NATIONAL INSTITUTE OF OCEANOGRAPHY
Wormley, Godalming, Surrey.

R. R. S. DISCOVERY
Cruise 47

9th June - 3rd July 1972

GEOLOGY AND GEOPHYSICS

ON AND AROUND THE ROCKALL PLATEAU

N. I. O. CRUISE REPORT NO. 52

(Issued August, 1972)

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DATES

Sailed	Barry, S. Wales	9th June	Day 161
Arrived	Barry, S. Wales	3rd July	Day 185

SCIENTIFIC PERSONNEL

		Affiliation
D. G. Roberts	(Principal Scientist)	NIO
D. A. Ardus [2]		IGS
D. Bishop		NIO
R. Bonner		NIO
E. P. Collins		NIO
C. Flewellen		NIO
Lt. Cdr. T. McAndrew [1]		HD
N. Olliff		NIO
C. Pelton		NIO
J. Sherwood		NIO
Mrs. R. Sherwood		NIO
H. Robertson [2]		IGS
M. Wilson		NIO

1 Hydrographic Department, Ministry of Defence

2 Institute of Geological Sciences. Continental Shelf Unit II. Edinburgh.

SHIP'S OFFICERS

G. L. Howe	Master
P. MacDermott	Chief Officer
A. Anderson	2nd Officer
P. Warns	3rd Officer
J. Lyttle	Radio Officer
C. Storrier	Chief Engineer Officer
R. Young	2nd Engineer Officer
C. Phillips	3rd Engineer Officer
J. Tomlinson	4th Engineer Officer
J. Roberts	Chief Electrical Officer
A. MacMahon	2nd Electrical Officer
K. Worth	Junior Engineer Officer
H. Davies	Junior Engineer Officer

SUMMARY OF CRUISE INTENTIONS

1. Bottom Sampling

The principal objective of this cruise was to intensively sample the outcrop geology of the shallower banks on the Rockall Plateau. The major tool was a 1 metre IGS drill but a vibrocorer, rock corers, dredges and a stereocamera were carried as alternative tools. Three main areas were selected for study:-

(a) Rockall Bank

Previous cruises to the area had provided good geophysical control and defined the location of outcrops and sediment distribution. Objectives included sampling of in-situ rocks, superficial sediments and use of the asdic for structural mapping of the outcrops and observation of sediment distribution patterns.

(b) George Bligh Bank and Hatton Bank

Previous seismic reflection profiles across these banks had shown outcropping basement at depths accessible to the available sampling equipment. The intention was to obtain in-situ rock for intercomparison of the geology of the three main banks of the Plateau.

2. Seismic Reflection Profiling

It was planned to continuously seismic profile on all passage tracks using Bolt air-guns and in the shallow water areas to obtain high resolution seismic profiles using the ORE 3.5 kHz seismic profiler.

3. Side-scan Sonar

The side-scan sonar was carried for continuous operation as a narrow beam echo-sounder in the deeper water areas and for use as a support for bottom sampling and sediment distribution studies in all depths less than 300 fathoms.

4. Magnetic and Bathymetric Data

Magnetics and depth data were to be obtained on all tracks.

NARRATIVE

R. R. S. Discovery sailed from Barry Docks at 1728/161 and hove to in Barry Roads to lower the Asdic. The Asdic installation was completed by 2148/161 and shortly afterwards, the P. D. R. fish was stream and scientific watchkeeping began. Overnight, asdic traverses were made through points of specific interest in the Bristol Channel. During the following day, the magnetometer was streamed (0842/162) and the start of the first seismic reflection profile at 50°N 10°W was reached at 2227/162. During the westward traverse across the Porcupine Sea bight, basement was followed to a depth of 3.0 seconds (two-way time). At 2252/163, the crest of Porcupine Bank was crossed and a zig was made to the southwest to examine the sub-surface expression of fracture zones beneath the Porcupine Abyssal Plain. A seismic traverse was then made in a northerly direction toward the Rockall Trough. Basement was continually followed on this traverse and penetration locally reached 3.75 seconds. Several traverses were made across the Feni Ridge to examine the basement topography and thickness variations in the sediments below the Feni Ridge. The southern end of the Rockall Bank was reached at 1703/167 and the seismic gear recovered. A northward asdic and magnetics passage was then made to the Empress of Britain Bank where metamorphic rocks were believed to outcrop. The area was reached at 0546/168 and the ORE seismic fish was streamed for a seismic and asdic survey to select suitable anchor and drill sites. On completion of the survey, dhanbuoy I was deployed and a grab station (7914) occupied on the drill site. 'Discovery' was successfully stern anchored by 1400/168 but the increasing swell and wind speed caused the ship and dhanbuoy to drag anchors. By 1500, both anchors were weighed and the dhanbuoy was recovered shortly afterwards. Since further station work was impossible, the seismic profiler gear and magnetometer were streamed for an eastward traverse into the Rockall Trough that would link with seismic profiles originally planned for a later part of the cruise but would enable rapid access to the Bank. The weather remained severe however, and a seismic profile was made up the axis of the Rockall Trough to give a valuable tie-line between previous seismic profiles. Between 2300/169 and 1134/170, a seismic profiler survey was made of the moat and ridge around Anton-Dohrn Seamount. The Rosemary Bank was also traversed

and a seismic profiler section was made between this Bank and Lousy Bank to define the northern extension of the Feni-Ridge. During this period (0630/171 - 2000/171), the Speedomax meteorological data analogue recorder became noisy although good data have been logged on disc. The seismic hydrophone also became noisy due to chafing by the air-gun bridle. The traverse was completed before this fault became too serious and it was then quickly rectified in time for a zig-zag into the Rockall Trough and onto the George Bligh Bank. The crest of George Bligh Bank was reached at 1630/172. Our original intention was to end seismic profiling here for station work on the Rockall Bank. However, a severe gale 9 was forecast and the seismic profile was therefore continued into the northern part of the Hatton-Rockall Basin. By 0845/174, the wind speed had increased to 69.1 knots veering to the north west forcing us to head into the wind crossing the Hatton Bank at 1500/173. Despite bad weather, excellent seismic records were obtained throughout this period. By 0100/174, the weather had moderated enabling us to turn southeastward to return to the Rockall Bank and make a further seismic traverse of the Hatton Bank and Hatton-Rockall Basin. At 1700/175, the previous survey area on Rockall Bank was reached and a series of grab and rock corer stations were occupied on the known outcrops since the weather did not permit anchoring or dredging; Stations 7916 - 7947 were occupied during the period 1955/175 to 1340/176 and metamorphic rocks were successfully cored at several. By 1340/176, the weather had further deteriorated so the seismic gear was streamed and a profile taken south westward across the southern part of the Hatton-Rockall Basin and the S.W. Margin of the Rockall Plateau. During this period, 40 ft. waves and wind speeds of 50 knots were recorded. The weather forecast eventually showed signs of a future improvement so the seismic profile was ended at 1915/178 and course was set for Rockall Bank at full speed arriving there at 1410/179 when the magnetometer was brought inboard. On the basis of the previous survey, we immediately anchored and occupied several drill and grab stations. The drill/television showed only gravel or boulders and despite manoeuvring the ship no good rock outcrop could be found. Anchors were weighed at 0100/180 and we steamed to another part of the outcrop occupying stations 7950-7954 on passage. Anchoring was completed by 0916/180 using the LORAN-C and topography as control and the ship was positioned in a water depth

of 147 m when a 10 cm core of garnet-plagioclase granulite (7955A) was drilled. Further attempts to drill here were aborted firstly due to electrical failures and finally to the total loss of the drill barrel and water jacket during retraction after it had penetrated some 30 cm of rock. Whilst at anchor, the opportunity was taken to take several grabs and to occupy a stereo-camera station (7956, 7957). Due to the damage sustained by the drill, no further rock drilling seemed possible at this stage. However, a careful look at the damage suggested reconstruction of the drill might be possible. Since metamorphic rock had been confirmed at this locality, we steamed 50 n miles northward to another outcrop that was a suitable drill or dredge site occupying en-route grab stations 7958 and 7963 and running the asdic at all times. Overnight (180/181), Mr. Bonner and Mr. C. Storrier (Chief Engineer Officer), in a splendid effort that saved the day, had completely rebuilt the drill and dri lling was possible once more. At 0045/181, the P. D. R. failed due to a seized paper drive shaft and pre-anchoring manoeuvres were made using the bridge echo-sounder. Anchoring was completed by 1022/181, and drilling began at 1229/181. This station (7964) yielded a 17 cm core of a microperthite granulite. Deteriorating weather and time did not permit further station work and anchor was weighed at 1400/181 prior to our return passage to Barry.

The magnetometer was streamed at 1446/181 and Discovery headed south down the Rockall Bank to the start point of the return passage seismic profile streaming the seismic gear at 2244/181. A faulty hydrophone delayed the start of the profile which finally began at 0100/182. During this profile from Rockall Bank to Achill Island, the compressor failed twice due to a fractured valve seat and leaking flexible coupling. Despite the heavy weather, over 2. 5 seconds penetration was recorded on this profile. Discovery arrived off Achill Island at 0720/183 and the seismic gear was retrieved for the run to Barry along the shelf west of Ireland. The Varian magnetometer failed at 1150/183, due to a fault in one of the components of the pre-amplifier. During the passage back round Ireland and up the Bristol Channel P. D. R. and asdic watches were maintained and a brief diversion was made to examine the ground near Lundy Island before proceeding to Breaksea. All watchkeeping ended at 2145/184 and computer logging was shut down at 2145/184.

This was a most successful cruise bearing in mind the atrocious weather experienced for this time of year. Some 2300 mls of excellent seismic profiler data were taken and some 49 stations were occupied on the Rockall Bank.

It is a real pleasure for me to thank and acknowledge the splendid help and co-operation of Captain G. L. Howe, the officers and crew in continually trying weather conditions. I would particularly like to express my thanks to the scientists without whose teamwork we would not have been able to obtain the results in the prevailing weather conditions.

PROJECT REPORTS

1. Bottom Sampling

The bottom sampling programme was severely curtailed by the heavy weather encountered throughout the cruise. Although we were unable to occupy any stations on the George Bligh and Hatton Banks, we did occupy some 49 stations on the Rockall Bank, exclusive of the large number of sub-stations occupied during periods at anchor. At these stations, we obtained a 70% success rate.

The drilling programme was retarded to a very limited extent by failures of various components but we successfully drilled (and cored) metamorphic rock at several points and also drilled a 17 cm core of a microperthite granulite at a second locality. The drill and television results conclusively confirm that the Rockall Bank is continental in geology as well as in seismic character. Numerous grabs were taken and yielded materials with a typically high organic and carbonate content. These sediments are extremely coarse and heavy mineral analyses will be made for comparison with the drill and previous dredge data. The drill cores will be submitted to a detailed petrological analysis with age determinations if possible.

D. G. R.

2. Drilling Operations

The I. G. S. rock drill consists of a pressure-compensated, 3 phase electric motor driving a 1 metre, EX, single wall core barrel fitted with a diamond bit and reaming shell. A small pump, driven by cogged belt from the motor shaft, provides water flow for flushing the bit. A TV system with a 2000 ft. water depth capability provides the means of locating and confirming in situ outcrops and the subsequent monitoring of the drilling. A 2000 ft. cable supplies power to the drill or alternatively to the I. G. S. vibrocorer.

A self-retraction system for the rock drill, currently being developed, was not available for the cruise and the present means of barrel withdrawal imposed the need for very precise station holding on the ship.

The first two drilling attempts found no rock in situ and during a traverse

over a boulder area on the second site a failure of the drill trigger and subsequent repeated striking of the drill barrel on the rocks caused the barrel to unscrew and it was lost.

The third attempt was successful but lateral motion of the ship relative to the drill site and the absence of the self-retracting mechanism caused damage to the reaming shell. This was remachined to eliminate the damaged section.

Damage to a TV cable caused by tangling of the swival on the main hoist wire during the search phase of the operation cut short the next attempt while water in the power plug prevented drilling when the equipment was in place on the next decent.

The following attempt achieved penetration of some 30 cm but retrieval of the sample failcd due to the ship yawing relative to the drill position. Again the self-retracting mechanism would have eliminated this problem. The retraction strop, water-packer and barrel were lost.

The remaining barrel was modified to provide water injection and fitted with an adaptor (made up previously because of the lack of another spare reaming shell) to take the drill bit while a new push-fit attachment was made for the motor shaft.

The next site was occupied successfully and a 17 cm core obtained.

D. A. A.

3. Seismic Reflection Profiling

The seismic profiling system was operated for approximately 400 hours covering some 2300 n. m. at between 5 and 8 knots. The system was essentially the same as that employed during Cruise 43 and consisted of:-

1. A Bolt Par 1500C 40 cu. in air-gun firing at intervals of 8 or 10 seconds at a pressure between 1000 and 1800 psi.
2. An NIO hydrophone array consisting of a 100 ft. spring section joined to four 50 ft. sensor sections and a 50 ft. tail section, all nearly neutrally buoyant and towed on an 8 core weighted cable 500 yds. long with an elastic strop connected to the towing boom to prevent surging.
3. A Mufax 18" wet paper recorder displaying the data on a 2 second or 4 second sweep with an adjustable delay.

4. A Bell and Howell VR 3360 tape recorder operating at a tape speed of 1 7/8 ips.

A modification introduced since Cruise 43 that has proved successful is a double barrel drum for the hydrophones and high pressure bundle. The latter now uses an all polyurethane high pressure hose instead of metal reinforced hose thereby completely eliminating bursting of the outer sheath.

Due to bad weather conditions, both hydrophones developed intermittent faults. One was repaired at the expense of 200 yds. of neutrally buoyant cable and was used for the latter part of the cruise. Depth sensors in both hydrophones were inoperative for the whole of the cruise and we were therefore unable to tune the system to its maximum capability. The Williams and Jones compressor broke down twice and remains a weak link in this otherwise satisfactory system. Breakdowns were caused by the failure of a flexible coupling and the fracture of a valve plate. A larger capacity compressor would be more useful enabling larger chambers to be fired at the present repetition rates.

All in all the system operated extremely well even in Force 11 gales and consistently yielded in excess of 2.0 secs. penetration.

D. P. B.
D. G. R.

4. Side-scan Asdic

The side-scan asdic was used almost continually throughout the cruise. It was employed in slant mode in all depths less than 300 fathoms and as a narrow beam echo-sounder in greater depths. Record quality was generally good except in the rougher weather. In the latter cases we were usually in deeper water and no useful records could be taken. The asdic was invaluable as a means of locating rock outcrops on the Rockall Bank. Traverses were taken outbound and inbound to fill gaps in the NIO asdic coverage of the Bristol Channel.

D. G. R.

5. Topographic and Magnetic Data

Soundings were taken continuously throughout the cruise using the Mk III NIO Precision Echo-sounder and an NIO Mk II towed fish. One breakdown was

experienced due to a seized paper drive shaft but a new shaft was made and the system was subsequently operated satisfactorily. Soundings were manually entered into the computer at 5 minute intervals.

A Varian magnetometer was operated throughout the cruise and total magnetic field values were processed and stored on disc. The magnetometer failed on three occasions: on the first, the potentiometer slide wire drive seized due to lack of lubrications- on the second, the lower take-up spool drive motor finally stripped its gears and a new gear wheel had to be made; on the third occasion, the magnetometer failed completely due to a fault in the pre-amplifier.

D. G. R.

6. ORE Seismic Profiler

An ORE seismic profiler fish was loaned by the RVB for use as a method of detecting thin sediments. On delivery, the fish cable was substantially shorter than recommended by the manufacturer. This meant that it could not be towed below the keel and record quality was therefore severely affected by the rough seas. No useful seismic records were obtained.

7. Anchoring

The objective was to anchor with precision over rocky outcrops and drill cores from the in situ rock, an operation which required that the vessel have a minimum of movement while the drill was on the bottom. It was also desirable that on completion of drilling the hoisting wire should be as nearly as possible vertical over the drill for withdrawal from the hole. The water depth was approximately 160 metres.

It was decided to use two anchors astern and to try for a spread of 60 degrees with 600 metres of wire out on each, with the vessel stern on to the resultant direction of wind and tide and using the bow propeller to counter any yawing.

Anchors: 1 1500 lb Danforth & 1 approx. $1\frac{1}{2}$ ton Stockless.

Wires: $2\frac{1}{2}$" fitted with thimbled eyes connected to the anchors with swivels. These wires were installed about 8 years ago and reeled on the trawl winch wing drums for use with the Engels trawl - originally 1000 metres in length, they had

been cropped on various occasions to approx. 700 metres.

The port anchor (the Stockless $1\frac{1}{2}$ T.) was hung from the port A frame with the wire led normally around the dynamometer sheave which gave the advantage of a reading of 'wire out'.

The starboard anchor (1500 lb Danforth) could not be hung from the starboard A frame as this was required for the drill. A lead block was secured on deck by strops around the base of the capstan to give a lead to the after starboard Panama lead.

1st Mooring A dhan buoy was laid about 3 miles from the drilling site and the resultant direction of wind and tide deduced from it. Wind approx. 25 knots.

The plan for anchoring was as follows:- Hove to in Posn. 1, let go to port anchor, turn ship to posn. 2 with bow prop and with engines going astern and using the wind on the port side traverse to posn. 3 paying out 600 metres wire. At posn. 3 let go starboard anchor and pay out 600 metres wire on it with wind carrying vessel to posn. 4. Although a satisfactory mooring was obtained it fell short of what was required in two respects. The final position was too far downwind and the spread of the anchors was less than it should have been. Factors contributing:- The traverse from 2 to 3 was controlled by ranges and bearings of the dhan buoy which was later found to be drifting and the anchor failed to bite at first on the rocky ground. So far as the spread was concerned, the attitude of the ship during the traverse from 2 to 3 did not enable sufficient strain to be put on the port anchor wire to stretch it out properly. It evidently snagged on a rock as the ship moved from 3 to 4 which not only reduced the spread but damaged the wire as well.

The only real advantage that could be claimed for this method is that risk of fouling the screw is reduced to the minimum. Its chief fault is that one cannot put a decent strain on the first anchor wire.

2nd Mooring With the wire now marked at 600 metres the starboard anchor was let go first, while hove to in posn. 1 and vessel steamed across to posn. 2. A good strain was kept on the wire until the port anchor was let go and vessel allowed to fall downwind to posn. 3 paying out on wire as she was carried down.

This achieved the object of a good spread but made too much leeway on the traverse from 1 to 2 and the first anchor was a long time getting a good bite, with

the result that the vessel again wound up too far down wind.

3rd Mooring For the third mooring a steeper outcrop was selected to give the anchors a better chance of biting in right away. The traverse from posn. 1 to posn. 2 was controlled by Loran-C and the ship was kept much closer to the wind giving better control during this phase, a good strain was put on the first wire before letting to to the 2nd anchor. The final position was precisely over the shallowest part of the outcrop. The same procedure was followed at another position with equal success.

G. Howe
Master

8. Position Fixing and Surface Currents

The ship's position was fixed throughtout the traverse by Satellite Navigation and Loran-C. Satnav was used as the principal nagivational aid except for station work on the Rockall Bank when Loran was accepted.

A rigorous comparison of the two fixing systems has not been made but the data is available. Generally speaking agreement was better than $\pm$ 3 cables but discrepancies of more than a mile were not unusual. No absolute checks on either system were made.

Surface currents were estimated during the anticlockwise traverse round the bank by using the non-NIO EM log (which had been proved correct over short distances in calm weather and was moreover known to be so from previous experience of Captain and officers), gyro course and estimated leeway. The last was accepted from Captain Howe's formula $\frac{Wt}{(15 + 2.5v)}$ for a transverse wind and used to obtain a value for current which was then used after a 90° turn into a head wind, thus giving an approximate value of leeway for a head wind underway. The latter was surprisingly low (0.1 knot per 6 knots) but has been used nonetheless.

The currents experienced are shown on the accompanying 1:1M plotting sheet. It will be noted that they range from easterly on the eastern side of the bank, through NE and NW to the N and NW to W on the Western side zero to the SW and SW to the south. That is, an anticlockwise outward pointing system.

At the same time, a note was kept of the currents calculated from the NIO EM log by the computer. There appeared at first to be some correlation

between the observed and calculated currents and (more sharply) between predicted rising and falling tides. However, a long fast run in moderate wind and sea conditions showed conclusively that the fore and aft component of this log was overreading by 5% (mean current (calculated) 2132/178 - 0858/179 252° 0.67 Kt. course 073° Sp. 13 knots. Estimated true current - zero). The computer currents have not been recalculated; however, bearing in mind that the estimated currents tend to bear out the Lowestoft current meter observations, it may be that this would be a worthwhile exercise, now that the error of at least one component of the log is fairly accurately known.

Lt. Cdr. T. McAndrew.

9. Data Editing and Processing

Navigation, magnetics and bathymetry data were checked every twenty four hours. At approximately 0800 hrs. each day a course correction up-date was made and the previous 24 hours data was read onto a working file. From this a track was plotted from GEOF with superimposed satellite fixes at 1 in 1×10^6. This was compared with a running plot kept up manually using a combination of satellite and LORAN-C fixes. The track was then corrected by rejecting or accepting fixes as were necessary, and updating the GEOF file. Magnetics were checked by plotting the total field in the same form as the chart recorder and visually comparing the two for spurious readings etc. Similarly the P. E. S. records were checked every 24 hours and then checked against a listing of depths from DPCI files, any corrections or omissions being done accordingly. This resulted in a large number of sections of data, but it enabled fast up to date checking and relieved the watchkeeper of the long tedious P. E. S. roll check with 1053 output.

After the navigation was vetted and depths and magnetics duly corrected, final plots of track, bathymetry and magnetic anomaly were run to be copied onto master sheets. When a file was filled, profiles of course speed, magnetic anomaly and bathymetry were run and checked for any mistakes that might have been missed. This proved useful as bathymetry was in corrected metres and showed where the Matthews area corrections were wrong. A few spurious times were also detected this way.

On the whole this system of data checking was very successful after initially debugging one or two programs and loading them. The programming time was rather slow due to sampling and on-line LORAN-C computations.

N. J. O.

10. Shipboard Computer System

Navigation and meteorological data were logged continuously throughout the cruise. Occasional gaps in data, usually of a few minutes were probably due to as yet unsolved interactions between various programs.

Because this was the first cruise on which LORAN-C was logged by the computer several faults in the interface and in the software became apparent. After the first week these were largely overcome and LORAN was sampled whenever possible while in the Rockall area. Radio transmissions invariably upset the receiver and there are many gaps an erroneous readings in the LORAN data. Reception in the Rockall area seemed very poor at times, especially during the first week. SL3-W and Y were used. The W slave was always much weaker than the master and Y slave and was the most prone to jumping. The receiver was usually indexed on the 4th or 5th cycle and good fixes were obtained by comparison with the Satellite Navigator. Decca Navigator was run on line on the return passage and no trouble was experienced with the interface.

Throughout the cruise the computer used satellite navigation as the primary aid. The receiver functioned very well and the faults of the previous cruise seem to have been cured.

The computer behaved very reliably, but some trouble was experienced with the mechanical devices: both 1053 printers occasionally went off line and the tape preparation equipment was at the usual low standard of reliability.

J. S.

11. Meteorological Data

Daily meteorological readings were taken manually to keep a running comparison with the data produced by the computer, as well as servicing the sensors. A continuous visual record of the sensors' output was provided by the Speedomax multi-channel recorder. This functioned well throughout the cruise and suffered one breakdown because it required servicing. R. A. S. T. U. S.

readings were also taken to obtain wet and dry readings as well as sea temperature. R. A. S. T. U. S. was very prone to periods of wild fluctuations. On occasions the readings would be totally inaccurate, e. g. wet reading higher than dry; or the lights used for setting up each sensor would both stay on regardless of what temperature the dial was set at. However the faults were intermittent and sensible readings were obtained for some of the cruise. The anemometer connected to the computer also behaved erratically, and gave up to a 180° error of wind direction. Comparison with the bridge anemometer for wind speed was not possible, as it was generally thought that this instrument was reading 5 knots (approx.) slow.

The general weather over the whole cruise was appalling for the time of year. A succession of 'lows' over the N. Atlantic (covering a very extensive area) caused high wind speeds and a heavy swell. The average wind speed over the cruise period was between 25 and 30 knots. The maximum wind speed recorded was 69. 1 knots on the 21 June, and during a 3 hour period on the 25th June when the wave recorder was running, a 40 ft. wave was recorded.

C. D. P.

12. Underwater Photography

Following persistent malfunctioning of the stereo-camera flash unit, when operating at depth on previous cruises, a completely new type of flash has been designed and built for use on this camera, work being completed just prior to Discovery Cruise 47.

The use of miniature components, combined with a more efficient electrical circuit, giving an overall reduction in power requirements, made it possible to contain the flash and relevant battery pack in one small pressure housing. This has eliminated a number of problems associated with high voltage existing in underwater cables and connectors which were largely responsible for most of the failures experienced in the past.

The station (7957) was carried out on Day 180 with the camera operating at a nominal depth of 180 m. Over a period of 125 minutes 38 photographs were taken; the flash functioning normally on each occasion.

Resultant nagatives show a good overall lighting effect free from hot spots, and in general compare favourable with any obtained previously with this camera.

Further trials at more extreme depths are now required to finally establish the overall reliability of this equipment.

E. P. C.

TABLE I

Cruise 47. Station Position List (key to equipment used, see p. 26)

Station No.	Type	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to Lat. N Long. W	D/B /NAVAID Used	Depth Range UCF	CF	CM	Comments
7914	G	SMI	16.6.72	1308/168	1313/168	56°21.55'N 15°08.41'W		I	101	104	192	1 small pebble.
7915	A	-	16.6.72	1400/168	1454/168	56°21.63'N 15°09.00'W	56°21.75'N 15°07.87'W	I	97- 112	100- 115	184- 212	Station abandoned, anchors dragged in heavy swell and wind conditions.
7916	RC		23.6.72	1955/175	2120/175	56°23.29'N 15°13.20'W	53°23.26'N 15°13.02'W	Loran-C/ Satellite	104- 103	106- 102	193- 194	A B No sample. Barrel C damaged.
7917	G	SMI S	23.6.72	2028/175	2100/175	56°23.34'N 15°13.14'W	53°23.3'N 15°13.01'W	"	103	105	192	A No sample. Changed from Smith McIntyre Shipek. B Gravel.
7918	G	S	23.6.72	2145/175	2204/175	56°21.85'N 15°13.77'W	56°21.83'N 15°13.69'W	"	92- 94	94- 96	172-175	A Carbonate/gravel. B Carbonate/gravel.
7919	RC		23.6.72	2204/175	2235/175	56°21.83'N 15°13.69'W	56°21.8'N 15°13.47'W	"	92- 96	94- 98	172- 179	A No sample. B No sample. C Pebble trapped in barrel.
7920	G	S	23.6.72	2256/175	2306/175	56°22.09'N 15°11.92'W	56°22.13'N 15°11.36'W	"	92- 98	94- 100	172- 183	A No sample. B Shelly sand. C Shelly sand.

Station No.	Type	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to Lat. N Long. W	D/B /NAVAID Used	Depth Range UCF	CF	CM	Comments
7921	RC		23.6.72	2307/175	2320/175	56°22.13'N 15°11.36'W	56°21.7'N 15°11.36'W	Loran-C/ Satellite	93	95	173	Sand and gravel.
7922	G	S	24.6.72	0004/176	0015/176	56°19.29'N 15°10.50'W	56°19.33'N 15°10.32'W	"	97- 102	99- 104	182- 190	A No sample. B No sample.
7923	RC		24.6.72	0017/176	0032/176	56°19.37'N 15°10.32'W	56°19.2'N 15°10.28'W	"	103	105	192	Coarse sand and mud.
7924	G	S	24.6.72	0051/176	0100/176	56°18.37'N 15°12.52'W	56°18.05'N 15°12.9'W	"	85	87	159	A No sample. B A few sand grains - discarded
7925	RC		24.6.72	0104/176	0156/176	56°18.09'N 15°12.95'W	56°18.22'N 15°12.9'W	"	87	89	162	Core lost. Rock and sediment.
7926	G	S	24.6.72	0215/176	0229/176	56°17.4'N 15°13.11'W	56°17.5'N 15°13.06'W	"	85	87	159	A No sample. B A few sand grains
7927	RC		24.6.72	0231/176	0238/176	56°17.5'N 15°13.05'W	56°17.56'N 15°13.04'W	"	86	88	160	Pebble and sediment.
7928	G	S	24.6.72	0258/176	0302/176	56°16.77'N 15°12.41'W	56°16.8'N 15°12.41'W	"	74	75	138	No sample.
7929	RC		24.6.72	0305/176	0313/176	56°16.8'N 15°12.49'W	56°16.8'N 15°12.5'W	"	72- 73	73- 74	134- 136	A No core. B Rock (metamorphic & fish head).
7930	G	S	24.6.72	0340/176	0350/176	56°16.69'N 15°13.07'W	56°16.6'N 15°12.5'W	"	88	90	164	A No sample. B No sample.

Station No.	Type	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to	Lat. N Long. W	NAVAID /D/B Used	Depth Range UCF	CF	CM	Comments
7931	RC		24.6.72	0355/176	0417/176	56°16.53'N 15°12.53'W		56°16.27'N 15°12.47'W	Loran-C Satellite	82- 88	84- 90	153- 164	A No core. B No core. C Rocks (metamorphic).
7932	G	S	24.6.72	0432/176	0440/176	56°14.91'N 15°12.21'W		56°14.91'N 15°12.21'W	"	82	84	153	No sample.
7933	RC		24.6.72	0444/176	0449/176	56°14.76'N 15°12.16'W		56°14.76'N 15°12.16'W	"	82	84	153	Hard blocky material. Metamorphic fragments.
7934	G	S	24.6.72	0525/176	0530/176	56°13.62'N 15°15.8'W		56°13.6'N 15°15.8'W	"	96	98	179	No sample.
7935	RC		24.6.72	0533/176	0550/176	56°13.6'N 15°15.8'W		56°13.5'N 15°15.8'W	"	98- 101	100- 103	183- 188	A No sample. B Shelly green-black sand.
7936	G	S	24.6.72	0615/176	0629/176	56°15.6'N 15°14.6'W		56°15.6'N 15°14.5'W	"	99	101	185	A Small volume of fine sand. B No sample. C Small volume of fine sand.
7937	RC		24.6.72	0639/176	0655/176	56°15.6'N 15°14.4'W		56°15.6'N 15°14.3'W	"	98- 99	100- 101	183- 185	A Compact white ooze core (3") & green brown sediment. B Semi-consolidated coarse iron-stained white ooze.
7938	G	S	24.6.72	0726/176	0734/176	56°17.4'N 15°14.3'W		56°17.38'N 15°14.4'W	"	92	94	172	No sample.

Station No.	Type	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to Lat. N Long. W	NAVAID /D/B Used	Depth Range UCF	CF	CM	Comments
7939	RC		24.6.72	0738/176	0752/176	56°17.4'N 15°14.4'W	56°17.3'N 15°14.4'W	Loran-C Satellite	91	93	170	A No core. B No core.
7940	G	S	24.6.72	0828/176	0848/176	56°19.4'N 15°15.6'W	56°19.3'N 15°15.6'W	"	105	107	196	A Sample. B Sample.
7941	RC		24.6.72	0857/176	0924/176	56°19.2'N 15°15.5'W	56°19.2'N 15°15.8'W	"	107	109	200- 201	A No core. B No core.
7942	G	S	24.6.72	0953/176	1020/176	56°20.3'N 15°13.1'W	56°20.6'N 15°13.2'W	"	99	101	185	A No sample. B No sample. C
7943	RC		24.6.72	1020/176	1045/176	56°20.6'N 15°13.2'W	56°20.6'N 15°12.75'W	"	92- 102	94- 104	172- 190	A No core. B No core.
7944	G	S	24.6.72	1124/176	1143/176	56°23.2'N 15°14.9'W	56°23.2'N 15°14.9'W	"	110	112	205	A No sample. B No sample. C
7945	RC		24.6.72	1151/176	1210/176	56°23.28'N 15°14.68'W	56°23.3'N 15°14.4'W	"	112- 115	114- 117	209- 215	A No core. B No core.
7946	G	S	24.6.72	1310/176	1336/176	56°22.35'N 15°11.9'W	56°22.4'N 15°12.45'W	"	94	96	175	A Medium carbonate sand. B Carbonate sand & rock fragments.
7947	RC		24.6.72	1340/176	1357/176	56°22.4'N 15°12.37'W	56°22.4'N 15°12.37'W	"	92	94	172	Metamorphic rocks.

Station No.	Type	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to	Lat. N Long. W	D/B or NAVAID	Depth Range UCF	CF	CM	Comments
7948A	G	SMI	27.6.72	1540/179	1545/179	56°23.2'N 15°11.6'W			Satellite/ Loran-C	98	100	183	A Coarse sand & dark pebbles & epifauna.
7948B	G	SMI	27.6.72	1645/179	1700/179	"			"	106	108	198	B No sample.
7948C	G	SMI	27.6.72	1715/179	1720/179	"			"	106	108	198	C No sample.
7948D	G	SMI	27.6.72	1730/179	1742/179	"			"	105	107	196	D Medium coarse carbonate sand & 1 large echinoid.
7948E	G	SMI	27.6.72	1755/179	1805/179	"			"	105	107	196	E Coarse gravel & carbonate.
7948F	G	SMI	27.6.72	2110/179	2125/179	"			"	104	106	194	F Pebbles & rich epifauna.
7948G	G	SMI	27.6.72	2201/179	2215/179	"			"	104	106	194	G Coarse sand & pebbles.
7949A	Drill/UTV		27.6.72	1830/179	2018/179	"			"	104	106	194	A Sediment bottom. 2 pebbles recovered.
7949B	Drill/UTV		27.6.72	2255/179	2325/179	"			"	104	106	194	B Lost drill barrel.
7950A	G	SMI	28.6.72	0200/180	0209/180	56°24'N 14°58.2'W			"	108	110	201	A Medium carbonate sand.
7950B	G	SMI	28.6.72	0221/180	0230/180	"			"	108	110	201	B Medium sand & transparent animals.

Station No.	Type	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to	Lat. N Long. W	D/B or NAVAID	Depth Range UCF	CF	CM	Comments
7951A	G	SMI	28.6.72	0326/180	0333/180	56°18.6'N 14°48.4'W			Satellite/ Loran-C	112	114	210	A Fine sand & live echinoderm.
7951B	G	SMI	28.6.72	0340/180	0349/180	"			"	112	114	210	B Fine sand.
7952A	G	SMI	28.6.72	0442/180	0455/180	56°15.0'N 14°58.2'W			"	118	120	220	A No sample.
7952B	G	SMI	28.6.72	0500/180	0509/180	"			"	118	120	220	B No sample.
7953A	G	SMI	28.6.72	0611/180	0621/180	56°10.2'N 15°08.0'W			"	123	125	229	A No sample.
7953B	G	SMI	28.6.72	0630/180	0635/180	"			"	123	125	229	B 1 unidentified animal.
7954A	G	SMI	28.6.72	0727/180	0735/180	56°11.5'N 15°17.4'W			"	126	129	235	A Fine sand.
7954B	G	SMI	28.6.72	0740/180	0747/180	"			"	126	129	235	B No sample.
7955A	Drill/UTV		28.6.72	1013/180	1050/180	56°16.5'N 15°11.80'W			"	79	81	147	A 10 cm of plagioclase-garnet granulite.
7955B	Drill/UTV		28.6.72	1442/180	1500/180	"			"	84	86	157	B) Electrical) failures -) drilling
7955C	Drill/UTV		28.6.72	1614/180	1638/180	"			"	84	86	157	C) aborted.
7955D	Drill/UTV		28.6.72	1912/180	2027/180	"			"	82	84	153	D Approx. 40 cm penetration into rock. Loss of barrel & core during retraction.

Station No.	Type	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to	Lat. N Long. W	D/B or NAVAID	Depth Range UCF	CF	CM		Comments
7960A	G	SMI	29.6.72	0435/181	0450/181	56°57.0'N 14°42.8'W			Satellite/ Loran-C	93	95	173	A	1 sub-angular metamorphic rock and epifauna.
7960B	G	SMI	29.6.72	0455/181	0500/181	"			"	93	95	173	B	Fine sand & gravel.
7961A	G	SMI	29.6.72	0605/181	0610/181	57°01.0'N 14°52.7'W			"	140	143	261	A	No sample.
7961B	G	SMI	29.6.72	0620/181	0629/181	"			"	140	143	261	B	Stiff green carbonate sand.
7962A	G	SMI	29.6.72	0730/181	0745/181	57°06.9'N 14°49.2'W			"	162	165	302	A	No sample.
7962B	G	SMI	29.6.72	0747/181	0755/181	"			"	162	165	302	B	Stiff green carbonate sand.
7963A	G	SMI	29.6.72	0850/181	0900/181	57°04.9'N 14°37.8'W			"	102	104	190	A	Sand and rock fragments.
7963B	G	SMI	29.6.72	0903/181	0908/181	"			"	102	104	190	B	Small sand sample.

Station No.	Type	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W to Lat. N Long. W	D/B or NAVAID	Depth Range UCF	CF	CM	Comments
7956A		SMI	28.6.72	1115/180	1125/180	56°16.5'N 15°11.80'W	Satellite/ Loran-C	79	81	147	A No sample.
7956B		SMI	28.6.72	1130/180	1143/180	"	"	79	81	147	B 1 jellyfish.
7956C		SMI	28.6.72	1710/180	1720/180	"	"	79	81	147	C Carbonate sand & shells.
7956D		SMI	28.6.72	1734/180	1742/180	"	"	79	81	147	D Bryozoa fragments and sponge.
7957	SC	SC	28.6.72	1300/180	1423/180	"	"	80	82	149	38 stereopairs.
7958A	G	SMI	29.6.72	0012/181	0020/181	56°31'N 15°02'W	"	108	110	202	A Medium carbonate sand
7958B	G	SMI	29.6.72	0032/181	0040/181	"	"	110	112	205	B Medium carbonate sand & transparent animal.
7959A	G	SMI	29.6.72	0210/181	0220/181	56°41.5'N 14°51.5'W	"	101	103	188	A Coarse sand & small pebbles.
7959B	G	SMI	29.6.72	0225/181	0232/181	"	"	101	103	188	B 3 sub-angular metamorphic rocks with epifauna.

Station No.	Type	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to	Lat. N Long. W	D/B or NAVAID	Depth Range UCF	CF	CM	Comments
7964	Drill/UTV		29.6.72	1229/181	1333/181	57°04.27'N 14°31.95'W			Satellite/ Loran-C	80- 81	82- 83	149- 151	17 cm of microperthite granulite.

KEY

G: Grab

SMI: Smith McIntyre type
S: Shipek type

SC: Stereocamera

Drill/UTV: IGS Midi drill/Underwater Television/Videotape system

A: Anchor

TABLE II

SEISMIC REFLECTION PROFILES

Traverse No. & Distance	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to Lat. N Long. W	Depth Range UCF	CF	CM	Comments
1 (165 n.m)	Airgun (40 cu.in)	11.6.72	0016/163	2252/163	51°00.5'N 10°10.5'W	51°29.5'N 14°31.5'W	60- 976	60- 997	111-1824	Shelf S.W. of Ireland to Porcupine Bank via Porcupine Seabight.
2 (58 n.m)	"	11.6.72 12.6.72	2252/163	0600/164	51°29.5'N 14°31.5'W	52°17.5'N 15°26.0'W	260-1208	265-1234	486-2258	Porcupine Bank. W. margin of Porcupine Bank.
3 (96 n.m)	"	12.6.72	0600/164	1920/164	52°17.5'N 15°26.0'W	51°26.0'N 17°35.0'W	1208-2480	1234-2555	2258-4674	Continental Rise.
4 (141.5 n.m)	"	12.6.72 13.6.72	1920/164	1730/165	51°26.0'N 17°35.0'W	53°37.0'N 15°44.0'W	2480-1626	2555-1665	4674-3045	S. Approaches to Rockall Trough.
5 (76.5 n.m)	"	13.6.72 14.6.72	1730/165	0425/166	53°37.0'N 15°44.0'W	54°45.5'N 16°35.5'W	1626-1180	1665-1206	3045-2206	Mouth of the Rockall Trough.
6 (86 n.m)	"	14.6.72	0425/166	1630/166	54°45.5'N 16°35.5'W	53°32.0'N 17°46.5'W	1273-1316	1301-1345	2380-2461	Mouth of the Rockall Trough and Feni Ridge.
7 (76.5 n.m)	"	14.6.72 15.6.72	1630/166	0040/167	53°32.0'N 17°46.5'W	54°32.5'N 18°06.5'W	1308- 810	1337- 826	2446-1512	Mouth of the Rockall Trough and Feni Ridge.
8 (43.5 n.m)	"	15.6.72	0040/167	0645/167	54°32.5'N 18°06.5'W	53°53.5'N 18°36.0'W	786-1376	802-1407	1467-2574	S.E. Margin Rockall Bank.
9 (26 n.m)	"	15.6.72	0645/167	1021/167	53°53.5'N 18°36.0'W	54°09.1'N 19°16.0'W	1384- 800	1415- 816	1493-2589	S.E. Margin Rockall Bank - Lorien Bank.

Traverse No. & Distance	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to Lat. N Long. W	Depth Range UCF	CF	CM	Comments
10 (36 n.m)	"	15.6.72	1021/167	1535/167	54°09.1'N 19°16'W	54°37.5'N 18°39'W	826- 491	843- 501	1542- 918	Lorien Bank.
11 (11 n.m)	"	15.6.72	1535/167	1703/167	54°37.5'N 18°39'W	54°49'N 18°28'W	636- 558	649- 570	1188-1044	Lorien Bank to Rockall Bank.
12 (97 n.m)	"	16.6.72 17.6.72	2115/168	1106/169	56°29.5'N 14°42'W	56°16'N 11°46.5'W	105-1412	108-1444	199-2461	S. Rockall Bank to axis of Rockall Trough.
13 (71 n.m)	"	17.6.72	1106/169	2358/169	56°16'N 11°46.5'W	57°21.5'N 11°00'W	1412- 358	1444-366	2461- 671	Along axis of Rockall Trough to Anton-Dohrn Seamount.
14 (34 n.m)	"	17.6.72 18.6.72	2358/169	0600/170	57°21.5'N 11°00'W	57°40'N 11°52'W	324-1114	332-1136	608-2079	Anton-Dohrn Seamount.
15 (17.5 n.m)	"	18.6.72	0600/170	0835/170	57°40'N 11°52'W	57°49.00'N 11°26.30'W	944-1040	963-1061	1763-1941	) Survey of Anton-Dohrn Seamount.
16 (22 n.m)	"	18.6.72	0835/170	1134/170	57°49.00'N 11°26.30'W	57°31.92'N 11°01.31'W	1143- 352	1166- 360	2133- 660	)
17 (20 n.m)	"	18.6.72	1134/170	1515/170	57°31.92'N 11°01.31'W	57°49.9'N 11°45.5'W	352-1170	360-1194	660-2184	)
18 (87 n.m)	"	18.6.72 19.6.72	1515/170	0401/171	57°49.9'N 11°45.5'W	59°15.49'N 10°14.59'W	1112- 253	1134- 257	2075- 471	Anton-Dohrn Seamount to Rosemary Bank.
19 (111 n.m)	"	19.6.72	0401/171	2200/171	59°15.49'N 10°14.59'W	59°57.70'N 13°30.3'W	253- 959	257- 974	471-1783	Rosemary Bank to S.W. foot of Lousy Bank.
20 (20 n.m)	"	19.6.72 20.6.72	2200/171	0110/172	59°57.70'N 13°30.3'W	59°46.47'N 13°47.2'W	516- 670	522- 678	955-1240	Col between Hatton Bank and and Lousy Bank.

Traverse No. & Distance	Equipment Used	Date	Time Z/Day No. From	To	Lat. N Long. W	to Lat. N Long. W	Depth Range UCF	CF	CM	Comments
21 (52 n.m)	"	20.6.72	0110/172	1038/172	59°46.47'N 13°47.2'W	59°13.55'N 12°26.21'W	643- 798	653-810	1195-1483	Col to W. central Rockall Trough.
22 (138 n.m)	"	20.6.72 21.6.72	1038/172	1100/173	59°13.55'N 12°26.21'W	58°17.5'N 16°37.0'W	250- 798	254- 810	466-1483	Rockall Trough - George Bligh Bank - Hatton - Rockall Basin.
23 (91 n.m)	"	21.6.72 22.6.72	1100/173	0900/174	58°19.5'N 16°37.0'W	59°03'N 19°24'W	298-1464	305-1492	559-2730	Hatton-Rockall Basin - Hatton Bank - W. Margin Rockall Plateau.
24 (80 n.m)	"	22.6.72	1100/174	2130/174	59°03'N 19°24'W	57°45'N 18°45'W	338-1477	346-1505	634-2754	W. Margin of Rockall Plateau to Hatton Bank.
25 (132 n.m)	"	22.6.72 23.6.72	2130/174	1700/175	57°45'N 18°45'W	56°40.37'N 15°13.90'W	173- 705	178- 719	326-1316	Hatton Bank - Hatton-Rockall Basin - Rockall Bank.
26 (123 n.m)	"	24.6.72 25.6.72	1550/176	2152/177	56°21.91'N 15°23.34'W	56°28.65'N 19°03.65'W	144- 761	148- 777	172-1421	Rockall Bank - S. Hatton - Rockall Basin.
27 (120 n.m)	"	25.6.72 26.6.72	2152/177	1828/178	56°28.65'N 19°03.65'W	55°13.4'N 21°48.9'W	696-1510	710-1539	1300-2816	S. Hatton - Rockall Basin - S.W. Margin Rockall Plateau.
28 (200 n.m)	"	30.6.72 1.7.72	0100/182	0720/183	56°19.5'N 14°51.8'W	53°54.5'N 10°55.1'W	1502- 81	1592- 82	2924- 150	Rockall Bank - Rockall Trough - Irish Continental Shelf.

TABLE III

ASDIC TRAVERSES

Traverse No.	Mode of Operation	Date	Time Z/Day No. From	To	Lat. N Long. W	to Lat. N Long. W	Depth Range UCF	CF	CM	Comments
1	Side-scan	9.6.72 10.6.72	2020/161	0215/162	51°24'N 3°52'W	51°15.5'N 4°35.5'W	20- 24	20- 24	36- 46	))) Bristol Channel.
2	Side-scan	10.6.72	0215/162	1100/162	51°15.5'N 4°35.5'W	51°06.5'N 6°54.0'W	24- 46	24- 46	44- 85	))
3	Side-scan	10.6.72 11.6.72	1100/162	0001/163	51°06.5'N 6°54.0'W	51°00'N 10°09'W	46- 61	46- 61	85- 113	Shelf S.E. and S. of Ireland.
4	Side-scan	11.6.72	0001/163	0712/163	51°00'N	51°29.5'N	61- 409	61- 418	113-765	Shelf S.W. of Ireland.
	Narrow beam mode		0712/163	1925/163	10°09'W	14°31.5'W	409- 977	418-998	765-1826	Porcupine Seabight.
	Side-scan		1925/163	2252/163			234- 300	239- 306	438- 561	Porcupine Bank.
5	Side-scan	11.6.72	2252/163	0334/164	51°29.5'N	52°17.5'N	264- 928	270- 948	494-1734	Porcupine Bank.
	Narrow beam mode	12.6.72	0334/164	0600/164	14°31.5'W	15°26.0'W	928-1208	948-1234	1734-2258	W. Margin of Porcupine Bank.
6	Narrow beam mode	14.6.72	0838/166	1630/166	54°21'N 17°03'W	53°32'N 17°46.5'W	1290-1316	1318-1345	2412-2461	Feni Ridge - Rockall Trough.
7	Narrow beam mode	14.6.72 15.6.72	1630/166	0040/167	53°32'N 17°46.5'W	54°32.5'N 18°06.5'W	1308- 810	1337- 826	2446-1512	Feni Ridge - Rockall Trough.
8	Narrow beam mode	15.6.72	0040/167	0645/167	54°32.5'N 18°06.5'W	53°53.5'N 18°36.0'W	786-1376	802-1407	1467-2574	S.E. Margin Rockall Bank.
9	Narrow beam mode	15.6.72	0645/167	1021/167	53°53.5'N 18°36.0'W	54°09.1'N 19°16'W	1384- 800	1415- 816	1493-2589	Lorien Bank - Rockall Bank.

Traverse No.	Mode of Operation	Date	Time Z/Day No. From	To	Lat. N Long. W	to Lat. N Long. W	Depth Range UCF	CF	CM	Comments
10	Narrow beam mode	15.6.72	1021/167	1535/167	54°09.1'N 19°16'W	54°37.5' N 18°39'W	826- 491	843- 501	1542- 918	Lorien Bank - Rockall Bank.
11	Slant mode	15.6.72	1535/167	1703/167	54°37.5'N 18°39'W	54°49'N 18°28'W	636- 558	649- 570	1188-1044	S. Rockall Bank.
12	Slant mode	15.6.72 16.6.72	1703/167	0545/168	54°49'N 18°28'W	56°09.5'N 15°12'W	558- 121	570- 125	1044- 229	
13	Slant mode	16.6.72	0545/168	0839/168	56°09.5'N 15°12'W	56°24.81'N 15°13.00'W	121- 89	125- 92	229- 169	
14	Slant mode	16.6.72	0839/168	0846/168	56°24.81'N 15°13.00'W	56°24.91'N 15°11.28'W	121- 121	125- 125	229- 229	Survey of proposed drill site on S. Rockall Bank.
15	Slant mode	16.6.72	0846/168	0928/168	56°24.91'N 15°11.28'W	56°20.00'N 15°11.77'N	121- 92	125- 95	229- 175	
16	Slant mode	16.6.72	0928/168	1023/168	56°20.00'N 15°11.77'W	56°26.09'N 15°05.49'W	97- 119	100- 123	184- 225	
17	Slant mode	16.6.72	1916/168	2335/168	56°29.5'N 14°53'W	56°28.5'N 14°03'W	100- 473	103- 483	190- 885	Rockall Bank.
18	Narrow beam mode	16.6.72 17.6.72	2335/168	0430/169	56°28.5'N 14°03'W	56°19.5'N 13°02.5'W	473-1324	483-1353	885-2476	East margin of Rockall Bank.
19	Narrow beam mode	18.6.72	1007/170	1134/170	57°39.56'N 11°14.46'W	57°31.92'N 11°01.31'W	1087- 352	1109- 360	2029- 660	
20	Narrow beam mode	18.6.72	1134/170	1515/170	57°31.92'N 11°01.31'W	57°49.9'N 11°45.5'W	352-1170	360-1194	660-2184	Anton-Dohrn Seamount.
21	Narrow beam mode	18.6.72	1515/170	1649/170	57°49.9'N 11°45.5'W	57°58.13'N 10°41.57'W	1110-1132	1100-1122	2072-2053	

Traverse No.	Mode of Operation	Date	Time Z/Day No. From	To	Lat. N Long. W	to	Lat. N Long. W	Depth Range UCF	CF	CM	Comments
22	Narrow beam mode	19.6.72	0600/171	2200/171	59°20.34'N 10°36.92'W		59°57.7'N 13°30.3'W	253- 959	257- 974	471-1783	Rosemary Bank to S.W. foot of Lousy Bank.
23	Narrow beam mode	19.6.72 20.6.72	2200/171	0110/172	59°57.7'N 13°30.3'W		59°46.47'N 13°47.2'W	516- 670	522- 678	955-1240	Col between Hatton Bank and Lousy Bank.
24	Narrow beam mode	20.6.72	0110/172	1038/172	59°46.47'N 13°47.2'W		59°13.55'N 12°26.21'W	643- 798	653- 810	1195-1483	Col of W. central Rockall Trough.
25	Narrow beam mode	20.6.72 21.6.72	1038/172	1100/173	59°13.55'N 12°26.21'W		58°17.0'N 16°37.0'W	250- 798	254- 810	466-1483	Rockall Trough - George Bligh Bank - Hatton-Rockall Basin.
26	Narrow beam mode	21.6.72 22.6.72	1100/173	0810/174	58°17.0'N 16°37.0'W		59°00'N 19°17'W	1274- 292	1297- 297	2373- 544	Hatton-Rockall Basin - Hatton Bank - W. Margin of Plateau.
27	Narrow beam mode	22.6.72	0810/174	1620/174	59°00'N 19°17'W		58°20.16'N 19°00.89'W	564-1477	526-1505	1054-2574	Hatton Bank - Hatton-Rockall Basin.
28	Narrow beam mode	22.6.72	1620/174	2130/174	58°20.16'N 19°00.89'W		57°45'N 18°45'W	353- 564	361- 576	662-1505	Hatton Bank - Hatton-Rockall Basin.
29	Narrow beam mode	22.6.72 23.6.72	2130/174	1435/175	57°45'N 18°45'W		56°50.67'N 15°37.81'W	353- 705	361- 719	662-1316	Hatton Bank - Hatton-Rockall Basin.
30	Slant mode	23.6.72	1435/175	1700/175	56°50.67'N 15°37.81'W		56°40.37'N 15°30.9'W	173- 372	178- 381	326- 697	Hatton-Rockall Basin - Rockall Bank.
31	Slant mode	23.6.72	1700/175	1745/175	56°40.37'N 15°30.9'W		56°37.0'N 15°13.34'W	157- 173	161- 178	296- 326	Rockall Bank.
32	Slant mode	23.6.72 24.6.72	1745/175	1550/176	56°37.0'N 15°13.34'W		56°21.91'N 15°23.34'W	Depths various			Courses & speeds various while manoeuvring to occupy stations 7916-7947.

Traverse No.	Mode of Operation	Date	Time Z/Day No. From	To	Lat. N Long. W	to	Lat. N Long. W	Depth Range UCF	CF	CM	Comments
33	Slant mode	24.6.72 25.6.72	1550/176	0725/177	56°21.91'N 15°23.34'W		56°27.7'N 17°08.9'W	144- 311	148- 318	272- 583	S. Rockall Bank.
34	Narrow beam mode	25.6.72	0725/177	2152/177	56°27.7'N 17°08.9'W		56°28.65'N 19°03.65'W	311- 761	318- 777	583-1421	S. Hatton-Rockall Basin.
35	Narrow beam mode	25.6.72 26.6.72	2152/177	1710/178	56°28.65'N 19°03.65'W		55°19.04'N 21°38.3'W	696-1488	710-1517	1300-2775	S. Hatton-Rockall Basin/S.W. Margins of Plateau.
36	Narrow beam mode	26.6.72 27.6.72	2339/178	0955/179	55°24.63'N 20°30.25'W		56°02.4'N 17°01.1'W	862- 254	879- 260	1609- 477	Fangorn Bank - S. Hatton-Rockall Basin - Rockall Bank.
37	Slant mode	27.6.72	0955/179	1540/179	56°02.4'N 17°01.1'W		56°22.8'N 15°12.2'W	254- 98	260- 101	477- 186	
38	Slant mode	28.6.72	0100/180	2205/180	56°22.6'N 15°12.7'W		56°15.5'N 15°11.0'W	- -	- -	- -	Co & Speed various. Stations 7948-7955.
39	Slant mode	28.6.72 29.6.72	2205/180	1025/181	56°15.5'N 15°11.0'W		57° 3.61'N 14°33.5'W	- -	- -	- -	Co & Speed various. Stations 7956-7964.
40	Slant mode	29.6.72	1446/181	1614/181	57° 3.76'N 14°32.0'W		56°54.3'N 14°27.0'W	86- 95	89- 98	164- 181	
41	Slant mode	29.6.72	1614/181	2244/181	56°54.3'N 14°26.9'W		56°27.16'N 14°45.27'W	98- 103	101- 107	186- 196	S. Rockall Bank.
42	Slant mode	29.6.72 30.6.72	2244/181	0335/182	56°27.16'N 14°45.27'W		56° 7.1'N 14°31.5'W	103- 485	107- 495	186- 907	

Traverse No.	Mode of Operation	Date	Time Z/Day No. From	To	Lat. N Long. W	to Lat. N Long. W	Depth Range UCF	CF	CM	Comments
43	Narrow beam mode	30.6.72	0335/182	0732/182	56° 7.1'N 14°31.5'W	55°49'N 13°56'W	485-1293	495-1322	907-2418	E. Margin of Rockall Bank.
44	Narrow beam mode	1.7.72	0009/183	0243/183	54°29.02'N 11°51.93'W	54°16.67'N 11°31.78'W	1485- 403	1519- 412	2279- 754)))	
45	Slant mode	1.7.72	0243/183	0720/183	54°16.67'N 11°31.78'W	53°54.5'N 10°55.1'W	403- 81	412- 82	754- 150))	W. Irish continental slope and shelf.
46	Slant mode	1.7.72	0720/183	1900/183	53°54.5'N 10°55.1'W	52°09.52'N 11°03.26'W	81- 62	82- 62	150- 115	W. Irish shelf.
47	Slant mode	1.7.72	1900/183	2302/183	52°09.52'N 11°03.26'W	51°25.91'N 10°24.63'W	72- 46	72- 46	133- 85	W. Irish shelf.
48	Slant mode	1.7.72 2.7.72	2302/183	0130/184	51°25.91'N 10°24.63'W	51°11.99'N 9°43.66'W	68- 54	68- 54	126- 100	W. Irish shelf.
49	Slant mode	2.7.72	0130/184	2145/184	51°11.99'N 9°43.66'W	51°20'N 03°19'W	54- 13	54- 13	100- 22	Celtic Sea - Bristol Channel.

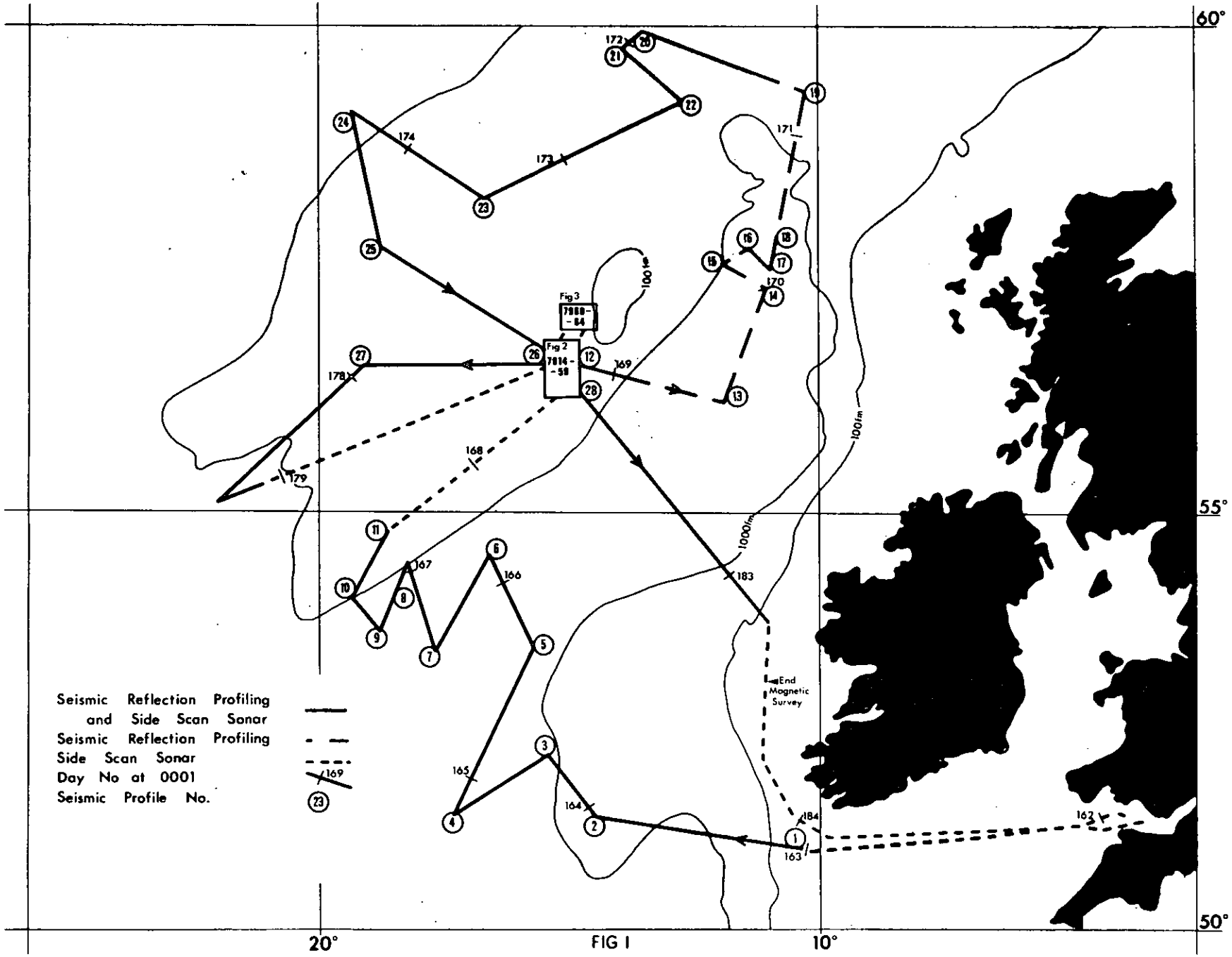
60°
55°
50°
20°
10°
Seismic Reflection Profiling and Side Scan Sonar
Seismic Reflection Profiling
Side Scan Sonar
Day No at 0001
Seismic Profile No.
Fig 3 7988 - 94
Fig 2 7914 - 58
End Magnetic Survey
100fm
1000fm

FIG 1

FIGURE II A

ROCKALL BANK
DETAIL STATIONS AREA 'A'

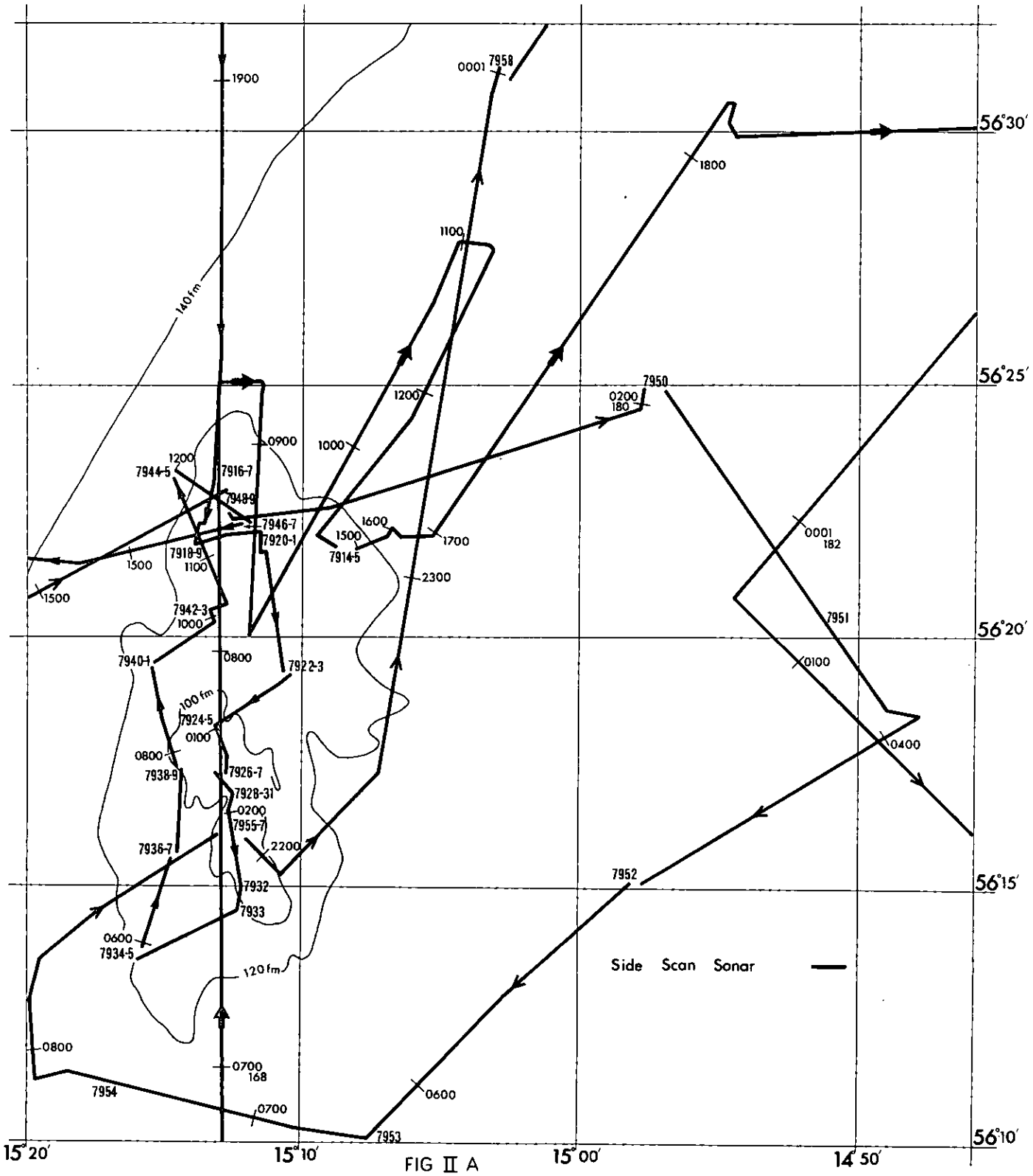
56°30′
56°25′
56°20′
56°15′
56°10′
15°20′
15°10′
15°00′
14°50′
1900
0001 7958
1800
1100
140 fm
1200
7950
0200
180
1000
0900
1200
7944-5
7916-7
7949-9
7946-7
7920-1
1600
1500
1700
7914-5
7918-9
1100
1500
2300
1500
7942-3
1000
0001
182
7951
0800
7940-1
7922-3
0100
100 fm
7924-5
0100
0400
0800
7938-9
7926-7
7928-31
0200
7955-7
2200
7936-7
7952
7932
7933
0600
7934-5
120 fm
Side Scan Sonar
0800
0700
168
7954
0700
0600
7953

FIG II A

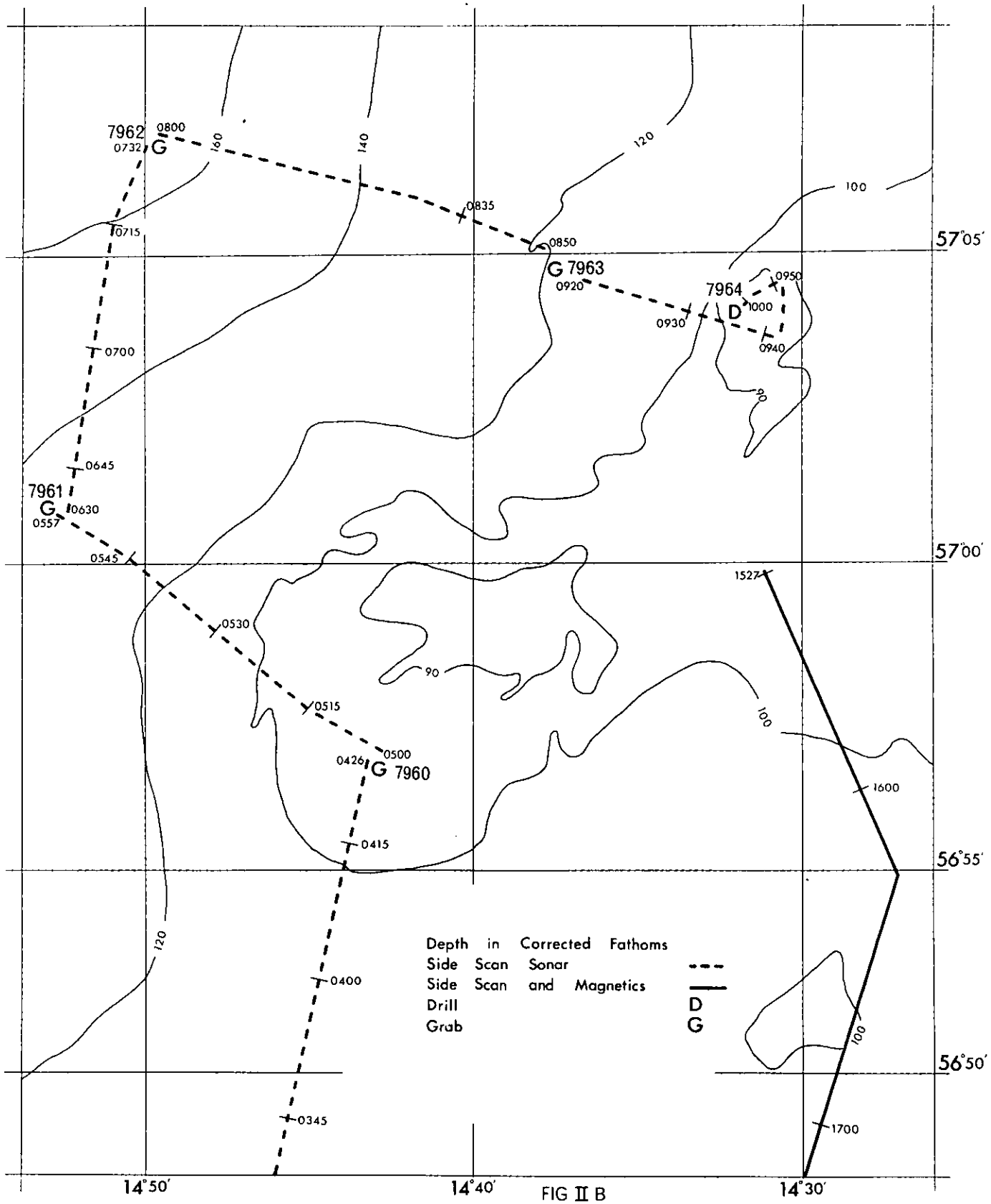
7962
0800
0732
G
160
140
120
100
0835
0715
0850
57°05'
G 7963
0920
7964
0950
D
1000
0930
0940
0700
90
0645
7961
G
0630
0557
0545
57°00'
1527
0530
90
0515
100
0500
0426
G 7960
1600
0415
56°55'
120
0400
100
56°50'
0345
1700
14°50'
14°40'
14°30'
Depth in Corrected Fathoms
Side Scan Sonar
Side Scan and Magnetics
Drill
Grab
D
G

FIG II B