R.R.S. FREDERICK RUSSELL - CRUISE 82/7 - 24 MAY - 3 JUNE, 1982.

Cruise Report

1. Personnel:

D.S. Harbour	MBA, Plymouth
R.P. Harris	" "
R.N. Head	" "
P.M. Holligan	" "
P. Tranter	" "
Q. Espey	Southampton University
D. Purdie	" "
J. Le Fèvre	Brest, France (second half of cruise only)

2. Itinerary

The attached chart shows the ship's track and station positions. The ship left Plymouth at 1800 h, 24 May and returned 1600 h, 3 June. A port call was made to Brest, 1000 - 2300 h, 29 May.

Details of station positions, times, water depth etc. are given in Table 1.

The original programme was modified considerably to investigate 'high reflectance features' shown by images of the Coastal Zone Colour Scanner (CSCS) on the Nimbus satellite immediately prior to and during the cruise. This formed part of a joint investigation being carried out with French scientists. Also hydrographic observations were made at the positions of moorings to be laid on cruise 82/8 to the south west of Ushant. No problems were experienced with carrying out the unscheduled work within French waters.

3. Work completed

a. Hydrography - continuous measurements of temperature, salinity, chlorophyll fluorescence, inorganic nutrients (NO_3, NO_2, NH_3, Si), dissolved oxygen and surface irradiance were maintained throughout the cruise, both for surface waters whilst steaming and for pump profiles (2-60m) at each station. More than 300 chlorophyll *a* + phaeopigment measurements were made to calibrate the fluorometer records. Two XBT temperature sections were completed across the shelf break. Vertical light profiles were made at stations 5, 6, 7, 8, 9, 10, 17, 21, 25 and 27.

b. Phytoplankton - standing stock measurements were made in terms of both chlorophyll *a* (See above) and, at each station, particulate organic carbon and nitrogen. Preserved samples (Lugols solution and neutralised formalin) were collected for cell counts and determination of cell carbon. Direct microscope observations were also made on living material throughout the cruise. Finally four *in situ* ^{14}C primary production and oxygen experiments were completed at stations 6, 17, 20 (E5) and 24 (E5).

c. Zooplankton - zooplankton samples, taken with the Flygt pump and WP2 net, were obtained at each station to investigate vertical distribution and vertical migration in relation to observed fluorescence profiles. Subsamples were frozen for carbon and nitrogen determinations. Oblique hauls with a 500 µm bongo net were made at stations 11-16 to provide material for larval fish analysis carried out by P. Camus (ISTPM, Nantes). At major stations zooplankton feeding experiments were conducted using ship-board incubations to estimate grazing pressure by dominant herbivorous copepods on the phytoplankton standing stock.

d. Oxygen measurements - Table 2 shows the oxygen measurements and experiments carried out. Oxygen determinations were made using the conventional Winkler technique. A new oxygen titrator system incorporating a Hewlett Packard 85 microprocessor controlled burette was used for the first time at sea. The new system functioned well and indications are that a greater precision can be obtained than with the old RCA 1800 controlled system used on previous cruises.

Oxygen profiles were determined at stations A1, 5, 6 and E5 and samples also taken to calibrate the oxygen probe.

'In situ' incubation experiments were carried out in conjunction with ^{14}C primary production measurements at stations 6, 17 and E5 (2). Water samples were incubated at 'in situ' depths suspended from a bouy moored to the ship while on station. Oxygen respiration measurements were made on board ship in the deck incubator.

Several bottle comparison incubation experiments were made on water collected at station E5 (2), 4, 10 and 025. Comparisons were made between Glass and Polystyrene bottles incubated in the dark for between 7 and 13 hours. Light incubated comparisons were not attempted due to problems of incubating 2 litre polystyrene bottles at natural light intensities. Some biomass (chlorophyll and particulate carbon) determinations were made both at zerotime and after incubations in both types of bottle.

Water samples were collected in 35 litre Niskin or 7 litre N.I.O. bottles and occasionally from the pump sampler.

e. Adsorptive bubble separation experiments to study the enrichment of trace metals and organic carbon in both the dissolved and particulate phases, and dissolved/particulate phase transfers occurring on the interface of rising bubbles were carried out for the first time at sea, immediately after sampling, using the foam tower from the Southampton University Oceanography Department. These were done using water from profiles 3, 4, 5, 6, 8, 8, 12, 17, 20, 24 and position 50°16'N, 4°34'W covering a range of water types from near shore to near open ocean. All eleven experiments were carried out in the batch mode, eight without artificial surfactant addition (bubble fractionation experiments relating to in situ marine processes). One experiment each of anionic, cationic and nonionic surfactant addition was carried out to study possible foam fractionation/froth flotation extraction of trace metals from sea water. In most cases a sample was taken after studying the pump chlorophyll profile and determining the depth of the maxima, this being the only available indication of where the P.O.C. and D.O.C. maxima might be.

D.T.M., P.T.M., D.O.C. and P.O.C. analyses will be carried out in the laboratory on subsamples, formates and residues.

A variety of water sampling mechanisms were employed in an attempt to find a suitable one - 30ℓ Niskin bottles; 7ℓ N.I.O. bottles, Flygt pump, ships scientific supply and polythene bucket over the side (during occurence of a natural slick). However none of these methods are really suitable for trace metal research and in future it would be better to use a peristaltic pump (silicone tubing) over the side of an inflatable dinghy well away from the ship. It would also be an improvement to operate the column in a continuous mode so as to process much larger volumes of water.

4. Miscellaneous notes

a. The treatment of the hydrographic wire with fish oil during the cruise led to a lot of problems with handling equipment on the wire and with obtaining 'clean' water samples for experimental work. For the type of work being undertaken the wire should either be left untreated or be lightly coated with some non-toxic material that does not coagulate or adhere to hands or apparatus. Is there no recommended procedure for NERC ships? This problem was probably the major cause for the loss of a 30ℓ General Oceanics bottle.

b. Coarser filters that will allow the passage of planktonic organisms less than 5 or 10 mm in diameter are required for the intake of the clear water supply. This will allow proper sampling of the plankton from this water supply, and also reach the frequency of filter cleaner. The Chief Engineer agreed to order suitable new filters.

c. During the cruise several attempts to relay information to the ship about the latest satellite images, both through Lands End and Brest radio stations, either failed completely or were delayed by 1 or more days. The reasons for this are not certain, but possible ways of overcoming this difficulty should be looked into.

5. Equipment loss

On 1 June, a 30ℓ General Oceanics water bottle was lost over the side of the ship while being transferred from the wire to the rack. The bottle was full of water and being handled by two scientists - generally considered sufficient manpower under the very calm conditions prevailing. At the time the wire, messenger and sides of the bottle were heavily coated in fish oil, and this was probably a major factor in causing the accident. Subsequently, some time was spent in trying to remove the excess oil from the wire. Another difficulty with this type of operation is the very restricted working space around the hydrographic platform.

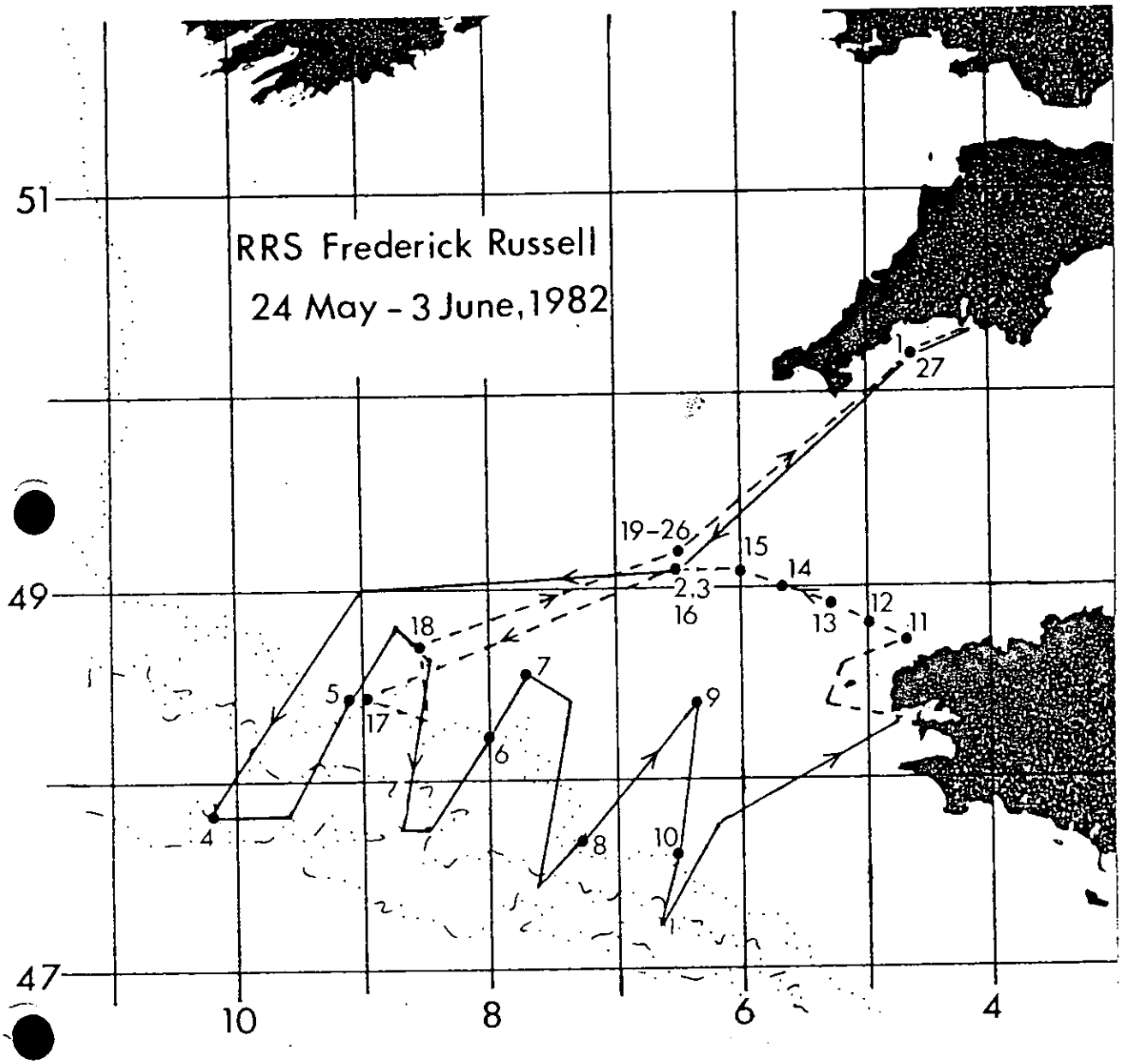
RRS Frederick Russell
24 May - 3 June, 1982
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Table 1. Station Positions

Date	St. No.	Time (BST)	Position N	Position W	Depth (m)	SDD (m)
24/5	1 (A1)	2300 - 0200	50°12.5'	4°40'	57 - 60	-
25/5	2, 3 (E5)	1200 - 1615	49°04'	6°32'	120 - 122	15
26/5	4	1200 - 1440	47°50'	10°08'	~4000	15
	5	2017 - 2217	48°24'	9°02'	?	3
27/5	6	1148 - 1752	48°13'	8°00'	170 - 190	2.5
	7	1945 - 2035	48°30'	7°42'	170	11
28/5	8	0522 - 0654	47°40'	7°20'	168	9
	9	1138 - 1225	48°25'	6°25'	139	18
	10 (067)	1655 - 1820	47°34'	6°35'	183	12
30/5	11 (028)	0550 - 0900	48°42'	4°49'	100	11
	12 (027)	1108 - 1215	48°48'	4°59'	111	13
	13 (026B)	1354 - 1502	48°53'	5°19'	115	11
	14 (026A)	1740 - 1829	48°59'	5°40'	114	17
	15 (025)	1948 - 2120	49°05'	6°00'	118	9
31/5	16 (E5)	0005 - 0115	49°07'	6°31'	122	-
	17	1055 - 1730	48°26'	8°59'	188 - 192	6.5
	18	2110 - 2204	48°40'	8°32'		
1/6	19 (E5)	0615	49°10'	6°31'	120	16
	20 "	1015	49°12'	6°31'	"	
	21 "	1307	49°13'	6°31'	"	13
	22 "	2005	49°11'	6°30'	"	
2/6	23 (E5)	0120	49°14'	6°30'	120	
	24 "	0603	49°10'	6°31'	"	16
	25 "	1313			"	
	26 "	1904	49°09'	6°23'		
3/6	27 (A1)	0904 - 1200	50°12.5'	4°40'	61	18

TABLE 2.

Date	Station No.	Time	Experiment Description	Depths (m) Sampled/Incubated	Incubation times
24.05	A1	23.30	Oxygen Profile	0/5/10/15/20/ 35/50M	-
25.05	E5	13.15	Bottle comparison Glass v Polystyrene (Zerotime/Light/Dark)	10/30M	14.00-21.00 (7h)
26.05	4	14.40	Bottle comparison Glass v Polystyrene (Zerotime/Light/Dark)	17M	15.00-21.00 (6h)
26.05	5	21.45	Oxygen Profile	0/10/22M	-
27.05	6	12.15	"In situ" incubation	2/4/8/16M (only 2M sampled)	12.45-17.45 (5h)
27.05	6	18.00	Oxygen Profile	2/5/10/15/20/40M	-
28.05	leg?	16.00	Oxygen probe calibration	2M	-
28.05	10	18.15	Bottle comparison Glass v Polystyrene (Zerotime/dark)	20M	19.15-08.15 (13h)
29.05			IN DOCK BREST		
30.05	025	21.30	Bottle comparison Glass v Polystyrene (Zerotime/dark)		22.30-08.30 (10h)
31.05	17	11.30	In situ incubation	2/4/8M	12.15-17.15 (5h)
01.06	E5	11.30	In situ incubation	2/5/10/21M	11.45-18.15 (6½h)
01.06	E5	23.10	Bottle comparison Glass v Polystyrene (Zerotime/Dark)	21M	23.45-09.45 (10h)
02.06	E5	07.30	Full and Half Day 'in situ' incubation		09.00-20.00 20.00-09.00 (11h and 24h)
02.06	E5	18.00	Point oxygen determinations	21/30/4M	-