

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

1979 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA: CRUISE 3

(PROVISIONAL: Not to be quoted without prior reference to the author)

STAFF

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DURATION

Left Grimsby 1710 h 13 March

Arrived Grimsby 1950 h 1 April

LOCALITY

Irish Sea: Firth of Clyde

AIMS

1. Radionuclide studies in the Irish Sea. Samples to be taken of the sea bed (including interstitial water), particulate suspended material and water. Particulate size distribution, suspended loads and radionuclides will be measured as appropriate. Velocity measurements using recording current meters will be made near the Windscale outflow and at two locations off the Scottish coast in the North Channel. The 137-Caesium in-situ measuring instrument will be used. Sea bed drifters will be released at selected localities.

Core samples for radionuclide analysis will be taken in the Clyde area.

2. To measure the distribution of selected dissolved and particulate trace metals in the water over the Liverpool Bay sludge dumping ground and off the Marchon chemical works sea discharge pipeline. Surface sea bed samples to be collected at selected localities in the latter area.

3. If time and opportunity permits, water samples for trace element analysis will be collected in the vicinity of Scapa Flow.

NARRATIVE

CIROLANA sailed at 1710 h/13 March and proceeded to the Irish Sea via the English Channel. Sea bed drifters were released on the Ireland-Anglesey and Anglesey-Isle of Man sections between 0600-1000 h/16 March. Thereafter the vessel dodged in force 8-9 NNE winds until noon 17 March. Suspended load measurements were subsequently made in an area south of Wigtown Bay over a tidal cycle from 1530 h/17 March until 0430 h the following day. CIROLANA then proceeded to the Windscale area and laid two

current meter rigs after making a satisfactory test of one of the assemblies designed to give near bottom data. These activities lasted from 0930 to 1530 h 18 March. The vessel next worked the North Channel section between 1930 and 2400 h making observations on temperature and suspended load, releasing sea bed drifters and collecting samples for the analysis of salinity, caesium 134-137 and plutonium. Between 0015 and 0715/19 March suspended load measurements were made and between 0800 and 1600 h in the same area off the Scottish coast in the North Channel, two sets of current meter assemblies were deployed. Each pair consisted of a conventional two-meter rig and a near bottom meter in a specially designed frame. The vessel then proceeded to the Clyde area to collect a series of core samples between 2200 h 19 March and 0030 h 21 March. The Northern Ireland-Isle of Man water sampling section was worked between 0600 h and 1130 h 21 March, following which, CIROLANA proceeded to Liverpool Bay collecting suspended load samples on passage. The trace metal survey of the sludge dumping ground commenced at 1830 h the same day but was interrupted after the first station when the vessel had to dodge in a NW gale. The wind had moderated by the early morning of 22 March. The survey was re-commenced at 0800 h and was completed by 1530 h the following day. Water samples and cores were then collected on the Isle of Man-Cumbria section between 1930 h/23 March and 0730 h/24 March. From 0830 h to 1530 h 24 March several core samples were taken approximately 1 mile NW of the Windscale discharge pipeline for a chemical study of interstitial water. CIROLANA then worked a grid of stations for suspended load analysis extending to Liverpool Bay and thence northwards to Wigtown Bay, completing the series at 0530 h 25 March. During the same day water sampling sections were worked from the Isle of Man to the Scottish coast (0845-1130 h) and across the mouth of the Solway Firth (1330-1730 h). In addition, two core stations were worked on the Isle of Man-Cumbria section between 1830 and 2030 h. The survey of effluent from the Marchon chemical plant near Whitehaven was started at 0800 h 26 March and completed by 0500 h the following day. The Windscale current meters were recovered between 0830 and 1030 h and those in the North Channel between 1400 and 1900 h. A meter was lost from the North Channel set when one of the rigs became attached to the vessels' bow propellor during recovery. Later the same day attempts were made to collect cores at two stations on the Ireland-Isle of Man section, but deteriorating weather conditions prevented successful deployment of the corers. During the morning of 28 March the newly designed near bed sea water sampler was tested off Windscale. However the exercise was discontinued by noon owing to increasing wind strength. The sampler became difficult to recover without the aid of the bow propeller which was not in use because of possible damage from the incident of the previous day. Suspended load samples were taken over a tidal cycle off St Bees Head between 1630/28 and 0430 h/29 March during a northerly force 8-9 gale. In view of the prevailing weather it was decided not to proceed north to Scapa Flow. The vessel departed from the area at 0800 h the same day with the intention of further hydrographic work south of the Isle of Man. However the gale force winds prevented this activity and CIROLANA continued her passage to Grimsby via the English Channel docking at 1950 h 1 April.

## RESULTS

1. Many of the samples collected for radionuclide studies will require final analysis/counting back at the shore laboratory. Samples were taken for both total plutonium analysis and speciation studies.

Several water samples were also collected for caesium-137 estimation. However, using the in situ probe for this nuclide, continuous records were obtained and results were processed on board for the first time. The

highest levels recorded were in the vicinity of the Windscale pipeline outfall and showed maximum values of 1000 p Ci/l. Levels in the Clyde ranged from 40-70 p Ci/l. In Liverpool Bay inshore values were approximately 150 p Ci/l, falling to 45-50 p Ci/l at the offshore edge of the grid. In the North Channel values were 40 p Ci/l at the western edge but rising to 50-55 p Ci/l on the eastern side.

The suspended load samples will require weighing at the laboratory but a visual inspection of the filter membranes gives some idea of the suspended load distribution. Levels in the North Channel were moderate with the highest value, perhaps 10 ppm near the bed on the Scottish side. All round the Isle of Man and extending to Northern Ireland suspended loads were low. However, levels increased towards both the English and Scottish coasts. On a number of occasions a higher load was observed in surface water than near the bed. The variation of suspended load with time was observed in the North Channel, off Wigtown Bay and off St Bees Head. The last mentioned observations were made during a northerly gale but there was a significant variation with time, the highest values being obtained at about high water.

All 6 current meter rigs were recovered but one meter was lost on recovering a rig in the North Channel. All but one of the meters recovered appear to have worked correctly at least for part of the time, although the deepest meter in the North Channel leaked slightly.

The newly designed near bed sea water sampler was tested off Windscale and shown to work well. However poor weather coupled with shortage of time prevented proper deployment of this instrument.

Nine sea bed cores were obtained from the mouth of the Clyde as far upstream as the mouth of Holy Loch and Loch Fyne. The core from opposite the mouth of Holy Loch contained anaerobic material. The 4 cores obtained between Windscale and the Isle of Man, were intended mainly for comparison with cores taken in the same area on earlier cruises. At all four positions the bottom consisted of fairly soft mud, even though one core was taken quite near the Isle of Man.

A number of cores were taken near the Windscale discharge pipeline. Interstitial water was extracted immediately after collection and pH, redox, ferrous iron, nitrate + nitrite and phosphate were analysed on board the vessel. Substantial concentrations of ferrous iron were observed in these samples. High phosphate levels were also measured and nitrate + nitrite was approximately 5 times higher just below the sediment surface than in the water above, but diminishing rapidly down the core. Samples will be returned to the laboratory for the analysis of total iron, manganese and zinc. About 0.5 l of interstitial water was collected for plutonium studies. The filtered water was placed inside dialysis bags against distilled water. It is hoped to show if Pu IV complexes exist which can pass through the dialysis membrane.

2. The continuous on line mercury analyser was used during most of the survey and the instrument performed well. Mercury levels on unfiltered surface water ranged from less than 5 ng/l in offshore areas up to about 50 ng/l in Liverpool Bay.

The anodic stripping analyser was tested on board for the first time for the measurement of cadmium and lead. The instrument worked well but the validity of the data will need to await the completion of the analysis of the samples ashore. The levels of lead measured however, indicate shipboard contamination from some source.

Water samples from both the Marchon and the Liverpool Bay surveys were deep-frozen for the analyses ashore of cadmium, copper, nickel and zinc by atomic absorption. Both particulate and soluble phases will be measured. Some surface sediment samples were collected by cone dredge on the Marchon survey to supplement samples taken during CIROLANA cruise 1/78.

Dissolved nitrate and phosphate was measured on board from water collected over the Marchon grid. The plume of high phosphate levels clearly delineated the extent of the effluent from the Marchon chemical plant and the data will be useful in helping to interpret the trace metal results.

P G W Jones  
4 April 1979

SEEN IN DRAFT: Master  
Skipper

INITIALLED: AJL

DISTRIBUTION: Basic List +

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