentioned, these turbidites, unlike all other turbidites identified at Site 929 and all other sites, contain predominately silt-sized grains of quartz with appreciable amounts of feldspar, mica, chlorite, and iron oxide. Without exception, all other turbidites are carbonate rich, dominated by silt- to sand-sized foraminifers. These younger turbidites are assumed to be associated with sediment transport processes occurring on the distal part of the Amazon Cone, which extends out onto the Ceara Abyssal Plain to the north of the Ceara Rise. The turbidites occur predominately during glacial intervals, which are represented by the darker, more clay-rich sediments of Unit I. Other turbidites are related to downslope transport events that originated on the Ceara Rise itself.

In summary, Site 929, the deep-water end-member of the Ceara Rise transect, exhibits lithologic variability that, when compared in detail with the shallower sites along the transect, is related to deep-water changes affecting carbonate and silica dissolution gradients. Such changes are related to the interaction between, and relative importance of, deep waters from northern and southern sources.

BIOSTRATIGRAPHY

Introduction

Site 929 is located at 5°58.57'N, 43°44.39'W, in 4356 m water depth, and is the deepest site of the Ceara Rise depth transect. Five holes were cored (Holes 929A through 929E) through sediments of late Paleocene to Holocene age. Shipboard biostratigraphy was accomplished by studies of calcareous nannofossils and planktonic foraminifers. Severe carbonate dissolution at some levels reduced the number of datums that were recognized, particularly planktonic foraminifer datums.

Calcareous Nannofossils

Calcareous nannofossils recovered at Site 929 represent a stratigraphic succession from the Pleistocene (Zone CN15) through the upper Paleocene (Zone CP8). Biostratigraphic events recognized at Site 929 are presented in Table 2. The summary of the nannofossil biostratigraphy is reported in Figure 6.

The relative abundance and preservation of nannofossils vary throughout the sequence recovered. Nannofossils are generally abundant and well or moderately preserved, except in some intervals in the Pleistocene and upper and middle Miocene, where intervals barren of nannofossils were observed. Slumps and turbidites were present in the upper and middle Miocene interval, which have obviously disturbed the biostratigraphic succession. Biostratigraphic inversions associated with sedimentological evidence of turbidites and slumps were documented in Cores 154-929A-18X through -22X.

The Pleistocene–Pliocene section includes Cores 154-929A-1H through -15H, 154-929B-1H through -15H, and 154-929C-1H through -14X. Hole 929D recovered only the Pleistocene section between Zone CN15 and Subzone CN13b. In the upper part of the Pleistocene section (Cores 154-929A-1H through -5H), strongly dissolved assemblages and samples barren of nannofossils were observed, and reworked Miocene species were observed in some levels. Nevertheless, all the Pleistocene bioevents were recognized. The Pliocene interval was characterized by rich and well-preserved as-

semblages, with abundant discoasterids, helicoliths, reticulofenestrids, *Calcidiscus* spp., and common ceratolithids.

The Pliocene/Miocene boundary approximately corresponds to the top of the disturbed and partially dissolved interval. The complicated biostratigraphic relationships of the condensed upper and middle Miocene section, with slumps, turbidites, reworking, and hiatuses(?), are summarized in Figure 7 (“casino” interval).

The entire Miocene section (Zone CN9 to Subzone CN1c) was recovered in Hole 929A, and includes Cores 154-929A-16X through -35X. The upper–middle Miocene section (Zones CN9 to CN4) was recovered in Hole 929B. Hole 929C bottomed in the upper Miocene Subzone CN9bC. In the lower Miocene, nannofossils showed increased overgrowth on discoasterids and dissolution of other forms. Preservation improved in the lowermost Miocene and uppermost Oligocene interval, where the nannofossil assemblages were generally well preserved. As observed at Site 928, nannofossil assemblages at the Miocene–Oligocene transition were characterized by high species diversity, by abundant discoasterids and sphenoliths, and by abundant and diversified helicoliths, such as the large *Helicosphaera truempyi*. Peaks in abundance of *Triquetrorhabdulus carinatus* were recorded in this interval. The short-ranging species *Sphenolithus delphix*, which approximates the Miocene/Oligocene boundary, was observed within Core 154-929A-35X.

The Oligocene section was recovered in Hole 929A, from Cores 154-929A-35X through -54X. The lowermost part of Hole 929A was placed within the upper Eocene (top of Zone CP15). Hole 929E recovered the lower part of the lower Oligocene, corresponding to Zone CP16, from Cores 154-929E-1R to -4R. The nannofossil biozonal boundaries within the Oligocene were recognized by means of sphenolith events (i.e., *Sphenolithus ciperoensis*, *S. distentus*, and *S. predistentus*). The lower Oligocene section contained diatoms and radiolarians, often abundant and well preserved.

The last occurrence (LO) of *Discoaster saipanensis*, which approximates the Oligocene/Eocene boundary, was recorded between Samples 154-929A-54X-5, 20 cm, and -54X-CC, and between Samples 154-929E-4R-4, 39 cm, and -4R-CC. In the Eocene interval, nannofossils are moderately well preserved. Only discoasterids and specimens belonging to genus *Nannotetrina* (in the middle Eocene) and *Tribrachiatus* (in the lower Eocene) showed strong overgrowth. Nevertheless, these forms could be recognized and provided useful events for the biostratigraphic classification of this interval. Other nannofossils characterizing the Eocene assemblages were helicoliths, commonly abundant and diversified, sphenoliths, *Chiasmolithus* spp., *Coccolithus* spp., and *Reticulofenestra* spp. The first occurrence (FO) of the large *Reticulofenestra umbilicus* within the middle Eocene was a clear event occurring at 609.55 mbsf (between Samples 154-929E-15R-2, 120 cm, and -15R-3, 40 cm).

The FO of *Discoaster subloboensis* marks the Zone CP11/CP12 boundary and approximates the middle/lower Eocene boundary. In the preliminary shipboard investigation, we did not attempt to determine this event because of overgrowth, which made it difficult to separate *D. subloboensis* from the 5-rayed variety of *Discoaster lodoensis*. Likewise, we did not attempt to determine the range of *Coccolithus crassus*, the FO of which marks the Zone CP10/CP11 boundary. The LO of *Tribrachiatus orthostylus*, which is an easily recognized event, even when affected by calcite overgrowth, was used to approximate the Zone CP10/CP11 boundary (Fig. 6).

The series of nannofossil events across the Eocene/Paleocene boundary transition interval and in the uppermost Paleocene was observed in Cores 154-929E-29R through -35R, despite the low recovery (about 50%) in these cores, including no recovery in Core 154-929E-32R and 0.03-m recovery in Core 154-929E-33R. The evolutionary transition from *Tribrachiatus contortus* to *Tribrachiatus orthostylus* was observed in Core 154-929E-29R. Overgrowth prevented recognition of the transition from *Tribrachiatus bramlettei* to *T. contortus*. The base of the *Tribrachiatus* lineage, however, was observed in Core 154-929E-31R, which also contained the base of *Discoaster diastypus*.

Table 2. Calcareous nannofossil events in Holes 929A, 929B, 929C, 929D, and 929E.

Calcareous nannofossil events	Age (Ma)	Sample range	Depth (mbsf)	Mean depth (mbsf)	Composite depth (m)	Mean composite depth (m)
Hole 929A:						
T <i>Pseudoemiliana lacunosa</i>	0.46	3H-2, 120 cm, to 3H-3, 40 cm	16.70–17.70	17.05	18.32–18.82	18.67
Reentrance medium <i>Gephyrocapsa</i> spp.	1.03	5H-1, 140 cm, to 5H-2, 20 cm	34.40–34.70	34.55	37.50–37.80	37.65
T Large <i>Gephyrocapsa</i> spp.	1.24	5H-6, 80 cm, to 5H-6, 120 cm	41.30–41.70	41.50	44.29–44.80	44.60
B Large <i>Gephyrocapsa</i> spp.	1.46	6H-4, 120 cm, to 6H-5, 40 cm	48.20–48.78	48.49	52.81–53.39	53.10
T <i>Calcidiscus macintyre</i>	1.60	6H-5, 120 cm, to 6H-6, 40 cm	49.50–50.28	49.93	54.19–55.09	54.54
B Medium <i>Gephyrocapsa</i> spp.	1.67	7H-1, 20 cm, to 7H-1, 40 cm	52.20–52.40	52.30	58.16–58.36	58.26
T <i>Discoaster brouweri</i>	1.95	7H-5, 120 cm, to 7H-6, 20 cm	59.20–59.70	59.45	65.16–65.66	65.41
B Acme <i>Discoaster triradiatus</i>	2.15	8H-2, 80 cm, to 8H-3, 10 cm	63.80–64.60	64.20	71.76–72.56	72.16
T <i>Discoaster pentaradiatus</i>	2.44	8H-CC, 9H-1, 80 cm	70.95–71.80	71.38	78.91–80.57	80.15
T <i>Discoaster surculus</i>	2.61	9H-2, 80 cm, to 9H-3, 80 cm	73.30–74.80	74.05	82.07–83.57	82.82
T <i>Discoaster tamalis</i>	2.76	9H-CC, to 10H-1, 40 cm	80.90–80.45	80.90	90.37–90.02	90.37
T <i>Sphenolithus</i> spp.	3.62	11H-CC, to 12H-3, 80 cm	100.04–103.20	101.62	110.11–114.16	112.48
T <i>Reticulofenestra pseudoumbilicus</i>	3.77	12H-5, 20 cm, to 12H-5, 30 cm	105.70–105.80	105.75	116.56–116.66	116.61
B <i>Ceratolithus rugosus</i>	5.04	15H-2, 116 cm, to 15H-2, 140 cm	130.66–130.90	130.78	142.09–142.33	142.21
T <i>Ceratolithus acutus</i>	5.04	15H-2, 116 cm, to 15H-2, 140 cm	130.66–130.90	130.78	142.09–142.33	142.21
B <i>Ceratolithus acutus</i>	5.34	15H-4, 80 cm, to 15H-5, 20 cm	133.30–134.20	133.75	144.73–145.63	145.18
T <i>Triquetrorhabdulus rugosus</i>	5.34	15H-4, 80 cm, to 15H-5, 20 cm	133.30–134.20	133.75	144.73–145.63	145.18
T <i>Discoaster quinqueramus</i>	5.56	15H-6, 20 cm, to 16H-1, 10 cm	135.70–137.60	136.65	147.13–149.35	148.08
T <i>Amaurolithus amplifolius</i>	5.88	16H-1, 120 cm, to 16H-2, 40 cm	138.70–139.40	139.05	150.45–151.15	150.80
B <i>Amaurolithus amplifolius</i>	6.5	19X-2, 120 cm, to 20X-1, 20 cm	169.10–176.30	172.70	182.01–191.85	185.61
B <i>Amaurolithus primus</i>	7.3	19X-2, 120 cm, to 20X-1, 20 cm	169.10–176.30	172.70	182.01–191.85	185.61
B <i>Discoaster berggrenii</i>	8.4	23X-1, 40 cm, to 23X-1, 120 cm	205.60–206.30	205.90	219.90–220.70	220.30
T <i>Catinaster calyculus</i>	9.36	23X-1, 40 cm, to 23X-1, 120 cm	205.60–206.30	205.90	219.90–220.70	220.30
T <i>Discoaster hamatus</i>	9.4	23X-1, 40 cm, to 23X-1, 120 cm	205.60–206.30	205.90	219.90–220.70	220.30
B <i>Discoaster hamatus</i>	10.4	23X-3, 120 cm, to 24X-2, 80 cm	209.30–216.70	213.00	223.70–231.10	227.40
B <i>Catinaster coalitus</i>	10.7	23X-3, 120 cm, to 24X-2, 80 cm	209.30–216.70	213.00	223.70–231.10	227.40
T <i>Coccolithus miopelagicus</i>	10.8	23X-3, 120 cm, to 24X-2, 80 cm	209.30–216.70	213.00	223.70–231.10	227.40
T <i>Cyclargolithus floridanus</i>	13.2	24X-3, 82 cm, to 24X-4, 75 cm	218.22–219.65	218.94	232.62–234.05	233.34
T <i>Sphenolithus heteromorphus</i>	13.6	24X-5, 85 cm, to 24X-6, 20 cm	221.25–222.10	221.68	235.65–236.50	236.08
T <i>H. ampliata</i>	15.8	25X-2, 40 cm, to 25X-3, 40 cm	225.90–227.40	226.65	241.32–242.82	242.07
T Abundant <i>Discoaster deflandrei</i>	16.2	25X-4, 40 cm, to 25X-5, 40 cm	228.90–230.40	229.65	244.32–245.82	245.07
B <i>Sphenolithus heteromorphus</i>	18.1	27X-4, 80 cm, to 27X-5, 10 cm	248.70–249.50	249.10	264.12–264.92	264.52
T <i>Sphenolithus belemnos</i>	18.4	27X-5, 118 cm, to 27X-6, 10 cm	250.58–251.00	250.79	266.00–266.42	266.21
B <i>Sphenolithus belemnos</i>	19.7	28X-CC, to 29X-1, 40 cm	259.90–262.60	261.25	275.32–278.02	276.67
T <i>Sphenolithus delphix</i>	23.7	35X-2, 120 cm, to 35X-3, 40 cm	323.10–323.80	323.45	338.52–339.22	338.78
B <i>Sphenolithus delphix</i>	24.4	35X-5, 40 cm, to 35X-6, 20 cm	326.80–327.60	327.20	342.22–343.02	342.62
T <i>Sphenolithus ciperoensis</i>	24.7	37X-2, 40 cm, to 37X-3, 40 cm	341.60–343.10	342.35	357.02–358.52	357.77
T <i>Sphenolithus distentus</i>	26.5	42X-CC, to 43X-CC	388.28–405.31	396.80	403.70–420.73	412.22
B <i>Sphenolithus ciperoensis</i>	28.1	43X-CC, to 44X-CC	405.31–416.96	411.14	420.73–432.38	426.56
B <i>Sphenolithus distentus</i>	30.4	47X-CC, to 48X-CC	446.03–455.06	450.55	461.45–470.48	465.97
T <i>Reticulofenestra umbilicus</i> >14 µm	32.1	50X-4, 116 cm, to 50X-5, 40 cm	470.66–471.40	471.03	486.08–486.82	486.45
T <i>Coccolithus formosus</i>	32.7	51X-4, 40 cm, to 51X-4, 140 cm	479.50–480.50	480.00	495.87–496.87	496.37
T <i>Discoaster saipanensis</i>	34.2	54X-5, 20 cm, to 54X-CC	509.40–509.85	509.62	525.74–526.19	525.96
T <i>Discoaster barbadiensis</i>	34.5	55X-1, 2 cm, to 55X-CC	507.82–508.58	508.20	524.16–524.92	524.54
T <i>Cribrocentrum reticulatum</i>	35.0	55X-1, 2 cm, to 55X-CC	507.82–508.58	508.20	524.16–524.92	524.54
Hole 929B:						
T <i>Pseudoemiliana lacunosa</i>	0.46	1H-CC, to 2H-CC	9.54–19.26	14.40	9.59–19.88	14.24
Reentrance medium <i>Gephyrocapsa</i> spp.	1.03	4H-CC, to 5H-CC	38.25–47.46	42.85	40.85–50.54	45.70
T Large <i>Gephyrocapsa</i> spp.	1.24	4H-CC, to 5H-CC	38.25–47.46	42.85	40.85–50.54	45.70
B Large <i>Gephyrocapsa</i> spp.	1.46	5H-CC, to 6H-CC	47.46–57.26	52.36	50.54–60.61	55.56
T <i>Calcidiscus macintyre</i>	1.60	5H-CC, to 6H-CC	47.46–57.26	52.36	50.54–60.61	55.56
B Medium <i>Gephyrocapsa</i> spp.	1.67	6H-CC, to 7H-3, 40	57.26–60.40	58.33	60.61–64.47	62.54
T <i>Discoaster brouweri</i>	1.95	7H-3, 40 cm, to 7H-4, 40 cm	60.40–61.90	61.15	64.47–65.97	65.52
B Acme <i>Discoaster triradiatus</i>	2.15	7H-CC, to 8H-1, 40 cm	66.59–66.90	66.74	70.66–71.57	71.11
T <i>Discoaster pentaradiatus</i>	2.44	7H-CC, to 8H-CC	66.59–76.40	71.49	70.66–81.07	75.87
T <i>R. pseudoumbilicus</i>	2.76	9H-6, 40 cm, to 9H-6, 120 cm	83.90–84.7	84.30	89.52–90.32	89.92
B <i>Ceratolithus rugosus</i>	3.77	12H-4, 40 cm, to 12H-4, 120 cm	109.40–110.20	109.80	116.26–117.06	116.66
B <i>Ceratolithus rugosus</i>	5.04	14H-CC, to 15H-1, 30 cm	131.55–133.40	132.52	140.36–141.89	141.12
B <i>Ceratolithus acutus</i>	5.34	15H-1, 120 cm, to 15H-2, 40 cm	134.30–135.00	134.65	142.79–143.49	143.14
T <i>Triquetrorhabdulus rugosus</i>	5.34	15H-1, 120 cm, to 15H-2, 40 cm	134.30–135.00	134.65	142.79–143.49	143.14
T <i>Discoaster quinqueramus</i>	5.56	15H-2, 40 cm, to 15H-2, 120 cm	135.00–135.80	135.40	143.49–144.29	143.89
T <i>Amaurolithus amplifolius</i>	5.88	15H-3, 40 cm, to 15H-CC	136.50–137.09	136.80	144.99–145.78	145.29
B <i>Amaurolithus amplifolius</i>	6.5	15H-CC, to 17X-CC	137.09–161.92	149.50	145.78–170.31	158.04
B <i>Amaurolithus primus</i>	7.3	18X-CC, to 19X-CC	171.35–180.84	176.10	181.66–192.09	186.87
B <i>Discoaster berggrenii</i>	8.4	21X-CC, to 22X-CC	200.32–208.57	204.44	210.84–220.01	215.42
T <i>Catinaster calyculus</i>	9.3	23X-1, 120 cm, to 23X-2, 40 cm	210.90–211.60	211.25	220.96–221.66	221.31
T <i>Discoaster hamatus</i>	9.4	23X-1, 120 cm, to 23X-2, 40 cm	210.90–211.60	211.25	220.96–221.66	221.31
B <i>Discoaster hamatus</i>	10.4	23X-3, 40 cm, to 23X-3, 120 cm	213.10–213.90	213.50	223.16–223.96	223.56
B <i>Catinaster coalitus</i>	10.7	23X-3, 40 cm, to 23X-3, 120 cm	213.10–213.90	213.50	223.16–223.96	223.56
T <i>Cyclargolithus floridanus</i>	13.2	24X-3, 40 cm, to 24X-3, 120 cm	222.80–223.60	223.20	233.94–234.74	234.34
T <i>Sphenolithus heteromorphus</i>	13.6	24X-4, 40 cm, to 24X-4, 120 cm	224.30–225.10	224.70	235.44–236.24	235.84
Hole 929C:						
T <i>Pseudoemiliana lacunosa</i>	0.46	2H-4, 12 cm, to 2H-4, 80 cm	17.12–17.80	17.46	17.95–18.63	18.29
Reentrance medium <i>Gephyrocapsa</i> spp.	1.03	4H-CC, to 5H-CC	41.08–50.78	45.93	43.80–54.20	49.00
T Large <i>Gephyrocapsa</i> spp.	1.24	4H-CC, to 5H-CC	41.08–50.78	45.93	43.80–54.20	49.00
B Large <i>Gephyrocapsa</i> spp.	1.46	5H-CC, to 6H-CC	50.78–60.12	55.45	54.20–64.35	59.27
T <i>Calcidiscus macintyre</i>	1.60	6H-CC, to 7H-CC	60.12–69.83	64.97	64.35–74.72	69.53
B Medium <i>Gephyrocapsa</i> spp.	1.67	6H-CC, to 7H-CC	60.12–69.83	64.97	64.35–74.72	69.53
T <i>Discoaster brouweri</i>	1.95	6H-CC, to 7H-CC	60.12–69.83	64.97	64.35–74.72	69.53
B Acme <i>Discoaster triradiatus</i>	2.15	7H-CC, to 8H-CC	69.83–79.04	70.43	74.72–84.19	79.45
T <i>Discoaster pentaradiatus</i>	2.44	7H-CC, to 8H-CC	69.83–79.04	70.43	74.72–84.19	79.45
T <i>Discoaster tamalis</i>	2.76	8H-CC, to 9H-CC	79.04–88.73	83.89	84.19–94.27	89.23
T <i>R. pseudoumbilicus</i>	3.77	11H-CC, to 13H-CC	107.79–126.87	117.33	114.00–135.28	124.65
B <i>Ceratolithus rugosus</i>	5.04	13H-CC, to 14H-CC	126.87–126.83	126.85	135.28–135.33	135.30

Table 2 (continued).

Calcareous nanofossil events	Age (Ma)	Sample range	Depth (mbsf)	Mean depth (mbsf)	Composite depth (m)	Mean composite depth (m)
B <i>Ceratolithus acutus</i>	5.34	15X-1, 40 cm, to 15X-2, 40 cm	136.50–138.00	137.25	145.21–146.71	145.96
T <i>Triquetrorhabdulus rugosus</i>	5.34	15X-1, 40 cm, to 15X-2, 40 cm	136.50–138.00	137.25	145.21–146.71	145.96
T <i>Discoaster quinqueramus</i>	5.56	15X-3, 21 cm, to 15X-3, 40 cm	139.31–139.50	139.40	148.02–148.21	148.11
B <i>Emiliania huxleyi</i>	0.26	1H-CC, to 2H-CC	6.64–16.52	11.58	7.05–17.18	13.11
T <i>Pseudoemiliania lacunosa</i>	0.46	2H-CC, to 3H-CC	16.52–25.98	21.25	17.18–27.81	22.50
Reentrance medium <i>Gephyrocapsa</i> spp.	1.03	3H-CC, to 4H-CC	25.98–35.66	30.82	27.81–37.92	32.86
T Large <i>Gephyrocapsa</i> spp.	1.24	4H-CC, to 5H-CC	35.66–45.02	40.34	37.92–48.24	43.08
B Large <i>Gephyrocapsa</i> spp.	1.46	5H-CC, to 6H-CC	45.02–54.67	49.84	48.24–58.86	53.55
T <i>Coccolithus formosus</i>	32.7	1R-1, 30 cm, to 1R-CC	471.80–481.38	476.59	487.51–497.09	492.30
T <i>Discoaster saipanensis</i>	34.2	4R-4, 39 cm, to 4R-CC	505.78–506.32	506.05	516.02–516.20	519.11
T <i>Discoaster barbadiensis</i>	34.5	4R-4, 39 cm, to 4R-CC	505.78–506.32	506.05	516.02–516.20	519.11
T <i>Cribrocentrum reticulatum</i>	35.0	4R-4, 39 cm, to 4R-CC	505.78–506.32	506.05	516.02–516.20	519.11
T <i>Calcidiscus protoannulus</i>	35.4	7R-CC, to 8R-1, 40 cm	534.29–539.40	536.85	546.09–551.20	548.65
T <i>Chiasmolithus grandis</i>	37.1	9R-CC, to 10R-CC	555.70–567.40	561.55	567.50–579.20	573.35
B <i>Dictyococcites hesslandii</i>	40.4	12R-2, 40 cm, to 12R-2, 120 cm	579.40–580.20	579.80	591.20–592.00	591.60
<i>Dictyococcites bisectus</i>						
T <i>Nannoterrina</i> spp.	41.9	14R-5, 120 cm, to 14R-6, 120 cm	604.10–605.60	604.85	615.9–617.40	616.65
B <i>Reticulofenestra umbilicus</i> > 14µm	42.2	15R-2, 120 cm, to 15R-3, 40 cm	609.20–609.90	609.55	621.00–621.70	621.35
T <i>Chiasmolithus gigas</i>	44.6	16R-4, 120 cm, to 16R-5, 40 cm	621.80–622.50	622.15	633.60–634.30	633.95
B <i>Chiasmolithus gigas</i>	46.3	17R-CC, to 18R-1, 40 cm	635.04–635.70	635.37	646.84–647.50	647.17
B <i>Nannoterrina fulgens</i>	47.0	19R-6, 40 cm, to 19R-CC	652.90–654.85	653.88	664.70–666.65	665.68
T <i>Discoaster subdoenensis</i>	47.2	19R-CC, to 20X-CC	654.85–663.75	659.20	666.65–675.55	671.10
B <i>Nannoterrina</i> spp.	47.8	21R-4, 121 cm, 21R-5, 116 cm	670.01–671.43	670.72	681.81–683.26	682.52
T <i>Discoaster lodoensis</i>	47.9	21R-5, 116 cm, to 21R-CC	671.43–671.65	671.54	683.26–683.45	683.34
T <i>Trifarctatus orthostylus</i>	50.8	25R-7, 40 cm, to 26R-1, 40 cm	711.90–712.60	712.25	723.70–724.40	724.05
B <i>Discoaster lodoensis</i>	52.0	26R-CC, to 27R-CC	719.18–727.36	723.27	730.98–738.16	735.07
B <i>Sphenolithus radians</i>	53.1	28R-CC cm to 29R-CC	738.66–748.13	743.40	750.46–759.93	755.20
Transition <i>T. contortus</i> – <i>T. orthostylus</i>	53.3	29R-2, 116 cm, to 29R-3, 80 cm	743.86–745.00	744.43	755.66–756.80	756.23
B <i>Trifarctatus</i> spp.	53.9	31R-2, 120 cm, to 31R-3, 40 cm	763.30–764.00	763.65	775.10–775.80	775.45
T <i>Fasciculithus</i> spp.	54.1	33R-4, 40 cm, to 33R-4, 120 cm	784.78–785.58	785.18	796.58–797.38	796.28

Note: T = top, B = base, and Tc = Top occurrence.

Numerous *Rhomboaster* spp. (*Rhomboaster cuspidus*) were observed in Sample 154-929E-31R-CC and in upper Core 154-929E-33R, together with other upper Paleocene forms such as *Discoaster multiradiatus*, *Neochiastozygus junctus*, *Campylosphaera eodela*, *Toweius occultatus*, and *Toweius eminens*. *Fasciculithus tympaniformis* is common in Sample 154-929E-33R-CC (5–10 specimens per field of view), but it was not observed in Sample 154-929E-31R-CC. A marked reduction in abundance occurred in Sample 154-929E-33R-6, 120–121 cm, yielding only 1–2 specimens per 10 fields of view at approximately the identical background particle density. *Fasciculithus tympaniformis* occurred continuously as a rare member of the total nanofossil assemblage up to and including Sample 154-929E-33R-4, 120–121 cm; a sample 0.8 m higher in the section lacked *F. tympaniformis*, a level which thus probably represents the LO of this species. The few specimens observed to occur above that level in Core 154-929E-33R are considered reworked.

Sample 154-929E-35R-CC contained common *D. multiradiatus*, a few *C. eodela*, and abundant fasciculiths, including *Fasciculithus schaubii*, placing this sample in Subzone CP8b. *Ericsonia robusta* was not observed, supporting the suggestion that Hole 929E was terminated in Subzone CP8b.

Planktonic Foraminifera

Planktonic foraminifer datums determined at Site 929 are given in Table 3.

Pleistocene and Pliocene

Several planktonic foraminifer datums were not constrained at Site 929 (4356 m water depth) because of the poor carbonate preservation. Sample 154-929A-1H-3, 70–72 cm, has moderately poor preservation caused by dissolution. A comparable degree of dissolution was not encountered until Core 154-928A-3H at Site 928 (4012 m water depth) and not until the bottom of Core 154-926A-10H at Site 926 (3598 m water depth). Delicate species such as *Globorotalia*

pertenuis and *G. exilis*, which were common at all other sites on the Ceara Rise, were virtually absent.

The LO of *Globigerinoides fistulosus* does not clearly mark the Pliocene/Pleistocene boundary in Hole 929A. Specimens attributable to *G. fistulosus* s.l. are found in Sample 154-929A-8H-3, 70–73 cm, but they are not well-developed forms. The more delicate sensu stricto specimens were probably lost to dissolution. The FO of *G. truncatulinoidea* is found well above the LO of *G. fistulosus* between Samples 154-929A-7H-4, 70–72 cm, and -7H-5, 70–72 cm. *G. truncatulinoidea* is a more dissolution-resistant species than *G. fistulosus*, so its FO is probably a more reliable datum.

A badly dissolved interval through the bottom of Core 154-929A-8H and the top of Core 154-929A-9H made the identification of the LO of *Globorotalia miocenica* difficult. The Atlantic reappearance of *Pulleniatina* is one section above the LO of *G. miocenica* at the other Ceara Rise sites. In Hole 929A, *Pulleniatina* reappears six sections above the disappearance of *G. miocenica*. By again using the more dissolution-resistant species as a more reliable event, it is deduced that the LO of *G. miocenica* is unreliable.

The stratigraphic range of *Globorotalia triangula* in Hole 929A is similar to its range in Hole 928A. It is found in several samples from Sample 154-929A-7H-2, 70–72 cm, in the lower part of Zone N22/N23, to Sample 154-929A-9H-5, 70–72 cm, in the upper part of Zone N20/N21.

The LO of *Dentoglobigerina altispira* between Samples 154-929A-10H-4, 70–72 cm, and -10H-5, 70–72 cm, is one section below the LO of *Globorotalia multicamerata*, as it has been found at the other Ceara Rise sites. This stratigraphic relationship is maintained in this hole because both of these species are relatively dissolution resistant.

Miocene

The Miocene/Pliocene boundary is approximated by the FO of *Sphaeroidinella dehiscens*, a dissolution-resistant species, between Samples 154-929A-14H-6, 70–72 cm, and -14H-7, 70–72 cm. The opening of a secondary aperture on the spiral side defines the transi-

Sample 154-929A-21X-2, 70–72 cm, includes *Paragloborotalia mayeri* and is therefore assignable to Zone N14. The sample above it (Sample 154-929A-21X-2, 70–72 cm) is badly dissolved but it contains *Globigerinoides extremus* and is assigned to Zone N17. The

In Hole 929A, only one sample lacks both *Catapsydrax dissimilis* and *Praeorbulina sicana* and is assigned to Zone N7. At the next deeper site in Hole 928B, these two marker species co-occur in three samples. In Hole 929A, the FO of *P. sicana* (Sample 154-929A-27X-2, 73–75 cm) is immediately above the LO of *C. dissimilis* (Sample 154-929A-27X-3, 114–115 cm), and they are separated by one very poorly preserved sample (Sample 154-929A-27X-3, 60–62 cm). Furthermore, the sample including the LO of *C. dissimilis* is in an interval

Figure 6 (continued).

identified as a turbidite (see "Lithostratigraphy" section, this chapter). All of this evidence suggests that Zone N7 is either absent or very short in this region. At shallower, less dissolved sites (Sites 925 and 927) *Catapsydrax dissimilis* is very rare and may range higher in the sections, but it was not found during shipboard examinations.

Oligocene

The Oligocene/Miocene boundary is approximated by the FO of *Paragloborotalia kugleri* between Samples 154-929A-35X-2, 70–72 cm, and -35X-3, 70–72 cm. *Paragloborotalia mendacis* was found in Sample 154-929A-35X-3, 70–72 cm (see "Biostratigraphy" section, "Site 925" chapter). Preservation, which was poor in the lower Miocene, improved in the lowermost Zone N4 and some samples in the upper Oligocene (Cores 154-929A-36X, -37X, and -38X) were well preserved. In Cores 154-929A-39X through -44X, preservation was generally described as "moderate."

The most stratigraphically complicated interval in the Oligocene section of Hole 929A is in Cores 154-929A-43X, -44X, and -45X. The preservation of planktonic foraminifers in Cores 154-929A-43X and -44X is moderate, and planktonic foraminifers in Core 154-929A-45X are poorly preserved. In Cores 154-929A-43X and -44X, each sample examined was alternately assignable to Subzone P21b or P21a; that is, *Chiloguembelina cubensis* was present in the fine fraction in every other sample. Samples in Cores 154-929A-45X, -46X, and the top of -47X are all assigned to Zone P20, but the preservation of planktonic foraminifers is poor to extremely poor through this interval. Poor preservation may be the reason for the irregular distribution of *Chiloguembelina cubensis*. However, the absence of this species in the higher interval (Cores 154-929A-43X and -44X) cannot be explained by poor preservation. Lithostratigraphic evidence (see "Lithostratigraphy" section, this chapter) indicates that there is

Figure 7. Details of the nannofossil biostratigraphy in the disturbed interval of Hole 929A in the middle–upper Miocene section. Shaded areas correspond to intervals barren of calcareous microfossils. Dashed lines correspond to intervals with slumps, turbidites, or turbidites in slumps. b = barren.

slumping from Section 154-929A-44X-2 to -44X-5 and from Section 154-929A-45X-3 to -46X-1, but there is no lithostratigraphic evidence for disturbance in Core 154-929A-43X. In situ Subzone N21a is apparently not preserved in Hole 929A because of carbonate dissolution. Biostratigraphic evidence suggests that sediment accumulation was interrupted in the interval assigned to Zone P20 and resumed in Subzone P21b, but was disturbed at least twice by turbidites bringing better preserved older material (Subzone P21a) to Site 929.

The planktonic foraminifers in the bottom half of Core 154-929A-47X and all of -48X are moderately well preserved and assignable to Zone P19. The remainder of the Oligocene in Hole 929A (Cores 154-929A-48X through -52X) is poorly preserved or barren. Sample 154-929A-52X-4, 70–72 cm, the last sample in the Oligocene of Hole 929A, contains no *Pseudohastigerina* and is therefore tentatively assigned to Zone P19.

Eocene

For both Holes 929A and 929E, recognition of the Eocene/Oligocene boundary is hampered by dissolution. The highest unequivocal Eocene planktonic foraminifers in Hole 929A are in Sample 154-929A-52X-6, 45–47 cm, which contains very poorly preserved *Hantkenina* fragments. No *Turborotalia cerroazulensis* was recognized in this sample, so it is tentatively assigned to Zone P18. Samples in Cores 154-929A-53X and -54X are either barren of planktonic foraminifers or very poorly preserved. The lowest sample examined from Hole 929A was Sample 154-929A-56X-1, 27–29 cm, which contains inflated *Hantkenina alabamensis* and *Turborotalia cer-*

Table 3. Planktonic foraminifer datums recognized at Site 929.

Event	Age (Ma)	Sample range	Depth (mbsf)	Mean depth (mbsf)	Composite depth (m)	Mean composite depth (m)
Hole 929A:						
B <i>Pulleniatina finalis</i>	1.4	7H-5, 70–72 cm, to 7H-6, 70–72 cm	58.70–60.20	59.45	64.67–66.17	65.42
T <i>Globigerinoides fistulosus</i>	1.7	8H-2, 70–72 cm, to 8H-3, 70–72 cm	63.70–65.20	64.45	71.67–73.17	72.42
T <i>Globobulborotalia apertura</i>	1.9	7H-2, 70–72 cm, to 7H-4, 70–72 cm	54.20–57.20	55.70	60.17–63.17	61.67
T <i>Globigerinoides extremus</i>	1.9	6H-6, 70–72 cm, to 7H-2, 70–72 cm	50.58–54.20	52.39	55.20–60.17	57.69
B <i>Globorotalia truncatulinoides</i>	2.0	7H-4, 70–72 cm, to 7H-5, 70–72 cm	57.20–58.70	57.95	63.17–64.67	63.92
T <i>Globorotalia miocenica</i>	2.3	8H-6, 70–72 cm, to 9H-2, 70–72 cm	69.70–73.20	71.45	77.67–81.98	79.83
Reappearance <i>Pulleniatina</i>	2.3	8H-4, 70–72 cm, to 8H-6, 70–72 cm	66.70–69.70	68.20	74.67–77.67	76.17
T <i>Globobulborotalia decoraperta</i>	2.6	10H-2, 70–72 cm, to 10H-3, 70–72 cm	82.70–84.20	83.45	92.18–93.68	92.93
T <i>Dentoglobigerina altispira</i>	3.0	10H-4, 70–72 cm, to 10H-5, 70–72 cm	85.70–87.20	86.45	95.18–96.68	95.93
T <i>Globorotalia multicamerata</i>	3.0	10H-3, 70–72 cm, to 10H-4, 70–72 cm	84.20–85.70	84.95	93.68–95.18	94.43
T <i>Sphaeroidinellopsis seminulina</i>	3.1	11H-2, 70–72 cm, to 11H-3, 70–72 cm	92.20–93.70	92.95	102.28–103.78	103.03
Disappearance <i>Pulleniatina</i>	3.5	12H-1, 30–32 cm, to 12H-2, 123–124 cm	99.80–102.23	101.02	110.67–113.09	111.88
B <i>Globorotalia miocenica</i>	3.6	12H-4, 170–19 cm, to 12H-5, 130–132 cm	105.74–106.80	106.25	116.56–117.67	117.11
T <i>Globorotalia margaritae</i>	3.6	13H-3, 42–44 cm, to 13H-4, 100–102 cm	112.42–114.50	113.46	124.28–126.37	125.32
T <i>Globobulborotalia nepenthes</i>	4.3	13H-5, 47–49 cm, to 13H-6, 65–67 cm	115.47–117.15	116.31	127.34–129.02	128.18
T <i>Globorotalia plesiotumida</i>	4.4	13H-3, 103–105 cm, to 13H-4, 100–102 cm	113.03–114.50	113.77	124.89–126.37	125.63
T <i>Neoglobobulborotalia acostaensis</i>	5.1	13H-4, 100–102 cm, to 13H-5, 47–49 cm	114.50–115.47	114.99	126.37–127.34	126.86
B <i>Sphaeroidinella delticensis</i>	5.6	14H-6, 70–72 cm, to 14H-7, 70–72 cm	124.84–126.25	125.55	137.01–138.42	137.72
B <i>Globorotalia tumida</i>	5.9	16X-1, 70–72 cm, to 16X-2, 70–72 cm	138.20–139.70	138.95	149.96–151.46	150.71
B <i>Globorotalia margaritae</i>	6.2	16X-4, 29–31 cm, to 17X-1, 70–72 cm	142.29–147.80	145.05	154.05–161.07	157.56
B <i>Globigerinoides extremus</i>	8.0	21X-1, 70–72 cm, to 21X-2, 70–72 cm	186.40–187.90	187.15	200.96–202.46	201.71
B <i>Globorotalia plesiotumida</i>	8.2	20X-6, 70–72 cm, to 21X-1, 70–72 cm	184.30–186.40	185.35	198.86–200.96	199.91
T <i>Paraglobobulborotalia mayeri</i>	10.3	22X-4, 70–72 cm, to 24X-6, 70–72 cm	200.60–222.60	211.60	214.85–237.01	225.93
B <i>Globobulborotalia nepenthes</i>	10.8	22X-4, 70–72 cm, to 24X-6, 70–72 cm	200.60–222.60	211.60	214.85–237.01	225.93
B <i>Globobulborotalia decoraperta</i>	11.2	22X-4, 70–72 cm, to 24X-6, 70–72 cm	200.60–222.60	211.60	214.85–237.01	225.93
T <i>Fohsella s.l.</i>	11.8	22X-4, 70–72 cm, to 24X-6, 70–72 cm	200.60–222.60	211.60	214.85–237.01	225.93
B <i>Fohsella robusta</i>	12.7	22X-4, 70–72 cm, to 24X-6, 70–72 cm	200.60–222.60	211.60	214.85–237.01	225.93
B <i>Fohsella fohsi</i>	13.5	22X-4, 70–72 cm, to 24X-6, 70–72 cm	200.60–222.60	211.60	214.85–237.01	225.93
B <i>Fohsella "praefohsi"</i>	14.0	22X-4, 70–72 cm, to 24X-6, 70–72 cm	200.60–222.60	211.60	214.85–237.01	225.93
T <i>Fohsella peripheron</i>	14.6	24X-6, 70–72 cm, to 25X-4, 70–72 cm	222.60–229.20	225.90	237.01–244.63	240.82
B <i>Fohsella peripheron</i>	14.7	24X-6, 70–72 cm, to 25X-4, 70–72 cm	222.60–229.20	225.90	237.01–244.63	240.82
B <i>Orbulina</i>	15.1	24X-6, 70–72 cm, to 25X-4, 70–72 cm	222.60–229.20	225.90	237.01–244.63	240.82
B <i>Globorotalia archeomenardii</i>	15.5	24X-6, 70–72 cm, to 25X-4, 70–72 cm	222.60–229.20	225.90	237.01–244.63	240.82
B <i>Praeorbulina glomerata</i>	16.1	25X-6, 70–72 cm, to 26X-2, 70–72 cm	232.22–235.80	234.01	247.63–251.23	249.43
B <i>Praeorbulina sicana</i>	16.4	27X-2, 73–75 cm, to 27X-3, 114–115 cm	245.63–247.54	246.59	261.06–262.96	262.01
T <i>Catapsydrax dissimilis</i>	17.3	27X-2, 73–75 cm, to 27X-3, 114–115 cm	245.63–247.54	246.59	261.06–262.96	262.01
T <i>Paraglobobulborotalia kugleri</i>	21.6	30X-2, 74–76 cm, to 30X-4, 60–62 cm	274.16–277.00	275.58	289.57–292.43	291.00
T <i>Paraglobobulborotalia pseudokugleri</i>	23.3	30X-2, 74–76 cm, to 30X-4, 60–62 cm	274.16–277.00	275.58	289.57–292.43	291.00
B <i>Paraglobobulborotalia kugleri</i>	23.7	35X-2, 70–72 cm, to 35X-3, 70–72 cm	322.60–324.10	323.35	338.03–339.53	338.78
B <i>Paraglobobulborotalia pseudokugleri</i>	26.3	38X-4, 69–71 cm, to 39X-2, 70–72 cm	354.59–361.20	357.90	370.02–376.63	373.33
T <i>Paraglobobulborotalia opima</i>	27.1	41X-4, 70–72 cm, to 43X-3, 67–69 cm	383.30–401.07	392.19	398.73–416.50	407.62
T <i>Chiloguembelina cubensis</i> (common)	28.5	42X-CC to 43X-3, 67–69 cm	387.70–401.07	394.39	403.70–416.50	409.81
B "Globigerina" angulatus	29.7	43X-4, 67–69 cm, to 44X-2, 61–63 cm	402.57–409.21	405.89	418.00–424.64	421.32
T <i>Turborotalia ampliapertura</i>	30.3	47X-3, 50–53 cm, to 47X-4, 70–72 cm	439.60–441.30	440.45	455.02–456.73	455.98
Hole 929E:						
T <i>Hantkenina alabamensis</i>	33.8	52X-4, 70–72 cm, to 52X-6, 45–47 cm	489.40–492.15	490.78	506.12–508.87	507.50
T <i>Hantkenina alabamensis</i>	33.8	3R-3, 103–105 cm, to 5R-2, 71–73 cm	495.03–512.63	503.83	509.80–533.19	521.50
T <i>Turborotalia cerroazulensis</i> s.l.	33.9	3R-3, 103–105 cm, to 5R-2, 71–73 cm	495.03–512.63	503.83	509.80–533.19	521.50
T <i>Morozovella spinulosa</i>	38.1	10R-4, 70–72 cm, to 11R-2, 70–71 cm	563.50–570.10	566.80	584.08–590.68	587.38
T <i>Orbulinoides beckmanni</i>	40.2	11R-6, 70–71 cm, to 12R-2, 70–72 cm	576.10–579.70	577.90	596.68–600.28	598.49
B <i>Orbulinoides beckmanni</i>	40.6	12R-2, 70–72 cm, to 12R-4, 70–72 cm	579.70–582.70	581.2	600.28–603.28	601.78
T <i>Morozovella aragonensis</i>	43.7	15R-6, 68–70 cm, to 16R-2, 70–72 cm	614.68–618.30	616.49	635.26–638.88	637.07
B <i>Morozovella aragonensis</i>	52.0	27R-2, 72–74 cm, to 28R-2, 91–93 cm	724.12–734.01	729.06	744.70–754.54	749.64
T <i>Morozovella velascoensis</i>	53.4	31R-2, 70–71 cm, to 31R-CC	762.80–770.47	766.63	783.38–791.05	787.22
T <i>Globanomalina pseudomenardii</i>	56.1	35R-2, 24–30 cm, to 35R-3, 0–2 cm	800.14–801.05	800.60	820.72–821.63	821.18

Note: B = bottom, and T = top.

roazulensis and is assigned to Zone P16/P17. The absence of *Cribohantkenina* may be a result of poor preservation.

The highest recognizable Eocene assemblage in Hole 929E is in Sample 154-929E-5R-2, 71–73 cm. This sample contains *Hantkenina alabamensis* in association with *Turborotalia cerroazulensis* and thus is assigned to Zone P17. It apparently indicates a lower stratigraphic level than the highest recognizable Eocene sample recorded in Hole 929A.

Many samples in the middle and late Eocene are barren of planktonic foraminifers and others are poorly preserved. Consequently, no datums were recognized in Cores 154-929E-6R through -10R.

Samples in Cores 154-929E-11R and -12R are sufficiently well preserved to assign tentative biostratigraphic ages. Sample 154-929E-11R-2, 70–71 cm, contains various muricate forms such as *Morozovella crassata*, *Morozovella spinulosa*, *Acarinina rohri*, and *Acarinina topilensis* in association with *Hantkenina liebusi* and rare *H. alabamensis*. This assemblage, in the absence of *Orbulinoides beckmanni*,

indicates Zone P14. The LO of *O. beckmanni*, which marks the base of Zone P14, can be recognized between Samples 154-929E-11R-6, 41–43 cm, and -12R-2, 70–72 cm, despite very poor preservation. The base of Zone P13, which is marked by the FO of *O. beckmanni*, is between Samples 154-929E-12R-2, 70–72 cm, and -12R-4, 70–72 cm.

Samples from Cores 154-929E-13R and -14R are barren or very poorly preserved because of dissolution. Sample 154-929E-15R-4, 68–70 cm, contains *Hantkenina liebusi*, *Acarinina soldadoensis*, and *Morozovella densa* but no *Morozovella aragonensis* and so is assigned to Zone P12. The LO of *M. aragonensis*, which marks the base of Zone P12, is between Samples 154-929E-15R-6, 68–70 cm, and -16R-2, 70–72 cm. Recrystallization, in addition to severe dissolution, affects assemblages below this level of the early and middle Eocene, although *M. aragonensis* is present fairly continuously in those samples that are not barren. The zonal markers *Hantkenina nuttalli*, *Globigerinatheka kugleri*, and *Planorotalites palmerae* are all absent, however, so that Zones P7 through P11 were not differentiated.

The FO of *M. aragonensis*, which marks the base of Zone P7, is between Samples 154-929E-26R-CC and -27R-2, 72–74 cm. This upper sample also contains intergrades between *M. aragonensis* and *M. lensiformis*, and the whole group is sinistrally coiled.

Poor preservation is again a difficulty in Cores 154-929E-28R through -31R. The dominant morozovellid in these samples is dextrally coiled *Morozovella subbotinae*. The LO of *Morozovella velascoensis*, which marks the base of Zone P6 (see “Biostratigraphy” section, “Explanatory Notes” chapter, this volume, for a discussion of the Paleocene and early Eocene P-notation), and is used to approximate the Paleocene/Eocene boundary, is in a very poorly preserved interval between Samples 154-929E-31R-2, 70–72 cm, and -31R-CC. Typical *M. velascoensis* differs from *M. subbotinae* by possessing more chambers in this final whorl, a more highly vaulted umbilical side, a deeper and more open umbilicus, and stronger ornamentation. However, note that *M. velascoensis* sensu stricto is relatively rare in comparison to *Morozovella parva*, which is regarded as a variant differing from *M. velascoensis* by possessing fewer chambers in the final whorl. Another closely related form, *Morozovella occlusa*, is also common in the upper Paleocene from Hole 929E. All of these forms are almost exclusively sinistrally coiled, whereas *M. subbotinae* is usually dextrally coiled.

The LO of *Globanomalina pseudomenardii*, which marks the base of Zone P5, was found between Samples 154-929E-35R-2, 29–30 cm, and 154-929E-35R-3, 0–2 cm. The lowermost sample examined (Sample 154-929E-35R-CC) contains both *Globanomalina pseudomenardii* and *Acarinina soldadoensis* and so is assigned to Subzone P4c (>56.1 Ma).

Benthic Foraminifers

Paleocene to Holocene benthic foraminifers were examined from Hole 929A (Samples 154-929A-1H-CC through -55X-CC), and Hole 929E (Samples 154-929E-1R-CC through -35R-CC). Benthic foraminifers are mainly common or abundant and well preserved in the Pleistocene to upper Miocene. In the middle and lower Miocene, benthic foraminifers are rare or few, and some samples are barren. In the Oligocene and Eocene, preservation is generally moderate or good, but benthic foraminifers are few or rare, and several samples are barren. Paleocene benthic foraminifers are rare to common and better preserved than those in the lower Eocene. Benthic foraminifer faunas at Site 929 are divided into four major subgroups, as follows.

Pleistocene to Upper Miocene

In Samples 154-929A-1H-CC through -20X-CC, the benthic foraminifer fauna is characterized by the dominance of *Nuttallides umbonifera* and *Epistominella exigua*, which indicates the strong influence of southern source deep water, such as Antarctic Bottom Water and Circumpolar Deep Water. In Sample 154-929A-5H-CC, however, *Pullenia subcarinata*, *Epistominella exigua*, and *Oridorsalis umbonatus* are common and *N. umbonifera* is absent. This is similar to the fauna of the glacial deep water in the North Atlantic reported by Schnitker (1979). Also, uvigerinids do not occur at all, and small and thin-walled species such as *Ioanella tumidula*, *Ioanella pusilla*, and *Pseudoparrella* sp. are less common than at Site 928. Unlike at Sites 925, 926, 927, and 928, the distinct glacial-interglacial fluctuations of benthic foraminifers are not recognized at Site 929. Another faunal association observed is *Oridorsalis umbonata*, *Pullenia subcarinata*, and *Pullenia osloensis*. The first abundant occurrence of *N. umbonifera* is in the upper Miocene (Sample 154-929A-20X-CC), which apparently indicates the first influence of modern-type AABW. This occurs at a similar level to Site 928 but lower than at the shallower sites (Sites 926 and 927). The common occurrence of *Epistominella exigua*, which is also considered to be one of the Circumpolar Deep Water species, begins in the middle upper Miocene (Sample 154-929A-18X-CC).

Middle Miocene to Oligocene

In Samples 154-929A-21X-CC through -51X-CC, the main benthic foraminifer faunal components are *Globocassidulina subglobosa* and *Oridorsalis umbonatus*. This fauna is divided into two subgroups. The Oligocene fauna includes several species of cibicidoids such as *Cibicidoides havanensis*, *C. praemundulus*, and *C. mexicanus*. These “Paleogene”-type benthic foraminifers occur up to the lower Miocene (below Sample 154-929A-33X-CC) and are similar to those observed at Sites 925, 926, 927, and 928. This fauna also includes *Cibicidoides incrassatus* and *C. laurisae* in some samples. The occurrences of *Bulimina semicostata* and *Hanzawaia ammoniphila* are restricted to the lower Oligocene.

Eocene

In Samples 154-929A-52X-CC through -56X-CC, and in Samples 154-929E-1R-CC through -31R-CC, the benthic foraminifer fauna contains *Cibicidoides grimsdalei*, *Nuttallides truempyi*, *Cibicidoides eoceanus*, and *Spiroplectammina spectabilis*. Another association includes *Aragonia aragonensis*, *Bulimina semicostata*, and *Abysaminella poagi*. Some of these species continue up to the Oligocene. At Site 925, many of the complex agglutinated genera occur in the lower Oligocene to middle Eocene. At Site 929, however, agglutinated foraminifers are less common than at Site 925 in spite of the greater depth. On the other hand, calcareous benthic foraminifers are common or abundant and well or moderately preserved. The observations suggest that the middle part of the deep-water mass at Site 925 had a lower oxygen content, possibly because of the rapid sedimentation of organic matter. In the lowest Eocene, samples are barren of benthic foraminifers (Cores 154-929E-29R through -30R). The major benthic foraminifer faunal break is just below this barren zone.

Paleocene

In Samples 154-929E-33R-CC through -35R-CC, Paleocene benthic foraminifers such as *Neoflabellina jarvisi*, *Aragonia aragonensis*, *Nuttallides florealis*, *Stensioina beccariformis*, *Cibicidoides hyphalus*, and *Bulimina midwayensis* occur. Another association is *Pullenia coryelli*, *Gyroidinoides globosa*, and several agglutinated species such as *Dorothyia trochoides*, *Tritaxia havanensis*, *Ammodiscus* spp., *Bathysiphon* spp., *Cyclammina* spp., and *Spiroplectammina spectabilis*. These typical Paleocene species disappear just below the Paleocene/Eocene boundary (Tjalsma and Lohmann, 1983). At this site, most of the Paleocene-type foraminifers disappear at Sample 154-929E-33R-CC, although a possible occurrence of some benthic foraminifers in Sample 154-929E-31R-CC requires further investigation.

PALEOMAGNETISM

We measured the remanent magnetization on the archive halves of all APC cores from Hole 929A after 20-mT demagnetization treatment (except for Core 154-929A-14H, which was highly disturbed). As was the case with the sediments from other sites measured during Leg 154, the magnetic remanence of the sediments taken at Site 929 shows a strong tendency for declinations to lie close to 0° (in uncorrected core coordinates) with high inclination values (Fig. 8). These features correspond to the overprint described for all the previous sites in that it shows a radially inward and downward geometry (see “Paleomagnetism” section, “Site 926” chapter, this volume). As was found at other sites, the pattern deviates from this somewhat in the uppermost few cores; however, there is no clear indication that an ancient remanence has been preserved. Thus, we conclude that the pervasive radial remagnetization affecting other Leg 154 sites has largely, if not entirely, overprinted the primary remanence in the sediments taken from Site 929.

Figure 8. Downcore profiles of the direction and intensity of remanence after AF demagnetization at 20 mT on APC cores from Hole 929A. The clustering of declinations (not corrected from core orientations in the horizontal plane) about 0° is characteristic of the pervasive radial remagnetization observed at all Leg 154 sites.

COMPOSITE SECTION

Continuity of the sedimentary sequence was documented in the upper 235 mbsf of the five holes drilled at Site 929, extending to the late Miocene. Continuity was also demonstrated from 470 to 510 mbsf (Cores 154-929A-50X to -53X). Overlap of cores from the adjacent holes is demonstrated by the Site 929 composite depth section. On the composite depth scale (expressed in meters composite depth [mcd]), sedimentary features present in adjacent holes are aligned so that they occur at approximately the same depth. Working from the top of the sedimentary sequence, for each core in each hole a constant was added to the mbsf depth to arrive at an mcd depth for that core. The depth offsets that constitute the composite depth section are given in Table 4 and are on the CD-ROM disc (back pocket).

Magnetic susceptibility and natural gamma data collected on the MST, and color reflectance data from Holes 929A through 929C were the primary parameters used to determine depth offsets of the composite depth section. GRAPE wet-bulk-density variations were low in amplitude and thus were not useful for composite depth section construction at Site 929. When possible, magnetic susceptibility measurements were made at high sensitivity. However, because of time considerations, where the magnetic susceptibility signal was higher in amplitude (most of the Site 929 section), measurements were often taken at lower sensitivity but at higher sampling resolution (3 cm). Natural gamma measurements (10-s counts) were typically taken at 10-cm sampling resolution.

Color reflectance collected on the split cores (at 5-cm sampling resolution) was also useful for hole-to-hole correlations. Because of the low carbonate content (and consequent low reflectance) of the sediments at Site 929, variations in color reflectance often had a lower signal-to-noise ratio than the magnetic susceptibility and natural

gamma variations. Although color reflectance at Site 929 is generally inversely correlated to susceptibility, sedimentary features were often recorded differently by these two parameters. Correlations between holes based on susceptibility, natural gamma, and reflectance were integrated to arrive at a composite depth section for Site 929. All of these records on the Site 929 composite depth scale are shown in Figure 9.

Site 929 was marked by several intervals of redeposited sediments (see "Lithostratigraphy" section, this chapter). However, the composite depth section from the multiple holes successfully demonstrates excellent agreement between the three holes even over these intervals in the sedimentary sequence. Stretching and compression of sedimentary features in aligned cores indicate distortion of the cored sequence. Because much core distortion occurs on scales of <9 m, it is not possible to align every feature in the susceptibility and reflectance records accurately by simply adding a constant to the mbsf core depth. Depth-scale changes on a within-core basis will be required to align smaller scale sedimentary features. Verification of the hole-to-hole correlations of the composite depth scale was provided by biostratigraphic data. In most intervals where biostratigraphic (nannofossil) events were recorded in multiple holes, overlap of the events on the composite depth scale was documented.

Continuity of the composite depth section was uncertain at approximately 130 mbsf (140 mcd), where the overlap of Cores 154-929B-14X and 154-929A-15H could not be confidently determined because of core disturbance and poor recovery. However, reflectance data and core photos from the core catcher of Core 154-929B-14X appear to support the slight overlap assigned to these two cores. Overlap of Holes 929A and 929B continues below this interval to 250 mcd, the base of Hole 929B. From Core 154-929A-25X through -50X, successive cores from Hole 929A were placed at original (mbsf) depths plus the accumulated mcd offset. At the base of Hole 929A, the last four XCB cores (Cores 154-929A-50X through -53X) overlap with the top three cores of the rotary-cored section from Hole 929E. This interval is also included in the composite depth section for Site 929. Below 510 mcd (492 mbsf), the accumulated mcd offset was added to the remaining cores in Hole 929E.

The depth offsets (Table 4) required to transform mbsf depth to the mcd depth scale are plotted vs. mbsf depth in Figure 10 for the top 250 mcd. Excellent overlap between holes was maintained throughout the composite depth section. From 0 to 50 mbsf (0 to about 55 mcd), the mcd scale growth relative to the mbsf scale is 10%, typical of Leg 154 sites. From 50 to 220 mbsf (55–250 mcd), growth of the mcd scale averages only 5%, which is much less than at other Leg 154 sites. This smaller offset may be related to compositional differences between the sediments at Site 929 and at Sites 925–928 (see "Physical Properties" section, this chapter).

Following the construction of the composite depth section for Site 929, a single spliced record was assembled from the aligned cores. The Site 929 splice can be used as a sampling guide to recover a single sedimentary sequence from the top 230 mbsf (250 mcd) of Site 929, which spans approximately the past 17 m.y. The composite depths were aligned so that tie points between adjacent holes occurred at exactly the same depth in meters composite depth (within the sampling resolution of the magnetic susceptibility). Intervals having significant disturbance or distortion were not included in the splice. In addition, intervals of core that had not been run through the MST (because of distorted or damaged liners) were not included in the splice. Despite intervals of disturbance and nonrecovery at Site 929, a continuous splice could be constructed down to 250 mcd aside from the possible data gap at 140 mcd. Below Core 154-929A-25X, the cores from Hole 929A were appended to the composite splice down to 490 mcd, where a splice between Holes 929A and 929E was constructed. Below 510 mcd, the remaining cores in Hole 929A were appended to the composite splice. The tie points for the Site 929 splice are given in Table 5, and plots of splice for magnetic susceptibility and reflectance are in Figure 11.

SEDIMENTATION RATES

The stratigraphic section recovered at Site 929 is 801.41 m thick, representing the interval from the Holocene to the uppermost Paleocene. Magnetostratigraphy was not obtained at Site 929 because of severe overprint problems. The sedimentation rates were determined on the basis of calcareous nannofossil and planktonic foraminifer biostratigraphy.

Five holes were drilled at Site 929. Sedimentation rate calculations were based on biostratigraphic data from the APC- and XCB-cored intervals in Hole 929A (0–518.52 mbsf), and the RCB-cored interval in Hole 929E (471.50–801.41 mbsf). These depth intervals represent the Holocene through Oligocene, and the lowermost Oligocene through uppermost Paleocene, respectively. The overlapping section between the two holes was precisely correlated using MST data and corroborated by biostratigraphic evidence (see “Composite Section” section, this chapter).

The depths (mcd) of nannofossil and planktonic foraminifer datums from Holes 929A and 929E are plotted vs. age in Figure 12A. A subset of the sedimentation rate history for the upper Oligocene through Pleistocene interval is shown in Figure 12B and that of the lower Oligocene through uppermost Paleocene is shown in Figure 12C. Individual datums are listed in Table 6, and those events chosen as sedimentation rate control points are listed in Table 7.

Sedimentation rates shown for the Pliocene–Pleistocene interval are considered accurate. On the other hand, complicated biostratigraphic relationships, combined with intervals barren of calcareous floras and faunas, characterize the middle and upper Miocene. Despite evidence of enhanced carbonate dissolution, the package of upper Miocene sediments yielded anomalously high sedimentation rates because of the deposition of slumps and turbidites. The added sediment is largely of upper Miocene origin. A hiatus of 1-m.y. duration is probably present at the base of the late Miocene (Fig. 13).

The middle Miocene is thin, occupying a little over 20 m of the stratigraphic column. About 25%–30% of this thin interval is barren of calcareous material (see “Biostratigraphy” section, this chapter). The strong condensation resulted in an average sedimentation rate of only 3 m/m.y.

Low sedimentation rates (<10 m/m.y.) prevailed throughout the upper two thirds of the early Miocene. The middle part of the Oligocene shows a large scatter of datums (Fig. 12B), indicating that existing age estimates for the low-latitude western Atlantic Ocean need revision. An average sedimentation rate of about 17–18 m/m.y. prevailed throughout the Oligocene and late Eocene (Fig. 12C). Below that, a marked change occurred to a different sedimentation rate regime with variable rates (5–23 m/m.y.) during the middle Eocene.

The 26 Eocene age-depth indications used offered an average resolution of about 1.3 events/m.y. The number of planktonic foraminifer datums available was limited because of dissolution. Calcite overgrowth caused problems with the recognition of some nannofossil marker events. Nevertheless, determinable points show virtually no scatter and the rate values shown in Figure 12C are considered reliable.

The Paleocene and Paleocene/Eocene boundary sedimentation rates are less well understood, partly because of nil or poor recovery in the critical cores, and partly because of dissolution, which in particular prevented a precise determination of the position of the boundary marker *Morozovella velascoensis* (774.61–793.95 mcd). Possible reworking in Core 154-929E-33R added to the uncertainty of the latest Paleocene sedimentation rate history. A Paleocene rate of 20 m/m.y. is indicated, using the top of *Globanomalina pseudomenardii* as the Paleocene control point. Carbon isotope stratigraphy may help to constrain the Paleocene sedimentation rates in Hole 929E (see Shackleton, 1986).

Sedimentation rates from Site 929 are plotted vs. age and mcd in Figure 13. As at the other Leg 154 sites, the Pliocene and Pleistocene interval shows a progressive increase in sedimentation rate through time. Furthermore, as at Site 928, the late Miocene is reflected in an

artificially high rate introduced by slumping. The low rate regime terminated in the earliest Pliocene, as at Site 928. The earliest Miocene through late Eocene interval shows little variability and intermediate to high sedimentation rates, whereas the interval representing the middle Eocene through latest Paleocene shows repeated changes from a low rate regime to an intermediate or high rate regime. The average rate for the entire Site 929 sequence, covering 0–55.1 Ma, is 15 m/m.y.

GEOCHEMISTRY

Hydrocarbon Geochemistry

We routinely measured the volatile hydrocarbon content in all sediment cores from Holes 929A and from Cores 154-929E-5R through -14R for a total of 62 analyses. Concentrations of methane remained at or near background levels, and no heavier hydrocarbons were found. These results suggest that biogenic methanogenesis was minimal at Site 929. Sediment total carbon measurements and interstitial-water sulfate determinations indicate relatively low organic carbon inputs to the site and incomplete sulfate reduction throughout the section (see “Interstitial-water Geochemistry and Solid-phase Geochemistry” section, below).

Interstitial-water Geochemistry

We collected interstitial water from 55 samples at Site 929: 48 from Hole 929A at depths ranging from 1.45 to 496.35 mbsf, and 7 from Hole 929E at depths ranging from 521.30 to 782.68 mbsf (Table 8). Samples from these holes have been combined into a single depth profile. In the top 6 cores of Hole 929A, we took one sample per section to obtain pore water for shore-based oxygen isotope analyses; shipboard analyses were performed on a subset of these samples, generally on 2 samples per core. Interstitial-water recovery from samples from Hole 929E was relatively low, and the majority of the water recovered was reserved for shore-based studies; a complete set of analyses was not performed on these samples. Chemical gradients in the interstitial waters at Site 929 are very similar to those at the four shallower sites drilled on the Ceara Rise.

Chlorinity, as measured by titration, generally increases with depth, with a few large deviations from this trend. Concentrations range from 555 to 590 mM (Fig. 14). The sodium profile, as calculated by charge balance, generally decreases with depth, with concentrations dropping from over 480 mM near the surface to nearly 400 mM at depth (Fig. 14). Some of the sodium concentrations were calculated for samples without a complete set of analyses (Table 8). Of particular significance for the sodium calculation, alkalinity was not always measured as pore-water recovery decreased. The inclusion of alkalinity in these charge balance calculations would drive the estimated sodium values lower. Salinity, as measured by a handheld refractometer, varies from 34 to 36 g/kg (Fig. 14). There is a sharp salinity peak near 10 mbsf and generally higher values deeper than 400 mbsf.

Alkalinity is fairly constant in the top 100 mbsf of the section, with values ranging from 3.5 to 3.9 mM (Fig. 14). Deeper in the section there is a broad peak, centered at about 250 mbsf, with an alkalinity maximum of 9.4 mM. This feature is similar, in magnitude and in the age of the surrounding sediments, to the peaks observed at the shallower sites. Alkalinity increases again, with a value of 8.3 mM at 469.35 mbsf, and then decreases to an extreme low of 0.3 mM at the base of the section. The detailed profile of alkalinity in this deeper interval could not be determined, however, because of the limited pore-water recovery. The pH remains within a narrow range, with all values between 6.5 and 7.6 (Fig. 14). At 276.30 mbsf, within the interval of the alkalinity high, pH is at its lowest, with a value of 6.54. The pH of the deepest sample is relatively high (7.6).

Dissolved silica concentrations are low (near 150 μ M) in the top 200 m of the section (see “Site 926” chapter, Fig. 15, this volume). A

Table 4. Composite depth section, Site 929.

Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)	Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)	Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)
154-929A-					12H-4	150	104	10.86	114.86	24X-5	150	220.4	14.4	234.8
1H-1	150	0	0	0	12H-5	150	105.5	10.86	116.36	24X-6	150	221.9	14.4	236.3
1H-2	150	1.5	0	1.5	12H-6	150	107	10.86	117.86	24X-7	44	223.4	14.4	237.8
1H-3	141	3	0	3	12H-7	32	108.5	10.86	119.36	24X-CC	37	223.84	14.4	238.24
1H-CC	18	4.41	0	4.41	12H-CC	42	108.82	10.86	119.68	25X-1	150	224	15.42	239.42
2H-1	150	4.5	1.05	5.55	13H-1	150	109	11.86	120.86	25X-2	150	225.5	15.42	240.92
2H-2	150	6	1.05	7.05	13H-2	150	110.5	11.86	122.36	25X-3	150	227	15.42	242.42
2H-3	150	7.5	1.05	8.55	13H-3	150	112	11.86	123.86	25X-4	150	228.5	15.42	243.92
2H-4	150	9	1.05	10.05	13H-4	150	113.5	11.86	125.36	25X-5	150	230	15.42	245.42
2H-5	150	10.5	1.05	11.55	13H-5	150	115	11.86	126.86	25X-6	150	231.5	15.42	246.92
2H-6	150	12	1.05	13.05	13H-6	143	116.5	11.86	128.36	25X-7	32	233	15.42	248.42
2H-7	20	13.5	1.05	14.55	13H-7	22	117.93	11.86	129.79	25X-CC	32	233.32	15.42	248.74
2H-CC	13	13.7	1.05	14.75	14H-1	95	118.5	12.16	130.66	26X-1	150	233.6	15.42	249.02
3H-1	150	14	1.62	15.62	14H-2	138	119.45	12.16	131.61	26X-2	150	235.1	15.42	250.52
3H-2	150	15.5	1.62	17.12	14H-3	150	120.83	12.16	132.99	26X-3	150	236.6	15.42	252.02
3H-3	150	17	1.62	18.62	14H-4	150	122.33	12.16	134.49	26X-4	150	238.1	15.42	253.52
3H-4	150	18.5	1.62	20.12	14H-5	31	123.83	12.16	135.99	26X-5	150	239.6	15.42	255.02
3H-5	150	20	1.62	21.62	14H-6	141	124.14	12.16	136.3	26X-6	86	241.1	15.42	256.52
3H-6	150	21.5	1.62	23.12	14H-7	108	125.55	12.16	137.71	26X-CC	46	241.96	15.42	257.38
3H-7	51	23	1.62	24.62	14H-CC	73	126.63	12.16	138.79	27X-1	150	243.4	15.42	258.82
3H-CC	30	23.51	1.62	25.13	15H-1	150	128	11.43	139.43	27X-2	150	244.9	15.42	260.32
4H-1	150	23.5	2.09	25.59	15H-2	150	129.5	11.43	140.93	27X-3	150	246.4	15.42	261.82
4H-2	150	25	2.09	27.09	15H-3	150	131	11.43	142.43	27X-4	150	247.9	15.42	263.32
4H-3	150	26.5	2.09	28.59	15H-4	150	132.5	11.43	143.93	27X-5	150	249.4	15.42	264.82
4H-4	150	28	2.09	30.09	15H-5	150	134	11.43	145.43	27X-6	100	250.9	15.42	266.32
4H-5	150	29.5	2.09	31.59	15H-6	150	135.5	11.43	146.93	27X-CC	39	251.9	15.42	267.32
4H-6	150	31	2.09	33.09	15H-7	73	137	11.43	148.43	28X-1	150	253	15.42	268.42
4H-7	47	32.5	2.09	34.59	15H-CC	45	137.73	11.43	149.16	28X-2	150	254.5	15.42	269.92
4H-CC	2	32.97	2.09	35.06	16X-1	150	137.5	11.75	149.25	28X-3	150	256	15.42	271.42
5H-1	150	33	3.1	36.1	16X-2	150	139	11.75	150.75	28X-4	150	257.5	15.42	272.92
5H-2	150	34.5	3.1	37.6	16X-3	150	140.5	11.75	152.25	28X-5	60	259	15.42	274.42
5H-3	150	36	3.1	39.1	16X-4	69	142	11.75	153.75	28X-CC	30	259.6	15.42	275.02
5H-4	150	37.5	3.1	40.6	16X-CC	13	142.69	11.75	154.44	29X-1	150	262.2	15.42	277.62
5H-5	150	39	3.1	42.1	17X-1	150	147.1	13.26	160.36	29X-2	150	263.7	15.42	279.12
5H-6	150	40.5	3.1	43.6	17X-2	150	148.6	13.26	161.86	29X-3	150	265.2	15.42	280.62
5H-7	55	42	3.1	45.1	17X-3	150	150.1	13.26	163.36	29X-4	150	266.7	15.42	282.12
5H-CC	41	42.55	3.1	45.65	17X-4	150	151.6	13.26	164.86	29X-5	150	268.2	15.42	283.62
6H-1	150	42.5	4.61	47.11	17X-5	150	153.1	13.26	166.36	29X-6	150	269.7	15.42	285.12
6H-2	150	44	4.61	48.61	17X-6	40	154.6	13.26	167.86	29X-7	43	271.2	15.42	286.62
6H-3	150	45.5	4.61	50.11	17X-CC	52	155	13.26	168.26	29X-CC	31	271.63	15.42	287.02
6H-4	138	47	4.61	51.61	18X-1	150	156.8	12.79	169.59	30X-1	150	271.9	15.42	287.32
6H-5	150	48.38	4.61	52.99	18X-2	150	158.3	12.79	171.09	30X-2	150	273.4	15.42	288.82
6H-6	150	49.88	4.61	54.49	18X-3	150	159.8	12.79	172.59	30X-3	150	274.9	15.42	290.32
6H-7	34	51.38	4.61	55.99	18X-4	150	161.3	12.79	174.09	30X-4	150	276.4	15.42	291.82
6H-CC	28	51.72	4.61	56.33	18X-5	150	162.8	12.79	175.59	30X-5	150	277.9	15.42	293.32
7H-1	150	52	5.96	57.96	18X-6	38	164.3	12.79	177.09	30X-6	150	279.4	15.42	294.82
7H-2	150	53.5	5.96	59.46	18X-CC	40	164.68	12.79	177.47	30X-7	45	280.9	15.42	296.32
7H-3	150	55	5.96	60.96	19X-1	150	166.4	12.91	179.31	30X-CC	37	281.35	15.42	296.77
7H-4	150	56.5	5.96	62.46	19X-2	150	167.9	12.91	180.81	31X-1	150	281.6	15.42	297.02
7H-5	150	58	5.96	63.96	19X-3	150	169.4	12.91	182.31	31X-2	150	283.1	15.42	298.52
7H-6	150	59.5	5.96	65.46	19X-4	120	170.9	12.91	183.81	31X-3	150	284.6	15.42	300.02
7H-7	58	61	5.96	66.96	19X-5	35	172.1	12.91	185.01	31X-4	150	286.1	15.42	301.52
7H-CC	39	61.58	5.96	67.54	19X-CC	42	172.45	12.91	185.36	31X-5	150	287.6	15.42	303.02
8H-1	150	61.5	7.96	69.46	20X-1	150	176.1	14.55	190.65	31X-6	150	289.1	15.42	304.52
8H-2	150	63	7.96	70.96	20X-2	150	177.6	14.55	192.15	31X-7	29	290.6	15.42	306.02
8H-3	150	64.5	7.96	72.46	20X-3	150	179.1	14.55	193.65	31X-CC	16	290.89	15.42	306.31
8H-4	150	66	7.96	73.96	20X-4	150	180.6	14.55	195.15	32X-1	150	291.3	15.42	306.72
8H-5	150	67.5	7.96	75.46	20X-5	150	182.1	14.55	196.65	32X-2	150	292.8	15.42	308.22
8H-6	150	69	7.96	76.96	20X-6	150	183.6	14.55	198.15	32X-3	150	294.3	15.42	309.72
8H-7	40	70.5	7.96	78.46	20X-7	53	185.1	14.55	199.65	32X-4	150	295.8	15.42	311.22
8H-CC	5	70.9	7.96	78.86	20X-CC	22	185.63	14.55	200.18	32X-5	150	297.3	15.42	312.72
9H-1	150	71	8.77	79.77	21X-1	150	185.7	14.55	200.25	32X-6	107	298.8	15.42	314.22
9H-2	150	72.5	8.77	81.27	21X-2	150	187.2	14.55	201.75	32X-CC	48	299.87	15.42	315.29
9H-3	150	74	8.77	82.77	21X-3	150	188.7	14.55	203.25	33X-1	150	301	15.42	316.42
9H-4	150	75.5	8.77	84.27	21X-4	150	190.2	14.55	204.75	33X-2	150	302.5	15.42	317.92
9H-5	150	77	8.77	85.77	21X-5	150	191.7	14.55	206.25	33X-3	150	304	15.42	319.42
9H-6	150	78.5	8.77	87.27	21X-6	138	193.2	14.55	207.75	33X-4	150	305.5	15.42	320.92
9H-7	55	80	8.77	88.77	21X-CC	36	194.58	14.55	209.13	33X-5	150	307	15.42	322.42
9H-CC	35	80.55	8.77	89.32	22X-1	150	195.4	14.24	209.64	33X-6	150	308.5	15.42	323.92
10H-1	150	80.5	9.47	89.97	22X-2	150	196.9	14.24	211.14	33X-7	42	310	15.42	325.42
10H-2	150	82	9.47	91.47	22X-3	150	198.4	14.24	212.64	33X-CC	17	310.42	15.42	325.84
10H-3	150	83.5	9.47	92.97	22X-4	150	199.9	14.24	214.14	34X-1	150	310.7	15.42	326.12
10H-4	150	85	9.47	94.47	22X-5	150	201.4	14.24	215.64	34X-2	150	312.2	15.42	327.62
10H-5	150	86.5	9.47	95.97	22X-6	150	202.9	14.24	217.14	34X-3	150	313.7	15.42	329.12
10H-6	100	88	9.47	97.47	22X-7	51	204.4	14.24	218.64	34X-4	150	315.2	15.42	330.62
10H-7	64	89	9.47	98.47	22X-CC	17	204.91	14.24	219.15	34X-5	150	316.7	15.42	332.12
10H-CC	30	89.64	9.47	99.11	23X-1	150	205.1	14.4	219.5	34X-6	150	318.2	15.42	333.62
11H-1	150	90	10.07	100.07	23X-2	150	206.6	14.4	221	34X-7	36	319.7	15.42	335.12
11H-2	150	91.5	10.07	101.57	23X-3	150	208.1	14.4	222.5	34X-CC	43	320.06	15.42	335.48
11H-3	150	93	10.07	103.07	23X-4	150	209.6	14.4	224	35X-1	150	320.4	15.42	335.82
11H-4	150	94.5	10.07	104.57	23X-5	150	211.1	14.4	225.5	35X-2	150	321.9	15.42	337.32
11H-5	150	96	10.07	106.07	23X-6	150	212.6	14.4	227	35X-3	150	323.4	15.42	338.82
11H-6	150	97.5	10.07	107.57	23X-7	58	214.1	14.4	228.5	35X-4	150	324.9	15.42	

Table 4 (continued).

Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)	Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)	Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)
36X-2	150	331.5	15.42	346.92	49X-7	49	464.3	15.42	479.72	7H-2	150	58.5	4.07	62.57
36X-3	150	333	15.42	348.42	49X-CC	44	464.79	15.42	480.21	7H-3	150	60	4.07	64.07
36X-4	150	334.5	15.42	349.92	50X-1	150	465	15.42	480.42	7H-4	150	61.5	4.07	65.57
36X-5	150	336	15.42	351.42	50X-2	150	466.5	15.42	481.92	7H-5	150	63	4.07	67.07
36X-6	150	337.5	15.42	352.92	50X-3	150	468	15.42	483.42	7H-6	150	64.5	4.07	68.57
36X-7	41	339	15.42	354.42	50X-4	150	469.5	15.42	484.92	7H-7	43	66	4.07	70.07
36X-CC	31	339.41	15.42	354.83	50X-5	150	471	15.42	486.42	7H-CC	16	66.43	4.07	70.5
37X-1	150	339.7	15.42	355.12	50X-6	150	472.5	15.42	487.92	8H-1	150	66.5	4.67	71.17
37X-2	150	341.2	15.42	356.62	50X-7	45	474	15.42	489.42	8H-2	150	68	4.67	72.67
37X-3	150	342.7	15.42	358.12	50X-CC	38	474.45	15.42	489.87	8H-3	150	69.5	4.67	74.17
37X-4	150	344.2	15.42	359.62	51X-1	150	474.6	16.37	490.97	8H-4	150	71	4.67	75.67
37X-5	150	345.7	15.42	361.12	51X-2	150	476.1	16.37	492.47	8H-5	150	72.5	4.67	77.17
37X-6	150	347.2	15.42	362.62	51X-3	150	477.6	16.37	493.97	8H-6	150	74	4.67	78.67
37X-7	39	348.7	15.42	364.12	51X-4	150	479.1	16.37	495.47	8H-7	66	75.5	4.67	80.17
37X-CC	42	349.09	15.42	364.51	51X-5	150	480.6	16.37	496.97	8H-CC	24	76.16	4.67	80.83
38X-1	150	349.4	15.42	364.82	51X-6	150	482.1	16.37	498.47	9H-1	150	76	5.62	81.62
38X-2	150	350.9	15.42	366.32	51X-7	48	483.6	16.37	499.97	9H-2	150	77.5	5.62	83.12
38X-3	150	352.4	15.42	367.82	51X-CC	34	484.08	16.37	500.45	9H-3	150	79	5.62	84.62
38X-4	150	353.9	15.42	369.32	52X-1	150	484.2	16.71	500.91	9H-4	150	80.5	5.62	86.12
38X-5	150	355.4	15.42	370.82	52X-2	150	485.7	16.71	502.41	9H-5	150	82	5.62	87.62
38X-6	130	356.9	15.42	372.32	52X-3	150	487.2	16.71	503.91	9H-6	130	83.5	5.62	89.12
38X-CC	2	358.2	15.42	373.62	52X-4	150	488.7	16.71	505.41	9H-7	42	84.8	5.62	90.42
39X-1	150	359	15.42	374.42	52X-5	150	490.2	16.71	506.91	9H-CC	19	85.22	5.62	90.84
39X-2	150	360.5	15.42	375.92	52X-6	108	491.7	16.71	508.41	10H-1	150	85.5	5.08	90.58
39X-3	150	362	15.42	377.42	52X-CC	36	492.78	16.71	509.49	10H-2	150	87	5.08	92.08
39X-4	150	363.5	15.42	378.92	53X-1	150	493.5	16.34	509.84	10H-3	150	88.5	5.08	93.58
39X-5	150	365	15.42	380.42	53X-2	150	495	16.34	511.34	10H-4	150	90	5.08	95.08
39X-6	93	366.5	15.42	381.92	53X-3	144	496.5	16.34	512.84	10H-5	150	91.5	5.08	96.58
39X-CC	55	367.43	15.42	382.85	53X-CC	48	497.94	16.34	514.28	10H-6	150	93	5.08	98.08
40X-1	150	368.5	15.42	383.92	54X-1	150	503.2	16.34	519.54	10H-7	63	94.5	5.08	99.58
40X-2	150	370	15.42	385.42	54X-2	150	504.7	16.34	521.04	10H-CC	19	95.13	5.08	100.21
40X-3	150	371.5	15.42	386.92	54X-3	150	506.2	16.34	522.54	11H-1	150	95	5.48	100.48
40X-4	150	373	15.42	388.42	54X-4	150	507.7	16.34	524.04	11H-2	150	96.5	5.48	101.98
40X-5	150	374.5	15.42	389.92	54X-5	23	509.2	16.34	525.54	11H-3	150	98	5.48	103.48
40X-6	56	376	15.42	391.42	54X-CC	42	509.43	16.34	525.77	11H-4	150	99.5	5.48	104.98
40X-CC	50	376.56	15.42	391.98	55X-1	42	507.8	18.39	526.19	11H-5	150	101	5.48	106.48
41X-1	150	378.1	15.42	393.52	55X-CC	36	508.22	18.39	526.61	11H-6	150	102.5	5.48	107.98
41X-2	150	379.6	15.42	395.02	56X-1	34	517.8	18.39	536.19	11H-7	47	104	5.48	109.48
41X-3	150	381.1	15.42	396.52	56X-CC	38	518.14	18.39	536.53	11H-CC	27	104.47	5.48	109.95
41X-4	150	382.6	15.42	398.02	155-929B-					12H-1	150	104.5	6.86	111.36
41X-5	19	384.1	15.42	399.52	1H-1	150	0	0.05	0.05	12H-2	150	106	6.86	112.86
41X-CC	43	384.29	15.42	399.71	1H-2	150	1.5	0.05	1.55	12H-3	150	107.5	6.86	114.36
42X-CC	58	387.7	15.42	403.12	1H-3	150	3	0.05	3.05	12H-4	150	109	6.86	115.86
43X-1	150	397.4	15.42	412.82	1H-4	150	4.5	0.05	4.55	12H-5	150	110.5	6.86	117.36
43X-2	150	398.9	15.42	414.32	1H-5	150	6	0.05	6.05	12H-6	150	112	6.86	118.86
43X-3	150	400.4	15.42	415.82	1H-6	150	7.5	0.05	7.55	12H-7	60	113.5	6.86	120.36
43X-4	150	401.9	15.42	417.32	1H-7	33	9	0.05	9.05	12H-CC	26	114.1	6.86	120.96
43X-5	120	403.4	15.42	418.82	1H-CC	21	9.33	0.05	9.38	13H-1	150	114	8.31	122.31
43X-6	38	404.6	15.42	420.02	2H-1	150	9.5	0.62	10.12	13H-2	150	115.5	8.31	123.81
43X-CC	33	404.98	15.42	420.4	2H-2	150	11	0.62	11.62	13H-3	150	117	8.31	125.31
44X-1	150	407.1	15.42	422.52	2H-3	150	12.5	0.62	13.12	13H-4	150	118.5	8.31	126.81
44X-2	150	408.6	15.42	424.02	2H-4	150	14	0.62	14.62	13H-5	150	120	8.31	128.31
44X-3	150	410.1	15.42	425.52	2H-5	150	15.5	0.62	16.12	13H-6	150	121.5	8.31	129.81
44X-4	150	411.6	15.42	427.02	2H-6	150	17	0.62	17.62	13H-7	56	123	8.31	131.31
44X-5	150	413.1	15.42	428.52	2H-7	44	18.5	0.62	19.12	13H-CC	2	123.56	8.31	131.87
44X-6	150	414.6	15.42	430.02	2H-CC	32	18.94	0.62	19.56	14X-1	150	123.5	8.81	132.31
44X-7	45	416.1	15.42	431.52	3H-1	150	19	1.13	20.13	14X-2	150	125	8.81	133.81
44X-CC	41	416.55	15.42	431.97	3H-2	150	20.5	1.13	21.63	14X-3	150	126.5	8.81	135.31
45X-1	150	416.7	15.42	432.12	3H-3	150	22	1.13	23.13	14X-4	150	128	8.81	136.81
45X-2	150	418.2	15.42	433.62	3H-4	150	23.5	1.13	24.63	14X-5	142	129.5	8.81	138.31
45X-3	150	419.7	15.42	435.12	3H-5	150	25	1.13	26.13	14X-CC	63	130.92	8.81	139.73
45X-4	150	421.2	15.42	436.62	3H-6	150	26.5	1.13	27.63	15X-1	150	133.1	8.49	141.59
45X-5	85	422.7	15.42	438.12	3H-7	44	28	1.13	29.13	15X-2	150	134.6	8.49	143.09
45X-CC	31	423.55	15.42	438.97	3H-CC	16	28.44	1.13	29.57	15X-3	66	136.1	8.49	144.59
46X-1	150	426.4	15.42	441.82	4H-1	150	28.5	2.6	31.1	15X-CC	33	136.76	8.49	145.25
46X-2	150	427.9	15.42	443.32	4H-2	150	30	2.6	32.6	16X-1	19	142.6	8.49	151.09
46X-3	83	429.4	15.42	444.82	4H-3	150	31.5	2.6	34.1	17X-1	150	152.2	8.39	160.59
46X-CC	48	430.23	15.42	445.65	4H-4	150	33	2.6	35.6	17X-2	150	153.7	8.39	162.09
47X-1	150	436.1	15.42	451.52	4H-5	150	34.5	2.6	37.1	17X-3	150	155.2	8.39	163.59
47X-2	150	437.6	15.42	453.02	4H-6	150	36	2.6	38.6	17X-4	150	156.7	8.39	165.09
47X-3	150	439.1	15.42	454.52	4H-7	50	37.5	2.6	40.1	17X-5	150	158.2	8.39	166.59
47X-4	150	440.6	15.42	456.02	4H-CC	25	38	2.6	40.6	17X-6	150	159.7	8.39	168.09
47X-5	150	442.1	15.42	457.52	5H-1	150	38	3.08	41.08	17X-7	37	161.2	8.39	169.59
47X-6	150	443.6	15.42	459.02	5H-2	150	39.5	3.08	42.58	17X-CC	35	161.57	8.39	169.96
47X-7	48	445.1	15.42	460.52	5H-3	150	41	3.08	44.08	18X-1	150	161.8	10.31	172.11
47X-CC	45	445.58	15.42	461	5H-4	150	42.5	3.08	45.58	18X-2	150	163.3	10.31	173.61
48X-1	150	445.7	15.42	461.12	5H-5	150	44	3.08	47.08	18X-3	150	164.8	10.31	175.11
48X-2	150	447.2	15.42	462.62	5H-6	150	45.5	3.08	48.58	18X-4	150	166.3	10.31	176.61
48X-3	150	448.7	15.42	464.12	5H-7	44	47	3.08	50.08	18X-5	150	167.8	10.31	178.11
48X-4	150	450.2	15.42	465.62	5H-CC	2	47.44	3.08	50.52	18X-6	100	169.3	10.31	179.61
48X-5	150	451.7	15.42	467.12	6H-1	150	47.5	3.35	50.85	18X-7	55	170.3	10.31	180.61
48X-6	120	453.2	15.42	468.62	6H-2	150	49	3.35	52.35	18X-CC	50	170.85	10.31	181.16
48X-7	39	454.4	15.42	469.82	6H-3	150	50.5	3.35	53.85	19X-1	150	171.4	11.15	182.55
48X-CC	27	454.79	15.42	470.21	6H-4	150	52	3.35						

Table 4 (continued).

Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)	Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)	Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)
20X-1	150	181	9.85	190.85	7H-3	150	63	4.89	67.89	3H-CC	52	25.36	1.93	27.29
20X-2	150	182.5	9.85	192.35	7H-4	150	64.5	4.89	69.39	4H-1	150	26	2.26	28.26
20X-3	150	184	9.85	193.85	7H-5	150	66	4.89	70.89	4H-2	150	27.5	2.26	29.76
20X-4	150	185.5	9.85	195.35	7H-6	150	67.5	4.89	72.39	4H-3	150	29	2.26	31.26
20X-5	150	187	9.85	196.85	7H-7	59	69	4.89	73.89	4H-4	150	30.5	2.26	32.76
20X-6	150	188.5	9.85	198.35	7H-CC	24	69.59	4.89	74.48	4H-5	150	32	2.26	34.26
20X-7	41	190	9.85	199.85	8H-1	150	69.5	5.15	74.65	4H-6	150	33.5	2.26	35.76
20X-CC	37	190.41	9.85	200.26	8H-2	150	71	5.15	76.15	4H-7	45	35	2.26	37.26
21X-1	150	190.7	10.52	201.22	8H-3	150	72.5	5.15	77.65	4H-CC	21	35.45	2.26	37.71
21X-2	150	192.2	10.52	202.72	8H-4	150	74	5.15	79.15	5H-1	150	35.5	3.22	38.72
21X-3	150	193.7	10.52	204.22	8H-5	150	75.5	5.15	80.65	5H-2	150	37	3.22	40.22
21X-4	150	195.2	10.52	205.72	8H-6	150	77	5.15	82.15	5H-3	150	38.5	3.22	41.72
21X-5	150	196.7	10.52	207.22	8H-7	29	78.5	5.15	83.65	5H-4	150	40	3.22	43.22
21X-6	150	198.2	10.52	208.72	8H-CC	25	78.79	5.15	83.94	5H-5	150	41.5	3.22	44.72
21X-7	26	199.7	10.52	210.22	9H-1	150	79	5.54	84.54	5H-6	150	43	3.22	46.22
21X-CC	36	199.96	10.52	210.48	9H-2	150	80.5	5.54	86.04	5H-7	31	44.5	3.22	47.72
22X-1	150	200.4	11.44	211.84	9H-3	150	82	5.54	87.54	5H-CC	21	44.81	3.22	48.03
22X-2	150	201.9	11.44	213.34	9H-4	150	83.5	5.54	89.04	6H-1	150	45	4.19	49.19
22X-3	150	203.4	11.44	214.84	9H-5	150	85	5.54	90.54	6H-2	150	46.5	4.19	50.69
22X-4	150	204.9	11.44	216.34	9H-6	150	86.5	5.54	92.04	6H-3	150	48	4.19	52.19
22X-5	100	206.4	11.44	217.84	9H-7	47	88	5.54	93.54	6H-4	150	49.5	4.19	53.69
22X-6	60	207.4	11.44	218.84	9H-CC	26	88.47	5.54	94.01	6H-5	150	51	4.19	55.19
22X-CC	57	208	11.44	219.44	10H-1	150	88.5	5.58	94.08	6H-6	150	52.5	4.19	56.69
23X-1	150	209.7	10.06	219.76	10H-2	150	90	5.58	95.58	6H-7	51	54	4.19	58.19
23X-2	150	211.2	10.06	221.26	10H-3	150	91.5	5.58	97.08	6H-CC	16	54.51	4.19	58.7
23X-3	150	212.7	10.06	222.76	10H-4	150	93	5.58	98.58					
23X-4	150	214.2	10.06	224.26	10H-5	150	94.5	5.58	100.08	154-929E-				
23X-5	150	215.7	10.06	225.76	10H-6	150	96	5.58	101.58	1R-1	61	471.5	15.71	487.21
23X-6	83	217.2	10.06	227.26	10H-7	47	97.5	5.58	103.08	1R-2	150	472.11	15.71	487.82
23X-CC	23	218.03	10.06	228.09	10H-CC	16	97.97	5.58	103.55	1R-3	150	473.61	15.71	489.32
24X-1	150	219.4	11.14	230.54	11H-1	150	98	6.21	104.21	1R-4	150	475.11	15.71	490.82
24X-2	150	220.9	11.14	232.04	11H-2	150	99.5	6.21	105.71	1R-5	150	476.61	15.71	492.32
24X-3	150	222.4	11.14	233.54	11H-3	150	101	6.21	107.21	1R-6	150	478.11	15.71	493.82
24X-4	150	223.9	11.14	235.04	11H-4	150	102.5	6.21	108.71	1R-7	150	479.61	15.71	495.32
24X-5	150	225.4	11.14	236.54	11H-5	150	104	6.21	110.21	1R-CC	27	481.11	15.71	496.82
24X-6	150	226.9	11.14	238.04	11H-6	150	105.5	6.21	111.71	2R-1	150	481.3	15.94	497.24
24X-7	46	228.4	11.14	239.54	11H-7	54	107	6.21	113.21	2R-2	150	482.8	15.94	498.74
24X-CC	19	228.86	11.14	240	11H-CC	25	107.54	6.21	113.75	2R-3	150	484.3	15.94	500.24
154-929C-					12H-1	150	107.5	6.4	113.9	2R-4	150	485.8	15.94	501.74
1H-1	66	3	0.76	3.76	12H-2	150	109	6.4	115.4	2R-5	150	487.3	15.94	503.24
1H-2	150	3.66	0.76	4.42	12H-3	150	110.5	6.4	116.9	2R-6	112	488.8	15.94	504.74
1H-3	150	5.16	0.76	5.92	12H-4	150	112	6.4	118.4	2R-CC	8	489.92	15.94	505.86
1H-4	150	6.66	0.76	7.42	12H-5	150	113.5	6.4	119.9	3R-1	150	491	14.77	505.77
1H-5	150	8.16	0.76	8.92	12H-6	150	115	6.4	121.4	3R-2	150	492.5	14.77	507.27
1H-6	150	9.66	0.76	10.42	12H-7	52	116.5	6.4	122.9	3R-3	120	494	14.77	508.77
1H-7	147	11.16	0.76	11.92	13H-1	150	117	8.5	125.5	3R-4	40	495.2	14.77	509.97
1H-CC	20	12.63	0.76	13.39	13H-2	150	118.5	8.5	127	3R-CC	28	495.6	14.77	510.37
2H-1	150	12.5	0.83	13.33	13H-3	150	120	8.5	128.5	4R-1	150	500.8	20.58	521.38
2H-2	150	14	0.83	14.83	13H-4	150	121.5	8.5	130	4R-2	150	502.3	20.58	522.88
2H-3	150	15.5	0.83	16.33	13H-5	150	123	8.5	131.5	4R-3	150	503.8	20.58	524.38
2H-4	150	17	0.83	17.83	13H-6	150	124.5	8.5	133	4R-4	87	505.3	20.58	525.88
2H-5	150	18.5	0.83	19.33	13H-7	60	126	8.5	134.5	4R-CC	15	506.17	20.58	526.75
2H-6	150	20	0.83	20.83	13H-CC	27	126.6	8.5	135.1	5R-1	150	510.4	20.58	530.98
2H-7	38	21.5	0.83	22.33	14X-CC	33	126.5	8.5	135	5R-2	150	511.9	20.58	532.48
2H-CC	11	21.88	0.83	22.71	15X-1	150	136.1	8.71	144.81	5R-3	150	513.4	20.58	533.98
3H-1	150	22	1.42	23.42	15X-2	150	137.6	8.71	146.31	5R-4	108	514.9	20.58	535.48
3H-2	150	23.5	1.42	24.92	15X-3	150	139.1	8.71	147.81	5R-CC	27	515.98	20.58	536.56
3H-3	150	25	1.42	26.42	15X-4	150	140.6	8.71	149.31	6R-1	150	520	20.58	540.58
3H-4	150	26.5	1.42	27.92	15X-5	150	142.1	8.71	150.81	6R-2	150	521.5	20.58	542.08
3H-5	150	28	1.42	29.42	15X-6	150	143.6	8.71	152.31	6R-3	150	523	20.58	543.58
3H-6	150	29.5	1.42	30.92	15X-7	54	145.1	8.71	153.81	6R-4	150	524.5	20.58	545.08
3H-7	57	31	1.42	32.42	15X-CC	42	145.64	8.71	154.35	6R-5	100	526	20.58	546.58
3H-CC	19	31.57	1.42	32.99	16X-1	150	145.6	8.72	154.32	6R-6	53	527	20.58	547.58
4H-1	150	31.5	2.72	34.22	16X-2	150	147.1	8.72	155.82	6R-CC	22	527.53	20.58	548.11
4H-2	150	33	2.72	35.72	16X-3	150	148.6	8.72	157.32	7R-1	150	529.3	20.58	549.88
4H-3	150	34.5	2.72	37.22	16X-4	150	150.1	8.72	158.82	7R-2	150	530.8	20.58	551.38
4H-4	150	36	2.72	38.72	16X-5	142	151.6	8.72	160.32	7R-3	150	532.3	20.58	552.88
4H-5	150	37.5	2.72	40.22	16X-CC	54	153.02	8.72	161.74	7R-4	26	533.8	20.58	554.38
4H-6	150	39	2.72	41.72						7R-CC	23	534.06	20.58	554.64
4H-7	43	40.5	2.72	43.22	154-929D-					8R-1	150	539	20.58	559.58
4H-CC	15	40.93	2.72	43.65	1H-1	150	0	0.41	0.41	8R-2	150	540.5	20.58	561.08
5H-1	150	41	3.42	44.42	1H-2	150	1.5	0.41	1.91	8R-3	150	542	20.58	562.58
5H-2	150	42.5	3.42	45.92	1H-3	150	3	0.41	3.41	8R-4	87	543.5	20.58	564.08
5H-3	150	44	3.42	47.42	1H-4	150	4.5	0.41	4.91	8R-CC	38	544.37	20.58	564.95
5H-4	150	45.5	3.42	48.92	1H-5	46	6	0.41	6.41	9R-1	150	548.6	20.58	569.18
5H-5	150	47	3.42	50.42	1H-CC	18	6.46	0.41	6.87	9R-2	150	550.1	20.58	570.68
5H-6	150	48.5	3.42	51.92	2H-1	150	7	0.66	7.66	9R-3	150	551.6	20.58	572.18
5H-7	59	50	3.42	53.42	2H-2	150	8.5	0.66	9.16	9R-4	150	553.1	20.58	573.68
5H-CC	19	50.59	3.42	54.01	2H-3	150	10	0.66	10.66	9R-5	84	554.6	20.58	575.18
6H-1	150	50.5	4.23	54.73	2H-4	150	11.5	0.66	12.16	9R-CC	26	555.44	20.58	576.02
6H-2	150	52	4.23	56.23	2H-5	150	13	0.66	13.66	10R-1	150	558.3	20.58	578.88
6H-3	150	53.5	4.23	57.73	2H-6	150	14.5	0.66	15.16	10R-2	150	559.8	20.58	580.38
6H-4	130	55	4.23	59.23	2H-7	36	16	0.66	16.66	10R-3	150	561.3	20.58	581.88
6H-5	150	56.3	4.23	60.53	2H-CC	16	16.36	0.66	17.02	10R-4	150	562.8	20.58	583.38
6H-6	150	57.8	4.23	62.03	3H-1	150	16.5	1.93	18.43	10R-5	150	564.3	20.58	584.88
6H-7	55	59.3	4.23	63.53	3H-2	150	18	1.93	19.93	10R-6	140	565.8	20.58	586.38</

Table 4 (continued).

Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)	Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)	Core and section	Section length (cm)	Depth (mbsf)	Offset (m)	Composite depth (mcd)
11R-4	150	572.4	20.58	592.98	17R-CC	15	634.89	20.58	655.47	25R-7	67	711.5	20.58	732.08
11R-5	150	573.9	20.58	594.48	18R-1	150	635.3	20.58	655.88	25R-CC	15	712.17	20.58	732.75
11R-6	44	575.4	20.58	595.98	18R-2	150	636.8	20.58	657.38	26R-1	150	712.2	20.58	732.78
11R-CC	1	575.84	20.58	596.42	18R-3	150	638.3	20.58	658.88	26R-2	150	713.7	20.58	734.28
12R-1	150	577.5	20.58	598.08	18R-4	150	639.8	20.58	660.38	26R-3	150	715.2	20.58	735.78
12R-2	150	579	20.58	599.58	18R-5	147	641.3	20.58	661.88	26R-4	150	716.7	20.58	737.28
12R-3	150	580.5	20.58	601.08	18R-CC	18	642.77	20.58	663.35	26R-5	74	718.2	20.58	738.78
12R-4	150	582	20.58	602.58	19R-1	150	645	20.58	665.58	26R-CC	24	718.94	20.58	739.52
12R-5	150	583.5	20.58	604.08	19R-2	150	646.5	20.58	667.08	27R-1	150	721.9	20.58	742.48
12R-6	150	585	20.58	605.58	19R-3	150	648	20.58	668.58	27R-2	150	723.4	20.58	743.98
12R-7	29	586.5	20.58	607.08	19R-4	150	649.5	20.58	670.08	27R-3	150	724.9	20.58	745.48
12R-CC	24	586.79	20.58	607.37	19R-5	150	651	20.58	671.58	27R-4	75	726.4	20.58	746.98
13R-1	150	587.2	20.58	607.78	19R-6	150	652.5	20.58	673.08	27R-CC	21	727.15	20.58	747.73
13R-2	150	588.7	20.58	609.28	19R-7	63	654	20.58	674.58	28R-1	150	731.6	20.58	752.18
13R-3	150	590.2	20.58	610.78	19R-CC	22	654.63	20.58	675.21	28R-2	150	733.1	20.58	753.68
13R-4	150	591.7	20.58	612.28	20R-1	150	654.7	20.58	675.28	28R-3	150	734.6	20.58	755.18
13R-5	150	593.2	20.58	613.78	20R-2	150	656.2	20.58	676.78	28R-4	150	736.1	20.58	756.68
13R-6	79	594.7	20.58	615.28	20R-3	150	657.7	20.58	678.28	28R-5	89	737.6	20.58	758.18
13R-CC	2	595.49	20.58	616.07	20R-4	150	659.2	20.58	679.78	28R-CC	17	738.49	20.58	759.07
14R-1	150	596.9	20.58	617.48	20R-5	150	660.7	20.58	681.28	29R-1	150	741.2	20.58	761.78
14R-2	150	598.4	20.58	618.98	20R-6	138	662.2	20.58	682.78	29R-2	150	742.7	20.58	763.28
14R-3	150	599.9	20.58	620.48	20R-CC	17	663.58	20.58	684.16	29R-3	150	744.2	20.58	764.78
14R-4	150	601.4	20.58	621.98	21R-1	150	664.3	20.58	684.88	29R-4	150	745.7	20.58	766.28
14R-5	150	602.9	20.58	623.48	21R-2	150	665.8	20.58	686.38	29R-5	33	747.2	20.58	767.78
14R-6	150	604.4	20.58	624.98	21R-3	150	667.3	20.58	687.88	29R-CC	60	747.53	20.58	768.11
14R-7	66	605.9	20.58	626.48	21R-4	150	668.8	20.58	689.38	30R-1	150	750.9	20.58	771.48
14R-CC	2	606.56	20.58	627.14	21R-5	113	670.3	20.58	690.88	30R-2	96	752.4	20.58	772.98
15R-1	150	606.5	20.58	627.08	21R-CC	22	671.43	20.58	692.01	30R-CC	14	753.36	20.58	773.94
15R-2	150	608	20.58	628.58	22R-1	150	673.9	20.58	694.48	31R-1	150	760.6	20.58	781.18
15R-3	150	609.5	20.58	630.08	22R-2	150	675.4	20.58	695.98	31R-2	150	762.1	20.58	782.68
15R-4	150	611	20.58	631.58	22R-3	150	676.9	20.58	697.48	31R-3	150	763.6	20.58	784.18
15R-5	150	612.5	20.58	633.08	22R-4	150	678.4	20.58	698.98	31R-4	150	765.1	20.58	785.68
15R-6	150	614	20.58	634.58	22R-5	144	679.9	20.58	700.48	31R-5	150	766.6	20.58	787.18
15R-7	49	615.5	20.58	636.08	22R-CC	17	681.34	20.58	701.92	31R-6	150	768.1	20.58	788.68
15R-CC	10	615.99	20.58	636.57	23R-1	150	683.2	20.58	703.78	31R-7	30	769.6	20.58	790.18
16R-1	150	616.1	20.58	636.68	23R-2	150	684.7	20.58	705.28	31R-CC	57	769.9	20.58	790.48
16R-2	150	617.6	20.58	638.18	23R-3	93	686.2	20.58	706.78	33R-1	150	779.9	20.58	800.48
16R-3	150	619.1	20.58	639.68	23R-CC	22	687.13	20.58	707.71	33R-2	148	781.4	20.58	801.98
16R-4	150	620.6	20.58	641.18	24R-1	150	692.8	20.58	713.38	33R-3	150	782.88	20.58	803.46
16R-5	150	622.1	20.58	642.68	24R-2	150	694.3	20.58	714.88	33R-4	150	784.38	20.58	804.96
16R-6	100	623.6	20.58	644.18	24R-3	150	695.8	20.58	716.38	33R-5	150	785.88	20.58	806.46
16R-7	68	624.6	20.58	645.18	24R-4	150	697.3	20.58	717.88	33R-6	130	787.38	20.58	807.96
16R-CC	19	625.28	20.58	645.86	24R-5	140	698.8	20.58	719.38	33R-7	36	788.68	20.58	809.26
17R-1	150	625.8	20.58	646.38	24R-CC	16	700.2	20.58	720.78	33R-CC	14	789.04	20.58	809.62
17R-2	150	627.3	20.58	647.88	25R-1	150	702.5	20.58	723.08	34R-CC	3	789.5	20.58	810.08
17R-3	150	628.8	20.58	649.38	25R-2	150	704	20.58	724.58	35R-1	65	799.2	20.58	819.78
17R-4	150	630.3	20.58	650.88	25R-3	150	705.5	20.58	726.08	35R-2	120	799.85	20.58	820.43
17R-5	150	631.8	20.58	652.38	25R-4	150	707	20.58	727.58	35R-3	35	801.05	20.58	821.63
17R-6	100	633.3	20.58	653.88	25R-5	150	708.5	20.58	729.08	35R-CC	1	801.4	20.58	821.98
17R-7	59	634.3	20.58	654.88	25R-6	150	710	20.58	730.58					

broad peak in silica coincides with the alkalinity peak around 280 mbsf. A second silica peak, around 470 mbsf, also corresponds with higher alkalinity. Silica concentrations decrease with depth below this second peak to a minimum in this section of 59.4 μM in the deepest pore-water sample recovered at 782.68 mbsf. As at Sites 925, 926, and 928, the shallow peak in dissolved silica occurs in sediments of early Miocene age. The deeper peak occurs in sediments of early Oligocene age and was not noted at Site 925 where sediments of this same age were recovered. Siliceous microfossils were observed in the sediment within both these time intervals and in higher abundance than at the shallower sites (see "Lithostratigraphy" and "Biostratigraphy" sections, this chapter). This differential preservation of the siliceous microfossils with respect to greater depth is most likely related to higher concentrations of silica in the bottom waters at the deeper Site 929 than at the shallower sites on the Ceara Rise. Sedimentation-rate-enhanced preservation cannot account for the changes because the rates at Site 929 are similar or lower than those at the shallower sites (see "Sedimentation Rates" section, this chapter). The large decrease in dissolved silica to the base of the cored section suggests a silica sink at depth and that no high concentrations of biosiliceous sediments exist deeper in the section.

Sulfate decreases by about 55% over the sampled interval from a near-seawater value near the surface to a low of 12.82 mM at 782.68 mbsf, but it is never fully reduced (Fig. 14). This is consistent with the background-level methane concentrations throughout the cored sequence, as at the shallower Ceara Rise sites, but the total amount of sulfate reduction is less than at the previous sites, suggesting lower

organic matter burial at Site 929. Ammonium increases systematically with decreasing sulfate (Fig. 14). The rate of change of sulfate and ammonium concentrations with depth within the drilled interval is greatest in the top 30 mbsf, where the sulfate reduction is the most intense, and is lower deeper in the section. Between about 300 and 400 mbsf, the gradient of sulfate increases slightly, whereas ammonium is more variable.

Manganese concentrations in the pore waters exhibit two large maxima: at 5.95 and 218.8 mbsf (Fig. 14). The upper peak reflects the modern redox boundary, whereas the deeper peak suggests more complex redox conditions and a source of dissolved manganese at depth. The deep section is immediately below the slump deposit and is characterized by low calcium carbonate concentrations and a reddish color. It was also noted to be an interval containing layers of iron oxides (see "Lithostratigraphy" section, this chapter).

Strontium concentrations increase from a near-seawater value of 80 μM near the sediment-water interface to a maximum of 1918 μM at 782.68 mbsf (Fig. 14). Strontium determinations for Sample 154-929A-21X-3, 140–150 cm, and for samples from Hole 929E were made onshore, using the flame atomic absorption (AA) method in the Marine Analytical Labs at the University of California, Santa Cruz. The strontium levels are unusually high at Site 929, as at all sites drilled during Leg 154, indicating extensive calcite recrystallization within the section, particularly in the deepest part of the cored interval.

Lithium pore-water concentrations increase slowly over the top 100 mbsf from near-seawater values of 30 μM at the top of the section to about 69 μM near 130 mbsf, and then increase more sharply to a

Figure 9. Magnetic susceptibility, natural gamma, and percentage of reflectance from Site 929 on the composite depth scale. Data are included on CD-ROM (back pocket). Plot lines are vertically offset from one another. Hole 929A = solid line, Hole 929B = dotted line, Hole 929C = dashed line, and Hole 929D = large dashed line. In the composite depth interval from 480 to 530 mcd, Hole 929E is represented by a dashed line. Magnetic susceptibility values are in uncorrected instrument units.

Figure 9 (continued).

maximum of 892 μM in the sample at 469.35 mbsf (Fig. 14). Samples from Hole 929E were not measured on board the ship. The lithium concentrations from this site, although unusually high, are lower than those measured at the previous sites throughout much of the cored interval. As at the previous sites, the pore-water lithium at depth is nearly 50 times more concentrated than typically found in pelagic

deep-sea sediments (e.g., see Leg 130, Kroenke, Berger, Janecek, et al., 1991; Leg 138, Mayer, Pisias, Janecek, et al., 1992; Leg 145, Rea, Basov, Janecek, Palmer-Julson, et al., 1993).

Calcium concentrations increase with depth from values near 10 mM shallow in the section to nearly 80 mM in the deepest sample at 782.68 mbsf. Magnesium concentrations decrease from about 52 mM

Table 5. Splice tie points, Site 929.

Core, section, interval (cm)	Depth (mbsf)	Composite depth (mcd)		Core, section, interval (cm)	Depth (mbsf)	Composite depth (mcd)
154-929A-1H-3, 69.5	3.69	3.69	tie to	154-929B-1H-3, 64.5	3.64	3.69
154-929B-1H-5, 144.6	7.45	7.5	tie to	154-929C-1H-4, 8.5	6.74	7.5
154-929C-1H-7, 92.5	12.09	12.85	tie to	154-929D-2H-4, 68.6	12.19	12.85
154-929D-2H-6, 125.6	15.76	16.42	tie to	154-929B-2H-5, 29.5	15.8	16.42
154-929B-2H-6, 139.5	18.4	19.02	tie to	154-929D-3H-1, 59.5	17.09	19.02
154-929D-3H-2, 77.5	18.77	20.7	tie to	154-929C-2H-5, 137.5	19.88	20.7
154-929C-2H-7, 23.5	21.74	22.56	tie to	154-929B-3H-2, 94.5	21.44	22.56
154-929B-3H-3, 124.5	23.25	24.37	tie to	154-929C-3H-1, 95.6	22.96	24.37
154-929C-3H-7, 11.6	31.12	32.53	tie to	154-929D-4H-3, 128.5	30.28	32.53
154-929D-4H-5, 56.5	32.56	34.81	tie to	154-929C-4H-1, 59.6	32.1	34.81
154-929C-4H-7, 20.5	40.71	43.42	tie to	154-929B-5H-2, 84.5	40.35	43.42
154-929B-5H-6, 134.5	46.85	49.92	tie to	154-929C-5H-4, 101.5	46.51	49.92
154-929C-5H-6, 122.7	49.73	53.14	tie to	154-929B-6H-2, 79.5	49.79	53.14
154-929B-6H-6, 34.5	55.35	58.7	tie to	154-929A-7H-1, 74.5	52.74	58.7
154-929A-7H-6, 59.5	60.1	66.06	tie to	154-929C-7H-1, 116.6	61.17	66.06
154-929C-7H-6, 2.5	67.53	72.42	tie to	154-929B-8H-1, 124.5	67.75	72.42
154-929B-8H-6, 139.5	75.39	80.06	tie to	154-929A-9H-1, 29.5	71.29	80.06
154-929A-9H-5, 54.5	77.54	86.31	tie to	154-929C-9H-2, 26.7	80.77	86.31
154-929C-9H-4, 146.6	84.97	90.51	tie to	154-929A-10H-1, 54.5	81.04	90.51
154-929A-10H-7, 4.6	89.05	98.52	tie to	154-929C-10H-3, 143.6	92.94	98.52
154-929C-10H-5, 68.5	95.18	100.76	tie to	154-929A-11H-1, 69.5	90.69	100.76
154-929A-11H-6, 39.5	97.89	107.96	tie to	154-929C-11H-3, 74.5	101.75	107.96
154-929C-11H-6, 65.5	106.15	112.36	tie to	154-929A-12H-2, 49.5	101.5	112.36
154-929A-12H-5, 94.5	106.44	117.3	tie to	154-929B-12H-4, 144.5	110.44	117.3
154-929B-12H-6, 34.6	112.35	119.21	tie to	154-929C-12H-4, 80.5	112.81	119.21
154-929C-12H-5, 134.5	114.85	121.25	tie to	154-929A-13H-1, 39.5	109.39	121.25
154-929A-13H-5, 124.5	116.25	128.08	tie to	154-929C-13H-2, 109.6	119.6	128.08
154-929C-13H-6, 128.6	125.79	134.27	tie to	154-929B-14X-2, 47.7	125.48	134.27
154-929B-14X-5, 128.6	130.79	139.58	tie to	154-929A-15H-1, 14.5	128.15	139.58
154-929A-15H-6, 69.5	136.2	147.63	tie to	154-929C-15X-2, 131.6	138.92	147.63
154-929C-15X-7, 50.5	145.61	154.32	tie to	154-929B-16X-1, 2.7	145.63	154.35
154-929B-16X-5, 113.6	152.74	161.46	tie to	154-929A-17X-1, 89.6	153.1	161.46
154-929B-17X-7, 26.5	161.46	169.82	tie to	154-929A-18X-1, 24.5	157.04	169.82
154-929A-18X-4, 14.5	161.45	174.23	tie to	154-929B-18X-2, 62.5	163.93	174.23
154-929B-18X-7, 14.5	170.45	180.75	tie to	154-929A-19X-1, 144.5	167.85	180.75
154-929A-19X-4, 54.5	171.44	184.34	tie to	154-929B-19X-2, 32.5	173.22	184.34
154-929B-19X-6, 85	179.75	190.87	tie to	154-929A-20X-1, 19.5	176.3	190.87
154-929A-20X-7, 49.5	185.6	200.15	tie to	154-929B-21X-1, 4.5	185.74	200.29
154-929A-21X-5, 139.5	193.1	207.65	tie to	154-929B-21X-5, 42.5	197.13	207.65
154-929B-21X-6, 112.5	199.32	209.84	tie to	154-929A-22X-1, 19.5	195.6	209.84
154-929A-22X-7, 48	204.88	219.12	tie to	154-929A-23X-1, 3	205.13	219.53
154-929A-23X-7, 55.5	214.65	229.05	tie to	154-929A-24X-1, 3.1	214.43	228.83
154-929B-24X-6, 123.5	223.13	237.53	tie to	154-929B-24X-5, 100.5	226.4	237.53
154-929B-24X-7, 12.5	228.52	239.66	tie to	154-929A-25X-1, 23.5	224.24	239.66
154-929A-25X-6, 139.5	232.9	248.32				
154-929A-50X-6, 138.5	473.89	489.31	tie to	154-929E-1R-3, 4.5	473.65	489.36
154-929E-1R-7, 4.5	34.5	479.95	tie to	154-929A-51X-4, 18.5	479.29	495.66
154-929A-51X-6, 101	483.11	499.48	tie to	154-929E-2R-2, 74.5	483.54	499.48
154-929E-2R-4, 144.5	487.24	503.18	tie to	154-154-929A-52X-2, 78.5	486.49	503.2
154-929A-52X-5, 131	491.51	508.22	tie to	154-929E-3R-2, 94.5	93.45	508.22
154-929E-3R-4, 4.5	495.25	510.02	tie to	154-929A-53X-1, 18.5	493.68	510.02
154-929E-35R-3, 23.6	801.29	813.09				

near the sediment-water interface to 21.01 mM in the deepest sample (Fig. 14). These profiles are similar to those at the other Ceara Rise sites and reflect the replacement of calcium with magnesium in basement rocks. The calcium gradient is 8.66 mM/100 m and the magnesium gradient is -3.9 mM/100 m. These are steeper gradients than at the shallower sites and reflect the lower average sedimentation rate at Site 929. Potassium concentrations decrease with depth from 12.0 mM at 1.45 mbsf to 2.17 mM in the deepest sample (Fig. 14), presumably because of the uptake of potassium during basement alteration.

Phosphate was measured over the shallow interval of the section to 75.45 mbsf. Except in the top two samples, concentrations were below the detection limit of the technique (Table 8). The low values in the top two samples are consistent with diffusion from the overlying bottom waters.

In summary, the general patterns in the interstitial-water profiles at Site 929 are similar to those at the four shallower sites on the Ceara Rise. Somewhat less sulfate reduction than at the shallower sites on the Ceara Rise suggest less organic carbon burial at Site 929. The dissolved manganese profiles show modern redox boundaries within the top few meters. The dissolved silica profile indicates more extensive opal deposition in the early Miocene than is evident from the visual core descriptions. The increase in dissolved silica concentrations in the lower Oligocene sediments corresponds to the common occurrence of siliceous microfossils within this section. The high

strontium values suggest that extensive recrystallization has affected the biogenic carbonate component of the sediments within the cored interval. The maximum lithium concentration is somewhat lower at Site 929 than at the shallower sites. The calcium, magnesium, and potassium profiles appear to be generally controlled by the alteration of basalt and subsequent diffusion of these constituents to the sediment-water interface.

Solid-phase Geochemistry

A total of 255 samples were analyzed for calcium carbonate content, resulting in a 3-m sampling interval from one complete stratigraphic section from Site 929 (Table 9). A subset of 70 samples was measured for total carbon (Table 9), nitrogen, and sulfur content. The nitrogen and sulfur concentrations are near the detection limits of the analytical technique and are not significantly different from zero for all samples analyzed from this site.

The sediments at Site 929 are a mixture of biogenic carbonate and terrigenous material. The mean calcium carbonate concentration for each of the lithologic units recovered from this deepest site drilled on the Ceara Rise is significantly lower than measured in the shallower sites (see "Lithostratigraphy" section, this chapter). In general, dissolution of carbonate material rather than dilution by noncarbonate components is responsible for the lower concentrations. Distinct intervals

of low carbonate concentration occur from 162 to 230 mbsf and from 670 to 809 mbsf (Fig. 15). These intervals of low carbonate are either barren or contain a highly dissolved assemblage of calcareous microfossils (see "Biostratigraphy" section, this chapter). Within the shallower low carbonate section, there is a carbonate-rich slump deposit accounting for the high concentrations between 170 and 200 mbsf.

The organic carbon, measured as the difference between total carbon and carbonate carbon, is below 0.5% (Fig. 15 and Table 9). Many of the samples have concentrations below the detection limits of the technique, and the difference between total carbon and carbonate carbon yielded negative values.

Accumulation Rates

The age model for Site 929, based on recognized biostratigraphic datums (see "Sedimentation Rates" section, this chapter), was used to determine the mass accumulation rate (MAR) of the carbonate and noncarbonate sediment components (Fig. 16). Because the biostratigraphic age model provides the long-term (10^5 - to 10^6 -yr) changes in sedimentation rate, only the large-scale features in the accumulation rates are interpreted. MARs were determined on a subset of 235 of the 255 samples analyzed for calcium carbonate content, corresponding to those with dry-bulk-density measurements either from the same sample or from adjacent samples (see "Physical Properties" section, this chapter).

The high accumulation rates between 140 and 210 mbsf are associated with the slump deposit and are not representative of the pelagic deposition in the interval. A few small hiatuses were noted in the interval from 210 to 250 mbsf, and these rates may be anomalously low. The carbonate MAR at Site 929 is significantly lower than that measured at the shallower sites drilled on the Ceara Rise (Fig. 17). These lower rates and the generally poorer preservation of the carbonate material reflects the influence of depth-dependent dissolution. The Oligocene section cored at this site exhibits high rates of carbonate accumulation and the assemblage is well preserved, indicating that the CCD within the Atlantic during the Oligocene was much deeper than in older and younger time intervals.

Throughout much of the cored section, the noncarbonate accumulation is of similar magnitude or lower than rates at other sites drilled on the Ceara Rise (Fig. 17). However, within the Pliocene-Pleistocene time interval, the mean rate of noncarbonate accumulation is greater than at the other sites and increases by more than a factor of 4 over the past 10 m.y. This increase in terrigenous material, largely derived from the Amazon River outflow, indicates an enhanced source since that time, most likely associated with Andean Uplift (Benjamin et al., 1987).

PHYSICAL PROPERTIES

Physical properties measurements at Site 929 were conducted on whole-round core sections and on discrete samples from split cores. The whole-round measurements include GRAPE density and compressional-wave velocity (using the *P*-wave logger on the MST). These MST measurements were made on the APC section of the recovered intervals, corresponding to the upper 130 m of the section at Site 929. Index properties, compressional-wave velocity (using the DSV and the HF), shear strength, and resistivity were measured on split cores from Holes 929A, 929B, 929C, and 929E. One interval from Hole 929D was chosen for "high-resolution" discrete measurements of acoustic velocities and bulk densities. All measurement methods are described in the "Physical Properties" section of the "Explanatory Notes" chapter (this volume).

Index Properties

Bulk density, porosity, water content (expressed as a percentage of wet and dry mass), grain density, and dry density (determined by measuring the wet mass), wet volume, and dry mass of discrete

Figure 10. Depth offsets of successive cores on the mcd scale relative to mbsf depth, indicating the "growth" of the composite depth scale with increasing depth.

samples are listed in Table 10. Continuous wet bulk densities estimated by the GRAPE device are shown in Figure 18. The GRAPE profile follows a similar path to those of the other sites, with two exceptions. Spikes of high bulk density are observed in the upper 50 m of Site 929. These correspond to intervals of extremely high magnetic susceptibility and to narrow zones of anomalously high transverse velocity measured by the *P*-wave logger. All three anomalies can be clearly correlated in split cores to intervals with iron sulfide nodules. Although these features are not unique to Site 929, their abundance and intensity are apparently much greater than at the shallower water sites on the Ceara Rise.

The effect of greater water depth, and therefore greater carbonate dissolution, at Site 929 is also reflected in the initial bulk densities of the uncompacted section. As seen in Figure 19, the uppermost sequence at Site 929 has distinctly lower bulk density than shallower coring locations with more calcareous sediments. Under modest overburden, bulk densities quickly converge to similar values at both Sites 925 and 929 below 20–30 mbsf.

The index properties profile reconstructed from discrete measurements over the 790 m of cored sediments at Site 929 (Fig. 20) shows major excursions in bulk density. As will be discussed in the "Acoustic Velocity" section (below), these anomalies are also associated with variations in sonic velocity, and so may be seen as prominent reflections in seismic profiles. We focus our attention on the four major inversions of the bulk-density trend with depth: at about 210–240 mbsf, at 260–290 mbsf, at 460–490 mbsf, and at 680–720 mbsf. All are associated with reductions of 0.10 Mg/m³ or more relative to the general trend of bulk densities. The first three anomalies correspond precisely to intervals of biosiliceous sedimentation identified in smear slides (see "Lithostratigraphy" section, this chapter). Pore-water silica profiles provide additional evidence for biogenic silica dissolution (see "Geochemistry" section, this chapter). It seems likely that the high porosities characteristic of uncompacted biosiliceous sediments (e.g., Mayer, 1979; Wilkens and Handyside, 1985) have been preserved to some degree despite burial of up to 500 m. The interval of lower bulk densities at around 700 mbsf corresponds to a nannofossil claystone with a mean carbonate content of <30%.

Acoustic Velocity

Acoustic velocity was measured using two discrete methods: the DSV and the HF (see "Physical Properties" section, "Explanatory Notes" chapter, this volume) and the *P*-wave logger on the MST.

Figure 11. Spliced records of magnetic susceptibility, natural gamma, and percentage of reflectance from the upper 300 mcd of Site 929. Tie points for forming the splice are given in Table 5. Hole 929A = solid, Hole 929B = dotted line, Hole 929C = dashed line, Hole 929D = large dashed line, and Hole 929E = dotted line.

Figure 11 (continued).

Table 6. Biostratigraphic data from Holes 929A and 929E.

Hole	Marker species	Age (Ma)	Depth (mbsf)	(±)	Nannofossils (mbsf)	Foraminifers (mbsf)	Nannofossils (mcd)	Foraminifers (mcd)
929A	T <i>Pseudoemiliania lacunosa</i>	0.46	16.70–17.40	0.35	17.05		18.67	
929A	Reentrance medium <i>Gephyrocapsa</i>	1.03	34.40–34.70	0.15	34.55		37.65	
929A	T1 <i>Gephyrocapsa</i>	1.24	41.30–41.70	0.20	41.50		44.60	
929A	B <i>Pulleniatina finalis</i>	1.4	58.71–60.20	0.75		59.45		65.42
929A	B1 <i>Gephyrocapsa</i>	1.46	48.20–48.78	0.29	48.49		53.10	
929A	T <i>Calcidiscus macintyre</i>	1.60	49.58–50.28	0.35	49.93		54.54	
929A	B <i>Gephyrocapsa medium</i>	1.67	52.20–52.40	0.10	52.30		58.26	
929A	T <i>Globigerinoides fistulosus</i>	1.7	63.70–65.20	0.75		64.45		72.42
929A	T <i>Globigerinoides extremus</i>	1.9	50.58–54.20	1.81		52.39		57.69
929A	T <i>Discoaster brouweri</i>	1.95	59.20–59.70	0.25	59.45		65.41	
929A	B <i>Globorotalia truncatulinoides</i>	2.0	57.21–58.70	0.75		57.95		63.92
929A	Ba <i>Discoaster triradiatus</i>	2.15	63.80–64.60	0.40	64.20		72.16	
929A	T <i>Globorotalia miocenica</i>	2.3	69.71–73.21	1.75		71.46		80.23
929A	Reappearance <i>Pulleniatina</i>	2.3	66.71–69.71	1.50		68.21		76.17
929A	T <i>Discoaster pentaradiatus</i>	2.44	70.95–71.80	0.42	71.38		79.74	
929A	T <i>Globigerina decoraperta</i>	2.6	82.71–84.21	0.75		83.46		92.93
929A	T <i>Discoaster tamalis</i>	2.76	80.90–80.90	0.00	80.90		90.02	
929A	T <i>Dentoglobigerina altispira</i>	3.0	85.71–87.21	0.75		86.46		95.93
929A	T <i>Globorotalia multicamerata</i>	3.0	84.20–85.71	0.75		84.95		94.43
929A	T <i>Sphaeroidinellopsis seminulina</i>	3.1	92.21–93.71	0.75		92.96		103.03
929A	Disappearance <i>Pulleniatina</i>	3.5	99.81–102.24	1.21		101.02		111.88
929A	B <i>Globorotalia miocenica</i>	3.6	105.70–106.82	0.56		106.25		117.11
929A	T <i>Globorotalia margaritae</i>	3.6	112.43–114.50	1.03		113.46		125.32
929A	T <i>Sphenolithus</i>	3.62	100.04–103.30	1.63	101.67		112.14	
929A	T <i>Reticulofenestra pseudoumbilicus</i>	3.77	105.70–105.80	0.05	105.75		116.61	
929A	T <i>Globigerina nepenthes</i>	4.3	115.48–117.15	0.83		116.31		128.18
929A	T <i>Globorotalia plesiotumida</i>	4.4	113.04–114.51	0.73		113.78		125.64
929A	B <i>Ceratolithus rugosus</i>	5.04	130.66–130.90	0.12	130.78		142.21	
929A	T <i>Ceratolithus acutus</i>	5.04	130.66–130.90	0.12	130.78		142.21	
929A	T <i>Neoglobobulimina acostaensis</i>	5.1	114.51–115.48	0.48		115.00		126.86
929A	B <i>Ceratolithus acutus</i>	5.34	133.30–134.20	0.45	133.75		145.18	
929A	T <i>Triquetrorhabdulus rugosus</i>	5.34	133.30–134.20	0.45	133.75		145.18	
929A	T <i>Discoaster quinqueramus</i>	5.56	135.70–137.60	0.95	136.65		148.08	
929A	B <i>Sphaeroidinella dehiscens</i>	5.6	124.85–126.26	0.70		125.56		137.72
929A	T <i>Amaurolithus amplifusus</i>	5.88	138.70–139.40	0.35	139.05		150.80	
929A	B <i>Globorotalia tumida</i>	5.9	138.21–139.71	0.75		138.96		150.71
929A	B <i>Globorotalia margaritae</i>	6.2	142.30–147.81	2.76		145.06		156.81
929A	B <i>Amaurolithus amplifusus</i>	6.5	169.10–176.30	3.60	172.70		186.43	
929A	B <i>Amaurolithus primus</i>	7.3	169.10–176.30	3.60	172.70		186.43	
929A	B <i>Globigerinoides extremus</i>	8.0	186.41–187.91	0.75		187.16		201.71
929A	B <i>Globorotalia plesiotumida</i>	8.2	184.31–186.31	1.00		185.31		199.86
929A	B <i>Discoaster berggrenii</i>	8.4	205.50–206.30	0.40	205.90		220.30	
929A	T <i>Discoaster hamatus</i>	9.4	205.50–206.30	0.40	205.90		220.30	
929A	T <i>Catinaster calyculus</i>	9.36	205.50–206.30	0.40	205.90		220.30	
929A	T <i>Paragloborotalia mayeri</i>	10.3	200.61–222.61	11.00		211.61		226.01
929A	B <i>Discoaster hamatus</i>	10.4	209.30–216.70	3.70	213.00		227.40	
929A	B <i>Catinaster coalitus</i>	10.7	209.30–216.70	3.70	213.00		227.40	
929A	T <i>Coccolithus miopelagicus</i>	10.8	209.30–216.70	3.70	213.00		227.40	
929A	B <i>Globigerina nepenthes</i>	10.8	200.61–222.61	11.00		211.61		226.01
929A	B <i>Globigerina decoraperta</i>	11.2	200.61–222.61	11.00		211.61		226.01
929A	T <i>Fohsella fohsi</i> s.l.	11.8	200.61–222.61	11.00		211.61		226.01
929A	B <i>Fohsella robusta</i>	12.7	200.61–222.61	11.00		211.61		226.01
929A	T <i>Cyclicargolithus floridanus</i>	13.2	218.22–219.65	0.72	218.94		233.34	
929A	T <i>Sphenolithus heteromorphus</i>	13.6	221.25–222.10	0.42	221.68		236.08	
929A	B <i>Fohsella fohsi</i>	13.5	200.61–222.61	11.00		211.61		226.01
929A	B <i>Fohsella "praefohsi"</i>	14.0	200.61–222.61	11.00		211.61		226.01
929A	B <i>Fohsella peripheroronda</i>	14.6	222.61–229.21	3.30		225.91		241.33
929A	B <i>Fohsella peripheroacuta</i>	14.7	222.61–229.21	3.30		225.91		241.33
929A	B <i>Orbulina suturalis</i>	15.1	222.61–229.21	3.30		225.91		241.33
929A	B <i>Globorotalia archeomenardii</i>	15.5	222.61–229.21	3.30		225.91		241.33
929A	T <i>Helicosphaera ampliopena</i>	15.8	225.90–227.40	0.75	226.65		242.07	
929A	B <i>Praeorbulina glomerata</i>	16.1	232.21–235.81	1.80		234.01		249.43
929A	T <i>Discoaster deflandrei</i> abundance	16.2	228.90–230.40	0.75	229.65		245.07	
929A	T <i>Praeorbulina sicana</i>	16.4	245.64–247.55	0.95		246.59		262.01
929A	T <i>Catapsydrax dissimilis</i>	17.3	245.64–247.55	0.95		246.59		262.01
929A	B <i>Sphenolithus heteromorphus</i>	18.1	248.70–249.50	0.40	249.10		264.52	
929A	T <i>Sphenolithus belemnos</i>	18.4	250.58–251.00	0.21	250.79		266.21	
929A	B <i>Sphenolithus belemnos</i>	19.7	259.90–262.60	1.35	261.25		276.67	
929A	T <i>Paragloborotalia kugleri</i>	21.6	274.15–277.01	1.43		275.58		291.00
929A	T <i>Sphenolithus delphix</i>	23.7	323.10–323.80	0.35	323.45		338.87	
929A	B <i>Paragloborotalia kugleri</i>	23.7	322.61–324.11	0.75		323.36		338.78
929A	T <i>Sphenolithus ciperoensis</i>	24.7	341.60–343.10	0.75	342.35		357.77	
929A	B <i>Paragloborotalia pseudokugleri</i>	26.3	354.59–361.21	3.31		357.90		373.33
929A	T <i>Sphenolithus distentus</i>	26.5	388.28–405.31	8.52	396.80		412.22	
929A	T <i>Paragloborotalia opima</i>	27.1	383.31–401.08	8.88		392.20		407.62
929A	B <i>Sphenolithus ciperoensis</i>	28.1	405.31–416.96	5.83	411.14		426.56	
929A	Tc <i>Chiloguembelina cubensis</i>	28.5	387.70–401.08	6.69		394.39		409.81
929A	B <i>Globigerina angulatusuturalis</i>	29.7	402.58–409.22	3.32		405.90		421.32
929A	T <i>Turborotalia ampliopena</i>	30.3	439.61–441.31	0.85		440.46		455.88
929A	B <i>Sphenolithus distentus</i>	30.4	446.03–455.06	4.52	450.55		465.97	
929A	T <i>Reticulofenestra umbilicus</i> ≤ 14 µm	32.1	470.66–471.40	0.37	471.03		486.45	
929A	T <i>Coccolithus formosus</i>	32.7	479.50–480.50	0.50	480.00		496.37	
929E	T <i>Hantkenina alabamensis</i>	33.75	495.04–512.62	8.79		503.83		514.16
929E	T <i>Turborotalia cerroazulensis</i> s.l.	33.85	495.04–512.62	8.79		503.83		514.16
929A	T <i>Discoaster saipanensis</i>	34.2	509.40–509.85	0.23	509.63		525.97	
929A	T <i>Discoaster barbadiensis</i>	34.5	507.82–508.58	0.38	508.20		526.59	
929A	T <i>Cribrocentrum reticulatum</i>	35.0	507.82–508.58	0.38	508.20		526.59	
929E	T <i>Calcidiscus protoannulus</i>	35.4	534.29–539.40	2.56	536.85		557.43	
929E	T <i>Chiasmolithus grandis</i>	37.1	555.70–567.40	5.85	561.55		582.13	

Table 6 (continued).

Hole	Marker species	Age (Ma)	Depth (mbsf)	(±)	Nannofossils (mbsf)	Foraminifers (mbsf)	Nannofossils (mcd)	Foraminifers (mcd)
929E	T <i>Morozovella spinulosa</i>	38.1	563.51–570.11	3.30		566.81		587.39
929E	T <i>Orbulinoides beckmanni</i>	40.2	576.10–579.71	1.80		577.90		598.49
929E	B <i>Dicystococites bisectus</i>	40.4	579.40–580.20	0.40	579.80		600.38	
929E	B <i>Orbulinoides beckmanni</i>	40.6	579.71–582.71	1.50		581.21		601.79
929E	T <i>Nannotetrina</i>	41.9	604.10–605.60	0.75	604.85		625.43	
929E	B <i>Reticulofenestra umbilicus</i> ≤ 14 µm	42.2	609.20–609.90	0.35	609.55		630.13	
929E	T <i>Morozovella aragonensis</i>	43.7	614.69–618.31	1.81		616.50		637.08
929E	T <i>Chiasmolithus gigas</i>	44.6	621.80–622.50	0.35	622.15		642.73	
929E	B <i>Chiasmolithus gigas</i>	46.3	635.04–635.70	0.33	635.37		655.95	
929E	B <i>Nannotetrina fulgens</i>	47.0	652.90–654.85	0.98	653.88		674.46	
929E	T <i>Discoaster subloboensis</i>	47.2	654.85–663.75	4.45	659.30		679.88	
929E	B <i>Nannotetrina</i>	47.8	670.01–671.42	0.70	670.72		691.30	
929E	T <i>Discoaster lodoensis</i>	47.9	671.42–671.65	0.12	671.54		692.12	
929E	T <i>Tribrachiatulus orthostylus</i>	50.8	711.90–712.60	0.35	712.25		732.83	
929E	B <i>Discoaster lodoensis</i>	52.0	719.18–727.36	4.09	723.27		743.85	
929E	B <i>Morozovella aragonensis</i>	52.0	724.13–734.02	4.94		729.08		749.66
929E	B <i>Sphenolithus radians</i>	53.1	738.66–748.13	4.74	743.40		763.98	
929E	B <i>Tribrachiatulus orthostylus</i>	53.3	743.86–745.00	0.57	744.43		765.01	
929E	T <i>Morozovella velascoensis</i>	53.4	762.81–770.47	3.83		766.64		787.22
929E	B <i>Tribrachiatulus</i>	53.9	763.30–764.00	0.35	763.65		784.23	
929E	T <i>Fasciculithus</i>	54.1	784.78–785.58	0.40	785.18		805.76	
929E	T <i>Globanomalina pseudomenardi</i>	56.1	800.14–801.05	0.46		800.59		821.18

Notes: T = top, Tl = top large (>5.5 µm), B = base, Bl = top large (>5.5 µm), Ba = base acme, Bc = base common, and Tc = top common.

Table 7. Biostratigraphic control points for Site 929 sedimentation rates.

Hole	Marker species	Age (Ma)	Depth (mbsf)	Sedimentation rate (mbsf/m.y.)	Depth (mcd)	Sedimentation rate (mcd/m.y.)
929A	Top section	0.00	0.00		0.00	
929A	T <i>Pseudoemiliania lacunosa</i>	0.46	17.05	37	18.67	41
929A	T <i>Discoaster brouweri</i>	1.95	59.45	28	65.41	31
929A	T <i>Reticulofenestra pseudoumbilicus</i>	3.77	105.75	25	116.61	28
929A	T <i>Ceratolithus acutus</i>	5.04	130.78	20	142.21	20
929A	T <i>Amaurolithus amplifiscus</i>	5.88	139.05	10	150.80	10
929A	T <i>Discoaster berggrenii</i>	8.40	205.90	27	220.30	28
929A				Hiatus		Hiatus
929A	T <i>Discoaster hamatus</i>	9.40	205.90		220.30	
929A	T <i>Helicosphaera ampliaperta</i>	15.8	226.65	3	242.07	3
929A	T <i>Sphenolithus belemnus</i>	18.4	250.79	9	266.21	9
929A	T <i>Paragloborotalia kugleri</i>	21.6	275.58	8	291.00	8
929A	B <i>Paragloborotalia kugleri</i>	23.7	323.36	23	338.78	23
929A	T <i>Turborotalia ampliapertura</i>	30.3	440.46	18	455.88	18
929E	T <i>Chiasmolithus grandis</i>	37.1	561.55	18	582.13	19
929E	B <i>Dicystococites bisectus</i>	40.4	579.80	6	600.38	6
929E	B <i>Reticulofenestra umbilicus</i> ≥ 14 µm	42.2	609.55	17	630.13	17
929E	T <i>Chiasmolithus gigas</i>	44.6	622.15	5	642.73	5
929E	B <i>Chiasmolithus gigas</i>	46.3	635.37	8	655.95	8
929E	T <i>Discoaster lodoensis</i>	47.9	671.54	23	692.12	23
929E	B <i>Tribrachiatulus orthostylus</i>	53.3	744.43	13	765.01	13
929E	T <i>Globanomalina pseudomenardii</i>	56.1	800.60	20	821.18	20
929E	Bottom of Hole 929E	55.1	801.41	20	821.99	20

Notes: T = top, and B = base.

Wherever possible, discrete velocity was measured in both longitudinal and transverse directions. All data are corrected for the speed of sound of the pore fluid at the in situ temperature, using a gradient of 0.047°C/mbsf and are listed in Table 11.

Within lithologic Unit I (0–128 mbsf), acoustic velocity increases with depth below seafloor from values slightly lower than seawater velocity to average values of 1640 m/s (Fig. 21). An offset occurs near the Unit I/II boundary (128 mbsf) in which velocity decreases to 1570 m/s. Disturbed cores plagued recovery within Unit II, but the limited measurements suggest variable velocity throughout this unit. The variability is probably associated with variations in carbonate content (see “Geochemistry” section, this chapter). The Unit II/III boundary at 230 mbsf is characterized by a sharp increase in velocity to values greater than 1800 m/s. This increase is probably associated with the change from ooze to chalk.

Acoustic velocity within lithologic Unit III (230–801 mbsf) is again variable, but the variations are consistent with changes in color

reflectance (see “Lithostratigraphy” section, this chapter). Intervals of high acoustic velocity correspond to intervals of high reflectance. In general, acoustic velocity increases with depth within Unit III. However, a large decrease in velocity occurs from approximately 660 to 750 mbsf, which corresponds to an interval of decreased carbonate concentration and reflectance.

Acoustic anisotropy generally increases with depth below seafloor at Site 929, as expected for a more terrigenous clay-dominated sediment section. A linear regression of anisotropy vs. depth below seafloor shows an increase in anisotropy of 1% per 100 m (Fig. 21). The anisotropy is probably associated with normal consolidation where the clay fabric changes from an isotropic to a transverse preferred orientation. Anisotropy appears to be reduced over intervals of high carbonate content, suggesting that the carbonate inhibits the normal consolidation process.

Acoustic traveltime as a function of depth below seafloor (mbsf) was calculated using discrete velocity measurements (Fig. 22). These

Figure 12. Age-depth plots of calcareous nannofossil (open circles) and planktonic foraminifer (open squares) events at Site 929. **A.** Paleocene to Pliocene. **B.** Oligocene to Pliocene. **C.** Paleocene to Oligocene. The vertical bar within symbols represents depth uncertainty. The events are plotted on the mcd depth scale. The upper line in Figure 12B represents the corresponding sedimentation rate line on the mbsf depth scale. Crosses on the mbsf line represent control points. Sedimentation rates are given for both scales: that is, "41 (37)" represents rates expressed in meters per million years on the mcd and mbsf (in parentheses) scales, respectively. The dashed line represents the interval with uncertain sedimentation rates.

Figure 13. Plots of sedimentation rates at Site 929 on the mcd depth scale vs. age and mcd depth. The figure on the right also shows the average sedimentation rate at Site 929 using the mcd scale.

data are compared with the results from the site-survey, wide-angle reflection and refraction measurements of two-way traveltime (TWT) vs. depth below seafloor. The correlation between the core and remote measurements is excellent, providing confidence in the laboratory measurements and in the correlation between the seismic reflection data and the borehole data.

Acoustic impedance was calculated for Site 929 using discrete velocity and bulk-density measurements. Eight large impedance contrasts occur within the drilled sediment section (see Fig. 23, horizontal lines). The shallowest potential reflection event occurs at 0.21 s TWT, which corresponds to the base of the transparent reflection interval (see Mountain and Curry, this volume). The potential events at 0.49 and 0.57 s TWT correspond to the top and bottom of the discontinuous parallel reflectors that occur within the hyperbolic reflection zone. The deepest potential reflection events identified by impedance occur at 0.82 and 0.84 s TWT. These correspond to the top of the parallel reflection events at the base of the hyperbolic reflection interval.

Shear Strength

Shear strength was measured at Site 929 using the miniature vane shear device and estimated from unconfined compression measurements using the pocket penetrometer (see "Physical Properties" section, "Explanatory Notes" chapter, this volume). Measurements were made for Holes 929A, 929B, and 929C and are listed in Table 12.

Shear strength at Site 929 increases gradually with depth below seafloor to about 140 mbsf (Fig. 24). Small fluctuations about the mean trend reflect lithologic heterogeneity. This increase is not high enough for the sediment to be normally consolidated because the S_u/P_o' ratio is very low (Fig. 24), as was observed at Sites 925 through 927. The sharp increase in strength below 140 mbsf appears to coincide with the transition to the low carbonate "red clay" portion of lithologic Unit II. The S_u/P_o' ratio increases slightly below this transition, suggesting a sediment section closer to normal consolidation. A similar change in shear strength has been observed at the same

Table 8. Interstitial-water geochemistry results summary for samples from Holes 929A and 929E.

Core, section, interval (cm)	Depth (mbsf)	Cl ⁻ (mM)	Na ⁺ (mM)	Salinity (g/kg)	Alkalinity (mM)	pH	SiO ₂ (μM)	SO ₄ ²⁻ (mM)	NH ₄ ⁺ (μM)	Mn ²⁺ (μM)	Sr ²⁺ (μM)	Li ⁺ (μM)	Ca ²⁺ (mM)	Mg ²⁺ (mM)	K ⁺ (mM)	PO ₄ ³⁻ (μM)
154-929A-																
1H-1, 145-150	1.45	557	480	34.0	3.597	7.43	167.5	28.84	48.60	37	80	30	10.64	52.09	11.99	2
1H-2, 145-150	2.95	555		34.0	3.742	7.19				73						2
1H-3, 136-141	4.36	560	486	34.0	3.807	7.32	169.7	29.07	107.86	78		28	10.53	51.69	12.14	0
2H-1, 145-150	5.95	560	486		3.916	7.19	190.1	28.40	157.13	87	72	29	10.48	51.86	11.14	0
2H-2, 145-150	7.45	561		34.5						60						0
2H-3, 145-150	8.95	562								46						0
2H-4, 145-150	10.45	556	477	36.0	3.931	7.12	192.4	26.14	183.10	60	93	30	10.36	51.72	10.47	0
2H-5, 145-150	11.95	560								36						0
2H-6, 145-150	13.45	561								28						0
3H-1, 145-150	15.45	557	479	34.0	3.778	7.09	210.5	26.57	225.04	34	108	29	10.24	51.27	11.14	0
3H-2, 145-150	16.95	561								16						0
3H-3, 145-150	18.45	565								17						0
3H-4, 145-150	19.95	557	483	34.0	3.841	7.21	199.1	26.93	247.01	29	114	30	10.29	50.00	11.10	0
3H-5, 145-150	21.45	567								16						0
3H-6, 145-150	22.95	565								13						0
4H-1, 145-150	24.95	557	478		3.755	7.49	194.6	24.62	294.95	19	122	30	10.44	50.41	10.05	0
4H-2, 145-150	26.45	565														0
4H-3, 145-150	27.95	561														0
4H-4, 145-150	29.45	558	482	34.0	3.896	7.36	181.0	26.24	289.62	21	135	29	10.41	50.03	11.35	0
4H-5, 145-150	30.95	563														0
4H-6, 145-150	32.45	566														0
5H-1, 145-150	34.45	557	481		3.454	7.46	167.5	25.37	324.24	15	148	31	10.37	48.86	11.42	0
5H-2, 145-150	35.95	564														0
5H-3, 145-150	37.45	563														0
5H-4, 145-150	38.95	561	484	34.0	3.487	7.26	162.9	24.43	359.53	16	172	31	10.58	49.04	10.74	0
5H-5, 145-150	40.45	565														0
5H-6, 145-150	41.95	564														0
6H-1, 145-150	43.95	557	479	34.0	3.558	7.39	178.8	24.77	344.88	14	194	33	10.70	49.22	10.22	0
6H-2, 145-150	45.45	567														0
6H-3, 133-138	46.83	565														0
6H-4, 145-150	48.45	561	484	34.5	3.665	7.47	187.8	24.20	344.88	14	185	34	10.93	48.92	9.90	0
6H-5, 145-150	49.83	565														0
6H-6, 145-150	51.33	569														0
9H-3, 145-150	75.45	562	482	34.0	3.451	7.26	174.3	22.65	400.15	10	262	39	11.41	48.63	8.91	0
12H-3, 145-150	103.95	563	481	34.0	3.697	7.09	185.6	22.13	398.15	12	337	53	12.63	48.26	8.24	
15H-3, 145-150	132.45	563	476	34.0	4.493	6.97	237.6	21.29	344.88	26	370	69	14.27	49.18	6.98	
18X-3, 145-150	161.25	561	468	34.0	5.652	7.62	273.8	21.98	406.80	36	533	113	16.38	50.36	7.97	
21X-3, 140-150	190.10	564	471	34.0	6.624	7.49	280.6	21.26	402.14	30	699	192	19.68	47.54	7.80	
24X-3, 140-150	218.80	556	445				701.5	20.87	310.93	69	824	315	24.74	47.72	5.75	
27X-3, 140-150	247.80	571	472	34.0	9.403	7.36	943.7	21.44	453.41	13	902	428	26.67	43.64	7.83	
30X-3, 140-150	276.30	566	461	34.0	9.052	6.54	1131.5	18.83	374.85	12	1020	552	28.61	41.47	7.73	
33X-3, 140-150	305.40	554	443		8.576	7.52	1206.2	18.89	310.93	13	1137	663	31.94	42.51	5.39	
36X-3, 140-150	334.40	556	444	34.0	6.664	7.49	681.2	17.81	337.56	10	1158	700	32.81	39.52	5.75	
39X-3, 140-150	363.40	572	454	34.0	6.346	6.57	681.2	16.39	464.06	9	1215	777	34.18	38.53	7.43	
43X-3, 135-150	401.75	573	451	34.5	5.222	6.63	706.1	15.16	464.73	8	1312	838	37.52	35.37	7.09	
47X-3, 135-150	440.45	577	446	34.0		7.59	1172.2	15.15	438.76	9	1376	862	42.89	32.54	5.60	
50X-3, 135-150	469.35	574	449	34.5	8.298	7.39	1441.5	15.81		10	1208	892	46.29	30.78	5.84	
53X-2, 135-150	496.35	562	431				812.4	14.28	353.54	11	1282	849	45.23	30.26	3.87	
154-929E-																
6R-1, 130-150	521.30	582	449	35.5			589.7	13.23					47.65	29.56	5.54	
10R-5, 130-150	565.60	561	426					12.75					52.46	26.32	3.04	
14R-3, 130-150	601.20	596	448	36.0			422.5	13.65			1680		57.31	27.60	4.03	
19R-1, 130-150	646.30	578	429	35.5			446.7	13.61			1695		60.00	24.98	4.06	
23R-1, 130-150	684.50	574	415				431.3	12.60			1726		65.07	24.48	2.82	
28R-3, 130-150	735.90	575	405	35.0			299.3	12.04			1748		70.33	24.62	2.36	
33R-2, 128-148	782.68	590	415	35.5	0.332	7.64	59.4	12.82			1918		78.30	21.54	2.17	

stratigraphic position at other sites on the Ceara Rise (see "Physical Properties" sections, "Site 927" and "Site 928" chapters, for examples). Swings in shear strength below 150 mbsf occur where weaker intervals are encountered in a cohesive clayey unit.

Resistivity

Resistivity at Site 929 was measured using the small ODP probe (see "Physical Properties" section, "Explanatory Notes" chapter, this volume). Data for the five holes are presented in Figure 25 and Table 13. Measurements were made at high frequency over the upper 500 m of the sediment column, but less frequently in the more indurated deeper stratigraphic interval. Resistivities measured on samples taken from Holes 929A, 929B, and 929C are in very good agreement over the upper 225 mbsf. Calculated values seem comparable with data obtained at other Ceara Rise sites at equivalent depths. Below this, measurements were made for Holes 929A (to 491 mbsf) and 929E (below 473 mbsf); thus, no interhole comparisons below 225 mbsf are possible. The measurements show a general increase of resistivity with depth, as would be expected in a sediment column undergoing

mechanical and chemical porosity reduction. However, as the sediment becomes progressively harder, it becomes more difficult to obtain reliable resistivity measurements. The large variance in apparent resistivity below 550 mbsf may partly reflect such problems.

Elastic Rebound

As described for Site 925 (see "Physical Properties" section, "Site 925" chapter, this volume), elastic rebound contributes to the growth of the site composite depth scale (mcd) when compared to depth calculated in mbsf. Elastic rebound was estimated using a coefficient of rebound from Valent et al. (1982) and discrete index measurements for Holes 929A and 929B. Estimated elastic rebound closely matches the mcd offset in Hole 929B to 148 mbsf (Fig. 26). The mcd offset growth is significantly reduced below 148 mbsf, suggesting that the elastic rebound of the sediment is much lower than at all other sites. For Hole 929A, the general shape of the mcd offset follows the elastic rebound offset curve in the upper 150 mbsf, but two sharp increases in mcd offset that occur at 5.5 mbsf (1 m) and 62 mbsf (2 m) cannot be accounted for by elastic rebound.

Table 9. Concentrations of inorganic (carbonate) carbon, calcium carbonate, total carbon, and organic carbon (total – inorganic) in samples from Holes 929A and 929E.

Core, section, interval (cm)	Depth (mbsf)	Inorganic carbon (%)	CaCO ₃ (%)	Total carbon (%)	Organic carbon (%)	Core, section, interval (cm)	Depth (mbsf)	Inorganic carbon (%)	CaCO ₃ (%)	Total carbon (%)	Organic carbon (%)
154-929A-						30X-1, 78–80	272.68	6.86	57.16		
1H-1, 67–68	0.67	1.74	14.49	2.16	0.42	30X-3, 135–137	276.25	8.02	66.83	7.92	0.00
1H-2, 72–73	2.22	2.05	17.08	1.82	0.00	30X-5, 4–6	277.94	6.83	56.91		
1H-3, 78–79	3.78	0.38	3.17	0.38	0.00	31X-1, 16–18	281.76	6.06	50.50		
2H-1, 67–68	5.17	2.71	22.57	2.84	0.13	31X-3, 80–82	285.40	7.54	62.83	7.71	0.17
2H-3, 70–71	8.20	1.00	8.33	1.35	0.35	31X-6, 58–60	289.68	7.75	64.58		
2H-5, 26–27	10.76	2.73	22.74	2.90	0.17	32X-1, 113–114	292.43	9.05	75.41		
3H-2, 53–54	16.03	6.00	49.98	5.81	0.00	32X-3, 65–66	294.95	5.29	44.08	5.35	0.06
3H-5, 93–94	20.93	2.44	20.33	2.48	0.04	32X-6, 42–43	299.22	4.12	34.33		
3H-7, 23–24	23.23	1.84	15.33	1.50	0.00	33X-2, 125–127	303.75	7.12	59.33		
4H-2, 86–87	25.86	4.52	37.65			33X-4, 39–41	305.89	8.13	67.75	8.25	0.12
4H-3, 54–55	27.04	3.50	29.16	1.46	0.00	33X-6, 105–107	309.55	6.05	50.41		
4H-5, 112–113	30.62	4.70	39.15			34X-2, 66–67	312.86	6.42	53.50		
5H-1, 76–77	33.76	5.22	43.48			34X-4, 92–93	316.12	6.35	52.91	6.50	0.15
5H-3, 76–77	36.76	0.06	0.50	0.26	0.20	34X-6, 85–86	319.05	7.92	66.00		
5H-5, 80–81	39.80	2.03	16.91			35X-1, 108–109	321.48	7.52	62.66		
6H-1, 82–84	43.32	5.70	47.48			35X-3, 67–68	324.07	7.28	60.66	7.51	0.23
6H-3, 104–105	46.54	4.02	33.49	4.08	0.06	35X-5, 73–74	327.13	7.93	66.08		
6H-5, 56–57	48.94	4.52	37.65			36X-1, 116–117	331.16	6.79	56.58		
7H-1, 123–124	53.23	3.10	25.82			36X-3, 88–89	333.88	3.17	26.42	3.36	0.19
7H-3, 115–116	56.15	5.29	44.07	5.32	0.03	36X-5, 118–119	337.18	5.49	45.75		
7H-5, 110–111	59.10	4.16	34.65			37X-1, 79–80	340.49	8.24	68.66		
8H-1, 80–81	62.30	4.61	38.40			37X-3, 74–75	343.44	7.39	61.58	7.56	0.17
8H-3, 86–87	65.36	3.62	30.15	3.79	0.17	37X-5, 75–76	346.45	5.82	48.50		
8H-5, 89–90	68.39	3.67	30.57			38X-2, 76–77	351.66	8.17	68.08		
9H-1, 76–77	71.76	2.37	19.74			38X-4, 79–80	354.69	8.03	66.91	8.16	0.13
9H-3, 80–81	74.80	2.99	24.91	3.10	0.11	38X-6, 102–103	357.92	8.82	73.50		
9H-5, 88–89	77.88	5.78	48.15			39X-1, 79–80	359.79	6.93	57.75		
10H-1, 77–78	81.27	5.21	43.40			39X-3, 83–84	362.83	8.04	67.00	8.46	0.42
10H-3, 79–80	84.29	4.44	36.99	4.46	0.02	39X-5, 110–111	366.10	8.40	70.00		
10H-5, 76–77	87.26	4.53	37.73			40X-1, 86–87	369.36	8.48	70.66		
11H-1, 77–78	90.77	6.75	56.23			40X-3, 81–82	372.31	7.34	61.16	7.52	0.18
11H-3, 79–80	93.79	4.13	34.40	4.24	0.11	40X-5, 76–77	375.26	8.17	68.08		
11H-5, 79–80	96.79	5.74	47.81			41X-1, 77–78	378.87	3.90	32.50		
12H-1, 86–87	100.36	4.23	35.24			41X-1, 124–125	379.34	8.95	74.58	9.18	0.23
12H-3, 78–79	103.28	6.55	54.56	6.53	0.00	41X-3, 72–73	381.82	8.14	67.83		
12H-5, 79–80	107.79	6.44	53.65			43X-1, 64–65	398.04	8.19	68.25		
13H-1, 77–78	109.77	4.32	35.99			43X-3, 61–62	401.01	8.18	68.16	8.23	0.05
13H-3, 77–78	112.77	6.55	54.56	6.43	0.00	43X-5, 59–60	403.99	8.32	69.33		
13H-5, 78–79	115.78	3.89	32.40			44X-1, 115–116	408.25	8.80	73.33		
14H-4, 77–78	123.10	3.86	32.15	3.93	0.07	44X-3, 97–98	411.07	9.87	82.25	9.36	0.00
14H-6, 58–59	124.72	6.47	53.90			44X-5, 102–103	414.12	9.02	75.16		
15H-1, 77–78	128.77	5.10	42.48			45X-1, 18–20	416.88	9.18	76.50		
15H-3, 79–80	131.79	3.18	26.49	3.15	0.00	45X-3, 96–98	420.66	7.48	62.33	7.59	0.11
15H-5, 79–80	134.79	4.56	37.98			45X-5, 30–32	423.00	10.45	87.08		
16X-1, 78–79	138.28	7.63	63.56			46X-1, 109–111	427.49	9.37	78.08		
16X-3, 81–82	141.31	7.68	63.97	7.60	0.00	46X-2, 16–18	428.06	9.79	81.58	9.77	0.00
16X-4, 53–54	142.53	4.61	38.40			46X-3, 58–60	429.98	6.40	53.33		
17X-1, 31–32	147.41	2.73	22.74			47X-2, 108–109	438.68	9.35	77.91	9.52	0.17
17X-3, 31–32	150.41	3.21	26.74	3.26	0.05	47X-4, 81–82	441.41	9.51	79.25		
17X-5, 58–59	153.68	7.52	62.64			47X-6, 148–149	445.08	7.30	60.83		
18X-1, 103–104	157.83	3.98	33.15			48X-2, 92–93	448.12	7.79	64.91	7.97	0.18
18X-3, 37–38	160.17	6.34	52.81	6.33	0.00	48X-4, 14–15	450.34	8.36	69.66		
18X-5, 34–35	163.14	8.02	66.81			48X-6, 26–27	453.46	7.75	64.58		
19X-1, 76–77	167.16	1.32	11.00			49X-1, 61–63	455.91	8.72	72.66		
19X-3, 39–40	169.79	0.13	1.08	0.17	0.04	49X-3, 50–52	458.80	7.83	65.25	7.98	0.15
19X-4, 27–28	171.17	0.08	0.67			49X-5, 118–120	462.48	7.53	62.75		
20X-1, 82–83	176.92	6.57	54.73			50X-1, 36–37	465.36	6.90	57.50		
20X-4, 74–75	181.34	7.92	65.97	7.77	0.00	50X-3, 89–90	468.89	7.36	61.33	7.57	0.21
20X-6, 77–78	184.37	6.82	56.81			50X-5, 75–76	471.75	7.64	63.66		
21X-1, 83–84	186.53	8.53	71.05			51X-1, 26–27	474.86	6.98	58.16		
21X-3, 77–78	189.47	9.74	81.13	9.63	0.00	51X-3, 64–65	478.24	7.26	60.50	7.28	0.02
21X-6, 77–78	193.97	8.96	74.64			51X-5, 106–107	481.66	7.21	60.08		
22X-1, 62–63	196.02	1.04	8.66			52X-1, 103–104	485.23	7.02	58.50		
22X-4, 51–52	200.41	6.00	49.98	6.03	0.03	52X-3, 148–149	488.68	7.28	60.66	7.36	0.08
22X-5, 61–62	202.01	3.17	26.41			52X-5, 144–145	491.64	6.83	56.91		
23X-1, 75–76	205.85	4.46	37.15			53X-1, 76–77	494.26	6.25	52.08		
23X-3, 79–80	208.89	0.14	1.17	0.34	0.20	53X-2, 74–75	495.74	3.90	32.50	4.15	0.25
23X-5, 73–74	211.83	0.05	0.42			53X-3, 54–55	497.04	4.48	37.33		
24X-1, 80–81	215.20	2.86	23.83			54X-1, 79–80	503.99	6.44	53.66		
24X-3, 80–81	218.20	0.06	0.50	0.10	0.04	54X-3, 91–92	507.11	8.05	67.08	8.24	0.19
24X-5, 83–84	221.23	1.88	15.67			54X-4, 93–94	508.63	7.13	59.41		
25X-1, 107–108	225.07	7.64	63.66			55X-1, 18–19	507.98	6.70	55.83	6.83	0.13
25X-3, 82–83	227.82	7.47	62.25	7.55	0.08	56X-1, 7–8	517.87	7.92	66.00	8.08	0.16
25X-5, 124–125	231.24	9.51	79.25								
26X-1, 50–51	234.10	9.06	75.50			154-929E-					
26X-3, 35–36	236.95	8.73	72.75	8.68	0.00	1R-1, 52–54	472.02	4.88	40.67		
26X-5, 20–21	239.80	9.39	78.25			1R-3, 44–46	474.05	6.13	51.08	6.13	0.00
27X-1, 39–40	243.79	8.39	69.91			1R-5, 143–145	478.04	5.57	46.41		
27X-3, 29–30	246.69	6.66	55.50	6.78	0.12	2R-1, 49–50	481.79	7.49	62.41		
27X-5, 58–59	249.98	6.80	56.66			2R-3, 24–25	484.54	4.87	40.58	5.10	0.23
28X-1, 91–93	253.91	6.14	51.16			2R-5, 106–107	488.36	4.70	39.17		
28X-3, 83–85	256.83	6.03	50.25	5.98	0.00	3R-1, 136–137	492.36	6.23	51.91		
28X-5, 52–54	259.52	9.15	76.25			3R-2, 38–39	492.88	7.10	59.16	7.09	0.00
29X-1, 25–27	262.45	8.36	69.66			3R-3, 101–102	495.01	7.13	59.41		
29X-3, 33–35	265.53	7.17	59.75	7.10	0.00	4R-1, 124–125	502.04	6.33	52.75		
29X-5, 96–98	269.16	1.19	9.92			4R-2, 130–132	503.60	7.84	65.33	7.87	0.03
						4R-3, 11–12	503.91	7.89	65.75		

Table 9 (continued).

Core, section, interval (cm)	Depth (mbsf)	Inorganic carbon (%)	CaCO ₃ (%)	Total carbon (%)	Organic carbon (%)
5R-1, 32–34	510.72	6.57	54.75		
5R-2, 56–58	512.46	8.43	70.25	8.46	0.03
5R-4, 41–42	515.31	6.80	56.66		
6R-2, 7–8	521.57	7.72	64.33	7.71	0.00
6R-4, 8–9	524.58	8.20	68.33		
7R-1, 15–16	529.45	5.51	45.91		
7R-2, 146–147	532.26	5.86	48.83	5.87	0.01
7R-3, 80–81	533.10	5.77	48.08		
8R-1, 133–134	540.33	7.23	60.25	7.17	0.00
8R-3, 143–144	543.43	7.48	62.33		
9R-1, 111–112	549.71	7.02	58.50		
9R-3, 90–91	552.50	8.11	67.58	8.11	0.00
9R-4, 91–92	554.01	7.38	61.50		
10R-1, 38–39	558.68	7.81	65.08		
10R-3, 56–57	561.86	6.67	55.58	6.75	0.08
10R-5, 28–29	564.58	6.41	53.41		
11R-1, 133–134	569.23	6.93	57.75		
11R-3, 64–65	571.54	7.66	63.83	7.68	0.02
11R-5, 28–29	574.18	6.80	56.66		
12R-1, 140–141	578.90	7.82	65.16		
12R-3, 65–66	581.15	5.21	43.41	5.21	0.00
12R-5, 88–89	584.38	7.52	62.66		
13R-1, 13–14	587.33	8.52	71.00		
13R-4, 111–112	592.81	8.29	69.08	8.26	0.00
13R-6, 76–77	595.46	6.05	50.41		
14R-1, 37–38	597.27	6.77	56.41		
14R-3, 60–61	600.50	7.36	61.33	7.35	0.00
14R-5, 139–140	604.29	7.14	59.50		
15R-1, 86–87	607.36	5.94	49.50		
15R-4, 70–71	611.70	6.77	56.41	6.73	0.00
15R-6, 46–47	614.46	4.93	41.08		
16R-1, 66–67	616.76	6.45	53.75		
16R-3, 39–40	619.49	7.19	59.91	7.15	0.00
16R-5, 116–117	623.26	6.72	56.00		
17R-1, 76–77	626.56	6.24	52.00		
17R-3, 56–58	629.36	6.60	55.00	6.55	0.00
17R-6, 65–66	633.95	7.04	58.66		
18R-1, 135–136	636.65	6.88	57.33		
18R-3, 41–42	638.71	8.24	68.66	8.20	0.00
18R-5, 60–61	641.90	3.60	30.00		
19R-1, 45–46	645.45	7.93	66.08		
19R-3, 81–82	648.81	3.96	33.00	3.92	0.00
19R-5, 49–50	651.49	5.71	47.58		
20R-1, 65–67	655.35	6.80	56.66		
20R-3, 97–98	658.67	6.55	54.58	6.54	0.00
20R-5, 144–146	662.14	6.20	51.66		
21R-2, 29–30	666.09	5.28	44.00		
21R-3, 139–140	668.69	4.71	39.25	4.84	0.13
21R-5, 42–43	670.72	4.59	38.25		
22R-1, 126–127	675.16	4.22	35.17		
22R-3, 90–91	677.80	4.81	40.08	4.84	0.03
22R-5, 136–137	681.26	2.30	19.17		
23R-1, 9–10	683.29	3.84	32.00	3.82	0.00
23R-3, 10–11	686.30	1.86	15.50		
24R-1, 23–24	693.03	1.79	14.92		
24R-3, 30–31	696.10	3.40	28.33	3.38	0.00
24R-5, 128–129	700.08	2.99	24.92		
25R-1, 125–126	703.75	1.02	8.50		
25R-3, 117–118	706.67	1.79	14.92	1.83	0.04
25R-4, 123–124	708.23	3.78	31.50		
25R-5, 111–112	709.61	3.60	30.00		
26R-1, 111–112	713.31	4.58	38.17		
26R-2, 69–70	714.39	0.07	0.58	0.01	0.00
26R-4, 34–35	717.04	3.74	31.17		
27R-1, 42–43	722.32	3.97	33.08		
27R-3, 83–85	725.73	4.47	37.25	4.49	0.02
27R-4, 29–30	726.69	4.15	34.58		
28R-1, 69–70	732.29	5.21	43.41		
28R-3, 112–115	735.72	3.90	32.50	3.87	0.00
28R-5, 58–59	738.18	5.18	43.16		
29R-1, 111–112	742.31	5.05	42.08		
29R-3, 54–55	744.74	5.90	49.16	5.93	0.03
29R-5, 30–31	747.50	3.67	30.58		
30R-1, 60–61	751.50	6.01	50.08	5.98	0.00
31R-1, 28–30	760.88	7.11	59.25		
31R-3, 49–51	764.09	7.07	58.91	7.14	0.07
31R-5, 45–47	767.05	7.92	66.00		
33R-2, 83–84	782.23	6.43	53.58		
33R-4, 28–29	784.66	6.41	53.41	6.49	0.08
33R-6, 118–119	788.56	4.08	34.00		
35R-1, 54–55	799.74	7.94	66.16		
35R-2, 92–93	800.77	7.16	59.66	7.22	0.06
35R-3, 19–20	801.24	7.94	66.16		

Summary

Sediments recovered at Site 929 show a complex evolution of physical properties with depth. Four large-amplitude, broad-scale anomalies in acoustic velocity and bulk density were encountered. These coincide with significant lithologic changes and thus may be related to important paleoceanographic events. A rapid increase in shear strength is observed at 145 mbsf; however, it cannot properly be termed the “ooze-chalk” transition, as the interval that follows is nearly devoid of carbonate for 50 m.

DOWNHOLE MEASUREMENTS

Logging Operations and Log Quality

The Quad and geochemical tool strings were run at Hole 929E; the compensated neutron porosity sonde (CNT-G) was not included in the Quad tool string because of the generally poor performance of this tool in these high-porosity sediments. A wiper trip was conducted and bridges were encountered near 105, 413, and 720 mbsf. In anticipation of poor borehole conditions, the SES was employed during all logging runs. The WHC was employed to offset mild ship heave (about 0.4 m). The total depth at Hole 929E (808.90 mbsf) was not reached because of an impassable constriction near 690 mbsf. Quad logging was conducted at 900 ft/hr in two overlapping passes covering the bottom (681.5–476.4 mbsf) and top (540.5–110.5 mbsf) portions of the hole. Both standard mode (15-cm sampling) and high-resolution (2.5-cm sampling) data were recorded. Because of time restrictions, the geochemical tool string was only run as a single pass (at 600 ft/hr) from 582.5 to 110.5 mbsf. A summary of logging operations is presented in Table 14.

Quad data quality were adversely affected by irregular borehole roughness and washouts, particularly for the interval above 440 mbsf. As at other Leg 154 sites, the density, photoelectric effect, and sonic velocity logs were greatly affected by irregular borehole diameter variations, and these data should not be considered reliable. Related sonic “cycle-skipping” errors can be corrected after post-cruise processing of the full sonic waveform data. The core and log natural gamma data were used to shift the Quad log depths linearly to equivalent core depths at Hole 929E. The core and log natural gamma data for Hole 929E are shown in Figure 27. The core and log natural gamma data compare very well, and some intervals can be correlated at the meter scale. Selected Quad logs for Hole 929E are shown in Figure 28. Data from the geochemical tool string will undergo extensive post-cruise processing.

Log Interpretation and Lithology

The natural gamma, density, sonic velocity, and resistivity logs provide confirmation of major lithologic unit boundaries derived from core descriptions (Fig. 28). The log data begin near the lithologic Unit I/II boundary at 128 mbsf. The natural gamma log shows sharp increases within Subunits IIA and IIB, similar to previous sites (see “Downhole Measurements” sections, “Site 925,” “Site 926,” “Site 927,” and “Site 928” chapters, this volume). The Unit II gamma-ray values are the highest encountered at any of the previous sites; the Hole 929E Unit II values are up to 30% higher than those at Hole 928B. Very low gamma-ray values within the upper part of lithologic Subunit IIB (176–205 mbsf) indicate resedimented, carbonate-rich sediments over this interval (see “Lithostratigraphy” section, this chapter). A marked decrease in accumulation rates occurs within lithologic Unit II (see “Sedimentation Rates” section, this chapter) that is attributed to greatly increased carbonate dissolution; high gamma-ray values reflect correspondingly enhanced terrigenous concentrations.

The ooze-chalk transition was defined at approximately 205 mbsf, based on substantially increased shear strength values (see “Lithostratigraphy” and “Physical Properties” sections, this chapter). Excessive borehole washout over this interval at Hole 929E masked

Table 10. Index properties measured on discrete samples for all holes at Site 929.

Core, section, interval (cm)	Depth (mbsf)	Water content (bulk wt%)	Water content (dry wt%)	Bulk density (Mg/m ³)	Grain density (Mg/m ³)	Dry density (Mg/m ³)	Porosity (%)
154-929A-							
1H-1, 70-72	0.70	52.24	109.39	1.490	2.959	0.711	75.96
1H-2, 69-71	2.19	55.12	122.80	1.449	2.948	0.650	77.94
2H-1, 66-68	5.16	51.01	104.11	1.453	2.573	0.712	72.33
2H-3, 66-68	8.16	50.39	101.58	1.504	2.864	0.746	73.95
2H-5, 23-25	10.73	49.14	96.62	1.532	2.937	0.779	73.48
3H-2, 58-60	16.08	44.43	79.94	1.612	2.978	0.896	69.91
3H-5, 97-99	20.97			1.614			
3H-7, 20-22	23.20	43.93	78.34	1.588	2.793	0.891	68.11
4H-2, 80-82	25.80	43.90	78.26	1.623	2.989	0.910	69.54
4H-3, 51-53	27.01	43.61	77.33	1.617	2.923	0.912	68.81
4H-5, 114-116	30.64	43.12	75.79	1.630	2.951	0.927	68.59
5H-1, 77-79	33.77	42.37	73.52	1.617	2.814	0.932	66.88
5H-3, 77-79	36.77	36.58	57.68	1.715	2.806	1.088	61.24
5H-5, 77-79	39.77	38.86	63.56	1.698	2.917	1.038	64.41
6H-1, 78-80	43.28	34.16	51.88	1.651	2.418	1.087	55.05
6H-3, 101-103	46.51	40.77	68.84	1.666	2.927	0.987	66.30
6H-5, 53-55	48.91	41.38	70.58	1.669	3.000	0.978	67.39
7H-1, 119-121	53.19	40.36	67.67	1.673	2.925	0.998	65.89
7H-3, 116-118	56.16	39.16	64.37	1.611	2.553	0.980	61.60
7H-5, 112-114	59.12	37.54	60.10	1.710	2.862	1.068	62.67
8H-1, 76-78	62.26	37.02	58.78	1.726	2.891	1.087	62.38
8H-3, 83-85	65.33	36.42	57.27	1.738	2.892	1.105	61.79
8H-5, 86-88	68.36	36.29	56.97	1.744	2.908	1.111	61.79
9H-1, 73-75	71.73	35.60	55.27	1.741	2.836	1.121	60.48
9H-3, 77-79	74.77	35.15	54.19	1.756	2.864	1.139	60.24
9H-5, 86-88	77.86	37.81	60.80	1.706	2.866	1.061	62.98
10H-1, 74-76	81.24	37.73	60.59	1.713	2.892	1.067	63.10
10H-3, 76-78	84.26	36.81	58.25	1.726	2.873	1.091	62.03
10H-5, 74-76	87.24	34.89	53.58	1.769	2.897	1.152	60.24
11H-1, 74-76	90.74	38.60	62.88	1.675	2.786	1.028	63.10
11H-3, 76-78	93.76	34.96	53.75	1.765	2.888	1.148	60.24
11H-5, 76-78	96.76	35.80	55.77	1.744	2.867	1.120	60.95
12H-1, 84-86	100.34	34.02	51.57	1.807	2.980	1.192	60.00
12H-3, 75-77	103.25	35.57	55.20	1.749	2.868	1.127	60.71
12H-6, 77-79	107.77	36.09	56.47	1.737	2.861	1.110	61.19
13H-1, 75-77	109.75	33.38	50.11	1.790	2.862	1.193	58.33
13H-3, 75-77	112.75	36.21	56.75	1.738	2.875	1.109	61.43
13H-5, 76-78	115.76	32.45	48.04	1.811	2.870	1.224	57.37
14H-4, 74-76	123.07	32.57	48.30	1.816	2.897	1.225	57.73
14H-6, 59-61	124.73	33.83	51.12	1.763	2.792	1.167	58.21
15H-1, 74-76	128.74	31.93	46.90	1.822	2.869	1.240	56.78
15H-3, 77-79	131.77	31.29	45.54	1.816	2.802	1.248	55.47
15H-5, 77-79	134.77	31.76	46.53	1.828	2.878	1.247	56.66
16X-4, 23-25	142.23	27.24	37.44	1.897	2.786	1.380	50.46
16X-4, 51-53	142.51	29.41	41.67	1.866	2.835	1.317	53.56
17X-1, 29-31	147.39	30.58	44.05	1.844	2.846	1.280	55.02
17X-3, 28-30	150.38	28.41	39.68	1.870	2.780	1.339	51.85
17X-5, 56-58	153.66	30.31	43.50	1.830	2.782	1.275	54.15
18X-1, 100-102	157.80	28.27	39.41	1.860	2.740	1.334	51.31
18X-3, 38-40	160.18	27.62	38.16	1.877	2.751	1.359	50.61
18X-5, 35-37	163.15	29.70	42.25	1.765	2.542	1.241	51.18
18X-6, 22-24	164.52	29.59	42.02	1.842	2.771	1.297	53.20
19X-1, 74-76	167.14	29.08	41.00	1.867	2.817	1.324	53.00
19X-2, 74-76	168.64	30.43	43.73	1.831	2.794	1.274	54.39
19X-3, 40-42	169.80	30.54	43.96	1.821	2.766	1.265	54.27
19X-4, 28-30	171.18	30.24	43.34	1.835	2.792	1.280	54.15
20X-1, 83-85	176.93	29.49	41.82	1.838	2.751	1.296	52.90
20X-2, 51-53	178.11	29.55	41.95	1.818	2.693	1.281	52.45
20X-4, 75-77	181.35	28.53	39.92	1.837	2.688	1.313	51.16
20X-6, 78-80	184.38	27.70	38.31	1.859	2.702	1.344	50.25
21X-1, 84-86	186.54	27.27	37.49	1.883	2.745	1.369	50.11
21X-3, 77-79	189.47	27.23	37.41	1.859	2.673	1.353	49.39
21X-6, 78-80	193.98	31.11	45.15	1.882	3.026	1.297	57.15
22X-1, 60-62	196.00	29.96	42.77	1.856	2.843	1.300	54.27
22X-2, 65-67	197.55	28.29	39.45	1.855	2.727	1.330	51.22
22X-4, 48-50	200.38	28.41	39.69	1.871	2.785	1.340	51.90
22X-5, 58-60	201.98			1.825			
23X-1, 73-75	205.83	28.29	39.46	1.846	2.700	1.324	50.98
23X-2, 85-87	207.45			1.902			
23X-3, 76-78	208.86	31.24	45.43	1.815	2.793	1.248	55.33
23X-4, 76-78	210.36			1.770			
23X-5, 77-79	211.87			1.795			
23X-6, 59-61	213.19	32.42	47.97	1.788	2.784	1.208	56.59
23X-7, 29-31	214.39			1.778			
24X-1, 81-83	215.21	34.21	52.00	1.725	2.678	1.135	57.61
24X-2, 80-82	216.70			1.759			
24X-3, 81-83	218.21			1.822			
24X-4, 83-85	219.73			1.718			
24X-6, 59-61	222.49	33.10	49.48	1.765	2.749	1.181	57.04
25X-1, 108-110	225.08	31.82	46.67	1.749	2.610	1.192	54.32
25X-2, 61-63	226.11	36.62	57.78	1.691	2.708	1.071	60.43
25X-3, 84-86	227.84	28.42	39.71				
25X-4, 126-128	229.76	32.41	47.94	1.766	2.705	1.194	55.87
25X-5, 125-127	231.25			1.607			
26X-1, 46-48	234.06	27.19	37.34	1.783	2.464	1.298	47.31

Table 10 (continued).

Core, section, interval (cm)	Depth (mbsf)	Water content (bulk wt%)	Water content (dry wt%)	Bulk density (Mg/m ³)	Grain density (Mg/m ³)	Dry density (Mg/m ³)	Porosity (%)
26X-2, 37-39	235.47	30.79	44.49	1.855	2.900	1.283	55.74
26X-3, 33-35	236.93	29.12	41.08	1.740	2.440	1.233	49.45
26X-4, 13-15	238.23	40.10	66.94	1.673	2.902	1.002	65.47
26X-5, 16-18	239.76	29.15	41.15	1.726	2.402	1.223	49.11
26X-6, 71-73	241.81	33.50	50.38	1.653	2.394	1.100	54.07
27X-1, 36-38	243.76	25.40	34.05	1.859	2.574	1.387	46.11
27X-1, 116-118	244.56	26.30	35.69	1.847	2.588	1.361	47.41
27X-2, 51-53	245.41	26.80	36.62	1.832	2.575	1.341	47.92
27X-2, 114-116	246.04	30.05	42.95	1.763	2.552	1.233	51.69
27X-3, 26-28	246.66	26.32	35.72	1.854	2.609	1.366	47.64
27X-3, 91-93	247.31	34.21	51.99	1.654	2.429	1.088	55.21
27X-4, 7-9	247.97	33.43	50.21	1.673	2.454	1.114	54.60
27X-4, 115-117	249.05	27.56	38.05	1.829	2.609	1.325	49.21
27X-5, 55-57	249.95	29.15	41.14	1.797	2.606	1.273	51.14
27X-5, 138-140	250.78	25.55	34.33	1.842	2.536	1.371	45.93
27X-6, 7-9	250.97	27.61	38.15	1.813	2.566	1.312	48.86
28X-1, 2-4	253.02	30.04	42.95	1.733	2.465	1.212	50.82
28X-1, 88-90	253.88	25.19	33.67	1.853	2.547	1.387	45.57
28X-2, 18-20	254.68	26.31	35.71	1.839	2.568	1.355	47.23
28X-2, 92-94	255.42	26.00	35.14	1.828	2.523	1.353	46.40
28X-3, 81-83	256.81	27.48	37.89	1.464	1.748	1.062	39.27
28X-3, 142-144	257.42	24.53	32.50	1.895	2.618	1.430	45.37
28X-4, 50-52	258.00	27.83	38.56	1.817	2.591	1.312	49.37
28X-4, 142-144	258.92	24.94	33.22	1.872	2.580	1.405	45.56
28X-5, 50-52	259.50	25.61	34.43	1.847	2.554	1.374	46.19
29X-1, 25-27	262.45	23.78	31.20	2.039	2.951	1.554	47.33
29X-2, 55-57	264.25	26.38	35.83	1.872	2.661	1.378	48.20
29X-2, 148-150	265.18	24.62	32.65	1.948	2.761	1.469	46.81
29X-3, 35-37	265.55	24.52	32.49	1.925	2.694	1.453	46.07
29X-3, 116-118	266.36	27.05	37.08	1.854	2.649	1.352	48.94
29X-4, 7-9	266.77	25.94	35.03	1.932	2.802	1.431	48.93
29X-4, 97-99	267.67	27.08	37.14	1.832	2.589	1.336	48.41
29X-5, 31-33	268.51	30.16	43.18	1.892	2.983	1.321	55.70
29X-5, 105-107	269.25	29.55	41.95	1.898	2.956	1.337	54.75
29X-6, 45-47	270.15	35.48	54.98	1.780	2.995	1.149	61.64
29X-6, 126-128	270.96	31.24	45.44	1.859	2.950	1.278	56.68
30X-1, 80-82	272.70	30.21	43.29	1.767	2.576	1.233	52.12
30X-1, 120-122	273.10	26.05	35.23	1.894	2.702	1.401	48.17
30X-2, 36-38	273.76	30.92	44.76	1.746	2.549	1.206	52.69
30X-2, 131-133	274.71	26.43	35.93	1.879	2.683	1.382	48.48
30X-3, 132-134	276.22	26.83	36.66	1.842	2.604	1.348	48.23
30X-4, 89-91	277.29	30.12	43.11	1.764	2.561	1.233	51.87
30X-5, 6-8	277.96	28.07	39.03	1.809	2.580	1.301	49.57
30X-5, 130-132	279.20	28.54	39.93	1.803	2.589	1.289	50.23
30X-6, 2-4	279.42	29.58	42.00	1.726	2.424	1.216	49.85
30X-6, 103-105	280.43	28.69	40.24	1.806	2.605	1.288	50.58
31X-1, 16-18	281.76	29.40	41.64	1.776	2.558	1.254	50.97
31X-2, 77-79	283.87	45.02	81.87	1.613	3.044	0.887	70.86
31X-3, 76-78	285.36	25.10	33.52	1.830	2.484	1.370	44.83
31X-3, 148-150	286.08	22.10	28.37	1.605	1.913	1.250	34.63
31X-4, 2-4	286.12	22.11	28.39	1.956	2.636	1.523	42.21
31X-4, 104-106	287.14	27.94	38.77	1.893	2.821	1.364	51.63
31X-5, 2-4	287.62	27.12	37.21	1.974	3.014	1.439	52.26
31X-6, 60-62	289.70	25.12	33.55	1.858	2.555	1.391	45.55
32X-1, 30-32	291.60	27.62	38.15	1.869	2.727	1.353	50.39
32X-1, 115-117	292.45	24.45	32.37	1.455	1.683	1.099	34.72
32X-2, 20-22	293.00	26.64	36.31	1.833	2.570	1.345	47.66
32X-2, 118-120	293.98	23.32	30.42	1.916	2.607	1.469	43.63
32X-3, 2-4	294.32	28.60	40.05	1.789	2.553	1.278	49.95
32X-3, 67-69	294.97	27.36	37.66	1.813	2.552	1.317	48.41
32X-4, 57-59	296.37	24.92	33.19	1.887	2.618	1.417	45.90
32X-4, 105-107	296.85	29.54	41.92	1.777	2.569	1.252	51.25
32X-5, 36-38	297.66	27.17	37.31	1.782	2.462	1.298	47.27
32X-5, 89-91	298.19	24.85	33.07	1.869	2.571	1.405	45.35
32X-6, 39-41	299.19	32.73	48.66	1.732	2.608	1.165	55.33
33X-1, 35-37	301.35	25.25	33.78	1.842	2.521	1.377	45.39
33X-1, 135-137	302.35	26.95	36.89	1.791	2.473	1.308	47.10
33X-2, 37-39	302.87	27.32	37.58	2.000	3.115	1.454	53.33
33X-2, 125-127	303.75	26.95	36.88	1.827	2.570	1.335	48.05
33X-3, 36-38	304.36	26.74	36.51	1.821	2.544	1.334	47.54
33X-3, 134-136	305.34	26.75	36.52	1.850	2.622	1.355	48.31
33X-4, 39-41	305.89	25.02	33.36	1.855	2.543	1.391	45.30
33X-4, 143-145	306.93	27.66	38.24	1.840	2.646	1.331	49.69
33X-5, 22-24	307.22	24.07	31.70	1.879	2.555	1.427	44.15
33X-5, 113-115	308.13	25.62	34.45	1.864	2.596	1.386	46.61
33X-6, 61-63	309.11	24.92	33.19	1.877	2.594	1.409	45.66
33X-6, 105-107	309.55	26.25	35.60	1.861	2.623	1.372	47.68
34X-1, 48-50	311.18	27.85	38.59	2.014	3.210	1.453	54.73
34X-1, 125-127	311.95	27.39	37.72	1.958	2.983	1.422	52.34
34X-2, 59-61	312.79	25.94	35.02	1.800	2.449	1.333	45.57
34X-2, 142-144	313.62	27.11	37.19	1.887	2.747	1.375	49.93
34X-3, 76-78	314.46						
34X-3, 103-105	314.73	25.20	33.69	1.920	2.722	1.436	47.23
34X-4, 33-35	315.53	27.49	37.91	1.864	2.704	1.352	50.02
34X-4, 94-96	316.14	27.28	37.51	1.891	2.771	1.375	50.36
34X-5, 8-10	316.78	26.92	36.83	1.897	2.764	1.386	49.85

Table 10 (continued).

Core, section, interval (cm)	Depth (mbsf)	Water content (bulk wt%)	Water content (dry wt%)	Bulk density (Mg/m ³)	Grain density (Mg/m ³)	Dry density (Mg/m ³)	Porosity (%)
34X-5, 144-146	318.14	21.45	27.31	1.885	2.446	1.481	39.47
34X-6, 83-85	319.03	26.92	36.84	1.906	2.790	1.393	50.08
34X-7, 7-9	319.77	27.68	38.28	1.878	2.757	1.358	50.74
35X-1, 88-90	321.28	25.48	34.20	1.926	2.755	1.435	47.91
35X-1, 111-113	321.51	24.28	32.06	1.959	2.769	1.483	46.42
35X-2, 72-74	322.62	24.81	33.00	1.959	2.803	1.473	47.44
35X-2, 143-145	323.33	24.67	32.75	1.945	2.757	1.465	46.84
35X-3, 68-70	324.08	24.65	32.71	1.977	2.841	1.490	47.57
35X-3, 140-142	324.80	25.99	35.11	1.929	2.794	1.427	48.92
35X-4, 79-81	325.69	24.51	32.48	1.955	2.773	1.476	46.78
35X-4, 143-145	326.33	25.32	33.90	1.955	2.826	1.460	48.32
35X-5, 70-72	327.10	23.93	31.46	1.971	2.779	1.499	46.05
35X-5, 144-146	327.84	23.80	31.24	1.997	2.840	1.522	46.41
35X-6, 63-65	328.53	26.00	35.14	1.902	2.720	1.407	48.26
35X-6, 144-146	329.34	23.38	30.52	2.006	2.834	1.537	45.77
36X-1, 97-99	330.97	27.95	38.80	1.868	2.746	1.346	50.98
36X-1, 113-115	331.13	24.13	31.80	1.997	2.861	1.515	47.03
36X-2, 64-66	332.14	24.53	32.50	1.950	2.761	1.472	46.69
36X-2, 140-142	332.90	25.72	34.62	1.939	2.805	1.440	48.66
36X-3, 88-90	333.88	27.12	37.20	1.893	2.766	1.380	50.11
36X-3, 110-112	334.10	26.85	36.70	1.902	2.774	1.391	49.84
36X-4, 67-69	335.17	25.22	33.73	1.932	2.755	1.445	47.56
36X-4, 140-142	335.90	24.24	31.99	1.949	2.740	1.477	46.11
36X-5, 71-73	336.71	24.22	31.97	1.972	2.800	1.494	46.63
36X-5, 115-117	337.15	24.24	31.99	1.965	2.783	1.489	46.50
36X-6, 80-82	338.30	25.23	33.75	1.948	2.800	1.457	47.98
36X-6, 144-146	338.94			1.947			
37X-1, 80-82	340.50	22.11	28.39	2.009	2.762	1.565	43.35
37X-1, 138-140	341.08	21.75	27.80	2.098	2.960	1.642	44.55
37X-2, 5-7	341.25	22.36	28.80	1.998	2.750	1.551	43.60
37X-2, 84-86	342.04	22.43	28.92	2.001	2.762	1.552	43.81
37X-3, 21-23	342.91	22.03	28.25	2.024	2.795	1.578	43.52
37X-3, 73-75	343.43	21.47	27.33	2.040	2.797	1.602	42.74
37X-4, 70-72	344.90	23.74	31.13	1.958	2.734	1.494	45.38
37X-4, 144-146	345.64	21.28	27.04	2.019	2.738	1.590	41.95
37X-5, 71-73	346.41	22.24	28.59	2.000	2.748	1.555	43.41
37X-5, 138-140	347.08	21.67	27.66	2.017	2.755	1.580	42.65
37X-6, 39-41	347.59	26.51	36.08	1.890	2.717	1.389	48.90
37X-6, 81-83	348.01	25.37	33.99	1.933	2.768	1.443	47.87
37X-7, 28-30	348.98	28.03	38.96	1.841	2.671	1.325	50.39
38X-1, 24-26	349.64	21.86	27.98	2.023	2.781	1.580	43.17
38X-1, 79-81	350.19	25.60	34.40	1.932	2.779	1.438	48.27
38X-2, 60-62	351.50	21.76	27.81	1.993	2.704	1.559	42.33
38X-2, 77-79	351.67			1.960			
38X-3, 88-90	353.28	23.99	31.56	1.961	2.756	1.491	45.92
38X-3, 142-144	353.82	24.76	32.90	1.974	2.840	1.485	47.70
38X-4, 76-78	354.66	26.53	36.11	1.899	2.746	1.395	49.18
38X-4, 143-145	355.33	24.91	33.17	1.930	2.730	1.449	46.92
38X-5, 77-79	356.17	23.49	30.71	1.949	2.697	1.491	44.70
38X-5, 141-143	356.81	25.16	33.62	1.934	2.757	1.447	47.50
38X-6, 73-75	357.63	24.75	32.90	1.931	2.723	1.453	46.65
38X-6, 100-102	357.90	22.95	29.78	2.012	2.822	1.550	45.07
39X-1, 76-78	359.76	22.51	29.05	2.008	2.783	1.556	44.11
39X-1, 143-145	360.43	23.51	30.74	1.975	2.763	1.510	45.33
39X-2, 77-79	361.27	22.24	28.60	1.999	2.745	1.554	43.38
39X-2, 137-139	361.87	21.17	26.85	2.016	2.724	1.589	41.65
39X-3, 80-82	362.80	23.23	30.25	1.947	2.676	1.495	44.14
39X-3, 122-124	363.22	23.89	31.38	1.974	2.784	1.503	46.03
39X-4, 78-80	364.28	22.74	29.44	1.972	2.711	1.524	43.79
39X-4, 135-137	364.85	23.45	30.64	1.948	2.690	1.491	44.58
39X-5, 71-73	365.71	21.93	28.09	2.013	2.762	1.572	43.10
39X-5, 107-109	366.07	21.24	26.96	2.005	2.703	1.579	41.57
39X-6, 59-61	367.09	23.25	30.29	1.974	2.745	1.515	44.80
39X-6, 81-83	367.31	20.55	25.87	2.026	2.711	1.609	40.64
40X-1, 84-86	369.34	21.96	28.14	2.025	2.792	1.580	43.40
40X-1, 137-139	369.87	21.44	27.29	2.045	2.809	1.607	42.80
40X-2, 84-86	370.84	23.96	31.52	1.974	2.789	1.501	46.18
40X-2, 143-145	371.43	22.74	29.43	1.984	2.739	1.533	44.04
40X-3, 78-80	372.28	21.00	26.58	2.073	2.848	1.638	42.50
40X-3, 125-127	372.75	22.66	29.30	1.977	2.716	1.529	43.72
40X-4, 88-90	373.88	24.81	33.00	1.943	2.759	1.461	47.05
40X-4, 120-122	374.20	21.64	27.62	2.018	2.756	1.581	42.62
40X-5, 73-75	375.23	20.41	25.64	2.077	2.819	1.653	41.36
40X-5, 131-133	375.81	21.39	27.21	2.040	2.794	1.604	42.59
40X-6, 9-11	376.09	21.07	26.69	2.063	2.827	1.628	42.42
41X-1, 75-77	378.85	29.59	42.02	1.831	2.736	1.289	52.88
41X-1, 125-127	379.35	20.46	25.72	2.048	2.755	1.629	40.89
41X-1, 142-144	379.52	21.11	26.75	2.041	2.779	1.610	42.05
41X-2, 75-77	380.35	20.75	26.18	2.080	2.848	1.648	42.12
41X-2, 144-146	381.04	24.55	32.54	1.927	2.702	1.454	46.19
41X-3, 73-75	381.83	21.10	26.75	2.013	2.714	1.588	41.47
41X-3, 144-146	382.54	22.84	29.61	1.972	2.715	1.521	43.96
41X-4, 14-16	382.74	28.62	40.09	1.830	2.673	1.306	51.13
41X-4, 55-57	383.15	21.82	27.92	1.980	2.677	1.548	42.18
41X-4, 138-140	383.98	24.47	32.40	1.921	2.683	1.451	45.90
43X-1, 65-67	398.05	20.45	25.71	2.024	2.702	1.610	40.41
43X-1, 138-140	398.78	21.34	27.13	1.978	2.646	1.556	41.20

Table 10 (continued).

Core, section, interval (cm)	Depth (mbsf)	Water content (bulk wt%)	Water content (dry wt%)	Bulk density (Mg/m ³)	Grain density (Mg/m ³)	Dry density (Mg/m ³)	Porosity (%)
43X-2, 89-91	399.79	20.19	25.30	2.004	2.642	1.599	39.48
43X-3, 58-60	400.98	21.29	27.06	2.001	2.696	1.575	41.59
43X-4, 79-81	402.69	23.36	30.49	1.937	2.658	1.484	44.16
43X-4, 79-81	402.69			1.829			
43X-4, 120-122	403.10	20.97	26.53	2.012	2.703	1.590	41.18
43X-5, 57-59	403.97	20.71	26.11	2.035	2.740	1.613	41.12
43X-6, 3-5	404.63	22.27	28.65	1.946	2.623	1.513	42.31
44X-1, 112-114	408.22	21.07	26.69	1.845	2.346	1.456	37.93
44X-2, 63-65	409.23	19.52	24.26	2.058	2.725	1.656	39.22
44X-3, 26-28	410.36	19.39	24.06	2.028	2.705	1.654	38.84
44X-3, 94-96	411.04	19.68	24.50	1.886	2.376	1.515	36.23
44X-4, 8-10	411.68	18.98	23.42	1.909	2.392	1.546	35.35
44X-4, 101-103	412.61	18.89	23.29	1.995	2.714	1.679	38.16
44X-5, 27-29	413.37	18.70	23.01	1.932	2.427	1.571	35.27
44X-5, 103-105	414.13	16.90	20.33	1.966	2.417	1.634	32.42
44X-6, 48-50	415.08	17.95	21.87	2.040	2.604	1.674	35.73
44X-6, 130-132	415.90	22.93	29.75	1.970	2.716	1.519	44.09
45X-1, 21-23	416.91	20.93	26.47	2.095	2.897	1.657	42.81
45X-2, 50-52	418.70	21.68	27.69	2.050	2.835	1.605	43.39
45X-2, 137-139	419.57	19.00	23.45	2.044	2.666	1.656	37.91
45X-3, 98-100	420.68	21.84	27.94	1.966	2.644	1.536	41.90
45X-3, 142-144	421.12	21.03	26.64	1.973	2.619	1.558	40.51
45X-4, 50-52	421.70	20.60	25.95	1.982	2.617	1.574	39.86
45X-4, 139-141	422.59	19.14	23.67	1.978	2.537	1.600	36.96
46X-1, 105-107	427.45	20.53	25.83	1.994	2.639	1.584	39.95
46X-2, 12-14	428.02	20.14	25.22	1.928	2.480	1.540	37.91
47X-1, 9-11	436.19	18.66	22.95	2.023	2.605	1.645	36.85
47X-1, 140-142	437.50	20.49	25.78	1.975	2.596	1.570	39.51
47X-2, 37-39	437.97	20.63	26.00	1.981	2.615	1.572	39.89
47X-2, 108-110	438.68	20.70	26.10	2.014	2.692	1.597	40.69
47X-3, 59-61	439.69	21.36	27.16	2.015	2.732	1.584	42.01
47X-4, 3-5	440.63	21.51	27.41	1.998	2.702	1.568	41.96
47X-4, 82-84	441.42	20.51	25.80	1.974	2.595	1.569	39.52
47X-5, 9-11	442.19	19.28	23.89	2.032	2.655	1.640	38.24
47X-5, 80-82	442.90	19.83	24.73	1.972	2.557	1.581	38.17
47X-6, 43-45	444.03	19.40	24.06	1.957	2.506	1.577	37.05
47X-6, 145-147	445.05	20.87	26.38	1.940	2.539	1.535	39.53
48X-1, 53-55	446.23	28.53	39.92	1.951	3.054	1.395	54.34
48X-1, 120-122	446.90	22.43	28.91	1.916	2.559	1.486	41.94
48X-2, 42-44	447.62	18.64	22.92	2.027	2.612	1.649	36.88
48X-2, 90-92	448.10	21.34	27.13	1.928	2.534	1.516	40.16
48X-3, 5-7	448.75	21.88	28.01	1.915	2.531	1.496	40.90
48X-3, 79-81	449.49	24.71	32.82	1.863	2.548	1.403	44.94
48X-4, 15-17	450.35	22.69	29.34	1.914	2.568	1.480	42.38
48X-4, 63-65	450.83	21.26	27.00	1.936	2.548	1.524	40.18
48X-5, 5-7	451.75	23.54	30.79	1.917	2.619	1.465	44.05
48X-5, 120-122	452.90	22.28	28.66	1.921	2.564	1.493	41.77
48X-6, 28-30	453.48	23.87	31.35	1.906	2.609	1.451	44.39
49X-1, 61-63	455.91	24.32	32.13	1.855	2.509	1.404	44.03
49X-1, 96-98	456.26	25.99	35.11	1.868	2.626	1.382	47.37
49X-2, 138-140	458.18	24.98	33.30	1.843	2.511	1.383	44.94
49X-3, 49-51	458.79	20.43	25.67	1.960	2.561	1.560	39.08
49X-3, 105-107	459.35	21.64	27.62	2.008	2.732	1.573	42.41
49X-4, 6-8	459.86	24.32	32.14	1.877	2.562	1.420	44.56
49X-4, 142-144	461.22	29.36	41.56	2.228	4.356	1.574	63.86
49X-5, 5-7	461.35	24.30	32.10	1.870	2.544	1.416	44.36
49X-5, 118-120	462.48	21.82	27.92	1.939	2.582	1.516	41.30
49X-6, 139-141	464.19	27.13	37.23	1.825	2.573	1.330	48.32
49X-7, 20-22	464.50	23.11	30.05	1.911	2.582	1.469	43.10
50X-1, 37-39	465.37	23.95	31.49	1.892	2.581	1.439	44.24
50X-1, 130-132	466.30	23.71	31.07	1.878	2.534	1.433	43.46
50X-2, 41-43	466.91	24.80	32.98	1.839	2.492	1.383	44.51
50X-2, 127-129	467.77	22.15	28.45	1.905	2.520	1.483	41.17
50X-3, 14-16	468.14	23.79	31.21	1.865	2.508	1.422	43.31
50X-3, 86-88	468.86	22.60	29.19	1.900	2.532	1.471	41.91
50X-4, 48-50	469.98	25.43	34.11	1.835	2.512	1.368	45.55
50X-4, 124-126	470.74	24.10	31.75	1.879	2.556	1.426	44.20
50X-5, 72-74	471.72	24.13	31.81	1.882	2.564	1.427	44.32
50X-5, 123-125	472.23	23.25	30.29	1.796	2.326	1.378	40.75
50X-6, 24-26	472.74	29.38	41.61	1.742	2.458	1.230	49.95
50X-7, 6-8	474.06	24.84	33.05	1.824	2.458	1.371	44.23
51X-1, 28-30	474.88	28.67	40.20	1.731	2.395	1.235	48.45
51X-1, 117-119	475.77	26.24	35.57	1.830	2.540	1.350	46.86
51X-2, 65-67	476.75	28.46	39.78	1.757	2.455	1.257	48.80
51X-3, 62-64	478.22	24.71	32.83	1.863	2.548	1.403	44.94
51X-3, 147-149	479.07	25.08	33.47	1.842	2.514	1.380	45.09
51X-4, 44-46	479.54	25.14	33.58	1.835	2.498	1.373	45.01
51X-4, 86-88	479.96	30.80	44.52	1.716	2.453	1.187	51.59
51X-5, 104-106	481.64	24.64	32.70	1.824	2.450	1.375	43.88
51X-6, 15-17	482.25	37.78	60.71	1.579	2.351	0.982	58.22
51X-6, 86-88	482.96	32.16	47.40	1.673	2.391	1.135	52.52
51X-7, 16-18	483.76	24.37	32.22	1.856	2.512	1.403	44.13
52X-1, 26-28	484.46	30.48	43.85	1.721	2.453	1.197	51.22
52X-1, 104-106	485.24	27.86	38.62	1.781	2.491	1.285	48.43
52X-2, 63-65	486.33	32.58	48.31	1.710	2.527	1.153	54.37
52X-2, 146-148	487.16	24.98	33.30	1.850	2.529	1.388	45.12
52X-3, 145-147	488.65	27.26	37.47	1.886	2.754	1.372	50.18

Table 10 (continued).

Core, section, interval (cm)	Depth (mbsf)	Water content (bulk wt%)	Water content (dry wt%)	Bulk density (Mg/m ³)	Grain density (Mg/m ³)	Dry density (Mg/m ³)	Porosity (%)
52X-4, 46-48	489.16	28.28	39.43	1.785	2.525	1.281	49.29
52X-4, 138-140	490.08	26.07	35.26	1.929	2.800	1.426	49.07
52X-5, 143-145	491.63	23.25	30.30	1.923	2.620	1.476	43.65
52X-6, 30-32	492.00	25.44	34.12	1.932	2.768	1.440	47.97
52X-6, 91-93	492.61	25.32	33.90	1.858	2.565	1.387	45.92
53X-1, 73-75	494.23	19.05	23.54	2.001	2.579	1.620	37.21
53X-1, 143-145	494.93	19.68	24.50	1.975	2.555	1.586	37.93
53X-2, 6-8	495.06	18.77	23.11	1.999	2.562	1.624	36.62
53X-2, 70-72	495.70	23.74	31.14	2.020	2.895	1.540	46.80
53X-3, 51-53	497.01	24.25	32.01	1.883	2.574	1.427	44.58
53X-3, 61-63	497.11	24.63	32.68	1.972	2.826	1.486	47.41
53X-CC, 12-14	498.06	17.85	21.73	2.026	2.572	1.664	35.29
54X-1, 51-53	503.71	17.47	21.17	2.052	2.604	1.693	34.99
54X-1, 76-78	503.96	22.06	28.30	2.014	2.772	1.570	43.36
54X-2, 68-70	505.38	20.88	26.38	1.998	2.667	1.581	40.72
54X-2, 105-107	505.75	18.50	22.70	2.032	2.616	1.656	36.69
54X-3, 14-16	506.34	26.33	35.74	1.888	2.701	1.391	48.52
54X-3, 88-90	507.08	18.27	22.35	2.061	2.662	1.684	36.74
54X-4, 94-96	508.64	22.04	28.27	2.080	2.702	1.548	42.71
55X-1, 22-24	508.02	21.00	26.58	2.033	2.754	1.606	41.67
56X-1, 3-5	517.83	19.25	23.83	2.005	2.598	1.619	37.67
154-929B-							
1H-2, 106-108	2.56	53.23	113.79	1.483	3.019	0.693	77.03
1H-4, 61-63	5.11	50.45	101.82	1.528	3.062	0.757	75.27
1H-6, 67-69	8.17	50.52	102.11	1.523	3.028	0.754	75.11
2H-2, 64-66	11.64	49.20	96.83	1.540	3.004	0.782	73.95
2H-4, 21-23	14.21	44.31	79.58	1.605	2.923	0.894	69.42
2H-6, 115-117	18.15	46.80	87.97	1.572	2.966	0.836	71.81
3H-2, 30-32	20.80	44.42	79.93	1.612	2.976	0.896	69.90
3H-4, 72-74	24.22	43.91	78.29	1.615	2.941	0.906	69.21
3H-6, 54-56	27.04	42.20	73.02	1.659	3.030	0.959	68.35
4H-2, 115-117	31.15	44.90	81.50	1.600	2.952	0.882	70.14
4H-4, 53-55	33.53	41.72	71.60	1.648	2.923	0.961	67.13
4H-6, 33-35	36.33	43.22	76.10	1.620	2.907	0.920	68.35
5H-2, 70-72	40.20	38.83	63.48	1.697	2.909	1.038	64.32
5H-4, 82-84	43.32	41.91	72.15	1.649	2.946	0.958	67.48
5H-6, 113-115	46.63	39.34	64.87	1.671	2.829	1.014	64.17
6H-2, 18-20	49.18	41.51	70.97	1.656	2.942	0.968	67.08
6H-4, 81-83	52.81	40.73	68.72	1.679	2.991	0.995	66.74
6H-6, 107-109	56.07	40.83	69.01	1.658	2.892	0.981	66.08
7H-2, 59-61	59.09	39.00	63.92	1.683	2.856	1.027	64.05
7H-4, 14-16	61.64	38.05	61.42	1.718	2.942	1.064	63.82
7H-6, 98-100	65.48	36.22	56.80	1.706	2.743	1.088	60.33
8H-2, 75-77	68.75	35.95	56.13	1.737	2.849	1.113	60.95
8H-4, 74-76	71.74	38.53	62.69	1.697	2.883	1.043	63.83
8H-6, 75-77	74.75	34.45	52.56	1.767	2.852	1.158	59.40
9H-2, 75-77	78.25	38.35	62.21	1.711	2.935	1.055	64.05
9H-4, 78-80	81.28	34.59	52.88	1.777	2.906	1.162	60.00
9H-6, 75-77	84.25	39.86	66.28	1.677	2.902	1.008	65.25
10H-2, 77-79	87.77	36.26	56.88	1.736	2.869	1.107	61.43
10H-4, 86-88	90.86	37.60	60.25	1.693	2.792	1.057	62.15
10H-6, 88-90	93.88	35.66	55.42	1.751	2.886	1.127	60.95
11H-2, 86-88	97.36	38.52	62.65	1.691	2.855	1.040	63.58
11H-4, 108-110	100.58	35.98	56.20	1.756	2.933	1.124	61.67
11H-6, 74-76	103.24	34.13	51.80	1.758	2.795	1.158	58.57
12H-2, 76-78	106.76	34.61	52.93	1.783	2.932	1.166	60.24
12H-4, 87-89	109.87	37.14	59.09	1.722	2.880	1.082	62.42
12H-6, 76-78	112.76	31.81	46.66	1.821	2.857	1.242	56.54
13H-2, 74-76	116.24	33.54	50.48	1.796	2.897	1.194	58.81
13H-4, 67-69	119.17	35.09	54.07	1.772	2.928	1.150	60.71
13H-5, 5-7	120.05	33.81	51.07	1.771	2.822	1.172	58.45
14X-2, 79-81	125.79			1.805			
14X-4, 76-78	128.76	33.34	50.02	1.804	2.914	1.203	58.72
14X-CC, 22-24	131.14	30.17	43.20	1.835	2.788	1.281	54.03
15X-2, 84-86	135.44	32.36	47.84	1.809	2.855	1.224	57.14
15X-3, 25-27	136.35	28.88	40.61	1.879	2.840	1.336	52.96
16X-1, 10-12	142.70	29.04	40.92	1.843	2.739	1.308	52.25
17X-1, 76-78	152.96	29.84	42.54	1.870	2.880	1.312	54.46
17X-2, 70-72	154.40	27.72	38.36	1.900	2.826	1.373	51.41
17X-3, 75-77	155.95	31.13	45.20	1.814	2.782	1.249	55.11
17X-4, 76-78	157.46	28.83	40.51	1.814	2.639	1.291	51.06
18X-2, 48-50	163.78	27.13	37.23	1.912	2.821	1.393	50.62
18X-4, 91-93	167.21	30.81	44.53	1.844	2.865	1.276	55.47
18X-5, 139-141	169.19	29.82	42.49	1.848	2.806	1.297	53.78
18X-6, 36-38	169.66	28.56	39.99	1.840	2.698	1.314	51.29
19X-2, 58-60	173.48	29.29	41.42	1.851	2.779	1.309	52.91
19X-4, 82-84	176.72	29.63	42.11	1.829	2.734	1.287	52.91
19X-6, 44-46	179.34	30.06	42.98	1.854	2.843	1.297	54.39
20X-1, 61-63	181.61	29.44	41.71	1.825	2.708	1.288	52.44
20X-4, 73-75	186.23	28.41	39.68	1.748	2.429	1.251	48.48
20X-6, 98-100	189.48	27.85	38.59	1.893	2.814	1.366	51.46
21X-2, 95-97	193.15	27.92	38.73	1.840	2.659	1.326	50.13
21X-4, 71-73	195.91	28.84	40.52	1.856	2.766	1.321	52.25
21X-6, 70-72	198.90	30.44	43.77	1.836	2.811	1.277	54.56
22X-2, 80-82	202.70	28.63	40.11	1.866	2.781	1.332	52.13
22X-4, 120-122	206.10	28.72	40.29	1.866	2.787	1.330	52.29

Table 10 (continued).

Core, section, interval (cm)	Depth (mbsf)	Water content (bulk wt%)	Water content (dry wt%)	Bulk density (Mg/m ³)	Grain density (Mg/m ³)	Dry density (Mg/m ³)	Porosity (%)
22X-6, 26-28	207.66	29.63	42.10	1.840	2.766	1.295	53.20
23X-2, 95-97	212.15	30.70	44.30	1.835	2.825	1.272	54.99
23X-4, 52-54	214.72	32.02	47.10	1.809	2.830	1.230	56.54
23X-6, 19-21	217.39	31.73	46.49	1.796	2.763	1.226	55.63
24X-3, 70-72	223.10	30.74	44.37	1.804	2.723	1.249	54.12
154-929D-							
4H-3, 29-31	29.29	40.64	68.47	1.660	2.887	0.986	65.87
4H-3, 88-90	29.88	43.18	75.99	1.626	2.937	0.924	68.54
4H-3, 129-131	30.29	43.20	76.07	1.610	2.847	0.914	67.88
4H-4, 30-32	30.80	42.65	74.36	1.633	2.926	0.937	67.99
4H-4, 56-58	31.06	43.66	77.48	1.618	2.935	0.912	68.94
4H-4, 93-95	31.43	46.19	85.85	1.577	2.935	0.848	71.09
4H-4, 139-141	31.89	42.63	74.30	1.610	2.796	0.924	66.98
154-929E-							
1R-1, 50-52	472.00	30.95	44.83	1.729	2.499	1.194	52.23
1R-2, 45-47	472.56	29.54	41.92	1.753	2.496	1.235	50.53
1R-2, 137-139	473.48	28.98	40.81	1.768	2.512	1.256	50.02
1R-3, 41-43	474.02	27.18	37.32	1.786	2.470	1.300	47.37
1R-3, 118-120	474.79	24.41	32.30	1.881	2.577	1.422	44.83
1R-4, 10-12	475.21	24.41	32.30	1.860	2.525	1.406	44.32
1R-5, 145-147	478.06	31.51	46.01	1.690	2.411	1.158	51.99
1R-6, 39-41	478.50	26.89	36.79	1.807	2.514	1.321	47.44
1R-6, 106-108	479.17	28.12	39.12	1.738	2.390	1.250	47.71
1R-7, 98-100	480.59	30.21	43.29	1.728	2.458	1.206	50.95
1R-CC, 9-11	481.20	23.35	30.47	1.862	2.480	1.427	42.45
2R-1, 47-49	481.77	29.62	42.08	1.768	2.544	1.244	51.10
2R-1, 115-117	482.45	27.58	38.09	1.799	2.526	1.303	48.43
2R-2, 33-35	483.13	28.84	40.53	1.765	2.496	1.256	49.69
2R-2, 109-111	483.89	34.74	53.24	1.677	2.536	1.094	56.86
2R-3, 22-24	484.52	33.83	51.12	1.683	2.506	1.114	55.56
2R-3, 114-116	485.44	31.48	45.93	1.701	2.442	1.166	52.26
2R-5, 104-106	488.34	31.56	46.10	1.735	2.551	1.188	53.44
2R-6, 106-108	489.86	33.72	50.87	1.674	2.472	1.110	55.11
2R-CC, 3-5	489.95	32.52	48.19	1.694	2.473	1.143	53.78
3R-1, 9-11	491.09	28.27	39.41	1.781	2.511	1.277	49.14
3R-1, 137-139	492.37	24.48	32.41	1.860	2.528	1.405	44.44
3R-2, 39-41	492.89	23.41	30.56	1.864	2.488	1.428	42.60
3R-3, 106-108	495.06	21.11	26.75	1.973	2.622	1.556	40.64
4R-1, 28-30	501.08	19.13	23.66	2.073	2.736	1.676	38.72
4R-1, 126-128	502.06	21.25	26.98	1.924	2.522	1.515	39.91
4R-2, 131-133	503.61	17.98	21.92	2.004	2.535	1.643	35.16
4R-3, 15-17	503.95	18.36	22.49	1.996	2.537	1.629	35.77
4R-3, 112-114	504.92	19.68	24.51	2.022	2.656	1.624	38.85
5R-1, 31-33	510.71	18.63	22.89	2.034	2.626	1.655	36.98
5R-2, 57-59	512.47	16.93	20.37	2.086	2.644	1.733	34.46
5R-2, 138-140	513.28	17.40	21.06	2.088	2.673	1.725	35.46
5R-3, 22-24	513.62	18.82	23.18	2.074	2.719	1.684	38.09
5R-3, 120-122	514.60	19.45	24.15	2.011	2.620	1.620	38.18
5R-4, 44-46	515.34	18.66	22.94	2.029	2.618	1.650	36.96
6R-1, 64-66	520.64	16.21	19.35	2.112	2.658	1.769	33.42
6R-1, 118-120	521.18	18.07	22.06	2.062	2.654	1.689	36.36
6R-2, 5-7	521.55	18.99	23.45	2.053	2.684	1.663	38.06
6R-2, 94-96	522.44	17.15	20.69	2.068	2.620	1.713	34.60
6R-3, 25-27	523.25	18.00	21.96	2.068	2.663	1.696	36.34
6R-3, 112-114	524.12	18.04	22.02	2.074	2.678	1.700	36.53
6R-4, 3-5	524.53	16.80	20.20	2.068	2.604	1.720	33.92
6R-4, 93-95	525.43	17.86	21.75	2.117	2.755	1.739	36.90
7R-1, 16-18	529.46	20.51	25.79	1.993	2.635	1.584	39.88
7R-2, 147-149	532.27	19.40	24.08	1.999	2.593	1.611	37.86
7R-3, 81-83	533.11	21.92	28.08	1.919	2.542	1.498	41.06
7R-3, 140-142	533.70	22.79	29.51	1.898	2.537	1.466	42.22
7R-CC, 10-12	534.16	21.83	27.92	1.916	2.530	1.497	40.81
8R-1, 37-39	539.37	17.28	20.89	2.058	2.607	1.702	34.71
8R-1, 134-136	540.34	17.01	20.50	2.083	2.643	1.729	34.59
8R-2, 50-52	541.00	15.54	18.40	2.093	2.591	1.768	31.76
8R-2, 128-130	541.78	16.76	20.14	2.107	2.677	1.754	34.47
8R-3, 20-22	542.20	16.65	19.97	2.084	2.626	1.737	33.86
8R-3, 146-148	543.46	15.94	18.97	2.120	2.660	1.782	32.99
8R-4, 60-62	544.10	15.60	18.49	2.129	2.660	1.797	32.43
9R-1, 4-6	548.64	20.32	25.49	2.028	2.702	1.616	40.21
9R-1, 109-111	549.69	16.42	19.64	2.098	2.643	1.754	33.63
9R-2, 134-136	551.44	16.79	20.18	2.132	2.727	1.774	34.94
9R-3, 40-42	552.00	17.40	21.06	2.139	2.775	1.767	36.32
9R-3, 92-94	552.52	15.65	18.55	2.114	2.633	1.783	32.29
9R-4, 37-39	553.47	17.16	20.72	2.077	2.638	1.720	34.78
9R-4, 89-91	553.99	16.51	19.78	2.118	2.684	1.768	34.13
10R-1, 40-42	558.70	14.98	17.62	2.088	2.555	1.775	30.52
10R-1, 134-136	559.64	16.27	19.43	2.021	2.493	1.693	32.09
10R-2, 22-24	560.02	14.61	17.11	2.117	2.590	1.808	30.20
10R-2, 88-90	560.68	15.75	18.70	2.066	2.551	1.741	31.77
10R-3, 54-56	561.84	18.34	22.45	2.001	2.546	1.634	35.81
10R-3, 129-131	562.59	17.51	21.22	2.013	2.532	1.661	34.41
10R-4, 22-24	563.02	17.03	20.53	2.041	2.563	1.693	33.93
10R-4, 119-121	563.99	16.15	19.27	2.077	2.590	1.742	32.76
10R-5, 26-28	564.56	17.51	21.23	2.136	2.776	1.762	36.52

Table 10 (continued).

Core, section, interval (cm)	Depth (mbsf)	Water content (bulk wt%)	Water content (dry wt%)	Bulk density (Mg/m ³)	Grain density (Mg/m ³)	Dry density (Mg/m ³)	Porosity (%)
10R-5, 92-94	565.22	16.25	19.40	2.048	2.540	1.715	32.48
10R-6, 63-65	566.43	21.08	26.70	1.910	2.482	1.507	39.28
10R-6, 131-133	567.11	15.17	17.88	2.088	2.565	1.772	30.92
11R-1, 32-34	568.22	17.73	21.56	2.032	2.578	1.671	35.17
11R-1, 134-136	569.24	16.79	20.18	2.021	2.514	1.681	33.12
11R-2, 47-49	569.87	21.85	27.96	1.910	2.519	1.493	40.74
11R-2, 89-91	570.29	17.57	21.32	2.007	2.523	1.654	34.43
11R-3, 7-9	570.97	17.91	21.81	1.971	2.468	1.618	34.45
11R-3, 68-70	571.58	21.70	27.71	1.909	2.510	1.495	40.44
11R-4, 51-53	572.91	16.64	19.96	2.026	2.517	1.689	32.90
11R-4, 121-123	573.61	21.05	26.67	1.923	2.510	1.518	39.52
11R-5, 26-28	574.16	17.22	20.80	2.008	2.509	1.662	33.75
11R-5, 142-144	575.32	18.23	22.29	1.957	2.455	1.600	34.82
11R-6, 39-41	575.79	18.97	23.40	1.920	2.414	1.556	35.55
12R-1, 3-5	577.53	16.57	19.86	2.079	2.613	1.734	33.63
12R-1, 144-146	578.94	15.98	19.01	2.078	2.584	1.746	32.41
12R-2, 41-43	579.41	16.61	19.92	2.077	2.612	1.732	33.69
12R-2, 144-146	580.44	19.53	24.27	1.983	2.566	1.596	37.81
12R-3, 60-62	581.10	19.23	23.81	2.015	2.617	1.627	37.81
12R-3, 107-109	581.57	16.82	20.23	2.061	2.592	1.714	33.85
12R-4, 16-18	582.16	22.43	28.91	1.936	2.606	1.502	42.37
12R-4, 48-50	582.48	28.46	39.78	1.775	2.505	1.270	49.31
12R-4, 144-146	583.44	18.57	22.80	2.072	2.703	1.687	37.56
12R-5, 81-83	584.31	17.46	21.15	2.024	2.549	1.670	34.48
12R-5, 142-144	584.92	18.42	22.57	2.042	2.633	1.666	36.71
12R-6, 62-64	585.62	17.77	21.62	2.051	2.619	1.687	35.59
13R-1, 11-13	587.31	17.83	21.70	2.086	2.692	1.714	36.32
13R-1, 121-123	588.41	15.89	18.89	2.109	2.635	1.774	32.70
13R-2, 4-6	588.74	16.25	19.40	2.120	2.674	1.775	33.61
13R-2, 138-140	590.08	18.28	22.38	2.063	2.669	1.686	36.83
13R-3, 3-5	590.23	16.45	19.69	2.095	2.638	1.751	33.64
13R-3, 71-73	590.91	18.36	22.49	2.034	2.614	1.661	36.46
13R-4, 39-41	592.09	16.32	19.50	2.093	2.628	1.751	33.34
13R-4, 112-114	592.82	16.45	19.69	2.077	2.605	1.736	33.36
13R-5, 4-6	593.24	16.49	19.75	2.058	2.570	1.719	33.13
13R-5, 88-90	594.08	16.26	19.42	2.103	2.643	1.761	33.38
13R-6, 74-76	595.44	18.28	22.36	2.028	2.597	1.658	36.18
14R-1, 35-37	597.25	17.39	21.05	2.050	2.596	1.693	34.79
14R-1, 123-125	598.13	19.67	24.49	1.982	2.571	1.592	38.07
14R-2, 48-50	598.88	15.88	18.88	2.118	2.653	1.782	32.83
14R-2, 144-146	599.84	17.92	21.84	2.021	2.566	1.659	35.35
14R-3, 57-59	600.47	15.72	18.65	2.059	2.536	1.735	31.59
14R-3, 124-126	601.14	18.67	22.96	2.016	2.592	1.640	36.74
14R-4, 60-62	602.00	20.50	25.79	2.008	2.669	1.596	40.19
14R-4, 132-134	602.72	18.61	22.87	2.024	2.604	1.647	36.76
14R-5, 82-84	603.72	18.93	23.35	2.040	2.654	1.654	37.69
14R-5, 137-139	604.27	18.33	22.44	2.015	2.573	1.646	36.05
14R-6, 27-29	604.67	18.22	22.29	2.016	2.569	1.648	35.85
14R-6, 147-149	605.87	18.43	22.60	2.048	2.645	1.670	36.84
15R-1, 85-87	607.35	19.46	24.16	2.030	2.660	1.635	38.55
15R-1, 136-138	607.86	21.64	27.61	1.875	2.433	1.469	39.60
15R-2, 4-6	608.04	17.73	21.56	2.038	2.590	1.676	35.28
15R-2, 76-78	608.76	19.44	24.13	1.953	2.500	1.573	37.06
15R-3, 70-72	610.20	21.37	27.18	1.955	2.595	1.537	40.78
15R-3, 144-146	610.94	19.28	23.88	1.968	2.524	1.589	37.04
15R-4, 71-73	611.71	19.85	24.76	1.979	2.572	1.586	38.34
15R-4, 137-139	612.37	20.47	25.74	1.920	2.478	1.527	38.37
15R-5, 48-50	612.98	21.13	26.79	1.944	2.559	1.533	40.09
15R-5, 137-139	613.87	16.38	19.59	1.969	2.402	1.646	31.47
15R-6, 43-45	614.43	20.46	25.73	1.951	2.542	1.552	38.96
15R-6, 94-96	614.94	22.85	29.62	1.848	2.426	1.426	41.23
16R-1, 62-64	616.72	18.83	23.20	2.024	2.617	1.643	37.21
16R-1, 138-140	617.48	18.06	22.04	2.026	2.582	1.660	35.72
16R-2, 3-5	617.63	19.50	24.23	2.004	2.609	1.614	38.16
16R-2, 93-95	618.53	17.57	21.32	2.071	2.647	1.707	35.52
16R-3, 40-42	619.50	21.02	26.62	1.945	2.555	1.536	39.90
16R-3, 144-146	620.54	19.11	23.62	2.036	2.655	1.647	37.97
16R-4, 42-44	621.02	19.50	24.23	2.034	2.672	1.637	38.72
16R-4, 113-115	621.73	20.31	25.48	2.022	2.689	1.611	40.07
16R-5, 88-90	622.98	19.82	24.71	2.000	2.616	1.604	38.69
16R-5, 117-119	623.27	19.73	24.58	1.988	2.587	1.596	38.30
16R-6, 64-66	624.24	19.63	24.43	2.017	2.643	1.621	38.66
17R-1, 20-22	626.00	18.43	22.60	2.000	2.548	1.631	35.98
17R-1, 74-76	626.54	19.87	24.80	1.963	2.539	1.573	38.07
17R-2, 53-55	627.83	20.46	25.72	1.975	2.595	1.571	39.45
17R-2, 121-123	628.51	20.20	25.32	1.922	2.469	1.533	37.90
17R-3, 58-60	629.38	18.55	22.77	1.988	2.531	1.620	36.00
17R-3, 117-119	629.97	16.27	19.43	2.010	2.473	1.683	31.92
17R-4, 10-12	630.40	19.76	24.63	1.944	2.496	1.560	37.51
17R-4, 89-91	631.19	17.31	20.93	2.014	2.525	1.665	34.03
17R-5, 61-63	632.41	18.74	23.06	1.967	2.497	1.599	35.98
17R-5, 94-96	632.74	19.35	23.99	1.945	2.480	1.569	36.74
17R-6, 62-64	633.92	19.39	24.06	1.975	2.543	1.592	37.39
17R-6, 78-80	634.08	18.68	22.97	1.970	2.500	1.602	35.91
18R-1, 9-11	635.39	17.46	21.15	2.026	2.554	1.672	34.52
18R-1, 133-135	636.63	18.70	23.00	2.000	2.561	1.626	36.51
18R-2, 44-46	637.24	18.63	22.89	1.980	2.518	1.612	36.01

Table 10 (continued).

Core, section, interval (cm)	Depth (mbsf)	Water content (bulk wt%)	Water content (dry wt%)	Bulk density (Mg/m ³)	Grain density (Mg/m ³)	Dry density (Mg/m ³)	Porosity (%)
18R-2, 140-142	638.20	15.56	18.42	2.154	2.704	1.819	32.72
18R-3, 39-41	638.69	18.21	22.27	2.046	2.631	1.674	36.38
18R-3, 140-142	639.70	18.63	22.90	1.987	2.531	1.617	36.14
18R-4, 9-11	639.89	17.44	21.13	2.076	2.651	1.714	35.34
18R-4, 81-83	640.61	17.42	21.09	2.023	2.547	1.671	34.40
18R-5, 61-63	641.91	21.81	27.89	1.931	2.565	1.510	41.11
18R-5, 137-139	642.67	17.84	21.71	2.019	2.559	1.659	35.16
19R-1, 43-45	645.43	18.89	23.29	2.004	2.577	1.625	36.95
19R-1, 85-87	645.85	18.79	23.14	1.968	2.502	1.599	36.10
19R-2, 30-32	646.80	20.73	26.14	1.929	2.507	1.529	39.02
19R-2, 141-143	647.91	19.59	24.37	1.964	2.528	1.579	37.55
19R-3, 51-53	648.51	22.36	28.79	1.896	2.511	1.472	41.37
19R-3, 113-115	649.13	19.06	23.55	1.984	2.545	1.605	36.90
19R-4, 84-86	650.34	23.17	30.16	1.878	2.507	1.442	42.47
19R-4, 147-149	650.97	20.29	25.46	1.931	2.493	1.539	38.25
19R-5, 52-54	651.52	19.44	24.14	1.957	2.509	1.577	37.15
19R-5, 120-122	652.20	20.36	25.57	1.933	2.500	1.539	38.41
19R-6, 23-25	652.73	19.37	24.02	1.931	2.453	1.557	36.51
19R-6, 115-117	653.65	20.58	25.92	1.959	2.566	1.556	39.36
19R-7, 51-53	654.51	19.24	23.82	1.982	2.550	1.601	37.22
20R-1, 63-65	655.33	19.45	24.15	1.941	2.477	1.564	36.87
20R-1, 143-145	656.13	19.61	24.39	1.953	2.508	1.570	37.38
20R-2, 12-14	656.32	20.66	26.04	1.929	2.505	1.530	38.90
20R-2, 98-100	657.18	20.54	25.84	2.006	2.666	1.594	40.21
20R-3, 17-19	657.87	19.15	23.68	1.983	2.547	1.603	37.06
20R-3, 95-97	658.65	20.24	25.37	2.013	2.666	1.606	39.77
20R-4, 67-69	659.87	19.69	24.51	1.991	2.590	1.599	38.26
20R-4, 144-146	660.64	21.61	27.57	1.961	2.621	1.537	41.36
20R-5, 46-48	661.16	22.52	29.07	1.857	2.432	1.439	40.82
20R-5, 141-143	662.11	18.70	23.01	2.025	2.613	1.647	36.98
20R-6, 32-34	662.52	22.81	29.56	1.879	2.495	1.451	41.85
20R-6, 87-89	663.07	23.27	30.33	1.883	2.525	1.445	42.78
21R-1, 36-38	664.66	21.08	26.71	1.913	2.490	1.510	39.36
21R-1, 140-142	665.70	21.00	26.58	1.980	2.633	1.564	40.59
21R-2, 26-28	666.06	20.83	26.32	1.980	2.625	1.568	40.27
21R-2, 106-108	666.86	22.43	28.91	1.993	2.742	1.546	43.62
21R-3, 32-34	667.62	21.38	27.20	1.903	2.481	1.496	39.71
21R-3, 140-142	668.70	22.09	28.35	1.888	2.480	1.471	40.70
21R-4, 16-18	668.96	20.30	25.48	1.927	2.484	1.535	38.19
21R-4, 104-106	669.84	21.59	27.53	1.901	2.487	1.491	40.06
21R-5, 41-43	670.71	21.54	27.45	1.889	2.459	1.483	39.72
22R-1, 12-14	674.02	21.58	27.51				
22R-1, 64-66	674.54	21.93	28.09	2.004	2.741	1.565	42.91
22R-1, 126-128	675.16	22.14	28.43				
22R-2, 35-37	675.75	22.13	28.41	2.024	2.800	1.576	43.71
22R-2, 125-127	676.65	22.90	29.70	1.971	2.716	1.519	44.05
22R-3, 48-50	677.38	22.27	28.65	1.903	2.523	1.479	41.37
22R-3, 84-86	677.74	21.98	28.17	1.934	2.578	1.509	41.48
22R-4, 30-32	678.70	20.12	25.19	1.988	2.606	1.588	39.05
22R-4, 57-59	678.97	23.11	30.06	1.963	2.708	1.509	44.27
22R-5, 87-89	680.77	23.02	29.90	1.881	2.509	1.448	42.28
22R-5, 135-137	681.25	25.02	33.37	1.852	2.535	1.389	45.23
23R-1, 5-7	683.25	24.03	31.63	1.870	2.531	1.421	43.86
23R-1, 71-73	683.91	20.76	26.19	1.914	2.478	1.517	38.79
23R-1, 107-109	684.27	23.08	30.00	1.898	2.550	1.460	42.75
23R-2, 62-64	685.32	26.19	35.47	1.851	2.592	1.366	47.30
23R-2, 121-123	685.91	21.50	27.38	1.948	2.587	1.529	40.88
23R-3, 10-12	686.30	27.37	37.68	1.833	2.608	1.331	48.96
23R-3, 22-24	686.42	24.68	32.77	1.856	2.528	1.398	44.71
24R-1, 24-26	693.04	27.91	38.71	1.776	2.480	1.280	48.38
24R-1, 140-142	694.20			1.856			
24R-2, 40-42	694.70	22.28	28.67	1.918	2.558	1.491	41.71
24R-2, 96-98	695.26	20.64	26.00	1.953	2.556	1.550	39.35
24R-3, 31-33	696.11	24.81	33.00	1.851	2.522	1.392	44.82
24R-3, 62-64	696.42	23.65	30.97	1.892	2.565	1.445	43.67
24R-4, 19-21	697.49	25.41	34.07	1.817	2.468	1.355	45.08
24R-4, 73-75	698.03	22.39	28.85	1.913	2.552	1.485	41.81
24R-5, 22-24	699.02	26.54	36.14	1.826	2.545	1.341	47.30
24R-5, 129-131	700.09	25.59	34.39	1.834	2.519	1.365	45.82
25R-1, 74-76	703.24	26.43	35.92	1.819	2.522	1.338	46.93
25R-1, 123-125	703.73	26.08	35.28	1.788	2.425	1.321	45.51
25R-2, 56-58	704.56	29.78	42.40	1.726	2.433	1.212	50.17
25R-2, 130-132	705.30	25.60	34.42	1.826	2.498	1.358	45.63
25R-3, 37-39	705.87	28.77	40.40	1.741	2.426	1.240	48.89
25R-3, 114-116	706.64	27.01	37.00	1.744	2.356	1.273	45.97
25R-4, 32-34	707.32	27.41	37.75	1.796	2.510	1.304	48.05
25R-4, 120-122	708.20	25.11	33.53	1.856	2.550	1.390	45.49
25R-5, 70-72	709.20	27.90	38.70				
25R-5, 113-115	709.63	24.93	33.20	1.869	2.574	1.403	45.49
25R-6, 52-54	710.52	27.08	37.14	1.809	2.529	1.319	47.83
25R-6, 144-146	711.44	25.67	34.54	1.849	2.561	1.374	46.34
25R-7, 61-63	712.11	24.73	32.86	1.874	2.576	1.411	45.25
26R-1, 57-59	712.77	27.83	38.56	1.757	2.425	1.268	47.72
26R-1, 112-114	713.32	26.70	36.42	1.837	2.584	1.347	47.88
26R-2, 39-41	714.09	30.47	43.82	1.722	2.454	1.197	51.21
26R-2, 71-73	714.41	31.16	45.27				
26R-2, 128-130	714.98	24.76	32.91	1.881	2.595	1.415	45.47

Table 10 (continued).

Core, section, interval (cm)	Depth (mbsf)	Water content (bulk wt%)	Water content (dry wt%)	Bulk density (Mg/m ³)	Grain density (Mg/m ³)	Dry density (Mg/m ³)	Porosity (%)
26R-3, 49–51	715.69	26.07	35.27	1.821	2.510	1.346	46.35
26R-3, 115–117	716.35	25.99	35.12	1.846	2.569	1.366	46.83
26R-4, 36–38	717.06	24.23	31.98	1.894	2.599	1.435	44.79
26R-4, 111–113	717.81	24.92	33.19	1.889	2.623	1.418	45.94
27R-1, 44–46	722.34	22.87	29.65	1.922	2.596	1.482	42.90
27R-1, 100–102	722.90	22.92	29.74	1.915	2.584	1.476	42.86
27R-2, 44–46	723.84	22.73	29.41	1.896	2.528	1.465	42.05
27R-2, 140–142	724.80	23.22	30.24	1.869	2.490	1.435	42.36
27R-3, 85–87	725.75	23.03	29.93	1.927	2.618	1.483	43.34
27R-4, 29–31	726.69	24.25	32.02	1.857	2.510	1.406	43.96
28R-1, 14–16	731.74	23.21	30.23	1.908	2.581	1.465	43.24
28R-1, 70–72	732.30	22.24	28.60	1.932	2.587	1.502	41.93
28R-2, 86–88	733.96			2.000			
28R-3, 116–118	735.76	24.84	33.05	1.967	2.826	1.478	47.69
28R-4, 29–31	736.39	22.26	28.63	1.904	2.525	1.480	41.37
28R-4, 117–119	737.27	22.74	29.44	1.912	2.566	1.477	42.44
28R-5, 56–58	738.16	21.20	26.90	1.933	2.538	1.523	39.99
29R-1, 18–20	741.38	20.97	26.53	1.963	2.592	1.551	40.16
29R-1, 109–111	742.29	20.57	25.90	1.959	2.565	1.556	39.34
29R-2, 91–93	743.61	20.59	25.93	1.961	2.571	1.558	39.42
29R-2, 139–141	744.09	21.14	26.80	1.967	2.610	1.551	40.58
29R-3, 52–54	744.72	21.70	27.71	1.939	2.576	1.518	41.06
29R-3, 147–149	745.67	20.30	25.47	1.959	2.552	1.561	38.82
29R-4, 47–49	746.17	21.03	26.63	2.000	2.679	1.579	41.06
29R-4, 137–139	747.07	19.88	24.81	1.987	2.591	1.592	38.56
29R-5, 28–30	747.48	18.53	22.74	2.014	2.580	1.641	36.41
30R-1, 59–61	751.49	21.02	26.62	1.955	2.578	1.544	40.11
30R-1, 146–148	752.36	23.96	31.51	1.924	2.661	1.463	45.01
30R-2, 34–36	752.74	20.85	26.34	1.910	2.474	1.512	38.88
31R-1, 30–32	760.90	19.50	24.23	1.958	2.513	1.576	37.28
31R-1, 136–138	761.96	19.62	24.41	1.987	2.579	1.597	38.06
31R-2, 137–139	763.47	20.47	25.73	1.935	2.508	1.539	38.65
31R-3, 46–48	764.06	19.78	24.66	1.979	2.568	1.587	38.20
31R-4, 2–4	765.12	20.04	25.06	1.958	2.537	1.565	38.29
31R-4, 140–142	766.50	19.97	24.95	1.970	2.560	1.577	38.41
31R-5, 43–45	767.03	21.23	26.95	1.945	2.567	1.532	40.31
31R-6, 8–10	768.18	21.65	27.64	1.930	2.553	1.512	40.79
31R-6, 142–144	769.52	21.67	27.66	1.930	2.555	1.512	40.83
33R-1, 132–134	781.22	21.05	26.66	1.958	2.586	1.546	40.22
33R-2, 80–82	782.20	21.16	26.85	1.958	2.592	1.544	40.45
33R-3, 66–68	783.54	21.16	26.85	1.962	2.601	1.547	40.53
33R-4, 26–28	784.64	21.27	27.02	1.936	2.549	1.524	40.20
33R-4, 134–136	785.72	21.53	27.44	1.946	2.583	1.527	40.90
33R-5, 51–53	786.39	21.75	27.79	1.931	2.560	1.511	40.98
33R-5, 142–144	787.30	21.99	28.19	1.951	2.619	1.522	41.88
33R-6, 116–118	788.54	22.32	28.73	1.924	2.573	1.495	41.91
33R-7, 2–4	788.70	20.81	26.28	1.919	2.491	1.520	39.00
35R-1, 55–57	799.75	17.01	20.50	2.026	2.534	1.682	33.65
35R-2, 93–95	800.78	16.14	19.24	2.097	2.627	1.759	33.04
35R-3, 17–19	801.22	16.24	19.39	2.064	2.569	1.729	32.71

many of the log responses to increased lithification observed at other sites (Fig. 28).

Low and relatively constant gamma-ray values identify the increased carbonate content of lithologic Unit III (below 230 mbsf). Increased sonic velocity and resistivity values within Subunits IIIA and IIIB are attributable to increased rigidity and tortuosity of these carbonate-rich sediments. Sharp decreases in sonic velocity, density, and resistivity occur within Subunit IIIC as a result of enhanced biosiliceous sedimentation between 450 and 490 mbsf.

The individual K, U, and Th channels of the spectral natural gamma tool can be used to identify changes in terrigenous mineralogy (e.g., Fertl, 1979). As described for previous sites (see “Downhole Measurements” sections, “Site 926,” “Site 927,” and “Site 928” chapters, this volume), there are dramatic increases in K concentrations relative to Th near the Subunit IIA/IIIB boundary (Fig. 29). At Site 928, the decreased Th/K ratio above Subunit IIIB was shown to reflect increased abundances of illite relative to kaolinite based on X-ray mineralogy (see “Downhole Measurements” section, “Site 928” chapter, this volume). This mineralogy shift was coincident with the lithologic Subunit IIA/IIIB boundary at Sites 925, 926, and 927. The intermittent occurrence of resedimented material at Sites 928 and 929 appears to have affected the relative stratigraphic position of this mineralogic change.

This relative increase in illite over kaolinite occurs near 7.5–8 Ma at all sites (Fig. 30). The total or standard gamma-ray (SGR) log and

the respective Th/K ratios are shown as time series for Sites 925, 926, 927, 928, and 929 in Figure 30 (see “Sedimentation Rates” sections, “Site 925,” “Site 926,” “Site 927,” “Site 928,” and “Site 929” chapters, this volume, for age models). The latest Miocene (ca. 7.5–8 Ma) decrease in Th/K ratios is clearly apparent at all sites.

This mineralogical transition coincides with the onset of a steady increase in terrigenous sediment supply after 8 Ma at all sites (see “Sedimentation Rates” section, this chapter), most likely reflecting increases in Amazon terrigenous input. At DSDP Site 354, Zimmerman (1977) observed high kaolinite concentrations in middle Miocene sediments and a dramatic increase in illite concentrations near 8 Ma. The increased illite concentrations were attributed to the development and progradation of the Amazon River delta (e.g., Damuth and Kumar, 1975).

Comparison of Core and Log Physical Properties Measurements

Log compressional-wave velocities and bulk densities obtained at Hole 929E are plotted vs. depth in Figure 31 and compared with the laboratory measurements of the same properties obtained on cores retrieved at Holes 929A and 929E. The caliper record is also shown in Figure 31. Laboratory compressional velocities were corrected to in situ temperatures calculated using the 0.05°C/m gradient measured at Site 926 (see “Physical Properties” section, “Site 926” chapter).

Figure 14. Interstitial-water geochemistry vs. depth, Site 929.

However, neither the bulk densities nor the *P*-wave velocities were corrected for porosity rebound.

As observed at Sites 925 through 928, compressional-wave velocities measured downhole are very sensitive to borehole conditions (see above). A composite compressional-wave velocity profile is shown in Figure 31; this was obtained by using the highest of four redundant log velocity measurement configurations of the sonic digital tool (see also "Downhole Measurements" section, "Site 928" chapter, this volume). However, from about 230 mbsf to the top of the logged interval, all sonic log data (DTL and DTLF) were adversely affected by poor borehole conditions. Thus, the edited velocity profile shows erroneous low and high values that clearly depart from laboratory data and reflect poor borehole conditions (Fig. 31). A dominant feature in the core and log velocity profiles is the low-velocity interval within lithologic Subunit IIIC between 450 and 490 mbsf; this interval corresponds to a marked increase in biosiliceous components.

Laboratory compressional velocities are lower than the log velocities. Because of the small porosity rebound effect observed in the bulk-density data at this site (see below), the discrepancy between the two velocity profiles is most probably a result of the decrease in sediment elastic rigidity during core retrieval. This decrease in the elastic moduli results in lower laboratory velocities. Although some of the maxima and minima of the log profile are echoed in the laboratory profiles, the offsets between the log and laboratory profiles are not a simple function of sub-bottom depth. The magnitude of the

offset and its variability downhole argue either for unrecovered changes in sediment moduli associated with core disturbance, or for problems in the intercalibration of the successive methods used to measure *P*-wave velocity in sediment cores as consolidation takes place (see discussion in "Downhole Measurements" and "Physical Properties" sections, "Site 927" chapter, this volume).

The long-term trends in the core and log density profiles are well correlated throughout the common interval of measurement. However, above 420 mbsf, the log data exhibit sharp low density departures from this trend. The poor log density data (anomalously low values) can be attributed to borehole washout intervals (see Fig. 31, caliper log), which prevent the density logging tool from maintaining good contact with the borehole wall. As with the velocity data, the low-density biosiliceous interval between 450 and 490 mbsf is a dominant feature in both the core and log profiles.

Shore-based Log Processing

Shore-based log processing figures for Site 929 are presented at the end of this chapter and processed geochemical logs are shown in Figure 32. Shipboard calcium carbonate measurements are compared to the GST-derived oxides/carbonates. The normalization factor for the geochemical logs is displayed also. A lower normalization factor (Fig. 32) represents better counting statistics and therefore higher quality data. All shore-based log processing data are available on CD-ROM.

Table 11. Uncorrected and corrected acoustic velocity measured on discrete samples for all holes at Site 929.

Core, section, interval (cm)	Depth (mbsf)	Longitudinal acoustic velocity (m/s)	Transverse acoustic velocity (m/s)	Temperature (°C)	Corrected longitudinal velocity (m/s)	Corrected transverse velocity (m/s)
154-929A-						
1H-1, 25	0.25	1530	1549	21.9	1411	1428
1H-3, 73	3.73	1488	1497	21.9	1399	1407
2H-1, 66	5.16	1504	1503	21.9	1416	1416
2H-3, 68	8.18	1501	1508	21.9	1418	1425
2H-5, 24	10.74	1501	1503	21.9	1421	1423
3H-1, 50	14.5	1527	1475	21.9	1448	1401
3H-5, 98	20.98	1532	1526	21.9	1457	1451
3H-7, 21	23.21	1516	1511	21.9	1443	1439
4H-2, 88	25.88	1540	1540	21.7	1467	1467
4H-3, 59	27.09	1553	1546	21.7	1479	1473
4H-3, 111	27.61	1572	1529	21.7	1496	1457
4H-5, 109	30.59	1572	1558	21.7	1498	1485
5H-1, 63	33.63	1532	1532	21	1463	1463
5H-1, 124	34.24	1568	1532	21	1496	1463
5H-3, 30	36.3	1589	1571	21	1516	1500
5H-3, 110	37.1	1587	1568	21	1514	1497
5H-5, 19	39.19	1596	1577	21	1523	1506
5H-5, 96	39.96	1529	1555	21	1463	1486
6H-1, 45	42.95	1558	1558	21.4	1490	1490
6H-1, 87	43.37	1592	1586	21.4	1521	1516
6H-3, 26	45.76	1557	1546	21.4	1490	1480
6H-3, 108	46.58	1601	1558	21.4	1531	1492
6H-5, 54	48.92	1585	1561	21.4	1517	1495
7H-1, 121	53.21	1585	1565	20.9	1518	1500
7H-3, 54	55.54	1590	1555	20.9	1524	1492
7H-3, 118	56.18	1630	1596	20.9	1561	1530
7H-5, 35	58.35	1635	1609	20.9	1566	1542
7H-5, 114	59.14	1635	1589	20.9	1566	1524
8H-1, 78	62.28	1613	1574	22	1547	1511
8H-3, 85	65.35	1633	1571	22	1566	1509
8H-5, 87	68.37	1652	1596	22	1585	1533
9H-1, 75	71.75	1642	1599	22	1577	1537
9H-3, 79	74.79	1672	1615	22	1605	1553
9H-5, 87	77.87	1637	1596	22	1574	1536
10H-1, 75	81.25	1559	1589	22	1502	1530
10H-3, 77	84.27	1653	1593	22	1590	1535
10H-5, 75	87.25	1622	1672	22	1562	1609
10H-1, 75	81.25	1630	1586	22	1568	1527
10H-3, 76	84.26	1690	1645	22	1625	1583
10H-5, 78	87.28	1694	1652	22	1629	1590
11H-1, 75	90.75	1630	1586	22	1571	1530
11H-3, 76	93.76	1690	1645	22	1627	1585
11H-5, 78	96.78	1694	1652	22	1632	1593
12H-1, 85	100.35	1676	1676	22	1616	1616
12H-3, 77	103.27	1672	1609	22	1613	1554
12H-6, 77	107.77	1698	1632	22	1638	1577
13H-1, 76	109.76	1680	1622	21	1622	1568
13H-3, 76	112.76	1671	1589	21	1614	1538
13H-5, 77	115.77	1719	1655	21	1660	1600
14H-4, 75	123.08	1670	1662	21	1616	1608
14H-6, 61	124.75	1669	1723	21	1615	1666
15H-1, 75	128.75		1642	22		1591
15H-3, 78	131.78		1646	22		1595
15H-5, 77	134.77		1659	22		1608
16H-4, 24	137.97		1742	22		1687
16H-4, 51	138.24		1693	22		1641
17X-1, 122	148.32		1717	22		1666
17X-1, 33	147.43		1669	22		1620
17X-3, 33	150.43		1705	22		1655
17X-5, 57	153.67		1727	22		1676
17X-5, 128	154.38		1707	22		1658
18X-1, 49	157.29		1708	22		1659
18X-1, 97	157.77		1704	22		1656
18X-3, 39	160.19		1758	22		1707
18X-3, 133	161.13		1744	22		1694
18X-5, 40	163.2		1784	22		1732
18X-5, 124	164.04		1718	22		1670
19X-1, 60	167		1686	22		1641
19X-1, 95	167.35		1709	22		1662
19X-2, 62	168.52		1723	22		1676
19X-3, 34	169.74		1702	22		1656
19X-4, 22	171.12		1686	22		1641
20X-1, 95	177.05		1757	22		1710
20X-2, 72	178.32		1709	22		1665
20X-3, 91	180.01		1734	22		1689
20X-4, 64	181.24		1724	22		1680
20X-5, 95	183.05		1761	22		1715
20X-6, 69	184.29		1764	22		1718
21X-1, 66	186.36		1825	22		1777
21X-2, 86	188.06		1758	22		1713
21X-3, 67	189.37		1774	22		1729
21X-4, 44	190.64		1769	22		1724
21X-5, 92	192.62		1829	22		1782
22X-1, 52	195.92		1723	22		1682
22X-2, 64	197.54		1761	22		1718

Table 11 (continued).

Core, section, interval (cm)	Depth (mbsf)	Longitudinal acoustic velocity (m/s)	Transverse acoustic velocity (m/s)	Temperature (°C)	Corrected longitudinal velocity (m/s)	Corrected transverse velocity (m/s)
22X-4, 45	200.35		1741	22		1700
22X-5, 62	202.02		1723	22		1683
26X-1, 47	234.07	1882	1946	22	1842	1904
26X-3, 34	236.94	1858	1907	22	1819	1866
26X-5, 17	239.77	1842	1874	22	1805	1835
26X-6, 72	241.82	1994	2022	22	1952	1978
27X-1, 37	243.77	1851	1890	22	1815	1852
27X-1, 117	244.57	1720	1783	22	1689	1749
27X-2, 52	245.42	1793	1858	22	1759	1821
27X-2, 115	246.05	1842	1890	22	1806	1852
27X-3, 27	246.67	1774	1858	22	1741	1822
27X-3, 92	247.32	2153	2132	22	2105	2085
27X-4, 8	247.98	2139	2132	22	2092	2085
27X-4, 116	249.06	1815	1864	22	1781	1828
27X-5, 56	249.96	1677	1738	22	1648	1707
27X-6, 8	250.98	1823	1888	22	1789	1851
28X-1, 3	253.03	1954	1941	22	1916	1903
28X-1, 89	253.89	1739	1789	22	1709	1757
28X-2, 19	254.69	1781	1818	22	1749	1785
28X-2, 93	255.43	1732	1790	22	1702	1758
28X-3, 82	256.82	1704	1759	22	1675	1729
28X-3, 143	257.43	1727	1771	22	1698	1740
28X-4, 51	258.01	1716	1752	22	1688	1722
28X-4, 143	258.93	1964	1976	22	1927	1939
28X-5, 51	259.51	1874	1907	22	1841	1872
29X-1, 26	262.46	1690	1679	22	1663	1653
29X-2, 56	264.26	1839	1890	22	1807	1857
29X-2, 149	265.19	1679	1633	22	1653	1608
29X-3, 36	265.56	1673	1702	22	1647	1675
29X-3, 117	266.37	1670	1706	22	1644	1679
29X-4, 8	266.78	1706	1739	22	1680	1712
29X-4, 98	267.68	1731	1785	22	1704	1756
30X-1, 81	272.71	1766	1781	22	1739	1754
30X-1, 121	273.11	1739	1774	22	1712	1746
30X-2, 37	273.77	1850	1871	22	1820	1840
30X-2, 132	274.72	1689	1742	22	1665	1716
30X-3, 133	276.23	1781	1799	22	1754	1771
30X-4, 90	277.3	1713	1773	22	1688	1746
30X-5, 7	277.97	1735	1796	22	1709	1768
30X-5, 131	279.21	1730	1781	22	1705	1755
30X-6, 3	279.43	1898	1931	22	1868	1900
30X-6, 104	280.44	1727	1781	22	1702	1754
31X-1, 17	281.77	1715	1727	22	1691	1703
31X-3, 77	285.37	1772	1788	22	1747	1763
31X-3, 149	286.09	1698		22	1675	
31X-4, 3	286.13	1763	1752	22	1738	1728
31X-4, 105	287.15	1618	1583	22	1597	1563
31X-5, 3	287.63	1706		22	1684	
31X-6, 61	289.71	1758	1787	22	1734	1762
32X-1, 31	291.61	1644	1735	22	1623	1712
32X-1, 116	292.46	1774	1753	22	1750	1730
32X-2, 21	293.01	1724	1767	22	1701	1743
32X-2, 119	293.99	1831	1854	22	1806	1828
32X-3, 3	294.33	1710	1754	22	1688	1731
32X-3, 68	294.98	1724	1771	22	1702	1748
32X-4, 58	296.38	1843	1866	22	1818	1840
32X-4, 106	296.86		1728	22		1706
32X-5, 37	297.67	1752	1797	22	1730	1774
32X-5, 90	298.2	1752	1804	22	1730	1780
32X-6, 40	299.2	1677	1704	22	1657	1683
33X-1, 36	301.36	1793	1829	22	1770	1806
33X-1, 137	302.37	1752	1792	22	1731	1770
33X-2, 38	302.88	1748	1784	22	1727	1762
33X-2, 126	303.76	1766	1809	22	1745	1786
33X-3, 37	304.37	1855	1890	22	1832	1866
33X-3, 135	305.35	1752	1810	22	1732	1788
33X-4, 144	306.94	1718	1781	22	1699	1760
33X-4, 40	305.9	1818	1849	22	1796	1827
33X-5, 23	307.23	1811	1858	22	1789	1835
33X-5, 114	308.14	1749	1803	22	1729	1782
33X-6, 62	309.12	1819	1842	22	1798	1820
33X-6, 106	309.56	1756	1803	22	1736	1782
34X-1, 49	311.19	1719		22	1700	
34X-1, 126	311.96	1687	1693	22	1669	1675
34X-2, 60	312.8	1699	1774	22	1681	1754
34X-2, 143	313.63	1703	1687	22	1685	1669
34X-3, 104	314.74	1724	1788	22	1706	1768
34X-4, 33	315.53	1741	1874	22	1723	1853
34X-4, 94	316.14	1756	1788	22	1737	1769
34X-5, 145	318.15	1720	1752	22	1702	1734
34X-5, 9	316.79	1771	1736	22	1752	1718
34X-6, 84	319.04	1694	1694	22	1677	1677
34X-7, 7	319.77	1775	1808	22	1757	1789
35X-1, 89	321.29	1706	1753	22	1689	1735
35X-1, 111	321.51	1773	1787	22	1755	1769
35X-2, 73	322.63	1782	1828	22	1764	1809
35X-2, 144	323.34	1741	1749	22	1724	1732

Table 11 (continued).

Core, section, interval (cm)	Depth (mbsf)	Longitudinal acoustic velocity (m/s)	Transverse acoustic velocity (m/s)	Temperature (°C)	Corrected longitudinal velocity (m/s)	Corrected transverse velocity (m/s)
35X-3, 68	324.08	1742	1786	22	1725	1768
35X-3, 141	324.81	1663	1690	22	1648	1674
35X-4, 80	325.7	1812	1863	22	1794	1844
35X-4, 144	326.34	1797	1820	22	1779	1802
35X-5, 71	327.11	1805	1820	22	1787	1802
35X-5, 145	327.85	1763	1793	22	1746	1776
35X-6, 145	329.35	1763	1789	22	1747	1772
36X-1, 114	331.14	1771	1812	22	1755	1795
36X-2, 65	332.15	1875	1905	22	1857	1887
36X-2, 141	332.91	1868	1909	22	1851	1891
36X-3, 89	333.89	1727	1778	22	1712	1762
36X-3, 111	334.11	1922	1975	22	1904	1956
36X-4, 68	335.18	1771	1831	22	1756	1815
36X-4, 141	335.91	1744	1804	22	1729	1788
36X-5, 72	336.72	1925	1966	22	1907	1948
36X-5, 116	337.16	1789	1847	22	1774	1831
36X-6, 81	338.31	1896	1922	22	1879	1905
36X-6, 145	338.95	1918	1923	22	1901	1906
37X-1, 81	340.51	1809	1870	22	1794	1854
37X-1, 139	341.09	1851	1913	22	1836	1897
37X-2, 6	341.26	1825	1925	22	1810	1908
37X-2, 85	342.05	1839	1888	22	1824	1872
37X-3, 74	343.44	1843	1894	22	1828	1878
37X-3, 22	342.92	1926	1969	22	1910	1952
37X-4, 71	344.91	1789	1863	22	1775	1848
37X-4, 145	345.65	1815	1871	22	1801	1856
37X-5, 72	346.42	1814	1879	22	1800	1864
37X-5, 139	347.09	1835	1888	22	1821	1873
37X-6, 82	348.02	1888	1966	22	1873	1950
37X-7, 29	348.99	1996	2040	22	1980	2023
38X-1, 25	349.65	1853	1915	22	1839	1900
38X-1, 80	350.2	1929	1947	22	1914	1932
38X-2, 78	351.68	1959	2038	22	1944	2022
38X-2, 61	351.51	1864	1935	22	1851	1921
38X-3, 89	353.29	1752	1828	22	1740	1815
38X-3, 143	353.83	1927	1936	22	1913	1922
38X-4, 77	354.67	1936	1952	22	1922	1938
38X-4, 144	355.34	1985	1989	22	1971	1975
38X-5, 78	356.18	1908	1988	22	1895	1974
38X-5, 142	356.82	1763	1808	22	1752	1796
38X-6, 74	357.64	1718	1788	22	1708	1777
38X-6, 101	357.91	1852	1871	22	1840	1859
39X-1, 144	360.44	1930	1970	22	1918	1957
39X-1, 77	359.77	1770	1831	22	1759	1820
39X-2, 78	361.28	1855	1891	22	1844	1879
39X-2, 138	361.88	1938	1980	22	1926	1967
39X-3, 81	362.81	1913	1978	22	1901	1966
39X-3, 123	363.23	1793	1867	22	1783	1856
39X-4, 136	364.86	1900	1935	22	1889	1924
39X-4, 79	364.29	1887	1933	22	1876	1921
39X-5, 72	365.72	1832	1866	22	1822	1856
39X-5, 108	366.08	1934	1956	22	1923	1945
39X-6, 60	367.1	1792	1853	22	1783	1843
39X-6, 82	367.32	1874	1925	22	1864	1914
40X-5, 74	375.24	1881	1905	22	1872	1896
40X-3, 126	372.76	1970	2027	22	1960	2016
40X-2, 144	371.44	1891	1945	22	1882	1935
40X-4, 121	374.21	1974	1983	22	1964	1973
40X-5, 132	375.82	1971	1997	22	1962	1988
40X-6, 10	376.1	1871	1914	22	1863	1905
40X-3, 79	372.29	1872	1931	22	1863	1921
40X-2, 85	370.85	1792	1847	22	1783	1838
40X-1, 85	369.35	1892	1930	22	1882	1920
40X-4, 89	373.89	1774	1834	22	1766	1826
40X-1, 138	369.88	1853	1896	22	1844	1886
41X-1, 126	379.36	1966	2007	22	1958	1998
41X-1, 143	379.53	1863	1901	22	1856	1893
41X-2, 76	380.36	1836	1871	22	1829	1864
41X-2, 145	381.05	2131	2111	22	2122	2102
41X-3, 74	381.84	1866	1938	22	1859	1930
41X-3, 145	382.55	1961	2021	22	1953	2013
41X-4, 15	382.75	1687	1776	22	1681	1770
41X-4, 56	383.16	1965	2006	22	1958	1998
41X-4, 139	383.99	2100	2114	22	2092	2106
43X-1, 66	398.06	1848	1850	22	1845	1846
43X-1, 139	398.79	1814	1835	22	1811	1832
43X-2, 90	399.8	1831	1837	22	1828	1834
43X-3, 59	400.99	1891	1895	22	1888	1892
43X-4, 121	403.11	1777	1801	22	1775	1799
43X-4, 80	402.7	1862	1912	22	1859	1909
43X-6, 4	404.64	1784	1793	22	1782	1791
43X-5, 58	403.98	1785	1847	22	1783	1845
44X-1, 113	408.23	2147	2067	22	2145	2065
44X-2, 64	409.24	1972	1942	22	1971	1941
44X-3, 27	410.37	2182	2215	22	2181	2214
44X-3, 95	411.05	2239	2208	22	2238	2207
44X-4, 9	411.69	2192	2171	22	2191	2170

Table 11 (continued).

Core, section, interval (cm)	Depth (mbsf)	Longitudinal acoustic velocity (m/s)	Transverse acoustic velocity (m/s)	Temperature (°C)	Corrected longitudinal velocity (m/s)	Corrected transverse velocity (m/s)
44X-4, 102	412.62	2151	2196	22	2150	2195
44X-5, 28	413.38	2228	2203	22	2228	2203
44X-5, 104	414.14	2188	2295	22	2188	2295
44X-6, 49	415.09	2087	2081	22	2087	2081
44X-6, 131	415.91	1888	1884	22	1888	1884
45X-1, 22	416.92	1814	1877	22	1814	1877
45X-2, 138	419.58	1890	1891	22	1891	1892
45X-3, 99	420.69	1835	1916	22	1836	1917
45X-3, 143	421.13	1803	1815	22	1804	1816
45X-4, 51	421.71	2009	2111	22	2011	2113
45X-4, 140	422.6	2121	2143	22	2123	2145
45X-5, 33	423.03	2122	2132	22	2124	2134
46X-2, 13	428.03	2026	1951	22	2029	1954
47X-1, 10	436.2	2080	2186	22	2086	2192
47X-1, 141	437.51	1892	1944	22	1897	1949
47X-2, 38	437.98	1867	1910	22	1872	1915
47X-2, 109	438.69		1971	22		1977
47X-3, 60	439.7	1917	1911	22	1923	1916
47X-4, 4	440.64	1924	1887	22	1930	1893
47X-4, 83	441.43		2034	22		2041
47X-5, 10	442.2	1970	2105	22	1976	2112
47X-6, 44	444.04	2196	2205	22	2205	2214
47X-6, 145	445.05	1916	2048	22	1923	2056
48X-1, 54	446.24	2009	2080	22	2017	2088
48X-1, 121	446.91	1937	2073	22	1944	2081
48X-2, 43	447.63	2080	2142	22	2089	2151
48X-2, 91	448.11	1998	2032	22	2006	2040
48X-3, 6	448.76	2081	2126	22	2090	2135
48X-3, 80	449.5		1918	22		1926
48X-4, 16	450.36	1987	2059	22	1996	2068
48X-4, 64	450.84	2110	2183	22	2120	2193
48X-5, 6	451.76	1866	1880	22	1874	1888
48X-5, 121	452.91	1922	2002	22	1931	2011
48X-6, 29	453.49		1897	22		1905
49X-1, 62	455.92	2070	2071	22	2081	2082
49X-1, 97	456.27	1871	1966	22	1880	1976
49X-2, 139	458.19	1950	2049	22	1960	2060
49X-3, 50	458.8	2061	2140	22	2072	2152
49X-3, 106	459.36	1931	2040	22	1941	2051
49X-4, 7	459.87	1910	1940	22	1920	1950
49X-4, 143	461.23	1923	1996	22	1933	2007
49X-5, 6	461.36	1878	1984	22	1888	1995
49X-5, 119	462.49	1982	2031	22	1993	2043
49X-6, 140	464.2	1882	1975	22	1893	1987
49X-7, 21	464.51	1994	2042	22	2006	2055
50X-1, 38	465.38	1907	1993	22	1918	2005
50X-1, 131	466.31	2000	2100	22	2012	2114
50X-2, 42	466.92	1957	2013	22	1969	2026
50X-2, 128	467.78	1994	2071	22	2007	2085
50X-3, 15	468.15	1994	2091	22	2007	2105
50X-3, 87	468.87	2004	2108	22	2017	2123
50X-4, 49	469.99	1966	2023	22	1979	2037
50X-4, 125	470.75	1997	2080	22	2011	2095
50X-5, 72	471.72	2063	2142	22	2078	2158
50X-5, 124	472.24	1902	1994	22	1915	2008
50X-6, 25	472.75	2327	2405	22	2346	2425
50X-7, 7	474.07	1814	2131	22	1826	2147
51X-1, 29	474.89	1914	2003	22	1927	2018
51X-1, 118	475.78	1928	2004	22	1942	2019
51X-2, 66	476.76	1865	1949	22	1878	1963
51X-3, 63	478.23	1951	2051	22	1966	2067
51X-4, 45	479.55	2037	2131	22	2053	2149
51X-4, 87	479.97	1878	1977	22	1892	1992
51X-3, 148	479.08	2025	2113	22	2041	2130
51X-5, 105	481.65	1987	2080	22	2003	2098
51X-6, 87	482.97	1906	1957	22	1921	1973
51X-6, 16	482.26	1766	1841	22	1779	1855
51X-7, 17	483.77	1963	2041	22	1979	2058
52X-1, 27	484.47	1927	1996	22	1943	2013
52X-1, 105	485.25	1934	2016	22	1950	2033
52X-2, 64	486.34	1914	1975	22	1930	1992
52X-2, 147	487.17	1997	2063	22	2015	2082
52X-3, 146	488.66	1736		22	1749	
52X-4, 47	489.17	1900	1988	22	1916	2006
52X-4, 139	490.09	1746	1861	22	1760	1877
52X-5, 144	491.64	1998	2105	22	2017	2126
52X-6, 31	492.01	1846	1924	22	1862	1941
52X-6, 92	492.62	2224	2310	22	2247	2335
53X-1, 74	494.24	2157	2309	22	2179	2335
53X-1, 144	494.94	2080	2165	22	2101	2188
53X-2, 7	495.07	2103	2216	22	2125	2240
53X-2, 71	495.71	1893	1986	22	1911	2005
53X-3, 52	497.02	1906	2011	22	1924	2031
53X-3, 62	497.12	2021	2099	22	2041	2121
53X-4, 13	496.63	2124	2218	22	2146	2242
54X-1, 52	503.72	2191	2259	22	2217	2287
54X-1, 77	503.97	1794	1829	22	1811	1847

Table 11 (continued).

Core, section, interval (cm)	Depth (mbsf)	Longitudinal acoustic velocity (m/s)	Transverse acoustic velocity (m/s)	Temperature (°C)	Corrected longitudinal velocity (m/s)	Corrected transverse velocity (m/s)
54X-2, 69	505.39	1997	2084	22	2019	2108
54X-2, 106	505.76	2125	2186	22	2150	2212
54X-3, 89	507.09	2143	2201	22	2169	2228
54X-4, 95	508.65	1858	1871	22	1878	1891
55X-1, 23	508.03	1934	2022	22	1955	2045
56X-1, 4	517.84	2175	2253	22	2205	2285
154-929B-						
1H-2, 117	2.67	1505	1500	23	1411	1407
1H-4, 69	5.19	1508	1514	23	1420	1425
1H-6, 76	8.26	1500	1514	23	1418	1430
2H-2, 66	11.66	1511	1511	22.5	1431	1431
2H-4, 22	14.22	1526	1540	22.5	1447	1459
2H-6, 118	18.18	1524	1511	22.5	1448	1436
3H-2, 38	20.88	1524	1540	22.9	1449	1464
3H-4, 66	24.16	1519	1503	22.9	1447	1432
3H-6, 63	27.13	1552	1558	22.9	1478	1484
4H-2, 126	31.26	1552	1523	22.4	1480	1454
4H-4, 60	33.6	1542	1526	22.4	1472	1457
4H-6, 35	36.35	1560	1561	22.4	1490	1490
5H-2, 66	40.16	1555	1543	22.5	1486	1475
5H-4, 89	43.39	1584	1561	22.5	1514	1493
5H-6, 115	46.65	1582	1535	22.5	1514	1470
6H-2, 26	49.26	1604	1580	22.4	1535	1513
6H-4, 74	52.74	1553	1593	22.4	1489	1526
6H-6, 108	56.08	1606	1580	22.4	1539	1515
7H-2, 67	59.17	1584	1565	22.2	1519	1502
7H-4, 27	61.77	1608	1568	22.2	1542	1505
7H-6, 99	65.49	1612	1555	22.2	1547	1495
8H-2, 76	68.76	1609	1639	22.5	1545	1573
8H-4, 75	71.75	1648	1632	22.5	1582	1567
8H-6, 77	74.77	1625	1659	22.5	1562	1593
9H-2, 77	78.27	1630	1589	22.5	1567	1529
9H-4, 79	81.29	1653	1609	22.5	1590	1549
9H-6, 77	84.27	1608	1586	22.5	1549	1528
10H-2, 78	87.78	1667	1628	22.5	1604	1568
10H-4, 76	90.76	1648	1602	22.5	1587	1545
10H-6, 76	93.76	1650	1618	22.5	1590	1560
11H-2, 87	97.37	1592	1577	22.5	1537	1523
11H-4, 109	100.59	1698	1625	22.5	1636	1569
11H-6, 76	103.26	1682	1618	22.5	1622	1563
12H-2, 74	106.74	1690	1618	22.5	1631	1563
12H-4, 88	109.88	1682	1622	22.5	1624	1568
12H-6, 77	112.77	1722	1672	22.5	1662	1615
13H-2, 75	116.25	1710	1625	22.5	1652	1572
13H-4, 76	119.26		1662	22.5		1607
13H-5, 13	120.13	1621	1655	22.5	1569	1601
14H-2, 80	124.36	1549		21.5	1503	
14H-4, 77	124.33	1577	1620	21.5	1529	1569
14H-CC, 23	123.79	1584	1648	21.5	1535	1595
15X-3, 26	136.36	1617	1651	23	1569	1601
16X-1, 10	142.7		1648	23		1600
17X-2, 92	154.62	1648	1703	23	1602	1654
17X-4, 70	157.4		1684	23		1637
17X-6, 40	160.1	1622	1659	23	1579	1614
18X-2, 57	163.87	1648	1725	22.8	1604	1677
18X-4, 73	167.03	1639	1714	22.8	1596	1667
18X-4, 134	167.64		1659	22.8		1615
18X-6, 29	169.59	1659	1641	22.8	1616	1598
19X-2, 57	173.47	1648	1659	22.8	1606	1616
19X-4, 92	176.82	1659	1655	22.8	1617	1613
19X-6, 59	179.49	1642	1644	22.8	1601	1603
20X-1, 69	181.69		1666	23		1625
20X-4, 80	186.3		1669	23		1628
20X-6, 107	189.57	1679	1706	23	1639	1664
21X-2, 96	193.16		1692	23		1652
21X-4, 69	195.89		1691	23		1651
21X-6, 77	198.97		1673	23		1635
22X-2, 81	202.71		1640	23		1604
22X-4, 117	206.07		1657	23		1621
22X-6, 23	207.63		1654	23		1618
23X-2, 91	212.11		1631	23		1597
23X-4, 49	214.69		1634	23		1600
23X-6, 16	217.36		1652	23		1618
24X-1, 88	220.28		1571	23		1541
24X-5, 91	226.31		1627	23		1596
154-929D-						
4H-3, 30	29.3	1484	1536	21.5	1417	1465
4H-3, 90	29.9	1544	1558	21.5	1472	1485
4H-3, 130	30.3	1517	1524	21.5	1448	1454
4H-4, 30	30.8	1552	1552	21.5	1480	1480
4H-4, 56	31.06	1514	1506	21.5	1445	1438
4H-4, 93	31.43	1481	1536	21.5	1415	1466
4H-4, 146	31.96	1536	1539	21.5	1466	1469
154-929E-						
1R-1, 51	472.01	1822	1890	22	1834	1902

Table 11 (continued).

Core, section, interval (cm)	Depth (mbsf)	Longitudinal acoustic velocity (m/s)	Transverse acoustic velocity (m/s)	Temperature (°C)	Corrected longitudinal velocity (m/s)	Corrected transverse velocity (m/s)
1R-2, 46	472.57	2336	2339	22	2355	2358
1R-2, 138	473.49	1850	1937	22	1862	1950
1R-3, 42	474.03	1912	1990	22	1925	2004
1R-3, 119	474.8	1937	2031	22	1951	2046
1R-4, 11	475.22	1954	2070	22	1968	2086
1R-5, 146	478.07	1817	1894	22	1830	1908
1R-6, 40	478.51	1966	2013	22	1981	2029
1R-6, 107	479.18	1832	1889	22	1845	1903
1R-7, 99	480.6	1856	1914	22	1870	1929
1R-CC, 10	481.21	2023	2080	22	2039	2097
2R-1, 48	481.78	1972	2060	22	1988	2077
2R-1, 116	482.46	2150	2277	22	2169	2298
2R-2, 34	483.14	1924	1957	22	1939	1973
2R-2, 110	483.9	1744	1814	22	1757	1828
2R-3, 23	484.53	1817	1878	22	1831	1893
2R-3, 115	485.45	1814	1919	22	1828	1935
2R-5, 105	488.35	1785	1866	22	1799	1882
2R-6, 107	489.87	1792	1878	22	1807	1894
2R-CC, 4	489.96	1795	1940	22	1810	1957
3R-1, 10	491.1	1858	1932	22	1874	1949
3R-1, 138	492.38	1941	2047	22	1959	2067
3R-2, 40	492.9	1953	1969	22	1971	1987
3R-3, 107	495.07	1926	2102	22	1944	2124
4R-1, 29	501.09	2050	2154	22	2072	2178
4R-1, 127	502.07	1925	1915	22	1945	1934
4R-2, 132	503.62	2034	2122	22	2056	2146
4R-3, 16	503.96	2087	2163	22	2111	2188
4R-3, 17	503.97	1934	1967	22	1954	1988
5R-1, 32	510.72	2034	2160	22	2058	2187
5R-2, 58	512.48	2123	2174	22	2150	2202
5R-2, 139	513.29	1981	2086	22	2004	2112
5R-3, 23	513.63	1974	2049	22	1997	2074
5R-3, 121	514.61	1982	2100	22	2006	2127
5R-4, 45	515.35	2029	2097	22	2054	2124
6R-1, 65	520.65	2228	2363	22	2260	2399
6R-1, 119	521.19	2123	2206	22	2152	2238
6R-2, 6	521.56	2172	2252	22	2203	2285
6R-2, 95	522.45	2131		22	2161	
6R-3, 26	523.26	2006	2177	22	2033	2208
6R-3, 113	524.13	2077	2226	22	2106	2259
6R-4, 4	524.54	2163	2277	22	2194	2312
6R-4, 94	525.44	1993	1992	22	2020	2019
7R-1, 17	529.47	2025	2122	22	2054	2153
7R-2, 148	532.28	2061	2062	22	2091	2092
7R-3, 82	533.12	1873	1940	22	1898	1967
7R-3, 141	533.71	1837	1907	22	1861	1933
7R-CC, 11	534.17	1882	1916	22	1908	1943
8R-1, 38	539.38	2157	2271	22	2192	2310
8R-1, 135	540.35	2158	2195	22	2194	2232
8R-2, 51	541.01	2363	2445	22	2406	2491
8R-2, 129	541.79	2227	2350	22	2265	2393
8R-3, 21	542.21	2167	2281	22	2203	2321
8R-3, 147	543.47	2254	2378	22	2294	2422
8R-4, 61	544.11	2201	2343	22	2239	2386
9R-1, 5	548.65	2181	2332	22	2220	2376
9R-1, 110	549.7	2129	2252	22	2166	2294
9R-2, 135	551.45	2114	2175	22	2151	2214
9R-3, 41	552.01	2108	2199	22	2145	2240
9R-3, 93	552.53	2266	2352	22	2309	2399
9R-4, 38	553.48	2157	2245	22	2196	2288
9R-4, 90	554	2167	2245	22	2207	2288
10R-1, 41	558.71	2242	2328	22	2286	2376
10R-1, 135	559.65	2155	2228	22	2196	2272
10R-2, 23	560.03	2230	2352	22	2274	2401
10R-2, 89	560.69	2186	2296	22	2229	2343
10R-3, 55	561.85	2057	2172	22	2095	2214
10R-3, 130	562.6	2073	2228	22	2112	2273
10R-4, 23	563.03	2205	2325	22	2249	2374
10R-4, 120	564	2162	2284	22	2205	2332
10R-5, 27	564.57	2112	2160	22	2153	2203
10R-5, 93	565.23	2161	2181	22	2204	2225
10R-6, 64	566.44	2328	2580	22	2378	2642
10R-6, 132	567.12	2178	2180	22	2222	2224
11R-1, 33	568.23	2089	2210	22	2130	2256
11R-1, 135	569.25	2122	2232	22	2165	2279
11R-2, 48	569.88	2369	2420	22	2422	2476
11R-2, 90	570.3	2130	2346	22	2173	2398
11R-3, 8	570.98	2181	2353	22	2226	2406
11R-3, 69	571.59	2208	2315	22	2255	2366
11R-4, 52	572.92	2176	2284	22	2222	2335
11R-4, 122	573.62	2209	2317	22	2256	2369
11R-5, 27	574.17	2061	2073	22	2102	2115
11R-5, 40	574.3	2110	2394	22	2153	2450
11R-6, 143	576.83	2131	2286	22	2176	2338
12R-1, 4	577.54	2231	2352	22	2281	2407
12R-1, 144	578.94	2236	2401	22	2286	2459
12R-2, 42	579.42	2321	2423	22	2375	2482

Table 11 (continued).

Core, section, interval (cm)	Depth (mbsf)	Longitudinal acoustic velocity (m/s)	Transverse acoustic velocity (m/s)	Temperature (°C)	Corrected longitudinal velocity (m/s)	Corrected transverse velocity (m/s)
12R-2, 145	580.45	2028	2166	22	2070	2214
12R-3, 61	581.11	2052	2181	22	2095	2229
12R-3, 108	581.58	2240	2339	22	2291	2395
12R-4, 17	582.17	1978	2129	22	2018	2175
12R-4, 49	582.49	1894	2006	22	1931	2047
12R-4, 145	583.45	2177	2302	22	2226	2357
12R-5, 82	584.32	2288	2327	22	2342	2383
12R-5, 143	584.93	2192	2321	22	2242	2377
12R-6, 63	585.63	2315	2317	22	2371	2373
13R-1, 12	587.32	2270	2377	22	2325	2437
13R-1, 122	588.42	2247	2352	22	2301	2411
13R-2, 5	588.75	2292	2378	22	2348	2438
13R-2, 139	590.09	2319	2422	22	2377	2485
13R-3, 4	590.24	2308	2365	22	2365	2425
13R-3, 72	590.92	2372	2468	22	2433	2534
13R-4, 40	592.1	2223	2318	22	2277	2376
13R-4, 113	592.83	2348	2478	22	2408	2545
13R-5, 5	593.25	2235	2318	22	2290	2377
13R-5, 89	594.09	2271	2414	22	2328	2478
13R-6, 75	595.45	2103		22	2152	
14R-1, 36	597.26	2148	2233	22	2200	2289
14R-1, 124	598.14	2109	2155	22	2159	2207
14R-2, 49	598.89	2234	2381	22	2290	2445
14R-2, 145	599.85	2350	2446	22	2413	2514
14R-3, 58	600.48	2265	2391	22	2324	2456
14R-3, 125	601.15	2240	2390	22	2297	2455
14R-4, 61	602.01	2163	2305	22	2217	2366
14R-4, 133	602.73	2223	2356	22	2280	2420
14R-5, 83	603.73	2211	2313	22	2268	2375
14R-5, 138	604.28	2174	2283	22	2229	2344
14R-6, 28	604.68	2328	2468	22	2391	2539
14R-6, 148	605.88	2141	2264	22	2195	2324
15R-1, 86	607.36	2083	2228	22	2134	2287
15R-1, 137	607.87	2307	2435	22	2370	2506
15R-2, 5	608.05	2098	2242	22	2150	2302
15R-2, 77	608.77	2258	2386	22	2319	2454
15R-3, 71	610.21	2266	2363	22	2328	2430
15R-3, 145	610.95	2194	2314	22	2252	2379
15R-4, 72	611.72	2270	2381	22	2332	2450
15R-4, 138	612.38	2425	2516	22	2497	2593
15R-5, 49	612.99	2245	2329	22	2306	2395
15R-5, 138	613.88	2067	2170	22	2119	2228
15R-6, 95	614.95	2150	2327	22	2207	2394
15R-6, 44	614.44	2071	2192	22	2124	2251
16R-1, 63	616.73	2156	2300	22	2214	2366
16R-1, 139	617.49	2268	2394	22	2332	2466
16R-2, 4	617.64	2332	2431	22	2400	2505
16R-2, 94	618.54	2212	2317	22	2273	2384
16R-3, 41	619.51	2399	2432	22	2472	2507
16R-3, 145	620.55	2270	2394	22	2335	2467
16R-4, 43	621.03	2273	2401	22	2339	2474
16R-4, 114	621.74	2223	2326	22	2286	2395
16R-5, 89	622.99	2398	2540	22	2472	2623
16R-5, 118	623.28	2223	2280	22	2286	2347
16R-6, 65	624.25	2187	2320	22	2249	2390
17R-1, 21	626.01	2295	2226	22	2364	2290
17R-1, 75	626.55	2066	2157	22	2122	2218
17R-2, 54	627.84	2194	2278	22	2257	2346
17R-2, 122	628.52	2302	2410	22	2372	2487
17R-3, 59	629.39	2185	2299	22	2248	2369
17R-3, 118	629.98	2160	2267	22	2222	2335
17R-4, 11	630.41	2265	2350	22	2333	2424
17R-4, 90	631.2	2210	2329	22	2275	2401
17R-5, 62	632.42	2418	2522	22	2497	2608
17R-5, 95	632.75	2112	2198	22	2172	2263
17R-6, 63	633.93	2107	2263	22	2167	2332
17R-6, 79	634.09	2217	2299	22	2283	2371
18R-1, 10	635.4	2264	2352	22	2334	2427
18R-1, 134	636.64	2196	2339	22	2262	2414
18R-2, 45	637.25	2344	2473	22	2420	2557
18R-2, 141	638.21	2245	2431	22	2315	2513
18R-3, 40	638.7	2394	2464	22	2473	2548
18R-3, 141	639.71	2262	2418	22	2333	2499
18R-4, 82	640.62	2171	2314	22	2237	2389
18R-4, 10	639.9	2162	2247	22	2227	2317
18R-5, 62	641.92	1968	2142	22	2022	2206
18R-5, 138	642.68	2264	2413	22	2336	2495
19R-1, 44	645.44	2293	2418	22	2368	2502
19R-1, 86	645.86	2217	2290	22	2287	2365
19R-2, 31	646.81	2168	2299	22	2235	2375
19R-2, 142	647.92	2394	2544	22	2477	2638
19R-3, 52	648.52	2013	2142	22	2071	2208
19R-3, 114	649.14	2173	2277	22	2241	2352
19R-4, 85	650.35	2000	2142	22	2058	2209
19R-4, 148	650.98	2150	2230	22	2217	2303
19R-5, 53	651.53	2108	2254	22	2173	2328
19R-5, 121	652.21	2141	2219	22	2208	2291

Table 11 (continued).

Core, section, interval (cm)	Depth (mbsf)	Longitudinal acoustic velocity (m/s)	Transverse acoustic velocity (m/s)	Temperature (°C)	Corrected longitudinal velocity (m/s)	Corrected transverse velocity (m/s)
19R-6, 24	652.74	2154	2194	22	2222	2265
19R-6, 116	653.66	2196	2292	22	2267	2370
19R-7, 52	654.52	2213	2355	22	2286	2437
20R-1, 64	655.34	2288	2459	22	2366	2549
20R-1, 144	656.14	2268	2391	22	2345	2477
20R-2, 13	656.33	2261	2430	22	2337	2519
20R-2, 99	657.19	2161	2305	22	2231	2385
20R-3, 18	657.88	2128	2305	22	2196	2385
20R-3, 99	658.69	2115	2236	22	2182	2311
20R-4, 68	659.88	2206	2315	22	2280	2396
20R-4, 145	660.65	2070	2196	22	2135	2269
20R-5, 47	661.17	2010	2112	22	2071	2180
20R-5, 142	662.12	2162	2327	22	2234	2410
20R-6, 33	662.53	1995	2142	22	2056	2212
20R-6, 88	663.08	2031	2174	22	2094	2247
21R-1, 37	664.67	2138	2217	22	2209	2293
21R-1, 141	665.71	2015	2122	22	2078	2192
21R-2, 27	666.07	2085		22	2153	
21R-2, 107	666.87		2162	22		2235
21R-3, 33	667.63	2033	2151	22	2098	2223
21R-3, 141	668.71	2048	2153	22	2114	2226
21R-4, 17	668.97	2028	2140	22	2093	2212
21R-4, 105	669.85	1956	2059	22	2016	2126
21R-5, 42	670.72	2010	2150	22	2074	2223
22R-1, 65	674.55	1968	2086	22	2030	2156
22R-1, 127	675.17	1978		22	2041	
22R-2, 36	675.76	1982	2142	22	2045	2216
22R-2, 126	676.66	1995	2187	22	2059	2265
22R-3, 49	677.39	2015	2064	22	2081	2133
22R-3, 85	677.75	2081	2215	22	2152	2295
22R-4, 31	678.71	2108	2254	22	2181	2337
22R-4, 58	678.98	1964	2121	22	2027	2195
22R-5, 88	680.78	2007	2140	22	2073	2216
22R-5, 136	681.26	1968	2112	22	2032	2186
23R-1, 6	683.26	1954	2127	22	2017	2202
23R-1, 72	683.92	2023	2170	22	2091	2249
23R-1, 108	684.28	2014	2161	22	2082	2239
23R-2, 63	685.33	1972	2127	22	2037	2203
23R-2, 122	685.92	2093	2233	22	2167	2317
23R-3, 11	686.31	1964	2141	22	2029	2218
23R-3, 23	686.43	2084	2244	22	2157	2329
24R-1, 25	693.05	1907	2004	22	1970	2073
24R-1, 141	694.21	1991	2152	22	2060	2232
24R-2, 41	694.71	2033	2131	22	2105	2210
24R-2, 97	695.27	2113	2242	22	2191	2330
24R-3, 32	696.12	2000	2088	22	2070	2164
24R-3, 63	696.43	2039	2163	22	2112	2245
24R-4, 74	698.04	2071	2211	22	2146	2297
24R-4, 20	697.5	2039	2153	22	2112	2235
24R-5, 23	699.03	1932	2022	22	1998	2094
24R-5, 130	700.1	1982	2118	22	2052	2198
25R-1, 75	703.25	1991	2100	22	2062	2179
25R-1, 124	703.74	1822		22	1881	
25R-2, 57	704.57	1869	1966	22	1932	2036
25R-2, 131	705.31	1931	2053	22	1998	2129
25R-3, 38	705.88	1886	1994	22	1950	2066
25R-3, 115	706.65	1881	2007	22	1945	2080
25R-4, 33	707.33	1972	2066	22	2043	2144
25R-4, 121	708.21	1959	2071	22	2029	2149
25R-5, 71	709.21	1842		22	1904	
25R-5, 114	709.64	1978	2085	22	2050	2165
25R-6, 53	710.53	1954	2032	22	2024	2108
25R-6, 145	711.45	1954	2052	22	2024	2130
25R-7, 62	712.12	1963	2090	22	2034	2171
26R-1, 58	712.78	1899	1962	22	1966	2033
26R-1, 113	713.33	1987	2047	22	2060	2125
26R-2, 40	714.1	1886	1958	22	1952	2029
26R-2, 129	714.99	1899	2018	22	1966	2094
26R-3, 50	715.7	1995	2080	22	2070	2161
26R-3, 116	716.36	2019	2112	22	2096	2196
26R-4, 37	717.07	2050	2174	22	2129	2263
26R-4, 112	717.82	2009	2128	22	2085	2214
26R-2, 72	714.42	1837	1888	22	1900	1954
27R-1, 45	722.35	2061	2189	22	2142	2281
27R-1, 101	722.91	2124	2226	22	2211	2322
27R-2, 45	723.85	2156	2285	22	2246	2386
27R-2, 141	724.81	2122	2230	22	2209	2326
27R-3, 86	725.76	2154	2249	22	2244	2347
27R-4, 30	726.7	2102	2185	22	2188	2278
28R-1, 15	731.75	2065	2230	22	2149	2329
28R-1, 71	732.31	2173	2277	22	2267	2380
28R-4, 30	736.4	2183	2217	22	2279	2316
28R-4, 118	737.28	2110	2223	22	2200	2323
28R-5, 57	738.17	2303	2410	22	2411	2528
29R-1, 19	741.39	2276	2378	22	2382	2494
29R-1, 110	742.3	2361	2465	22	2476	2591
29R-2, 92	743.62	2282	2401	22	2390	2520

Table 11 (continued).

Core, section, interval (cm)	Depth (mbsf)	Longitudinal acoustic velocity (m/s)	Transverse acoustic velocity (m/s)	Temperature (°C)	Corrected longitudinal velocity (m/s)	Corrected transverse velocity (m/s)
29R-2, 140	744.1	2297	2409	22	2406	2529
29R-3, 53	744.73	2263	2380	22	2369	2498
29R-3, 148	745.68	2101	2233	22	2193	2337
29R-4, 48	746.18	2240	2203	22	2344	2304
29R-4, 138	747.08	2191	2346	22	2291	2461
29R-5, 29	747.49	2194	2419	22	2295	2542
30R-1, 60	751.5	2300	2342	22	2412	2458
30R-1, 147	752.37	2100	2162	22	2193	2261
30R-2, 35	752.75	1995	2153	22	2079	2251
31R-1, 31	760.91	2517	2603	22	2656	2752
31R-1, 137	761.97	2517	2542	22	2656	2684
31R-2, 138	763.48	2610	2645	22	2761	2800
31R-3, 47	764.07	2477	2513	22	2613	2653
31R-4, 141	766.51	2487	2617	22	2625	2770
31R-4, 3	765.13	2592	2542	22	2742	2686
31R-5, 44	767.04	2428	2456	22	2560	2591
31R-6, 9	768.19	2441	2527	22	2574	2670
31R-6, 143	769.53	2662	2559	22	2822	2707
33R-1, 135	781.25	2287	2465	22	2408	2607
33R-2, 81	782.21	2302	2452	22	2425	2592
33R-3, 67	783.55	2362	2441	22	2493	2581
33R-4, 27	784.65	2304	2380	22	2428	2513
33R-4, 135	785.73	2414	2561	22	2551	2716
33R-5, 52	786.4	2362	2417	22	2494	2555
33R-5, 143	787.31	2365	2461	22	2497	2605
33R-6, 117	788.55	2100	2218	22	2204	2334
33R-7, 3	788.71	1989	2140	22	2082	2248
35R-1, 56	799.76	2388	2487	22	2528	2639
35R-2, 94	800.79	2288	2392	22	2417	2533
35R-3, 18	801.23	2393	2517	22	2534	2674

Figure 15. Calcium carbonate, percentage of color reflectance in the green (550 nm) band, and organic carbon vs. depth, Site 929. Lithologic unit boundaries are shown on the right side of the diagram.

SUMMARY AND CONCLUSIONS

Situated on the northern flank of the Ceara Rise, at a depth of 4356 m, Site 929 is located below today's carbonate lysocline, and was close to the CCD as recently as the last glacial maximum. It is the deepest member of the Ceara Rise depth transect cored during Leg 154 and the site most likely to have been affected by dissolution in the

Figure 16. Calcium carbonate and noncarbonate accumulation rates vs. depth for Site 929. Solid dots represent values calculated from discrete carbonate and associated dry-bulk-density measurements. The age and sedimentation rates for each sample were based on linear interpolation between selected age datums (see "Sedimentation Rates" section, this chapter). The thick solid line in the plots is the mean value of the MARs between each of the selected age datums. Lithologic unit boundaries are shown on the right side of the diagram.

Figure 17. Mean calcium carbonate and noncarbonate accumulations vs. age for Sites 925, 926, 928, and 929. The water depth for each site is indicated. Note that the scale for the carbonate is twice the range of the noncarbonate MAR in the separate plots.

Figure 18. GRAPE bulk-density data vs. depth for the three long APC holes at Site 929.

past. Thus, it is the site best located for the purpose of quantifying past rates of dissolution. Site 929 also provided the longest stratigraphic section recovered during Leg 154, with a virtually complete section to the base of the Eocene.

Even at this depth, calcareous microfossils were present throughout most of the section cored. Red clay was encountered in the lower Pliocene and within several intervals of the Miocene. Recovery of this clay was difficult, particularly in its upper part, so that the generation of a composite section was only fully successful down to a depth of about 140 mcd (see "Composite Section" section, this chapter). This upper section was cored in triplicate to provide sufficient material for detailed, high-resolution paleoceanographic investigations over the complete depth transect through the late Neogene. Despite the reduced carbonate contents caused by more intense dissolution at this site than at the shallower sites, the high-resolution lithologic cycles that were monitored by MST and reflectance data (Fig. 11) can be correlated in detail to the records from these shallower sites without difficulty. Sporadic, distinct, thin distal turbidites containing quartz and feldspar and clearly originating in the Amazon are confined to glacial stages of the past 1 m.y. Although displaced material also

Figure 19. Comparison of the bulk densities in the upper 50 mbsf of Holes 925D and 929B as measured by the GRAPE instrument. Note that bulk densities at the shallower, more carbonate-rich Site 925 are systematically higher in the uppermost 20 m.

occurs intermittently deeper in the section, as is to be expected at this location, it has in all other cases originated at shallower depths on the Ceara Rise rather than from the Amazon Fan.

Below the highly dissolved Miocene sediments, an almost continuous sequence through the entire Oligocene and Eocene and into the upper Paleocene was recovered. The Paleogene sequence is re-

Table 12. Undrained shear strength from miniature vane shear measurements and unconfined compression test results from the pocket penetrometer for Holes 929A, 929B, and 929C.

Core, section, interval (cm)	Depth (mbsf)	Undrained shear strength (kPa)	Pocket penetrometer (kg/cm ²)	Core, section, interval (cm)	Depth (mbsf)	Undrained shear strength (kPa)	Pocket penetrometer (kg/cm ²)
154-929A-				14H-7, 80	126.35		1.75
1H-1, 13	0.13	4.9		15H-1, 80	128.8		1.6
1H-3, 60	3.6	5.2		15H-1, 81.1	128.811	75.1	
2H-1, 60	5.1	10.6		15H-2, 80	130.3		1.9
2H-3, 56	8.06	8.2		15H-3, 80	131.8		1.75
2H-5, 56	11.06	11.8		15H-3, 83.4	131.834	90.5	
3H-2, 58	16.08	13.7		15H-4, 80	133.3		1.8
3H-5, 58	20.58	19.5		15H-5, 80	134.8		1.9
3H-7, 37	23.37	17.8		15H-5, 84.2	134.842	81.8	
4H-2, 97	25.97	21.4		16H-4, 18.3	137.913	85.9	
4H-3, 70	27.2	21.7		16H-4, 54.5	138.275	92.6	
4H-5, 95	30.45	25.4		16X-1, 80	138.3		1.1
5H-1, 135	34.35	24.7		16X-2, 80	139.8		1.9
5H-3, 125	37.25	21.7		16X-3, 80	141.3		2.6
5H-5, 70	39.7	26		16X-4, 30	142.3		2.7
6H-1, 96	43.46	23.9		18X-1, 80	157.6		2.6
6H-3, 95.1	46.451	26.1		18X-2, 80	159.1		3.1
6H-5, 64	49.02	23.3		18X-3, 75	160.55		3.25
7H-1, 136.8	53.368	22.8		18X-4, 84	162.14		2.6
7H-3, 101.8	56.018	31.7		18X-5, 45	163.25		3.75
7H-5, 100.9	59.009	35.3		18X-6, 17	164.47		2.2
8H-1, 80	62.3		0.55	19X-1, 75	167.15		2.0
8H-1, 85.8	62.358	39.1		19X-2, 83	168.73		2.3
8H-2, 80	63.8		0.6	19X-3, 46	169.86		2.1
8H-3, 76.8	65.268	45.5		19X-4, 33	171.23		1.7
8H-3, 80	65.3		0.75	20X-1, 86	176.96		2.5
8H-4, 80	66.8		0.85	20X-2, 80	178.4		2.0
8H-5, 77.4	68.274	45.7		20X-3, 80	179.9		1.75
8H-5, 80	68.3		1.0	20X-4, 80	181.4		1.75
8H-6, 80	69.8		0.75	20X-5, 80	182.9		3.0
8H-7, 20	70.7		0.9	21X-1, 80	186.5		2.25
9H-1, 80	71.8		1.0	21X-2, 80	188		3.75
9H-1, 81.9	71.819	51.9		21X-3, 80	189.5		4.25
9H-2, 80	73.3		1.0	22X-1, 70	196.1		2.75
9H-3, 80	74.8		0.8	22X-2, 70	197.6		3.2
9H-3, 85	74.85	47.8		22X-3, 70	199.1		2.75
9H-4, 80	76.3		0.55	22X-4, 70	200.6		4.2
9H-5, 80	77.8		0.75	22X-5, 70	202.1		4.3
9H-5, 93.2	77.932	37		23X-1, 80	205.9		4.3
9H-6, 80	79.3		0.7	23X-1, 115	206.25		4.25
9H-7, 20	80.2		0.8				
10H-1, 80	81.3		0.8	154-929B-			
10H-1, 82.3	81.323	41.7		1H-4, 61	9.94	5.4	
10H-2, 80	82.8		1.1	1H-6, 68	10.01	8.5	
10H-3, 80	84.3		1.0	1H-2, 127	10.6	6	
10H-3, 82.8	84.328	46.8		2H-4, 32	19.26	9.3	0.3
10H-4, 80	85.8		0.8	2H-2, 56	19.5	11.0	0.25
10H-5, 80	87.3		1.2	2H-6, 107	20.01	16.5	0.3
10H-5, 83.5	87.335	48.9		3H-2, 50	28.94	14.3	0.4
10H-6, 80	88.8		0.75	3H-6, 51	28.95	16.2	0.5
10H-7, 30	89.3		0.8	3H-4, 54	28.98	14.3	0.3
11H-1, 80	90.8		0.7	4H-6, 47	38.47	18.0	0.4
11H-1, 82.7	90.827	41.1		4H-4, 51	38.51	19.5	0.3
11H-2, 80	92.3		1.0	4H-2, 137	39.37	30.7	0.25
11H-3, 80	93.8		1.2	5H-2, 47	47.91	24.1	0.25
11H-3, 82.9	93.829	64.8		5H-4, 98	48.42	24.4	0.4
11H-4, 80	95.3		1.3	5H-6, 102	48.46	24.1	0.4
11H-5, 80	96.8		1.1	6H-2, 8	57.05	23.3	0.25
11H-5, 85.6	96.856	64.3		6H-4, 89	57.86	22.1	0.5
11H-6, 80	98.3		1.25	6H-6, 97	57.94	18.1	0.25
11H-7, 20	99.2		1.5	7H-4, 11	66.54	37.0	0.25
12H-1, 80	100.3		1.3	7H-2, 53	66.96	27.7	0.3
12H-1, 90.7	100.407	89.5		7H-6, 77	67.2	40.2	0.35
12H-2, 80	101.8		1.1	8H-1, 80	67.3		0.7
12H-3, 69.3	103.193	64.8		8H-2, 85	77.01	42.2	0.25
12H-3, 80	103.3		1.25	8H-3, 80	70.3		0.5
12H-4, 80	104.8		1.3	8H-4, 67	76.83	36.2	0.4
12H-5, 80	106.3		1.25	8H-4, 80	71.8		0.6
12H-6, 80	107.8		1	8H-5, 80	73.3		0.5
12H-6, 85.7	107.857	65.8		8H-6, 70	76.86	45.2	0.6
12H-7, 20	108.7		1.9	8H-6, 80	74.8		0.8
13H-1, 80	109.8		1.3	8H-7, 40	75.9		0.75
13H-1, 82.7	109.827	68.9		9H-1, 80	76.8		0.65
13H-2, 80	111.3		1.4	9H-2, 80	78.3		0.65
13H-3, 80	112.8		1.1	9H-2, 83	86.05	34.8	1
13H-3, 82.8	112.828	63.3		9H-3, 80	79.8		0.7
13H-4, 80	114.3		1.25	9H-4, 80	81.3		0.75
13H-5, 80	115.8		1.6	9H-4, 85	86.07	36.2	1.25
13H-5, 88.2	115.882	83.3		9H-5, 80	82.8		0.65
13H-6, 80	117.3		1.5	9H-6, 69	85.91	20.4	1.5
14H-4, 80	123.13		1.75	9H-6, 80	84.3		0.4
14H-4, 83.5	123.165	89.5		9H-7, 10	84.9		0.7
14H-5, 20	124.03		1.5	10H-1, 80	86.3		0.8
14H-6, 68	124.82	70		10H-2, 80	87.8		0.9
14H-6, 80	124.94		1.5	10H-2, 85	95.98	52.3	1.25

Table 12 (continued).

Core, section, interval (cm)	Depth (mbsf)	Undrained shear strength (kPa)	Pocket penetrometer (kg/cm ²)	Core, section, interval (cm)	Depth (mbsf)	Undrained shear strength (kPa)	Pocket penetrometer (kg/cm ²)
10H-3, 80	89.3		1.2	19X-6, 50	181.29	176.8	
10H-4, 80	90.8		0.7	20X-1, 75	181.75		1.8
10H-4, 83	95.96	30.3	2.25	20X-2, 75	183.25		2.2
10H-5, 80	92.3		0.72	20X-3, 75	184.75		2.1
10H-6, 80	93.8		1	22X-4, 115	206.05		4.1
10H-6, 83	95.96	47.5	1.25	22X-5, 60	207		4.25
10H-7, 30	94.8		0.8	22X-6, 30	207.7		3.75
11H-1, 80	95.8		0.5	23X-1, 90	210.6		4.5
11H-2, 80	97.3		0.5	23X-2, 100	212.2		4
11H-2, 93	105.4	22.3	1.6	23X-3, 100	213.7		3.9
11H-3, 80	98.8		0.9	23X-4, 56	214.76		3.25
11H-4, 80	100.3		0.6	23X-5, 56	216.26		3.8
11H-4, 114	105.61	44.4	1	23X-6, 10	217.3		3.75
11H-5, 80	101.8		0.8				
11H-6, 80	103.3		1	154-929C-			
11H-7, 20	104.2		0.7	3H-1, 80	22.8		0.25
11H-6, 81	105.28	60.5	1.7	3H-2, 80	24.3		0.3
12H-1, 80	105.3		0.75	3H-3, 80	25.8		0.3
12H-2, 80	106.8		1.4	3H-4, 80	27.3		0.4
12H-2, 83	114.93	76.4	1.75	3H-5, 80	28.8		0.3
12H-3, 80	108.3		1.2	3H-6, 80	30.3		0.5
12H-4, 80	109.8		1.25	3H-7, 30	31.3		0.25
12H-4, 94	115.04	42.4	2	4H-1, 80	32.3		0.3
12H-5, 80	111.3		1.7	4H-2, 80	33.8		0.4
12H-6, 80	112.8		1.7	4H-3, 80	35.3		0.25
12H-6, 82	112.82	89.1	2.9	4H-4, 80	36.8		0.4
12H-7, 50	114		1.4	4H-5, 80	38.3		0.4
13H-1, 80	114.8		0.9	4H-6, 80	39.8		0.25
13H-2, 80	116.3		1.4	4H-7, 30	40.8		0.5
13H-2, 87	124.43	41.6	2.8	5H-1, 80	41.8		0.25
13H-3, 80	117.8		1.5	5H-2, 80	43.3		0.3
13H-4, 80	119.3		1.4	5H-3, 80	44.8		0.25
13H-4, 85	124.41	78.4	2.75	5H-4, 80	46.3		0.35
13H-5, 80	120.8		1.5	5H-5, 80	47.8		0.25
13H-6, 20	123.76	38.2	2.25	5H-6, 80	49.3		0.4
13H-6, 80	122.3		1.25	5H-7, 30	50.3		0.6
13H-7, 20	123.2		1.5	13H-1, 80	117.8		1
14X-1, 9	123.65	110.1	3.25	13H-2, 80	119.3		1.25
14X-1, 80	124.3		0.8	13H-3, 80	120.8		1.5
14X-2, 80	125.8		1.4	13H-4, 80	122.3		1.25
14X-2, 86	124.42	65.1	2.2	13H-5, 80	123.8		2.25
14X-3, 80	127.3		1.5	13H-6, 80	125.3		1.25
14X-4, 87	124.43	80.6	2.75	13H-7, 20	126.2		1.6
14X-4, 80	128.8		1.25	15X-1, 80	136.9		1
14X-5, 80	130.3		1.5	15X-2, 80	138.4		1.7
14X-CC, 13	131.05	101.8	3.5	15X-3, 80	139.9		1.75
14X-CC, 30	131.2		1.9	15X-4, 80	141.4		2
14X-CC, 33	131.23	104.9	3.4	15X-5, 80	142.9		2.9
15X-1, 80	133.9		1.4	15X-6, 80	144.4		2.8
15X-2, 80	135.4		1.25	15X-7, 20	145.3		2.75
15X-3, 30	136.4		2	16X-1, 80	146.4		2.25
15X-3, 32	136.42	94.6		16X-2, 78	147.88	86.6	
16X-1, 10	142.7		2.3	16X-2, 80	147.9		2.2
17X-1, 80	153		1.9	16X-3, 80	149.4		2.75
17X-2, 80	154.5		2.75	16X-3, 87	149.47	94.6	
17X-3, 80	156		1.7	16X-4, 80	150.9		3.4
17X-4, 80	157.5		2.25	16X-4, 88	150.98	111.4	
18X-1, 80	162.6		2	16X-5, 80	152.4	137	3.5
18X-2, 80	164.1		2.25	16X-6, 86	153.96	183.9	
18X-3, 80	165.6		3.3	16X-CC, 16	153.18		3.25
19X-1, 75	172.15		2.5	18X-1, 80	165.4	156.5	
19X-2, 75	173.65		3.1	18X-2, 80	166.9	142.3	
19X-3, 75	175.15		3.2	18X-3, 80	168.4	145	
19X-4, 75	176.65		2.8	18X-4, 80	169.9	178.6	
19X-5, 75	178.15		2.75	18X-5, 80	171.4	148.5	
19X-6, 70	179.6		3.1	18X-6, 30	172.9	128.2	

markedly homogeneous, being characterized throughout by cyclic alternations of darker and paler greenish gray chalks and clays grading into limestone and claystone. In the Paleocene, there apparently was a significant change to a more uniform lithology lacking obvious cyclicity; unfortunately, only five cores were recovered from this section. Although the preservation of calcareous microfossils varies with carbonate content, it is good enough to provide excellent age control in this tropical sequence. Both the Oligocene sequence that was cored with the XCB, and the Eocene that was cored with the RCB had good recovery of over 70%; the sedimentary cyclicity was successfully documented by magnetic susceptibility and natural gamma measured on the MST and by color measured using the handheld

spectrophotometer. To further test the value of the natural gamma tool, which is a relatively recent addition to the MST on *JOIDES Resolution*, the Pleistocene section of Hole 929D was analyzed in high resolution with long enough counting times (100 s) to permit the information provided by the discrete energy channels to be exploited.

The sedimentation rate variability at Site 929 parallels the changes observed in other Ceara Rise site locations (Fig. 13). A late Neogene increase in overall sedimentation rate is caused by an increase in the terrigenous mass accumulation rate at about 8 Ma (Fig. 17). This increase correlates with a change in the clay mineralogy from kaolinite to illite dominance as recorded in the Th/K ratio in the downhole log data (Figs. 29 and 30). Terrigenous sedimentation increased most

Table 13. Resistivities measured from the small ODP probe for all holes at Site 929.

Core, section, interval (cm)	Depth (mbsf)	Resistivity (Ω m)	Core, section, interval (cm)	Depth (mbsf)	Resistivity (Ω m)	Core, section, interval (cm)	Depth (mbsf)	Resistivity (Ω m)	Core, section, interval (cm)	Depth (mbsf)	Resistivity (Ω m)
154-929A-			14H-6, 80	124.94	0.1475	31X-6, 85	289.95	0.31	48X-6, 80	454	0.425
1H-1, 83	0.83	0.0615	14H-7, 80	126.35	0.1475	32X-1, 80	292.1	0.39	48X-7, 15	454.55	0.3925
1H-1, 20	0.2	0.06	15H-1, 80	128.8	0.145	32X-2, 80	293.6	0.475	49X-1, 80	456.1	0.4175
1H-2, 20	1.7	0.052	15H-2, 80	130.3	0.1525	32X-3, 80	295.1	0.4025	49X-2, 80	457.6	0.41
1H-2, 90	2.4	0.0605	15H-3, 80	131.8	0.1625	32X-4, 80	296.6	0.365	49X-3, 80	459.1	0.475
1H-3, 20	3.2	0.05175	15H-4, 80	133.3	0.14	32X-5, 80	298.1	0.46	49X-4, 80	460.6	0.4475
1H-3, 90	3.9	0.0585	15H-5, 80	134.8	0.145	32X-6, 80	299.6	0.4175	49X-5, 80	462.1	0.4125
2H-1, 75	5.25	0.06275	16X-1, 80	138.3	0.1225	33X-1, 80	301.8	0.46	49X-6, 80	463.6	0.3125
2H-2, 75	6.75	0.054	16X-2, 80	139.8	0.13	33X-2, 80	303.3	0.3825	49X-7, 30	464.6	0.48
2H-3, 75	8.25	0.05575	16X-3, 80	141.3	0.1325	33X-3, 80	304.8	0.37	50X-1, 80	465.8	0.415
2H-4, 75	9.75	0.05375	16X-4, 30	142.3	0.1475	33X-4, 80	306.3	0.3325	50X-2, 80	467.3	0.3875
2H-5, 75	11.25	0.05375	17X-1, 94	148.04	0.143	33X-5, 80	307.8	0.3175	50X-3, 80	468.8	0.4425
2H-6, 75	12.75	0.05325	17X-2, 94	149.54	0.14225	33X-6, 80	309.3	0.345	50X-4, 80	470.3	0.38
3H-1, 52	14.52	0.06425	17X-3, 94	151.04	0.126	33X-7, 20	310.2	0.46	50X-5, 80	471.8	0.3425
3H-2, 50	16	0.06175	17X-4, 95	152.55	0.1285	34X-1, 80	311.5	0.4275	50X-6, 80	473.3	0.34
3H-3, 50	17.5	0.058	17X-5, 60	153.7	0.1245	34X-2, 80	313	0.4125	50X-7, 20	474.2	0.36
3H-4, 54	19.04	0.062	18X-2, 80	159.1	0.1645	34X-3, 80	314.5	0.3175	51X-1, 80	475.4	0.3075
3H-5, 100	21	0.06375	18X-1, 80	157.6	0.136	34X-4, 80	316	0.45	51X-2, 80	476.9	0.275
3H-6, 100	22.5	0.06625	18X-3, 75	160.55	0.132	34X-5, 80	317.5	0.4175	51X-3, 80	478.4	0.32
3H-7, 28	23.28	0.06375	18X-4, 84	162.14	0.1255	34X-6, 80	319	0.3775	51X-4, 80	479.9	0.34
4H-1, 75	24.25	0.064	18X-5, 45	163.25	0.1235	34X-7, 20	319.9	0.3575	51X-5, 80	481.4	0.39
4H-2, 75	25.75	0.064	18X-6, 17	164.47	0.1365	35X-1, 50	320.9	0.215	51X-6, 50	482.6	0.4825
4H-3, 75	27.25	0.0635	19X-1, 75	167.15	0.13375	35X-2, 35	322.25	0.2175	52X-1, 77	484.97	0.25525
4H-4, 75	28.75	0.0635	19X-2, 83	168.73	0.12975	35X-3, 50	323.9	0.2575	52X-2, 120	486.9	0.27125
4H-5, 75	30.25	0.06275	19X-3, 46	169.86	0.1395	35X-4, 50	325.4	0.2625	52X-3, 140	488.6	0.27625
4H-6, 65	31.65	0.06325	19X-4, 33	171.23	0.12925	35X-5, 50	326.9	0.225	52X-4, 80	489.5	0.29625
5H-1, 80	33.8	0.0705	20X-1, 86	176.96	0.129	36X-1, 50	330.5	0.21	52X-5, 104	491.24	0.3425
5H-2, 80	35.3	0.0685	20X-2, 80	178.4	0.131	36X-4, 40	334.9	0.27			
5H-3, 80	36.8	0.075	20X-3, 80	179.9	0.10675	36X-5, 50	336.5	0.2525	154-929B-		
5H-4, 80	38.3	0.069	20X-4, 80	181.4	0.12	36X-6, 60	338.1	0.2475	1H-1, 10	0.1	0.082
5H-4, 102	38.52	0.06875	20X-5, 80	182.9	0.121	37X-1, 56	340.26	0.24	1H-1, 115	1.15	0.07575
5H-5, 80	39.8	0.07175	20X-6, 80	184.4	0.10725	37X-2, 90	342.1	0.2675	1H-2, 68	2.18	0.08075
5H-6, 80	41.3	0.074	21X-1, 80	186.5	0.13025	37X-3, 60	343.3	0.3075	1H-3, 75	3.75	0.07925
6H-1, 83	43.33	0.082	21X-2, 80	188	0.1325	37X-4, 65	344.85	0.26	1H-4, 75	5.25	0.07775
6H-2, 83	44.83	0.075	21X-3, 80	189.5	0.1125	37X-5, 75	346.45	0.2725	1H-5, 75	6.75	0.08425
6H-3, 83	46.33	0.07575	21X-4, 80	191	0.109	37X-6, 85	348.05	0.25	1H-6, 75	8.25	0.083
6H-4, 85	47.85	0.0825	21X-5, 80	192.5	0.12825	38X-1, 90	350.3	0.2525	2H-1, 120	10.7	0.08525
6H-5, 74	49.12	0.08125	21X-6, 80	194	0.11425	38X-2, 90	351.8	0.2325	2H-2, 120	12.2	0.0805
6H-6, 80	50.68	0.0825	22X-1, 70	196.1	0.143	38X-3, 90	353.3	0.2525	2H-3, 120	13.7	0.0805
7H-1, 30	52.3	0.09575	22X-2, 70	197.6	0.129	38X-4, 90	354.8	0.245	2H-4, 30	14.3	0.078
7H-2, 60	54.1	0.07675	22X-3, 70	199.1	0.1095	38X-5, 90	356.3	0.235	2H-5, 30	15.8	0.082
7H-3, 60	55.6	0.08425	22X-4, 70	200.6	0.1215	38X-6, 66	357.56	0.255	2H-6, 30	17.3	0.08075
7H-4, 60	57.1	0.07375	22X-5, 70	202.1	0.1385	39X-1, 70	359.7	0.225	2H-7, 30	18.8	0.07925
7H-5, 60	58.6	0.07925	22X-6, 70	203.6	0.14375	39X-2, 70	361.2	0.3025	3H-1, 70	19.7	0.084
7H-6, 60	60.1	0.0875	23X-1, 80	205.9	0.119	39X-3, 70	362.7	0.3025	3H-2, 48	20.98	0.08275
7H-7, 50	61.5	0.06875	23X-1, 115	206.25	0.117	39X-4, 70	364.2	0.26	3H-3, 70	22.7	0.07775
8H-1, 80	62.3	0.11	23X-2, 80	207.4	0.12625	39X-5, 70	365.7	0.265	3H-3, 103	23.03	0.0805
8H-2, 80	63.8	0.1025	23X-3, 80	208.9	0.10975	40X-1, 82	369.32	0.32	3H-4, 80	24.3	0.07625
8H-3, 80	65.3	0.11	23X-4, 80	210.4	0.12875	40X-2, 85	370.85	0.305	3H-5, 75	25.75	0.07425
8H-4, 80	66.8	0.1125	23X-5, 80	211.9	0.12525	40X-3, 75	372.25	0.33	3H-6, 70	27.2	0.0735
8H-5, 80	68.3	0.12	23X-6, 80	213.4	0.134	40X-4, 50	373.5	0.2925	4H-1, 50	29	0.07325
8H-6, 80	69.8	0.1225	24X-1, 80	215.2	0.22675	40X-5, 74	375.24	0.26	4H-3, 50	32	0.07425
8H-7, 20	70.7	0.125	24X-2, 80	216.7	0.2425	41X-1, 47	378.57	0.235	4H-2, 110	31.1	0.06725
9H-1, 80	71.8	0.1325	24X-3, 80	218.2	0.24675	41X-1, 62	378.72	0.2175	4H-4, 50	33.5	0.06975
9H-2, 80	73.3	0.1275	24X-4, 80	219.7	0.23875	41X-2, 70	380.3	0.2525	4H-5, 50	35	0.07
9H-3, 80	74.8	0.1425	24X-5, 80	221.2	0.2125	41X-3, 70	381.8	0.235	4H-6, 43	36.43	0.06925
9H-4, 80	76.3	0.1275	25X-2, 70	226.2	0.29125	41X-4, 70	383.3	0.25	5H-1, 75	38.75	0.074
9H-5, 80	77.8	0.1175	25X-4, 90	229.4	0.2845	42X-CC, 49	388.19	0.2875	5H-2, 75	40.25	0.0785
9H-6, 80	79.3	0.1225	26X-1, 80	234.4	0.33	43X-1, 70	398.1	0.3025	5H-3, 75	41.75	0.08475
9H-7, 20	80.2	0.13	26X-3, 75	237.35	0.16	43X-2, 87	399.77	0.255	5H-4, 75	43.25	0.079
10H-1, 80	81.3	0.135	26X-4, 80	238.9	0.32	43X-3, 60	401	0.2825	5H-5, 80	44.8	0.0775
10H-2, 80	82.8	0.14	26X-2, 80	235.9	0.2825	43X-4, 25	402.15	0.2575	5H-6, 75	46.25	0.077
10H-3, 80	84.3	0.135	26X-5, 80	240.4	0.2825	44X-1, 80	407.9	0.265	6H-1, 60	48.1	0.09
10H-4, 80	85.8	0.1275	26X-6, 68	241.78	0.2625	44X-2, 80	409.4	0.3875	6H-3, 60	51.1	0.08275
10H-5, 80	87.3	0.135	27X-1, 80	244.2	0.3575	44X-3, 80	410.9	0.455	6H-2, 60	49.6	0.08275
10H-6, 80	88.8	0.1325	27X-2, 80	245.7	0.305	44X-4, 80	412.4	0.405	6H-4, 60	52.6	0.08525
10H-7, 30	89.3	0.14	27X-3, 80	247.2	0.31	44X-5, 80	413.9	0.465	6H-5, 60	54.1	0.0865
11H-1, 80	90.8	0.135	27X-4, 80	248.7	0.355	44X-6, 80	415.4	0.455	6H-6, 60	55.6	0.08475
11H-2, 80	92.3	0.135	27X-5, 80	250.2	0.2875	44X-7, 19	416.29	0.465	7H-1, 90	57.9	0.09725
11H-3, 80	93.8	0.14	27X-6, 80	251.7	0.315	45X-1, 80	417.5	0.4325	7H-3, 90	60.9	0.09775
11H-4, 80	95.3	0.1425	28X-1, 80	253.8	0.295	45X-2, 80	419	0.3175	7H-4, 85	62.35	0.092
11H-5, 80	96.8	0.14	28X-2, 80	255.3	0.275	45X-3, 80	420.5	0.345	7H-5, 90	63.9	0.091
11H-6, 80	98.3	0.1375	28X-3, 80	256.8	0.2375	45X-4, 80	422	0.405	7H-6, 90	65.4	0.09275
11H-7, 20	99.2	0.1625	28X-4, 80	258.3	0.25	46X-1, 80	427.2	0.5325	7H-6, 103	65.53	0.104
12H-1, 80	100.3	0.125	28X-5, 35	259.35	0.3575	46X-2, 80	428.7	0.4275	8H-1, 80	67.3	0.1425
12H-2, 80	101.8	0.1225	29X-1, 80	263	0.325	46X-3, 80	430.2	0.5275	8H-2, 80	68.8	0.145
12H-3, 80	103.3	0.1225	29X-2, 80	264.5	0.3425	46X-4, 15	429.55	0.495	8H-3, 80	70.3	0.1375
12H-4, 80	104.8	0.14	29X-3, 80	266	0.38	47X-1, 80	436.9	0.4125	8H-4, 80	71.8	0.1375
12H-5, 80	106.3	0.155	29X-4, 80	267.5	0.3475	47X-2, 80	438.4	0.3425	8H-5, 80	73.3	0.1325
12H-6, 80	107.8	0.1325	29X-5, 80	269	0.28	47X-3, 80	439.9	0.41	8H-6, 80	74.8	0.145
12H-7, 20	108.7	0.1475	30X-1, 80	272.7	0.41	47X-4, 80	441.4	0.4675	8H-7, 40	75.9	0.1425
13H-1, 80	109.8	0.155	30X-2, 80	274.2	0.3	47X-5, 80	442.9	0.465	9H-1, 80	76.8	0.1375
13H-2, 80	111.3	0.145	30X-3, 80	275.7	0.2925	47X-6, 80	444.4	0.39	9H-2, 80	78.3	0.14
13H-3, 80	112.8	0.13	30X-4, 80	277.2	0.3025	47X-7, 15	445.25	0.465	9H-3, 80	79.8	0.1425
13H-4, 80	114.3	0.135	30X-5, 80	278.7	0.3125	48X-1, 80	446.5	0.3575	9H-4, 80	81.3	0.15
13H-5, 80	115.8	0.14	30X-6, 80	280.							

Table 13 (continued).

Core, section, interval (cm)	Depth (mbsf)	Resistivity (Ω m)	Core, section, interval (cm)	Depth (mbsf)	Resistivity (Ω m)	Core, section, interval (cm)	Depth (mbsf)	Resistivity (Ω m)	Core, section, interval (cm)	Depth (mbsf)	Resistivity (Ω m)
10H-3, 80	89.3	0.155	154-929C-			12H-6, 90	115.9	0.1275	5R-2, 80	512.7	0.455
10H-4, 80	90.8	0.14	1H-2, 80	4.46	0.1075	13H-1, 80	117.8	0.1475	5R-3, 80	514.2	0.42
10H-5, 80	92.3	0.135	1H-3, 80	5.96	0.0975	13H-2, 80	119.3	0.145	5R-4, 80	515.7	0.365
10H-6, 80	93.8	0.1525	1H-4, 80	7.46	0.105	13H-3, 80	120.8	0.145	10R-1, 80	559.1	0.94
10H-7, 30	94.8	0.14	1H-5, 80	8.96	0.105	13H-4, 80	122.3	0.145	10R-2, 80	560.6	0.99
11H-1, 80	95.8	0.1625	1H-6, 80	10.46	0.1025	13H-5, 80	123.8	0.1475	10R-3, 80	562.1	0.53
11H-2, 80	97.3	0.13	1H-7, 80	11.96	0.1025	13H-6, 80	125.3	0.14	10R-4, 80	563.6	0.6175
11H-3, 80	98.8	0.1475	2H-1, 80	13.3	0.115	13H-7, 20	126.2	0.18	10R-5, 80	565.1	0.57
11H-4, 80	100.3	0.13	2H-2, 80	14.8	0.11	14X-CC, 20	126.7	0.1625	11R-1, 80	568.7	0.4725
11H-5, 80	101.8	0.14	2H-3, 80	16.3	0.11	15X-1, 80	136.9	0.1925	11R-2, 80	570.2	0.7275
11H-6, 80	103.3	0.1525	2H-4, 80	17.8	0.11	15X-2, 80	138.4	0.1475	11R-3, 80	571.7	0.53
11H-7, 20	104.2	0.1325	2H-5, 80	19.3	0.115	15X-3, 80	139.9	0.155	11R-4, 80	573.2	0.33
12H-1, 80	105.3	0.13	2H-6, 80	20.8	0.12	15X-4, 80	141.4	0.1675	11R-5, 80	574.7	0.45
12H-2, 80	106.8	0.1375	2H-7, 20	21.7	0.1125	15X-5, 80	142.9	0.15	11R-6, 20	575.6	0.7025
12H-3, 80	108.3	0.1425	3H-1, 80	22.8	0.135	15X-6, 80	144.4	0.1475	12R-1, 80	578.3	0.3675
12H-4, 80	109.8	0.13	3H-2, 80	24.3	0.13	15X-7, 20	145.3	0.1575	12R-2, 90	579.9	0.315
12H-5, 80	111.3	0.14	3H-3, 80	25.8	0.135	16X-1, 80	146.4	0.165	12R-3, 69	581.19	0.32
12H-6, 80	112.8	0.1425	3H-4, 80	27.3	0.125	16X-2, 80	147.9	0.1475	12R-4, 51	582.51	0.2375
12H-7, 50	114	0.1375	3H-5, 80	28.8	0.12	16X-3, 80	149.4	0.1575	12R-5, 69	584.19	0.47
13H-1, 80	114.8	0.145	3H-6, 80	30.3	0.125	16X-4, 80	150.9	0.165	13R-1, 66	587.86	0.345
13H-2, 80	116.3	0.14	3H-7, 30	31.3	0.1225	16X-5, 80	152.4	0.1625	13R-2, 64	589.34	0.3725
13H-3, 80	117.8	0.16	4H-1, 80	32.3	0.125	16X-CC, 16	153.18	0.2025	13R-3, 79	590.99	0.375
13H-4, 80	119.3	0.1575	4H-2, 80	33.8	0.135				13R-4, 71	592.41	0.29
13H-5, 80	120.8	0.1575	4H-3, 80	35.3	0.125	154-928D-			14R-1, 102	597.92	0.73
13H-6, 80	122.3	0.145	4H-4, 80	36.8	0.125	1H-1, 80	0.8	0.1	14R-2, 105	599.45	0.4375
13H-7, 20	123.2	0.1375	4H-5, 80	38.3	0.125	1H-2, 80	2.3	0.1075	14R-3, 83	600.73	0.5175
14X-1, 80	124.3	0.1525	4H-6, 80	39.8	0.1175	1H-3, 80	3.8	0.1025	14R-4, 79	602.19	0.51
14X-2, 80	125.8	0.16	4H-7, 30	40.8	0.1325	1H-4, 80	5.3	0.105	14R-5, 85	603.75	0.3775
14X-3, 80	127.3	0.15	5H-1, 80	41.8	0.1475	1H-5, 30	6.3	0.105	15R-1, 78	607.28	0.33
14X-4, 80	128.8	0.18	5H-2, 80	43.3	0.145	2H-2, 80	9.3	0.11	15R-2, 75	608.75	0.45
14X-5, 80	130.3	0.16	5H-3, 80	44.8	0.145	2H-3, 80	10.8	0.1075	15R-6, 75	614.75	0.415
14X-CC, 30	131.22	0.165	5H-4, 80	46.3	0.1475	2H-4, 80	12.3	0.115	16R-1, 80	616.9	0.4325
15X-1, 80	133.9	0.145	5H-5, 80	47.8	0.1375	2H-5, 80	13.8	0.1075	16R-2, 76	618.36	0.375
15X-2, 80	135.4	0.1525	5H-6, 80	49.3	0.1475	2H-6, 80	15.3	0.1125	16R-3, 85	619.95	0.3525
15X-3, 30	136.4	0.165	5H-7, 30	50.3	0.155	3H-1, 80	17.3	0.12	18R-1, 80	636.1	0.55
16X-1, 10	142.7	0.165	6H-1, 50	51	0.1	3H-2, 80	18.8	0.135	18R-2, 80	637.6	0.525
17X-1, 80	153	0.14775	6H-2, 50	52.5	0.1125	3H-3, 80	20.3	0.1225	18R-3, 64	638.94	0.68
17X-2, 80	154.5	0.165	6H-3, 50	54	0.1025	3H-4, 80	21.8	0.125	19R-1, 80	645.8	0.4675
17X-3, 80	156	0.144	6H-4, 50	55.5	0.09	3H-5, 80	23.3	0.12	19R-2, 25	646.75	0.7575
17X-4, 80	157.5	0.15375	6H-5, 80	57.1	0.09	3H-6, 80	24.8	0.125	19R-3, 80	648.8	0.29
18X-1, 80	162.6	0.15575	6H-6, 50	58.3	0.0875	4H-1, 80	26.8	0.2225	19R-4, 35	649.85	0.9075
18X-2, 80	164.1	0.15125	7H-1, 60	60.6	0.1125	4H-2, 80	28.3	0.21	19R-5, 75	651.75	0.7525
18X-3, 80	165.6	0.14525	7H-2, 60	62.1	0.115	4H-3, 80	29.8	0.1925	19R-6, 110	653.6	0.755
19X-1, 75	172.15	0.165	7H-3, 60	63.6	0.1125	4H-4, 80	31.3	0.19	19R-7, 45	654.45	0.7375
19X-2, 75	173.65	0.159	7H-4, 60	65.1	0.1075	4H-5, 80	32.8	0.1875	20R-1, 89	655.59	0.58
19X-3, 75	175.15	0.16825	7H-5, 60	66.6	0.105	4H-6, 80	34.3	0.1875	20R-2, 80	657	0.6425
19X-4, 75	176.65	0.169	7H-6, 60	68.1	0.1025	5H-1, 80	36.3	0.19	20R-3, 75	658.45	0.64
19X-5, 75	178.15	0.18025	8H-1, 75	70.25	0.1175	5H-2, 80	37.8	0.195	20R-4, 80	660	0.735
19X-6, 70	179.6	0.167	8H-2, 75	71.75	0.1175	5H-3, 80	39.3	0.195	20R-5, 80	661.5	0.615
20X-1, 75	181.75	0.148	8H-3, 75	73.25	0.1175	5H-4, 80	40.8	0.205	20R-6, 75	662.95	0.69
20X-2, 75	183.25	0.14075	8H-4, 75	74.75	0.1175	5H-5, 80	42.3	0.1875	21R-1, 80	665.1	0.7725
20X-3, 75	184.75	0.13575	8H-5, 75	76.25	0.105	5H-6, 80	43.8	0.1875	21R-2, 80	666.6	0.6425
20X-4, 75	186.25	0.1425	9H-1, 100	80	0.12	5H-7, 10	44.6	0.18	21R-3, 80	668.1	0.41
20X-5, 75	187.75	0.135	9H-2, 100	81.5	0.13	6H-1, 80	45.8	0.1875	21R-4, 80	669.6	0.43
21X-1, 80	191.5	0.1495	9H-3, 100	83	0.1225	6H-2, 80	47.3	0.175	21R-5, 69	670.99	0.525
21X-3, 76	194.46	0.15075	9H-4, 100	84.5	0.125	6H-3, 80	48.8	0.185	22R-1, 95	674.85	0.38
21X-4, 76	195.96	0.14475	9H-5, 100	86	0.1225	154-929E-			22R-2, 80	676.2	0.41
21X-5, 75	197.45	0.124	9H-6, 100	87.5	0.12	1R-2, 80	472.91	0.4225	23R-2, 82	685.52	0.665
21X-6, 75	198.95	0.1275	10H-1, 95	89.45	0.1275	1R-3, 80	474.41	0.41	23R-3, 86	687.06	0.5775
21X-6, 123	199.43	0.1445	10H-2, 95	90.95	0.125	1R-4, 80	475.91	0.4225	23R-4, 82	687.02	0.6625
22X-4, 115	206.05	0.16625	10H-3, 95	92.45	0.1075	1R-5, 80	477.41	0.3875	23R-5, 71	686.91	0.7175
22X-5, 60	207	0.166	10H-4, 95	93.95	0.1175	1R-6, 80	478.91	0.3275	25R-2, 76	704.76	0.3475
22X-6, 30	207.7	0.14625	10H-5, 95	95.45	0.1175	1R-7, 80	480.41	0.4025	25R-3, 65	706.15	0.325
23X-1, 90	210.6	0.15625	10H-6, 95	96.95	0.1325	2R-1, 80	482.1	0.2975	28R-3, 72	735.32	0.6925
23X-2, 100	212.2	0.1805	11H-1, 50	98.5	0.1325	2R-2, 80	483.6	0.325	28R-4, 68	736.78	0.7975
23X-3, 100	213.7	0.175	11H-2, 50	100	0.135	2R-3, 80	485.1	0.3325	28R-5, 44	738.04	0.675
23X-4, 56	214.76	0.165	11H-3, 50	101.5	0.14	2R-4, 80	486.6	0.305	29R-1, 80	742	0.5075
23X-5, 56	216.26	0.178	11H-4, 50	103	0.13	2R-5, 80	488.1	0.33	29R-2, 80	743.5	0.5
23X-6, 10	217.3	0.178	11H-5, 50	104.5	0.1275	2R-6, 80	489.6	0.44	29R-3, 80	745	0.54
24X-2, 62	221.52	0.1855	11H-6, 50	106	0.125	3R-1, 80	491.8	0.4225	29R-4, 80	746.5	0.5675
24X-3, 44	222.84	0.1405	12H-1, 90	108.4	0.125	3R-2, 80	493.3	0.4025	31R-1, 80	761.4	0.7725
24X-4, 75	224.65	0.16525	12H-2, 90	109.9	0.1325	4R-1, 80	501.6	0.5475	31R-2, 80	762.9	0.745
24X-5, 40	225.8	0.16575	12H-3, 90	111.4	0.135	4R-2, 80	503.1	0.81	33R-1, 80	780.7	0.5825
			12H-4, 90	112.9	0.14	4R-3, 80	504.6	0.4775	35R-1, 20	799.4	0.8225
			12H-5, 90	114.4	0.13	5R-1, 80	511.2	0.455	35R-2, 63	800.48	0.875

markedly after about 5 Ma. Carbonate accumulation decreased overall throughout the late Neogene, a change that reflects the decrease in carbonate productivity observed in the shallow sites.

Very low sedimentation rates are encountered in the autochthonous Miocene section. The widespread occurrence of red clays and several sections barren of calcareous microfossils attest to the shoaling of the CCD at this time. These red clays correlate with a nearly identical section observed in the deeper sites of Leg 108

(Ruddiman, Sarnthein, Baldauf, et al., 1988). Higher sedimentation rates and orbitally induced rhythmic sedimentation are encountered in the lower Miocene, Oligocene, and upper Eocene sections at Site 929, which reflect orbital-scale changes in carbonate productivity and dissolution. Middle and lower Eocene sedimentation rates are very variable; a part of this variability can be accounted for by changes in carbonate content, but further work is required to explain all of the variations.

Figure 20. Discrete measurements of bulk density for all holes at Site 929.

Figure 21. Compressional-wave velocities and velocity anisotropy vs. depth, Site 929.

Figure 22. Two-way traveltimes derived for Site 929 from discrete velocity data.

Figure 23. Impedance profile for Site 929 constructed from bulk-density and compressional-wave velocity measurements. Horizontal lines indicate features in two-way traveltimes that may be seen in reflection seismic records.

Figure 24. Undrained shear strength measured using the miniature vane shear device and the pocket penetrometer for Holes 929A and 929B. The ratio of shear strength to overburden stress at Site 929 is shown on the right.

REFERENCES*

- Benjamin, M., Johnson, N.M., and Naeser, C.W., 1987. Recent rapid uplift in the Bolivian Andes: evidence from fission-track dating. *Geology*, 15:680–683.
- Damuth, J.E., and Kumar, N., 1975. Amazon cone: morphology, sediments, age and growth pattern. *Geol. Soc. Am. Bull.*, 86:863–878.

* Abbreviations for names of organizations and publications in ODP reference lists follow the style given in *Chemical Abstracts Service Source Index* (published by American Chemical Society).

- Fertl, W.H., 1979. Gamma ray spectral data assists in complex formation evaluation. *Log Analyst*, 20:421–423.
- Kroenke, L.W., Berger, W.H., Janecsek, T.R., et al., 1991. *Proc. ODP, Init. Repts.*, 130: College Station, TX (Ocean Drilling Program).
- Mayer, L., Pisias, N., Janecsek, T., et al., 1992. *Proc. ODP, Init. Repts.*, 138 (Pts. 1 and 2): College Station, TX (Ocean Drilling Program).
- Mayer, L.A., 1979. Deep sea carbonates: acoustic, physical, and stratigraphic properties. *J. Sediment. Petrol.*, 49:819–836.
- Rea, D.K., Basov, I.A., Janecsek, T.R., Palmer-Julson, A., et al., 1993. *Proc. ODP, Init. Repts.*, 145: College Station, TX (Ocean Drilling Program).
- Ruddiman, W., Sarnthein, M., Baldauf, J., et al., 1988. *Proc. ODP, Init. Repts.*, 108 (Sections 1 and 2): College Station, TX (Ocean Drilling Program).
- Schnitker, D., 1979. The deep water of the western north Atlantic during the past 24,000 years, and the re-initiation of the western boundary undercurrent. *Mar. Micropaleontol.*, 4:265–280.
- Shackleton, N.J., 1986. Paleogene stable isotope events. *Palaeogeogr., Palaeoclimatol., Palaeoecol.*, 57:91–102.
- Tjalsma, R.C., and Lohmann, G.P., 1983. Paleocene-Eocene bathyal and abyssal benthic foraminifera from the Atlantic Ocean. *Micropaleontol. Spec. Publ.*, 4.
- Valent, P.J., Altschaeffl, A.G., and Lee, H.J., 1982. Geotechnical properties of two calcareous oozes. In Demars, K.R., and Chaney, R.C. (Eds.), *Geotechnical Properties, Behavior, and Performance of Calcareous Soils*. ASTM Spec. Tech. Publ., 777:79–96.
- Wilkens, R.H., and Handyside, T., 1985. Physical properties of equatorial Pacific sediments. In Mayer, L., Theyer, F., Thomas, E., et al., *Init. Repts. DSDP*, 85: Washington (U.S. Govt. Printing Office), 839–847.
- Zimmerman, H.B., 1977. Clay mineral stratigraphy and distribution in the South Atlantic Ocean. In Supko, P.R., Perch-Nielsen, K., et al., *Init. Repts. DSDP*, 39: Washington (U.S. Govt. Printing Office), 395–405.

Ms 154IR-108

Table 14. Summary of logging operations at Hole 929E.

19 March 1994	
Drillers' TD = 5176.4 (808.90) mbrf, WD = 4367.5 mbrf	
0350 hr	Last core on deck; Hole 929E. Begin wiper trip; rig up SES; rig up Quad with temperature tool. RIH with Quad.
20 March 1994	
0330 hr	Begin Quad Pass 1 uplog (bottom) at 900 ft/hr from TD (5049–4843.9 mbrf; 681.5–476.4 mbsf). WHC on.
0340 hr	Stop at 5035 mbrf (667.5 mbsf).
0430 hr	Stop at 4843.9 mbrf (476.4 mbsf) to pull pipe and pump pill. End Quad Pass 1 at 4843.9 mbrf (476.4 mbsf).
0525 hr	Lower Quad for Pass 2; hung up on bridge at 4864 mbrf (496.5 mbsf). Pull up into pipe at 4706 mbrf (338.5 mbsf).
0600 hr	Lower pipe to 4895 mbrf (527.5 mbsf) and run Quad down to 4832 mbrf (464.5 mbsf).
0615 hr	Stop at 4832 mbrf (464.5 mbsf); continue down to TD at 4908 mbrf (540.5 mbsf).
0645 hr	Begin Quad Pass 2 uplog (top) at 900 ft/hr from TD (4908–4478 mbrf; 540.5–110.5 mbsf).
0803 hr	Quad at 4650 mbrf (282.5 mbsf); stop to pull up pipe to 4485 mbrf (117.5 mbsf).
0832 hr	Restart run at 4650 mbrf (282.5 mbsf).
0910 hr	Quad in pipe.
1300 hr	End Quad Pass 2 at 4478 mbrf (110.5 mbsf); Quad POOH; rig up GLT.
1345 hr	RIH with GLT.
1700 hr	Begin GLT Pass 1 uplog (main) at 600 ft/hr from TD (4950–4478 mbrf; 582.5–110.5 mbsf)
1915 hr	WHC off at 4250 mbrf (152.5 mbsf); enter pipe.
1930 hr	End GLT Pass 1 at 4478 mbrf (110.5 mbsf); GLT POOH.
2100 hr	End of logging operations.

Note: TD = total depth, WD = water depth, SES = side-entry sub, RIH = run in hole, WHC = wireline heave compensator, POOH = pull out of hole, and GLT = geochemical logging tool.

Figure 25. Composite of resistivity data for all holes at Site 929 vs. depth.

Figure 26. Estimated elastic rebound (solid line) compared with the composite depth offset (solid circles) for Hole 929A and Hole 929B.

NOTE: For all sites drilled, core-description forms ("barrel sheets") can be found in Section 4 beginning on page 445. Forms containing smear-slide data can be found in Section 5, beginning on page 1087. High-resolution, conventional, temperature, and geochemical logs; sonic waveforms; and carbon, GRAPE, index properties, MAGSUS, natural gamma, P-wave, and reflectance data are presented on CD-ROM (back pocket) for Site 929.

Figure 27. Comparison of core and log measurements of natural gamma activity. Core data (left) are shown without background corrections. Log depths (right) have been linearly shifted to equivalent core depths.

Figure 29. Total gamma ray (SGR) and Th/K ratio from Hole 929E. Note the decreased Th/K ratio near the Subunit IIA/IIB boundary.

Figure 28. Summary of selected log data from Hole 929E. Lithologic units are shown at right (see "Lithostratigraphy" section, this chapter).

Figure 30. Time series of total gamma-ray (SGR) logs and calculated Th/K ratios from Sites 925, 926, 927, 928, and 929. Note the dramatic and simultaneous decreases in Th/K near 7.5–8 Ma. Age control was constrained by biostratigraphic control (see “Sedimentation Rates” sections, “Site 925,” “Site 926,” “Site 927,” “Site 928,” and “Site 929” chapters, this volume); slight temporal offsets are probably the result of core-to-log depth scale errors.

Figure 31. Comparison of core and log physical properties (compressional-wave velocity and bulk density) at Site 929.

Figure 32. **A.** Processed natural gamma data from Hole 929E. **B.** Estimates of major oxide weight fractions from geochemical logs, Hole 929E. Solid diamonds represent shipboard carbonate measurements on core material. The oxide closure model normalization factor (F) is displayed to the right of the logs. A lower normalization factor represents better counting statistics and therefore higher quality data.

SHORE-BASED LOG PROCESSING

Hole 929E

Bottom felt: 4367.5 mbrf (used for depth shift to seafloor)

Total penetration: 808.9 mbsf

Total core recovered: 246.65 m (73.1%)

Logging Runs

Logging string 1: DIT/SDT/HLDT/NGT (upper and lower section)

Logging string 2: ACT/GST/NGT

The wireline heave compensator (WHC) was used to counter mild ship heave. The WHC was turned off at ~490 mbsf during the DIT/SDT/HLDT/NGT run because of a power failure. The WHC was turned off at ~155 mbsf during the ACT/GST/NGT run.

Drill Pipe

The following drill-pipe depths are as they appear on the logs after differential depth shift (see **Depth shift** section below) and depth shift to the seafloor. As such, there might be a discrepancy with the original depths given by the drillers on board. Possible reasons for depth discrepancies are ship heave, use of wireline heave compensator, and drill-string and/or wireline stretch.

DIT/HLDT/SDT/NGT: Bottom of drill pipe at ~117 mbsf

ACT/GST/NGT: Bottom of drill pipe at ~120 mbsf

Processing

Depth shift: The reference run for depth shift was DIT/SDT/HLDT/NGT (upper section).

For consistency with the core-log correlation performed by the logging scientists on board using multisensor track data, this run was first depth-shifted +5 m. Then, all original logs were interactively depth-shifted with reference to NGT from the DIT/SDT/HLDT/NGT run, and to the seafloor (-4367.5 m).

Gamma-ray processing: The NGT data have been processed to correct for borehole size and type of drilling fluid.

Acoustic data processing: The sonic logs have been processed to eliminate some of the noise and cycle skipping experienced during recording. Acoustic data were recorded in both the "short-spacing" (DT, DTL, TT1, etc.) and "long-spacing" modes (DTLN, DTLF, LTT1, etc.). The data recorded in the short-spacing mode was of very good quality below 448 mbsf, and no processing was necessary. In the upper part, however, processing was performed on the long-spacing data, which appear to be of better quality.

Geochemical processing: For a detailed explanation of the geochemical processing, please refer to the "Explanatory Notes" chapter (this volume) or to the geochem.doc file on the CD-ROM in the back pocket.

The elemental yields recorded by the GST tool represent the relative contribution of only some of the rock-forming elements (iron,

calcium, chlorine, silica, sulfur, hydrogen, gadolinium, and titanium, the last two of which were computed during geochemical processing) to the total spectrum. Because other rock-forming elements are present in the formation (such as aluminum, potassium, etc.), caution is recommended in using the yields to infer lithologic changes. Instead, ratios (see acronyms.doc on the CD-ROM) are more appropriate to determine changes in the macroscopic properties of the formation. A list of oxide factors used in geochemical processing includes the following:

$\text{SiO}_2 = 2.139$

$\text{CaCO}_3 = 2.497$

$\text{FeO}^* = 1.358$

$\text{TiO}_2 = 1.668$

$\text{K}_2\text{O} = 1.205$

$\text{Al}_2\text{O}_3 = 1.889$

$\text{FeO}^* =$ computed using an oxide factor that assumes a 50:50 combination of Fe_2O_3 and FeO factors.

Data merging: Resistivity, acoustic, density, caliper, and gamma-ray data were merged at 500 mbsf.

Quality Control

Data recorded through pipe should be used qualitatively only because of the attenuation on the incoming signal.

Hole diameter was recorded by the hydraulic caliper on the HLDT tool (CALI). The caliper closed at ~132 mbsf; therefore, no borehole size correction can be performed between this depth and the bottom of the pipe. For this reason, this portion of the data is not presented here.

The extremely rugose nature of the borehole wall and the frequent washouts have affected some of the elemental readings, particularly of aluminum, which locally is extremely high (155–158, 180–183, 192–194, 210–211.5, 214–220, 221–223, 270–272, and 282–284 mbsf). For this reason, aluminum has been interpolated (assuming a constant value). The results of the processing are presented along with the calcium carbonate measurements performed on board.

FACT = quality control curve in geochemical processing. The accuracy of the estimates is inversely proportional to the magnitude of the curve.

Details of standard shore-based processing procedures are found in the "Explanatory Notes" chapter, this volume. For further information about the logs, please contact:

Cristina Broglia
Phone: 914-365-8343
Fax: 914-365-3182
E-mail: chris@ldeo.columbia.edu

Elizabeth Pratson
Phone: 914-365-8313
Fax: 914-365-3182
E-mail: beth@ldeo.columbia.edu

Hole 929E: Resistivity-Velocity-Natural Gamma Ray Log Summary

Hole 929E: Resistivity-Velocity-Natural Gamma Ray Log Summary (cont.)

Hole 929E: Resistivity-Velocity-Natural Gamma Ray Log Summary (cont.)

Hole 929E: Resistivity-Velocity-Natural Gamma Ray Log Summary (cont.)

Hole 929E: Resistivity-Velocity-Natural Gamma Ray Log Summary (cont.)

Hole 929E: Density-Natural Gamma Ray Log Summary

Hole 929E: Density-Natural Gamma Ray Log Summary (cont.)

Hole 929E: Density-Natural Gamma Ray Log Summary (cont.)

Hole 929E: Density-Natural Gamma Ray Log Summary (cont.)

Hole 929E: Processed Natural Gamma Ray Log Summary

Hole 929E: Processed Natural Gamma Ray Log Summary (cont.)

Hole 929E: Processed Natural Gamma Ray Log Summary (cont.)

Hole 929E: Processed Geochemical Log Summary

Hole 929E: Processed Geochemical Log Summary (cont.)

Hole 929E: Processed Geochemical Log Summary (cont.)