Natural Environment Research Council

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Miss
Mrs P Edwards

PROVISIONAL CRUISE REPORT

VESSEL: RRS Frederick Russell
Cruise 19/84

CRUISE LOCATIONS: SW Approaches/Bay of Biscay.

CRUISE PERIOD: 23 October-6 November 1984.

PERSONNEL:
A D Heathershaw (Principal Scientist)
J D Humphery
P M Hooper
A A Read
D A Young
Mrs B L Wainwright
G W Miller (RVS)
C Washington (RVS)

OBJECTIVES:

a) To deploy current meter and thermistor chain moorings in the vicinity of Black Mud Canyon (moorings BMC1-7, Fig 1), to study the effects of internal waves and tidal currents in relation to sediment transport processes.

b) To carry out salinity and temperature measurements using CTD, XBT and thermosalinograph equipment, to further study the effects of internal waves and other processes at the shelf-edge.

c) To carry out echosounding and sidescan sonar surveys to determine the distribution of sandwaves and other bedforms in the head of Black Mud Canyon.

d) To carry out a programme of sediment sampling and underwater photography in the Canyon and on the shelf-edge.

e) To carry out trials of remote recording sediment transport and boundary layer equipment (STABLE).

f) To recover an autonomous recording inverted echosounder buoy (ARIES) (this equipment was in fact recovered just prior to sailing from the RRS Discovery.)

EQUIPMENT PERFORMANCE:

a) Current meter and thermistor chain moorings:

All moorings were successfully deployed and recovered and no problems experienced with acoustic releases in general. However, one current meter was found to have a missing rotor when recovered (although it is not clear when this happened) and on another a lead had become disconnected internally and no data had been recorded. One release failed its wire test due to a faulty battery. No problems were experienced with the thermistor chains.

b) CTD equipment:

Similarly to last year a combination of RVS and University College of North Wales (UCNW) Grundy 9400 CTD equipment was

used on this cruise. The majority of measurements were made with the RVS Grundy CTD and the UCNW Plessey 8700 auto-ranging and signal processor unit. Data logging was carried out using the RVS Apple II computer and UCNW software. Towards the end of the cruise the RVS Grundy 9400 unit failed and was replaced with the UCNW unit. However, this also failed and measurements could only be continued using a combination of the UCNW depth and temperature sensors with the RVS conductivity cell.

Regular checks on salinity and temperature were carried out using NIO water bottles and reversing thermometers. Salinities were determined using a Plessey 6230 portable salinometer and these measurements showed that computed values from the RVS unit were about .2-.3‰ too high. Temperature readings were about .1-.2°C too low when compared with the thermometer readings.

c) XBT and thermosalinograph equipment:

XBT equipment was not used on this cruise. The Plessey 6600 thermosalinograph was run more or less continuously with regular checks on salinity and temperature readings from water samples and reversing thermometer measurements.

d) Echosounding and sidescan sonar equipment:

PES(10 KHz) data was gathered routinely throughout the cruise using the hull transducer (PES fish not available). In heavy seas this led to poor quality data as the ship pitched. Additionally, during current meter recovery operations it was found that the hull mounted transducer was not as effective as the towed fish for interrogating and releasing moorings. The Mufax recorder in the plot operated satisfactorily despite excessive noise from the motor drive unit.

There was insufficient time on this cruise, due to adverse weather conditions, to use the ships Atlas 600 (33 KHz) echo-sounder for internal wave studies. Similarly IOS Taunton's EG & G 272 fish (105 KHz) and the RVS 259 winch and cable were not employed. However, the opportunity was taken to evaluate the IOS Wormley 36 KHz medium range, hull mounted sidescan sonar. Although this equipment operated satisfactorily the results were disappointing due to excessive ship motion. However, the records will be useful in determining sandwave distribution and orientation.

e) Sediment sampling and underwater photography:

Due to the poor weather conditions there was insufficient time on this cruise to use the IOS Taunton UMEL 35 mm underwater camera and the RVS gravity coring equipment for sediment studies. However, a programme of sediment sampling was successfully completed using the RVS Shipek grab.

f) STABLE (Remote recording sediment transport and boundary layer equipment):

This equipment, minus sensor packages and power packs, was

successfully deployed and recovered in a water depth of about 140 m. STABLE was first launched through the 'A' frame over the ship's stern and then released. Its free-fall descent to the seabed was monitored using STABLE's acoustic beacon and the ship's PES equipment. Preliminary calculations gave a rate of descent of $\sim$ 1 m s^{-1} which is in fairly close agreement with tank test values. After a short period of time on the seabed STABLE's acoustic releases were successfully fired, using the hull mounted PES transducer, and the rig was brought to the surface where it was recovered over the ship's stern. A second 'simulated' release of the by now net positively buoyant rig was carried out over the ship's side, using the HIAB crane, to test this particular mode of deployment. As before STABLE was recovered over the ship's stern through the 'A' frame. This second method of deployment was found to be preferable to the first due to the reduced tendency of the rig to swing as the ship rolled. Launching over the stern would probably have resulted in damaged sensors had they been fitted. Recovery on the second test was greatly assisted by a stray line attached to the central lifting point of the rig.

SHIP PERFORMANCE:

The ship again provided good accommodation and laboratory facilities. However, as remarked previously, her effectiveness as a 'working platform' is greatly restricted by the uncomfortable motion experienced by those on board, especially on passage, in even moderately poor weather conditions. Although very well equipped the ship is probably too small for working in the Bay of Biscay and SW Approaches in winter.

The ship's scientific equipment was operated satisfactorily although difficulties were experienced with a worn bearing on the hydrographic winch (CTD wire drum). The CTD could only be operated by coupling both drums of the winch together.

Throughout the cruise Decca main chain and satellite navigation equipment were used for position fixing. As on previous cruises satellite navigation updates gave positions which might differ by as much as 1-2 miles from those previously calculated. All current meter and thermistor chain moorings were accurately located prior to recovery using Decca main chain navigation equipment. However, the Decca was not generally reliable at night and for accurate survey work there is clearly a need for a more accurate position fixing system than that which is presently available.

CTD work was most successfully accomplished by having the ship keep station on a dahn buoy and, in moderate sea and swell conditions, it was possible to keep within 1-2 cables of the buoy using radar.

RESULTS:

SW Approaches and Bay of Biscay.

A total of 14 recording current meters and 2 thermistor chains were successfully deployed and recovered on this cruise. With the exception of one current meter which, on recovery, was found to have its rotor missing, and another which had a

faulty connection, approximately 7 days of useful current meter and thermistor chain data were obtained from each instrument. This information will be used to determine the likely roles of tidal and internal wave currents in promoting sediment transport at the shelf-edge, particularly in the vicinity of a submarine canyon.

A good quantity of salinity and temperature data was also obtained from CTD and thermosalinograph equipment. Approximately 80 CTD casts were completed in the shelf-break region of Black Mud Canyon together with frequent checks on salinity and temperature from bottle casts and reversing thermometer measurements. This information will also prove useful in examining internal waves and tides in relation to sediment transport processes.

About 40 sediment samples were obtained from the canyon head area. These will be analysed for grain size and carbonate content and this information will be used, together with the current meter data, to determine sediment mobility and potential sand transport rates at the shelf-break. Due to the generally poor weather it was not possible to carry out any underwater photography or gravity coring work.

Fairly extensive bathymetric surveying of the canyon head area was completed using the PES equipment. This information also enabled the distribution and asymmetry of sandwaves to be determined. Information on sandwaves was also obtained using medium range 36 KHz sidescan sonar. Although this data was of poor quality, due to ship motion and quenching effects, it should be possible to determine the orientation and distribution of sandwaves along the ship's track and out to a distance of 1.5 Km on one side of it.

The successful deployment and recovery of STABLE was in many respects the highlight of the cruise, representing as it did the culmination of nearly 2 years painstaking research and development work. These tests have shown that, in principle, STABLE should provide a suitable platform for remote deployments of boundary layer flow sensor and sediment transport equipment at continental shelf depths.

ITINERARY: Cruise 19/84

22.10.84	IOS and RVS staff join ship in Falmouth. Load scientific equipment and carry out sidescan sonar tests.
23.10.84	1615 Remaining IOS staff join ship. 1800 Sailed Falmouth for Black Mud Canyon.
24.10.84	On passage at reduced speed due to heavy weather. 1045 Main engine stopped due to smoking cam box. 1250 Underway again but continuing at reduced speed due to weather.
25.10.84	0921 Hove to at BMC1 for wire tests on acoustic releases. 1100 Recovered acoustic releases.

1239 Laid current meter mooring BMC1.
1410 Laid current meter mooring BMC2.
1420 Positioned sidescan sonar pole on port side.
1510 Hove to for wire tests on acoustic releases.
1546 Completed wire tests. Proceeded to BMC3.
2001 Laid current meter mooring BMC3.
2030 Started overnight echosounding and sidescan sonar survey through mooring positions.

26.10.84 Continued overnight survey work.
0925 On station at BMC4 position.
1135 Laid current meter mooring BMC4.
1320 Hove to for wire tests on acoustic releases.
1442 Completed wire tests.
1548 Laid current meter mooring BMC5 and proceeded to BMC6 position.
1906 Laid thermistor chain mooring BMC6 and proceeded to BMC7 position.
2138 Laid thermistor chain mooring BMC7.
2210 Started echosounding and sidescan sonar survey around head of Black Mud Canyon.

27.10.84 Continued survey overnight.
1347 Completed survey, recovered sidescan sonar pole and proceeded to Helford River to shelter from gales.

28.10.84 0722 Anchored in Helford River, sheltering from gales.

29.10.84 0700 Weighed anchor and sailed Helford River for survey area. Proceeded at reduced speed due to fog.

30.10.84 0630 Arrived Black Mud Canyon area.
0904 Laid dahn buoy at BMC4 position for CTD observations.
0932 Commenced CTD observations.

31.10.84 1118 Completed CTD observations at BMC4.
1128 Recovered dahn buoy.
1142 Started echosounding and sidescan sonar survey.
1505 Stopped echosounding and sidescan sonar survey.
1531 Started sediment sampling.

1.11.84 Continued sediment sampling through night.
2210 Finished sediment sampling. Hove to for night.

2.11.84 0809 Recovered current meter mooring BMC1.
0931 Recovered current meter mooring BMC2.
1232 Recovered current meter mooring BMC3.
1642 Recovered current meter mooring BMC4.
1752 Recovered thermistor chain mooring BMC6.
1813 Started echosounding and sidescan sonar survey.
2100 Recovered sidescan sonar pole. and started sediment sampling.

3.11.84 Continued sediment sampling overnight.
0813 Recovered thermistor chain mooring BMC7.
1044 Recovered current meter mooring BMC5.
1100 Started wire tests on STABLE acoustic release command unit at position BMC5.

	1125 Completed wire tests. 1301 Deployed STABLE through 'A' frame over stern. 1321 Recovered STABLE through 'A' frame over stern. 1339 STABLE deployed mid-ship on port side using HIAB crane. 1353 Recovered STABLE through 'A' frame over stern. 1420 Started echosounding and sidescan sonar survey from position BMC5 to position BMC3. 1840 Stopped to recover sidescan sonar pole and proceeded at full speed to BMC3 position for CTD observations. 2020 Commenced CTD observations at BMC3.
4.11.84	1015 Completed CTD observations at BMC3. 1030 Depart survey area for Plymouth.
5.11.84	1400 Berthed Millbay Dock, Plymouth.
6.11.84	Unload scientific equipment. IOS personnel leave ship and return to Taunton. RVS personnel return to Barry.

PREPARED BY: (A D HEATHERSHAW)

APPROVED BY: (K R DYER)

DATE: 9/4/84

APPENDIX A

Details of IOS current meter and thermistor chain mooring positions

Black Mud Canyon

	Decca (SW British)		Lat/Long (Sat. Nav. DRT only)	
BMC1	Red F11.63	Green E42.60	47° 34.963'N	7° 57.965'W
BMC2	F9.30	E43.47	47° 39.520'N	7° 55.515'W
BMC3	F4.16	E45.06	47° 51.074'N	7° 48.680'W
BMC4	E18.11	F30.90	48° 9.421'N	7° 39.615'W
BMC5	E9.36	F33.18	48° 20.465'N	7° 33.891'W
BMC6	E15.26	F32.73	48° 11.545'N	7° 45.942'W
BMC7	E21.31	E45.22	48° 08.922'N	7° 31.503'W

Note: The Sat. Nav. DRT positions are not particularly reliable

APPENDIX B

Details of heights of current meters and thermistor chains, and deployment periods

Current Meter/ Thermistor chain	Station	Depth (m)	Height (m)	Start (GMT)	Finish (GMT)	Sensors
RCM 6750	BMC1	2700	2	1220/25/10/84	0830/2/11/84	T
RCM 3261	BMC2	1320	2	1345/25/10/84	0945/2/11/84	T
RCM 6938	BMC3	495	2	1655/25/10/84	1250/2/11/84	C/T/P
6751			250	1720/25/10/84	1300/2/11/84	C/T/P
5915			465	1815/25/10/84	1310/2/11/84	C/T/P
RCM 5912	BMC4	180	2	0910/26/10/84	2015/2/11/84	C/T/P
5229			5	0920/26/10/84	1950/2/11/84	C/T
6941			10	0930/26/10/84	1940/2/11/84	C/T
6942			20	0940/26/10/84	1905/2/11/84	C/T
3368			50	0950/26/10/84	1850/2/11/84	C/T/P
5913			143	1000/26/10/84	1835/2/11/84	C/T/P
RCM 3926	BMC5	145	2	1420/26/10/84	1245/3/11/84	C/T/P
7063			50	1425/26/10/84	1220/3/11/84	C/T/P
5914			105	1425/26/10/84	No data	C/T/P
TC 602	BMC6	185	75/150	1700/26/10/84	1920/2/11/84	T
TC 834	BMC7	182	90/140	2010/26/10/84	0840/3/11/84	T

Notes:

RCM denotes a recording current meter.

TC denotes a thermistor chain.

C is conductivity, T is temperature and P is pressure.

Finish times are shown here to the nearest minute.

Cycling interval 5 minutes

RRS FREDERICK RUSSELL CRUISE : 9/84 23/10/84 – 6/11/84 LOCATION 'A'

IOS TAUNTON

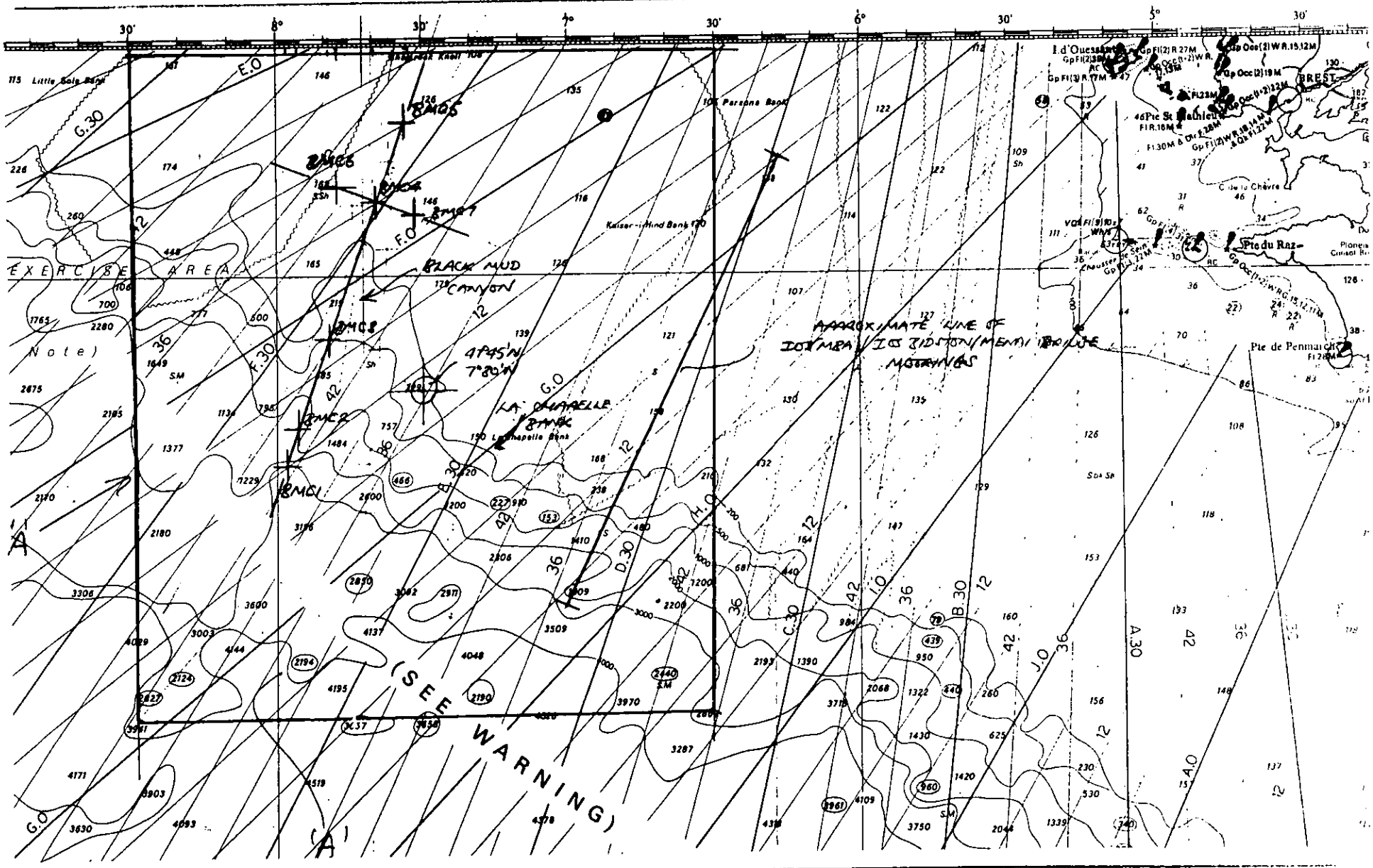

FIG. 1

REPRODUCED FROM ADMIRALTY CHART 2(D)(MC)1104
COURTESY HYDROGRAPHER OF THE NAVY