

INSTITUTE OF GEOLOGICAL SCIENCES

GEOPHYSICAL DIVISION

MARINE GEOPHYSICS UNIT

Report No. 17

CRUISE REPORT FOR M.V. "MORAY FIRTH IV"

NORTH IRISH SEA SURVEY 69/2;

10 April - 16 May 1969

by

Susan E. Arnold

Released; September, 1971

5 Princes Gate
London SW7

Tel. 01-584 6465

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OBJECTIVE

Survey 69/2 continued a regional geophysical survey of the Irish Sea commenced in 1967 by IGS as part of its programme of geophysical and geological investigation of the British continental shelf. The survey covered the area from the Solway Firth to the Northern Ireland coast, west and north of the Isle of Man.

MOBILISATION

For this survey an 800 ton, 182 ft cargo boat, the m.v. "Moray Firth IV", was chartered by NERC from Messrs. Gillie and Blair of Newcastle-upon-Tyne. On the 11th April mobilisation of the ship commenced in Barry under the supervision of M.C. Tully. A laboratory was built in the after hold. It was fitted out with benches to facilitate the mounting of the geophysical recorders, ample plotting space and a light table. A hut was fitted to the top deck aft. The trigger units power units and capacitor banks for the E.G. & G. sparker system were operated from this hut. Three diesel generators - two 11 KVA and one $3\frac{1}{2}$ KVA were operated in the forward hold. These generators were linked to a fuel supply on deck which was linked to the ship's fuel system. The major items of equipments in the laboratory were:-

One E.G. & G. 254 seismic recorder

One E.G. & G. 259 side-scan sonar, dual channel recorder

One Varian magnetometer

One dry paper recorder for Kelvin Hughes MS 43 Mk 1 Transit Sonar

One Kelvin Hughes MS 36 shallow water hydrographic echo-sounder with digital
readout.

One Decca Mk 12 repeater, linked to the Decca Mk 12 receiver on the bridge.

An intercom was fitted linking the laboratory, the bridge and the hut. A Decca Mk 12 track plotter was installed on the bridge. Two booms were fitted, one to each side of the ship, near the stern, and these were used towing the magnetometer fish and the hydrophone eel outside of the ship's wake. Brackets were fitted on each side of the ship, amidships, on which were mounted transducers for the Kelvin Hughes Transit Sonar and the Kelvin Hughes MS 36 echo-sounder.

NARRATIVE

The survey programme was divided into three legs - 16th to 26th April, 26th April to 8th May and 8th to 16th May. Table I gives the number of people involved during the various legs of the cruise. Table II is a summary of the lines surveyed, the instruments used, the energy of the sparker and mileage.

Leg 1: A fault was noted in the Kelvin Hughes MS 36 shortly before the ship sailed on the 16th April. Kelvin Hughes were informed and technical service was arranged for Douglas, Isle of Man. The ship sailed direct to Douglas from Barry, carrying out equipment trials on passage. On the 18th April a Kelvin Hughes technician came on board and examined the echo-sounder. It was found that additional spares were needed, so the ship sailed late afternoon without the echo-sounder being repaired. From the 18th to 20th, lines 6, 7, 8, 9, 10 and part of 11 were surveyed using the E.G. & G. sparker at 3000 joules, the Varian magnetometer and the Kelvin Hughes transit sonar. During this period the sea state was 2-5. The ship returned to Douglas Bay for a further attempt to repair the echo-sounder, with no success. In late evening of 20th April, the ship sailed to Peel to shelter from easterly winds 6-7, and anchored off Peel for 24 hours due to easterly gales. Another attempt was made to trace the fault in the echo-sounder, again without success. On 22nd April the ship sailed to Douglas as winds veered to S.W. Arrangements were made for a stand-by echo-sounder to be sent to the Isle of Man along with extra spares for the MS 36. Survey work commenced in early evening but was abandoned after 40 minutes due to rapidly deteriorating weather conditions. Between 23rd and 26th April, the survey work continued uninterrupted in force 4-6 conditions. Sparker, magnetometer and transit sonar records were obtained on lines 20, 19, 18, 17, 16, 15, 14, 13, 12, 11 (pt II), and part of line 35. On 25th April the ship was asked to leave Luce Bay by the Ministry of Technology Range Controller and requested to obtain clearance from the Ministry before returning to the area to complete work. At 21.35 hrs. 25th April an excellent observation was made of the spectacular meteorite which passed over the

Irish Sea within a few miles of the ship. At 0800 hrs. 26th April the ship docked in Douglas.

Leg. 2: The ship left Douglas on 27th April with a Kelvin Hughes engineer on-board fitting a stand-by MS 32 echo-sounder to be used as a replacement for the MS 36 until spares could be obtained for the latter. Lines 32, 31 and part of 30 were surveyed. On 28th the ship proceeded to Douglas to disembark R. McQuillin and the Kelvin Hughes engineer. Between 28th and 30th part of line 42 and lines 41, 33, 1, 2, 3, 4, part of 35, 36A, 5, and part of 34 were surveyed. The Decca track-plotter was inoperative from line 2 onwards. On 30th, the ship called into Douglas to allow a Decca engineer to inspect the track plotter. No apparent fault could be found. A replacement plotter was ordered in case of future breakdown. Between 30th April and 2nd May lines 21, 40, 39, part of 38, 37, 47, 48, 36 and 22 were surveyed. The track plotter immediately gave trouble on recommencement of survey on 30th. Line 22 was abandoned due to bad weather and the ship proceeded to Peel for shelter. The track plotter was replaced and a new transducer for the MS 36 was fitted. In the meantime, the ship's radar failed and the Decca engineers were unfortunately unable to repair this which subsequently restricted the operations of the ship during the following days because fog was encountered. From 4th to 7th May, lines 41, part of 42, 43, 44, 45, 46, part of lines 38 and 35, 34, 33, 29, 28, 27 and 26 were surveyed. The ship berthed in Douglas at 0945 hrs on the 7th May.

Leg. 3: While in port on 7th and 8th May, Decca engineer returned but once more could not find anything to explain the erratic behaviour of the track-plotter. Routine maintenance on all equipment was carried out. The ship sailed late on the evening of the 8th and the 9th, lines 22, 23, 24, 25 and 23R were surveyed using 3000 joule sparker, magnetometer and transit sonar. Contact was made with the Luce Bay range and clearance obtained for work inside the range area on the 10th and 11th. On 10th, lines 39 and 34 were surveyed using 3000 joule sparker, magnetometer and transit sonar thus completing the primary coverage of the area.

The ship then moved into the area of the Luce Bay range and surveyed line 13R with E.G. & G. side-scan sonar and lines 39A, east end of 38 and 12R using 500 joule sparker and transit sonar. Between 11th and 16th May lines 11R, 10R, 6R, 5R, 30, 30R, 1R, 2R, 3R, 4R, 7R2, 9R, 34R, 26R, 24R, 42R, 22R, 27R and 37R were surveyed using sparker and transit sonar. (See table II for sparker energy). On 12th May a television team from Border TV came on board for a few hours. Very little time was lost during this period, and such hold-ups as occurred were mainly due to fog. At the end of the survey the ship berthed at Ayr on 16th May.

EQUIPMENT PERFORMANCE

E.G. & G. Sparker system:- This system functioned satisfactorily throughout.

At energy levels of 500 and 3000 joule, good sparker records were obtained in both shallow and deep water using the E.G. & G. 16-element hydrophone with its pre-amplifiers removed. An excessively large direct pulse from the sparker known to be particularly troublesome in very shallow water was thus avoided. When using the sparker at 6000 joules, the hydrophone had its pre-amplifiers replaced. At this energy, penetrations to identifiable horizons in the region of 600 m beneath sea-bottom were obtained.

*Kelvin Hughes Transit Sonar:- Little trouble was encountered with this equipment except those caused by normal usage. Good records were obtained on both the 300 and 600 yd range. It was found that Kelvin Hughes Echo Dry Paper PATT. 191369 ZU-4585 gave a better quality record than Dry Paper PATT 191390 ZU-6043 M.

*Varian Magnetometer:- The magnetometer gave excellent service throughout the survey.

E.G. & G. Side-scan Sonar:- The Side-scan was tried out on one line only and was found to be working on one channel only and suffering from interference from the sparker system which was operating concurrently at 500 joules.

Kelvin Hughes MS 36 shallow water hydrographic echo-sounder:- Prior to leaving Barry on 16th April, the transducer assembly was tested in the water and on being taken out of the water anti-freeze fluid was seen to leak from the housing

from the join between the base plate and the upper dome section. Contact was made immediately with Kelvin Hughes and arrangements made to meet a Kelvin Hughes engineer in Douglas on 18th. The engineer, on inspecting the transducer assembly, decided that the transducer tank was irreparable, and so phoned London for a new fibreglass tank to be delivered by air to Douglas. On 20th April, the transducers were fitted to the new tank. The equipment was still found to be inoperative - no signal being recorded on either paper recorder or digital readout. The engineer was unable to detect the fault after twenty-four hours work, so Kelvin Hughes were again contacted and arrangements made for extra spares for the MS 36 to be sent to Douglas and also for either a MS 26 or MS 32 to be put on hire to IGS as a stand-by equipment. On 26th/27th a Kelvin Hughes MS 32 echo sounder was installed. On 3rd May, a new transducer assembly for the MS 36 was fitted and found to function well. The MS 36 worked satisfactorily until the end of the survey. However, the digital readout only operated satisfactorily to 40-50 m which was considerably below the maximum recorder depth of + 100 m.

Kelvin Hughes MS 32 echo-sounder:- The MS 32 was installed on 26th/27th April as a stand-by echo-sounder. It was reliable and gave no trouble when used.

Decca Track Plotter:- The plotter worked satisfactorily for leg 1 of the cruise. After this it began to behave erratically and despite repeated attempts by Decca engineers to discover why, no cause could be detected. Eventually a replacement plotter was installed, but this behaved erratically also. Further tests on the plotter and the Decca Mk 12 receiver failed to trace the fault.

RESULTS

The survey resulted in complete coverage of the area by a grid of lines on which 3000 joule sparker, magnetometer and transit sonar had been operated. A number of lines in the shallow water area of the Solway Firth were resurveyed with 500 joule sparker so as to obtain higher resolution with less penetration. In the deep water areas between the Isle of Man and the Northern Ireland coast, a number of lines were resurveyed using a 6000 joule sparker, the lines being

chosen where deep penetration was expected. On these profiles identifiable horizons can be recognised at depths in excess of 500 m beneath the sea-bottom,

A map of the thickness of the upper seismic layer, assuming a velocity of 1800 m/sec was prepared on the ship. The thickest deposits of 180 m or more lie in the channel of deep water between Northern Ireland and the Isle of Man. There were a number of areas where the geophysical records indicate sea-bed exposures of solid formations and areas of thin drift. These areas occur around the coast of Northern Ireland, between Northern Ireland and the Mull of Galloway, parts of the approaches to the Solway Firth and also isolated outcrops in the channel between Isle of Man and Northern Ireland. Such isolated exposures, revealed as strongly reflecting bodies on the sparker records, correlate in most places with magnetic anomalies and with exposure features on the transit sonar records.

CONCLUSIONS

With the completion of the present survey, there is an overall coverage with sparker, magnetics and sonar of the Irish Sea from Southern Scotland to North Wales and from Northern Ireland to Cumberland and Lancashire, on approximate 6-kilometre grid. A sea-bottom gravity survey has been carried out by Bott and Young (Durham University) in the east and south of the area. Following the cruise reported here a gravity survey of the western area was carried out using a La Coste- and Romberg air-sea gravity meter, thus giving an overall regional gravity coverage of the Irish Sea, and substantially increasing our geophysical knowledge of the area.

TABLE I

Personnel

PERSONNEL	MOBILIZATION 10th-16th April 1969	LEG 1 16th-26th April 1969	LEG 2 26th April- 8th May 1969	LEG 3 8th-16th May 1969
<u>M.G.U.</u>				
R. McQuillin	*	P.C.	(to 28th)	P.C.
J. Sunderland	*		P.C.	*
M.C. Tully	P.C.	*		
R.A. Floyd		*	*	*
S.E. Arnold		*	*	*
N. Kenolty	*	*	*	
<u>A.G.U.</u>				
D. Irwin			*	*
C. Burr		*		
<u>R.V.U.</u>				
P. Owen			*	*
<u>TILBURY</u>				
J.A. Powell		*	*	*
T. Holmes		*	*	*

TABLE II

Summary of work

Line	Fixes	Sparker	Var.M.	KHTS	S-S	ES	N.M.	S.M.	KILOM.
1	1-13	3000J	*	*	-	MS 32	14.75	16.98	27.33
1R	1-14	500J	-	*	-	MS 36	15.75	18.13	29.18
2	1-16	3000J	*	*	-	MS 32	17.00	19.57	31.50
2R	1-17	500J	-	*	-	MS 36	16.50	18.99	30.57
3	1-17	3000J	*	*	-	-	19.00	21.87	35.21
3R	1-17	500J	-	*	-	MS 36	19.00	21.87	35.21
4	1-19	3000J	*	*	-	MS 32	22.25	25.61	41.23
4R	1-28	500J	-	*	-	MS 36	23.00	26.47	42.62
5	1-24	3000J	*	*	-	MS 32	27.50	31.65	50.96
5R	1-25	500J	-	*	-	MS 36	26.25	30.21	48.64
6	1-25	3000J	*	*	-	-	26.25	30.21	48.64
6R	1-24	500J	-	*	-	MS 36	26.25	30.21	48.64
7		3000J	*	*	-	-	24.50	28.20	45.40
7R	1-22	3000J	*	*	-	-	24.50	28.20	45.40
7R ₂	1-26	6000J	-	*	-	MS 36	25.75	29.64	47.71
8	1-23	3000J	*	*	-	-	25.00	28.78	46.33
9	1-20	3000J	*	*	-	-	22.50	25.90	41.69
9R	1-17	6000J	-	*	-	MS 36	15.75	18.13	29.18
10	1-22	3000J	*	*	-	-	22.50	25.90	41.69
10R	1-24	500J	-	*	-	MS 36	23.50	27.05	43.55
11	1-25	3000J	*	*	-	-	} 27.50	31.65	50.96
11	26-34	3000J	*	*	-	-			
11R	1-30	500J	-	*	-	MS 36	29.00	33.38	53.74
12	1-38	3000J	*	*	-	-	36.50	42.01	67.63
12R	1-33	500J	-	*	-	MS 36	31.75	36.54	58.83
13	1-34	3000J	*	*	-	-	26.75	30.79	49.57
13R	1-17	3000J	-	*	*	MS 36	20.25	23.31	37.52
14	1-17	3000J	*	*	-	-	18.25	21.01	33.82
15	1-23	3000J	*	*	-	-	20.75	23.88	38.45
16	1-23	3000J	*	*	-	-	27.25	31.36	50.49
17	1-33	3000J	*	*	-	-	30.75	35.39	56.98
18	1-34	3000J	*	*	-	-	36.25	41.72	67.17
19	1-44	3000J	*	*	-	-	40.25	46.33	74.58
20	1-40	3000J	*	*	-	-	44.25	50.93	82.00
21	1-35	3000J	*	*	-	MS 32	38.00	43.74	70.71
22	1-38	3000J	*	*	-	MS 32	} 40.00	46.04	74.12
22	39-47	3000J	*	*	-	MS 36			
22R	1-20	6000J	-	*	-	MS 36	23.00	26.47	42.62
23R	1-36	3000J	*	*	-	MS 36	39.50	45.46	73.19
24	1-34	3000J	*	*	-	MS 36	37.75	43.45	69.95
24R	1-21	6000J	-	*	-	MS 36	21.00	24.17	38.91
25	1-29	3000J	*	*	-	MS 36	33.75	38.85	62.54
26	1-23	3000J	*	*	-	MS 36	25.75	29.64	47.71
26R	1-21	6000J	-	*	-	MS 36	22.25	25.61	41.23
27	1-21	3000J	*	*	-	MS 36	22.25	25.61	41.23
28	1-17	3000J	*	*	-	MS 36	18.00	20.72	33.35
29	1-11	3000J	*	*	-	MS 36	10.75	12.37	19.92
30	1-15	3000J	*	*	-	MS 32	15.50	17.84	28.72
30	16-29	500J	*	*	-	MS 36	16.25	18.70	30.11
30R	1-19	6000J	-	*	-	MS 36	19.25	22.16	35.67
30R	19-24	500J	-	*	-	MS 36	6.75	7.77	12.71

TABLE II (cont'd)

Line	Fixes	Sparker	Var.M.	KHTS	S-S	ES	N.M.	S.M.	KILOM.
31	1-15	3000J	*	*	-	MS 32	17.50	20.14	32.43
32	1-22	3000J	*	*	-	MS 32	27.25	31.36	50.49
33	1-47	3000J	*	*	-	MS 32	85.25	98.12	158.15
33	48-75	3000J	*	*	-	MS 36			
34	1-25	3000J	*	*	-	MS 32	78.25	90.07	145.00
34	26-82	3000J	*	*	-	MS 36			
34R	1-79	6000J	-	*	-	MS 36	73.00	84.02	135.27
35	1-23	3000J	*	*	-	-	78.50	90.35	145.46
35	24-39	3000J	*	*	-	MS 32			
35	40-65	3000J	*	*	-	MS 36	68.75	79.13	127.39
36	1-37	3000J	*	*	-	-			
36	38-78	3000J	*	*	-	MS 32			
36A	1-5	3000J	*	-	-	MS 32	5.25	6.04	9.73
37	1-60	3000J	*	*	-	MS 32	67.25	77.04	124.61
37R	1-19	6000J	*	*	-	-	22.25	25.61	41.23
38	1-22	3000J	*	*	-	MS 32	57.00	65.61	105.62
38	23-52	3000J	*	*	-	MS 36			
38	53-60	500J	-	*	-	MS 36	19.75	22.73	36.60
39	1-18	3000J	*	*	-	MS 32			
39A	1-8	500J	-	*	-	MS 36	7.25	8.34	13.43
40	1-16	3000J	*	*	-	MS 32	15.00	17.27	27.80
41	1-16	3000J	*	*	-	MS 32	40.00	46.04	74.12
41	17-37	3000J	*	*	-	MS 36			
42	1-8	3000J	*	*	-	MS 32	27.75	31.94	51.42
42	9-30	3000J	*	*	-	MS 36			
42R	1-7	6000J	-	*	-	MS 36	7.25	8.34	13.43
43	1-16	3000J	*	*	-	MS 36	20.25	23.31	37.52
44	1-15	3000J	*	*	-	MS 36	16.25	18.70	30.11
45	1-13	3000J	*	*	-	MS 36	9.75	11.22	18.07
46	1-33	3000J	*	*	-	MS 36	35.25	40.57	65.32
47	1-17	3000J	*	*	-	MS 32	15.00	17.27	27.80
48	1-9	3000J	*	*	-	MS 32	10.50	12.09	19.46
49	1-24	3000J	*	*	-	MS 36	27.00	31.08	50.03

TOTAL LINE MILEAGE : 2056.25 nautical miles
 2366.36 statute miles
 3810.89 kilometres

Key:
 Var.M. Varian Magnetometer
 KHTS Kelvin Hughes Transit Sonar
 S-S E.G. & G. Side-scan Sonar
 ES Echo-sounder
 N.M. Nautical miles
 S.M. Statute miles
 KILOM. Kilometres
 * Record obtained
 - No record obtained