

R V SARSIA
Cruise 3/77

21 March - 7 April 1977

Vibrocoreing and suspended sediment/velocity
profile measurements in Swansea Bay

Cruise Report No 55B

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Institute of Oceanographic Sciences
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SCIENTIFIC STAFF

Dr A P Carr	(Principal Scientist)	21 March - 26 March
Dr A D Heathershaw*	(Principal Scientist)	23 March - 7 April
R Paske	(AERE, Harwell)	23 March - 25 March
C N Puckett		21 March - 7 April
T Upham		21 March - 23 March
P Hooper		26 March - 7 April
G Le Good		26 March - 1 April
M Lees		1 April - 7 April

*Principal Scientist from 26 March - 7 April

SHIP'S OFFICERS

Captain E Dowell (Master)
N Bryant (Mate)
I Jude (Fishing Mate)
R Young (Chief Engineer)
G Parker (2nd Engineer)
J Taylor (3rd Engineer)

OBJECTIVES

The objectives of this cruise were as follows:

- (1) To carry out vibrocoring at various locations in Swansea Bay (see Fig 1) to determine the thickness and structure of potentially mobile sediment and in the radioactive tracer zone to determine the depths of burial of tracer (the latter in conjunction with AERE Harwell);
- (2) In conjunction with AERE Harwell to carry out spectral degradation measurements to determine the depths of burial of the tracer;
- (3) To determine near-bed suspended sediment concentrations and particle size distributions at locations offshore between Port Talbot and Porthcawl (Fig 2);
- (4) To make near-bed velocity profile measurements at those locations in (3) to enable sediment flux rates and bed shear stresses to be calculated.

EQUIPMENT AND METHODS

Sediment core samples were taken with the IOS vibrocorer. This equipment is described in detail in Unit of Coastal Sedimentation (now IOS Taunton) Report No UCS/10/1972.

Suspended sediment and velocity profile measurements were made using the IOS boundary layer rig. This is described in some detail in IOS Cruise Report No 44, 1976, and shown schematically in Fig 3 of this report. No further description of this equipment will be given here.

At vibrocoring stations the ship was positioned using Decca Main Chain and HiFix position fixing systems. The ship was then anchored with a single bow anchor. The vibrocoring equipment was handled over the side with the ship's derrick and winches in the usual manner.

The practice, developed during the previous cruise (RV Sarsia, 10-21 January 1977) of changing the vibrocorer barrel over the side of the ship with the rig secured in the outboard position was continued on this cruise. This was again found to give considerable savings in time.

The position co-ordinates for each sediment sample were recorded using both the Main Chain and HiFix systems.

Prior to cores being taken in the radioactive tracer zone, activity levels on the sea-bed were measured using an AERE Harwell scintillation counter. Some spectral degradation measurements were also made. The activity levels in some core samples from the tracer zone were monitored with the sample in the barrel and when the core had been removed from the barrel. The usual precautions were taken when handling this material.

Before suspended sediment and velocity profile measurements could be made the majority of the vibrocoring equipment had to be removed from the ship and the platform for the suspended sediment and velocity profiling rig erected over the anchor cables and wires in the usual manner.

These measurements were made with the ship anchored fore and aft, (two bow anchors and a single stern anchor) and equipment was lowered onto the seabed using the ship's derrick and winches. Associated electronic and pumped sampling equipment was operated from the ship's forward laboratory.

Measurements with the suspended sediment and velocity profiling rig were of the mean flow (\bar{u}) every minute at elevations of .15, .40, 1.00 and 1.80m above the seabed, and the suspended sediment every half hour at elevations of .10, .15, .25, .40, .80 and 1.80m. The total depth was recorded every half hour approximately. The mean flow speed and direction were also recorded every 10 minutes using a Braystoke Direct Reading current meter suspended at 5m below the surface.

RESULTS

10 core samples were obtained at the locations shown in Fig 1. Two of these core samples were from the radioactive tracer zone and the top section of each was later sent to AERE for gamma spectroscopy measurements. The full analysis of these cores remains to be completed. Position co-ordinates for core samples are given in Table 1.

Attempts to take vibrocore samples at other locations were curtailed on 24.3.77 when the main lifting wire became detached from the vibrocoring rig. With the assistance of divers (see APPENDIX 1: NARRATIVE) the cable was re-attached and the rig successfully recovered with a badly bent barrel. However the vibrocorer electrical cable was severely damaged and no further coring could be carried out.

From those locations shown in Fig 2 a total of 579 filtered sediment samples (material coarser than $40 \mu m$) and 579 water samples (containing material finer than $40 \mu m$) were obtained. These samples are at present being analysed.

Where possible suspended sediment and velocity profile measurements were carried out over periods of at least 12.5 hours at each location. However there were inevitable gaps in these records due to the rig being inboard as the tide turned or for repairs to damaged sensors and cables.

EQUIPMENT PERFORMANCE

Vibrocoreing equipment

Similarly to the previous cruise on the RV Sarsia (10 - 21 January 1977) no serious difficulties were experienced with the vibrocoreing equipment. The same minor problems due to the 18ft legs on the vibrocoreing rig being too long to clear the ship's side, were experienced on this cruise. However the practice of changing the barrel over the side of the ship, reduced the number of times that the rig needed to be lifted inboard and outboard so that no serious delays were experienced.

For this cruise a compass and inclinometer were fitted to the vibrocoreing rig to provide information on the orientation of cores and their deviation from the vertical. However only the compass operated satisfactorily there being a fault on the inclinometer cable.

Bent barrels were again a cause of minor delays on this cruise. However the most serious difficulties were experienced when trying to remove cores from the barrels even when these were straight and when all the necessary precautions had been taken; the time taken to extract cores, cut, cap and label them, really governs the rate at which cores can be taken when working on a closely spaced grid of stations.

The main lifting wire, attached to the vibrocoreing rig with a shackle, became detached during this cruise, the only remaining contact with the rig being the electrical umbilical cable. Every precaution should be taken on future cruises to ensure that the shackle is properly secured and seized.

Suspended sediment and velocity profile measuring equipment

The shipboard pumped sampling equipment operated satisfactorily throughout the cruise with pumps and filters being run, more or less continuously, for periods of 12 - 14 hours.

However there were frequent delays as a result of damage to electrical cables and damage to the Braystoke rotors and pumped sampler nozzles on the rig. All the electrical cables (Braystoke cable, inclinometer cable and solenoid box cable) were completely severed at various stages of the experiment, and the pumped sampler hose was punctured on one occasion. Braystoke rotor spindles were damaged on no fewer than 7 occasions and 1 reed switch was damaged beyond repair. Pumped sampler nozzles were on various occasions bent out of alignment. The subsequent repairs to this equipment caused considerable delays.

It is not clear why so much damage to the rig occurred during this cruise. However considerable difficulty was experienced in keeping the ship on station, the bow anchors dragging on a number of occasions, and this may have resulted in the electrical and lifting cables becoming fouled on the rig. An examination of the Braystoke electrical cable revealed that the flooding of this cable may have occurred on a previous occasion as conductors and screening were badly corroded.

Difficulty was also experienced as a result of a faulty circuit board in the Braystoke Interface. This was eventually corrected but resulted in a partial loss of information from two rotors.

AERE Harwell equipment

This operated satisfactorily throughout the cruise. The results of the spectral degradation measurements are not known at the moment and this work was in any case a development of this technique. It is hoped that in future the spectral degradation method will provide much additional information on the depths of burial of radioactive tracer.

HiFix Equipment

On this cruise a HiFix trackplotter was used to position the ship on vibrocoring stations (great accuracy being required when positioning a ship in the radioactive tracer zone). This and all other HiFix equipment operated satisfactorily.

SHIP PERFORMANCE

While it has been possible on this and previous cruises on the RV Sarsia to partially carry through the planned objectives of the study it has become apparent that there are limitations on the scope of the work imposed by the ship and its machinery.

In particular there can be little doubt that greatly improved anchoring facilities are required; measurements of the type described in this report in which it is necessary to deploy equipment on the sea-bed and remain in position above it require better anchoring facilities than are available on the RV Sarsia, particularly, as is the case in Swansea Bay, when working in difficult conditions of wind and tide. It is a credit to the ship's officers and crew that any results were achieved at all.

As has been previously stated the facilities for handling the vibrocoring

rig on the Sarsia are not entirely suitable. Firstly there is insufficient space on deck and secondly the lifting facilities are inadequate. The derrick head block on the ship is rated at 3 tons SWL. During this cruise a load of at least 5 tons (possibly greater) was experienced when trying to pull the rig out of the sea-bed. Better facilities are also required for handling the barrels on deck.

CONCLUSIONS

The overall results of this cruise were reasonably pleasing but only as a result of the perseverance of the scientists and the ship's officers and crew.

Only two cores could be obtained from the radioactive tracer zone, further attempts being curtailed by the rig cable becoming detached and the subsequent damage to the electrical cable during recovery. This was particularly disappointing as these cores were urgently required for estimates of the depth of burial of the tracer.

The results of the suspended sediment and velocity profile measurements are not known at the moment. However due to weather conditions and damage to equipment the hoped-for coverage of stations in Swansea Bay could not be achieved. The data which were obtained should enable estimates to be made of the variations in the concentration of suspended sediment and the bed shear stress over a tidal cycle. It is also hoped that the two sets of measurements from Stn PS2 will enable some general conclusions to be drawn regarding the Neap/Spring variations in suspended sediment and the bed shear stress.

ACKNOWLEDGEMENTS

We are once again indebted to Captain E Dowell and the Officers and Crew of the RV Sarsia for their cheerful co-operation throughout this cruise, particularly through the tense moments when the vibrocoring rig was being recovered by divers. We are grateful to Captain B Davies of the RV Ocean Crest, HM Coastguard at Mumbles, University College Swansea and the Swansea Pilotage Authority for their assistance with the recovery operation. Finally we would like to thank Dr C F Wooldridge, and Mr C R Price for carrying out the diving operations under the most difficult of conditions.

Captain M Perry made all necessary arrangements for our use of the ship and the work was carried out with the permission of Dr E Denton, Director of the Marine Biological Association.

A D HEATHERSHAW

A P CARR

TABLE 1

SWANSEA BAY VIBROCORE SITES (RV SARSIA CRUISE - 23 MARCH to 7 APRIL 1977)

Sample No	Decca Main Chain		Lat	Long	Approximate core length(m)
	G	P	N	W	
SWB 3/77 VC17/A-B	37.55	68.18	51°30.05'	3°48.90'	2
SWB 3/77 VC18/A	37.80	68.08	51°30.18'	3°48.70'	1
SWB 3/77 VC19/A-B	39.14	63.20	51°29.60'	3°51.03'	2
SWB 3/77 VC20/A-B	40.92	59.97	51°29.80'	3°53.45'	2
SWB 3/77 VC21/A	42.23	56.77	51°29.60'	3°55.32'	1
SWB 3/77 VC22/	38.52	76.80	51°31.97'	3°48.50'	No sample ^(a)
SWB 3/77 VC23/A-D	38.40	73.97	51°32.73'	3°47.90'	4
SWB 3/77 VC24/A-B	41.17	73.14	51°34.80'	3°50.45'	2
SWB 3/77 VC25/	37.85	67.58	51°30.05'	3°48.95'	No sample ^(a)
SWB 3/77 VC26/A	38.04	68.28	51°30.40'	3°48.95'	1
SWB 3/77 VC27/A-C	40.45	65.59	51°31.18'	3°51.73'	3 ^(b)
SWB 3/77 VC28/A-B	40.65	65.08	51°31.12'	3°52.00'	2 ^(b)
SWB 3/77 VC29/	40.39	65.71	51°31.05'	3°51.45'	No sample ^(a)

(a) No core sample was obtained either as a result of poor or inadequate penetration or of the core being lost from the barrel.

(b) Cores containing radioactive tracer.

Note: Decca chain is 1B/MP (SW British)

APPENDIX 1

Narrative

Friday		Loaded equipment onto RV Sarsia at Millbay Dock.
18 March		
Sunday	2045	IOS Taunton party join ship in Plymouth.
20 March		
Monday	0745	RV Sarsia moved to outer harbour. C Puckett joined ship.
21 March		MSES HiFix delivered to ship by D Joyce. Sailing delayed due to faulty Decca.
	1215	A D Heathershaw arrived with additional HiFix equipment.
	1340	Sailed for Swansea Bay. Continued setting up HiFix on passage.
	2055	Anchored off Porthleven due to weather conditions.
Tuesday	0730	Weighed anchor and continued on passage.
22 March	2310	Arrived Swansea Bay and anchored off North Kenfig Patches.
Wednesday	0815	Weighed anchor and proceeded to Swansea.
23 March	1012	Commenced vibrocoring.
	2025	Finished vibrocoring for day. Proceeded to Swansea.
	2305	Berthed at No 11 Hoist, King's Dock. R Paske and A D Heathershaw joined ship. C Puckett and T Upham returned to Taunton.
Thursday	0635	Left quay.
24 March	0723	Calibrated HiFix and proceeded to vibrocoring stations.
	0852	Commenced vibrocoring on Kenfig Patches.
	1235	Vibrocoring in radioactive tracer zone.
	1515	Lifting cable parted from vibrocoring rig.
		Contacted HM Coastguard, Mumbles, via RV Ocean Crest requesting assistance from divers immediately.
	1900	Divers (C F Wooldridge and C R Price) put on board by MV Seamark.
	1915	Divers down with line and shackle.
	1925	Divers inboard - current too strong.
Friday	0010	Further attempts at recovery by divers abandoned
25 March		following two abortive dives.

Friday	0400	Divers prepared for further recovery attempt.
25 March	0507	Divers inboard after C R Price successfully attached lifting wire to rig. Decided to wait for daylight before lifting rig.
(continued)	0650	Decided to lift rig due to deteriorating weather conditions.
	0822	Rig onboard but electrical cable severed as result of fouling anchor. Proceeded to Swansea.
	1000	Berthed at 'C' shed, King's Dock. C Puckett rejoined ship. R Paske returned to AERE Harwell.
Saturday		In port. Crew rest day and scientist changeover.
26 March		Unloaded vibrocoring equipment. Set up platforms and repositioned pumped sampling equipment. P Hooper and G Le Good joined ship. A Carr returned to Taunton. D Joyce from and to Taunton with lorry. HiFix equipment transferred to RV Ocean Crest. Finished setting up pumped sampling equipment.
Sunday	1020	Sailed Swansea.
27 March	1402	Started suspended sediment measurements at PS2.
Monday	0230	Finished measurements at PS2 and remained at anchor.
28 March	0900	Difficulty with Braystoke interface.
	1050	Decided to return to Swansea to get assistance with interface.
	1305	Berthed at No 11 Hoist, King's Dock.
	1530	Problem with interface resolved after telephone calls to A Salkield. Decided to sail am on 29 March.
Tuesday	1045	Left berth.
29 March	1115	Sailed Swansea.
	1250	Started suspended sediment and velocity profile measurements at PS2.
Wednesday	0230	Finished measurements at PS2 and remained at anchor overnight.
30 March	0845	Weighed anchor and proceeded to PS5.
	0936	Anchored at PS5.
	1020	Started suspended sediment and velocity profile measurements.

Wednesday	1624	Anchors dragged, rig dragged, rig brought on deck.
30 March	1643	Re-anchored but anchors still dragging .
(continued)	1700	Rig down.
	1733	Rig up due to deteriorating weather conditions and dragging anchors.
	1750	Weighed anchor and proceeded to Swansea for shelter.
	1905	Berthed alongside 'C' shed, King's Dock.
Thursday	0630	Decided to stay in port due to weather conditions (Lundy - SW gales Force 6/8).
31 March	1355	Forecast still giving SW Gales Force 6/8 for Lundy. Decided to delay sailing until Saturday and to spend Friday in port taking on fuel and water.
Friday		In port. Crew rest day. Scientist changeover.
1 April		G Le Good returned to Taunton and M Lees joined ship.
Saturday	0730	Sailed Swansea and proceeded to Stn PS5 .
2 April	0900	Tried anchoring at PS5. Fault on bow thruster. Tried anchoring again but not successful.
	1005	Abandoned PS5 due to weather conditions.
	1105	Anchored off Mumbles Head. Anchor dragged. Re-anchored.
	1355	Decided to remain at anchor overnight due to weather conditions.
Sunday	0615	Weighed anchor and proceeded to Stn PS5.
3 April	0710	Anchored and rig down .
	0713	Started suspended sediment and velocity profile measurements.
	1632	Decided after 3 attempts at re-anchoring and extensive damage to electrical cables on rig to abandon PS5.
	1650	Decided to go into Swansea due to deteriorating weather conditions.
	1810	Berthed in King's Dock, No 6 berth.
Monday	0847	Left berth (Pilot 2 hours late) .
4 April	0928	Sailed Swansea .
	1030	Anchored Stn PS2 .
	1055	Rig down .
	1100	Started suspended sediment and velocity profile measurements.
	1302	Rig up while tide turned .

Monday	1500	Rig down .
4 April	1540	Rig up with electrical cables parted .
(continued)	1720	Rig down after repairs .
	1926	Rig up for tide to turn and repairs .
	2125	Rig down .
	2400	Rig up. Finished measurements at PS2. Remained at anchor overnight.
Tuesday	0645	Started repairs to damaged rotor .
5 April	0750	Anchored at Stn PS4 .
	0930	Rig down following delay due to repairs .
	0937	Started measurements on PS4 .
	1307	Rig up while tide turned .
	1459	Rig down.
	1930	Rig up while tide turned .
	1940	Re-anchored .
	2125	Rig down .
	2230	Rig up. Finished measurements at PS4 .
	2250	Weighed anchor and departed from Swansea Bay for Plymouth.
Wednesday	.	On passage.
6 April	1845	Berthed Plymouth. Unloaded ship. IOS equipment and personnel returned to Taunton.

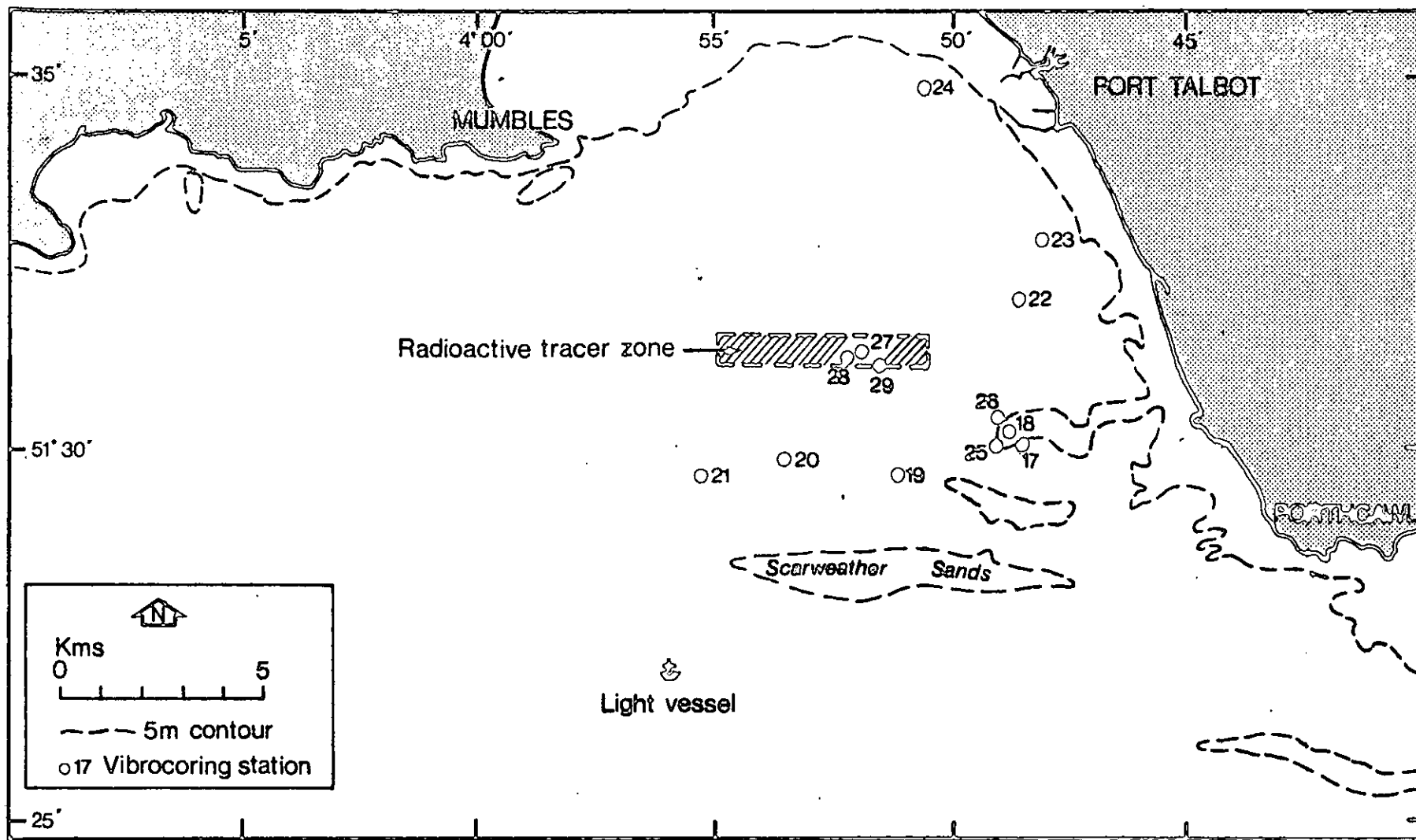
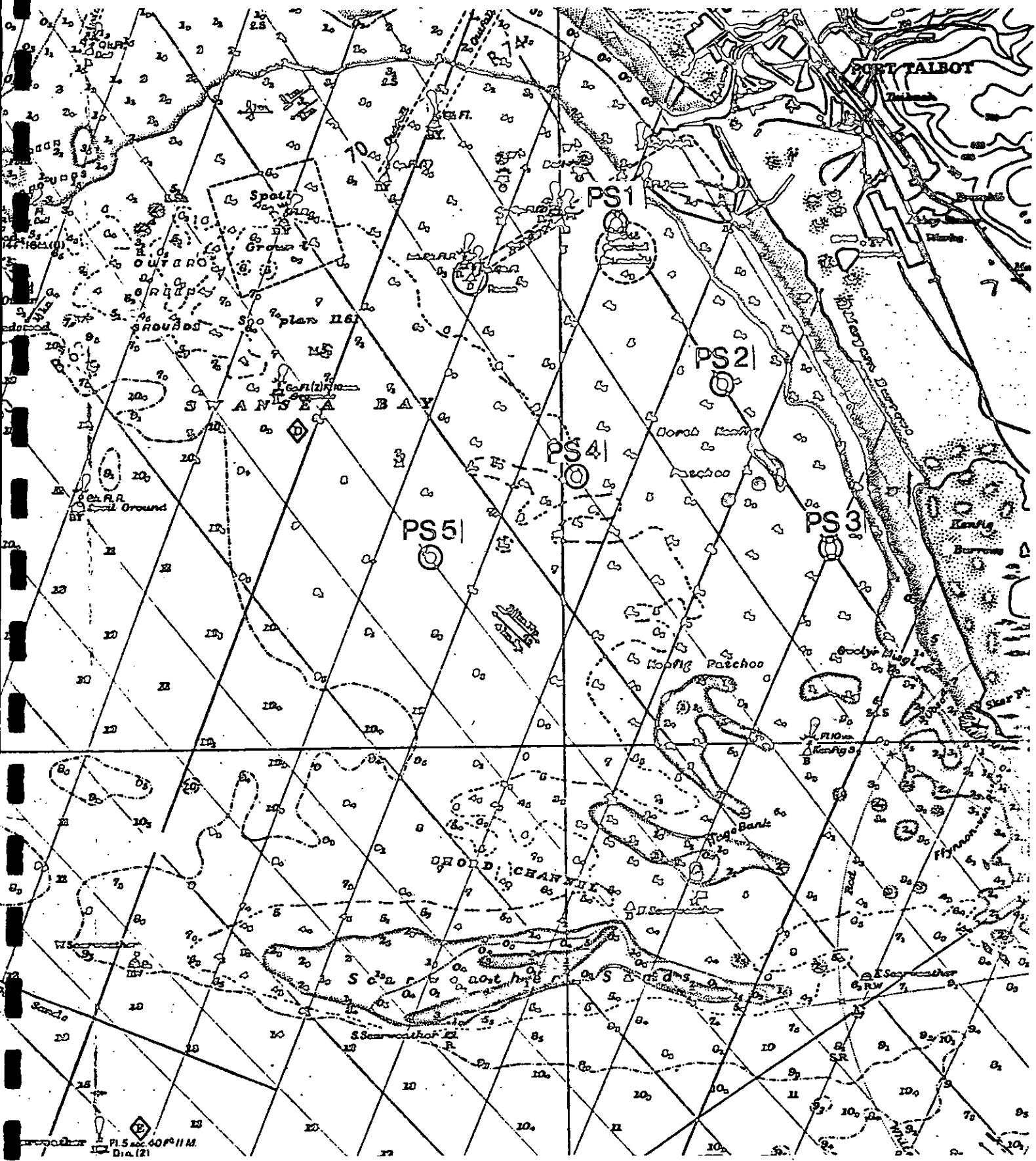


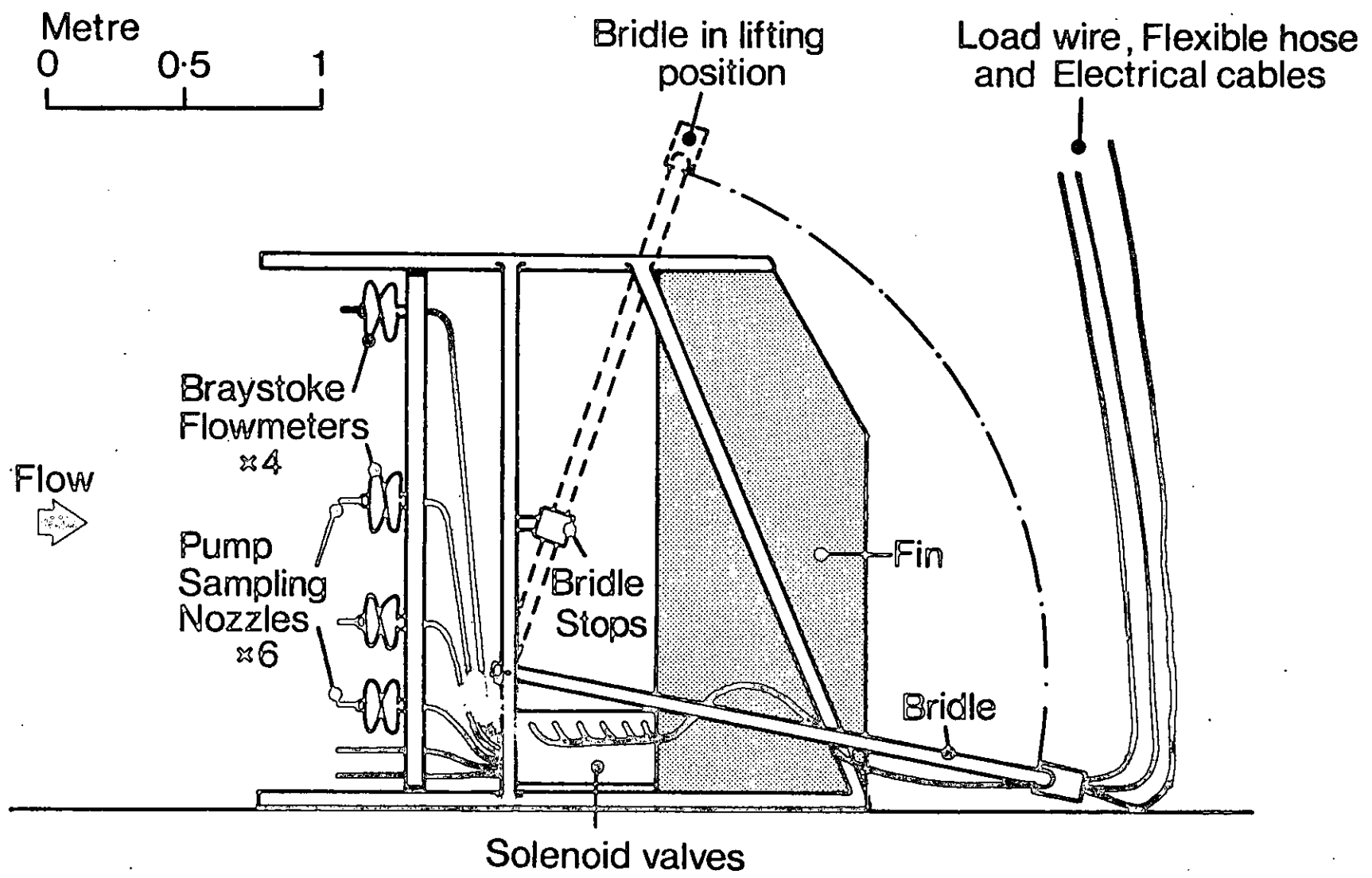
Fig.1

Positions of Vibrocoring stations in Swansea Bay during R.V.Sarsia cruise 21 March - 7 April 1977. Position co-ordinates are given in Table 1.



© Pumped Sampling Stations

Pumped Sampling Stations.
Fig. 2



Schematic diagram of Pumped Sampling Apparatus.

Fig. 3

CRUISE REPORTS

RRS DISCOVERY

CRUISE NO

REPORT NO

1	JUN - AUG 1963	1*
2	AUG - DEC 1963	2*
3	DEC 1963 - SEP 1964	3*

NIO CR**

4	FEB - MAR 1965	4
10	TO	10
37	NOV - DEC 1970	37
38	JAN - APR 1971	41
39	APR - JUN 1971	40
40	JUN - JUL 1971	48
41	AUG - SEP 1971	45
42	SEP 1971	49
43	OCT - NOV 1971	47
44	DEC 1971	46
45	FEB - APR 1972	50
46	APR - MAY 1972	55
47	JUN - JUL 1972	52
48	JUL - AUG 1972	53
49	AUG - OCT 1972	57
50	OCT 1972	56
51	NOV - DEC 1972	54
52	FEB - MAR 1973	59
53	APR - JUN 1973	58

IOS CR***

54	JUN - AUG 1973	2
55	SEP - OCT 1973	5
56	OCT - NOV 1973	4
57	NOV - DEC 1973	6
58	DEC 1973	4
59	FEB 1974	14
60	FEB - MAR 1974	8
61	MAR - MAY 1974	10
62	MAY - JUN 1974	11
63	JUN - JUL 1974	12
64	JUL - AUG 1974	13
65	AUG 1974	17
66	AUG - SEP 1974	20
68	NOV - DEC 1974	16
69	JAN - MAR 1975	51
73	JUL - AUG 1975	34
74/1+3		35
	SEP - OCT 1975	
74/2		33
75	OCT - NOV 1975	43
77	JUL - AUG 1976	46
78	SEP - OCT 1976	52
79	OCT - NOV 1976	54
82	MAR - MAY 1977	59
83	MAY - JUN 1977	61
84	JUN - JUL 1977	60
86	SEP 1977	57
87	OCT 1977	58
88	OCT - NOV 1977	65
89	NOV - DEC 1977	67
90	JAN - MAR 1978	68
91	MAR 1978	69

* REPORTS 1 TO 3 WERE PUBLISHED AND DISTRIBUTED BY THE ROYAL SOCIETY FOLLOWING THE INTERNATIONAL INDIAN OCEAN EXPEDITION

** NIO CR: NATIONAL INSTITUTE OF OCEANOGRAPHY, CRUISE REPORT

*** IOS CR: INSTITUTE OF OCEANOGRAPHIC SCIENCES, CRUISE REPORT

CRUISE REPORTS

CRUISE DATES	REPORT NO
RRS "CHALLENGER"	
AUG - SEP 1974	IOS CR 22
MAR - APR 1976	IOS CR 47
RV "EDWARD FORBES"	
OCT 1974	IOS CR 15 X
JAN - FEB 1975	IOS CR 19
APR 1975	IOS CR 23
MAY 1975	IOS CR 32
MAY - JUN 1975	IOS CR 28
JUL 1975	IOS CR 31
JUL - AUG 1975	IOS CR 36
AUG - SEP 1975	IOS CR 41
AUG - SEP 1975	IOS CR 44
FEB - APR 1976	IOS CR 48
APR - JUN 1976	IOS CR 50
MAY 1976	IOS CR 53
RRS "JOHN MURRAY"	
APR - MAY 1972	NIO CR 51
SEP 1973	IOS CR 7
MAY - APR 1974	IOS CR 9
OCT - NOV & DEC 1974	IOS CR 21
APR - MAY 1975	IOS CR 25
APR 1975	IOS CR 39
OCT - NOV 1975	IOS CR 40
AUG - OCT 1975	IOS CR 42
OCT - NOV 1976	IOS CR 53
MAR - APR 1977	IOS CR 66
NC "MARCEL RAYARD"	
FEB - APR 1971	NIO CR 44
MV "RESEARCHER"	
AUG - SEP 1972	NIO CR 60
RV "SARZIA"	
MAY - JUN 1975	IOS CR 30
AUG - SEP 1975	IOS CR 38
MAR - APR 1976	IOS CR 44
RRS "STACKLETON"	
AUG - SEP 1973	IOS CR 3
JAN - FEB 1975	IOS CR 18
MAR - MAY 1975	IOS CR 24
FEB - MAR 1975	IOS CR 29
JUL - AUG 1975	IOS CR 37
JUN - JUL 1976	IOS CR 45
OCT - NOV 1976	IOS CR 49
JUL 1977	IOS CR 62
MV "SURVEYOR"	
FEB - APR 1971	NIO CR 38
JUN 1971	NIO CR 39 X
AUG 1971	NIO CR 42 X
DE "VICKERS VOYAGER" AND "PISCES III"	
JUN - JUL 1973	IOS CR 1