9/12/68

REPORT ON JOHN MURRAY GEOPHYSICAL CRUISE

Hebrides-Shetlands-Faroes, 29th June - 26th July 1968

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1. INTRODUCTION.

The Durham University geophysics cruise on the R.R.S. John Murray lasted from 29th June to 26th July, 1968. The main objects of the cruise were as follows:-

1. To investigate the geological and crustal structure of the continental shelf and margin to the northwest of the Orkney and Shetland Islands, including traverses across the Shetland-Faroes channel, using surface ship gravimeter, magnetometer and seismic profiling.

2. To continue investigations of the structure of the Minch commenced in 1967.

3. To test an airgun profiling system using pulse-compression techniques.

Subsidiary tasks which were undertaken included (1) gravity lines in Cardigan Bay for Birmingham University, on outward passage, (2) testing of the British Antarctic Survey airgun profiling system, and (3) sparker traverse across Kish Bank gravity anomaly (east Irish coast). Unfortunately it was not possible to undertake short coring and plankton hauls in the Shetland-Faroes channel as requested by Dr. Wiseman, since the coring winch could not be used with the gravimeter on board.

The cruise was divided into two legs:- Leg 1 Plymouth-Lerwick 29th June-12th July.

Leg 2 Lerwick-Plymouth 14th July-26th July.

We called at Stornaway during leg 1 and at Thorshavn during leg 2.

2. SCIENTIFIC PERSONNEL.

Leg 1:-	Professor M.H.P. Bott	Senior scientist and i/c cruise.
	Mr. A. McKay (Durham)	Research Assistant.
	Mr. D. Asbery (Durham)	Senior Technician.
	Mr. H.A. Allerton (Durham)	M.Sc. postgraduate student.

	Mr. A.B. Watts (Durham)	Ph.D. postgraduate student.
	Mr. M. Wingfield (NERC)	Technician.
Leg 2:-	Mr. A. McKay (Durham)	Senior scientist.
	Mr. P. Butler (Durham)	M.Sc. postgraduate student.
	Mr. F. Hetherington (Birmingham)	Technician.
	Mr. P. Morgan (Durham	Undergraduate student.
	Mr. J. H. Peacock (Durham)	Ph.D. postgraduate student.
	Mr. A.B. Watts (Durham)	Ph.D. postgraduate student.
	Mr. J. Bulled (NERC)	Technician.

3. EQUIPMENT INSTALLED.

The following items of scientific equipment were put on board for the survey:-

1. NERC pool: Varian magnetometer, E.G.&G. sparker, PDR, coring and plankton haul equipment.

2. Durham University: Airgun and pulse-polarity computer, EMI tapedeck, speed recorder, test equipment etc.

3. Cambridge University: Graf Askania gravimeter and cross-coupling computer.

4. Glasgow University: Littlemore magnetometer (spare).

5. Birmingham University: Airgun system for testing.

Navigation depended on Decca and visual fixes.

4. NARRATIVE - LEG 1.

We sailed from Plymouth at 0830 (BST) on 29th June. The gravimeter was operated from the start, but not magnetometer or sparker. Shortly after leaving Plymouth there were two short DC failures which entailed clamping the gravimeter.

We reached the start of the gravity line requested by Birmingham at 2310 on 29th June, and the three segments of the line were completed by 1725 on 30th June. The magnetometer was run during the third segment and was found to be operating satisfactorily. From 2030 to 2100 the sparker was tested and found to be working. By the evening of 30th June the cross coupling computer was working satisfactorily

We reached the start of leg 1 of the Minch survey at 0825 on 2nd July. Four east-west traverses of the Minch were done using gravimeter, magnetometer and sparker. During the last leg the sea was rising and a strong swell from the north was building up. As we sailed towards Stornaway, at 0305 on 3rd July a wave put the sparker generator out of action, causing a small burn-out. From 0630, the cut-out switch on the unit supplying stabilised AC power to the gravimeter was being repeatedly actuated by the unit's movement in a heavy swell. (This fault was later remedied by fixing the unit more firmly.) We reached Stornaway at 0830 on 3rd July to make a gravimeter base observation.

As a gale was forecast, the sailing from Stornaway was postponed nearly 24 hours. The sparker generator was repaired by the Engineers, and the spare Decca set which had a fault in the lane identification was repared by the Decca agent.

We sailed from Stornaway at 1015 on 4th July to complete the last two legs of the Minch survey and to proceed with the main shelf survey. There was a heavy swell from the north which persisted for two days. The swell caused excessive rolling and the Minch survey was abandoned after half a line. We proceeded with the shelf survey. The magnetometer was out of action for 24 hours between 4th and 5th July.

Otherwise there were no serious difficulties and the survey proceeded as planned, using sparker as well as gravimeter and magnetometer whenever sea conditions were suitable. Excellent results were obtained, and nearly all the work planned for the leg was completed. We reached Lerwick at 0900 on 12th July, completing leg 1 of the survey.

5. NARRATIVE - LEG 2.

We sailed from Lerwick at 0845 on 14th July. The magnetometer was streamed when clear of port, and was operated, together with the gravimeter and precision depth recorder, along two short tracks on the way to the start of stage 3 of the shelf survey. This stage comprised three legs to the north of Shetland. On part of each leg, the sparker was operated at 1 K joule, giving a clear record on the first two, but on the third leg, the record became very noisy due to a growing head swell. On this leg too, the depth recorder gave out in a depth that coincided with a blind part of the range of the bridge echo sounder, so that for about 12 hours, no depth record was obtained.

At 1500 on the 16th July, we began a run along the axis of the Shetland-Faroes Deep. On completion of this run, at 0730 on the 17th, we headed NW on to the Faroes Block, initially running the sparker at 10 KJ, but lowering this to 2 KJ (1 KJ on each of two units) when we reached shallower waters. This track was followed by a run to the SE, on which a good sparker record of the margin of the Faroes Block was obtained, with a one-way penetration of 0.3 sec through sediments observed there.

At 1400 on 17th July, we noticed that no current was being supplied to the gravimeter heaters, and that the temperature of the instrument had fallen from 40°C to 27.5°C. It had been cooling since 1800 on the previous day when we omitted to re-close the heating circuit after replacing a blown fuse. We considered it necessary to go at once to a port where a gravity tie-in could be made, and the nearest convenient port was Thorshavn. Accordingly, an unscheduled third transit of the Faroes Block margin was begun, taking us towards that port. The gravimeter regained stability at its working temperature by 2200. We reached Thorshavn at 0800 on 19th July, where the discrepancy in the value given by the gravimeter fortunately proved to be of a size attributable to drift since Lerwick.

We left Thorshavn at 1315 and retraced the second Faroes Block run, in order to obtain an accurate gravity record. This done, we made our way to the starting point of the 4th stage of the shelf survey, which involved five NW-SE crossings of the continental margin between the Orkneys and Lewis, with the sparker running whenever possible. As time was pressing, two of these runs, which were to have gone in close to the north coast of Scotland, had to be cut short.

The second stage of the Minch Survey was begun at 1500 on the 22nd, with a view to filling in what had had to be abandoned on the first part of the cruise because of bad weather. On finishing this, we headed for the Irish Sea and completed a run with the sparker off Dublin Bay, between 1140 and 1600 on the 24th July. Our last run was a 50 mile track off Lands End, which we finished at 1700 on the 25th July.

Weather conditions were very good throughout the second part of the cruise, a typical swell being about 4 feet.

Because of time lost in taking the gravimeter into Thorshavn, a track across the Wyville-Thomson Ridge had to be abandoned, but otherwise the courses that had been planned for the second part of the cruise were completed.

At convenient times during the second part of the cruise, testswere carried out on the Durham airgun profiling system with some measure of success, and the Birmingham (British Antarctic Survey) array and recording equipment were tested satisfactorily with a signal from one of the sparker units.

Details of the track followed on both parts of the cruise are given in the appendix and are shown on the accompanying map.

6. SCIENTIFIC RESULTS.

The cruise was exceptionally successful and nearly all the intended programme of investigations was carried out. Weather only caused us to lose about 20 hours, and for a lot of the cruise gravimeter, magnetometer, sparker and PDR were in concurrent operation. Although it has not yet been possible to look at the results in any detail, we have now obtained good coverage of quite a large area of continental shelf and margin where there are spectacular gravity anomalies, and the good coverage extends to the Faroe Isles. The airgun testing was satisfactorily accomplished.

We should like to warmly acknowledge the co-operation and help from Captain Perry and the Officers and Crew, who went out of their way to make the cruise both successful and a pleasure. We also wish to thank Mr. B.C. Browne for the loan of the Graf Askania gravimeter, which was an important factor in the success of the cruise.

APPENDIX

Table of major course changes.

Instruments in operation on each section are indicated by:

G - gravimeter

M - magnetometer

P - depth recorder

S - sparker

The letters are shown in brackets where the instrument was in operation for part of the section only.

DATE	HOUR	LATITUDE	LONGITUDE	HEADING	INSTRUMENTS	
29th June	0830	Sailed from Plymouth				
Birmingham Traverses						
29th June	2310	50°50'N	05°45'	000°	GP	Start
30th June	0903	52°3.8'	05°45.5'	050°	GP	
	1448	52°401'	04°43.0'	283°	GMP	
	1725	52°44'	05°44'			End
Minch Survey (stage 1)						
2nd July	0825	57°45.8'N	06°52'W	090°	GMPS	Start
	1211	57°46.5'	05°52.5'	000°	GMPS	
	1239	57°51.4'	05°50.8	272°	GMPS	
	1623	57°52'	06°32'	043°	GMP	
	1755	58°0.6'	06°17.2'	099°	GMPS	
	2210	57°56.8'	05°29.6'	000°	GMP	
3rd July	0030	58°16.0'	05°29.3'	053°	GMP	
	0145	58°21.4'	05°15.9'	268°	GMP(S)	Heavy swell from north
	0517	58°20.5'	06°08.6'	129°	GMP	" " " "
	0623	58°13.6'	05°58.0'	245°	GMP	" " " "
	0830	Stornaway	Stornaway			
4th July	1015	Sailed from	Stornaway			
	1100	58°10.2'	06°15'	090°	G(M)P(S)	" " " "
	1306	58°10.4'	05°47.8'	046°	GP	" " " "
	1436	58°18.8'	05°31.9'	315°	GP	" " " "
	1630	58°29'	05°51'			End of stage 1

Shelf Survey (stage 1)

4th July	1630	58°29'N	05°51'W			Start
				325°	GP	Heavy swell from north.
5th July	2240	59°03.5'	06°38.5'	013°	GP	" " " "
"	0503	59°45'	06°14'	141°	G(M)P	" " " "
"	1650	58°36.2'	04°21.4'	043°	GMP	Swell decreasing.
"	1830	58°465'	04°00.2'			End of stage 1

Orkneys-Faroes Traverses

5th July	1830	58°46.5'N	04°00.2'W			Start
				325°	GM(P)	Heavy swell decreasing.
6th July	2111	61°37.2'	07°07.9'	062°	GMP	
7th July	0012	61°47.7'	06°22.0'	144°	GMP(S)	
"	2305	59°28'	02°55'			End

Shelf Survey (stage 2)

7th July	2305	59°28'N	02°55'W			Start of stage 2
				225°	GMP	
8th July	0142	59°12.8'	03°29.2'	329°	GM(P)	Heavy bow sea, slowed to 6 knots.
	1103	60°11'	04°40'	060°	GM	Heavy swell from north.
	1445	60°21.6'	03°57.0'	139°	GMP.	" " " "
	1801	60°01'	03°22'	118°	GMP	
	2155	59°44.3'	02°18.3'	145°	GMP	
9th July	0130	59°17.7'	01°45.7'	129°	GMP	
	0225	59°12.8'	01°35.7'	000°	GMP	
	0540	59°34.2'	01°35.7'	302°	GM(P)(S)	
	2043	60°21.8'	03°36'	054°	GMPS	
	2200	60°27.8	03°13.3	125°	GMP(S)	

(Stage 2 continued)

10th July	0656	59°52'	01°34'	022°	GMPS	
	0925	60°05.7'	01°22.3'	264°	GMPS	
	1115	60°04.4'	01°41.8'	337°	GMPS	
	1422	60°17.7'	01°53.2'	296°	GMPS	
	2025	60°33.3'	03°02'	097°	GMPS	
11th July	0324	60°29.6'	01°38.3'	333°	GMP	
	0512	60°41.5'	01°51'	095°	GMP	
	0800	60°40'	01°11'	316°	GMPS	
	1430	61°09.1'	02°08.2'	047°	GMPS	
	1610	61°17.5'	01°50'	130°	GMPS	
	2232	60°52.2'	00°42.3'	182°	GMPS	
12th July	0556	59°58'	00°46'	308°	G(M)P(S)	Airgun sledge tested.
	0900	Lerwick				

Shelf Survey (stage 3)

14th July	0900	Sailed from Lerwick				
	0940	60°06'N	01°00'W			Start of stage 3
	1240	60°06'	00°10'	090°	GMP	
	2100	61°03'	00°09'	000°	GMP(S)	
15th July	0740	61°48'	01°23'	323°	GMP(S)	
	0930	62°01'	00°44'	056°	GMP	
	1940	61°01'	00°30'E	150°	GMPS	Moderate swell from north.
	2100	61°04'	00°44'	059°	GMPS	
16th July	1500	62°54'	00°16'W.	348°	GM(P)(S)	Swell increasing to moderate from north. End of stage 2

Faroes Deep Traverse

16th July	1500	62°54'	00°16'W			Start
				222°	GM	Moderate swell from north.
17th July	0130	61°41'	02°16'			
				204°	GM	" " " "
	0730	61°01'	03°00'			End

Faroes Block Runs

17th July	0730	61°01'	03°00'			Start
				315°	GM(S)	Heavy swell from north
	2200	62°10'	05°30'			Gravimeter doubtful.
				224°	(G)MS	until Thorshavn.
18th July	0030	61°55'	06°04'			
				141°	(G)MS	
	1150	60°51'	04°16'			
				237°	(G)M	
	1510	60°15'	04°20'			
				326°	(G)MS	
19th July	0540	61°46'	06°35'			
				001°	(G)M	
	0710	61°55'	06°35'			
	0800	Thorshavn				
	1315	Sailed from Thorshavn				
	1330	62°02'	06°43'			
				091°	GMP	
	1500	62°02'	06°16'			
				141°	GMP	
20th July	0200	60°51'	04°16'			
				185°	GMP	

Shelf Survey (stage 4)

20th July	0630	60°15'N	04°20'W			Start of stage 4
				147°	GMP(S)	
	1615	59°12'	03°04'			
				270°	GMP	
	1705	59°12'	03°17'			
				214°	GMP	
	2040	58°47'	03°44'			
				336°	GMPS	Moderate swell from west.

(Stage 4 continued)

21st July	0930	60°02'	05°00'			
				238°	GMP	
	1325	59°47'	05°46'			
				146°	GMPS	Moderate swell from south.
	1810	59°19'	05°09'			
				238°	GMP	
	2105	59°07'	05°43'			
				326°	GMPS	
22nd July	0200	59°36'	06°21'			
				237°	GMP	
	0430	59°27'	06°50'			
				146°	GMP(S)	
	1300	58°37'	05°44'			
				237°	GMP	
	1500	58°28'	06°09'			End of shelf survey.

Minch Survey (stage 2)

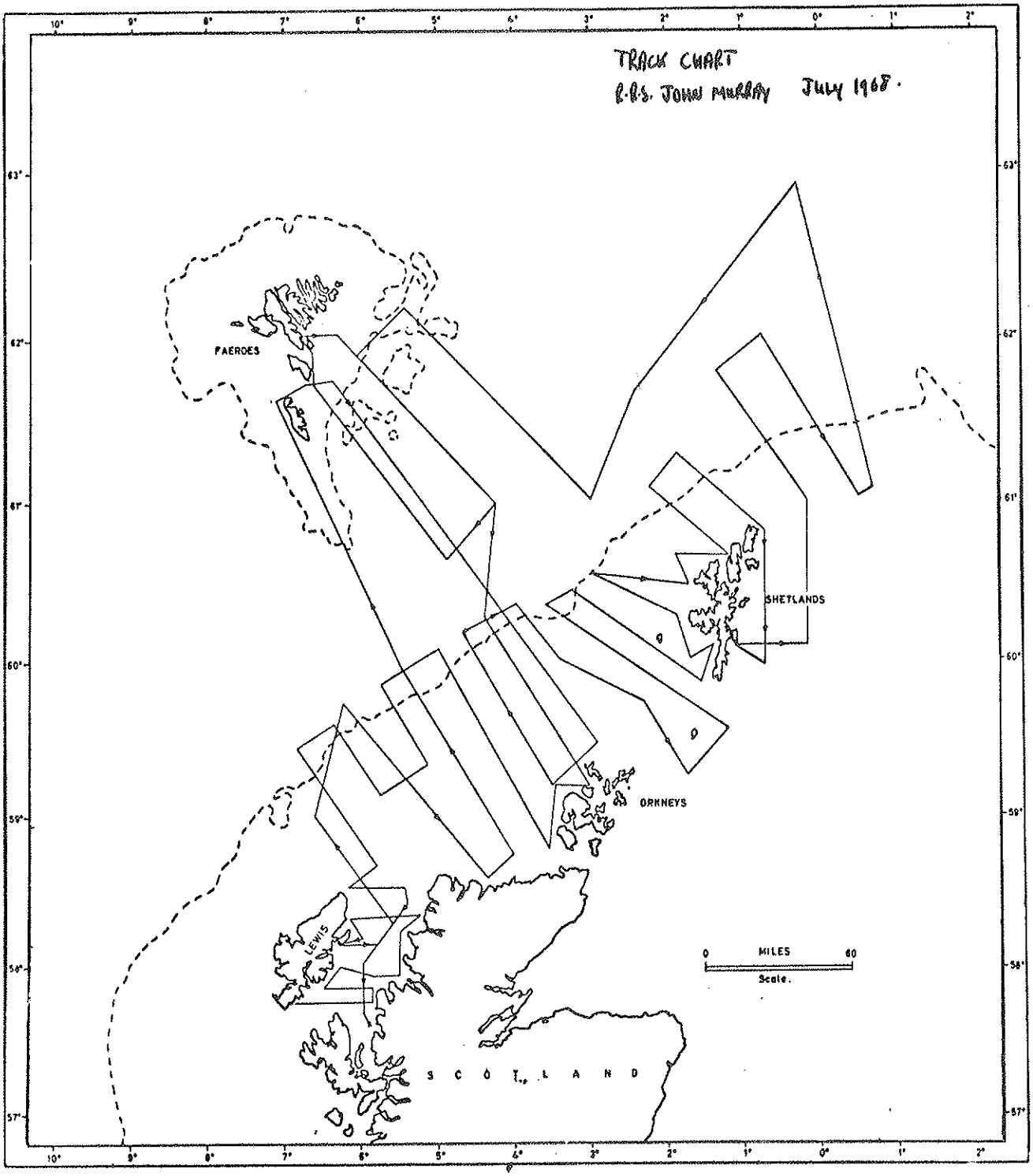
22nd July	1500	58°28'N	06°09'W			Start of stage 2
				083°	GMPS	Strong tidal currents.
	1830	58°30'	05°22'			
				183°	GMP	
	1930	58°22'	05°24'			
				224°	GMP	
	2300	58°02'	06°01'			
				180°	GMP	
23rd July	0140	57°38'	06°02'			End of Minch survey.

Dublin Bay Run

24th July	1140	53°41'	05°46'			Start
				179°	GMPS	
	1410	53°20'	05°46'			
				148°	GMPS	
	1600	53°05'	05°31'			End

Lands End Run

25th July	1100	50°41'	06°09'	158°	GMP	Start
	1700	49°44'	05°39'			End
26th July	0600	Plymouth.				


TRACK CHART
R.R.S. JOHN MURRAY JULY 1968.
FAEROES
SHETLANDS
ORKNEYS
LEWIS
SCOTLAND
0 MILES 60
Scale.