LOW LEVEL WASTE OCEAN DISPOSAL PROGRAM

Report URI-6

CRUISE REPORT

R/V ENDEAVOR CRUISE EN-071

NORTH ATLANTIC

AUGUST 8 - 18, 1981

by

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Abstract

Under investigation during Endeavor Cruise 071 (August 8 - August 18, 1981) was study area E-N3, an area of the Hatteras Abyssal Plain located between 31° 45'34° 00' N and 69° 37.5' - 72° 07.5' W. 2300 track km of 3.5 kHz sub-bottom acoustic profiles and 500 track km of minisparker profiles were obtained. Twelve piston cores and 6 sphincter cores were attempted; and 2 camera lowerings, 4 harpoon (*in situ* water sampler) lowerings, and one hydrocast were carried out. In addition, an unsuccessful attempt was made to retrieve abandoned components of instrumented mooring CMME-3 (installation failed during Endeavor Cruise 069).

Introduction

R/V Endeavor departed from Narragansett, Rhode Island at 1327Z (GMT) on August 8, 1981. Within the study area E-N3 (Fig. 1), sampling was concentrated at 11 station locations, encompasing regions of the Hatteras Abyssal Plain and the Bermuda Rise (Fig. 2). These areas had been previously identified and investigated during Endeavor Cruise 053 (7/26/80 - 8/15/80) and Endeavor Cruise 069 (6/19/81 - 7/4/81).

The types of observations carried out during EN-071 are described in Table 1 and a summary of operations and samples collected is presented in Table 2. EN-071 ended in Narragansett, Rhode Island at 1330Z on August 18, 1981.

Cruise participants are listed in Table 3.

Results

Camera

Two camera lowerings were undertaken during EN-071 using a Benthos camera and Kodak Plus X (black and white) 35 mm film (Fig. 2 and Table 4). Two of the 36 exposures taken at station location KK are of good quality, and reveal an irregular (not smooth) seafloor character. The remaining photographs at that site appear underexposed. At station location JJ, all 36 exposures appear underexposed, and the seafloor is obscured by near-bottom turbulence.

Table 1. Types of information collected during EN-071

TYPE OF OBSERVATION	PURPOSE
Camera	Assess influence of bottom currents; determine presence or absence of epibenthic fauna.
Harpoon	*In situ* pore water samples to determine vertical sub-bottom profiles of nitrates, nitrites, silica, phosphate, ammonia, manganese, and iron.
Hydrocast	Large volume water sample to determine near-bottom concentrations of cobalt, nickel, iron, and manganese (filtrate and particulate).
Piston core	Sediment samples of up to 12 m in length to determine sedimentation rates, and geotechnical properties (shear strength, compressional wave velocity, water content, bulk density profiles).
Seismic survey	Sub-bottom profiles to assess sediment layering between core sites, and identify possible erosional areas.
Sphincter core	Samples of high quality (large diameter: 21 cm) to assess lateral uniformity of deposition, and for determining geotechnical properties.

Table 3. Scientific staff on EN-071

Edward P. Laine	Chief Scientist URI
Les Shephard	Contract Representative Sandia Laboratories
Jay McCreery	Coring, Photography URI
Steve Dickson	Coring, Photography URI
Peter Lemmond	Coring, Geotechnical Properties URI
Kenneth Baldwin	Coring, Geotechnical Properties URI
Ricky Siciliano	Coring, Geotechnical Properties URI
Dave Heggie	Water Sampling (Harpoon), Geochemistry URI
Dave Graham	Water Sampling, Geochemistry URI
Tim Lewis	Water Sampling, Geochemistry URI
Steve Imms	Technician, Minisparker URI
Wayne Fissett	Coring/Minisparker URI
Dave Walsh	Coring/Camera URI
Nancy Friedrich	Scribe URI

Elaine Boespflug

Watchstander
Sandia Laboratories

Sediment Sampling

Twelve large diameter (9.8 cm) piston cores were attempted (Fig. 2 and Table 5). Forty foot core barrels (four 10 ft. sections) were used at station locations KK and NN, and 30 foot barrels (three 10 ft. sections) were used at the remaining core locations. Successfully recovered cores range in length from 91 - 858 cm. A trigger core was also secured at each core site.

Damage to the core catcher resulted in the failure of piston core 8-V. Cores 1-KK and 2-LL are of limited use as, upon recovery, they were noted to be discontinuous (numerous voids were observed throughout the core barrel liner). Their respective sample lengths (Table 5) are representative of compacted lengths.

Piston core 9-V is also of limited use. The top two sections of the core liner became lodged within the core barrel (the bottom section was removed and stored). After returning to URI, repeated attempts to remove the liners were unsuccessful. The contents were subsequently subcored using a small diameter coring tube; however, these handling procedures resulted in the loss of some of the sample.

The successful cores were split (longitudinally) on board. One-half was preserved for archiving purposes and stored under refrigeration; the other half was photographed and used for determination of geotechnical properties. Shear strength and compressional wave velocity profiles were determined on board. In addition, subsamples were secured for laboratory analysis (at URI) of bulk density, water content, triaxial shear strength, and consolidation/permeability.

Six sphincter cores were attempted, of which 3 were recovered successfully, ranging in length from 21 - 80 cm (Fig. 2 and Table 6). The corer failed to trip at core sites LL, QQ, and DD. Analyses of geotechnical properties were performed on sphincter cores 2-U and 4-PP.

Core 3-NN was subsampled for geological, geotechnical, and geochemical (pore water) analyses.

Pore Water Sampling

In order to obtain *in situ* pore water samples from bottom sediments for geochemical analyses, 4 harpoon lowerings were carried out (Fig. 2 and Table 7). A 1.7-liter Niskin bottle was lowered with harpoons 1-KK and 4-PP in order to obtain a control sample of bottom water. These operations were unsuccessful. Harpoons 1-KK and 3-NN did not penetrate the seafloor (samples drawn were of bottom water). Harpoons 2-JJ and 4-PP showed evidence of penetration; however, shipboard analyses revealed that the samples collected were also of bottom water.

Due to the repeated failure of the harpoon, pore waters were extracted from selected sediment core samples in order to carry out the geochemical analyses. Waters from piston core 11-QQ, sphincter core 3-NN, and trigger cores 2-LL, 3-JJ, and 12-DD were analyzed for concentrations of nitrates, nitrites, silica, phosphate, ammonia, manganese and iron.

Water Sampling

At station location DD, a hydrocast was completed using a 60-liter Niskin bottle (Fig. 2 and Table 8). The sample, obtained from a depth of 5340 m, was transferred into plastic containers, one of which was retained for geochemical analyses at URI. The remainder of the sample was delivered to Sherman Williams at Knolls Atomic Power Laboratory for determinations of cobalt, nickel, iron, and manganese.

Seismic Survey

Sub-bottom seismic profiling, using a Raytheon CESP 3.5 kHz profiler, was carried out at all times during EN-071, producing 2300 track km of records. Within the study area E-N3, an additional 500 track km of profile records were obtained by means of a Teledyne Model 253,

800 joule minisparker. Supplementary 12 kHz profiling was carried out while steaming to and from E-N3.

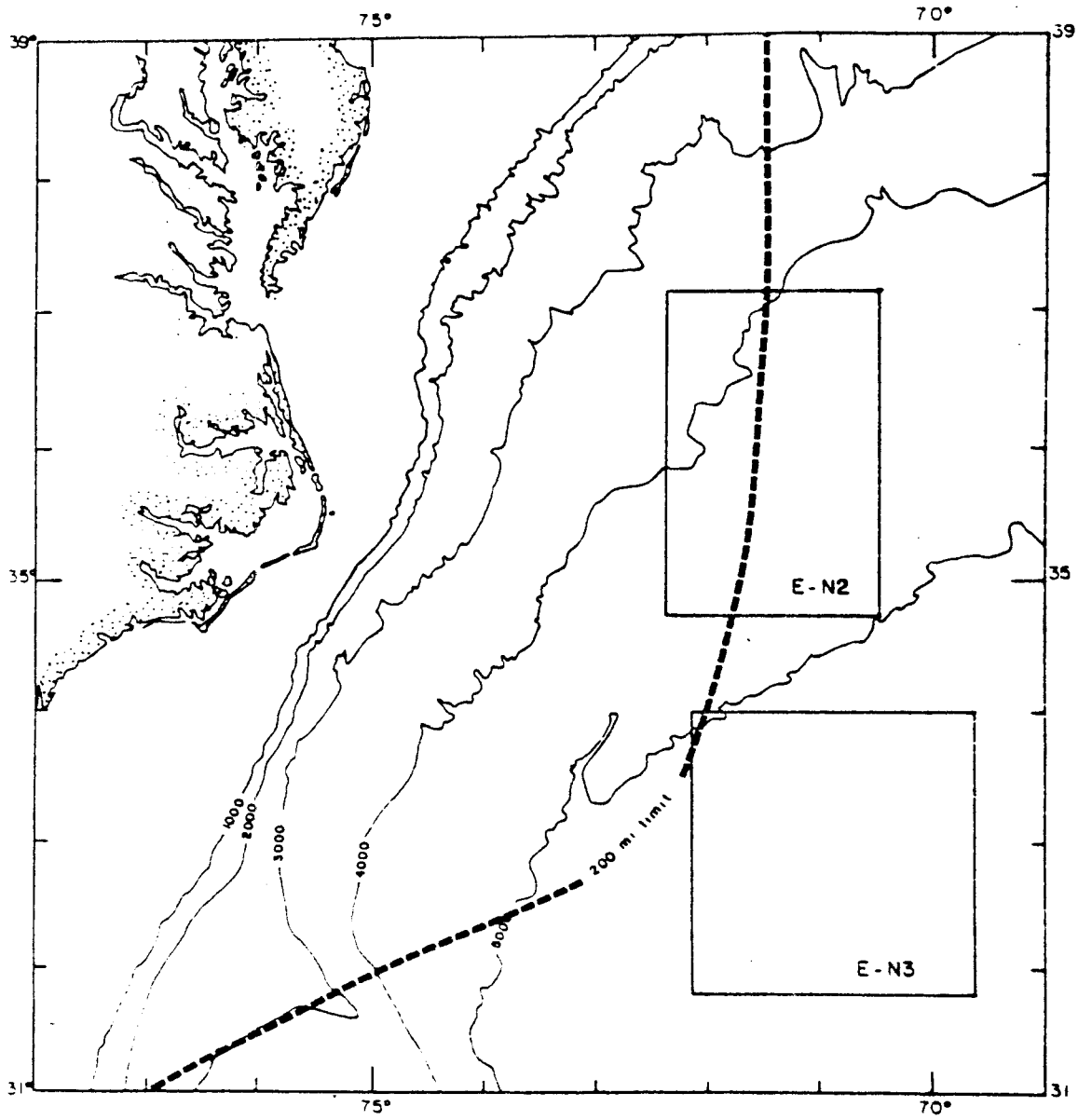
Current Meter Mooring

Installation of CMME-3 at station location DD (33^{o} 08.4' N, 70^{o} 29.0' W) (Fig. 2) failed during Endeavor Cruise 069. Two releases and 3 floatation spheres were abandoned at the site. An attempt was made to retrieve these components during EN-071. However, the release command gear failed to operate on deck and, due to time constraints, efforts were curtailed.

FIGURE CAPTIONS

Fig. 1 Position of LLWODP study area E-N3 in relation to the coastline and the 200 mile limit. Bathymetric contours are given in meters.

Fig. 2. LLWODP study area E-N3 showing EN-071 track lines (dotted), station locations, and operations (PC: piston core; SC: sphincter core; HP: harpoon; CAM: camera; HYD: hydrocast). Bathymetric contours are given in fathoms.


75°
70°
39°
39
35°
35
31°
31
E-N2
E-N3
1000
2000
3000
4000
200 mi limit

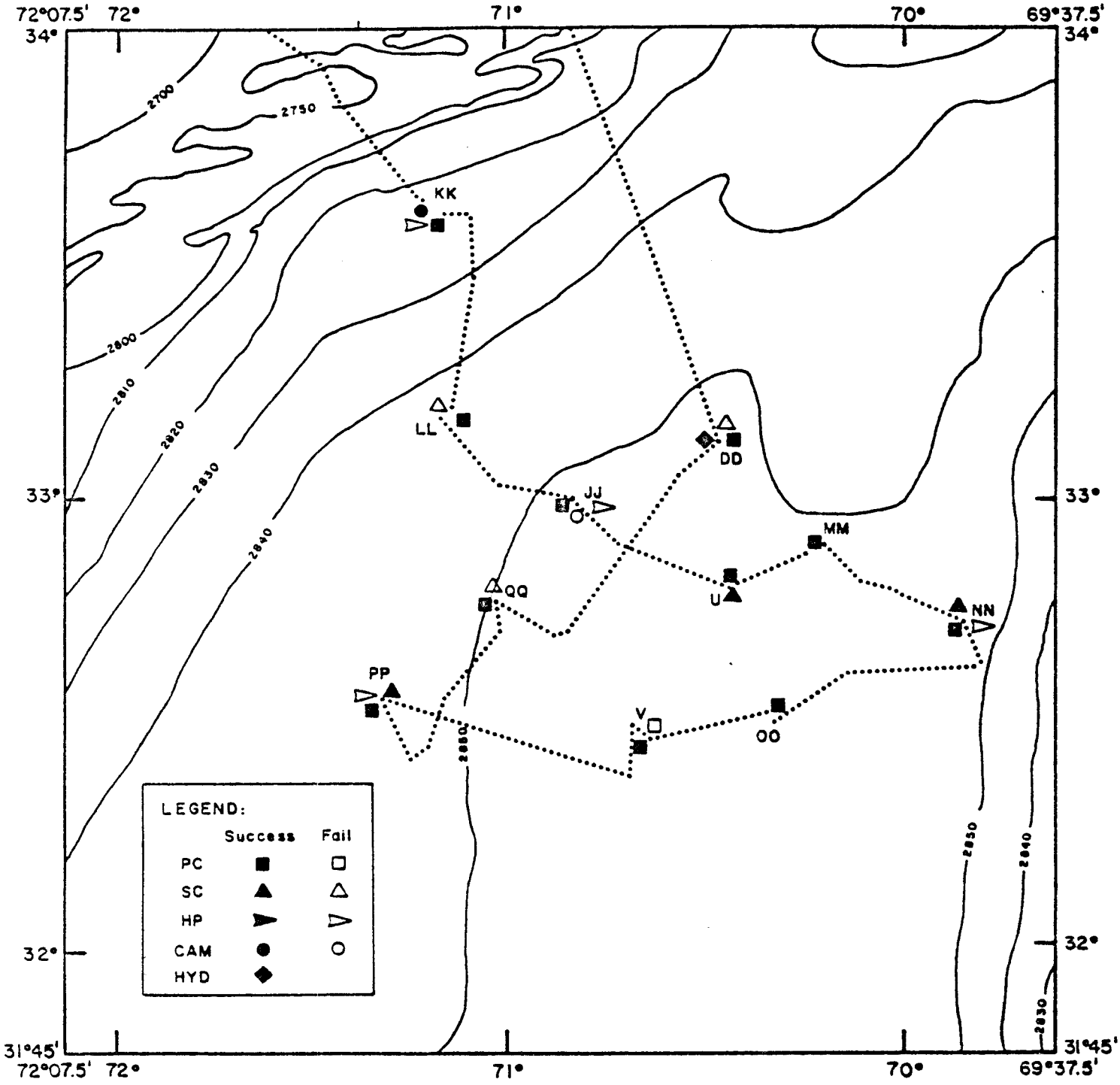

72°07.5'
72°
71°
70°
69°37.5'
34°
33°
32°
31°45'
2700
2750
2800
2810
2820
2830
2840
2850
KK
LL
DD
JJ
MM
QQ
U
NN
PP
V
OO
LEGEND:
Success
Fail
PC
SC
HP
CAM
HYD

Table 2. Time sequence of operations during EN-071.

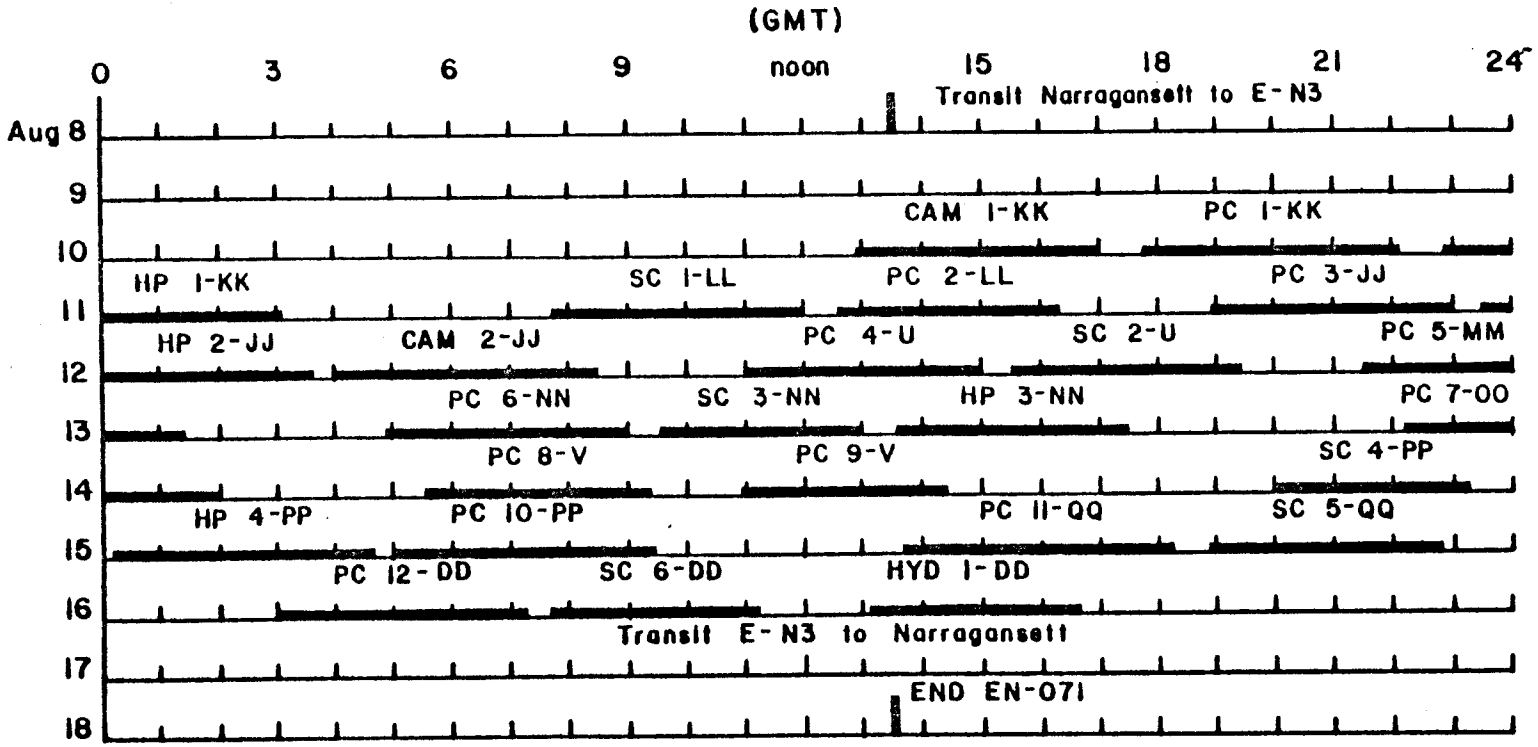


TABLE 4

POGO CAMERA LOWERINGS EN-071

CAMERA STATION-LOCATION	POSITION	DATE	TIME(Z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	CAMERA TYPE (mm)	COMMENTS
1-KK	33°35.4'N 71°10.7'W	08/10/81	1253-1659 (1443)	5304	A.P.; distinct	35	2 exposures of good quality: irregular (bed-forms?); Sargasso weed
2-JJ	32°55.6'N 70°46.5'W	08/12/81	0401-0832 (0554)	5343	A.P.; mushy	35	All exposures underexposed

LARGE DIAMETER PISTON CORES EN-071

PC STATION-LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	BARREL LENGTH (SAMPLE) (cm)	COMMENTS
1-KK	33°36.2'N 71°07.5'W	08/10/81	1740-2205 (1919)	5304	A.P.; distinct	1220(40') (94)	Disturbed, discontinuous
2-LL	33°06.4'N 71°04.7'W	08/11/81	1232-1621 (1419)	5338	A.P.; mushy	910(30') (150)	Disturbed, discontinuous
3-JJ	32°59.3'N 70°50.3'W	08/11/81	1855-2258 (2047)	5341	A.P.; mushy	910(30') (347)	For Geotech. and Geology
4-U	32°49.3'N 70°27.3'W	08/12/81	1100-1459 (1242)	5347	A.P.; distinct	910(30') (168)	For Geotech. and Geology
5-MM	32°53.1'N 70°13.8'W	08/12-13/81	2129-0122 (2304)	5349	A.P.; mushy	910(30') (138)	For Geotech. and Geology
6-NN	32°44.9'N 69°50.6'W	08/13/81	0456-0856 (0651)	5325	Bermuda Rise Hills; hyper-bolic	1220(40') (858)	For Geotech. and Geology
7-OO	32°32.0'N 70°20.0'W	08/13-14/81	2212-0202 (2353)	5351	A.P.; mushy	910(30') (613)	For Geotech. and Geology
8-V	32°29.9'N 70°39.5'W	08/14/81	0537-0923 (0718)	5347	A.P.; mushy	910(30') -	Failure; core catcher damaged
9-V	32°26.4'N 70°39.2'W	08/14/81	1056-1425 (1221)	5347	A.P.; mushy	910(30') (574)	For Geotech. and Geology
10-PP	32°29.2'N 71°15.6'W	08/15/81	0501-0936 (0727)	5330	A.P.; distinct, nugget area	910(30') (500)	For Geotech. and Geology
11-QQ	32°46.4'N 70°59.9'W	08/15/81	1346-1816 (1535)	5342	A.P.; mushy	910(30') (91)	For Geochem. and Geology
12-DD	33°03.5'N 70°34.0'W	08/16/81	0302-0719 (0442)	5345	A.P.; distinct	910(30') (210)	For Geotech. and Geology

SPHINCTER CORES EN-071

SC STATION-LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	LENGTH BARREL (SAMPLE) (c m)	COMMENTS
1-LL	33°10.4'N 71°10.4'W	08/11/81	0741-1157 (0955)	5335	A.P.; mushy	-	Failure; did not trip
2-U	32°49.3'N 70°25.1'W	08/12/81	1526-1924 (1716)	5347	A.P.; distinct	89 (58)	For Geotech. and Geology
3-NN	32°44.2'N 69°49.7'W	08/13/81	0935-1301 (1123)	5330	Bermuda Rise Hills; hyperbolic	89 (80)	For Geology, Geotech., and Geochem.
4-PP	32°34.0'N 71°19.0'W	08/14/81	2005-2318 (2147)	5330	A.P.; distinct, nugget area	89 (21)	For Geotech. and Geology
5-QQ	32°42.7'N 70°54.7'W	08/15/81	1851-2250 (2052)	5345	A.P.; mushy	-	Failure; did not trip
6-DD	33°04.9'N 70°32.2'W	08/16/81	0741-1115 (0934)	5345	A.P.; distinct	-	Failure; did not trip

TABLE 7

WATER SAMPLING (HARPOON) EN-071

HARPOON STATION-LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION (ON BOTTOM-OFF BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SUB-BOTTOM SAMPLE DEPTH (cm)	COMMENTS
1-KK	33°36.4'N 71°05.4'W	08/10-11/81	2252-0308 (0114-0124)	5304	A.P.; distinct	-	Failure; probes did not penetrate bottom
2-JJ	32°56.2'N 70°47.6'W	08/11-12/81	2326-0344 (0132-0202)	5343	A.P.; mushy	-	Failure; penetration but no pore water
3-NN	32°43.0'N 69°48.1'W	08/13/81	1336-1737 (1534-1600)	5333	Bermuda Rise Hills; hyperbolic	-	Failure; probes did not penetrate bottom
4-PP	32°31.5'N 71°17.0'W	08/15/81	0012-0446 (0206-0240)	5330	A.P.; distinct, nugget area	-	Failure; penetration but no pore water

HYDROCAST EN-071

HYDROCAST STATION-LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION (BOTTLE TRIPPED)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE DEPTH (m)	COMMENTS
1-DD	$33^{o}08.4'N$ $70^{o}28.6'W$	08/16/81	1305-1642 (1511)	5345	A.P.; distinct	5340	For Geochem.