NATIONAL INSTITUTE OF OCEANOGRAPHY
Wormley, Godalming, Surrey

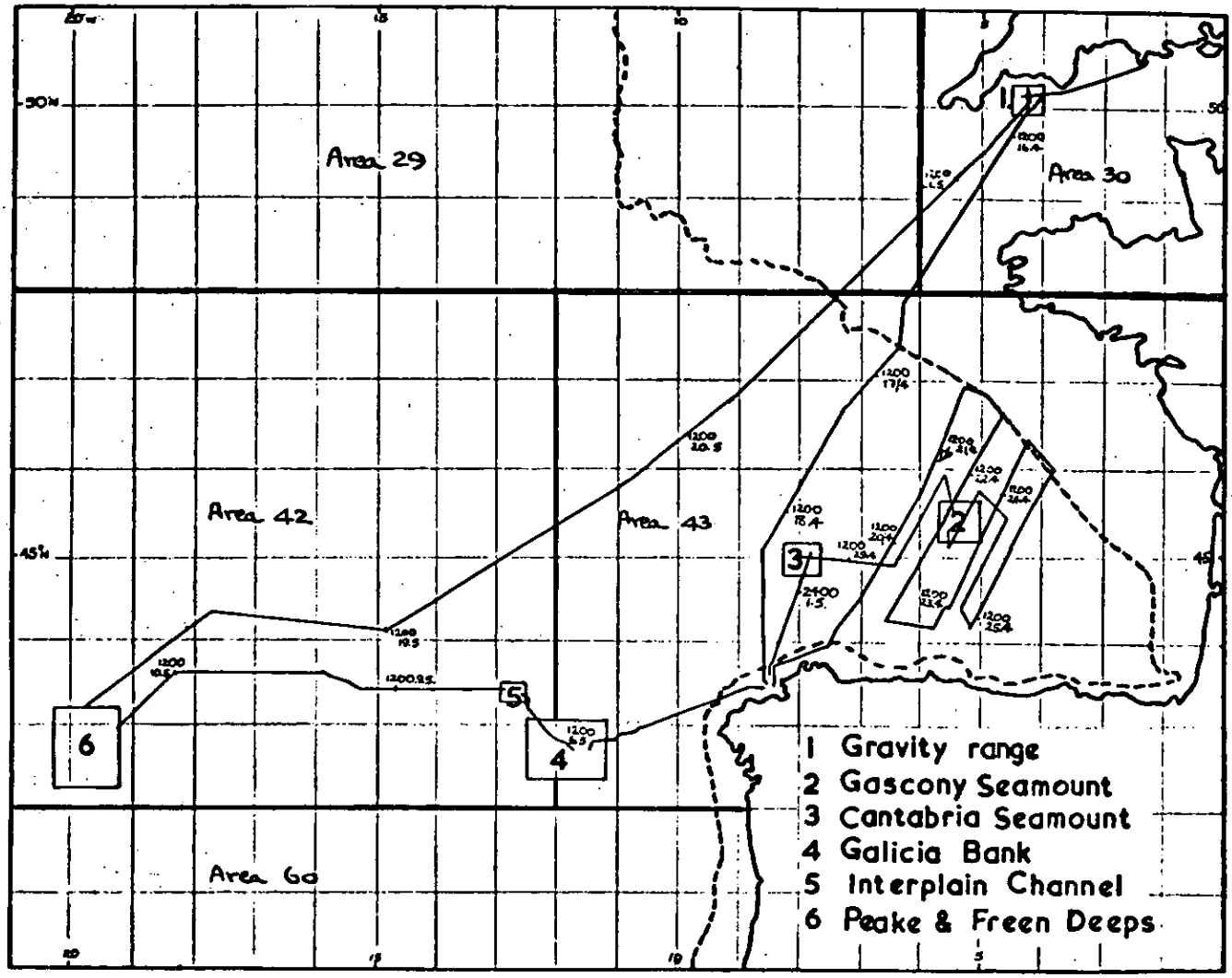
"DISCOVERY" CRUISE 11 REPORT

April-May 1966

GEOLOGY AND GEOPHYSICS IN N.E. ATLANTIC

N.I.O. CRUISE REPORT SERIES: CR 11

CONTENTS LIST



R.R.S. DISCOVERY

Cruise 11 April - May 1966

NOON POSITIONS

Departed Plymouth	15th April 1966	(Day 105)
Arrived Portland	16th April 1966	(Day 106)
Departed Portland	16th April 1966	(Day 106)
Arrived Corunna	19th April 1966	(Day 109)
Departed Corunna	19th April 1966	(Day 109)
Arrived Corunna	2nd May 1966	(Day 122)
Departed Corunna	5th May 1966	(Day 125)
Arrived Plymouth	21st May 1966	(Day 141)

Stations occupied: 5936 - 5989

SCIENTIFIC PERSONNEL

		Leg
Dr. A.S. Laughton (Principal Scientist)	National Institute of Oceanography	1 and 2
Mr. E.P. Collins		1
Mr. J. Francis		1 and 2
Mr. D.G. Roberts		1
Dr. D.H. Matthews	Department of Geodesy and Geophysics, Cambridge	1 and 2
Mr. G.A. Day		1
Mr. E.J.W. Jones		1 and 2
Mr. R. Haworth		1 and 2
Mr. D.T. Pugh		1 and 2
Mr. C. Tramontini		1
Mr. T. Vertue		1 and 2
Mr. R.B. Whitmarsh		1 and 2
Miss C.A. Williams		1 and 2
Dr. B.J. Funnell	Department of Geology, Cambridge	2
Mr. M.J. Fisher		1 and 2
Mrs. R. Pilbeam		2
Mr. J.R. Cann	Department of Mineralogy and Petrology, Cambridge	2
Dr. D.S. Cronan	Department of Mining Geology, Imperial College, London	1 and 2
Dr. F. Gray	Department of Geology, Durham	1
Mr. A.P. Stacey		1 and 2
Lt.Cdr. R.P.F. Martin, R.N.	Hydrographic Department	1
Lt. D.G. Clifford, R.N.	Naval Weather Service	1 and 2
Mr. D.J. Phipps	Decca Navigator Company	1
Mr. J.K.V. Lee		1

SHIP'S OFFICERS

Mr. R.H.A. Davies	Master
Mr. G.L. Howe	Chief Officer
Mr. J.T. Walker	Second Officer
Mr. M. Bradley	Third Officer
Mr. D.G.P. Wells	Chief Engineer
Mr. F.B. Jilla	Second Engineer Officer
Mr. J. Myers	Third Engineer Officer
Mr. B.S. Brown	Fourth Engineer Officer
Mr. W. Pearce	Junior Engineer Officer
Mr. R.R. Tilley	Junior Engineer Officer
Mr. J.L. Hancock	Senior Electrical Engineer Officer
Mr. T. Wagstaff	Junior Electrical Engineer Officer
Mr. E.C. Agius	Radio Officer

CRUISE INTENTIONS

The main project for the first leg of the cruise was to study the origin of the Bay of Biscay by mapping lineations in the magnetic and gravity fields, by exploring the buried basement using seismic profiling and by surveying and sampling two of the seamounts emerging from the abyssal plain.

In the second leg, there were two main projects. The first was to make seismic profiles across Galicia Bank with a view to finding prominent strata which outcrop and which could be sampled. The second was to extend the investigations in Peake and Freen Deeps in the King's Trough area N.E. of the Azores, with special emphasis on a very detailed survey of the ridge between the deeps where basalts, serpentinites and tertiary rocks were found on cruise 4 (Feb. - March 1965) and to map the ridge geologically with precision dredging. Seismic profiling across the deeps was planned to help the interpretation of heat flow data and of seismic refraction measurements obtained in 1965.

Separate projects included:-

(a) Study of state and distribution of manganese in sediments in different environments (Cronan).

(b) Study of surface living foraminifera in relation to recent sedimentation (Pilbeam).

(c) The stability of bottom water in enclosed basins in relation to the flow of heat from the sea floor (Pugh).

(d) Instrumental development of a pop-up bottom seismic system (Whitmarsh).

(e) Operational trials of Sea Fix Navigation system in the deep ocean (Decca).

(f) Cross-coupling errors in gravity measurements (Haworth).

NARRATIVE

Leg 1: 15th April - 2nd May: 105-122

R.R.S. "Discovery" sailed in force 6 easterly wind from Plymouth at 0030 on 15th April directly to Portland where trials were made on the A.U.W.E. noise range of the acoustic output and pulse shape of the airgun seismic profiler. Although good records were obtained the small depth of water and high output tended to overload the hydrophone array when the ship was immediately above, and at longer slant ranges, surface-bottom reflections caused interference. After the trials we berthed alongside for a gravimeter base measurement.

After last-minute stores arrived from N.I.O., we sailed at 2000 back towards the Eddystone Light, in order to run over a pattern of gravity stations made by Dr. Bott using a bottom gravimeter. Two E-W and two N-S lines were made to investigate the cross-coupling errors introduced by pitching and surging movements of the ship. Bt this time the weather and sea had moderated considerably.

By 0930 on 16th April (Day 106 of 1966) we finished the gravity trials and set course directly towards Corunna in N. Spain, in order to calibrate the gravimeter. The gravimeter, a Graf-Askania kindly lent by the Hydrographer, was new and its calibration factor and drift rate were unknown. Our passage to Corunna was considerably retarded by a south-westerly gale and we did not berth alongside at Corunna until 0900 /109. On passage we made continuous magnetic field measurements (using Cambridge magnetometers and also a Varian magnetometer on loan from the Hydrographer). Magnetic measurements were made throughout the cruise on passage runs and surveys. A short seismic profile was made approaching the shelf edge.

We sailed from Corunna at 1230 /109 to start on long traverses of the Bay of Biscay 25 miles apart, from shelf to shelf on 030-210° courses. On about half of these, seismic profiles were obtained and several stops were made for bottom water temperature gradient, short core and camera stations, and pressure tests on glass spheres. From these reconnaissance lines the linearity of the magnetic anomalies trending toward the S.E. corner of Biscay were confirmed, and the seamount at 45° 20'N, 5° 25'W, known from earlier soundings, was found to be a ridge partly buried beneath the abyssal plain, trending parallel to the magnetic anomalies. It was decided to examine this ridge, now named Gascony Seamount, in more detail ans so interlacing profiles were made between the earlier lines in the region of the rdige. The navigation on these lines was entirely by Decca using the S.W. British, French and Spanish Chains, with two Mk XII receivers and Deccometers with a track plotter. In daytime, good fixing was possible but at night signals were not adequate to hold the lane identification.

Two dan buoys (D/B1 and D/B2) fitted with Sea Fix slaves 1 and 2, were laid straddling the ridge 10 miles apart on day 116, and much of the day was spent establishing the base line and checking the lane counting. Difficulty occurred with interference from radio transmissions on board and from Hi-Fix chains operatiog in U.K. and arriving as sky waves. The survey, therefore, was made by radar and D.R. during night 116/117. On returning to the buoys changes were made in the aerial sensitivity and the system used successfully for a dredge station (5940) on the south cliffs of the ridge. This yielded only mud. It was followed by a camera station showing no rocks. The seismic profiles showed strata tilted down to the northward which we hoped would outcrop on the south cliff but may in fact be mantled by the recent sedimentation from the continental margin. Two cores were taken on the ridge yielding recent sediment. The Sea Fix slaves had both died by now due to short battery life, (the capacity had had to be reduced because of temporary battery boxes) so they were recovered and we left the Gascony Seamount in search of more exposed rocks.

On day 118 we steamed to another seamount, now named Cantabria Seamount, at 45°N 8°W, making some diversions and stations en route. On day 119 we laid dan buoys 3 and 4 (with Sea Fix slaves 2 and 1) just north of the ridge and surveyed it with lines 5 miles apart on 030° - 210°, making continuous seismic profiles at 5 kts. The survey was navigated on Sea Fix (which showed some distortion due to buoy movement), Decca (Spanish Chain) and radar. The Decca fixes were used in the final plot. The seismic profiles showed Cantabria Seamount to be another tilted block, this time down to the south with steep exposed benches on the north side, related to a "basement" and a "transparent layer". A camera station on the cliff showed many loose boulders but no bedrock, but a dredge haul (5946) brought up a fine collection of sedimentary rocks and indurated oozes.

Both dan buoys were recovered on day 121 and we berthed alongside in Corunna at 0830 /122, where gravity base measurements were made.

During the first leg, after the gales of the first few days the weather moderated and cool S.E. winds blew off Spain but kept the skies clear and the sea very calm.

Leg 2: 5th May - 21st May: 125-141

We sailed from Corunna at 1615, having delayed six hours to await the arrival of a new 16" glass sphere from U.K. However due to Customs and freighting delays, it did not reach us and so we left without it. We steamed into heavy head seas to the eastern side of Galicia Bank and after a station, started on a number of E.W. seismic reflection profiles of Galicia Bank ending with one along seismic stations 3972 and 3972 of 1958. These demonstrated gently dipping strata interrupted by faulting. A dan buoy (D/B5) was laid near small cliffs on the western side of the flat top and

a successful dredge haul of limestones was brought aboard. A camera station across the line of the dredge haul showed bedrock outcropping on the cliffs and a large quantity of detrital and erratic boulders lying on the sediment. A series of short cores on the top gave only small quantities of winnowed foraminiferal sand.

We lifted D/B5 on day 128 and set course for the head of the Southern Interplain Channel connecting the Biscay and Iberian abyssal plains, where during the survey in 1960, correlated benches were found from the topography in the 100 fathom deep cut in the Biscay plain. Four seismic reflection profiles across this showed that these benches could be correlated with prominent sub-bottom reflections.

We left the Interplain Channel at 0030/129 and headed west towards Peake and Freen Deeps via a deep enclosed basin where a bottom water temperature gradient station was made. This basin showed remarkable sub-bottom structure on both E/S and precision pinger records 20 fathoms below the sea floor.

We arrived at Peake Deep in the evening of 130 in a S.W. gale, and had some difficulty locating it by topographic fitting. In view of the bad weather, we delayed laying buoys and spent 36 hours on six stations in Peake Deep examining the temperature gradients and chemistry of the bottom 100 metres using modified heat flow apparatus and closely spaced bottles. The position of these stations had to be fixed by topographic fitting to the 1965 chart, and showed a considerable set to the west.

By the morning of 132 the weather had moderated and was to remain very calm until the end of the cruise. Two dan buoys (D/B 6 and 7) with Sea Fix slaves 1 and 2 were laid straddling Palmer Ridge (between the deeps) 15 miles apart, and another (D/B 8) on the ridge near our proposed dredging area, since the life of the Sea Fix buoys was limited to 48 hours. A "mini survey" of 13 N.S. lines ¾mile apart was made on the crest and south facing cliff of Palmer Ridge where in 1965 dredge hauls had shown basalts, serpentinites and tertiary limestones. The survey was navigated by Sea Fix and radar. Unfortunately D/B 6 started to go adrift during the survey and so the Sea Fix base line changed its orientation. A final compromise of Sea Fix and radar plot was used to contour the survey. The sections showed benches on the cliff (identified by hyperbolae in a long reverberating echo) and these could be correlated between tracks. Two dredge hauls were made on day 133 before we set off to the north of Peake Deep plain to make a seismic reflection profile southwards across both deeps and to the position of seismic refraction station 5637. During this line both Sea Fix slaves died and we therefore returned to pick both dan buoys up and established that D/B 6 had drifted some 5 miles to the east.

Five core stations followed; the first in Peake Deep with an unsuccessful heat flow measurement, the remaining on the north slope of Palmer Ridge. Hard Eocene sediments were sampled near the base of the slope but no cores could be got near the top.

By now it was clear that D/B 8 had shifted its position and when recovered, was found to be supporting its anchor having moved into deeper water. Another dan buoy (D/B 9) was laid on the ridge and after a small locating survey an intensive dredging programme was started to sample the benches and to delimit the geological regions. Eight out of nine dredge hauls produced fine collections of rocks. The dredging programme was interrupted for two core stations, one in Freen Deep and one, with a successful heat flow measurement, in Peake Deep.

D/B 9 was recovered at 2100/137 and we steamed south across Freen Deep to start a seismic reflection profile northwards across both deeps to the

position of seismic refraction station 5632 of 1965. Both seismic reflection profiles across the area showed layered sediment basins in the deeps and to the north and south, with a "transparent layer" mantling part but not all of the ridge regions.

At 1200/138, we set course for Plymouth via various diversions to fill in topographic and magnetic gaps in the collected data. On passage we stopped for three short core and plankton stations and also for pulse shape measurements of the airgun output.

Our course past the Eddystone Light was along the gravity range occupied at the start of the cruise, for more cross-coupling measurements, and we anchored in Plymouth Sound at 2000/141.

PROJECT REPORTS

1. Dredging

The programme of dredging on this cruise was more successful than it has ever been before. Fourteen dredge hauls were made, and in only one was the dredge completely empty. Two more were relatively unsuccessful, one in which the main dredge was empty but the conical dredge contained mud, and another which recovered only one rock of somewhat indeterminate character. The other eleven produced good hauls, sometimes verging on the spectacular. The success may be attributed to the confidence we felt in the equipment, with its series of reliable weak links which make it difficult for the dredge to become fast on the bottom, and also to the greater care taken in ship manoeuvring. The scale profiles of the bottom enabled us to ensure that the dredge was actually travelling across the bottom, and also made it possible to aim for and successfully to sample particular terraces on the sea floor.

In the Bay of Biscay, Cantabria Seamount gave a good haul of soft limestone and stiff clays which could be correlated with the outcrop of a reflector found by seismic profiling. A haul on the W side of Galicia Bank produced a fine collection of flaggy limestones and soft limestones to supplement the series of rocks already collected from here on previous cruises. Eleven hauls were made on the crest and on the southern facing slopes of Palmer Ridge in the Peake Deep area in order to fill out the information gained last year. Limestones were collected ranging in age from lowest Eocene through to Upper Tertiary, and several hauls successfully sampled the basement beneath these, producing weathered basalts, metamorphosed basalts and dolorites, and serpentinites. These hauls have amply extended the work of last year, and make it clear that here we are sampling a section through at least the upper part of the oceanic crust, though further careful work on the specimens will be necessary to determine exactly how this section through the crust has been exposed. Not only are these rocks important in determining the geological history of this area, but palaeontologically and petrologically they form an important addition to our knowledge of the rocks of the deep ocean. (J.R.C.)

2. Coring

Cores were taken for four purposes:-

a) Small gravity cores of the top few centimetres of sediment were taken for the purpose of comparing the populations of planktonic Foraminifera in the surface sediment with those obtained in 300-0 metre plankton tows at the same stations (Mrs. Pilbeam).

b) Long gravity cores were taken in the Bay of Biscay and on the north slope of Palmer Ridge for the measurements of eH and pH variations both with

depth in the sediment and depth below the sea surface. (Cronan)

3) Two long gravity cores were taken in Peake Deep in association with heat-flow measurements (Pugh).

4) One long gravity core was obtained in Freen Deep for sedimentary studies of pelagic turbidities (T.A.Davies - not on the cruise).

In all 12 small gravity cores and 14 long gravity cores were attempted; 10 of the former and 11 of the latter were successful. (B.J.F.)

3. pH and eH measurements in cores

As part of a study on the state and distribution of manganese in pelagic sediment cores, pH and eH measurements were made on seven of the cores collected. In all cases the eH was found to be very or moderately oxidising at the sediment surface, and to decrease with depth. The variation was greatest in cores collected from abyssal plains and deeps, and smallest in those from seamounts and ridges.

pH measurements approached the average value for sea water at the sediment surface and also decreased with increasing depth. The cores will be analysed for manganese in order to examine whether its distribution is governed in any way by the pH, eH variations found. (D.S.C.)

4. Pelagic and benthonic foraminiferal studies

Planktonic foraminifera were collected in all twelve vertical plankton net stations using an N50 net between 300 and 0 metres. Maintaining some of these geologically significant animals in culture was attempted in the constant temperature laboratory under varying conditions with limited success. The remaining plankton were preserved.

Benthonic foraminifera were sampled from the top few centimetres of gravity cores and living tissue identified by staining. Both living benthonic and living planktonic foraminifera were identified in the core stations. (R.P.)

5. Bottom water temperature gradient measurements

As part of an investigation into the relationship between thermal gradients in the bottom water, and in the sediments, combined water bottle and temperature gradient measurements were made in a number of localities. Bottles were normally spaced at five metre intervals over the bottom fifty metres of water, and the temperature gradients in this water were measured using a modified Lister Heat Flow Apparatus, with reversing thermometers as a control on absolute temperature. Salinity, oxygen and silicate concentrations were measured on all water-bottle samples.

A total of eight bottom and one intermediate water-bottle stations were occupied; six of these were in Peake Deep, which was subjected to a special survey. In addition one heat-flow measurement was made in this deep. (D.T.P.)

6. Seismic reflection profiling with an airgun sound source

The Cambridge seismic profiler, consisting of a pneumatic sound source ("airgun"), a fifty feet towed hydrophone array and modified Mufax weather chart recorder, was extensively used on both legs of the cruise. The first part of the work involved five traverses with the airgun over the sound range at A.U.W.E., Portland, to obtain its pulse shape from calibrated sea-bed hydrophones. The ship had the full co-operation of the sound range laboratory, which in addition to recording the pulses both on tape and paper recorders, continuously plotted the ship's tracks. It seemed that the

hydrophone overloaded at close ranges whereas farther away the pulses tended to be obscured by surface-bottom reflections. Shots at intermediate ranges should yield the data required. The pulse shape was also determined for two types of airgun much later in the cruise, by suspending a single calibrated hydrophone 300 ft. below the ship. This method has many advantages over that in shallow waters. The results were very satisfactory and should supplement the Portland data well.

The profiler has been operated on many portions of the ship's track, unfortunately only at 6 knots because array noise at speeds greater than this obscures sub-bottom echoes. The quality of the records at 6 knots is good and compares well with reflection data obtained by other workers.

On the first leg the profiler gave evidence of a buried median ridge in the Bay of Biscay, the only evidence of which on the echo sounder is a slight change in depth of the abyssal plain. The two seamounts surveyed had several airgun lines across them from which a good picture of the sediment distribution and "basement" depth can be obtained. The profiler supported dredging and coring work well, since stations could be positioned in significant places in the region of the airgun lines.

The work on the second leg was confined to three areas - Galicia Bank, the Interplain Channel between the Biscay and Iberia Abyssal Plains, and the Peake-Freen Deeps area. The records in the first two areas yielded data which confirms and supplements previous ideas. Galicia Bank for the most part is made up of horizontally bedded strata overlying a reverberant "basement", whilst sedimentary layers do outcrop in the Interplain Channel confirming the idea of its being an erosional feature.

Two N-S crossings in the Peake-Freen Deeps area show the generalised sediment distribution and will greatly help in the assessment of the main geological structure. (E.J.W.J.)

7. Pop-up ocean bottom seismics

During this cruise the intention was to subject the pop-up ocean bottom system to various tests which were aimed at having the system operational by our return to Plymouth. However the buoyant glass instrument housings, which are an integral part of the apparatus, have proved to be unreliable and most of the time was spent testing them.

A new design of rig to contain the sphere was floated for the first time. It appeared to be well suited for use in the experiment and is much better than a previous design.

During pressure tests a damaged 16" sphere imploded at about 4000 m. A second 16" sphere was pressure-tested 7 times and eventually imploded at 4400 m. This sphere had leaked on the six previous tests (probably leaking started between 10 m and 250 m) due to poor contact between the ground glass faces. It imploded after the faces had been reground on board ship. These tests are believed to be more extensive than any others carried out so far on 16" glass spheres.

A radar transponder for recovering the pop-up devices was found to give accurate bearings within 1 mile range. Tests on the recording and playback systems showed that except for a few details this part of the system is ready to be used. (R.B.W.)

8. Cross-coupling experiments

Measurements were made almost continuously throughout the cruise to determine the cross-coupling errors experienced aboard R.R.S. "Discovery"

by Graf-Askania Sea Gravimeter No. 20. The errors involved have been shown by other research workers to depend quite critically upon the response of the ship in various sea conditions. Experiments were conducted to determine the response of "Discovery", and hence the magnitude of the error involved, and also to try to obtain an output from the gravimeter corrected for this error.

The investigation involved using an analogue computer whose inputs, analogues of the vertical and horizontal accelerations, experienced by the ship, were provided respectively by the A.C. component of the gravimeter and an attempt will be made to correlate the amplitude of this error with the prevailing sea conditions. Results in the latter part of the cruise indicate that it is feasible to obtain a corrected gravimeter output although difficulties were encountered in achieving this due to the computer interfering with the records of the routine gravity survey. (R.T.H.)

9. Sea-Fix navigation aid (Decca)

Due to delays in construction only two of the three Sea-Fix buoys were available, and for these the battery capacity in temporary cases was reduced to 80 A.H. at 24V. A two-range system using two slaves in the buoys and the master on board, was laid three times during the cruise, the slaves remaining active for between 36 and 46 hours. The first lay on Gascony Seamount was successful for a short time after some aerial adjustments had been made, but was put out of action by interference from radio transmissions on board and skywave reflections at night from Hi-Fix chains in U.K. The second lay operated well during the battery life of the slaves but suffered pattern distortion due to relative buoy movement. The third lay in Peake and Freen Deeps was successful for the first few hours but then D/B 6 (slave 1) went adrift with a consequent rotation of the base line. At a range of 25 miles good signal strength was still obtained. The buoys and aerials stood up well to handling into the sea and to constant movement in the water. The limitations of the system lie in buoy movement and in battery life. The distortions to a track chart due to buoy shift are less easy to interpret than with radar fixing. (A.S.L.)

10. Decca and Loran navigation

In the Bay of Biscay, S.W. British, French and Spanish Decca Chains were used for navigation, using two MK. XII receivers. In the centre of the Bay, night reception was poor, and consequently unusable. On Cantabria Seamount, the Spanish Chain (just installed) gave good daytime fixes but poor night time fixes. Decca navigation was used successfully on Galicia Bank by day but not by night.

On passage and at Peake-Freen Deeps, Loran A gave good signals but errors on the charts made them unreliable. A lattice (computed at N.I.O. based on assumed station positions) was made self consistent by adjusting 1S5 by 20 μsec; checked against topography, the lattice appeared to shift day by day up to 5 miles, and was therefore only useful for relative fixing. (A.S.L.)

11. Stereo underwater camera

A new stereo underwater camera uas used in the four camera stations on the cruise. Also new were the camera pingers (of N.I.O. type B) and the flash light used was the MK. II 100 joule flash with a built-in reflector. A Benthos bottoming switch was used.

The first two stations were cut short by camera and bottoming switch failures. The latter two were fully successful taking 56 and 83 pairs respectively. (A.S.L.)

DAN BUOY POSITIONS

D/B	Laid	Recovered	Position	Remarks
1	1100/116	1520/118	45° 19·8'N to 45° 17·5'N 5° 35'W 5° 31·5'W	Fixed by Decca (French and S.W. British Chains). Drifted S.E. from about 1900/116.
2	1330/116	1640/118	45° 29·5'N to 45° 27·5'N 5° 27·5'W 5° 27·0'W	Fixed by Decca (French and S.W. British Chains). Probably not adrift.
3	1600/119	1920/121	45° 06·5'N 7° 59·3'W	Fixed by Decca Spanish chain.
4	1840/119	2040/121	45° 08·0'N 7° 44·3'W	Fixed by Decca Spanish Chain.
5	2230/127	0600/128	42° 39·0'N 11° 56·0'W	Fixed by comparison of soundings with Black et al (1964) (and on D.R. from Decca fixes).
6	1053/132 (Adrift from 1800/132)	1700/134	42° 58'N to 42° 55·5'N 19° 59'W 19° 48'W	Fixed by comparison with topography of Peake-Freen Deeps obtained in March 1965. No reliable star or sunsights. Loran useful only for relative positions.
7	1412/132	1445/134	42° 43·0'N 20° 00·0'W	
8	2000/132 (Adrift from 1800/133)	1240/135	42° 53·2'N to 42° 55·5'N 20° 10·7'W 20° 05·7'W	
9	1356/135	2106/137	42° 54·5'N 20° 11·6'W	

R.R.S. "DISCOVERY"

STATION LIST - CRUISE 11 - APRIL-MAY 1966

BWTG Bottom water temperature gradient
C Corer
SC Short Corer
CHF Corer and heat flow
RD Rodk dredge
CD Conical dredge
SUC Stereo underwater camera
WB Water bottles
N50 N50 vertical net 300-0 m.
UCF Uncorrected fathoms
CF Corrected fathoms
CM Corrected metres

"Station positions taken at mid-point of station

Stn. No	Gear	Date (1966)	Day No.	Times (BST)	Position Lat.	Long.	Acuracy	Method of Fixing and D/B No.	Depths UCF	CF	CM	Comments
BAY OF BISCAY												
5936	BWTG	20/4	110	0900-1800	45°12'N	06°27'W	±0·5'	Decca	2560	2645	4836	Successful
5937	C	21/4	111	0730-1618	46°13'N	05°43'W	±1·0'	Decca				90cm core (10 cm core in trigger weight)
5938	SUC	23/4	113	1130-1340	44°31'N	05°37'W	±0·5'	Decca	2500	2581	4720	6 pictures; film jammed
5939	BWTG	23/4	113	1350-1900	44°29'N	05°39'W	±0·5'	Decca	2500	2581	4720	Successful
GASCONY SEAMOUNT												
5940	RD+CD	27/4	117	1420-2010	45°19'N	05°24'W	±0·5'	I,II, Seafix Decca	2329	2401	4390	No rocks. Mud in conical dredge
5941	SUC	27/4	117	2053-2300	45°19·0'N	05°23·2'W	±0·5'	I,II Seafix	2300	2371	4336	15 pictures; bottoming switch stuck.
5942	C	28/4	118	0830-1045	45°20·5'N	05°21·0'W	±1·0'	I,II, Decca	2140	2204	4031	173 cm core (and trigger weight core)

Stn. No	Gear	Date (1966)	Day No.	Times (BST)	Position Lat. Long.	Accuracy	Method of Fixing and D/B No.	Depths UCF	Depths CF	Depths CM	Comments
GASCONY SEAMOUNT (Contd.)											
5943	CHF	28/4	118	1145-1424	45°15·8'N 05°23·0'W	±1·0'	I,II, Decca	2454	2532	4630	169cm core (and trigger weight core) HF recorder flooded
BAY OF BISCAY											
5944	C	29/4	119	0620-0820	44°51'N 06°25'W	±1·0'	Decca	2560	2644	4335	No core; plastic barrel fractured
CANTABRIA SEAMOUNT											
5945	SUC	1/5	121	0100-0555	45°04·3'N 8°00·2'W		III, IV, Decca	2400	2475	4526	56 pictures
5946	C	1/5	121	0702-0920	45°04·5'N 8°00·1'W			2400	2475	4526	110cm core
5947	C	1/5	121	0950-1150	45°04·0'N 8°00·3'W			2328	2400	4389	171cm core
5948	RD+CD	1/5	121	1230-1830	45°05'N 8°00·2'W			2583-2324	2669-2396	4724-4382	Good haul limestones (mud in conical dredge)
GALICIA BANK											
5949 (5950) No Stn.	SC,N50	6/5	126	1040-1240	42°49·2'N 11°25·0'W	±1·0'	Decca, Topogy.	1045	1074	1965	30cm core
5951	RD+CD	7-8/5	127-8	2330-0130	42°35·8'N 11°57·5'W	±2·0'	V	538-553	554-569	1013-1040	Good haul limestones and erratics (Conical dredge empty)
5952	SC	8/5	128	0226-0256	42°38·8'N 11°56·8'W	±2·0'	V	480	494	903	10cm core
5953	SC	8/5	128	0326-0336	42°38·1'N 11°57·7'W	±2·0'	V	503	517	945	5cm core
5954	SC	8/5	128	0355-0406	42°37·5'N 11°58·1'W	±2·0'	V	516	531	971	5cm core
5955	SUC	8/5	128	0452-0734	42°35·8'N 11°57·1'W	±2·0'	V	563-522	579-537	1059-982	83 pictures
5956	SC	8/5	128	0925-1004	42°40·5'N 11°44·0'W	±1·0'	Decca	402	414	757	Little sand in catcher.

Stn. No	Gear	Date (1966)	Day No.	Times (BST)	Position Lat.	Position Long.	Accuracy	Method of Fixing and D/B No.	Depths UCF	Depths CF	Depths CM	Comments
INTERPLAIN CHANNEL												
5957	SC,N50	8/5	128	1705-1920	43°21'N	12°34'W	±1·0'	Decca	2662	2752	5032	15 cm core
ON PASSAGE TO PEAKE-DEEP												
5958	SC,N50	9/5	129	0836-0950	43°29'N	14°15'W	±2·0'	D.R.	2534	2619	4786	Smear only
5959	SC,N50	9/5	129	1700-1905	43°36'N	15°46'W	±2·0'	D.R.	2996	3107	5682	18 cm core
5960	BWTG	9/5	129	2000-2303	43°36'N	15°46'W	±2·0'	D.R.	3008	3119	5704	Successful
5961	SC,N50	10/5	130	1040-1220	43°38'N	18°22'W	±4·0'	D.R. Sun Topog^{y}.	2044	2103	3846	No core
PEAKE-FREEN DEEPS												
5962	BWTG	10-11/5	130-1	2340-0318	43°02'N	19°36'W	±2·0'	Topog^{y}.	3135	3254	5950	Successful
5963	BWTG	11/5	131	0640-0955	43°05·5'N	20°51·0'W	±2·0'	Topog^{y}.	3139	3257	5956	Successful
5964	BWTG	11/5	131	1220-1541	43°07·5'N	20°01·0'W	±1·0'	Topog^{y}.	3137	3256	5954	Successful
5965	WB	11/5	131	1635-1945	43°06·5'N	20°03·7'W	±1·5'	Topog^{y}.	3137	3256	5954	Successful
5966	BWTG	11-12/5	131-2	2130-0041	43°03·6'N	20°10'W	±1·0'	Topog^{y}.	3139	3257	5956	Partially successful; cast lowered on bottom
5967	BWTG	12/5	132	0400-0620	43°06·0'N	20°10·0'W	±0·5'	Topog^{y}.	3137	3256	5954	Successful
5968	RD+CD	13/5	133	1325-1822	42°50·3'N	20°12·2'W	±0·5'	VIII	2918-2440	3024-2517	5329-4604	Limestones and Serpentinite (conical dredge empty)
5969	RD+CD	13-14/5	133-4	2015-0005	42°55·0'N	20°11·5'W	±0·5'	VIII	1998-1704	2055-1750	3758-3200	Limestone (conical dredge empty)
5970	CHF,N50	14/5	134	1815-2105	43°04·8'N	19°49·0'W	±2·0'	Topog^{y}.	3136	3255	5952	250 cm core; no HF (timing failure)
5971	C,N50	14-15/5	134-5	2343-0210	43°01·4'N	20°07·0'W	±0·5'	Topog^{y}.	2800	2898	5300	180 cm core
5972	C,N50	15/5	135	0250-0540	42°57·8'N	20°07·3'W	±0·5'	VIII	2390	2465	4507	214 cm core
5973	C,N50	15/5	135	0620-0815	42°55·5'N	20°07·2'W	±0·5'	VIII	1900	1954	3573	No core; pressure release failure.

Stn. No.	Gear	Date (1966)	Day No.	Times (BST)	Position Lat.	Position Long.	Accuracy	Method of Fixing and D/B No.	Depths UCF	Depths CF	Depths CM	Comments
5974	C	15/5	135	0850-1025	42°55·9'N	20°07·2'W	±0·5'	VIII	2010	2068	3731	No core; trigger mechanism failure
5975	RD	15/5	135	1655-2015	42°54·2'N	20°12·8'W	±0·5'	IX	1702	1750	3200	Serpentinites
5976	RD+CD	15-16/5	135-6	2110-0125	42°53·6'N	20°15·7'W	±0·5'	IX	1702	1750	3200	One rock (conical dredge empty)
5977	RD	16/5	136	0145-0530	42°54·2'N	20°15·9'W	±0·5'	IX	1774-1726	1825-1775	3338-3246	Limestones
5978	RD	16/5	136	0631-0900	42°54·6'N	20°11·2'W	±0·5'	IX	1856-1798	1900-1850	3475-3383	Basalt and erratics
5979	RD	16/5	136	1000-1510	42°50·7'N	20°16·2'W	±0·5'	IX	2805-2491	2900-2575	5303-4709	Metagabbros, basalts and erratics
5980	C,N50	16/5	136	1600-1810	42°48·2'N	20°14·3'W	±0·5'	IX and D.R.	2814	2913	5327	391 cm core
5981	RD	16/5	136	1850-2200	42°51·5'N	20°16·5'W	±0·5'	IX	2491-2468	2575-2550	4709-4663	Limestones and metabasalts
5982	RD	16-17/5	136-7	2300-0255	42°52·2'N	20°11·9'W	±0·5'	IX	2456-2124	2534-2187	4635-4000	No rocks
5983	RD	17/5	137	0320-0630	42°54·4'N	20°13·4'W	±0·5'	IX	1774-1678	1825-1725	3338-3155	Limestones and Serpentinites
5984	CHF,N50	17/5	137	0835-1140	43°06·2'N	20°09·5'W	±1·0'	IX,D.R. Topog^{y}.	3132	3250	5944	370 cm core. HF result
5985	RD	17/5	137	1322-1800	42°52·0'N	20°12·4'W	±0·5'	IX	2515-2231	2600-2300	4755-4206	Metabasalts, limestones and Serpentinites
5986	C,N50	17/5	137	2125-2305	42°56·5'N	20°17·5'W	±1·0'	D.R. from IX				No core
ON PASSAGE TO PLYMOUTH												
5987	SC,N50	19/5	139	1040-1220	44°09'N	14°55'W	±1·0'	Sun + Venus	2724	2712	4960	18 cm core
5988	SC,N50	19/5	139	2125-2238	45°02'N	12°54'W	±2·0'	D.R.	1978	2034	3720	20 cm core
5989	SC,N50	20/5	140	1612-1709	46°52·5'N	09°05'W	±1·0'	Decca	2253	2319	4240	20 cm core