MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, FISHERIES LABORATORY, PAKEFIELD ROAD, LOWESTOFT, SUFFOLK, NR33 OHT

1992 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA CRUISE 2

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	A Downes (UCD)	)	part (b)

AIMS:

1. To collect and process surface water (and bottom water from selected sites) from the S. North Sea and Channel for ^{99}Tc, ^{125}Sb and ^{137}Cs analysis as part of a MAST project (ACA5, COGEMA).

2. To collect and analyse surface water samples from the S. North Sea for nutrients (BGC2, N. Sea Task Force).

3. To study the particle and colloidal association of Pu, Am and Th radionuclides in Irish Sea water using various innovative techniques. (ACA3, ACB8, UCD, NLH).

4. To collect a large sample of N. Atlantic seawater from the Malin Shelf area for intercomparison measurements of ^{99}Tc. (ACA5, MAST).

NARRATIVE:

CIROLANA sailed from Lowestoft at 1800h on 17 January 1992. During the period 17-21 January a grid of surface water stations was worked for radionuclide and nutrient analyses in the southern North Sea forming a series of transects towards the Dutch, Belgian and French coast-lines. At three North Sea Task Force (NSTF) sites, depth profiles for nutrients, suspended load, salinity, temperature and surface chlorophyll were carried out using the CTD Rosette Array. This particular work was fitted into the programme to help complete a survey scheduled for CORYSTES 1/92 but not fully achieved because of technical problems on that cruise. Plans to deploy the CTD Rosette Array to collect samples of bottom water at five stations north of the Fresian Islands as part of the MAST1 programme, had to be abandoned because of bad weather on 19/20 January.

A series of cross-Channel transects was worked from South Goodwin to Cherbourg during 21-22 January for surface water radionuclide and nutrient analyses. CIROLANA then docked at Cherbourg at 0930h on 23 January to exchange scientists and equipment and to collect an intercomparison water sample for processing on board during the cruise. Following a short reception hosted by COGEMA, the ship sailed at 1300h to complete the collection of surface water samples for the MAST1 programme en route for work in the Irish Sea.

A 200 litre sample of water, collected between Land's End and the Scilly Isles, provided the first of three samples to be analysed on this cruise with a view to demonstrating whether or not the recently-renewed "clean seawater" supply on the ship is now free from a "memory effect" (particularly for radionuclide contaminants). A transect of surface water stations was then worked for nutrient levels from this point to the western Irish Sea, and the first of a series of samples, designed to check present concentrations of ^{99}Tc throughout the Irish Sea, was collected. The first of four large-volume water samples for colloidal radionuclide studies was collected to the east of Dundalk Bay on 24 January. Separate portions of this sample were fractionated down to 1K Dalton nominal molecular weight (NMW) using both DFR and UCD ultrafiltration equipment. Filtration through a series of aluminium oxide beds and cation exchange were also undertaken by UCD in order to compare the performance of different methods of ultra-filtration separation techniques. During the lengthy time period required for processing these samples, CIROLANA proceeded to the Malin Shelf area to collect 1500 l of Atlantic water. This will be analysed by Dutch, German and British participants in the MAST 2 project to establish a base-line concentration for ^{99}Tc in seawater. High pressure, bright sunshine and force 3-4 winds created excellent weather conditions for this collection.

After returning to the Irish Sea, the period 26-29 January was spent continuing the radionuclide colloid studies at three sites between the Isle of Man and St Bees Head. The newly-acquired high pressure (120 psi) pumping system for the FILTRON cross-flow ultra filters considerably increased the rate of filtration over that which had been available previously, especially when using the 1K Dalton NMW filters. Interspersed with the collection and processing for this study, the remaining samples of the ^{99}Tc survey in the Irish Sea were collected and processed.

The opportunity was also taken whilst work was in progress off Sellafield to launch the Sea-rider on 28 January in order to test the SHIPMATE radio-navigation equipment. The Sea-rider will be used on part (c) of the cruise (weather permitting) to collect samples close inshore in the vicinity of the Marchon phospho-gypsum plant. Both the boat and its navigation system worked well during the trials.

After completing all the scheduled work and some additional radio-colloid studies, the ship docked at Workington at 0930h on 31 January for a second exchange of scientific staff and equipment.

RESULTS:

1. Surface seawater was collected from 42 locations in the southern North Sea and Channel and chemically processed for the analysis of Tc-99, Ru-106, Sb-125 and Cs-137 at DFR and COGEMA. The radiochemistry and radiometric determinations will be completed at the laboratories. Mapping the distribution of these radionuclides, which are derived mainly from the La Hague discharges, will be used to help validate models of the transfer of contaminants in the region.

2. Nutrient determinations (nitrate, phosphate and silicate) were carried out on 75 surface water samples. These included 6 North Sea Task Force sites, at 3 of which mid and bottom water samples were also included, and a transect of 8 sites from Land's End to the western Irish Sea (east of Dundalk Bay). Nutrients were also determined at the 4 ultra filtration stations in the Irish Sea (21 samples).

3. Surface water samples were collected at 13 locations throughout the Irish Sea and its approaches for the determination of ^{99}Tc. These like the MAST samples were passed through ion-exchange columns on board to extract the ^{99}Tc. The purpose of this mini-survey was to provide a general indication of present concentrations of this nuclide to assist with planning the forthcoming pre-EARP/MAST 2 study scheduled for the end of 1992.

4. Two large-volume (300 l) samples of seawater collected on a recent German research cruise were brought on board at Cherbourg to be processed for the determination of Tc-99 and Sb-125. These samples form part of an analytical intercomparison exercise within the MAST 1 project. A large (1500 l) sample of Atlantic seawater was collected at the Malin Shelf area during part (b) of the cruise. This will be divided between German, Dutch and British participants in the MAST 2 project for analysis to determine a base line concentration of Tc-99 in seawater.

5. Samples of 300-500 litres of seawater (surface and bottom) were collected at 4 carefully selected locations in the Irish Sea for the study of radiocolloids. This work forms part of a broader study of the behaviour of artificial radionuclides discharged from the British Nuclear Fuels plc (BNF) nuclear reprocessing plant at Sellafield. Samples were size-fractionated using 0.45 μm membrane filters and 1K Dalton (NMW) ultra filters. Aliquots (totals, permeates and retentates) were taken for transuranic and other analyses with initial chemical separations being carried out on the ship. Twenty-one samples were processed for total Pu, Pu IV and Pu V and dissolved organic carbon (DOC) samples were taken from each fraction for analysis back at Lowestoft.

Water samples (up to 175 l) were also collected at the same 4 locations by UCD to be fractionated at 0.45 μm 10K Dalton, 3K Dalton and 1K Dalton by ultrafiltration. Aliquots of the samples were also passed through a series of Al_2O_3 beds as an alternative means of colloid fractionation. Analyses similar to those being carried out by DFR will be undertaken at Dublin and the results of the comparative studies will be published jointly in due course.

B R Harvey
Scientist in Charge Parts (a) & (b)
20 February 1992

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DISTRIBUTION

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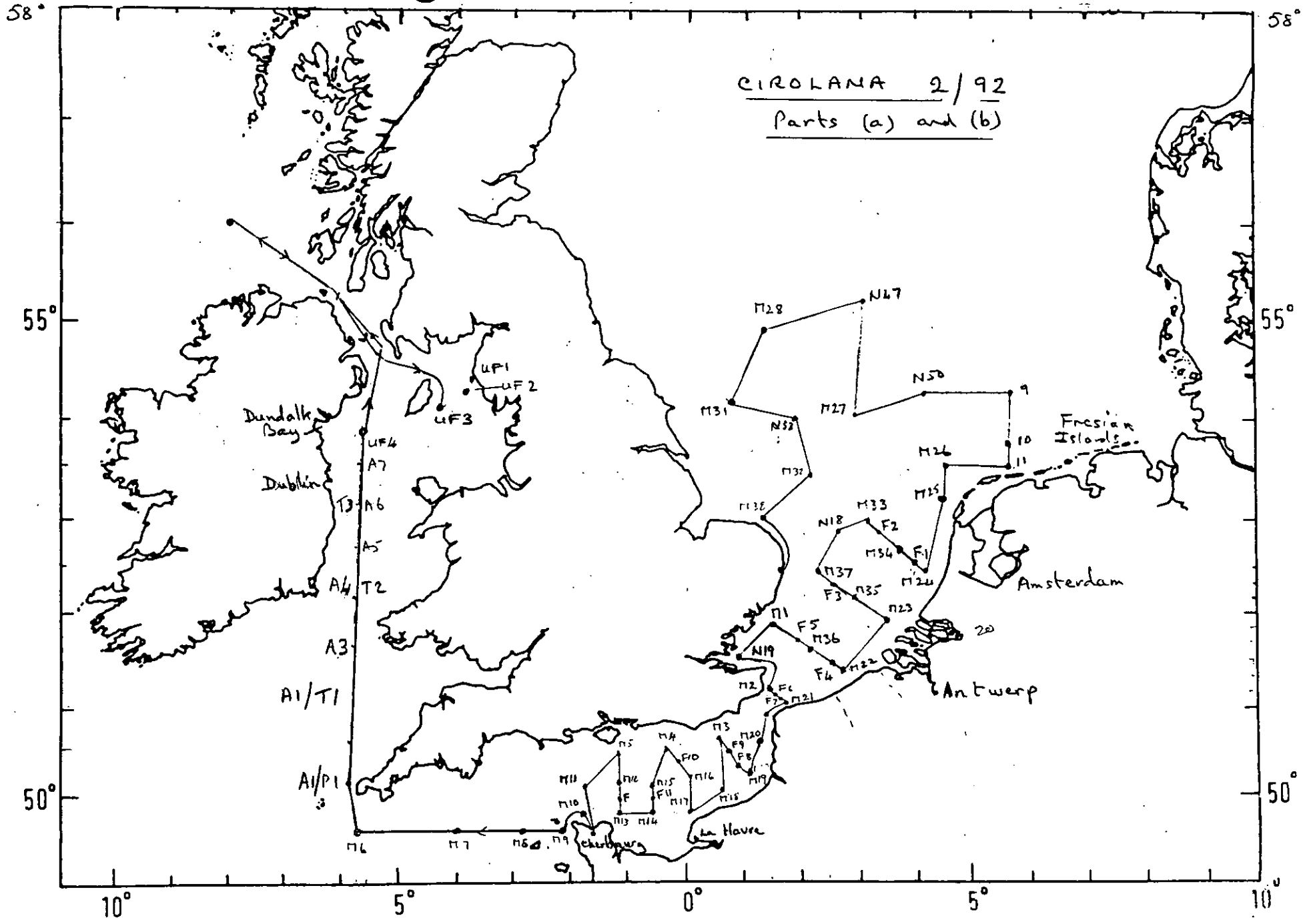
CIROLANA 2/92
Parts (a) and (b)
58°
55°
50°
10°
5°
0°
5°
10°
Dundalk Bay
Dublin
UF1
UF2
UF3
UF4
A7
A6
A5
A4
A3
A2
A1/T1
A1/P1
T3
T2
N28
N47
N27
N50
N31
N32
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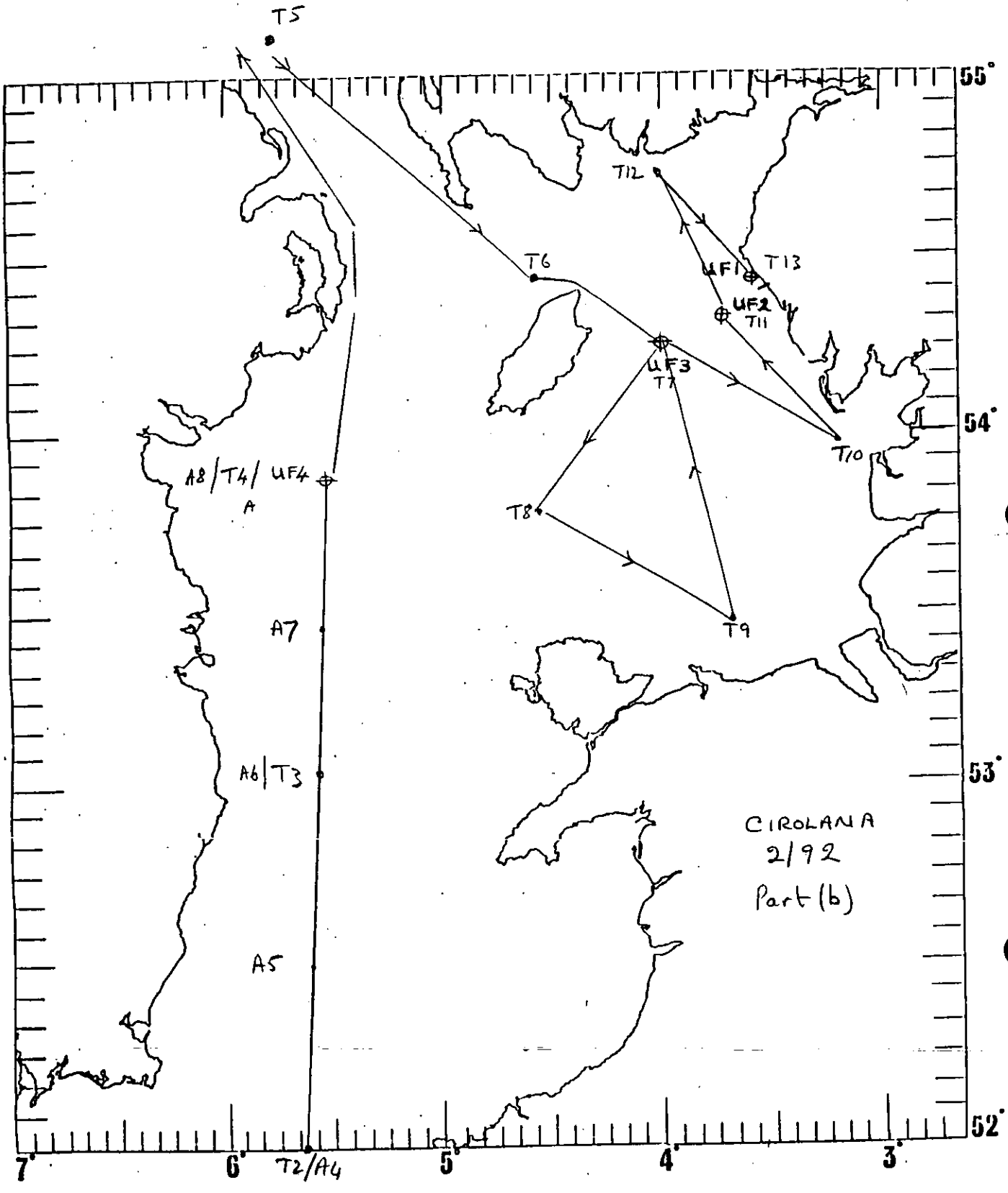
20
Frisian Islands
Amsterdam
Antwerp
Le Havre
Cherbourg


T5
T12
T6
UF1
T13
UF2
T11
UF3
T7
T10
T8
T9
A8/T4/UF4
A
A7
A6/T3
A5
T2/A4
CIROLANA
2/92
Part (b)
55°
54°
53°
52°
7°
6°
5°
4°
3°