SOUTHAMPTON OCEANOGRAPHY CENTRE

CRUISE REPORT No. 23

RRS *DISCOVERY* CRUISE 237
25 SEP - 08 OCT 1998

BENGAL:
High resolution temporal and spatial study of the
BENthic biology and Geochemistry of a
north-eastern Atlantic abyssal Locality

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1999

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STN	DATE 1998	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES (GMT)	COMMENT	MEAN SOUND. (M)
13627 #15	3/10	48 49.93N	16 29.64W	MLT.CORER	4836-4836	0740-	12 good cores	4836
13627 #16	3/10	48 50.14N	16 29.34W	VEGEBOX	4837-4837	1121-	Good core	4837
13627 #17	3/10	48 49.90N	16 30.50W	BOX CORER	4837-4837	1323-1637	Good core	4837
13627 #18	3/10	48 49.99N 48 49.94N	16 29.99W 16 29.97W	CTD MS	0- 150	1711-1742	Bottles 150m (3), 50m (3), 20m (3)	4837
13627 #19	3/10	48 50.06N 48 50.30N	16 30.13W 16 29.46W	CTD MS	0-4833	1809-2225	Bottles 10-1000mab	4836
13627 #20	4/10	48 50.32N	16 29.91W	MLT.CORER	4838-4836	0057-	12 good cores	4838
13627 #21	4/10	48 49.86N	16 30.59W	BOX CORER	4837-4837	0437-	Small, very disturbed sample discarded	4837
13627 #22	4/10	48 50.47N	16 30.32W	MLT.CORER	4836-4836	0859-	11 cores, slight disturbance	4836
13627 #23	5/10	48 58.93N 49 03.88N	16 45.22W 16 40.66W	OTSB14	4814-4837	0130-0345	Good catch, over small abyssal hill	4840
13627 #24	5/10	48 50.47N 48 52.51N	16 44.37W 16 42.53W	CP	4840-4840	1400-1504	Good, if small, catch	4840
13627 #25	5/10	48 59.55N	16 26.39W	SED TRAP	4835-4835	2248-	SOC rig, for recovery Sept. 1999	4835

DOCUMENT DATA SHEET

AUTHOR

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REFERENCE

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ABSTRACT

RRS *Discovery* Cruise 237 was the sixth of series of cruises within a 3-year contract, funded under the MAST III Programme (Contract No. MAS3-5-0018) of the EU as part of the BENGAL Project, to study seasonal changes in the abyssal benthos. The cruise programme was designed to complete a full seasonal sampling programme at a single abyssal locality on the Porcupine Abyssal Plain (48° 50'N 16° 30'W). This last short cruise of the BENGAL Project aimed to fill the gaps in seasonal sampling of near bottom water, sediment and fauna and to recover long term moorings. Samples of the benthos, sediment and overlying water were collected using different gears: the Chalut à perche and the OTSB for megafauna, the USNEL Boxcorer (plain and vegematic) for macrofauna, the multiple corer for meiofauna, microfauna and chemical analysis. Only 5 working days out of 8 days on station was possible, as 34 hours were lost due to weather conditions and 24 hours to repair the winch.

KEYWORDS

BENGAL, BENTHIC BIOLOGY, BENTHIC COMMUNITIES, BIOTURBATION, CHALUT À PERCHE, CORING, CRUISE 237 1998, CURRENT METERS, *DISCOVERY*, LANDERS, MICROBIOLOGY, NEPHELOMETRY, OTSB, PHOTOGRAPHY, PORCUPINE ABYSSAL PLAIN, SEDIMENT CHEMISTRY, SEDIMENT TRAPS, TRAWLING, WATER SAMPLING

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ITINERARY

Sail Southampton, Friday, 25 September 1998, at 0900Z

Arrive work area Sunday 27 September 1998 at 1100Z

Depart work area Monday 5 October 2250Z

Arrive Southampton Thursday 8 October 0900Z

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INTRODUCTION

Discovery cruise 237 is the sixth in a series of cruises within a 3-year contract, BENGAL, funded under the MAST III programme of the EU.

The overall objective of BENGAL is to understand how the physics, chemistry and biology of the abyssal benthic boundary layer responds to, and modifies, the incoming chemical signal from the overlying water column and thus affects the palaeoceanographic record in the underlying sediment. The seabed operations were designed to study the temporal and spatial variability of benthic organisms and the geochemistry of the sediment, and to analyse the changes in the environment, particularly the effect of phytodetritus deposition in the summer months.

The chosen study area, centred on 48° 50'N 16° 30'W on the Porcupine Abyssal Plain and at a depth of about 4850m, was known to be affected by a regular seasonal deposition of phytodetritus, normally arriving in July/August each year. The BENGAL programme therefore aimed to follow the temporal changes associated with this phenomenon with a series of cruises between March 1997 and October 1998.

A planned cruise on the French research vessel *l'Atalante* in September 1997 was cancelled because of a seamen's strike and was replaced by a short cruise on RRS *Challenger* (October 1997). It was not possible on that cruise to complete a full seasonal sampling programme. Therefore, the last short cruise of the BENGAL project (Discovery 237) aimed to fill the gaps in seasonal sampling of sediment and fauna, and to recover some long-term moorings.

SPECIFIC OBJECTIVES OF DISCOVERY CRUISE 237

1. To recover long-term moorings deployed on *Discovery* cruise 231 in April 1998:

a) MAP: Module Autonome Pluridisciplinaire,

b) MAC: Module Autonome de Colonisation.

2. To operate a variety of seabed samplers:

a) Multiple corer to obtain samples of the seabed and sediment-water interface for sediment chemistry and meiofauna studies,

b) Box corer to obtain samples of the seabed for macrofauna using a plain box core (for IFREMER) and a vegematic box core (for Scottish Association for Marine Sciences).

3. To operate a variety of towed gears:

a) Semi-balloon Otter Trawl (OTSB) to obtain samples for epibenthic megafauna,

b) Beam trawl (Chalut à perche) to obtain samples for epibenthic megafauna,

c) Wide angle seabed photography system (WASP), to photograph the seabed,

d) Epibenthic sledge to photograph the seabed.

4. To operate a CTD/rosette multisampler, for profiling the water column and sampling large volumes of water overlying the sediment and within the water column.

5. To deploy a long-term mooring:

a) SOC sediment traps at depths of 1000 m, 3000 m and 100 m above the bottom.

NARRATIVE

The vessel sailed with fine weather from Southampton at 0900H Friday 25 September. The scientists had arrived previously on 24 September and had attended a safety briefing meeting at 1500H.

Saturday 26 September

Clocks were put back one hour to Greenwich Mean Time (Z) during the night. Weather conditions deteriorated during the day to about Force 4 to 5.

Sunday 27 September

The ship arrived at the site of the MAC mooring at 1100Z. The weather was fine and the first operation began with the release of the MAC mooring which had been laid during *Discovery* cruise 231. The MAC arrived at the surface at 1325Z. Sampling for organic chemical analyses and for macrofauna was undertaken. Numerous polychaetes probably Polynoidea and amphipods had colonized the substrate (a mixture of fish flour and glass beads).

As soon as the MAC was onboard the CTD was prepared. A short CTD cast to 150m. was started at 1545Z. The USNEL plain box corer was also prepared.

A second CTD cast was undertaken at the same locality, but throughout the water column down to within 5 m of the seabed (depth 4850m). Water bottle samples (10 L Niskins) were taken at a number of depths above the bottom : 10 m, 20 m, 40 m, 60 m, 80 m, 100 m, 200 m, 400 m, 600 m, 800 m and 1000 m. The water from the shallowest samples (2 bottles) was used to prepare the fixative needed for the SOC sediment traps. The other samples were used for the analyses of total organic carbon (TOC) by the University of Liverpool and biogenic silica by the University of Brest.

A meeting was held in the deck laboratory in order to organize the next phase of the work (sediment coring) and identify those responsible for fishing and sampling operations with the USNEL plain box corer, the vegematic box corer and the multiple corer.

At 1935Z the CTD was inboard. All the bottles had fired. The ship now sailed to the central BENGAL site.

The USNEL Box corer was deployed at 2027Z. It arrived at the seafloor at 2206Z, left the bottom at 2209Z with a pull-out of 8 tonnes, and was recovered at 2348Z. The surface appeared to have been disturbed. However, the different layers (0-1, 3-5, 5-10, 10-15, 15-20 cm) were subsampled as usual and 2 subcores were taken for organic matter and macrofauna.

Monday 28 September

The vegematic corer was deployed at 0020Z. It arrived on the bottom at 0200Z, left the bottom at 0206Z and was recovered at 0340Z. The sample was good.

The multiple corer was deployed at 0424Z, reached the bottom at 0616Z and was on board again at 0751Z. Twelve good cores were recovered and used for biological and chemical purposes.

The ship then proceeded to the MAP position. The release command was sent at 0854Z and the MAP was at the surface at 1025Z and on board at 1100Z. The camera, flash and nephelometer were all still working properly. The current-meter vane was not working at the time the MAP was recovered. The sediment trap had also worked properly (12 samples had been taken).

We then steamed to the central station where the USNEL boxcorer was deployed. The gear was in the water at 1200Z, on the bottom at 1338Z, and on board again at 1517Z. Small hollows and foraminifera (*Rhizammina)* were visible, but most of the surface of the core was disturbed, probably due to leakage of water between the spade and the box during recovery. Next, the vegematic box corer was deployed. The gear was in the water at 1542Z, on bottom at 1724Z, pulled out two minutes later, and on board again at 1850Z. The sample was satisfactory and yielded two specimens of the xenophyophore *Reticulammina labyrinthica.* At 1923Z, the USNEL box corer was deployed again, but this time it was fitted with a different spade in order to overcome the leakage problem. The gear arrived at the bottom at 2105Z and was immediately hauled in, arriving back on deck at 2245Z. For the first time on this cruise, it yielded a good, relatively undisturbed sample. The deployment of the WASP began at 2317Z. Some problems were encountered in detecting the acoustic signals being transmitted by WASP, but these were sorted out and the deployment was continued after 45 minutes.

Tuesday 29 September

The WASP arrived near the bottom at 0148Z, photographs and video was taken until 0328Z. The gear was then hauled in and was on deck at 0520Z. We then steamed back to the central position in order to deploy the multiple corer. However the weather suddenly deteriorated and the ship hove to. Scientific work was suspended until better conditions. Weather and wind strong (force 8-10).

Wednesday 30 September

The winch was prepared for trawling. The OTSB was shot at 1140Z and reached the bottom at 1620Z. The net lifted off the seabed at 1825Z.

Thursday 1 0ctober

The Chalut à perche (Beam trawl) was prepared and shot at 0455Z. The wire was paid out at 0519Z. The trawl arrived on the bottom at 0745Z with a wire length of 8000 m. The maximum wire deployed was 8354 m. We started to recover the trawl at 0915Z, but at 0938Z, with 8128 m of wire out, the winch stopped. There was a problem with one of the motors of the winch system and large amount of hydraulic fluid had leaked all over the winch room floor. A major fault with the winch system had occurred and all work had to be suspended until the following morning. The net was only 100 m or so above the seabed so the ship's course was changed several times to avoid locations know to have abyssal hills. After working for 16 hours non-stop on the winch problem the technical team had to rest for a few hours.

Friday 2 October

The winch was repaired early the next morning, 24 hours after the problem occurred. Hauling was commenced at 0910Z (50m/min) with the winch working only on one motor. The Chalut à perche was on board at 1230Z. The net was torn across the whole part of the top of the net. The catch was in relatively good condition considering the long time on the bottom. The duration of the trawl on the seabed was probably about 02H15. We then steamed to the central position, a distance of about 30 miles. We arrived at the corer station at 1830Z. The multiple corer was in water at 1844Z, was on bottom at 2030Z and was on board at 2159Z with 12 good cores. Immediately after the recovery, the vegematic box corer was deployed at 2223Z.

Saturday 3 October

The vegematic box corer was on bottom at 0004Z and on board at 0138Z with a good sample. The USNEL plain box corer was deployed at 0205Z, was on bottom at 0353Z and on board with a good sample at 0526Z. As the weather was still relatively calm we continue with the coring programme. The multiple corer was in water at 0550Z on bottom at 0741Z and on board with 12 good cores at 0914Z. The vegematic corer was deployed immediately after at 0944Z and arrived on the bottom at 1121Z and recovered at 1259Z. The USNEL box corer was deployed at 1323Z, was on bottom at 1504Z and on board at 1645Z with a good sample. The subsampling was carried out using the standard BENGAL protocol.

The weather changed and became stormy. Because of this the CTD was deployed at 1711Z for two casts: one to 150 m (150, 50, 20) and the other to within 3 m of the bottom. Water was collected at the following depths: 10 m above bottom, 20 mab , 50mab, 100mab, and at 3000 m depth and at 1000 m depth. The CTD was on board at 2225Z. The Chalut à perche was prepared with a new net for another deployment. However the weather became very bad and it was not possible to launch the net.

Sunday 4 October

The weather was too strong (wind 35 to 40 kts) to work.

During the evening the sea became calmer and the OTSB trawl was deployed at 2030Z.

A fax was sent to Dr Fay, Superintendent RVS in order to ask for a supplement of one day to the cruise because of the time taken to repair the winch (24H).

Monday 5 October

The OTSB trawl was on bottom at 0130Z and was hauled at 0345Z. The trawl was on board at 0730Z with a good sample of the typical dominant holothurians species : *Oneirophanta mutabilis*, *Pseudostichopus villosus*, *Psychropotes longicauda*, and a large quantity of the fragile *Amperima rosea*.

The ship proceeded to the position of trawling with the Chalut à perche. The trawl was shot at 1100Z and arrived on bottom at 1400Z. It was decided that the trawl has only a short track on the bottom in order to save time for the sediment trap mooring before sailing for Southampton. A small trawl catch was landed on deck at 1845Z. The ship sailed to the mooring site and arrived on station at 1940Z. At 1943Z the deployment of the long mooring line was started (with 3 sediment traps to be moored at 1000, 3000 and 4700m depth). The mooring deployment ended at 2206Z and reached the bottom at 2248Z. The ship sailed immediately for Southampton arriving back in port at 0900h on Thursday 8 October. Most of the cruise objectives had been achieved with the exception of at least 2 more good trawl catches, the epibenthic sledge photographic work, and 3 WASP deployments.

GEAR AND TOPIC REPORT

MAP (Module Autonome Pluridisciplinaire, IFREMER) Recovery

The aim of the long term MAP mooring was to collect simultaneous observations at the water-sediment interface in order to understand the effect of variability in the physical environment on the near-bottom supply of particulate material and on benthic animal behaviour.

After a first long term mooring of the MAP between August 96 (*Discovery* 222) and October 97 (*Challenger* 135) during which the camera was unfortunately flooded, it was decided to launch it again with a reduced equipment during *Discovery* 231. It was recovered on 28 September 1998. The rig was released at 0854Z, reaching the surface at 1026Z and the mooring was on the deck at 1100Z.

The MAP is a lander which sits on the bottom and which is equipped with a camera with a flash (picture every 6 hours), a nephelometer which made measurements every half hour, a MORS current meter (time interval: 1 hour) and a sediment trap (12 bottles). The sediment trap sampling was the same as that of the SOC sediment trap mooring according to the Table 1.

Table 1.

Start date	Sample no	Duration (days)	day no
22/03/98	1	28	81
19/04/98	2	14	109
03/05/98	3	14	123
17/05/98	4	14	137
31/05/98	5	7	151
07/06/98	6	14	158
21/06/98	7	14	172
05/07/98	8	14	186
19/07/98	9	14	200
02/08/98	10	14	214
16/08/98	11	14	228
30/08/98	12	14	242
13/09/98	close		256

After external observation of the instruments, at recovery, it appeared that:

- the flash was still working and the camera motor was still turning,

- the nephelometer was still recording each half-hour,

- the current meter rotor still worked but the vane did not,

- the sediment trap had worked.

No more can be said about the data storage before data processing at the lab.

ANNICK VANGRIESHEIM, PHILIPPE CRASSOUS

MAC (Module Autonome de Colonisation, IFREMER) Recovery

MAC experiments were carried out to obtain data on recolonisation of an artificial substrate enriched with organic matter at different concentrations.

This MAC was deployed on 04.03.98 (13368#8). It was released on 27 September 98 at 1100H and recovered at 1325H.

The experiment was successful. The fauna will be sorted out at IFREMER and the consumption of organic carbon will be calculated.

PHILIPPE CRASSOUS

Multiple corer

The multiple corer was deployed five times and on each occasion returned with a full set of 12 cores (Table 2), generally 29-32cm in length. The final deployment (13627#22) was made in heavy seas and the cores were somewhat disturbed, although still usable. Otherwise, the quality of the cores was excellent. The surfaces were generally rather featureless, apart

Table 2 . Fate of multicore samples

Station and series	13627#5	13627#12	13627#15	13627#20	13627#22
UGENT: Metazoan meiofauna	3	3	3	0	3
IOP: Metazoan meiofauna	0	0	0	12	0
UL: frozen	1	1	1	0	1
organic chemistry	1	1	1	0	1
PCBs	1	1	1	0	1
Patras: barite & silicates	1	1	1	0	1
Ancona: RNA/DNA, microscopy	1	1	1	0	1
NUIG: Microbiol community structure*	1	1	1	0	1
IUEM: pore-water chemistry	1	1	1	0	1
SOC: Foram meiofauna	1	1	1	0	1
TOTAL USED	**12**	**12**	**12**	**12**	**12**

*Core-top water from all cores (except 13627#22) used for microbiol community structure

from the occasional burrow and komokiacean mudball. Only occasional traces of phytodetritus were observed on a few cores. As on previous cruises, the cores were used for a variety of purposes, outlined below. In addition, the core-top water was removed from all cores, except those from the final, somewhat disturbed set, and used for microbiological studies. All sampling procedures (except those for IOP) were conducted in the constant temperature laboratory at 5-6°C.

Metazoan meiofauna (University of Gent)

Three cores were collected for metazoan meiofauna analysis from each of four different multicore deployments. Each core was sliced, after removal of the overlying water, into 0.5 cm horizons for the first two layers, and in 1cm horizons between 1cm and 5cm depth. For each deployment, all horizons from one core were subsampled twice. One 1ml subsample was taken for bacterial counts (Galway), while a second 1ml subsample was collected for organic carbon analysis. These subsamples were taken with open-ended 5ml syringes. The bacterial subsamples were fixed with formaldehyde, final concentration 2%, while the second series of subsamples were stored at -70°C. All the remaining samples were fixed with formalin. The 4% formaldehyde was neutralised with borax and diluted with filtered (32µm) seawater.

Meiofauna samples will be used for estimating meiobenthic standing stock in terms of densities and biomass and for comparing the size spectra between the different cruises.

Metazoan meiofauna (Institut Océanographique, Paris)

All 12 cores from one deployment of the multiple-corer (13627#20) were subsampled to 5cm depth using a cut-off plastic syringe of cross-sectional area 5.31cm^2. The subsamples (0-5cm, one from each core) were preserved in buffered formalin. They will be used to analyse the spatial distribution of the metazoan meiofauna.

Chemistry (Universities of Liverpool, Ancona, Lancaster, Patras)

Sediment samples from 4 multiple corer deployments were used for chemical studies. The cores were sectioned using a plastic ring and a brass cutting plate into the following layers: 0-0.5, 0.5-1.0, 1-2, 2-3, 3-4, 4-5, 5-6, 6-10, 10-15, 15-20cm. The sediment samples were stored in the appropriate containers, (solvent rinsed, foil wrapped petri dishes for Liverpool and Ancona and acid washed plastic vials for Patras). Three replicate cores were taken for microscopy (Ancona); these were sectioned as before, and 1 cm^3 subsamples of sediment from each section placed in sterile plastic test tubes. Approximately 3 mls of 2% formalin was added to each sample and the mixture homogenised by shaking. Two whole

cores were retained from each drop, one for PCB studies (University of Lancaster), the other as a backup core for Liverpool. They were frozen at -70°C, extruded while still frozen, wrapped in solvent wiped foil, and stored at -20°C.

Microbiology (National University of Ireland, Galway)

Cores were sliced into the following layers: 0-1, 1-2, 2-3, 3-4, 4-5, 5-7, 7-10cm. Subsamples of sediment were preserved in formalin (final concentration 1%) and stored at 4°C for subsequent determination of bacterial abundance by epifluorescence microscopy. The remaining material was stored at -20°C for later analysis of microbial community structure by nucleic-acid -based methods.

Water overlying the cores (sediment contact water: SCW) was siphoned off from all cores obtained from the first four deployments (13627#5, #12, #15, #20). Subsamples of SCW were preserved with formalin (final concentration 0.5%) and stored at 4°C for subsequent determination of bacterial abundance by epifluorescence microscopy. SCW samples from 13627#5 (6L) and 13627#15 (6.5L) were filtered through 0.2µm Sterivex filters (Millipore Inc.) at 6°C. Lysis buffer (1.8ml: Sucrose/EDTA/Na Cl) was added to each filter. Filters were stored at -20°C for subsequent determination of microbial community structure by nucleic-acid -based methods. Tangential flow filtration with a 0.2µm filter cassette was used to concentrate the bacterial fraction of SCW samples from 13627#12 (7L) and 13627#20 (7L). Concentrated samples were stored at -20°C after the addition of an equal volume of glycerol (40% in particle free seawater). It is hoped that this will reserve the bacteria in the sample in a viable state for subsequent experiments on shore to determine the effects of pressure and other environmental variables on community structure

Pore-water chemistry (Institut Universitaire Européen de la Mer)

Samples were collected for analyses of silicic acid and aluminium in pore waters from four multicores taken at the central position. Cores were sliced into 0.5 cm layers between the surface and 4cm, 1 cm layers between 4cm and 10 cm and then 2cm thick layers between 10cm and 30cm. After centrifugation at 3600 rpm and 4°C, porewater samples from each sediment slice were filtered to 0.2 µm. After acidification with 20 µl of HNO_3, samples were stored cool in Teflon vials.

Foraminiferal meiofauna (Southampton Oceanography Centre)

One core from each of four deployments will be used for analysis of the population density and species diversity of 'live' benthic foraminifera. Two cores (13627#5 and #12) were sliced into 0.5cm layers between the surface and 2cm depth and 1cm thick layers between 2cm and 15cm. One core (13627#20) was sliced in a similar way but only down to

5cm. The final core (13627#22) was sliced into 0.5cm layers down to 2cm depth. All sediment layers were preserved in 4% borax buffered formalin filtered through a 32µm sieve to remove contaminating organisms.

ANDY GOODAY, JOELLE GALÉRON, MORGANE GALLINARI, SANSHA HARRIS, NICOLAS HESSE, KAREN MACKENZIE, JOHN PATCHING , ANN VANREUSEL

Box Corer (USNEL plain box)

Macrofauna was sampled using a modified USNEL-type boxcorer, with a plain box. As a result of experience from the previous cruises, depth limiters were added on the column, limiting the penetration of the core to about 2/3 of the height of the box. Five deployments were carried out, four in good sea conditions, the last one in rough weather. The paying-out speed when arriving on the bottom and the speed when hauling-in were 20m/min, following previous sampling experience on *Discovery* cruise 231.

The first core (13627#3) was disturbed but it was kept in case the following ones were worse. The second one (13627#6) was not accepted because it was completely disturbed, probably due to a problem on the spade. The rubber was unstuck on a width of about 8 cm along the front side. Then we changed the box and spade for the third core (13627#8). This core was acceptable. Nevertheless it had quite deep traces of bioturbation on the back half, and small balls of sediment scattered at the surface on the front half, which suggests that the surface could have been washed. The fourth (13627#14) boxcore was good even if it presented the same features as the previous core, if in slightly better condition. The fifth box (13627#17) was a good one. The sixth deployment (13627#21) took place in bad weather and it failed: one of the doors at the top of the box was open and about 1/3 of the sediment along the back side of the box had disappeared.

Four cores were processed according to the IOS protocol. Standard sievings were carried out : 1 mm, 500 µm, 300 µm and 250 µm for the 4 upper layers (0-1 cm, 1-3 cm, 3-5 cm, 5-10 cm), and just 1 mm and 500 µm for the deeper (10-15 cm and 15-20 cm) layers. All the subsamples were preserved in buffered formalin for a further sorting of macrofauna at IFREMER. One vegematic subcore was taken by P. Lamont from the six box cores, also for macrofauna sorting purposes.

JOELLE GALÉRON, PHILIPPE CRASSOUS, MYRIAM SIBUET

Box Corer (USNEL vegematic box core)

The yellow USNEL boxcorer was used throughout sampling and no problems were experienced. The spade cam clamps were stiff to start with but loosened with use. These will probably stiffen again unless greased. When attaching the spade to the box the last clamp arm to be seated is invariably obstructed by misalignment of the spade lug and corer

frame. It was observed that there is sufficient side to side play to enable the remaining lugs to be aligned and the last clamp to be seated without the need for use of the mallet, provided the spade is sufficiently loose to be manipulated. To permit this adjustment during assembly, the three other clamps must not be tightened nor the spade jacked up too tightly against the corer until all four cam clamps are seated.

Four vegematic boxcores were obtained, all of which were acceptable.

Subcores were extruded and horizontally sectioned at 10 cm. Sediment was placed in 4% buffered seawater formaldehyde and sieved after a few days into two fractions on 300 and 250 μm sieves. One subcore from the inner nine was sectioned into 0-1, 1-2, 2-3, 3-5 and 5-10 cm levels with each section treated and sieved in the same manner as the other subcores.

The first vegematic core, 13627#4, was fairly featureless with few burrows. A shallow mound was present in the corner subcore A1 and there was a small brittle star (*Ophiocten* sp.) in subcore A5. Small egg clusters resembling Olympic rings were found in one subcore and an indeterminate xenophyophore was removed for examination by A. Gooday.

13627#7 possessed more surface fauna though some exposed *Rhizammina* indicated a little disturbance of the surface, as did lumps in subcores C5 to E5. Subcore E4 contained a small sponge firmly anchored to the sediment by spicules extending about 50 mm down into the sediment. Some xenophyophores were removed for examination by A. Gooday, including one from D3. Subcore C1 was disturbed before processing and some supernatant water was lost.

13627#13 possessed many surface features and fauna but had also experienced some disturbance in subcores D1 to 3 and E1 and 2, though C4 contained a radiolarian skeleton in addition to Komokiacean mudballs. Specimens of *Reticulammina* were obtained from C1 and D4 for A. Gooday.

The last vegematic core, 13727#16, showed least disturbance with xenophyophores in D1 and E2 of a different species from the earlier cores. A radiolarian skeleton was observed in C2. Many burrows were present, most of 2 mm diameter, some of 6 mm diameter and one of 10 mm diameter (subcore A4).

1) Notes were made of any features of interest on the surface and the general surface condition, depth of box penetration into the sediment, etc.

2) Subcoring: one 92 x 92 mm vegematic core was inserted into the sediment if possible before the surface water is drained off, where possible.

3) When the subcore was freed from the sediment the core was extracted by a piston fitted with a rubber gasket forced up from below. Metal core sections cut to the required depths were held onto the top of the subcore to receive the sediment which was then sliced off and placed into a sample vessel with 10% formalin (4% formaldehyde)

4) Delicate surface fauna such as xenophyophores and perforated tubes were removed as the core was being extracted and placed in separate jars.

5) After two or more days the sediment was washed through a stack of two sieves and the residues were retained and returned to formalin or 80% - 90% alcohol.

PETER LAMONT

Beam Trawl (Chalut à perche)

The beam trawl was fished twice during this cruise to collect megafauna (13627#11 and 13627#24).

For the first deployment, the trawl was on the bottom after paying out 8000 m wire at 60 m/min. The ship's speed varied from 1 knot to 1.5 knots. The trawl was on the bottom for approximately 2H15. 354 m of wire were paid out during the tract on the bottom. After having hauled in 226 m wire, the winch failed. It took 24 hours to be repaired.

When the trawl came back, the net was torn across the total width of the top, surely due to the pinger bracket. It was thought that this happened during the time the trawl was on or close to the bottom because of the winch problem, because it seemed that the invertebrate catch was quite normal and one would have suspected a larger quantity of fish in the trawl if it had fished normally without this tear.

The haul produced a clean catch of about 24 kg of invertebrates in not too bad condition, considering the winch problem and the amount of clinker. Nevertheless, the specimens of the soft-bodied holothurians *Amperima,* which were stuck at the end of the net, were badly damaged.

The second deployment was carried out with a new net. 8400 m wire were paid out at 50 m/min before the trawl was on the bottom. The ship's speed varied from 1.5 knots to 1.9 knots. It was decided to shorten the time on the bottom because of the lack of time at the end of the cruise, so it was on the bottom for just 1 hour.

The catch was small but good, with less clinker and about 12 kg of invertebrate megafauna in good condition.

Table 3. Abundances and weights of invertebrate megafauna from Chalut à perche

Taxon	13627#11		13627#24	
	Nb of ind.	Wet weight (g)	Nb of ind.	Wet weight (g)
Porifera	1	5	1	8
Pennatulacea	4	4	5	6
Actiniaria	118	21	51	172
Zoantharia	53	10	21	4
Scleractinia	5	7	2	2
Polychaeta	80	107	31	32
Echiura	4	17		
Sipunculida	1	2		
Bivalvia	4	7.5	3	12
Gastropoda	8	12	1	1
Cephalopoda			1	620
Pycnogonida	3	6.5	3	5
Cirripedia	6	11	2	6
Decapoda Natantia	13	66	3	165
Decapoda Reptantia	11	175		
Oneirophanta mutabilis	197	7800	54	2335
Pseudostichopus villosus	82	7905	16	1251
Pseudostichopus sp.	72	1300	16	284
Psychropotes longicauda	154	1696	56	4850
Paroriza prouhoi	8	1500	8	1702
Mesothuria sp.	9	390	1	12
Amperima rosea	560	1490	not counted	300
Kolga sp.+ Ellipinion sp.	15	20	3	3
Peniagone sp.	2	10		
Deima validum	4	268	3	352
Gen. sp.	1	7.5		
Holothuroidea (total)	1091	20825	138	6981
Asteroidea	47	514	29	139
Ophiuroidea	15	32	8	20
Crinoidea	1	1	1	2
Tunicata	11	8	7	5
Pogonophora				
Total	1489	23392	326	12288

JOËLLE GALÉRON, PHILIPPE CRASSOUS, MYRIAM SIBUET

Otter trawl

The otter trawl was deployed twice during the cruise (13627#10 and 13627#23). Both trawls were successful and yielded a large and varied catch. Details of the biomass of the fauna collected are given in Table 4, with the data corrected per unit area. The acoustic monitor could not be seen owing to the weather conditions, so the estimated fishing distance was calculated from changes in wire tension. During the second trawl a major correction in trawling direction had to be made owing to a shift in the wind direction. This took the net

Table 4. RRS Discovery Cruise 237 25 September - 8 October 1998

		13627#10 Wet wt	per hectare 11.2488 hectares	13627#23 Wet wt	per hectare 7.8260 hectares
PORIFERA				15	1.9
PENNATULACEA	Umbellula	6	0.5	5	0.6
ACTINIARIA	Actinauge abyssorum	262	23.3	314	40.1
	Amphianthus bathybium	92	8.2	120	15.3
	Doantesia	70	6.2	43	5.5
	Iosactis	30	2.7	19	2.4
	Kadosactis	8	0.7	24	3.1
	Misc	15	1.3	26	3.3
	Segonzactis platypus	13	1.2	15	1.9
	Sicyonis biotrans	507	45.1	181	23.1
	Total Actiniaria	**997**	**88.6**	**742**	**94.8**
MADREPORARIA				24	3.1
ZOANTHIDEA		20	1.8	20	2.6
ECHIURA		78	6.9	102	13.0
NEMERTINA					
SIPUNCULA		36	3.2		
ANNELIDA	Polynoidae	56	5.0	91	11.6
	Worm tubes	307	27.3	277	35.4
	Total Annelida	**363**	**32.3**	**368**	**47.0**
CIRRIPEDIA		51	4.5	7	0.9
DECAPODA	Benthesicymus				
	Munidopsis	22	2.0	88	11.2
	Natantia	77	6.8	203	25.9
	Plesiopeneus armatus	42	3.7	185	23.6
	Stereomastis	82	7.3	49	6.3
	Total Decapoda	**223**	**19.8**	**525**	**67.1**
ECTOPROCTA				1	0.1
PYCNOGONIDA		7	0.6	8	1.0
GASTROPODA		7	0.6	17	2.2
SCAPHOPODA				1	0.1
BIVALVIA		18	1.6	1	0.1
CEPHALOPODA		5	0.4	545	69.6
ASTEROIDEA					
	Dytaster	130	11.6	182	23.3
	Freyella	65	5.8	5	0.6
	Hyphalaster	684	60.8	170	21.7
	Misc				
	Styracaster	262	23.3	53	6.8
	Total Asteroidea	**1141**	**101.4**	**410**	**52.4**
OPHIUROIDEA		91	8.1	24	3.1
ECHINOIDEA					
HOLOTHURIOIDEA	Amperima rosea	2000	177.8	2171	277.4
	Benthodytes sp			66	8.4
	Deima validum	301	26.8	523	66.8
	Ellipinion/Kolga			3	0.4
	Mesothuria candelabri	193	17.2	125	16.0
	Misc			8	1.0
	Molpadia blakei	55	4.9		
	Oneirophanta mutabilis	9056	805.1	12016	1535.4
	Paroriza prouhoi	3812	338.9	2568	328.1
	Peniagone	5	0.4	28	3.6
	Protankyra brychia	8	0.7		
	Pseudostichopus sp.	1100	97.8	1781	227.6
	Pseudostichopus villosus	7555	671.6	6630	847.2
	Psychropotes longicauda	9811	872.2	13150	1680.3
	Psychropotes semperiana				
	Total Holothuroidea	**33896**	**3013.3**	**39069**	**4992.2**
CRINOIDEA		1	0.1		
TUNICATA		12	1.1	35	4.5
OTHER	Clinker	40800	3627.1	16000	2044.5
	Fish	2890	256.9	9300	1188.3
Total Invertebrates		**36952**	**3285.0**	**41919**	**5356.4**
GRAND TOTAL		**80642**	**7168.9**	**67219**	**8589.2**

over a slight rise in bathymetry (c. 20m). Fortunately the net had lifted off the seabed and was well clear of it before the new course passed over a particularly large abyssal hill.

The catches were dominated by holothurians, notably *Oneirophanta mutabilis*, *Psychropotes longicauda*, *Pseudostichopus villosus*, *Pseudostichopus* sp. and *Amperima rosea*. There appeared to be fewer specimens of *A. rosea* than encountered previously at this site. The second trawl had a large catch of fish, about half from midwater. Details of the fish catches from the Otter Trawl and the Chalut à perche are given in Table 4.

DAVID BILLETT, BEN BOORMAN, EVA RAMIREZ LLODRA, BEN WIGHAM

Fish

Fish were caught in all the OTSB and Chalut à perche trawls. Altogether, 122 fish were caught using the OTSB and 29 fish were caught using the Chalut system making a total of 151 fish. The largest fish caught was the macrourid *Coryphaenoides armatus*. A total of seven of these fish were caught over the four trawls, with a mean wet weight per fish of 1.3kg. Immediately after landing, samples of muscle and liver tissue were removed for analysis by Alex Rogers at SOC.

PENNY HOWELL

WASP -Wide Angle Seabed Photography

Although at least four deployments of WASP were planned at the start of the cruise only one deployment was made (13627#9). It had been planned to replace the other WASP camera runs with one long epibenthic sledge run across the bottom, but owing to the problem with the ship's winch there was not enough time to deploy the sledge.

The WASP deployment was successful. Both the OCEAN CAM 6000 still photography camera and the OCEAN CAM 6000 digital video camera worked well. WASP reached the bottom in near perfect conditions at 0148Z 29/09/98 and remained within 10m of the seabed until 0338Z, apart from a small period close to the end of the deployment. During this period the weather deteriorated very rapidly with the wind increasing from a gentle breeze to a severe gale. It became increasingly difficult to keep the camera system close to the seabed. Despite this the still camera took 428 frames and the digital camera 65 minutes of video. The camera varied in altitude 2 to 10m above the seabed.

Some power problems were experienced towards the end of the run and the acoustic signals became faint. Otherwise, there were no problems with the acoustic monitor, altimeter or power systems. The new altimeter worked particularly well, locking onto the seabed at an altitude of precisely 100m, and switching on the camera systems at an altitude of precisely 10m.

The video showed a wide variety of fauna, notably the holothurians *Pseudostichopus villosus* and *Psychropotes longicauda*. There were numerous tracks, trails and the burrows/feeding traces of large infaunal echiuran worms.

DAVID BILLETT, ANDY HARRIS

CTD and water bottle rosette

The CTD system/rosette water sampler was deployed four times during the cruise. Two casts were shallow (150m: 13627#1 and #18) and two (13627#2 and #19) were to within a few meters of the bottom, as determined acoustically. Variations of temperature, salinity, oxygen and fluorescence with depth were recorded. The depth reading derived from the CTD pressure sensor appeared to be offset when compared to the ship's echosounder. The difference increased to a maximum of 30m at 5m OB (over bottom) on both deep casts. For this reason, a post-cruise pressure calibration will be carried out.

The CTD was equipped with 3 turgidity sensors in order to examine the bottom nepheloid layer during the deep casts: a Chelsea nephelometer, a Sea Tech transmissometer and a Sea Tech LSS (back scattering). The Chelsea nephelometer appeared to have a stability problem. The LSS and the transmissometer seemed to work better. The profile of the bottom nepheloid layer appeared to differ between casts. On both sets of deep profiles, the turgidity signals increased gradually from 4300m to 4400m (~500m above bottom). At depths greater than 4600/4700m, turgidity increased further with depth during cast 13627#2 but remained constant during 13627#19. This may indicate variability in the bottom nepheloid layer, which unfortunately could not be examined in more detail because of the smallness of the data set.

ANNICK VANGRESHEIM, PAUL HOWARTH

Water Column Samples

All attempts at bottle firing were successful. Table 5 provides further details.

Table 5. Fate of water column samples

	Water depth	Max. cast depth	Sample depths	Bottles fired	Fate of Samples
13627#1	4850	151	151	6	NUIG (DNA, viable)
			101	6	NUIG (DNA) SOC (for sediment traps)
13627#2	4850	6 OB	10 OB	1	UL (TOC), IUEM (biogenic silica)
			20 OB	1	UL (TOC), IUEM (biogenic silica)
			40 OB	1	UL (TOC), IUEM (biogenic silica)
			60 OB	1	UL (TOC), IUEM (biogenic silica)
			80 OB	1	UL (TOC), IUEM (biogenic silica)
			100 OB	1	UL (TOC), IUEM (biogenic silica)
			200 OB	1	UL (TOC), IUEM (biogenic silica)
			400 OB	1	UL (TOC), IUEM (biogenic silica)
			600 OB	1	UL (TOC), IUEM (biogenic silica)
			800 OB	1	UL (TOC), IUEM (biogenic silica)
			1000 OB	2	UL (TOC), IUEM (biogenic silica)
13627#18	4802	150	150	3	NUIG (viable)
			50	3	NUIG (DNA)
			20	3	NUIG (DNA, virus)
13627#19	4802	3 OB	10 OB	3	UL (TOC), IUEM (biogenic silica), NUIG (DNA, virus)
			20 OB	1	UL (TOC), IUEM (biogenic silica)
			50 OB	1	UL (TOC), IUEM (biogenic silica)
			100 OB	2	UL (TOC), IUEM (biogenic silica), NUIG (DNA)
			3000	3	NUIG (DNA, virus)
			1000	2	NUIG (DNA)

OB = over bottom. All depths in metres

JOHN PATCHING

Water Microbiology (NUIG)

Fifty millilitres of each water sample processed for NUIG (see Table 5) were preserved with formalin (final concentration 0.5%) and stored at 4°C for subsequent determination of bacterial abundance by epifluorescence microscopy.

Samples (16-26 L: designated "DNA" in Table 5) were taken from several depths for the determination of microbial community structure by nucleic-acid -based methods.

Samples were filtered through 0.2µM Sterivex filters (Millipore Inc.) at 6°C. Lysis buffer (1.8ml: Sucrose/EDTA/Na Cl) was added to each filter and they were stored at -20°C. In some cases (designated "virus" in Table 5) the filtrate was retained for subsequent determination of virus abundance by microscopy and molecular probe methodology. To

avoid problems with transport and further processing, these samples were concentrated to 300 - 600ml volumes by means of a tangential flow filter system equipped with a 100 Mda filter cassette. The filtrate from the tangential flow system was retained for use in the preparation of algal media (SOC).

Tangential flow filtration with a 0.2µm filter cassette was used to concentrate the bacterial fraction of samples (150m; 25L) designated «viable» in Table 5. Concentrated samples were stored at -20°C after the addition of an equal volume of glycerol (40% in particle free seawater). It is hoped that this will preserve the bacteria in the sample in a viable state for subsequent experiments on shore to determine the effects of pressure and other environmental variables on community structure

JOHN PATCHING

Biogenic Silica (IUEM) and Total Organic Carbon (UL)

Samples were chosen in order to estimate the effect of the resuspension on suspended particulate material (especially biogenic silica and TOC) profiles in the bottom 800m of the water column. After filtration of 2L on Nucleopore 0.6µm filters, samples for the determination of biogenic silica were dried at 60°C and stored. Samples for the determination of total organic carbon (2L: designated "TOC" in Table 5) were filtered through Whatman GF/F filters. The filters were then wrapped in solvent rinsed foil and frozen at -70°C.

NICHOLAS HESSE, MORGANE GALLINARI, KAREN, MACKENZIE.

SOC SEDIMENT TRAP

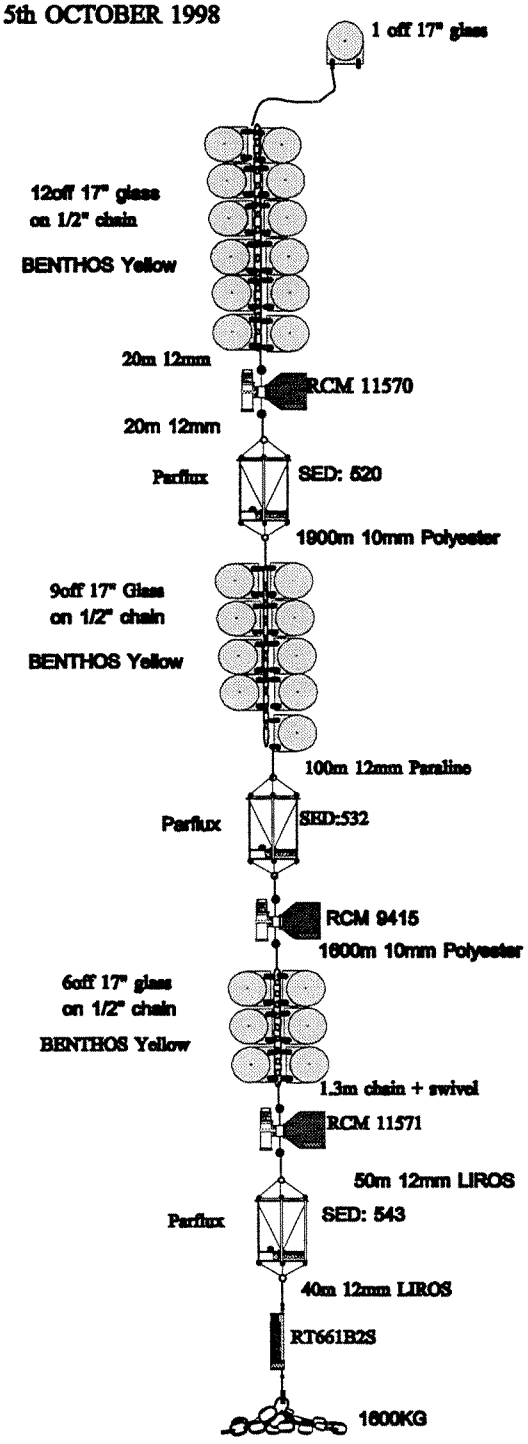
Jason Tilling prepared the three RCM8 Aanderaa current meters.

The Top RCM (s/n 11570) was equipped with a 0-3000psia pressure sensor; the Mid RCM (s/n 9415) was equipped with a 0-5000 psia pressure sensor, the Bottom RCM (s/n 9903) was a standard unit. All three RCMs were set to sample at one-hour intervals and collected their first data at 12:00 GMT on October 2nd 1998 (J Day 275).

The rig was deployed on Monday 5th October 1998 (J Day 277) starting at 1942h, the rig was completely away at 2206h. As each trap was deployed all the bottles appeared to be well sealed with no leaks apparent. The mooring reached the bottom at 2241h and the pinger was switched off at 2245h. The position of the rig at launch was 48°59.54'N 16°26.38'W with a sounding of 4804uc m.

MOORING DEPLOYED 5th OCTOBER 1998

Position: 48 59.54 N
16 26.38 W



Recovery is intended in September 1999. The release details are as follows:

Mors RT661 B2S s/n: 254
Window : EC57
Release: EC85
Pinger: EC94
DIAG: EC87
Off: EC59

Sediment Trap Program
Event 01 of 14 = 10/11/98 12:00:00
Event 02 of 14 = 12/06/98 12:00:00
Event 03 of 14 = 01/31/99 12:00:00
Event 04 of 14 = 03/28/99 12:00:00
Event 05 of 14 = 04/25/99 12:00:00
Event 06 of 14 = 05/23/99 12:00:00
Event 07 of 14 = 06/06/99 12:00:00
Event 08 of 14 = 06/20/99 12:00:00
Event 09 of 14 = 07/04/99 12:00:00
Event 10 of 14 = 07/18/99 12:00:00
Event 11 of 14 = 08/01/99 12:00:00
Event 12 of 14 = 08/15/99 12:00:00
Event 13 of 14 = 08/29/99 12:00:00
Event 14 of 14 = 09/26/99 12:00:00

The above program was common to all sediment traps deployed.

JASON TILLING, PAUL HOWARTH

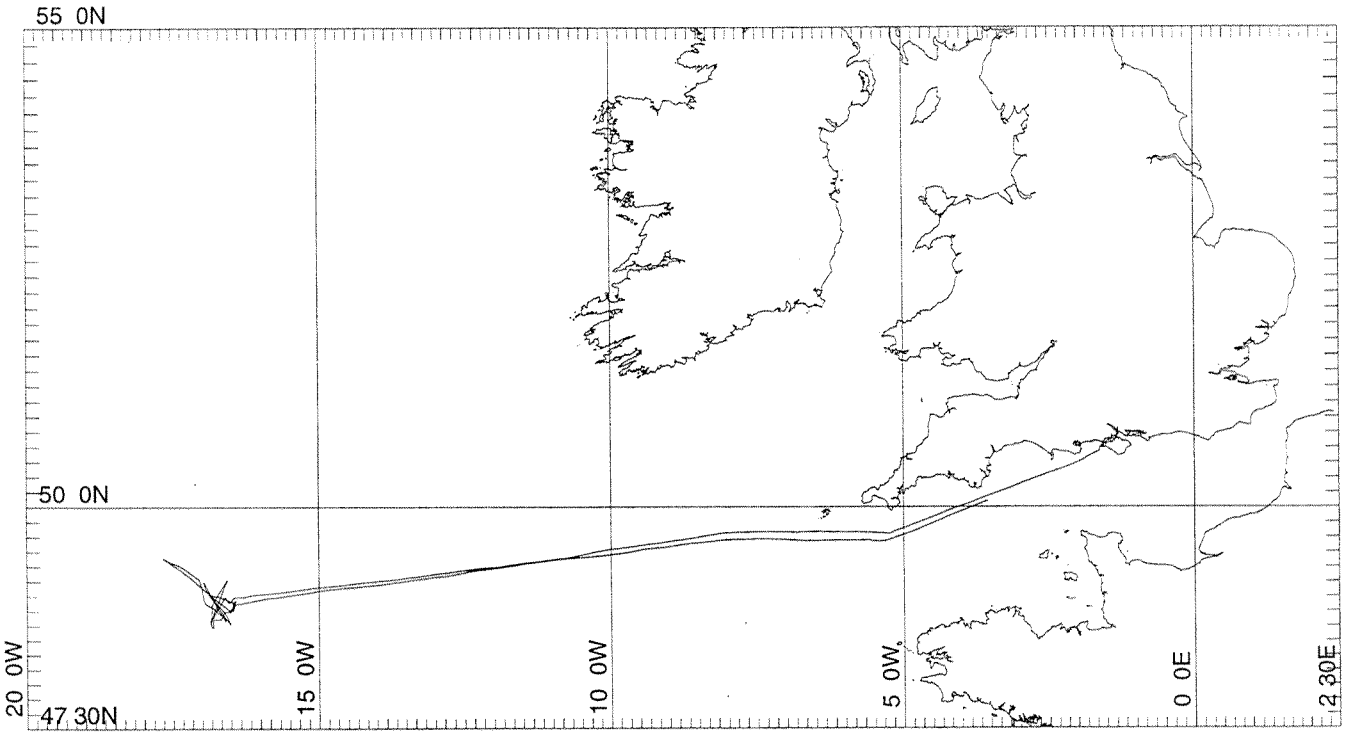


Figure 1. RRS *Discovery* cruise 237 track chart.

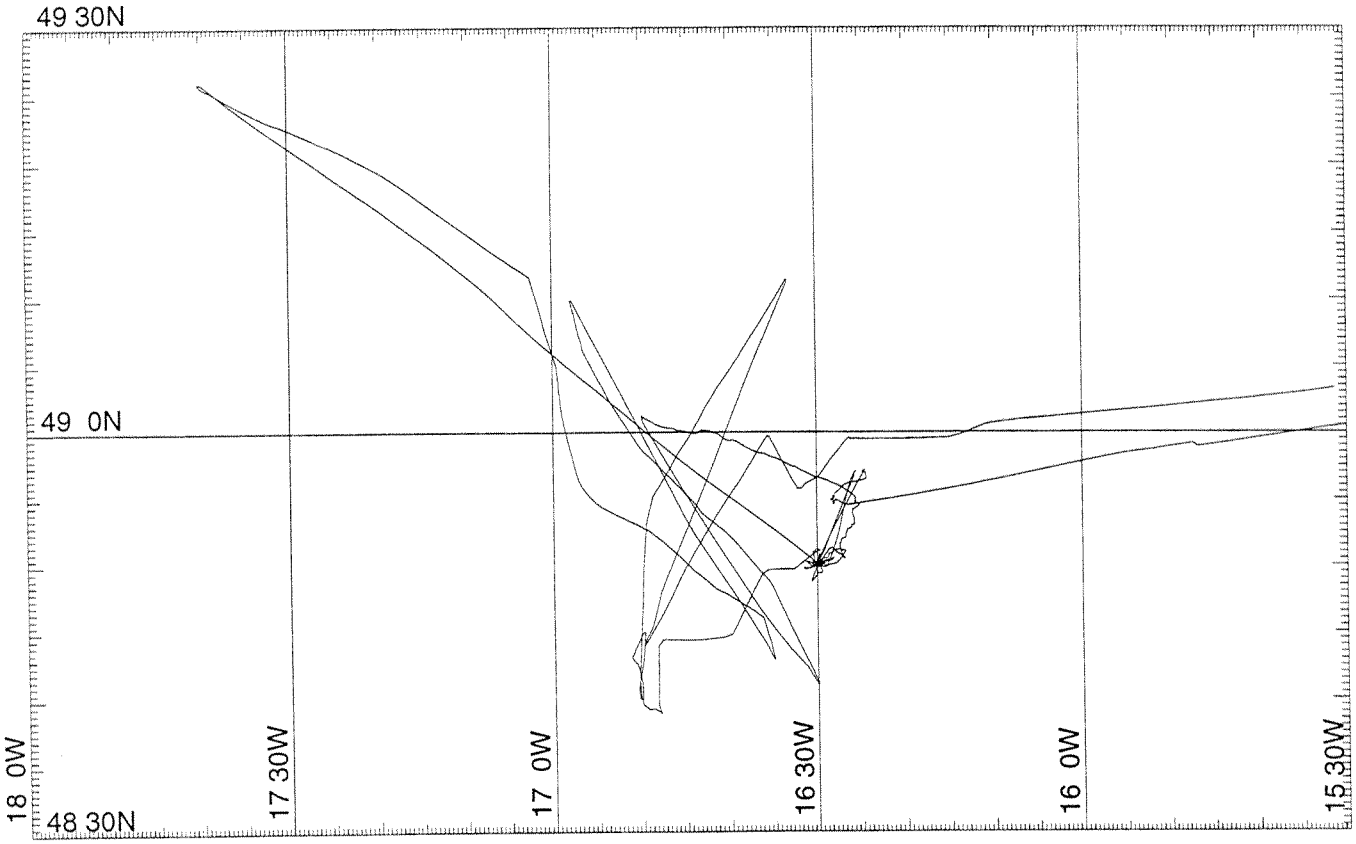


Figure 2. RRS *Discovery* cruise 237. Detailed track chart of movements in the main work area.

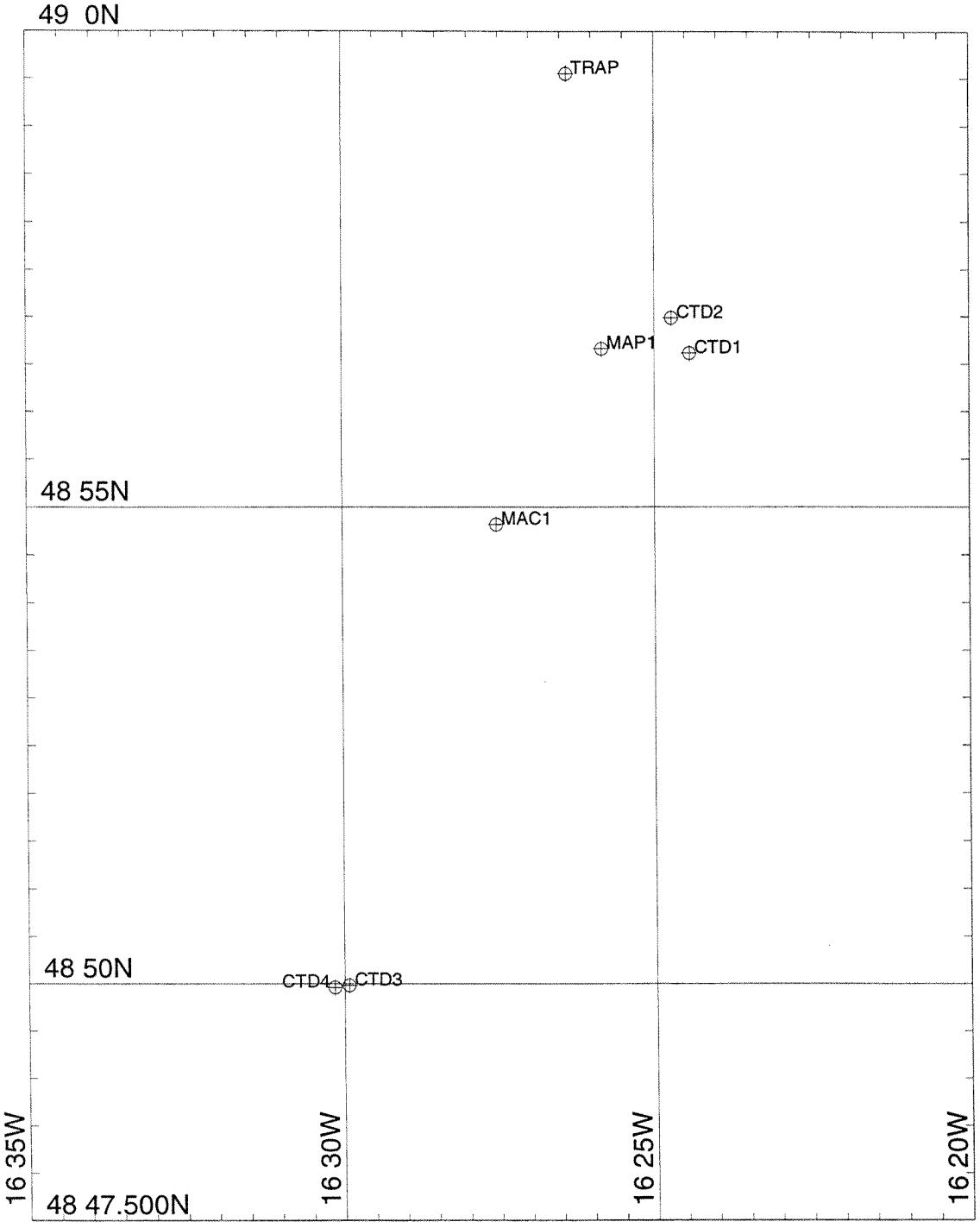


Figure 3. RRS *Discovery* cruise 237. Position of moorings and CTD stations.

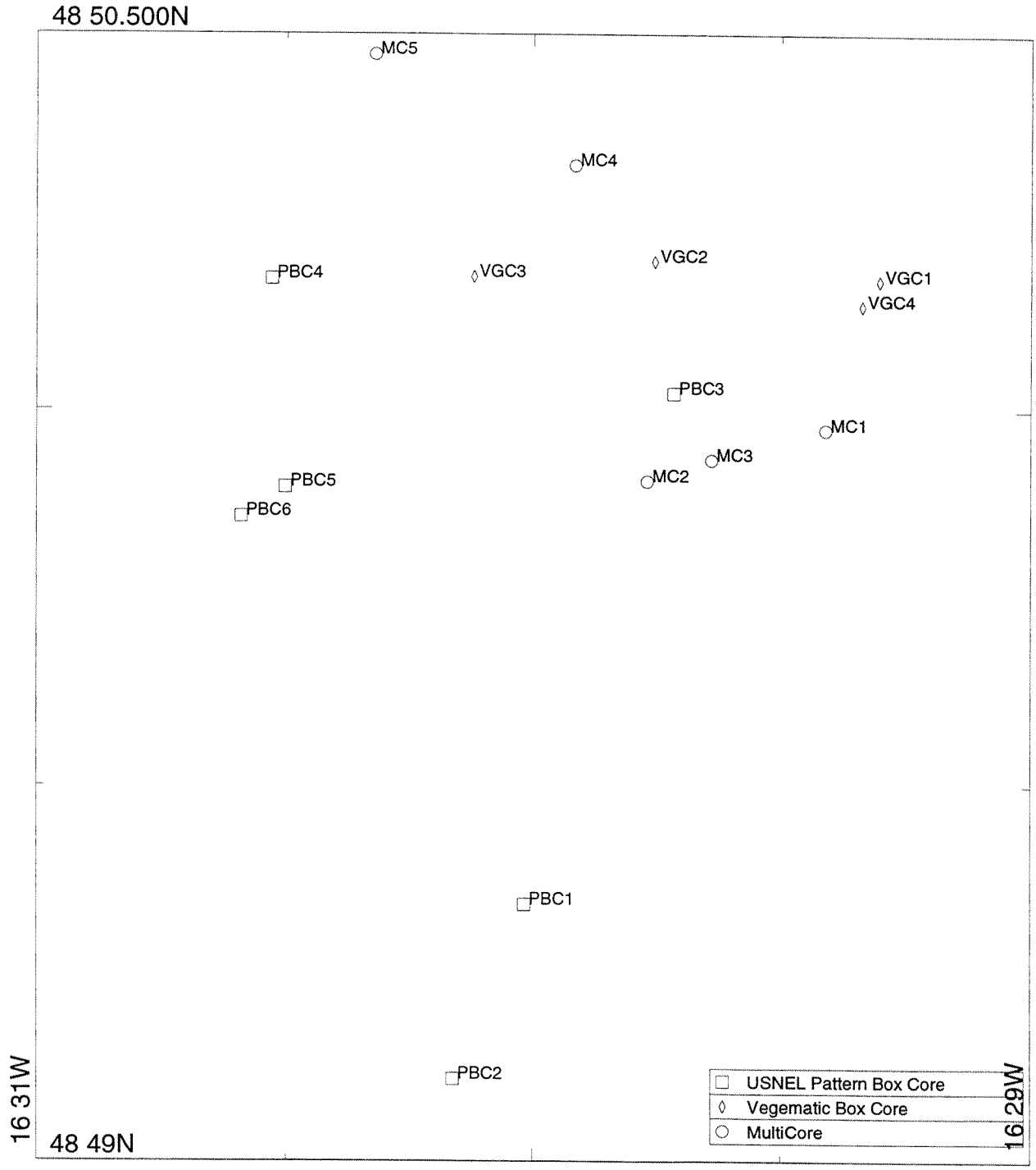


Figure 4. RRS *Discovery* cruise 237. Positions of multiple corer and box corer (plain and vegematic) deployments.

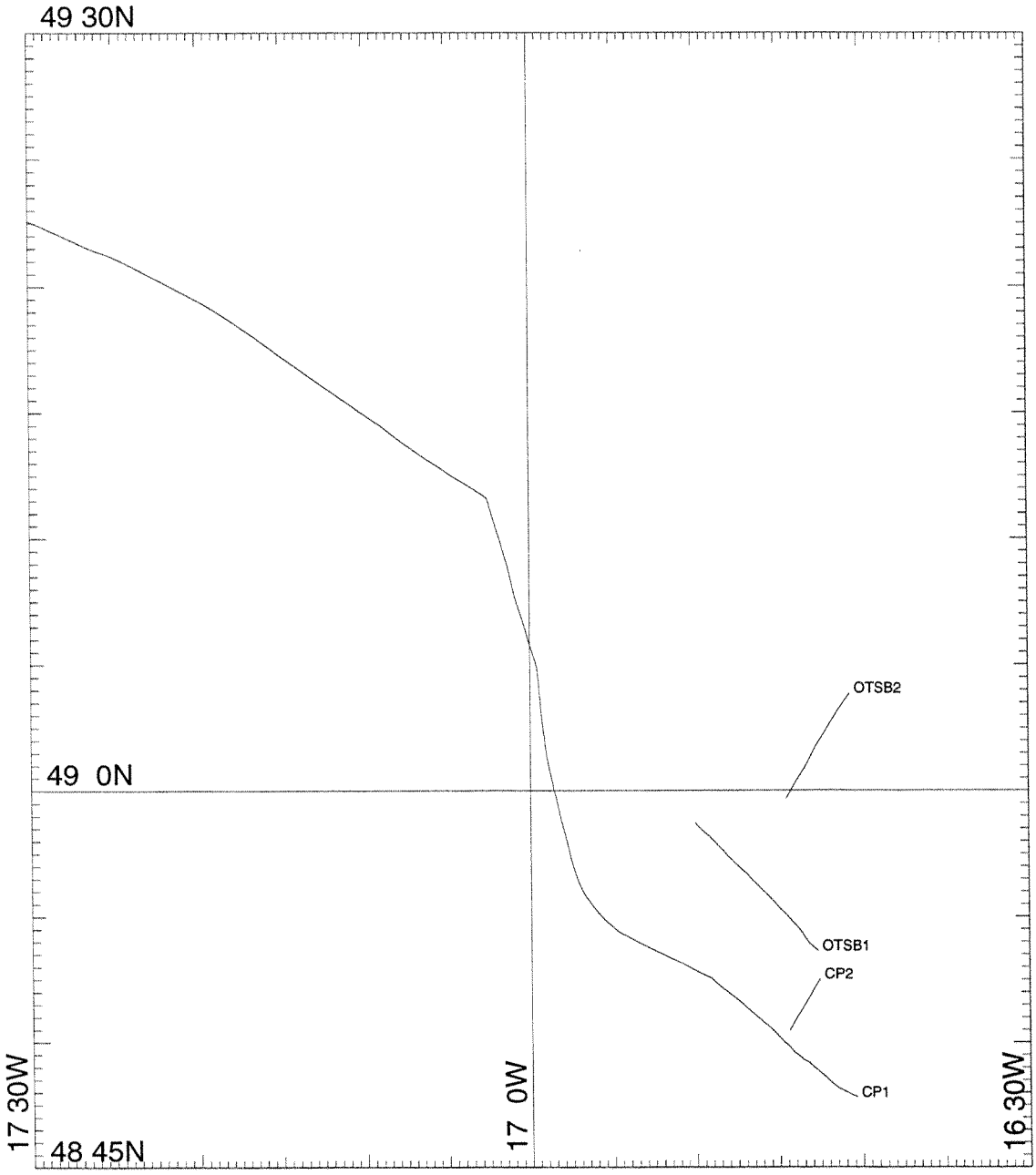


Figure 5. RRS *Discovery* cruise 237. Bottom tracks of OTSB and Chalut à perche trawls.

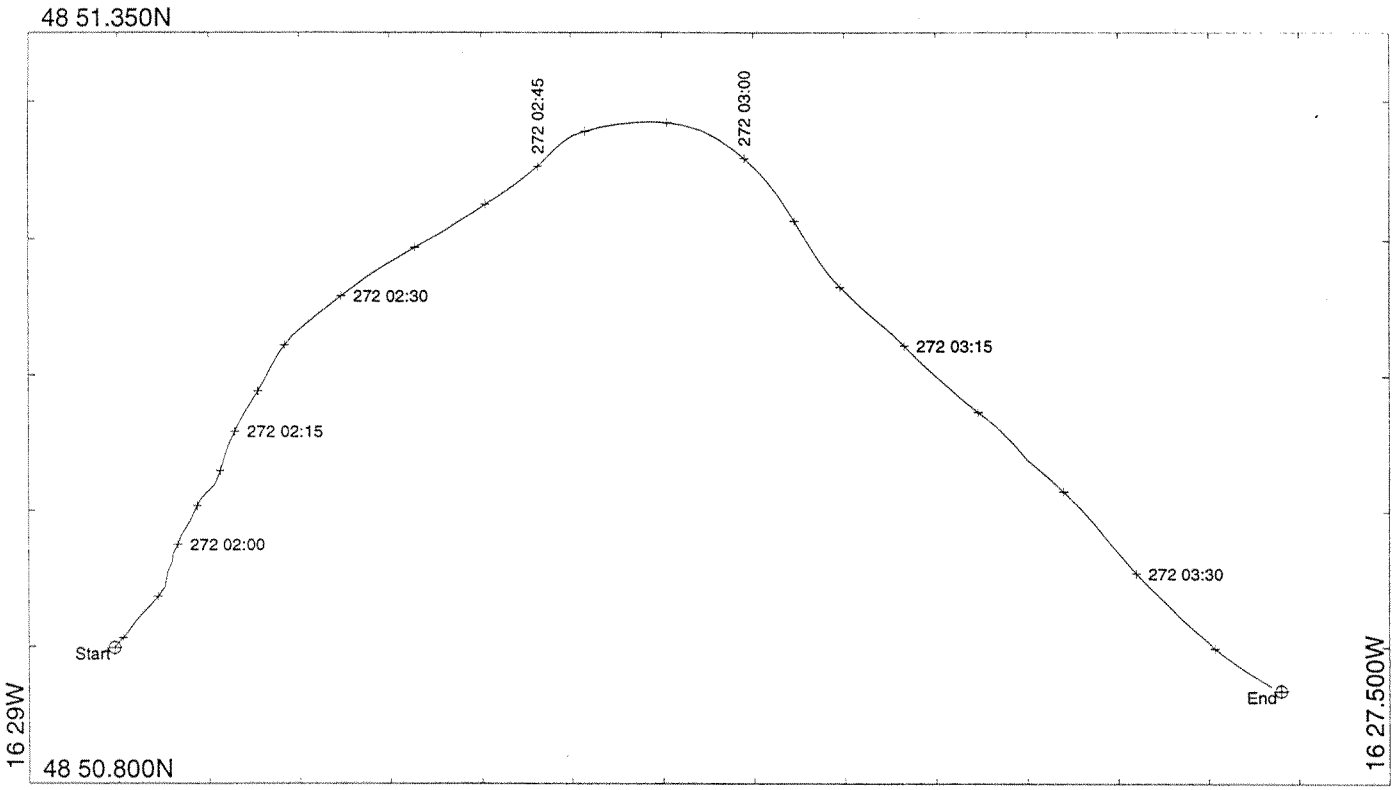


Figure 6. RRS *Discovery* cruise 237. Track showing WASP deployment.

GEAR CODES USED IN STATION LIST

CP	Chalut à perche: 6m beam trawl
CTD	Conductivity-temperature depth probe
MAC	Module Autonome de Colonisation: long-term enrichment and recolonisation experiment
MAP	Module Autonome Pluridisciplinaire
MLT CORER	Multiple corer, SMBA pattern, using 12 57mm i.d. core tubes
MS	Multi-sampler: water bottle rosette mounted on CTD frame
OTSB	Semi-balloon otter trawl with 14m headline and effective fishing width 8.6m
SED TRAP	Sediment trap array. SOC version with three carousel traps at 1000m, 3000m and 100mab:
BOX CORER	USNEL Spade box corer ($0.25m^2$), modified USNEL type, fitted with plain box
VEGEBOXC	Spade box corer ($0,25m^2$) modified USNEL type fitted with vegematic subcores (10x10)
WASP	Wide Angle Survey Photography instrument

STN	DATE 1998	POSITION LAT.	POSITION LONG.	GEAR	DEPTH (M)	TIMES (GMT)	COMMENT	MEAN SOUND. (M)
13368 # 8	4/ 3 27/ 9	48 55.02N	16 27.91W	MAC	4848-4848	2138-1100	Good samples	4848
13368 # 9	4/ 3 28/ 9	48 56.52N	16 25.74W	MAP	4848-4848	2305-0854	Good samples current meter vane stuck	4848
13627 # 1	27/ 9	48 56.56N 48 56.67N	16 24.41W 16 24.44W	CTD MS	0- 152	1456-1515	Bottles 151m (6), 101m (6)	4844
13627 # 2	27/ 9	48 56.87N 48 56.53N	16 24.50W 16 25.10W	CTD MS	0-4840	1546-1935	Bottles 10-1000mab	4845
13627 # 3	27/ 9	48 49.34N	16 30.02W	BOX CORER	4845-4845	2206-	Moderately disturbed core	4845
13627 # 4	28/ 9	48 50.17N	16 29.30W	VEGEBOX	4844-4844	0200-	Good core	4844
13627 # 5	28/ 9	48 49.97N	16 29.41W	MLT.CORER	4845-4845	0616-	12 good cores	4845
13627 # 6	28/ 9	48 49.11N	16 30.16W	BOX CORER	4844-4844	1338-	Disturbed core	4844
13627 # 7	28/ 9	48 50.20N	16 29.75W	VEGEBOX	4844-4844	1724-	Good core	4844
13627 # 8	28/ 9	48 50.02N	16 29.72W	BOX CORER	4845-4845	2105-	Good core	4845
13627 # 9	29/ 9	48 50.90N 48 50.87N	16 28.90W 16 27.62W	WASP	4835-4844	0148-0338	Good video/camera. Power loss at end	4845
13627 #10	30/ 9	48 53.64N 49 01.98N	16 42.65W 16 53.26W	OTSB14	4835-4837	1600-2032	Good sample	4835
13627 #11	1/10	48 47.82N 48 54.14N	16 40.37W 16 53.95W	CP	4835-4835	0745-1330	Winch failure. Total tow c. 31 hours	4835
13627 #12	2/10	48 49.90N	16 29.77W	MLT.CORER	4836-4836	2030-	12 good cores	4836
13627 #13	3/10	48 50.17N	16 30.12W	VEGEBOX	4838-4838	0004-	Good core	4838
13627 #14	3/10	48 50.17N	16 30.53W	BOX CORER	4837-4837	0353-	Good core	4837