CRUISE REPORT

Ship Name: R/V CONRAD

Cruise No. 2209

Departure: 1900, 5 July 1979 (Date) from St. George, Bermuda (Port)

Arrival: 0600, 19 July 1979 (Date) at Halifax, Nova Scotia (Port)

Days at Sea: 14

(count day of departure but not day of arrival in port)

Days Foreign Port: 3

(number of days in arrival port before next leg)

Area of Operation: Nova Scotian Continental Rise

Program Description: Geological and geophysical surveys of the Nova Scotian continental rise for the HEBBLE (High Energy Benthic Boundary Layer Experiment) program to define the nature of the sedimentary record and large-scale aspects and details of zonation in the benthic-boundary layer beneath the Western Boundary Undercurrent. Underway seismics (12 kHz, 3.5 kHz, profiler), piston coring, standard camera/nephelometer, Troika camera sled, and the BOM system were used.

Program Support: ONR (TO-210, Scope S).

Participants: (all L-DGO unless otherwise specified)

	NAME	SHIPBOARD TITLE
1.	B. Tucholke (WHOI)	Chief Scientist
2.	J. Damuth (LDGO)	Co-Chief Scientist
3.	R. Flood (LDGO)	Pinger-hydrophone studies
4.	K. Baldwin (URI)	Core, 3.5 kHz studies
5.	P. Lemmond (URI)	Core, 3.5 kHz studies
6.	M. Coffin (LDGO)	Core studies
7.	E. Pokras (LDGO)	Core studies
8.	M. Sundvik (LDGO)	Core studies, sonobuoys
9.	P. Bruchhausen (LDGO)	BOM/Camera Tech.
10.	M. Holland (LDGO)	Camera Tech.
11.	J. Cutillo (LDGO)	E.T.
12.	J. DiBernardo (LDGO)	Airgun Tech.
13.	M. Banuve (LDGO)	Core Bosun

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

NARRATIVE

This cruise was the first in a series of anticipated cruises to study benthic-boundary-layer processes on the Scotian rise. Our purpose was to initially characterize the area according to echo character, sediment properties, microtopography and zonation of current effects. A subsequent cruise (KNORR - September) will conduct detailed investigations of the water column.

Underway Surveying

We conducted a grid survey of the Scotian rise. Underway geophysical measurements included 12 and 3.5 kHz profiling, and seismic profiling with the standard L-DGO airgun. Initial plans to use the large-volume airguns were abandoned because of the limited time available in the survey area and the limitation to a 5-knot towing speed with the large-volume airguns.

Stations

A variety of bottom sampling techniques were used:

A. Near-bottom hydrophone pinger (3.5 kHz): This instrument was used successfully at only one station and in a vertical-incidence reflection mode because laminated echo-character with deep (greater than 40m) penetration was uncommon in the survey area and because of limited survey time.

The system was first tried at Station 356 with the 1000' hydrophone cable for wide-angle reflection. Upon deployment, the direct electrical glitch from the pinger faded when the pinger entered the water. Although we could not immediately resolve the problem, we decided to lower the system to record vertical incidence reflections. However, at this point the winch operator two-blocked the pinger, breaking the top plug on the pinger and thus terminating the experiment.

The system was repaired and again tried at Station 370, this time with the short (30') hydrophone cable for vertical incidence reflection, because we were uncertain that the direct glitch problem had been resolved. Although the direct glitch faded when the pinger entered the water, it later reappeared as the system was lowered to the seafloor. We recorded near-bottom vertical incidence reflection data for a period of about four hours as the ship drifted some 3.2 km near the location of Piston Core 13. When we attempted to retrieve the system, the STD winch (with 2900 fm of wire out) would not pull in the wire. The oil supply in the hydraulic system was found to be low, and when replenished the STD winch was able to haul the wire, although with a rather jerky start-up response.

The 3.5 kHz pinger also was deployed sans hydrophone on the hydrowire 20 fm. above the camera at Station 375, and this vertical incidence reflection data was tape recorded via the ship's tranducers.

B. Standard camera/nephelometer: Twenty-four lowerings were conducted. Murky bottom water with undetectable or scarcely detectable bottom in the photographs was observed at the four deepest stations in the presumed axis of the Western Boundary Undercurrent. At one station (K54A) no bottom hits or photographs were recorded; a large wire angle and strong surface (and deep?) currents were present at this station. All other stations recorded good quality photographs and nephelometer records.

C. Troika Tows: Two Troika tows were conducted - at Station 367 a transect of about 3.4 km, and at Station 371 a transect of about 8.1 km. In both instances, strobe firing was delayed for about three hours from the time the system was readied aboard ship. This allowed time for launching and lowering plus one to one and a half hours of towing on the bottom (to stabilize the sled) before the strobe began firing. This lead time appears to be adequate; in each case we towed with about 500-600 m of wire out over the water depth (in about 4900m of water). Because of occasional problems with the Troika sled lifting off bottom, this extra length of wire for towing is considered minimal for successful results.

D. Piston Coring: We obtained fifteen piston cores, two of which (cores 3,8) recovered only small samples (in jars) because of pre-trips before the corer reached the seafloor.

Pre-trips occurred three times, probably because of 1) difficulty in controlling overly rapid descent with the water brake, and 2) the large surface area and possible kiting of the new LDGO trigger corer (the new trigger corer with square barrel was used at all stations). The problem was resolved by lowering the unarmed corer to about 2000fm before sending down a double messenger to arm the trigger arm (descent rate of the double messenger was measured with string at 115 fm/min.). The corer could not be lowered to more than 2000fm before sending the messengers because the hydraulic system was inadequate to swing in the gallows frame with more weight on the gallows arm.

To our consternation, only two 20' core barrels and one 10' core barrel were available on CONRAD. When one 20' barrel was severely bent at the first coring station, only 9' of the barrel could be salvaged. Coupled with the 10' section and the other good 20' section, we were restricted to "2-barrel" cores (and very often to one-barrel cores for fear of irreparably damaging the only available barrels).

The performance of the square trigger corer was considered marginal because it rarely recovered even half a barrel of sediment. Part of the problem appears to be the inefficiency of the core catcher in trapping the sample.

Several times the piston corer was recovered with the trigger line tightly spiralled around the core wire. The new, apparently high-torque, core wire on the core winch probably accounts for this problem. The high torque also threw a number of kinks in this wire when tension was slacked after core recovery, necessitating cutting off the bad wire and refitting the termination. It is recommended that such high-torque wire be strictly avoided in the future. In dredging operations, the probable kinking that would occur with alternating intervals of tension and slack could easily ruin the lower part of the wire and even result in loss of the dredge.

BOM System

One of the AMF acoustic releases for the BOM system was found to be non-functional as the system was being prepared for launch. The other release contained a burned-out resistor that was repaired, and the release then appeared to function correctly. Both of these releases had been intensively checked by an AMF technician at LDGO for a two-day period prior to shipment, and no logical cause for the release malfunctions could be determined.

Because of the high cost of the BOM system and the value of the data it was designed to acquire, I decided not to moor the system with only one presumably functional release. We arranged to have an AMF technician meet us in Halifax immediately following the cruise. He repaired and thoroughly tested both releases, and the entire BOM system was prepared for launch at the beginning of the next leg (C22-10). (The system has since been successfully moored on C22-10 near 40^{o} 05.5'N, 62^{o} 22.5'W). Two sediment traps that were to be included on the BOM Tripod were not used because of a malfunction in the timed release that was to close the traps.

As deployed, the BOM system includes:

1. LDGO time-lapse camera (1 hr. rep. rate)
2. LDGO time-lapse nephelometer (1 hr. rep. rate)
3. Zanaveld (Oregon State) transmissometer (one-meter folded unit).
4. Current meter @ 0.5 m. above bottom
5. Current meter (with CTD) @ 3.5 m above bottom
6. 2 AMF Releases
7. Flotation and Recovery (radio, light) package

The system will be recovered in October by R/V KNORR.

Preliminary Scientific Results.

Shipboard data analyses show the following current zonation in the area 39.5^{o} - 42^{o}N, 60^{o} - 64^{o}W:

1. Below 4900 meters seafloor depth: extremely murky bottom

water and inferred current speeds greater than 50 cm/sec to the southwest and west.

2. 4800-4900 m: strong contour currents to the W and SW with well developed current lineations and nearly ubiquitous "longitudinal ripples". Clearer bottom water.

3. 4400-4800 m: moderate current smoothing and lineations, also to W and SW, with increasing benthic activity.

4. 3700-4400 m: weaker currents, decreasing to tranquil conditions above about 4000 m with abundant benthic activity. Clear bottom water.

Thus there is an overall increase in strength of W to SW contour current flow with depth, from tranquil conditions at 3700 to 4000 m, to very strong currents at 4900-5000 m. Nephelometer films show a corresponding increase in the thickness and intensity of the bottom nepheloid layer with increasing depth.

The fifteen piston and trigger cores contain surficial foraminiferal clays (all water depths) with about 20-40% foraminifera. These overlie clays with abundant "contourite" silt beds and locally important turbidites which appear to correlate closely with laminated and prolonged echoes, respectively, in the 3.5 kHz profiles. Uncorrected (laboratory) compressional wave velocities vary from about 1490 m/s in the clays to more than 1800 m/s in the turbidite sands.

The two Troika camera-sled tows were taken along and perpendicular to strike in the deep region of "longitudinal ripples", and are expected to clearly define the length and width scales of these unusual bedforms and help determine their genesis and relation to sediment type and current patterns.

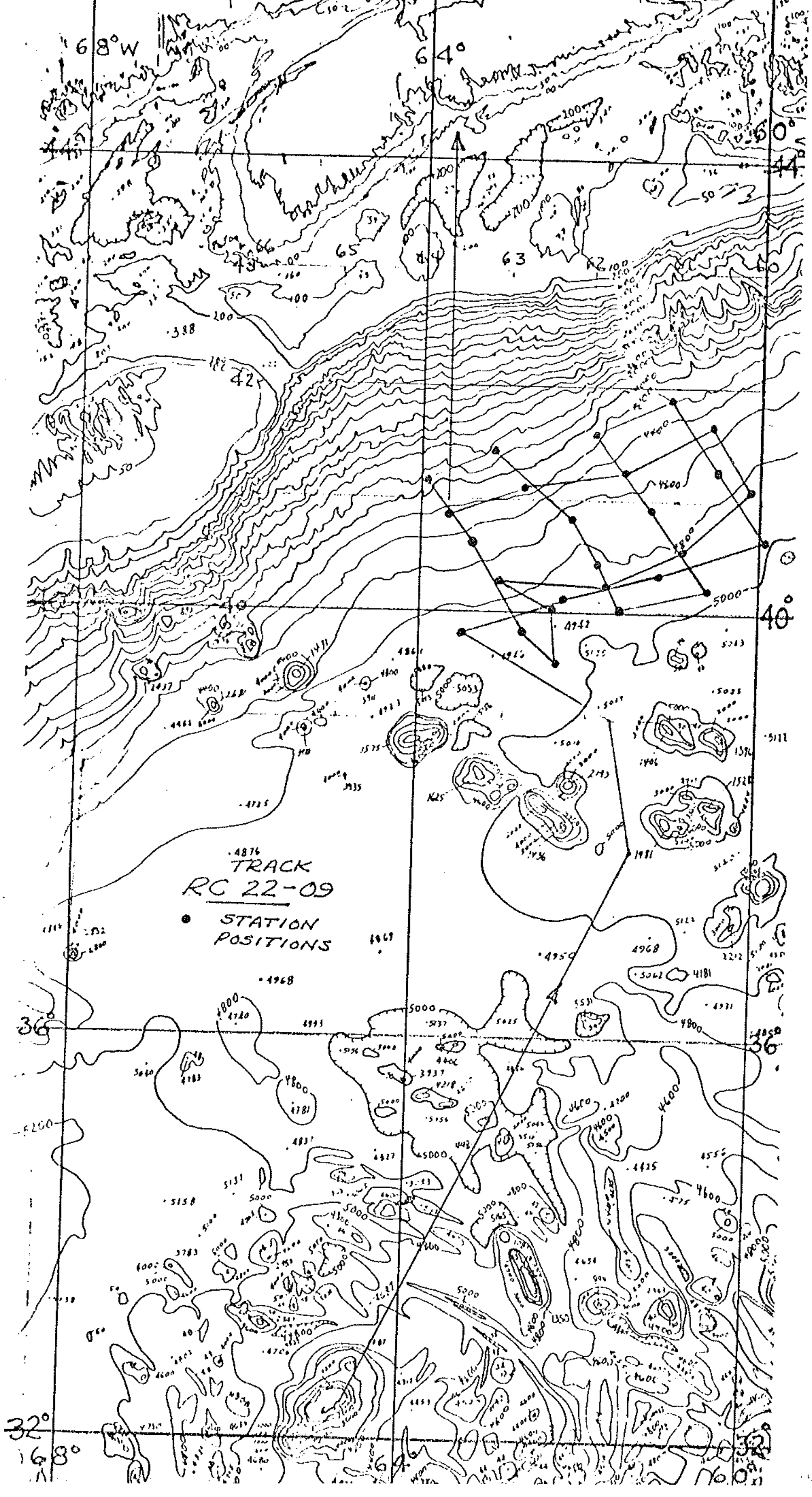
The BOM system was moored near 4850 meters in the zone of longitudinal ripples and just landward of the zone of very murky bottom water. After retrieval by KNORR in September, this system should have provided early and useful data on the time variability of current speed and direction, salinity, temperature, suspended-matter concentration, bedform migration, and biologic activity in the Scotian HEBBLE area.

Other

Although we had a rather intensive station and survey program, all hands in the scientific crew accomplished their tasks cheerfully and with general efficiency. Captain J. P. Olander and the ship's crew were very helpful in many aspects of the program; their willingness to be of service, their ability, and their maintainence of the ship and winches all are to be commended.

26 July 1979

Brian E. Tucholke



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