

VESSEL

RRS FREDERICK RUSSELL

CRUISE PERIOD

18 April - 2 May 1984

PERSONNEL

R M Warwick (Principal Scientist)  
A Draper  
J M Gee  
C L George (19 April only)  
I T Gillson  
A J Pomroy  
P C Reid  
A Graham (Dept. Zoology, Univ. Galway: Irish Observer)

ITINERARY

Tuesday 17 April : Loaded equipment

Wednesday 18 April: 1030 Departed Falmouth (Sailing delayed in order to permit NERC Fleet Safety Adviser to attend vessel at 0830 to brief ship's complement on operation of ship's winches. Set course for Station 1. 1710 Turned back due to medical problem with scientist (C L George). 2130 Transferred George to Newlyn Pilot vessel: reset course for Station 1.

Thursday 19 April: 1057 - 1133 Trial tow with UOR. 1305 - 1427 Trial tow with UOR. 1900 - 2100 Acoustic release tests for sediment trap mooring at Station 1 (2 tests failed). 2220. Sediment trap mooring laid in water depth of 165m at Station 1 (49° 14.92'N 10° 39.409'W) using contingency dhan buoy with U-shaped configuration.

Friday 20 April: On Station 1. Primary production studies: 1 in situ experiment at 9 depths, 1 on deck at 5 simulated depths. Samples for chlorophyll, inorganic nutrients and enumeration of phytoplankton, flagellates, cyanobacteria and bacteria. Chlorophyll distribution determined in various size fractions (>5µm, 1-5µm, 0.2-1µm). Light attenuation and vertical chlorophyll distribution measured with submersible sensors. Benthic sampling : 20 Day grab and 10 Craib core samples collected. Work completed 2200, set course for Station 3. Trial tow with UOR. Undulator hit bottom due to winch brake failure : only minor damage to body.

Saturday 21 April: On Station 3 (500m). Primary production and phytoplankton studies as at St.1. Water samples concentrated for culturing cyanobacteria and for TEM preparations. Wire test of acoustic release for sediment trap mooring (successful). Sediment trap deployed 1440. Benthic sampling: Craib coring - only 1 successful sample due to patchy bottom of rock outcrops and sand (see 29 April for confirmation).

Sunday 22 April: On Station 3. <sup>3</sup>H - Thymidine experiment to measure heterotrophic production in water column. Bottle drop for chlorophyll etc. Vertical light attenuation and chlorophyll measurements. Benthic sampling: Day grabs all empty due to nature of bottom. 1000 abandoned benthic

sampling and set course for Station 2 (300m). UOR trial tow on passage 1013 - 1057. On Station 2. Benthos sampling: 16 Day grabs, 7 Craib core samples, 1 Naturalists dredge sample (0.5h tow at 1kt). 1802 - 1837 UOR trial tow. Chlorophyll sensor and water bottle drop for chlorophyll etc. Set course for Station 4.

Monday 23 April: On passage for Station 4. Surface water samples concentrated for culturing cyanobacteria and TEM examination. 6 trial tows with UOR : fog prevented further trials at 1900 - ship's maximum speed 5kt.

Tuesday 24 April: On Station 4 (1000m). Primary production measurements and <sup>3</sup>H-Thymidine experiment as Station 1. 0727 - 0906 2 UOR trial tows. Benthic sampling: 4 drops with USNEL box-corer (2 successful). Meiofauna subcores taken from box cores. 1700 sea conditions become too rough to continue box coring. 2025 - 0015 2 UOR trial tows.

Wednesday 25 April: On Station 4. Vertical light attenuation and chlorophyll measurements. Bottle drop for chlorophyll etc. Concentrations for culturing and TEM. Benthic sampling: 6 successful box-cores. Meiofauna subcores from box-cores. 2012 - 2209 2 UOR trial tows.

Thursday 26 April: On Station 5 (2000m). Primary production measurements and <sup>3</sup>H-Thymidine experiment as Station 1. Benthic sampling: 2 drops with box corer (1 successful). Meiofauna sub-cores. Frozen sub-core for determination of vertical distribution of natural radionuclides. 1130 box coring terminated due to strong winds and heavy swell. 1453 - 1531 UOR trial tow.

Friday 27 April: On Station 5. Bottle drop for chlorophyll etc. Benthic sampling: 6 box-cores (3 successful). Meiofauna sub-cores. Sampling terminated 1700 due to heavy swell. Set course for Station 1. 1840 - 1951 UOR trial tow.

Saturday 28 April: On Station 1. 0800 recovered sediment trap array. Bottle drop and chlorophyll sensor drop. Benthic sampling: 1 0.5h tow at 1kt with Naturalists dredge. Sipunculans removed from sample and kept alive for MBA (Dr P Gibbs). Set course for Station 3. 1429 - 1500 UOR trial tow. On Station 3. Naturalists dredge sample unsuccessful: net ripped and weak link broken due to nature of bottom (?). 1700 commenced attempt to locate and release sediment trap array.

Sunday 29 April: On Station 3. Attempts to fire release mechanism on sediment trap abandoned at 0900, when grappeling for the mooring commenced. Strain-gauge read-out on grappel wire indicated rocky bottom in patches, as suggested earlier from grab and core sampling. Unsuccessful attempts to recover mooring abandoned at 1700. 6 UOR trial tows on passage to 49° 15'N 13° 00'W

Monday 30 April: 0034 Commenced UOR transect, recovering undulator at each half degree of Longitude to remove fish eggs from net. Water samples from ships non-toxic supply

for chlorophyll determinations, to calibrate UOR chlorophyll sensor, taken at each station.

Tuesday 1 May: 0226 Terminated UOR transect at 7° 30'W due to strong winds and heavy seas. Set course for Plymouth. Docked Plymouth 1848.

### Objectives

To investigate benthic invertebrate community structure (macrobenthos and meiobenthos) across the Shelf break and down the Continental Slope, as it relates to production and sedimentation processes in the water column.

a) To collect and process a series of replicate benthic samples from eight stations between 170 and 4,500 m depth for subsequent analysis in the laboratory on return to Plymouth.

b) To measure in situ and on deck primary production at seven stations and to partition production into different size-classes of phytoplankton: to measure the abundance and vertical distribution of phytoplankton, bacteria and flagellates: to measure bacterial production throughout the water column. To obtain concentrated samples for culturing of cyanobacteria and for TEM examination.

c) To deploy and recover sediment traps at two stations at the Shelf break, and to service a sediment trap array off Plymouth.

d) To test the Undulating Oceanographic Recorder sensor and recording packages: to modify servo control logic: to adjust servo gain circuitry/crank arm leverage: to continue bridal/wing configuration trials: to run a standard sampling transect for environmental parameters and fish eggs across the Shelf edge and Great Sole Bank.

Additionally, to obtain undisturbed cores of deep-sea sediment for analysis of distribution of natural radionuclides (for E I Hamilton, IMER) and to obtain living specimens of the sipunculans Aspidosiphon muelleri and Phascolion strombi for chemical analysis of body fluids (for P Gibbs, MBA).

### Procedures and Methods

Outlined in Cruise Programme IMER CI/84

### Equipment and Other Failures

The nature of the bottom at the 500m Shelf break station (St.3) precluded benthic sampling, but good series of replicate benthic samples for macrofauna and meiofauna were obtained from Stations 1 and 2 on either side of the Shelf break. Station 2 was relocated slightly deeper than originally intended (300m instead of 200) to accommodate for the lack of samples at 500m. The time taken to collect replicate box-core samples from the deeper slope stations had been underestimated and only two of these stations were consequently worked. However, excellent undisturbed samples were obtained from each of these, so that a good coverage of the shelf break and slope was obtained.

### Ships Equipment

1. Main winch: no emergency stop. Wire length metre was not reading, at first spasmodically and then permanently.
2. Schatt-davitt winch: brake would not hold and at one stage would not haul in. Also, davitt would not slew inboard at one time, so undulator had to be manhandled aboard. On an early tow the cable rode out over the winch-drum cheek and was nearly severed: some kind of leading device would seem desirable.
3. SATNAV hard copy printer ceased to function.

### Gear on Loan from RVS

1. The two General Oceanics water bottles were supplied with no messengers.
2. Day grab. Wire on the safety pin was too long; it was severed in the mechanism and lost overboard. We did not attempt to replace it.
3. SMBA type deep sea box-corer. In general this worked well, but proved to be not particularly robust and suffered some minor damage during the course of normal operation. We effected some more or less temporary repairs which will need more permanent attention at RVS:
  - a. 3 of the 4 bolts connecting the spade pulley bar to the spade arms were lost, and the bolt hole threads stripped. The holes were drilled out, retapped and larger bolts put in. We recommend that there should be 3 bolts in each side rather than only 2.
  - b. One of the retaining brackets for the main trigger bar sheared off: as it did not affect operation of the corer it was not replaced.
  - c. One Allen cap head on the right hand side of the outer gimbal joint sheared off. It was not replaced.
  - d. Split pin on the right hand spade arm pivot was broken and replaced.
  - e. Additional spacing washers were added to the base of the brackets connecting the spade arm to the spade base on the right hand side. These were not tightening satisfactorily when first used.
  - f. One retaining pin from the box shaft was lost. The pin jammed in the spade as it was being released, and had to be abandoned. We recommend that the rope attached to the pin should be twice its present length to enable it to be removed when the corer is well outboard. A temporary pin was made to replace the lost one.
  - g. The wire controlling the front set of doors sheared at the point of exit from the Allen retaining ring on the top door. This was temporarily replaced with 3mm welding rod, but needs replacing with stainless steel.
  - h. The brackets holding the door retaining rods bent a number of times, causing the doors to jam open. These had to be straightened with a hammer. The retaining bolts on the left hand bracket of the rear lower door sheared and the bracket was welded back on. One bolt also sheared in the door bracket of the front top door, and was also welded on.
  - i. All the rubber linings to the doors came unstuck very quickly and were removed. The corer operated satisfactorily without them.
  - j. In none of the samples obtained did the surface of the mud reach the level of the lowest drain hole in the side of the box. We drilled one more hole at the bottom and plugged the top hole in order that the cover plate still covered all the holes. As presently arranged the lower hole is not watertight when the spout plate is bolted in place.
  - k. The two joints on the front of the base frame are designed for 4 bolts: only 2 were present on each side at the start of operations. These kept working loose and one was lost on the last drop. We recommend that these

bolts should go right through the frame and have locking nuts on the inside. The bolts in the upper slots of the side joints of the base frame on both sides were sheared. They were not replaced.

1. Generally speaking nearly all the bolts on the apparatus worked loose far too easily and had to be frequently checked.
  
4. Sediment trap moorings. Mooring 1 at 49°14.9'N 10°39.4'W: wire tests on acoustic releases nos. 247 and 249 failed. Dr. Reid attributes the first failure to operator inexperience in the interpretation of traces on the Mufax. In the second test the puffer tube was activated but failed to give any indication of the Mufax. As a consequence of these failures the mooring was deployed with a U-shaped configuration using the contingency dhan buoy and was subsequently recovered successfully. Mooring 2 at 49°12.9'N 11°29.3'W: wire test on acoustic release no 2365 was successful in all respects, so this mooring was deployed with this acoustic release. On returning to the site 7 days later Dr Reid was unable to trigger any response from the release. The ship stayed in the area of the mooring for 24 hrs while Dr Reid tried to trigger the release, and 7 tows were made with a grappel unsuccessfully. RVS equipment lost includes:
  - a. Acoustic release no. 2365
  - b. 1 32" subsurface buoy
  - c. 2 2-ton swivels

#### Results

All results await sample analysis at IMER.

Prepared by: R M Warwick

Approved by: *B L Bayne*

Date : 15 May 1984

#### Circulation List:

Internal: B L Bayne, I R Joint, S H Coombes, G A Robinson, All Cruise Personnel, Notice Board, File.

External: NERC Foxton (Swindon), RVS Skinner (Barry), IOS Angel, Rice, Thurston(Wormley), MBA Denton, DAFS McIntyre.

