I.O.S.

RRS CHARLES DARWIN
CRUISE 1/85
13 FEBRUARY – 4 MARCH 1985

PHYSICAL OCEANOGRAPHIC STUDIES IN THE NORTHEAST ATLANTIC OCEAN

CRUISE REPORT NO. 173
1985

NATURAL ENVIRONMENT RESEARCH COUNCIL
INSTITUTE OF OCEANOGRAPHIC SCIENCES

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INSTITUTE OF OCEANOGRAPHIC SCIENCES

WORMLEY

RRS CHARLES DARWIN

Cruise 1/85

13 February - 4 March 1985

Physical oceanographic studies in the NE Atlantic Ocean

Principal Scientist

W.J. Gould

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The work described in this report has, in part, been carried out under contract for the Department of the Environment. The results will be used in the formulation of Government policy but at this stage they do not necessarily represent that policy.

CONTENTS

SCIENTIFIC PERSONNEL

W J Gould	IOS (Wormley)	Principal Scientist
J.W. Cherriman	"	"
D Grohmann	"	"
N W Millard	"	"
J.A. Moorey	"	"
G.R.J. Phillips	"	"
K J Richards	"	"
P M Saunders	"	"
J. Smithers	"	"
Miss G Sutton	"	"
J C Swallow	"	"

R Griffiths	RVS	(Barry)
R Hopkin	"	"
C Jackson	"	"
P Mason	"	"
A Robinson	"	"
J Strangwood	"	"

Miss T M R de Araujo Portuguese Observer

SHIP'S OFFICERS

G Long	Master
D Avery	Chief Officer
J Seymour	2nd Officer
T Boult	3rd Officer
C Storrier	Chief Engineer
J Baker	Radio Officer

Acknowledgements

This, the first scientific cruise of the Charles Darwin proved to be extremely successful and it is a pleasure to acknowledge the willing and capable assistance of the ship's officers and crew in carrying out the work described in this report.

CRUISE OBJECTIVES

(in approximately chronological order)

1. Recovery of the ARIES inverted echo sounder in the SW approaches.
2. Deployment of a near surface current buoy at the same site.
3. Deployment of four SOFAR floats near 41° 30'N 14° 30'W.
4. Working a line of CTD stations across the east Azores Fracture Zone.
5. Recovery of three current meter moorings at GME (31° 30'N 25° 00'W).
6. Deployment of replacement moorings.
7. Deployment of deepsea tide gauge in GME area.
8. Working of CTD stations in GME area and around Madeira abyssal plain.

NARRATIVE

RRS Charles Darwin sailed from Falmouth on her first scientific cruise at 1400Z/13 February (044). This was one day later than scheduled due to the overrun of engine room repairs being carried out by the shipyard. Problems were encountered immediately when the changeover from electric to diesel drive was attempted. It was found that positive propeller pitch could not be selected. The cause of the malfunction was located and rectified and by 1730 course was set at 10kts towards the position of DB2 (48° 40'N 08° 57'W) in the southwest approaches.

The position was reached at 1230/14th (045) and the ARIES (Inverted Echo Sounder) mooring located acoustically. The mooring was recovered by 1330Z. The wind which at noon had been around 22kts had by then increased to 30kts and with a large sea running the Collar near surface current buoy was launched through the aft "A" frame. During this operation the buoy hull hit the ship's stern and the light became detached. The buoy was recovered (with difficulty) and advice taken from IOS as to whether the buoy should be deployed without its light and whether the ingress of sea water was likely to jeopardise the buoy's performance. The buoy was deployed by 1610 the light fitting having been replaced with a plastic cap araldited into place and protected with a plastic bag. The wind was by now gusting to 40kts and the master deemed that the weather was unfit to occupy the planned CTD station at the ARIES site.

The deck equipment was secured, the PES fish deployed and course set towards a position near 42° N 14° W for the launch of a small cluster of long range SOFAR floats. Continuing heavy weather overnight reduced passage speed to 5-6kts by 0400/15th (046) but thereafter conditions improved and the speed returned to 10kts in the forenoon. At noon the vessel hove to and the hydrophone array was lowered on the CTD winch to 1500m in order to listen to transmissions from SOFAR floats launched by MAFF in October 1984. The objective was to locate the floats in order that further floats could be launched near to the current position of the MAFF floats. Three floats were heard, only one identified as a MAFF, the others suspected as being WHOI and COB floats.

A CTD station (CTD 1) was then worked to a depth of 4000m in order to test the system. Several winch defects came to light on this station, the most serious of which were inoperative or erratic wire length readout and very poor level winding of the wire on the winch drum. The station was completed by 1915/15th (046) and passage resumed.

At noon on the 16th (047) the ship again stopped to listen to the MAFF floats and with the hydrophone at 1700m the three floats transmitting at 1330, 1430 and 1450 were heard. Their ranges showed that they were quite widely spread and passage was resumed towards 43°N 15°W to occupy another listening station in order to determine their positions and to monitor their temperature telemetry. This was completed between 0000 and 0350/17th (048) and the vessel then continued towards the float launch position at 41°36'N 14°36'W. The first float (No. 36) was launched at 1146 but after the first transmission of its fast cycle mode nothing more was heard. A second float (No. 32) was launched at 41°25'N 14°27'W at 1424 and its fast cycle pressure telemetry monitored until 1900 when it had reached 2250db and was nearing its equilibrium depth (the intended pressure level was 2000db).

By this time the wind had increased to 30kts and with a heavy sea running it was deemed imprudent to attempt to launch further floats in darkness. The vessel therefore remained hove to and at 0430/18th (049) the hydrophone was deployed and float 32 pressure monitored at 2170db. Float 36 was not heard. Three further floats (63, 67 and 66) were successfully launched between 0900 and 1400 and on completion of this work course was set towards the east Azores Fracture Zone. The vessel stopped between 1530 and 1820 to listen to the recently launched floats. All were confirmed to be operating successfully and thereafter course was resumed towards ALS mooring 380 (37°32'N 18°26'W).

The vessel stopped again between 0340 and 0715/19th (050) to listen to the floats launched on the previous day and again between 1600 and 2120 in order to take advantage of the great depth to tension the CTD wire to 5500m (in excess of the greatest expected CTD operating depth). This stop confirmed that the level winding of wire on the CTD winch was indeed ineffective at depths shallower than ca 3000m.

The ALS mooring site was reached at 0200/20th (051) but an extensive acoustic search up to 0600 failed to make contact with the mooring. A first CTD station (CTD 2) was worked between 0830 and 1300 and on completion the ship returned to the vicinity of ALS mooring 380 to attempt to operate the mooring release during daylight hours. Again no sign (visual or acoustic) of the mooring was found. The search was abandoned at 1730 and two further CTD stations worked overnight. On completion of these at 0500/21st (052) a site was located for a replacement ALS mooring. The mooring was deployed between 0830 and 1100/21st (052). The last CTD station of the section crossing the EAFZ (CTD5) was completed by 1730 and course set for the Great Meteor East (GME) site. Early on this passage two complete power failures on the ship caused temporary loss of navigation and echo sounding data.

Passage continued throughout the 22nd (053) and on arrival at 32°N 24°W float No. 33 was launched at 0115/23rd (054). The fast cycle pressure telemetry was monitored until 0200 when course was set towards mooring 365 which was reached at 0615. The hydrophone array was lowered and the temperature data telemetry on float 33 monitored. The mooring release was fired at 0719 and the mooring recovered by 0934. At the end of the mooring recovery the vessel remained stopped from 0940 to 1026 while an inspection was made of the propeller shaft thrust bearing. Mooring 366 position was reached at 1210 and the release fired. The acoustic records showed that the release pinger had become very weak when the release fired but there was sufficient evidence to confirm that the mooring had separated from its anchor. At the expected surfacing time a visual watch was kept but nothing seen. Position was adjusted to the DR position of the vessel at the time the release had been fired and shortly thereafter the buoy was sighted and recovered. The final mooring (367) was recovered uneventfully by 1700/23rd (054) and a CTD station (CTD 6) worked at the mooring position.

Between 2235/23rd and 0235/24th CTD 7 was worked at mooring 366 position and then from 0400 to 0740/24th (055) the hydrophone was deployed and the float signals including the pressure telemetry from float 33 received. The replacement for mooring 367 (new mooring 387) was deployed between 0940 and 1122 and between 1216 and 1348 mooring 388 as a replacement for 366. On completion of the second mooring deployment the ship remained lying to while engine room repairs were carried out. At 1513 the buoyancy from the mooring just laid was seen at the surface. The mooring was recovered by 1623 when it was discovered that one pyro release unit had pulled apart releasing the anchor. The pyro was replaced with a unit from a different production batch and the rig (389) redeployed between 1656 and 1828.

On completion of the mooring work CTD stations were occupied at the positions of mooring 365 (CTD 8) and at 32°N 24°W (CTD 9). On completion of these stations (at 1008/35th (056)) the remaining 8 floats of the array centred on 32°N 24°W were deployed between 1215 and 2358. The ship then ran to 31°30'N 24°21'W for CTD 10 and on its completion at 0830/26th (057) course was set towards the position of mooring 365 for the deployment of a full depth mooring. The mooring (390) was laid buoy first and its anchor released at 1412 but when the acoustic release was at about 2000m an abrupt decrease in its descent rate was noticed. This was not immediately interpreted as being due to a failure of the mooring but it became clear by 1600 that the subsurface buoy was not going to submerge despite the acoustic release being clear of the sea bed.

The opportunity was taken to deploy a deepsea tide gauge and on completion of this mooring 390 was recovered between 1700 and 1945. It was discovered that one of the retractor units had failed and released the anchor.

Shortage of time and the fact that three more anchors than originally intended had been used precluded the redeployment of the full depth mooring and a near bottom rig 391 was deployed between 2045 and 2238/26th (057). The ship then embarked on a wide ranging CTD survey interspersed with listening to float temperature (0000-0700/27th (058)) and pressure (0000-0700/28th (059)) telemetry. The CTD stations which were reoccupations of stations from previous cruises continued throught Feb 28th and March 1st and 2nd at 0833/3rd (062) SOFAR float No. 1 was launched west of Madeira and the final CTD station (No. 19) worked. The PES fish was then recovered and course set for Madeira.

The vessel entered Funchal at 0900/4th (063).

INDIVIDUAL PROJECT REPORTS

Moorings (Gould, Cherriman, Phillips, Grohman)

Several problems were encountered on the cruise which resulted in the mooring work proving more difficult than might have been expected. Moorings were recovered and deployed from the after deck using the IOS selfcontained double barrelled winch. The winch and reeler were fitted to new bed plates designed to pick up on the 1m centre bolt down points on the Charles Darwin's working deck. This system proved very easy to use and the winch was fitted very quickly. It was decided that the main A frame height would be too great to enable mooring work to be carried out safely in rough weather and a 5 ton block was therefore hung at about half A frame height and guyed to the sides of the A frame. This provided sufficient height and a good line lead to the D-B winch.

Comments on the mooring operations in approximately chronological order follow.

(1) Recovery of ARIES (inverted echo sounder). Carried out without difficulty in 20-25kt winds. Vessel maneuvered alongside ARIES unit which was then separated and lifted inboard by the midships crane. The remaining subsurface mooring was then passed aft and recovered through the aft A frame. The ARIES recording unit was still working on recovery but the magnetic tape had been exhausted.

(2) Deployment of COLLAR near surface current buoy. Carried out in 30-35kt winds and heavy seas. The mooring was deployed buoy-first and on the initial attempt the surface buoy struck the stern of the ship and the light became dislodged. The buoy was recovered and repaired minus the light and redeployed. With hindsight it would appear to have been better to deploy the surface buoy from midships using the crane and the subsurface buoy and remainder of the mooring in the normal fashion from the aft A frame.

(3) Interrogation and attempted recovery of ALS mooring 380. Although it had not been intended to service the ALS moorings on this cruise the proximity of ALS 380 to a line of CTD stations across the east Azores Fracture Zone made it worthwhile to interrogate the mooring. As related in the narrative contact with the mooring's acoustic release could not be made and a subsequent attempt to release the mooring from its anchor did

not produce any result. It must be assumed that either (a) the acoustic release is totally imoperative or (b) that the mooring line has broken below the release and the mooring drifted away or (c) that the release has fired or failed and the mooring drifted away. In view of subsequent experiences on this cruise with pyrolease units it seems possible that a pyro unit has failed and released the mooring from its anchor.

(4) Recovery of near bottom moorings 365, 366 and 367. These were moorings supported by glass ball buoyancy and covering the bottom 1000m of the water column with instruments nominally 10, 100 and 1000m above the sea bed. 365 and 367 were recovered without difficulty. Mooring 366 release fired but immediately thereafter the release pinger failed. The mooring was located visually at the surface and recovered. The cause of the pinger failure has not yet been identified. All mooring hardware was in excellent condition and all the current meters were still operating. Their tapes were translated at sea and a preliminary inspection of the data carried out using a BBC microcomputer.

(5) Redeployment of the moorings in (4) above. The first of these (367 replacement) was carried out successfully and uneventfully. The second (366 replacement) was seen to reach the sea bed successfully but some 2 hours later was sighted on the surface. On recovery it was found that one pyro unit had pulled apart and released the anchor. This problem had been experienced before but it was thought to have been cured by regluing the pyros and then load testing them at atmospheric pressure and room temperature. The problem is thought to be present in a single production batch of pyros but henceforth the units are to be glued and threaded. The replacement for mooring 365 was planned to be a full depth mooring carrying a total of seven current meters (the shallowest to be 200m below the surface). The mooring was deployed uneventfully buoy first but with the acoustic release at only 2000m (approximately) a sudden decrease in anchor descent rate was noticed. The cause of this was not immediately identified but when after 2 hours the anchor had still apparently not reached the sea bed and the subsurface buoy not submerged it was clear that the anchor had become detached. The mooring was recovered and it was discovered that one retractor unit (retractors had been used in place of pyros) had leaked and released the anchor. The leak was found to have

been caused by a speck of dirt on an "O" ring. Lack of time and shortage of anchors precluded the redeployment of the full depth mooring and a replacement near bottom mooring was successfully deployed.

(6) A MKIV deep sea tide gauge was deployed close to the site of mooring 367. It is planned for recovery in early spring 1986 and is the deepest deployment so far attempted.

CTD Stations (Saunders, Smithers, Moorey)

Nineteen CTD stations were worked, all from the midships winch and all utilising the new CTD/Multisampler frame. The new frame maintains the side-by-side configuration favoured by the IOS physicists and provides room for a near bottom echo sounder and for the addition of a 10kHz acoustic release for test purposes (mounted vertically) as well as a 1m path transmissometer (mounted horizontally). In addition the frame contains a junction box which allows the main cable from the winch to be disconnected at will and connected to another instrument, e.g. the hydrophone used for listening to SOFAR floats. The frame and instruments weigh approximately 200kg in air but the considerable height of the A frame, its unobstructed lift and considerable outboard reach ensured ease of handling in the roughest weather encountered on the cruise.

Except for the first (test) station lowerings were made to within 10m of the sea bed utilising the near bottom echo sounder. A field telephone installed between the echosounder MUFAX in the main lab and the winch driver's position provided a reliable communications link enabling the watch leader to control the CTD lowering and handling. On station 13 hampered by quite heavy rolling and a momentary telephone failure the frame was set down on the sea bed: it toppled over and the bridle fouled the transmissometer. On recovery the aluminium bar to which the transmissometer was bolted was found to be bent but the transmissometer appears to have been unharmed.

At the start of the cruise the multisampler was loaded with six bottles with thermometer frames and six without but on recovery the lanyards were found to be tangled. Subsequently four bottles with frames and eight without were used quite successfully. On station 15 the multisampler behaviour was erratic and on recovery an electronics board in the sea unit was replaced and other servicing carried out.

Throughout, the CTD operated flawlessley (see Table 2). The conductivity, temperature and oxygen sensors appeared stable but our ability to examine the data was hampered by the very limited computing power available. Raw data were logged on the Digidata deck (for replay ashore) whilst a real time display was provided by a BBC microcomputer. This inexpensive system worked very well.

Oxygen and salinity samples for calibration purposes were obtained on the majority of stations. Salinities were determined by use of a Guildline Autosal salinometer based in the ship's constant temperature laboratory. The use of the constant temperature lab resulted in some of the best salinity values yet determined by IOS. Oxygens were determined by Winkler titrations.

WATER BOTTLE SAMPLING AND REVERSING THERMOMETERS (Moorey)

When using the 12 bottle rosette multisampler with six thermometer frames we again experienced trouble with adjacent frames catching on one another. It is possible that the frames swing about continuously when the CTD is being hauled and that they occasionally swing beyond the horizontal towards the righted position but do not stay in the "greater than 90°" position long enough to drain. However if they jam in this position against another frame then they do in fact drain and the temperature reading is lost. Changing to a 12 bottle, 4 frame configuration (where frames can never touch each other) gave us almost 100% success in frame reversals.

The wet laboratory is ideal for sampling and thermometer reading. On other ships thermometers are usually read leaning across a bench, on the Darwin one can stand in closer, also the light is good enough to read without the usual torch.

The constant temperature laboratory is very accessible from the wet lab facilitating transfer of samples. The salinometer and oxygen filtration unit were installed in the CT lab which was set to 19°C and the salinometer water bath to 21°C. Siting of the salinometers in the CT lab resulted in the best agreement of duplicate samples that we have ever achieved. One set of samples was measured one day with one operator and the duplicates measured another day with another operator after restandardising. Duplicates usually agreed to within ± 0.001 s.u. However agreement between duplicate oxygen samples is not as good as we could wish.

SOFAR FLOATS (Millard, Gould, Swallow)

The 15 SOFAR floats were shipped in a 20' container with removable canvas top. This was stowed on the main working deck where it could be plumbed by either the midships or after crane. Two further prototype floats were shipped in the 20' laboratory container which also contained the SOFAR float shipboard receiver and ALS stations. This was stowed in the inboard upper deck container position.

Floats were monitored prior to launch via the Serial ASCII Interface Loop (SAIL) and clock drift checked against time information from the GOES satellite. Monitoring of floats at and after launch was via an ALS hydrophone lowered on the midships conducting cable and the signals being monitored and displayed by a shipboard correlator and pen recorder.

The first task was the attempted location of floats deployed on the Iberian Abyssal Plain by the MAFF Fisheries laboratory Lowestoft in Sept/Oct 1984. Float signals were received at several listening sites (data on float signals received are given in Tables 4 to 14) but revealed that the initial cluster of floats was probably well dispersed and in consequence the new batch of floats were launched at sites close to the Sept/Oct launch site. Details of float launch positions, transmission times and performance are given in Table 3. Float ballast weights were made up from lengths of preweighed circular section mild steel bar wrapped in PVC tape and held to the float stainless steel banding with plastic cable ties and PVC tape.

The floats were launched from their galvanised steel shipping and launching cradles by bolting on a set of hydraulically actuated jaws. The floats were lowered into the water amidships and not released from the cradle until one complete transmission had been heard in the water. Of the floats launched at the MAFF and at the IOS sites (the latter near 32°N 24°W) a total of four failed to complete their fast cycle telemetry shortly after release from the launch cradle. The cause of this failure is thought to be neither external wires becoming detached nor leakage of any of the float electronics or battery spheres. Its likely cause is still under investigation.

Several hours were spent at a variety of positions listening to transmissions from floats launched on this cruise or floats launched previously by MAFF in the Iberian basin, WHOI/URI in the Canary/Madeira basin or COB floats launched west of the mid Atlantic ridge. The details of signal arrival times and telemetry time delays are detailed for each position in Tables 4 to 14. Poor geometry and unknown float clock errors precluded the accurate derivation of float positions but there were strong indications of a westsouthwesterly movement of the WHOI/URI floats launched near 32° N 24° W.

COMPUTING (Jackson, Robinson, Mason)

The new level A, B and C system was used. There were many teething problems. With the level A for the CTD there was a problem that we could not solve on board. With the level B we had to use a fall back technique. To fix that problem properly we would have destroyed logged data and been for some considerable period without logging at all. The base was asked to fix it on shore for the next cruise. Other problems were fixed as they occurred.

Gyro, em-logs, satellite fixes an depths were logged.

1. Level A

Gyro and satnav level A's sampled without fail. The em-log level A ran OK for several days and then the test light came on and it reset itself every 10 seconds. We tried powering off, manual resetting and stopping and starting the sampling through the console monitor. These had no effect. After 15 minutes it cured itself. Next day the same thing happened. We moved the eproms and the analogue board to the spare level A and since then there has been no further occurrences noticed.

The 8086 based CTD level A took up most of the software effort for the cruise. We did not discover the real cause of the problem until the evening of the last Friday of the cruise. Then it was too late to contact the base. Three CTD dips were logged but the data was incomplete because the input board will not pass certain bytes to its buffer.

2. Level B

This logged data throughout the cruise. After the first tape had been filled we were unable to use the magtape any more. The level B would not accept a new tape until the old one had been properly ended, but the instruction TAPE END caused the machine to crash. We could not reset it without resetting the FIFO pointers and overwriting data on the Winchester disc. As a fall back we logged only to FIFO but passed the data to the level C without parsing where it was put to tape as a backup.

3. Level C

Depth entry - modifications were required. Users managed to lock files, destroy the form, enter wrong data and lock the keyboard. Instructions are now displayed permanently on the screen. When the parser and its resultant tasks were running response for depth entry was very slow.

Tektronix plotting - the problems were cured by reducing the transmission speed from 9600 baud to 4800.

Parser - we ran the parser to read messages from a file not from the Cambridge ring. About 10 messages a second are parsed.

Navigation - The suite was modified to create an intermediate file holding reduced relative navigation. This permits re-processing of navigation if logs and/or gyro are offset or re-claibrated. Autodr and autoupdate work but generate many defunct processes. Eventually the process table becomes full and we have to crash the system. Resetting the system after a crash is not a trivial task.

Level A CTD development - this was carried out through the cruise and required sending high speed test data from level C to the level A. This could not be done when the parser etc. was running because the test data was transmitted too slowly. So for much of the time the parser was shut off and by the end of the cruise the processing was several days behind.

Level C utilities - some useful programs were written by the engineer to give information about the state of the RVS data file system.

4. Hardware

The vertical deflection circuite of the Melodata colour terminal failed.

The Kinemetrics Satellite Synchronised Clock does not work.

TABLE 1

Moorings

Date	Time GMT	Lat N		Long W		Water Depth	Mooring type and number
14.II.85	1300-1330	48°	44'5N	08°	55'9	166	384 ARIES recovery
14.II.85	1547-1610	DB2	305° x 1.58nm			150	385 Collar buoy deployment
21.II.85	0835-1058	37°	17'9N	18°	39'2	3735	386 Deploy ALS 15
23.II.85	0719-0938	31°	30'4N	24°	45'0	5375	365 Recovery
23.II.85	1212-1450	31°	30'9	25°	02'5	5398	366 Recovery
23.II.85	1533-1730	31°	29'8	25°	09'9	4999	367 Recovery
24.II.85	0942-1119	31°	29'5	25°	09'0	4989	387 Deployment
24.II.85	1216-1348	31°	30'9	25°	02'6	5433	388 Deployment
24.II.85	1548-1623	31°	30'9	25°	02'6	5433	388 Recovery
24.II.85	1655-1928	31°	30'6	25°	03'0	5433	389 Deployment
26.II.85	1045-1412	31°	30'3	24°	45'5	5438	390 Deployment
26.II.85	1700-1945	31°	30'3	24°	45'5	5438	390 Recovery
26.II.85	2045-2238	31°	29'9	24°	44'8	5438	391 Deployment

TABLE 2

CTD Station List

Station No.	Time Down	Day of Year 1985	Lat. N	Long. W	Water Depth,m	Closest Bottom Approach,m	Comments
1	1722	046	46 13.0	10 48.8	4801	760	Test
2	1020	051	37 38.1	18 52.9	5280	15	
3	2052	051	37 27.9	18 50.4	4525*	10	
4	0231	052	37 12.6	18 48.5	4485	12	
5	1514	052	36 58.5	18 53.1	4852	7	
6	1918	054	31 30.1	25 09.7	5056	12	GME: at mooring 367
7	0020	055	31 30.6	25 02.8	5438	8	At mooring 366
8	2239	055	31 29.0	24 44.7	5440	12	At mooring 365
9	0752	056	31 58.7	23 59.7	5438	10	SOFAR float array
10	0611	057	31 29.4	24 20.8	5444	10	Repeat of Stn. 10804
11	1518	058	31 33.4	26 07.4	5199	8	
12	2212	058	31 46.6	26 36.9	5393	8	
13	1143	059	31 56.0	26 59.8	5202	0	Damage to frame sustained
14	1635	059	32 00.0	27 10.8	4211*	14	Flank of Cruiser seamount
15	0812	060	32 59.3	25 15.6	5375	16	Repeat of Stn. 10803 multi-sampler malfunction
16	2220	060	33 00.3	23 29.2	5424	11	Repeat of Stn. 10809
17	1129	061	31 40.8	22 34.8	5216	8	Repeat of Stn. 10807
18	0011	062	32 15.3	21 14.1	5051	12	Repeat of Stn. 10850
19	1024	062	32 20.3	20 15.3	4724	9	Repeat of Stn. 10835

* Above irregular terrain; estimated from CTD and near bottom echo-sounder.

(Day 046 is 15.II.85)

TABLE 3

Float #	Time/Day Launch	Position N W	MPTZ	DLTA (hours)	Z_0(db)	T_0 °C	P_0dbar	Odd/Even	Time Error ± ms	MAFF/IOS	Actual Depth	Remarks
01	0833 062	32° 19.6 20° 15.8	0010	24	3000	N/A	-	0		I		Old float Valdes P/T board
23	2016 056	31° 48.5 24° 00.1	0430	12	3000	2.00	2500	E	+19	I		Delay between fast cycle correlations on deck in excess of 7 mins. 1st to 2nd correlation period in water 1 min 43 secs. 2nd to 3rd - 2 mins 4 sec. 3rd to 4th - 3 mins 11 secs. No more heard. not heard on subsequent listening stations.
28	1227 056	32° 10.5 23° 47.1	0050	12	3000	2.00	2500	E	-25	I		
29	1443 057	31° 30.4 24° 46.2	0010	12	3000	2.00	2500	E	0	I		Correct time lost, reset before launch. Fast cycle appeared normal. 5th correlation very weak after which no more heard. Not heard on subsequent listening stations.
30	1358 056	32° 11.1 24° 00.1	0410	12	3000	2.00	2500	E	+41	I		
32	1424 048	41° 24.9 14° 27.5	0550	12	2500	0.0	1800	E	+10	M	2170	Watched on fast cycle to 2230m in 4 hrs 08mins. Correct time lost, reset before launch.
33	0115 054	32° 00.3 24° 00.0	0650	12	3000	2.00	2500	E	+43	I		

TABLE 3 (continued)

Float #	Time/Day Launch	Position	MPTZ	DLTA (hours)	Z_0(db)	T_0 °C	P_0dbar	Odd/ Even	Time Error ± ms	MAFF/ IOS	Actual Depth	Remarks
34	1658 056	31° 59.5 24° 13.5	0330	12	3000	2.00	2500	E	-41	I		
35	1532 056	32° 11.0 24° 12.8	0350	12	3000	2.00	2500	E	-9	I		
36	1145 048	41° 35.7 14° 35.5	0650	12	2500	0.0	1800	E	+10	M		Produced 1 fast cycle correlation after which no more were heard. Not heard on subsequent listening stations.
62	1842 056	31° 48.9 24° 13.0	0310	12	3000	2.00	2500	E	-60	I		
63	0858 049	41° 20.2 14° 42.2	0420	12	2500	0	1800	E	-67	M		
64	2154 056	31° 48.6 23° 47.0	0450	12	3000	2.00	2500	E	-150	I		1st to 2nd correlation period 7 mins 17 sec. 2nd to 3rd correlation period 3 mins 04 sec. No more heard. Not heard on subsequent listening stations
65	2334 056	31° 54.8 23° 46.4	0510	12	3000	2.00	E	0	0	I		Correct time lost, reset before launch
66	1349 049	41° 19.9 14° 12.2	0530	12	2500	0	1800	E	0	M		Correct time lost, reset before launch.
67	1145 049	41° 11.0 14° 27.1	0440	12	2500	0	1800	E	+1	M		

MPTZ - Main pulse transmit time (GMT)
DLTA - Float transmit time interval
Z_0 - Intended float pressure
T_0 - Temperature for minimum time delay
P_0 - Pressure for minimum time delay
O/E - Temperature telemetered on odd/even Julian day.

TABLE 4

Date 15.II.85 From 1209 To 1535

Julian Day 6102 Lat 46° 14'9N Long 10° 51'7W

Hydrophone depth 1500m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
13 16 46	-	W142?/5	E	13 00 00	16 46	-	2C correlation height
13 38 36)		M25/7	E	13 30 00	8 36	-	) Both weak correlations
13 39 30)					9 30	-	)

TABLE 5

Date 16.II.85 From 1253 To 1532

Julian Day 6103 Lat 43° 29'4N Long 13° 03'5W

Hydrophone depth 1500m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
13 13 17)	-	W142?/5	E	13 00 00	13 17	-	
13 13 52)	-				13 52		
13 34 42	-	M25/7	E	13 30 00	4 42	-	
13 44 24	-	? /7					
14 33 35	-	M24/7	E	14 30 00	3 35	-	
14 54 29	-	M22/7	E	14 50 00	4 29	-	

TABLE 6

Date 17.II.85 From 0022 To 0350

Julian Day 6104 Lat 42° 58'ON Long 15° 07'OW

Hydrophone depth 1700m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
01 32 58	01 38 16	M25/7	E	01 30 00	2 58	5 18	3.9° C
02 33 17	02 38 29	M24/7	E	02 30 00	3 17	5 12	3.8° C
02 54 34	02 59 46	M22/7	E	02 50 00	4 34	5 12	3.8° C

TABLE 7

Date 18.II.85 From 0504 To 0748

Julian Day 6105 Lat 41° 26'8N Long 14° 42'5W

Hydrophone depth 1700m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
05 51 37	05 56 41	M32/7	E	05 50 00	1 37	5 04	2165db
06 32 56	06 38 21	M26/7	E	06 30 00	2 56	5 25	2210db

TABLE 8

Date 18.II.85 From 1531 To 1820

Julian Day 6105 Lat 41° 09'1N Long 14° 24'3W

Hydrophone depth 1700m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
16 21 45	-	M63/7	E	16 20 00	1 45	-	
16 41 26	-	M67/7	E	16 40 00	1 26	-	
17 31 42	-	M66/7	E	17 30 00	1 42	-	
17 51 42	-	M32/7	E	17 50 00	1 42	-	

TABLE 9

Date 19.II.85 From 0338 To 0715

Julian Day 6106 Lat 39° 49'1N Long 16° 04'2W

Hydrophone depth 1700m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
04 23 39	04 30 10	M63/7	E	04 20 00	3 39	6 31	5.4° C
04 43 39	04 47 18	M67/7	E	04 40 00	3 39	3 39	2.1° C
05 33 57	05 40 28	M66/7	E	05 30 00	3 57	6 31	5.4° C
05 53 53	-	M32/7	E	05 50 00	3 53	-	Telemetry not seen
06 33 36	06 38 47	M26/7	E	06 30 00	3 36	5 11	3.8° C

TABLE 10

Date 23.II.85 From 0100 To 0218

Julian Day 6110 Lat 31° 59'9N Long 24° 00'2W

Hydrophone depth 100 - 400m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
01 29 53	01 33 84	W128/5	0	01 20 00	9 53	4 01	
01 44 25	01 46 12	W139/5	E	01 40 25	4 25	1 47	
01 51 59	01 56 22	?	?			4 23	Uncertain identity

TABLE 11

Date 23.II.85 From 0615 To 0716

Julian Day 6110 Lat 31° 31'1N Long 24° 45'3W

Hydrophone depth 700m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
06 23 04	06 29 04	W131/5	E	06 20 00	3 04	6 00	
06 43 02	06 47 42	W138/5	0	06 40 00	3 02	4 40	
06 52 23	06 58 06	I33/7	E	06 50 00	2 23	5 43	64° C

TABLE 12

Date 24.II.85 From 0406 To 0740

Julian Day 6111 Lat 31° 30'5 Long 24° 46'7

Hydrophone depth 1500m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
04 29 14	04 37 15	W126/5	0	04 20 00	9 14	8 01	
04 41 55	04 51 56	W124/5	0	04 40 00	1 55	10 01	
05 04 27	05 06 12	W120/5	E	05 00 00	4 27	1 45	
05 23 35	05 30 30	W121/5	0	05 20 00	3 35	6 55	
05 44 44	05 48 22	W123/5	E	05 40 00	4 44	3 38	
06 01 53	06 11 53	W135/5	0	06 00 00	1 53	10 00	
06 23 04	06 27 21	W131/5	E	06 20 00	3 04	4 17	
06 49 39	06 57 04	W138/5	0	06 40 00	9 39	7 25	
06 52 22	06 59 40	I33/7	E	06 50 00	2 22	7 18	3130db
07 09 23	07 11 12	W132/5	E	07 00 00	9 23	1 49	
07 25 07	07 26 47	W141/5	0	07 20 00	5 07	1 40	

TABLE 13

Date 27.II.85 From 0000 To 0720

Julian Day 6114 Lat 31° 27'5N Long 24° 52'0W

Hydrophone depth 1500m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
00 03 18	00 08 11	W127/5	0	00 00 00	3 18	4 53	
00 23 31	00 30 17	W119/5	E	00 20 00	3 31	6 46	
00 42 53	00 47 37	W133/5	0	00 40 00	2 53	4 44	
00 52 47	01 02 15	I28.7	E	00 50 00	2 47	9 28	11.0°C
01 02 50	01 12 50	W142/5	E	01 00 00	2 50	10 00	
01 25 04	01 33 37	W128/5	0	01 20 00	5 04	8 33	
01 45 31	01 52 56	W139/5	E	01 40 00	5 31	7 25	
01 46 54	01 52 11	C03/7	?	01		5 17	
02 03 10	02 07 54	W137/5	0	02 00 00	3 10	4 44	
02 06 22	02 14 09	C04/7				7 47	
02 41 01	02 44 59	W130/5	0	02 40 00	1 01	3 58	
02 49 49	02 51 37	? /7				1 48	
03 12 12	03 18 31	I62/7	E	03 10 00	2 12	6 19	7.12°C
03 32 17	03 39 03	I34/7	E	03 30 00	2 17	6 46	7.72°C
03 42 45	03 52 46	W125/5	E	03 40 00	2 45	10 01	
03 52 30	03 54 59	I35/7	E	03 50 00	2 30	2 29	2.62°C
04 03 48	04 08 33	W129/5	0	04 00 00	3 48	4 45	
04 12 39	04 15 06	I30/7	E	04 10 00	2 39	2 27	2.62°C
04 29 19	04 30 45	W126/5	0	04 20 00	9 19	1 26	
04 41 43	04 44 56	W124/5	0	04 40 00	1 43	3 13	
05 04 24	05 14 25	W120/5	E	05 00 00	4 24	10 01	
05 12 43	05 15 11	I65/7	E	05 10 00	2 43	2 28	2.62°C
05 23 26	05 27 14	W121/5	0	05 20 00	3 26	3 48	
05 44 37	05 51 35	W123/5	E	05 40 00	4 37	6 58	
06 01 56	06 04 43	W135/5	0	06 00 00	1 56	2 47	
06 23 00	06 29 11	W131/5	E	06 20 00	3 00	6 11	
06 49 45	06 56 50	W138/5	0	06 40 00	9 45	7 05	
06 52 24	06 54 57	I33/7	E	06 50 00	2 24	2 33	2.62°C

TABLE 14

Date 28.II.85 From 0020 To 0700

Julian Day 6115 Lat 31° 48'5N Long 26° 36'0W

Hydrophone depth 1600m

First Arrival	Telemetry	Float ID /Channel	Odd/ Even	Transmit Time	Travel Time	Telemetry Delay	Comments
00 21 37	00 25 04	W119/5	E	00 20 00	1 37	3 27	
00 41 17	00 47 17	W123/5	0	00 40 00	1 17	6 00	
00 54 18	00 56 20	I28/7	E	00 50 00	4 18	2 02	2500db
01 01 57	01 03 23	W142/5	E	01 00 00	1 57	1 26	
01 27 02	01 34 01	W128/5	0	01 20 00	7 02	6 59	
01 42 39	01 49 54	C02/03/7	?	?	?	7 15	
01 46 26	01 51 05	W139/5	E	01 40 00	6 26	3 39	
02 01 59	02 09 14	W137/5	0	02 00 00	1 59	7 15	
02 14 58	02 17 53	?	?	?	?	2 55	
02 41 28	02 49 29	W130/5	0	02 40 00	1 28	8 01	
03 06 59	03 13 33	W143/5	0	03 00 00	6 59	6 34	
03 13 54	03 23 19	I62/7	E	03 10 00	3 54	9 25	3390db
03 41 39	03 46 29	W125/5	E	03 40 00	1 39	4 50	
03 52 19	03 59 47	I35/7	E	03 50 00	2 19	7 28	3155db
04 02 00	04 07 53	W129/5	0	04 00 00	2 00	5 53	
04 14 04	04 21 37	I30/7	E	04 10 00	4 04	7 33	3163db
04 40 59	04 50 59	W124/5	0	04 40 00	00 59	10 00	
05 02 39	05 04 05	W120/5	E	05 00 00	2 39	1 26	
05 15 43	05 22 36	I65/7	E	05 10 00	5 43	6 53	3090db
05 23 37	05 30 51	W121/5	0	05 20 00	3 37	7 14	
06 03 22	06 13 23	W135/5	0	06 00 00	3 22	10 01	
06 54 02	07 02 55	I33/7	E	06 50 00	4 02	8 53	3330db

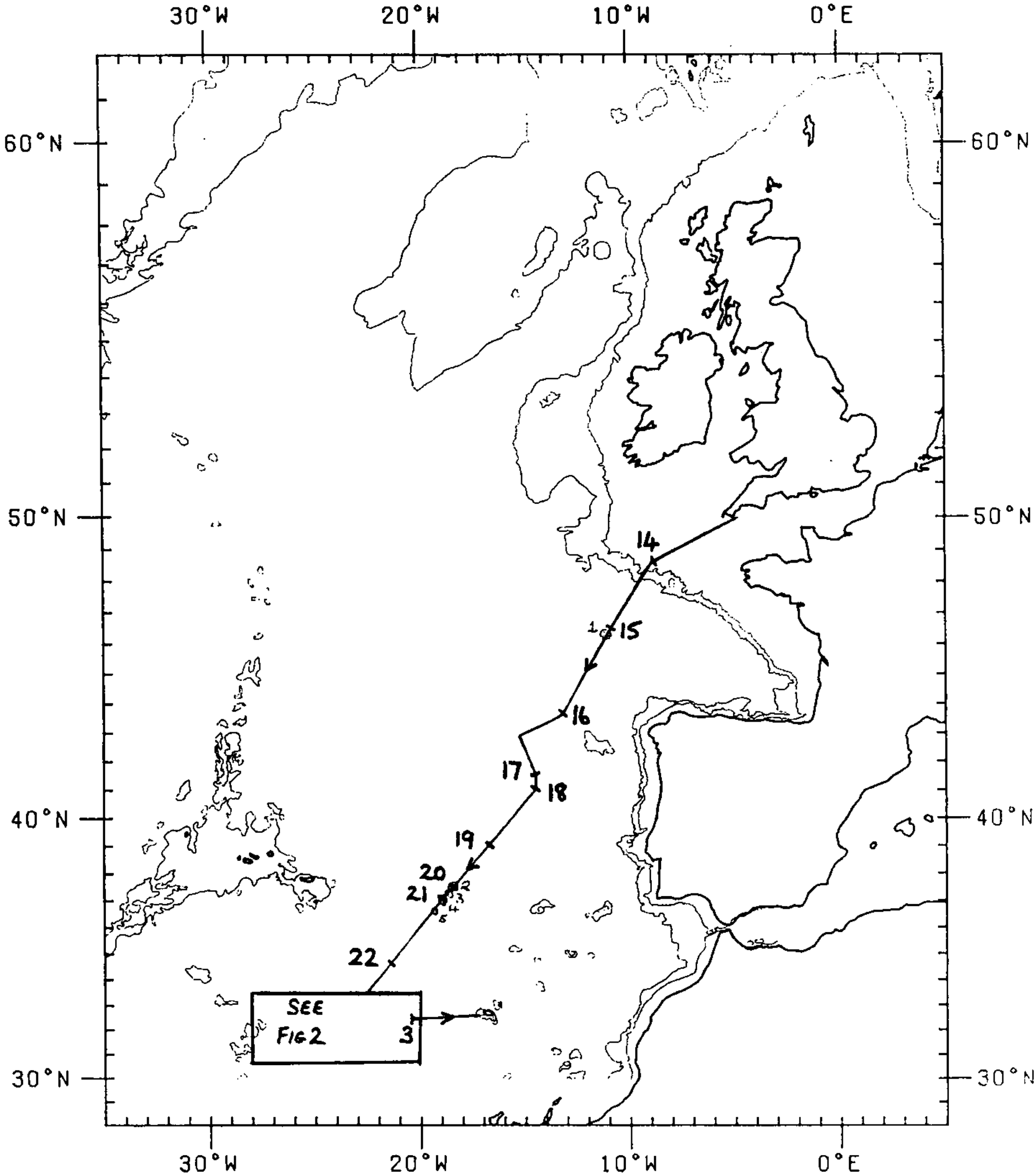

FIG 1

GENERAL TRACK CHART. NOON POSITIONS

FOR DAYS IN FEBRUARY/MARCH 1985

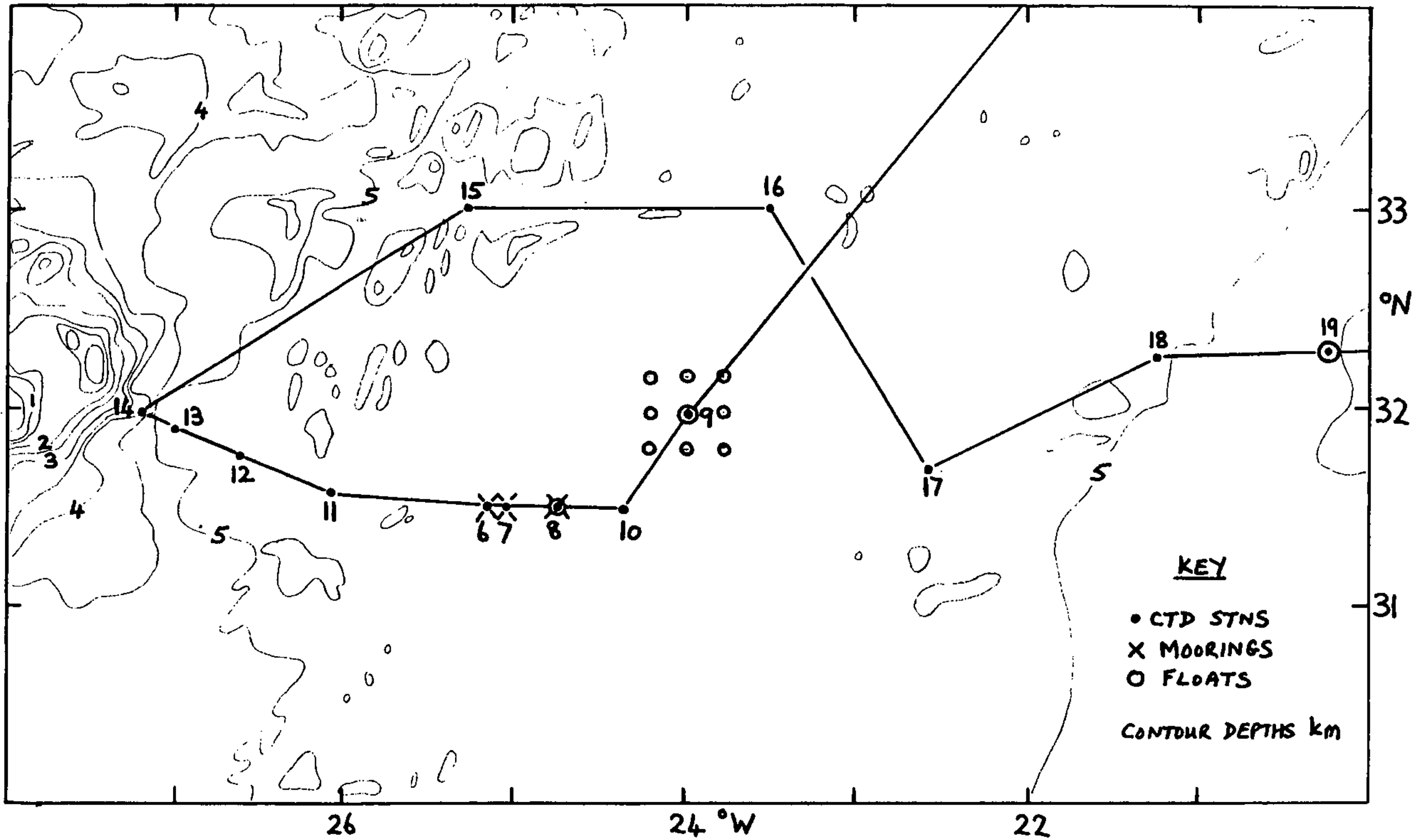
KEY
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Fig 2