

CALL SAUNDERS EN-085
Arthur H. Saunders, Jr.
June 9, 1982

CRUISE REPORT
ENDEAVOR CRUISE EN-085
NORTH ATLANTIC
May 27-June 8, 1982

by
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JUNE 1982

EN-085

Abstract

The main operations of Endeavor Cruise EN-085 (May 27 - June 8, 1982) were conducted within the Hatteras Abyssal Plain study location E-N3 located between $31^{\circ}00' - 34^{\circ}00'N$; $69^{\circ}00' - 73^{\circ}00'W$. Additional operations were carried out within the study location E-N2 situated on the lower continental rise ($36^{\circ}00' - 37^{\circ}00'N$; $71^{\circ}00' - 72^{\circ}30'W$). In total, 2471 track km of 3.5 kHz subbottom acoustic profiles were obtained. Within E-N3 study location, 3 piston cores, 2 sphincter cores, 2 gravity cores and 4 boomerang cores were attempted; one current meter mooring (CMME-2) was recalled and 2 current meter moorings (CMME-4 and CMME-5) were installed; and 6 pogo camera lowerings, 7 CTD with transmissometer lowerings and 3 pinger probe lowerings were carried out. In addition, an unsuccessful attempt was made to retrieve components of instrumented mooring CMME-3.

In route between study locations E-N3 and E-N2, one CTD with transmissometer lowering was carried out within the lower continental rise hills province. One current meter mooring (CMME-6) and one Bottom Ocean Monitor were deployed; one CTD with transmissometer lowering was carried out, and one piston core was attempted within E-N2 study location.

Introduction

R/V Endeavor departed from Narragansett, Rhode Island at 1337Z (GMT) on May 27, 1982. Sampling occurred at 10 station locations, within the Hatteras Abyssal Plain study area and lower continental rise steps province (E-N3) (Figs. 1, 2, and 3). Areas of interest had been previously identified and investigated during Endeavor cruises EN-053 (7/26-8/15/80), EN-069 (6/19-7/4/81) and EN-071 (8/8-8/18/81). One sampling station was located in the lower continental rise hills province between E-N3 and E-N2 study locations (Figs. 2 and 3). Within the E-N2 study location sampling was concentrated around one station location (Fig. 4 and 5).

The various operations carried out during EN-085 are described in Table 1 and a summary of samples collected is presented in Table 2. EN-085 ended in Woods Hole, Massachusetts at 0930Z on June 8, 1982.

Cruise participants are listed in Table 3.

Results

Bottom Ocean Monitor

A Bottom Ocean Monitor (instrumented tripod) was installed within the E-N2 study area at station location H (Fig. 5; Table 4). The tripod consists of a nephelometer, a current meter, and a 35 mm time-lapse camera (Fig. 6). The system will be recalled in the spring of 1983.

Camera

Six camera lowerings were undertaken using a Benthos 371 "Pogo" camera and Kodak Plus-X (black and white) and Kodak Tri-X (black and white; one lowering) 35 mm film. Only one roll of 36 exposures taken at station

Table 1. Information Collected During EN-085

TYPE OF OBSERVATION	PURPOSE
Bottom Ocean Monitor	Time-lapse photography of seafloor joined with light scattering and current velocity time series to monitor the influence of near-bottom currents and organisms in the stability of the seabed.
Camera	Assess influence of bottom currents; determine presence or absence of epibenthic fauna.
CTD	Provide detailed vertical profiles of temperature, salinity, oxygen and silicates to assess water mass distribution, characterize nepheloid layer and trace advected mixed layers.
Current Meter	Determine vertical velocity profile in water column; determine coherence of circulation patterns.
Free-Fall Cores	Provide sample of surface sediments.
Gravity Core	Provide sediment samples to determine geological and geotechnical properties.
Pinger Probe	Provide record of detailed acoustic response of seafloor sediments.

Piston Core	Sediment samples of up to 8 m in lengths to determine sedimentation rates, geophysical properties.
Sediment Trap	Define downward and upward fluxes of particles in water column. Characterize energy input to benthic ecosystem and determine if buoyant particles could provide potential "short circuit" across water column.
Seismic Survey	Seismic profiles to allow interpretation between cores and identify possible areas of erosion.
Silicates	To map distribution of deepwater masses.
Sphincter Core	High quality sediment samples to assess lateral uniformity of sediments.
Suspended Matter	Samples to calibrate transmissometer.
Transmissometer (moored)	Provide time-series record of near-bottom light transmission to assess temporal variability of the nepheloid layer.
Transmissometer (wire-lowered)	Provide detailed vertical profile of light transmission to chart the nepheloid layer.

TABLE 2

Time sequence (GMT) of operations during EN-085 in study areas E-N2 and E-N3. Refer to figures 2 - 5 for station locations (BOM: Bottom Ocean Monitor; CMME: Current Meter with Sediment Trap Mooring; SC: Sphincter Core; CAM: Camera; PP: Pinger Probe; FFC: Free-fall Core; PC: Piston Core; GC: Gravity Core).

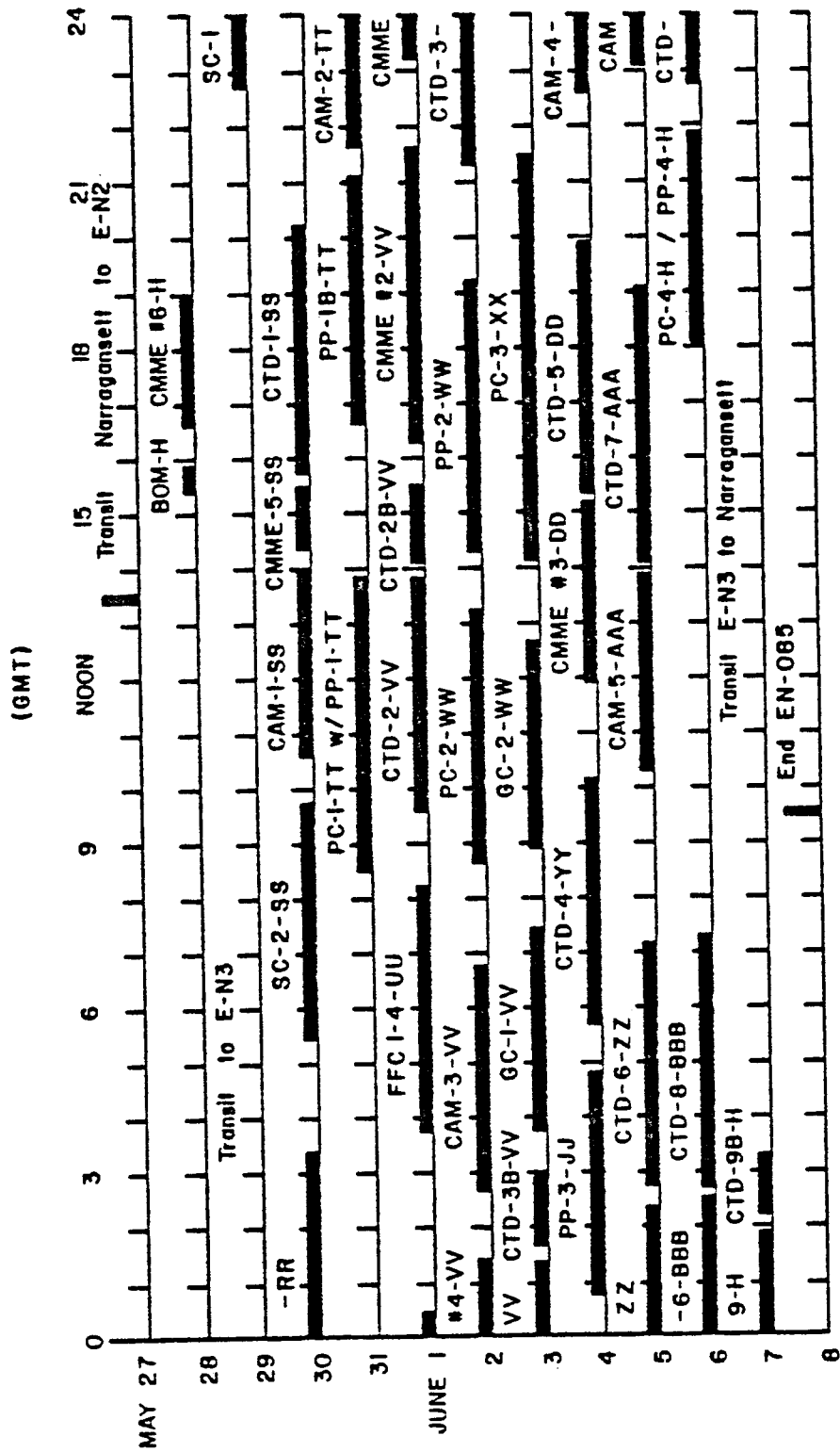


Table 3. Scientific Staff on EN-085

Edward P. Laine	Chief Scientist URI
Dennis Root	CMME'S OSU
Chris Moser	CMME'S OSU
Jay Simpkins	CMME'S OSU
Lisa Kaskan	CMME'S OSU
Peter Bruchausen	BOM, Photography Lamont-Doherty
Ted Benttinen	Hydro-Technician URI
Bill Hahn	Hydro-Technician URI
Jan Szelak	CTD URI
Dave Walsh	Coring URI
Jim Guilmette	Coring URI
Julie Fisher	Scribe/Watch URI
Jay McCreery	Coring/Pinger Probe/Watch URI
Steve Dickson	Coring/Watch URI

Ann Isley

Suspended Matter/Watch
URI

Mary Baker

Watch
URI

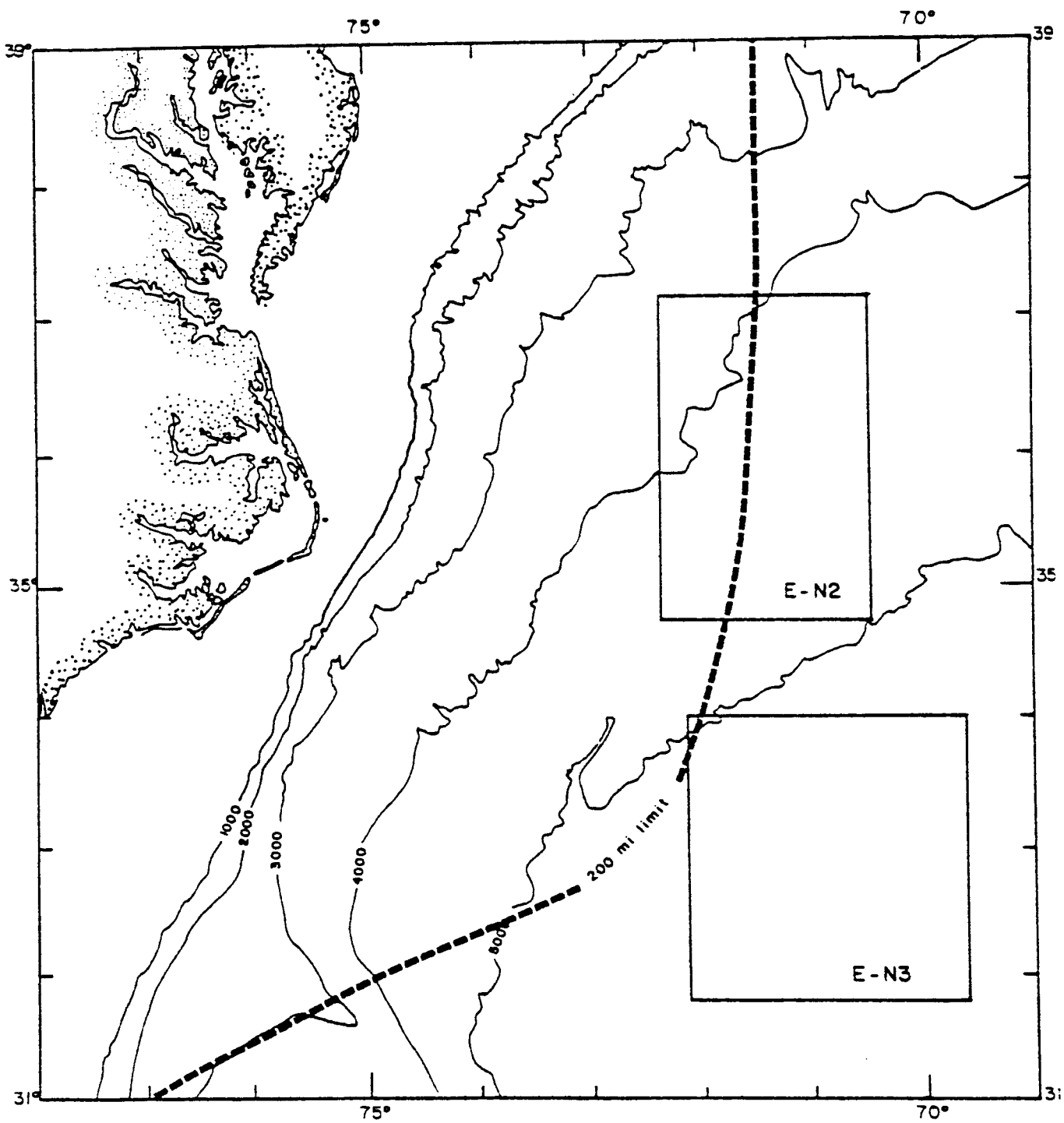


Figure. 1 Position of Study area E-N2 and E-N3 in relation to the coastline and 200 mile limit.

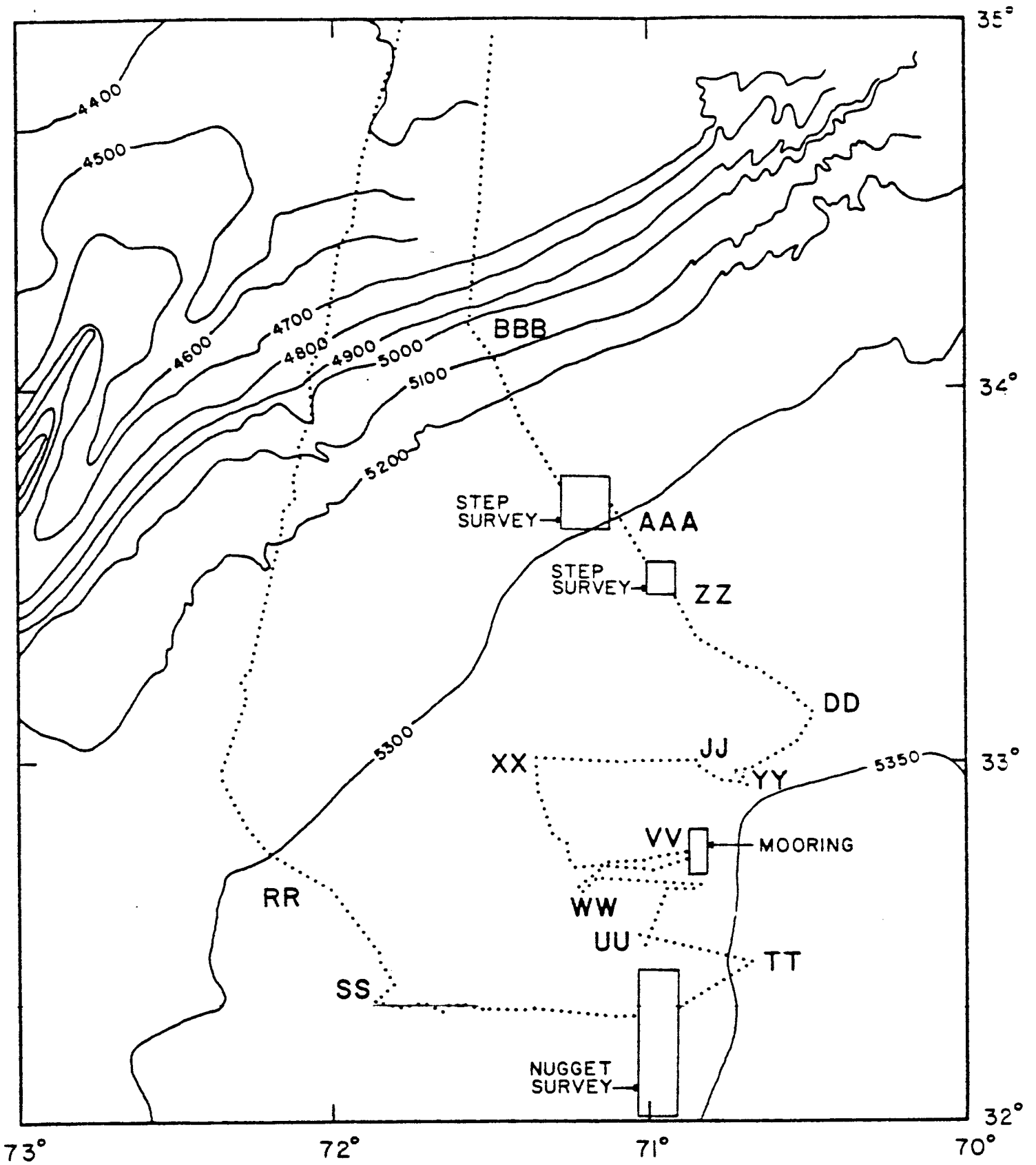


Figure. 2 Study area E-N3; EN-085 track lines (dotted) and station locations (letters).

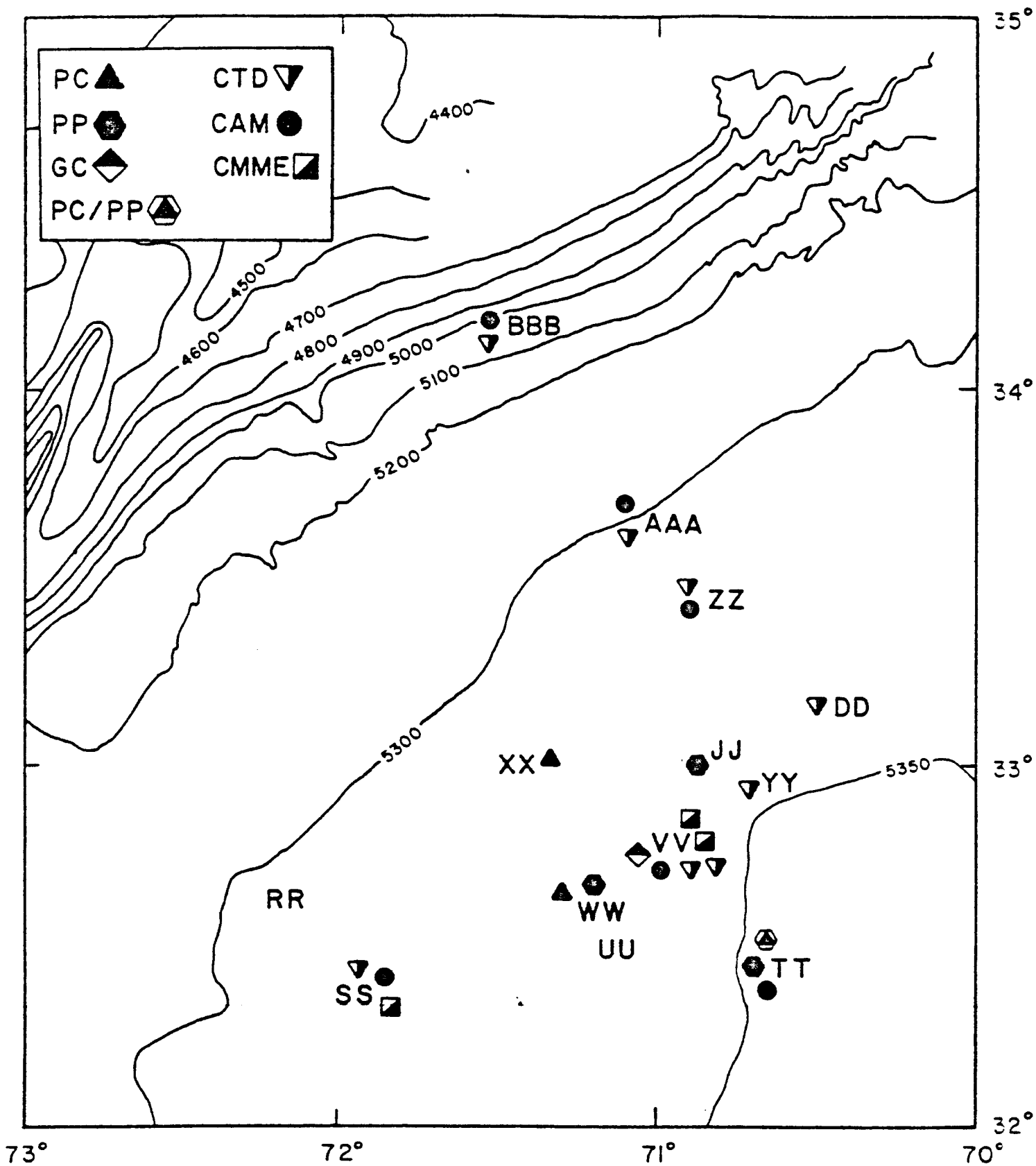


Figure. 3 Study area E-N3 showing EN-085 station locations (letters) and station operations (PC: Piston Core; PP: Pinger Probe; GC: Gravity Core; CAM: Camera; CMME: Current meter and sediment trap mooring). Bathymetric contours are given in meters.

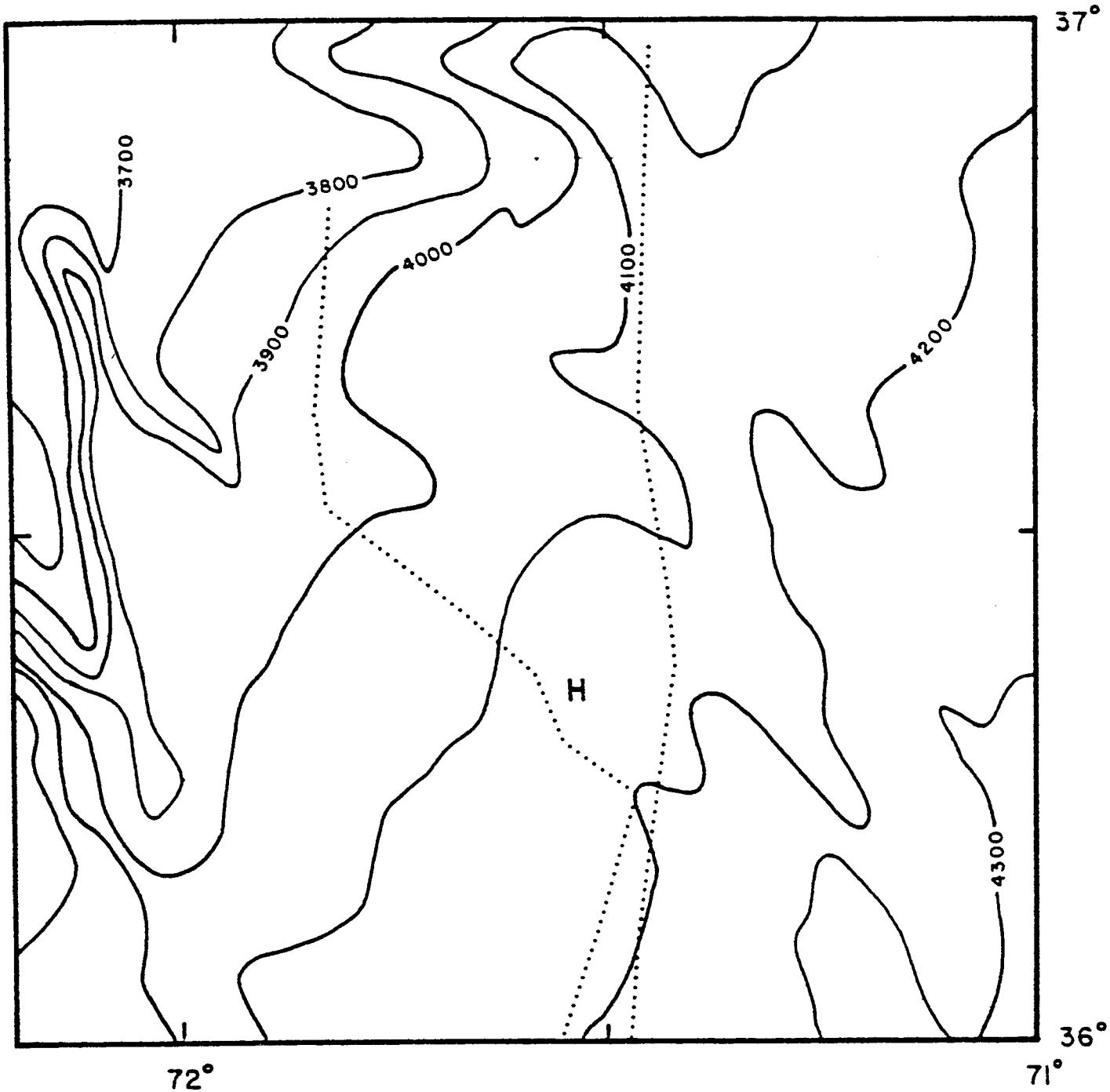


Figure. 4 Detailed study area within E-N2 showing EN-085 track lines (dotted) and station locations (letters).

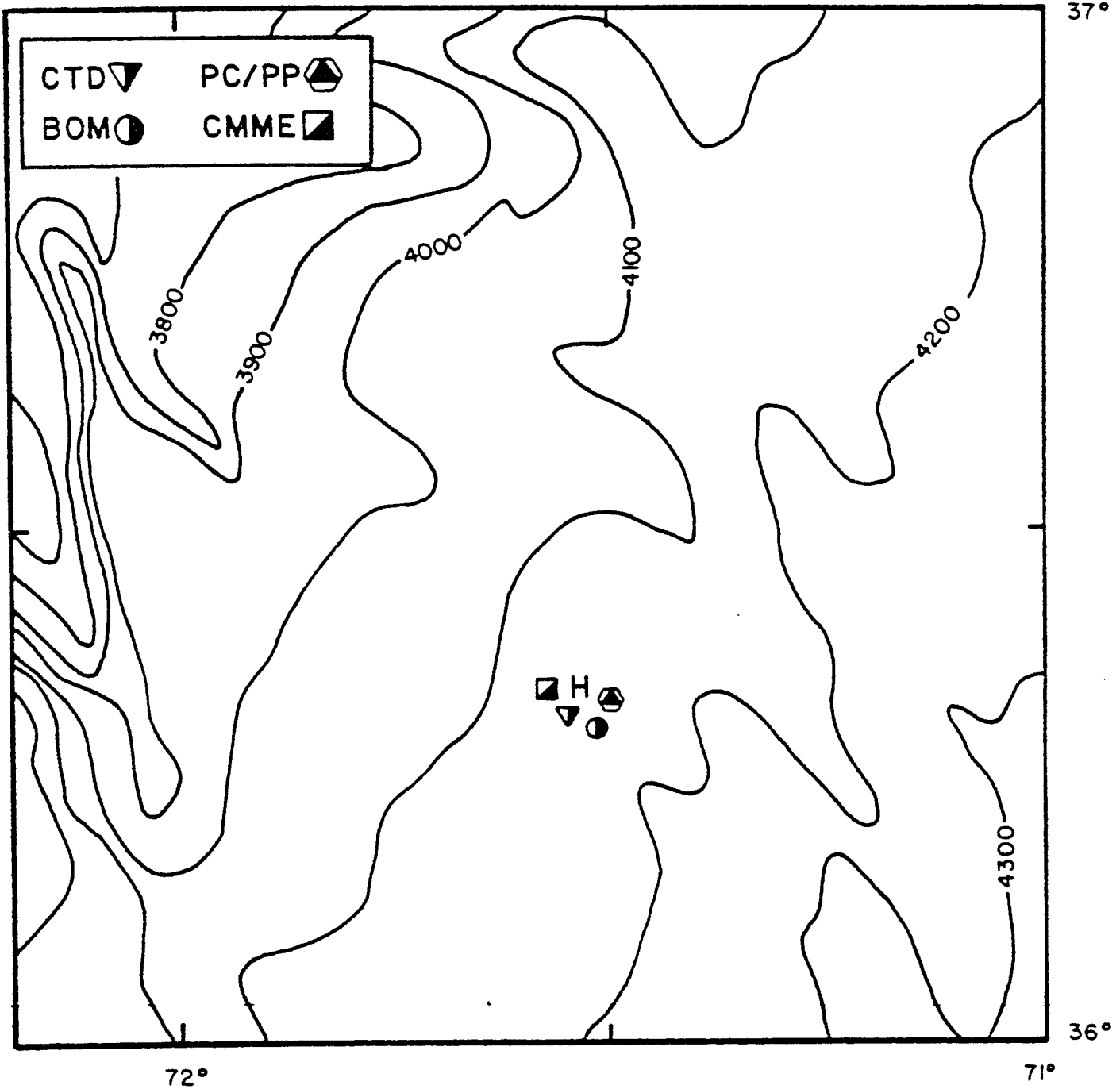


Figure. 5 Detailed Study area within E-N2 showing EN-085 station locations (letters) and station operations (BOM: Bottom Ocean Monitor; CMME: Current meter and sediment trap mooring; PC: Piston Core; PP: Pinger Probe). Bathymetric contours are given in meters.

SANDIA BOM
ENDEAVOR CRUISE EN-085
MAY 27 - JUNE 8, 1982

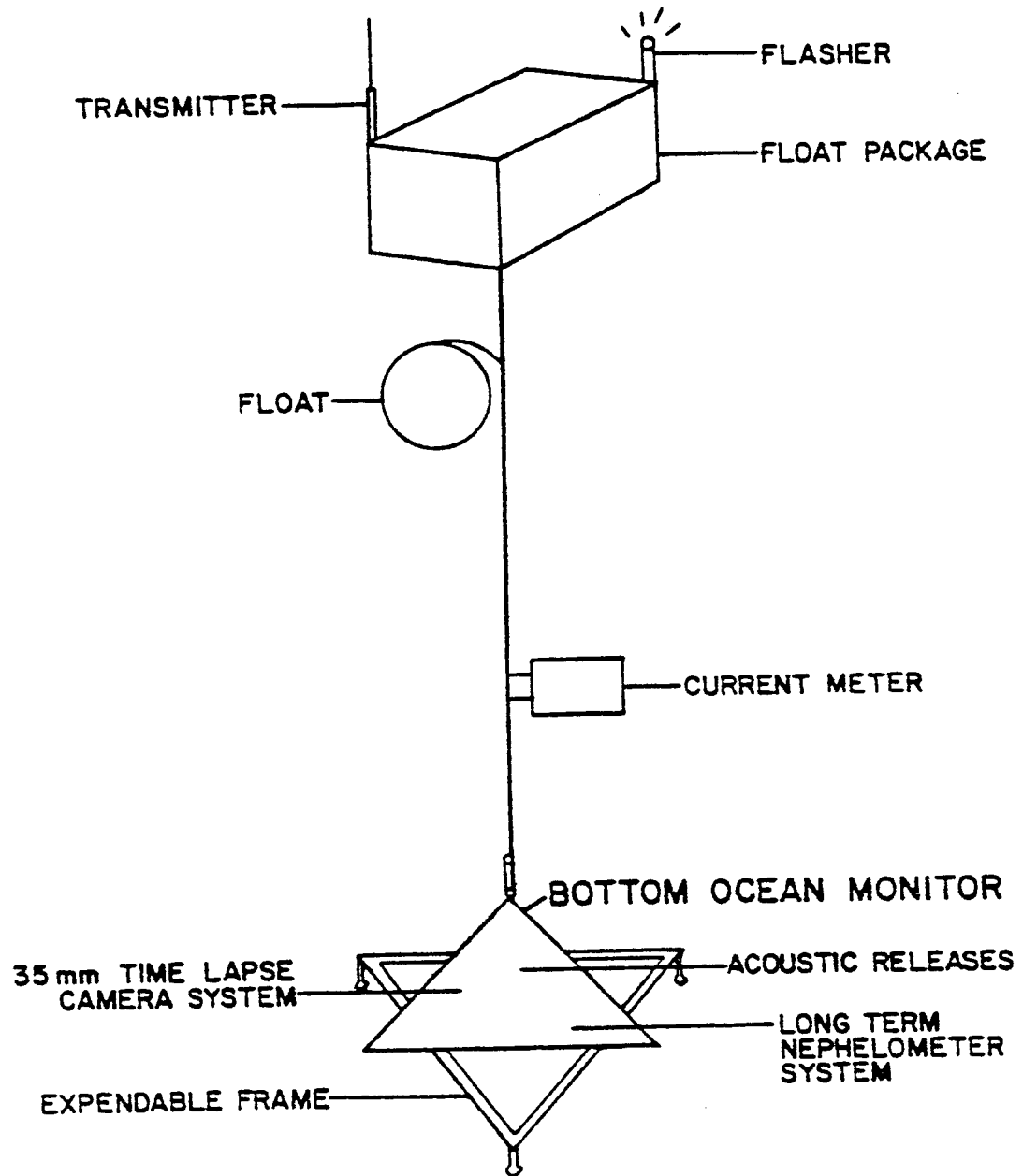


Figure. 6 Schematic illustration of Bottom Ocean Monitor installed at station location H (refer to Figure 5 for location) during EN-085.

location SS (Fig. 3; Table 5) was developed on board ship. The photographs revealed a slightly irregular seafloor with numerous tracks.

Current Meter and Sediment Trap Moorings

At station location H ($36^{\circ} 16.1'N$; $71^{\circ} 32.5'W$ /E-N2 study location) current meter mooring CMME-6 was installed (Figs. 4 and 5; 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. 7). A shorter mooring, CMME-5, consisting of 2 regular sediment traps, one inverted sediment trap, one current meter and 2 current meters with transmissometers was deployed at station location SS ($32^{\circ} 21.4'N$; $71^{\circ} 50.0'W$ /E-N3 study location) (Figs. 3 and 8). At station location VV ($32^{\circ} 44.5'N$; $70^{\circ} 49.7'W$ /E-N3 study location) long mooring CMME-4, consisting of 4 regular sediment traps, 2 inverted sediment traps, 3 current meters and 2 current meters with transmissometers was installed (Figs. 3 and 9).

CMME-2 was recovered from station location VV ($32^{\circ} 47.1'N$; $70^{\circ} 49.0'W$) (Fig. ~~10~~), having been operable for 332 days (deployed 07/3/81 during EN-069). ^{Report UCI-5.} An unsuccessful attempt was made to retrieve components (releases) of CMME-3 at station location DD ($33^{\circ} 08.0'N$; $70^{\circ} 28.8'W$) (Figs. 3 and ~~11~~).

Seismic Survey

A Raytheon CESP 3.5 kHz profiler was used at all times during the cruise to collect subbottom seismic profiles, resulting in 2471 km of records (Figs. 2 and 4). Three small areas were surveyed in detail; one area within the "nugget" region, and two areas within the lower continental rise steps province (Fig. 2). Depths were noted at 15-minute intervals.

Water Column Sampling

Nine lowerings of a Neil Brown III CTD with an O_2 probe were made during the cruise (Figs. 3 and 5; Table

CMME-6

36°16.1'N 71°32.5'W

1906Z 5/28/82

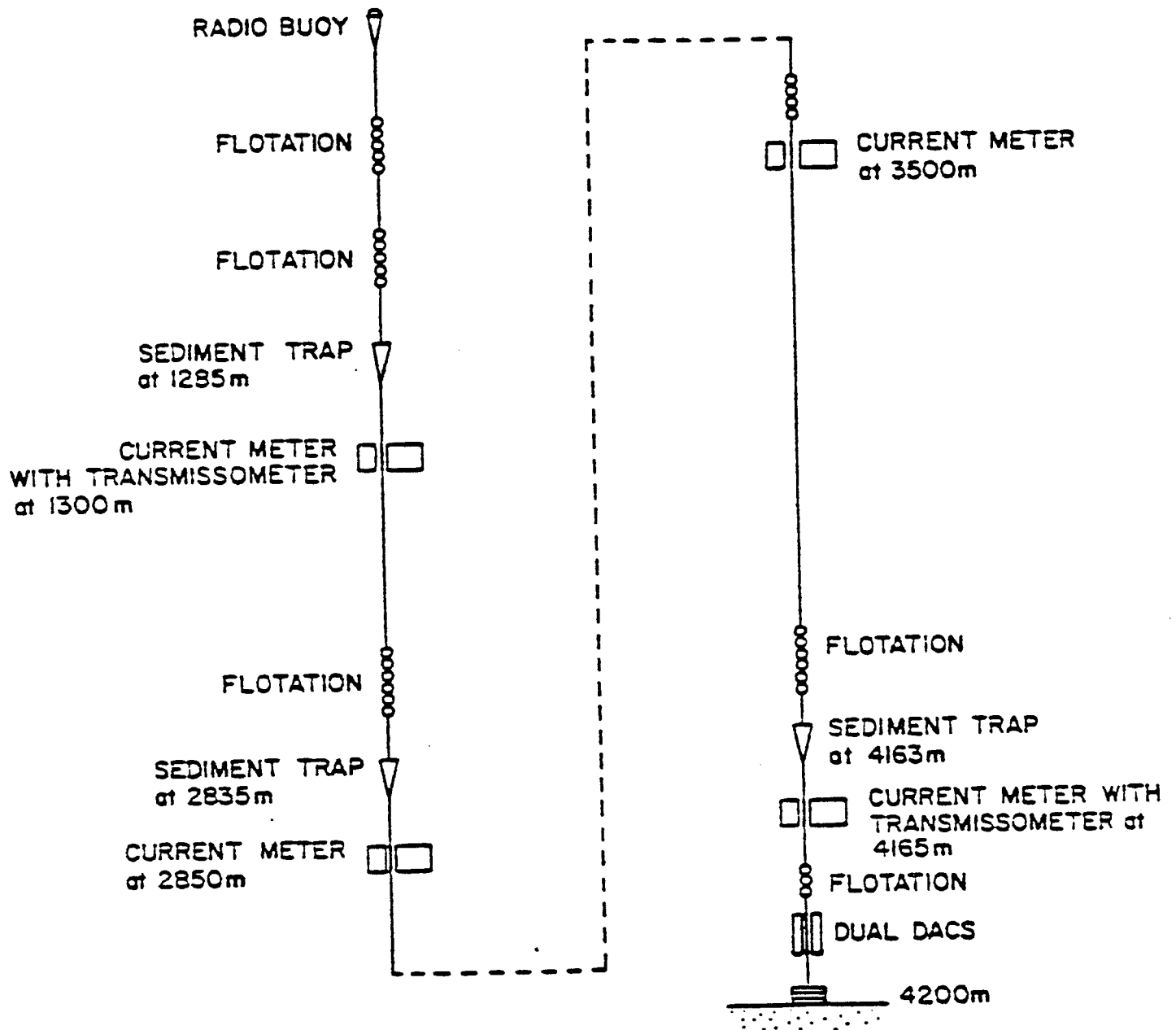


Figure. 7 Schematic illustration of CMME-6 installed at station location H (refer to Figure 5 for location) during EN-085.

CMME-5
32°21.4'N 71°50.0'W
1521Z 5/30/82

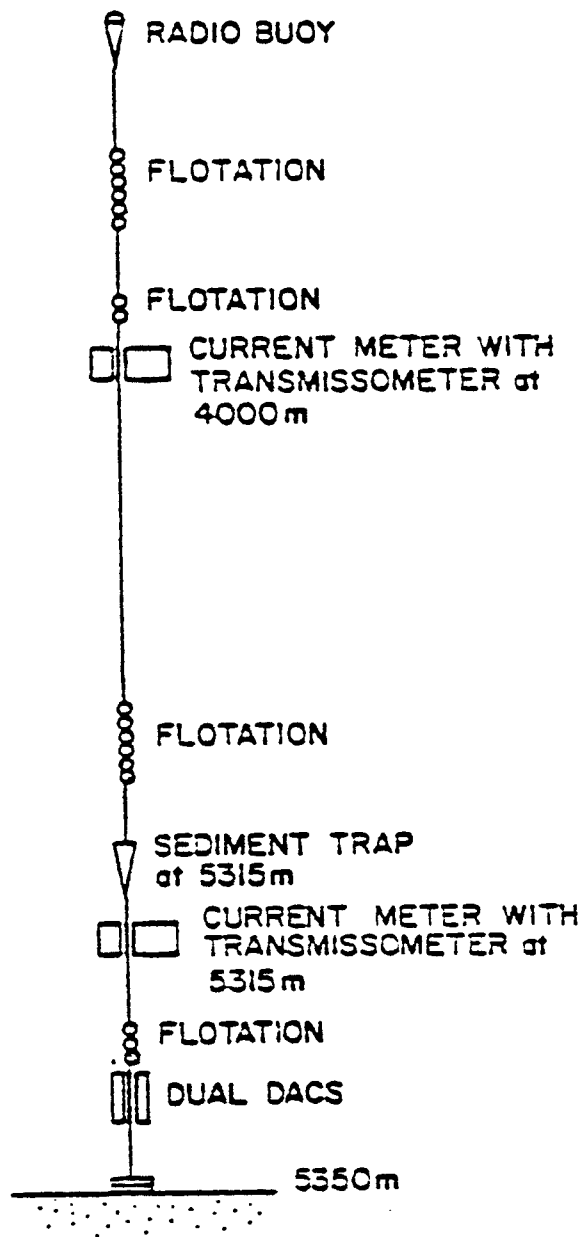


Figure. 8 Schematic illustration of CMME-5 installed at station location SS (refer to Figure 3 for location) during EN-085.

CMME-4

32°44.5'N 70°49.7'W

0128Z 6/01-02/82

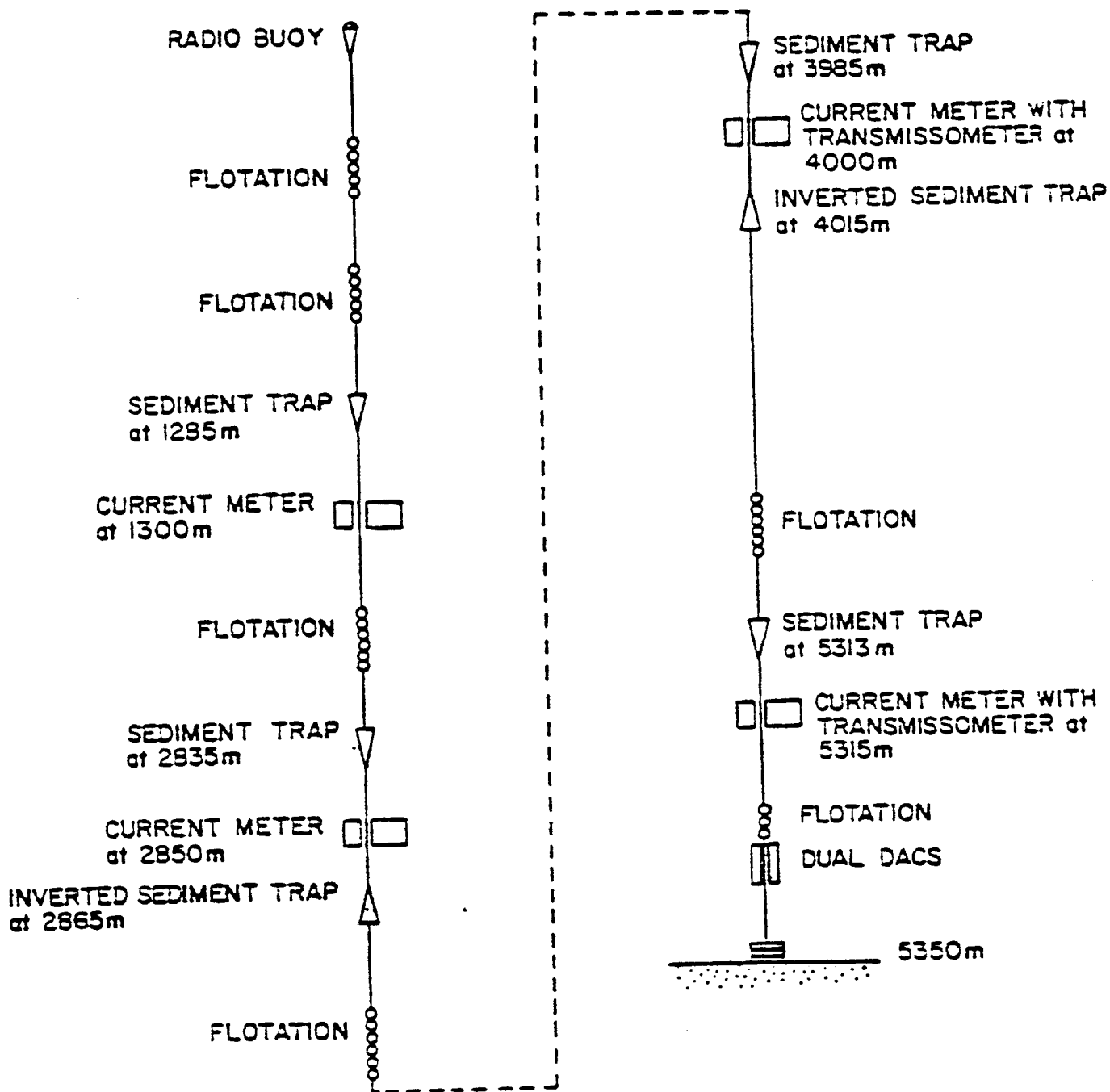


Figure. 9 Schematic illustration of CMME-4 installed at station location VV (refer to Figure 3 for location) during EN-085.

CMME-4

32°44.5'N 70°49.7'W

0128Z 6/01-02/82

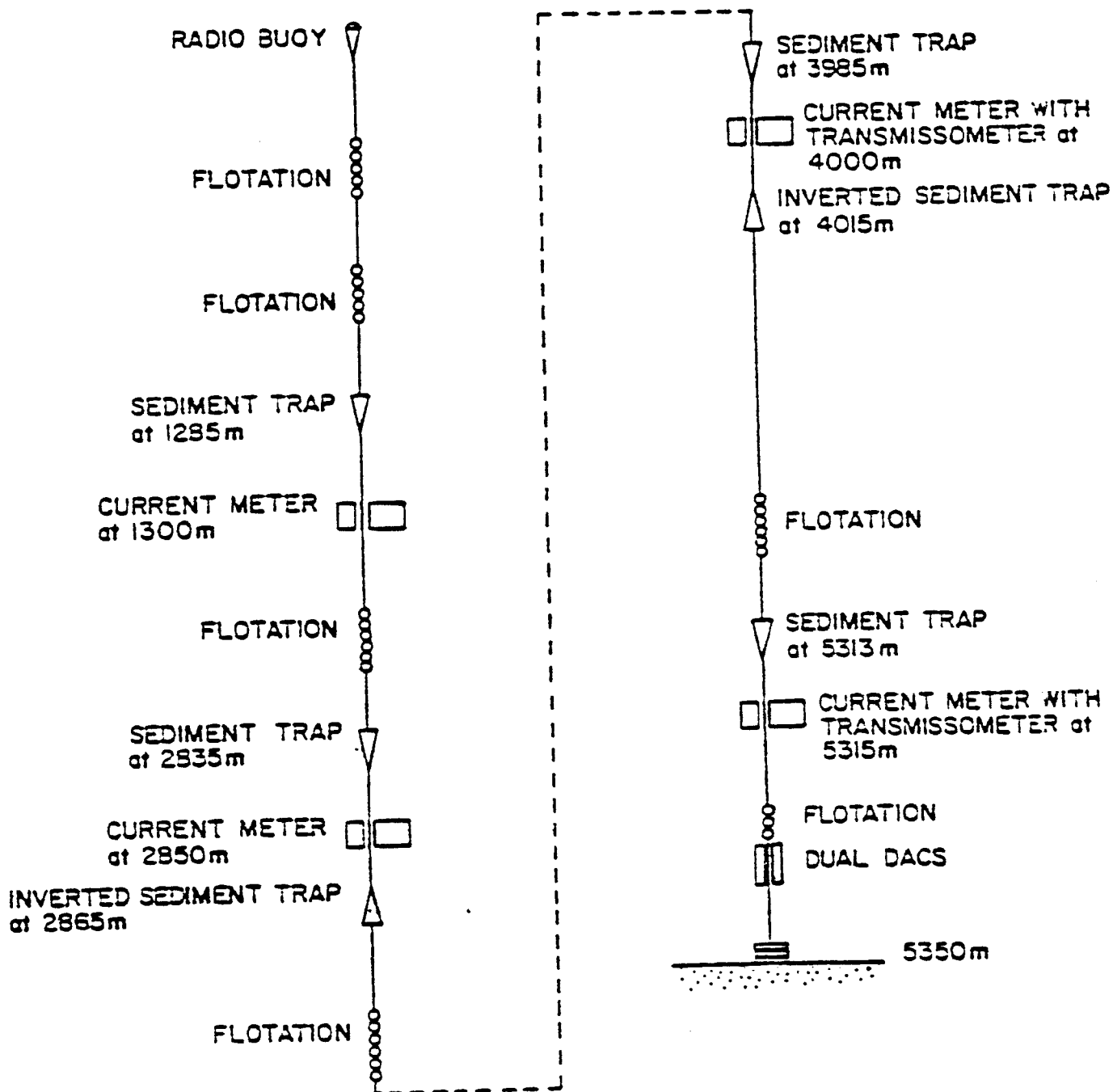


Figure. 9 Schematic illustration of CMME-4 installed at station location VV (refer to Figure 3 for location) during EN-085.

CMME-2

32°47.1'N 70°49.0'W

1648Z 6/01/82

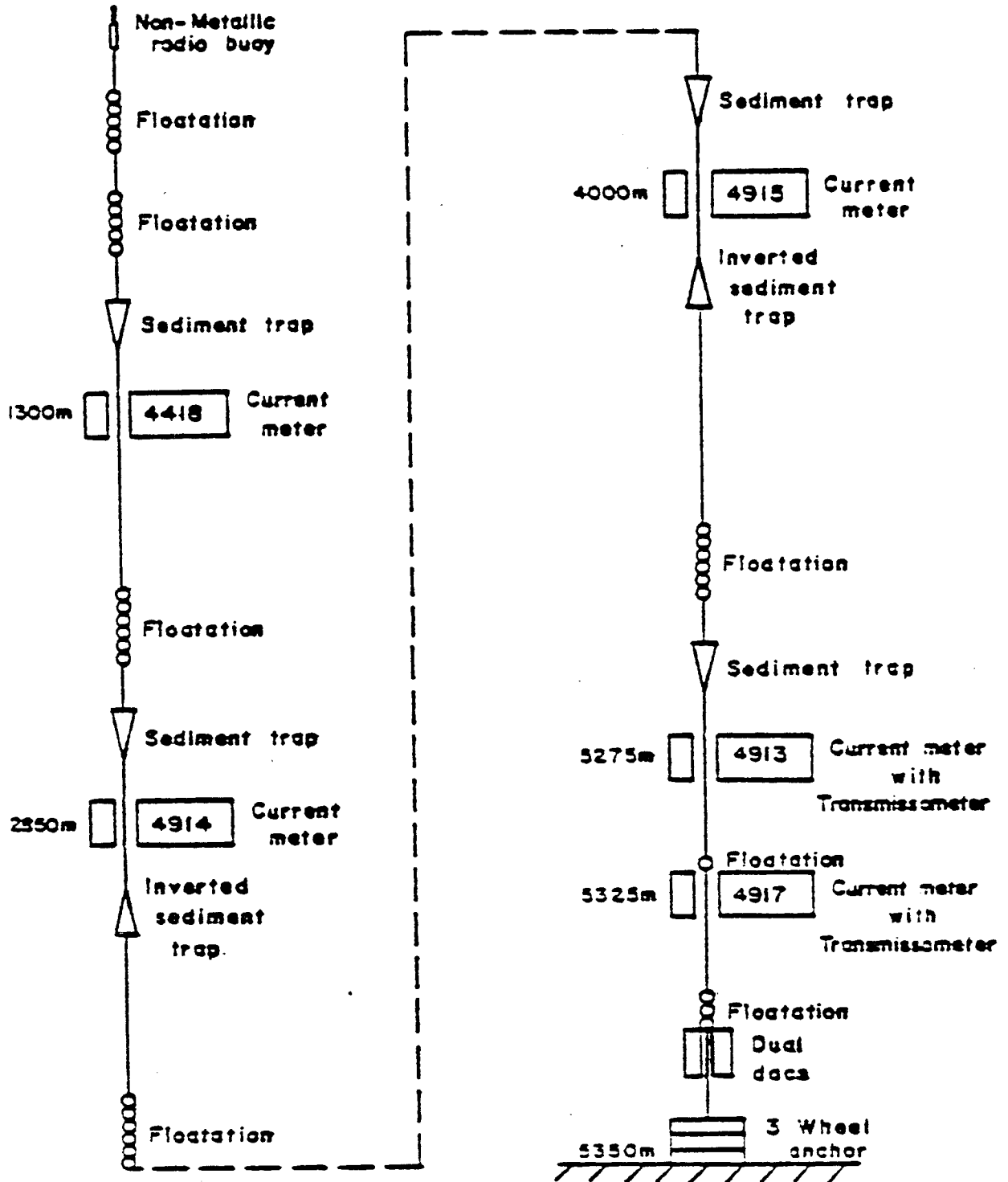


Figure. 10 Schematic illustration of CMME-2 recalled at station location VV (refer to Figure 3 for location) during EN-085.

CMME-3

33°08.0'N 70°28.8'W

1157Z 6/04/82

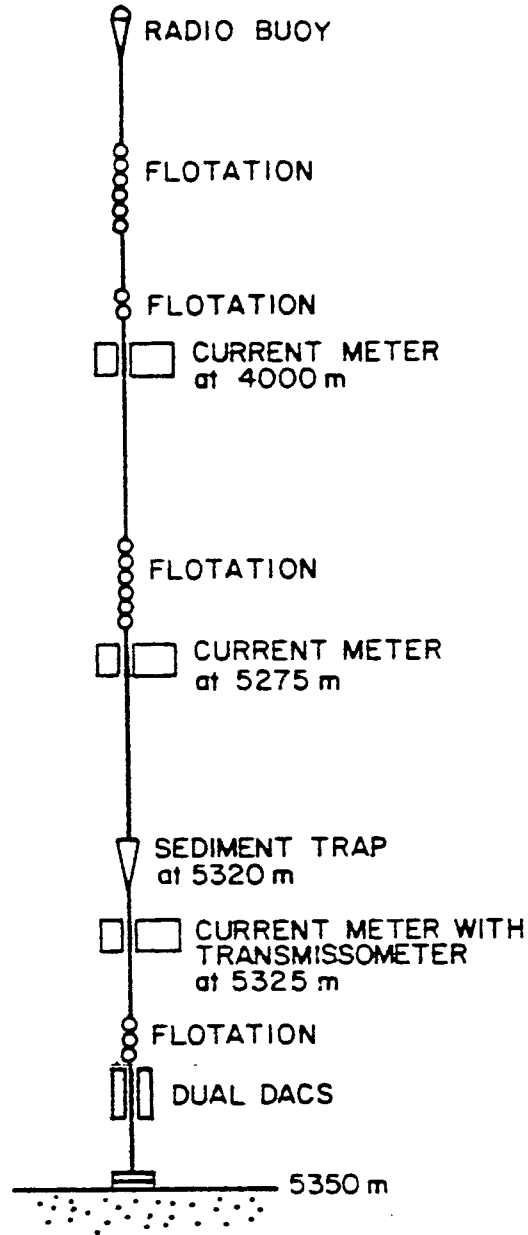


Figure. 11 Schematic illustration of CMME-3; recalled but failed to surface at station location DD (refer to Figure 3 for location) during EN-085.

6). A SEATECH transmissometer with a 1 m light path was mounted on the frame in order to collect data on the well-mixed layer. Lowerings were made to the bottom, and the bottom bottle was tripped on all nine casts. Thirteen 5-liter niskin bottles, 6 with reversing thermometers, were tripped during each lowering. At stations where current meter moorings with sediment traps were located, two casts were made, totaling seventeen 5-liter niskin bottles.

In general, bottles were tripped at approximately 200, 1300, 2850, 4000, 4400, 4800, 5200 (2 bottles) dBars (depth and at bottom), with remaining bottles tripped at intervening depths. At CMME sites 3 bottles were tripped at depths corresponding to sediment traps.

Samples were analyzed at sea for salinity and oxygen content. In order to calibrate the transmissometer, 111 samples were filtered for total suspended matter and 19 samples were filtered for organics. In addition, silicate samples were taken from all bottles at each station. Two 50 ml samples were taken from CTD -3 lowering for trace metal analysis to be performed by Dr. Robert Collier at Oregon State University.

Pinger Probe

Five pinger probe lowerings were carried out during the cruise (Figs. 3, 5, and Table 10); three lowerings on the conducting wire and two lowerings on the deep sea wire, mounted 100 m above the piston core. The probe consisted of 3.5 kHz and 12.K pingers. A receiving hydrophone was attached on lowerings using the conducting wire. During the three single lowerings the probe was held just above the bottom for about one-half hour while pinger to ship, ship to hydrophone and pinger to hydrophone signals were recorded. Pinger probe lowering accompanying piston core attempts provided pinger to ship recordings directly over the core site. Pinger probe data will be used to determine the relationship between the detailed acoustic response of seafloor sediments and the geophysical properties of the sediments.

Sediment Sampling

Four standard (40 ft.) piston cores were attempted during EN-085 (Figs. 3, 5, and Table 11). All four attempts were successful and recovered cores range in length from 606-671 cm. Trigger cores were also secured at each core site and varied in length from 16.5 to 143.5 cm.

Some slight damage to the piston core cutter occurred during PC-2-WW. The cutter sample was damaged by rain due to retrieval of the corer during a downpour. The bottom 10 foot section of the core barrel of PC-3-XX is bent and attempts to remove the core liner have, thus far, been unsuccessful. The core liner in the bottom barrel of PC-4-H is also lodged in the core barrel and has not yet been removed. Sample lengths for these cores are, therefore, estimates.

Two unsuccessful sphincter core attempts were made (Fig. 2; Table 12). The corer failed to trip at site RR and at location SS, the corer was tripped and showed evidence of penetration but retrieved no mud.

Only one of two gravity core attempts was successful (Fig. 3; Table 9). Twenty-one cm of mud was recovered at site VV and the core cutter returned dented. Apparently, the corer was laid on its side during the second coring attempt, as there was mud along one side of the barrel. Four free-fall corers were tested at station location UU (Fig. 3; Table 8). All four cores were seen to surface but rain squalls prevented the recovery of three of the corers. Only one glass ball of the fourth corer was retrieved, the net having ripped.

Upon return to URI, cores were split, photographed, and subsamples were taken for geological and geotechnical analysis, including bulk density, water content, Atterberg limits, triaxial shear strength, consolidation, permeability, and calcium carbonate content.

TABLE 4
 BOTTOM OCEAN MONITOR EN-085

BOH STATION- LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ANCHOR DEPLOYED)	BOTTOM DEPTH (m)			COMMENTS
11	36° 21.7' 71° 36.0'	05/28/82	1527-1553 (1542)	4117			E-N2 study location.

TABLE 5
POCO CAMERA LOWERINGS EN-085

CAMERA STATION-LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	CAMERA TYPE (mm)	COMMENTS
1-SS	32°20.5' 71°48.9'	05/10/82	1036-1359 (1210)	5325	Transitional-distinct discontinuous/diffuse reflector (Hatteras Deep Sea Fan).	35	Black and white
2-TT	32°25.1' 70°39.8'	05/31-06/01/82	2141-0125 (2376)	5347	Distinct discontinuous (Hatteras AP)	35	Black and white
3-VV	32°41.3' 70°50.3'	06/02/82	0242-0643 (0422)	5344	Distinct discontinuous	35	Black and white
4-ZZ	33°26.3' 70°54.7'	06/04-05/82	2241-0223 (0026)	5333	Distinct continuous (terrace-AP boundary)	35	Black and white
5-AAA	33°37.9' 71°06.5'	06/05/82	1026-1358 (1200)	5298	Trans-Distinct Continuous;/ Diffuse reflector (Terraces)	35	Black and white
6-BBB	34°09.6' 71°33.1'	06/05-06/82	2309-0236 (0050)	5013	Lower Continental Rise Hills Province.	35	Black and white

TABLE 6
CTD WITH TRANSMISSOMETER LOWERINGS EN-085

CTD W/TRANS. STATION-LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE PRESSURE (db)	COMMENTS
1-SS	32°20.0' 71°49.7'	05/30/82	1545-2013 (1750)	5325	Transitional and distinct discontinuous/diffuse reflector (Hatteras Deep Sea Fan)	5497	Bottles 4, 5, 6 Bottles 7, 8, 9
						5488	
2-VV	32°44.6' 70°50.3'	06/01/82	0936-1345 (1133)	5344	Distinct discontinuous	5480	Bottles 5 & 6 Bottles 8 & 9
						5462	
2B-VV	32°44.8' 70°49.9'	06/01/82	1403-1527 (1450) (at max depth)	5344	Distinct discontinuous	5467	Bottles 11 & 12 Bottles 13 & 14 Bottle 16
						4162	
3-VV	32°45.4' 70°50.3'	06/02-03/82	2120-0125 (2315)	5344	Distinct discontinuous	2850	Bottom Bottle
						1300	
						200	
						5573	
						5489	
						5461	
						5436	
						5424	
						5426	
						4161	
						4164/4165	
						3015	
						3014/3015	
						1466	
						202	
						5574	
						5503	
						5480	
						5464	
						5465/5466	
						5261	
						4163	
						4162/4161	
						3014	
						3015/3015	

TABLE 6
CTD WITH TRANSMISSOMETER LOWERINGS EN-085

CTD W/TRANS. STATION- LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE PRESSURE (dB)	COMMENTS
1B-VV	32°44.0' 70°49.3'	06/03/82	0143-0255 (0221z) (at max depth)	5344	Distinct discontinuous	1349 1348/1347 203	Bottles 2 & 3
4-VV	32°55.1' 70°42.5'	06/04/82	0544-1012 (0738)	5340	Transitional- distinct discontinuous/ diffuse reflector.	5512 5475 5468 5362 5297 5254 5196 4797 4399 4001 2856 1301 204	
5-DD	33°07.8' 72°28.4'	06/04/82	1522-1956 (1705)	5344	Distinct Contin- uous	5509 5492 5418 5387 5388 5197 4800 4398 3996 2847 1301 207	Bottles 2 & 3

TABLE 6

CTD WITH TRANSMISSOMETER LOWERINGS EN-085

CTD W/TRANS. STATION- LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE PRESSURE (db)	COMMENTS
6-22	33°24.8' 70°57.4'	06/05/82	0248-0715	5333	Distinct continuous (Terrace-AP Boundary).	5501	
						5439	
						5438	
						5198	
						5291	
						5200	
						5196	
						4800	
						4395	
						4000	
2837							
1303							
206							
7-AAA	33°38.2' 71°07.2'	06/05/82	1406-1905 (1553)	5298	Trans-Distinct continuous/ diffuse reflector (Terraces)	5357	Bottom bottle Bottles 1 & 2
						5329	
						5266	
						5214	
						5123	
						4733	
4343							
3959							
2840							
1285							
190							
8-BBB	34°09.1' 71°33.7'	06/06/82	0243-0720 (0435)	4990	Lower Contin- ental Rise Hills Province	5130	
						5122	
						5120	
						5050	
						5002	
						4950	
						4949	
						4802	
4400							

TABLE 6
CTD WITH TRANSMISSOMETER LOWERINGS FN-085

CTD W/TRANS. STATION- LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	SAMPLE PRESSURE (db)	COMMENTS
8-BBB (cont)						4001 2853 1305 206	
9-II	36° 18.9' 71.27.0'	06/06-07/82	2246-0157 (0024)	4197		4270 4268 4255 4254 4253 4117 3499 3498 3496 2851 2852 2850	
9B-II	36° 21.0' 71° 25.4'	06/07/82	0214-0317 (0244) (at max. depth)	4197		1309 1308 1307 205	

TABLE 7
CURRENT METER MOORINGS EN-085

CABLE STATION- LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ANCHOR DEPLOYED)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	COMMENTS
II-CABLE #6	36° 16.1' 71° 32.5'	05/28/82	1640-1906 (1906)	4172		Deployed in F-N2 study location.
SS-CABLE #5	32° 21.4' 71° 50.0'	05/30/82	1426-1536 (1521)	5325	Transitional - distinct discontinuous/ diffuse reflector (Hatteras Deep Sea Fan)	Deployed.
VV-CABLE #2	32° 47.1' 70° 49.0'	06/01/82	1620-2140 (1648) (on surface)	5343	Distinct continuous	Recalled.
VV-CABLE #4	32° 44.5' 70° 49.7'	06/01-02/82	2316-0136 (0128)	5344	Distinct continuous	Deployed.
III-CABLE #3	33° 08.0' 70° 28.8'	06/04/82	1157-1515	5344	Distinct continuous	Recalled - failed to surface.

TABLE 8
(FREE-FALL) CORES EN-085

IC STATION LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (DEPLOY/RECOVER)	BOTTOM DEPTH	BOTTOM CHARACTER	BARREL LENGTH (SAMPLE) (cm)	COMMENTS
1-UU	32° 30.8' 71° 01.3'	06/01/82	0345-0816 (0347/ -)	5337	Distinct Contin uous (Hatteras Deep Sea Fan)	143 (0)	Recovered only one flashing sphere; no cores. All surfaced but squalls prohibited recovery.
2-UU	32° 29.8' 71° 01.9'	06/01/82	(0407/ -)	5339	"	143 (0)	
3-UU	32° 29.7' 71° 00.9'	06/01/82	(0409/ -)	5339	"	143 (0)	
4-UU	32° 29.5' 71° 00.8'	06/01/82	(0415/ -)	5338	"	143 (0)	

TABLE 10
PINGER PROBE EN-085

PP STATION- LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	COMMENTS
1-TT	32°26.8' 70°40.6'	05/31/82	0830-1348 (1118)	5348	Distinct continuous (Hatteras AP)	Pinger probe on wire with PC #1.
1R-TT	32°23.7' 70°40.1'	05/31/82	1638-2110 (1826)	5348	Distinct continuous (Hatteras AP)	
2-WW	32°41.0' 70°50.3'	06/02/82	1422-1915	5332	Diffuse reflector	
4-II	36°19.3' 71°26.1'	06/01/82	1806-2155 (2011)	4197	Distinct continuous (AP Province)	Pinger probe on wire with PC-6.

TABLE 12
SPINNING CORES EN-085

SC STATION-LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH	BOTTOM CHARACTER	LENGTH BARREL (SAMPLE) (cm)	COMMENTS
1-RR	32° 39.2' 72° 03.3'	05/29-30/82	2247-0324 (0144)	5308	Distinct discontinuous (Hatteras Deep Sea Fan)	89 (0)	Corer did not trip.
2-SS	32° 23.4' 71° 50.5'	05/30/82	0527-0942 (0750)	5323	Transitional - distinct discontinuous/diffuse reflector (Hatteras Deep Sea Fan)	89 (0)	Cutter sample = (5 gms) only.

TABLE 11
PISTON CORES EN-085

I/C STATION- LOCATION	POSITION N W	DATE	TIME (±) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	BARREL LENGTH (SAMPLE) (cm)	COMMENTS
1-TT	32°23.9' 70°41.4'	05/23/82	0830-1348 (1118 ₂)	5348	Distinct discontinuous (Hatteras AP)	1220 (690)	3.5 kilz and 12 kil Pinger on wire ± 100 m above corer for Pinger test.
2-WW	32°40.6' 71°16.4'	06/02/82	0838-1315 (1046)	5333	Diffuse reflector	1220 (606)	
3-XX	32°58.4' 71°23.1'	06/03/82	1408-2132 (1927)	5329	Distinct continuous (AP Province)	1220 (669)	
4-II	36°19.3' 71°26.1'	06/06/82	1804-2155 (2011)	4197		1220 (671)	Deep sea wire jammed in the block.

TABLE 9
GRAVITY CORES EN-085

GC STATION-LOCATION	POSITION	DATE	TIME (z) TOTAL STATION (ON BOTTOM)	BOTTOM DEPTH (m)	BOTTOM CHARACTER	BARREL LENGTH (SAMPLE) (cm)	COMMENTS
1-VV	32°42.4' 70°54.4'	06/03/82	0350-0721 (0541)	5344	Distinct continuous	250 (21)	Cutter dented slightly.
2-WV	32°42.1' 71°13.4'	06/03/82	0857-1236 (1056)	5331	Diffuse reflector	250 (0)	