

9/8/68

Cruise Report

Department of Geology, Bristol University

Cruise 5/68 in R.R.S. John Murray, 18 April - 6 May 1968

*English Channel, Celtic Sea.*

Aims.

In general terms, the aim of the cruise was to investigate the geological nature of the sea-floor, i.e. the superficial sediments, the solid rocks and their structure, from about the middle reaches of the English Channel westwards to the edge of the continental shelf and northwards into the South Celtic Sea, and to examine in detail a submarine canyon complex on the continental slope.

More specifically the objectives were to;

1. Examine in detail the nature of the Hurd Deep, in the English Channel, determine its possible mode of origin.
2. Make continuous seismic profiles and magnetometer traverses of the area between 50°10'N, 2°W. and 4°W. to collect data on sub-surface geological structure, in an area that has already been intensively cored.
3. Sample the surface sediments at selected sites both close inshore and in the open sea to determine (a) the biomass of the foraminiferid population, (b) the sediment type.
4. Make continuous seismic profiles and magnetometer traverses over numerous core stations in the area west of 5°W to the edge of the continental shelf, into the South Celtic Sea, and around the Lizard.
5. Make a detailed bathymetric survey of the lower part of the submarine canyon system already partly mapped to complete our chart, and make sediment, microfaunal and photographic surveys down the canyon system.

6. Obtain sea experience in laying bottom current meter stations prior to setting up long term recording stations in the canyon system and in an area of sediment study south of the Lizard. Two Bergen current meters, kindly loaned by N.I.O. were used.

### Narrative

The cruise was divided into two parts, from April 18 to April 24, and from April 24 to May 6.

#### April 18 - April 24.

The following scientific personnel joined the ship at Plymouth for this part of the cruise.

D. Hamilton, Bristol University, (Principal Scientist).

D. Curry, Bristol Group.

Dr. F. Banner. Swansea University

M. Talbot. Bristol University.

J.R. Wilson. Bristol University.

R. Watson. Bristol University.

J. Joseph. Geophysics, Bath University.

In order to test the sparker and other equipment at sea, Messrs. E. Bulled & S. Jones, N.E.R.C. Technical Officers accompanied us during a sparker and magnetometer survey south from Plymouth along  $4^{\circ} 10'W$  to  $48^{\circ} 53'N$ . and back along  $4^{\circ} 05'W$ . during 18 April. They both disembarked at Plymouth at the end of the day. The survey of the Hurd Deep area was commenced by making a continuous seismic profile (sparker) and magnetometer survey south along  $4^{\circ} 30'W$ . over a series of core stations and to cross the line of south-westerly extension of the Hurd Deep

(See Chart 1). The feature was then bracketed by a series of 10 north-east and south east tracks up to  $3^{\circ} 10' W$ . from which point a profile was made north east along the axis of the deep to its eastern extremity. The tributary channel system to the deep was traversed by a N.-S. and a S.-N. track.

The structure of the solid rocks in the area west of  $50^{\circ} 10' N$ ,  $2^{\circ} W$ . was surveyed in a series of N.-S. tracks passing over 40 of our core stations at five mile intervals to give stratigraphic control.

In an attempt to obtain core samples of the sedimentary fill in the Hurd Deep, coring was attempted at  $49^{\circ} 49' N$ ,  $2^{\circ} 38' W$ , and  $49^{\circ} 49' N$ ,  $2^{\circ} 29' W$ .

These attempts were unsuccessful as the superficial sediment contained large blocks of igneous, metamorphic and cemented sedimentary rocks up to 18 inches across. Samples of the surface sediment were collected by dredging at the ~~stations~~<sup>coring</sup> stations in the Hurd Deep, and  $49^{\circ} 28' N$ ,  $4^{\circ} 00' W$ .

Three gravity coring stations were manned near  $49^{\circ} 50' N$ ,  $2^{\circ} 50' W$ . to obtain solid rock samples. In the first part of the sparker survey of the southwestern end of the Hurd Deep the sparker records using an output of 500 joules twice a second were not as satisfactory as the later setting of the sparker to 1,000 joules once a second so it was decided to retrace the tracks over the Hurd Deep from  $3^{\circ} 15' W$ . on the homeward journey.

The sparker record deteriorated badly on the afternoon of 23 April due to a strong interference pattern and this completely masked any geological information on the run back into Plymouth, where the ship berthed at 05.30 on 24 April.

April 24 - May 6.

The scientific party disembarked and the following joined the ship for the second part of the cruise.

D. Hamilton, Bristol University (Principal Scientist)

Dr. J.W. Murray, Bristol University

Dr. D. Parkin, Geophysics, Bath University.

D. Channon, Bristol University

L. Smith, Bristol University

R. Godwin, Bristol University

G. Day, Bristol University

S. Jones, R.V.U.

The ship's tracks for this part of the cruise are shown on Chart 2.

After making preparations during 24 & 25 April, we left Plymouth at 14.00 on 25 April in dense fog. This forced the ship to anchor in Cawsands Bay until the following morning and provided an opportunity to test a surface sediment sampler constructed by Dr. Murray, and also to build a tetrahedron from scaffolding in which to mount a Bergen current meter to record bottom currents. This was laid overnight to record a tidal cycle.

On leaving Plymouth at 09.40, 25 April, the sparker was tested during a run to the Fowey River mouth, where coring and sediment sampling was carried out. Sparker testing was continued to Falmouth, whence a magnetometer and sparker survey was made close inshore around the Lizard into Mounts Bay.

From here sparker and magnetometer surveys were made south along 5° 20'W. to 49° 15'N, to 49° 15'N., 5° 05'W, to 49° 48'N., 5° 06'W. where a current meter on a small weighted frame was laid to record bottom currents. A second current meter, on a buoyed mounting was laid at 49° 36'N., 5° 06'W. also to record bottom currents. Core, Shipek and Murray sediment samples taken at the current meter stations and also at 49° 45'N. 5° 05'W., and 49° 50'N. 5° 04.5'W. At the latter station the N.E.R.C. coring bomb was lost when the cable parted.

During the night of 27 April sparker and magnetometer surveys were made south along 4° 55'W. east along 49° 36'N. to 4° 50'W., and north along 4° 50'W to 49° 48' N. to sample the superficial sediments by Shipek and Murray samplers at 5 mile intervals. This continued until gale warnings for the area forced us to shelter in the Helford River mouth overnight. Here the underwater camera was tested and sediment samples taken.

On the following morning (29 April), with a considerable swell running, the buoyed current meter was recovered successfully but the one on the frame received damage during its recovery. Further sediment samples were taken at 5 mile intervals in the area south of the Lizard during the day.

We then proceeded westwards towards the submarine canyon area, making sparker and magnetometer surveys along 49° 25'N. from 5° 05'W. to 7° 15'W., then south to 48° 25'N. west along 48° 25'N. to the continental margin, and thence north west to 49° 10'N. 10° 50'W. to the area of the submarine canyons.

We started our programme of sediment sampling, underwater photography and bathymetry of the canyon on the evening of 1 May, with dredge, core, Shipek and Murray samples in the head of the canyon at 300 fathoms. During the night sparker and magnetometer runs were made over the heads of the canyons.

Our programme of work on the submarine canyons met with successive troubles on May 2. On the first coring station in 570 fathoms the cable fouled on the stoppering block, causing a kink in the cable at 1,000 metres. Inspection revealed no damage to the cable. On resuming sediment sampling, a joint in the hydraulics of the winch system blew, putting both the main and hydrographic winches out of action, so preventing any further deep water sediment sampling. During our time in the canyon area, the second Decca navigator set, specially installed to receive the British N.W. chain, was unstable. As this would not lock on, we were unable to navigate with the required precision to carry out our intended bathymetric survey. In any case the Giffit Recorder was an unsuitable instrument for recording the rapid changes of depths in traverses of submarine canyons.

After taking a plankton sample, two free-fall corers were launched in perfect conditions at dusk but neither of these returned to the surface.

We were forced to abandon our canyon programme on the evening of May 2 and commenced a sparker and magnetometer survey northeast into the South Celtic Sea to  $51^{\circ} 16.5'N$ ,  $6^{\circ} 47'W$ ., taking 5 surface sediment samples

in shallow water using the small electric bathythermograph winch. Further surface sediment samples were taken at 4 mile intervals along part of the easterly track towards Lundy Island.

On this leg the sparker record deteriorated and gave little information on a circuit of Lundy Island, so we anchored overnight on May 4 - 5 at Lundy Island to repair the sparker. A further circuit was made on May 5 but there was little improvement in the sparker record in spite of intensive work on it. The proposed sparker and magnetometer survey of the area north of the Scilly Isles had to be abandoned on May 5 due to gale warnings (force 10, moderating to force 8).

During May 6, whilst sheltering in the lee of the south coast, a series of surface sediment samples were taken at right angles to the coast in Mounts Bay, Gerrans Bay and from Eddystone into Plymouth, where the ship docked at 2700 on 6 May.

#### Conclusions.

(See Charts 1 and 2).

The following results were achieved.

1. The Hurd Deep was surveyed in detail throughout its length using the sparker and magnetometer, and the superficial sediments were sampled by dredge and Shipek grab.
2. Evidence of sub-surface geological structure in the area between  $50^{\circ} 10' N.$   $2^{\circ} W.$ , and  $4^{\circ} W.$  was obtained, to supplement our information from coring.
3. Surface sediment samples were collected at several inshore areas on the south coast west of Plymouth, and at offshore sites south of

the Lizard, in the head of a canyon, and sites in the South Celtic Sea. These samples are for sediment and foraminiferal biomass studies.

4. Considerable experience was gained in the mounting and laying of three current meter stations to record bottom currents. Two successful stations were laid in the open sea south of the Lizard, but due to the breakdown of the main winches it was not possible to start the current metering programme in the submarine canyons.
5. Sparker profiles and magnetometer surveys were made around the Lizard and in the area to the south of the Lizard to supplement information from our coring.
6. Similar surveys were made along the edge of the continental shelf and into the South Celtic Sea in areas covered by thicker superficial sediments where solid rock samples are not readily obtainable by gravity coring.
7. A partially successful sparker and magnetometer survey was made of Lundy Island.
8. No progress was made on our work on sediment sampling, photography, bathymetry, or current measurements in the submarine canyon area.

Summary of operations

Total number of scientists participating.	13
Number of days at sea	18
Total distance covered	2367m. miles.
Approx. distance covered by sparker and magnetometer surveys	1,000m. miles



Number of core, dredge and surface sediment samples collected	74
Number of successful camera stations	2
Number of plankton samples	1.