

INSTITUTE OF GEOLOGICAL SCIENCES
GEOPHYSICAL DIVISION
MARINE GEOPHYSICS UNIT

Report No. 20

Project 71/3 : BRISTOL CHANNEL

Cruise Report for m.v. Researcher

14 May - 7 June 1971

by

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Released : July 1971

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CRUISE REPORT BRISTOL CHANNEL

Objective

The main objective of this survey was to continue the IGS programme mapping the geological structure of the continental shelf. A plan of the area and the profiles surveyed are shown in Figure 1. As well as routine surveying, tests were carried out using the sparker system, with a hydrophone designed by Dr J Jones of Cambridge University, over the continental slope. These tests were to assess the capabilities of the hydrophone in deep water and its suitability for use with air guns in later surveys. A geologist for the Continental Shelf Unit 1 worked on board for part of the survey to abstract data from the seismic profiles for planning future sampling and drilling work.

Narrative

The m v Researcher left Barry at 0700 hrs on 14 May two days late. This delay was due to difficulties encountered in fitting the automatic steering and gyro compass. To have sailed on time would have meant using hand steering resulting in poor course keeping and impaired performance of the gravity meter. After leaving Barry Dock steering trials were instigated, and proved successful. Survey work was started at 1450 hrs and continued without a break till Friday, 21 May when the ship returned to Barry for a replacement Trigger Unit for the seismic system. Over 12 hours of survey time were lost in this operation. Survey work then continued until 24 May when the m v Researcher sailed to Waterford. The weather had been good with sea states of 3 or 4, enabling over 2250 km of profile to be surveyed covering about a third of the survey area.

The ship was in Waterford by 1800 hrs on 24 May where routine maintenance, re-provisioning and relaxation were the orders. When in Waterford the m v Researcher had a police guard at all times and strict security arrangements were in force when the ship sailed on 26 May.

On leaving Waterford the ship sailed west to do hydrophone trials over the continental slope. Adverse weather and engine failure caused the delay of this

project for over 24 hours, including anchoring off Cork for the night of the 27th. However the continental slope was reached late on 28 May and instrument trials began. These trials proved successful and seismic records were obtained using a sparker energy of 6000 joules in depths of up to 2000 m. Gravity and magnetic measurements were taken in both the outward and homeward journeys.

The main survey area was reached again on 29 May at 1500 hr and routine surveying recommenced. The transit sonar was not successfully launched and the ORE sub-bottom profiler could not be used as we found it impossible to launch or recover the transducer in only moderate swells. Depths to the sea floor were computed from the seismic records for two days. By 30 May the weather had calmed down to Force 3 and the ORE was successfully launched and operated for the rest of the survey. Though weather conditions increased to Force 5 at times no trouble was encountered. Routine surveying continued uninterrupted till Sunday 6 June when it was time to return to Barry. The survey had to be terminated 4 hours early due to Decca going off the air at 0900 hrs. on June 6th. A profile was surveyed back to Barry to provide an overlap with Swansea University's work in the inner Bristol Channel. During the latter part of the survey 2000 km were profiled in 8 days. The total line-km survey completed was 4250 representing more than half the total line shown in Figure 1.

Personnel

M C Tully	Senior Scientist	IGS London	12 May - 7 June
R Floyd		IGS London	" "
S Arnold		" "	" "
J Sunderland		" "	12 May - 24 May
B Billen		" "	12 May - 7 June
B King		RVU	" "
B Fletcher		IGS Leeds	25 May - 7 June
M Thompson		University of Wales Swansea	" "
D Smith		Tilbury	12 May - 7 June
M Hill		"	" "
N Ray		"	" "

Instrumentation

On board the m v Researcher magnetic, gravity, sonar and shallow seismic instruments were in operation. Depths were recorded by the ORE sub-bottom profiler.

LaCoste Romberg gravity meter. Good records were obtained by this meter in most of the sea states encountered. However in a heavy swell at sea state of force 5 and over the results were poor with swings of more than 10 milligals. Failure of the instrument did not occur except when an hour was lost replacing a faulty potentiometer pot. Records obtained showed small cross-over errors and the drift-rate was negligible; less than 1 milligal between Barry and Waterford and back to Barry.

Barringer Magnetometer. No instrument failure occurred though some fuzziness was noticed in the analog record on a very few occasions. The sensor was towed at 300 ft astern after tests were carried out going west showing the ships effect to be less than 3 gammas. To have towed the fish further stern could have caused problems in the shallower water areas with possible damage to or loss of the sensor.

Seismic Profiling System

With two complete systems on board no time was lost due to instrument failure. The Huntec recorder with tape-deck was employed for the first part of the project, but instrument failure were encountered involving tape playback; also the paper drive gave problems. The EGG 254 recorder was utilised for the latter half of the project. Failure of one of the trigger units, which eluded all attempts at repair, necessitated a return to Barry for a replacement. Other failures were of a minor nature. During the cruise various types of multi-electrode spark sources were tested. Most were successful. Failures included one design by RVU in which the insulation failed. Three arrays produced by Automatic Control and Instrumentation which fired successfully failed to give power output sufficient for good records. The cause has yet to be traced. Another array produced by RVU was very successful as were sources designed by EMR of Galasheils and Calan Electronics. The Calan source for some reason gives

a pulse with energy concentrated in a higher frequency band than the other arrays. This has resulted in improved resolution and a shorter pulse length. Further tests need to be made to determine why. The EMR array and the RVU arrays have stood up better to constant firing than the Calan array.

Tests were carried out using a hydrophone designed by Dr J Jones of Cambridge University which has been kindly lent to us for the season. These tests were over the continental slope. Two spark arrays were used, the EMR multispark array and the EGG 3-electrode, firing simultaneously with 3000 Joules on each. Good records were obtained until water depth were in excess of 2000 metres at which depth the recording system was no longer capable of adequate performance.

Transit Sonar

This instrument was operated only up to the visit to Waterford. Records have varied as recorder failures hampered operations. A replacement recorder was obtained at Waterford but could not be used because of trouble with the mounting frame for the transducer. Before leaving Barry this frame had to be installed by crane on the side of the ship. Just before going in to Waterford, several bolts sheared and the frame had to be brought inboard using the ship's derrick and several ropes. Subsequent failure of the ships derrick motor was one of the factors precluding further launchings. This method of mounting a transit sonar transducer is quite impractical and unnecessarily complicated.

ORE Sub-bottom Profiler. The profiler was successfully used during the cruise as an echo-sounder. Difficulties were encountered in towing as the upper deck on which the transducer was mounted is so high from the water. This difficulty was overcome to some extent by using a lower boom for towing purposes. In Sea states above force 5 towing arrangements were inadequate. Some damage was caused to the transducer during a recovery in moderate seas.

Navigation

The navigational system used in this survey was the Main Chain Decca; South West British Chain D1. Decca MK12 receiver and associated track plotter were used. Profiles were kept as straight as possible with only small course changes of 2° allowed at any one

time. For most of the survey these profiles were good but the occasional poor line can only be accounted for by errors of the Decca system. These errors relate to transmission variations during Decca Twilight periods though not occurring at the same time each day. Navigation fixes were taken at 10 minute intervals and plotted on UTM series 1 to 100,000 charts. Drawing facilities were available on the ship and fair charts were plotted on UTM series 1:100,000 and 1:250,000 maps.

X A Walker log and gyro compass repeater gave bearings and distances travelled which will be used as a back up navigational system to gravity calculations.

Results

Interpretation of the seismic and magnetometer profiles was undertaken onboard, firstly by Dr Sunderland, and then by Dr Fletcher of the Leeds Office. Plans for sampling and coring to be carried out at a later date will be based on this interpretation. A Bouguer Anomaly map was prepared on board from 10 minute fix points. Mr Thompson from Swansea brought aboard gravity information from University College of Wales, Swansea and helped amalgamate results from the area surveyed with that to the east being surveyed by Swansea.

Over 4000 line Kilometers were surveyed during the four weeks, not including lines surveyed in trials over the continental slope. The total number of days actually employed on surveying in the major area was 19, which for a survey speed of 7 knots indicate that about 19 hours out of 24 hours were employed on line.

Three days were employed in tests and travel over the continental slope; 24 hours were lost due to instruments failures, and 24 hours were lost due to bad weather.



CRUISE 7100 BROAD CHANNEL

LINE NO.	DATE	GRAV.	MAG.	SONAR	EDR	SPARKER	TYPE	MILES	FIXES
1	14-15/5/71	+	+	+	+	500-1000J	RVU	115	117
2	15-16/5/71	+	+	+	+	1000J	RVU	120	96
3	16/5/71	+	+	+	+	1000J	RVU-CALAN	112	105
4	16-17/5/71	+	+	+	+	1000J	RVU	110	80
5	17-18/5/71	+	+	+	+	1000J	RVU-CALAN	70	73
6	18/5/71	+	+	+	+	1000J	RVU	120	84
7	18/5/71	+	+	+	+	1000J	RVU	18	15
8	18/5/71	+	+	+	+	1000J	CALAN	37	25
9	19/5/71	+	+	+	+	1000J	CALAN	50	36
10	19/5/71	+	+	+	+	1000J	RVU	37	26
11	19/5/71	+	+	+	+	1000J	RVU	25	20
12	19-20/5/71	+	+	+	+	1000J	RVU	55	46
13	20/5/71	+	+	+	+	1000J	RVU	55	48
14	20/5/71	Lost fix 23-32	+	+	+	1000J	RVU	80	57
15	21/5/71	+	+	+	+	1000J	RVU	40	23
16	21-22/5/71	+	+	+	+	1000J	RVU	128	99
17	22-23/5/71	+	+	+	+	1000J	EMR	67	50
18	23/5/71	+	+	+	+	1000J	EMR	55	48
19	23/5/71	+	+	+	+	1000J	EMR	48	42
20	24/5/71	+	+	-	+	1000J	EMR	42	34
21	24/5/71	+	+	-	+	1000J	EMR	40	34
A	27/5/71	+	+	-	Some	-	-	55	14
P	28-29/5/71	+	+	-	-	1000-6000J Fix 21-30	EMR	180	37
22	29/5/71	+	+	-	-	1000J	EG & G	180	33
23	29-30/5/71	+	+	-	-	1000J	EG & G	120	85
24	30-31/5/71	+	+	-	-	1000J	CALAN	130	108
25	31/5/71	+	+	-	+	1000J	EMR	130	92
26	1-2/6/71	+	+	-	+	1000J	CALAN	128	96
27	2/6/71	+	+	-	+	1000J	EMR	120	90
28	2/6/71	+	+	-	+	1000J	RVU	80	57
29	3/6/71	+	+	-	+	1000J	RVU	87	62
30	3-4/6/71	+	+	-	+	1000J	RVU	85	82
31	4/6/71	+	+	-	+	1000J	RVU	85	69
32	4-5/6/71	+	+	-	+	1000J	RVU	76	72
	5-6/6/71	+	+	-	+	1000J	RVU	65	50
33	6/6/71	+	+	-	+	1000J	EMR	24	22
34	6/6/71	+	+	-	+	1000J	EMR	18	14
35	6/6/71	+	+	-	+	1000J	EMR	13	12
36	7/6/71	+	+	-	+	1000J	EMR	45	28

+ Record obtained.
- No record obtained.

IGS MARINE GEOPHYSICS UNIT
PROJECT 71/3 SOUTH WEST APPROACHES
AND BRISTOL CHANNEL

