I.O.S.

R.R.S. DISCOVERY

CRUISE 74 LEG 2

15 SEPTEMBER – 26 SEPTEMBER 1975

SEISMIC REFLECTION PROFILING ACROSS THE CONTINENTAL MARGIN IN THE SOUTH WEST APPROACHES (NORTH BISCAY)

CRUISE REPORT NO. 33

1975

NATURAL ENVIRONMENT RESEARCH COUNCIL

INSTITUTE OF OCEANOGRAPHIC SCIENCES

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R.R.S. DISCOVERY
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Institute of Oceanographic Sciences,
Wormley,
Godalming,
Surrey.

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DATES

Sailed Bantry Bay, Eire	15th September	Day 258
Arrived Brest, France	26th September	Day 269

Scientific Personnel

D.G. Roberts	Principal Scientist	I.O.S.(W)
D.G. Bishop		I.O.S.(W)
D. Booth		Galway Univ.
Y. Camus		Service Hydrographique, Brest
G.F. Caston		I.O.S.(W)
R. Ferguson		I.O.S.(W)
C. Flewellen		I.O.S.(W)
P. Hartland		I.O.S. (Barry)
D. Jones		I.O.S. (Barry)
J. Langford		I.O.S.(W)
J. Legg		I.O.S.(W)
P. Miles		I.O.S.(W)
G. Rothwell		I.O.S.(W)
C. Spong		I.O.S.(W)
W. Strudwick		I.O.S.(W)
R. Stubbs		I.O.S.(W)
R. Wallace		I.O.S.(W)

Ship's Officers

M.A. Harding	Master
E.M. Bowen	Chief Officer
T.N. Gray	2nd Officer
A.J. Howse	3rd Officer
P.E. Stone	Chief Engineer
S. Turton	2nd Engineer
C.J. Phillips	3rd Engineer
R. Fletcher	4th Engineer
C.B.A. Harman	5th Engineer
P.F. Fuller	5th Engineer
J.G. Lewis	Senior Electrical Engineer
L. Wilson	Electrical Engineer
R.G. Hopkins	Catering Officer
R. Hammerton	Radio Officer

SUMMARY OF CRUISE INTENTIONS

The principal objective of this cruise was to occupy a number of closely spaced seismic profiles across the outer shelf, slope and rise between the Porcupine Seabight and Brittany. These profiles were to complement profiles previously taken during Discovery Cruises 47 and 60, and 24 channel seismic profiles to be occupied by the Institut Francais du Petrole in August. These data were to provide a firm data base on which to construct an accurate regional picture of the stratigraphy and structure of the continental margin so as to define drilling objectives for Glomar Challenger and drill sites for detailed survey. The following projects were included in the cruise:-

1. Multichannel seismic reflection profiling

The acquisition of 6-channel seismic reflection profiler data using a multichannel Geomeccanique hydrophone consisting of 6 active and 6 passive sections made available by I.O.S. (Barry). It was intended to digitally process limited sections of the multichannel data on return to I.O.S. Two EPC recorders will be run continuously at different filter settings or displaying an 8-trace average.

2. Magnetics and bathymetry

Magnetics and the PDR were to be run on all passage tracks.

3. Dredging

If the seismic profiles revealed outcrops likely to give improved geological control on interpretation, it was intended to dredge subject to time and weather.

4. Wide angle reflection/disposable sonobuoys

Disposable sonobuoys will be used to obtain velocity data in the thick sedimentary sequences of the margin. The velocity data will be useful in processing the multichannel data.

5. Side-scan sonar

It was intended to use the sonar as a telesounder, echo-sounder and side-scan system. Telesounding would be done in 50 m water depths off Brittany and Ireland.

6. <u>3.5 kHz Echo-sounder</u>

The high resolution 3.5 kHz profiling system was used to aid interpretation of sedimentary processes on the outer shelf and upper slope and to identify dredge sites and the sediment cover over potential drill sites.

7. <u>Seismic signal processing</u>

The seismic profiler and sonobuoy data will be processed to a limited extent using the Nova 2 computer. In addition, running averages of 8-traces will be displayed on line on an EPC recorder.

NARRATIVE

R.R.S. Discovery sailed from Bantry Harbour at 2021/258 and hove to in Bantry Bay to lower the Asdic plate. Our departure from Bantry Harbour had been delayed because of repairs to the autopilot and the arrival of a replacement crew member from Shannon. During this period, the seismic and sonar recording equipment was set up.

The P.D.R. fish was streamed at 2108/258 and computer logging and watchkeeping begun. At 0012/259 the Asdic installation was completed and we began passage to the start of the first seismic line off SW Ireland. On passage, the opportunity was taken to examine the Devonian and Carboniferous outcrops on the floor of Bantry Bay and shelf. During the early morning, it was necessary to increase speed to balance the engines. The vibration associated with the misbalance may have contributed to the minor leak in the Asdic trunk first noted at 0800. At 0808/259 a small electrical fire, that was rapidly extinguished, began in the Asdic trunk due to a short in the cable leading to the servo unit. At 0851/259 the air-gun was streamed, followed by the 3.5 kHz profiler fish at 1008 and the IOS (Barry) array at 1131.

The initial seismic records were of poor quality owing to the poor signal/noise levels recorded on four out of the six sections. Although the noise was at first considered to be electrical, it was soon found that the noise was being generated because of the position of the array at or just below the surface. An unsuccessful attempt to ballast the array was made by adding further weights. It was by then clear that the array was too buoyant and that it would be necessary to jettison some oil to achieve the correct buoyancy. To avoid losing ground, we continued profiling overnight across the Porcupine Seabight using and recording the two operative sections of the array. The magnetometer was streamed at 1950/259. Overnight and during the next day we continued our profile across the Seabight occupying station 8907 en route and terminating the traverse at 1644/260. At 1645 we reduced speed to 4 kts and jettisoned some 15 gallons of oil by slowly pulling the array inboard and leaking oil from each section. These measures effected only a slight improvement on channels 1 and 2 and none on channels 3-6. The IOS (Barry) array was therefore retrieved and the IOS (W) array streamed at 2046/260 for an overnight run across the Pendragon escarpment and Goban Spur. This traverse ended at 1030/261 and, at 1116/261, we reduced speed to 4 kts transferring the IOS (W) array to the port quarter to allow profiling while the IOS (Barry) array was ballasted. Approximately 90 gallons of oil (often under considerable pressure) were jettisoned from the array and about 90 lbs of lead weight (made up on board using odd lead pieces) were added to the tow cable. These drastic measures gave a considerable improvement in the signal/noise on all channels. We therefore retrieved the IOS (W) array, streamed the magnetometer and began our next westward traverse across the continental margin. During the evening, we occupied sonobuoy stations 8908 and 8909 using buoys with gain modifications. At about 2000 the sonar transmitter failed but was repaired quickly. The end of this traverse was reached at 2011/261, and we then began a dog-leg toward the King Arthur Canyon. This seismic section showed a series of grabens and horsts that often showed evidence of internal bedding possibly representing sediments of Early Mesozoic age. At 2033/262, sonobuoy station 8910 gave refractions and continued radio transmission to a range of 30 km. During the evening, the air-gun firing interval was adjusted to 14 seconds and the ship's speed to 6.9 kts to give double coverage for common depth point processing. At 0126/263, we altered course southward to compare the deeper water section to the south with that on the Goban Spur. We reached the end of this traverse at 1253/263 and then altered course to return to the shelf briefly reducing speed to change the air-gun. During this traverse, we occupied sonobuoy stations 8912 and 8913, the former failing after only 15 minutes transmission. The shelf edge was reached at 1536/264 when we turned southward to cross the numerous canyons of the area reaching the end of the traverse at 0832/265. During the next traverse toward the shelf, sonobuoy stations 8914, 8915 and 8916 were occupied. The shelf edge was reached at 0000/266 when we altered course to make a strike section of 20 mls before turning southwards to cross the Shamrock canyon and the western edge of the Meriadzek terrace. At 0800/266, the gun failed due to leakage and on retrieval it was found that the shuttle had sheared. At 0834, we began profiling again and occupied station 8917 marred during its latter part by the failure of the 'O' ring seals in the air-gun. At 0150/267, we reached the end of the traverse and headed northward to cross the Meriadzek Terrace where the seismic profile showed clear evidence of buried horsts and grabens. During this traverse we occupied sonobuoy station 8918 to measure interval velocities in the thick sediment fill. The sonar was used with a recorder range of 3000 m during the traverse across the slope and gave echoes continuously in depths shallower than 2500 m. We altered course at 1056/267 to run parallel to the shelf edge for 30 mls before turning southward across the margin again. Sonobuoy station 8919 was occupied during this traverse. Throughout this day, there was a progressive deterioration in wind and sea conditions. At 1703/267, we altered course westward along the crest of the Meriadzek terrace occupying stations 8920, 8921 and 8922. During this period, heavy swell and high winds necessitated a speed reduction to 4 kts. At 0454/268, we altered course northwestward to cross profiles made earlier in the cruise and occupied sonobuoy stations 8923, 8924, 8925. At 1230/268, we reduced speed to 4 kts and commenced recovery of the air-gun, hydrophone, magnetometer and 3.5 kHz profiler fish. At 1404/268 we commenced a sonar traverse across the shelf to Douarnenez Bay where it was intended to recover the Asdic. We telesounded into Douarnenez Bay completing this run at 0405/269 when course was laid for Brest. Watchkeeping was terminated at 0410/269.

This was a most successful cruise that was considerably aided by the prompt arrival of Discovery in Bantry Bay. All the planned profiles were occupied save one. The time lost and failure to record multichannel data throughout can be directly attributed to the hydrophone buoyancy problem.

It is a pleasure to me to record my thanks and appreciation for the friendly support of Captain Mike Harding, the officers and crew. In particular, I like to thank my colleagues for their spirited and strapping efforts.

PROJECT REPORTS

1. <u>Seismic Reflection Profiling</u>

The equipment used during this cruise was essentially the same as that used on previous cruises with the exception of the hydrophone array and winch. The hydrophone supplied by IOS (Barry) consisted of 6 passive and 6 active sections spaced alternately. This large array was used to permit separate recording of the 6 active sections for subsequent application of CDP signal processing.

On initial deployment of the array, it was found that the first two sections gave reasonable signals but that the last four were extremely noisy. As the array had no depth sensor, we could only infer that the array was floating on the surface because of excessive buoyancy. Initially, twenty gallons of oil were removed from the array and extra weights added before redeployment. However, this made at best a marginal difference in the signal/noise performance of the last 4 sections. To make an effective improvement, between 80 and 100 gallons of oil were jettisoned and an additional 90 lbs of lead weights were strapped to the cable. To minimise loss of data, the IOS(W) array was streamed during the trimming operation. Comparison of the output of the two arrays provided a check on the depth of the IOS (Barry) array.

These measures partly solved the buoyancy problem although the last two section remained somewhat noisy probably because the badly worn valves in the last two sections prevented enough oil being jettisoned. These sections were partly inoperative for the cruise.

The air-guns, electronics and compressors worked well with two minor exceptions. The shuttle of one air-gun sheared after four days operation and one air-gun firing circuit failed.

Apart from the initial problems, the cruise was successful acquiring some 1600 n.mls. of profile at an average speed of 7 kts using the 160 cu. in. chamber fired every 14 seconds at 1500 p.s.i. Penetration of up to 3 seconds subseabed was achieved consistently.

D.G.B.

2. 3.5 kHz Edo Western high resolution profiling system

The Edo Western fish, cable, and transceiver were provided by IOS (Barry), together with an E.P.C. recorder. The system was deployed by 1100 on 15th September, and run continuously until 1230, 25th September. Apart from a minor problem with the paper take-up mechanism on the recorder the system functioned well and provided records for water depths ranging from less than 200 m to greater than 5000 m. However gaps in the record occurred, usually on the steeper parts of the slope or in deeper water where the sea floor was giving a low acoustic return. The 1 sec sweep and 5 millisec pulse were found to give the best results, even in deeper water. Operator errors also caused a few data gaps.

The instrument shows detailed structure and acoustic character in the near surface sediment. Sub-bottom reflections were obtained to a maximum depth of 90 m below the sea floor, more commonly 35-40 m.

The records were interpreted in conjunction with the side-scan sonar records and charted. Features recognised included buried channels, sediment pinch outs, areas of rock outcrops and facies changes (differentiated only by the acoustic character and unsubstantiated by any sampling). On the slope the surface sediment layers of faulted horsts and canyons were observed whilst on the shelf sand wave areas were clearly shown.

Correlation of the mapped sediment types and thicknesses with the seismic profiling records may provide information on the sediment cover, or lack of it, over potential drill sites.

G.F.C.

3(a) <u>36 kHz Side-Scan Sonar</u>

On the shelf echoes out to the full range of 1500 m could be obtained even in depths of 30 m. On the continental slopes very strong echoes were encountered at extreme ranges; so on the final runs the system was modified to give a recorder range of 3000 m. In depths of 1500 m greater echoes were received occasionally at maximum range and regularly to 2500 m. In deep water the equipment was used as an echo-sounder to record the bottom as far as possible and to observe scattering layer structures (maximum depth 1300 m) and migrations.

<u>Equipment</u> Trials were carried out successfully to investigate the parameters and use of a logarithmic amplifier, an automatic gain control (AGC) amplifier and time varied gain (TVG) circuits.

3(b) <u>250 kHz Telesounder</u>

It is proposed to investigate automatic depth plotting from Telesounder data. To further this on the final night tape recordings were obtained in shallow water for testing circuitry at the Institute. At other times the water was too deep for useful recordings.

A.R.S.

4. Disposable Sonobuoys

A number of disposable sonobuoys were deployed to determine the velocity structure required for a more complete analysis of the seismic reflection profiling data. Minor modifications to the buoys were carried out prior to launch. Four buoys out of a total of eighteen failed shortly after launch; this was probably due to the buoy hydrophone cable fouling the magnetometer or air-gun cables.

Good refraction data were recorded from the buoys and data and radio range were maintained to 25 km from the ship.

J.L.

5. Signal processing

The signal processor performed on-line real time processing of the seismic reflection profiling data. A program to perform 8-trace averaging was developed and run to improve signal to noise ratio of the reflection data; this was quite effective during adverse conditions of noisy data.

A 4-trace averaging program was modified with a suitable delay to enable disposable sonobuoy data to be displayed with some compensation for the move out effect caused by increasing ship/buoy range.

J.L.

6. Magnetic and bathymetric measurements

Magnetic records were taken throughout the cruise using the Varian V-75 magnetometer. The data were automatically digitally logged by the computer, the IGRF correction being calculated for each field sample using the navigational information in the computer.

The magnetometer operated well during the cruise, showing the familiar radio transmission interference but requiring only routine maintenance. The new routing of the spare inboard cable along the port forecastle deck continued to be satisfactory.

Continuous bathymetric data was recorded using the IOS Mark III Precision Echo-Sounder. Bathymetric measurements digitised every six minutes were manually entered into the computer using the manual entry console which gave problems concerning the thumb wheels not locking into position.

P.M.

7. Meteorological Report

Throughout the duration of the cruise daily manual observations were made from the following instruments:-

1. Bridge barometer
2. Bridge Wet and Dry Bulb thermometer
3. R.A.S.T.U.S. (indicating the hull temperature)
4. Anemometer,

and these readings were compared with those taken by the IBM 1800 computer. It was found that the readings were of good quality and gave a good correlation; although, as the readings were taken at dusk to avoid unnecessary interference with the computer, some discrepancies did arise in some cases, due to radio transmission.

During the cruise all the instruments performed well and only required general servicing.

G.R.

8. Data Editing

Navigation, bathymetric and magnetic data was edited on a 24 hour basis. New programs for more efficient data presentation were tested particularly with regard to track charts and profiles suitable for cruise data reports.

(a) Navigation

Daily track charts were checked for position jumps, spurious velocities and poor satellite fixes. Necessary course updates and satellite rejections were made but some position jumps could not be eradicated by the existing software and required manual entry of modified course corrected data. Computer plots of ship's track at 1:1,000,000 for both Admiralty plotting sheets and a special 46°N standard latitude sheet were produced.

(b) Bathymetry

The Mufax recorder roll was checked against a computer listing of depth entries both for incorrect readings and omitted times, the latter being errors from watchkeeping and the P.E.S. entry console. Depths plotted by the computer were compiled on Admiralty plotting sheets in corrected metres.

(c) Magnetics

A profile of the previous days sampled total magnetic field was displayed on the V.D.U., compared with the magnetometer analogue record and checked for data spikes - these were mainly caused by radio transmission interference. Magnetic anomaly charts were compiled at 1:1,000,000 at 46°N standard latitude.

(d) Computing

Profiles of magnetic anomaly, depth, course made good and speed made good of each day's data suitable for direct reproduction in data report format were generated during the cruise to save land based computer time. Following the problems of Cruise 74, the decision to have the assistance of an IOS (Wormley) programmer in building the new track and profile plotting routines was well rewarded in a significant advance of shipboard geophysical data processing.

9. Computing

The computer functioned normally for most of the cruise, however there were three hardware faults. The 1053 typewriter in the plotting office jammed consistently when attempting to tab and at the end of the second leg this was still causing problems. One of the alphanumeric terminals developed a fault but this was replaced with its back-up. Disk drive zero occasionally refused to cold-start. This may be due to a disk error or, more probably, because of the paper tape reader misreading.

Data was edited on a daily basis. A program was written to use the 1800 reference voltage for the detection of spikes caused by radio noise and this proved very effective.

The new Mercator Chart routines were implemented for use during the cruise. These new routines supplement the existing programs. The geophysics profile plotting program was also implemented successfully.

W.S.

10. 1800 Computer Engineering

On previous cruises problems of an intermittent nature have occurred in the digital clock interface. These faults occurred again at the start of Leg 2, causing the computer to switch from the external to the internal clock on many occasions causing timing errors. Examination of the clock data input to the computer showed intermittent latch up of certain bits caused by a faulty bistable I.C. which was replaced.

The plot typewriter was found to hang-up on 'tab' operations caused by missing interrupts. Even though the tab feedback contacts were replaced with a new set, this problem persists because IBM timing information was lacking.

On one occasion the system crashed and a disk read/write error was suspected as the system would not then cold start. Examination of the disk heads showed that they were still in good condition but the engineering disk diagnostics showed two read errors from the first sector of the test disk. As downtime was now becoming a problem, it was decided to try a cold start to get the sampling back. This was successful. It was concluded that the system crashed for unknown reasons (but disk error is possible) and that the cold start would not work due to the disk head being out of the home position.

The third problem was the complete failure of the plot A.N.T. caused by a blown transistor on the CRT driver card which resulted in the 26 volt supply shorting to ground. The display was restored by replacing the transistor though we still could not use the A.N.T. as it caused the system to hang up. After several methods were tried, the CAMAC diagnostics were run and showed a CAMAC read error of an intermittent nature. The CAMAC interface was changed and the test ran successfully.

A circuit was built to detect radio interference on the computer's analogue inputs to see if it could be used directly or indirectly to inhibit sampling during radio transmissions. This is still under development.

The documentation on the digital patch board was rewritten to eliminate the confusion of the previous version.

P.H.

11. Surface current analysis

A detailed analysis of the surface currents derived by conventional methods and those by satellite fixes calculated by the computer was made. The principal conclusions of this study (the complete analysis and report is held at the Institute of Oceanographic Sciences) are as follows:-

(a) Probably the program which calculates the drift of the vessel between two satellite positions is in error. It would be useful to research in particular a correction factor resulting from an old calibration of the e.m. log.

(b) It is useful to take up again the work effected here in calculating the speed and the average ship's head of the vessel for each section of track considered (from the average of the values of log and gyro), the speed and average ship's head over the ground (from the average of the distance separating two consecutive satellite fixes), the speed of drift of the vessel from the difference between these two vectors.

(c) It would be useful to research the historical results corresponding to diverse branches of the North Atlantic Drift in this region and, proceeding by successive iterations, to attempt the distinction between the effect of wind and the effect of current on the vessel.

(d) It will then become possible to attempt an estimation of the calibration of the e.m. log.

Y.C.

Table I

STATION POSITION LIST

Stn. No.	Type	Day No.	Date	Time		Start		End		Depth Range						Remarks
										UCF		CF		CM		
				Start	End	Lat. N	Long. W	Lat. N	Long. W	Max	Min	Max	Min	Max	Min	
8907	DSB	260	17.9.75	1500	1608	50°12.45'	14°4.71'	50°12.24'	14°16.06'	1997	1932	2050	1982	3749	3624	Abortive - poor reception.
8908	DSB	261	18.9.75	1750	1840	49°19.70'	13°35.43'	49°18.67'	13°39.07'	2236	2180	2299	2241	4203	4097	"
8909	DSB	261	18.9.75	1905	1948	49°17.83'	13°42.15'	49°16.37'	13°47.55'	2307	2288	2374	2354	4341	4304	"
8910	DSB	262	19.9.75	2033	2315	48°22.11'	11°20.58'	48°7.40'	11°9.31'	2161	1746	2221	1789	4061	3271	Successful
8911	DSB	263	20.9.75	0927	1114	47°30.84'	12°6.40'	47°26.43'	12°22.84'	2497	2314	2574	2381	4707	4354	Successful
8912	DSB	263	20.9.75	1700	1736	47°48.29' (at 1658)	12°54.89'	47°52.95'	12°57.28'	2362	2342	2432	2411	4447	4409	One buoy failed - loss of RX transmission.
8913	DSB	263	20.9.75	1743	2000	47°54.13' (at 1742)	12°57.89'	48°8.10' (at 1958)	13°5.44'	2392	2371	2463	2441	4502	4464	
8914	DSB	265	22.9.75	0921	1150	47°24.41' (at 0920)	11°05.72'	47°37.52' (at 1148)	10°49.51'	2446	2326	2522	2396	4612	4381	Co alteration during experiment.
8915	DSB	265	22.9.75	1719	1930	48°03.59' (at 1720)	10°09.74'	48°13.36' (at 1930)	09°53.90'	1998	960	2053	982	3754	1795	Successful
8916	DSB	265	22.9.75	2106	2325	48°22.9'	09°44.60'	48°33.23'	09°27.0'	237	94	244	97	446	177	Successful
8917	DSB	266	23.9.75	1306	1456	48°41.98'	09°33.65'	47°30.4'	09°39.9'	2268	2043	2335	2099	4270	3838	Successful
8918	DSB	266	23.9.75	1947	2146	47°5.62'	09°44.4'	47°03.95'	09°23.07'	2382	2370	2457	2444	4493	4469	Successful
8919	DSB	267	24.9.75	1109	1319	48°11.94'	07°59.71'	48°9.42'	07°39.80'	100	92	100	92	182	168	Successful
8920	DSB	267	25.9.75	2338	0107	47°30.66'	08°14.39'	47°34.98'	08°26.11'	1104	980	1138	1005	2070	1837	Successful

Stn. No.	Type	Day No.	Date	Time		Start		End		Depth Range						Remarks
										UCF		CF		CM		
				Start	End	Lat. N	Long. W	Lat. N	Long. W	Max	Min	Max	Min	Max	Min	
8921	DSB	268	25.9.75	0114	0317	47°35.87'	08°29.44'	47°39.75'	08°44.03'	1696	1026	1742	1053	3185	1925	Successful
8922	DSB	268	25.9.75	0326	-	47°39.30'	08°45.08'	-	-	-	-	-	-	-	-	Buoy failed - no RX
8923	DSB	268	25.9.75	0600	0800	47°40.08'	08°48.15'	47°43.76'	08°25.48'	2048	1151	2107	1181	3853	2159	Successful
8924	DSB	268	25.9.75	0851	1025	47°43.91' (at 0848)	08°17.25'	47°44.29'	08°01.95'	744	441	764	454	1397	830	Successful
8925	DSB	268	25.9.75	1028	1230	47°44.32'	08°01.39'	47°45.34'	07°41.13'	600	360	617	371	1128	678	Successful

Table II

SEISMIC REFLECTION PROFILES

Traverse No. and Distance	Equipment used	Date	Time Z/Day No.		Lat. N Long. W	to Lat. N Long. W	Depth Range						Comments
							UCF		CF		CM		
			From	To			Max	Min	Max	Min	Max	Min	
1 204 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	16.9.75 to 17.9.75	1945/259	1644/260	50°49.11' 11°10.88'	50°12.41' 14°22.11'	2052	155	2107	158	3853	289	Shelf S.W. Ireland to Porcupine Abyssal Plain via Porcupine Seabight
2 132 km	Airgun (160 cu.in.) IOS(W) array 3.5 kHz fish	17.9.75 to 18.9.75	2245/260	1125/261	50°5.25' 14°37.69'	49°25.52' 13°2.94'	2182	780	2243	797	4101	1457	Porcupine Abyssal Plain to Goban Spur
3 108 km	Airgun (160 cu.in.) IOS(W) array RVB Geomecc. array 3.5 kHz fish	18.9.75 to 19.9.75	1125/261	0130/262	49°25.52' 13°2.34'	48°42.10' 13°31.18'	2396	875	2468	894	4513	1635	Goban Spur to Porcupine Abyssal Plain
4 110 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	19.9.75	0130/262	1250/262	48°42.10' 13°31.18'	49°10.19' 11°53.07'	2350	433	2419	443	4423	810	Goban Spur to Bay of Biscay (continental rise)
5 127 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	19.9.75 to 20.9.75	1250/262	0126/263	49°10.19' 11°53.07'	47°55.26' 10°59.18'	2205	421	2267	431	4145	788	Continental margin of North Biscay
6 114 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	20.9.75	0126/263	1253/263	47°54.14' 10°50.01' (at 124)	47°23.07' 12°38.36' (at 1248)	2497	1824	2574	1871	4707	3421	Continental rise of North Biscay to the Pendragon escarpment
7 92 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	20.9.75	1253/263	2142/263	47°23.07' 12°38.36' (at 1248)	48°20.06' 13°12.91' (at 2146)	2392	1944	2463	1995	4504	3648	Pendragon escarpment to shelf in the SW Approaches

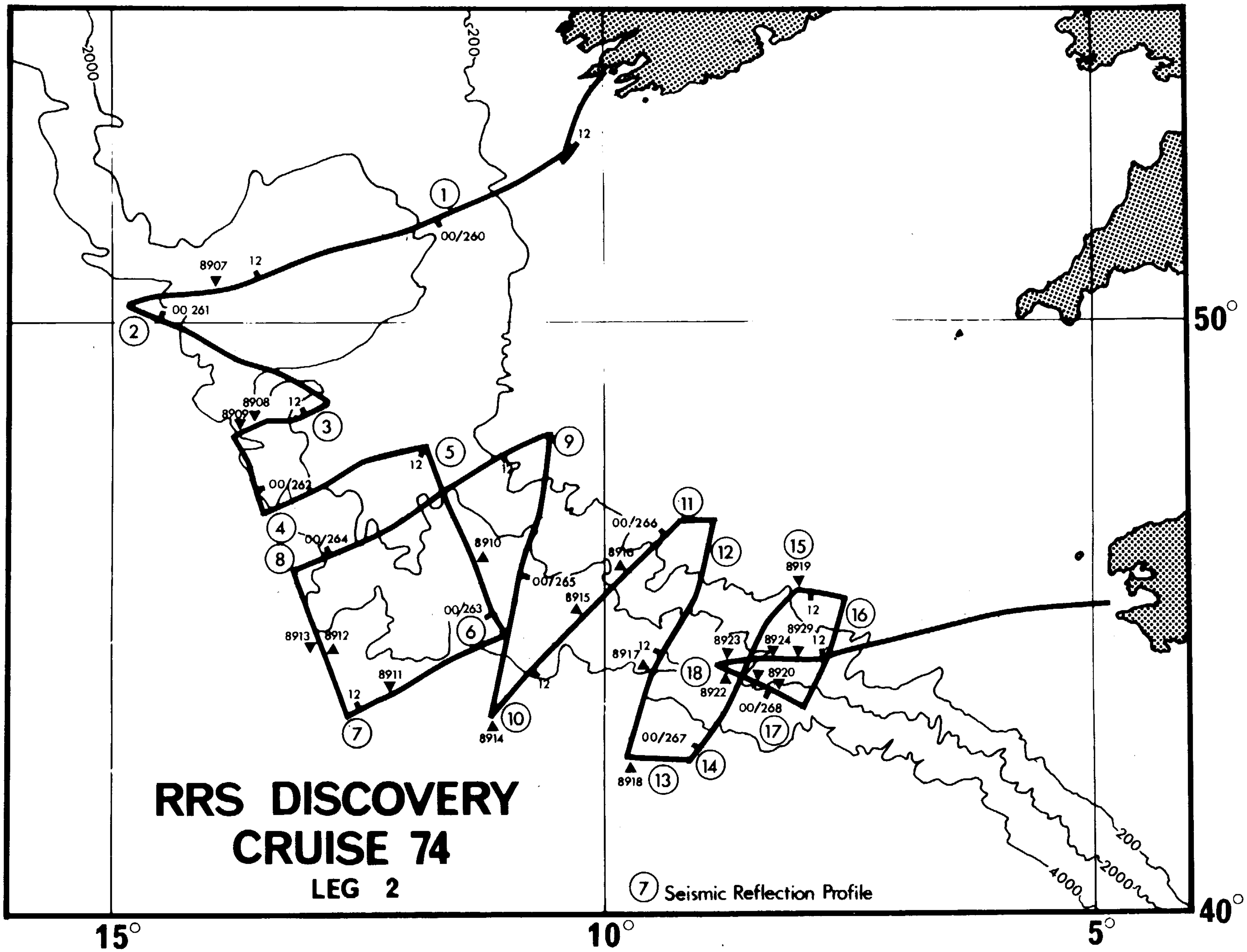
Traverse No. and Distance	Equipment used	Date	Time Z/Day No.		Lat. N Long. W	to Lat. N Long. W	Depth Range						Comments
			From	To			UCF		CF		CM		
							Max	Min	Max	Min	Max	Min	
8 185 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	20.9.75 to 21.9.75	2142/263	1526/264	48°19.26' 13°12.13' (at 263)	49°16.21' 10°32.77'	2366	78	2541	79	4646	144	**Porcupine Abyssal Plain to Goban Spur to shelf in SW Approaches**
9 181 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	21.9.75 to 22.9.75	1526/264	0850/265	49°16.21' 10°32.77'	47°21.89' 11°9.46'	2464	78	2541	79	4646	144	**Shelf in SW Approaches to continental rise in Bay of Biscay**
10 169.5 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	22.9.75 to 23.9.75	0850/265	0127/266	47°21.89' 11°09.46'	48°42.45' 09°12.66'	2462	86	2539	89	4643	162	**Continental rise to Little Sole Bank**
11 21.5 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	23.9.75	0127/266	0330/266	48°42.45' 09°12.66'	48°41.28' 08°53.79'	87	76	90	78	164	142	**Little Sole Bank to Trevelyan Escarpment via Sham Rock**
12 158.5 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	23.9.75	0330/266	1910/266	48°41.28' 08°53.79'	47°06.26' 09°48.82'	2387	86	2462	89	4502	162	**Little Sole Bank to Trevelyan Escarpment via Sham Rock Canyon**
13 28.5 km	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	23.9.75	1910/266	2253/266	47°06.26' 09°48.82'	47°3.52' 09°11.03'	2396	2370	2472	2444	4520	4469	**E-W traverse along continental rise**
14	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	24.9.75	2253/266	1056/267	47°3.52' 09°11.03'	48°11.63' 08°1.28'	2374	90	2449	93	4478	170	**Continental rise to La Chapelle Bank via Meriadzek terrace**
15	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	24.9.75	1056/267	1417/267	48°11.63' 08°1.28'	48°9.28' 07°31.73'	100	92	100	92	182	168	**Shelf traverse**

Traverse No. and Distance	Equipment used	Date	Time Z/Day No.		Lat. N Long. W to	Lat. N Long. W	Depth Range						Comments
			From	To			UCF		CF		CM		
							Max	Min	Max	Min	Max	Min	
16	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	24.9.75	1417/267	2138/267	48°9.28' 07°31.73'	47°24.98' 07°58.90'	1920	93	1974	93	3610	170	La Chapelle Bank to continental rise
17	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	24.9.75	2138/267	0510/267	47°24.98' 07°58.9'	47°42.58' 08°54.00'	2048	980	2107	1105	3853	1837	E-W traverse along Meriadzek terrace
18	Airgun (160 cu.in.) RVB Geomecc. array 3.5 kHz fish	24.9.75	0510/268	1230/268	47°42.58' 08°54.00'	47°45.35' 07°40.47'	1796	363	1845	374	3374	683	Meriadzek terrace to shelf edge

Table III

SONAR TRAVERSES

Run	Vertical Mode	Side Scan Mode	Date From	Date To	Time Z / Day No. From	Time Z / Day No. To	Latitude N Longitude W	to Latitude N Longitude W	Depth Range (Fms) From	Depth Range (Fms) To	Comments
1		x	16/9/75	16/9/75	0032/259	2140/259	51°42' 9°30'	50°44' 11°25'	10	808	
2	x		16/9/75	17/9/75	2140/259	0940/260	50°44' 11°25'	50°23' 13°16'	808	1390	
3	x		17/9/75	19/9/75	2130/260	1200/262	50°8' 14°45'	49°9' 12°2'	480	2400	
4		x	19/9/75	19/9/75	1200/262	1435/262	49°9' 12°2'	49°0' 11°44'	480	742	
5	x		19/9/75	21/9/75	1500/262	1015/264	48°58' 11°42'	49°01'* 11°21'	464	2500	*Fresh data rather than course correction data
6		x	21/9/75	21/9/75	1015/264	2030/264	49°01'* 11°21'	48°42' 10°40'	74	784	
7	x		21/9/75	22/9/75	2030/264	2030/265	49°42' 10°40'	48°20' 9°47'	680	2470	
8		x	22/9/75	23/9/75	2030/265	0910/266	48°20' 9°47'	48°07' 9°09'	76	680	
9	x		23/9/75	24/9/75	0910/266	0700/267	48°07' 9°09'	47°50' 8°28'	860	2396	
10		x	24/9/75	24/9/75	0700/267	1937/267	47°50' 8°28'	47°37' 7°49'	85	1018	
11	x		24/9/75	25/9/75	1937/267	0752/268	47°37' 7°49'	47°43' 8°27'	880	2050	
12		x	25/9/75	26/9/75	0752/268	0345/269	47°43' 8°27'	48°07' 4°22'	10	1248	


RRS DISCOVERY
CRUISE 74
LEG 2
7 Seismic Reflection Profile
15°
10°
5°
50°
40°
200
2000
4000
00/260
00 261
00/262
00/263
00/264
00/265
00/266
00/267
00/268
8907
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