P.O.L.

*RRS CHALLENGER*
CRUISE 125

# LEG A: ARDROSSAN TO ARDROSSAN

31 JANUARY 1996
-
12 FEBRUARY 1996

M J HOWARTH

LOIS SHELF EDGE STUDY

CRUISE REPORT NO. 22

1996

PROUDMAN
OCEANOGRAPHIC
LABORATORY

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POL CRUISE REPORT NUMBER 22

# RRS CHALLENGER 125

# LOIS SHELF EDGE STUDY

## Leg A: Ardrossan to Ardrossan

**Principal Scientist: M.J. Howarth**

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ABSTRACT

The cruise was the fifth of a sequence seven planned SES cruises at approximately 3 month intervals. Its main objectives were to service the SES mooring array, to deploy three 'cascade' moorings and to obtain CTDs across the shelf break along set lines.

The cruise started well with four days of good weather (one of which was spent steaming to the site) before degenerating into the expected pattern of one day's work followed by one or two days lost to bad weather. Of the potential on site time of 10 days, 5.5 days were spent working and 4.5 days were spent hove to or sheltering.

The moorings at S140 (ADCP / BPR), S400 (ADCP), N140 (BPR) and N1500 (sediment trap) were recovered and redeployed. Moorings were deployed at S140 (U shaped and instrumented toroid), S200 (STABLE), S300, S700 and N300. Marker buoys were recovered and redeployed or deployed at all these sites, except N1500. The three 'cascade' moorings were deployed.

47 CTDs were recorded, 43 to full depth and 4 for recording transmissometer calibration. The S and N lines were completed; the R and P lines were partially completed. On five of the casts water samples were obtained for POC analysis. Marine snow photographs were taken on 14 casts on the S and N lines. The warmest temperatures (about 10.5°C) and saltiest water (about 35.4) were in the vicinity of the 500 m contour, with sea surface temperature and salinity decreasing both to seaward and to shoreward. Up to the 500 m contour the water column was well mixed and horizontal density differences were small.

The vessel ADCP measured northward currents at all positions and times, with speeds generally between 0.25 and 0.5 m $s^{-1}$.



ACKNOWLEDGEMENTS

It is a pleasure to thank the master, officers and crew of RRS *Challenger* for their skill, willing assistance and cooperation. Without it, and the expertise and flexible support of the RVS technicians, the programme of work could not have been completed.



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CONTRACT

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The Library, Proudman Oceanographic Laboratory.

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**Notes**

1. Times are in GMT.
2. Data referred to in this report can be obtained via BODC.

## 1. OBJECTIVES

LOIS-Shelf Edge Study (SES) Objectives are:-

(a) to identify the time and space scales of ocean-shelf momentum transmission and to quantify the contributions to ocean-shelf water exchange by physical processes;

(b) to estimate fluxes of water, heat and certain dissolved and suspended constituents across a section of the shelf edge with special emphasis on net organic carbon export from, and nutrient import to, the shelf;

(c) to relate sediment properties and fluxes to the physical context;

(d) to quantify organic carbon cycling in shelf-edge sediments;

(e) to incorporate process understanding into models which will be tested by comparison with observations and provide a basis for estimation of fluxes integrated over time and the length of the shelf edge.

These SES objectives are being pursued by measurements at the shelf edge west of Scotland, and by the development of numerical models representing physical processes and microbiology. The overall plan for measurements includes an initial sea-bed survey, maintenance of moorings from spring 1995 to summer 1996, seasonal measurements of distributions, coring, tracking of drogued buoys and remote sensing. RRS *Challenger* cruise 125 is the fifth of a sequence of seven planned SES cruises at intervals ~ 3 months, for the previous cruise see Huthnance (1995).

Specific objectives for leg A of RRS *Challenger* cruise 125 were:-

1.1 Recoveries and redeployment of the mooring array (Figures 1, 5 - 20).

| | *Latitude N* | *Long. W* | *depth* | *Configuration (responsibility)* |
|---|---|---|---|---|
| "South" | 56°27.6′ | (9°39′) | 1500 | BPR (POL) |
| section | 56°27.6′ + 27.14′ | (9°9.5′) | 700 | pop-up (RVS) + marker (POL) |
| | 56°27.6′ | (9°5′) | 400 | ADCP (RVS) |
| | 56°27.6′ + 27.14′ | (9°4′) | 300 | pop-up (RVS) + marker (POL) |
| | 56°27.6′ | (9°2.7′) | 200 | STABLE + marker buoy (POL) |
| | 56°27.6′ + 27.14′ | 8°58′,57.5′ | (145) | 'U', instrumented toroid, marker(DML), ADCP / BPR(POL) |
| "North" | 56°42.6′ + 43.13′ | (9°24.5′) | 1500 | BPR (POL) + pop-up sediment trap (RVS) |
| section | 56°38.8′ + 39.3′ | (9°6.75′) | 700 | no redeployment |
| | 56°37.45′ + 38′ | (9°1.35′) | 300 | pop-up (RVS) + marker (POL) |
| | 56°37.2′ | (9°0.38′) | 200 | no redeployment |
| | 56°36.3′ + 35.9′ | (8°56.1′) | (138) | BPR + marker buoy (POL) |

After these mooring deployments searches and attempted recoveries, including dragging, will be made for 'lost' moorings. The highest priorities are :-

1) The BPRs deployed at S1500 on *Charles Darwin* 91 and at N1500 on *Charles Darwin* 93.

2) Two S200 moorings (deployed on *Charles Darwin* 93 and *Challenger* 121A) located acoustically at 56° 15′ N 9° 10.08′ W, with ranges of 1.9 and 2.5 km.

3) The S140 mooring deployed on *Charles Darwin* 93 located acoustically at the N140 site.

Sea bed photographs will be taken near the STABLE S200 site with a bed-hopping camera.

1.2 Deployment of three 'cascade' moorings at:-

| *Latitude N* | *Long. W* | *depth* | *Configuration (responsibility)* |
|---|---|---|---|
| 56° 36.54′ | 9° 0.91′ | 230 | CC1 (POL/UWB) |
| 56° 37.32′ | 9° 2.15′ | 360 | CC2 (POL/UWB) |
| 56° 42.95′ | 8° 59.45′ | 230 | CC3 (POL/UWB) |

1.3 CTD and water sampling at locations of moorings; also, as time permits, at designated depths (130/140, 170, 300, 500, 700, 850, 1000, 1150, 1300, 1400, 1500, 1600 m) on cross-slope sections N, P, R, S, W, plus depths 170, 500, 1000 m at designated latitudes L, M, T, U, W, near neap tides and near spring tides (Figure 1). The CTD will record conductivity, temperature, dissolved oxygen, transmittance, fluorescence, irradiance and will be fitted with a marine snow camera. Pictures with the marine snow camera will be taken on the upcast on CTDs on the S and N sections, stopping for 2 minutes about five times per cast. Throughout the cruise surface values of temperature, conductivity, transmittance, fluorescence, irradiance and PAR will be logged, as will the ship's position and the water depth. The ship's ADCP will measure the current profile in 8 m bins, averaged over 5 minutes.

1.4 Test in-line acoustic releases.

## 2. SUMMARY

The cruise started well with four days of good weather (one of which was spent steaming to the site) before degenerating into the expected pattern for the time of year of one day's work followed by one or two days lost to bad weather. Of the potential on site time of 10 days, 5.5 days were spent working and 4.5 days were spent hove to or sheltering.

2.1 The moorings at S140 (ADCP / BPR), S400 (ADCP), N140 (BPR) and N1500 (sediment trap) were recovered and redeployed. Moorings were deployed at S140 (U shaped and instrumented toroid), S200 (STABLE), S300, S700 and N300. Marker buoys were recovered and redeployed or deployed at all these sites, except N1500. The acoustic release on the S300 mooring, which had been deployed during *Challenger* 123 and was now missing its sub-surface buoy, did not respond to the release command. No acoustic contact could be made with the BPRs at S1500 (deployed on *Charles Darwin* 91) or at N1500 (deployed on *Charles Darwin* 93). The S200 mooring deployed on *Charles Darwin* 93 was located at 56° 14.75′ N 9° 8.48′ W. Two unsuccessful passes with a grapnel were made before bad weather interrupted dragging.

2.2 The three 'cascade' moorings were deployed.

2.3 47 CTDs were recorded, 43 to full depth and 4 for recording transmissometer calibration. The S and N lines were completed; the R and P lines were partially completed. On five of the casts water samples were obtained for POC analysis. Marine snow photographs were taken on 14 casts on the S and N lines.

2.4 Three acoustic in-line releases (Benthos, Oceano, Sonardyne) were tested whilst sheltering in the Sound of Jura. The site was not ideal; a site at the shelf break would have been much better but poor weather prevented this.

## 3. PERSONNEL

Scientists

| | | |
|---|---|---|
| M.J. | Howarth | POL |
| N.G.C | Ballard | POL |
| A.D. | Banaszek | POL |
| F. | Pérez-Castillo | UWB |
| R.N. | Cramer | BODC |
| I.A. | Ezzi | DML |
| A.P. | Geary | SOC |
| A.E. | Hammerstein | UWB |
| A.J. | Harrison | POL |
| J.D. | Humphery | POL |
| J. | Lawson | POL |
| G.W.J | Miller | RVS |
| R.O. | Pearce | RVS |
| P.G. | Taylor | RVS |

Ship's officers

| | | |
|---|---|---|
| M.A. | Harding | Master |
| R.J. | Chamberlain | Mate |
| J.T. | Morse | Second mate |
| J.C. | Holmes | Third mate |
| I.R. | Bennet | Chief engineer |
| S.F. | Dean | Second engineer |
| G.A. | Jones | Third engineer |
| W.D. | Lutey | Electrical engineer |
| M. | Trevaskis | C.P.O. (Deck) |

## 4. NARRATIVE

All times are in GMT. See Figure 1 for a schematic diagram of the mooring positions and the CTD lines; Figure 2 for the complete cruise track; Figure 3 for an enlargement of the cruise track in the SES area; Figure 4 for a map of the CTD positions. Work was split into day-time operations, initially concentrating on mooring work, and night-time operations, CTDs.

**31 January** RRS *Challenger* left Ardrossan at 08.00 and made a course for S200. During the morning logging of position, water depth, irradiance, PAR, surface temperature, conductivity, transmittance and fluorescence was started. The ship's ADCP was switched on.

**1 February** The first CTD profile, during which a recording transmissometer was calibrated, was recorded between 07.17 and 07.55, at S200. Since the CTD / hydro winch wire readout would not switch on, depths were controlled from the CTD readout. This fault was rectified before the next CTD profile. STABLE (S200) was deployed at 08.14, followed by the U shaped rig at S140 (09.09 - 09.43). (This mooring had been recovered at the end of the previous cruise, *Challenger* 124, on their way back to Ardrossan.) The S140 ADCP and ballast frame were recovered (10.23 - 10.55) and redeployed at 11.43, after changing over the instruments. During the changeover the second CTD was recorded to calibrate a recording transmissometer. The surface monitoring buoy, fitted with a transmissometer and a fluorometer was deployed between 13.00 and 13.17. Finally at S140 the 8' marker toroid was recovered (13.42 - 14.11), a new Argos beacon fitted and its mooring rope replaced, and redeployed (14.39 - 14.57). During these deployments the wind was blowing from the north-east, with a speed between 10 and 15 knots. Surface currents, as measured by the ship-mounted ADCP were consistently 0.3 - 0.4 m $s^{-1}$ towards the north.

The S300 site was visited next; the marker toroid was missing. The sub-surface buoy and top current meter of the S300 mooring deployed during *Challenger* 123 had been recovered on 21 January 1996 floating free at 61° 39′ N 8° 16′ W by the trawler *Vesturland*. If there had been

no further damage to the mooring there was sufficient back-up buoyancy for the recovery of the two remaining current meters. However, although the acoustic release responded to interrogation, giving consistent ranges, it did not acknowledge the release command or respond to the diagnostic command, which would have indicated whether it was upright, or switch on as a beacon. After an hour the site was left and the marker toroid at S200 was deployed 1 cable north of STABLE (17.04 - 17.20).

The night was devoted to CTDs along the S line from S140 to S1000 - 10 CTDs in all the first of which was to calibrate a recording transmissometer. The snow camera was operated on most of the CTDs. During the final CTD, which lasted from 04.45 to 05.50 and was at S1000, a recording transmissometer of the type to be deployed on the cascade moorings was successfully pressure tested. The CTD records were quite noisy, so during the next day the wire was reterminated at the probe end (there were a couple of kinks in it) and the slip rings were cleaned and rewired.

**2 February** Back at S300, the acoustics were again interrogated (08.00 - 08.30), with the same unhelpful response as the previous afternoon. The chances of recovering the remainder of this mooring are small and dragging will be necessary. A new pop-up mooring was deployed (09.19 - 09.45), followed by a marker toroid (10.41 - 10.52). Conditions were similar to yesterday's except that the wind speeds were slightly stronger (15 - 20 knots). The ADCP at S400 was recovered between 11.15 and 11.32.

The spar marker at N140 was recovered between 13.34 and 13.55 - it was low in the water because, it was discovered after the recovery, water had got into the light and battery compartment. The pressure recorder and ballast frame were recovered (14.22 - 14.46) and redeployed with a new instrument at 15.57. The marker buoy, fitted with a new light and with the rope replaced, was redeployed between 16.24 and 16.39.

During the night CTD profiles 13 - 17 were recorded at S1500, S1400, S1300 and S1150. An extra dip was carried out at S1400 to calibrate the cascade mooring transmissometers. There was a marked improvement in the quality of the CTD signal as a result of the day's efforts. At S1500 an unsuccessful half hour attempt was made to talk to the acoustics on the bottom pressure recorder deployed on *Charles Darwin* 91.

**3 February** The cascade moorings CC1, CC2 and CC3 were deployed at 08.46 - 09.01, 10.22 - 10.35 and 11.51 - 12.03. The sub-surface mooring at N300 was deployed at 14.52 - 15.21; due to a shortage of transmissometers the bottom current meter was not, as planned, fitted with one. Its associated spar marker was deployed at 16.03 - 16.36. Conditions were similar to the first two days. A notable feature, so far, has been the strong northward current, present everywhere and more or less uniform with depth, and usually about 0.3 m $s^{-1}$ strong (occasionally up to 0.5 m $s^{-1}$).
CTDs along the N line were started at N140 at 17.15. The last two recording transmissometers were calibrated on the first dip (18). The next profile (19), also at N140, was delayed until it was completely dark to ensure consistency of conditions for the marine snow camera. CTDs were carried out until CTD29 had been recorded at N1000, when the weather became too rough.

**4 February** *Challenger* was hove to in the SES region throughout the day in the face of a southerly gale.

**5 February** Since the gale had abated *Challenger* proceeded to N1500 and recovered the sediment trap mooring - it was released at 10.45, on the surface at 11.02 and all inboard by 12.12. The sediment traps had just finished their 22 week duty cycle - four sample jars were missing from the top trap and one from the bottom trap. The S700 mooring was deployed between 15.50 and 17.53, finishing after dark so it was not possible to see whether the sub-surface buoy sank correctly. The acoustics were checked and showed the rig was upright; the Argos beacon on the sub-surface buoy could not be detected - indicating the sub-surface was correctly below the water. The ADCP at S400 was redeployed at 19.58, reaching the sea bed at 20.04.

Since the CTD records had again become noisy, the slip rings had again been cleaned during the day. CTDs 30 - 32 were recorded between 21.04 and 22.50 at R140, R150, R200. During the deployment of the CTD at R300 the ship rolled in a confused swell and the CTD hit the side of the ship heavily. Both the CTD and the 'Tonefire' electronics in the rosette ceased to work. The CTD was disassembled and a loose wire found. The rosette was replaced with the spare. However by the time the CTD system was ready to be checked (05.00), the weather had deteriorated and was too rough for its deployment.

**6 February** *Challenger* hove to in northwest winds, force 7-8. As the weather improved and since it was feared that the improvement would be short-lived, it was decided to deploy the sediment trap rig at N1500 after nightfall. The release was wire tested successfully between 16.41 and 17.54 on site. The start of the deployment was delayed for half an hour whilst a problem with the safety stop on the starboard auxiliary winch was investigated. Since the problem could not be solved, the deployment went ahead using the port auxiliary winch only, although this entailed the sediment traps going on their side or upside down. The rig was deployed between 19.35 and 20.24, after which it took 14 minutes to reach the sea floor (20.38). A CTD (33) was recorded immediately afterwards and during it unsuccessful attempts were made to talk to the bottom pressure recorder there. During the night CTDs 34 - 39 were recorded at N1300 - N1150 (completing the line) and from R1000 - R300. With the completion of the N line the 'snow' camera was removed from the CTD frame.

**7 February** The marker toroid at S700 was deployed from 09.12 to 09.36, completing the high priority mooring work. Although there was a swell, the wind had fallen to 10 - 15 knots from the northwest. All the marker buoys and acoustic releases on the S line were checked. At 11.30 a course was set for 56° 15′ N 9° 10′ W, where the acoustics of two S200 moorings had previously been detected. On arrival, at 14.10, one of the acoustics responded and was switched to pinger mode (the mooring had been deployed on *Charles Darwin* cruise 93). The location of the mooring was determined to be 56° 14.75′ N 9° 8.48′ W. Dragging commenced at 15.43 (the sub-surface buoy had already been recovered adrift) with a giffard grapnel and another grapnel at the end of 600 m of wire. After two unsuccessful passes dragging was stopped at 17.30, since the weather had deteriorated rapidly in a manner which had not been forecast (35 - 45 knot northwesterly winds with snow). *Challenger* headed for the shelter of the Sound of Jura.

**8 February** In the Sound of Jura acoustic tests were conducted on a Benthos, a Sonardyne and an Oceano release between 10.30 and 17.30. Since southeasterly winds were forecast the ship steamed through the Sound of Islay (19.00 - 22.00), to the north side of Jura in the approaches to the Firth of Lorne.

**9 February** The whole day was spent sheltering from southeasterly gales - gusts up to 55 knots were observed by the ship.

**10 February** Since the winds had died down and since there looked to be a period when work might be carried out before northwesterly winds blew (the depression was slow moving, centred near the ship and filling) it was decided to steam to the SES area. CTDs 40 - 47 were recorded throughout the night from, 19.30 - 04.46, at CC3 and along the P line from P140 - P1300.

**11 February** R1300 was reached at 07.00, but by then conditions were too rough to deploy the CTD, with a strong northwesterly winds. It was still too rough at S140 (09.00), so that unfortunately no POC samples were obtained at this site. After the ship took a heavy roll at 10.30 scientific work was ended and a course set for Ardrossan. Surface logging was stopped at 16.40.

**12 February** *Challenger* arrived off Ardrossan at 07.00 but was prevented from berthing by gale force northerly winds blowing down the Firth of Clyde. After low tide had passed and the weather had improved *Challenger* docked at 12.45.

## 5. TECHNICAL REPORTS

### 5.1 Vessel mounted ADCP and echo sounder (G.W.J. Miller)

The vessel mounted ADCP system operated in stand alone mode running Transect / Navsoft software. Transect configuration files: SES5.CNF - recording 300 s average data only, which includes navigation (dgps) data, to drive C. At the end of the cruise the data were downloaded to floppy discs. Data were recorded in 64 eight metre bins from 16.1 to 520.1 m below the ship. Note - record raw ADCP data and navigation data NOT enabled. The navigation configuration file was SES5.NAV. Trimble dgps messages: GPGLL and GPZDA. Delimiters: start, $GPGLL; end,1996. The system appears to have performed throughout leg A without problems.

The SIMRAD EA500 echo sounder operated on the hull transducer for the whole cruise. Its performance was satisfactory for mooring and CTD operations, but its record deteriorated significantly in bad weather as would be expected.

### 5.2 Surface monitoring (G.W.J. Miller)

Themosalinograph TSG103
No apparent problems occurred with the system except for a period of about 16.5 hours starting at 07.45 6 February, during which the housing temperature jumped by about 0.5 °C to a low reading, causing a correspondingly high salinity value to be computed (by about 0.6). The cause is not known. The system salinity was checked against autosal samples, Table 8, and temperature and salinity were compared with CTD readings at 5 m, Table 9. These checks showed no differences comparing before and after the event referred to above.

Surface fluorometer (Aquatracka Mk2 SN 246) and transmissometer (Seatech 25 cm SN 104D) Both systems appeared to function without problems.

Deckmounted lightmeters
Total irradiance - Kipp & Zonen, port SN ?, starboard SN ?
$2\pi$PAR - PML, port SN ?, starboard SN ?
The PAR meters looked ok. There is some doubt about the data from both the total irradiance sensors as logged by the ABC system. This is being investigated.

**5.3 CTD and 'tonefire' rosette system (G.W.J. Miller)**

CTD - Neil Brown Mk 3B, SN 1195; calibration file IMCT1195.C93
Fluorometer - Aquatracka Mk2 SN 229
Transmissometer - Seatech 25 cm, SN 103D
Lightmeters - Downwelling SN 1; upwelling SN ?
Reversing thermometers - SIS SNs 260, 262
Dissolved oxygen - Beckman with Seabird plenum and pump
The rosette was fitted with 10 litre Niskin water bottles

The system worked reliably - 47 casts being completed despite poor weather conditions for much of the time, Table 3 and Figure 4. After the first twelve casts the lightmeters were removed at S1500 (as their depth capability was to be exceeded for the first time) and, since most CTD deployments were at night, they were not reinstalled. Using the altimeter casts were recorded down to 5 m above the sea bed.

The addition of a 'snow' camera to the CTD frame made the whole CTD package even more cumbersome to handle in the restricted space around the starboard gantry. This further limits operations when *Challenger* is working in Atlantic swells (see minutes of Health & Safety meeting held during the cruise).

Noise problems were encountered early in the cruise. The sliprings were cleaned and reconfigured to avoid using the centre rings (low insulation resistance). Also the cable was reterminated and cable connectors cleaned. The data since looked clean.

The pumped dissolved oxygen sensor still appears to take time to purge itself of air and there is doubt about the effectiveness of the pump. This should be the subject of a separate report. For the last few casts the 'plumbing' was rearranged with the pump pointing up and an air bleed valve at the highest point. Two casts were completed without the pump / plenum fitted to the sensor for comparison.

During the deployment of cast 33, in marginal weather conditions, the CTD took a smack against the ship's side, resulting in the CTD and rosette ceasing to function! The CTD was repaired and installed back in the system, the rosette had to be replace with the spare unit. The temperature and salinity checks / calibrations, Tables 4 and 5, showed that the sensors were unaffected by the blow.

**5.4 Chlorophyll (I. Ezzi)**

Fluorometer calibration
Two fluorometers were used on or from the ship, one attached to the CTD and one in the deck tank being fed from non-toxic sea water supply for continuous underway sampling. In order to

calibrate the CTD instrument, water samples were taken from 5 m and 30/60 m alternately from all CTD dips and filtered / frozen for later extraction and measurement at DML. The deck tank fluorometer was calibrated using water samples taken from the tank at regular intervals, Table 10.

*In situ* Fluorometer
Aquatracka fluorometer 012 was deployed on S140 toroid buoy on 1 February. Calibration was carried out on board against a range of concentrations of *Skeletonema costatum* cultured at DML.

### 5.5 Water sampling for particulate organic carbon (F. Perez-Castillo)

To complement the sediment trap experiment, seawater samples were taken for the analysis of particulate organic carbon (POC). Whole vertical profiles of water samples were taken by duplicate in selected CTD casts. For each sample, 1000 ml of seawater were filtered in pre-combusted GF/F fibre glass filters. Afterwards the filters were frozen to be taken to DML for further analysis. A total of five POC water column profiles were made during CTD casts, Table 6.

### 5.6 Marine Snow Camera (A. Geary)

What is Marine Snow?
Marine snow is loosely defined as being aggregated particles, generally of biogenic origin, formed at the base of the Upper Mixed Layer during periods of phytoplankton abundance as well as being resuspended due to increased physical activity at the sediment/ water interface. Particles are defined as being greater than 0.5 mm diameter. It is these particles which are thought to be of great importance in the biogeochemical cycling of the oceans. The basic problem in study of such aggregates is due not only to their very low numbers in the water column but also their fragility. Thus, although sediment traps provide good quantifiable data on the vertical flux of these particles, this may be supplemented with photographic evidence of the size and abundance of marine snow particles, so as to provide good quality data on spatial and temporal variability.

The Collection and Analysis of Photographic Data.
*Challenger* 125A provided a good opportunity for the collection of vertical profiles through the water column covering 14 stations across the shelf ranging from 140 m to 1500 m along the North and South transects. On this cruise, it was possible (as is usual) to set the camera array up in 'CAD mode'. That is to say that an IOS MK IV camera is placed at a set distance (80 cm) from a Fresnel lens which has set behind it a high speed flash. This enables the production of a light column which is photographed at right angles and so essentially a known volume of water is sampled. When placed on the CTD, the obvious advantage is that all other parameters recorded may be precisely related to each frame taken. Therefore exact time and depth are available and profiles constructed with confidence. Images were collected at 15 second intervals, giving the maximum number possible, ranging from approximately 160 at shallow stations to 300 + for deepest stations. All stations and times are given in Table 7.

Once back in the laboratory, each film is processed using a C41 processing method. Any scratched, out of focus or generally sub-standard images are excluded from analysis. The analysis involves the use of a Kontron Image Analysis System and Vidas Software. Each frame is scanned for particles in a smaller size range and secondly for particles in the larger categories.

The data are then processed using specially created macros and final profiles constructed.

It was hoped that a new camera system may be tested on this cruise, however, time did not permit this given that all CTD's were undertaken at night. It would be useful if in the future, there may be some work of this nature carried out in daylight, perhaps enabling transects to be replicated day and night.

### 5.7 Data Logging (R. Pearce)

The RVS ABC computer system was used to log over 220 Mbytes of data from the following scientific and navigational instruments:-

Neil Brown Mk 3b CTD
Surface sampling Fluorometer, Transmissometer & Thermosalinograph
$2\pi$ PAR light meters
Kipp & Zonen Solar Integrator
SIMRAD EA500 echo sounder (10.5 kHz)

Two Differentially corrected GPS receivers (DECCA MK53G, Trimble 4000DS)
Non - Differential GPS receiver (Trimble 4000AX)
Ship's Log and Gyro Compass

The DECCA MK53G unit received real-time differential corrections via radio from the reference station/beacon 'R of Islay'. For periods when the DECCA MK53G differential beacon was out of range the Trimble 4000DS receiver was set up to receive real-time differential corrections from the reference station 'Butt of Lewis', via a longer wavelength radio link. Unfortunately the reception of the 'Butt of Lewis' station was marginal, giving differential corrections for less than 20% of the time it was used.

Some processing of CTD and surface sampling data was performed to provide a 'first look' at the collected data, navigation processing was also carried out on a similar basis. Plots of the processed data were produced during the course of the cruise.

There were no significant equipment failures or other events that affected the data logging operation. All the collected data has been passed to BODC (via Ray Cramer) for screening, calibration and final archiving.

### 5.8 Sediment Traps (F. Perez-Castillo)

The recovery of the sediment trap array at station N1500, which had been deployed on 5 September 1995 during cruise *Challenger* 121C (SES3), was carried out on 5 February. At 10:23 it was ranged at 1575 m and at 10:45 the sediment trap mooring was released. Argos and release worked fine. The mooring was recovered with bottles 3, 4, 7 and 8 missing from the top trap and bottle 18 missing from the bottom trap. Reasonable quantities of material were collected in the 22 bottles in both traps through 22 weeks. The top trap worked properly this time without the accumulation of the bulk material in the last bottle. Something had happened in the previous deployment maybe due to the nature of the material collected - too fine or sticky.

The bottles were removed and the material was left to settle, then 30 ml of the supernatant was emptied. Finally, 1 ml of formaldehyde was added to the samples to ensure preservation. The data were unloaded and the carousel and electronics rinsed down and cleaned. The batteries were NOT replaced, since they were only 20% used (volts=19.2). The units were reassembled, the bottles fitted and topped up with preservative and the units were reprogrammed.

To prepare the traps for deployment, a standard procedure was carried out. Each bottle was coded using an engraver and then marked as: XVI A No. bottle (1000 m trap) and XVI B No. bottle (1400 m trap), where XVI is the deployment code. The bottles were washed with Decon-90 detergent and rinsed with distilled water. On February 1, five days before the traps' deployment, a preservative was prepared, consisting of GF/F filtered deep seawater (600 m) from station S700, 5% A.R. formaldehyde, A.R. NaCl and A.R. Borax .

Deployment Header for Top Trap: CH125.N1500.XVI-A.1000
Deployment Header for Bottom Trap: CH125.N1500.XVI-B.1400

Before the traps' deployment, the cones and the baffles were washed with Decon-90 and rinsed with tap water. The cone was washed using a sponge and the baffle using a wash plastic brush. Then, both were fitted in the trap's frame and the trap was covered with a plastic bag to keep it dust-free. Bottles were filled with the preservative and fitted in each trap. Finally, traps were programmed for 22 events at seven day intervals starting on February 11 at 12:00 and ended on July 7, 1996 at 12:00. It needs to be discussed if they will be serviced in April 1996 during the SES-6 Cruise.

Two Parflux mark 7G-21 sediment traps were deployed on February 6, at 1000 m and 1400 m (100 m above sea-bed), on one mooring at station N1500. At 20:24 the sediment trap mooring was released; at 20:38 it had reached the bottom. The position was 56° 43.54′ N 09° 24.94′ W, water depth 1514 m. Current-meter RCM7-11820 and transmissometer Sea Tech 631 were deployed in the array. In order to facilitate the deployment, since one winch was not working, we decided to deploy the traps upside down. No preservative leaks from the bottle collectors were seen in either trap.

### 5.9 Acoustic Trials (A.J. Harrison)

*Challenger* 125 presented an opportunity to carry out sea trials on new types of in-line release acoustic units coming on to the market offering the user improved technology at a competitive price for shelf edge moorings. Two temporary moorings were deployed in the Sound of Jura whilst sheltering from gales on the 8 February 1996, and equipped with three types of release systems to test and evaluate their performance.

After appropriate wire testing, release units loaned from Benthos and Sonardyne were configured on separate single point, sub-surface pop-up moorings in a water depth of nominally 100 m and tested under the prevailing marine conditions for transponder range and command function execution. An Oceano release unit of the type currently in use by NERC/POL for shelf edge moorings was also attached to the Benthos mooring to act as a control and allow useful comparisons to be made.

Since the trial was constrained to a 6 hour period by the changing weather pattern and available

daylight for mooring recovery, there was only limited time to explore the transponder range capability of the Sonardyne unit which seemed to be only 3.7 km, whereas a range of nearer 10 km was expected. Similarly, the Benthos unit transponder was enabled at a range of 2.7 km and so could not be tested at greater distances on this occasion, although on a previous trial the same unit had given ranges up to 7 km.

Various command functions were successfully tested on all units concluding with the release function to allow both moorings to be recovered without incident.

## 6. CONCLUSIONS

The cruise was generally successful with the main objectives achieved - the moorings were turned round or deployed and the majority of the CTD stations on the S, R, P and N lines occupied. This success can largely be ascribed to the period of good weather at the beginning of the cruise. However little progress was made towards recovering the bits of moorings known still to be in the area. Acoustic release trials were conducted whilst sheltering in the Sound of Jura but the site was not ideal and it is difficult to see how to apply any conclusions to an open sea area.

Whilst *Challenger* is a good ship for mooring work, with its two auxiliary winches, and for CTDs, it is debatable whether she is really suitable for this kind of work in this region at this time of year. A main concern is putting the RVS CTD into and out of the water if she is rolling, combined with the lack of deck space for this operation. Indeed during the cruise the CTD hit the side of the ship heavily once, damaging both the CTD and the rosette system. This problem can only become more urgent as the size and weight of the CTD package grows. For part of this cruise it was aggravated by the addition of a snow camera. Also, in adverse conditions her manoeuvrability becomes restricted (during this cruise she took a heavy roll in a moderate beam sea) and her speed through the water falls off rapidly.

Minor problems were experienced with :-

- the pumping system for the CTD oxygen sensor (see section 5.3).
- the surface irradiance sensors (see section 5.2).
- the wire readouts for the CTD winch - this could have been solved easily if the onboard documentation had been kept up to date (see section 4).
- noise from the slip rings on CTD winch (see section 5.3).
- the thermosalinograph for half a day (see section 5.2).

Sea surface temperatures were in the region of 10°C - warmest temperatures (about 10.5°C) and saltiest water (about 35.4) were in the vicinity of the 500 m contour, with sea surface temperature and salinity decreasing both to seaward and to shoreward. Up to the 500 m contour the water column was well mixed and horizontal density differences were small. There was a small front separating the 140 m stations from the shelf break (cooler with density compensated by fresher water). Seaward of the 500 m contour surface density increased. Compared with the last SES cruise, at the end of November 1995 (Huthnance, 1995), the sea surface had cooled by about 1.5°C, but appeared still to be warmer than average, and had become saltier - the anomalous surface layer of fresher water was not present, presumably having been mixed in by winter storms.

The vessel ADCP measured northward currents at all positions and times, with speeds generally between 0.25 and 0.5 m $s^{-1}$. There was a good correspondence between the ship's officers estimates of the surface current whilst handling the ship and the ADCP figures.

## 7. ACKNOWLEDGEMENTS

It is a pleasure to thank the master, officers and crew of RRS *Challenger* for their skill, willing assistance and cooperation. Without it, and the expertise and flexible support of the RVS technicians, the programme of work could not have been completed.

## 8. ABBREVIATIONS

| | |
|---|---|
| ABC | Ship-borne data logging system |
| ADCP | Acoustic Doppler Current Profiler |
| BODC | British Oceanographic Data Centre, Bidston Observatory, Birkenhead, L43 7RA |
| BPR | Bottom Pressure Recorder |
| CTD | Conductivity, Temperature, Depth |
| DGPS | Digital Global Positioning System |
| DML | Dunstaffnage Marine Laboratory, PO Box 3, Oban, Argyll, PA34 4AD |
| LOIS | Land Ocean Interaction Study |
| PAR | Photosynthetically Active Radiation |
| POC | Particulate Organic Carbon |
| POL | Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, L43 7RA |
| RVS | Research Vessel Services, SOC, Empress Dock, Southampton, SO14 3ZH |
| SES | Shelf Edge Study |
| SOC | Southampton Oceanographic Centre, Empress Dock, Southampton, SO14 3ZH |
| UWB | School of Ocean Sciences, Menai Bridge, University of Wales Bangor, Anglesey, LL59 5EY |

## 9. REFERENCES

Huthnance, J.M. 1991 RRS *Challenger* cruise 123, Leg A. POL Cruise Report, 21.

| CHALLENGER 125A (SES 5) | | | | | MOORINGS DEPLOYMENTS/RECOVERIES/LOSSES |
|---|---|---|---|---|---|
| Date & Time | Site | Latitude | Longitude | Depth | Mooring Type |
| DEPLOYMENTS | | | | | |
| 01/02/96 08:12 | S200 | 56 27.60N | 9 2.83W | 210 | STABLE |
| 01/02/96 09:27 | S140 | 56 27.61N | 8 57.87W | 145 | 'U' SHAPE CURRENT METER MOORING WITH SPAR BUOY |
| 01/02/96 11:43 | S140 | 56 27.51N | 8 57.79W | 147 | RDI ADCP |
| 01/02/96 13:17 | S140 | 56 27.53N | 8 58.02W | 147 | TOROID MOORING |
| 01/02/96 14:57 | S140 | 56 27.55N | 8 57.53W | 147 | LARGE TOROID MARKER BUOY (MET BUOY) |
| 01/02/96 17:06 | S200 | 56 27.41N | 9 2.75W | 199 | TOROID MARKER BUOY |
| 02/02/96 09:58 | S300 | 56 27.14N | 9 3.97W | 299 | SUB-SURFACE CURRENT METER MOORING |
| 02/02/96 10:53 | S300 | 56 26.97N | 9 4.03W | 301 | TOROID MARKER BUOY |
| 02/02/96 15:56 | N140 | 56 36.34N | 8 56.03W | 136 | BOTTOM PRESSURE RECORDER |
| 02/02/96 16:40 | N140 | 56 36.63N | 8 56.07W | 137 | SPAR MARKER BUOY |
| 03/02/96 09:01 | CC1 | 56 36.51N | 9 0.92W | 227 | SUB-SURFACE CASCADE THERMISTOR CHAIN MOORING |
| 03/02/96 10:34 | CC2 | 56 37.30N | 9 2.11W | 357 | SUB-SURFACE CASCADE THERMISTOR CHAIN MOORING |
| 03/02/96 12:03 | CC3 | 56 42.89N | 8 59.46W | 234 | SUB-SURFACE CASCADE THERMISTOR CHAIN MOORING |
| 03/02/96 15:21 | N300 | 56 37.45N | 9 1.33W | 301 | SUB-SURFACE CURRENT METER MOORING |
| 03/02/96 16:36 | N300 | 56 37.64N | 9 1.11W | 304 | SPAR MARKER BUOY |
| 05/02/96 17:53 | S700 | 56 27.89N | 9 9.81W | 700 | SUB-SURFACE THERMISTOR CHAIN/CURRENT METER MOORING |
| 05/02/96 19:59 | S400 | 56 27.25N | 9 4.86W | 396 | RVS ADCP |
| 06/02/96 20:24 | N1500 | 56 43.61N | 9 24.78W | 1516 | POP-UP SEDIMENT TRAP |
| 07/02/96 09:36 | S700 | 56 27.11N | 9 9.44W | 701 | TOROID MARKER BUOY |
| | | | | | |
| RECOVERIES | | | | | |
| 01/02/96 10:47 | S140 | 56 26.97N | 8 59.04W | 146 | RDI ADCP |
| 01/02/96 14:12 | S140 | 56 27.03N | 8 59.30W | 147 | LARGE TOROID MARKER BUOY (MET BUOY) |
| 02/02/96 11:32 | S400 | 56 27.40N | 9 4.98W | 413 | RVS ADCP |

Table 1. Summary of mooring operations.

| CHALLENGER 125A (SES 5) | | | | | MOORINGS DEPLOYMENTS/RECOVERIES/LOSSES |
|---|---|---|---|---|---|
| Date & Time | Site | Latitude | Longitude | Depth | Mooring Type |
| RECOVERIES | | | | | |
| 02/02/96 13:55 | N140 | 56 36.77N | 8 56.23W | 136 | SPAR MARKER BUOY |
| 02/02/96 14:41 | N140 | 56 36.61N | 8 56.15W | 136 | BOTTOM PRESSURE RECORDER |
| 05/02/96 12:12 | N1500 | 56 43.20N | 9 27.27W | 1530 | POP-UP SEDIMENT TRAP |
| | | | | | |
| LOSSES | | | | | |
| 02/02/96 | S300 | | No Release | | SUB-SURFACE CURRENT METER MOORING |
| 02/02/96 | S300 | | Missing | | TOROID BUOY |
| | N1500 | | Presumed lost (CD93) | | BOTTOM PRESSURE RECORDER |
| | S1500 | | Presumed lost | | BOTTOM PRESSURE RECORDER |

Table 1 (continued). Summary of mooring operations.

| CHALLENGER 125A (SES 5) | | | | | | | | MOORING INSTRUMENTATION | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Status | Rig | Instrument | Serial Number | Date & Time Starte/Finish | Date & Time In/Out Water | Sample Interval | Owner | Comments |
| S140 | D | U-Shape | Argos SMM500 | 11443 | | 01/02/96 09:07 | | RVS | |
| | | | Sub-Surface Buoy | | | 01/02/96 09:09 | | RVS | 40 inch diameter |
| | | | RCM7 | 8240 | 31/01/96 16:00:00 | 01/02/96 09:09 | 30 min | RVS | |
| | | | RCM7 | 11814 | 01/02/96 08:30:15 | 01/02/96 09:17 | 30 min | POL | |
| | | | SeaTech | 556 | | 01/02/96 09:17 | | POL | |
| | | | Oceano Release | 223 | | 01/02/96 09:23 | | DRA | |
| | | | Spar Marker Buoy | | | 01/02/96 09:41 | | DML | |
| S140 | R | Pop-Up | ADCP RDI | 1149 | | 01/02/96 10:47 | 10 min | POL | Model BBCS-150 |
| | | | WLR | 444 | | 01/02/96 10:47 | 15 min | POL | |
| | | | Benthos Release | 3B/4A | | 01/02/96 10:47 | | POL | |
| S140 | D | Pop-Up | ADCP RDI | 1148 | | 01/02/96 11:43 | 10 min | POL | Model BBCS-150 |
| | | | WLR | 444 | | 01/02/96 11:43 | 15 min | POL | |
| | | | Benthos Release | 3B/4A | | 01/02/96 11:43 | | POL | |
| S140 | D | Toroid | Marker Buoy | TB7 | | 01/02/96 13:07 | | POL | |
| | | | Argos Beacon | 22184 | | 01/02/96 13:07 | | POL | |
| | | | Fluorometer | 2530/012 | | 01/02/96 13:08 | 60 min | DML | Calibrated on Ship (I. Ezzi) |
| | | | Transmissometer | TRB1-001 | 31/01/96 15:20:00 | 01/02/96 13:08 | 1 min | POL | |
| S140 | R | Toroid | Large Toroid Buoy | | | 01/02/96 14:12 | | DML | Met Buoy with no instrumentation |
| | | | Argos Beacon | 1451 | | 01/02/96 14:12 | | POL | |
| S140 | D | Toroid | Large Toroid Buoy | | | 01/02/96 14:57 | | DML | Met Buoy with no instrumentation |
| | | | Argos Beacon | 1450 | | 01/02/96 14:57 | | POL | |
| S200 | D | Pop-Up | STABLE | | | 01/02/96 08:12 | | POL | |
| S200 | D | Toroid | Marker Buoy | | | 01/02/96 17:06 | | POL | For STABLE |
| S300 | D | Sub-Surface | Sub-Surface Buoy | 3 | | 02/02/96 09:22 | | RVS | ss48 welded in: 48 inch diameter |

Table 2. Instrumentation on the moorings.

| CHALLENGER 125A (SES 5) | | | | | | | | MOORING INSTRUMENTATION | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Status | Rig | Instrument | Serial Number | Date & Time Starte/Finish | Date & Time In/Out Water | Sample Interval | Owner | Comments |
| | | | Argos SMM500 | 24331 | | 02/02/96 09:22 | | RVS | SN084 |
| | | | RCM7 | 10864 | 02/02/96 08:00:00 | 02/02/96 09:22 | 30 min | RVS | |
| | | | RCM7 | 10857 | 02/02/96 08:00:00 | 02/02/96 09:32 | 30 min | RVS | |
| | | | RCM7 | 11818 | 02/02/96 08:00:00 | 02/02/96 09:45 | 30 min | POL | |
| | | | SeaTech | 638 | | 02/02/96 09:45 | | POL | Calibrated on CTD3 |
| | | | Oceano Release | 162 | | 02/02/96 09:45 | | DRA | RT661 |
| S300 | D | Toroid | Marker Buoy | TB3 | | 02/02/96 10:42 | | RVS | |
| S400 | R | Pop-Up | RVS ADCP | 394 | 03/02/96 10:20:00 | 02/02/96 11:32 | 10 min | RVS | Model NBSC 300 |
| | | | Argos SMM500 | 24329 | | 02/02/96 11:32 | | RVS | SN053 |
| | | | Oceano Release | 361 | | 02/02/96 11:32 | | RVS | SN42 |
| S400 | D | Pop-Up | RVS ADCP | 394 | 04/02/96 08:00:00 | 05/02/96 19:52 | 10 min | RVS | Model NBSC 300 |
| | | | Argos SMM500 | 24329 | | 05/02/96 19:52 | | RVS | SN053 |
| | | | Oceano Release | 361 | | 05/02/96 19:52 | | RVS | SN42 |
| S700 | D | Sub-Surface | Sub-Surface Buoy | 2 | | 05/02/96 15:50 | | RVS | 48 inch diameter |
| | | | Argos SMM500 | 24335 | | 05/02/96 15:50 | | RVS | SN079 |
| | | | RCM7 | 6749 | 05/02/96 14:30:04 | 05/02/96 15:51 | 30 min | RVS | |
| | | | TC logger TR7 | 1444 | 05/02/96 14:00:04 | 05/02/96 15:58 | 30 min | POL | |
| | | | TC | 1758 | | 05/02/96 15:58 | 30 min | POL | 200m long |
| | | | RCM7 | 11049 | 05/02/96 14:40:05 | 05/02/96 16:31 | 30 min | POL | |
| | | | TC logger TR7 | 1141 | 05/02/96 13:30:04 | 05/02/96 16:31 | 30 min | DRA | |
| | | | TC | 1688 | | 05/02/96 16:31 | 30 min | DRA | 100m long |
| | | | TC logger TR7 | 1455 | 05/02/96 13:30:04 | 05/02/96 16:54 | 30 min | POL | |
| | | | TC | 2339 | | 05/02/96 16:54 | 30 min | POL | 100m long |
| | | | RCM7 | 11817 | 05/02/96 13:00:04 | 05/02/96 17:28 | 30 min | POL | |

Table 2 (continued). Instrumentation on the moorings.

| CHALLENGER 125A (SES 5) | | | | | | | | MOORING INSTRUMENTATION | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Status | Rig | Instrument | Serial Number | Date & Time Starte/Finish | Date & Time In/Out Water | Sample Interval | Owner | Comments |
| | | | SeaTech | 637 | | 05/02/96 17:28 | | POL | Calibrated on CTD18 |
| | | | Oceano Release | 262 | | 05/02/96 17:28 | | RVS | |
| S700 | D | Toroid | Marker Buoy | TB6 | | 07/02/96 09:13 | | RVS | |
| N140 | R | Pop-Up | WLR7 | 1042 | | 02/02/96 14:41 | | POL | |
| | | | Benthos Release | 5A | | 02/02/96 14:41 | | POL | |
| N140 | D | Pop-Up | WLR7 | 1042 | 02/02/96 12:00:50 | 02/02/96 15:56 | 15 min | POL | |
| | | | Benthos Release | 5A | | 02/02/96 15:56 | | POL | |
| N140 | R | Spar | Marker Buoy | | | 02/02/96 13:55 | | POL | |
| N140 | D | Spar | Marker Buoy | | | 02/02/96 16:40 | | POL | |
| N300 | D | Sub-Surface | Sub-Surface Buoy | 4 | | 03/02/96 14:54 | | RVS | 560 welded in: 48 inch diameter |
| | | | Argos SMM500 | 24574 | | 03/02/96 14:54 | | RVS | SN096 |
| | | | RCM8 | 9928 | 03/02/96 13:40:04 | | 20 min | DRA | |
| | | | RCM7 | 9603 | 03/02/96 13:40:04 | | 20 min | DRA | |
| | | | RCM7 | 9540 | 03/02/96 13:40:04 | | 20 min | DRA | |
| | | | Oceano Release | 158 | | | | DRA | |
| N300 | D | Spar | Marker Buoy | | | 03/02/96 16:05 | | POL | |
| N1500 | R | Pop-Up | Argos SMM500 | 24332 | | 05/02/96 11:25 | | RVS | SN099 |
| | | | Radio RF700A-1 | 9788 | | 05/02/96 11:25 | | RVS | 18189 also on Label |
| | | | Sediment Trap | 10452-1 | | 05/02/96 11:33 | | RVS | ParFlux Model Mark 7G-21 |
| | | | Sediment Trap | 10452-2 | | 05/02/96 12:05 | | RVS | ParFlux Model Mark 7G-21 |
| | | | Oceano Release | 255 | | 05/02/96 12:12 | | RVS | |
| N1500 | D | Pop-Up | Argos SMM500 | 24332 | | 06/02/96 19:35 | | RVS | SN099 |
| | | | Radio RF700A-1 | 9788 | | 06/02/96 19:35 | | RVS | 18189 also on Label |
| | | | Sediment Trap | 10452-1 | | 06/02/96 19:43 | | RVS | ParFlux Model Mark 7G-21 |

Table 2 (continued). Instrumentation on the moorings.

| CHALLENGER 125A (SES 5) | | | | | | | | MOORING INSTRUMENTATION | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Status | Rig | Instrument | Serial Number | Date & Time Starte/Finish | Date & Time In/Out Water | Sample Interval | Owner | Comments |
| | | | Sediment Trap | 10452-2 | | 06/02/96 20:07 | | RVS | ParFlux Model Mark 7G-21 |
| | | | RCM7 | 11820 | 06/02/96 15:00:14 | 06/02/96 20:17 | 60 min | POL | |
| | | | SeaTech | 631 | | 06/02/96 20:17 | | POL | Calibrated on CTD18 |
| | | | Oceano Release | 255 | | | | RVS | |
| CC1 | D | Pop-Up | RCM5 | 3727 | 02/02/96 13:20:00 | 03/02/96 09:01 | 20 min | IOS | Cascade |
| | | | TC logger TR7 | 1451 | 02/02/96 14:20:04 | | 20 min | POL | |
| | | | TC | 1701 | | | 20 min | POL | |
| | | | RCM7 | 3308 | 02/02/96 13:40:04 | | 20 min | RVS | |
| | | | Temperature Probe | 1362 | 03/02/96 08:00:00 | | 20 min | POL | |
| | | | Transmissometer | Tran4 | 03/02/96 00:00:00 | | 1 min | UCNW | Calibrated on CTD14 |
| | | | Temperature Probe | 1363 | 03/02/96 08:00:00 | | 20 min | POL | |
| | | | Temperature Probe | 1364 | 03/02/96 08:00:00 | | 20 min | POL | |
| | | | Benthos Release | 3A | | | | POL | |
| CC2 | D | Pop-Up | RCM5 | 7517 | 02/02/96 13:20:00 | 03/02/96 10:23 | 20 min | IOS | Cascade |
| | | | TC logger TR7 | 1453 | 02/02/96 14:40:06 | | 20 min | POL | |
| | | | TC | 1685 | | | 20 min | POL | |
| | | | RCM7 | 9587 | 02/02/96 13:20:05 | | 20 min | POL | |
| | | | Temperature Probe | 1365 | 03/02/96 08:00:00 | | 20 min | POL | |
| | | | Transmissometer | Tran3 | 03/02/96 00:00:00 | | 1 min | UCNW | Calibrated on CTD14 |
| | | | Temperature Probe | 1366 | 03/02/96 08:00:00 | | 20 min | POL | |
| | | | Temperature Probe | 1367 | 03/02/96 08:00:00 | | 20 min | POL | |
| | | | Benthos Release | 1B | | | | POL | |
| CC3 | D | Pop-Up | RCM5 | 7945 | 02/02/96 13:00:01 | 03/02/96 11:53 | 20 min | IOS | Cascade |
| | | | TC logger TR7 | 1454 | 02/02/96 15:00:05 | | 20 min | POL | |

Table 2 (continued). Instrumentation on the moorings.

| CHALLENGER 125A (SES 5) | | | | | | | | MOORING INSTRUMENTATION | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Status | Rig | Instrument | Serial Number | Date & Time Starte/Finish | Date & Time In/Out Water | Sample Interval | Owner | Comments |
| | | | TC | 1720 | | | 20 min | POL | |
| | | | RCM7 | 11608 | 02/02/96 14:00:04 | | 20 min | UCNW | |
| | | | Temperature Probe | 1368 | 03/02/96 08:00:00 | | 20 min | POL | |
| | | | Transmissometer | Tran1 | 03/02/96 00:00:00 | | 1 min | UCNW | Calibrated on CTD14 |
| | | | Temperature Probe | 1369 | 03/02/96 08:00:00 | | 20 min | POL | |
| | | | Temperature Probe | 1370 | 03/02/96 08:00:00 | | 20 min | POL | |
| | | | Benthos Release | 6B | | | | POL | |

Table 2 (continued). Instrumentation on the moorings.

| CHALLENGER 125A (SES 5) | | | | | | | | CTD CASTS |
|---|---|---|---|---|---|---|---|---|
| Cast | Site | Start Date/Time | End Date/Time | Start Lat | Start Lon | Start Depth | Bottle Depths | Comments |
| CTD1 | S200 | 01/02/96 07:17 | 01/02/96 07:55 | 56 27.50N | 9 2.98W | 217 | 5,30 | Chlorophyll:Oxygen pump always on |
| CTD2 | S140 | 01/02/96 11:10 | 01/02/96 11:30 | 56 27.27N | 8 58.85W | 147 | | Transmissometer Calibration |
| CTD3 | S140 | 01/02/96 18:01 | 01/02/96 18:24 | 56 27.76N | 8 57.52W | 147 | | Transmissometer Calibration |
| CTD4 | S140 | 01/02/96 18:37 | 01/02/96 18:55 | 56 27.67N | 8 57.52W | 147 | 5,60 | Chlorophyll |
| CTD5 | S150 | 01/02/96 19:23 | 01/02/96 19:38 | 56 27.57N | 8 59.25W | 149 | 5,30 | Chlorophyll |
| CTD6 | S200 | 01/02/96 20:12 | 01/02/96 20:35 | 56 27.97N | 9 2.52W | 198 | 5,60 | Chlorophyll |
| CTD7 | S300 | 01/02/96 21:16 | 01/02/96 21:48 | 56 28.37N | 9 3.39W | 291 | 5,15,30,60,100,200,275 | Particulate Organic Carbon:5,30 Chlorophyll |
| CTD8 | S400 | 01/02/96 22:31 | 01/02/96 23:06 | 56 27.68N | 9 4.96W | 432 | 5,60 | Chlorophyll |
| CTD9 | S500 | 01/02/96 23:55 | 02/02/96 00:24 | 56 28.03N | 9 6.29W | 498 | 5,30 | Chlorophyll |
| CTD10 | S700 | 02/02/96 01:07 | 02/02/96 02:16 | 56 27.87N | 9 9.65W | 688 | 5,15,30,60,100,200,300, 400,500,600,667 | Particulate Organic Carbon |
| CTD11 | S850 | 02/02/96 03:11 | 02/02/96 04:01 | 56 27.78N | 9 13.85W | 866 | 5,60 | Chlorophyll |
| CTD12 | S1000 | 02/02/96 04:45 | 02/02/96 05:50 | 56 27.17N | 9 18.11W | 1001 | 5,30 | Chlorophyll |
| CTD13 | S1500 | 02/02/96 22:14 | 02/02/96 23:58 | 56 27.45N | 9 38.96W | 1515 | 15,30,60,100,200,400,600, 800,1200,1400,1508 | Particulate Organic Carbon:60 Chlorophyll No more PAR readings |
| CTD14 | S1400 | 03/02/96 00:47 | 03/02/96 01:07 | 56 28.14N | 9 35.39W | 1388 | | Transmissometer Calibration |
| CTD15 | S1400 | 03/02/96 01:30 | 03/02/96 02:36 | 56 27.75N | 9 36.38W | 1418 | 5,30 | Chlorophyll |
| CTD16 | S1300 | 03/02/96 03:06 | 03/02/96 04:04 | 56 27.65N | 9 30.91W | 1297 | 5,60 | Chlorophyll |
| CTD17 | S1150 | 03/02/96 04:39 | 03/02/96 05:39 | 56 27.12N | 9 23.99W | 1145 | 5,30 | Chlorophyll |
| CTD18 | N140 | 03/02/96 17:20 | 03/02/96 17:41 | 56 36.13N | 8 55.64W | 137 | | Transmissometer Calibration |
| CTD19 | N140 | 03/02/96 18:23 | 03/02/96 18:42 | 56 36.12N | 8 56.16W | 137 | 5,60 | Chlorophyll |
| CTD20 | N150 | 03/02/96 19:12 | 03/02/96 19:25 | 56 37.53N | 8 58.70W | 149 | 5,30 | Chlorophyll |
| CTD21 | N200 | 03/02/96 19:49 | 03/02/96 20:12 | 56 36.61N | 9 0.56W | 198 | 5,60 | Chlorophyll |
| CTD22 | CC1 | 03/02/96 20:36 | 03/02/96 20:54 | 56 36.59N | 9 1.04W | 253 | 5,30 | Chlorophyll |
| CTD23 | N300 | 03/02/96 21:32 | 03/02/96 21:58 | 56 37.67N | 9 0.78W | 299 | 5,60 | Chlorophyll |
| CTD24 | CC2 | 03/02/96 22:31 | 03/02/96 22:56 | 56 37.35N | 9 2.31W | 368 | 5,30 | Chlorophyll |

Table 3. CTD profiles.

| CHALLENGER 125A (SES 5) | | | | | | | | CTD CASTS |
|---|---|---|---|---|---|---|---|---|
| Cast | Site | Start Date/Time | End Date/Time | Start Lat | Start Lon | Start Depth | Bottle Depths | Comments |
| CTD25 | N500 | 03/02/96 23:29 | 04/02/96 00:08 | 56 38.15N | 9 4.22W | 510 | 5,60 | Chlorophyll |
| CTD26 | N600 | 04/02/96 00:32 | 04/02/96 01:05 | 56 38.43N | 9 5.28W | 611 | 5,30 | Chlorophyll |
| CTD27 | N700 | 04/02/96 01:37 | 04/02/96 02:23 | 56 38.71N | 9 7.24W | 720 | 5,30 | Chlorophyll |
| CTD28 | N850 | 04/02/96 03:07 | 04/02/96 03:52 | 56 39.53N | 9 9.41W | 859 | 5,30 | Chlorophyll |
| CTD29 | N1000 | 04/02/96 04:48 | 04/02/96 05:43 | 56 39.79N | 9 12.35W | 1010 | 5,30 | Chlorophyll |
| CTD30 | R140 | 05/02/96 21:04 | 05/02/95 21:18 | 56 30.09N | 8 55.95W | 144 | 5,60 | Chlorophyll |
| CTD31 | R150 | 05/02/96 21:48 | 05/02/96 22:03 | 56 30.20N | 8 59.27W | 150 | 5,30 | Chlorophyll |
| CTD32 | R200 | 05/02/96 22:22 | 05/02/96 22:50 | 56 30.32N | 9 1.64W | 178 | 5,60 | Chlorophyll |
| CTD33 | N1500 | 06/02/96 21:26 | 06/02/96 22:52 | 56 42.54N | 9 24.35W | 1446 | 5,15,30,60,100,200,400, 800,1200,1400,1427 | Particulate Organic Carbon:5,30 Chlorophyll |
| CTD34 | N1300 | 06/02/96 23:29 | 07/02/96 00:27 | 56 41.97N | 9 19.98W | 1302 | 5,60 | Chlorophyll |
| CTD35 | N1150 | 07/02/96 01:02 | 07/02/96 01:56 | 56 41.25N | 9 15.17W | 1143 | 5,30 | Chlorophyll |
| CTD36 | R1000 | 07/02/96 03:27 | 07/02/96 04:21 | 56 31.00N | 9 17.77W | 1005 | 5,15,30,60,100,200,300, 400,500,600,800,1000 | Particulate Organic Carbon:5,60 Chlorophyll |
| CTD37 | R700 | 07/02/96 05:10 | 07/02/96 05:49 | 56 30.82N | 9 10.79W | 708 | 5,30 | Chlorophyll |
| CTD38 | R500 | 07/02/96 06:21 | 07/02/96 06:45 | 56 30.54N | 9 6.88W | 499 | 5,60 | Chlorophyll |
| CTD39 | R300 | 07/02/96 07:11 | 07/02/96 07:28 | 56 30.14N | 9 3.55W | 298 | 5,30 | Chlorophyll |
| CTD40 | CC3 | 10/02/96 19:36 | 10/02/96 19:56 | 56 42.84N | 8 59.42W | 239 | 5,60 | Chlorophyll |
| CTD41 | P140 | 10/02/96 21:19 | 10/02/96 21:32 | 56 32.95N | 8 55.98W | 141 | 5,30 | Chlorophyll |
| CTD42 | P150 | 10/02/96 22:05 | 10/02/96 22:20 | 56 33.50N | 8 59.89W | 154 | 5,60 | Chlorophyll |
| CTD43 | P200 | 10/02/96 22:46 | 10/02/96 23:05 | 56 33.86N | 9 1.86W | 204 | 5,30 | Chlorophyll |
| CTD44 | P500 | 10/02/96 23:51 | 11/02/96 00:20 | 56 34.55N | 9 6.98W | 509 | 5,60 | Chlorophyll |
| CTD45 | P700 | 11/02/96 00:51 | 11/02/96 01:30 | 56 35.23N | 9 10.89W | 703 | 5,30 | Chlorophyll |
| CTD46 | P1000 | 11/02/96 02:12 | 11/02/96 03:03 | 56 36.09N | 9 17.46W | 1001 | 5,60 | Chlorophyll |
| CTD47 | P1300 | 11/02/96 04:14 | 11/02/96 05:17 | 56 37.61N | 9 27.67W | 1301 | 5,30 | Chlorophyll: No Oxygen pump |

Table 3 (continued). CTD profiles.

## CTD STATION DATA
## CRUISE

| CH125A CTD temperature sensor vs reversing thermometers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Stat No | Dpth (dB) | Temp degC | T260 degC | T262 degC | Tc260 degC | Tc262 degC | dT260 degC | dT262 degC | Av dT degC |
| 1 | 30 | 10.437 | 10.417 | 10.428 | 10.433 | 10.425 | 0.004 | 0.012 | 0.008 |
| 4 | 60 | 10.339 | 10.321 | 10.331 | 10.337 | 10.328 | 0.002 | 0.011 | 0.006 |
| 5 | 30 | 10.407 | 10.388 | 10.398 | 10.404 | 10.395 | 0.003 | 0.012 | 0.007 |
| 6 | 60 | 10.409 | 10.390 | 10.399 | 10.406 | 10.396 | 0.003 | 0.013 | 0.008 |
| 7 | 275 | 10.488 | 10.469 | 10.479 | 10.485 | 10.476 | 0.003 | 0.012 | 0.007 |
| 8 | 426 | 10.490 | 10.471 | 10.480 | 10.487 | 10.477 | 0.003 | 0.013 | 0.008 |
| 9 | 474 | 10.253 | 10.241 | 10.253 | 10.257 | 10.250 | -0.004 | 0.003 | -0.001 |
| 10 | 667 | 9.626 | 9.607 | 9.626 | 9.623 | 9.623 | 0.003 | 0.003 | 0.003 |
| 11 | 535 | 9.580 | 9.560 | 9.571 | 9.576 | 9.568 | 0.004 | 0.012 | 0.008 |
| 13 | 1508 | 4.578 | 4.563 | 4.572 | 4.579 | 4.569 | -0.001 | 0.009 | 0.004 |
| 15 | 102 | 9.891 | 9.871 | 9.883 | 9.887 | 9.880 | 0.004 | 0.011 | 0.007 |
| 16 | 60 | 9.840 | 9.821 | 9.829 | 9.837 | 9.826 | 0.003 | 0.014 | 0.008 |
| 17 | 312 | 9.901 | 9.881 | 9.891 | 9.897 | 9.888 | 0.004 | 0.013 | 0.008 |
| 19 | 125 | 10.144 | 10.125 | 10.133 | 10.141 | 10.130 | 0.003 | 0.014 | 0.008 |
| 20 | 31 | 10.191 | 10.173 | 10.182 | 10.189 | 10.179 | 0.002 | 0.012 | 0.007 |
| 21 | 60 | 10.349 | 10.326 | 10.334 | 10.342 | 10.331 | 0.007 | 0.018 | 0.012 |
| 22 | 30 | 10.306 | 10.288 | 10.297 | 10.304 | 10.294 | 0.002 | 0.012 | 0.007 |
| 23 | 60 | 10.327 | 10.316 | 10.321 | 10.332 | 10.318 | -0.005 | 0.009 | 0.002 |
| 24 | 31 | 10.326 | 10.308 | 10.318 | 10.324 | 10.315 | 0.002 | 0.011 | 0.006 |
| 25 | 507 | 10.515 | 10.492 | 10.501 | 10.508 | 10.498 | 0.007 | 0.017 | 0.012 |
| 26 | 30 | 10.429 | 10.411 | 10.418 | 10.427 | 10.415 | 0.002 | 0.014 | 0.008 |
| 27 | 30 | 10.458 | 10.438 | 10.448 | 10.454 | 10.445 | 0.004 | 0.013 | 0.008 |
| 28 | 876 | 8.120 | 8.106 | 8.116 | 8.122 | 8.113 | -0.002 | 0.007 | 0.002 |
| 29 | 30 | 10.021 | 10.001 | 10.010 | 10.017 | 10.007 | 0.004 | 0.014 | 0.009 |
| 30 | 60 | 10.112 | 10.092 | 10.099 | 10.108 | 10.096 | 0.004 | 0.016 | 0.010 |
| 31 | 30 | 10.488 | 10.471 | 10.480 | 10.487 | 10.477 | 0.001 | 0.011 | 0.006 |
| 32 | 60 | 10.444 | 10.428 | 10.438 | 10.444 | 10.435 | 0.000 | 0.009 | 0.004 |
| 33 | 1427 | 4.826 | 4.825 | 4.834 | 4.841 | 4.831 | -0.015 | -0.005 | -0.010 |
| 34 | 60 | 10.171 | 10.150 | 10.160 | 10.166 | 10.157 | 0.005 | 0.014 | 0.009 |
| 35 | 1100 | 6.696 | 6.685 | 6.693 | 6.701 | 6.690 | -0.005 | 0.006 | 0.000 |
| 37 | 699 | 8.703 | 8.685 | 8.695 | 8.701 | 8.692 | 0.002 | 0.011 | 0.006 |
| 38 | 62 | 10.539 | 10.519 | 10.530 | 10.535 | 10.527 | 0.004 | 0.012 | 0.008 |
| 39 | 30 | 10.500 | 10.480 | 10.490 | 10.496 | 10.487 | 0.004 | 0.013 | 0.008 |
| 40 | 232 | 10.165 | 10.150 | 10.159 | 10.166 | 10.156 | -0.001 | 0.009 | 0.004 |
| 41 | 130 | 10.251 | 10.235 | 10.244 | 10.251 | 10.241 | 0.000 | 0.010 | 0.005 |
| 42 | 145 | 10.268 | 10.247 | 10.258 | 10.263 | 10.255 | 0.005 | 0.013 | 0.009 |
| 43 | 31 | 10.333 | 10.314 | 10.324 | 10.330 | 10.321 | 0.003 | 0.012 | 0.007 |
| 44 | 61 | 10.061 | 10.042 | 10.052 | 10.058 | 10.049 | 0.003 | 0.012 | 0.007 |
| 45 | 31 | 10.270 | 10.250 | 10.260 | 10.266 | 10.257 | 0.004 | 0.013 | 0.008 |
| 46 | 1008 | 7.384 | 7.364 | 7.373 | 7.380 | 7.370 | 0.004 | 0.014 | 0.009 |
| 47 | 1300 | 4.932 | 4.914 | 4.922 | 4.930 | 4.919 | 0.002 | 0.013 | 0.007 |

Table 4. CTD temperature checks against reversing thermometers. The mean and standard deviations of (CTD - reversing thermometer) are 0.002 ±0.004°C for thermometer 260 and 0.011 ±0.004°C for thermometer 262.

## CTD STATION DATA
## CRUISE

| CH125A CTD salinity calibration | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| Stat No | Dpth (dB) | Sal PSU | Samp Bot | Bridge Sal | dSAL ctd/brdg |
| 1 | 30 | 35.386 | 1 | 35.4230 | -0.037 |
| 6 | 60 | 35.388 | 3 | 35.4180 | -0.030 |
| 7 | 275 | 35.408 | 4 | 35.4340 | -0.026 |
| 8 | 426 | 35.412 | 5 | 35.4470 | -0.035 |
| 9 | 474 | 35.390 | 6 | 35.4160 | -0.026 |
| 10 | 667 | 35.334 | 8 | 35.3570 | -0.023 |
| 11 | 535 | 35.318 | 9 | 35.3450 | -0.027 |
| 12 | 987 | 35.388 | 10 | 35.4160 | -0.028 |
| 13 | 1508 | 34.962 | 11 | 34.9900 | -0.028 |
| 15 | 102 | 35.358 | 13 | 35.3860 | -0.028 |
| 16 | 60 | 35.351 | 14 | 35.3770 | -0.026 |
| 17 | 312 | 35.354 | 15 | 35.3830 | -0.029 |
| 19 | 125 | 35.337 | | | |
| 20 | 31 | 35.354 | 16 | 35.3840 | -0.030 |
| 21 | 60 | 35.383 | 17 | 35.4170 | -0.034 |
| 22 | 30 | 35.373 | 18 | 35.4050 | -0.032 |
| 23 | 60 | 35.383 | 19 | 35.4110 | -0.028 |
| 24 | 31 | 35.379 | 21 | 35.4090 | -0.030 |
| 25 | 507 | 35.411 | 22 | 35.4400 | -0.029 |
| 26 | 30 | 35.407 | 23 | 35.4350 | -0.028 |
| 27 | 30 | 35.415 | 24 | 35.4430 | -0.028 |
| 28 | 876 | 35.217 | 25 | 35.2500 | -0.033 |
| 29 | 30 | 35.378 | 26 | 35.4080 | -0.030 |
| 30 | 60 | 35.332 | 27 | 35.3600 | -0.028 |
| 31 | 30 | 35.431 | 28 | 35.4590 | -0.028 |
| 32 | 60 | 35.414 | 29 | 35.4440 | -0.030 |
| 33 | 1427 | 34.978 | 31 | 35.0120 | -0.034 |
| 34 | 60 | 35.394 | 33 | 35.4210 | -0.027 |
| 35 | 1100 | 35.123 | 34 | 35.1500 | -0.027 |
| 36 | 1002 | 35.204 | 35 | 35.2310 | -0.027 |
| 37 | 699 | 35.266 | 36 | 35.2920 | -0.026 |
| 38 | 62 | 35.443 | 37 | 35.4690 | -0.026 |
| 39 | 30 | 35.437 | 38 | 35.4630 | -0.026 |
| 40 | 232 | 35.401 | 3 | 35.4330 | -0.032 |
| 42 | 145 | 35.410 | 4 | 35.4410 | -0.031 |
| 43 | 31 | 35.427 | 5 | 35.4570 | -0.030 |
| 44 | 61 | 35.386 | 6 | 35.4140 | -0.028 |
| 45 | 31 | 35.416 | 7 | 35.4430 | -0.027 |
| 46 | 1008 | 35.168 | 9 | 35.1960 | -0.028 |
| 47 | 1300 | 34.992 | 10 | 35.0210 | -0.029 |

Table 5. CTD salinity calibrations. The mean and standard deviation of (CTD - salinometer) are -0.029 ±0.003.

TABLE 6. Station, date, CTD No. and water depth at which POC samples were taken:

| Station No. | S300 | S700 | S1500 | N1500 | R1000 |
|---|---|---|---|---|---|
| CTD no | 007 | 010 | 013 | 033 | 036 |
| Date (Feb) | 01 | 02 | 02 | 06 | 07 |
| time | 21:30 | 01:06 | 22:14 | 21:27 | 03:27 |
| water depth (metres) | | | | | |
| 5 | X | | X | X | X |
| 15 | X | X | X | X | X |
| 30 | X | X | X | X | X |
| 60 | X | X | X | X | X |
| 100 | X | X | X | X | X |
| 200 | X | X | X | X | X |
| 300 | 275 | X | | | X |
| 400 | | X | X | X | X |
| 500 | | X | | | X |
| 600 | | X | X | | X |
| 800 | | 667 | X | X | X |
| 1000 | | | | | X |
| 1200 | | | X | X | |
| 1400 | | | X | X | |
| 1500 | | | 1508 | 1427 | |
| * | 4 | 5 | 5 | 6 | 5.5 |

* depth above the bottom at which deepest samples were taken.

**LOIS SES 5**

**CRUISE:CH125A**

## MARINE SNOW CAMERA

| DATE | STATION | CTD No. | FRAME INTERVAL | TIME IN | TIME OUT | LAT | LONG | CAST DEPTH (m) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| 01/02/96 | S140 | 004 | 15 SECONDS | 18:38:16 | 18:54:51 | 56 27.64N | 8 57.40W | 142.2 | SLIGHT SWELL |
| 01/02/96 | S200 | 006 | 15 SECONDS | 20:13:04 | 20:33:04 | 56 28.26N | 9 02.54W | 198.3 | SLIGHT SWELL |
| 01/02/96 | S300 | 007 | 15 SECONDS | 21:18:00 | 21:47:09 | 56 28.76N | 9 03.23W | 275.4 | SLIGHT SWELL |
| 01/02/96 | S400 | 008 | 15 SECONDS | 22:33:00 | 23:07:10 | 56 28.27N | 9 04.80W | 427.2 | SLIGHT SWELL |
| 02/02/96 | S700 | 010 | 15 SECONDS | 01:09:42 | 02:13:40 | 56 29.18N | 9 09.95W | 670.3 | SLIGHT SWELL |
| 02/02/96 | S1000 | 012 | 15 SECONDS | 04:46:55 | 05:45:06 | 56 27.25N | 9 17.97W | 988.4 | SLIGHT SWELL |
| 02/02/96 | S1500 | 013 | 15 SECONDS | 22:15:49 | 23:55:17 | 56 28.20N | 9 39.41W | 1509.7 | SLIGHT SWELL |
| 03/02/96 | N140 | 019 | 15 SECONDS | 18:24:22 | 18:41:30 | 56 36.24N | 8 56.30W | 130.5 | SLIGHT SWELL |
| 03/02/96 | N200 | 021 | 15 SECONDS | 19:50:38 | 20:10:55 | 56 36.73N | 9 00.35W | 194.4 | SLIGHT SWELL |
| 03/02/96 | N300 | 023 | 15 SECONDS | 21:33:00 | 21:56:31 | 56 37.75N | 9 00.44W | 308.6 | SLIGHT SWELL |
| 03/02/96 | N500 | 025 | 15 SECONDS | 23:30:44 | 00:06:45 | 56 38.55N | 9 02.85W | 509.3 | SLIGHT SWELL |
| 04/02/96 | N700 | 027 | 15 SECONDS | 01:38:15 | 02:21:56 | 56 39.14N | 9 05.97W | 705.1 | MODERATE SWELL |
| 04/02/96 | N1000 | 029 | 15 SECONDS | 04:48:56 | 05:41:34 | 56 40.26N | 9 11.92W | 982.6 | HEAVY SWELL |
| 06/02/96 | N1500 | 033 | 15 SECONDS | 21:27:57 | 22:50:34 | 56 42.25N | 9 24.12W | 1429.0 | MODERATE SWELL |

***ALL CAMERA DEPLOYMENTS APPEARED SUCCESSFUL.

**CAMERA USED:IOS MK IV (P4-07)**

**FLASH USED:300 microsecond METZ.**

**FILM TYPE:ILFORD 400ASA XP2.**

Table 7. Marine snow camera deployments.

| CHALLENGER 125 TSG SAL AND TEMP | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| Date | Time | Ttsg | Stsg | Samp | Bridge | dSAL |
| | | degC | PSU | Bot | Sal | tsg/brdg |
| 1.2.96 | 08.45 | 10.209 | 35.340 | 2 | 35.3900 | -0.050 |
| 2.2.96 | 02.11 | 10.158 | 35.379 | 7 | 35.4290 | -0.050 |
| 3.2.96 | 00.10 | 9.773 | 35.349 | 12 | 35.3910 | -0.042 |
| 3.2.96 | 22.36 | 10.246 | 35.360 | 20 | 35.4090 | -0.049 |
| 6.2.96 | 05.36 | 10.316 | 35.347 | 30 | 35.4540 | -0.107 |
| 7.2.96 | 04.04 | 10.029 | 36.034 | 32 | 35.4200 | 0.614 |
| 8.2.96 | 12.32 | 7.964 | 34.232 | 39 | 34.2700 | -0.038 |
| 9.2.96 | 13.27 | 7.660 | 34.052 | 1 | 34.0990 | -0.047 |
| 10.2.96 | 09.53 | 7.824 | 34.292 | 2 | 34.3370 | -0.045 |
| 11.2.96 | 02.19 | 10.137 | 35.387 | 8 | 35.4260 | -0.039 |
| 11.2.96 | 17.02 | 8.758 | 35.076 | 11 | 35.1200 | -0.044 |

Table 8. Thermosalinograph salinity calibration against bottle samples. The mean and standard deviation of (thermosalinograph - salinometer) are -0.051 ±0.019. The check on 7.2.96 occurred in the period of erroneous thermosalinograph salinity readings (section 5.2).

**CTD STATION DATA**

**CRUISE**

| CH125A Thermosalinograph/CTD comparison | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| Stat No | Ttsg degC | Stsg PSU | Tctd at mark | Sctd at mark | dT ctd/tsg | dS ctd/tsg |
| 7 | 10.325 | 35.378 | 10.417 | 35.399 | -0.092 | -0.021 |
| 10 | 10.158 | 35.379 | 10.271 | 35.403 | -0.113 | -0.024 |
| 11 | 9.878 | 35.348 | 9.965 | 35.371 | -0.087 | -0.023 |
| 17 | 9.938 | 35.365 | 10.044 | 35.375 | -0.106 | -0.010 |
| 22 | 10.211 | 35.354 | 10.300 | 35.371 | -0.089 | -0.017 |
| 23 | 10.272 | 35.363 | 10.320 | 35.380 | -0.048 | -0.017 |
| 24 | 10.213 | 35.357 | 10.326 | 35.377 | -0.113 | -0.020 |
| 25 | 10.270 | 35.366 | 10.377 | 35.391 | -0.107 | -0.025 |
| 26 | 10.298 | 35.388 | 10.421 | 35.407 | -0.123 | -0.019 |
| 27 | 10.330 | 35.398 | 10.442 | 35.413 | -0.112 | -0.015 |
| 28 | 10.248 | 35.393 | 10.352 | 35.408 | -0.104 | -0.015 |
| 29 | 9.926 | 35.369 | 10.014 | 35.380 | -0.088 | -0.011 |
| 31 | 10.335 | 35.431 | 10.478 | 35.430 | -0.143 | 0.001 |
| 32 | 10.297 | 35.416 | 10.432 | 35.413 | -0.135 | 0.003 |
| 33 | 9.969 | 35.989 | 10.108 | 35.391 | -0.139 | 0.598 |
| 34 | 10.039 | 35.382 | 10.158 | 35.394 | -0.119 | -0.012 |
| 35 | 9.910 | 35.373 | 10.116 | 35.391 | -0.206 | -0.018 |
| 36 | 9.820 | 35.358 | 9.976 | 35.374 | -0.156 | -0.016 |
| 37 | 10.311 | 35.415 | 10.456 | 35.433 | -0.145 | -0.018 |
| 38 | 10.383 | 35.427 | 10.539 | 35.445 | -0.156 | -0.018 |
| 39 | 10.349 | 35.417 | 10.486 | 35.434 | -0.137 | -0.017 |
| 40 | 10.240 | 35.401 | 10.295 | 35.422 | -0.055 | -0.021 |
| 41 | 10.104 | 35.360 | 10.148 | 35.383 | -0.044 | -0.023 |
| 42 | 10.221 | 35.388 | 10.233 | 35.403 | -0.012 | -0.015 |
| 43 | 10.302 | 35.398 | 10.327 | 35.426 | -0.025 | -0.028 |
| 45 | 10.222 | 35.390 | 10.260 | 35.415 | -0.038 | -0.025 |
| 46 | 10.092 | 35.382 | 10.130 | 35.400 | -0.038 | -0.018 |
| 47 | 9.995 | 35.345 | 9.983 | 35.378 | 0.012 | -0.033 |

Table 9. Comparison of thermosalinograph with CTD measurements at 5 m. The mean and standard deviations of (thermosalinograph - CTD) for temperature are -0.097 ±0.050°C and for salinity are -0.018 ± 0.007. The check for CTD 33 occurred in the period of erroneous thermosalinograph salinity readings (section 5.2).

| CHALLENGER 125A (SES 5) | | | GENERAL NON-TOXIC SUPPLY (DECK TRANS) | |
|---|---|---|---|---|
| Sample | Date/Time | Site | Determinants | Comments |
| PG101 | 01/02/96 07:01 | | Chlorophyll | IE |
| PG102 | 01/02/96 12:36 | S140 | Chlorophyll | RNC |
| PG103 | 01/02/96 17:06 | S200 | Chlorophyll | RNC |
| PG104 | 01/02/96 20:52 | | Chlorophyll | IE |
| PG105 | 02/02/96 00:39 | S500 | Chlorophyll | IE |
| PG106 | 02/02/96 04:13 | S850 | Chlorophyll | IE |
| PG107 | 02/02/96 08:00 | | Chlorophyll | RNC |
| PG108 | 02/02/96 12:18 | | Chlorophyll | RNC |
| PG109 | 02/02/96 18:41 | | Chlorophyll | RNC |
| PG110 | 02/02/96 23:42 | | Chlorophyll | |
| PG111 | 03/02/96 04:15 | | Chlorophyll | IE |
| PG112 | 03/02/96 08:04 | | Chlorophyll | RNC |
| PG113 | 03/02/96 12:35 | | Chlorophyll | RNC |
| PG114 | 03/02/96 16:43 | | Chlorophyll | RNC |
| PG115 | 03/02/96 21:05 | | Chlorophyll | AH |
| PG116 | 04/02/96 01:14 | | Chlorophyll | IE |
| PG117 | 04/02/96 07:41 | | Chlorophyll | RNC |
| PG118 | 04/02/96 12:58 | | Chlorophyll | RNC |
| PG119 | 05/02/96 08:12 | | Chlorophyll | |
| PG120 | 05/02/96 13:58 | | Chlorophyll | RNC |
| PG121 | 05/02/96 20:13 | | Chlorophyll | RNC |
| PG122 | 06/02/95 07:47 | | Chlorophyll | RNC |
| PG123 | 06/02/96 14:52 | | Chlorophyll | RNC |
| PG124 | 06/02/96 21:15 | N1500 | Chlorophyll | RNC |
| PG125 | 07/02/96 01:29 | N1150 | Chlorophyll | |
| PG126 | 07/02/96 06:49 | R500 | Chlorophyll | |
| PG127 | 07/02/96 13:40 | | Chlorophyll | RNC |
| PG128 | 08/02/96 08:46 | | Chlorophyll | RNC |
| PG129 | 08/02/96 14:12 | | Chlorophyll | RNC (Sound of Jura) |
| PG130 | 08/02/96 19:24 | | Chlorophyll | RNC (Sound of Jura) |
| PG131 | 09/02/96 11:10 | | Chlorophyll | RNC (Sound of Lorne, Jura) |
| PG132 | 09/02/96 17:50 | | Chlorophyll | RNC (Sound of Lorne, Jura) |
| PG133 | 10/02/96 08:51 | | Chlorophyll | RNC |
| PG134 | 10/02/96 14:12 | | Chlorophyll | RNC |
| PG135 | 10/02/96 18:38 | CC3 | Chlorophyll | RNC |
| PG136 | 11/02/96 00:54 | P700 | Chlorophyll | IE |
| PG137 | 11/02/96 04:58 | P1300 | Chlorophyll | RNC |
| PG138 | 11/02/96 15:52 | | Chlorophyll | IE |

Table 10. Calibration samples for the surface fluorometer.

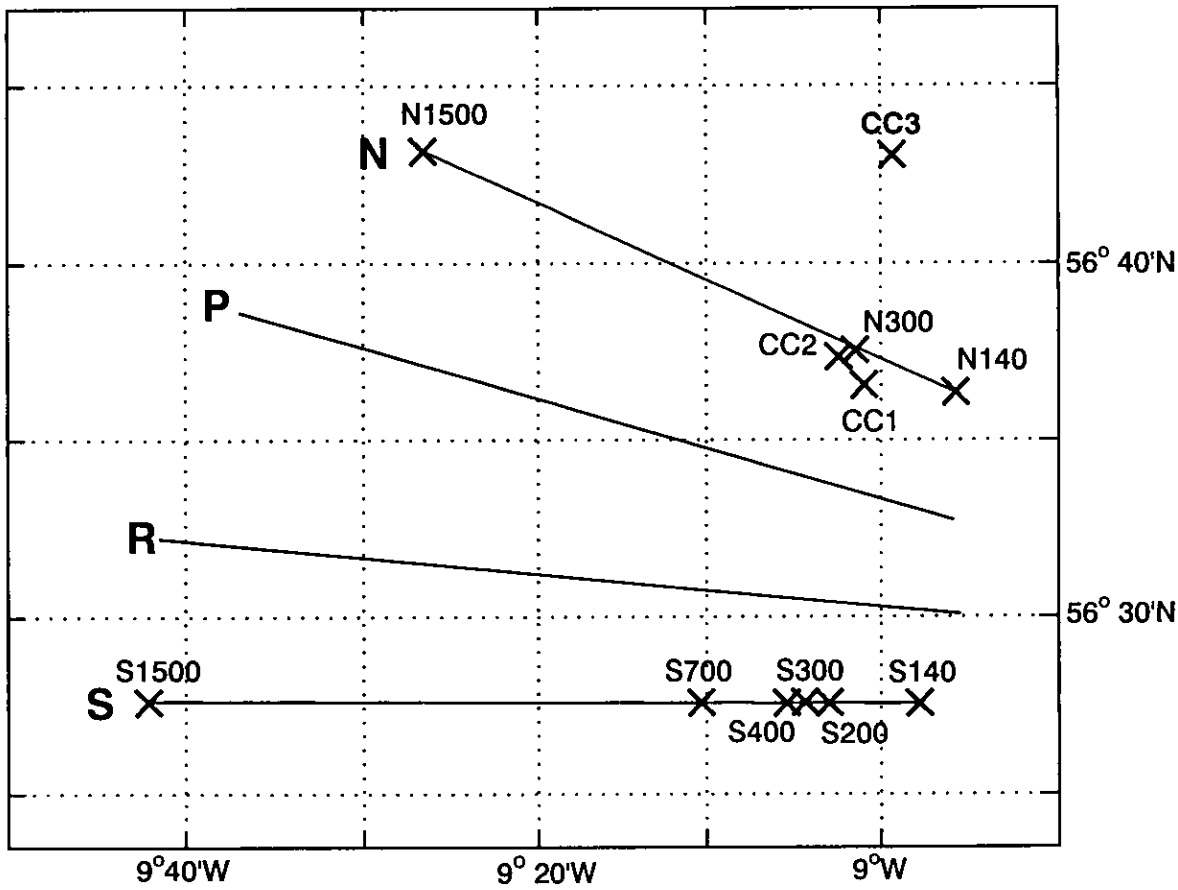
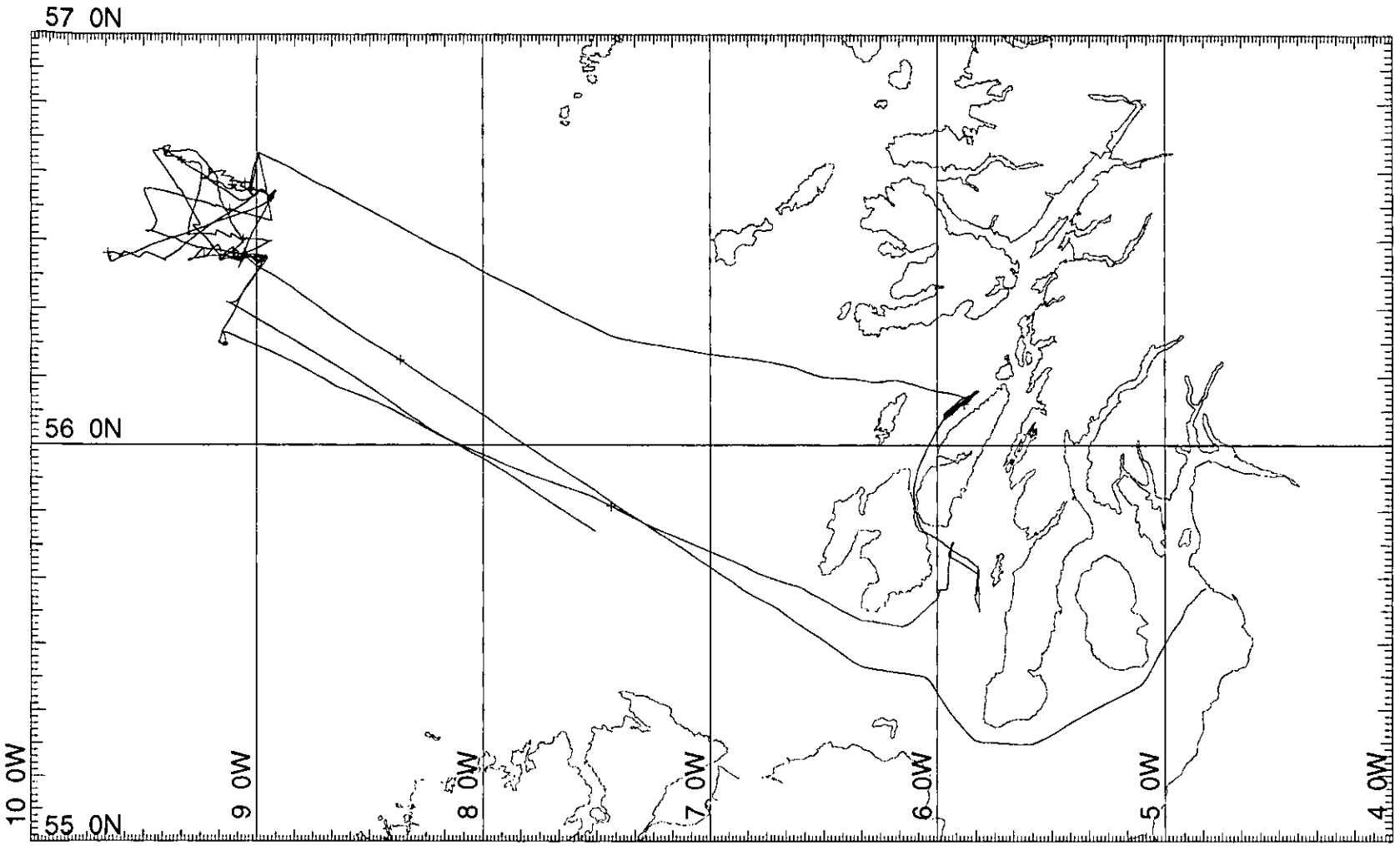



Figure 1. Schematic map of mooring positions and main CTD lines.



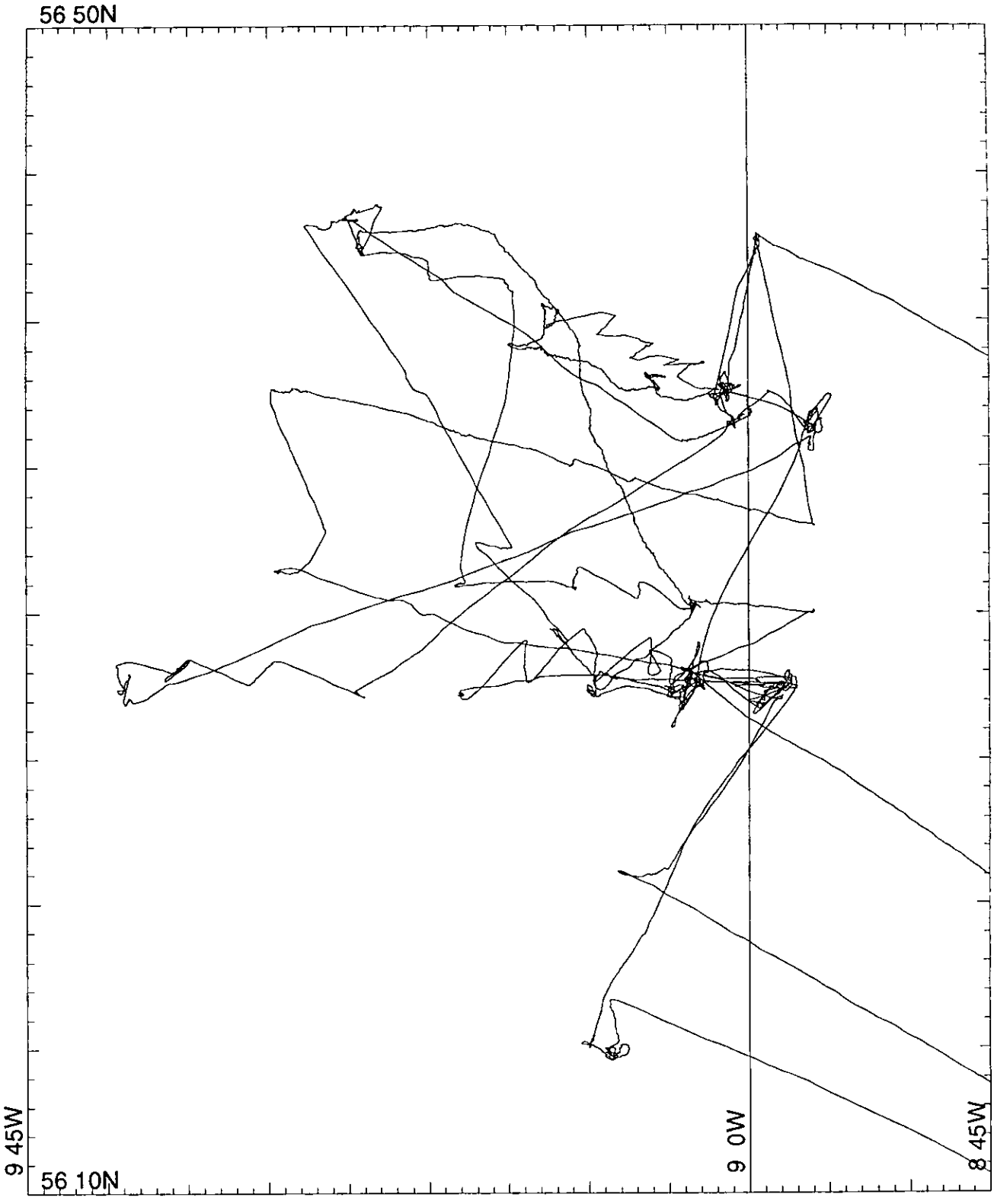

MERCATOR PROJECTION

SCALE 1 TO 1750000 (NATURAL SCALE AT LAT. 56)

INTERNATIONAL SPHEROID PROJECTED AT LATITUDE 0

RRS Challenger 125 Leg A - February 1996

Figure 2. Cruise track.




MERCATOR PROJECTION

SCALE 1 TO 375000 (NATURAL SCALE AT LAT. 56)

INTERNATIONAL SPHEROID PROJECTED AT LATITUDE 0

RRS Challenger 125 Leg A - February 1996

Figure 3. Detailed cruise track of SES area.

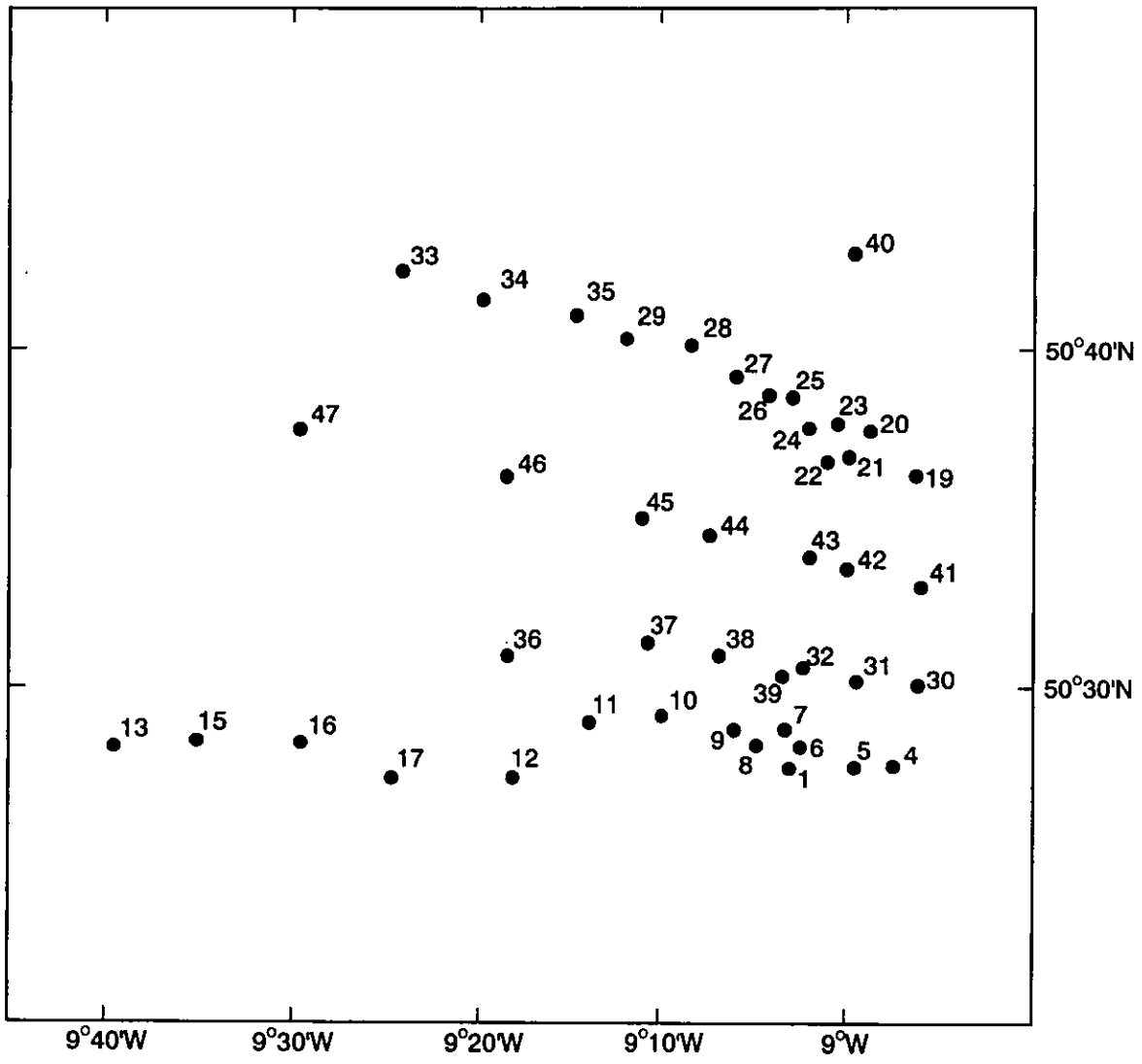



Figure 4. Map of CTD positions.

# Challenger Cruise SES 5

## South Section

## Reduced Instrumentation

## Deployments from February to April 1996

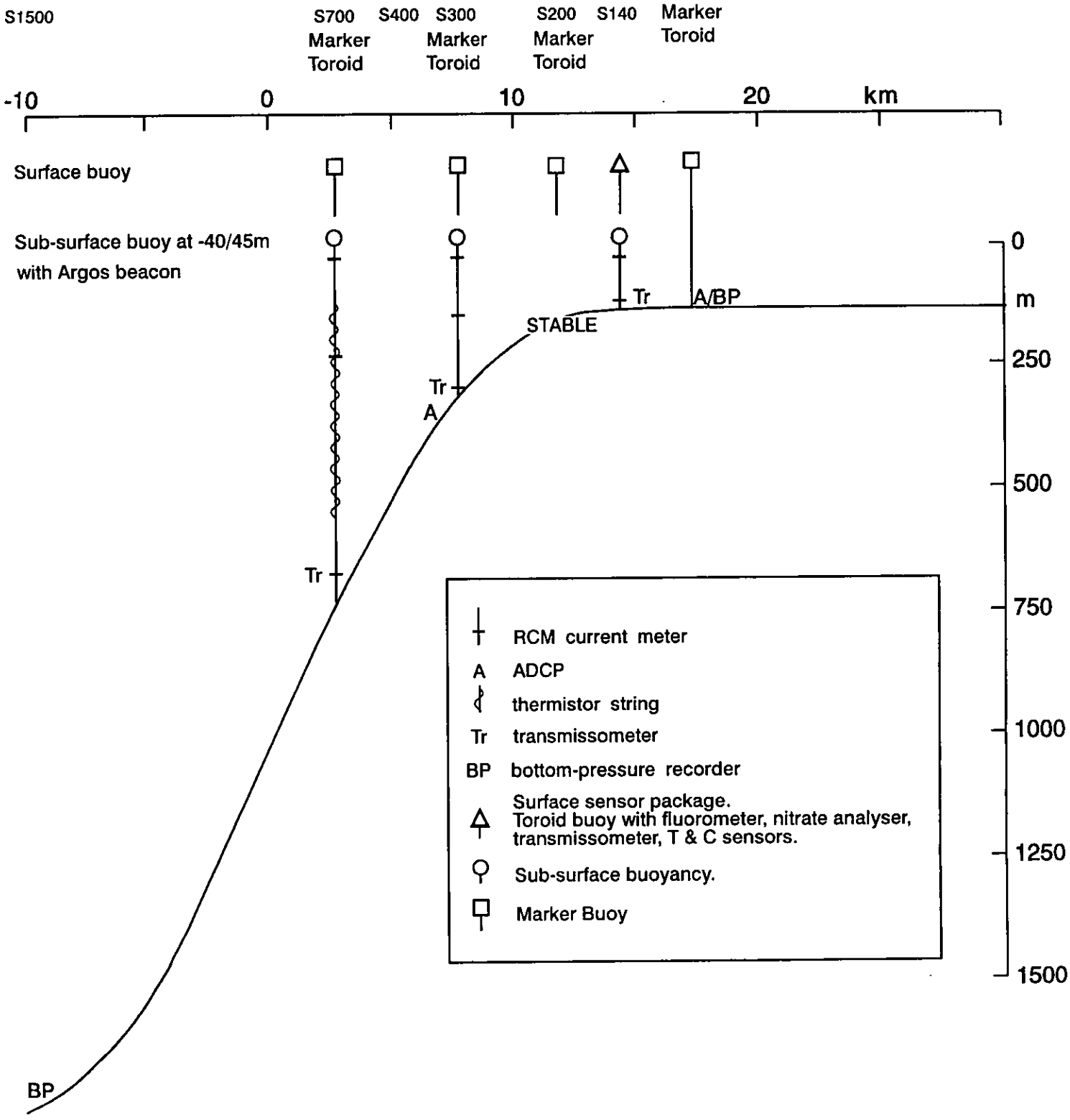



Figure 5. Summary of mooring array on S line. February '96

# Challenger Cruise SES 5

## North Section

Reduced Instrumentation

Deployments from February to April 1996

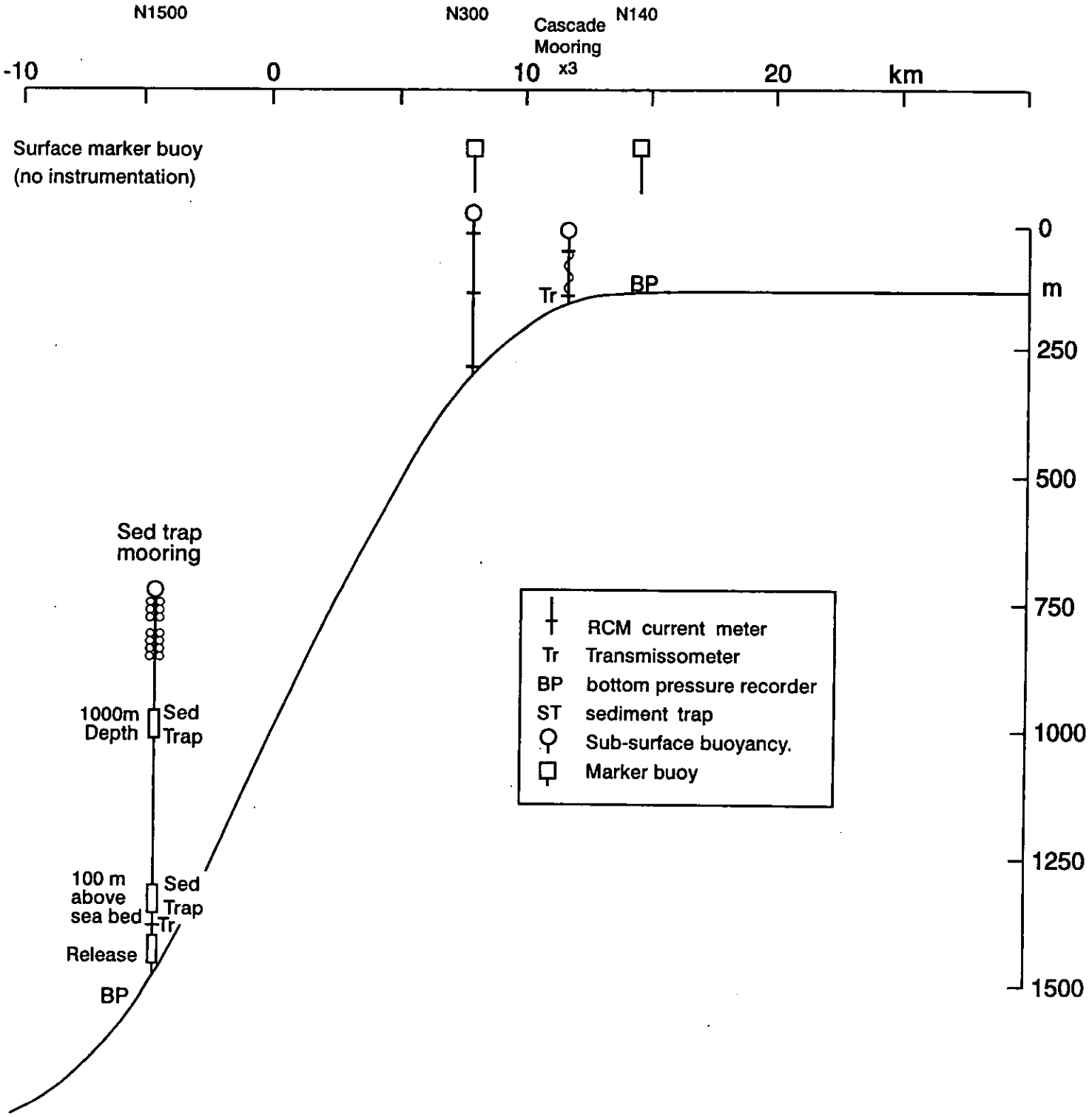
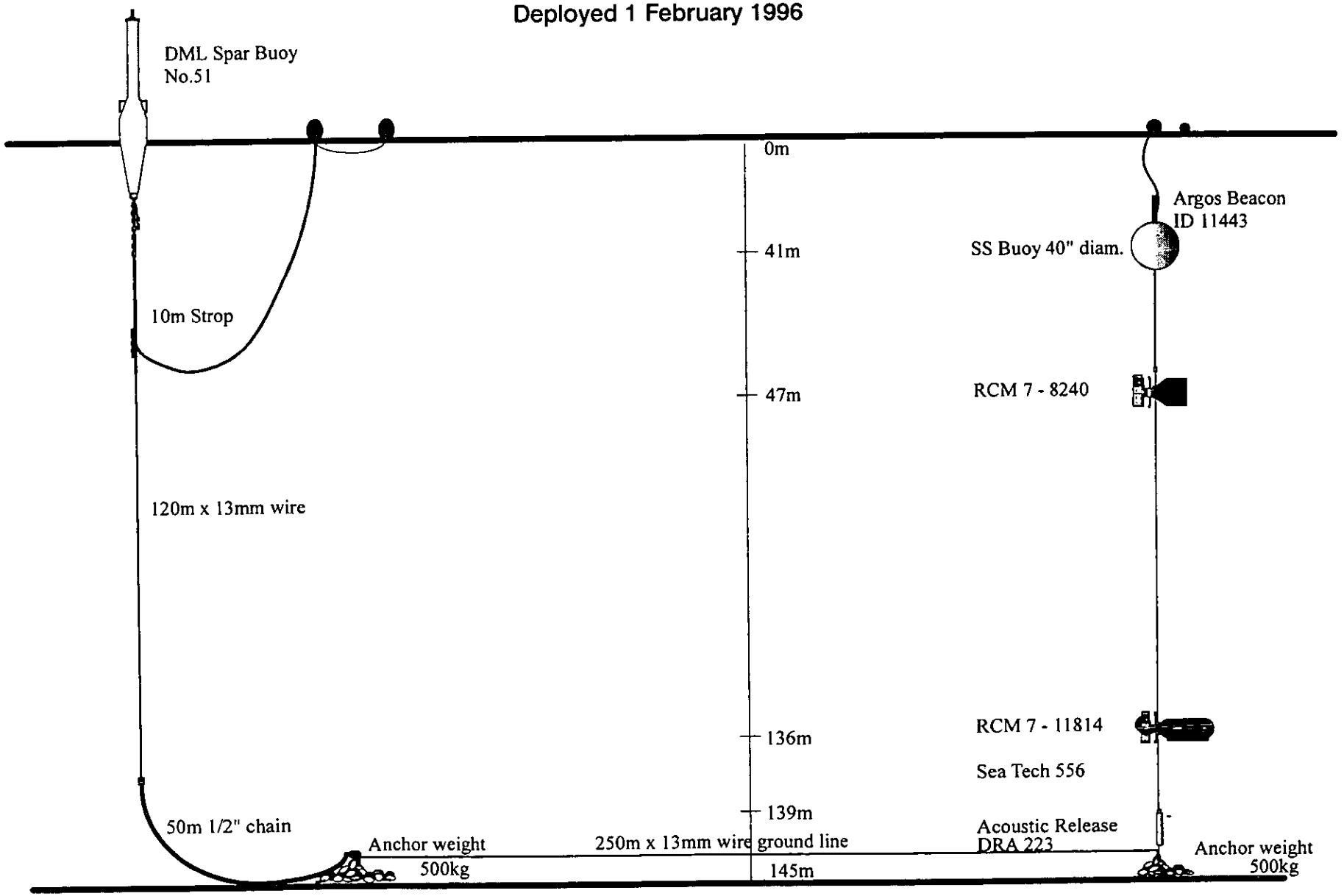



Figure 6. Summary of mooring array on N line. February '96

# Challenger Cruise SES 5

## S 140 South section mooring

### Deployed 1 February 1996

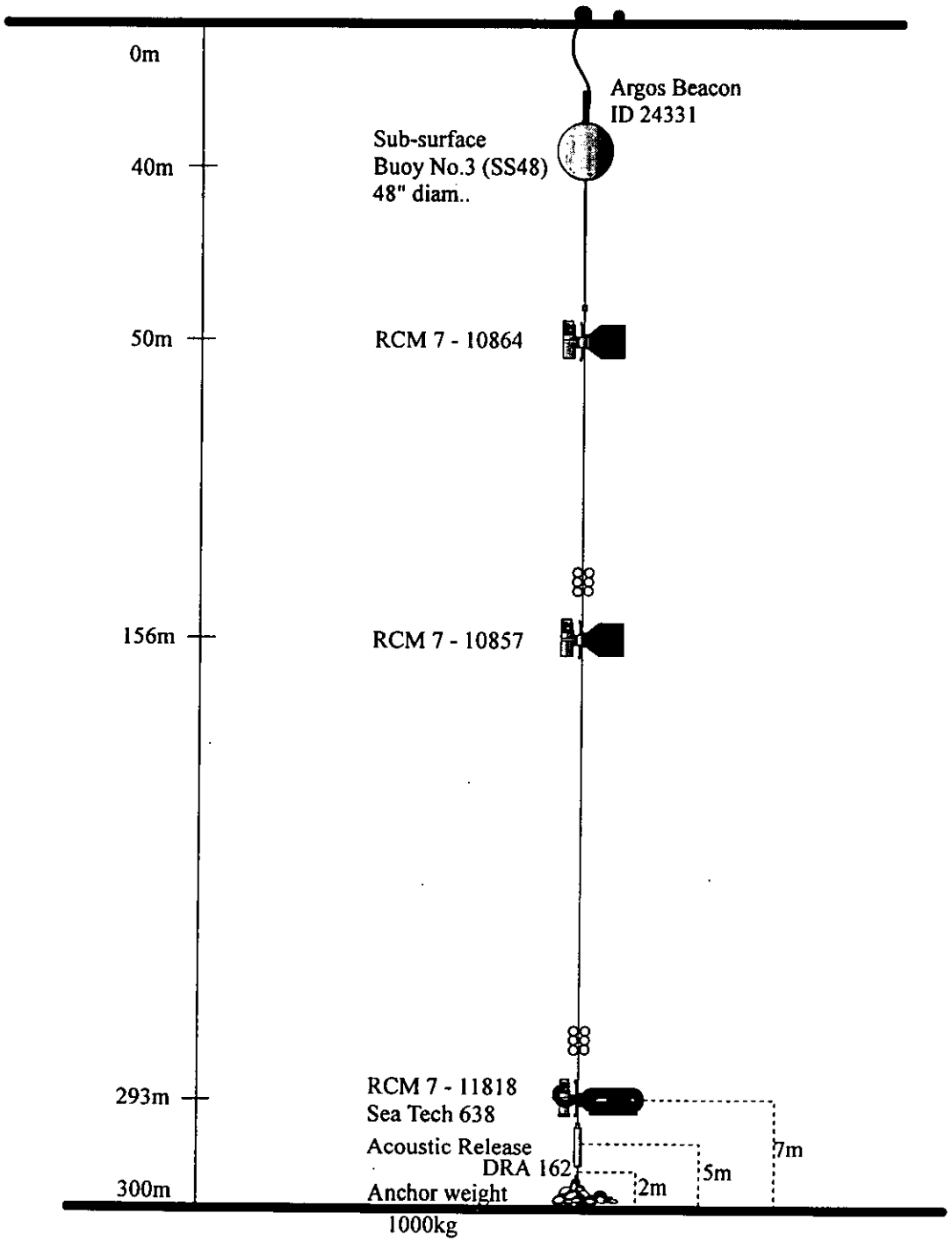



February '96

# Challenger Cruise SES 5

## S 300 South section (sub-surface mooring)

### Deployed 2 February 1996

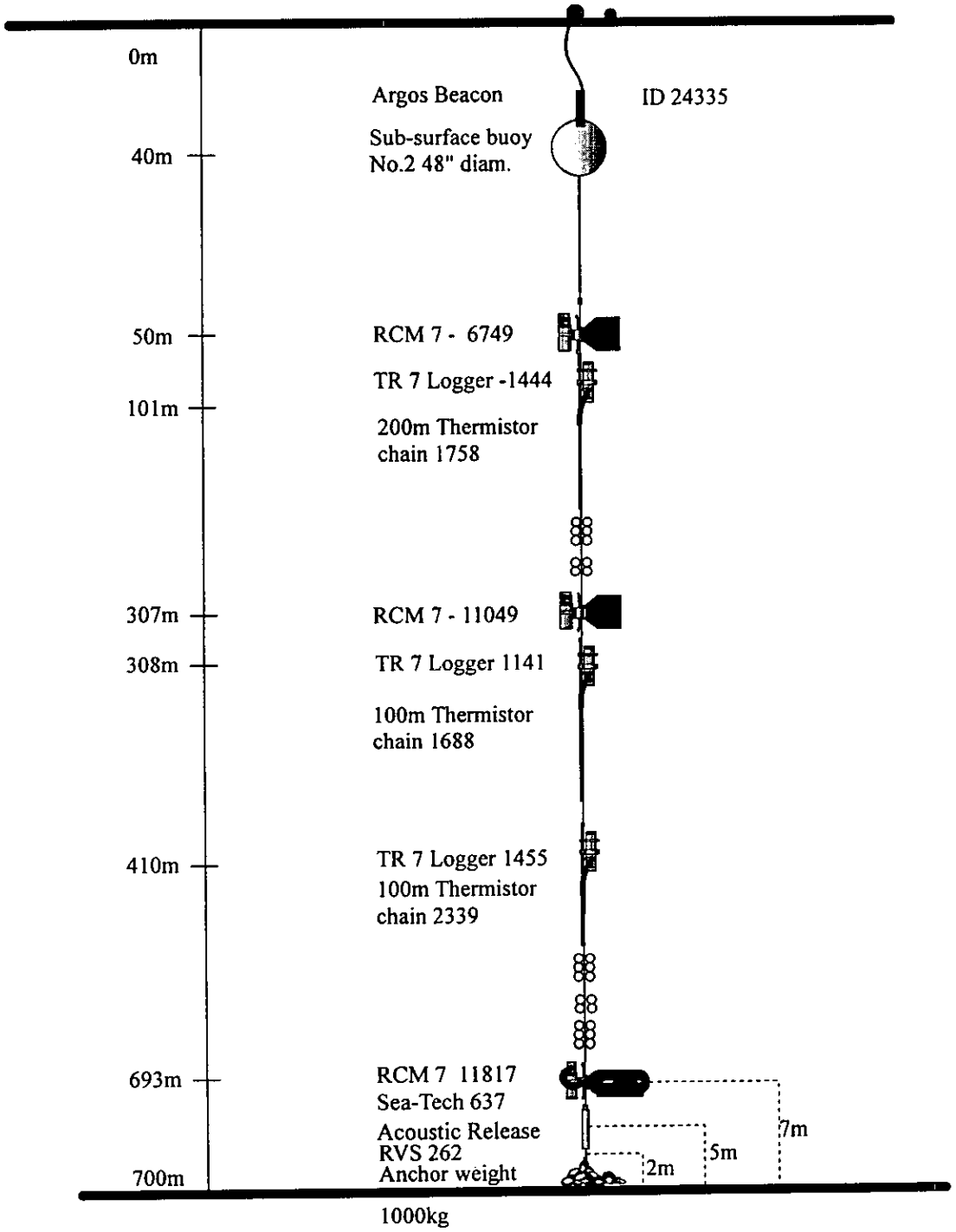



February '96

# Challenger Cruise SES 5

## S 700 South section (sub-surface mooring)

### Deployed 5 February 1996

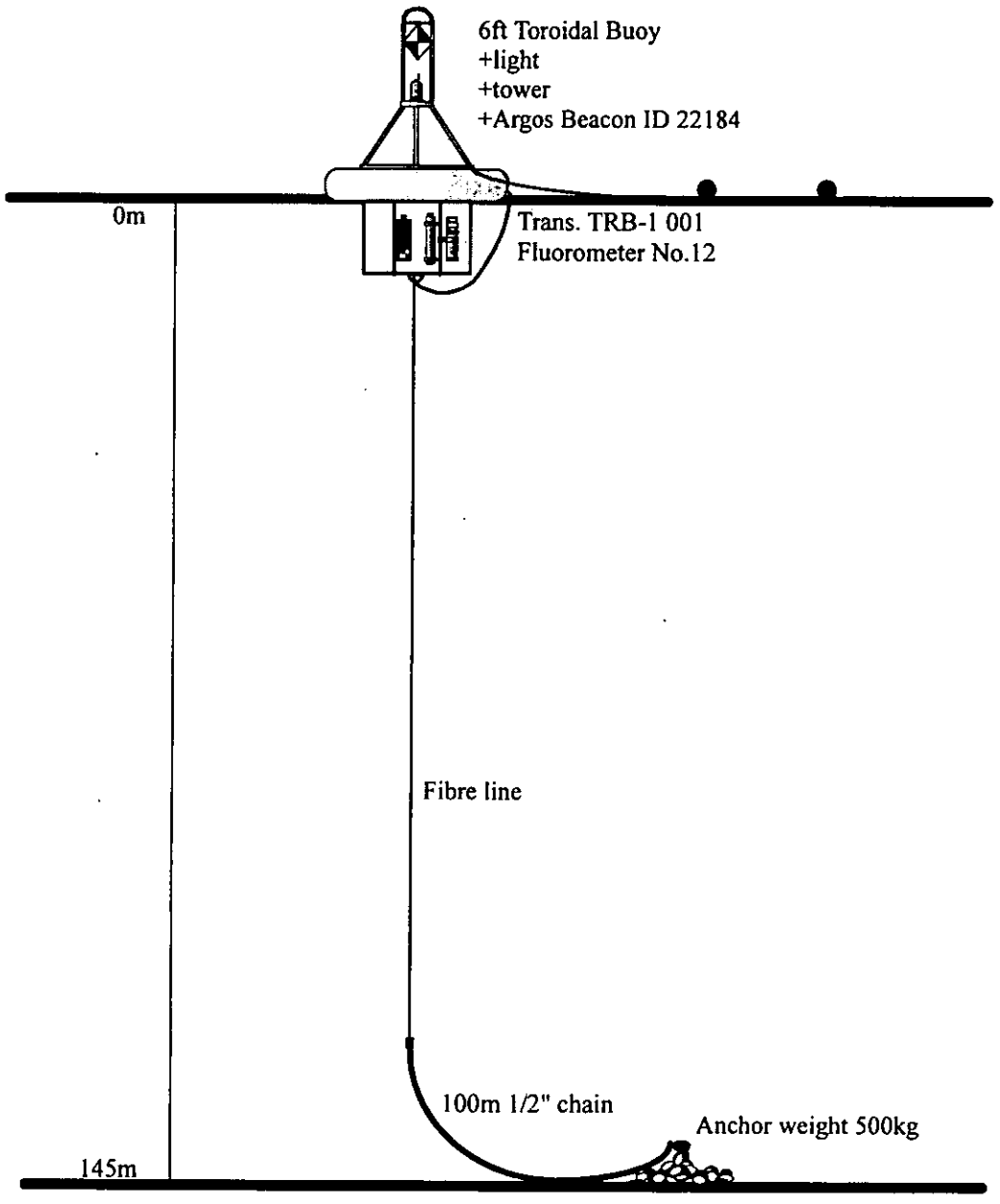



February. '96

# Challenger Cruise SES 5

## S 140 South section (surface buoy mooring)

### Deployed 1 February 1996

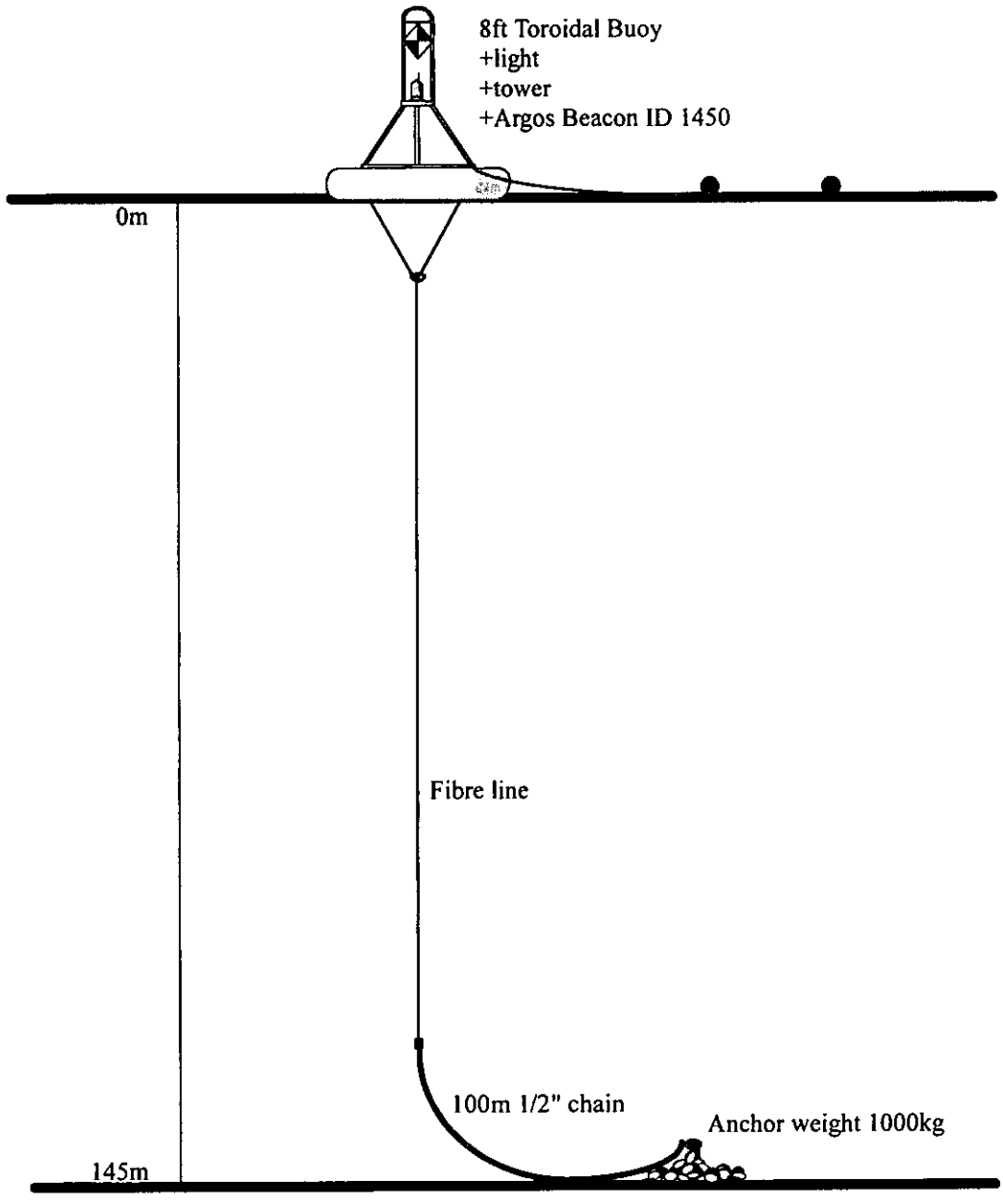



February '96

# Challenger Cruise SES 5

## S 140 South section (surface marker buoy mooring)

### Deployed 1 February 1996

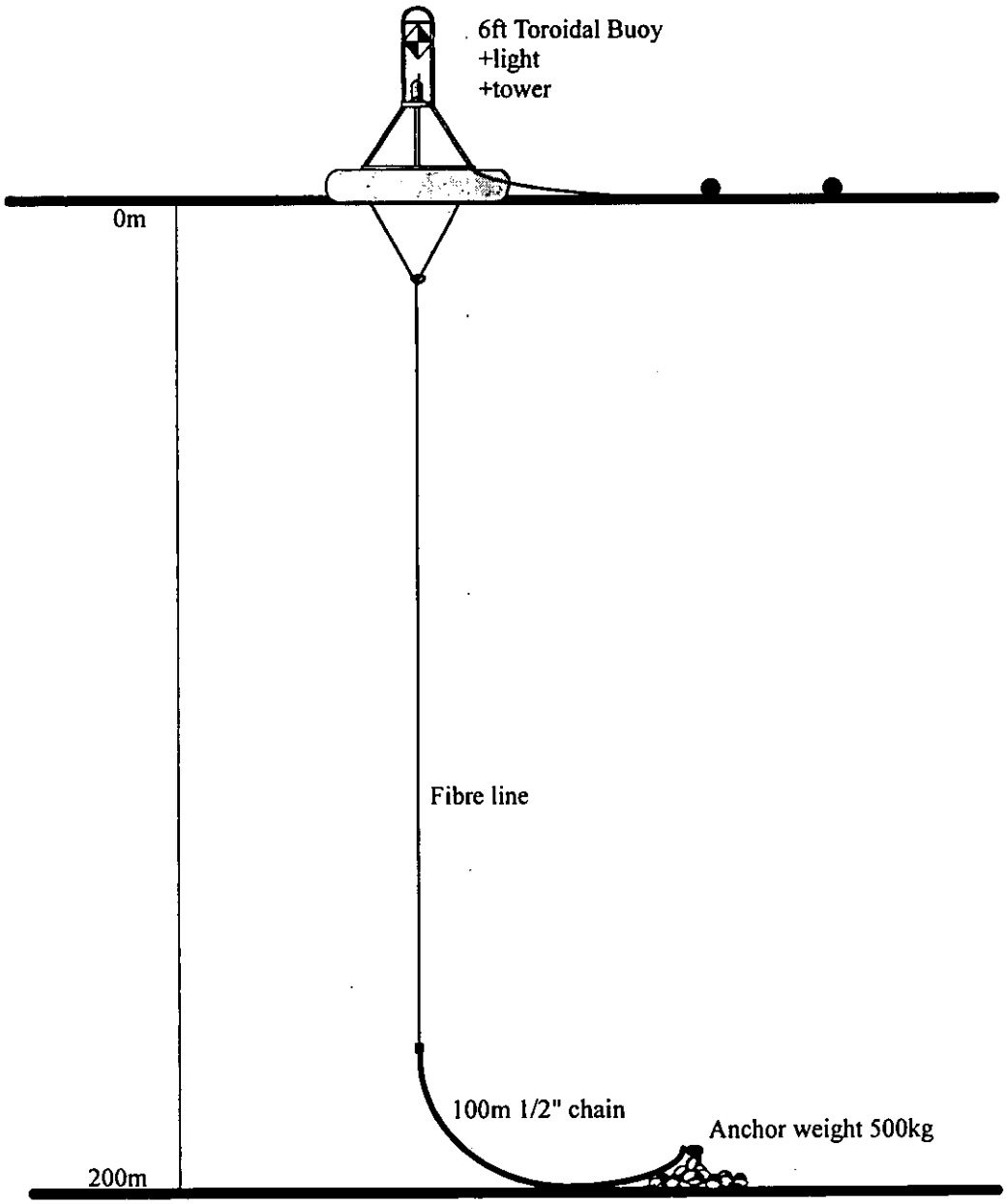



February '96

# Challenger Cruise SES 5

## S 200 South section (STABLE surface marker buoy mooring)

### Deployed 1 February 1996

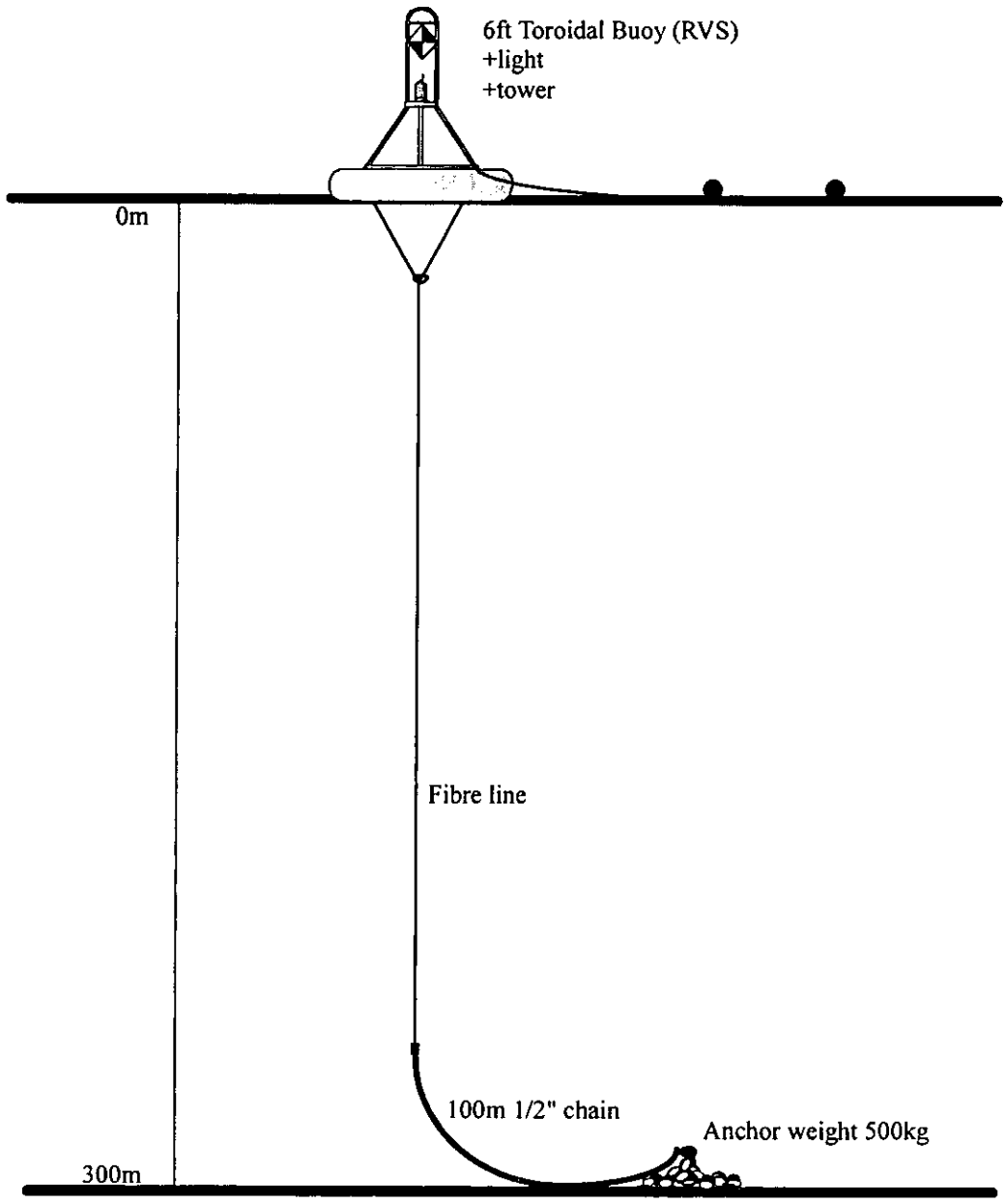



February '96

# Challenger Cruise SES 5

## S 300 South section (surface marker buoy mooring)

### Deployed 2 February 1996

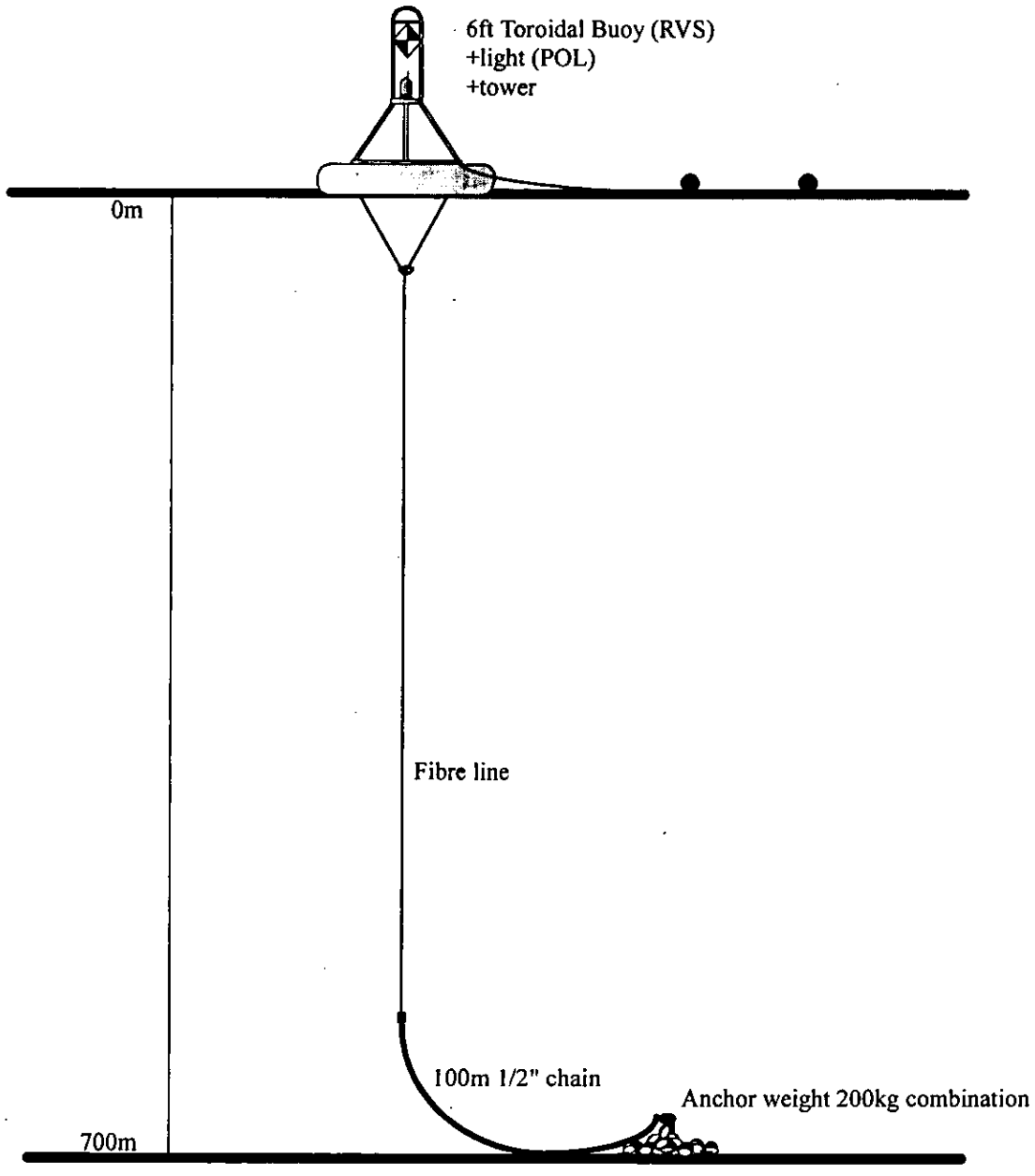



February '96

# Challenger Cruise SES 5

## S 700 South section (surface marker buoy mooring)

### Deployed 7 February 1996

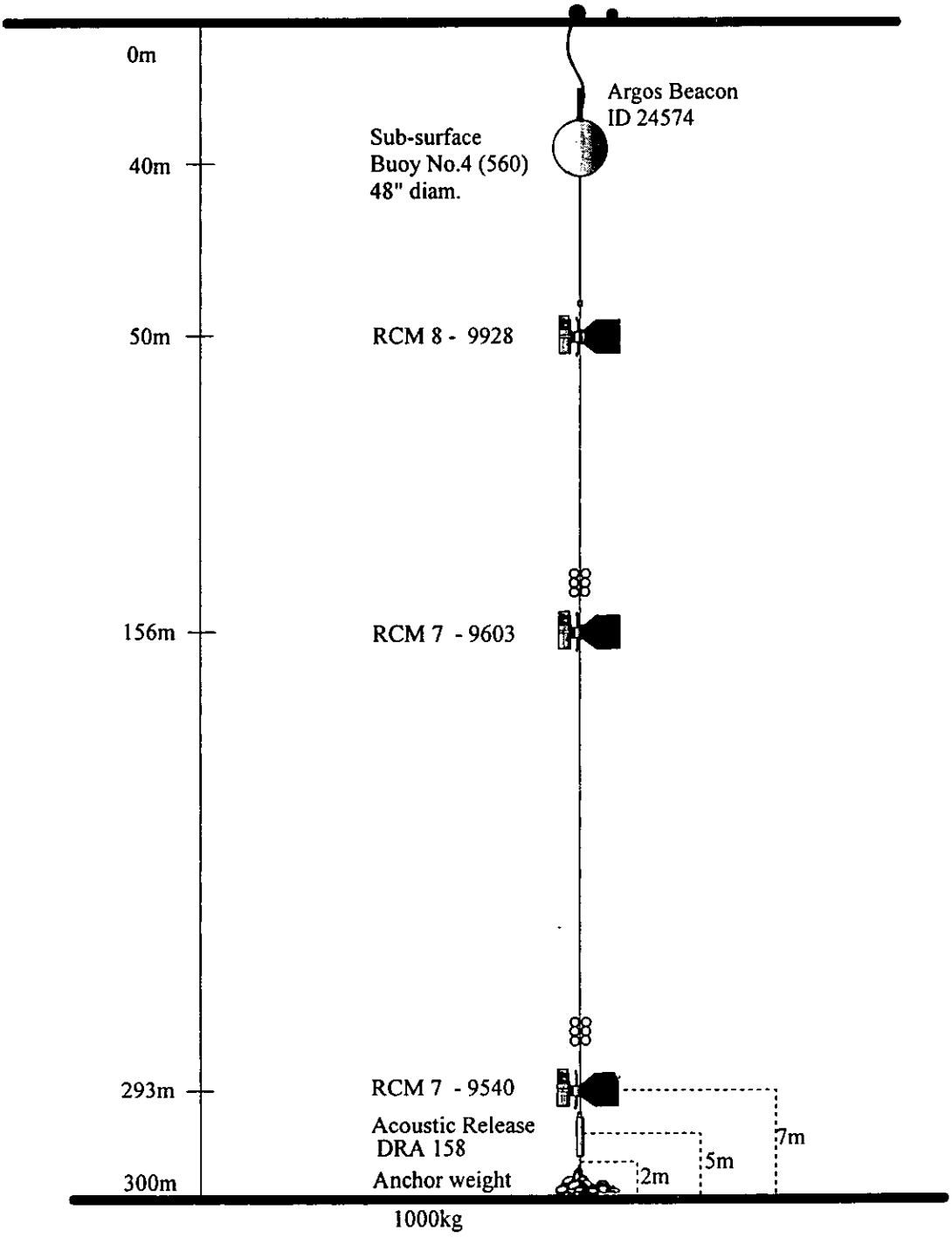



February '96

# Challenger Cruise SES 5

## N 300 North section (sub-surface mooring)

### Deployed 3 February 1996

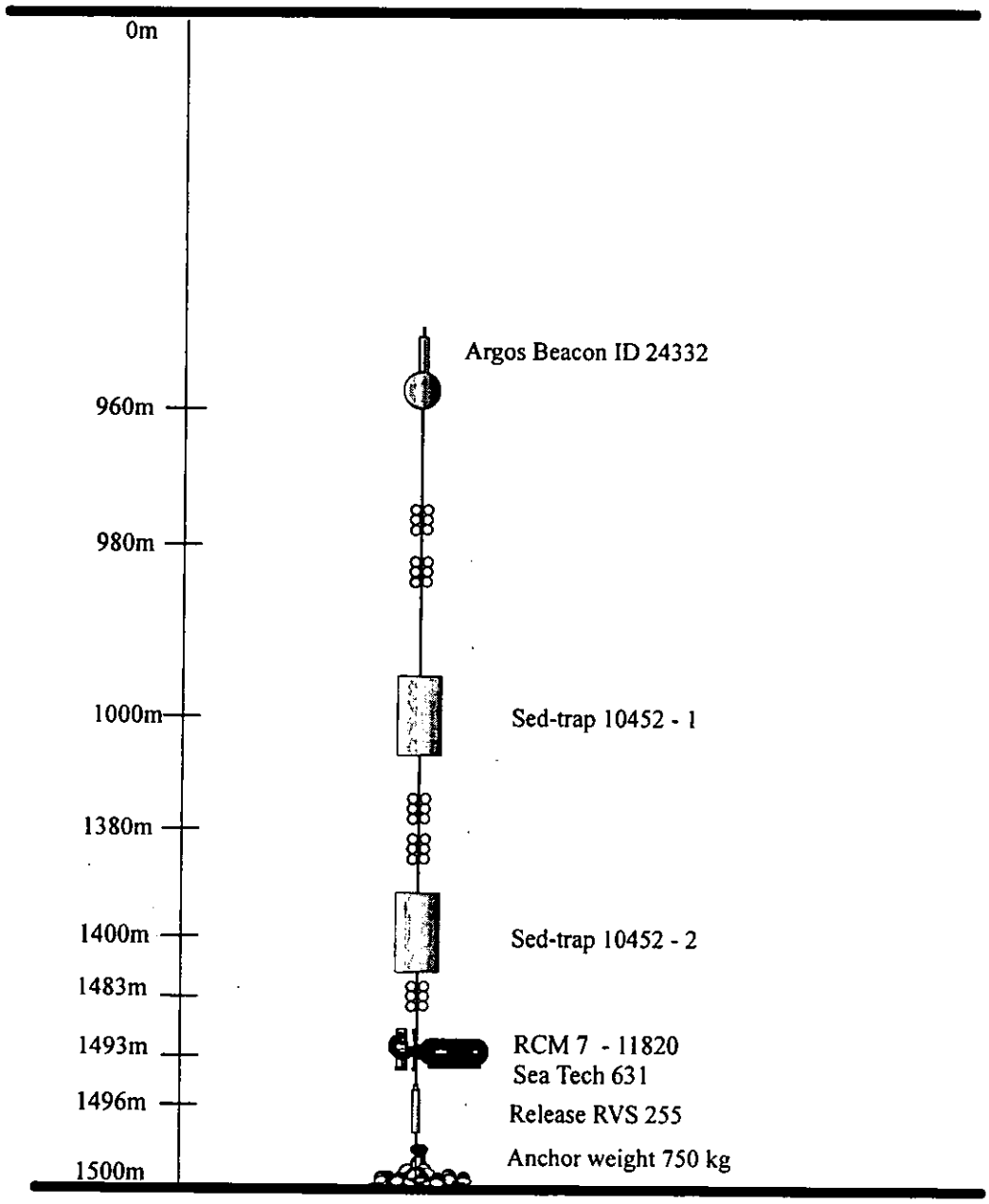



February '96

# Challenger Cruise SES 5

## N 1500 North section (sub-surface Sed-trap mooring)

### Deployed 6 February 1996

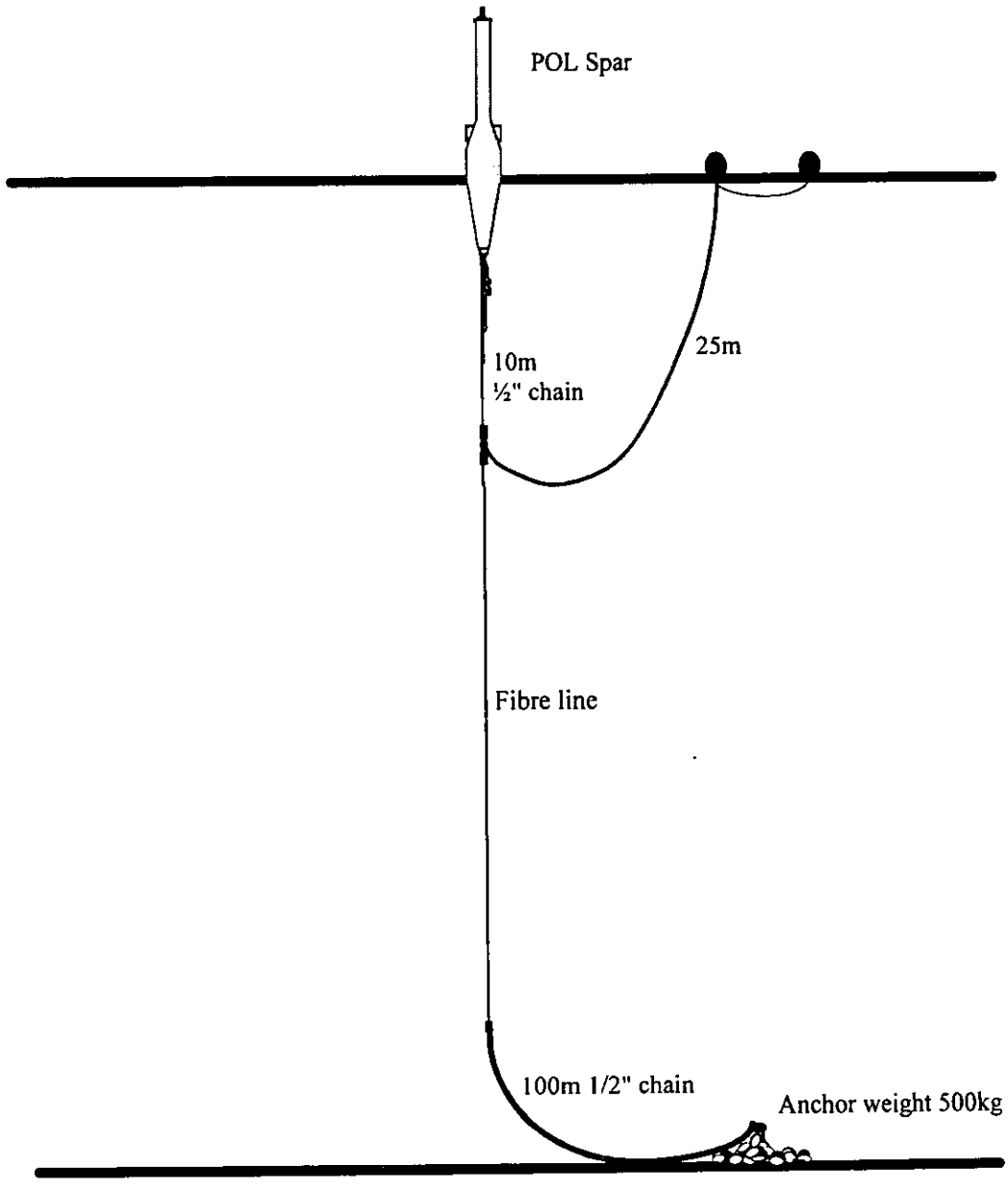



February '96

# Challenger Cruise SES 5

## N 140, N 300 North section (sub-surface mooring)

### Deployed 2 & 3 February 1996

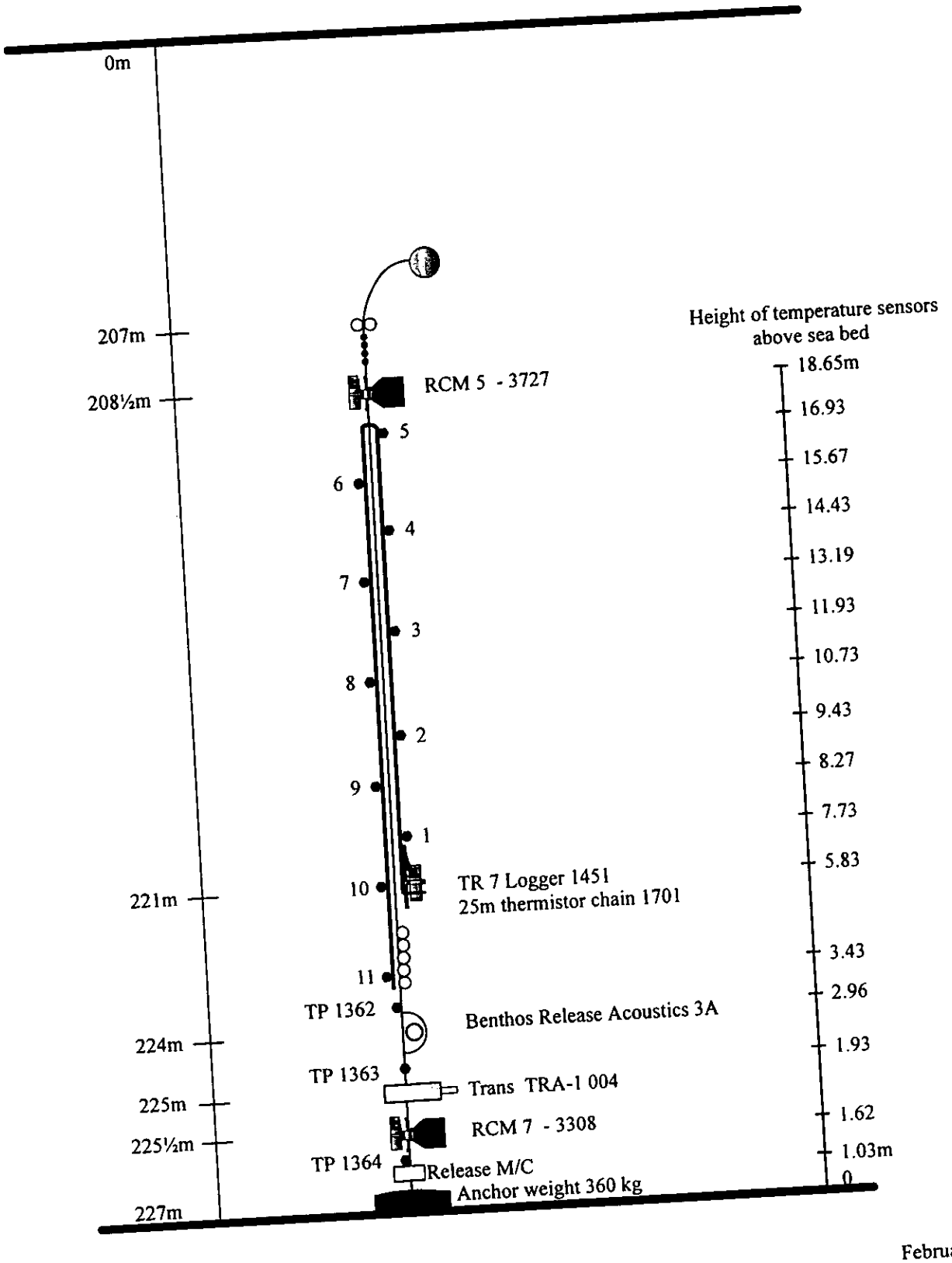



February '96

# Challenger Cruise SES 5

## Cascade mooring - CC1

### Deployed 3 February 1996 (20 min sampling)

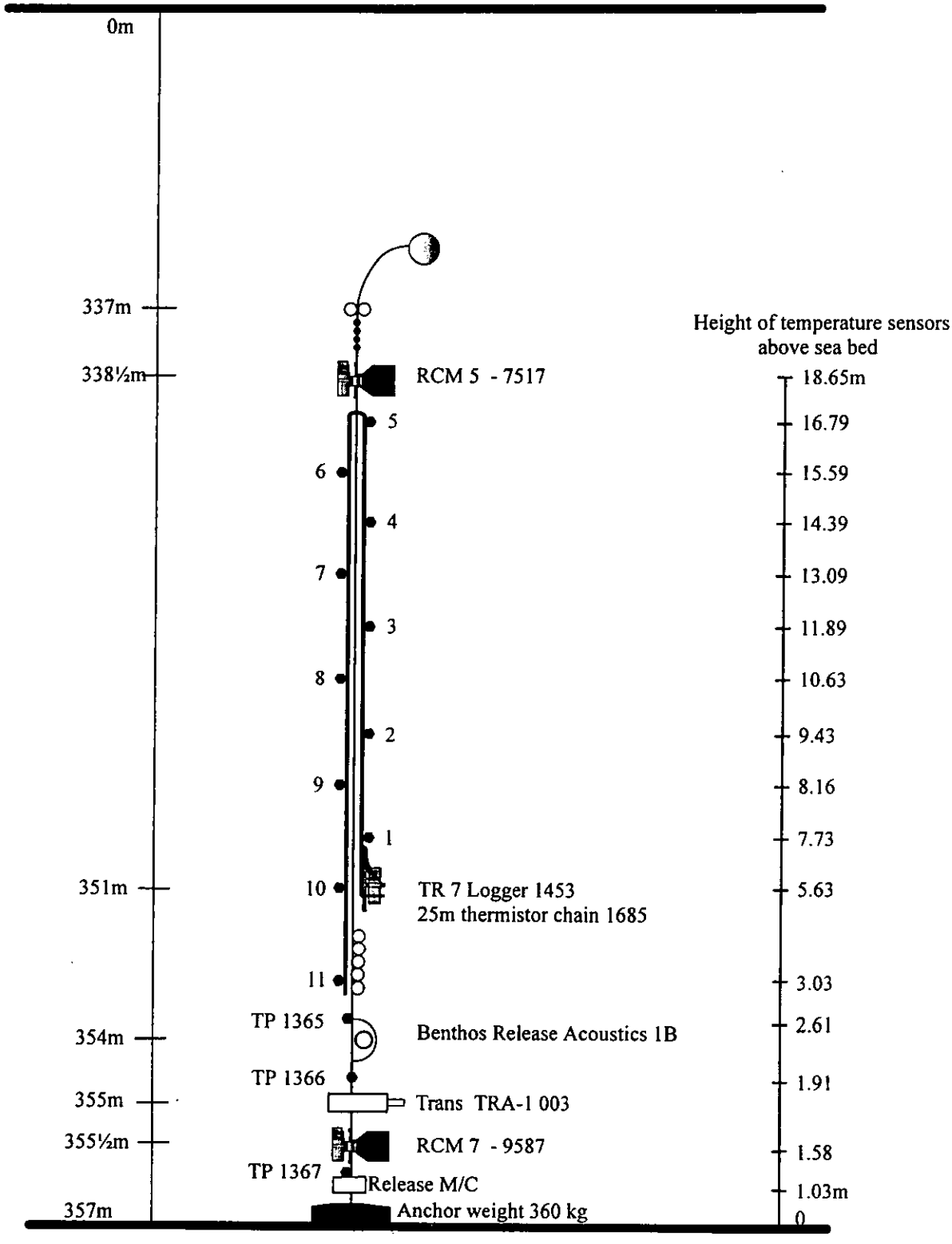



February '96

# Challenger Cruise SES 5

## Cascade mooring - CC2

### Deployed 3 February 1996 (20 min sampling)

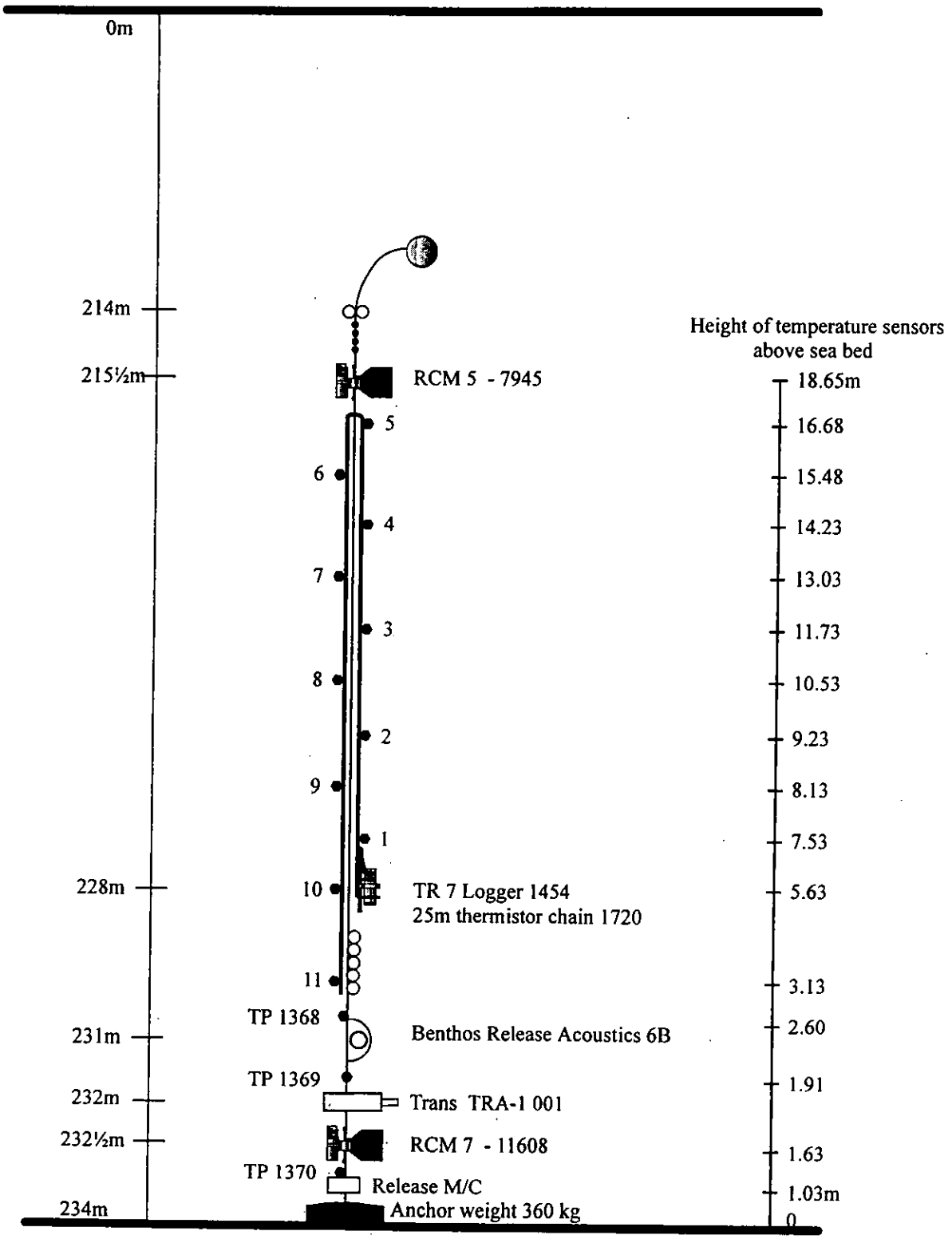



February '96

# Challenger Cruise SES 5

## Cascade mooring - CC3

### Deployed 3 February 1996 (20 min sampling)




February '96