B.O.D.S. (attn. Mrs. Edwards)

INSTITUTE OF OCEANOGRAPHIC SCIENCES
WORMLEY, GODALMING, SURREY

R. R. S. SHACKLETON

Cruise 6

August - September 1973

ICES OVERFLOW SURVEY 1973

I. O. S. CRUISE REPORT No. 3

(Issued December 1973)

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Scientific Staff

Leg 1

J.W. Cherriman
J. Crease (Pr. Sc.)
E. Darlington
D. Grohmann
R.E. Kirk
M.J. Larby
G.T. Mardell
J.A. Moorey
M. Morgan
D.G. Roberts
R. Spencer
T. Turner

Leg 2

D.E. Cartwright (Pr. Sc.)
J.W. Cherriman
D.I. Gaunt
M. Hayes
R.E. Kirk
M.J. Larby
J.A. Moorey
M. Morgan
D.G. Roberts
R. Spencer
R. Wallace

Leg 1. August 7 Aberdeen) with call at Stornoway
August 30 Thorshaven) 11th-14th August

Leg 2. September 1 Thorshaven) with call at Stranraer
September 14 Barry) 13th September

Ship's Officers

Captain	G.H. Selby-Smith
Ch. Off.	C.M.G. Adams
2nd Off.	D. Flower
3rd Off.	P.M.R. Coombes
Radio Off.	M.M. Sime
Ch. Steward	R.M. Cridland
Ch. Eng.	D.C. Rowlands
Elect. Off.	A. Lane
2nd Eng.	M.S.E. Fox
3rd Eng.	A.F. Patterson
4th Eng.	N. Walters

The Principal Scientists take this opportunity of thanking the scientists and officers and crew for their most willing co-operation during the cruise.

Narrative

Leg 1

The ship sailed from Aberdeen at 1858 August 7. All required equipment was on board except for a connecting cable for the Flexotir array. The satellite navigator programs would not load a few hours prior to departure - a fault that was traced to a lamp failure on the reader. Hewlett-Packard, Edinburgh very speedily sent a replacement by car and this was received as the ship left the dock. Work by Messrs Wallace, Gwilliam and Morrison from Wormley IOS and Price and Lewis from Barry IOS was much appreciated.

On leaving harbour we ran over the measured mile and got a good calibration of the fore/aft component of the EM log showing it to be 5% low. Several gyro repeaters were not working initially but all proceeded to work (for no apparent reason) during the early hours of the 8th.

Passage was made through Pentland Firth and watchkeeping was started and maintained on the PES and gravimeter for the remainder of the cruise. During the evening, acoustic tests of the deep sea and shallow tide gauges were made. After a site survey and further check out of the deep tide gauge acoustics it was launched (free fall) at 1806/9th. A TSD in the immediate vicinity demonstrated the very strong thermal gradients in the Atlantic and Norwegian Sea water interface. On recovery of the TSD the sheave jammed and the last 1000 m of wire was coated with grease and slid over the sheave without apparent damage. This was repaired by the Chief Engineer and Mate next morning.

By 0625/10 we were making a site survey of the channel between the Ymir and Wyville-Thompson ridges - this being a potential overflow channel. 2 current meters with deep buoyancy were placed close to the bottom in nearly the deepest part of the channel. 3 TSD stations were made across the channel although it was difficult to maintain station in the strong N.E. surface current.

Shortly after setting off for our next moorings the Captain reported that the Bosn's Mate, who had been off work for 2 days with a badly swollen leg, was in a poorer condition. He considered and I agreed that it would be wisest to land him so course was set for Stornoway. On arriving at Stornoway on the afternoon of the 11 August the ship's bow was damaged substantially enough to warrant emergency repairs. None could be carried out over the week-end and in the event we were not able to sail until Tuesday 14th. During our stay at Stornoway the gravimeter became unstable and although adjustments were made to the servo loop gains with some apparent small improvement it continued to be erratic. Mr Price came up from Barry and quickly found that the spring tension servo was out of action. This unit was replaced and the gravimeter operated satisfactorily.

On sailing, passage was made for the first shallow tide gauge site on the Faeroes shelf. The magnetometer was streamed, as it

was on all passages except those between stations very close together. On the 15th after a morning stop for acoustic tests of the release gear for the moorings the first T.G. and associated current meter were laid in 170 m of water in calm weather and fog. On passage to the 2nd T.G. the surface towed T/S probe was added to our routine watchkeeping. The nominal site of the 2nd T.G. was rather rough with 12 fathom peaks and troughs so we moved a mile to the S.W. for the actual mooring. No difficulties were encountered in laying this or the last mooring at the N.W. end of the shelf. The next 3 days were taken up with the laying of the remaining 4 C/M moorings (see mooring list). Only minor problems arose - the weather which had been largely foggy, deteriorated sufficiently to slow the ship up for a day although we were able to lay the bottom current meter mooring using a Levett release (which jammed on the first attempt) in a 35 kt wind. The arrangement of IOS double barrelled winch, spooling drum and big A frame was almost ideal for the mooring work when combined with the apparent stability of Shackleton around her fore deck working space. All the moorings had been placed to monitor, in various strategic places, the overflow through the Faeroe Bank channel. In retrospect this objective has probably been achieved except for mooring 150 which may well turn out to have been sited badly.

The remainder of the first leg from the 19th to the 29th August was devoted to TSD sections arranged to define the pattern of the overflow within the Faeroe Bank channel and after it had left the channel. We did not extend our survey along the base of the Iceland-Faeroe ridge as this region should be covered by other ships of the 'Overflow 1973' in particular the 'Meteor'. A preliminary interpretation of the bottom temperatures in fig. 3 gives an indication of the path of the overflow and its relation to the bottom topography whilst figure 4 of a temperature section across the Faeroe Bank channel indicates the extreme sharpness of the interface there. Station positions are shown in fig. 2, except for a repeat section across the channel which is omitted for reasons of clarity. In the last two days of the leg we made some attempts to use Dr W. Richardson's transport probes that he has used successfully in the Gulf Stream. 24 of these were generously made available free of charge to us. In principle they are simple to use. Floats, with dye markers, are released (at preset times) from a succession of depths and from their relative disposition when they return to the surface estimates can be made of the transport of water between the various levels. In the event out of 5 probes tried only one released three out of its four markers from various depths, the others only released the surface marker. We assumed that the clocks controlling the release failed (possibly at low temperatures). The one moderately successful probe did not yield any useful estimate as the sea state force 3-4 introduced sufficient dispersion to invalidate the measurement of relative separation of the markers. Rather than waste further probes the experiment was abandoned until an almost flat calm situation arose possibly on the 2nd leg. We had received a report from home that a cylindrical buoy of the type used on the current

meter moorings associated with the tide gauges had been recovered on the surface by a British trawler so it seems probable that the mooring had at some stage been trawled. On the evening of the 29th August we spent several unsuccessful hours trying to locate it before setting course for Thorshaven.

We docked at Thorshaven early on the 30th August along with other ships of the Overflow Survey (Meteor, Meerkatze II, Helland-Hansen, Boris Davidov, Challenger, Explorer (31st August). In the afternoon the Government of the Faeroe Islands most hospitably held a reception for 'Overflow 1973' participants and this was followed by an equally enjoyable party on the R.S. Meteor.

Leg 2

Intended to leave 1st September, but delayed by unwillingness of 'Challenger' (berthed alongside) to leave her berth in bad weather. Finally left 1100/2, to meet fine weather and moderate swell. (The weather was calm to moderate throughout the cruise, and did not upset the programme at any stage).

The first 48 hours were spent performing a line of TSD stations (287 to 294) NW of F.B. Channel, to fill a gap in data from Leg 1, and a few other isolated stations to the west (295-298). The gravimeter was run all the time and usually the magnetometer was streamed on passage. A continuous watch was kept on Loran coordinates, with Satellite Navigator as check against the occasional 10 microsecond 'jumps', otherwise very hard to detect.

The series of courses ended at the furthest west of the current meter moorings laid during Leg 1 - no. 150 - at 1130/4. After releasing this mooring, we proceeded eastwards, picking up mooring nos. 151 and 141 on the way, arriving at deep tidal gauge, mooring no. 140, at 1730/5. A few hours earlier, we caught sight of one of the Norwegian buoys floating freely with its mooring; 'Helland-Hansen' was informed of position by radio.

The capsule at 140 was located by its Command Pinger, but no amount of acoustic transmission would switch on its Release Pinger. After a whole night trying in vain, we decided to switch off C.P. and return later, after dealing with the rest of the moorings.

Shallow tide gauge, mooring no. 142, was reached 1000/6. Its associated current meter had already been wrecked by trawlers, and searched for towards the end of Leg 1. We could find no sign of the tide capsule either, despite a close search over a 2 mile square, lasting 7½ hours. The area, a narrow promontory at the southern end of the Faeroe shelf, is evidently densely trawled, and we now know that no oceanographic installation stands a chance of survival there for more than a few days. We then proceeded through the night to the northernmost moorings, nos. 146 and 147.

The tide gauge (146) and current meter (147) were released without difficulty, and by 1930/7 we had tide gauge (144) and current meter (145) on board also. The night of 7-8 September was spent on a geophysical traverse of the Faeroe Bank Channel, ending at the two current meter moorings 148/149 at first light.

Mooring 148 was inboard by 1010/8, but we could find no trace of 149. The rest of daylight was spent hunting over an area about 5 m x 7 m along the axis of the Channel, extending WNW of the lay position because the tendency would obviously be for a mooring to be carried by the strong bottom current, as on a previous occasion. During this period the 'tadpole' transmitter was found to have broken off its wire, possibly by fouling the propellor. The site was abandoned 2045/8, after 10½ hours of nil response on any frequency. During the night, we proceeded towards the deep tidal mooring (140) for another attempt, calling briefly at the site of mooring 142 for a final, fruitless, blast at the appropriate frequencies.

Tidal site 140 was reached at 1200/9 and the Command Pinger switched on again, but again no result from the release, after 8 hours trying. At 2000 we laid a Dhan Buoy and started an attempt to drag a loop of trawl warp round the capsule whose position we knew within 50 metres, though 1186 m deep. The very close manoeuvre was accomplished by Loran, with checks from radar bearings on the Dhan. At 2355, with 4800 m warp paid out and loop nearly completed, the release pinger suddenly came on. At this, the loop was brought inboard as quickly as possible, trying not to drag the capsule, as there now seemed hope of a normal release. However, the release mechanism has to 'click' through 10 positions before firing, and the pinger only meant that one stage had been passed. After another 9 hours of blasting on the release frequency, we started another drag loop, 0900-1200/10, which in fact produced no result. These operations inevitably ruined some 2 km of trawl warp, but were worth trying, though success at this depth of water was rather unlikely. At 1425/10, after checking that the tidal capsule had not moved from its original position, and switching off its Command Pinger, we abandoned site 140, and proceeded on 234° towards 'Anton Dohrn Seamount', where two current meter moorings were to be laid for a geophysical investigation. The two moorings were laid in the surrounding 'moat', no. 152, station 299, west of the seamount, laid 2200/11, and no. 153, station 300, east, laid 0320/12. We then proceeded on a geophysical traverse towards Barra, and finally turned directly towards the North Channel for the homeward course to Barry.

The Principal Scientist, R. Spencer, and a seaman were landed at Stranraer 1200/13 September, in order to return quickly for various urgent reasons.

Opportunity was taken, 1430/14, on passing a deep area of the Irish Sea, to lower an unused tide gauge sphere for pressure testing at 150 m. At 50 m, the winch was over-run (against instructions), the wire became slack, broke, and the sphere was rescued only after quick action by J. Cherriman. (For a full account of this incident, see D.G. Robert's insertion in Scientific Log Book).

The ship reached Barry Dock 2130/14 September.

Table 1

Station List

Key
CM current meter mooring
DTG deep tide gauge
STG shallow tide gauge
TSD 9006 Plessey TSD
WB water bottle station

All times are GMT and refer to time TSD is at bottom of cast or when messenger is released on W/B cast or when mooring is released on tide gauge and current meter moorings. Depths are in corrected metres either for Area 3 (soundings in FB channel and to east) or Area 7 (soundings to N.W. of the banks). Positions are best estimates (usually Loran C) at the given time.

Day	Time	Station No.	Work	Position	Depth
9-VIII	1955	199/73	DTG +TSD	60°10.25'N 06°19.9'W	1196
10-VIII	1231	200/73	CM	60°14.35'N 08°51.60'W	1101
	1414	201/73	TSD	60°14.7'N 08°51.4'W	1121
	1611	202/73	TSD	60°13.5'N 08°48.5'W	1028
	1800	203/73	TSD	60°14.25'N 08°49.2'W	1028
15-VIII	1439	204/73	STG	60°49.52'N 06°22.8'W	176
	1605	204/73	CM	60°50.02'N 06°24.92'W	165
	2253	205/73	STG	61°29.35'N 07°20.25'W	170
	2356	205/73	CM	61°27.9'N 07°18.4'W	163
16-VIII	0734	206/73	STG	62°16.4'N 08°29.95'W	168
	0837	206/73	CM	62°17.59'N 08°29.50'W	174
	2203	207/73	CM	61°23.8'N 08°06.5'W	724
17-VIII	0120	208/73	CM	61°21.2'N 08°06.5'W	806

Day	Time	Station No.	Work	Position	Depth
18-VIII	1631	209/73	CM	61°00.72'N 13°00.30'W	1681
19-VIII	0335	210/73	CM	60°40.75'N 11°19.50'W	1255
	1155	211/73	TSD	60°16.1'N 13°23'W	700
	1538	212/73	TSD	60°32.8'N 13°36.5'W	1645
	2012	213/73	TSD	60°45.1'N 13°57.5'W	1714
20-VIII	0240	214/73	TSD	60°56.2'N 14°18.2'W	1831
	1104	215/73	WB	60°56.2'N 14°19.5'W	1842
	1236	216/73	TSD	60°56.2'N 14°20.0'W	1843
	1537	217/73	TSD	61°01.8'N 14°28.0'W	1900
	1947	218/73	TSD	61°17.2'N 14°41.0'W	2046
	2330	219/73	TSD	61°23.0'N 14°54.0'W	2138
21-VIII	0508	220/73	TSD	61°39.0'N 13°59.0'W	1704
	0935	221/73	TSD	61°25.2'N 13°41.0'W	1778
	* 1319	222/73	TSD	61°14.5'N 13°28'W	1602
	1623	223/73	TSD	61°08'N 13°19'W	1767
	1955	224/73	TSD	61°00.5'N 13°06.5'W	1719
	2301	225/73	TSD	60°49.0'N 12°49.5'W	1231

* amended after consultation with James Crease on 14/7/75.

Day	Time	Station No.	Work	Position	Depth
22-VIII	0138	226/73	TSD	60°42.0'N 12°42.0'W	691
	0535	227/73	TSD	60°49.0'N 12°01.0'W	931
	0817	228/73	TSD	60°47.5'N 12°07.7'W	1201
	1102	229/73	TSD	61°07.5'N 12°17.5'W	1485
	1400	230/73	TSD	61°19.0'N 12°28.0'W	1529
	1704	231/73	TSD	61°27.0'N 12°34.0'W	1569
	1943	232/73	TSD	61°34.2'N 12°41.5'W	1480
	2252	233/73	TSD	61°46.5'N 12°54.0'W	1322
23-VIII	0346	234/73	TSD	61°47.5'N 12°09.5'W	1298
	0819	235/73	TSD	61°30.5'N 11°50.0'W	1421
	1059	236/73	TSD	61°24.2'N 11°36.0'W	1253
	1352	237/73	TSD	61°20.0'N 11°27.0'W	1399
	1720	238/73	TSD	61°08.2'N 11°27.0'W	1245
	2043	239/73	TSD	60°54.1'N 11°10.2'W	607
	2322	240/73	TSD	60°43'N 11°10.5'W	717
24-VIII	0058	241/73	TSD	60°40.18'N 11°15.92'W	1156
	0306	242/73	TSD	60°39.5'N 11°24.1'W	1247
	0511	243/73	TSD	60°38.7'N 11°36.8'W	1116
	0700	244/73	TSD	60°38.3'N 11°40.25'W	702

Day	Time	Station No.	Work	Position	Depth
	1308	245/73	TSD	61°08.5'N 10°33.2'W	1116
	2201	246/73	TSD	61°16.6'N 08°12.2'W	439
	2345	247/73	TSD	61°18.15'N 08°09.5'W	618
25-VIII	0142	248/73	TSD	61°19.5'N 08°10.0'W	746
	0338	249/73	TSD	61°19.5'N 08°07.0'W	839
	0517	250/73	TSD	61°22.7'N 08°03.5'W	799
	0707	251/73	TSD	61°24.7'N 08°01.7'W	673
	0925	252/73	TSD	61°25.4'N 07°58.0'W	450
	1023	253/73	TSD	61°26.5'N 07°57.25'W	263
	1918	254/73	TSD	62°01.0'N 09°44.0'W	728
	2150	255/73	TSD	61°54.0'N 10°02.0'W	867
26-VIII	0051	256/73	TSD	61°47.0'N 10°26.1'W	1020
	0500	257/73	TSD	61°42.0'N 10°59.0'W	1291
*	0926	258/73	TSD	61°34.5'N 10°53.5'W	1319
	1315	259/73	TSD	61°38.0'N 10°26.0'W	1344
	1706	260/73	TSD	61°27.2'N 10°26.0'W	1238
	2123	261/73	TSD	61°29.2'N 09°52.2'W	1090
27-VIII	0158	262/73	TSD	61°28.3'N 08°49.3'W	470
	0338	263/73	TSD	61°32.0'N 08°46.7'W	669

Day	Time	Station No.	Work	Position	Depth
	0517	264/73	TSD	61°34.5'N 08°41.3'W	878
	0653	265/73	TSD	61°38.0'N 08°38.00'W	834
	0848	266/73	TSD	61°37.3'N 08°38.25'W	885
	1117	267/73	TSD	61°39.8'N 08°34.2'W	786
	1321	268/73	TSD	61°41.9'N 08°30.0'W	640
	1452	269/73	TSD		450
28-VIII	0401	270/73	TSD	61°04.1'N 07°55.1'W	287
	0517	271/73	TSD	61°05.6'N 07°54.0'W	474
	0647	272/73	TSD	61°08.0'N 07°50.9'W	706
	0900	273/73	TSD	61°10.8'N 07°45.0'W	892
	1313	274/73	TSD	61°14.0'N 07°33.5'W	797
	1504	275/73	TSD	61°16.2'N 07°28.6'W	662
	1623	276/73	TSD	61°18.6'N 07°25.8'W	391
	1727	277/73	TSD	61°25.6'N 07°20.0'W	201
	2020	278/73	TSD	61°27.4'N 07°57.0'W	177
*	2155	279/73	TSD	61°29.9'N 07°53.2'W	331
	2343	280/73	TSD	61°25.5'N 07°56.3'W	561
29-VIII	0123	281/73	TSD	61°23.8'N 07°57.2'W	699
	0306	282/73	TSD	61°21.8'N 08°01.0'W	816

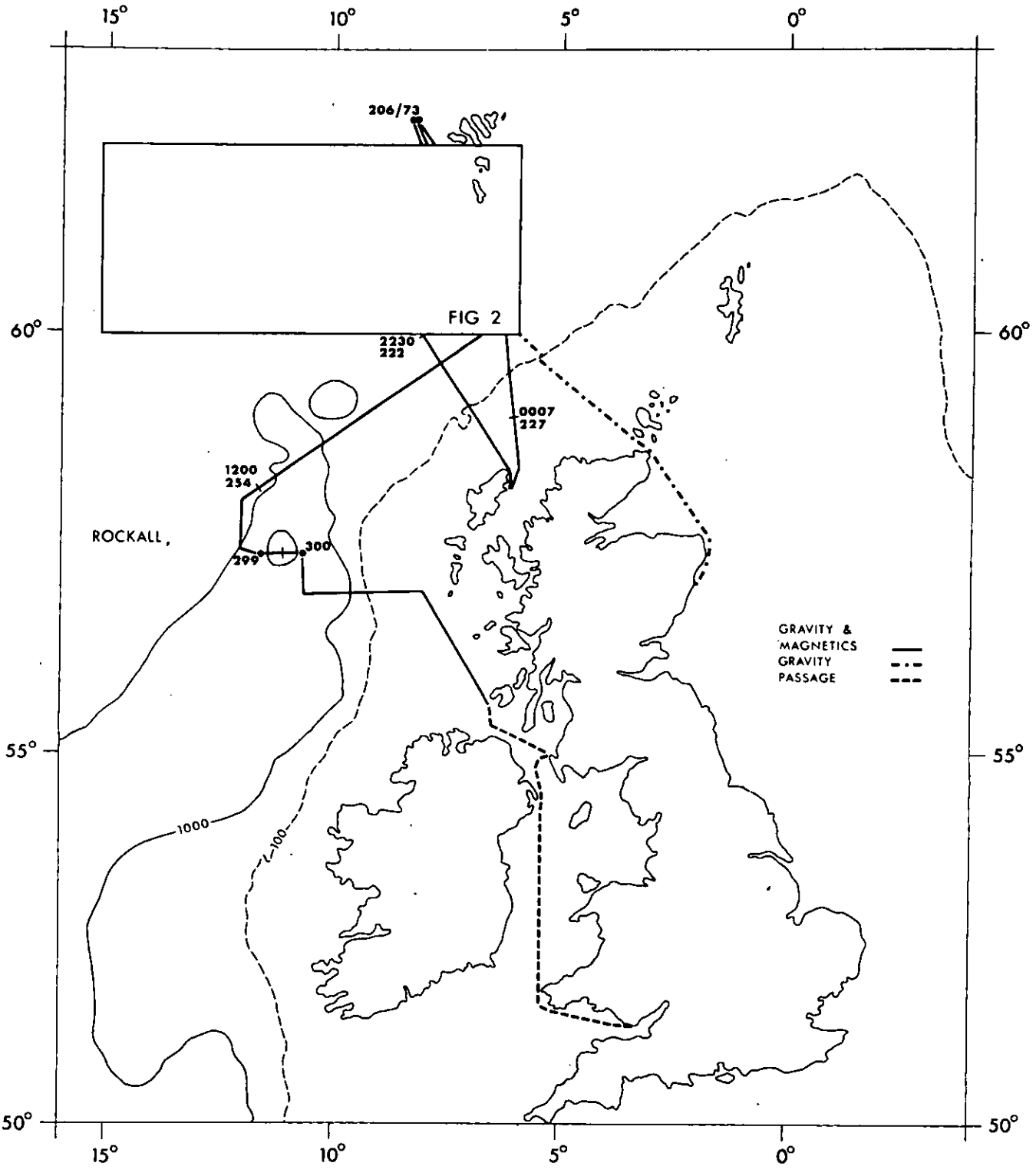
Day	Time	Station No.	Work	Position	Depth
	0442	283/73	TSD	61°19.7'N 08°05.3'W	849
	0615	284/73	TSD	61°18.2'N 08°07.5'W	737
	0734	285/73	TSD	61°17.1'N 08°08.6'W	591
	0841	286/73	TSD	61°15.9'N 08°08.5'W	525
2-IX	2240	287/73	TSD	62°00'N 09°02.5'W	460
3-IX	0032	288/73	TSD	61°56.37'N 09°05.75'W	525
	0220	289/73	TSD	61°51.5'N 09°17.0'W	612
	0403	290/73	TSD	61°48.0'N 09°18.5'W	741
	0550	291/73	TSD	61°44.0'N 09°24.0'W	832
	0800	292/73	TSD	61°40.5'N 09°30.0'W	899
	1040	293/73	TSD	61°36.5'N 09°40.0'W	1000
	1200	294/73	TSD	61°44.4'N 09°47.0'W	971
	1403	295/73	TSD	61°48.0'N 09°54.0'W	907
	2235	296/73	TSD	61°33.5'N 11°21.4'W	1036
4-IX	0225	297/73	TSD	61°37.48'N 12°02.91'W	1410
	0545	298/73	TSD	61°25.3'N 12°01.5'W	1337
11-IX	2105	299/73	CM(152)	57°28.0'N 11°44.2'W	2013
12-IX	0225	300/73	CM(153)	57°27.6'N 10°40.2'W	2213

Table 2

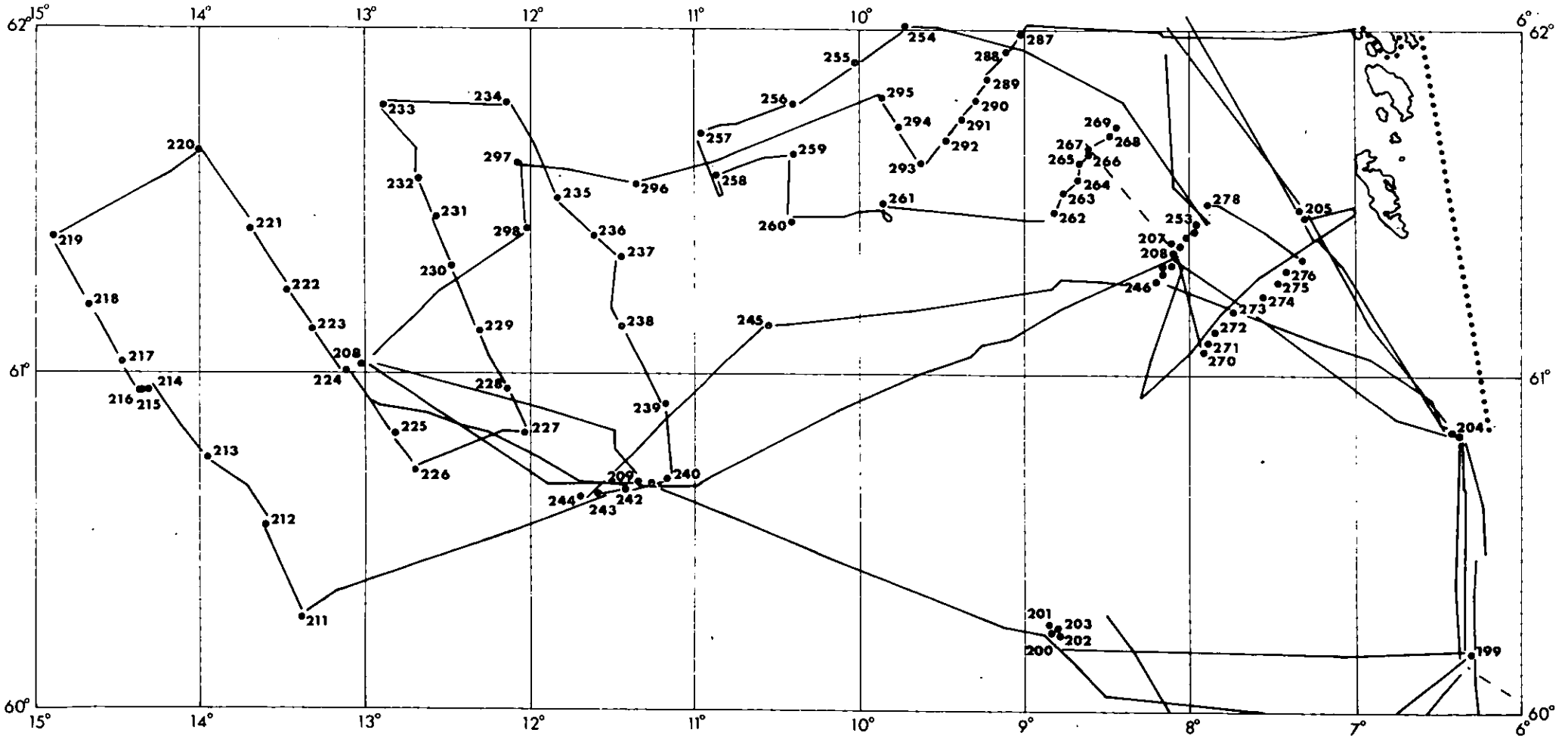
Mooring List

NIO mooring No.	Description	Laid	Recovered	Depth	Position	Loran C	Decca	Satellite
140	Deep Tide Gauge	1812/9/VIII/73	Located but not recovered	1185 m	60°10.25'N) 06°19.9'W)	SL3-W 32793.2 -Y 51623.3	A1.78 Red E40.89 Green	-
141	Bottom C/M mooring. C/Ms 12 & 24 m above bottom.	1231/10/VIII/73	0730/5/IX/73	1140 m	60°14.35'N) 08°51.60'W)	33199.1 51215.1	D10.83 E31.68	-
142	Shallow Tide Gauge	1439/15/VIII/73	Lost	174 m	60°49.52'N) 06°22.80'W)	33162.0 51713.1	I23.14 G39.44	
143	Single C/M associated with TG. C/M 26 m above bottom.	1605/15/VIII/73	Lost, buoy recovered by trawler	165 m	60°50.3'N) 06°24.9'W)	331.757 517.112	J00.01 G39.60	1556 60°50.02'N) 06°24.92'W)
144	Shallow Tide Gauge	2253/15/VIII/73	1910/7/IX/73		61°29.35'N) 07°20.25'W)	33695.0 51690.7	J10.32 H37.15	2252 61°29.33'N) 07°20.4'W)
145	Single C/M associated with TG. C/M 26 m above bottom.	2356/15/VIII/73	1943/7/IX/73	163 m	61°27.9'N) 07°18.4'W)	33677.2 51692.0	J10.64 H36.86	
146	Shallow Tide Gauge	0734/16/VIII/73	1045/7/IX/73	164 m	62°16.14'N) 08°29.95'W)	34081.0 51427.1	J17.41 I31.37	0736 62°16.60'N) 08°30.42'W)
147	Single C/M associated with TG. C/M 26 m above bottom.	0837/16/VIII/73	1130/7/IX/73	174 m	62°17.59'N) 08°29.50'W)	34086.5 51425.9	J16.68 I32.13	

NIO mooring No.	Description	Laid	Recovered	Depth	Position	Loran C	Decca	Satellite
148	C/M mooring. C/Ms @ 28, 80, 132, 441 m above bottom.	2203/16/VIII/73	1010/8/IX/73	726 m	61°23.8'N) 08°06.5'W)	33717.8 51525.7	AG.20 G44.10	2206 61°24.19'N) 08°05.12'W)
149	C/M mooring. C/Ms @ 110, 215, 522 m above bottom.	0120/17/VIII/73	Lost	805 m	61°21.2'N) 08°06.5'W)	33695.6 51524.9	A10.40 G44.03	0058 61°21.36'N) 08°04.60'W)
150	Bottom C/M mooring. C/Ms @ 12 & 24 m above bottom.	1631/18/VIII/73	1325/4/IX/73	1682 m	61°00.72'N) 13°00.30'W)	33686.5 50136.7	E7.04 E39.93	1640 61°00.52'N) 13°00.77'W)
151	C/M mooring. C/Ms @ 42, 854, 1109 m above bottom.	0335/19/VIII/73	1955/4/IX/73	1258 m	60°40.75'N) 11°19.50'W)	33543.0 50630.9	E4.11 E35.05	0238 60°40.13'N) 11°20.6'W)



R.R.S. SHACKLETON 6/73 FIG (1)



OVERFLOW'73 R.R.S. SHACKLETON CRUISE 6/73 TRACKS & STATION POSITIONS

FIG (2)

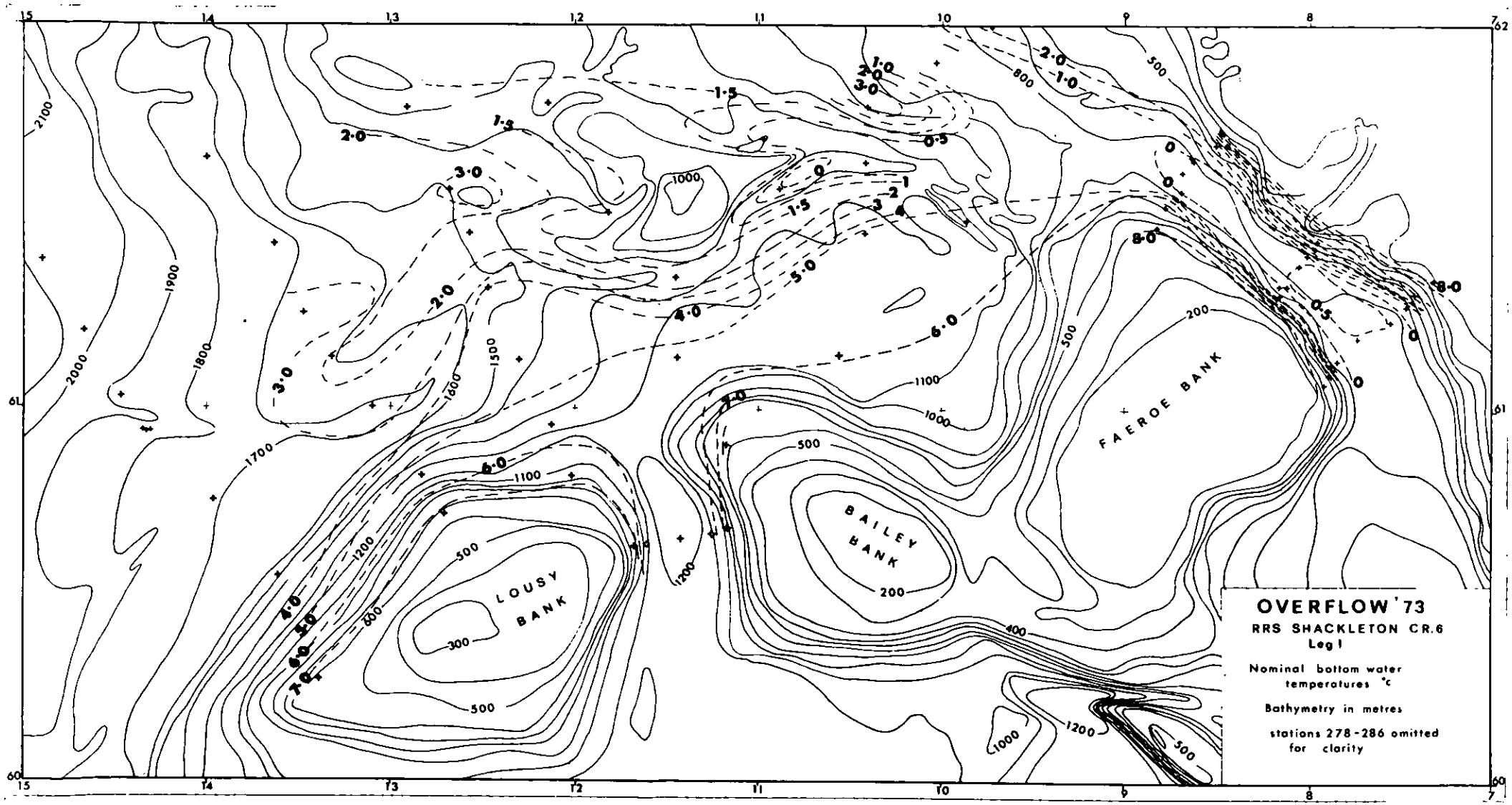
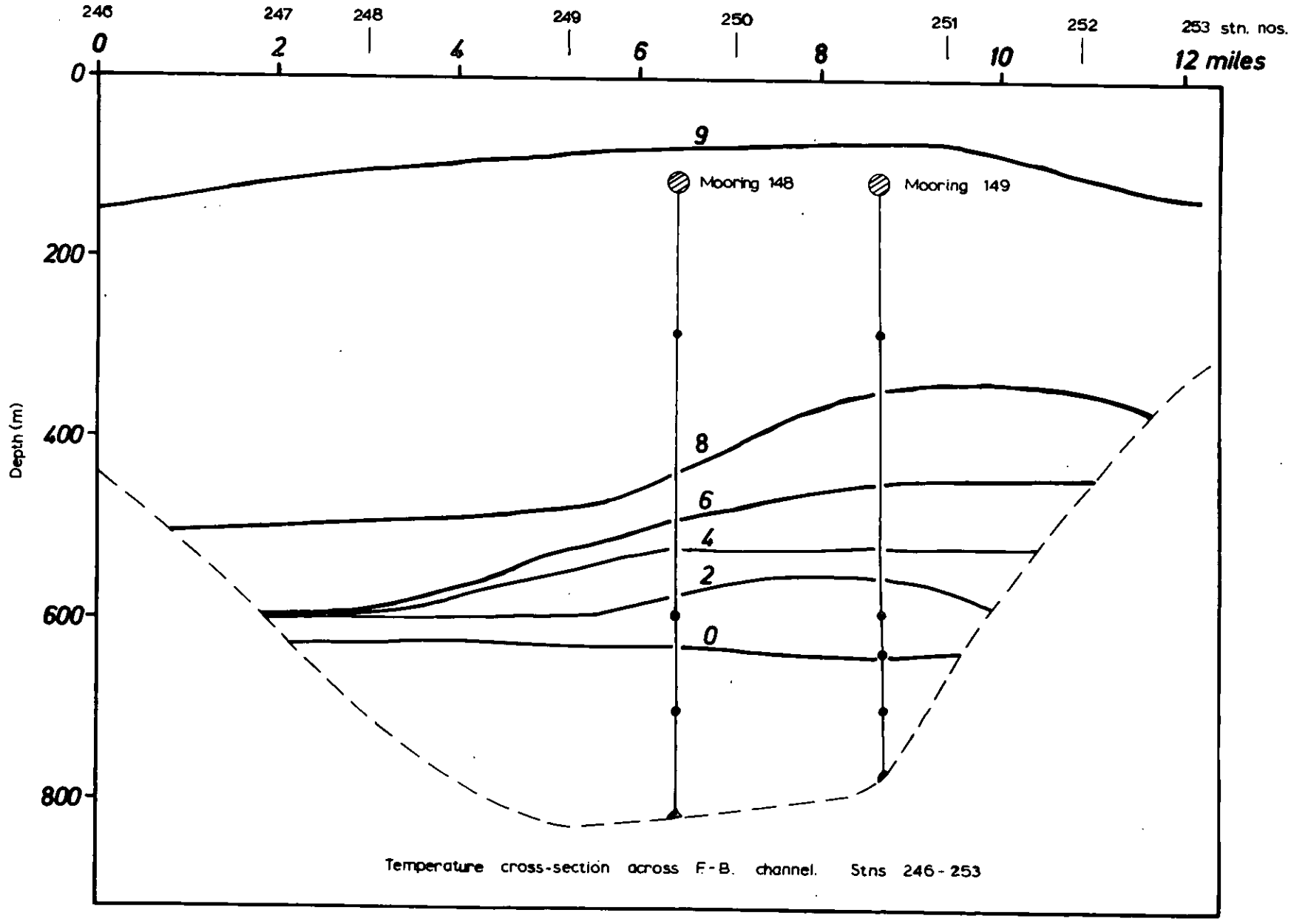

OVERFLOW '73
RRS SHACKLETON CR.6
Leg I
Nominal bottom water temperatures °c
Bathymetry in metres
stations 278-286 omitted for clarity
FAEROE BANK
BAILEY BANK
LOUSY BANK

Fig. (3)



Temperature cross-section across F-B. channel. Stns 246-253

Fig (4)