9/46/71

Department of Geology

University of Durham

REPORT ON M.V. RESEARCHER CRUISE TO THE REGION WEST OF THE HEBRIDES AND SHETLANDS, JULY 31 to AUGUST 15, 1971

1. Scientific objectives

During this short cruise, it was intended to continue the geophysical investigations west of the Shetland-Hebridean region which had been pursued during previous years. In particular, the 1970 Durham cruise with the R.R.V. John Murray had not been as successful as hoped because of faults in the ship's steering gear which effectively curtailed the length of the cruise. Thus the main objective of the 1971 cruise was to complete the work originally intended for 1970.

It was planned to start by observing a series of east-west geophysical lines (gravity, magnetics, sparker, bathymetry) across the large north-south elongated negative gravity anomaly adjacent to the south-west coast of the Shetland Isles. The northern part of this feature had been investigated in 1970 and on earlier cruises, but detailed lines were needed to delimit the southern part of the structure. After this, the main part of the planned programme was an investigation of the structure of the region to the west of the margin, with particular emphasis on the structure of the Wyville-Thomson Ridge and the region between Bailey Bank and the margin.

The cruise was originally planned as a single leg starting at Stornoway and finishing at Barry, but it was necessary to modify this plan because of faults in the gravimeter and seismic profiling setup.

2. Personnel

Durham:	M.H.P. Bott	(senior scientist to 7 August)
	E.M. Himsworth	(deputy senior scientist and senior scientist 7-15 August)
	D.Asbery	
	R. Backhouse	
	C.H. Boynton	
	B.I.R. Haigh	
	M.S. Maconochie	
	P. Maguire	
	L. Rimmer	
	P.J. Smith	
	T.H. Thompson	
R.V.U.	A. Cummings	

3. Narrative

The advance party arrived in Stornoway on 29 July and took over from the I.G.S. party on 30 July. Equipment on board included LaCoste gravimeter,

Barringer magnetometer, PDR and E.G.&G. sparker belonging to R.V.U. and Bolt airgun on hire to I.G.S. All equipment was reported as being satisfactorily operating. The remaining members of the Durham party arrived late on 30 July.

We sailed at 1515 (BST) on 31 July for the Shetland shelf survey area, gravity and magnetic observations being taken on passage. We started the Shetland shelf survey at 0610 on 1 August. This survey was completed as planned by 0130 on 3 August, and consists of legs 1/71 to 10/71, (see Appendix and map for details). Gravimeter, magnetometer, PDR and sparker were in operation for the whole of this survey except for a break from 1605 to 1905 on 2 August when the sparker generator broke down due to the failure of the linkage from motor to generator; this was repaired by the ship's Chief Engineer. Sea conditions were in general good during the survey although the sea increased to force 4 during the later part of 1 August.

At the end of the above survey, the sparker was pulled in and the flexotir array and airgun streamed. Before the main survey could start, the longitudinal gyro of the gravimeter table stopped at 0415 on 3 August. It was decided to sail for Lerwick to replace the gyro and make the subsequent necessary adjustments. All readings were suspended at 0600, and after the flexotir array had been pulled in, we sailed for Lerwick at full speed, arriving at 1415 (3 August). At Lerwick, the gyro was replaced and adjusted and the platform operated satisfactorily. On re-setting up of the gravimeter, it was found that the gravity counter and recorder appeared to give erroneous reading, and this was confirmed early morning 4 August. 4 August was therefore spent repairing this fault, which was finally tracked down to a faulty potentiometer which was replaced. The gravimeter was satisfactorily operating and tested by 1900 on 4 August, but sailing was postponed to a.m. on 5 August because of force 6 to 7 forecast.

We sailed from Lerwick to the start of the main survey area at 0805 on 5 August. Gravity and magnetics were observed on passage. At 1500 the start was reached, and the PDR, airgun and hydrophone array were streamed.

Line 11/71 (Appendix and map) were started at 1600 on 5 August. Line 11/71 was across the margin and line 12/71 which is the first line across the Wyville-Thomson Ridge was started at 0430 on 6 August. There was a heavy stern swell during this line, decreasing slightly. At 0900 the compressor stopped, and on restarting, the fan belt broke and an air valve slipped. The air valve was repaired but there was no spare fan belt and one could not be improvised with material on the ship. It was therefore decided to complete line 12/71 using the sparker for profiling, and then make for Stornoway to get spare fan belts. Between 1450 and 2220 the sparker was off because of faults in the E.G. & G. recorder which were repaired. At 2220 line 12/71 was terminated and line 13/71 across the margin towards Stornoway was started. The sparker was kept in operation until the 100 fathom depth contour was crossed at 0130 on 7 August, when sparker and PDR were pulled in and we proceeded at full speed towards Stornoway, observing gravity and magnetics only on passage. We arrived at Stornoway at 0850, and M.H.P. Bott took the opportunity to leave the ship, handing over to E.M. Himsworth as senior scientist for the remaining part of the cruise.

After obtaining several spare fan belts we left Stornoway at 1320 and proceeded to the beginning of line 14/71 measuring magnetics and gravity en route. On line 14/71 the P.D.R. and the airgun with a 20 cu.in chamber fitted were also used.

Line 15/71 was also completed satisfactorily apart from short failures of the compressor due to air locks in the fuel supply.

Line 16/71 was started at 1700 on August 8th. By this time the wind was freshening from the north and a heavy swell was beginning to develop.

At the start of line 17/71 the gravimeter readings were obviously being affected by the wave motions but the full survey was continued until 0100 on August 9th when the sea became too rough for work to be continued and there was some risk of losing equipment. The equipment was therefore all turned off and hauled in.

The next 30 hours were then spent riding out a Force 8-9 gale with the ship making slow progress to the south west into the wind. When work became possible again at 0730 on August 10th we decided to change the proposed lines and cut out any work over Bill Bailey or Lousy Bank.

Line 18/71 was carried out with the gravity meter, magnetometer, P.D.R., and airgun operating. The flexotir array was streamed and used for the rest of the cruise in the deep water. The shorter array was used in the shallower areas. Lines 19/71 to 23/71 were completed satisfactorily with the same equipment running apart from breakdowns of the compressor at 0010 and 1850 on the 11th August due to slipping drive belts. The trouble was rectified in about one hour each time.

On Line 24/71 the sparker was used instead of the airgun when the continental shelf was reached. It was intended to use the airgun again on Line 26/71 but there was insufficient time to finish this line so it was not needed.

The ship's engines were stopped for minor repairs at 2140 on the 12th but only for twenty minutes.

At 0700 on the 13th August, the time set by the captain, all the equipment except for the gravimeter and magnetometer were turned off and hauled in. We then headed for Barry at full speed. It was intended to continue Line 27/71 further south but the roll of the ship was so much at the increased speed that the gravimeter had to be closed down at 1215 on the 13th. The magnetometer was also turned off.

The ship's auto pilot failed early on the 13th and the radar had failed previously so the ship was manoeuvred home using its now doubtful steering gear, occasionally erroneous Mark 12 Decca navigator and gyro compass which appeared to jump at intervals.

Barry Dock was entered at 1300 on August 15th.

4. General comments

Despite poor weather conditions during part of the cruise, and the necessity to return twice to port due to failure of instruments, the cruise was a success and we managed to complete a substantial part of the planned programme. It was only necessary to abandon the lines originally planned from Faeroe Bank across Bailey Bank and Lousy Bank. Gravity, magnetic, seismic profiling and PDR were obtained along the lines shown in the track chart apart from short breaks for minor repair of equipment. It is anticipated that data obtained from this cruise will provide the following contributions:-

(1) Completion of the geophysical survey of the negative gravity region south-west of the Shetlands (lines 1/71 to 10/71).

(2) A preliminary investigation of the structure of the Wyville-Thomson Ridge (Lines 12/71, 15-18/71 and 21/71).

(3) Further contributions to the investigation of the regional structure of the margin to the west of the Hebrides and the region to the west of it (lines 11/71, 13-14/71, 22-27/71).

5. Acknowledgements

We are most grateful to Captain Smith and the officers and crew of M.V. ~~Explorer~~ RESEARCHER for their help, co-operation and hospitality during the cruise. We should also like to express our warm thanks to the Director and staff of the R.V.U. for their contribution to the cruise, and to Mr. J.C. Cleverly for providing the scientific equipment. Mr. A. Cummings of R.V.U. accompanied the cruise, and we owe much to his technical ability that failure of equipment did not seriously detract from the success of the cruise. The airgun was a most useful addition to the geophysical equipment, and the extended hire of this from Bolt's was made possible through most helpful co-operation of I.G.S. Marine Geophysics Unit.

M.H.P. Bott
E.M. Himsworth
August 1971
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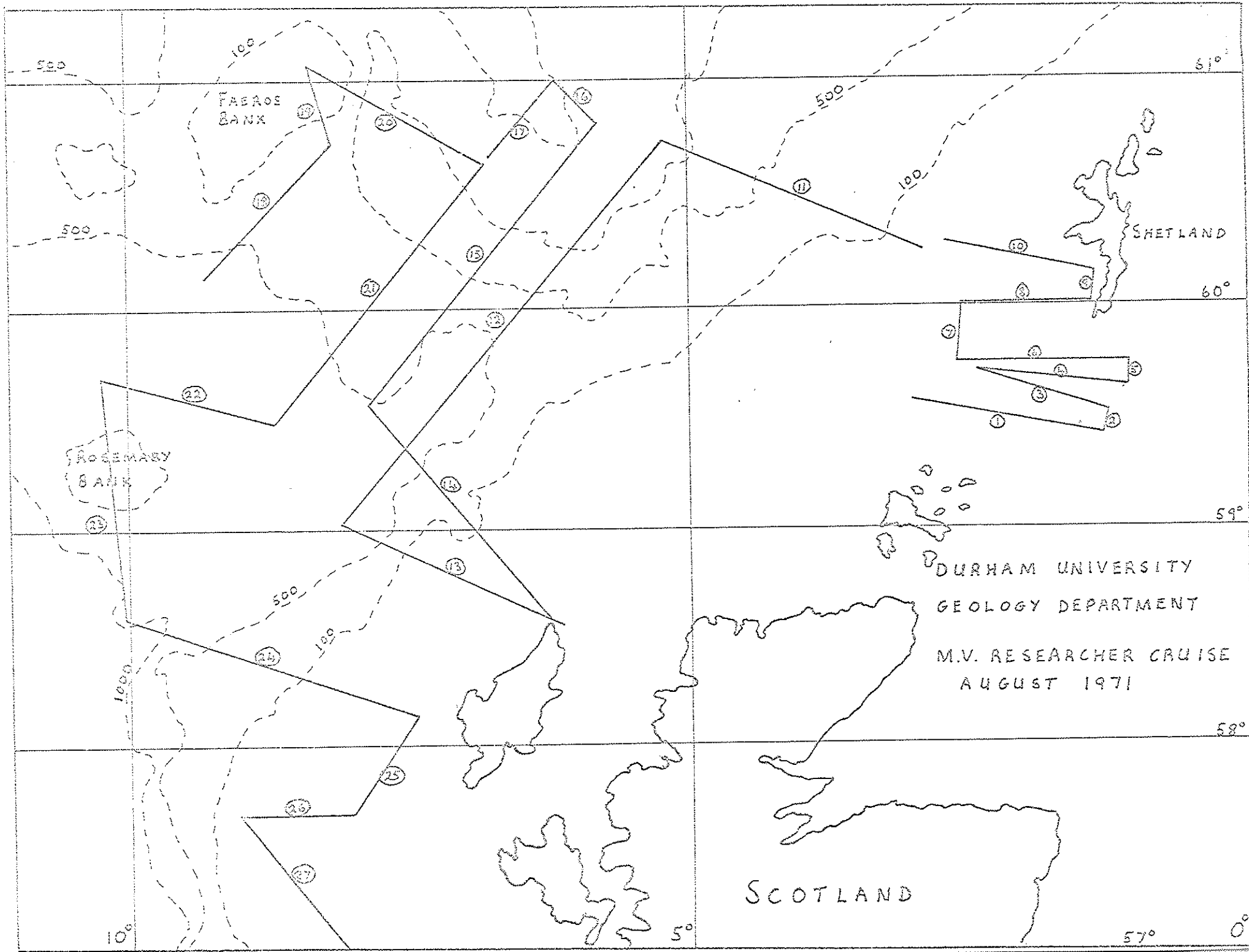
South Road,
Durham.

APPENDIX

Survey Lines

Date	Line	Start		End		Course	Instruments	Sea Conditions
August 1st	1/71	59°34'N	2°59W	59°25.8'N	1°18.0'W	95°	DGMP	2ft. from NW
August 1st	2/71	59°25.8'N	1°18.0'W	59°32'N	1°14'W	13°	DGMP	Slight swell
August 1st	3/71	59°32'N	1°14'W	59°41N	2°24'W	275°	DGMP	4ft from N.W. increasing
Aug.1st-2nd	4/71	59°41'N	2°24'W	59°38'N	1°05'W	82°	DGMP	5 ft. from NW
August 2nd	5/71	59°38'N	1°05'W	59°44'N	1°05'W	359°	DGMP	3 ft. from NW
August 2nd	6/71	59°44'N	1°05'W	59°44'N	2°35'W	255°	DGMP	2 ft. from W
August 2nd	7/71	59°44'N	2°35'W	59°59'N	2°31'W	357	DGMP	2 ft. from SE
August 2nd	8/71	59°59'N	2°31'W	60°0'N	1°21.8'W	85°	DGMP	2 ft. from SE
August 2nd	9/71	60°00'N	1°21.8W	60°5'N	1°25'W	345°	DGM	2 ft. from SE
Aug.2nd-3rd	10/71	60°06'N	1°26'W	60°17'N	2°42'W	277°	DGMP	2 ft. from SW
Aug.5th-6th	11/71	60°15'N	2°53'W	60°43'N	5°11'W	285°	DGMA	7 ft. from NE
August 6th	12/71	60°43'N	5°11'W	59°2'N	8°6'W	210°	DGMP	8 ft. from SE
Aug.6th-7th	13/71	59°2'N	8°6'W	58°32'N	6°11'W	108°	DGMP	3 ft. from W
Aug.7th-8th	14/71	58°35'N	6°15'W	59°33'N	7°52'W	315°	DGMA	3 ft. from W & NE
August 8th	15/71	59°33'N	7°52'W	60°49'N	5°41'W	40°	DGMA	3 ft from SE
August 8th	16/71	60°49'N	5°41'W	61°00'N	6°11'W	308°	DGMA	8 ft. from N
Aug.8th-9th	17/71	61°00'N	6°11'W	60°39'N	6°39N	220°	DGMA	10 ft. from N increasing
August 10th	18/71	60°8'N	9°20'W	60°44'N	8°10'W	42°	DGMA	7 ft. from W
August 10th	19/71	60°44'N	8°10'W	61°5'N	8°22'W	335°	DGMA	6 ft. from W
Aug.10-11th	20/71	61°5'N	8°22'W	60°38'N	6°48'W	115°	DGMA	4 ft. from S
August 11th	21/71	60°38'N	6°48'W	59°28'N	8°58'W	225°	DGMA	3 ft. from NE
Aug.11th-12th	22/71	59°28'N	8°58'W	59°40'N	10°12'W	290°	DGMA	3 ft. from NE
August 12th	23/71	59°40'N	10°12'W	58°36'N	10°00'W	180°	DGMA	3 ft. from E & SW
Aug.12th-13th	24/71	58°36'N	10°00'W	57°52'N	7°25'W	110°	DGM(A+P)	4 ft. from W
August 13th	25/71	57°52'N	7°25'W	57°39'N	8°00'W	230°	DGMP	1 ft. swell
August 13th	26/71	57°39'N	8°00'W	57°38'N	9°02'W	270°	DGMP	1 ft. from E
August 13th	27/71	57°38'N	9°02'W	57°00'N	8°06'W	140° varying	GM	

D = Precision Depth Recorder
G = Gravimeter
M = Magnetometer
P = Sparker Profiling
A = Airgun Profiling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ROCKEMARY BANK
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DURHAM UNIVERSITY
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M.V. RESEARCHER CRUISE
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