CRUISE REPORT

ENDEAVOR CRUISE EN-085

NORTH ATLANTIC

May 27-June 8, 1982

by

Edward P. Laine and Julie Fisher

JUNE 1982
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°00' - 34°00'N; 69°00' - 73°00'W. Additional operations were carried out within the study location E-N2 situated on the lower continental rise (36°00' - 37°00'N; 71°00' - 72°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 Battersh 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>
<thead>
<tr>
<th>TYPE OF OBSERVATION</th>
<th>PURPOSE</th>
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<tr>
<td>Bottom Ocean Monitor</td>
<td>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.</td>
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<tr>
<td>Camera</td>
<td>Assess influence of bottom currents; determine presence or absence of epibenthic fauna.</td>
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<td>CTD</td>
<td>Provide detailed vertical profiles of temperature, salinity, oxygen and silicates to assess water mass distribution, characterize nepheloid layer and trace advected mixed layers.</td>
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<td>Current Meter</td>
<td>Determine vertical velocity profile in water column; determine coherence of circulation patterns.</td>
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<td>Free-Fall Cores</td>
<td>Provide sample of surface sediments.</td>
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<td>Gravity Core</td>
<td>Provide sediment samples to determine geological and geotechnical properties.</td>
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<tr>
<td>Pinger Probe</td>
<td>Provide record of detailed acoustic response of seafloor sediments.</td>
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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 (ROM: 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).

(GMT)

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Ann Isley  Suspended Matter/Watch
Mary Baker  Watch
            URI
            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.
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° 16.1'N; 71° 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° 21.4'N; 71° 50.0'W/E-N3 study location) (Figs. 3 and 8). At station location VV (32° 44.5'N; 70° 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° 47.1'N; 70° 49.0'W) (Fig. 10), having been operable for 332 days (deployed 07/3/81 during EN-069). An unsuccessful attempt was made to retrieve components (releases) of CMME-3 at station location DD (33° 08.0'N; 70° 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 O2 probe were made during the cruise (Figs. 3 and 5; Table
Figure 7: Schematic illustration of CMME-6 installed at station location H (refer to Figure 5 for location) during EN-085.
Figure 8  Schematic illustration of CMME-5 installed at station location SS (refer to Figure 3 for location) during EN-085.
Figure 9 Schematic illustration of CME-4 installed at station location VV (refer to Figure 3 for location) during EN-085.
Figure 9  Schematic illustration of CME-4 installed at station location VV (refer to Figure 3 for location) during EN-085.
Figure 10 Schematic illustration of CMME-2 recalled at station location WW (refer to Figure 3 for location) during EN-085.
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.
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 12.0 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.
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<th>POSITION</th>
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<th>TIME (z) TOTAL STATION (ANCHOR DEPLOYED)</th>
<th>BOTTOM DEPTH (m)</th>
<th>COMMENTS</th>
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<td>1527-1553 (1542)</td>
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<td>BOTTOM CHARACTER</td>
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<td>BOTTOM CHARACTER</td>
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<td>8-RMB</td>
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<td>BOTTOM DEPTH (m)</td>
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<td>1426-1536 (1521)</td>
<td>5325</td>
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<td>VV-CMIE #2</td>
<td>32°47.1' 70°49.0'</td>
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<td>1620-2140 (1648) (on surface)</td>
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<td>VV-CMIE #4</td>
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<td>HD-CMIE #3</td>
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<td>TIME (z)</td>
<td>TOTAL STATION (DEPLOY/RECOVER)</td>
<td>BOTTOM DEPTH</td>
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<td>2-UU</td>
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<td>0407/ -</td>
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<td>3-UU</td>
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<td>0409/ -</td>
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<td>TIME (s) TOTAL STATION (ON BOTTOM)</td>
<td>BOTTOM DEPTH (m)</td>
<td>BOTTOM CHARACTER</td>
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<td>1-TT</td>
<td>32°26.8' 70°40.6'</td>
<td>05/31/82</td>
<td>0830-1348 (1118)</td>
<td>5348</td>
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<td>1B-TT</td>
<td>32°23.7' 70°40.1'</td>
<td>05/31/82</td>
<td>1638-2110 (1826)</td>
<td>5348</td>
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<td>2-WW</td>
<td>32°41.0' 70°50.3'</td>
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<td>1422-1915</td>
<td>5332</td>
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<td>POSITION</td>
<td>DATE</td>
<td>TIME (z) TOTAL STATION (ON BOTTOM)</td>
<td>BOTTOM DEPTH</td>
<td>BOTTOM CHARACTER</td>
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<td>1-RR</td>
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<td>05/29-30/82</td>
<td>2247-0324 (0144)</td>
<td>5308</td>
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<td>05/30/82</td>
<td>0527-0942 (0750)</td>
<td>5323</td>
<td>Transitional - distinct discontinuous/ diffuse reflector (Hatteras Deep Sea Fan)</td>
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<td>PC STATION-LOCATION</td>
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<td>TIME (h)</td>
<td>BOTTOM DEPTH (m)</td>
<td>BOTTOM CHARACTER</td>
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</table>
| 1-TT                | 32°23.9'N, 70°41.4'W | 05/23/82 | 0830-1348 | 5348            | Distinct discontinuous (Batteras AP)                 | 1220 (690)                  | 3.5 kHz and 12 kHz Finger on wire  
: 100 m above corer for Finger tent. |
<p>| 2-WW                | 32°40.6'N, 71°14.4'W | 06/02/82 | 0838-1315 | 5333            | Diffuse reflector                                    | 1270 (606)                  |                                               |
| 3-XX                | 32°58.4'N, 71°23.1'W | 06/03/82 | 1608-2132 | 5329            | Distinct continuous (AP Province)                    | 1220 (669)                  |                                               |
| 4-II                | 36°19.3'N, 71°26.1'W | 06/06/82 | 1804-2155 | 4197            |                                                      | 1220 (671)                  | Deep sea wire jammed in the block. |</p>
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<thead>
<tr>
<th>GC STATION-LOCATION</th>
<th>POSITION</th>
<th>DATE</th>
<th>TIME (T) TOTAL STATION (ON BOTTOM)</th>
<th>BOTTOM DEPTH (m)</th>
<th>BOTTOM CHARACTER</th>
<th>BARREL LENGTH (SAMPLE) (cm)</th>
<th>COMMENTS</th>
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<td>1-VV</td>
<td>32°42.4' 70°54.4'</td>
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<td>0350-0721 (0541)</td>
<td>5344</td>
<td>Distinct continuous</td>
<td>250 (21)</td>
<td>Cutter dented slightly.</td>
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<td>0857-1236 (1056)</td>
<td>5331</td>
<td>Diffuse reflector</td>
<td>250 (0)</td>
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