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FISHERIES LABORATORY
LOWESTOFT, SUFFOLK, ENGLAND

1981 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA: CRUISE 7

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

STAFF:

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DURATION:

8 July-5 August

LOCALITY:

North Sea, Norwegian Sea, Barents Sea, West Spitzbergen, Jan Mayen Island area, Faroes.

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 continue work on the examination of the oxidation states of plutonium and americium in seawater.

3. To determine the suspended load in seawater especially at stations where samples were to be analysed for plutonium.

4. To collect large volume samples of surface seawater in 6 areas, north of 79°N, and initially prepare on board for the determination of ^{134}Cs and ^{137}Cs by Woods Hole Oceanographic Institute.

5. To retain samples of suspended load from surface and bottom water for Dr R K O'Nions (University of Cambridge).

NARRATIVE:

CIROLANA left Grimsby on the morning tide of the 8th July and proceeded to work a line of stations from the entrance to the Humber to a position off North Norway at 71°00'N and 30°00'E (chart attached) and then a grid of stations at intervals of 0.5 degrees of latitude and 5.0 degrees of longtitude. The furthest point north reached was a position off West Spitzbergen at 80°00'N, 05°00'E at 0310 on 24 July. At all 122 stations 50 litres of surface seawater were collected, filtered and the filtrate (< 0.22 µm) was processed on board for later analysis of ^{137}Cs and ^{134}Cs. At 12 stations 600 litre samples of seawater were collected, filtered and the filtrate and particulate (> 0.22 µm) were initially prepared on board for later analysis of the transuranic nuclides ^{238}Pu, $^{239+240}$Pu and ^{241}Am. In addition at the same stations a further 50 litres were collected and retained for ^{90}Sr analysis. At 61 stations, seawater at depth was obtained

using a rosette array with 6 x 30 litre Niskin bottles. The CTD was run at all these stations and plots of salinity, temperature and in situ density were obtained by use of the Hewlett Packard computer. In depths of water less than 500 m, 50 litre samples were obtained from close to the bottom and two other positions in the water column and in depths greater than 500 m, except at two stations, from 500 m and two positions in the column dependent upon the salinity/temperature profile obtained. At two stations in depths of approximately 2500 m samples were obtained from 'near' bottom and five other positions in the water column. All samples will be analysed for radiocaesium and for a relationship if any, between depth, salinity, temperature and concentration.

Ice was encountered (see chart) at the northern end of the 30°E line at a position 76°50'N, 30°00'E and again off the South Cape of Spitzbergen. Ice was again observed approximately 3 miles west of a station at 78°30'N, 05°00'E and again encountered at 79°00'N 05°00'E. Reference to the publication "Arctic Pilot Vol II Seventh Edition published by the Hydrographic Dept. MOD showed the ice pack to be much further east of the mean boundary line established for July for the period 1966-1973. Upon completion of the station at 80°00'N 05°00'E the original plan had been to work a line of stations to the west and to follow the cold current down the north east coast of Greenland in an attempt to establish if radiocaesium of BNFL Windscale origin had yet reached there. However pack ice prevented work further west than 07°30'E on the 80°N line and with no possibility of getting further west than 05°00'E on the 78°N line it was decided to abandon the attempt to sample the cold water current off north east Greenland. An alternative plan was adopted to sample the edge of the warm West Spitzbergen current down the 05°00'E line to 73°00'N and then work a line of stations to the west and pick up the cold current to the north of Jan Mayen Island. This was done and pack ice again was found at about 07°00'W. A line of stations was then worked to the south until the warm surface water (≃ 6°C) was found on the 70°N line. At this point radio contact was made with the research vessel Knorr from Woods Hole which was working a station at 70°N 02°30'E. It was hoped a rendezvous might be possible to hand over five samples collected by CIROLANA for Dr H Livingston who was on board the Knorr but tight scheduling of station programmes by both ships prevented this. Water sampling continued as before until 1400 on 30 July at a position 67°00'N00°00'E on the original proposed track. An additional 35 stations had been worked, 19 at depth with 4 of those worked between 1400 m and 3600 m.

As 400 miles of steaming time had been saved by not being able to sample the currents of north east Greenland it was decided to continue sampling west on the 67°N line and then to work east on the 64°N line. Further deep sampling took place at 3 positions 67°00'N 07°27'W, 64°00'N 07°00'W and 64°00'N 00°00'W. The objective of the sampling was to look at radiocaesium concentrations in the deep water in an attempt to establish if ^{137}Cs was returning south from the Norwegian Sea in the deep bottom water and crossing the Faroe-Iceland, Faroe-Shetland ridges. With the successful completion of the modified programme CIROLANA rejoined the original proposed track and returned to Grimsby on the morning tide of 5 August.

RESULTS:

All but one of the 95 stations worked at depth were by the use of the rosette array from the davit on the starboard side aft and in conjunction with the CTD which proved a most useful 'tool' in planning and modifying the sampling programme. Plots of the temperature recorded at various depths showed that at the most northerly sampling point on the grid at 80°N 10°E although the surface water temperature was 0.5°C a narrow band width of water at 4°C was found at 27 m below the surface. This 4°C water had been found on the surface some 30 miles further south. Depth profiles of water temperature down the 5°E line on the edge of the Spitzbergen current south from 78°N to 73°N had demonstrated below zero temperatures at 500 m but a temperature of + 1°C was found at 79°N at that depth.

Twenty stations (plus two 600 litre distilled water blanks) were sampled for total Pu and Am. Of these, at seven stations 200 litre samples were treated with and without reductant Na_2So_3 in order to measure the reduced and oxidised species of Pu (and also Am if this element exists in different oxidation states in sea-water). It is intended to examine the sample concentrates back at the laboratory for isotopes of Thorium.

All aims were achieved but with some modification and additions to the original proposed programme.

D F Jefferies
12 August 1981

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