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EN-069

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Core Laboratory
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CRUISE REPORT

R/V ENDEAVOR CRUISE EN-069

NORTH ATLANTIC

JUNE 19 - JULY 4, 1981

by

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and Nancy E. Friedrich

EN-069

ABSTRACT

Under investigation during Endeavor Cruise 069 (June 19 - July 4, 1981) was study area E-N3, an area of the Hatteras Abyssal Plain located between $31^{\circ}45'$ - $34^{\circ}00'$ N and $69^{\circ}37.5'$ - $72^{\circ}07.5'$ W. 3200 km of 3.5 kHz sub-bottom acoustic profiles and 430 km of minisparker profiles were obtained, 19 sphincter cores were attempted (5 failed); and 11 CTD/transmissometer lowerings, 2 large volume water casts (producing 15 sub-samples), and 1 hydrocast were carried out. One current meter and sediment trap mooring attempt failed, a second installation attempt was successful, and a third mooring was recovered. In addition, 3 attempts to obtain water samples by means of wireless, metal-free bottom water samplers were unsuccessful.

INTRODUCTION

R/V Endeavor departed from St. George's, Bermuda at 1557Z (GMT) on 19 June 1981. Within the study area E-N3 (Fig. 1), sampling was concentrated at 18 locations encompassing areas of the Bermuda Rise, the Hatteras Abyssal Plain, and the lower continental rise (Fig. 2). These areas had been previously identified and investigated during Endeavor Cruise 053 (7/26 - 8/15/80). The types of observations carried out are described in Table 1, and a summary of operations and samples collected is presented in Table 2.

A port stop was made in Morehead City, North Carolina from 1200Z 29 June to 0130Z 30 June 1981 to transfer personnel. EN-069 ended in Morehead City, N.C. at 1415Z on 4 July 1981.

Cruise participants are listed in Table 3.

RESULTS

Water Column

Eleven lowerings of a Neil Brown Mark III CTD with an O₂ probe were made during the cruise (Fig. 2 and Table 4). In order to characterize the well-mixed layer, a SEATECH transmissometer, with a 1 m light path, was mounted on the frame. Lowerings were made to within 2 m of the bottom; however, during CTD's 4, 8, 9, and 10, a large wire angle developed due to the sea conditions, causing the unit to touch bottom, and consequently altering the conductivity sensor. Eleven 5 - liter

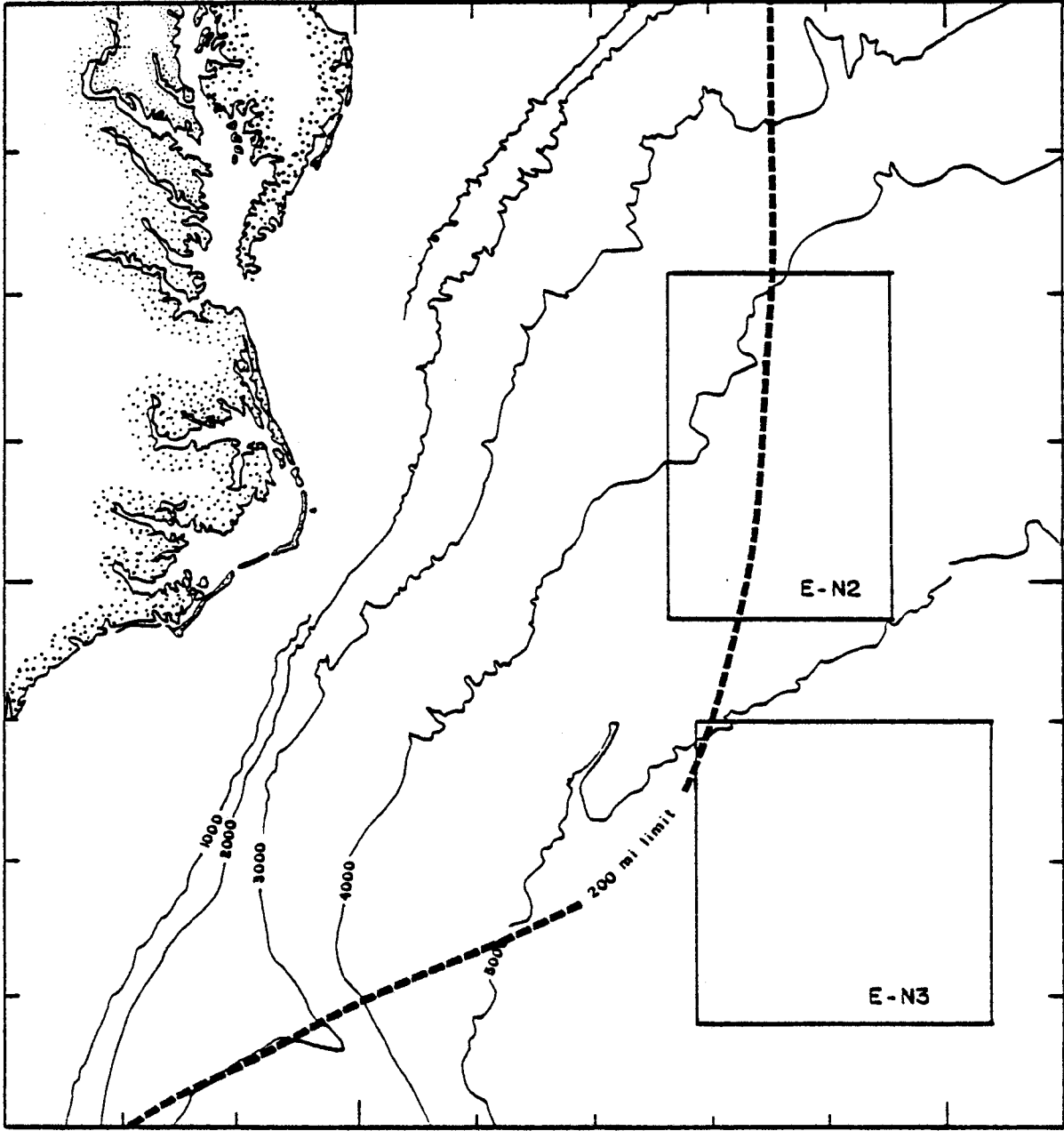


Figure 1. Position of study area E-N3 in relation to the coastline and the 200 mile limit.

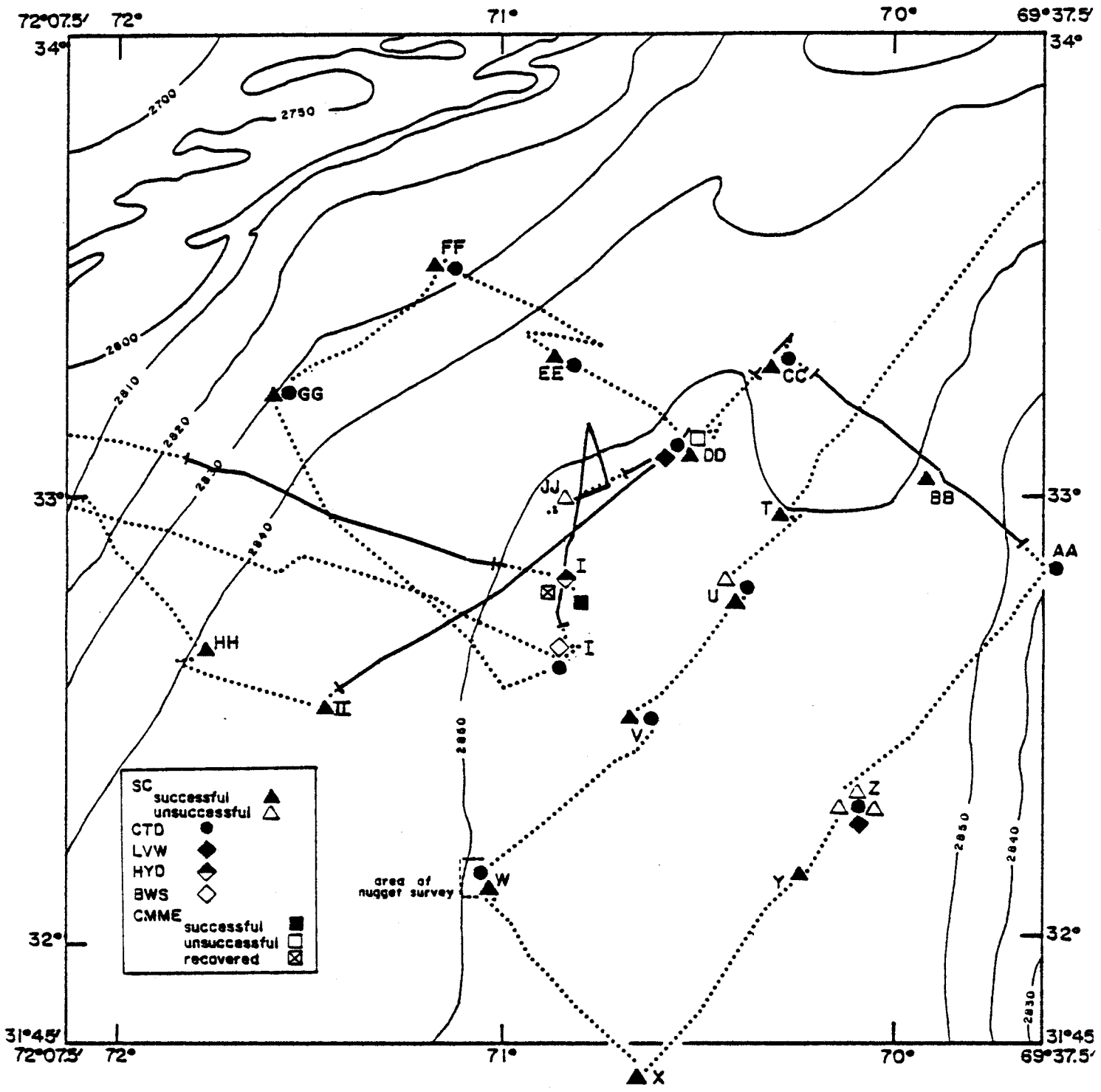


Figure 2. Study area E-N3 showing EN-069 track lines (dotted: 3.5 kHz profile lines; solid: 3.5 kHz and minisparker profile lines), station locations, and operations (SC: sphincter core; LVW: large volume water; HYD: hydrocast; BWS: bottom water sample; CMME: current meter and sediment trap mooring).

Table 1. Types of information collected during EN-069.

TYPE OF OBSERVATION	PURPOSE
Bottom water (metal-free sampler)	Provide uncontaminated (by metal) sample for analysis of trace metals.
CTD	Determine detailed vertical profiles of temperature, salinity, and oxygen to assess water mass distribution.
Current meter	Determine vertical velocity profile in the water column; determine lateral and vertical coherence of circulation patterns.
Hydrocast	Determine vertical profile of organic and inorganic suspended matter.
Large volume water	Determine concentrations of fall-out radio-nuclides at selected depths.
Sediment trap	Define downward and upward fluxes of particles through the water column. These data define the energy input to the benthic ecosystem and establish whether buoyant particles could form a potential "short circuit" across the water column.
Seismic survey	When combined with SASS data, seismic profiles will allow interpolation of sediment layering between core sites and identify possible erosional areas.
Sphincter core	Samples of high quality to assess lateral uniformity of deposition.

TYPE OF OBSERVATION

PURPOSE

Suspended matter

Spot measurements of total suspended matter to calibrate transmissometers.

Transmissometer
(moored)

Determine time-series record of near-bottom light transmission to assess variability of well-mixed layer.

Transmissometer
(wire-lowered)

Detailed vertical profile of light transmission to determine thickness and character of well-mixed layer.

Table 2. Time sequence (GMT) of operations during EN-069 in study area E-N3. Refer to Figure 2 for station locations (SC: sphincter core; LVW: large volume water; BWS: bottom water sample; HYD: hydrocast; CMME: current meter and sediment trap mooring).

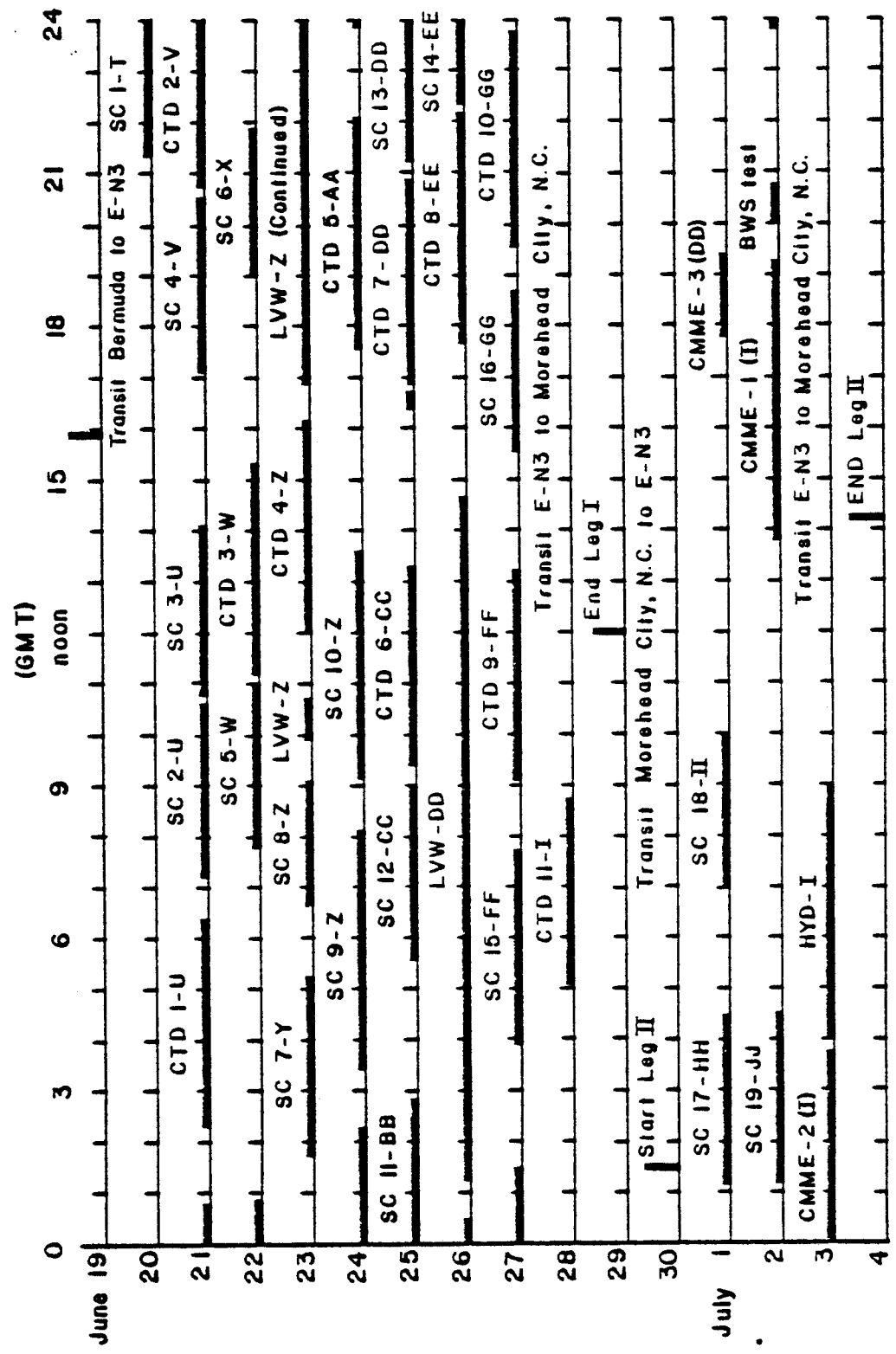


Table 3. Scientific staff on EN-069.

Leg I

Edward P. Laine	Chief Scientist URI
Julie Fisher	Seismics URI
Janis Smith	Suspended Sediment URI
Jan Szelak	CTD/Transmissometer URI
David Nelson	CTD/Transmissometer / Minisparker URI
Ted Benttinen	Oxygen/Salinity /Temperature URI
Doug Moore	Coring/Water Sampling WHOI
William Clark	Coring/Water Sampling WHOI
Lyn Brady	Coring/Water Sampling WHOI
Jay McCreery	Coring URI
Steve Dickson	Coring URI
Wayne Fissett	Coring /Minisparker URI
David Walsh	Coring URI
Nancy Friedrich	Scribe URI

Leg II

Edward P. Laine	Chief Scientist URI
Doug Moore	Coring/Water Sampling URI
William Clark	Coring/Water Sampling WHOI
Lyn Brady	Coring/Water Sampling WHOI
Peter Kalk	Sediment Traps WHOI
Dennis Root	Current Meter Moorings OSU
Jay Simpkins	Current Meter Moorings OSU
Chris Moser	Sediment Traps OSU
Ted Banttinen	Oxygen/Salinity URI
David Nelson	CTD/Transmissometer /Minisparker URI
Janis Smith	Water Sampling (Organics) URI
Jay McCreery	Coring URI
Steve Dickson	Coring URI
Wayne Fissett	Coring /Minisparker URI

Niskin bottles, 6 with reversing thermometers, were tripped during each lowering. Samples were analyzed at sea for salinity and oxygen content. In order to calibrate the transmissometer, each sample was also filtered to determine total suspended matter (completion of analyses to be made at URI).

In addition, an internally recording CTD with an acoustic nephelometer was mounted on the frame by Doug Moore of WHOI.

One hydrocast was completed at station location I (Fig. 2 and Table 5). Sixteen 5 - liter Niskin bottles were tripped, in pairs, at selected depths. Samples were analyzed at sea for salinity and oxygen content, and filtered in order to determine particulate organic carbon concentrations.

Sphincter Cores

Nineteen sphincter cores were attempted, of which 14 were recovered successfully, ranging in length from 15 - 74 cm (Fig. 2 and Table 6). The corer was damaged during SC 16-GG, repaired during the port stop, and damaged again during SC 19-JJ, curtailing coring operations.

Obtained for geochemical analyses, sphincter cores 1-T, 11-BB, 17-HH, and 18-II were extruded on deck and sub-sampled for analysis at WHOI. Cores taken for lithologic, sedimentary structure, CaCO_3 , and C_{14} analyses were preserved intact.

Current Meter and Sediment Trap Moorings

At station location DD ($33^{\circ}08.4'N$ $70^{\circ}29.0'W$) (Fig. 2), an attempt to install CMME-3 failed when the mooring anchor line fouled and broke during deployment. However, installation of CMME-2 at location I was successful (Table 7). The mooring is comprised of 4 regular sediment traps,

2 inverted sediment traps, 3 current meters, and 2 current meters with transmissometers (Fig. 3).

CMME-1 was recovered from station location I. The mooring was operable for 290 days, having been installed on 15 September 1980 during Endeavor Cruise 055.

Large Volume Water

Two large volume water casts were completed using 160 - liter Bodman bottles to obtain samples at selected depths (Fig. 2 and Table 8). The 6 samples collected from station location Z, and the 7 samples from location DD were transferred into plastic carboys for analysis of fall-out radionuclides at WHOI.

Three unsuccessful attempts were made to collect uncontaminated bottom water samples by means of wireless, metal-free samplers (Table 9). This operation was undertaken primarily to test the sampling technique.

Seismic Survey

Sub-bottom seismic profiling, using a Raytheon CESP 3.5 kHz profiler, was carried out at all times except during a CTD lowering or when in port (Fig. 2). 3200 km of records were obtained (1500 km within area E-N3). Depths and the acoustic character of the seafloor were noted at 15 - minute intervals.

A Teledyne Model 253, 800 joule minisparker was tested on EN-069. Approximately 430 km of profiles were obtained (Fig. 2).

CMME-2
 32°44.7' N 70°50.7' W
 2345Z 7/2/81

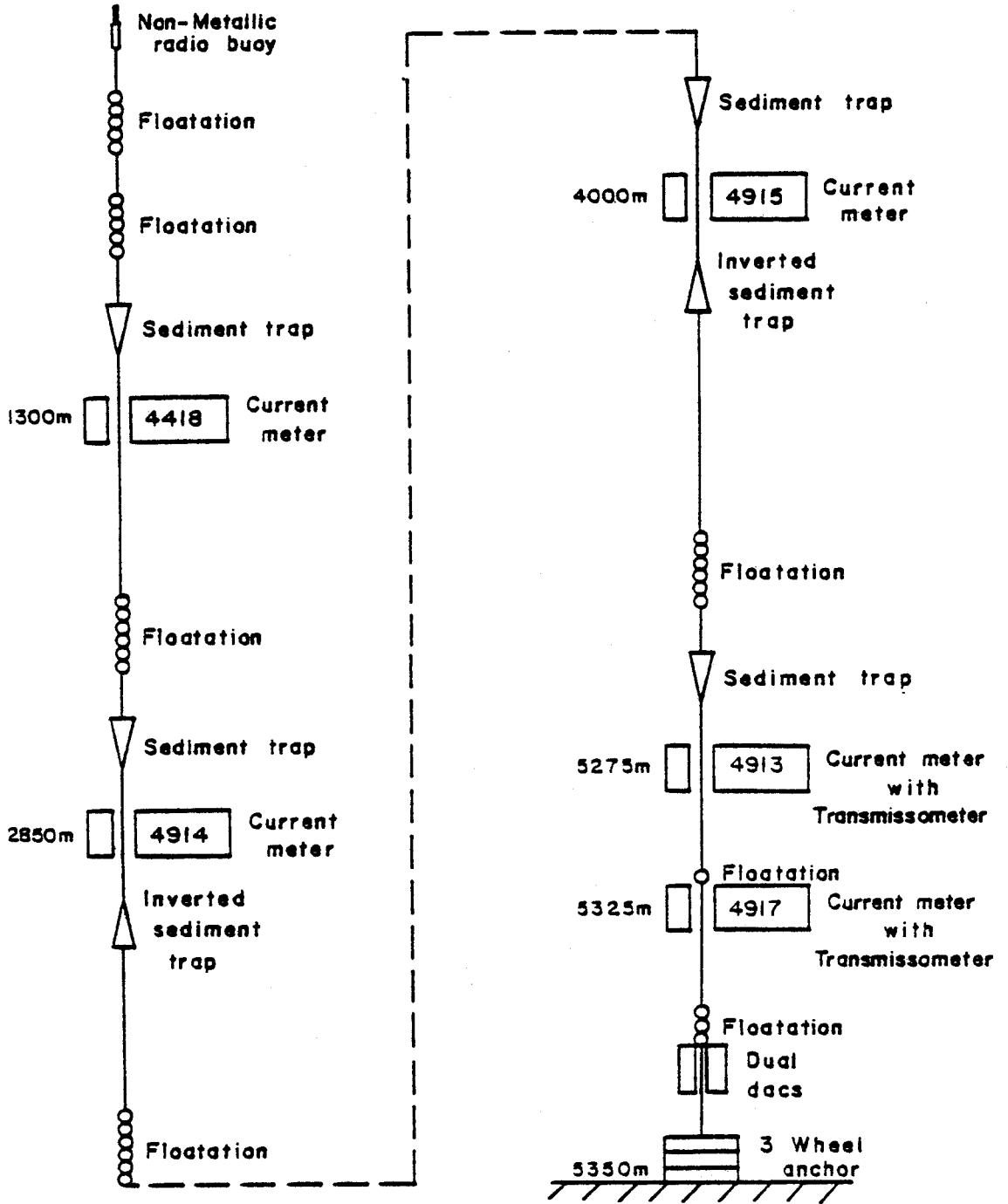


Figure 3. Schematic illustration of mooring CMME-2 installed at station location I (refer to Figure 2 for location) during EN-069.

TABLE 4

CTD W/TRANSMISSOMETER LOWERINGS EN-069

CTD w/trans. STATION- LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE PRESSURE (JOB)	COMMENTS
1-U	32°48.1'N 70°26.6'W	06/21/81	0220-0623 (0359)	5352	A.P.; distinct	5515	
						5504.6	
						5493.2	
						5298.8	
						5100.6	
						4896.9	
						4499.1	
						3496.3	
						2502.3	
						350.6	
257.9							
2-V	32°29.5'N 70°39.2'W	06/21-22/81	2044-0047 (2226)	5352	A.P.; distinct	5516.2	
						5500.6	
						5474	
						5400	
						4998.9	
						4600	
						3592.9	
						2500.3	
						1312.2	
						356	
254.4							
3-W	32°07.2'N 71°01.8'W	06/22/81	1110-1515 (1243)	5344	A.P.; distinct nugget area	5510	
						5500	
						5490	
						5460	
						5000	
						4500	
						3500	
						2500	
						1300	
						350	
250							

TABLE 4

CTD W/TRANSMISSOMETER LOWERINGS EN-069

CTD w/Trans, STATION- LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE PRESSURE (db)	COMMENTS
4-Z	32°19.3'N 70°06.2'W	06/23/81	1200-1610 (1334)	5354	A.P.; mushy(?)	5520	Touched bottom
						5505	
						5495	
						5480	
						5200	
						5125	
						4500	
						2850	
						1300	
						350	
250							
5-AA	32°50.8'N 69°38.3'W	06/24/81	1735-2202 (1945)	5588	B'da Rise hills; distinct	5460	
						5450	
						5435	
						5385	
6-CC	33°19.7'N 70°16.4'W	06/25/81	0921-1315 (1055)	5343	A.P.; distinct	5000	
						5239	
						5000	
						4500	
						2850	
						1300	
						350	
						250	
						5504	
						5500	
5495							
5480							
5430							
5000							
4500							
2850							
1300							
350							
250							

TABLE 4

CTD W/TRANSMISSOMETER LOWERINGS EN-069

CTD w/trans. STATION- LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE PRESSURE (DB)	COMMENTS
7-DD	33°05.9'N 70°34.0'W	06/25/81	1622-1646	5348	A.P.; distinct(?)		Recovered to remove transmissometer sponge protector
7(2)-DD	33°06.0'N 70°33.6'W	06/25/81	1648-2056 (1830)	5348	A.P.; distinct(?)	5510 5485 5450 5435 5400 5225 4500 2850 1300 350 250	
8-EE	33°18.2'N 70°50.5'W	06/26/81	1742-2210 (1940)	5343	A.P.; distinct	5505 5480 5455 5430 5380 4875 4825 4500 2850 1300 350	Bad wire angle; touched bottom

TABLE 4

CTD W/TRANSMISSOMETER LOWERINGS EN-069

CTD w/trans. STATION- LOCATION	POSITION	DATE	TIME (2) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE PRESSURE (dB)	COMMENTS
9-FF	33°30.1'N 71°09.4'W	06/27/81	0903-1311 (1107)	5315	LCR Steps; distinct	5480 5470 5460 5450 5260 5100 4900 4500 2850 1300 250	Bad wire angle; touched bottom
10-GG	33°12.9'N 71°36.5'W	06/27/81	1935-2339 (2121)	5300	LCR Steps; mushy	5475 5450 5405 5390 5370 5340 5200 4500 2850 1300 250	
11-I	32°37.1'N 70°50.8'W	06/28/81	0459-0840 (0637)	5349	A.P.; mushy	5570 5498 5487 5449 5438 5249.6 5097.4 4503 2851 1300 250	Touched bottom

TABLE 5

HYDROCAST EN-069

HYDROCAST STATION- LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE DEPTHS (corr. m)	COMMENTS
1-1	32°43.3'N 70°52.8'W	07/03/81	0400-0900	5347	A.P. : mucky	5383 5379 5363 5359 5339 5335 5314 5310 5040 5036 4046 4042 2902 2898 1362 1358	

TABLE 6

SPHINCTER CORES EN-069

SC STATION- LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	LENGTH BARREL (SAMPLE) (m)	COMMENTS
1-T	32° 57.0' N 70° 18.2' W	06/20-21/81	2135-0042 (2317)	5350	A.P.; mushy	89 (70)	For geochemistry
2-U	32° 48.05' N 70° 26.3' W	06/21/81	0716-1038 (0903)	5352	A.P.; distinct	-	Failure
3-U	32° 47.9' N 70° 23.2' W	06/21/81	1050-1405 (1226)	5352	A.P.; distinct	89 (74)	For geology
4-V	32° 31.8' N 70° 40.9' W	06/21/81	1705-2030 (1852)	5352	A.P.; distinct	89 (60)	For geology
5-W	32° 07.9' N 71° 02.5' W	06/22/81	0747-1058 (0921)	5344	A.P.; distinct nugget area	89 (60)	For geology
6-X	31° 41.7' N 70° 41.4' W	06/22/81	1900-2155 (2021)	5353	A.P.; distinct	89 (20)	For geology
7-Y	32° 09.4' N 70° 15.6' W	06/23/81	0144-0516 (0331)	5355	A.P.; mushy(?)	89 (63.5)	For geology
8-Z	32° 18.9' N 70° 06.8' W	06/23/81	0640-0903	5354	A.P.; mushy(?)	-	Descent aborted at 0758Z due to cable (hydrowire) parting
9-Z	32° 19.4' N 70° 05.9' W	06/24/81	0332-0809 (0604)	5354	"	-	Lowered by deep sea winch; corer pre-tripped but no core recovered

TABLE 6

SPHINCTER CORES EN-069

SC STATION-LOCATION	POSITION	DATE	TIME (2) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	LENGTH BARREL (SAMPLE) (m)	COMMENTS
10-2	32°18.8'N 70°06.3'W	06/24/81	0913-1333 (1130)	5354	A.P.; mushy(?)	-	Lowered by deep-sea winch; corer pre-tripped but no core recovered
11-BB	33°02.9'N 69°53.6'W	06/24-25/81	2349-0250 (0122)	5350	B'da Rise Hills; distinct	89 (60)	On acoustic wire. For geochemistry
12-CC	33°18.2'N 70°17.8'W	06/25/81	0536-0857 (0725)	5343	A.P.; distinct	89 (36)	On acoustic wire. For geology
13-DD	33°07.6'N 70°31.2'W	06/25-25/81	2110-0025 (2257)	5348	A.P.; distinct(?)	89 (56)	On acoustic wire. For geology
14-EE	33°18.6'N 70°47.8'W	06/26-27/81	2222-0127 (2358)	5343	A.P.; distinct	89 (60)	On acoustic wire. For geology
15-FF	33°30.1'N 71°09.4'W	06/27/81	0352-0742 (0602)	5325	LCR Steps; distinct	89 (53.3)	On acoustic wire. For geology
16-GG	33°13.0'N 71°36.5'W	06/27/81	1536-1845 (1714)	5300	LCR Steps; mushy	89 (63.5)	On acoustic wire. For geology (corer damaged)
17-HH	32°38.9'N 71°47.2'W	07/01/81	0107-0426 (0253)	5317	A.P.; distinct	89 (15)	On acoustic wire. For geochemistry
18-II	32°31.2'N 71°27.9'W	07/01/81	0702-1002 (0836)	5387	A.P.; distinct	89 (23)	On acoustic wire. For geochemistry
19-JJ	32°59.5'N 70°50.4'W	07/02/81	0109-0427 (0252)	5346	A.P.; distinct	-	Corer damaged; failure

TABLE 7

CURRENT METER MOORINGS EN-069

CHME STATION- LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION	BOTTOM DEPTH (m)	BOTTOM CHARACTER	COMMENTS
1-I	32°39.2'N 70°50.9'W	07/02/81	1350-1916	5347	A.P.; mushy	Recovered
2-I	32°44.7'N 70°50.7'W	07/2-3/81	2345-0344	5347	"	Installed
3-DD	33°08.4'N 70°29.0'W	07/01/81	1745-1922	5346	A.P.; distinct	Installation failure

TABLE 8

LARGE VOLUME WATER SAMPLING EN-069

BODMAN BOTTLE STATION-LOCATION	POSITION	DATE	TIME (Z) TOTAL STATION (BOTTLE TRIPPED)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE DEPTH (m)	COMMENTS
Z-Surf	32°19.4'N 70°07.0'W	06/23/81	0955-0958 (0957)	5354	A.P.; musby	Surface	On hydrowire
Z-400	32°19.4'N 70°06.8'W	06/23/81	1017-1044 (1035)	5354	"	400	"
Z-800	32°19.4'N 70°06.7'W	06/23/81	1057-1132 (1117)	5354	"	800	"
Z-4000	32°18.9'N 70°06.0'W	06/23/81	1654-1939 (1827)	5354	"	4000	On acoustic wire
Z-Bottom	32°19.5'N 70°07.4'W	06/23/81	1954-2306 (2136)	5354	"	5354	"
Z-Bottom (-50)	32°22.6'N 70°08.2'W	06/23-24/81	2315-0220 (0056)	5354	"	5304	"

TABLE 8

LARGE VOLUME WATER SAMPLING EN-069

BODMAN BOTTLE STATION-LOCATION	POSITION	DATE	TIME (Z) 'TOTAL STATION (BOTTLE TRIPPED)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE DEPTH (m)	COMMENTS
DD-Surf	33°05.9'N 70°33.5'W	06/26/81	0113-0117 (0115)	5347	A.P.; distinct	Surface	On acoustic wire
DD-400	33°06.3'N 70°33.2'W	06/26/81	0130-0206	5347	"	-	Messengers failed to trip bottle
DD-400(2)	33°06.7'N 70°32.4'W	06/26/81	0208-0233 (0221)	5347	"	400	On acoustic wire
DD-Bottom	33°07.2'N 70°31.6'W	06/26/81	0251-0629 (0446)	5348	"	5348	"
DD-Bottom (-50)	33°05.9'N 70°33.3'W	06/26/81	0725-1030 (0910)	5348	"	5298	"
DD-Bottom (-1000)	33°05.9'N 70°34.3'W	06/26/81	1102-1345 (1232)	5348	"	4348	"
DD-800	33°07.7'N 70°32.9'W	06/26/81	1357-1440 (1425)	5347	"	800	"

TABLE 9

METAL-FREE BOTTOM WATER SAMPLING EN-069

M-F BVS STATION-LOCATION	POSITION	DATE	TIME (Z)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE DEPTH (m)	COMMENTS
1-I	32°44.2'N 70°50.5'W	07/02/81	2002-2014	5347	A.P.; mushy	-	Recovered broken
2-I	32°44.4'N 70°50.3'W	07/02/81	2014-	5347	"	-	Broken on deck prior to deployment
3-I	32°44.5'N 70°50.4'W	07/02/81	2043-	5347	"	-	Deployed but not recovered

A. Ashraf