

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
FISHERIES LABORATORY, LOWESTOFT, SUFFOLK NR33 0HT, UK

1989 RESEARCH VESSEL PROGRAMME

REPORT: RV CORYSTES: CRUISE 3b

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

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|--------|---------------|-----|----------------|
| STAFF: | P J Kershaw | | |
| | D J Swift | | 5 to 16 March |
| | S J Malcolm | | 5 to 14 March |
| | N D Pearson | | 5 to 11 March |
| | D J Allington | | |
| | D C Denoon | | |
| | A K Young | | 5 to 11 March |
| | D L Smith | | |
| | A Watson | PML | 16 to 18 March |
| | M Liddicoat | PML | 16 to 18 March |
| | D Purdie | PML | 18 to 20 March |

DURATION: 5 to 20 March 1989

LOCALITY: Eastern Irish Sea and southern North Sea

AIMS:

1. To investigate the effects of tidally-induced resuspension of sediment on the scavenging of dissolved radionuclides in the north-east Irish Sea. Two anchor stations will be occupied, for at least 13 hours, and in both cases the NBVR will be deployed nearby. ACB4/6.
2. To examine the nature and rates of chemical processes in the sea bed using Ra-226, ultra-filtration, incubation experiments, fine resolution sampling and selective leaching. ACB3/4/8.
3. To determine temporal trends in the biological characterisation of representative sites. ACB1.
4. To measure the concentration of Ra-226 in sea water off Whitehaven and Maryport in relation to local anthropogenic sources. ACB4.
5. To collect water and sediment samples for C-14 analysis at SURRC, East Kilbride in support of a NERC/MAFF CASE Studentship. ACB10.
6. To examine further the distribution and inventory of transuranic and gamma-emitting radionuclides in seabed sediments at selected sites following improvements to the Kasten corer. ACB2.
7. To make a deliberate tracer release (sulphur hexafluoride and helium-3) in surface waters off the Netherlands coast, in conjunction with RRS CHALLENGER and PML scientists, to examine dispersion and venting to the atmosphere.

NARRATIVE:

CORYSTES sailed from Workington at 09.45 on Monday 6 March, having delayed departure by 24 hours because of southerly force 8 winds. The time in port was spent in preparation for the 'Anchor station' and pore-water studies. In moderating conditions, CORYSTES anchored to the west of St Bees Head and launched the NBVR at 11.45. The first dip of the CTD-rosette array took place at 12.30 and was repeated at hourly intervals for 25 hours. Surface, middle and bottom waters were collected and immediately filtered for suspended load determination. Every two hours large volume samples of surface and bottom water were taken and processed for Th-234/U-238 determination. In addition, the surface sediment was sampled with the Craib corer. This device did not perform very satisfactorily and modifications will be required for any replacement. The station was continued despite high winds (> 45 knots) for a time. On completion, the NBVR was recovered at 14.15 on the 7th. CORYSTES then steamed to the central mud patch, anchored and collected a series of Kasten and Craib cores for pore-water analysis. Pore-water was extracted to a depth of 50 cm and analysed for Ra-226 and an incubation experiment was initiated. A series of Reineck cores was collected on the morning of the 8th for the benthic survey. Further Craib cores were collected for pore-water studies, using the bow-thruster, in deteriorating weather conditions. Attempts to Kasten core were abandoned because of the increasing wind and swell. CORYSTES dodged for much of the afternoon with work continuing to process samples collected earlier and prepare for the next 'Anchor station'. Two surface water samples were collected, using the Jabsco pump, between the Cumbrian coast and the Isle of Man for C-14 determination.

Continuing high winds (force 6-8 southerlies) prevented any further sampling during the evening of the 8th and throughout the 9th, although experimental work continued. The wind and sea moderated sufficiently on the morning of the 10th to allow the launch of the NBVR, at 07.06, at the second 'Anchor station' in the central mud patch off Eskmeals. Hourly CTD dips commenced at 07.30 and continued for 25 hours, with the NBVR being recovered successfully at 09.20 on the 11th.

CORYSTES then proceeded to the second pore-water site, anchored, and Kasten cores were collected and processed for Ra-226. In freshening winds, the Workington Pilot Boat was used to put ashore 2 scientists. A transect of surface water stations (Jabsco pump) was worked from Maryport to St Bees Head for Ra-226 measurement. Further coring operations were postponed in deteriorating conditions (force 6-8 southwesterlies) but experimental work continued.

Conditions moderated sufficiently on the morning of the 12th to allow the operation of the Kasten corer for the Pu budget study. However, the wind increased (force 8-9 southerly) forcing the abandonment of coring activities. A water station was worked for Pb-210/Ra-226 between the Isle of Man and the Scottish coast before CORYSTES sought shelter in the lee of the Isle of Man overnight. Severe winds (> 70 knots) continued on the 13th but by afternoon had moderated enough to steam east and anchor off the Sellafield pipeline. Craib coring commenced but on the second dip the wire parted and the corer was lost. Attempts to recover it with a grapnel were unsuccessful. A single Reineck core was obtained for a chemical extraction experiment but further coring was judged to be too hazardous as, yet again, the swell built up from the south-west.

The swell was maintained into the morning of the 14th, preventing any further work. CORYSTES then steamed to Ramsey Bay to seek sheltered waters for the transfer of the third scientist to shore, using the Searider, before the wind

increased again (force 8 southwesterlies). Coring recommenced at PLZ at 04.30 on the 15th with a set of Reineck cores and a further 3 Kasten stations being worked before CORYSTES started to steam south at 09.10. Surface-water samples were collected on route (Jabsco pump) for C-14 and Pb-210/Ra-226 analysis.

CORYSTES rendezvoused with the NERC vessel TAMARIS at Cawsand Bay in Plymouth Sound at 16.05 on the 16th, for the transfer of one MAFF scientist ashore and of two PML scientists on-board. CORYSTES then steamed to a position north of the Mass Estuary (52°20'N 03°20'E) and rendezvoused with RRS CHALLENGER at 23.50 on the 17th. Difficulties were encountered by PML in preparing the tracer but these were eventually overcome and the release began at 09.15 on the 18th. ARGOS buoys were released by CHALLENGER at intervals and a CTD cast was made by CORYSTES. The release was completed at 14.30. The two PML scientists transferred, via the Searider, to CHALLENGER at 15.00 and a third PML scientist was brought onboard for transfer ashore. CORYSTES steamed eastwards and commenced a set of 6 CTD casts along a 50 n. mile east-west transect which was completed at 10.40 on the 19th. CORYSTES steamed north and docked at Immingham (dry docking) at 08.30 on 20 March.

RESULTS:

1. The NBVR was deployed at two sites, of differing water depth and sediment type, with hourly CTD dips over 25 hours. Fifty-two surface and bottom water samples, and 13 sediment samples were processed for the determination of Th-234/U-238 and 260 suspended load filtrations were carried out. The NBVR was fitted with current meters, acoustic back-scatter probes, transmissometer and time-lapse camera - the data arising will be analysed at DFR, UEA and Cambridge University. This experiment will provide information on the effects of wind- and tide-induced sediment resuspension on radionuclide scavenging.
2. Ra-226 was measured in pore-waters to a depth of 50 cm at two sites to assess the depth of irrigation. An incubation experiment was conducted, with a set of Craib cores, to measure the flux of Fe and Mn out of the sea bed - using poisoned sediment as a control to assess the effect of microbial processes. Selective chemical leaching was carried out, in a nitrogen atmosphere, to investigate the chemical associations of Pu and Am in seabed sediments. Further analyses will be made at Lowestoft.
3. Twelve Reineck cores were taken from two Decca boxes, previously surveyed in 1983-86, (approximate area 1 sq km) and sieved for the collection and identification of the benthic fauna to study time trends in faunal distributions.
4. Six surface-water samples were analysed for Ra-226 in nearshore waters between Sellafield and Maryport to identify any signal from the Marchon phosphate plant. A further two water samples were processed for Pb-210/Ra-226 to the north and south of the Isle of Man to assess the concentration of these radionuclides, in filtrate and on particulate, in water leaving and entering the region.
5. Surface water was collected at three sites for C-14 analysis at SURRC E. Kilbride in support of a NERC/MAFF CASE Studentship.

6. Cores were obtained from eight sites using a modified version of the Kasten corer, which provided a greater recovered length than had been possible previously, as part of the Pu budget study.
7. A tracer release experiment was conducted in the southern North Sea involving the controlled release of sulphur hexafluoride and helium-3 over a 5-hour period. The dispersion and venting to the atmosphere of the tracer pair was estimated from measurements made by RRS CHALLENGER, at the time of release and for several days following. An east-west transect of 6 CTD stations was worked to check for stratification in the water column.

P J Kershaw
20 March 1989

SEEN IN DRAFT: M Willcock, Master
R Graham, Senior Fishing Mate

INITIALLED: RJP

DISTRIBUTION:

Basic list +
P J Kershaw
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