CORE EN-023

CORE

University of Rhode Island
Kingston, RI 02881

CRUISE REPORT
Cruise No. EN-023

by

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Edward P. Laine

PROJECT: Sedimentological processes and physical properties of Northern Bermuda Rise.

SCHEDULE: Depart Narragansett June 2, 1978
Emergency Medical Stop, St. Georges, Bermuda
June 7, 1978
Return Narragansett, June 22, 1978

FUNDING: Office of Naval Research: 11 days (N00014-C-76-0226)
Department of Energy: 9 days (EII-1-2689)
Civil Engineering Laboratory: 1 day (N68305-78-C-0022)

SCIENTIFIC PARTY:

A. Silva	Co-Chief Scientist	URI
E. Laine	Co-Chief Scientist	URI
A. Driscoll	Coring Chief	WHOI
S. Akers	Graduate Research Assistant	URI
K. Baldwin*	Graduate Research Assistant	URI
M. Bell**	Summer Student	Wesleyan
D. Calnan	Research Associate	URI
S. Criscenzo	Graduate Research Assistant	URI
S. Imms	Marine Technician	URI
P. Lemmond	Graduate Research Assistant	URI
K. Moran	Graduate Research Assistant	URI
R. Knobel	Marine Technician	URI
P. Pegnato	Research Technician	URI
M.J. Richardson	Graduate Student	WHOI
J. Sammons	Marine Technician	URI
D. Shirley	Associate Scientist	U. Texas/ARL
A. Williams	Associate Scientist	WHOI

STUDY SITES:

1. Northern Bermuda Rise; Seabed Disposal Study Site MPG-3 and adjacent regimes: The primary study area is near 36°N; 62°W with a related area at 34°N; 59°W. These areas are of interest to DOE.

* Leave ship 6/7/78 in Bermuda

** Join ship 6/7/78 in Bermuda

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2. Eastern Bermuda Rise: Eastern Edge of Bermuda Rise near 33°N; 57°W. This is the primary site selected for ONR studies.

OBJECTIVES:

1. DOE Program

   Collection of bathemetric information, subbottom acoustic data, near bottom circulation data, and sediment cores in a tentative study area (MPG-3) for the Seabed Disposal Program. This data is to be integrated with that obtained on subsequent cruises in the assessment of the area as a possible generic study site for the disposal of high-level radioactive wastes.

2. ONR Program

   Integrated program to study sedimentary processes, including submarine slumping on the eastern edge of the Bermuda Rise.

3. CEL Program

   Comparison of doppler penetrometer results with physical properties obtained from core samples at the test sites for different sediment types.

MAJOR SCIENTIFIC EQUIPMENT

1. Large-diameter Piston Coring (LPC) System:

   This is a modified version of the Giant Piston Corer utilizing a 3,000 lb core weight and 4.5 inch I.D. barrels. A complete handling system including a davit/rail/trolley system, rotating core cradle, and extrusion system was installed on the ship. Total weight of the corer can be increased to approximately 5,500 lbs with the addition of lead weights in the core weight stand.

2. Large-diameter Gravity Coring (LGC) System:

   This is a URI design utilizing a 4 inch I.D. wound fiberglass core barrel and new weight stand with removable lead weights, circular shroud and valve assembly.

3. Subbottom Acoustic Profiling Systems:

   a) 3.5 kHz - Hull mounted
   b) Airgun
   c) Minisparker

4. Bottom Camera Systems

5. Free-fall Doppler Penetrometer System

6. Niskin Water Sampling

7. Moorings:

   a) Current meters
   b) Time-series nephelometers
   c) Sediment traps

8. Benthic Acoustic Stress Sensor (BASS)

OPERATIONAL DESCRIPTION

Extensive preparations were made to install the special coring systems including installation of 5/8 inch diameter cable on the deep sea winch and special handling gear for the two corers. Following is a brief description of the operational plan which was implemented. A track chart is included (see Figure 1).

1. Proceed to primary DOE site with underway 3.5 kHz system in operation. Attempt to use airgun and minisparker system at site but with no success. Take one LPC and one LGC in laminated sediment.
2. Medical emergency forces diversion to Bermuda to put K. Baldwin ashore and add M. Bell as replacement.
3. Proceed to second DOE site to study possible large scale erosional feature. Use LGC to obtain one core. Launch of LPC very successful with good penetration and pullout. However, failure of flag block during ascent causes loss of corer and cable. Successfully launch and recover BASS.
4. Proceed to ONR site. Complete program at this site using all remaining equipment, relying on LGC for coring program.
5. Set moorings and use BASS.
6. Return to primary DOE site. Attempt to use doppler penetrometer system but malfunction of sound sources forces cancellation of this program. Take one LGC.
7. Proceed to Gulf Stream Outer Ridge at 36°N, 66°W. Take one core and use BASS again.

RESULTS:

1. Bathemetry and Sub-bottom Acoustics:

   a) 3.5 kHz profiling - Approximately 1660 km of high quality and 1070 km of low quality 3.5 kHz profiles were gathered using the Raytheon CESP Correlator, PTR, and UGR recorder. Three speeds were used; 1, 1/2, and 1/4 second sweep records; depending on the scientific goals at the moment. Ship speed and sea state strongly effect the quality of records, and in some cases lower quality records were gathered at speeds exceeding 10 kts in sea states exceeding 2.

b) Airgun Profiling - We had planned to do about 2,000 km of airgun profiling using a system which consisted of PSR and PFR Raytheon recorders, Ithaco amplifiers, Allison filters, and URI streamers recently refurbished by Benthos. A compressor was rented from Price Compressors and two 40 cu. inch airguns towed 50' astern. The airguns and the compressor performed well but numerous problems with the streamers and electronics precluded gathering any usable records. Attempts to use a minisparker also were stymied for the same reasons.

2. Coring: Results of coring operations are summarized in Table 1.

a) Large-diameter Piston Cores.

Launch and recovery of LPC-01 went fairly well with recovery of a good quality, 12 meter core. Launch and descent of LPC-02 went extremely well and core was pulled out without the help of the jacking assist mechanism. However, during ascent, the bolts supporting the first flag block after the winch drum sheared off, causing breaking of the cable and loss of the coring system.

b) Large-diameter Gravity Cores.

The Large-diameter Coring system worked extremely well. Due to loss of the LPC, we devised a way to extend the core barrel length from 3 meters to 4.5 meters. On a few occasions the core sample was lost, due to failure of the core catcher or of the extension coupling. We launched and recovered the LGC twenty (20) times and recovered seventeen (17) good quality cores (see Table 1). Most of the cores were extruded and processed on board but a few were sealed for processing at the URI laboratory.

3. Bottom Photography.

We attempted 13 camera lowerings using a 35 mm EG & G camera "flown" 3-15 m off the bottom. Pictures were taken every 15 seconds for periods of 15 to 30 seconds. Both failures (Camera Station #'s 3 and 13 were due to a timer malfunction. We also attempted a lowering of a Hydro Projects 70 mm (Camera Station #4) which also failed due to failure of the strobe. Table 2 summarizes all camera lowerings.

4. Suspended Matter.

M.J. Richardson, of the Department of Geology and Geophysics of the Woods Hole Oceanographic Institution, completed 13 casts with 5 liter Niskins to collect sus-

pended matter, primarily in the lower 500 meters of the water column. The objectives of this program were accomplished. A single lowering (Suspended matter Station #1) with a 12 bottle, 5 liter Niskin-rosette was unsuccessful because of slip ring problems. These problems also prevented us from testing a wire-lowered, logging nephelometer on the same lowering. Table 3 lists all suspended matter lowerings.

5. Moorings.

Two moorings (Figure 2 and 3) were deployed to study the effect of the Gulf Stream System currents on suspended matter. The moorings included 2 VACM current meters, 16 sediment traps, and 2 time-series nephelometers. The gear is to be recalled in September from the R/V Melville.

6. BASS.

Dr. A. Williams of the Department of Ocean Engineering at the Woods Hole Oceanographic Institution made three successful deployments (Table 4) of a Benthic Acoustic Stress Sensor (BASS). The instrument performed well at all three deployments.

7. Doppler Penetrometer.

Ten deployments of the NCEL expandable Doppler Penetrometers were scheduled in conjunction with 5 LPC coring locations in Pelagic Clays. Two penetrometers were to be dropped at each coring site. After the first two were dropped a problem with the sound source developed, and data was not being received at the surface. Due to this problem, no additional penetrometer deployments were attempted.

DISCUSSION:

As indicated in the report, we had planned for a very busy cruise with the inclusion of many types of instruments and equipment. The loss of the Large-diameter Piston Corer (LPC) on the second launch was a major problem forcing us to resort to the Large-diameter Gravity Corer (LGC) for sediment sampling during the remainder of the cruise. It should be noted that the LPC system functioned very well and that the loss was not related to corer design or operation in any way. Subsequent investigations showed that design of the flag block support system was faulty and that the bolts were overstressed on previous coring expeditions. The LGC gave us excellent quality samples of the upper 3 to 4.5 meters, but unfortunately this corer is not designed to obtain samples below this depth.

Two other malfunctions caused cancellation of programs: the airgun/minisparker systems were not operational and the sound sources on the doppler penetrometers were faulty. However, all other systems functioned very well, and a great deal of valuable data was obtained. The Benthic Acoustic Stress Sensor (BASS) was used successfully three times. Two moorings were set on the East

Bermuda Rise with current meters, sediment traps, and time-series nephelometers. In addition bottom photographs were taken and suspended matter samples collected. One Large-diameter Piston core and seventeen Large-diameter Gravity cores were obtained.

Loss of the 5/8 inch cable due to failure of the flag block support bolts necessitate repairs and replacement of the cable prior to the next cruise.

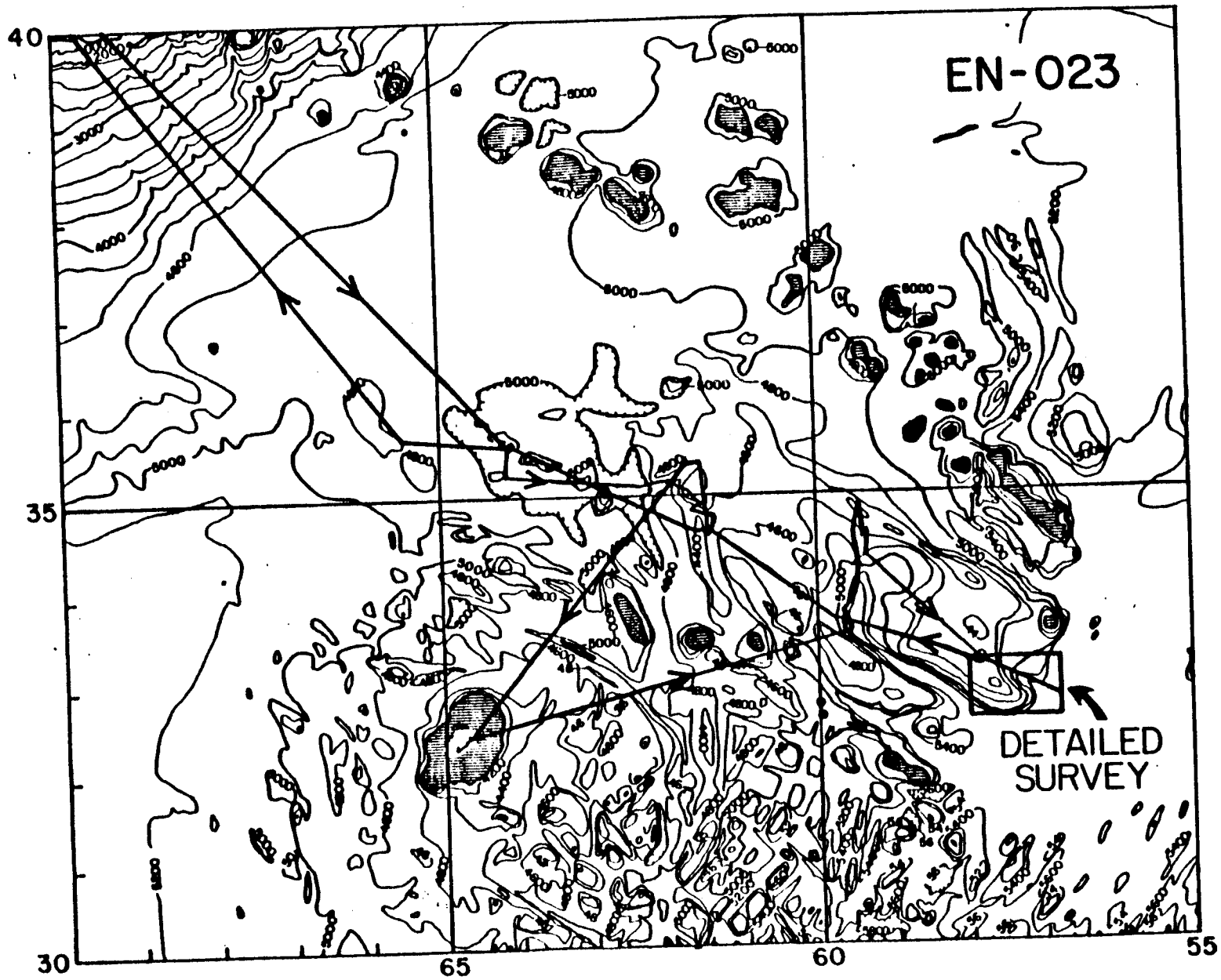
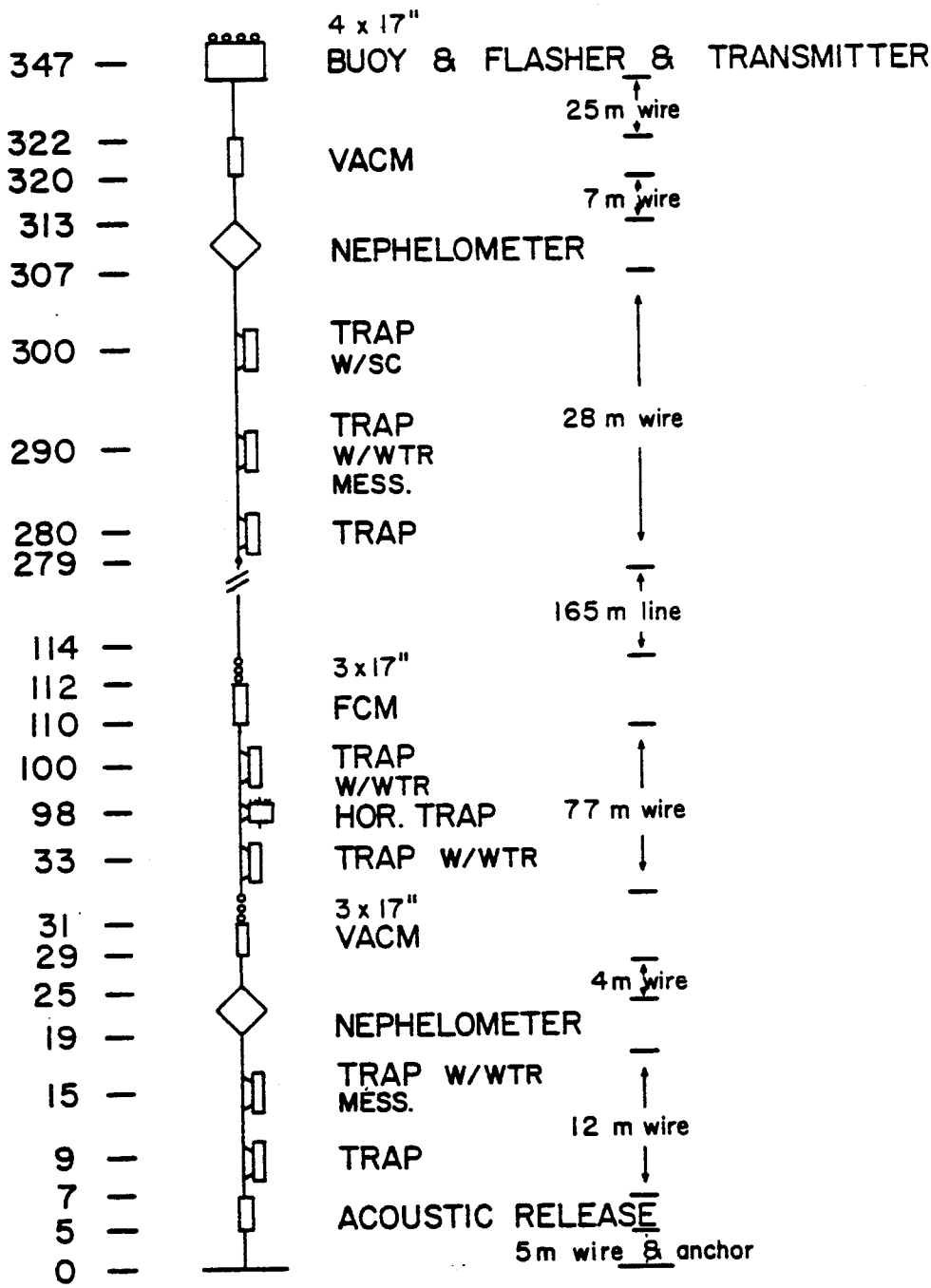


Figure 1: Track Chart

ENDEAVOR 23 - ARRAY A

LAUNCHED 06/17/78 2139 Z

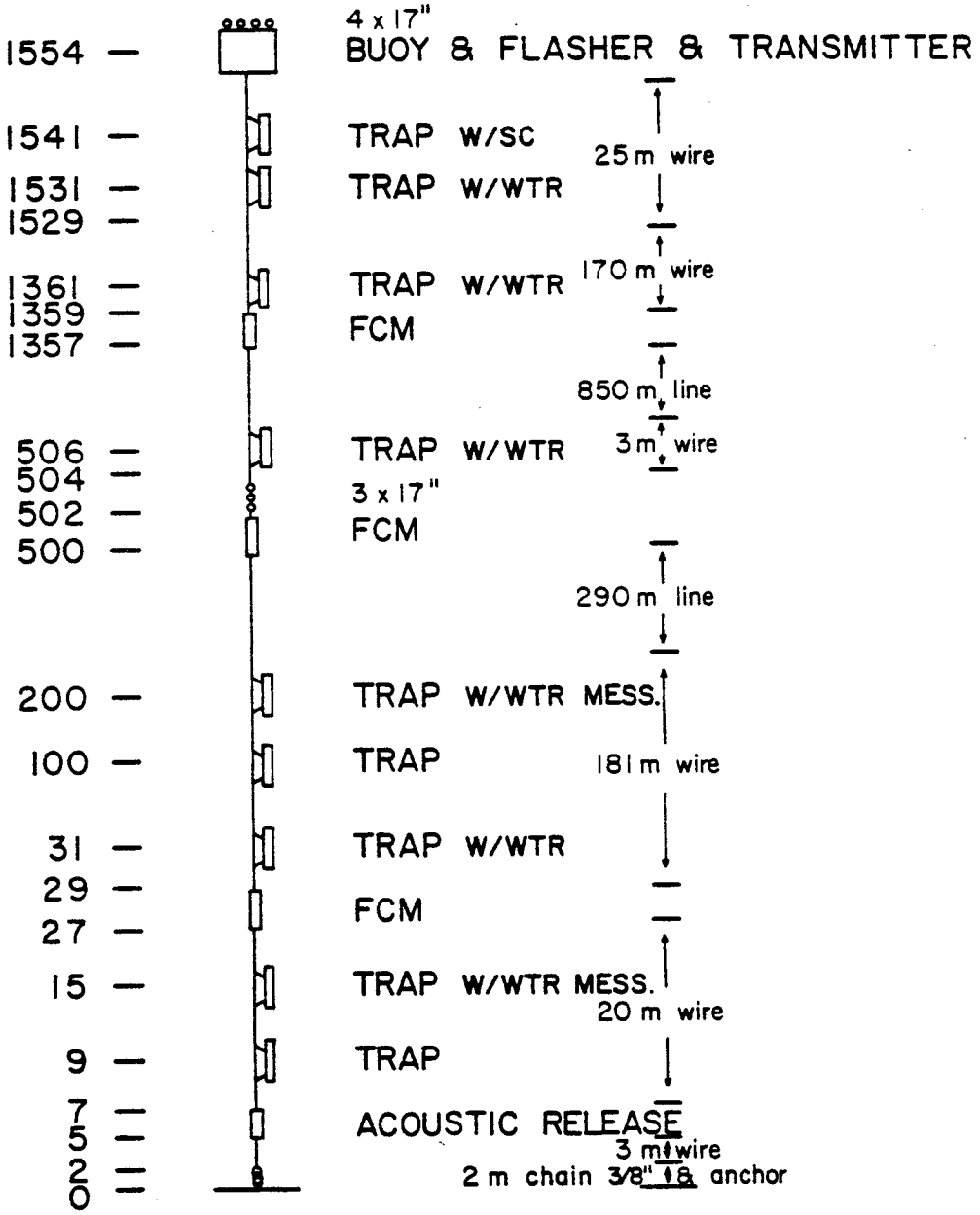
33° 04.6' N, 57° 47.9' W



VACM = VECTOR AVERAGING CURRENT METER
FCM = FILM CURRENT METER
SC = SAMPLE CHANGER
WTR = WILLIAMS TIMED RELEASE

Figure 2

ENDEAVOR 23 - ARRAY B
LAUNCHED 06/16/78 0119 z
32°44.5' N, 56° 54.2' W



SC = SAMPLE CHANGER
WTR = WILLIAMS TIMED RELEASE
FCM = FILM CURRENT METER

Figure 3

URI/MGL

CORING RESULTS

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CORE	DATE/ TIME (GMT)	POSITION (DEG-MIN)	UNCOR. WATER DEPTH (M)	CORE WT. (KG)	BARREL LENGTH (M)	SPEED (M/MIN)	PENE-TRATION (CM)	SED. REC. (CM)	NET PULL-OUT (KG)	COMMENTS
LGC-01	JUN 6 1504	34-29.6N 61-24.8W	4365	136	3.04	120	337	320	NA	LAMINATED OVER PENETRATED 30 CM INTO WT. STAND
LGC-02	JUN 9 1437	34-25.3N 59-21.5W	4720	204	3.04	120	300	0	95	CORE CATCHER PULLOUT NO SED. RECOVERED
LGC-03	JUN 10 1045	34-22.6N 59-21.7W	4740	204	3.04	120	NA	289	160	HYPERBOLIC-TRANSPARENT (HYP-T)
LGC-04	JUN 11 0804	33-03.4N 57-42.3W	4340	204	3.04	60	360	302	195	LAMINATED (L)
LGC-05	JUN 12 0037	32-51.0N 57-43.5W	5490	204	4.57	60	360	353	104	ABYSSAL PLAIN (AB)
LGC-06	JUN 12 1220	32-46.5N 56-53.0W	5490	204	4.57	60	NA	455	100	AB
LGC-07	JUN 13 0528	33-04.0N 57-42.4W	4399	204	4.57	90	445	455	50	L
LGC-08	JUN 13 1327	33-02.7N 57-38.0W	4665	204	4.57	100	456	456	79	HUMMOCKS (HUM)
LGC-09	JUN 13 2400	32-51.7N 57-29.0W	4645	204	3.04	90	254	254	181	HYP-T
LGC-10	JUN 14 0616	32-35.6N 57-33.1W	4549	204	3.04	50	NA	300	73	HUM-L
LGC-11	JUN 14 1838	32-44.6N 57-24.2W	4775	204	3.04	105	NA	445	110	HUM-L
LGC-12	JUN 15 0201	32-49.9N 57-26.5W	4707	204	4.57	95	NA	0	82	COUPLING FAILURE MAY HAVE UNDER-PENETRATED HYP-T
LGC-13	JUN 15 0847	32-56.6N 57-32.7W	4607	204	3.04	90	321	291	110	PENETRATION TO BOTTOM OF WT. STAND POOR LAMINATION
LGC-14	JUN 15 1502	32-46.1N 57-12.0W	4968	204	3.04	80	350	343	90	PENETRATION TO BOTTOM OF WT. STAND HUM-L
LGC-15	JUN 15 2041	32-50.9N 57-25.6W	4968	204	4.57	80	457	409	95	HUM-L
LGC-16	JUN 16 0516	32-46.8N 57-10.5W	5445	204	4.57	85	423	410	110	AB-T
LGC-17	JUN 16 0817	32-48.9N 57-08.7W	5488	204	4.57	75	405	434	135	AB
LGC-18	JUN 19 1030	34-43.0N 61-22.6W	4349	204	4.57	90	460	425	136	RAIL SYSTEM NOT USED L
LGC-19	JUN 21 0157	35-53.0N 66-23.2W	4905	204	4.57	90	150	0	60	UNDERPENETRATION (1.5M) NO RECOVERY LAMINATED OUTCROP
LGC-20	JUN 21 1000	35-54.8N 66-23.3W	4912	204	3.04	110	289	410	262	LAMINATED OUTCROP
LPC-01	JUN 6 1032	34-43.2N 61-24.4W	4305	1832	13.6	NA	-	1172	-	LAMINATED GOOD CORE
LPC-02	JUN 10 1437	34-15.5N 59-21.5W	4768	1832	13.6	NA	NA	NA	NA	FLAG BLOCK FAILURE CAUSED CABLE PARTING AND CORE LOST

LGC - LARGE GRAVITY CORE
LPC - LARGE PISTON CORE

Table 1

Item	Date	Time (GMT)		Depth (m)	Position		Success Level
		Begin	End	Uncorr.	Lat. (n)	Long (W)	
Camera 01	6/9/78	1840	2218	4690	34° 30.1'	59° 18.9'	Successful
Camera 02	6/12/78	0715	1116	5490	32° 46.3'	56° 55.5'	Successful
Camera 03	6/13/78	0810	1151	4420	33° 08.5'	57° 44.5'	Not Successful
Camera 04	6/14/78	0130	0454	4525	32° 53.1'	57° 30.4'	Not Successful
Camera 05	6/14/78	0726	1140	4376	32° 57.9'	57° 37.0'	Successful
Camera 06	6/15/78	0322	0700	4685	32° 53.4'	57° 28.1'	Successful
Camera 07	6/15-16/78	2205	0115	4990	32° 47.9'	57° 22.8'	Successful
Camera 08	6/16/78	0958	1814	5440	32° 52.0'	57° 08.0'	Successful
Camera 09	6/17/78	1200	1535	4416	33° 08.9'	57° 42.2'	Successful
Camera 10	6/17-18/78	2315	0300	4365	33° 03.9'	57° 53.2'	Successful
Camera 11	6/18-19/78	2247	0140	5200	33° 40.2'	59° 41.0'	Successful
Camera 12	6/20/78	0517	1022	5150	35° 31.2'	63° 59.8'	Successful
Camera 13	6/21/78	0342	0846	4907	35° 52.8'	66° 22.0'	Not Successful

Table 2. Camera Stations

Item	Date	Time (GMT)		Depth (m) Uncorr.	Position		Success Level
		Begin	End		Lat.	Long.	
Hydrocast 01	6/4/78	1745	0124	4985	35° 15.8'	64° 10.3'	Successful
Hydrocast 02	6/9/78	2243	0250	4640	34° 32.4'	59° 17.2'	Successful
Hydrocast 03	6/11/78	0940	1200	4340	33° 05.0'	57° 45.3'	Successful
Hydrocast 04	6/12/78	0144	0628	5490	32° 43.4'	56° 49.1'	Successful
Hydrocast 05	6/13/78	1702	2001	4543	32° 53.8'	57° 32.7'	Successful
Hydrocast 06	6/14/78	2045	0100	4760 4804	32° 49.0'	57° 25.5'	Successful
Hydrocast 07	6/16/78	1450	1814	5444	32° 52.2'	57° 11.5'	Successful
Hydrocast 08	6/17/78	0230	0656	5449	32° 45.9'	56° 53.2'	Successful
Hydrocast 09	6/18/78	0340	0836	4405	33° 03.1	57° 53.9'	Successful
Hydrocast 10	6/18/78	2247	0140	5200	33° 40.2'	59° 41.0'	Successful
Hydrocast 11	6/19/78	1447	1821	5273	34° 39.1'	61° 28.3'	Successful
Hydrocast 12	6/20/78	0517	1022	5150	35° 31.2'	63° 59.8'	Successful
Hydrocast 13	6/21/78	0342	0846	4907	35° 52.8'	66° 22.0'	Successful

Table 3. Suspended-Matter Stations

Item	Date	Time (GMT)		Depth (m) Uncorr.	Position		Successful Level
		Deploy	Recover		Lat. (N)	Long. (W)	
BASS I	6/9-10/78	1809	0407	4710	34° 26.7'	59° 20.8'	Successful
BASS II	6/17/78	2300	0956	4365	33° 03.9'	57° 52.2'	Successful
BASS III	6/21/78	0028	1130	4900	35° 54.9'	66° 22.3'	Successful

Table 4. BASS Deployments