SCOTTISH MARINE BIOLOGICAL ASSOCIATION

Dunstaffnage Marine Research Laboratory

CRUISE REPORT

RRS CHALLENGER

CRUISE 11/82

29 July-12 August

1982

RRS Challenger, Cruise 11/82

Duration : 1430 h, 29 July (Falmouth) - 1600 h, 12 August (Ardrossan), with overnight call at Thørshavn, Faroe Islands 7/8 August.

Locality : Irish shelf, Rockall Trough, Hebridean Continental Slope, Wyville Thomson Ridge, Faroe Bank Channel.

Scientific Participants :

J.D. Gage	SMBA	Principal Scientist
K.A. Faccenda	"	
M. Pearson	"	
A. Muirhead, University College of Swansea		
S.L. Pain	University College of Swansea	
P.A. Tyler	" " " "	
G.L.J. Paterson	British Museum (Natural History)	
H. Cochrane	Duke University, North Carolina	
P.D. Fry	Luton College of Higher Education	
K. Harrison	Nottingham University	
→ H.J. Lennon	Mar. Biol. Station, Portaferry	
S.J. Smith	Research Vessel Base, Barry	

Ship's Officers :

P. MacDermott, Master
K. Avery, Chief Officer
J. Price, Second Mate
R. Chamberlain Third Mate
D. Rowlands, Chief Engineer
C. Harman, Second Engineer
C. Phillips, Third Engineer
A. Greenhorn, Fourth Engineer.

Aims :

(1) To continue joint seasonal benthic sampling programmes on the SMBA Permanent Station ($56^{o}40'N$, $12^{o}16'W$) and in the vicinity of station 'M' ($57^{o}18'N$, $10^{o}23'W$) for SMBA and Univ. Coll. Swansea.

(2) To undertake a programme of quantitative benthic sampling in the northern Rockall Trough using the USNEL 0.15 m^2 box corer with "Sandia" and RVS modifications.

(3) To collect megabenthos using the Agassiz trawl at the box coring stations in order to continue collaborative studies on the zoogeography, and life history biology of echinoderms, coelenterates and other fauna with Univ. Coll. Swansea, BM(NH) and Luton.

(4) To collect deep-sea fishes in Agassiz trawl hauls for Dr. J.D.M. Gordon, SMBA.

(5) To continue seasonal collection of benthic megafauna for the MAFF Radiobiological Laboratory, Lowestoft (Dr. R.J. Pentreath).

(6) To undertake a programme of surface water sampling in order to continue Portaferry studies of phytoplankton growth on the shelf and at the shelf/slope break, particularly off the Hebrides.

Narrative*: CHALLENGER sailed from Falmouth at 1530 h on 29 July in excellent weather, rounding Valentia Island en route to the first station at midnight on Friday, and heaving to at 0500 h 31 July at $52^{o}43'N$ $11^{o}09'W$ on the Irish shelf for the first of two stops for expendable bathythermograph (XBT), fluorometer and water bottles for Portaferry. CHALLENGER then steamed for the next Portaferry Station on $53^{o}30'N$ $11^{o}05'W$, completing work by 1131 h. CHALLENGER then made a course for the SMBA

*All times GMT

Permanent Station (57°40'N, 12°16'W) for a full programme of benthic sampling as well as further work for Portaferry.

On arrival at 2055 h the PES fish was launched in calm sea conditions and immediately followed by a trial with the newly constructed box corer that replaced the gear lost the previous year. The scientific party were gratified to recover an excellent, 21-cm deep sample of undisturbed sediment at 2214 h. The epibenthic sled was next deployed in order to continue the sample time-series on this station started in 1975. During recovery, increasingly severe damage to the main warp was evident from 2,500 m payout, while from 212 m the wire was kinked so badly that it interfered with spooling on the winch drum. The wire had to be stoppered off in order to recover the remaining wire, which was in loose tangles. The sled was eventually recovered at 0547 h 1st August with no sample.

CHALLENGER then steamed 12 miles to westward in order to stream and crop the damaged warp. The main wire was cut at 2512 m; but leaving sufficient wire for the subsequent programme, and CHALLENGER then headed back to the Permanent Station for another epibenthic sled deployment. This was recovered at 1430 h with a good sample. While this sample was being washed, the RMT 1 was deployed for a deep midwater haul down to 2000 m depth, recovering a good sample at 1854 hrs. This completed work at the Permanent Station where throughout the work dense concentrations of the jellyfish, Pelagia noctiluca were observed floating by the ship in the calm water. When some of these were caught in a bucket of water, they could be seen to be associated with large numbers of the hyperiid amphipod, Hyperia galba, sheltering in the stomach.

Because of the excellent weather it was decided to work additional box corer stations on the Hebridean Slope in order to try and finish a transect left incomplete since 1976, and CHALLENGER steamed N.E. for the first and and shallowest position on the 400 m depth contour.

On heaving to on station at 1254 h 2 August work for Portaferry was undertaken during deployment of the box corer. The corer was recovered after the first drop at 1535 hrs with a washed, sandy bottom sample. The second and third drops on this station recovered similarly washed samples that, nevertheless, preserved some surface structure. Galatheid crabs were seen to emerge in numbers from burrows on the surface of the cores. At the 600 m contour, a similar sandy sediment was encountered in another box corer sample.

This time a large rattail fish (probably Coryphenoides rupestris) was found lying alive on the sediment surface. At 800 m an excellent core was recovered at 2026 h consisting of sandy material with stones overlying a sticky clay layer that effectively plugged the 25-30 cm deep core, retaining the overlying water. Two large living sea urchins (Echinus elegans) were found lying on the sediment surface along with a large half-buried brittle star (Ophiocten gracilis).

CHALLENGER hove to on the 1000 m station at 2113 h and the box corer was deployed at the same time as the Portaferry work on the hydrographic deck. A good box core of muddy sediment was recovered at 2241 h and CHALLENGER then proceeded to the 1200 m contour. No sample was obtained on this station owing to failure of the release mechanism of the corer. Time being short, CHALLENGER pressed on to the 2000 m contour for the first sample of this now almost completed series, arriving at 0400 h 3 August. After another failure of the release mechanism on the first box corer drop, it was surmised that the trouble lay in stiffening of the mechanism as a result of the gear receiving a bump on the side of the ship's stern. This was rectified by Mr. Smith of RVS and a further drop recovered an excellent sample at 0950 h. By this time, the backlog of box cores awaiting washing and sieving on deck was being slowly caught up with, and by the time CHALLENGER arrived on station 'M' for the benthic programme scheduled there, had been dealt with by our hard working participants. As previously, work for Portaferry was undertaken in the continuing excellent weather conditions by Miss Joan Lennon during a box-corer deployment. The latter recovered an excellent core with crystal-clear water overlying the muddy pelagic sediment which shared much evidence of biogenic activity, such as burrow openings and protruding tubes. On examination of vertical structure by removing one side of the box and making vertical sections, it was clear that the soft brownish surface layer was intensely reworked, and burrows of polychaete worms and other fauna extended deep into the underlying grey layer of a stiffer clay. A single large specimen of the deep-sea irregular sea urchin, Hemiaster expergitus, was found in a burrow about 12 cm deep in the sediment; this representing probably the first time the burrow system of this urchin has been observed.

In continuing excellent sea conditions, this successful box core was followed by the deep RMT 1 haul required, recovering a good sample at 1905 h. This was followed by epibenthic sled and Agassiz trawl hauls, both recovering good hauls at midnight and 0617 hrs 4 August, respectively.

The bottom tracks of these hauls, which continue a time series on this station, were maintained a distance of several miles from the logged position of the SMBA current meter mooring relaid by CHALLENGER in the previous May.

CHALLENGER then steamed north for the first of a series of stations in the northern Rockall Trough and Wyville Thomson Ridge area. At the first station in the deep water near Rosemary Bank, the Portaferry work was undertaken as previously during a box-corer drop. The latter gear again recovered a good core at 2233 h with clear overlying water, although with less evidence of biogenic surface structure than previously. This was followed by an Agassiz Trawl haul in the early hours of 5th August recovering a fairly small catch at 0351 h and a bent bar on the trawl. The next station at 1100 m depth on the south eastern flank of the Wyville Thomson Ridge was reached at midday and there followed a similar sequence of gear deployment as at the previous station. The first and second box corer drops were recovered having failed to close; although bottoming of the heavy gear was clearly indicated on the wire-tension record, no characteristic pull-out spike of increased tension was seen. The third attempt, however, recovered a 24-cm deep core that on investigation proved rich in fauna, with a superficial brownish layer of intensely worked, sandy material overlying a greyer layer that was criss-crossed with burrows, some lined with soft-brown sediment. Large fauna observed burrowing in this core included a living specimen of the brittle star Amphiura grandis that survived well in a small tank in the ship's cold room. This was followed by a Agassiz trawl which recovered a large sample including large numbers of the sea star Radiaster tizardi, and Phormosoma, Araeosoma and Echinus acutus, and much other fauna.

In order to reach Thørshavn in the Faroe Islands on schedule, a dog leg track to a station on the Wyville Thomson Ridge that was originally planned for the second leg was made; CHALLENGER arriving on station at 0100 h 6 August. In excellent sea conditions, the box corer recovered a good core from this position on the main route of deep overflow from the Faroe Bank Channel. Previous bottom photographs and small-diameter core samples taken by Dr. P.R.O. Barnett and Mr. J. Watson from CHALLENGER in 1976 had indicated a mixed shelly sand deposit present overlying a clay layer. This was indeed also found in the box core sample, the underlying clay having effectively plugged the core with no loss of overlying, clear water. The fauna appeared numerous but not diverse; consisting mainly of specimens of the brittle star Ophiocten gracilis that could

at 1730 h with a good catch after trouble and delays caused by a fault developing with the tension monitoring of the main wire. We were not able to rectify this and subsequent hauls had to make do without it. The catch, as expected from this depth, deviated only slightly from those obtained previously from station 'M' nearby; being poorer in the gorgonian Acanella and its associated brittle star Ophiacantha bidentata, but otherwise being characteristically dominated by large numbers of Echinus affinis and Ophiomusium lymani.

The next haul was made on the 1600 m contour recovering a small haul at 0424 h 11 August that was, nevertheless, rich in starfish. The catch also included a large specimen of the deep-water anomuran crab, Neolithodes grimaldi, and several fish. The final benthic haul of the cruise was obtained from the 1200 m depth contour recovering the Agassiz at 1030 h. The catch was rich in the holothurian Stichopus, the prawn Munidopsis and in pennatulids. Other interesting fauna from this haul included juveniles of Neolithodes grimaldi, which appears to have a wide bathymetric range in Rockall Trough, and specimens of the sea lily Rhizocrinus lofotensis.

Following this haul repairs were undertaken on the spooling gear of the hydrographic winch prior to the final Portaferry station scheduled on the Malin Shelf. However, southerly winds quickly freshening to gale force forced premature curtailment of the programme, and CHALLENGER steamed slowly to Ardrossan in a heavy beam sea with the wind gusting to 60 knots, berthing at Ardrossan at 1600 h 12 August after picking up the pilot off the Cumbraes.

Results (see Table 1): Aim 1) Good catches were obtained with the epibenthic sled both at the Permanent Station and station 'M', and the seasonal Agassiz haul from station 'M' yielded the usual rich collection of megafauna. These hauls extend the sample time series at those two repeat stations to seven and five years, respectively. Material sorted from the epibenthic sled hauls will not be available for study until laboratory sorting of the fine-screened material has been completed. However, the Agassiz haul from station 'M' was, as usual, sorted on deck. Gonads from fresh echinoderm material were dissected out and subsamples fixed either in 5% gluteraldehyde for electron microscope studies, frozen for biochemical analyses and bomb calorimetry, or fixed in 5% seawater formalin for paraffin wax histology. The remaining material was fixed in 5-8% buffered formalin.

Some significant improvement in maintaining contact with the pinger

untilised on these hauls was observed as a consequence of use of the backwards listening tadpole deployed over the stern of CHALLENGER.

P.A. Tyler, J.D. Gage.

Aim 2) Following a successful trial with the newly constructed box corer at the Permanent Station (2900 m depth) few problems were encountered with this gear compared to previous experiences. We attribute this entirely to the excellent sea conditions prevailing during its deployment. The gear recovered good cores, from 12 stations, many with the overlying water and sediment surface quite undisturbed, from depths ranging from 400 m to 2900 m, and in sediments ranging from a fairly stiff pelagic ooze to the poorly sorted calcareous sands on the upper continental slope. Although fully satisfactory samples were not collected on the latter sediments, such sediments pose problems for any existing design of coring gear. We were, in fact, surprised to obtain such good samples on the current-swept Wyville Thomson Ridge and Faroe Bank Channel, since the overlying sediment was quite coarse. We attribute the success of these attempts to the presence of an underlying clay layer that effectively sealed the lower end of the sample box.

However, despite our success on this cruise, it is clear that CHALLENGER is not the best platform for deploying box corers. This is because of the necessity to drop the gear from the stern of the ship where, along with the bow end, most vertical motion is experienced when hove to on station, head to wind. Another difficulty results from the need to run the swivel and release plate of the closed gear through the gantry block when getting the gear back on board; damage to the release plate may easily result and there is also the risk of a sudden snatch as these pieces are pulled through the sheave (such as that which parted the wire, losing us the corer, in 1981).

J.D. Gage, S.J. Smith.

Aim 3) The catches obtained with the Agassiz trawl on the seven box-corer positions, other than station 'M', generally yielded rich collections of megafauna. Sea stars and holothurians from these hauls were dissected as described for Aim 1). Gonads of a number of the galatheid crustacean Munidopsis were also dissected and fixed for E.M. studies and should, in conjunction with material from the station 'M' time series, yield an interesting comparison with recent results from American studies in the NW Atlantic. Notable amongst the sea stars collected were several specimens of the poorly known species Radiaster tizardi which we have collected only once previously (as a juvenile), one Ceramaster granularis? and several specimens of sea lily.

Although it was unfortunate that the bad weather forced abandonment of the sampling work planned on the Feni Ridge, where it had been hoped to make good collections of sea pens and gorgonians, quite good collections of species belonging to these and other coelenterate groups were made, both as usual on sta. 'M', and on the Hebridean Slope. Four species of coral (Flabellum alabastrum, Caryophyllia sp. aff cornuformis, C. sp. aff seguenzae and Fungiacyathus marenzelleri and seven species of pennatulid were collected (Kophoblemnon stellifera Distichoptilum gracile, Anthoptilum grandiflorum, Pennatula aculeata, a Pennatula sp juvenile specimens of Funiculina quadrangularis and an Umbellula sp.). In the vicinity of the Wyville Thomson Ridge, hydroids were collected from spines of a cidaroid sea urchin.

There are indications that many of the coelenterate distributions are strongly influenced by water movement; areas of strong bottom current possibly providing good feeding conditions for these suspension feeding forms.

Apart from the likelihood of such currents occurring on the Feni Ridge, strong near-bottom currents have been recorded at station 'M' where the gorgonian Acanella, together with species of pennatulid, occurs in numbers. It is also likely that fairly strong bottom currents occur on the upper part of the Hebridean Slope where a strong northward-flowing current recently has been detected from SMBA current meter moorings at 1000 m depth (sta 'R') near the trawling positions.

Northwards of station 'M' a few fragments only of Acanella were collected, and this, together with the paucity of some other coelenterates and indications from the box cores collected, suggests quieter currents in the deep water on the eastern side of the Rockall Trough north of the Anton Dohrn Seamount.

Only one haul with the Agassiz was made on the "cold" side of the Wyville Thomson Ridge in the Faroe Bank Channel. Probably owing to damage incurred to the bag when the net came fast on this rough ground, the catch (which included a large boulder) was poorer than was hoped. However, the fauna was sufficiently different from that in the previous hauls to emphasize the Wyville Thomson Ridge as a sharply defined zoogeographic boundary in this area of the N.E. Atlantic.

J.D. Gage, P.A. Tyler, G.L.J. Paterson.

Aim 4) The catches of bottom-living fish from all Agassiz trawl hauls worked have been passed on to Dr. Gordon, SMBA.

Aim 5) A parcel of megabenthic species from station 'M' was frozen for despatch to Dr. Pentreath (Radiobiological Lab., Lowestoft).

Aim 6) With the addition of two stations on the Irish Shelf, all stations sampled were those where box corer drops were made. Each station included an XBT (expendable bathythermograph) followed by overside measurements of fluorescence using a Subaquatracka submersible fluorometer lowered at 5 m intervals to 60 m depth. Finally, water samples were taken using NIO bottles on the hydro wire, with the bottles being placed at the surface, at the depth of the chlorophyll maximum, 60 m and at two other depths. Subsamples were then taken for phytoplankton counts from above, at the chlorophyll maximum and below it; few nutrient analyses (NH_3 - N, NO - NO_2 - N) at five depths; and for chlorophyll analysis from five depths. Water temperature measurements were made using reversing thermometers at all five depth levels. Phytoplankton samples were preserved with Lugol's iodine solution, and nutrient samples preserved with a dilute solution of Mercuric Chloride.

Experiments to investigate phytoplankton response to nutrient addition were also set up using surface water collected from the shelf, two slope stations and an offshore station (overlying deep water). For each, five treatments were applied: 1) control, 2) + NH_3, 3) + Fe EDTA, 4) + Na_2 Si O_3 and 5) + CW ("complementary water", i.e. for the offshore station 500 ml of offshore water was mixed with 500 ml of filtered shelf water, and vice versa). These cultures (in 1ℓ bottles) were maintained in a water bath lying on deck through which was pumped water from the ship's non-toxic supply. Samples were taken at 24 m intervals over 4 days; fluorescence was measured and an aliquot filtered through a membrane filter for analysis on shore, giving two independent methods for monitoring algal growth over the course of each experiment.

Two further experiments were also set up using water from the 400 m on the Hebridean Slope, S.E. of station 'M', and from station 'M'. A sixth experiment was set up with the object of using samples from above and below the thermocline in order to see if the algal populations suffer in response to nutrient addition, however, this had to be abandoned owing to heavy seas breaking culture bottles in the deck water bath.

Fluorescence was monitored continuously throughout the cruise, with the Subaquatracka fluorometer suspended in a bin, using the non-toxic supply; chlorophyll calibration samples being taken roughly every 4 h. Sea-surface salinity was measured continuously from the non-toxic supply while

temperature was logged by the officer-of-the watch on the bridge every half hour.

H.J. Lennon.

Acknowledgements : The scientific party wish to thank the Master, Capt. P. MacDermott, and his Officers and Crew for their efforts on our behalf which allowed such good use of the predominantly fine weather in a varied and demanding programme.

J.D. Gage
17 August 1982.

Table 1. RRS CHALLENGER Cruise 11/82. Station List (see also Figs 1-3)

Operation no.	SMBA sta. no.	Gear	Date	Position (at midpoint of bottom haul where appropriate)	Locality	Depth (m)* (at midpoint of bottom haul where appropriate)	Notes
1	-	XBT, Fluorometer and hydrocast to 60 m (F/H)	31.7.82	52°44'N 11°09'W	Irish shelf	-	
2	-	XBT, F/H	31.7.82	53°28'N 11°34'W			
3	-	XBT, F/H	31.7.82	54°40'N 12°16'W			
4	205	Spade box corer (SBC)	31.7.82	54°40'N 12°15'W		2906	Good, undisturbed core.
5	206	Epibenthic sled (ES)	1.8.82	54°40'N 12°16'W	SMBA Permanent station (Fig.2)	2900	Poor sample.
6	207	ES	1.8.82	54°40'N 12°11'W		2906	Large and faunally rich sample.
7	208	Rectangular midwater trawl (RMT 1)	1.8.82	54°40'N 11°58'W		-	Good sample. Net fished at approx. 2000 depth for 1 h
8		XBT, F/H	2.8.82	56°41'N 09°00'W		-	
9	209	SBC	2.8.82	56°41'N 09°00'W		416	Coarse shell sand with
10	210	SBC	2.8.82	56°40'N 09°00'W	Hebridean Slope	401	small pebbles
11	211	SBC	2.8.82	56°41'N 09°00'W		402	Overlying water lost. Some washing Sparse fauna

*Depths given corrected according to Matthews (1939) "Tables of the velocity of sound in pure water and sea water".

12	212	SBC	2.8.82	56°43'N 09°00'W		601	Slightly finer sand; large Coryphenoides lying on sediment. Overlying water lost.
13	213	SBC	2.8.82	56°45'N 09°06'W		841	Muddy sand with pebbles lying on clay layer. Overlying water clear.
14	-	XBT/FH	2.8.82	56°46'N 09°09'W		-	
15	214	SBC	2.8.82	56°45'N 09°11'W		1062	Soft sandy ooze with many burrow openings visible. Underlying layer of clay. Overlying water lost.
16		XBT, F/H	2.8.82	56°46'N 09°09'W		-	
1		XBT, F/H	3.8.82	57°00'N 09°52'W		-	
1	215	SBC	3.8.82	57°02'N 09°47'W		2001	Excellent, deep (28 cm) core with overlying water, sediment surface smooth with many burrow openings visible.
19		XBT, F/H	3.8.82	57°19'N 10°23'W		-	

20	216	SBC	3.8.82	57°19'N 10°23'W	station 'M' (Fig. 3)	2200	Excellent, deep core wit overlying wat sediment surface undulated an superficial soft, light brown layer with marked biogenic structure. Tubes and burrows extending >1 cm deep in underlying greyish clay
21	217	RMT 1	3.8.82	57°21'N 10°21'W			Net fished close to 2000 m depth Small catch recovered; net possibly choked with jelly-fish, Pelagia when fishing.
22	218	ES	3.8.82	57°22'N 10°24'W		2175	Large, rich catch, including ma large brittlestars
23	219	AT	3.8.82	57°25'N 10°28'W		1991	Large rich catch; as usual dominated numerically Ophiomusium Echinus affinis. Fewe Acanella tha usual.

24	-	XBT/F/H	4.8.82	59°05'N 08°51'W			
25	220	SBC	4.8.82	59°05'N 08°51'W	Near Rosemary Bank	1608	Excellent co with clear overlying wat Evidence of considerable biogenic activity in superficial soft, brown layer. Othe burrows extended dee into under- lying grey clay.
26	221	AT	6.8.82	59°05'N 08°55'W		1605	Small catch, including several fish a variety of echinoderms.
27	-	XBT/F/H	5.8.82	59°43'N 07°10'W			O.K.
28	222	SBC	5.8.82	59°43'N 07°10'W	Southern Bank of Wyville-Thomson Ridge.	1101	Good core wi superficial layer of san pelagic ooze overlying sti clay.Evidenc of considera biogenic activity.

29	223	AT	5.8.82	59°41'N 07°09'W		1075	Large catch with many fish (most still alive); a variety of echinoderms present including Phormosoma Echinus acutus & Radiaster tizardi.
30	-	XBT, F/H	6.8.82	60°09'N 08°23'W		-	
31	224	SBC	6.8.82	60°10'N 08°24'W	Ymir Ridge	903	Excellent core with clear overlying wate Superficial sediment was a coarse shell sand. An underlying clay layer plugged the core. Many brittlestars (Ophiocten gracilis) present, but little else.
32	-	XBT/ F/H	6.8.82	60°16'N 06°56'W		-	
33	225	SBC		60°16'N 06°56'W		1145	Excellent core; superficial sediment & muddy sand with underlying clay layer. Rich burrowed fauna present.

34	226	AT	6.8.82	60°16'N 06°53'W	Faroe Bank Channel	1118	Small sample dominated by Pycnogonids; several crinoids and sponges present
35	227	SBC	6.8.82	61°00'N 07°30'W	"	862	Good deep core with superficial layer of sandy mud overlying clay. Few fauna present.
36	-	XBT/ F/H	10.8.82	57°15'N 10°20'W	station 'M'	-	
37	228	AT	10.8.82	57°01'N 09°51'W		2026	Very large haul by Ophiomusium, Phormosoma & small Echinus affinis.
38	229	AT	10.8.82	56°43'N 09°30'N	Hebridean Slope	1587	Good catch, including many fish & asteroids (latter included Psilaster & Ceramaster. Other fauna present included several pennatulids.

39	230	AT		10.8.82	56°44'N 09°12'W	ca 1210 (uneven ground)	Good catch, including many Phormosoma & corals. Othe fauna include crinoids and pennatulids.

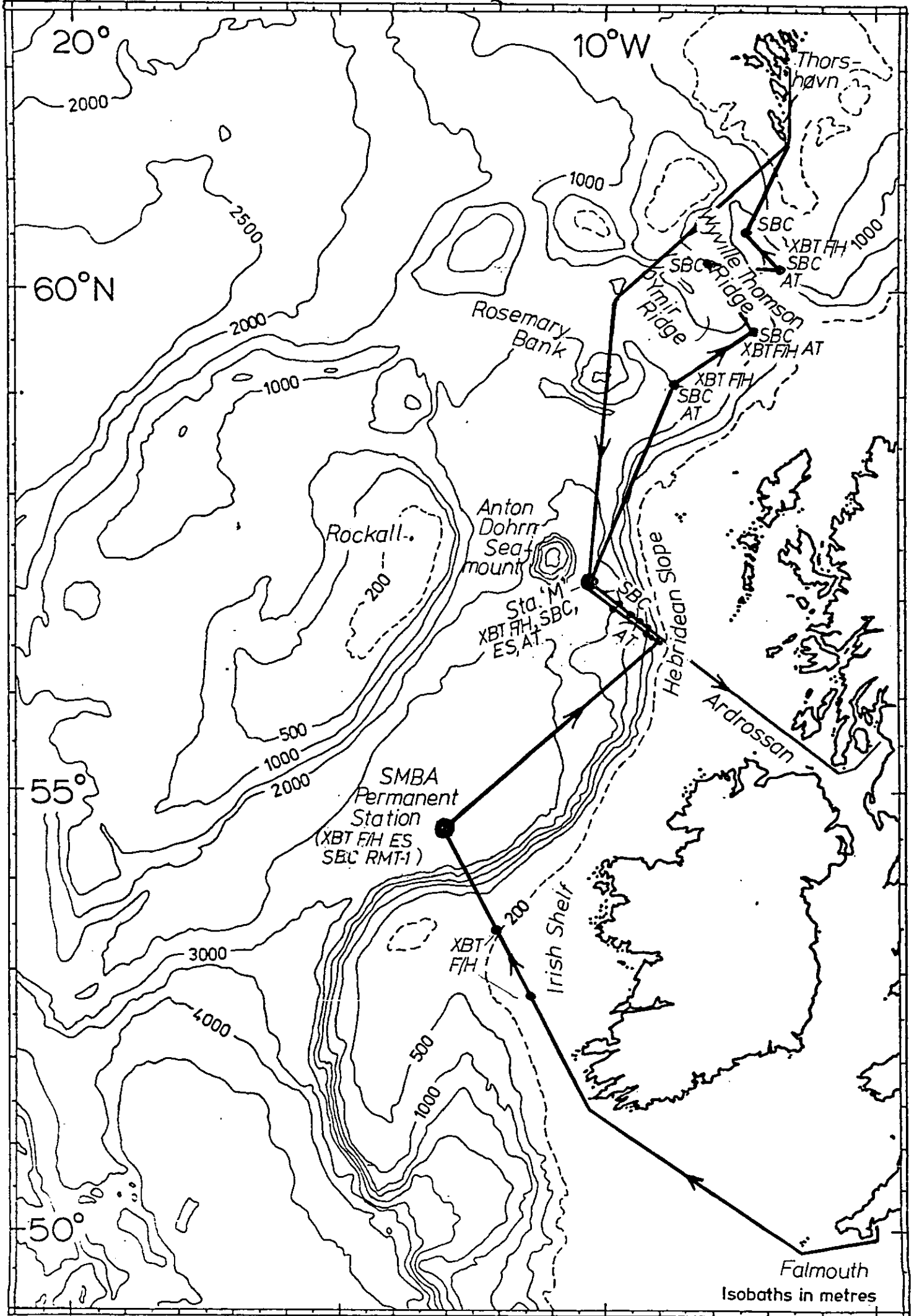

Fig. 1. RRS"CHALLENGER" Cruise 11/82, 29 July-12 August 1982, Cruise track and Stations worked (abbreviations as in Table 1).

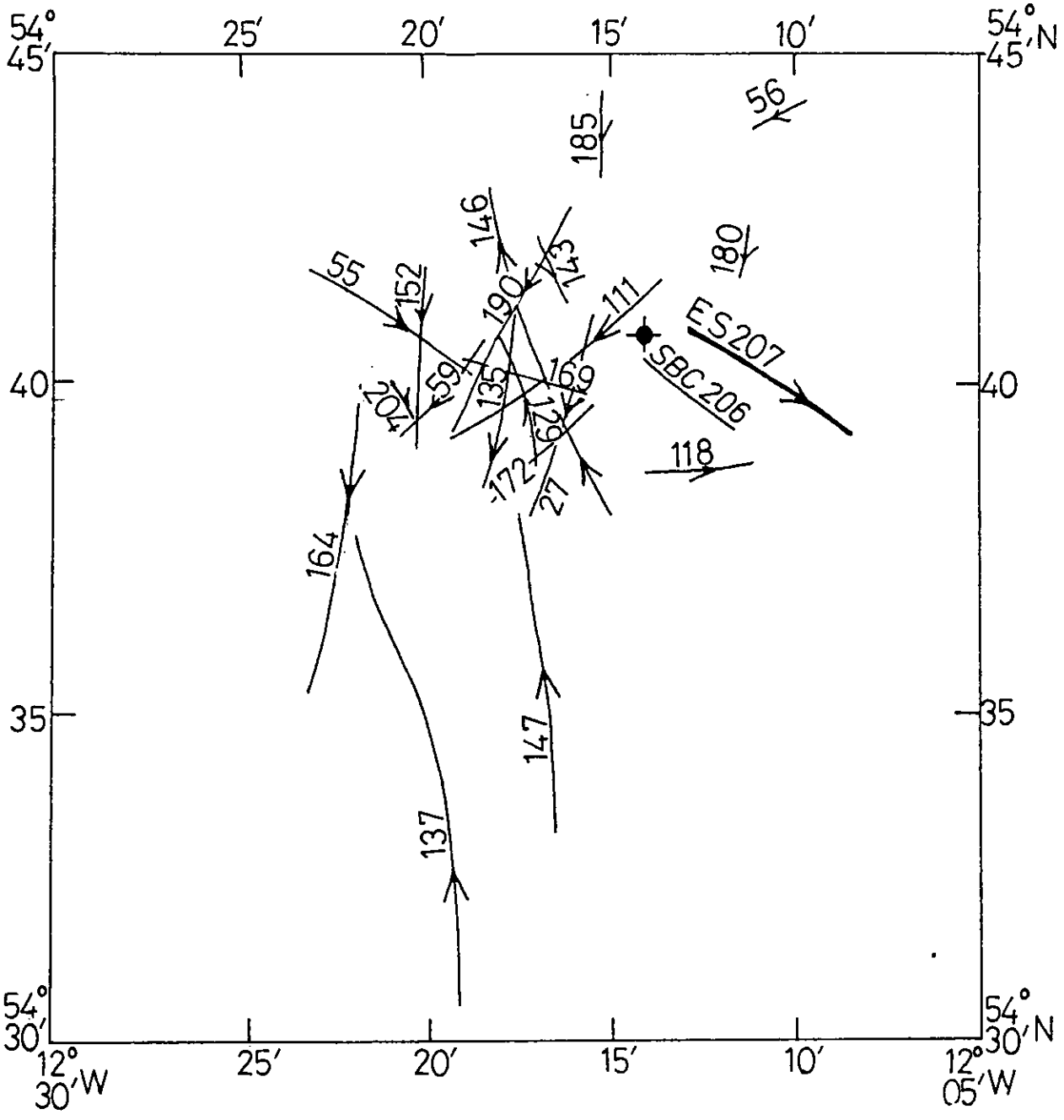

Fig. 2. SMBA Permanent Station, calculated bottom track of ES 207 (heavy line) and all previous hauls in the time series on this station. The position of SBC 206 (Table 1) is also shown.

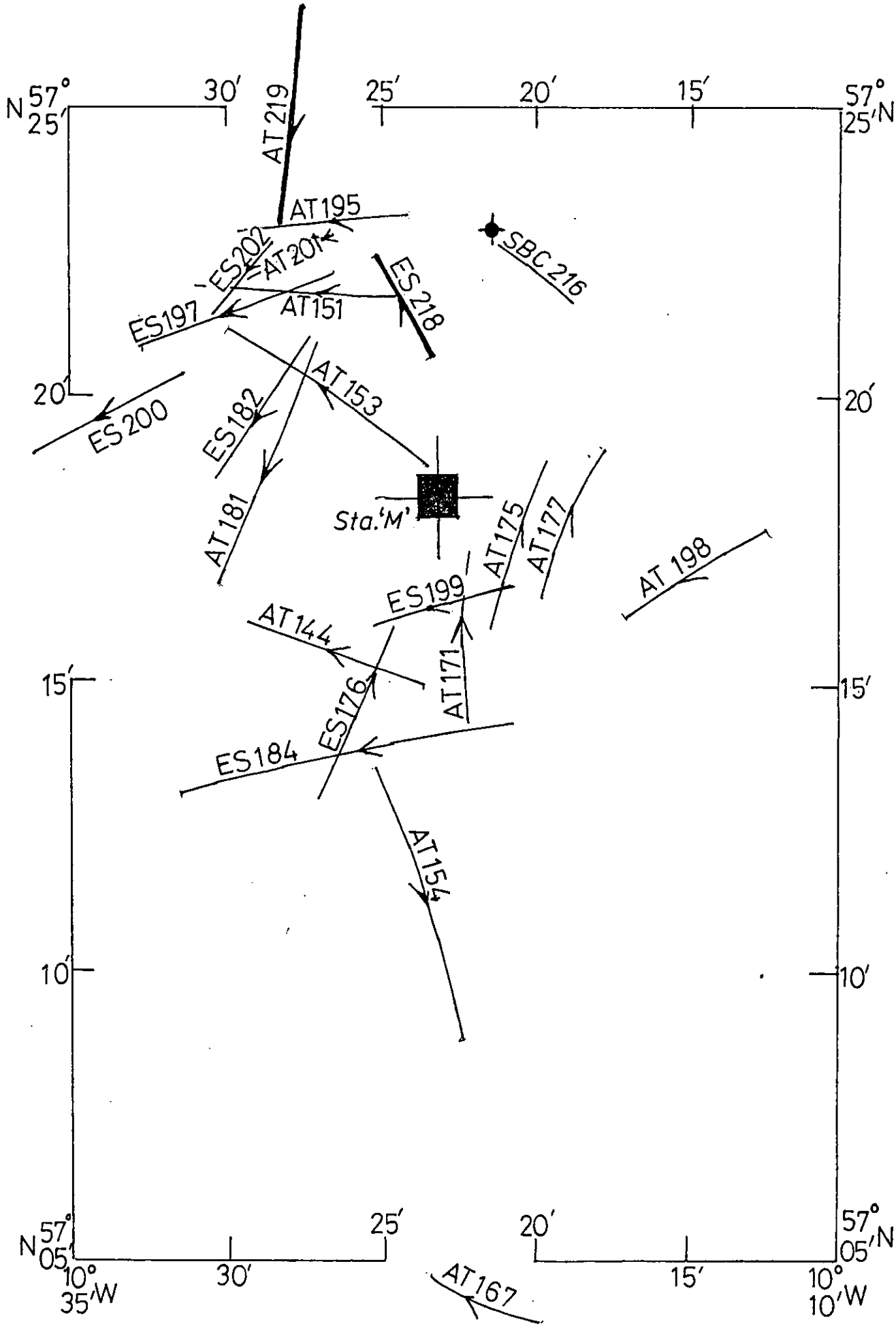

Fig. 3. Station 'M', calculated bottom tracks of ES 218 and AT 219 (heavy lines) and all previous SMBA hauls in the time series on this station. The position of SBC 216 (Table 1) is also shown.