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

**1982 RESEARCH VESSEL PROGRAMME**

**REPORT: RV CIROLANA: CRUISE 3**

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

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**DURATION:**

**25 February - 22 March**

**LOCALITY:**

**North Sea, Skagerrak, Kattegat, Baltic**

**AIMS:**

1. To continue the examination of the distribution of caesium-137, caesium-134, strontium-90, plutonium-238, plutonium-239/240 and americium-241 in seawater.
2. To collect core samples of the seabed of the North Sea for the determination of  $^{137}\text{Cs}$  and  $^{134}\text{Cs}$ .
3. To determine the suspended load in seawater in each locality.
4. To continue the investigation in the use of  $^{134}\text{Cs}$  as an onboard tracer for low-level radiocaesium and stable caesium determinations.
5. To collect 3 core samples in the Northern North Sea for Dr P Kershaw.

**NARRATIVE:**

CIROLANA left Grimsby on the morning tide of the 25 February and proceeded to work a grid of stations in the southern North Sea (chart attached) at intervals of  $0.5^\circ$  of latitude and longitude. North of  $54^\circ\text{N}$  the grid interval was increased to  $1^\circ$  of latitude and  $0.5^\circ$  of longitude. At all stations 50 litres of surface seawater were collected, filtered and the filtrate ( $<0.22\ \mu\text{m}$ ) was processed on board for later analysis of  $^{137}\text{Cs}$  and  $^{134}\text{Cs}$ . Samples were collected at depth at intermediate stations. Up to three other positions in the water column were sampled in addition to the surface. The sampling profile was dependent on the salinity/depth and temperature/depth profiles obtained by the use of the Guildline CTD, combined with a Hewlett Packard on board computer. Estimates of the suspended load at all depth stations were made by filtering 5 litre samples through weighed  $0.22\ \mu\text{m}$  membrane filters. At selected stations 200 litre samples of surface seawater were obtained, filtered and the filtrate and particulate ( $>0.22\ \mu\text{m}$ ) were initially prepared on board for later analyses of the transuranic nuclides  $^{238}\text{Pu}$ ,  $^{239+240}\text{Pu}$  and

24<sup>1</sup>Am. In addition, at the same stations a further 40 litres were collected and retained for <sup>90</sup>Sr analysis. At other selected stations, samples of the seabed were obtained by the Tennant box corer.

The sampling programme continued until the 3 March when strong gale force winds forced an abandonment of the programme until early on 4 March. Work continued under unpleasant conditions until the 8 March when CIROLANA had to seek shelter north of the Orkneys. The opportunity was taken to obtain extra water samples for the determination of <sup>241</sup>Am possibly originating from DERE Dounreay. Following further bad weather on 9 March both Hewlett Packard drive units were found to have developed disc drive faults. In the emergency situation the output from the CTD was put onto tape and direct readings from the deck unit were noted at fixed depth intervals. With the amount of time lost because of bad weather the decision was taken not to enter harbour to await the arrival of a computer engineer but to continue with the emergency arrangements made. Strong gale force winds continued and eventually 19 proposed stations to the west of the Shetlands and north of 61°N had to be abandoned and CIROLANA sailed south down the Norwegian coast to the Skagerrak where sampling began at 0120 on 14 March. With good weather conditions the planned programme in the Skagerrak, Kattegat and Baltic (chart attached) continued without any further delays and was completed at 1445 on 18 March. With some time regained from the programme of work in the Baltic area the opportunity was taken on return to the North Sea to resample at a position in the Norwegian Trench where, on the first occasion, weather conditions has prevented putting gear over the side. Two good mud cores were obtained from the seabed at this position. With continuing good weather the remainder of the proposed programme was completed and with a few hours in hand for the morning tide of 22 March a good mud core was obtained from the Silver Pits area.

#### RESULTS:

All the stations worked at depth were by the use of the rosette array in conjunction with the CTD. Plots of temperature and salinity with depth showed little significant change with depth except at two positions in the North Sea. One position was 58°N, 05°E where the surface salinity was 34.0‰ and at depths greater than 40 m was greater than 35.1‰. The other was at 54°N, 06°E with a salinity change from 31.6‰ at surface but with a sharp increase to 32.5‰ at 26 m. Stratification was noted at places in the Skagerrak, Kattegat and Baltic and each depth zone was sampled to examine relationships between radiocaesium concentrations and temperature and salinity. Suspended load samples were obtained at 200 spatial positions and initial results would suggest higher than normal suspended loads compared with those used in the NRPB box model for the areas concerned. The Tennant box sampler worked well and core samples were obtained from 5 areas of mud and sandy mud and surface layer samples obtained from 5 muddy sand areas. The efficacy of three types of sorbents for radioactive and stable caesium was tested using <sup>134</sup>Cs as a tracer. Bad weather and the presence of higher than expected levels of suspended [particulate] material in the samples hampered these investigations, but the properties of all three materials were assessed. The sorbents, ammonium molybdophosphate on silica gel and manganese dioxide/copper ferrocyanide coated fibres, will be returned to the laboratory for further processing and measurement of the retained caesium. All aims were achieved but with some modification to the original proposed programme.

D F Jefferies  
30 March 1982

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