R. Lidyder

Lamont - Doherty Geological Observatory of Columbia University | *Palisades, N.Y. 10964*

Cable: LAMONT, Palisades, New York State

Telephone: Code 914, Elmwood 9-2900
Twx: 710-576-2653

CRUISE REPORT

Ship Name: R/V CONRAD   Cruise No: 20 - Leg 12

Departure: 21 April 1977 (Date) from Balboa, Panama (Port)

Arrival: 18 May 1977 (Date) at New York, New York (Port)

Days at Sea: 27   Days Foreign Port: 3 (No. of days in arrival ports)

Area of Operation: Western North Atlantic

Program Description: Physical properties and sound-velocity measurements on piston cores from the Hatteras Abyssal Plain, Blake-Bahama Outer Ridge and continental rise in the western North Atlantic. Airgun-OBH reflection/refraction experiments on the southern Hatteras A. P. and above clathrate horizons on the B. B. O. R. and continental rise. Seismic profiler tie-lines to establish acoustic-stratigraphic correlations. Hydrophone-pinger experiments to determine shallow velocity structure. Troika camera tow in area of hyperbolated seafloor on B. B. O. R.

Participants: (all L-DGO unless otherwise specified)

NAME	SHIPBOARD TITLE
Tucholke, Brian	Co-Chief Scientist
Bryan, George	Co-Chief Scientist
Mountain, Greg	Physical Properties/Acoustics
Hoose, Peter	Physical Properties/Acoustics
Bitte, Ivars	OBH Technician
Gutierrez, Carlos	Electronics Technician
Holland, Michael	Camera Technician
Engvik, Alan	Gravity Technician/ET
Crimmins, Robert	Core Bosun
Iltzsche, Martin	Air Gun Technician

All inquiries regarding cruise should be made to the chief scientist.

SCIENTIFIC PROGRAM

CONRAD 20-12 encompassed a multifaceted program to study the acoustic and physical properties of the sedimentary section and oceanic crust in the western North Atlantic Ocean. Techniques are described below.

Piston Coring: Fifteen piston cores were taken from the Caicos Outer Ridge, Nares Abyssal Plain, Vema Gap (near DSDP Site 417), Hatteras Abyssal Plain, Blake and Bahama Outer Ridgesand continental rise. The cores were taken at locations which provide physical properties sections within or across 3.5 kHz acoustic provinces. The cores ranged in length from 8 to 16 meters, and they were sampled at 20 cm or smaller intervals for physical properties and compressional wave velocity. Raw velocity data show that clayey cores from non-abyssal-plain areas have velocities in the 1490-1540 m/sec range with downcore gradients near 1 per meter. Velocities in silts and sands in abyssal-plain cores reach 1600-1800 m/sec. Results from these measurements will be used to characterize the acoustic/physical nature of large portions of the western North Atlantic seafloor having uniform 3.5 kHz echo character.

Hydrophone-Pinger (HOP) Experiments: Five near-bottom variable-angle reflection experiments using the hydrophone-3.5 kHz pinger with 1000' cable (total drift range) were conducted on the Blake and Bahama Outer Ridges, the Hatteras Abyssal Plain, and lower continental rise. The 1 millisecond-pulse pinger was used exclusively, and it gave strong wide-angle reflections to full range (1000'). Three to five drops (repetitions) were made at each site, and all were recorded on tape. Very high quality recordings characterize the Bahama Outer Ridge sites.

Hydrophone-Airgun Experiments: Two experiments were conducted using the near-bottom hydrophone on the end of the STD wire and towed 0-200 fm off the bottom. Sound source was the 20 in^3 L-DGO airgun near 90' depth. Recordings were made while the ship drifted at about 1.0 knots. The first experiment was run at DSDP Site 417 where sediment thickness is highly variable and basement is irregular. Records have a low S/N ratio but show a strong coherent return from basement and a weak seafloor reflection. A well defined sub-basement reflector is present, but its origin is uncertain. The second experiment was run on the lower continental rise where a thick sedimentary section is present. A very poor S/N ratio was found to be due to a salt-water leak in the connection at the bottom of the STD wire. The results of the experiments are very encouraging for the use of a near-bottom receiver, which should provide much higher resolution of deep and basement structure.

OBH Experiments: Five OBH drops were made, the first four with two large-volume airguns as a sound source and the fifth with a 3.5 kHz pinger sound-source.

1) Bahama Outer Ridge (east flank) - this drop was made for the purpose of instrument testing before the later experiments in areas of higher scientific priority. The OBH failed to record a signal, apparently because of a large drift in bias voltage at the preamp. The voltage supply was modified to eliminate the problem.

2) Blake Outer Ridge (north flank) - The OBH was dropped in this location to test the effect of bottom currents (10-25 cm/sec at this site) on the S/N ratio of the record. The site also exhibits a thick acoustic section including Horizon Beta and smooth acoustic basement. Preliminary playback of some results indicates the record is noisier than at other, low-current-velocity sites, but that the seismic signal can still be picked.

3) Hatteras Abyssal Plain - This drop was in the center of an area where detailed sonobuoy work had previously been done by R. Houtz.

4) Blake Outer Ridge - Recorded above a prominent gas-hydrate reflector near the crest of the outer ridge.

Launch and recovery of the OBH at these sites was without incident. We attempted to schedule OBH recovery in darkness in each instance, taking advantage of the greater visibility of the recovery flasher at night over the orange flag in daylight. However, one recovery in early daylight went as smoothly as the night recoveries.

A sonobuoy record (SSQ41A) also was made at the same time we were shooting to the OBH at each site, the sonobuoy being dropped above the inferred position of the OBH.

Variable surface currents at the OBH sites and often sparse satellite fixes presented problems in shooting back across the exact position of the OBH. In each case we attempted to steam across the dropsite with or against the current, making 4-5 knots through the water, and firing the large-volume airguns at a 30-second rep rate.

For the fifth OBH experiment, the OBH was affixed to the end of the STD wire via a glider release below the 3.5 kHz pinger. A 15' trip-line on the glider release was set up to release the OBH in the same manner that a piston-corer is tripped. The OBH was lowered to the bottom at 25-27 fm/min. (OBH free-fall is about 30 fm/min), and was lowered the last 10 fm at 5 fm/min. Once the OBH was released, ship drift carried the 3.5 kHz pinger away from the instrument to record a wide-angle reflection profile. At the end of the OBH recording period, the ship had drifted about 1.5 mi. southwest from the OBH. The OBH did not surface upon our return to recover the instrument. We spent the next 28 hours in the immediate area, conducting experiments and searching for the instrument in the event it had released late, but eventually we were forced to depart for port call in New York not having found or recovered the OBH.

In general the OBH records were noisier than those obtained in tests on the Tiki. The sites chosen covered a wide range of bottom current situations, but the noise was fairly similar in all cases. The most serious problem came from short random bursts of relatively low-frequency noise. The only obvious change since the Tiki tests was the change in supply voltage mentioned above. Preamp supply voltage formerly supplied by separate 9 v dry cells was taken from the main lead-acid storage battery via Zener regulators. This modification seems an unlikely source of the noise. Preliminary environmental tests indicate that moisture condensation inside the pressure case can cause similar noise.

<u>Troika Camera Sled:</u> The Troika sled was towed on the bottom just south of the Blake Outer Ridge in an area where 3.5 kHz records showed distinct

focussing/defocussing of the signal. During the tow, a 12 kHz pinger mounted on the sled showed discrete overlapping hyperbolic echo pairs at several locations. A slight increase in cable tension and vibration of the cable also was noted at these locations, which are thought to be seafloor channels or furrows. A few frames of the 150' file were developed on the ship, showing intermittent slack in the towing cable, but only flat seafloor. When recovered, the Troika sled was muddy on the front and left side, as if it periodically nosed into the seafloor. The towing cable was affixed in the centermost towpoint on the frame. The Troika was towed on bottom for 126 min. with the camera timed to take pictures for about 105 minutes over a distance of about 2 km. Launch and recovery of the Troika were uneventful, primarily because of easy handling in a sea-state near zero.

EQUIPMENT PERFORMANCE

Core Winch: a) Despite numerous adjustments, the Liebus wind did not function properly, thus necessitating that someone apply pressure to the Liebus roller for smooth wrapping near the drum flanges. Excessive scuffing of the wire also occurred at the center of the drum. It appears that the mounting pads for the Liebus wind are not correctly centered.

b) Seals in the water-brake developed leaks during the cruise, and they should be replaced.

c) When the oil lubricating the planetary gears was replaced, the used oil contained abundant very fine metal particles, giving the oil a golden sheen. An earlier oil change had shown some metal particles, but not so abundant. No unusual vibration or knocking was noted in the gears during winch operation, but we recommend that the planetary gears be inspected and checked for alignment. These gears have had only about 120 operating hours since being replaced in San Juan in 1976.

STD Winch: 3990 fm of new STD was installed on the STD winch in Balboa. This wire was streamed in 5200m of water with the ship underway at about one knot after leaving the Caribbean. No weight was put on the end of the wire. The wire angle during streaming was about 60°. On retrieval, the bottom 700 fm of wire were found to be badly tangled, but the wire was clean and had not contacted the seafloor. The damaged portion of the wire was cut loose.

The slip-ring connector was found to be marginally operational. A new slip-ring assembly was installed and the mounting modified to give improved access to connectors, increased protection against salt spray, and better alignment with drum shaft.

The level-wind on the STD winch continues to be a headache, requiring two people to operate the winch when wire is retrieved (one to operate winch, one to attempt smooth winding). Even then a good wrap is not possible because the drum width is not commensurate with the wire diameter. A shim on one flange might correct this, and an appropriate gear ratio for the diamond-wind would then make winding a one-man job. Anticipated use of the STD wire will be heavy enough to warrant a reasonable effort to solve the problem.

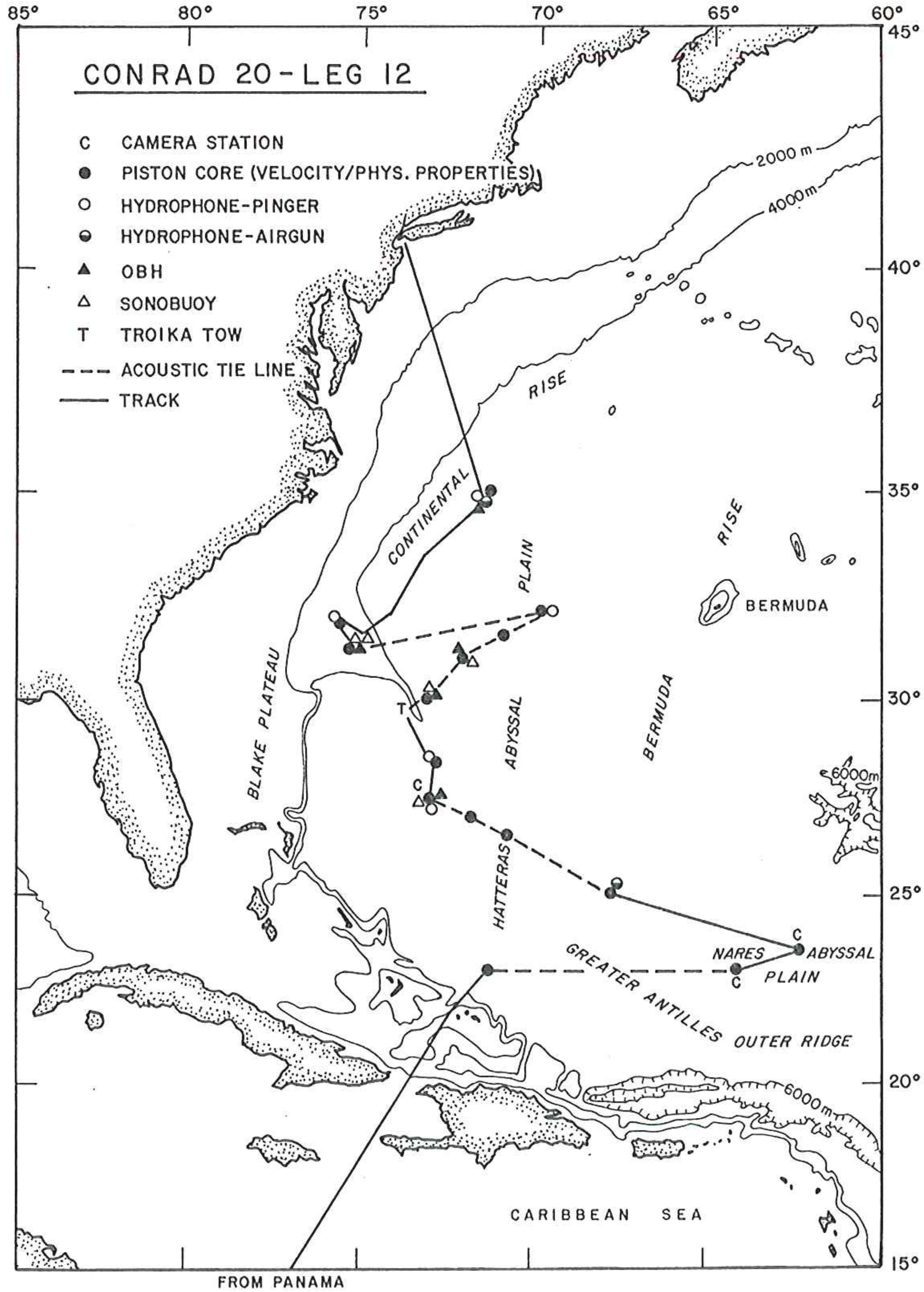
Piston Coring: a) A 3/16" wire-rope tag-line routinely was attached to the core pipe about 33' below the corehead, taped up the pipe, and the excess coiled and taped on the corehead. This allowed quick and easy hoisting of the core pipe upon retrieval, without the difficulties formerly experienced when running rope and chain down the pipe for retrieval. There was no noticeable difference in corer penetration with the wire rope attached outside the pipe.

b) There was no 2 1/2" diam. trigger corer on board, but this should be used as a matter of routine to recover a reasonable amount of surficial sediment for comparison with the piston core. If this cover is used routinely, the bracket that cradles the trigger corer on the side of the A-frame should be modified and moved higher to properly accomodate the larger trigger weight, allow easy attachment of pipe, and improve ease of handling.

Large-Volume Airguns were used at the first four OBH drops, were used to repeat a sonobuoy recording at the OBH #4 site on the crest of the Blake Outer Ridge, and were used along a course north of that site to complete an acoustic tie-line in a gap left during the RC 1903 cruise. Total operating time was 60 hours. No difficulties were experienced with the system except for the rupture of one high pressure hose on the compressor.

PERSONNEL

The scientific and ship's crew proved to be an excellent working group. The exceptional efforts of Captain J.P. Olander were a major factor in assuring the smooth operation and success of the scientific program as well as the general efficiency of the ship's crew and ship maintainance.


CONRAD 20-LEG 12
C CAMERA STATION
● PISTON CORE (VELOCITY/PHYS. PROPERTIES)
○ HYDROPHONE-PINGER
HYDROPHONE-AIRGUN
▲ OBH
△ SONOBUOY
T TROIKA TOW
ACOUSTIC TIE LINE
TRACK
85°
80°
75°
70°
65°
60°
45°
40°
35°
30°
25°
20°
15°
2000 m
4000m
6000m
6000m
CONTINENTAL
RISE
PLAIN
ABYSSAL
HATTERAS
BERMUDA
RISE
BERMUDA
BLAKE PLATEAU
NARES
ABYSSAL
PLAIN
GREATER ANTILLES OUTER RIDGE
CARIBBEAN SEA
FROM PANAMA