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REPORT ON CRUISE 11/68
NOV-DEC 1968

Bay of Biscay

GRAVITY, MAGNETIC AND SEISMIC SURVEY IN THE BAY OF BISCAY

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D A T E S

Joined ship at Plymouth 18th November

Leg (1)	Sailed from Plymouth	p.m. 21st Nov
	Returned to Plymouth	a.m. 4th Dec
Leg (2)	Sailed from Plymouth	a.m. 8th Dec
	Arrived Plymouth	a.m. 20th Dec

S C I E N T I F I C P E R S O N N E L

Dr F. Gray	(Cambridge)	Legs (1) and (2)
Mr M. Bacon	"	" "
Mr T.R.E. Owen	"	" "
Mr T. Vertue	"	" "
Mr T. Fitton	(R.V.U.)	" "
Mr B. King	"	
Dr A.P. Stacey	(Cambridge)	Leg (1)
Mr A. Ziolkowski	"	Leg (2)

CRUISE INTENTIONS

The purpose of this cruise was to gather seismic refraction and gravity data in the Bay of Biscay with a view to producing a structural cross-section across the Bay. It was proposed to obtain two gravity profiles across the Bay, and to shoot as much as possible of four refraction lines. The positions of three of these lines are shown on the track chart (Sta. 3/4, Sta. 5 and Sta. 6); the fourth was an East-West line, 50 miles long, situated about 30 miles north of Sta. 3/4. It was intended that all these lines should be reversed except Sta. 5, which was to be a split profile. The limitations on this program were those of time and quantity of explosive used; the former was aggravated by the difficulty of refraction shooting in rough seas from so small a ship, and the latter was caused by the impossibility of carrying more than 6000 lb. of explosive on the JOHN MURRAY. It was intended also to obtain airgun reflection profiles along each of these refraction lines to aid in the interpretation of the results.

A secondary objective was to obtain some gravity information on the French shelf to examine the possibility of shooting a long refraction line there at a later date.

An essential preliminary to these experiments was the testing of the sonobuoys to be used in the refraction experiments. The system of internally recording buoys was a new one which had been partially tested in the summer, at which time certain problems had been apparent, notably in connection with the buoy clock system; thus a further period of testing was necessary before conducting a full-scale refraction experiment.

NARRATIVE

Leg (1).

Sailing, originally due for 6 a.m. on 20th Nov., was delayed until 2.15 p.m. on the 21st by tests on the engines, 4 mm. winch and the P.D.R. fish. The first priority was to test the refraction sonobuoys for which reasonably calm water was desirable as there was a force 6 wind with large swell; it was decided to go into Douarnenez Bay for this purpose. Four days were spent here during which time the refraction system was set up and tested, initially with an airgun sound source

and subsequently with explosive charges fired outside the 10 mile limit. The P.D.R. fish and magnetometer were also tested and found satisfactory.

At the end of this time the sea off Brittany was still too rough to start seismics and so, as the weather prospects looked better to the South, it was decided to make a gravity and magnetic traverse from the Brittany coast to the North Spanish coast (the more Westerly of the traverses on the track chart). This traverse was started at 9.30 a.m. on 26th Nov. in a wind of force 3-5, and was finished at 4 a.m. on 28th Nov. It was then necessary to put in to La Coruña to tie in the gravimeter to the base station there, in view of the winch testing projected for later in the cruise which, it was feared, would have an adverse effect on the gravimeter stability.

As the weather had now moderated and the heavy swell was beginning to subside, it was decided to conduct a further test of the sonobuoy system off La Coruña. Five small charges were fired at distances of up to 7 miles; the resulting records were very satisfactory. The night of 28th/29th Nov. was then spent at La Coruña.

On sailing from La Coruña, we proceeded to the Western end of the first refraction line, which we fired during the night of 29th/30th Nov. (Sta. 3). 2400 lbs. of Geophex was used; unfortunately there were a large number of misfires, probably due to the charges sinking too deep, since a longer fuse length than normal had been adopted in an attempt to make it possible to fire 200 lb. charges without causing the circuit breakers on the main switchboard to jump off, resulting in a failure of the A.C. power supply.

On recovering the buoys at the end of the experiment, an airgun traverse was made to the other end of the line. The sonobuoys were then laid and the reversal of the previous refraction line fired (Sta. 4) on the night of 30th Nov/1st Dec. 2800 lbs. of Geophex was used.

After winch trials were carried out the gravimeter gyro, which had been removed prior to winch tests, was reinstalled, and a second gravity traverse across the Bay was made along with magnetometer and P.D.R. observations, as we had done on the previous traverse. On arrival off the French coast, we altered course and made a gravity and magnetic traverse parallel to the coast in shallow water (see track chart for details). Having finished this survey at 3 p.m. on 3rd

Dec. we made for Plymouth where we arrived at noon on the 4th.

Leg (2).

We sailed from Plymouth on the second leg of the cruise at 11.30 a.m. on 8th Dec. Sailing had been planned for 8 a.m., but work on the winch prevented the gravimeter gyro from being started until 8 a.m. As it had still not settled down by 11.30 it was not possible to tie the gravimeter in before leaving; it was therefore decided not to attempt gravity measurements until after the seismic refraction experiments and winch trials had been completed, for fear that these would upset the gravimeter sufficiently to render any tie-in afterwards of dubious validity. We therefore steamed straight to the position of Sta. 5, and laid a dan buoy there at 4 p.m. on 9th December. The weather had been deteriorating and was by now too poor for us to be able to shoot the line, so we waited until the weather moderated next morning before laying the sonobuoys. The shooting was completed by 4 p.m. on the 10th Dec, but on returning to recover the buoys we found that the dan had broken loose from its mooring and three of the sonobuoys had broken loose from the dan. Since the sonobuoys had no radar reflectors or lights it was necessary to wait until the morning before recovering them. They were then easily located by sound-ranging and picked up by 10.30 a.m. We then commenced an airgun run along the line of Station 5, which lasted until 9 p.m. that night (11th Dec.); on completion of this we set off to the position of Sta. 6.

Since it was desirable to shoot refraction lines at night owing to the improved radio reception we had some time in hand on arrival at the station; this was spent on winch trials. The sonobuoys were laid at 6 p.m. on 12th, and the line was shot immediately, using 1600 lb. of Geophex. The weather was now deteriorating rapidly; we encountered force 8 winds and a large swell. On recovery of the sonobuoys we tried to steam N.W. to the other end of Sta. 6 in order to lay the buoys there and reverse the line; we made very slow progress because of the poor weather. At 7 p.m. on the 13th the P.D.R. fish was lost when the support cable broke in heavy seas. We were hove to until 5 a.m. on the 14th in force 8-9 winds; then, with the barometer falling rapidly and force 10 winds forecast we decided to run for shelter on the Brittany coast and set course towards Belle Ile.

We anchored in the lee of Belle Ile at 4 a.m. on the 15th December; we then discovered that the tiller flat where the airgun compressor was housed was flooded, completely immersing the electric motor. This rendered the compressor and hence the airgun unusable for the remainder of the trip. We remained at anchor until 3 a.m. on 18th December; during this period force 10 and 11 winds were forecast for the Biscay area. On this occasion, as on many others throughout the trip, we felt severely the lack of a functional weather chart recorder.

On the 18th the weather forecast was a little better, promising a diminution of wind strength to force 8, and we accordingly took advantage of this opportunity to head for Plymouth, where we arrived early in the morning of 20th December. We would like to thank Capt Perry, the officers and crew of the JOHN MURRAY for their help and active participation in the scientific work on the ship.

PROJECT REPORTS

1. Testing sonobuoys

The system used on this cruise was essentially a new one, combining internal recording on magnetic tape in the buoys and the well-tried radio telemetry system. The initial testing off Douarnenez Bay and Coruna gave us valuable experience in handling the equipment over the side and in adjusting the system gain settings; once the latter was done correctly both telemetry and internal recording systems worked well. Some trouble was experienced with the digital clocks in the buoys resetting themselves on launching and so getting out of step, a serious matter in that these clocks controlled the cycling of the tape recorder. It was not possible to solve these problems completely but the worst effects were avoided by arranging that the tape recorders, instead of being cycled according to a pattern of, say, being on for 4 minutes every 20 mins, would simply be switched on after a pre-set delay time and then run continuously. The fact that the clocks were out of step did not much matter so far as the interpretation of the refraction results was concerned, because the time difference between them and the ship's clock was constant during the firing schedule, and the effect could therefore be allowed for by comparing the radio and tape records of the same shot.

2. Seismic Refraction

Some details of the stations are given in the station list. Additional notes on the individual stations follow.

Station 3. It was decided to anchor a dan buoy and attach the four sonobuoys to it with nylon rope, attached at 200 ft. intervals. The use of a mooring seemed to make the hydrophones rather noisier than they would normally be. There were numerous misfires (v. supra).

Station 4. This was the reversal of Sta. 3. The same method of mooring was employed. It was decided to use more explosive than on Sta. 3, because the amount remaining after this station would be insufficient to shoot a further line and because the arrivals at extreme range had been rather weak on Sta. 3. Accordingly, some 300 lb. shots were fired; 200 lb. had been the maximum charge size of Sta. 3. These 300 lb. shots caused the circuit breakers on the main switchboard to jump off, causing an inconvenient loss of A.C. power for a few moments.

Station 5. Again the same method of mooring was used. This line was shot in deteriorating weather and at one stage the ship's speed was down to 6 knots. At this speed even a 50 lb. charge caused the circuit breakers to jump off.

Station 6. For this station the buoys were laid free-floating with a consequent marked decrease in hydrophone noise. The spacing between buoys was 5, 2 and 1 miles, measured in the direction of shooting.

3. Gravity

All the gravity information shown was obtained on the first leg of the trip. The gravimeter behaved satisfactorily (up to force 6) considering the heavy swell during much of the time.

4. Airgun, magnetometer, P.D.R.

The mechanical behaviour of the airgun was satisfactory except for one occasion on which the pin came out of the shackle fastening the tow-rope to the gun: fortunately it was recovered on the air-hose. The records obtained were satisfactory although that of the run along the line of Sta. 5 is rather noisy owing to the heavy swell.

Magnetometer records were obtained whenever possible on the cruise and P.D.R. records were taken until the P.D.R. fish was lost.

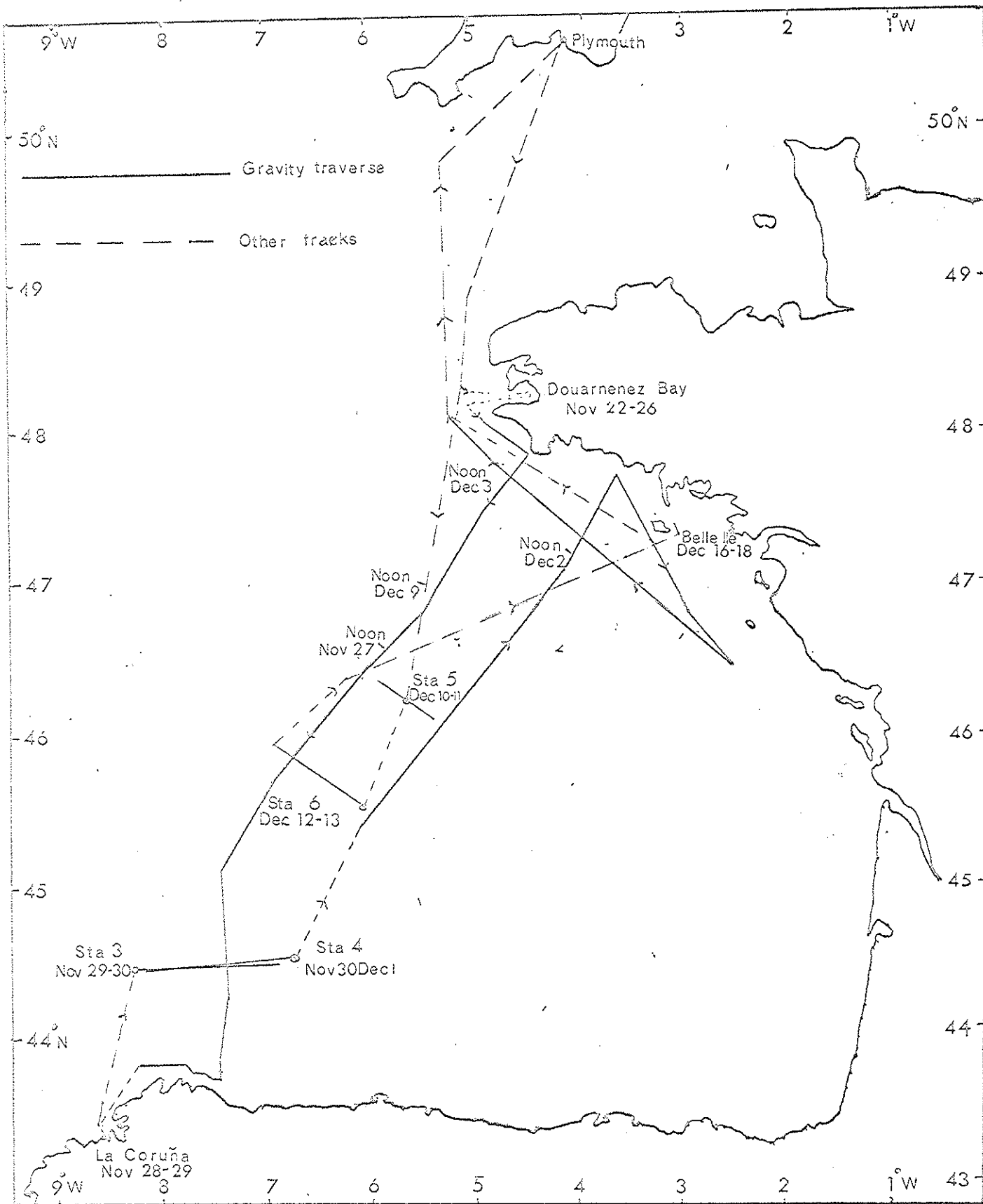
GENERAL REMARKS

1. The loss of the P.D.R. fish was unfortunate but unavoidable. If it is intended to fit another fish of similar type I would suggest that some arrangement should be made for recovering the fish in bad weather.
2. In my opinion it is essential that the JOHN MURRAY is fitted with a properly functioning weather chart recorder. This has been requested on numerous occasions, and because of the ship's limitations in bad weather, this should be given top priority.

STATION SUMMARY

Sta. No.	Date	Time GMT from to	Posn of sono-buoys		Length of line (nm)	Direction of line with respect to buoys	No. of shots					Total no. of shots used (lb)	Total wt. of explosive used (lb)	Comments
			Lat N	Long W			5 lb.	10 lb.	25 lb.	50 lb.	100 lb.			
1	25 Nov	1400 2000	48°07'	4°43'	12	270°	4	2				6	40	Testing buoys
2	28 Nov	1000 1500	43°30'	8°29'	7	315°	3	2				5	35	" "
3	29-30 Nov	2000 0300	44°30'	8°5'	56	89°	1		8	5	7	6	2355	
4	30 Nov-1 Dec	2100 0400	44°33'	6°38'	56	267°	5		8	5	3	3	2775	
5	10-11 Dec	0900 1100	46°15'	5°34'	a) 11	305°	6	4	6	1		17	250	Split profile
					b) 13	125°	4	4	4	3	15	310		
6	12-13 Dec	1800 0100	45°33'	5°55'	44	305°			6	5	2	5	1600	

TRACK CHART



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