

SH

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
FISHERIES LABORATORY, LOWESTOFT, SUFFOLK, ENGLAND

1978 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA: CRUISE 6
(PROVISIONAL: Not to be quoted without prior reference to the author)

STAFF

- R R Dickson
- G C Baxter
- J A Durance
- N D Pearson
- P Gurbutt
- S R Jones
- K J Medler
- M Thomas
- R J Read

DURATION

Sailed Grimsby 1800 h, 22 June
Docked Grimsby 0815 h, 25 July
All times are Greenwich Mean Time.

LOCALITY

Mid and Eastern Atlantic

AIMS

1. To recover and relay the NEADS-6 upper-bottom c/m mooring at 52°30N 17°45W, deployed during CIROLANA 11/77.
2. To recover the three upper bottom c/m moorings deployed in the Gibbs Fracture Zone during CIROLANA 11/77.
3. To lay an east-west network of upper bottom c/m moorings north east of the Azores between the mid-Atlantic Ridge and the NEADS-4 site at 41°N 25°W.
4. To test the MK II neutrally buoyant float tracking system at the above site.
5. To make XBT observations every 15-20 miles on passage with emphasis on the mid-Atlantic Ridge crestline and the continental slope of the eastern North Atlantic.
6. To conduct standard hydro sections and take oxygen and silicate samples in selected areas of the eastern Atlantic.
7. To test the deep-submergence scintillation counter.
8. To service the moorings at Spurn, Jonsis 1 and 2, Tyne and Tees.

NARRATIVE

CIROLANA sailed at 1800 h 22 June and proceeded to recover and relay the Spurn mooring that evening before continuing to service the Jonsis 1 and 2, Tyne and Tees moorings. All were relaid by 1820 h 23 June and CIROLANA then docked at Yarmouth at 1030 h 24 June to land the recovered gear and to repair a recurrent fault in the Sat Nav system. At 1245 h 25 June with these repairs completed, CIROLANA proceeded to the site of the NEADS-6 mooring at $52^{\circ}30'N$ $17^{\circ}45'W$ and this mooring was recovered and relaid without difficulty by 1347 h, 29 June. CIROLANA then continued to the mooring site in the Gibbs Fracture Zone making continuous bathymetric measurements and hourly XBT dips (T-4 and T-7 probes) on passage until arrival on site a.m. 1 July. Heavy swell and fog with visibility less than 2 cables prevented any immediate attempt at recovery of the moorings, but following a test of the TSD system a.m. 2 July the fog and swell moderated sufficiently to permit the recovery of all three moorings by 1921 h. Thereafter, with unsatisfactory performance from the TSD system, with wind and swell preventing meaningful use of Nansen casts and with no prospect of an adequate moderation of these conditions for at least 48 hours, plans for hydrographic sampling in the deepest layers of the trench were abandoned. Instead, after conducting a detailed bathymetric survey of the mooring site until 2125 h 2 July, CIROLANA steamed south towards her main working area north east of the Azores, making PDR and XBT measurements on passage as before.

Between 0900 h 5 July and 1023 h 7 July a series of seven upper-bottom moorings were laid with variable spacing along $41^{\circ}N$ between longitudes $27^{\circ}18'W$ and $23^{\circ}18'W$. Deep wire-tests of the acoustic release system were made prior to each launch and each deployment was timed to coincide with a Sat Nav update. Current meters were set at 50 and 1050 metres above the seabed in each case.

Following deep wire tests of neutrally buoyant floats and bottom transponders from 1550 h to 2155 h 7 July, CIROLANA returned westward to an area of relatively smooth bottom topography around $41^{\circ}N$ $25^{\circ}25'W$, close to the mid point of the current-meter section. There, the three bottom transponders were deployed on 8 July in the form of a 30 km triangle, and these were then accurately located by repeated Sat Nav fixes until noon, 9 July. Two floats set to nominal depths of 1500 m and 2500 m were then launched and these were followed continuously until 0900 h 11 July when their drift and depth had been adequately determined. Tracking was then suspended to carry out a bathymetric survey around the mooring at $41^{\circ}N$ $26^{\circ}26'W$ where the depth encountered had varied considerably from the charted depth. The two floats were then relocated before leaving the area to work an XBT survey southward towards the Azores. CIROLANA then continued to Ponta Delgada, docking on the evening of 12 July.

Leaving port a.m. 14 July CIROLANA resumed XBT and bathymetric coverage during her return to the float tracking area and the two floats were relocated during the night of 14/15 July. At 0840 h 15 July an attempt to recover float 10 failed; the return signal from the float clearly showed that the latching relay in the firing circuit had operated on command but the float failed to release its ballast. A subsequent attempt to release beacon 3 around 1000 h produced the same response, once again showing clearly that the "cut" command had been received but failing to release its anchor, despite the presence (in this case) of a dual pyro circuit. The remaining two beacons and Float 6 were then interrogated p.m. 15 July and all were recovered without difficulty by 1823 h with all pyros firing correctly.

Further lab and deep wire tests of the remaining floats during the evening of 15 July and 16 July were successful, and floats 8, 4 and 6 (2nd deployment) were then launched at nominal depths of 2900 m, 1715 m and 3870 m and were tracked by Satnav until the evening of 18 July. During this period a range of other work was carried out in the intervals between fixes including TSD/Niskin tests, deep Nansen casts, boomerang corer and deep scintillation counter trials, together with repeated approaches to Float 10 and Beacon 3 to check that they still remained at their original depth. On the evening of 18 July floats 4 and 8 were successfully recovered between 1659 h and 2020 h, and a further position fix on float 10 was obtained by 2239 h. Float 10 and beacon 3 were then finally abandoned and CIROLANA moved east to await daylight for the recovery of Float 6. Recovery was attempted at 0700 h 19 July, but despite almost continuous interrogation from 0700 h until 1200 h at a variety of horizontal ranges from 0-4 km the float once again failed to release its ballast and had to be abandoned.

CIROLANA then steamed homewards following the crestline of the Azores-Biscay rise with continuous bathymetric measurement and hourly XBT observations as before; 3 further core samples were taken with the boomerang corer at selected points along this track. On 22 July an XBT grid was worked in the Bay of Biscay in the vicinity of the NEADS-7 mooring where earlier French observations with satellite buoys had indicated the presence of high mesoscale eddy activity. No such features were observed, and the survey was ended at 2000 h, 22 July. CIROLANA then proceeded directly to Grimsby, docking 0815 h, 25 July.

RESULTS

1. The NEADS-6 upper-bottom mooring was successfully recovered and relaid. Initial processing shows that both meters obtained full $8\frac{1}{2}$ month records, and that these records are both highly coherent and highly energetic (as suspected when the site was selected).
2. The three moorings from the southern trench of the Gibbs Fracture Zone were also successfully recovered. Five of the six meters had full records while the remaining record was 25% complete. Initial processing shows a predominantly westward flow at all levels examined thus far, but that the westward flow weakens or turns eastward during winter when the supply of Iceland-Scotland-Overflow-Water is at a minimum. (Travel time between the source of this water and the GFZ is approximately 6 months). Shorter term variations in the flow, possibly due to mesoscale eddy activity, are evidently superimposed on the general seasonal flow pattern.
3. Seven upper-bottom moorings were laid across the eastern flanks of the mid-Atlantic Ridge at 41°N . By incorporating the NEADS-4 mooring at $41^{\circ}\text{N } 25^{\circ}\text{W}$, they form a 180 n.mi long east-west section of 8 moorings with mooring separations varying between 15 and 39 n.mi. The section is located to intercept the expected meridional flow in the deepest layers east of the Ridge but site selection was also influenced by the general absence of linear topographic features (which parallel the ridge crest to the north and south) as well as by the fact that the section is central to a local maximum in eddy potential energy.
4. The Float tracking exercise was generally successful providing reliable information on the speed and direction of drift at each of the 5 depths covered by the floats (840, 1017, 1875, 2040 and 3000 m), over periods of 2 to 9 days. The upper two floats showed a relatively fast westward drift

of ca 2 km/day near the core of the Mediterranean water, the lower two floats indicated a sluggish southeastward flow while the intervening float showed a net northeastward drift. As a class, these MK II floats showed a marked and consistent tendency to undershoot the depth for which they were set by some 600-900 m, though determination of the ratio of nominal to actual float density awaits final processing of the hydrographic data collected on the site. The failure of the ballast/anchor release systems on two floats and one bottom transponder, despite previous lab, shipboard and hydrowire tests (including in one case a previous deployment during this cruise) suggests that some teething troubles remain in the reliability of the firing circuit. Shipboard float tracking equipment performed well, though the hysteresis motor on the DOBFAX shorted-out after only a few days intermittent operation; a temporary repair was effected by earthing the motor through the short.

5. After failure of one IOS acoustic release (c/m mooring type) during deep hydrowire tests, incorrect wiring was found in the releasing channel of 3 of the 4 new releases, and is probably also present in the 4th release (already deployed at NEADS-6). The fault was corrected on all three, and the release in question tested well after repair (at least two others fired correctly before this repair was made, suggesting that this fault may not necessarily affect performance).

6. The TSD system tests provided good quality noise-free records in the relatively unchanging conditions below 2000 m depth, but the records in a band from 0 to 1500 m were unacceptably noisy despite slow lowering rates suggesting that a major fault remains in the present system. For this reason Nansen casts had to be employed in all areas requiring hydrographic sampling.

7. Good cores were obtained from 4 sites using the boomerang corer (Azores working area, Azores-Biscay Rise (2) and Biscay Abyssal Plain). These were frozen for Hamilton Dock.

8. Trials of the deep submergence scintillation counter showed that the system for acoustic transmission of the variable count-rate was a good one. However the counter has a severe cold-fault which affects the quality of the actual data obtained.

9. XBT observations were made at hourly intervals (~12-13 nmi) on passage throughout the cruise. T-4 probes (to 450 m) were used in the eastern Atlantic, alternating T-4 and T-7 probes (to 750 m) were used close to the mid-Atlantic Ridge and T-7 probes alone were used in the area of high eddy potential energy NE of the Azores. The results, plotted on board, show clear evidence of doming of isotherms over the northern part of the ridge crest (North of 47°N and west of 20°W approx). On the other hand no clear evidence of mesoscale features was obtained on any part of the track. In the vicinity of the NEADS-7 mooring in Biscay the pre-existing features were either absent or are barotropic rather than baroclinic in nature.

10. Bathymetry was monitored continuously during the cruise with position information from the Sat Nav at 15 minute intervals. Detailed surveys were worked across the Gibbs Fracture Zone and at one point on the 41°N current meter section where actual and charted depths were in marked disagreement. An uncharted seamount, rising to within 500 m of the surface from a surrounding seabed of 2400 m depth was encountered north east of the island of St Michaels, Azores centred on 38° 33.5'N 26° 07.2'W.

11. The moorings at Spurn, Jonsis 1 and 2 and Tyne were found on station in good condition and were relaid. The Tees mooring was laid.

INITIALLED: AJL

SEEN IN DRAFT: THF
WJS

DISTRIBUTION: Basic list +

R R Dickson
G C Baxter
A Durance
N D Pearson
P Gurbutt
S R Jones
K J Medler
M Thomas
R J Read
W J Gould (IOS Wormley - 2)

