SOUTHAMPTON OCEANOGRAPHY CENTRE

CRUISE REPORT No. 52

RRS *DISCOVERY* CRUISE 282
30 JUN - 01 AUG 2004

The environment and ecology of
Seine and Sedlo Seamounts, NE Atlantic

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2004

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ABSTRACT

The general aim of the cruise is to undertake a range of physical, chemical and biological investigations on and around Seine and Sedlo Seamounts. Specific objectives for the cruise included: a) the recovery of two current meter moorings from Seine Seamount (originally deployed from FS Poseidon in March 2004); b) to make underway observations of upper water column currents and zooplankton migrations (using ADCPs and 10 kHz echosounder); c) to assess water column hydrography, primary production and biogeochemistry through deployments of a CTD and water bottle rosette; d) to assess the biochemistry and biogeochemistry of suspended particulate matter by the use of SAPS (stand alone pumping system); e) to investigate the taxonomy, ecology and biogeochemistry of zooplankton communities using a multiple opening and closing net system (MOCNESS); f) to make photographic (stills and video) observations of the seabed and its larger fauna (megabenthos) using the SOC SHRIMP system (Seabed High Resolution Imaging Platform); and g) to carry out a suite of seabed sampling (coring, dredging and trawling) to investigate the taxonomy, ecology and biogeochemistry of seabed communities. The latter objective was immediately precluded by the unavailability of either the coring or trawl winches for the duration of this cruise. Only limited SHRIMP operations and no MOCNESS operations were undertaken at Sedlo Seamount as a result of the failure of the electro-optical tow winch. All other cruise objectives were fully achieved.

KEYWORDS

benthic communities, benthos, biochemistry, biogeochemistry, circulation, cruise 282, CTD, current meters, currents, *Discovery*, hydrodynamics, hydrography, megabenthos, MOCNESS, moorings, NE Atlantic, organic matter, primary production, SAPS, seabed, seamounts, Sedlo Seamount, Seine Seamount, SHRIMP, zooplankton

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Brian Bett (PS)	SOC-George Deacon Division
Dave Billett	SOC-George Deacon Division
Ben Boorman	SOC-George Deacon Division
Ana Mendonça	Centro do IMAR da Universidade dos Açores
Igor Bashmachnikov	Centro do IMAR da Universidade dos Açores
Michaela Treitschke	Universität Hamburg
Rolf Koppelmann	Universität Hamburg
Stefanie Hirch	Universität Hamburg *(Departed Madeira 13/7)*
Bettina Maus-Lau	Universität Hamburg
Kostas Kiriakoulakis	University of Liverpool
Juan Carlos Vilas	Universidad de Las Palmas de Gran Canaria
Minerva Espino Caballero	Universidad de Las Palmas de Gran Canaria
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Kevin Smith (TLO)	SOC-UKORS
Ian Rouse	SOC-UKORS
Jeff Bicknell	SOC-UKORS
James Cooper	SOC-UKORS
Alan Davies	SOC-UKORS
Alan McKean	Caley software subcontractor *(Departed Madeira 5/7)*

2. SHIP'S PERSONNEL

Robin Plumley	Master
John Mitchell	Chief Officer
Mike Hood	Second Officer
Andy Kirkaldy-Willis	Third Officer
Sam Moss	Chief Engineer
George Parkinson	Second Engineer
Keith Conner	Third Engineer
Tony Healy	Third Engineer
Phil Parker	Electrical-Technical Officer
Donald MacDiarmid	Asst. E O
Greg Lewis	CPO (Deck)
Simon Avery	CPO (Science)
Mike Trevaskis	CPO (Science) *(Departed Madeira 5/7)*
Stuart Cook	PO (Deck)
Stewart Barrett	Seaman 1A
Steve Day	Seaman 1A
Martin Jeavons	Seaman 1A
Alan Weatherhead	Seaman 1A
Gerry Cooper	Seaman 1A *(Joined Madeira 5/7, departed Madeira 6/7)*
Keith Curtis	Ship's Catering Manager
Paul Lucas	Chef
Lloyd Sutton	Assistant Chef
Graham Mingay	Steward

3. ITINERARY

Sailed Vigo		30 June 2004
Arrived Seine Seamount	6 July	
Departed Seine Seamount	18 July	
Arrived Sedlo Seamount	20 July	
Departed Sedlo Seamount	26 July	
Docked Govan		1 August 2004

4. OBJECTIVES

This cruise was undertaken jointly under the NERC Core Strategic Programme of the SOC George Deacon Division (BICEP: Biophysical Controls on Export Production) and the EU project OASIS (Oceanic Seamounts: an integrated study) project co-ordinated by Dr Bernd Christiansen, Universitat Hamburg (EVK3-CT-2002-00073-OASIS). The general aim of the cruise is to undertake a range of physical, chemical and biological investigations on and around Seine and Sedlo Seamounts.

Specific objectives for the cruise include:

- The recovery of two current meter moorings from Seine Seamount (originally deployed from FS *Poseidon* in March 2004).
- To make underway observations of upper water column currents and zooplankton migrations (using ADCPs and 10 kHz echosounder)
- To assess water column hydrography, primary production and biogeochemistry through deployments of a CTD and water bottle rosette.
- To assess the biochemistry and biogeochemistry of suspended particulate matter by the use of SAPS (stand alone pumping system).
- To investigate the taxonomy, ecology and biogeochemistry of zooplankton communities using a multiple opening and closing net system (MOCNESS).
- To make photographic (stills and video) observations of the seabed and its larger fauna (megabenthos) using the SOC SHRIMP system (Seabed High Resolution Imaging Platform).
- To carry out a suite of seabed sampling (coring, dredging and trawling) to investigate the taxonomy, ecology and biogeochemistry of seabed communities.

  N.B. this latter objective was immediately precluded by the unavailability of either the coring or trawl winches for the duration of this cruise.

5. NARRATIVE

5.1 Diary (see figures 1-5)

Monday 28 June
Discovery arrives Vigo ex-D281T, c. 09:00 (UTC+2), PSO visits vessel, demob / mob commences.

Tuesday 29 June
All scientific gear arrives and is loaded. Master signs on the scientific party and Mate gives safety briefing and familiarisation.

Wednesday 30 June
Discovery sails Vigo c. 11:00 (UTC+2) making for deep water and intended coring winch trials. Emergency muster and boat drill held at 16:15 (UTC+2).

Thursday 1 July
Continuing towards deep-water test site. At c. 11:30 stop and deploy PES fish. Then commence streaming of the direct pull coring winch cable. Completed c. 18:00. Winch speed and metering improved, some adjustment still required on scrolling. Continue southwards in international waters for further stream test tomorrow. Clocks retarded one hour over night to UTC+1.

Friday 2 July
Continuing southwards in international waters. Deploy coring wire for second stream at c. 08:00. Some difficulties experienced, a reverse of the scroll and lead developing on the scroll. Finally recovered c. 18:00. During the stream members of the scientific party receive training and familiarisation in the use of body harnesses.

Prepare for trial CTD deployment. After minor delay selecting appropriate CTD winch monitoring cameras, deploy CTD as stn 15430#1; some problems / confusion with bottle firing. Recover, check and redeploy as stn 15430#2 – still some problem bottles.

Saturday 3 July
Restart streaming of the direct pull coring cable at c. 06:00 – continuing to c. 18:00, with further scrolling problems emerging.

Prepare for another short CTD trial. Deploy CTD as stn 15431#1 to 100m and fire a pattern of bottles; all closed and watertight on recovery.

Coring warp deployed from starboard gantry with 2T test weight for final trial – no joy! Begin making for Madeira.

Sunday 4 July
Continuing towards Madeira. Science meeting with ship's side held. Winch status review meeting held. PES fish recovered for passage to Funchal.

Monday 5 July
Standing off Funchal awaiting boat transfer. CPOS (Trevaskis) and Caley software subcontractor (McKean) transfer off, seaman (Cooper) transfers on. Boat transfer complete at 12:30 (UTC+1). Make for position of mooring 2. Clocks retarded one hour to UTC overnight.

Tuesday 6 July
Arrive mooring 2 site at c. 05:30. Attempt to range on mooring from c. 06:00, but get no reliable response. Change of deck unit gives one sensible range. Release codes sent in hope. By 08:15 no sign of the mooring at the surface – move off downwind as a check. Try ranging from down wind, but get no responses. Then try ranging on the codes for mooring 1 and that gives consistent sensible ranges for mooring 2. Make back to mooring 2 site for another attempt using the mooring 1 codes. Mooring readily ranged and released.

The mooring did not stream fully on surfacing, with the lazy float tangled below the main syntactic float. When grappled, the lazy float would not come free. During the attempt to free the lazy float a seaman's fingers were trapped between a line and a grappling hook, resulting in serious injury.

The mooring was then successfully recovered and *Discovery* steamed for Funchal to get the injured seaman ashore.

The casualty (Cooper) was boat transferred off in the mouth of Funchal harbour at c. 11:30. Discovery headed back towards Sedlo Seamount.

Wednesday 7 July
En route back to Sedlo Seamount, making for the position of mooring 1. At the mooring site consistent ranges were recorded (c. 1550m) to both releases, confirming that the mooring was still in place (i.e. had not been released in error yesterday). The PES and 3.5 kHz fish were deployed and we made for site F.

At site F deploy CTD as stn 15432#1 for 450m cast. Redeploy CTD with four SAPS on the wire as stn 15432#2. After 1:45 at depth the CTD fails with all communications lost. Continue with the SAPS deployment.

Thursday 8 July
On recovery (15432#2) three of the four SAPS had worked successfully. The CTD connecting cable was replaced. Redeploy CTD as stn 15432#3 for a 2,000m cast. The CTD failed at depth prior to any bottle firing. Scrolling problem became apparent on recovery – wire paid out to in excess of deployed depth to correct the problem. On recovery the termination is

inspected and found to be wet. Re-termination does not cure the problem and the CTD is removed for inspection.

Begin 3.5 and 10 kHz profiling line (Site F to C) at 07:16 (heave to at 09:53 for a Sat phone call regarding CTD problems). Continue with profiling line as CTD repairs / testing go on. Line completed at 14:05, make for summit / Site A area for prospective MOCNESS (or / and CTD as available).

Deploy MOCNESS as stn 15433#1 for a tow across the summit through site A. Recover MOCNESS and deploy CTD as stn 15434#1 at site A – some bottle failures but sufficient water collected. Redeploy CTD with SAPS on the wire as stn 15434#2. On recovery no bottles had fired, though subsequently fired OK on deck. Connecting cable changed as a precaution.

Friday 9 July
Redeploy CTD at site A as stn 15434#3, a couple of bottles not closed at recovery, but sufficient water collected.

Relocate to MOCNESS start position. Short delay to sort out camera coverage for aft gantry. Deploy MOCNESS as stn 15435#1 for tow over the summit.

Relocate to site 5 and deploy CTD as stn 15436#1 for a data only cast. Make for site 3.

Arrive at site 3 c. 10:30 – assessing weather / sea state for proposed CTD deployment. Proceed with deployment as stn 15437#1. Recover the CTD and make for a MOCNESS launch position in the vicinity of site H.

Emergency muster and drill carried out.

Deploy MOCNESS as stn 15438#1 for deep tow (or as deep as we can get with the wire available) through vicinity of site H.

Saturday 10 July
Recover MOCNESS (15438#1) after successful deployment of full length of deep-tow cable available (c. 6425mwo).

Relocate to site H and deploy CTD as stn 15439#1 for shallow cast (450mwo). Redeploy CTD as stn 15439#2 with four SAPS on the wire for deep cast. At recovery of final SAPS, the CTD is washed against the hull below the waterline damaging some of the bottle mountings. Third CTD is postponed for repairs; make for MOCNESS launch position.

After some delay in getting the CLAM system up and running, deploy the MOCNESS as stn 15440#1 about 3 miles downwind of site H for a 1,000m tow. Recover MOCNESS and relocate on site H.

At site H deploy CTD, but abort immediately with no data on the CLAM system – a minor wire off event on the traction winch. The deployment gets underway as stn 15441#1. Recover CTD and move the deep-tow cable to the workshop for swivel bottle removal. Make for site 4.

Sunday 11 July
At site 4 deploy CTD as stn 15442#1, primarily for data only – but some water retained. Make for the summit (N.B. providing nice 10kHz profile).

At northern end of summit deploy SHRIMP as stn 15443#1 with intention of “driving over the edge”. After the nominal 4 hours, the edge had not appeared, so extended tow for a further 2 hours – edge still did not appear. Recover SHRIMP, only to find we have run over the edge while we were tying it down on deck. Make for site 1.

A little stop *en route* when we realise we have forgotten to bring the USBL probe back in.

At site 1 deploy CTD as stn 15444#1. Recover CTD and make for a SHRIMP site on west flank.

At the west flank, deploy SHRIMP as stn 15445#1.

Monday 12 July
After about 2 minutes of seabed observation SHRIMP (15445#1) power supply / communications fail and the tow is aborted.

An echo-sounding line is run from the NE flank to site E.

At site E deploy CTD as stn 15446#1 for a shallow cast. Redeploy CTD as stn 15446#2 for deep cast with SAPS. Complete and redeploy CTD as stn 15446#3 for a 2,000m cast. Recover CTD and make for a prospective SHRIMP site on the western flank.

Deploy SHRIMP on the western flank as stn 15447#1; but there is no power and / or ground fault and the deployment is aborted.

Recover 3.5 and 10kHz fish and set course for Madeira to disembark a scientist bereaved today.

Tuesday 13 July
Making for Funchal. Boat transfer scientist (Stefanie Hirch) at c. 10:00; heading for Seine Seamount c. 10:30.

Wednesday 14 July
Arrive site C c. 02:00. Deploy CTD as stn 15448#1 for shallow cast. Redeploy CTD with SAPS as stn 15448#2. Redeploy CTD as stn 15448#3 for 2,000m cast. Recover and make for remaining mooring site.

Mooring successfully released and recovered without incident. Make for SHRIMP launch site.

Deploy SHRIMP at northern edge site as stn 15449#1. Just after the seabed comes in to sight – it all goes bang again. On recovery it appears that the swivel has flooded. Make back to the mooring location.

At the mooring location deploy CTD as stn 15450#1 for a profile only cast. Having returned to first swivel, make back to the SHRIMP northern edge site.

Deploy SHRIMP as stn 15451#1 – but it goes bang again after 15mins in the water. Abort and make for site 2.

Thursday 15 July
Arrive site 2 c. 00:20 and deploy CTD as stn 15452#1 for profile only cast. Recover CTD and make for site I.

Arrive site I at 07:45 and prepare to launch CTD (15453#1), CTD drops on the wire – the wire appears to have come off the traction winch. Damage to the cable. End section (30-40m) cut off and cable reterminated. At 10:40 attempt load test on new termination; at 0.8T it goes bang with the off the winch again. The cable had part over a sheave on the hanger top. Start again on a retermination. At 13:15 the cable is rethreaded and back on deck to begin retermination. Mechanical termination is successfully load tested at 15:00. At c. 16:00 the electrical termination is completed and is apparently OK when connected to the CTD. After a little additional engineering – an additional keep roller added to the traction winch the CTD is finally redeployed as stn 15453#2 at 16:30 – almost 9 hours after originally coming on station! The shallow cast (#2) is successfully completed. The CTD is deployed with SAPS on the wire as stn 15453#3.

Friday 16 July
Recover CTD with SAPS (15453#3), all four SAPS having worked. Redeploy CTD as stn 15453#4 for 2,000m cast. Recover CTD and make for the northern edge site for a prospective SHRIMP dip on rebuilt swivel.

At northern edge prepare swivel and SHRIMP. Deploy as stn 15454#1 for a long extended tow, covering c. 300-2,900m. Make for site H.

At site H deploy MOCNESS as stn 15455#1 for 1,000m haul.

Saturday 17 July
Recover MOCNESS (15455#1) and make back to the western flank area with some echo-sounding to check track for following MOCNESS. Deploy MOCNESS as stn 15456#1 for 1,000m tow. Recover MOCNESS and make for summit area.

At summit deploy MOCNESS as stn 15457#1. Recover MOCNESS and make for site F.

At site F deploy CTD as stn 15458#1 for a 2,000m cast. Recover and head back to the MOCNESS flank launch site.

At west flank deploy MOCNESS as stn 15459#1 for a nightime 1,000m tow that completes the set at Seine. Make for the northern flank.

Sunday 18 July
Deploy SHRIMP as stn 15460#1 deep on the northern flank to continue previous transect. During hauling in recover USBL probe and 10 kHz fish. Recover SHRIMP and head for Sedlo Seamount at c. 13:40.

Monday 19 July
Continuing *en route* for Sedlo Seamount.

Tuesday 20 July
Continuing *en route* for Sedlo Seamount.

Arrive Sedlo site F at c. 23:30, deploy the 10 kHz fish and then deploy the CTD as stn 15461#1.

Wednesday 21 July
Recover CTD (151461#1) and redeploy as stn 15461#2 with four SAPS on the wire. And redeploy the CTD yet again as stn 15461#3 for a 2,000m cast. Complete CTD and make for northern edge of summit for a SHRIMP deployment.

Wind shifts during the transit and course is altered to a SHRIMP launch position on the southern saddle area. At that location deploy SHRIMP as stn 15462#1 for an extended tow. Recover and make for a position on the southern edge of the summit for another SHRIMP run.

At southern edge of summit deploy SHRIMP as stn 15463#1, covering the depths c. 800-1,400m

Thursday 22 July
Recover SHRIMP (stn 15463#1) and relocate to summit site A.

At site A deploy CTD for shallow cast as stn 15464#1. Recover and redeploy with SAPS on the wire as stn 15464#2. Recover and redeploy as stn 15464#3 for a full depth cast. Recover and make for southeast edge of summit for a MOCNESS launch site.

At southeast edge of summit, deploy MOCNESS as stn 15465#1 for a 700m tow across the summit. Recover MOCNESS and make for site Z.

At site Z, deploy CTD as stn 15466#1 for a profile only cast. Recover CTD and make for site F for a MOCNESS tow.

At site F deploy MOCNESS as stn 15467#1 for a 1,000m tow.

Friday 23 July
Recover MOCNESS (15467#1) and make back towards site X13 via two waypoints (A and B) for an echo-sound across the “little lump” immediately to the south of the southern summit of Sedlo.

Continue to site X13 and deploy the CTD as stn 15468#1 for a profile data only cast. Then make back towards site F via a waypoint (C) that crosses the “little lump” again.

At site F deploy MOCNESS as stn 15469#1. With a few hundred metres of wire out the winch develops problems. On pay out the winch is running away and on hauling the winch is stalling. The deep-tow winch is declared unfit for science. Haul aborted and DVD recorders started to record winch monitoring cameras during recovery. Lots and lots of stalls, all caught on DVD, later the MOCNESS is safely recovered. Make for site E.

At site E deploy CTD as stn 15470#1 for full depth data cast. Recover and make for site C; however, CTD deck unit has failed to write data file. Relocate to site E and redeploy CTD as stn 15470#2. Make for site C.

At site C deploy CTD as stn 15471#1 for a 450m cast. Redeploy CTD with SAPS on the wire as stn 15471#2.

Saturday 24 July
Recover CTD and SAPS (15471#2) and redeploy CTD as stn 15471#3. Relocate to site B.

At site B deploy CTD as stn 15472#1. Some problems with scrolling on the wire. Revise the programme and make for the deeper waters of site 3 in an attempt to correct the scroll.

At site 3 deploy CTD as stn 15473#1; scrolls out and in OK. Relocate to site 1A.

At site 1A, deploy CTD as stn 15474#1. On recovery heave to briefly for an inspection and test of the CTD connection, all OK. Relocate to site 2A.

At site 2A deploy CTD as stn 15475#1. Relocate to site 3A.

At site 3A deploy CTD as stn 15476#1. Relocate to site 4A.

At site 4A deploy CTD as stn 15477#1. Relocate to site 5A.

At site 5A deploy CTD as stn 15478#1. Relocate to site 6A.

At site 6A deploy CTD as stn 15479#1. Relocate to site 7A.

Sunday 25 July
At site 7A deploy CTD as stn 15480#1. Relocate to site 8A.

At site 8A deploy CTD as stn 15481#1. Relocate to site D.

At site D deploy CTD as stn 15482#1 for a 450m cast. Recover and redeploy with SAPS on the wire as stn 15482#2. Relocate as site 9A.

At site 9A deploy CTD as stn 15483#1. Relocate to site X2.

At site X2 deploy CTD as stn 15484#1. Relocate to site X1.

Monday 26 July
At site X1 deploy CTD as stn 15485#1. Recover CTD. Recover PES fish and steam for the Porcupine Abyssal Plain for sound velocity probe trial deployment in deep water.

Tuesday 27 July
Continuing towards Porcupine Abyssal Plain. At c. 44 51 N 020 47 W heave to for a test of the deep tow winch at c. 09:00. Wire veered and hauled while steaming at c. 6 knots, with no obvious reoccurrence of the previous problem. Recovered at c. 12:00. As we are in suitably deep water, at c. 12:30 deploy the sound velocity probe as stn 15486#1 to c. 4,400m. On recovery probe had recorded depth and temperature but not sound velocity. Settings adjusted and redeployed as stn 15486#2. Recover to find that yet again no sound velocity was recorded. Get back underway at c. 18:00.

Clocks advanced one hour overnight (to UTC+1).

Wednesday 28 July
Continued to Porcupine area. Hove to for SVP trial deployment at c. 08:00 UTC+1. The SVP is deployed as stn 15487#1 for a cast to c. 4,500m. Again it fails to record sound velocity data. Commence passage to Govan at 11:00 UTC+1.

Thursday 29 July
On passage to Govan. Emergency muster and liferaft drill carried out.

Friday 30 July
On passage to Govan. PSO and TLO’s RPC.

Saturday 31 July
On passage to Govan.

Sunday 1 August
Arrival Govan c. 12:00; some scientists leave the vessel.

Monday 2 August
Demobilisation; departure of remaining scientists.

Brian Bett

5.2. Conclusions

Relative to the original objectives:

- Two current meter moorings were successfully recovered from Seine Seamount.
- ADCP observations of upper water column currents and zooplankton migrations were undertaken.
- All planned, and a number of additional, CTD and water bottle rosette deployments were achieved.
- All planned, and one additional, SAPS deployments were achieved.
- A successful suite of MOCNESS tows was completed at Seine Seamount. The planned work at Sedlo Seamount was cut short by the failure of the E/O tow winch.
- Photographic observations of the seabed and its larger fauna were completed for essentially the entire bathymetric range of Seine Seamount. SHRIMP operations at Sedlo Seamount were cut short by the failure of the E/O tow winch.
- No coring, dredging and trawling could be carried out as a result of the unavailability of either core or trawl winches.

The unavailability of the core and trawl winches very substantially limited the operations undertaken during this cruise. The failure of the E/O tow winch curtailed the planned MOCNESS and SHRIMP operations at Sedlo Seamount. Having had to wait 12-months in postponement this is a very disappointing outcome. I can only hope that the continuing winch problems will now be tackled with urgency and vigor to return *Discovery* to a fully operational multidisciplinary platform.

5.3. Acknowledgements

My thanks to all aboard for making the best of the work that we could do. And thanks to all for making it a pleasant and friendly trip too.

Brian Bett

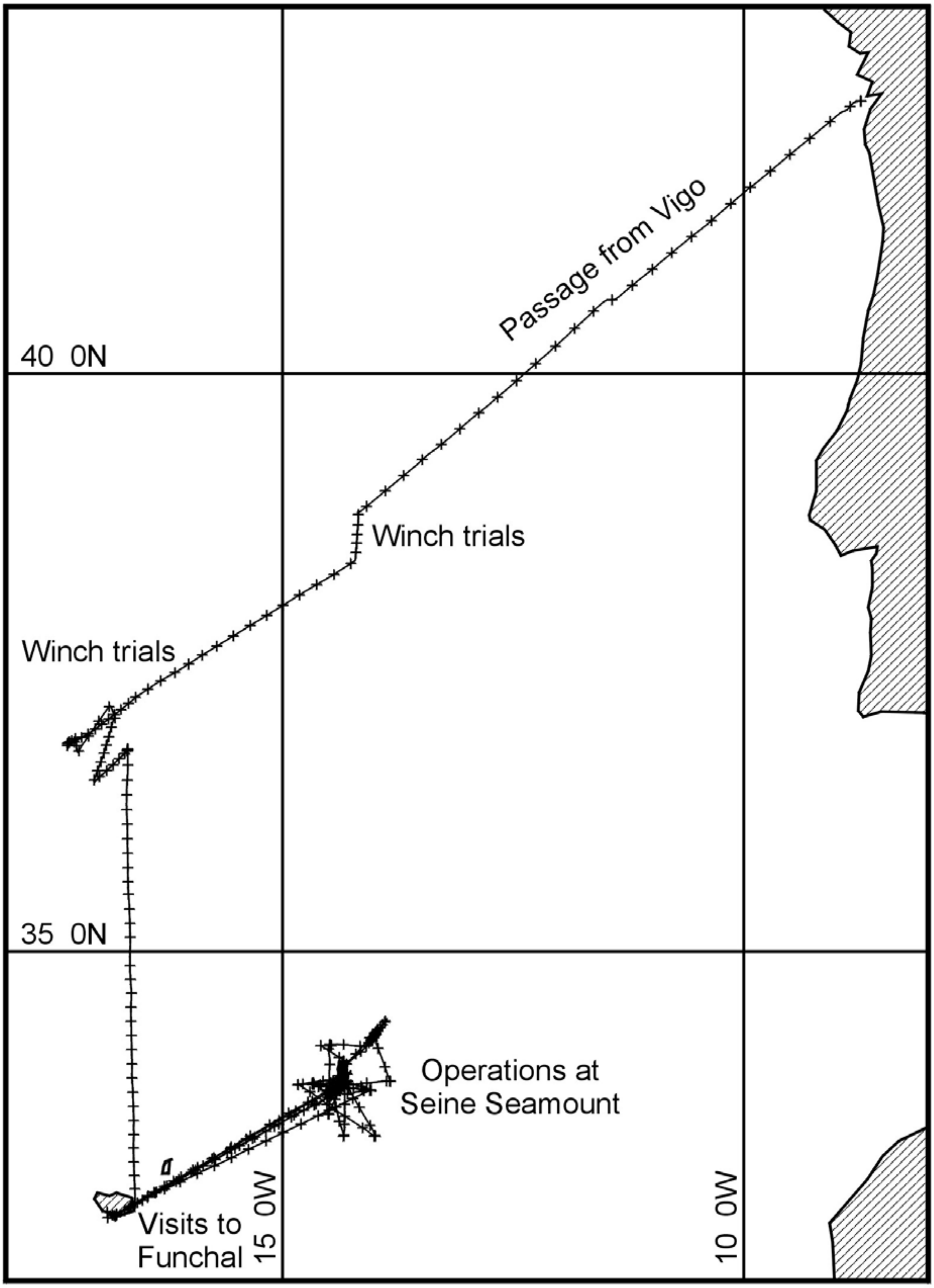

Figure 1. Ship’s track during first phase of RRS *Discovery* cruise 282.

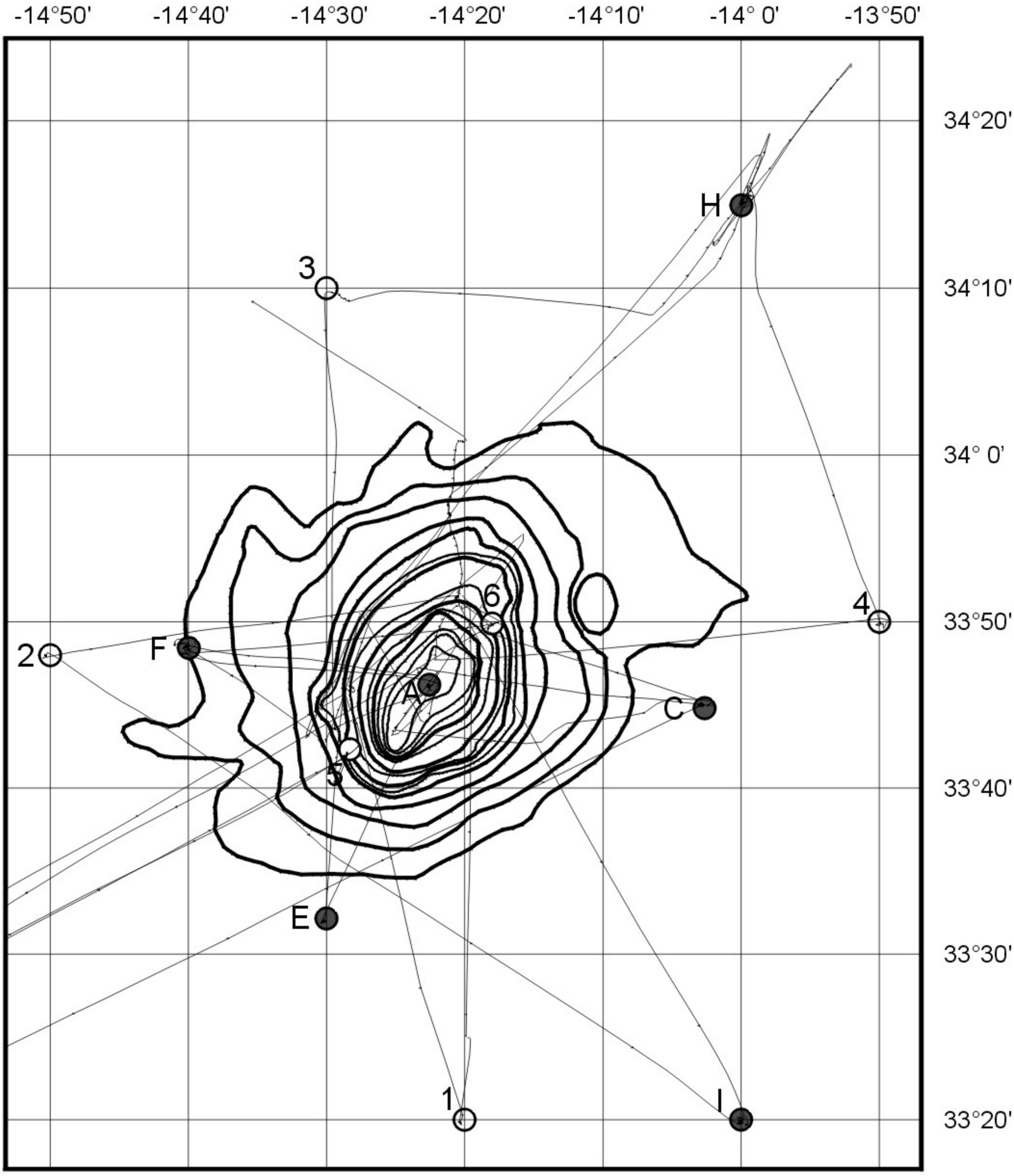

Figure 2. RRS *Discovery* cruise 282, ship's track during operations at Seine Seamount. Shown over bathymetry established during previous OASIS project cruises.

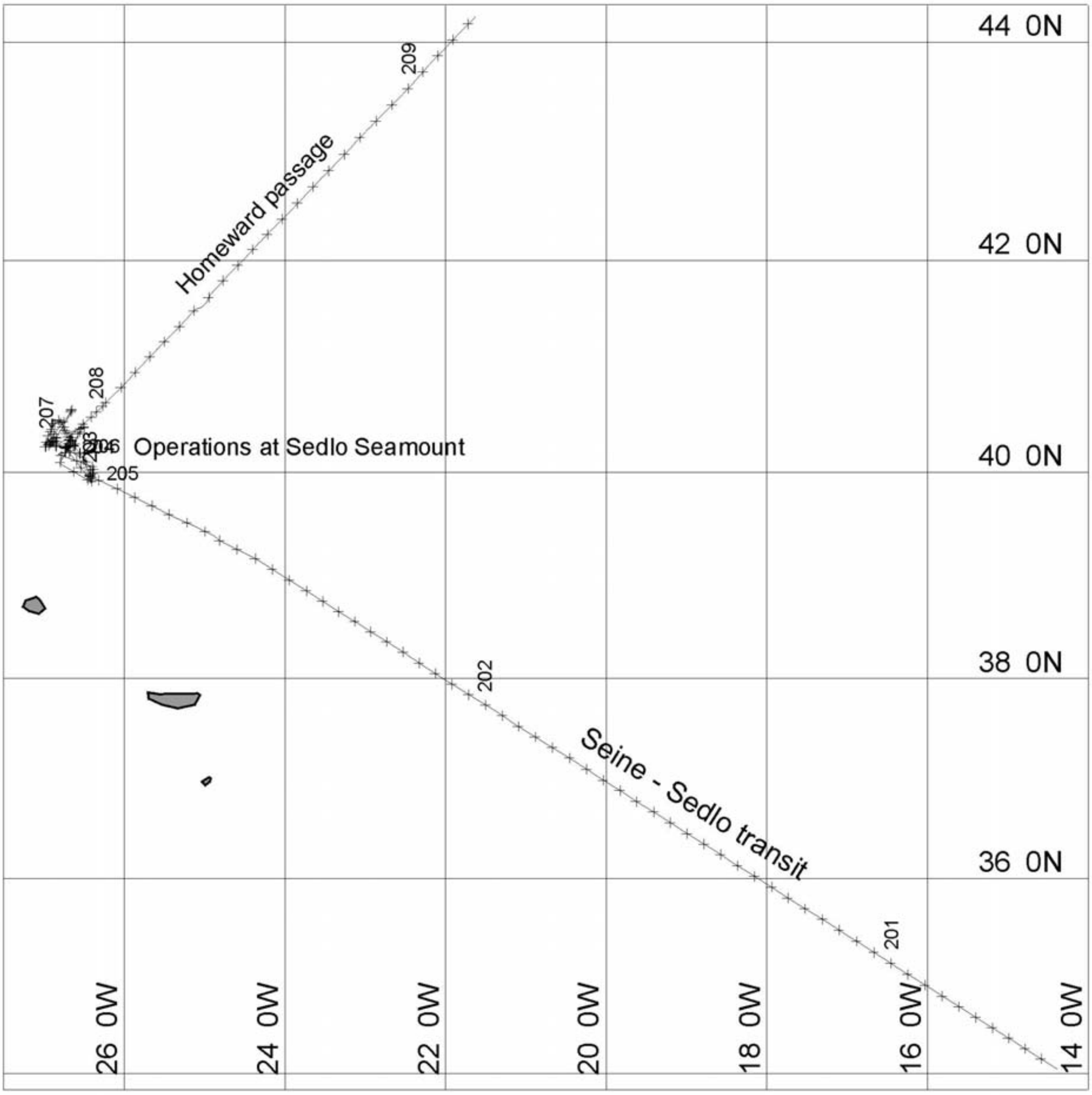

Figure 3. Ship's track during second phase of RRS *Discovery* cruise 282.

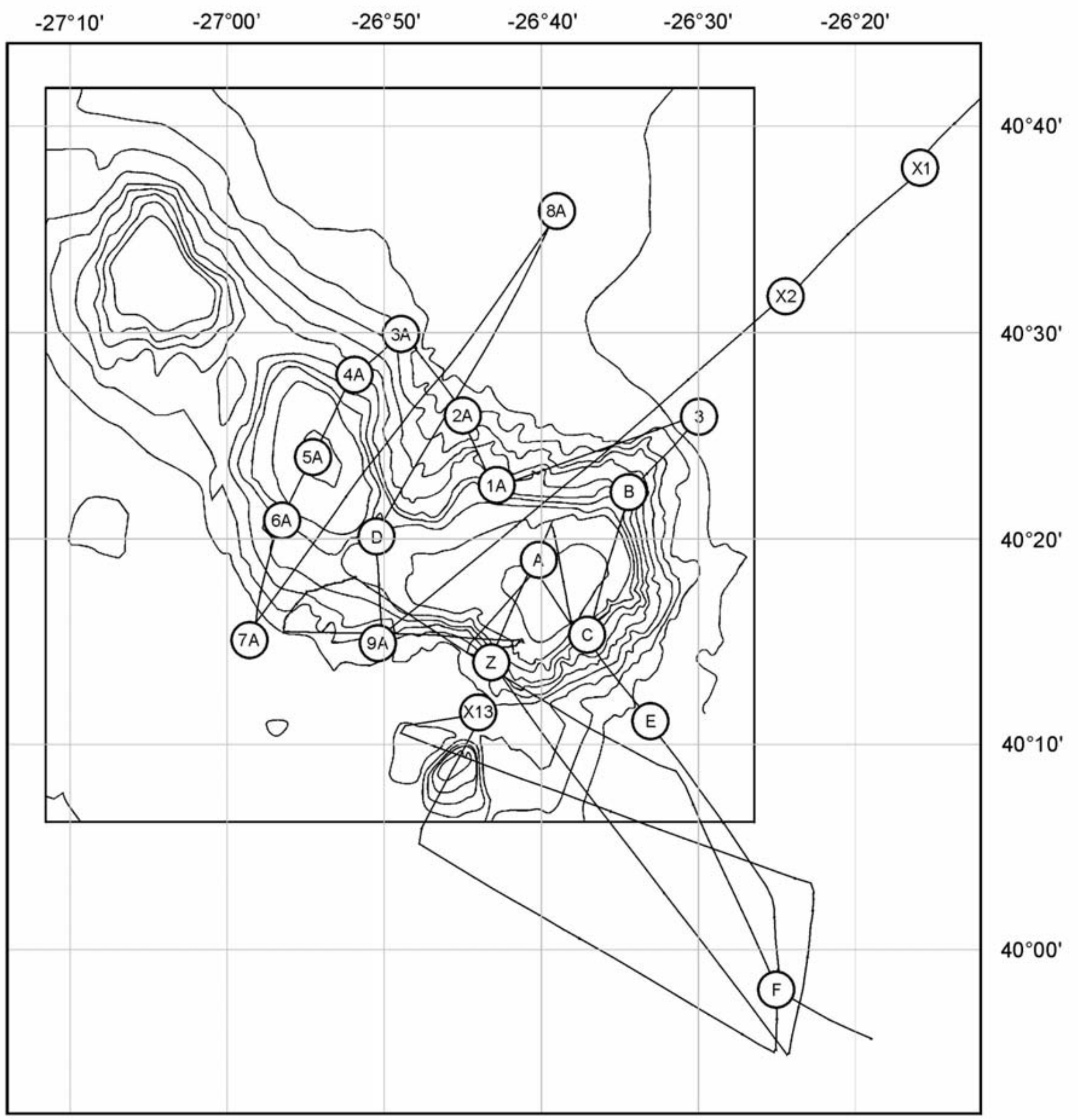

Figure 4. RRS *Discovery* cruise 282, ship's track during operations at Sedlo Seamount. Shown over bathymetry established during previous OASIS project cruises.

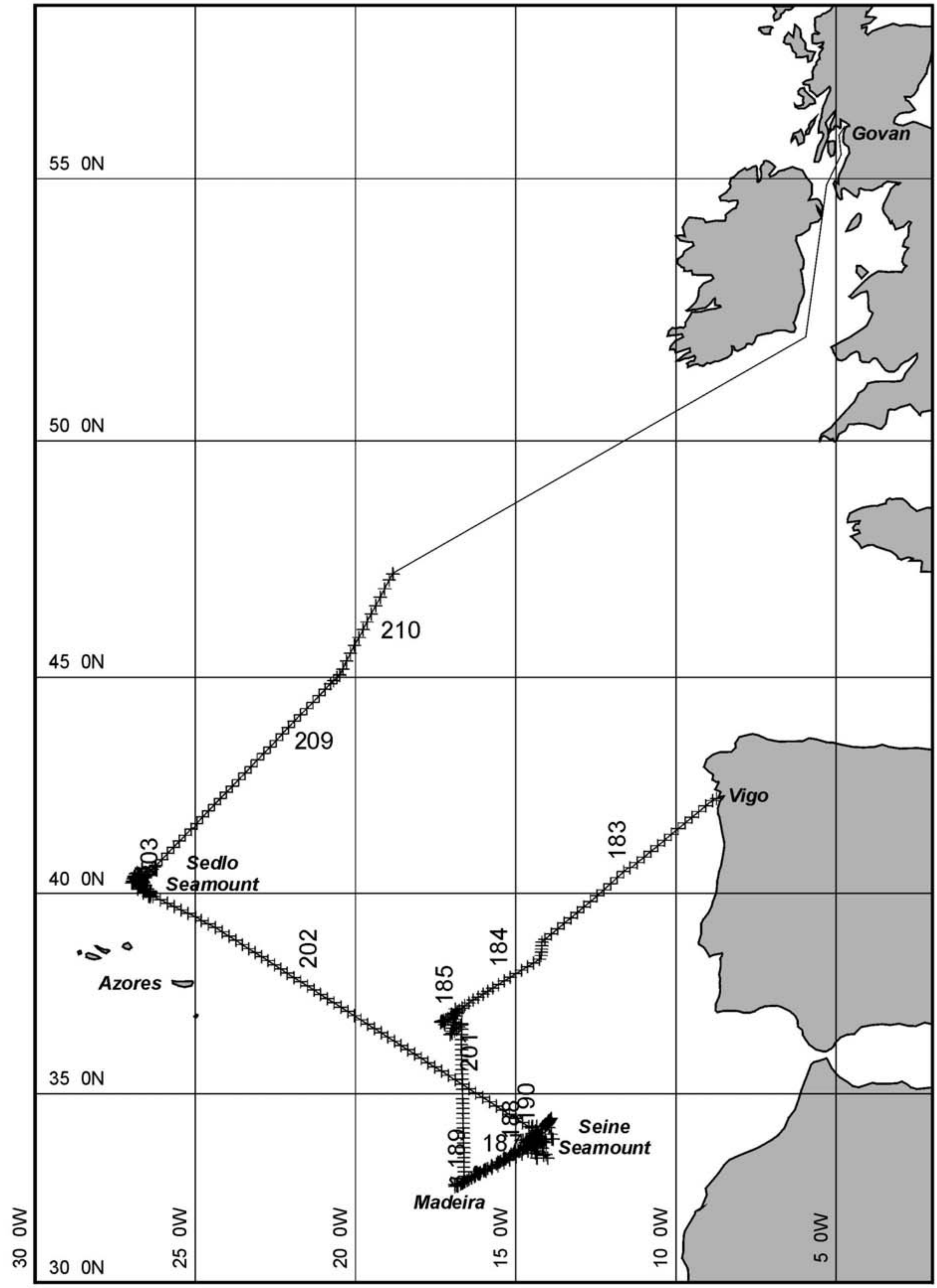

Figure 5. RRS *Discovery* cruise 282 cruise track.

6. SURVEY DESIGN

Vertical wire work was focussed on sites established by previous OASIS cruise (e.g. FS *Meteor* cruise 60/1, Nov-Dec 2003). A number of additional sites were added, primarily for CTD profile data. Tow gear operations (e.g. MOCNESS and SHRIMP) were located and run as appropriate to wind and sea conditions relative to seamount topography.

Seine Seamount
Primary vertical wire work (CTD and SAPS) was undertaken at sites A, C, E, F and H (see Figure 6), additional CTD casts were made at sites 1-6 and I (see Figure 6). MOCNESS tows were made in the vicinity of sites A, H and I and over the western flank of the seamount (see Chart 9). Three SHRIMP tows were undertaken forming a near continuous bathymetric transect from the summit to c. 4,000m down the northern flank (see Chart 7). Some brief SHRIMP footage was also obtained from an aborted deployment at site on the western flank (see Chart 7).

10 kHz echo sounding was carried out more-or-less continuously during operations at both seamounts; example profiles from Seine Seamount are included here (see Figures 7-10). These recording and those from Sedlo Seamount will be further analysed post-cruise.

Sedlo Seamount
Primary vertical wire work (CTD and SAPS) was undertaken at sites A, C, D and F (see Figure 11), additional CTD casts were made at sites 1A-9A, 3, B, E, X1, X2, X13 and Z (see Figure 11). Only two successful MOCNESS hauls were undertaken, one in vicinity of site A and one in the vicinity of site F (see Chart 10). Similarly, only two was tows were completed, one on the southern side of the “saddle” (the low between the mid and southern summits) and one on the southern flank of the southern summit (see Chart 8).

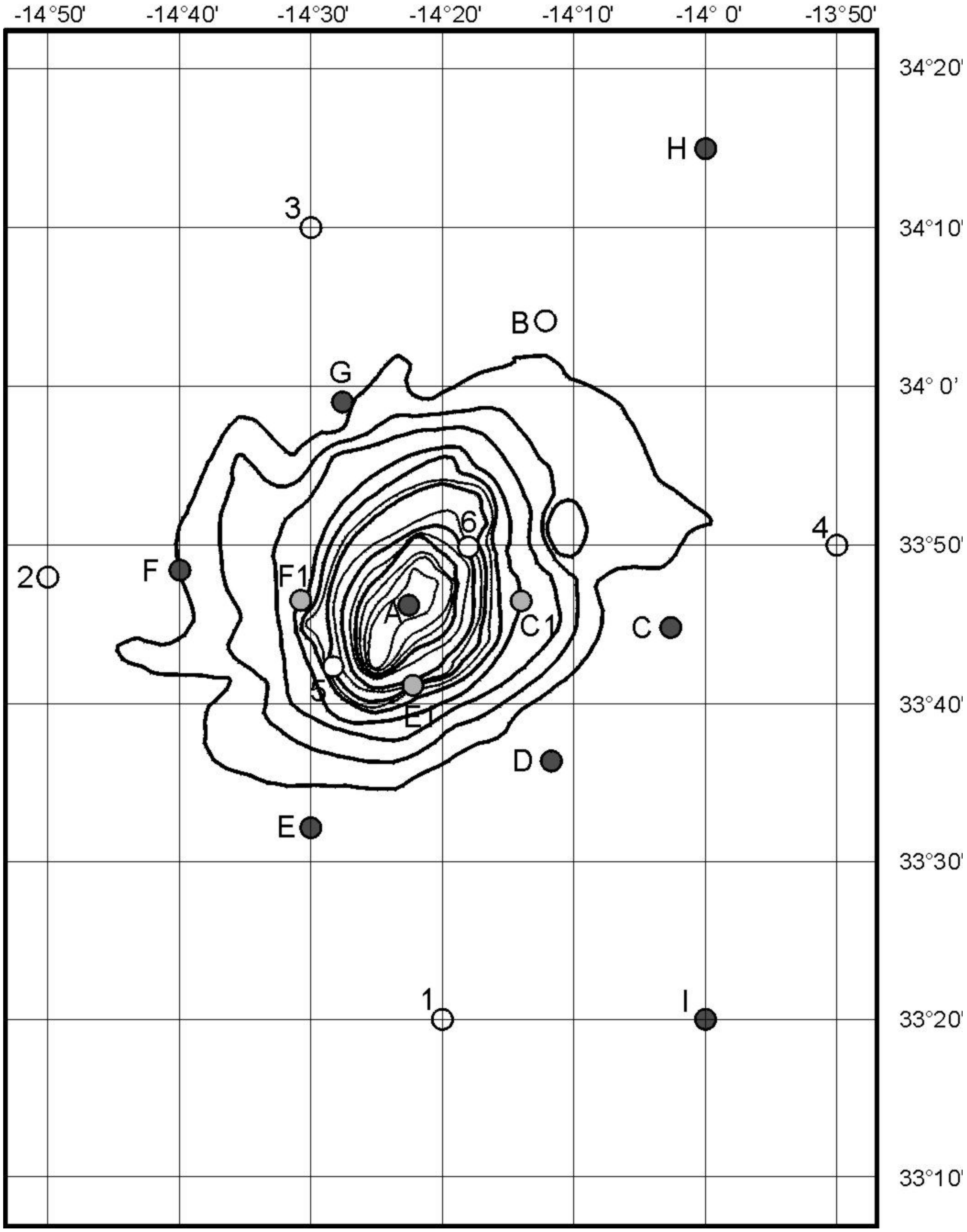

Figure 6. RRS *Discovery* cruise 282: Seine Seamount study sites.

Figure 7. Seine Seamount: 10kHz profile from site 4 to summit.

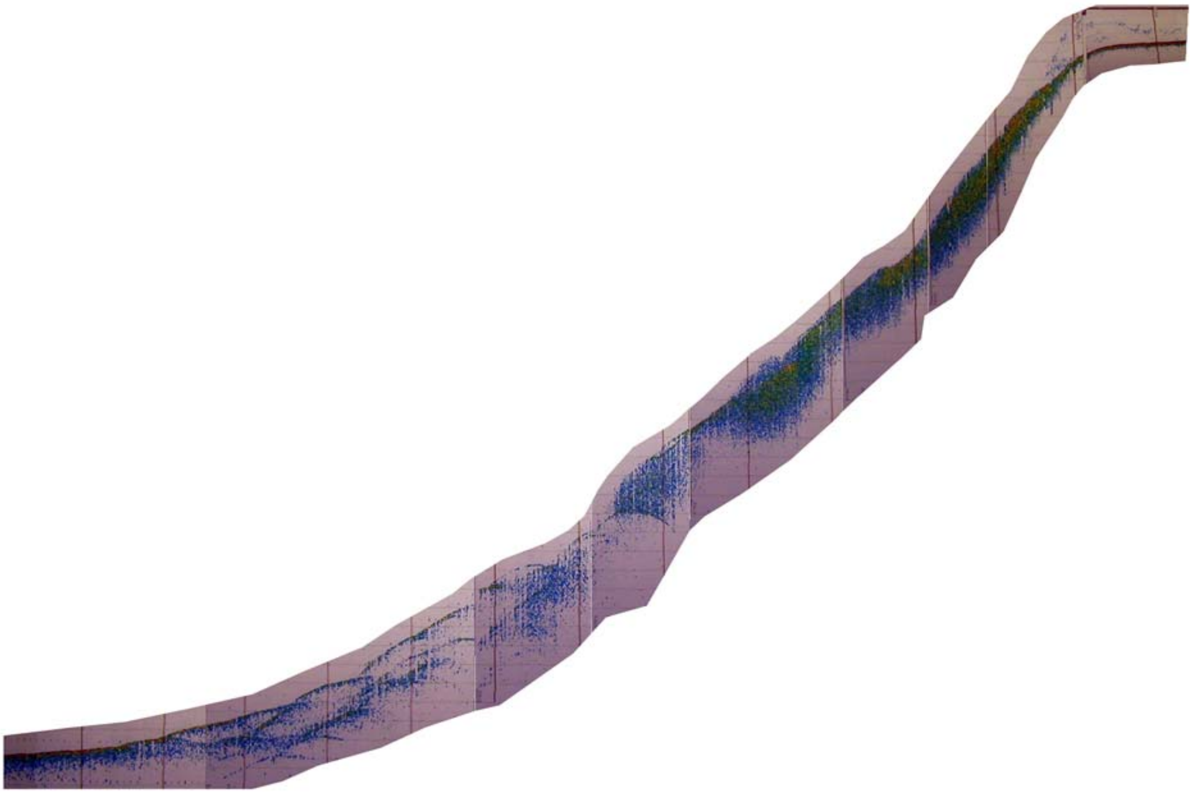

Figure 8. Seine Seamount: 10kHz profile from site F to summit.

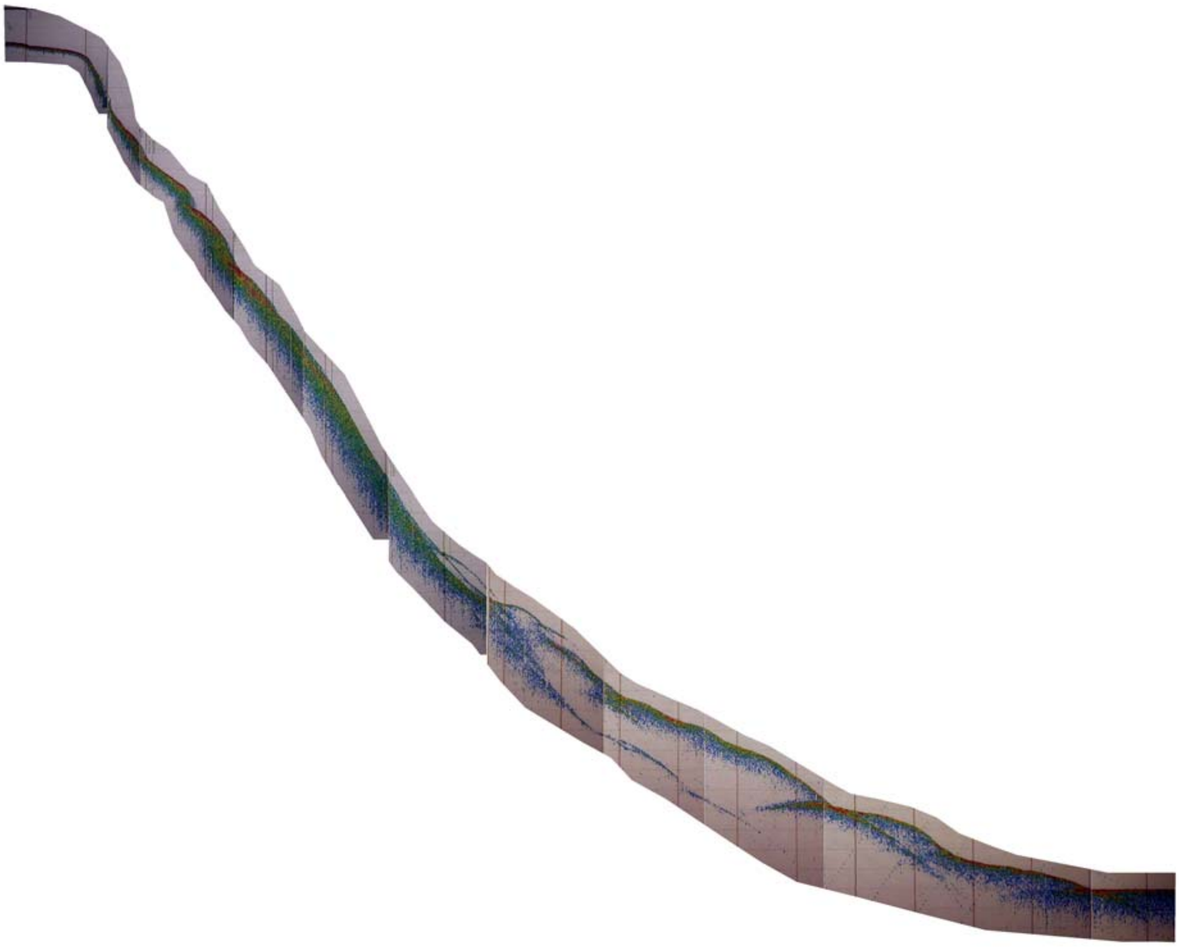

Figure 9. Seine Seamount: 10kHz profile from summit to site C.

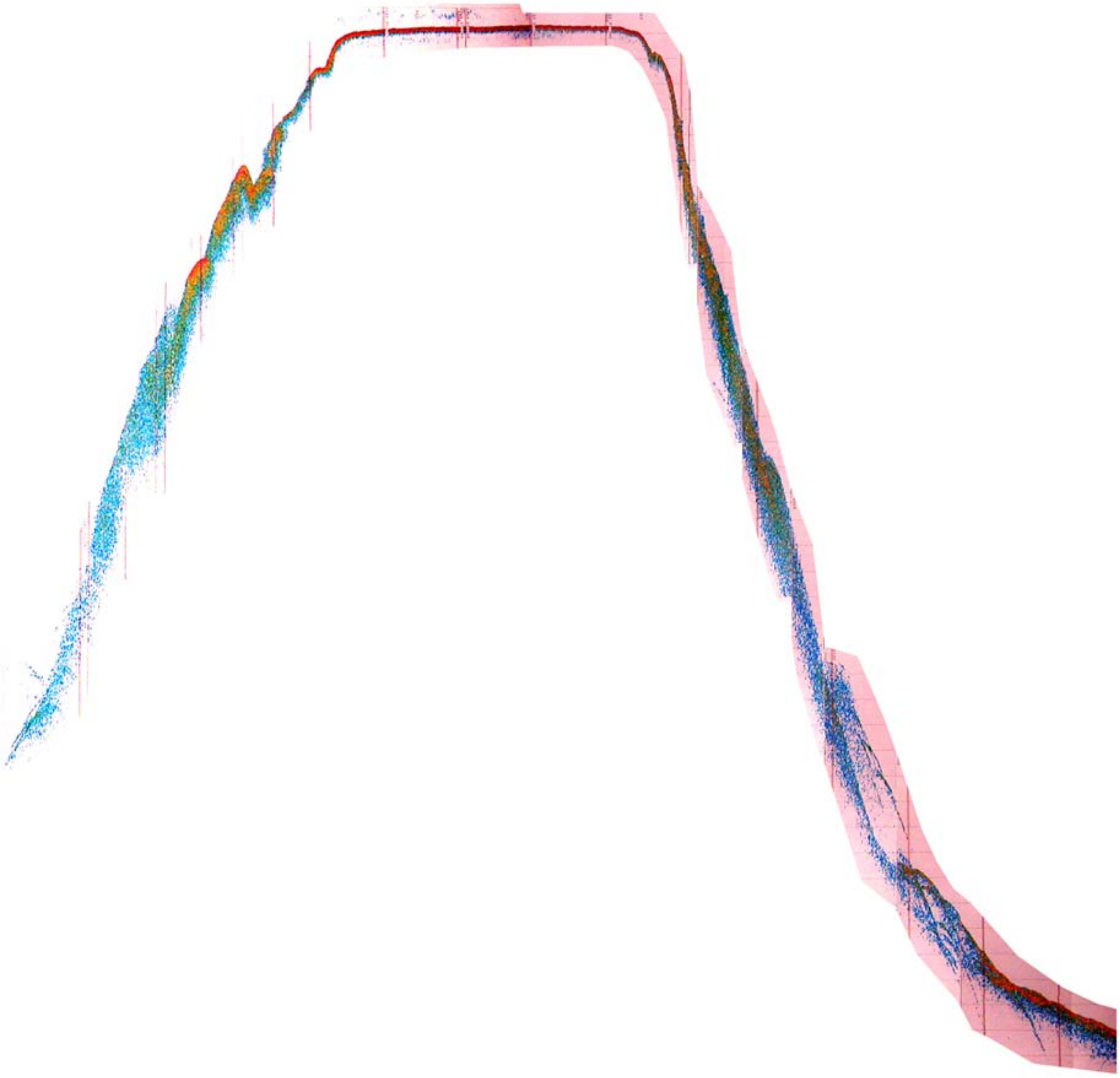

Figure 10. Seine Seamount: 10kHz profile from NE to SW.

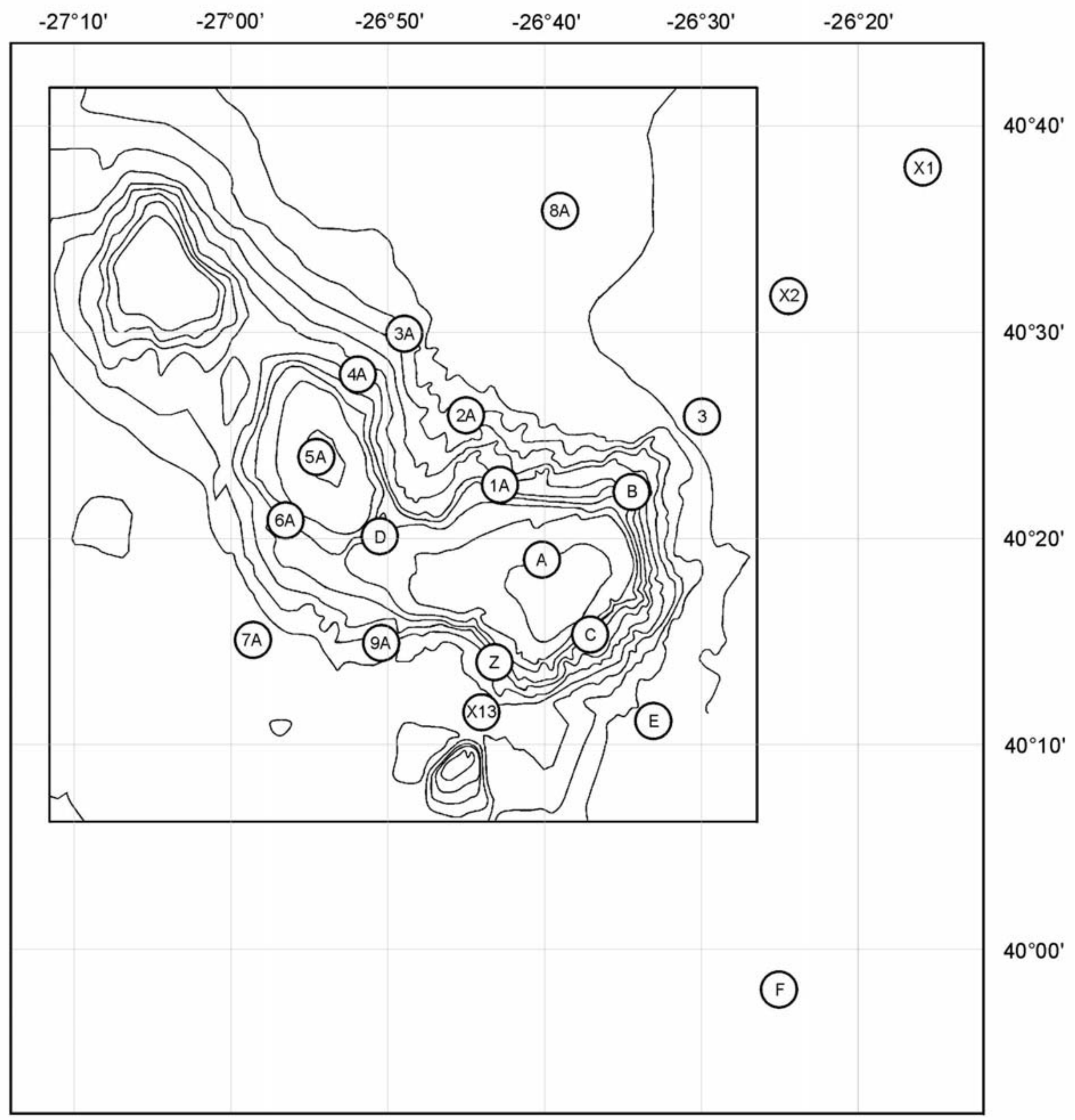

Figure 11. RRS *Discovery* cruise 282: Sedlo Seamount study sites.

7. GEAR

7.1. Winch Trials

Coring System

1. Level Wind Scrolling

Following extensive testing and some modification of the level wind system it still has not been completed satisfactory for operation. A problem appears with the speed and distance of the scroll pitch that, over a period of time, will lead to an unsatisfactory scroll. The principle of software design behind the scroll is that the level wind will index a set distance at a set speed every time a rotation switch on the drum is energised. This switch is energised 3 times for each drum rotation. The software parameters to modify are the speed of movement and distance of movement.

The requirement of the Coring system is to run constantly at a set line-out speed allowing the instruments to be deployed and retrieved. Testing of the system was therefore based upon this set line-out speed and this is where the problems arise. During testing it was found that the different layers of the drum would have varying results for the distance of scroll, i.e. if the drum was veering at 60m/min and was nearly full this would result in a lag compared to 60m/min with the drum nearly empty which would be ok. Similar results were found for lower speeds of the drum at different layers. The speed of the system appears to be influential on the error, as the faster the index speed the quicker the error would become apparent resulting in either the lead or lag. The speed and distance software parameters were modified on a number of occasions to reflect previous test results however these were unsuccessful as results sometimes appeared inconsistent, i.e. increasing the distance would actually result in shorter travel rather than longer. A number of operational graphs were taken to represent speed, distance, etc, of the system while running however these appeared to conflict the physical results, as they would maybe represent a lag however a lead would appear. Caley engineers will evaluate these graphs to assist solving the speed related problem.

Further tests were undertaken relating to drum speed, rather than line speed, and this appearing to minimise the scroll travel problems. This however is not suitable for system operation as a constant line-out is required.

Further discussions and evaluation are required by Caley engineers to solve this issue, however the tests have been positive in order to help find the actual source of the problem, i.e., the varying drum speed at constant line-out.

2. EOT Logic

During trials it was reported that it was possible to drive the level wind mechanism accidentally towards the EOT failsafe switches. Following investigation the PLC software was modified and tested successfully to rectify this fault.

3. Speed Accuracy
During testing a speed inaccuracy of approx 20% was measured for the line-out. This was calibrated as required and satisfactorily testing however this should be checked again after replacement of the above encoder.

Trawl System
Due to time and mechanical restraints very little testing of the Trawl system was undertaken. It should however be noted that the Level Wind System is similar to the Coring and therefore any modifications necessary would require to be implemented for the Trawl. In addition to this, testing is required to ensure the functionality at End of Travel is correct.

General

Line-out Accuracy
There appears to be an inaccuracy in the line-out reading for each of the winches of approx 0.1% to 0.2%. An area of software has been identified which may cause these errors however further discussions are required with Caley software engineers. Readings for the Coring system may be due to the current encoder arrangement that is to be replaced. Upon completion of replacement this value should be monitored and calibrated within the software if necessary.

Active Heave
Completion of Active Heave testing was not completed due to time constraints during the first set of tests. Onboard the MRU unit has now been fitted and successfully tested into the PLC and additional software testing has been undertaken by Caley engineers in Glasgow.

Render System
Although not fully tested during the trials, the basic functionality of the Render system was tested. It was noted that the functionality of the system operated as expected however the time period for the torque command to the drive to be reduced was greatly excessive. Modification of the PLC software is required to reduce this time period.

CLAM System
Additional ASCII strings are required to be sent to the CLAM system from the PLC system. This modification was not undertaken during the trials due to the programming software not operating correctly. The additional information has been noted and will be added at the next appropriate time.

Alan McKean

7.2 SHRIMP

System description

SHRIMP – Seafloor High Resolution Imaging Platform – is SOC's deep-towed video and camera imaging system. The system comprises of the vehicle attached to the main tow cable via an electro-optic swivel. At the ship is the vehicle's power supply, fibre-optic multiplexer, vehicle control computer, instrument data logger, DVD and video recorders and display monitors.

All signals and data to and from the vehicle are sent via a fibre-optic link. This consists of the main 6km combined conducting and fibre-optic tow cable, a Focal electro-optical swivel to decouple the vehicle from cable twist, an electro-optical slip ring on the ship's winch and two Focal 903 multiplexer units – one in the vehicle and one on the ship to send and receive the video and data signals.

The vehicle's main imaging instruments are a Simrad charged coupled device (CCD) underwater colour video camera, a Simrad silicon intensified target (SIT) underwater B&W video camera and an Ocean Instrumentation Ltd (OIL) M7 stills camera with F1200 flash unit. Lighting for the CCD camera is provided by two Deep Sea Power & Light SeaArc 400W high intensity discharge (HID) light with daylight lamps and flood reflectors for even illumination. Two C-Map systems10mW lasers are mounted 300mm apart, both pointing vertically down to give a scale for the cameras. One further 10mW laser is mounted at an angle of 50 degrees on the flash unit to give altitude information. There is a separation of 2.1m between the two scale lasers and the altitude laser.

As well as the cameras, the SHRIMP vehicle has a range of attitude sensors: an Advances Orientation Systems Inc. (AOSI) EZ-Compass 3 provides pitch, roll, heading and case temperature data, a Simrad Mesotech 808-A altimeter with a 200m range for vehicle altitude measurement and an AML Smart CTD. All these instruments have serial outputs and feed directly to the Focal multiplexer.

Control commands from the ship to turn on/off lights and cameras are sent via the RS-232 link and operated upon by the vehicle computer. Video signals from the CCD and SIT cameras are fed directly to the ship via the Focal multiplexer's optical link.

Power for the vehicle is derived from a 1.5kVac supply fed from the ship. In the vehicle this is transformed down to 240Vac, which is used to power the underwater lights and also the instruments via standard mains power supplies.

At the ship a 240 to 1.5kV, 3kVA transformer provides power to the vehicle down the main tow cable. This high voltage supply is protected by a Bender GFI (ground fault indicator) unit. The top end Focal 903 multiplexer provides the RS-232 data link and the CCD and SIT video feed signal. The video signal is buffered and is fed to the video monitor, the two DVD and one Hi-8 video recorders, a winch driver's monitor plus and a feed to a monitor on the ship's bridge. The SHRIMP deck unit computer displays and logs the RS-232 data from the vehicle as well as sending the commands to control the vehicle functions.

Laboratory setup

The SHRIMP recording deck unit is mounted inside a transit case. It is an easy task to strap this down to a suitable bench. The deck unit computer used a PC monitor in one of the cases for display. The video multiplexer was mounted next to the deck unit computer. The power supply was set up under the deep-tow cable junction box on the starboard side of the main laboratory.

The video signal is sent to the DVD and Hi-8 recorders and also to the winch cab and bridge.

Deployment, survey and recovery

Care must be taken when planning a SHRIMP survey run as the ship is only able to keep to a course close to the wind when slow-towing at 0.5 to 1.0knts. It is also best policy to ensure that the survey run is down slope as this reduces the risk of damaging the vehicle on the seafloor or worse, getting the vehicle stuck under an overhang. This technique also gives better video and photographic images as the vehicle is less likely to be bounced along the seafloor.

The SHRIMP vehicle weighs approximately 1000kg in air. It is an easy task to deploy it from the amidships gantry using just two stay lines. Deploying amidships reduces any pitch motion induced by the ship. It does still suffer somewhat from roll motion.

Once deployed the vehicle is switched on and checked for correct operation. If all is in order then it is paid away at 40m/s. Progress is initially monitored on the pressure gauge display progressing to the altitude monitor when within 200m of the seafloor. Visual contact is made when within 10-15m of the seafloor. The primary visual altimeter is formed by the three laser 'dots' on the seafloor. When all three dots line up the vehicle is 2.5m off the seafloor. If the vehicle is higher then the altimeter dot is off to the left of the two scale dots, closer then it's to the right. A secondary visual altimeter is formed by a 6kg lead weight on a 2.0m tether. This can be viewed on the video monitor and is used as a guide by the winch driver to keep the vehicle at the optimum height off the seafloor.

Once visual contact is made with the seafloor the winch driver keeps the vehicle at the optimum flying height by monitoring the visual altimeter. After a brief learning period all the winch drivers became highly adept at flying the vehicle.

It is strongly recommended that the winch driver and control be in the laboratory when SHRIMP is deployed. This reduces reaction time to commands, essential when only flying 2m off the seafloor. This is not possible with the current winch system aboard the *Discovery*. Efforts to remedy this should be made as soon as possible as lack of this facility will impact on other operations as well as SHRIMP.

During this cruise a Sonardyne USBL transponder was mounted 10m above the vehicle on the main tow cable. This enabled the vehicle to be accurately navigated to depths of 4000m.

At the end of the seafloor run the stills camera and DVD and video recorders are turned off and the vehicle recovered at 50m/s. Recovery is accomplished by bringing the vehicle to deck height and attaching two stay lines before bringing the vehicle aboard.

System performance

For this cruise the SHRIMP system was configured to work using the fibre-optic link and used a new 1.5kVac 3kVA power supply. This new unit enables more lights and instruments to be used on the vehicle, providing a lot of flexibility for future upgrades and modifications.

Also new for this cruise was new cabling and plug arrangement replacing the unreliable Impulse IE55(W) connectors. No vehicle connector problems were encountered during this cruise so this change seems successful. The deck computer software has been rewritten to include the CTD unit and a new vehicle computer incorporated into the design. This works well in the main but more work is needed to reduce spurious switching of functions which meant that turning the stills camera on and off could turn off the lights as well necessitating a 10-minute wait for the lamps to re-strike.

DVD recording of the video images is now standard with the old Hi-8 video recorders providing a backup in case of mishap. A 4.7Gbyte DVD disc in standard play mode gives 2 hours of recording time.

The vehicle was deployed 9 times during the cruise. The first run over the summit of the Seine seamount was successful but it was later found that only one of the underwater lamps was running. This was cured for subsequent runs. The second run was curtailed by a short circuit in the deep-tow cable termination bottle. The third, fourth and fifth runs were terminated by GFI trips. These were traced to high voltage connectors on the swivel breaking down and tracking to seawater ground. This was eventually cured by liberally spraying the connectors with silicone oil prior to mating. This expelled any moisture that could initiate tracking. Runs six to nine ran smoothly apart from the odd collision with the seafloor. Further runs were stopped due to winch misbehaviour.

Future improvements

From the experience gained on this cruise the following improvements to the system are highly desirable:

1. Less error prone switching of cameras and lights.
2. A fast method of copying the DVD disks for archiving.
3. A high-resolution underwater camera, preferably 3-chip digital.
4. A forward-looking camera and light for collision avoidance.
5. A larger monitor for viewing the real-time video.

This is not a complete list but highlights the major items discussed during the cruise.

Summary

During the cruise SHRIMP provided nearly 40 hours of seafloor video. This was the first time the new HV supply was used and clearly lessons have been learned on how to prepare the connectors. However, from this the SHRIMP system is now in a very strong position to be able to easily add more lighting, cameras and instruments as scientific requirement and funding dictate.

Ian Rouse

7.3. USBL

The Sonardyne USBL underwater navigation system comprises of a transducer head mounted on a deployable spar through the ship’s gate valve, a deck unit and two transponder units for attachment to underwater vehicles and equipment.

The transponder units operate with rechargeable batteries, these being fully charged prior to use.

The deck unit was set up in the main laboratory. A certain amount of detective work was required to track down the required inputs for the system. Once this was finally sorted out the cables were clearly marked and labelled to assist the next user of the system.

The USBL is a relatively new feature on the Discovery and as such no proper level ‘A’ logging scheme has been worked out. The scheme from the Darwin was tried but this seems to have a different format of survey output string compared to the Discovery system. For this cruise logging was done on a laptop computer using Hyper Terminal to read and record the NMEA data string.

The transponders were set up on the deck unit as HPR300 units operating on channel 06. The central meridian in the Seine work area was 16 degrees west and for the Sedlo area 27 degrees west.

On each SHRIMP run use the transducer spar had to be deployed prior to use and retracted afterwards. The maximum ship speed with the spar deployed is 5 knots.

For SHRIMP deployments a transponder was mounted 10m above the vehicle on the main tow cable. Good, consistent positions were obtained right out to the maximum depth of 4000m.

During SHRIMP run 8 the survey output from the USBL deck unit was accidentally switched off so no data was recorded. Apart from this the system was highly reliable.

Ian Rouse

7.4. 3k5 Profiler

The 3k5 chirp profiler system comprises of a combined transceiver and correlator unit, a logging and display computer, a 'Chivers' winch and deployment davit mounted on the port quarter and the 3k5 transducer fish itself. The system was briefly used early in the cruise. The results were good at slow ship speeds – less than 5 knots – but noisy at high speeds. This is not surprising given the tow position of the fish - at higher speeds the fish is almost level with the ship's propeller. Logging was on Zip disks with the data transferred to the ship's computer when a disk was full.

Ian Rouse

7.5. SHRIMP software

During deployments of the SHRIMP vehicle it was noted that the echo sounder (altimeter) telemetry data would cease to be displayed after several hours. The cause of which is assumed to be a software problem on the ship-side data display/acquisition PC. Modernisation will also need to be carried out to the embedded vehicle PC software in order to make the communication system more resilient to noise. It is assumed at present that this can be rectified with improved software, although there are indications that the problems encountered may be due to faults with the embedded computer itself. These faults do not seriously inhibit the operation of the SHRIMP vehicle, which remains fully deployable at present.

7.6. CTD system

The SBE model 11 CTD system performed as expected. New calibrations have been added to the on board sensors and the system is fully deployable. Initial problems with water ingress in the modem cable were rectified although this should be monitored on future cruises. It should also be noted that several of the water sampling bottles were damaged during an impact with the ship during recovery of a SAPS. This damage was repaired during the cruise, but it is recommended that SAPS should be placed at least 15 metres above the CTD frame in future operations.

The CTD frame was configured to record data in the following units, from the following sensors:

name 0 = prDM: Pressure, Digiquartz [db]
name 1 = depSM: Depth [salt water, m]
name 2 = t090C: Temperature [ITS-90, deg C]
name 3 = c0S/m: Conductivity [S/m]
name 4 = sal00: Salinity [PSU]
name 5 = t190C: Temperature, 2 [ITS-90, deg C]
name 6 = c1S/m: Conductivity, 2 [S/m]
name 7 = C2-C1S/m: Conductivity Difference, 2 - 1 [S/m]
name 8 = T2-T190C: Temperature Difference, 2 - 1 [ITS-90, deg C]
name 9 = sbeox0Mm/Kg: Oxygen, SBE 43 [umol/Kg]
name 10 = flC: Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
name 11 = xmiss: Beam Transmission, Chelsea/Seatech/Wetlab CStar [%]

name 12 = par: PAR/Irradiance, Biospherical/Licor
name 13 = par1: PAR/Irradiance, Biospherical/Licor, 2
name 14 = stLs6000: OBS, Seatech LS6000
name 15 = pumps: Pump Status
name 16 = modError: Modulo Error Count

All sensors were operational apart from the Light Scatter sensor, which developed a fault in the early stages of deployment and proved unserviceable. It should also be noted that the PAR/Irradiance sensors where only deployed on shallow casts (not greater than 450m) due to their pressure limits. Water sampling was realised using a SBE 24 x 20litre water bottle carousel that performed adequately.

Individual data channels were configured as shown below, along with the date of last calibration.

sensor 0 = Frequency 0 temperature, primary, 2728, 01\02\04
sensor 1 = Frequency 1 conductivity, primary, 2164, 03\02\04, cpcor = -9.5700e-08
sensor 2 = Frequency 2 pressure, 90573, 9/6/02
sensor 3 = Frequency 3 temperature, secondary, 2729, 01\02\04
sensor 4 = Frequency 4 conductivity, secondary, 2165, 2/12/04, cpcor = -9.5700e-08
sensor 5 = Extrnl Volt 0 Oxygen, SBE, primary, 0363, 06\02\03
sensor 6 = Extrnl Volt 2 altimeter
sensor 7 = Extrnl Volt 3 fluorometer, Chelsea, 108, 11/11/02
sensor 8 = Extrnl Volt 4 irradiance (PAR), primary, RVS7, 05\05\99
sensor 9 = Extrnl Volt 5 irradiance (PAR), secondary, RVS7, 05\05\99
sensor 10 = Extrnl Volt 6 sea tech ls6000, primary, N400, 28/05/04
sensor 11 = Extrnl Volt 7 transmissometer, primary, 161048, 28/05/04

James Cooper

7.7. SURFMET

SURFMET systems employed during D282 were as followed.

MANUFACTUER	SENSOR	SERIAL NO.	REMARKS
FSI	OTM TEMPERATURE	1340	
FSI	OTM TEMPERATURE	1348	
WETLABS	FLOUROMETER	248	
VAISALA	BAOMETRIC PRESSURE PTB100A	S3610008	
VAISALA	TEMPERATURE/HUMIDITY HMP44L	U1850012	
DIDCOT/ELE	PAR DRP-5	30470	PORT SIDE
DIDCOT/ELE	PAR DRP-5	30471	STBD SIDE
KIPP&ZONEN	TIR PYROMETER	994133	STBD SIDE
*FSI	OCM CONDUCTIVUTY	1376	INTERNAL CALIBRATIONS
*VAISALA	SENSOR COLLECTOR QLI59	R381005	
*VAISALA	ANEMOMETER WAA	522322	
*VAISALA	WIND VANE WAV	21214	

* indicates sensors without calibrations

James Cooper

7.8. Miscellanea

Deck Ornaments
The following items were not used hence no comments can be provided as to their operational status.
Multicorer
Box corer
Megacorer
Dauntless winch
Trawls (rock dredge, Agassiz, OTSB14)
2.4 tonne Lebus general purpose winch
Underway metal free water sampler

Operational items
The following items were used and each item is listed together with appropriate comments.

Double barrel reeling winch
Performed satisfactorily for the recovery of a number of previously deployed moorings. However, the drive chain of one of the reeling drums failed during the final recovery that will require repair. In addition the steelwork on the base frame is in an advanced stage of decay and it would be unsafe to use this item again until a complete refurbishment is completed. The other reeling drum was not used.

Fibre optic swivel
Both F.O. Swivels failed during early deployments of SHRIMP. Tests revealed the high voltage connectors had failed due to moisture ingress. These items are described by the manufacturer as non-user serviceable hence no information or spares are carried. However, after protracted discussions with base it was decided to dismantle one and replace the burnt out connector. This proved to be successful and the swivel performed satisfactorily with both SHRIMP and MOCNESS for the remainder of the cruise. It is suggested therefore that detailed information together with appropriate tools and spare parts are obtained for subsequent cruises.

Deep tow cable termination
The termination was carried out on the preceding trials cruise and performed satisfactorily with the exception of one electrical failure. This was traced to an internal flashover, however the damaged plastic connector holder was replaced and no further problems occurred. It is suggested that the design of this item be reviewed to make it less susceptible to failure in the future. Also thought should be given to replacing the cable sheath on the aft gantry to allow the termination to pass through without dismantlement, this would greatly reduce the risk of failure due to constant dismantlement of the bottle termination.

Liquid nitrogen generator
This performed satisfactorily throughout the cruise producing sufficient quantities of liquid

nitrogen. The oxygen deficiency alarm did fail however but upon examination an expiry date of 31/5/2003 was noted. This item therefore needs replacing before the next cruise. Arrangements are in hand to paint the unit and fit protective panels when it is returned to base.

Nitrogen generator

This item appears to work but no fittings were provided to enable gas to be withdrawn. Sufficient bits were sourced from the workshop to enable it to be used but in future an appropriate fittings kit should be deployed with the unit.

Flake ice maker

No problems were reported with this item.

Millipore system

During installation a number of internal leaks were discovered and rectified. Also filter bank changed. No problems were reported with its operation during the cruise. An attempt was made to replace the failed UV lamp however the spares box did not contain a new lamp only an old unserviceable one. It would be desirable if only new replacement lamps were left in the spares box in future.

SAPS stands

Sufficient stands were deployed and performed satisfactorily but they did not come with the correct number or type of fixings, which necessitated making some on site.

Precision echo sounders

The 3.5khz fish appeared to work and no problems were reported. The 10khz also performed satisfactorily. A small oil leak on the pressure gauge will be rectified during the passage back to Govan and the faulty brake-apportioning valve will also be changed.

Allan Davies

8. SCIENTIFIC REPORTS

8.1. Zooplankton investigations

Introduction

Zooplankton samples were taken at the Seine and Sedlo Seamounts in the NE Atlantic (Table 1) in order to investigate the role of this faunal element within the seamount ecology. Three hauls were taken at the top of the Seine Seamount from the surface to 140 m depth (day, night and dawn), two hauls from the surface to 1000 m at the SW flank of the seamount (day and night), and three hauls at a remote site, ca. 30 nm NE of the seamount from the surface to 3450 m covering day and night for the top 1000 m and one deep tow below 1000 m. At the Sedlo Seamount, two MOCNESS-hauls were taken: one at the top of the seamount from the surface to 700 m depth during the day and another one at the farfield-station, ca. 25 nm SE of the seamount, from the surface down to 1000 m during night. A daytime haul at the latter station failed due to winch problems. The problems were serious and the remaining sampling was cancelled.

In detail, the following objectives are posed:
- quantitative sampling of the pelagic faunas to estimate their composition and standing stock,
- determination of the variability of zooplankton on different scales in space and time,
- assessment of trophic levels and their analysis by means of diets of selected taxa,
- estimation of the carbon demands of the pelagic zooplankton fauna.

Sampling / Laboratory protocols

The standard device for the quantitative collection of zooplankton was a 1m^2-double-MOCNESS (WIEBE ET AL. 1985) equipped with 20 nets of 0.333 mm mesh size. The nets can be opened and closed sequentially. The water column was traversed by stratified oblique tows, interrupted by horizontal sampling for biochemical analyses (Table 2). The filtered volume (Table 3) was calculated by a flowmeter. To investigate diel vertical migrations, the hauls from the upper 1000 m were performed during day and night. The device carries CTD-probes. Discrete layers were fished with nets of 0.100 mm mesh to assess the small mesozooplankton. The material was preserved with buffered formaldehyde or was stored frozen at -20° C, -80° C, or in liquid nitrogen for the determination of stable isotopes (δ^{15}N, δ^{13}C), lipids and metabolic activity (ETSA), respectively (Table 4).

Stable isotope analysis

Stable isotope tracing is becoming an increasingly important tool in studies of aquatic food webs (PETERSON and FRY, 1987; PRESTON, 1992) in limnic as well as marine ecosystems (e.g. HOBSON ET AL., 1995; HOCH ET AL., 1996; MONTOYA ET AL., 1990; YOSHII ET AL., 1999 and studies cited therein). Since the δ^{15}N values of animals reflect their trophic level and the δ^{13}C values their diet, the isotopic signature of an organism provides integrated information about its feeding habits over longer time periods. Measurements of carbon and nitrogen isotope ratios (δ^{13}C, δ^{15}N) will be done using an isotope mass spectrometer in the home-laboratory.

The analytical error of this method is ≤0.1 ‰. Stable isotope values are expressed in δ-notations as parts per thousand (‰), where R is the ratio of $^{15}N/^{14}N$ and the standard is atmospheric nitrogen:

$$\delta^{13}C, \delta^{15}N\ [‰] = ((R_{sample}/R_{standard}) - 1) * 1000.$$

Lipid analysis

The fatty acid composition of single taxa will be determined using gas chromatography. These results will help to analyze the sources of food. The samples are stored at -80° C and the analyses will be done in the home-laboratory.

Electron transport system activity (ETSA)

The potential oxygen consumption of the mesozooplankton of the sieve fraction smaller than 5 mm and some single taxa shall be measured using the ETSA (electron transport system activity) method. One half of the samples were frozen in liquid nitrogen and the analysis will be done in the home-laboratory following the method of PACKARD (1971), modified by KENNER and AHMED (1975). The other half was stored at -20° C for reference biomass determination. The enzymatic activity will be recalculated for *in-situ* temperature using the Arrhenius equation assuming an activation energy of 13.2 kcal mol^{-1} for bathypelagic zooplankton (PACKARD ET AL. 1975) to determine the oxygen consumption in $\mu l O_2 d^{-1} g$ wet wg^{-1}. A respiration/ETS ratio of 0.5 will be used to adjust the potential oxygen consumption measured by the ETS method to respiration. The ratio found by KING and PACKARD (1975a) was modified by HERNÁNDEZ-LEÓN and GÓMEZ (1996) for the KENNER and AHMED (1975) version of the ETS assay. Since the respiration/ETS ratio has been shown to be insensitive to hydrostatic pressure (KING and PACKARD 1975b), the above ratio derived from upper ocean zooplankton will be also applied to deep-living zooplankton.

Table 1: MOCNESS haul data.

		Time = UTC		Coordinates				max.		
		Sampling time		Start		End		Water	Sampling	
Haul	Date	Start	End	Latitude	Longitude	Latitude	Longitude	depth	Depth	Remarks
MOC-D-01	08.07.04	17:45	18:58	33°44' N	14°24' W	33°46' N	14°22' W	175 m	0- 140 m	Sunset
MOC-D-02	09.07.04	03:01	04:02	33°43' N	14°24' W	33°45' N	14°23' W	167 m	0- 140 m	Night
MOC-D-03	09.07.04	17:01	01:10	34°09' N	14°05' W	34°22' N	13°52' W	4037 m	0-3450 m	Night
MOC-D-04	10.07.04	12:51	16:10	34°12' N	14°01' W	34°18' N	13°58' W	4113 m	0-1000 m	Day
MOC-D-05	16.07.04	23:10	01:53	34°12' N	14°01' W	34°16' N	13°58' W	4105 m	0-1000 m	Night
MOC-D-06	17.07.04	07:08	10:19	33°43' N	14°30' W	33°49' N	14°27' W	2191 m	0-1000 m	Day
MOC-D-07	17.07.04	12:43	13.37	33°44' N	14°22' W	33°45' N	14°22' W	174 m	0- 140 m	Day
MOC-D-08	17.07.04	20:13	23:13	33°43' N	14°29' W	33°49' N	14°27' W	1951 m	0-1000 m	Night
MOC-D-09	22.07.04	14:59	17:06	40°15' N	26°38' W	40°20' N	26°39' W	844 m	0- 700 m	Day
MOC-D-10	22.07.04	22:10	01:14	39°55' N	26°24' W	40°02' N	26°22' W	2788 m	0-1000 m	Night
MOC-D-11	23.07.04	09:33	11:55	39°55' N	26°25' W	40°01' N	26°25' W	2765 m	no sampling	failed

Table 2: MOCNESS hauls: sampled depth intervals in meter. * = 0.1 mm net.

	Haul MOC-									
Net	D-01	D-02	D-03	D-04	D-05	D-06	D-07	D-08	D-09	D-10
L1	0-140	0-140	0-3450	0-1000	0-1000	0-1000	0-140	0-1000	0-700	0-1000
L2*	140	140	3450	1000	1000	1000	140	1000	700	1000
L3	140	140	3450-3000	1000	1000-800	1000-800	140-100	1000-800	700-500	1000-800
L4	140-100	140-100	3000-2500	1000-800	800-600	800-600	100-50	800-600	500	800-600
L5	100	100	2500	800-600	600-500	600-500	50	600-500	500-300	600-500
L6	100-75	100-75	2500-2000	600-500	500	500	50-0	500	300-200	500
L7	75-50	75-50	2000-1500	500	500-300	500-300	-	500-300	200-100	500-300
L8	50	50	1500-1250	500-400	300-50	300-50	-	300-50	100-50	300-50
L9	50-25	50-25	1250-1000	400-300	50	50	-	50	50	50
L10	25-0	25-0	1000-0	300-0	50-0	50-0	-	50-0	50-0	50-0
R1	0-140	0-140	0-3450	0-1000-500	0-1000	0-1000	0-140	0-1000	0-700	0-1000
R2	140	140	3450	500-300	1000	1000	140	1000	700	1000
R3	140-125	140-125	3450-3000	300	1000-800	1000-800	140-100	1000-800	700-500	1000-800
R4	125-100	125-100	3000-2500	300-250	800-600	800-600	100-50	800-600	500	800-600
R5	100	100	2500	250-200	600-500	600-500	50	600-500	500-300	600-500
R6	100-75	100-75	2500-2000	200-150	500	500	50-0	500	300-200	500
R7	75-50	75-50	2000-1500	150-100	500-300	500-300	-	500-300	200-100	500-300
R8	50	50	1500-1250	100-50	300-50	300-50	-	300-150	100-50	300-50
R9	50-25	50-25	1250-1000	50	50	50	-	150-5	50	50
R10	25-0	25-0	1000-0	50-0	50-0	50-0	-	5-0	50-0	50-0

Table 3: MOCNESS hauls: filtered volume in m^3

	Haul MOC-									
Net	D-01	D-02	D-03	D-04	D-05	D-06	D-07	D-08	D-09	D-10
L1	Not quantitatively sampled									
L2	231	218	1069	521	480	629	273	512	335	384
L3	224	264	2465	802	728	1050	312	724	815	823
L4	846	286	1827	748	737	952	399	904	285	974
L5	151	174	820	864	416	552	164	588	1165	677
L6	632	367	1419	536	551	579	542	458	527	456
L7	315	337	1730	559	1008	1253	-	1131	516	1291
L8	177	173	915	552	1166	1402	-	1617	307	1150
L9	279	215	679	679	167	180	-	168	177	96
L10	560	627	4121	1664	264	368	-	289	334	279
R1	Not quantitatively sampled									
R2	224	264	1069	1231	480	629	273	512	335	384
R3	621	128	2465	456	728	1050	312	724	815	823
R4	225	158	1827	319	737	952	399	904	285	974
R5	151	174	820	264	416	552	164	588	1165	677
R6	632	367	1419	271	551	579	542	458	527	456
R7	315	337	1730	203	1008	1253	-	1131	516	1291
R8	177	173	915	220	1166	1402	-	984	307	1150
R9	279	215	679	105	167	180	-	1072	177	96
R10	560	627	4121	264	264	368	-	18	334	279

Table 4: MOCNESS hauls: Planned analyses. BT = Biomass and Taxonomy fixed in buffered formaldehyde. S = Stable isotopes (C,N) stored at -20°C . E = Electron transport system activity (ETSA) stored in liquid nitrogen. RB = Reference biomass for ETSA stored at -20°C. FA = Fatty Acid analyses stored at -80°C. C = Further BioChemistry stored at -20°C. DOC = DOC production experiment.

	Haul: MOC-									
Net	D-01	D-02	D-03	D-04	D-05	D-06	D-07	D-08	D-09	D-10
L1	C	C	C	C	C	C	C	C	C	C
L2	BT	BT	BT	BT	BT	BT	BT	BT	BT	BT
L3	½ E, ½ RB	½ E, ½ RB	BT	½ E, ½ RB	BT	BT	BT	BT	BT	BT
L4	S	S	BT	½ BT, ½ S	BT	BT	BT	BT	FA	BT
L5	½ E, ½ RB	½ E, ½ RB	½ E, ½ RB	BT	BT	BT	FA	BT	BT	BT
L6	BT	BT	BT	½ BT, ½ S	FA	FA	BT	FA	BT	FA
L7	BT	BT	BT	½ E, ½ RB	BT	BT	-	BT	BT	BT
L8	½ E, ½ RB	½ E, ½ RB	BT	BT	BT	BT	-	BT	BT	BT
L9	BT	BT	BT	BT	FA	FA	-	½ E, ½ RB	FA	FA
L10	BT	BT	C	C	BT	BT	-	BT	BT	BT
R1	C	C	C	C	C	C	C	C	C	C
R2	½ E, ½ RB	½ E, ½ RB	½ E, ½ RB	DOC	½ E, ½ RB	½ E, ½ RB	½ E, ½ RB	½ E, ½ RB	½ E, ½ RB	½ E, ½ RB
R3	BT	BT	S	½ E, ½ RB	S	S	S	S	S	S
R4	BT	BT	S	½ BT, ½ S	S	S	S	S	½ E, ½ RB	S
R5	½ E, ½ RB	½ E, ½ RB	½ E, ½ RB	½ BT, ½ S	S	S	½ E, ½ RB	S	S	S
R6	S	S	S	BT	½ E, ½ RB	½ E, ½ RB	S	½ E, ½ RB	S	½ E, ½ RB
R7	S	S	S	BT	S	S	-	S	S	S
R8	½ E, ½ RB	½ E, ½ RB	S	½ BT, ½ S	S	S	-	BT	S	S
R9	S	S	S	½ E, ½ RB	½ E, ½ RB	½ E, ½ RB	-	DOC	½ E, ½ RB	½ E, ½ RB
R10	S	S	C	BT	S	S	-	BT	S	S

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8.2. Upper ocean biogeochemistry

Introduction

From 30th June to 1st of August a cruise took place to Seine and Sedlo seamounts on board the RRS "DISCOVERY". In this cruise our team measured primary production, export production, and water-column remineralisation rates associated with Seine and Sedlo seamounts and "far-field" stations.

Objectives

In particular, this cruise aimed:

- To quantify the gross and net community production, and dark community respiration in the upper ocean;
- To evaluate the remineralisation rates of organic matter in the water column by assessing the respiratory activity of the Electron Transport System (ETS) in microbial communities and by calculating the Apparent Oxygen Utilization (AOU);
- To determine the contribution of dissolved and particulate organic carbon to estimate its contribution to the global remineralisation rates in the water column;
- To assess the phytoplankton/microbial community structure and biomass.

Sampling / Laboratory Protocols

A total of six stations (I, H, A, F, C and E) were sampled at Seine seamount of which two were far-field stations (I and H, southeast and northeast respectively). At each station, water samples were collected for determination of chlorophyll *a* (Chl a), plankton cell counts, proteins, respiration derived from ETS, and dissolved and particulate organic carbon. Incubations for production-respiration *in vitro* experiments were carried out on on-deck incubators at stations A, F, C, E and I.

Chlorophyll *a*, plankton cell counts and proteins

Chl *a*, plankton cells counts and proteins, were obtained from the 6 stations (I, H, A, F, C and E). At each station, water samples were collected from 6 different depths in the upper 150m. The phytoplankton/microbial community structure and biomass will be assessed through determination of Chl *a*, and using different techniques to identify and count the different size ranges of the phytoplankton/microbial community.

To determine Chl *a*, 1000 ml of water were filtered through glass-fibre filters (Whatman GF/F). The filters were stored in liquid nitrogen. Chlorophyll *a* will be measured fluorimetrically in the laboratory by means of a Turner Designs bench fluorimeter, calibrated with pure Chl *a* (Sigma Co.), following the recommendations of Yentsch and Menzel (1963) and as described in Arístegui *et al* (1997).

Seawater samples (45 ml) for autotrophic (NAF) and heterotrophic (NHF) nanoflagellate enumeration were preserved following Haas (1982). Immediately after collection, the samples were fixed with glutaraldehyde (0.3% final concentration). After 30 min. the samples were placed and filtered through a filtration system and fixed with DAPI (0.5 µg/ml final concentration) for 3-5 min. Samples were filtered using a 0.2 µm black polycarbonate membrane filter over a Watman GF/C backing filter, and finally mounted on a microscope slide with low fluorescence parafin oil. The slides were stored in the dark in a –20^{0}C freezer for later observation in the laboratory using the epifluorescence technique.

Samples (3 ml) for estimating the abundance of picoplankton (*Prochlorococcus*; *Synechococcus*, small nanoflagellates, and small heterotrophic bacteria) were fixed with paraformaldehyde and stored in liquid nitrogen. The samples will be analysed later in the laboratory using the flow cytometry technique.

To estimate large phytoplankton, samples were stored in dark glass bottles, fixed with lugol and placed in the dark at room temperature. In the laboratory they will be analysed by inverted microscopy.

Protein samples were obtained by filtration of seawater (4 L) through glass microfibre filters (Whatman GF/F 47 mm), at a low vacuum pressure (<1/3 atm). The samples were immediately stored in liquid nitrogen until assayed according to the Peterson´s modification (1977) of the Lowry method (1951) at the Marine Science Faculty Lab, Universidad de Las Palmas de Gran Canaria (ULPGC).

Respiration derived from ETS activity.

Enzymatic respiratory activity of the Electron Transport System **(**ETS activity, Packard, 1985) were used to calculate microbial respiration (R). ETS measurements in the water column will provide a proxy for (microbial) respiration rates, allowing calculation of the water-column instantaneous remineralisation rates and hence, export production.

The ETS method is thought to estimate, under substrate saturation, the maximum overall activity of the enzymes associated with the respiratory electron transport systems, in both eukaryotic and prokaryotic organisms (Packard, 1985a). ETS measurements are potential respiration rates. They need to be converted to *in vivo* respiration rates by empirically determined algorithms. R/ETS ratios from literature will be used to transform potential respiration (ETS) to actual respiration (R). Whenever possible, water samples, were collected at 6 stations (I, H, A, F, C and E) every 50 m from surface up to 1000 m, and every 500 m from 1000 m up to 3000 m. Sampling resolution and depth intervals were chosen such as to obtain the best estimation of the contribution to respiration from mesopelagic communities.

Samples (between 5-20 L, depending on plankton density) were filtered through glass microfibre filters (Whatman GF/F 47 mm), at a low vacuum pressure (<1/3 atm). The samples were immediately stored in liquid nitrogen. ETS determinations will be carried out at

ULPGC, according to the Kenner & Ahmed (1975) modification of the tetrazolium reduction technique proposed by Packard (1971), as described in Arístegui & Montero (1995). This analysis was made on board RRS *Discovery* during the 282 cruise.

Dissolved and Particulate Organic Carbon (DOC and POC)

Samples were collected at the same stations and depths of those for ETS to estimate POC and DOC contribution to microbial respiration in the water column. Water samples for DOC were gathered into glass ampoules (10 mL duplicates) directly from Niskin bottles (without any tube), immediately added 50 μL of 50% ortho-phosphoric acid and hermetically sealed. The samples were stored in the fridge until being analysed with a Total Organic Carbon (TOC) analyser (High-Temperature Catalytic Oxidation, HTCO, Sugimura and Suzuki, 1988) at ULPGC. Samples (2-4 L) for POC were filtered through pre-combusted (450ºC, 12 h) 25 mm Whatman GF/F filters. The filters were wrapped in pre-combusted aluminium foil and frozen at –20ºC until being processed, following the JGOFS protocol, and using a CHN 2400 elemental analyser, Perkin Elmer, at ULPGC.

Apparent Oxygen Utilization

Apparent Oxygen Utilization (AOU) was calculated by subtracting the *in situ* oxygen saturation value from the *in situ* measured oxygen concentration. This provides an estimate of the water-column remineralisation rates. These rates differ from those calculated from the ETS measurements. AOU estimates the oxygen anomaly of a water mass between sinking (and loosing contact with atmosphere) and the sampling moment, but corrected to its *"in situ"* value of salinity, temperature, and pressure. Remineralisation rates from AOU represent historical rates, whereas remineralisation rates from ETS represent instantaneous rates. Water samples were collected at the same stations and depths as those for ETS, poured into borosilicate bottles with a silicon tube and were analysed with a micro-Winkler titration system (Williams and Jenkinson, 1982) in the same way that those for production-respiration experiments.

Gross and Net Production and Respiration by oxygen changes

Gross primary production (Pg), net community production (Pn), and dark community respiration (Rd) were determined by oxygen evolution inside borosilicate bottles at six depths at each station (I, A, F, C and E). During this cruise the incubations were carried out "on-deck". Hence, a methodology was used to reproduce the *in situ* light conditions. A Photosynthetic Available Radiation (PAR) vertical profile was used to simulate the *in situ* light conditions. The type of mesh to cover each incubator (only for the light bottles) was chosen for each depth according to the PAR profile, while the dark bottles were incubated inside opaque PVC tubes. Temperature control of the bottles was performed by continuous seawater flow inside the incubation tubes. Water samples were collected with a rosette with 20-L Niskin bottles and poured into clear plastic carboys, carefully siphoned using a silicon tube into 5 replicate 't0', dark and light 125 mL BOD bottles (per depth). Dark and light bottles were placed in the incubators for 24 hours. The t0 bottles were fixed at the same time that the experiment started. Rd was estimated from the difference in oxygen concentration between the t0 and dark bottles. Pn was estimated as the difference in oxygen concentration between the light and t0 bottles. Pg was calculated as the sum of oxygen concentrations from Pn and Rd. Dissolved oxygen was measured by the Winkler technique, following the recommendations of Carrit & Carpenter (1966), Bryan et al. (1976) and Grasshoff et al. (1983). The entire contents of the bottles were titrated within ~3 min by means of an automated precise titration system with colorimetric end-point detection (Williams and Jenkinson, 1982).

Sample and Data Catalogue

				Nº of samples				
Station	Day	Longitud	Latitude	Chlorophyll a	Proteins	Picoplacton	Flagellates	Phytoplancton
F-15432#1	07/07/2004	14º 40´W	33º 48.5´N	5	5	5	5	5
A-15434#1	08/07/2004	14º 22.405' W	33º 46.160' N	6	6	6	6	6
H-15439#1	10/07/2004	14º 00.00' W	34º 15.00' N	6	6	6	6	6
E-15446#1	12/07/2004	14º 30.033'W	33º 31.994' N	6	6	6	6	6
C-15448#1	14/07/2004	14º 02.779'W	33º 45.062' N	6	6	6	6	6
I-15453#2	16/07/2004	14º00.02'W	33º20.02'N	6	6	6	6	6
			TOTAL	35	35	35	35	35

Table 1. Samples collected at Seine seamount from 0m to 150m.

				Nº of samples			
Station	Day	Longitud	Latitude	DOC	POC	O2	ETS
F-15432#1	07/07/2004	14º 40´W	33º 48.5´N	19	11	11	11
A-15434#1	08/07/2004	14º 22.405' W	33º 46.160' N	11	6	6	6
H-15439#1	10/07/2004	14º 00.00' W	34º 15.00' N	20	12	12	12
H-15444#1	10/07/2004	13º59'.49"W	34º15'7"N	20	11	11	11
E-15446#1	12/07/2004	14º 30.033'W	33º 31.994' N	21	12	12	12
E-15446#3	12/07/2004	14º 29.963' W	33º 32' N	19	11	11	11
C-15448#1	14/07/2004	14º 02.779'W	33º 45.062' N	22	12	12	12
C-15448#3	14/07/2004	14º02.82'W	33º45.02'N	22	11	11	11
I-15453#2	16/07/2004	14º00.02'W	33º20.02'N	24	12	12	12
I-15453#4	16/07/2004	13º59.983'W	33º19.986'N	22	11	11	11
F-15458#1	17/07/2004	14º40.02'W	33º48.48'N	21	11	11	11
			TOTAL	221	120	120	120

Table 2. Samples collected at Seine seamount from 0m to 2000m.

				Nº of samples				
Station	Day	Longitud	Latitude	Chlorophyll a	Proteins	Picoplacton	Flagellates	Phytoplancton
F-15461#1	20/07/2004	26º 25.211´W	39º 57.855´N	6	6	6	6	6
A-15464#1	22/07/2004	26º 39.885´W	40º 18.952´N	6	6	6	6	6
C-15471#1	23/07/2004	26º 39.96´W	40º 15.10´N	6	6	6	6	6
D-15482#1	25/07/2004	26º 50.49´W	40º 20.17´N	6	6	6	6	6
			TOTAL	24	24	24	24	24

Table 3. Samples collected at Sedlo seamount from 0m to 150m.

				Nº of samples			
Station	Day	Longitud	Latitude	DOC	POC	O2	ETS
F-15461#1	20/07/2004	26º 25.211´W	39º 57.855´N	21	12	12	12
F-15461#3	21/07/2004	26º 23.039´W	39º 58.149´N	20	11	11	11
A-15464#1	22/07/2004	26º 39.885´W	40º 18.952´N	21	12	12	12
A-15464#3	22/07/2004	26º 40.00´W	40º 18.97´N	11	6	6	6
C-15471#1	23/07/2004	26º 39.96´W	40º 15.10´N	20	11	12	12
C-15471#3	24/07/2004	26º 39.906´W	40º 15.286´N	17	9	9	9
D-15482#1	25/07/2004	26º 50.49´W	40º 20.17´N	20	12	12	11
D-15482#3	25/07/2004	26º 50.35´W	40º 20.49´N	15	9	9	9
			TOTAL	145	82	83	82

Table 4. Samples collected at Sedlo seamount from 0m to 2000m.

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8.3. Water column biogeochemistry

During RRS *Discovery* cruise D282 five water-column stations on Seine-Seamount (Tab. 1, stn.s 15434-15453) and four water-column stations on Sedlo-Seamount (Tab. 1, stn.s 15461-15485) were sampled using a 24-bottle CTD-rosette (bottle volume 20 litres). Sampled water depths ranged between 5m and 4420m (10m above the seafloor). At each depth two bottles were fired.

After the cast the water was filled into 20-litre HD-PE canisters. The water was analysed for particle-associated and dissolved ^{234}Th, TPM, Chlorophyll a, POC and PN. To determine radioactive ^{238}U/^{234}Th disequilibria ^{238}U will be calculated from salinity data.

^{234}Th

For the determination of particulate ^{234}Th 20 litres of water per site and depth were pressure-filtrated using 142mm Whatman Nuclepore Polycarbonate Membrane filters with 0.4µm pore width. Pressure was adjusted to 300-400mbar. During filtration the water had contact to HD-PE, Silicone and Teflon only. The filtrated water was collected in a 20-liter HD-PE canister.

After filtration the filters were folded twice to half and put in petri-dishes to air-dry. After that the filters were folded in a reproducible way to get 60-sheet packages measuring 18x18mm. These packages were wrapped in Mylar foil and sealed at the bottom with an adhesive sticker. After the cruise they will be analysed for beta radiation using a Risoe GM 25 Beta Multi Counter. The filtrated volume of water was determined using volumetric flasks.

After that 6 drops of 25% Ammonia solution, 250µl of $KMnO_4$ and 100µl of $MnCl_2$ were added to each sample to form a precipitate of MnO_2. Due to its particle-reactivity dissolved ^{234}Th can be extracted with an efficiency of more than 99.5%. After eight hours, for allowing the MnO_2-particles to grow, the water was filtrated again using 142mm Whatman Nuclepore Polycarbonate Membrane filters with 1.0µm pore width. Handling of filters and determination of filtrated water volume was conducted as described above.

After filtrating water containing MnO_2 the filtration device had to be cleaned using a mixture of 1 litre of 37% HCl, 100ml 30% H_2O_2 and 9 litres of de-ionized water.

TPM, POC, PN, Chla

The content of the second 20-litre canister per site and depth was split into two 8-litre samples using volumetric flasks. These subsamples were filled into 10-liter HD-PE canisters.

For the determination of TPM, POC and PN 8 litres of water were vacuum-filtrated using carbon-free preweighted 25mm Whatman GFF filters. Pressure was adjusted to max. -400mbar. After the filtration the filters were rinsed twice using 0.4µm filtrated seawater. Then the filters were put into 35mm Petri-dishes and frozen at -20°C. After the cruise the filters will be analysed using a Carlo Erba NC 2500 Elemental Analyser.

For the determination of Chla 8 litres of water were filtrated using unprepared 25mm Whatman GFF filters. After the filtration the filters were rinsed twice using Millipore water. Then the filters were put into 35mm Petri-dishes, wrapped in aluminium foil and frozen at -20°C. After the cruise the filters will be analysed either by HPLC or by photometric methods.

Tab. 1 – Sampling sites

Station	Date	Time [UTC]	Lat [°N]	Long [°W]	Depth [m]	Sampling depths [db]
15434	09.07.04	0029 - 0107	33°46,16	014°22,55	174	5, 10, 25, 50, 150, 166
15439	10.07.04	0510 - 1049	34°15,27	013°59,91	4070	5, 50, 150, 300, 600, 1300, 4000
15446	12.07.04	0945 - 1520	33°32,08	014°30,05	4138	5, 50, 150, 300, 600, 1300, 4138
15448	14.07.04	0437 - 1043	33°45,10	014°02,88	4410	5, 50, 150, 300, 600, 1300, 4411
15453	15.07.04	1815 - 0013	33°20,01	014°00,05	4401	5, 50, 150, 300, 600, 1300, 4420
15461	21.07.04	0140 - 0635	39°38,14	026°25,01	2749	5, 50, 150, 300, 600, 1300, 2749
15464	22.07.04	0815 - 1145	40°18,96	026°40,01	770	5, 50, 150, 300, 450, 600, 770
15471	23.07.04	2048 - 0056	40°15,28	026°37,00	1120	5, 50, 150, 300, 600, 1080
15485	26.07.04	0044 - 0311	40°38,00	026°16,00	2891	80

Stephan Werk and Christine Rietschel

8.4. Water column biochemistry

Particulate material on precombusted (400°C; >4 h) GF/F filters (293mm diameter) was collected using SAPS (Stand-Alone Pumping Systems; Challenger Oceanic). Six locations were sampled at and near the Seine and four at and near the Sedlo Seamounts (Table 1). The sampling depths were at 50 m (in the photosynthetic layer) at 15-100 m above bottom (mab; mostly in the benthic boundary layer) and two more intermediate depths (200-1200 m; see Table 1). The intermediate depth stations in the vicinity of the Seine Seamount were close to or within the Mediterranean Outflow Water (MOW) as determined from CTD profiles. The objective of sampling MOW at Sedlo Seamount was not always met, due to the complex hydrographic regime of that area. The pumps were deployed on the CTD wire together with the CTD and were operated at the chosen depths for two hours. On recovery, all but the last deployment (Sedlo Site D) filters were partitioned for measurement of ^{234}Th (University Rostock; ~25% of filter) and organic analyses (POC, TN, lipid, pigment, δ^{13}C and δ^{15}N of POM). No analyses were carried out on board.

Three of the pumps (two of University Liverpool and one of University Rostock) functioned correctly, pumping no less than 661 L and up to 1507 L (Table 1). The SOC/UKORS pumps (usually deployed at 200 m) however could not in most cases reach the same amounts ranging between 122-728 L (Table 1). The reason for this was not determined but it may be related to malfunctioning batteries.

Table 1 Sampling details of SAPS deployments

Date sampling (2004)	Starting Time sampling	Station No.	Site	pump used	Water Depth (m)	Volume pumped litres in 2h
07-Jul	20:15	15432#2	Seine F	ULIV	50	842
07-Jul	20:15	15432#2	Seine F	SOC/UKORS	200	0
07-Jul	20:15	15432#2	Seine F	URO	1300	1439
07-Jul	20:15	15432#2	Seine F	ULIV	15 mab	1289
08-Jul	09:45	15434#2	Seine Summit A	ULIV	50	661
08-Jul	09:45	15434#2	Seine Summit A	ULIV	20 mab	1500
10-Jul	07:00	15441#2	Seine Farfield H	ULIV	50	783
10-Jul	07:00	15441#2	Seine Farfield H	SOC/UKORS	200	728
10-Jul	07:00	15441#2	Seine Farfield H	URO	1200	1353
10-Jul	07:00	15441#2	Seine Farfield H	ULIV	15 mab	1251
12-Jul	11:30	15446#2	Seine E	ULIV	50	1088
12-Jul	11:30	15446#2	Seine E	SOC/UKORS	200	129
12-Jul	11:30	15446#2	Seine E	URO	1200	1312
12-Jul	11:30	15446#2	Seine E	ULIV	25 mab	1294
14-Jul	06:25	15448#2	Seine C	ULIV	50	916
14-Jul	06:25	15448#2	Seine C	SOC/UKORS	200	122
14-Jul	06:25	15448#2	Seine C	URO	1200	1341
14-Jul	06:25	15448#2	Seine C	ULIV	25 mab	1211
15-Jul	20:00	15453#2	Seine Farfield I	ULIV	50	870
15-Jul	20:00	15453#2	Seine Farfield I	SOC/UKORS	200	257
15-Jul	20:00	15453#2	Seine Farfield I	URO	1200	1507
15-Jul	20:00	15453#2	Seine Farfield I	ULIV	25 mab	1261
21-Jul	03:00	15461#2	Sedlo Farfield F	ULIV	50	828
21-Jul	03:00	15461#2	Sedlo Farfield F	SOC/UKORS	200	231
21-Jul	03:00	15461#2	Sedlo Farfield F	URO	800	1473
21-Jul	03:00	15461#2	Sedlo Farfield F	ULIV	25 mab	1336
22-Jul	09:00	15464#2	Sedlo Summit A	ULIV	50	662
22-Jul	09:00	15464#2	Sedlo Summit A	URO	200	1661
22-Jul	09:00	15464#2	Sedlo Summit A	ULIV	25 mab	1439
23-Jul	09:45	15471#2	Sedlo C	ULIV	90	1319
23-Jul	09:45	15471#2	Sedlo C	SOC/UKORS	200	222
23-Jul	09:45	15471#2	Sedlo C	URO	800	1480
23-Jul	09:45	15471#2	Sedlo C	ULIV	100 mab	1336 (E)
25-Jul	12:15	15482#2	Sedlo D	ULIV	50	773
25-Jul	12:15	15482#2	Sedlo D	SOC/UKORS	200	419
25-Jul	12:15	15482#2	Sedlo D	URO	800	1413
25-Jul	12:15	15482#2	Sedlo D	ULIV	25 mab	1336 (E)

Kostas Kiriakoulakis

8.5 Hydrography and hydrodynamics

The D282 cruise on the RRS “Discovery” was fulfilled in the framework of the EU project “OASIS” from June, 30 to August, 1 2004. Oceanographic investigations were conducted on two seamounts (SM): Siene (33^{o}N, 14^{o}W) and Sedlo (40^{o}N, 26^{o}W). In total, it was done 43 CTD casts (including 9 SAPS stations), 10 stations for zooplankton sampling (MOCNESS) and 5 stations for bottom underwater photography (SHRIMP). On Siene seamount 2 moorings were recovered. Current velocity profiles were collected during the whole length of the cruise with 150 and 75 kHz acoustic Doppler current profilers (ADCP). Bathymetric information was registered on the way with ship echosounder.

ADCP data

Two ship-mounted ADCP systems were operated during the cruise to measure the 3 dimensional flow field and to monitor the deep scattering layer to get an impression of the daily vertical zooplankton migration:

- RDI 150 kHz system with a bin length of 8 m and a maximum range of 480 m
- RDI 75 kHz Ocean Surveyor system with a bin length of 16 m and a maximum range of 960 m

The post-processing of the 150 kHz system data was started during the cruise using the CODAS3 (Common Oceanographic Database Access System) shipboard ADCP processing software. The main processing steps are:

1. to create the basic database containing the raw data
2. to check and edit the data for the quality of the navigation information, quality of the measurement (percent good check) as well as bad bins and/or profiles (bottom and wire interference)
3. calibration (gyro correction, water track method)
4. computation of absolute velocities

The processing work for both data sets will be finalized after the cruise and the final data set will be distributed across the OASIS working groups.

Siene seamount, moorings, preliminary results

One of the objectives of the cruise was to recover 2 current meter moorings deployed NE and SW of the Seine seamount in 1400 m water depth during the RV Poseidon cruise 309 in March 2004. Mooring work commenced on July 6th at 9:20 at the southwestern site of Seine seamount. A successful ranging check on both acoustic releases was carried out first. After a closer approach to the actual mooring position, a second ranging check was carried out and the mooring was released. At 9:45 the first subsurface buoy reached the surface. The recovery of the mooring went smooth and rapid and was finished at 11:30 with all instruments and buoyancy back on the ship.

The recovery of the second mooring at the northeastern seamount site was postponed due to changing weather conditions. On July 7th the ship was close to the site of the second mooring and a range check was carried out to get a reliable response. The range check was successful and it was decided to wait for improved recovery conditions. Recovery work started on July 14th at 14:10 and followed the same procedure as the first mooring. After a successful range check the mooring was released and the first subsurface buoy came on sight at 15:10. Again the recovery went smooth and rapid and was finished at 16:30.

Moorings summary.
The details of the two current meter moorings recovered at Seine seamount are as follows:

Mooring No. 1

Position:	Latitude:	33°42.178’ N
	Longitude:	14°28.357’ W
Water depth:	1543 m	
Current meters:	Top (1160m)	RCM7 No 11341
	Centre (1500m)	RCM8 No 11308
	Bottom (1533m)	RCM8 No 11224
Acoustic Releases:		AR No 181, Range Code 8167, Release Code 8168
	AR No 185, Range Code 8175, Release Code 8176	

Mooring No. 2

Position:	Latitude:	33°49.884’ N
	Longitude:	14°17.860’ W
Water depth:	1576 m	
Current meters:	Top (1190m)	RCM7 No 11332
	Centre (1521m)	RCM7 No 11334
	Bottom (1566m)	RCM8 No 11310
Acoustic Releases:		AR No 179, Range Code 8163, Release Code 8164
	AR No 180, Range Code 8165, Release Code 8166	

Sampling protocols

Mooring station 1:

Position: Latitude: 33°42.178' N
Longitude: 14°28.357' W

Water depth: 1543 m

Date: 06/07/2004

Time (UTC)	AR 181	AR 185	Comment
9:20	4003 m		Range check
	4002 m		
	4002 m		
9:25		4004 m	
		4003 m	
		4004 m	
9:30		1546 m	Range check
		1545 m	
		1546 m	
	1545 m		
	1545 m		
	1545 m		
9:31	Release procedure executed		
	1504 m		
	1494 m		Range check
	1479 m		
	1449 m		
9:32	1292 m		
9:34	1202 m		
9:35	1121 m		
9:36	1043 m		
9:37	959 m		
9:38	882 m		
9:39			
9:45			Buoy on the surface

Mooring station 2:

Position: Latitude: 33°49.884' N
Longitude: 14°17.860' W

Water depth: 1576 m

Date: 07/07/2004 and 14/07/2004

Time (UTC)	AR 179	AR 180	Comment
07/07/2004			
14:12	1554 m		Range check
	1555 m		(recovery postponed due to rough weather)
	1555 m		
14:14		1557 m	
		1557 m	
		1557 m	
14/07/2004			Range check
14:54	1592 m		
	1591 m		
	1591 m		
		1594 m	
		1594 m	
		1594 m	
14:55	Release procedure executed		
	1530 m		Range check
14:56	1459 m		
	1324 m		
14:57			Buoy on the surface
15:10			

Preliminary results summary

The moorings positions are given on Fig.1. The upper current meters were situated on the Mediterranean waters (MW) level. The two bottom ones were situated at approximately 10 and 55m from the seafloor. The number of DSU counts for each current meter corresponds to the one calculated for the given sampling interval and duration, which means that the data were recorded strictly at 10min interval, as it was set up in the beginning. The DSUs clock difference with the ship clock for the final count did not exceed 5min. Analysis of the data quality showed that temperature and currents sensors did not produce any substantial spikes or erroneous values. For the uncalibrated RCM 11334 (mooring 2, about 1521m depth) the pressure sensor gave unreasonably high, but stable, value of 1587dbar instead of expected 1525-1530dbar. Post-calibration of the RCM is needed. For both bottommost current meters 11224 (mooring 1, 1533m) and 11310 (mooring 2, 1566m) the salinity sensor showed unrealistic values for a substantial initial period (56 and 38 days respectively). For the rest of the period of observations, salinity time average from RCM 11224 was 32.7psu and RCM 11310 was 34.10psu, which is much lower then the values measured with CTD at the same depth: 35.3-35.4psu (see CTD preliminary results below). Thus all salinity data for the bottom sensors were discarded. The sensor failure may be related to a contact of the RCMs with the bottom- after the mooring weight reached the seafloor the other part of the mooring would be still going down and could hit the bottom or be plunged in the bottom mud.

Average values of temperature, salinity and currents are presented in Table 1. It can be seen that temperature on the mooring 1 is generally higher then on the mooring 2, whereas there is no clear difference in salinity.

Table 1. Average temperature (T), salinity (S), northward (U_north) and eastward (V_east) components of current velocity on different horizons of the moorings 1 and 2. Seine SM, 03-07.2004.

Moor./depth	T, ^{o}C	S, psu	U_north, cm/s	V_east, cm/s	comment
1, 1160m	9.40	35.85	-4.21	2.12	
1, 1500m	7.32	35.68	-1.15	0.20	
1, 1533m	7.12		-0.17	-0.13	Salinity sensor fails
2, 1190m	9.35	35.89	0.05	-0.05	
2, 1521m	7.16	35.63	-0.78	0.03	Pressure sensor showed wrong values
2, 1566m	7.00		-1.20	0.14	Salinity sensor fails

Mean currents at both moorings are directed mostly south-eastward. On the first mooring currents are higher at the MW level (see also Fig. 2), where they have steady south-east direction. Then currents decrease to the bottom, where they become very weak and irregular. Opposite situation is observed on mooring 2. On MW level currents are weak and irregular, full of vortex–like instabilities (Fig. 3). Then they become steadier and increase to the bottom. The mean current direction is also to the south-east.

Siene seamount, CTD casts, preliminary results

During the cruise Seabird (SBE 911plus) CTD System was used, supplied with two temperature and conductivity sensors, pressure and oxygen sensors, fluorometer (Chelsea) and transmissometer. In some shallow casts up and down looking sensors for photosynthetically active radiation (PAR) were added. Total 28 CTD casts were made on Seine seamount (Fig.4, see also Table 2 for details). At each station there was at least one CTD cast down to the bottom.

The raw CTD (incl. Oxygen) data were post-processed following the standard procedure for the corresponding Seabird 911 system, which includes instrument failure data elimination, temperature-conductivity profiles alignment, corrections for pressure loops caused by ship movement. The resulting profiles were filtered with Gaussian 25-45 window filter and averaged in 1 dbar bins. If density inversions were still present residual data the bins were marked as “bad”. All erroneous data were then replaced by linearly interpolated values to obtain the final vertical profiles. After the CTD data were converted into engineering units a rosette summary was created for later calibration of the oxygen sensor recordings.

Table 2. CTD cast on Seine seamount, July 2004

number	actual date	Julian day at deployment	station cast number	Approx. deployment depth, m	deployment latitude (nmea), °N	deployment longitude (nmea), °W	deployment time, UTC
A	2-Jul	184	15430#2	475	36 50.23	017 19.44	19:03
B	3-Jul	185	15431#1	100	36 46.60	016 40.00	18:12
1	7-Jul	189	15432#1	450	33 48.25	014 40.32	16:17
2	7-Jul	189	15432#2	4025	33 48.32	014 39.63	18:10
3	8-Jul	190	15432#3	2000	33 48.48	014 39.97	01:47
4	8-Jul	190	15434#1	150	33 46.15	014 22.40	19:53
5	8-Jul	190	15434#2	---	33 46.14	014 22.53	21:11
6	9-Jul	191	15434#3	150	33 46.35	014 22.46	00:29
7	9-Jul	191	15436#1	1750	33 43.61	014 29.18	05:30
8	9-Jul	191	15437#1	4200	34 09.70	014 29.32	11:02
9	10-Jul	192	15439#1	450	34 15.01	013 59.95	03:00
10	10-Jul	192	15439#2	4060	34 15.06	013 59.98	05:07
11	10-Jul	192	15441#1	2000	34 14.98	013 59.92	17:52
12	11-Jul	193	15442#1	4437	34 49.83	013 50.20	00:05
13	11-Jul	193	15444#1	4000	33 19.83	014 20.15	17:04
14	12-Jul	194	15446#1	450	33 31.10	014 30.07	07:35
15	12-Jul	194	15446#2	4138	33 32.06	014 30.00	09:45
16	12-Jul	194	15446#3	2000	33 31.99	014 29.97	16:03
17	14-Jul	196	15448#1	450	33 45.04	014 03.02	02:11
18	14-Jul	196	15448#2	4100	33 45.07	014 02.92	04:34
19	14-Jul	196	15448#3	2000	33 45.02	014 02.79	11:30
20	14-Jul	196	15450#1	2000	33 49.86	014 17.91	19:00
21	15-Jul	197	15452#1	4046	33 48.00	014 50.00	00:25
22	15-Jul	197	15453#2	450	33 19.91	014 00.02	16:23
23	15-Jul	197	15453#3	4420	33 19.99	013 59.92	18:09
24	16-Jul	198	15454#4	2000	33 19.96	013 59.98	00:43
25	17-Jul	199	15458#1	2000	33 48.49	014 40.01	15:34

The vertical profiles showed vertical structure, typical for the region, most clearly pronounced in salinity (Fig. 5). The upper 700m can be identified as North Atlantic Central water (NACW) layer, forming the main thermocline in the area. From 700 to 1500m strong Mediterranean water (MW) influence is observed, as a local maximum in salinity (Figs 5 & 6), and temperature, and a minimum in oxygen. Modified Labrador sea waters (LSW) are found below. Stations 8 and 10 showed very strong MW influence, apparently associated with the presence of a MW eddy (see also Fig.7). The eddy has also higher density then the surrounding waters (Fig. 8), meaning that the MW lens is rotating anticyclonically. As a result of its influence, the salinity (and temperature) profiles above and below the eddy are shifted upwards. The density (and apparently current structure) over Seine SM during the period of observations was governed by the influence of the MW vortex (Fig. 8).

Comparison of the average over all the CTD profiles collected over Seine SM during the cruises in July 2003, November 2003 and July 2004 respectively, showed similar temperature-salinity and oxygen-salinity diagrams (cf. Fig. 6). In November 2003 and July 2004, the MW influence seems to be more pronounced in temperature and salinity, which can be related with sampling in MW vortexes. Oxygen absolute values for the 3 cruises are very different and the SBE sensors data needs to be inter-calibrated. In November 2003 and July 2004, in addition to CTD sampling, oxygen content was also studied by the Winkler method, which will allow inter-calibration.

On Fig.9 the salinity profiles at the same point (1, 2, 3, 25) are shown. The second one was made 2 hours later then the first, the third- 9 hours later and the forth- 10 days later, respectively. We see that during less then 12 hours the upper 400-500m layer changed its characteristics significantly to be comparable with the changes in between the stations, whereas in below 600m we observe very little change of water structure. In 10 days (casts 2 & 25) significant changes occur also below the main thermocline, at the MW level. Thus we can conclude, that time variability of the profiles is also quite substantial (Fig. 9) and one should be careful with an interpretation of the horizontal distribution maps (cf. Figs 7 & 8).

Sedlo seamount, CTD casts, preliminary results

A total of 26 CTD casts were made on Sedlo seamount (Fig.10, see also Table 3 for details). At each station there was at least one CTD cast down to the bottom. The standard CTD processing procedure, described in the previous paragraph was also applied here to obtain final profiles.

The prevailing vertical structure in the region can be best seen on the far-field vertical profiles, away from the direct influence of the seamount (Fig. 11). We find again the similar vertical distribution with NACW in the upper 600m layer, but MW is now less pronounced and occupies a thicker layer between 700 and 1400m. Sometimes it is separated in upper (700-1000m) and lower (1000-1400m) MW. LSW is found below. For the east and south stations (2, 9, 27, 21) the MW influence is stronger. The water structure on Sedlo is similar to what was found for the Seine SM, which can also be seen on TS, SO diagrams (Fig. 12). We find again that the oxygen content at July 2004 was higher then during the previous surveys (Fig. 13).

Horizontal temperature distribution for the upper 150m layer over Sedlo SM is shown on Fig. 14. It is well correlated with salinity and temperature horizontal distributions: warmer, more saline (and less dense) waters over the SM are contrasting with colder, less saline (and more dense) waters to the north-east. If compared with the sea surface temperature (SST) form NOAA satellite, we can see that the colder water is related to a branch of the North Atlantic drift, passing to the north of the seamount. A branch of it seems to turn south along the south-eastern summit of Sedlo. Thus, it is plausible, that Sedlo SM is lying close to the border of a northward propagation of the warm subtropical waters, typical for the Azores region in summer.

Table 3. CTD cast on Sedlo seamount, July 2004

number	actual date	Julian day at deployment	station cast number	Approx. deployment depth, m	deployment latitude (nmea), °N	deployment longitude (nmea), °W	deployment time, UTC
1	20-Jul	202	15461#1	450	39 57.86	026 25.21	23:45
2	21-Jul	203	15461#2	2751	39 57.98	026 25.08	01:40
3	21-Jul	203	15461#3	2000	39 58.15	026 25.04	07:12
4	22-Jul	204	15464#1	450	40 18.95	026 39.86	06:10
5	22-Jul	204	15464#2	770	40 18.96	026 14.15	08:11
6	22-Jul	204	15464#3	770	40 19.00	026 39.88	12:41
7	22-Jul	204	15466#1	1400	40 13.98	026 43.19	18:26
8	23-Jul	205	15468#1	2095	40 11.50	026 44.00	04:50
9	23-Jul	205	15470#2	2690	40 10.91	026 33.10	16:11
10	25-Jul	205	15471#2	1080	40 15.26	026 37.20	20:47
11	25-Jul	206	15471#3	1180	40 15.29	026 36.90	01:27
12	25-Jul	206	15472#1	1732	40 22.25	026 34.51	05:11
13	25-Jul	206	15473#1	2881	40 25.97	026 29.99	07:43
14	25-Jul	206	15474#1	1530	40 22.54	026 43.01	10:56
15	25-Jul	206	15475#1	2395	40 26.04	026 44.94	13:29
16	25-Jul	206	15476#1	2452	40 29.95	026 48.97	16:24
17	25-Jul	206	15477#1	1860	40 28.02	026 51.85	18:54
18	25-Jul	206	15478#1	720	40 23.97	026 54.56	21:12
19	25-Jul	206	15479#1	1221	40 21.02	026 56.58	22:30
20	25-Jul	207	15480#1	2101	40 15.01	026 58.48	00:26
21	25-Jul	207	15481#1	2721	40 35.96	026 39.05	05:02
22	25-Jul	207	15482#1	450	40 20.15	026 50.48	08:58
23	25-Jul	207	15482#2	1110	40 20.00	026 50.68	11:08
24	25-Jul	207	15483#1	1920	40 14.99	026 50.40	16:30
25	25-Jul	207	15484#1	2880	40 31.86	026 24.27	20:49
26	26-Jul	208	15485#1	2897	40 37.93	026 16.08	00:44

Water structure below the upper 300m layer (Figs 16 and 13) reflects the influence of the seamount, or, more precise, its south-eastern summit, where the observations were conducted. At about 500m, the summit is characterized by lower temperature, then the surrounding waters (cf. Fig. 16), whereas at around 1200m the slope waters around the summit are generally warmer, and are surrounded with a ring of colder waters (cf. Fig. 17). The waters in the direct vicinity of the SM, at and below 500m, have higher density, then those around, encircling, in turn, the summit with a low density ring (Fig. 18). It looks like a tong of high density waters is stretched to the SM from the south-east (cf. Fig. 18 & Fig. 19).

Current meters during OASIS deployments 2003-2004 registered anticyclonic circulation around the SE summit. At the moment it is not yet clear whether the water structure observed is related to vertical pumping of water along the slopes due to anticyclonic circulation around the mountain, or this was an influence of a seamount trapped MW lens, or formed by residual tidal currents.

It is important to note that time variability of the profiles at one point can be significant (Fig. 20). In the upper 100m layer the variability can be attributed to weather related variability of the seasonal thermocline, but below 300m the dominating semidiurnal tide is the most probable candidate. At the summit station the time variability is of the same order as the horizontal variability and the results on Figs 16-19 should be interpreted with care.

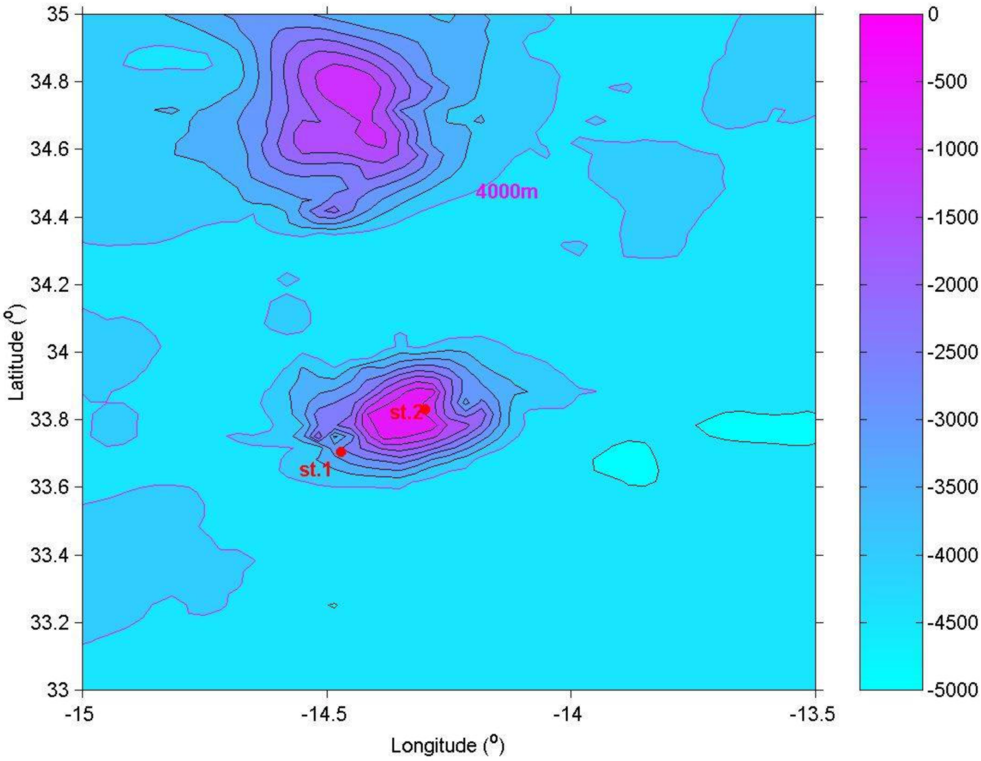

Fig. 1. Mooring positions on Seine 2003-2004

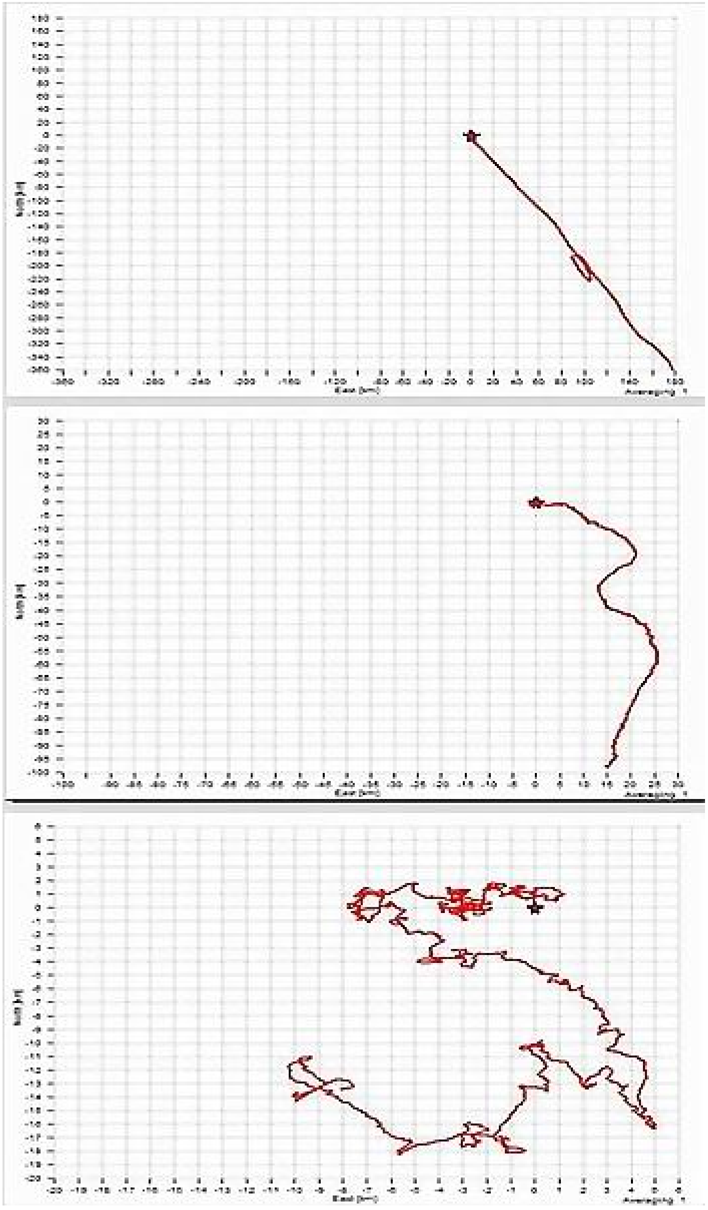

Fig. 2. Progressive vector diagrams for mooring 1, Seine, 2004. X-axis- east propagation, km, Y-axis- north propagation, km. Upper panel- 1160m, middle panel 1500m, lower panel 1533m. Please, pay attention that the scales on the graphs are different.

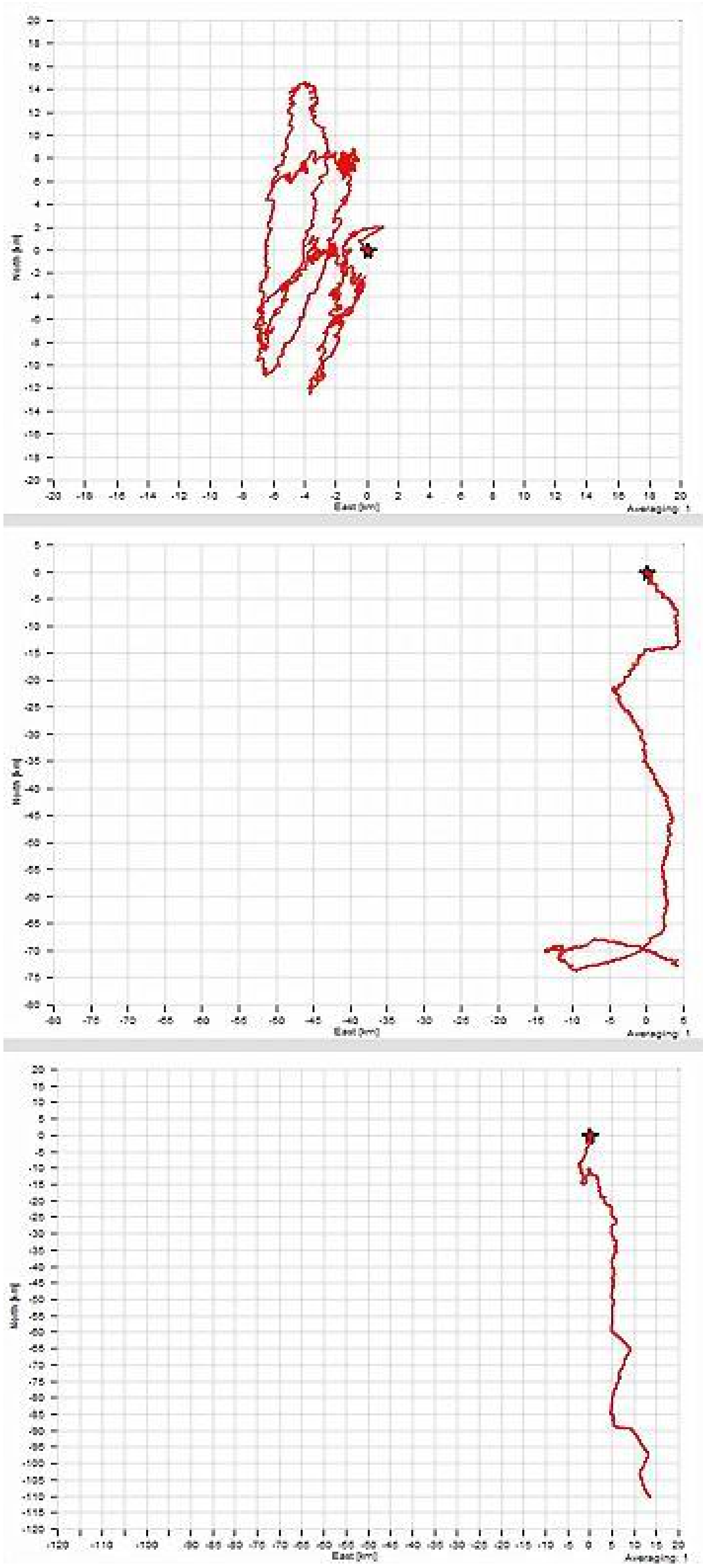

Fig. 3. Progressive vector diagrams for mooring 2, Seine, 2004. X-axis- east propagation, km, Y-axis- north propagation, km. Upper panel- 1190m, middle panel 1521m, lower panel 1566m. Please, pay attention that the scales on the graphs are different.

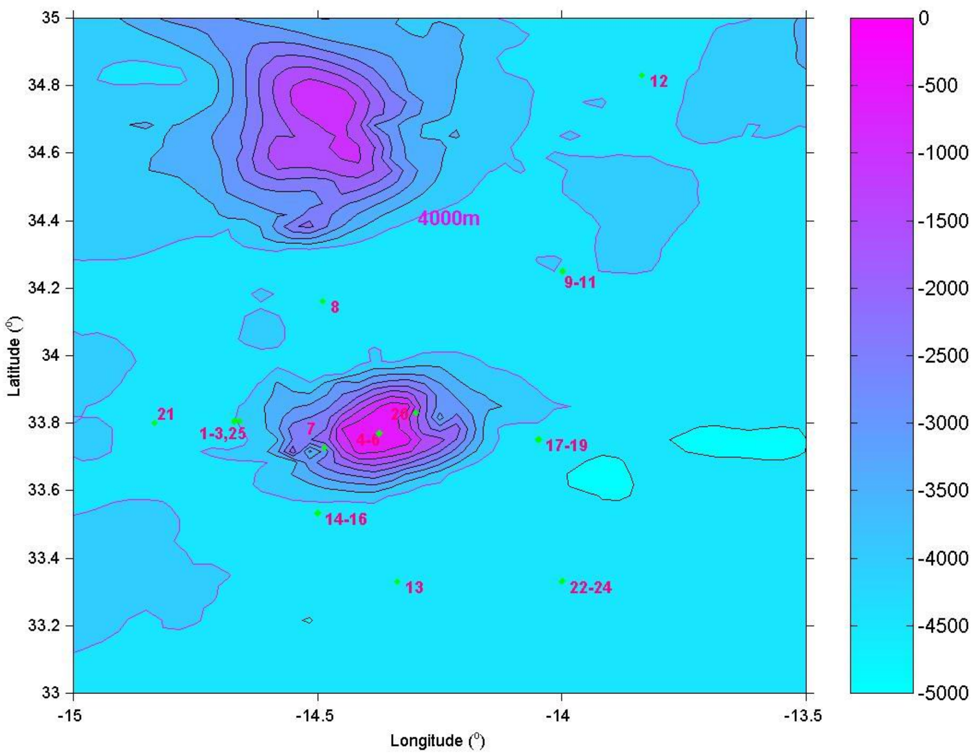

Fig. 4. Siene seamount bathymetry (m) with CTD stations positions in July 2004.

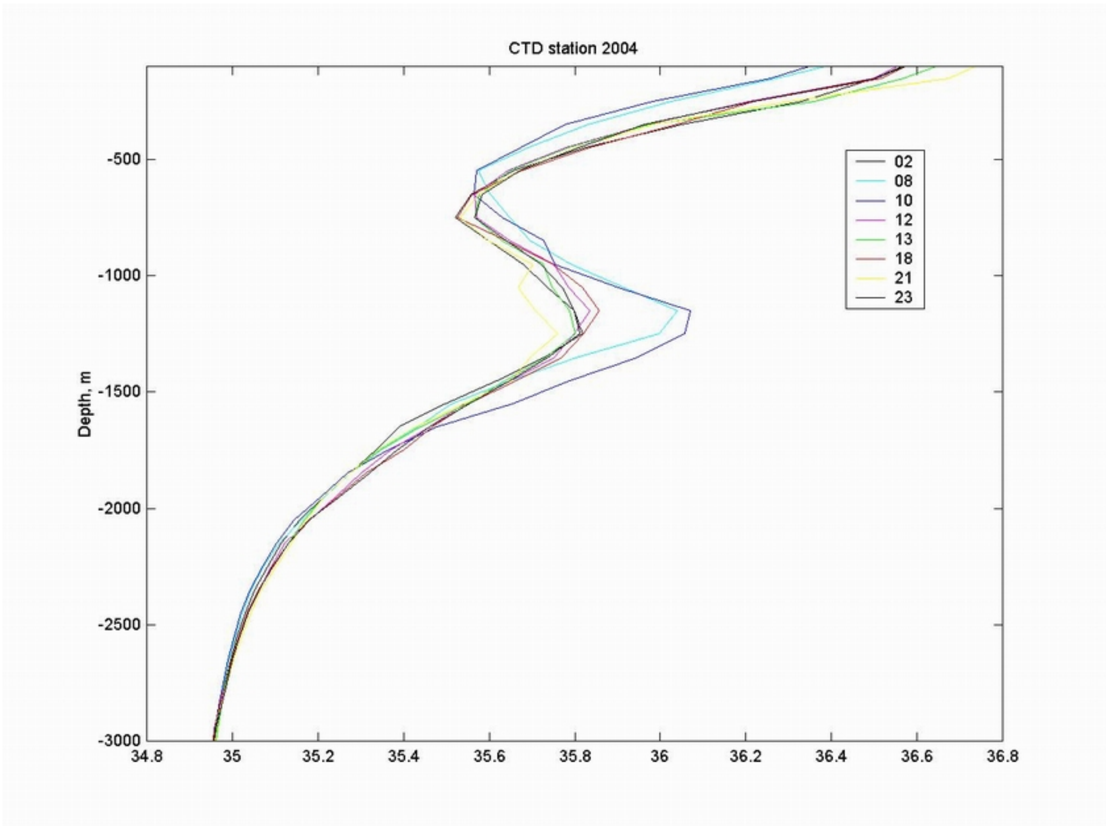

Fig 5. Salinity (psu) 100m averaged vertical profiles for deep casts over Seine SM, July 2004.

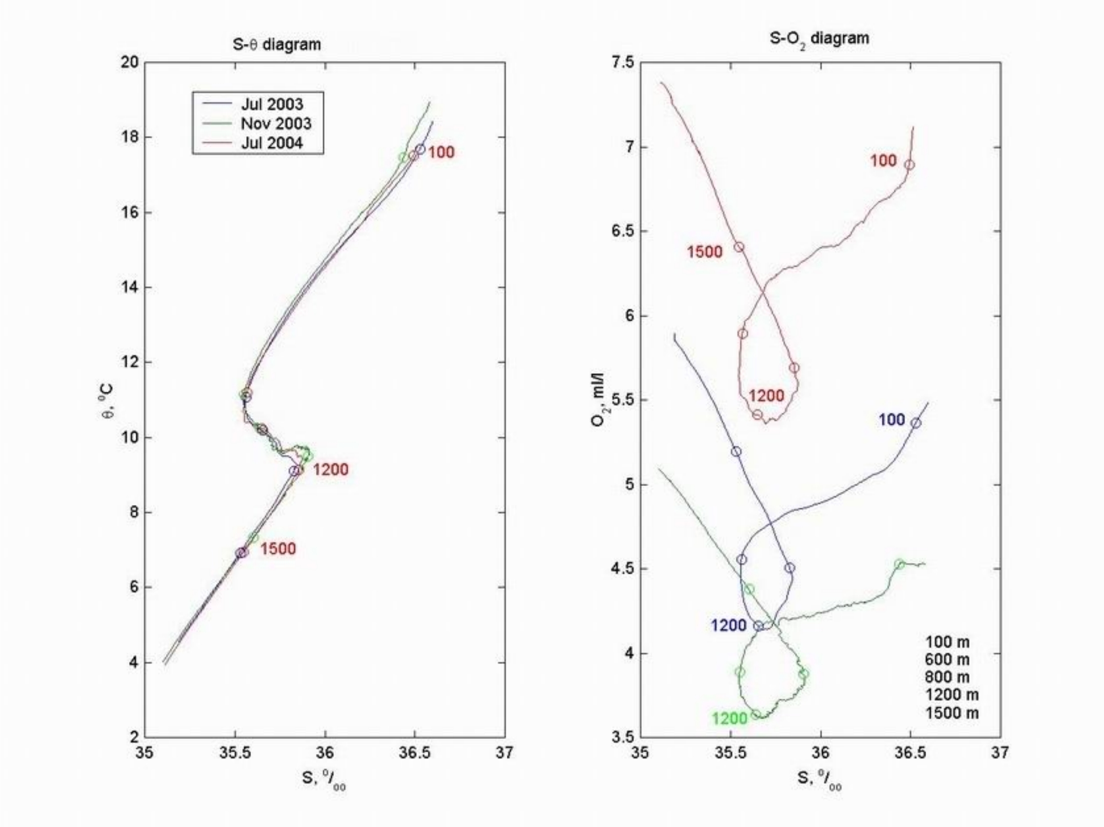

Fig 6. Left: salinity (psu) - potential temperature (°C) diagram. Right: salinity (psu)- oxygen (ml/l) diagram. Profiles are averaged over all CTD casts on Seine SM for July 2003, November 2003 and July 2004. The circles represent the depth marks for 100, 600, 800, 1200 and 1500m.

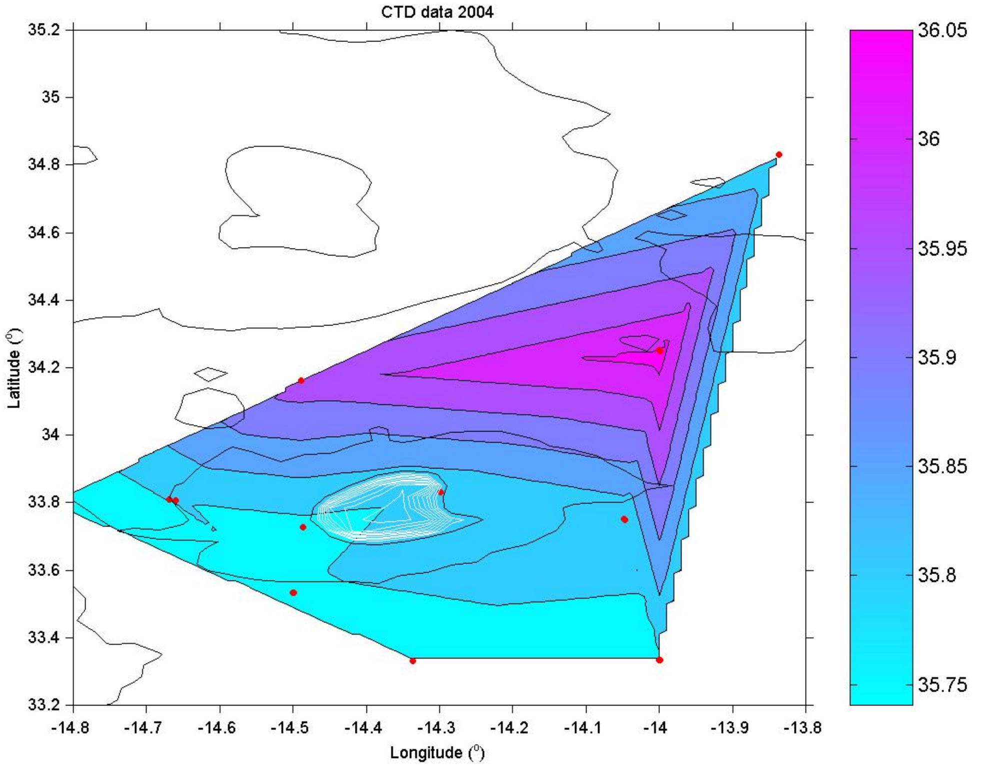

Fig. 7. Horizontal salinity (psu) distribution at 1200m depth. High salinity at station 10 marks a MW eddy.

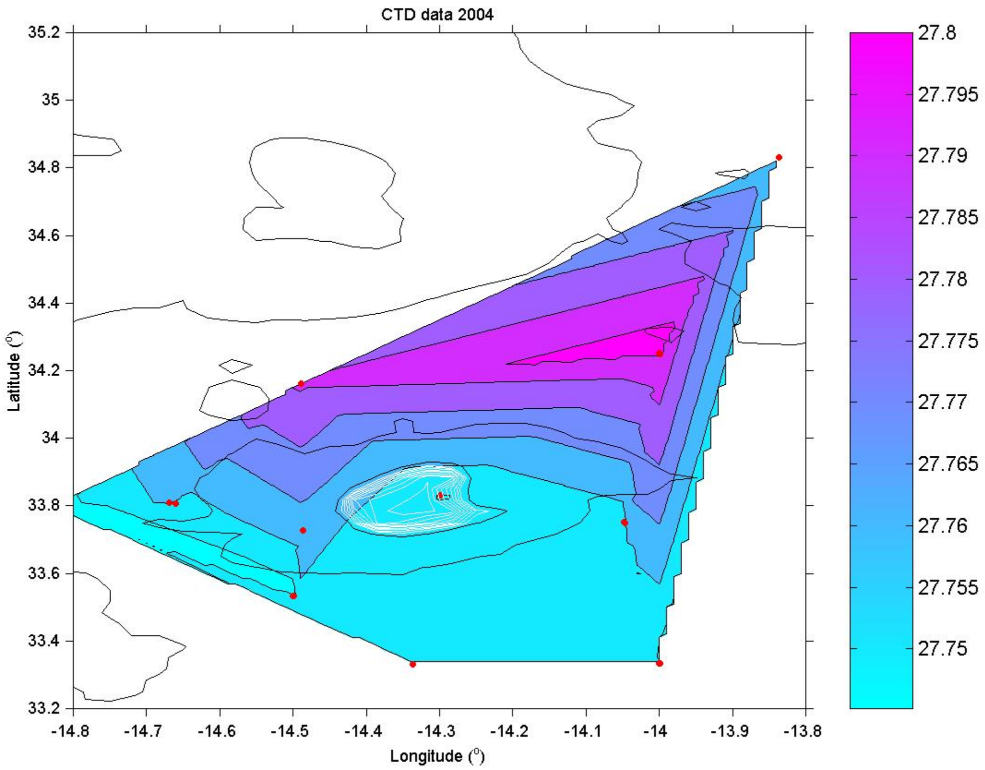

Fig. 8. Horizontal potential density (kg/m^3) distribution at 1200m depth. Station 10 has higher density.

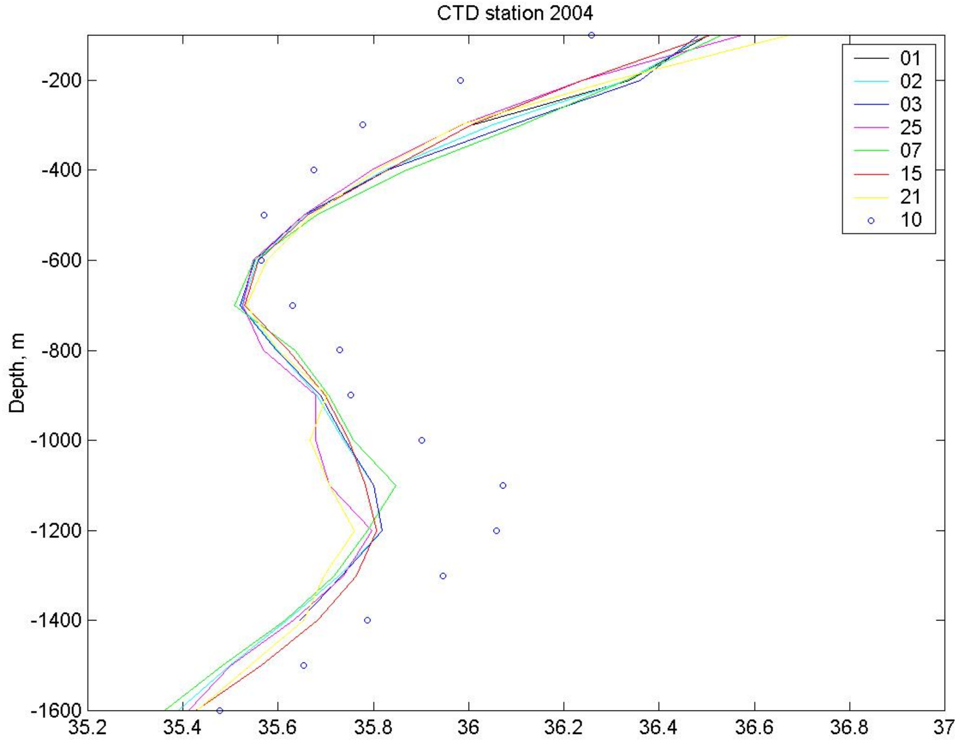

Fig 9. Salinity (psu) 100m averaged vertical profiles, 4 consequent casts in the point 33°48'N, 14°40'W: 01- 07 July 16:17, 02- 07July 18:10, 03- 08 July 01:47, 25- 17 July 15:34. For comparison the nearest stations 7, 15 and 21, as well as station 10 are also plotted.

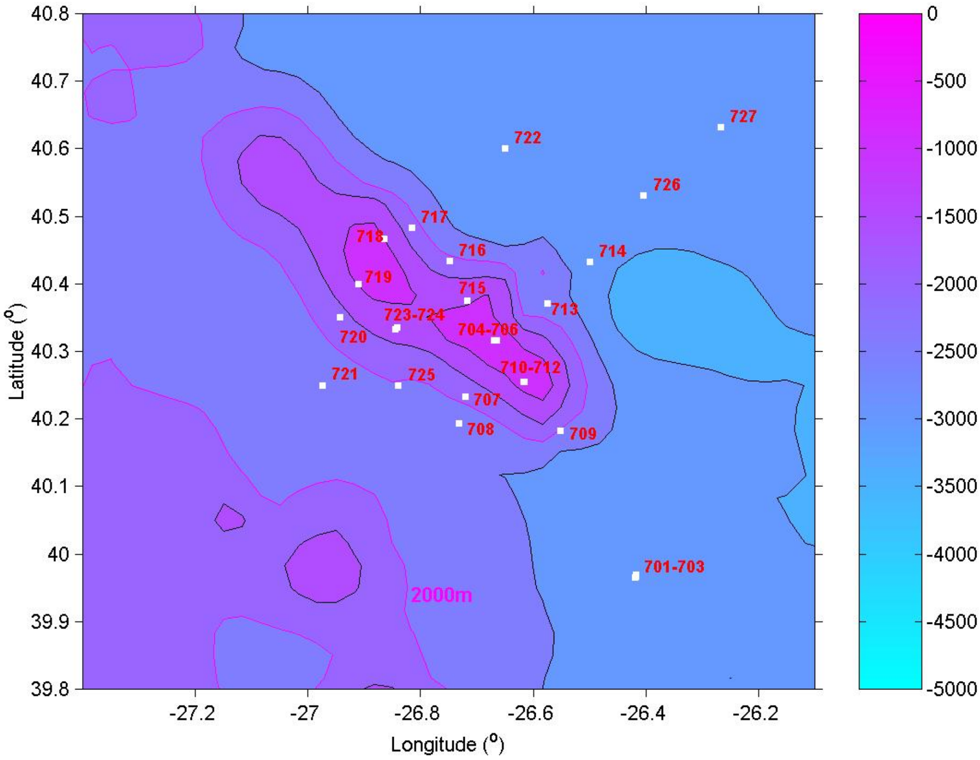

Fig. 10. Sedlo seamount bathymetry (m) with CTD stations positions in July 2004. The bathymetry from Etopo5 data set is quite approximate.

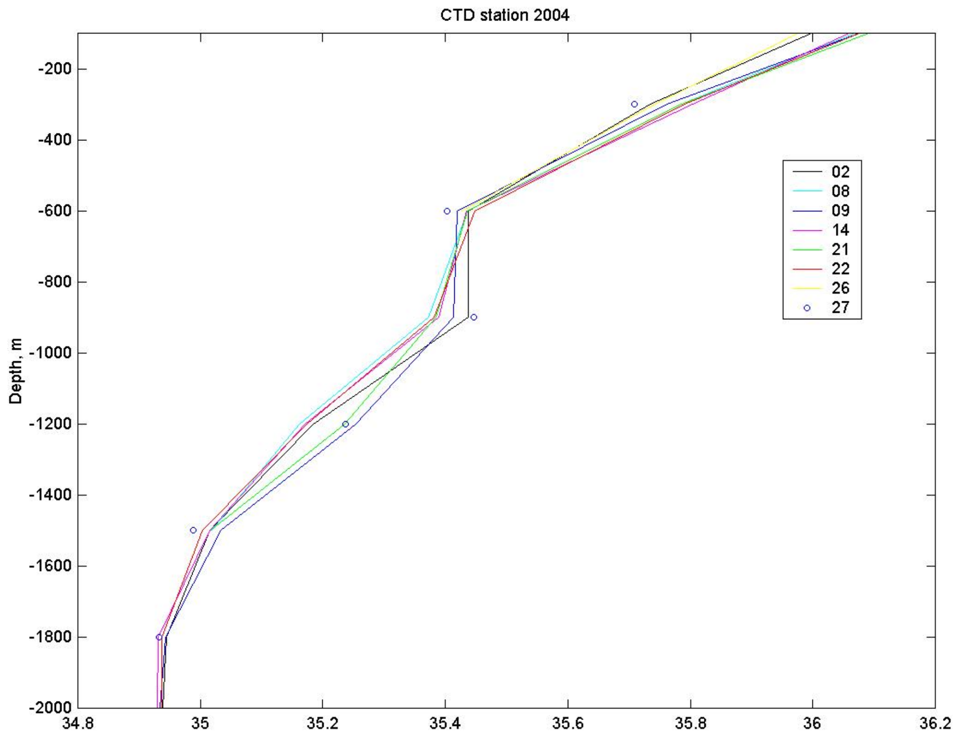

Fig. 11. Vertical profiles of salinity (psu) on the fare-field and near-slope stations at the Sedlo SM, July 2004, 300m vertical averages.

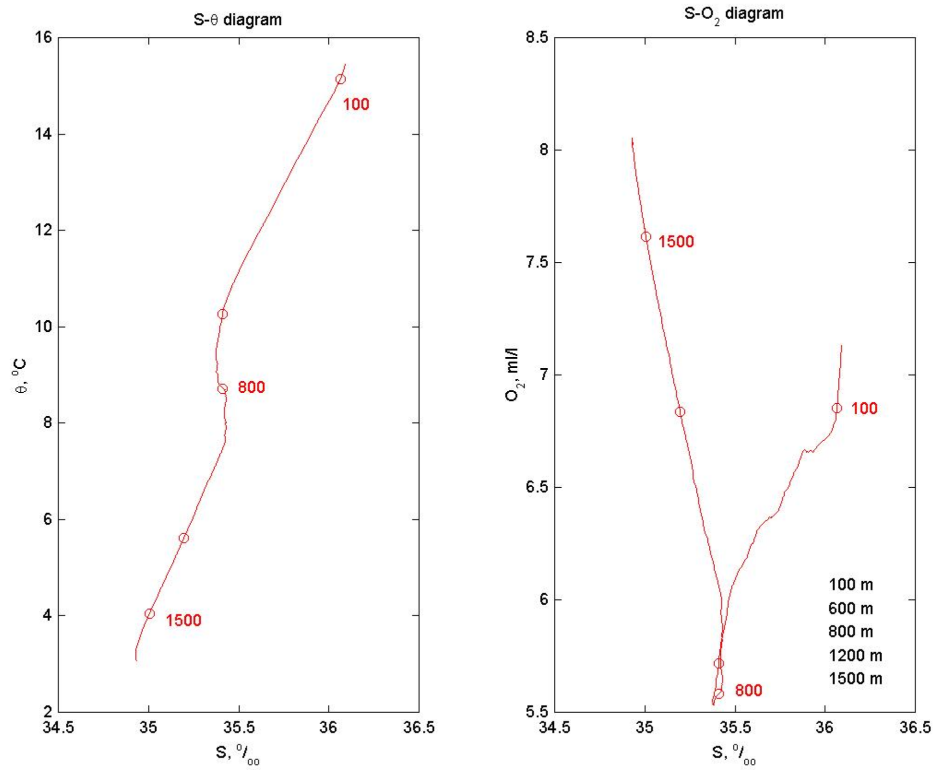

Fig. 12. Mean diagrams at Sedlo SM, July 2004. Left: potential temperature versus salinity (psu), right: oxygen (ml/l) versus salinity (psu).

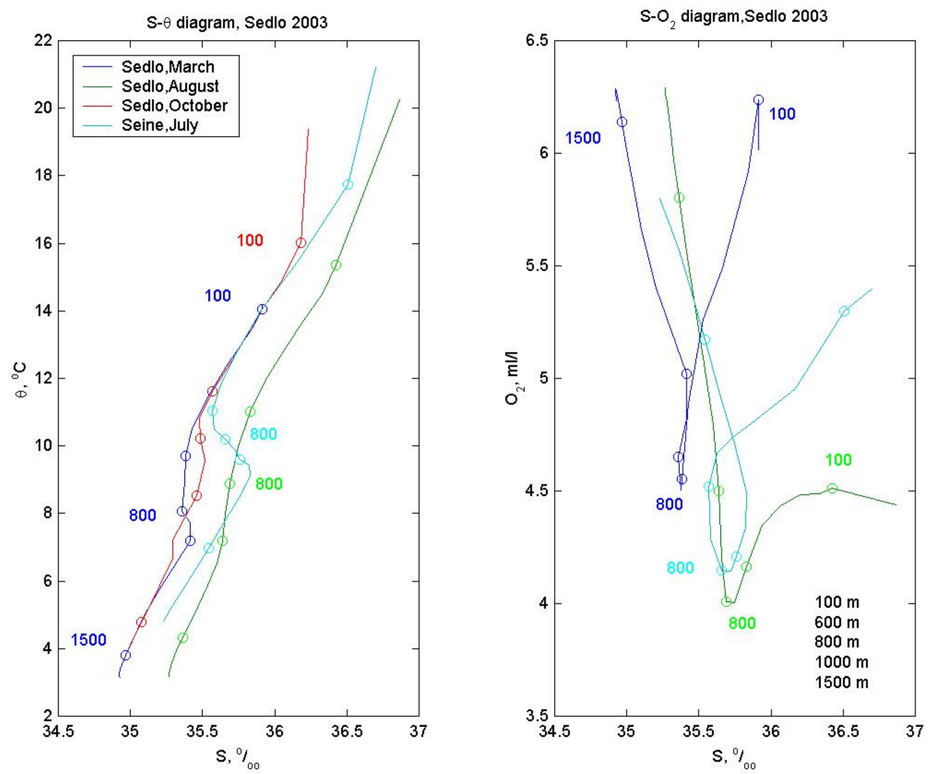

Fig. 13. Mean diagrams at Sedlo SM, March 2003, August 2003, October 2003 and Seine SM July 2003. Left: potential temperature versus salinity (psu), right: oxygen (ml/l) versus salinity (psu).

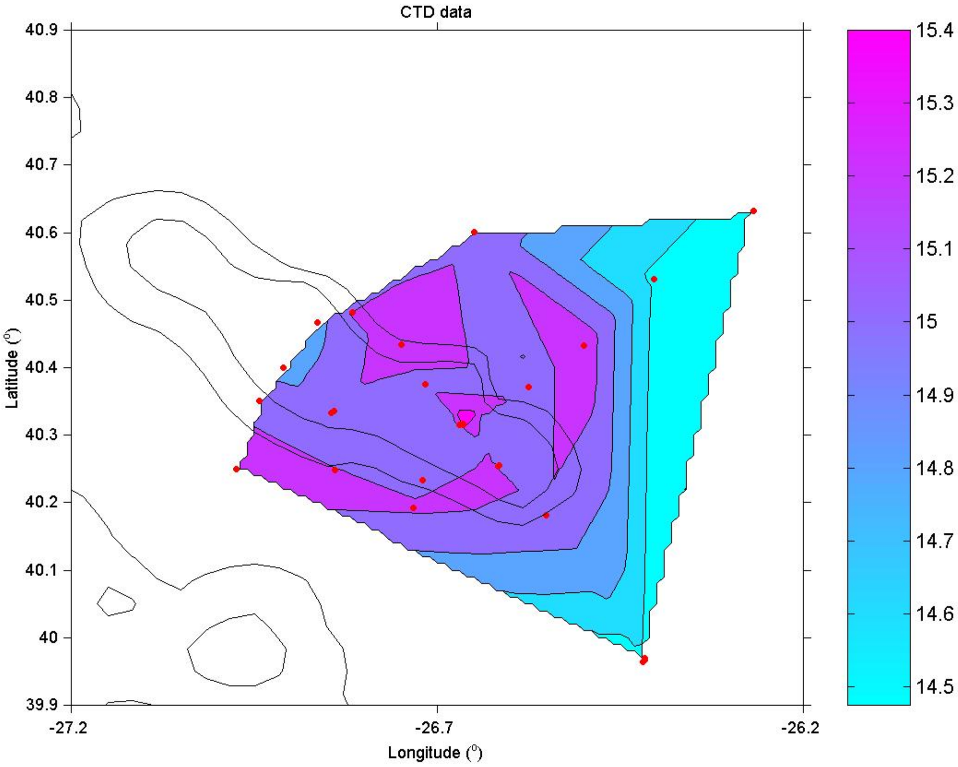

Fig. 14. Horizontal temperature distribution (^oC) upper 150m average layer over Sedlo SM, July 2004.

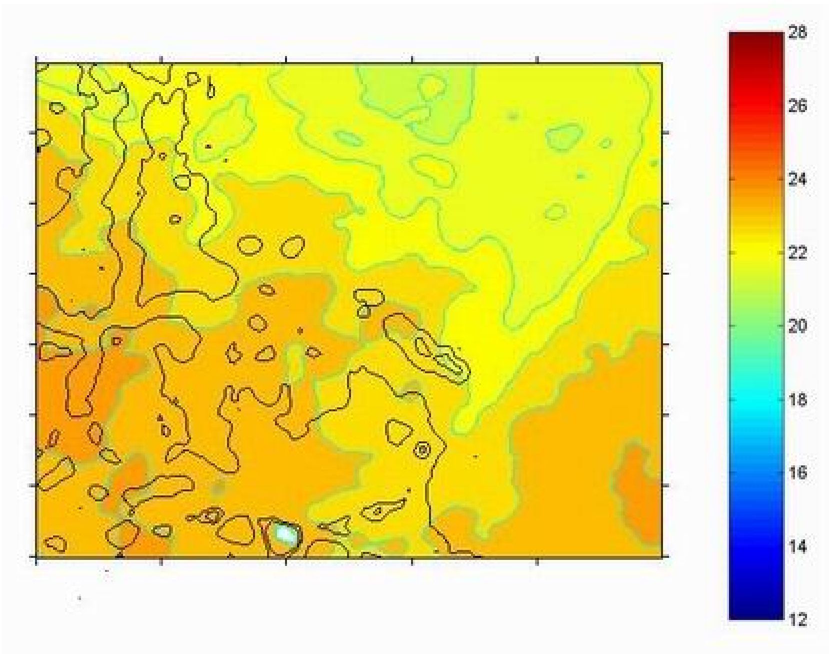

Fig. 15. Surface temperature (^oC) over Sedlo SM from NOAA satellite, average for August 2003.

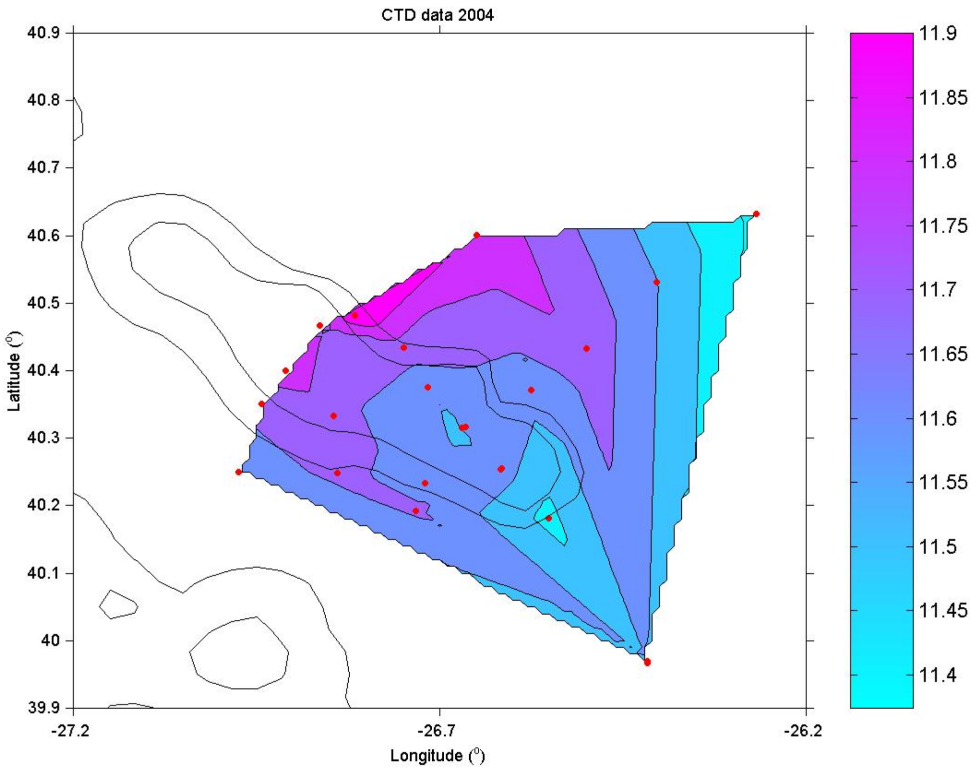

Fig. 16. Horizontal temperature distribution (°C) in 250-650m layer over Sedlo SM, July 2004.

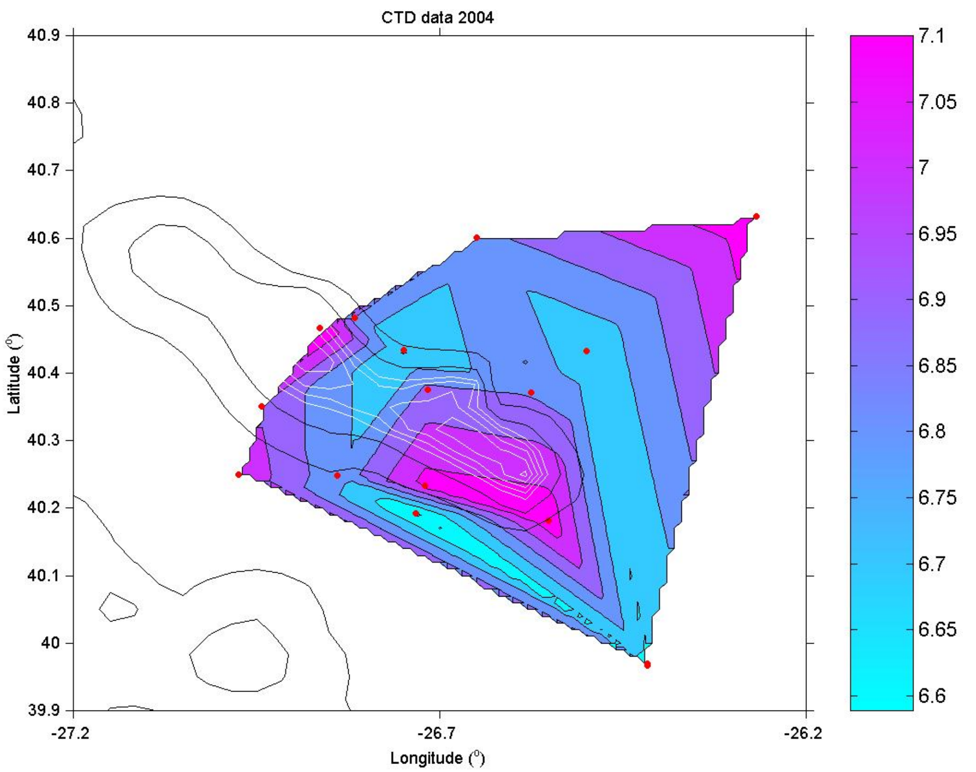

Fig. 17. Horizontal temperature distribution (°C) in 1050-1350m layer over Sedlo SM, July 2004.

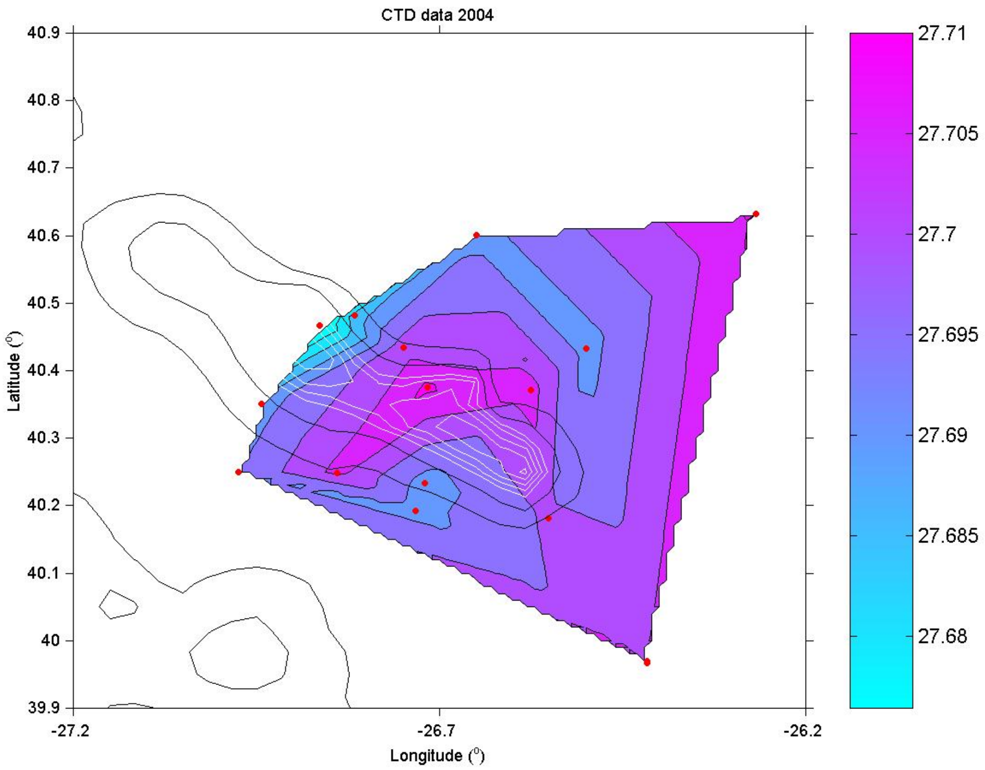

Fig. 18. Horizontal potential density distribution (kg/m^3) in 1050-1350m layer over Sedlo SM, July 2004.

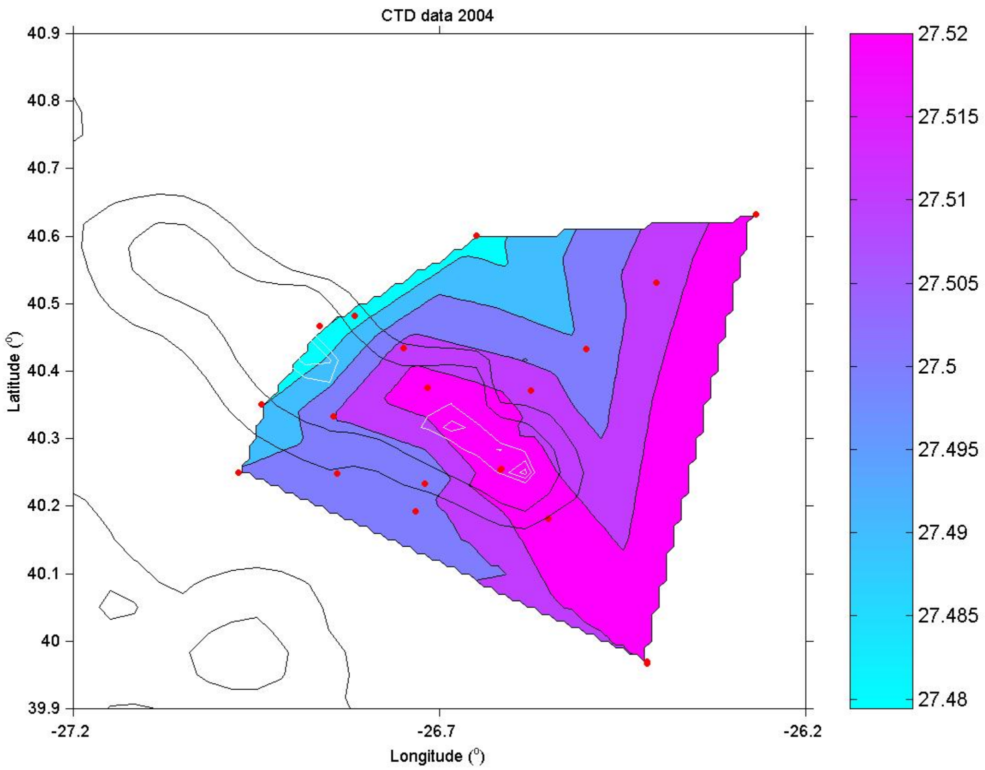

Fig. 19. Horizontal potential density distribution (kg/m^3) in 750-1050m layer over Sedlo SM, July 2004.

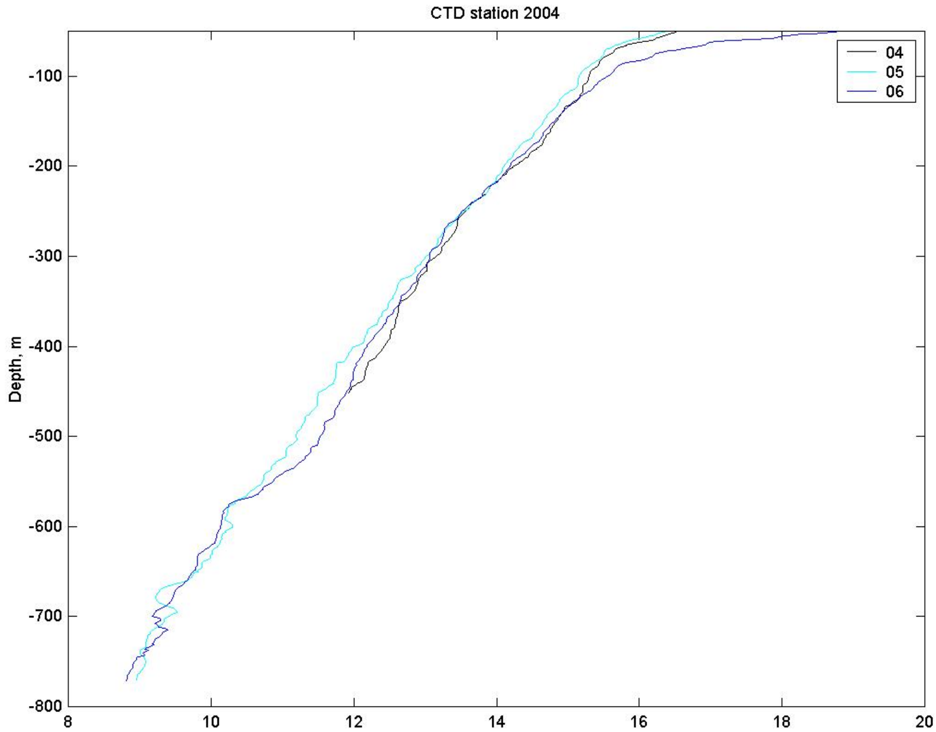

Fig. 20. Vertical profiles of salinity (psu) on the summit station: cast 4- 06:10, cast 5- 08:11, cast 6- 12:41. 22 July 2004 .

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8.6. Seabed observations

Seabed observations were undertaken with the SOC SHRIMP system, incorporating a conventional stills camera (loaded with Kodak Eastman Vision 250D colour negative film) and a colour video camera. Live video from the vehicle was recorded shipboard on DVDs (giving 2 hours duration per DVD). In total, approximately 50 hours of seabed video were recorded and some 4,500 still frames exposed.

Station	Site	Stills	Video	Seabed operation
15443#1	Seine - summit	c. 40m film run	DVD #001,2,3,4	05:48
15445#1	Seine – W flank	(with 15454#1)	DVD #005	00:14
15454#1	Seine – N flank	c. 40m film run	DVD #006,7,8,9,10	10:42
15460#1	Seine – N flank	c. 40m film run	DVD #011,12,13,14	07:41
15462#1	Sedlo – S saddle	c. 40m film run	DVD #015,16,17,18	07:22
15463#1	Sedlo – S flank	c. 40m film run	DVD #019,20	03:46

SHRIMP tow tracks are plots on Charts 7 and 8. Figures 12-14 below illustrate bathymetric profiles obtained by the 10 kHz echosounder during the SHRIMP tows.

In conjunction with video and stills footage from the SOC WASP system obtained during FS *Meteor* cruise 60/1 (Nov-Dec 2004) these images will be used to assess the seabed environment and its fauna. “Highlights” noted during the present cruise include:

- Dense fish layer over Seine summit – observed during SHRIMP descent and readily visible on 10 kHz echo sounder display.
- Abandoned / lost trawl net on Seine summit.
- Abundant massive sponge growth on Seine summit edge and upper-most flank.
- Both seamounts have highly variable terrain on the flanks from sedimented areas to overhanging exposed bedrock.
- The sedimented areas on both seamount flanks show strong ripples marks and other features (comet marks, sand shadows and gravel streaks) indicative of strong bottom current flows.
- On both seamounts the sessile megabenthos (chiefly gorgonians / octocoral and sponges) on the flanks are highly localised in their distribution, often aggregated along rock edges / ridges.

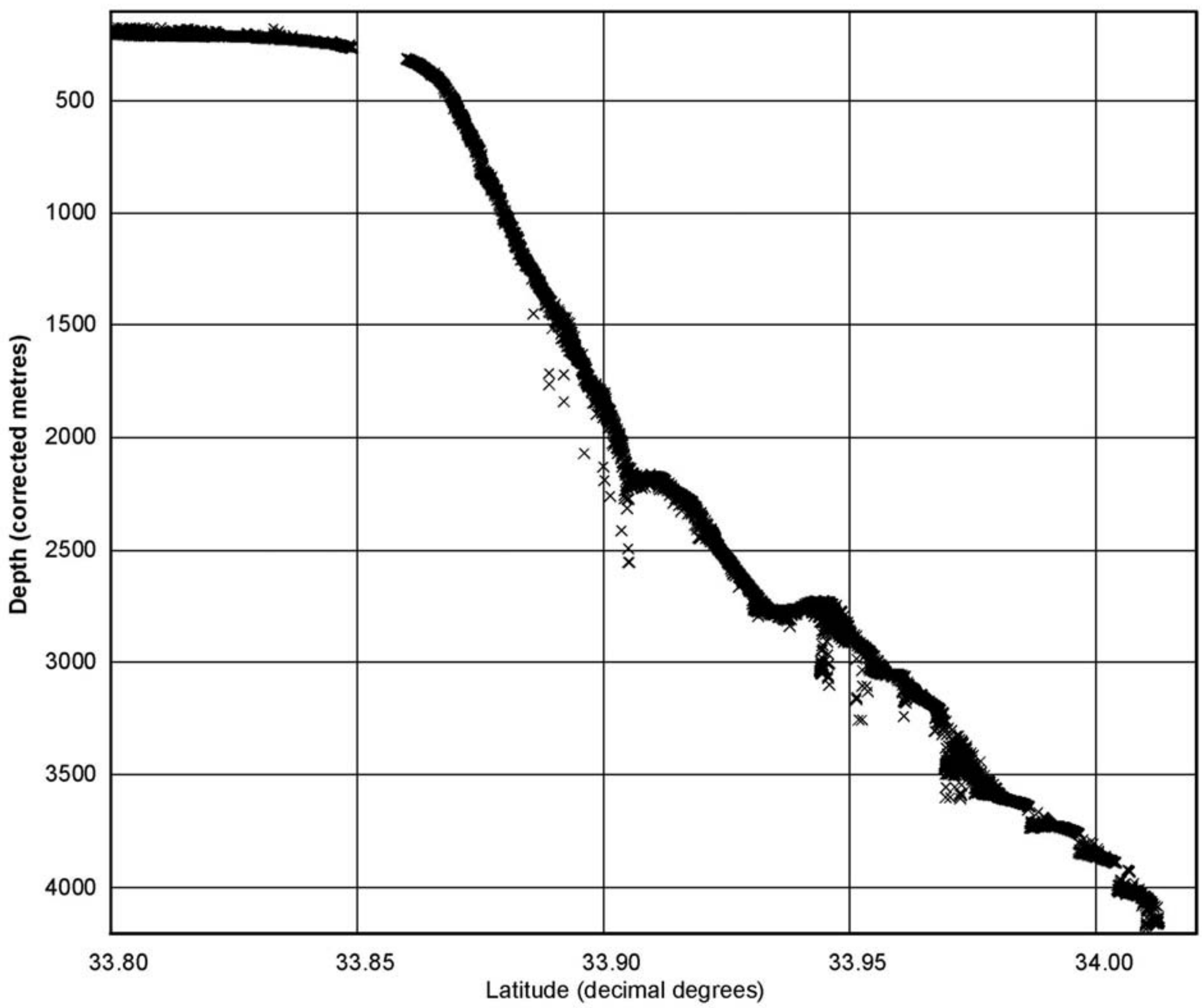

Figure 12. Echo-sounder profile obtained during SHRIMP stations 15443#1, 54#1 and 60#1 on the northern summit and flank of Seine Seamount.

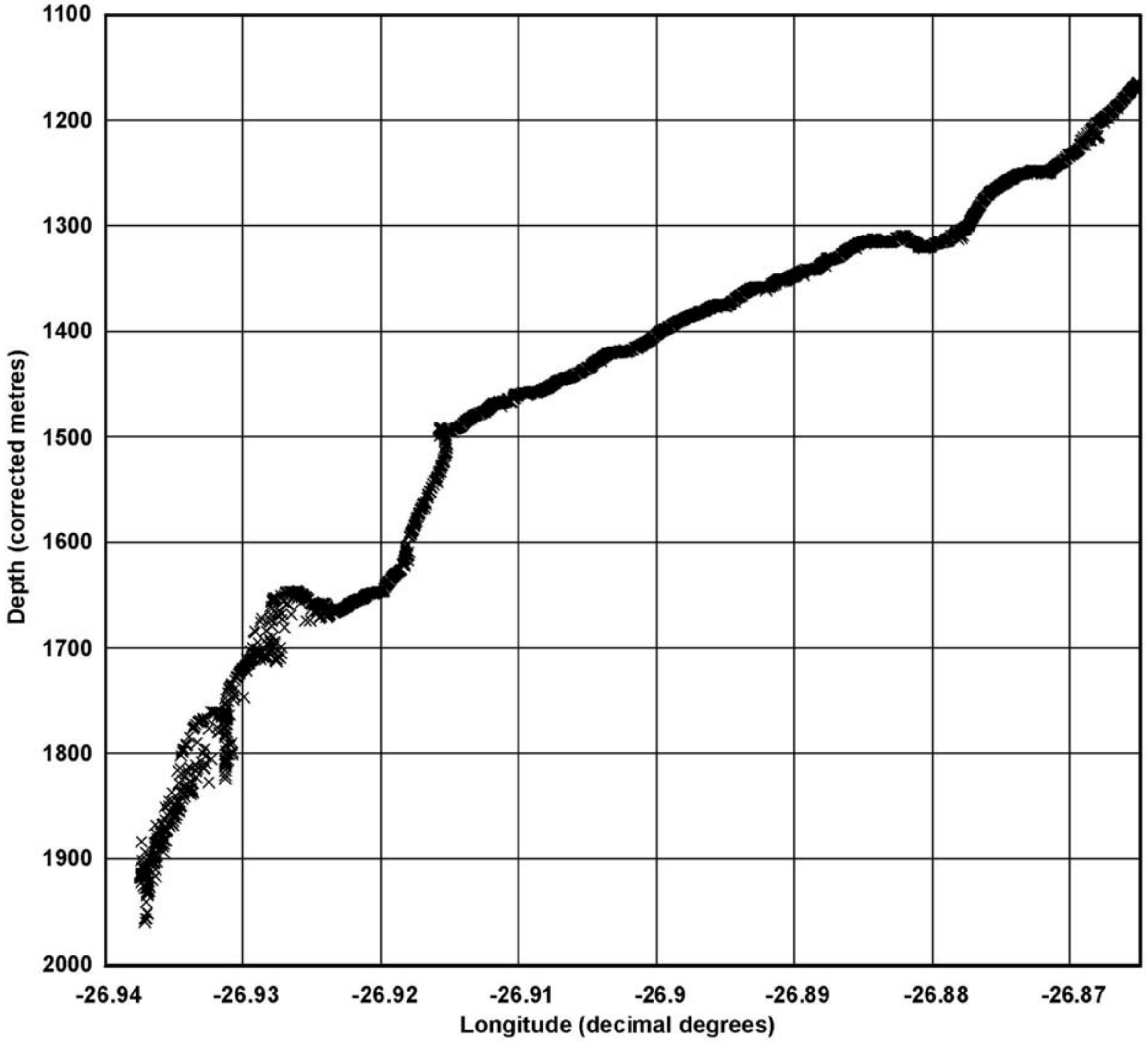

Figure 13. Echo-sounder profile obtained during SHRIMP station 15462#1 in the "saddle" area of Sedlo Seamount.

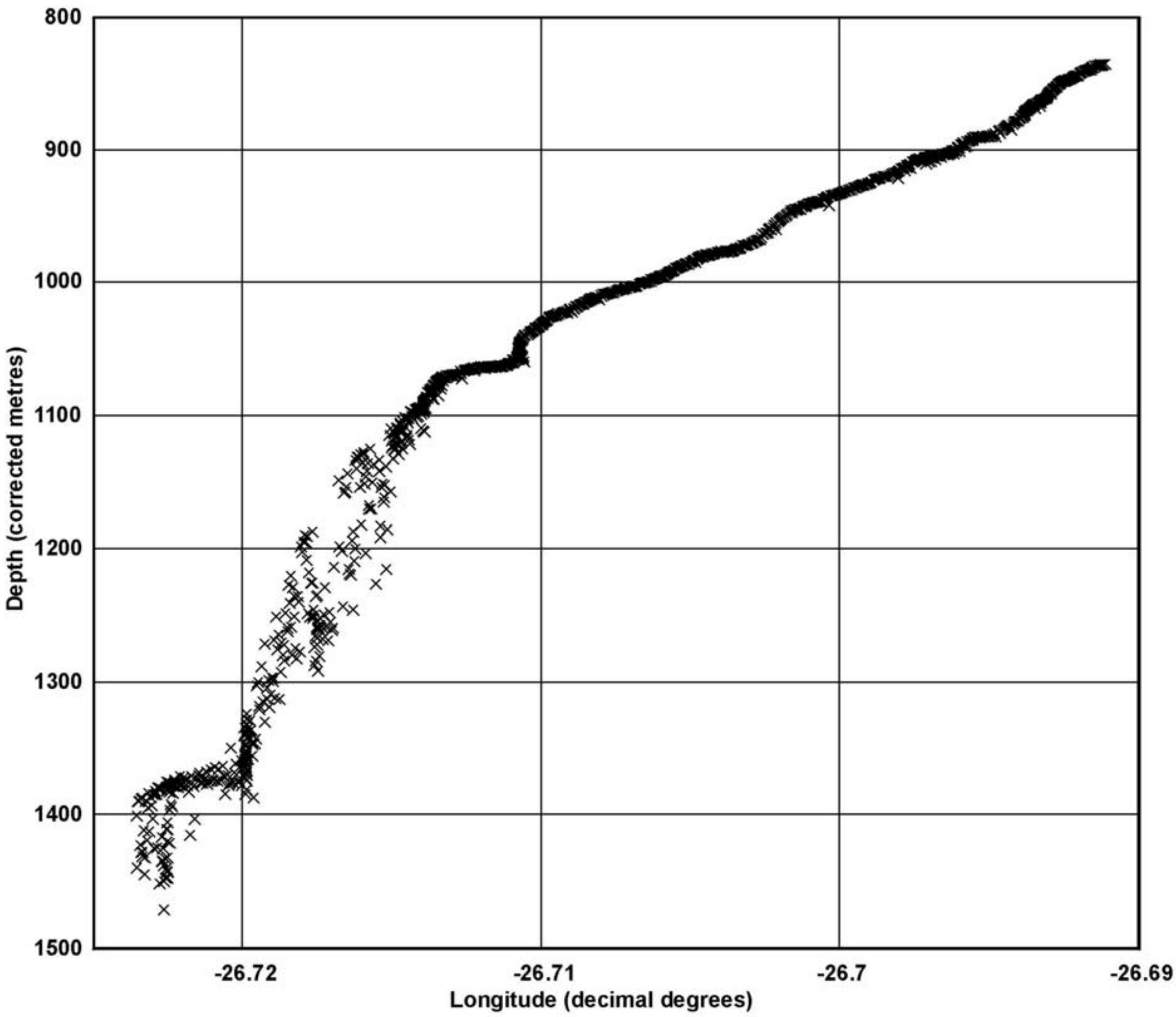

Figure 14. Echo-sounder profile obtained during SHRIMP station 15463#1 on the southern flank of the southern summit of Sedlo Seamount.

Brian Bett

9. CAPTAIN'S LOG

Date	Time	Date	Time		Indicator	dd hh:mm	hours
30/06	09:00	06/07	05:23	Trial time for Direct Coring wire; Vigo - Trials - Madeira - workarea - Emergency drill 301615-1645	D(R)	5 20:23	140.38
06/07	05:23	06/07	10:57	Recover mooring from 33-41.9N 14-28.4W	M(R)	0 05:34	5.57
06/07	10:57	07/07	14:10	Deviation to Funchal to land casualty (RSU deck rating) following accident on board	D(O)	1 03:13	27.22
07/07	14:10	07/07	14:23	Interrogate and check second mooring position	R	0 00:13	0.22
07/07	14:23	07/07	16:11	Reposition to Station F	R	0 01:48	1.8
07/07	16:11	07/07	16:57	CTD in 33-48.3N 14-40.3W - 450m	CTD	0 00:46	0.77
07/07	16:57	07/07	18:15	Waiting - process CTD	R	0 01:18	1.3
07/07	18:15	08/07	00:01	CTD & SAPS in 33-48.3N 14-39.6W - 4018m	CTD	0 05:46	5.77
08/07	00:01	08/07	01:43	Waiting - process CTD	R	0 01:42	1.7
08/07	01:43	08/07	04:17	CTD in 33-48.5N 14-40.0W - 1361m	CTD	0 02:34	2.57
08/07	04:17	08/07	07:15	Investigating problem with CTD	D(U)	0 02:58	2.97
08/07	07:15	08/07	16:43	PES survey of Seine Seamount	Surv	0 09:28	9.47
08/07	16:43	08/07	17:45	Waiting - preparing MocNess trawl	R	0 01:02	1.03
08/07	17:45	08/07	19:18	MOCNESS trawl deployed in 33-44.4N 14-24.5W	MOC	0 01:33	1.55
08/07	19:18	08/07	19:55	Waiting - process catch - reposition	R	0 00:37	0.62
08/07	19:55	08/07	20:25	CTD in 33-46.2N 14-22.4W - 450m	CTD	0 00:30	0.5
08/07	20:25	08/07	21:15	Waiting - process CTD	R	0 00:50	0.83
08/07	21:15	09/07	00:04	CTD & SAPS in 33-46.1N 14-22.5W - 4000m	CTD	0 02:49	2.82
09/07	00:04	09/07	00:32	Waiting - process CTD	R	0 00:28	0.47
09/07	00:32	09/07	01:08	CTD in 33-46.2N 14-22.9W - 2000m	CTD	0 00:36	0.6
09/07	01:08	09/07	03:00	Waiting - process CTD - reposition	R	0 01:52	1.87
09/07	03:00	09/07	04:08	MOCNESS trawl deployed in 33-43.7N 14-22.9W	MOC	0 01:08	1.13
09/07	04:08	09/07	05:33	Waiting - process catch - reposition	R	0 01:25	1.42
09/07	05:33	09/07	07:05	CTD in 33-43.6N 14-29.2W - 1748m	CTD	0 01:32	1.53
09/07	07:05	09/07	11:10	Waiting - process CTD - reposition	R	0 04:05	4.08
09/07	11:10	09/07	14:05	CTD in 34-09.6N 14-29.2W - 4261m	CTD	0 02:55	2.92
09/07	14:05	09/07	16:57	Waiting - process CTD - reposition - Emergency drill 1615-1645	R	0 02:52	2.87
09/07	16:57	10/07	01:30	MOCNESS trawl deployed in 34-09.0N 14-05.6W	MOC	0 08:33	8.55
10/07	01:30	10/07	03:02	Waiting - process MOCNESS - reposition	R	0 01:32	1.53
10/07	03:02	10/07	04:04	CTD in 34-15.0N 14-00.0W - 450m	CTD	0 01:02	1.03
10/07	04:04	10/07	05:10	Waiting - process CTD	R	0 01:06	1.1
10/07	05:10	10/07	10:48	CTD & SAPS in 34-15.0N 14-00.0W - 4060m	CTD	0 05:38	5.63
10/07	10:48	10/07	12:22	Waiting - process CTD - reposition	R	0 01:34	1.57
10/07	12:22	10/07	16:15	MOCNESS trawl deployed in 34-12.6N 14-01.8W	MOC	0 03:53	3.88
10/07	16:15	10/07	17:10	Waiting - process MOCNESS - reposition	R	0 00:55	0.92
10/07	17:10	10/07	17:52	Problem with CTD & Clam system	D(R)	0 00:42	0.7
10/07	17:52	10/07	19:48	CTD in 34-15.0N 13-59.9W 2000m	CTD	0 01:56	1.93
10/07	19:48	11/07	00:05	Waiting - process CTD - reposition	R	0 04:17	4.28
11/07	00:05	11/07	02:58	CTD in 33-49.9N 13-50.1W - 2000m	CTD	0 02:53	2.88
11/07	02:58	11/07	06:44	Waiting - process CTD - reposition - USBL deployed	R	0 03:46	3.77
11/07	06:44	11/07	13:09	SHRIMP in 33-47.9N 14-22.0W	Shrimp	0 06:25	6.42
11/07	13:09	11/07	17:09	Waiting - USBL recovered - reposition	R	0 04:00	4
11/07	17:09	11/07	19:43	CTD in 33-19.8N 14-20.1W - 4000m	CTD	0 02:34	2.57
11/07	19:43	11/07	23:58	Waiting - process CTD - reposition - deploy USBL	R	0 04:15	4.25
11/07	23:58	12/07	01:46	SHRIMP in 33-45.8N 14-28.1W - recovered early due to problem - 1247m	D(U)	0 01:48	1.8
12/07	01:46	12/07	02:24	Waiting - USBL recovered - investigate problem	R	0 00:38	0.63
12/07	02:24	12/07	06:55	PES survey of Seine Seamount	Surv	0 04:31	4.52
12/07	06:55	12/07	07:37	Waiting - prepare CTD	R	0 00:42	0.7
12/07	07:37	12/07	15:19	CTD & SAPS in 33-32.0N 14-30.1W - 4138m	CTD	0 07:42	7.7
12/07	15:19	12/07	16:04	Process CTD	R	0 00:45	0.75
12/07	16:04	12/07	17:48	CTD in 33-32.0N 14-30.0W - 2000m	CTD	0 01:44	1.73
12/07	17:48	12/07	18:45	Waiting - process CTD - reposition	R	0 00:57	0.95
12/07	18:45	12/07	20:48	Reposition - USBL deployed - prepare SHRIMP	R	0 02:03	2.05

12/07	20:48	12/07	21:41	SHRIMP in 33-46.0N 14-28.5W - recovered early due to problem - 214m	D(U)	0 00:53	0.88
12/07	21:41	12/07	22:38	Investigate problem - recover USBL - secure	R	0 00:57	0.95
12/07	22:38	14/07	02:03	Deviation to Funchal to land scientist for compassionate repatriation	D(O)	1 03:25	27.42
14/07	02:03	14/07	02:41	PES out - prepare CTD	R	0 00:38	0.63
14/07	02:41	14/07	03:42	CTD in 33-45.0N 14-03.0W - 450m	CTD	0 01:01	1.02
14/07	03:42	14/07	04:40	Waiting - process CTD	R	0 00:58	0.97
14/07	04:40	14/07	10:42	CTD & SAPS in 33-45.1N 14-02.9W - 4430m	CTD	0 06:02	6.03
14/07	10:42	14/07	11:33	Waiting - process CTD	R	0 00:51	0.85
14/07	11:33	14/07	13:20	CTD in 33-45.0N 14-03.0W - 2000m	CTD	0 01:47	1.78
14/07	13:20	14/07	14:50	Reposition for mooring recovery	R	0 01:30	1.5
14/07	14:50	14/07	16:30	Recover mooring from 33-49.8N 14-18.0W	M(R)	0 01:40	1.67
14/07	16:30	14/07	17:11	Reposition - deploy USBL - prepare SHRIMP	R	0 00:41	0.68
14/07	17:11	14/07	17:45	SHRIMP in 33-51.6N 14-20.4W - recovered early due to problem - 314m	D(U)	0 00:34	0.57
14/07	17:45	14/07	19:01	Waiting - recover USBL - reposition	R	0 01:16	1.27
14/07	19:01	14/07	20:14	CTD in 33-49.9N 14-17.9W - 1600m	CTD	0 01:13	1.22
14/07	20:14	14/07	20:58	Reposition - deploy USBL - prepare SHRIMP	R	0 00:44	0.73
14/07	20:58	14/07	21:30	SHRIMP in 33-51.5N 14-20.4W - recovered early due to problem - 250m	D(U)	0 00:32	0.53
14/07	21:30	15/07	00:29	Waiting - recover USBL - reposition	R	0 02:59	2.98
15/07	00:29	15/07	03:04	CTD in 33-48.0N 14-50.1W - 4043m	CTD	0 02:35	2.58
15/07	03:04	15/07	07:48	Process CTD - reposition	R	0 04:44	4.73
15/07	07:48	15/07	16:27	CTD jumped off Traction drum then wire parted during load test due to abrasion at spurling pipe box	D(R)	0 08:39	8.65
15/07	16:27	15/07	17:09	CTD in 33-19.9N 14-00.0W - 450m	CTD	0 00:42	0.7
15/07	17:09	15/07	18:10	Process CTD - waiting	R	0 01:01	1.02
15/07	18:10	16/07	00:13	CTD in 33-20.0N 14-00.0W - 4421m	CTD	0 06:03	6.05
16/07	00:13	16/07	00:50	Process CTD - waiting	R	0 00:37	0.62
16/07	00:50	16/07	02:42	CTD in 33-20.0N 14-00.0W - 2000m	CTD	0 01:52	1.87
16/07	02:42	16/07	08:05	Process CTD - reposition - deploy USBL - prepare SHRIMP	R	0 05:23	5.38
16/07	08:05	16/07	20:05	SHRIMP in 33-51.5N 14-20.3W - 2944m	Shrimp	0 12:00	12
16/07	20:05	16/07	23:05	Recover USBL - reposition - prepare MOCNESS	R	0 03:00	3
16/07	23:05	17/07	02:01	MOCNESS trawl deployed in 34-12.1N 14-01.2W	MOC	0 02:56	2.93
17/07	02:01	17/07	07:03	Process MOCNESS - reposition - prepare MOCNESS	R	0 05:02	5.03
17/07	07:03	17/07	10:25	MOCNESS trawl deployed in 33-43.3N 14-31.1W	MOC	0 03:22	3.37
17/07	10:25	17/07	12:39	Process MOCNESS - reposition	R	0 02:14	2.23
17/07	12:39	17/07	13:43	MOCNESS trawl deployed in 33-44.0N 14-22.5W	MOC	0 01:04	1.07
17/07	13:43	17/07	15:43	Process MOCNESS - reposition - prepare CTD	R	0 02:00	2
17/07	15:43	17/07	17:25	CTD in 33-48.3N 14-40.0W - 2000m	CTD	0 01:42	1.7
17/07	17:25	17/07	20:14	Process CTD - reposition - prepare MOCNESS	R	0 02:49	2.82
17/07	20:14	17/07	23:15	MOCNESS trawl deployed in 33-43.3N 14-29.6W - 1741m	MOC	0 03:01	3.02
17/07	23:15	18/07	02:41	Process MOCNESS - reposition - deploy USBL - prepare SHRIMP	R	0 03:26	3.43
18/07	02:41	18/07	13:21	SHRIMP in 33-56.5N 14-21.0W - 4131m	Shrimp	0 10:40	10.67
18/07	13:21	20/07	23:44	Recover USBL - secure Shrimp - reposition to Sedlo Seamount - waiting	R	2 10:23	58.38
20/07	23:44	21/07	00:40	CTD in 39-57.6N 26-15.7W - 450m	CTD	0 00:56	0.93
21/07	00:40	21/07	01:45	Process CTD	R	0 01:05	1.08
21/07	01:45	21/07	06:36	CTD & SAPS in 39-58.0N 26-25.1W - 2700m	CTD	0 04:51	4.85
21/07	06:36	21/07	07:13	Process CTD	R	0 00:37	0.62
21/07	07:13	21/07	08:45	CTD in 39-58.1N 26-25.0W - 2000m	CTD	0 01:32	1.53
21/07	08:45	21/07	12:16	Process CTD - reposition - prepare Shrimp	R	0 03:31	3.52
21/07	12:16	21/07	21:15	SHRIMP in 40-18.1N 26-51.9W - 4000m	Shrimp	0 08:59	8.98
21/07	21:15	21/07	23:35	Recover USBL - reposition - deploy USBL	R	0 02:20	2.33
21/07	23:35	22/07	04:29	SHRIMP in 40-14.9N 26-41.2W - 1466m	Shrimp	0 04:54	4.9
22/07	04:29	22/07	06:15	Recover USBL - reposition - prepare CTD	R	0 01:46	1.77
22/07	06:15	22/07	07:00	CTD in 40-18.9N 26-39.9W - 450m	CTD	0 00:45	0.75
22/07	07:00	22/07	08:15	Process CTD - waiting	R	0 01:15	1.25
22/07	08:15	22/07	11:44	CTD & SAPS in 40-18.9N 26-40.1W - 770m	CTD	0 03:29	3.48
22/07	11:44	22/07	12:44	Process CTD - waiting	R	0 01:00	1
22/07	12:44	22/07	13:38	CTD in 40-19.0N 26-39.9W - 770m	CTD	0 00:54	0.9

22/07 13:38	22/07 14:56	Process CTD - reposition - prepare MOCNESS	R	0 01:18	1.3
22/07 14:56	22/07 17:10	MOCNESS deployed in 40-16.0N 26-38.1W -	MOC	0 02:14	2.23
22/07 17:10	22/07 18:27	Process MOCNESS - reposition - prepare CTD	R	0 01:17	1.28
22/07 18:27	22/07 19:36	CTD in 40-14.0N 26-43.2W - 1400m	CTD	0 01:09	1.15
22/07 19:36	22/07 22:04	Process CTD - reposition - prepare MOCNESS	R	0 02:28	2.47
22/07 22:04	23/07 01:55	MOCNESS trawl deployed in 39-55.2N 26-24.2W - 2136m	MOC	0 03:51	3.85
23/07 01:55	23/07 07:04	PES survey of Sedlo Seamount	Surv	0 05:09	5.15
23/07 07:04	23/07 09:30	Reposition	R	0 02:26	2.43
23/07 09:30	23/07 10:00	MOCNESS trawl deployed in 39-55.2N 26-25.2W - 720m	MOC	0 00:30	0.5
23/07 10:00	23/07 12:00	Problem with Deep Tow Winch - recover wire and MOCNESS	D(R)	0 02:00	2
23/07 12:00	23/07 14:03	Reposition	R	0 02:03	2.05
23/07 14:03	23/07 15:47	CTD in 40-11.0N 26-33.1W	CTD	0 01:44	1.73
23/07 15:47	23/07 16:12	Process CTD - reposition	R	0 00:25	0.42
23/07 16:12	23/07 17:56	CTD in 40-10.9N 26-33.1W - 450m	CTD	0 01:44	1.73
23/07 17:56	23/07 18:52	Process CTD - reposition	R	0 00:56	0.93
23/07 18:52	24/07 00:57	CTD & SAPS in 40-15.2N 26-37.0W - 1081m	CTD	0 06:05	6.08
24/07 00:57	24/07 01:31	Process CTD - reposition	R	0 00:34	0.57
24/07 01:31	24/07 03:03	CTD in 40-15.3N 26-36.9W - 1081	CTD	0 01:32	1.53
24/07 03:03	24/07 05:15	Process CTD - reposition	R	0 02:12	2.2
24/07 05:15	24/07 06:36	CTD in 40-22.2N 26-34.5W - 1731m	CTD	0 01:21	1.35
24/07 06:36	24/07 07:45	Process CTD - reposition	R	0 01:09	1.15
24/07 07:45	24/07 09:38	CTD in 40-26.0N 26-30.0W - 2880m	CTD	0 01:53	1.88
24/07 09:38	24/07 11:00	Process CTD - reposition	R	0 01:22	1.37
24/07 11:00	24/07 12:08	CTD in 40-22.2N 26-43.0W - 1530m	CTD	0 01:08	1.13
24/07 12:08	24/07 13:28	Process CTD - reposition	R	0 01:20	1.33
24/07 13:28	24/07 15:29	CTD in 40-26.1N 26-45.0W - 1530m	CTD	0 02:01	2.02
24/07 15:29	24/07 16:25	Process CTD - reposition	R	0 00:56	0.93
24/07 16:25	24/07 18:20	CTD in 40-30.0N 26-49.0W - 2450m	CTD	0 01:55	1.92
24/07 18:20	24/07 18:56	Process CTD - reposition	R	0 00:36	0.6
24/07 18:56	24/07 20:35	CTD in 40-28.0N 26-51.9W - 1861m	CTD	0 01:39	1.65
24/07 20:35	24/07 21:15	Process CTD - reposition	R	0 00:40	0.67
24/07 21:15	24/07 21:50	CTD in 40-28.0N 26-52.0W - 700m	CTD	0 00:35	0.58
24/07 21:50	24/07 22:30	Process CTD - reposition	R	0 00:40	0.67
24/07 22:30	24/07 23:30	CTD in 40-21.0N 26-56.5W - 1220m	CTD	0 01:00	1
24/07 23:30	25/07 00:26	Process CTD - reposition	R	0 00:56	0.93
25/07 00:26	25/07 01:48	CTD in 40-15.0N 26-58.5W - 2099m	CTD	0 01:22	1.37
25/07 01:48	25/07 05:02	Process CTD - reposition	R	0 03:14	3.23
25/07 05:02	25/07 06:44	CTD in 40-36.0N 26-39.0W - 2718m	CTD	0 01:42	1.7
25/07 06:44	25/07 09:03	Process CTD - reposition	R	0 02:19	2.32
25/07 09:03	25/07 09:40	CTD in 40-20.1N 26-50.4W - 450m	CTD	0 00:37	0.62
25/07 09:40	25/07 11:12	Process CTD - reposition	R	0 01:32	1.53
25/07 11:12	25/07 15:11	CTD in 40-20.0N 26-50.6W - 1112m	CTD	0 03:59	3.98
25/07 15:11	25/07 16:30	Process CTD - reposition	R	0 01:19	1.32
25/07 16:30	25/07 18:05	CTD in 40-14.9N 26-50.4W - 1920m	CTD	0 01:35	1.58
25/07 18:05	25/07 20:48	Process CTD - reposition	R	0 02:43	2.72
25/07 20:48	25/07 23:25	CTD in 40-31.8N 26-24.2W - 2879m	CTD	0 02:37	2.62
25/07 23:25	26/07 00:44	Process CTD - reposition	R	0 01:19	1.32
26/07 00:44	26/07 03:11	CTD in 40-37.9N 26-16.1W - 2897m	CTD	0 02:27	2.45
26/07 03:11	26/07 03:42	Process CTD - secure	R	0 00:31	0.52
26/07 03:42	28/07 09:00	Transit to PAP	P	2 05:18	53.3
27/07 09:00	28/07 20:00	Stream deep tow cable, test deployments of Sound Velocity Probe (SVP)	R	0 11:00	11
28/07 20:00	01/08 09:00	Test deployment of SVP; transit to Clyde	P	3 13:00	85
01/08 09:00	01/08 11:00	Pilotage for River Clyde to KG V, Govan	P	0 02:00	2

Operation codings and time totals										
P	**MOC**	**CTD**	**Shrimp**	**Surv**	**M(R)**	**D(R)**	**D(U)**	**D(W)**	**D(O)**	**R**
140.30	32.08	114.43	42.97	19.13	7.23	151.73	6.75	0.00	54.63	200.73

Total hours = 770

P	Pilotage & Passage
MOC	Mocness Trawl on Deep Tow Cable
CTD	CTD on Standard CTD Cable
Shrimp	SHRIMP on Deep Tow Cable
Surv	PES echo-sounder survey
M(R)	Mooring recovery
D(R)	Downtime (RSU)
D(U)	Downtime (UKORS)
D(W)	Downtime (Weather)
D(O)	Downtine (Other) (Medical / Compassionate)
R	Preparation / Repositioning / Waiting

Robin Plumley, Master

10. STATION LIST

Station list abbreviations and notes

Station	Unique deployment identification number
Site	Site name
Gear	Equipment used (see listing below)
Start	Start of sampling operation
End	End of sampling operation
Date	Date of operation (dd/mm in 2004)
Time	Time of operation (UTC)
Position	Ship's position (or estimated net position for trawls)
DN	Ship's position degrees north
MN	Ship's position minutes north
DW	Ship's position degrees west
MW	Ship's position minutes west
Z	Depth of sampling operation
Sounding (m)	Mean sounding during sampling operations (corrected metres)
Comment	Results, observations etc.

Gear abbreviations and acronyms

CTD	Conductivity, temperature, depth probe with water bottle rosette
CTDS	CTD + SAPS (Stand Alone Pumping System) units deployed on wire above
MOC-D	MOCNESS net system – double 1m^2 net aperture
RCM-M	Recording current meter mooring
SHRIMP	Seabed High Resolution Imaging Platform
SVP	Sound Velocity Probe

Station	Site	Gear	Date start	Time Start	DN Start	MN Start	DW Start	MW Start	Z Start	Date End	Time End	DN End	MN End	DE End	ME End	Z End	Sound-Ing (m)	Comment
15430#1	Trial	CTD	02/07	18:21	36	50.18	17	19.79	0	02/07	18:46	36	50.29	17	19.76	475	4741	Trial deployment, problem with bottle firing.
15430#2	Trial	CTD	02/07	19:03	36	50.38	17	19.73	0	02/07	19:46	36	50.69	17	19.48	476	4773	Trial deployment, still some problem bottles.
15431#1	Trial	CTD	03/07	18:12	36	46.61	16	40	0	03/07	18:28	36	46.67	16	40.91	100	1824	Trial: 12 bottles fired successfully
	Mooring	RCM-M	30/03	11:30	33	42.33	14	28.26	1446	06/07	09:31	33	42.33	14	28.26	1446	1446	Mooring laid by FS Poseidon (PO 309 0020/2004)
15432#1	Site F	CTD	07/07	16:15	33	48.26	14	40.33	0	07/07	16:58	33	48.12	14	40.13	450	4038	All bottles fired (3 failed to seal)
15432#2	Site F	CTDS	07/07	18:20	33	48.33	14	39.64	0	08/07	00:02	33	48.64	14	40.74	4010	4038	CTD failed at depth; 3 of 4 SAPS successful
15432#3	Site F	CTD	08/07	01:45	33	48.5	14	40	0	08/07	04:18	33	48.67	14	39.8	2213	4036	CTD problem and some scrolling problems
15433#1	Summit	MOC-D	08/07	17:45	33	44.04	14	24.5	0	08/07	18:58	33	46.44	14	22.39	140	175	Sunset tow
15434#1	Site A	CTD	08/07	19:58	33	46.16	14	22.41	0	08/07	20:28	33	46.26	14	22.52	150	175	Some bottle failures
15434#2	Site A	CTDS	08/07	21:15	33	46.14	14	22.51	0	09/07	00:10	33	46.26	14	22.44	167	175	With 2 SAPS; all bottles failed to fire
15434#3	Site A	CTD	09/07	00:29	33	46.26	14	22.47	0	09/07	01:07	33	46.02	14	22.4	163	173	2 bottles failed
15435#1	Summit	MOC-D	09/07	03:01	33	43.76	14	24.77	0	09/07	04:02	33	45.39	14	23.23	140	167	Night tow
15436#1	Site 5	CTD	09/07	05:34	33	43.62	14	29.18	0	09/07	07:05	33	43.65	14	29.23	1669	1689	Data only cast
15437#1	Site 3	CTD	09/07	11:00	34	9.71	14	29.36	0	09/07	14:06	34	9.21	14	28.16	4260	4361	Profile only (some bottles fired for test purposes)
15438#1	Site H	MOC-D	09/07	17:01	34	9.13	14	5.48	0	10/07	01:10	34	22.65	13	52.75	3450	4127	Using all deep tow cable available (6489mwo)
15439#1	Site H	CTD	10/07	03:02	34	15	14	0	0	10/07	04:04	34	15.01	14	0	450	4098	2 bottles not fully sealed
15439#2	Site H	CTDS	10/07	05:10	34	15.06	14	0	0	10/07	10:47	34	15.46	13	59.01	4054	4079	Bottles damaged during last SAPS recovery
15440#1	Site H	MOC-D	10/07	12:51	34	12.59	14	1.8	0	10/07	16:10	34	18.38	13	58.21	1000	4113	Upper layer hauls, day tow
15441#1	Site H	CTD	10/07	18:00	34	14.97	13	59.94	0	10/07	19:50	34	15.1	13	59.8	2000	4086	5 bottles failed
15442#1	Site 4	CTD	11/07	00:05	33	49.84	13	50.2	0	11/07	02:55	33	49.89	13	49.8	4438	4448	All bottles fired at bottom
15443#1	Summit	SHRIMP	11/07	07:02	33	48.03	14	21.99	202	11/07	12:50	33	50.95	14	20.51	261	232	Good tow
15444#1	Site 1	CTD	11/07	17:10	33	19.84	14	20.15	0	11/07	19:46	33	20.07	14	20.13	4000	4418	All bottles fired at bottom
15445#1	Flank	SHRIMP	11/07	00:41	33	45.95	14	27.82	1291	12/07	00:55	33	46.01	14	27.86	1312	1306	Aborted, failure at swivel
15446#1	Site E	CTD	12/07	07:39	33	31.99	14	30.07	0	12/07	08:16	33	32.02	14	30	450	4136	Shallow cast
15446#2	Site E	CTDS	12/07	09:45	33	32.06	14	30	0	12/07	15:20	33	32.04	14	29.97	4138	4148	Deep cast with SAPS
15446#3	Site E	CTD	12/07	16:05	33	31.99	14	29.98	0	12/07	17:50	33	32.01	14	29.98	2000	4140	2000m cast
15447#1	Flank	SHRIMP	12/07	21:10	33	45.96	14	28.53	0	12/07	21:30	33	46.03	14	28.59	191	1589	Aborted, swivel failed
15448#1	Site C	CTD	14/07	02:41	33	44.99	14	3.02	0	14/07	03:42	33	45	14	3.02	450	4445	Shallow cast
15448#2	Site C	CTDS	14/07	04:36	33	45.08	14	2.93	0	14/07	10:41	33	45.04	14	2.66	4435	4445	Deep cast with 4 SAPS
15448#3	Site C	CTD	14/07	11:35	33	45.06	14	2.78	0	14/07	13:19	33	44.95	14	2.81	2000	4447	2000m cast
	Mooring	RCM-M	30/03	16:53	33	49.83	14	18.03	1408	14/07	14:56	33	49.83	14	18.03	1408	1408	Mooring laid by FS Poseidon (PO 309 0021/2004)
15449#1	N edge	SHRIMP	14/07	17:30	33	51.6	14	20.38	0	14/07	17:32	33	51.72	14	20.32	205	327	Cable short - aborted
15450#1	Site 6	CTD	14/07	19:05	33	49.86	14	17.91	0	14/07	20:09	33	49.85	14	17.99	1630	1507	Uncertain soundings
15451#1	N edge	SHRIMP	14/07	21:12	33	51.48	14	20.46	0	14/07	21:12	33	51.49	14	20.38	145	298	Cable short - aborted
15452#1	Site 2	CTD	15/07	00:28	33	47.98	14	50.03	0	15/07	03:05	33	48	14	49.99	4043	4060	Profile only cast

Station	Site	Gear	Date start	Time Start	DN Start	MN Start	DW Start	MW Start	Z Start	Date End	Time End	DN End	MN End	DE End	ME End	Z End	Sound-Ing (m)	Comment
15453#1	Site I	CTD	15/07	07:50														Aborted on deck - wire off the winch
15453#2	Site I	CTD	15/07	16:25	33	19.93	14	0.03	0	15/07	17:10	33	19.98	14	0.05	450	4438	Shallow cast
15454#1	N Flank	SHRIMP	16/07	08:18	33	51.61	14	20.33	308	16/07	19:00	33	57.01	14	21.06	2810	1560	Extended tow
15455#1	Site I	MOC-D	16/07	23:10	34	12.26	14	1.21	0	17/07	01:53	34	16.97	13	58.87	1000	4105	1,000m tow
15456#1	W Flank	MOC-D	17/07	07:08	33	43.47	14	30.99	0	17/07	10:19	33	49.59	14	27.89	1000	2193	1,000m tow
15457#1	Summit	MOC-D	17/07	12:43	33	44.04	14	22.49	0	17/07	13:37	33	45.72	14	22.08	150	174	12 nets only
15458#1	Site F	CTD	17/07	15:50	33	48.48	14	40.02	0	17/07	17:24	33	48.47	14	39.99	2000	4038	2,000m cast
15459#1	W Flank	MOC-D	17/07	20:13	33	43.37	14	29.63	0	17/07	23:13	33	49.26	14	27.07	1000	1951	1,000m tow
15460#1	N Flank	SHRIMP	18/07	04:04	33	56.53	14	21.07	2749	18/07	11:45	34	0.77	14	20.38	4076	3412	Extended tow
15461#1	Site F	CTD	20/07	23:45	39	57.86	26	25.21	0	21/07	00:39	39	57.59	26	25.69	450	2765	Shallow cast
15461#2	Site F	CTDS	21/07	01:40	39	57.98	26	25.08	0	21/07	06:35	39	58.15	26	24.97	2748	2763	With 4 SAPS
15461#3	Site F	CTD	21/07	07:13	39	58.15	26	23.04	0	21/07	08:46	39	58.05	26	25.08	2000	2763	2,000m cast
15462#1	S Saddle	SHRIMP	21/07	12:57	40	18.09	26	51.91	1139	21/07	20:19	40	16.09	26	56.24	1850	1500	Good tow
15463#1	S Flank	SHRIMP	22/07	00:02	40	14.93	26	41.46	830	22/07	03:48	40	14.09	26	43.41	1380	1105	Good tow
15464#1	Site A	CTD	22/07	06:14	40	18.95	26	39.88	0	22/07	07:00	40	18.89	26	40.12	450	770	Shallow cast
15464#2	Site A	CTDS	22/07	08:15	40	18	26	40.18	0	22/07	11:42	40	18.76	26	40.44	770	774	With SAPS on the wire
15464#3	Site A	CTD	22/07	12:20	40	18.97	26	40	0	22/07	13:39	40	18.96	26	40.11	763	771	Full depth cast
15465#1	Summit	MOC-D	22/07	14:59	40	15.97	26	38.13	0	22/07	17:06	40	20.7	26	39.44	700	747	Day tow
15466#1	Site Z	CTD	22/07	14:17	40	13.99	26	43.19	0	22/07	19:40	40	14.02	26	43.21	1400	1402	Profile only cast
15467#1	Site F	MOC-D	22/07	22:10	39	55.34	26	24.19	0	23/07	01:14	40	2.49	26	22.74	1000	2788	Night tow
15468#1	Site X13	CTD	23/07	04:50	40	11.57	26	43.95	0	23/07	06:11	40	11.52	26	43.78	2047	2057	Profile only cast
15469#1	Site F	MOC-D	23/07	09:33	39	55.51	26	25.12	0	23/07	11:55	40	1.56	26	25.23	200	2765	Aborted (no sampling) - winch failed
15470#1	Site E	CTD	23/07	14:01	40	10.97	26	33.1	0	23/07	15:46	40	10.96	26	33.06	2683	2690	Failed - no data recorded
15470#2	Site E	CTD	23/07	16:10	40	10.91	26	33.1	0	23/07	18:00	40	11	26	32.94	2695	2714	Profile only cast
15471#1	Site C	CTD	23/07	18:52	40	15.08	26	36.96	0	23/07	19:33	40	15.16	26	37	450	1130	Shallow cast
15471#2	Site C	CTDS	23/07	20:48	40	15.26	26	37.03	0	24/07	00:57	40	15.27	26	37.05	1080	1118	Cast with 4 SAPS
15471#3	Site C	CTD	24/07	01:30	40	15.29	26	36.91	0	24/07	03:03	40	15.58	26	37.2	1058	1078	Full depth cast
15472#1	Site B	CTD	24/07	05:14	40	22.24	26	34.5	0	24/07	06:36	40	22.24	26	34.58	1546	1560	Some scrolling problems
15473#1	Site 3	CTD	24/07	07:44	40	25.97	26	30	0	24/07	09:38	40	25.99	26	30	2880	2892	Profile only cast
15474#1	Site 1A	CTD	24/07	11:01	40	22.52	26	43.04	0	24/07	12:09	40	22.48	26	43.08	1491	1521	Uncertain soundings
15475#1	Site 2A	CTD	24/07	13:30	40	26.05	26	44.93	0	24/07	15:20	40	26.19	26	45.08	2395	2400	Profile only cast
15476#1	Site 3A	CTD	24/07	16:24	40	29.95	26	49.03	0	24/07	18:20	40	29.96	26	48.97	2426	2431	Profile only cast
15477#1	Site 4A	CTD	24/07	18:56	40	28.02	26	51.83	0	24/07	20:22	40	28.06	26	52.03	1801	1808	Profile only cast
15478#1	Site 5A	CTD	24/07	21:12	40	23.97	26	54.56	0	24/07	21:49	40	23.98	26	54.5	720	732	Profile only cast
15479#1	Site 6A	CTD	24/07	22:30	40	21.02	26	56.58	0	24/07	23:29	40	20.9	26	56.54	1220	1159	Profile only cast

Station	Site	Gear	Date start	Time Start	DN Start	MN Start	DW Start	MW Start	Z Start	Date End	Time End	DN End	MN End	DE End	ME End	Z End	Sound-Ing (m)	Comment
15480#1	Site 7A	CTD	25/07	00:26	40	15.01	26	58.43	0	25/07	01:48	40	15.03	26	58.55	2099	2111	Profile only cast
15481#1	Site 8A	CTD	25/07	05:02	40	35.99	26	39.04	0	25/07	06:44	40	35.87	26	39	2718	2733	Profile only cast
15482#1	Site D	CTD	25/07	11:25	40	20.17	26	50.49	0	25/07	09:39	40	20.06	26	50.47	450	1124	Shallow cast
15482#2	Site D	CTDS	25/07	11:12	40	19.99	26	50.67	0	25/07	15:13	40	20.03	26	50.59	1110	1114	With 4 SAPS on wire
15483#1	Site 9A	CTD	25/07	16:30	40	14.99	26	50.4	0	25/07	18:05	40	14.9	26	50.53	1920	1892	Profile only cast
15484#1	Site X2	CTD	25/07	20:49	40	31.86	26	24.27	0	25/07	23:25	40	31.73	26	24.62	2879	2892	Profile only cast
15485#1	Site X1	CTD	27/07	00:44	40	37.92	26	16.08	0	27/07	03:11	40	37.97	26	15.98	2890	2891	All bottles fired at bottom
15486#1	Trial	SVP	27/07	12:27	45	2.94	20	29.65	0	27/07	15:02	45	2.8	20	29.99	4480	4515	No SV data recorded
15486#2	Trial	SVP	27/07	15:23	45	2.82	20	30	0	27/07	17:57	45	2.54	20	29.45	4460	4510	No SV data recorded
15487#1	Trial	SVP	28/07	07:04	47	14.43	18	50.14	0	28/07	10:50	47	14.22	18	49.44	4560	4608	No SV data recorded

11. CHARTS

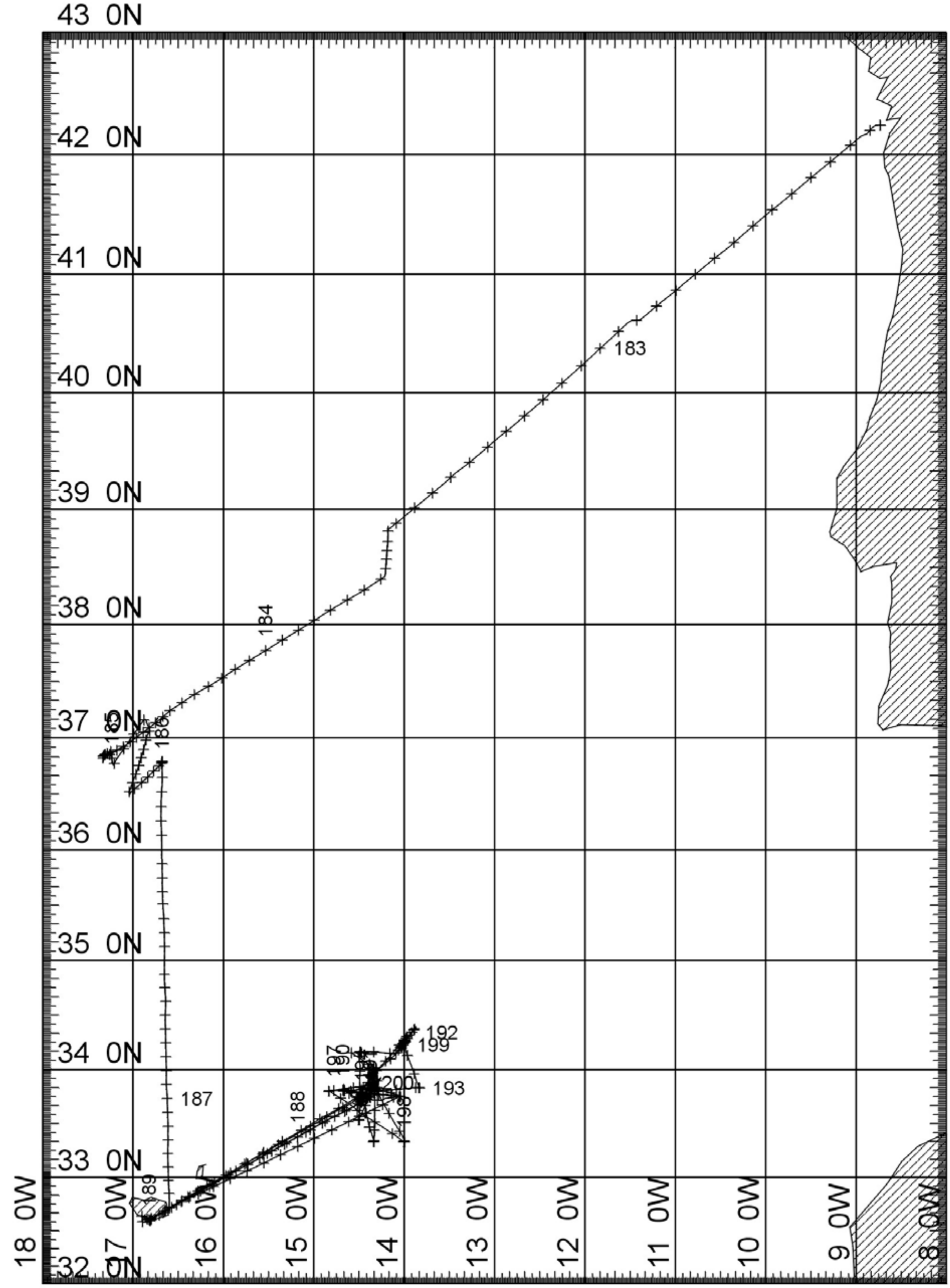

Chart 1. RRS *Discovery* cruise 282 phase 1: the passage from Vigo, operations around Seine Seamount and passages to and from Funchal.

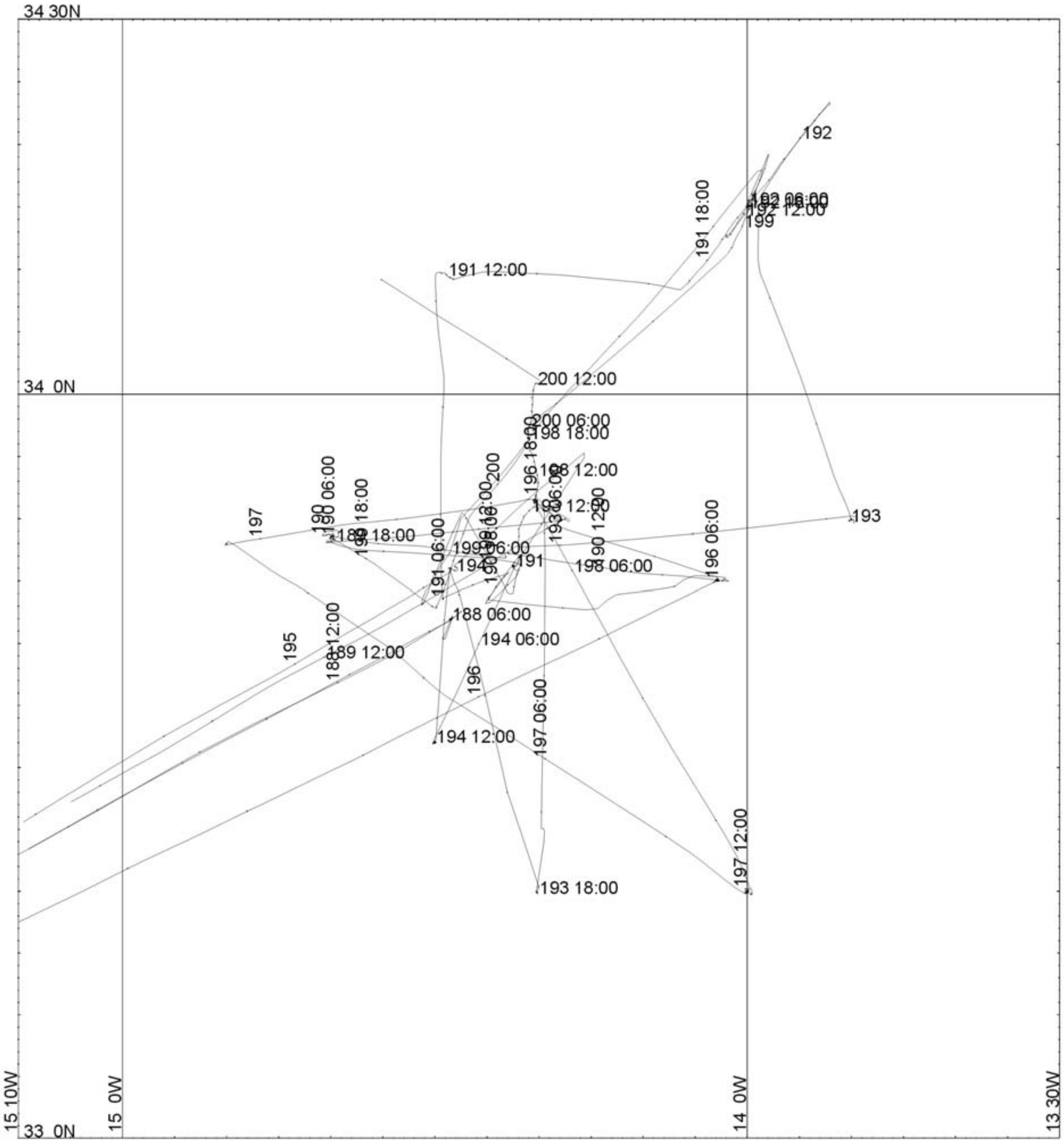

Chart 2. RRS *Discovery* cruise 282: operations around Seine Seamount.

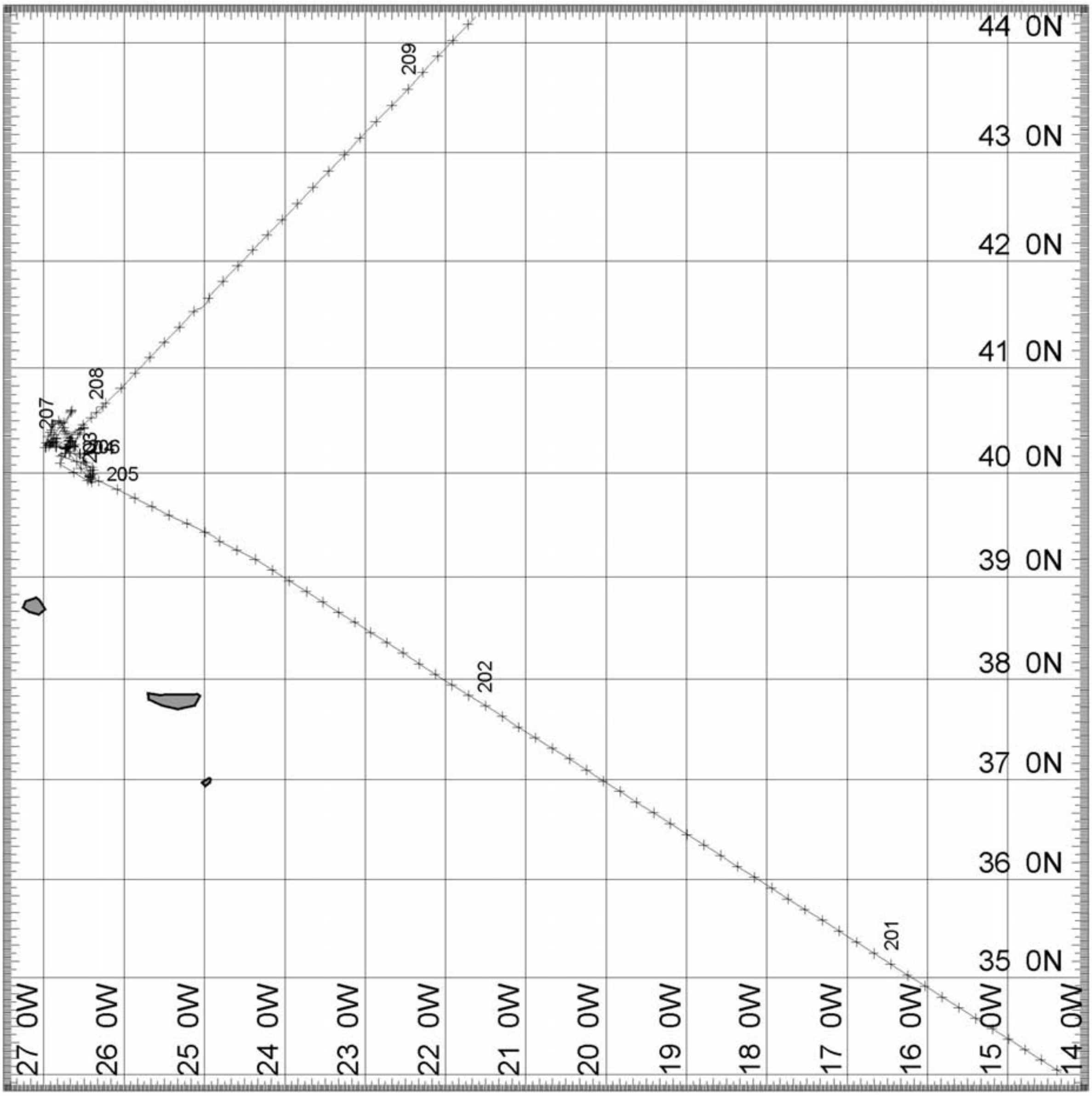

Chart 3. RRS *Discovery* cruise 282 phase 2: the passage from Seine Seamount and operations around Sedlo Seamount.

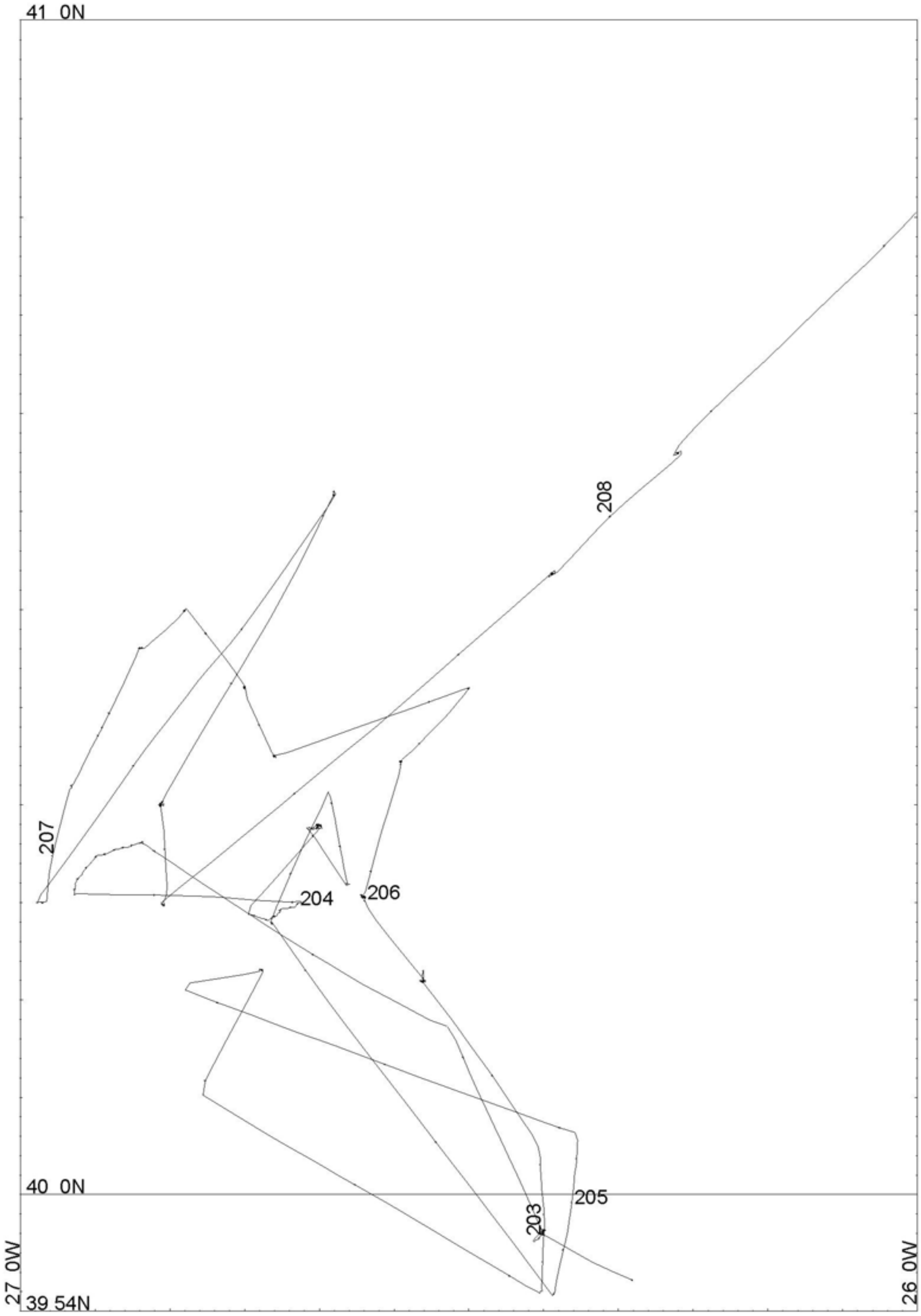

Chart 4. RRS *Discovery* cruise 282: operations around Sedlo Seamount.

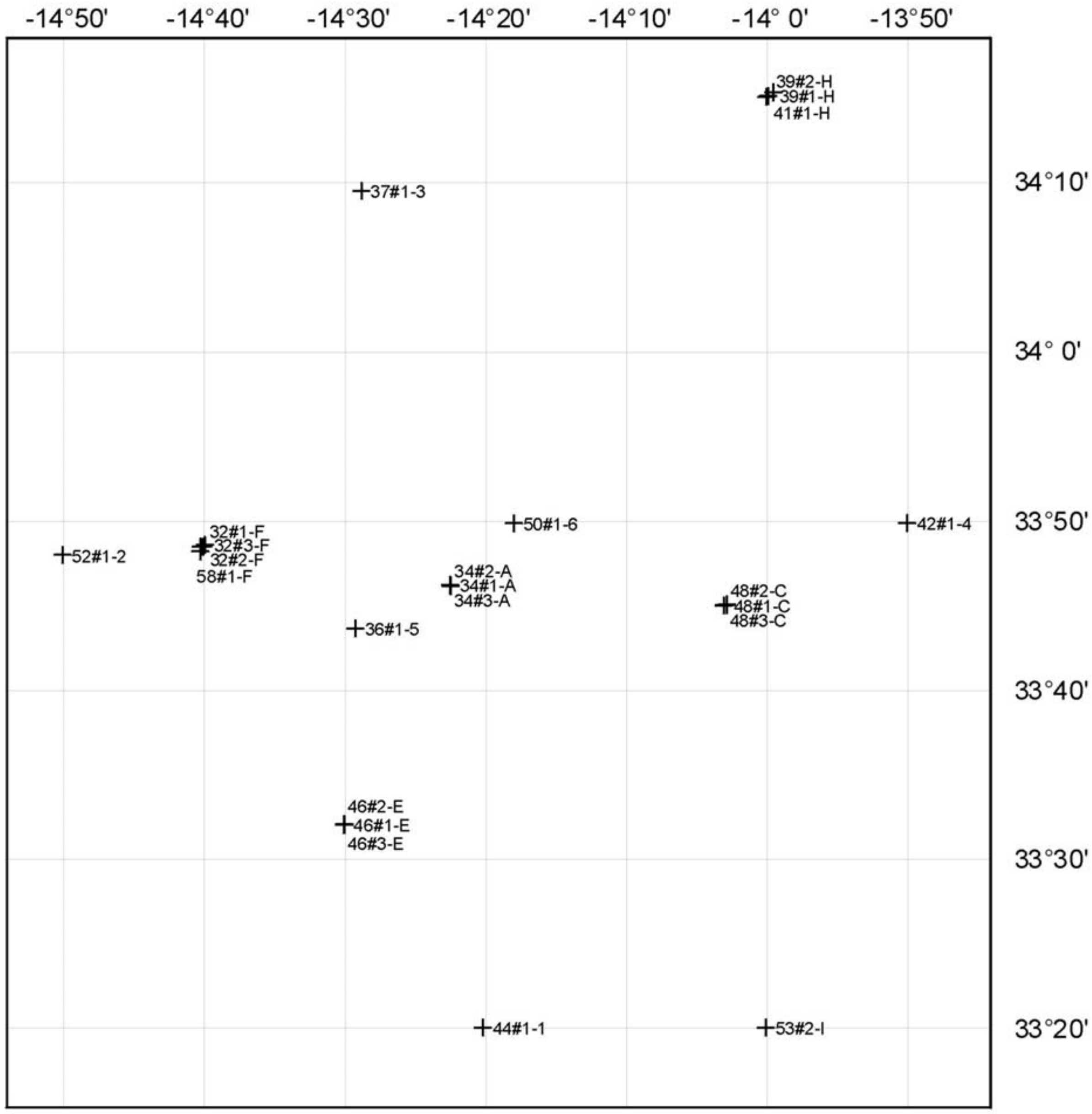

Chart 5. CTD deployments at Seine Seamount, indicated by abbreviated station number and site designation (e.g. 15446#2 at Site E: 46#2-E).

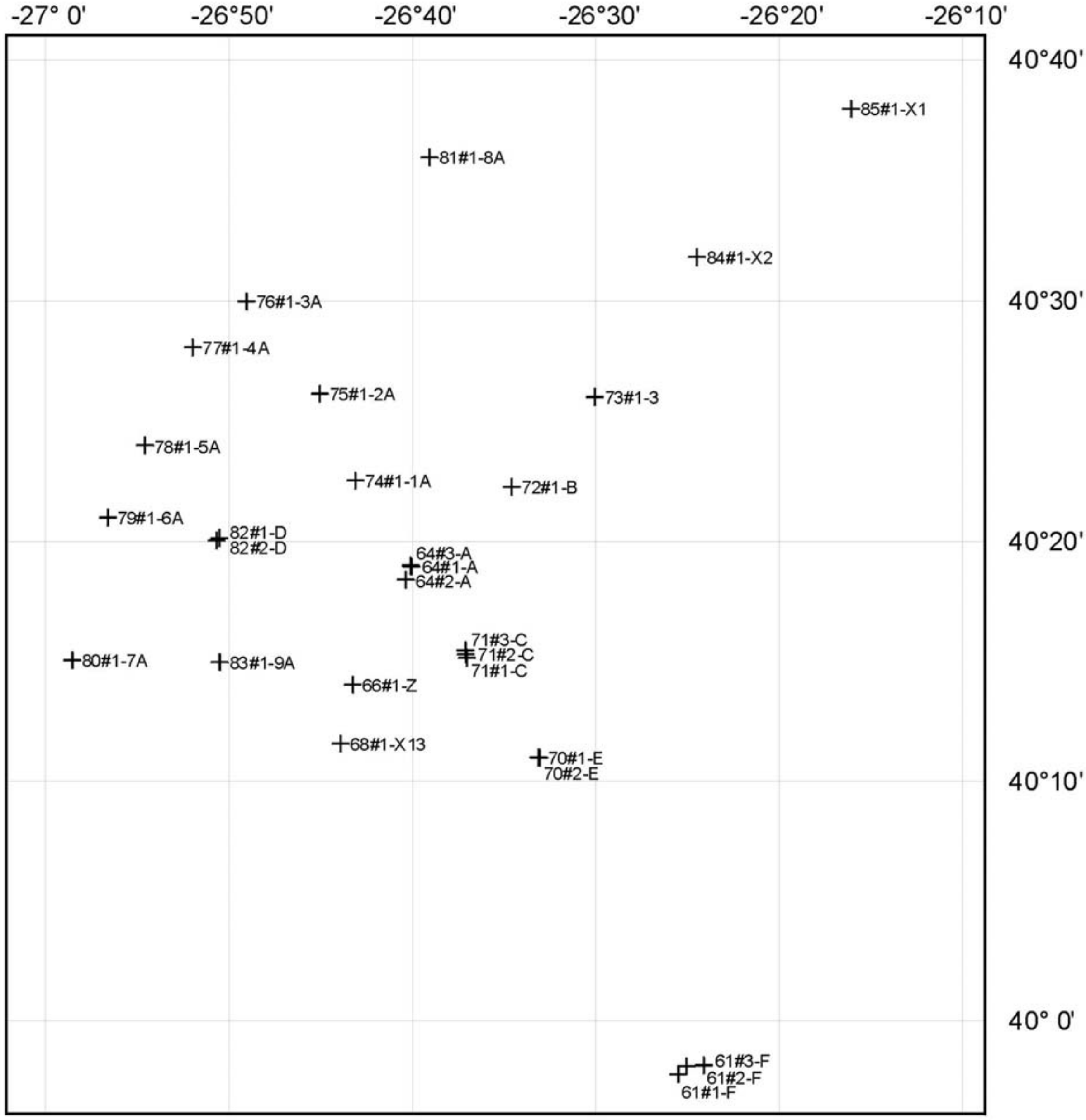

Chart 6. CTD deployments at Sedlo Seamount, indicated by abbreviated station number and site designation (e.g. 15471#2 at Site C: 71#2-C).

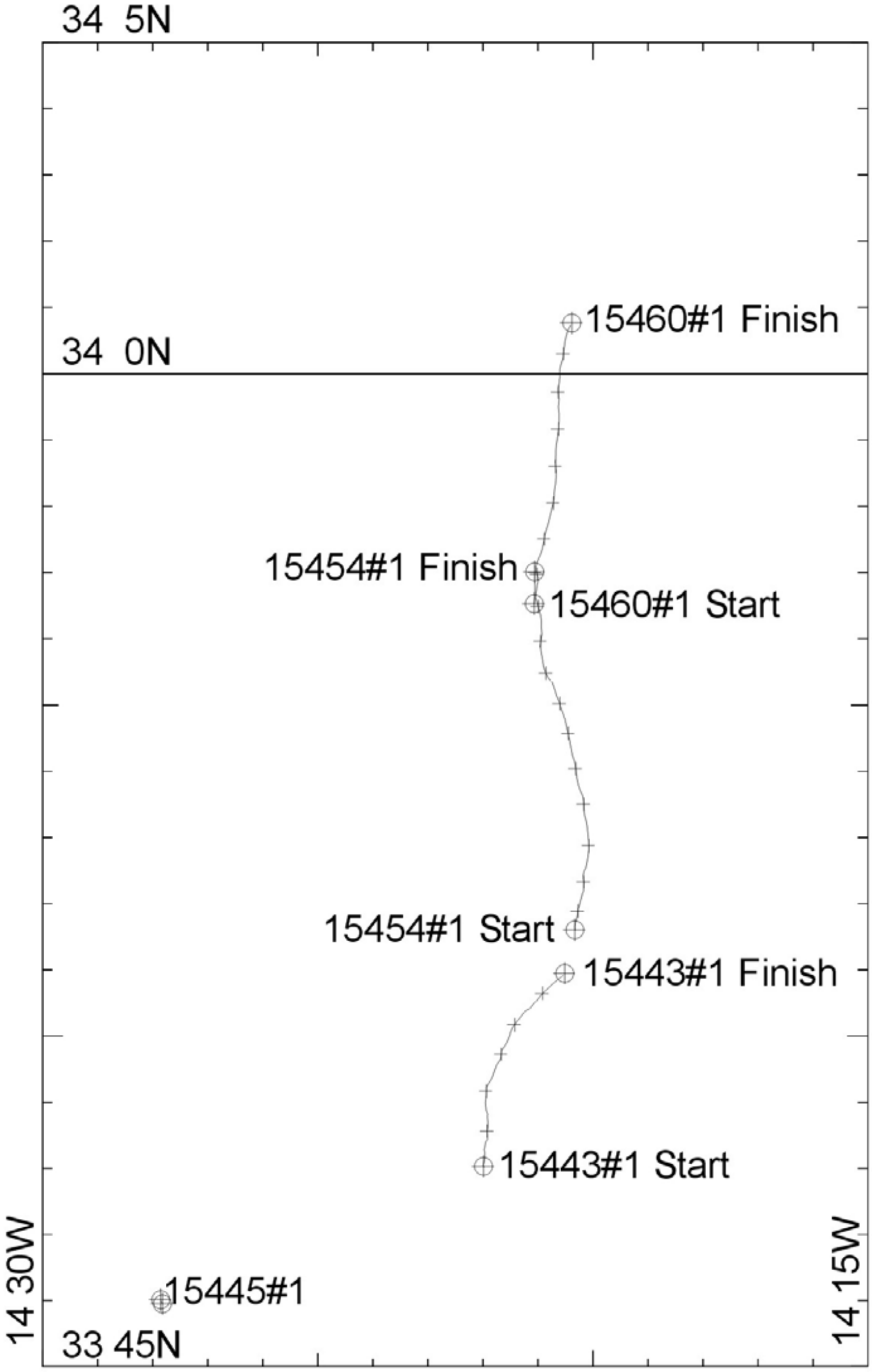

Chart 7. SHRIMP deployments at Seine Seamount.

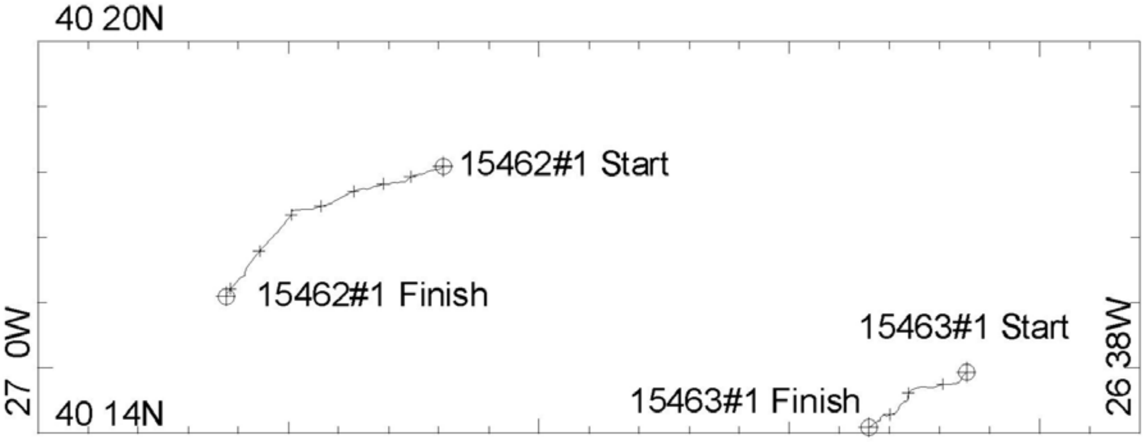

Chart 8. SHRIMP deployments at Sedlo Seamount.

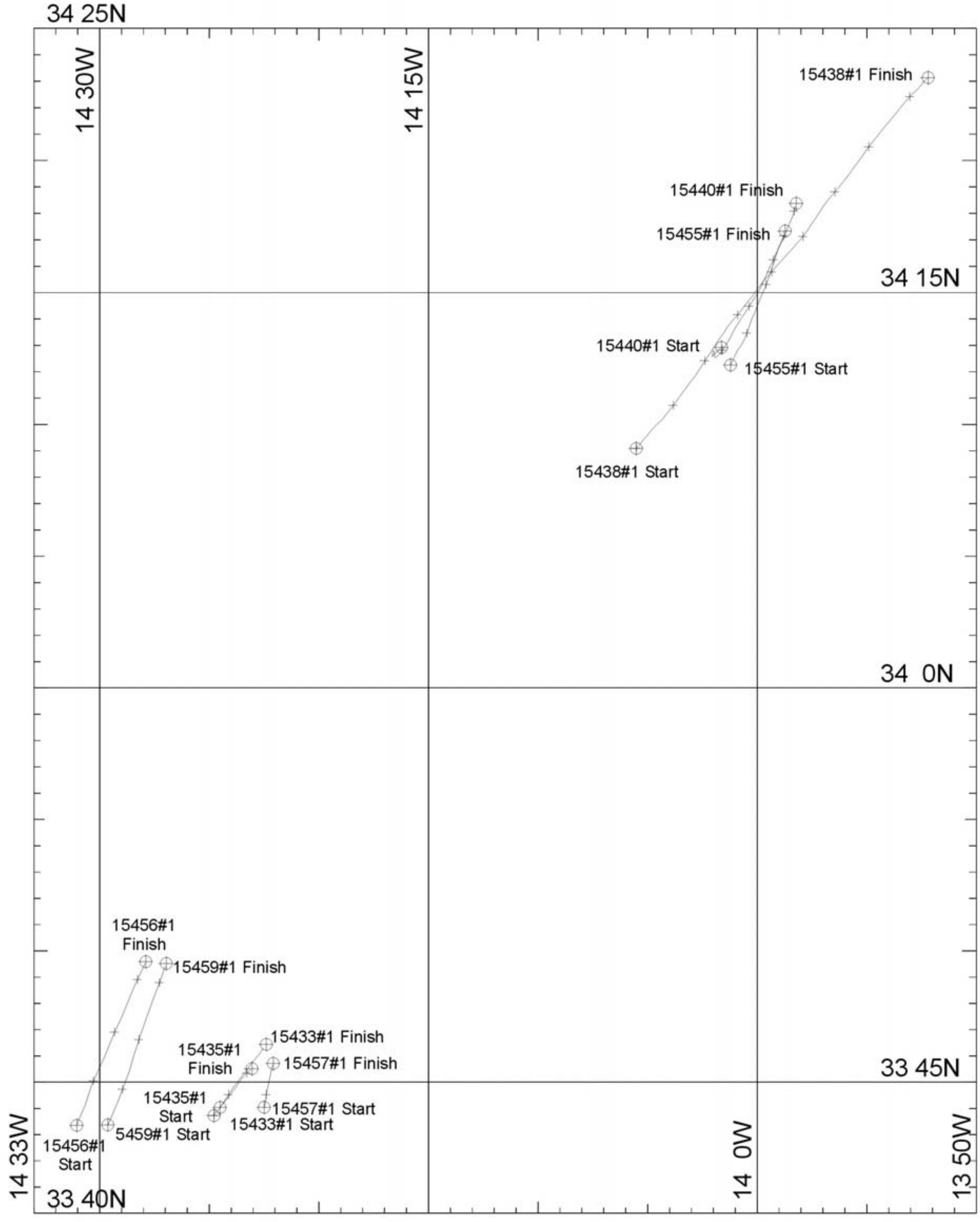

Chart 9. MOCNESS deployments at Seine Seamount.

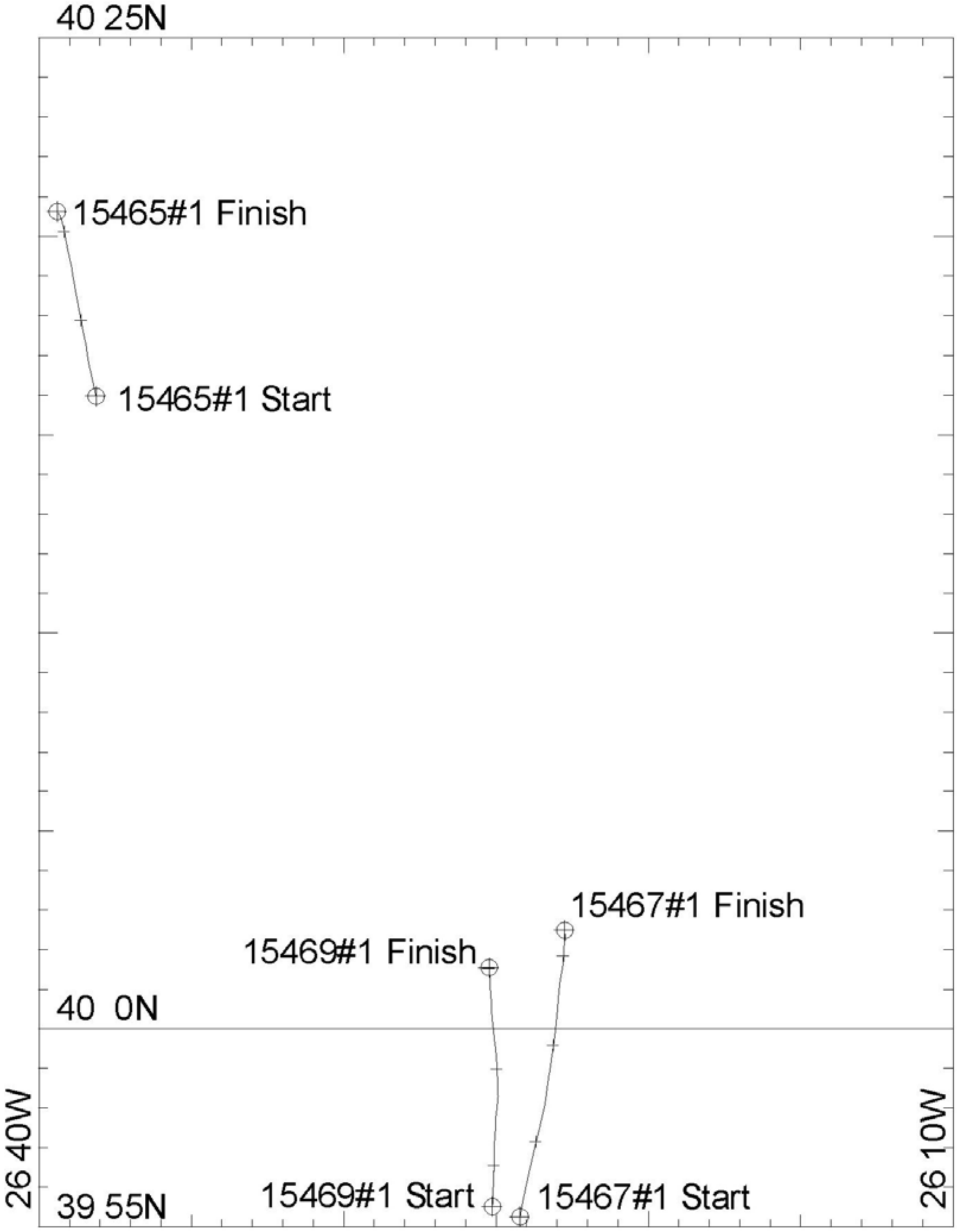

Chart 10. MOCNESS deployments at Sedlo Seamount.

11. The scientific party, RRS *Discovery* cruise 282