

I.O.S.

R V EDWARD FORBES CRUISES 6/76, 8/76 AND 11/76

2 - 13 APRIL, 29 APRIL - 7 MAY, AND 2 - 9 JUNE 1976

**SEDIMENTOLOGICAL SAMPLING AND STUDIES OF SEDIMENT
MOVEMENT USING RADIOACTIVE TRACER IN SWANSEA BAY**

CRUISE REPORT NO 50

1976

**NATURAL ENVIRONMENT
INSTITUTE OF OCEANOGRAPHIC
SCIENCES
RESEARCH COUNCIL**

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INSTITUTE OF OCEANOGRAPHIC SCIENCES

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Sedimentological sampling and studies of sediment
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Taunton

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(A)

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SCIENTIFIC STAFF

A P Carr	(Principal Scientist)	2 - 9 April
A D Heathershaw	(Principal Scientist)	9 - 13 April
M W L Blackley		2 - 9 April
J O Malcolm		6 - 13 April
P Hooper		2 - 6 April
K Reeves		9 - 13 April
G Yielding		2 - 12 April
G W Miller		9 April
P Taylor		9 April

SHIP'S OFFICERS

B Chapman (Master)
K Avery (1st Mate)
M Putnam (2nd Mate)
J O'Keefe (Chief Engineer)

B Chapman replaced by P Tilbury on 5 April
K Avery as Master from 3 - 5 April

OBJECTIVES

The objectives of this cruise were as follows:

- (a) To carry out background activity measurements in the Swansea Bay area prior to the injection of a Radioactive tracer on 29 April 1976 during a subsequent cruise.
- (b) To extend the knowledge of sedimentary structures in the area using sidescan sonar.
- (c) To carry out sediment sampling with a box-corer for examination of internal structure in sediments.
- (d) To replace the current meters on the long term mooring at Station A (see Fig 1) and change the sea-bed wave recorder off Port Talbot.

These objectives form part of a larger study being carried out in the

Swansea Bay area by IOS (Taunton), which is directed towards identifying and possibly quantifying those processes responsible for erosion of the foreshore along the E side of the bay.

This cruise report is the first in a series of three describing work undertaken from the RV Edward Forbes between April and June 1976 (Cruise Nos 6/8/11 - 1976).

EQUIPMENT AND METHODS

(a) Background activity measurements:

These were taken using a scintillation counter detector which was lowered to the sea-bed on a single electrical-strain cable. Power supplies and sampling electronics for the detector were situated on the ship. This equipment was on loan from AERE Harwell.

Measurements were made with the ship following a closely spaced array of stations, the positions of which were determined with Decca HiFix equipment operating on the Swansea Bay chain (1900.6 kHz).

At each station the ship was stopped, the detector lowered to the sea-bed, radioactive count rates and position co-ordinates then noted and the detector recovered before the ship proceeded to the next station. A count time of 5 seconds was generally used.

(b) Sidescan sonar observations:

These were carried out with an EG & G sidescan sonar system. Position fixing was again carried out using the Decca HiFix system.

For both (a) and (b), alone, it had been the intention to use the Maglog. However, because of an initial fault, manual recording was introduced and, in order to maintain consistency, continued throughout the whole cruise.

(c) Box-coring:

Box-core samples were taken with a Reineck box-corer. This equipment was handled over the stern of the ship using the 'A' frame. On this cruise box-coring was carried out at locations which had been selected on the basis of grab samples and sidescan sonar observations in order to validate interpretations of sidescan sonar records in terms of the nature of sedimentary deposits.

The procedure that was eventually adopted with this work was to take a preliminary grab sample (van Veen) at each station in order to prevent damage to the box-corer from large stones and pebbles (see Equipment Performance).

RESULTS

Between 2.4.76 and 11.4.76 a total 388 background activity measurements were made in the area shown in Fig 1. Count rates were in general low. No evidence was found to suggest that radioactive tracer from the experiment in 1975 (Sc^{46} - half life 84 days) was present in appreciable quantities. However in the vicinity of the Kenfig Patches some count rates of about 3 - 4 times the typical background values obtained elsewhere in the Bay suggest that there may have been very localised pockets of activity.

Background activity measurements proceeded without difficulty although on 3.4.76 a detector was lost while being brought to the surface on its cable. This appears to have been due to a badly corroded wire. Attempts to recover the lost detector by dredging were made on 11.4.76 and 13.4.76 without success.

Sidescan sonar work was carried out between 2.4.76 and 6.4.76 and proceeded satisfactorily although it was not possible to record HiFix position co-ordinates on the Decca Maglog. There were also a number of minor faults on the HiFix receiver system which were dealt with at the time.

Box-coring was carried out intermittently between 6.4.76 and 12.4.76. Forty-two cores were obtained, at locations shown in Fig 2, with penetration varying from the full 40cm in clays to 20-30cm in sands. Some evidence of cross bedding was obtained and in a number of cases there was a well-defined layer of sand overlying a clay deposit or the reverse.

Some damage to the box corer occurred as a result of the penetration of sediments containing large stones and pebbles. However with the assistance of the ship's engineer it was possible to carry out repairs and no serious delays were experienced. As a precautionary measure the sampling routine was subsequently modified.

A full report on the box-corer sampling, prepared by J O Malcolm, is included as Appendix II of this report.

Two Plessey MO21 recording current meters were successfully recovered on 9.4.76 from the long term mooring at Station A (see Fig 1).

On 12.4.76 attempts were made to recover the wave recorder deployed near Port Talbot. However, both wires, securing marker buoys to the mooring, parted when attempts were made to lift first the recorder and then the chain clump at the other end of the ground line. The position was left 'buoyed off' and further attempts are being made to recover the recorder.

EQUIPMENT PERFORMANCE

AERE Harwell - This equipment operated satisfactorily although it is considered that the loss of the detector was due to the cable being in an unsuitable condition. Inspection of the broken end of the cable has revealed that the wires were very badly corroded.

IOS Barry (MSES) - Difficulty was experienced with the Kelvin Hughes MS36 echosounder which was found to have a faulty governor control and tachometer. One of the MSES HiFix receivers (934) could not be 'locked in' apparently due to irregular relay operation (this was replaced with IOS Taunton's spare receiver). The other MSES receiver (957) was 'locked in' but with a very low voltage setting ($\approx 6V$). It was also found necessary to adjust the frequency internally on this receiver at a later stage of the cruise.

The current meters on the long term mooring at Station A were successfully recovered, although the top half of the fin on the top meter (No KA 244) was missing. However subsequent inspection of the magnetic tape records has shown that one meter recorded only 15 days' data and the other one something less than this. The problem appears to have been due to stiction between the tape and the record head assembly.

The 20A d.c. fuse (and its spare) on the MSES HiFix battery charger 'blew' when connected to the 3-phase mains supply. The IOS Taunton battery charger was then used and run from the scientific a.c. supply. The MSES charger was later substituted when replacement fuses were obtained.

IOS Taunton - The failure to recover the IOS Taunton wave-recorder mooring at Port Talbot was considered to be due to badly corroded wires and it is suggested that on future moorings these wires be changed at regular intervals (every 2 months).

During operation of the box-corer a number of modifications became apparent which would improve the handling of the equipment. However these are described in a separate report.

Blown fuses occurred on the Decca Maglog which necessitated position fixing manually with the HiFix system.

SHIP PERFORMANCE

A number of problems occurred with equipment on the ship, although these did not seriously delay the progress of the scientific programme. These were as follows:

- (1) The brake on the port aft winch which was not able to hold the weight of the box-corer. In order to raise the corer stem, so that the safety clamp could be set, it was necessary to 'play' the winch.
- (2) The winch starter motor failed to operate satisfactorily at times.
- (3) Long traverse times with the ship's 'A' frame (up to 7 minutes on occasions) made handling of the box corer extremely hazardous. Attempts were made by the ship's engineer to rectify this situation but these were not entirely successful.
- (4) Some difficulty was experienced with the ship's 3-phase power supply causing fuses to be 'blown' on the HiFix battery charger and possibly the Decca Maglog.

CONCLUSIONS

In general, with the exception of the wave recorder, which could not be recovered at Port Talbot, the objectives of this cruise were successfully achieved.

The area covered by background activity measurements was considered adequate for the anticipated excursions of the tracer material and sidescan sonar and box-coring have provided useful information on bed forms and sediment cover in the area, together with information on the vertical structure of sediments.

ACKNOWLEDGMENTS

The full co-operation of the Ship's Officers and crew throughout this work is gratefully acknowledged. In particular we wish to thank the Ship's engineer (J O'Keefe) for his invaluable assistance in making repairs to the box corer.

A D Heathershaw and A P Carr

IOS Taunton

November 1976

APPENDIX I
NARRATIVE

Thursday 1 April		IOS Taunton personnel and equipment travel to Barry. Equipment loaded on board RV Edward Forbes.
Friday 2 April	0800	Scientific party joined ship.
	0910	Ship sailed from Barry for the Swansea Bay area.
	1400	Calibrated Decca HiFix at SW Dolphin, Port Talbot.
	1445	Commenced background activity measurements.
	1655	Stopped survey work and proceeded to Swansea to put B Chapman ashore. K Avery took over as Master. Proceeded to survey area and continued measurements.
	2035	Stopped background activity measurements for day.
	2100	Anchored overnight NE of Mumbles.
Saturday 3 April	0800	Weighed anchor and proceeded to the area of the Kenfig Patches to carry out sidescan sonar work.
	0900 (approx).	Commenced sidescan sonar work.
	1245	Sidescan sonar work completed.
	1307	Commenced background activity measurements.
	1437	Lost detector due to corroded wire.
	1525	Substituted 2nd winch and detector.
	1700	Abandoned background survey work due to rapidly deteriorating weather conditions and decided to shelter in Swansea.
	2005	Berthed in King's Dock, Swansea.
Sunday 4 April	0700	Sailed from Swansea.
	0735	Checked HiFix.
	0854	Commenced sidescan sonar survey.
	1020	Fault developed on HiFix system.
	1602	Discontinued sidescan sonar work.
	1620	Commenced background survey work.
	1800	Dropped background survey work for day.
	1820	Recommenced sidescan sonar work.

Sunday	1930	Ceased sidescan survey.
4 April	1955	Calibrated HiFix system alongside outer jetty, Swansea.
(continued)	2020	Anchored for night.
Monday	0725	Checked HiFix and prepared initial track plot.
5 April	0800	Weighed anchor.
	0841	Began sidescan sonar work.
	1246	Finished sidescan sonar survey.
	1255	Commenced background survey work.
	1940	Finished background survey work for day and proceeded to Swansea.
	2035	Berthed in Kings Dock, Swansea.
Tuesday	am	B Chapman returned to the ship.
6 April	1200	J O Malcolm joined ship. Box corer weights loaded and sidescan equipment offloaded.
	1245	P Tilbury and P Hooper left the ship.
	1315 (approx)	Sailed from Swansea. Checked HiFix at outer jetty.
	1453	Commenced background survey work.
	1830	Finished background survey work for day.
	1930	Tried box corer. Some problems with box corer and winch.
	2030	Anchored for night.
	2135	HiFix failed - no a/c from Laboratory supply.
Wednesday	0830	Remained at anchor while trying to contact RVB regarding difficulties with ship's A/c supply and the HiFix equipment.
7 April	1007	HiFix equipment made operational and calibrated at outer jetty in Swansea.
	1117	Commenced background survey work in area of Kenfig Patches.
	1700	Completed background survey work for day and proceeded to Port Talbot area for box-coring.
	1730	Started box-coring.
	1920	Stopped box-coring and proceeded to Outer Green Grounds to anchor overnight.
	2000 (approx)	Dropped anchor.

Thursday 0745 Weighed anchor.

8 April 0830 Commenced box-coring.
1845 Completed box-coring for day and proceeded to Swansea.
2035 Berthed in King's Dock, Swansea.

Friday 0830 HiFix lost lock on both receivers overnight.

9 April 0925 A D Heathershaw and K Reeves joined ship and G W Miller
and P Taylor joined ship for day only.
1015 A P Carr and M W L Blackley left ship and returned to Taunton.
1100 Loaded replacement current meters and mooring equipment for
Stn A. Also loaded a rock dredge.
1145 Sailed from Swansea.
1240 Calibrated HiFix at outer jetty, Swansea, and proceeded
to long-term mooring at Stn A.
1355 Laid replacement mooring at Stn A.
1410 Recovered old mooring at Stn A and proceeded to Swansea.
1540 Berthed alongside outer jetty at Swansea to put G W Miller
and P Taylor ashore.
1550 Departed Swansea.
1710 Commenced background activity measurements.
2008 Completed background survey work for day.
2020 Anchored overnight at Outer Green Grounds.

Saturday 0800 Weighed anchor and proceeded SE for box coring.

10 April 0825 Commenced box coring.
1742 Discontinued box coring due to thick fog setting in.
1800 Anchored due S of Outer Green Grounds. Carried out
repairs to box-corer. Decided to remain at anchor
overnight.

Sunday 0800 Weighed anchor and proceeded to box coring area.

11 April 0835 Commenced box coring.
0930 Discontinued box coring due to deteriorating weather and
dangerous handling conditions.
0950 Commenced background survey work.
1853 Completed background survey work.
1930 Commenced dredging for lost detector (on HiFix).

Sunday
11 April
(continued)

2045 Completed dredging and returned to Outer Green Grounds to anchor overnight.

Monday
12 April

0745 Weighed anchor and proceeded to Swansea to put G Yielding ashore. HiFix lost lock and attempted to calibrate at outer jetty, Swansea.

0830 Put G Yielding ashore. Proceeded to box-coring stations. HiFix could not be 'locked in' and decided to carry out box-coring on Decca Main Chain (Note: It was discovered later that the HiFix failure was due to a loss of transmission from the slave station at Mumbles).

0933 Commenced box-coring.

1810 Completed box-coring for day and proceeded to Port Talbot to change wave recorder. Loaded cassette in replacement wave recorder and started first cycle.

1953 Tried lifting wave recorder from frame end but wire parted. Laid marker buoy near other end of mooring and then attempted to lift the chain clump. This wire also parted. 'Buoyed off' approximate position of wave recorder frame.

2011 Proceeded to overnight anchor station on Outer Green Grounds.

Tuesday
13 April

0800 Weighed anchor and proceeded to area of lost detector.

0852 Started dredging (on Decca Main Chain - no HiFix).

1008 Completed dredging. Detector not recovered. Departed from Swansea Bay area and proceeded to Barry.

1745 Arrived in Barry.

APPENDIX II

BOX CORING REPORT

The box corer operated very well in all lithologies other than very coarse gravels. Grab sampling was eventually instigated as a preliminary precaution to prevent damage to the boxes. Full boxes of 40cm or more were obtained in clays with thin sand cover. In the med/fine sands of the banks 20-30 cm penetration was considered to be good, in view of the short time that the corer could be left on the bottom because of the ship drifting off station in strong currents.

Handling of the corer on deck improved with practice but was made dangerous in a moderate swell by the time taken for the 'A' frame to travel to and from its outboard position. A minimum of three people were required to handle the corer in anything but a flat calm. Some modifications to the closing knife had to be made on board during the course of the cruise and in this respect the engineer, Mr J O'Keefe, was extremely helpful. A metal strip had to be made up and bolted through the leading edge of the knife blade. This was to prevent the rubber sealing pad from rucking up, and to give them a longer life.

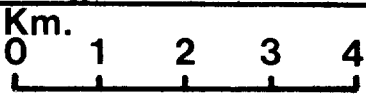
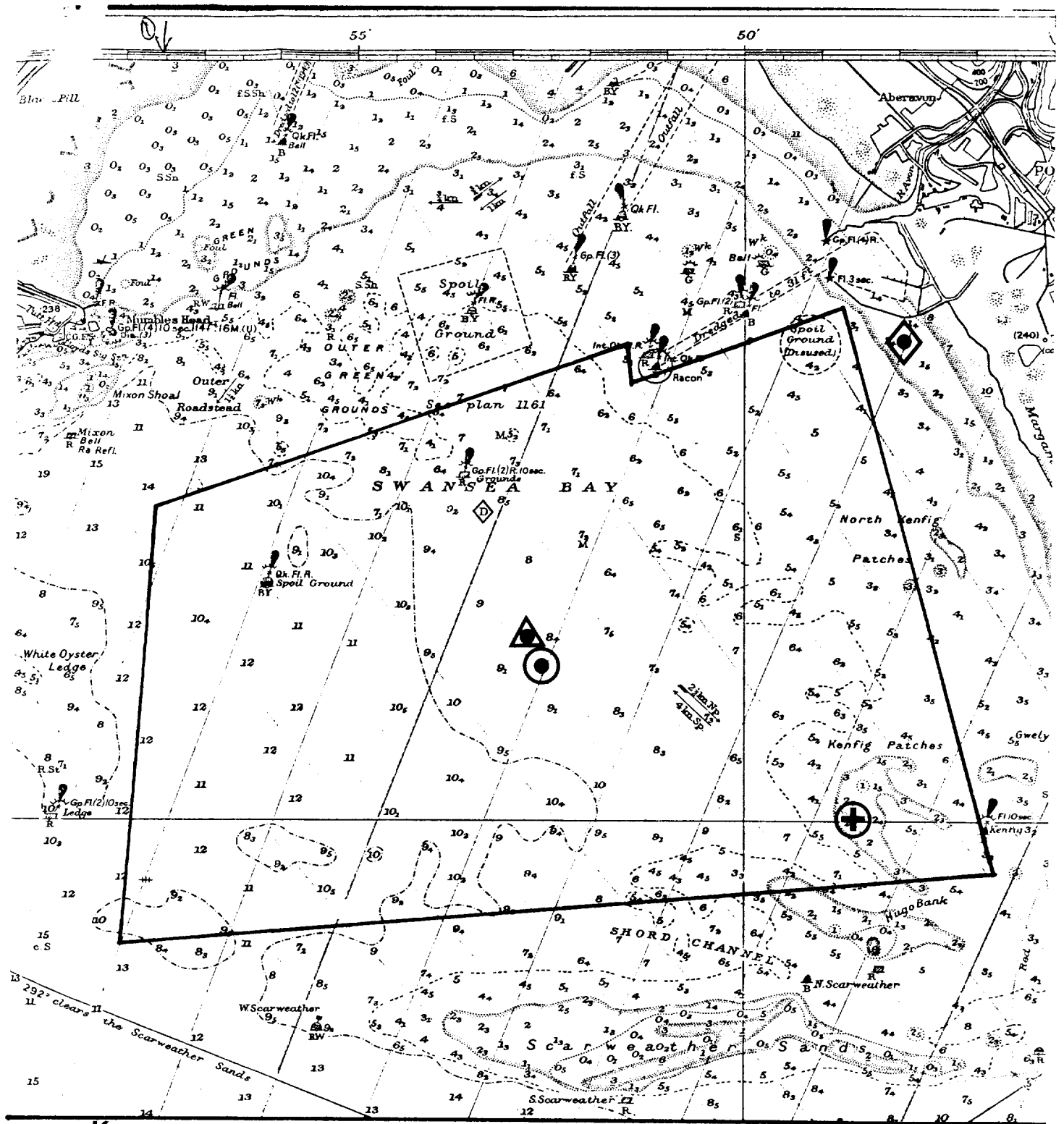
Operating experience suggested that the following modifications and additions would improve the performance of the corer:

1. Safety bar through central stem above gimbals to supersede present clamp system
2. Provision of cradle to position corer correctly on deck
3. Modifications to knife blade leading edge
4. Improve weight clamp
5. Improve box fitting and removal
6. Improve shoe fitting to minimise sample loss
7. Provide gimbals locks to prevent undue movement on deck
8. Provide sample view and syphoning port
9. Seal boxes to prevent water and sample loss
10. Provide box carrier
11. Provide smaller swivel
12. Provide corner plates for the skirt to prevent overpenetration in soft muds and to equalise resistance to the water flow
13. Provide a jack and rig for easier penetration of sub sample boxes

Other than the buckling of boxes and blade on large pebbles the coring programme went very smoothly. All stations were taken within the required period

with the exception of those deemed unsuitable from grab sample evidence and those where the current was too strong or the water too shallow. On the one occasion where a station was attempted in a strong current the ship drifted off station and the corer was pulled over, damaging a fin.

The all-steel construction of this box-corer stood up to the rigours of operation far better than the aluminium model used previously. Other than the buckled blade and fin, no damage was sustained.



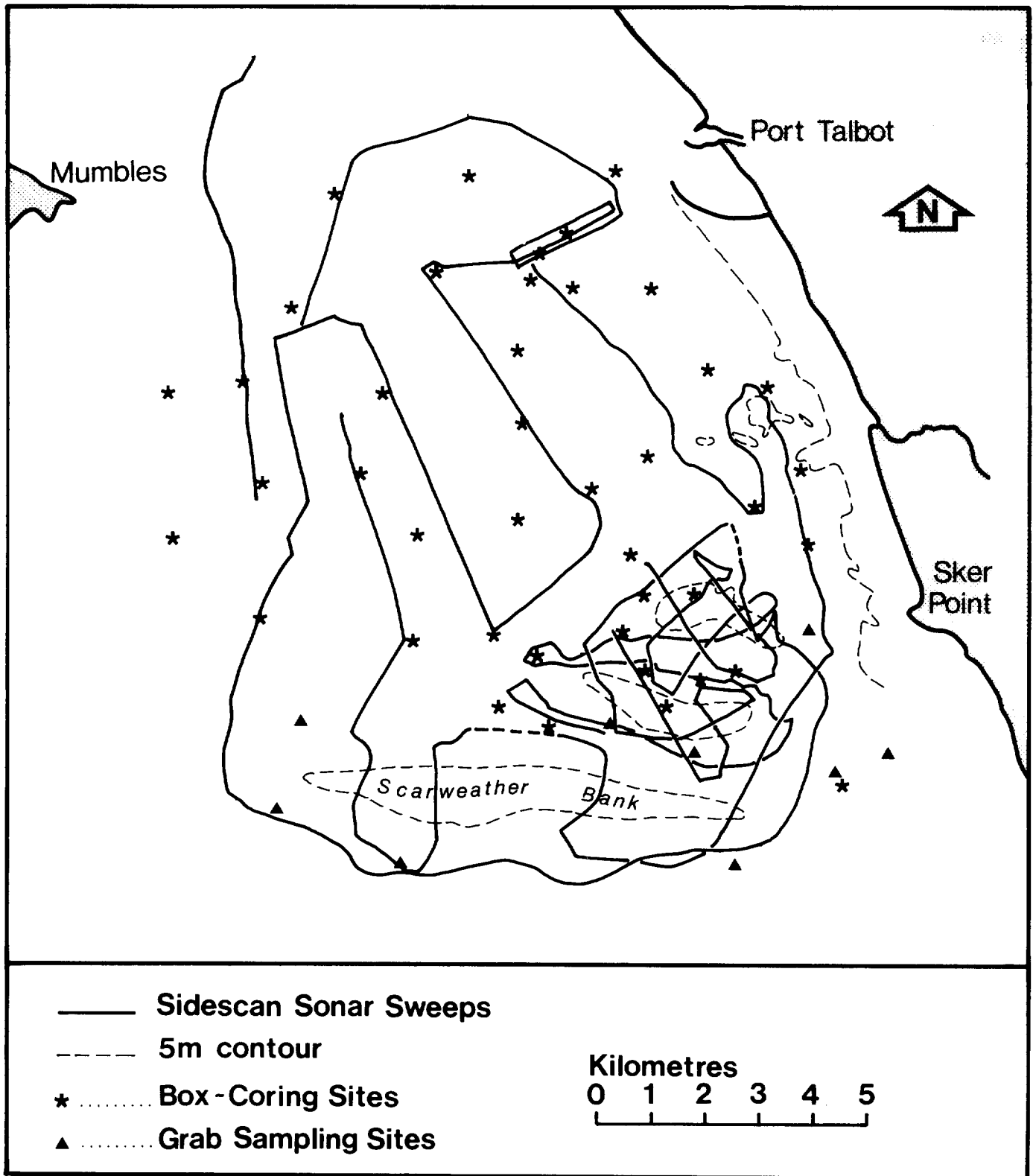
Depths in Fathoms. Based on H.O. Chart 1165



- ⊕ 1975 Injection Site.
- 1976 " " "

- ▲ Long Term Current Meter Mooring
- ◆ Seabed Pressure Wave Recorder
- Approximate Limit of 1976 Background Surveys

Fig.1



**Sidescan Sonar Survey, Box-Coring and Grab Sampling Sites.
R.V. Edward Forbes cruise 6/76**

Fig.2

INSTITUTE OF OCEANOGRAPHIC SCIENCES

RV EDWARD FORBES CRUISE 8/76

29 April - 7 May 1976

Sedimentological sampling and studies of sediment
movement using radioactive tracer in Swansea Bay

(B)

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SCIENTIFIC STAFF

A D Heathershaw (Principal Scientist)	29 April - 7 May
B J Lees	4 May - 7 May
C N Puckett	29 April - 4 May
G Yielding	29 April - 7 May
A Soleman	29 April - 3 May
M W L Blackley	4 May
J D Humphery	4 May
M Ivanovich (AERE Harwell)	29 April
D B Punter (AERE Harwell)	29 April
A Madgwick (IOS Wormley)	29 April

SHIP'S OFFICERS

K Avery	Master
P Tilbury	1st Officer
R Coutts	2nd Officer
C Phillips	Chief Engineer

OBJECTIVES

The objectives of this cruise were as follows:

- (a) to carry out the injection of a Radioactive tracer (Sc^{46}) for simulated sediment transport studies;
- (b) to carry out the initial monitoring of the tracer dispersion;
- (c) to re-deploy the Waverider buoy located due E of the Scarweather Light Vessel.

These objectives form part of a larger study being carried out in the Swansea Bay area, by IOS Taunton, which is directed towards identifying and possibly quantifying those processes responsible for the erosion of the foreshore between Port Talbot and Porthcawl on the E side of the bay.

This cruise report is the second in a series of three describing work undertaken from the RV Edward Forbes between April and June 1976 (Cruise Nos 6/8/11 - 1976).

EQUIPMENT AND METHODS

In order to study the potential movement of sediment in an area more typical of the processes affecting Swansea Bay as a whole, it was decided to carry out an injection of radioactive tracer at a site to the west of last year's injection on the Kenfig Patches.

The injection techniques were similar to those used on last year's injection. Ampoules containing the radioactive material were removed from their containers and dropped into a tube containing a constriction. The tube was secured to the side of the ship and extended from the surface to within 1 - 2m of the seabed. The ampoules were crushed against the constriction, and the radioactive tracer flushed to the sea-bed with sea-water.

The injection was carried out at low water slack at the location shown in Fig 1 and for this purpose the ship was anchored (single anchor only). The depth of water at the time of injection was approximately 18m.

Approximately 653 gm of Sc^{46} tracer were injected having a mean particle diameter of $160 \mu\text{m} \pm 20 \mu\text{m}$. The initial activity of the tracer was approximately 92 curies.

Position fixing of the ship during the injection and subsequent monitoring was carried out using a Decca HiFix system (Swansea BTDB chain).

Initial monitoring of the tracer was carried out using the standard AERE Harwell detection equipment consisting of a scintillation detector and a hand operated winch with associated shipboard power supplies and sampling electronics. Measurements were made, with the ship stationary, by lowering the detector onto

the sea-bed.

During the injection operation the after deck of the RV Edward Forbes was cordoned off and only AERE Harwell and one IOS Taunton staff were permitted in this area. All scientific personnel and the ship's officers and crew were issued with film badges prior to the injection. During the injection radiation levels were monitored around the isotope containers and on the ship's bridge.

The radioactive tracer injection operations were filmed by Mr A Madgwick of IOS Wormley.

The Waverider buoy and mooring deployed approximately 1 mile E of Scarweather Light Vessel was of the conventional type and details of this equipment are not included here.

RESULTS

The results of the initial monitoring of tracer dispersion are shown in Fig 1. A total of 1021 activity measurements were made during the cruise. An averaging time of 5s was generally used. The results are similar to those obtained from the injection on the Kenfig Patches last year; the strong rectilinear tidal flow appears to have been reflected in the initial movement of the tracer which remained in an elongated body. After 5 - 6 days this was approximately 5.5 km long (in an E - W direction) and up to 500m wide.

Similarly to last year the direction of initial movement, even after several tidal cycles, seems to be highly dependent on the phase of the tide at the time of injection. Thus, in this case where the injection was carried out on a LW slack, net movement after 5 - 6 days was towards the E, covering a distance of some 4 km approximately from the injection site.

Unfortunately, due to a breakage which occurred in the plastic injection tube, thereby causing a delay of some 32 minutes, not all the tracer could be injected over the slack water period. The remaining tracer was injected approximately 70 minutes into the Flood and thus may have been dispersed further to the E than similar material injected at slack water. Assuming that the end of the injection tube was some 2m above the seabed and that the mean flow near the seabed was of the order 0.5 ms^{-1} , a calculation of the particle settling velocity indicates that the material may have settled up to 50m from the injection site. However this is considered to be the maximum likely excursion and it is more probable that the displacement was less than this, of the order of 10 - 20m.

The Waverider buoy was deployed without incident and has been operating satisfactorily since.

EQUIPMENT PERFORMANCE

AERE Harwell equipment:

This equipment operated satisfactorily although Detector 4 and its associated electronics caused some difficulty during the monitoring of the tracer immediately after injection. This unfortunately prevented the initial displacement of the material to the E, on the first tidal cycle, from being determined. The reason for this fault is not entirely clear as the equipment was later found to operate satisfactorily. However, the trouble may have been due to a faulty lead connection.

Detector 4 was replaced with Detector 5 and this operated satisfactorily until 1 May 1976, when the portable winch 'seized up'. The winch was carefully dismantled but could not be freed. This equipment was replaced with Detector 4, by then made operational.

Calibration of the instruments with a Co⁶⁰ source was complicated by high count rates obtained with the detector on the deck of the ship. A later inspection of the ship by AERE Harwell revealed that this may have been due to a very small amount of activity remaining in the area of the tracer container and the extreme sensitivity of the detectors.

IOS Barry (MSES) equipment:

HiFix receiver 957 and the Kelvin Hughes MS36 echosounder operated satisfactorily (although the latter was only used for about half an hour). All the HiFix equipment was operated successfully from the ship's (domestic) 240v ac supply. HiFix receiver 934 was still found to be giving irregular relay operation (as reported on the previous cruise).

IOS Taunton equipment:

HiFix receiver 277 and the HiFix track plotter operated satisfactorily throughout this cruise. The difficulty previously experienced on cruise 6/76 with this receiver locking in at a low reference level ($\approx 6v$) was not found to occur on this occasion, a reference level of 10v being obtained.

SHIP PERFORMANCE

No serious difficulties occurred with equipment on the ship. However, a delay of approximately 30 minutes occurred on 30 April 1976 as a result of an oil leak on the main engine and a further delay of 20 minutes occurred on 2 April 1976 due to the main engine stopping during a battery change-over. On 6 May 1976

two bolts were found to have sheared on the main engine manifold necessitating that the ship leave the Swansea Bay area earlier than planned and return to Barry at reduced speed. However this only caused an effective loss of some 2 - 3 hours from the scientific programme.

CONCLUSIONS

Despite poor weather conditions during the latter part of the survey, the objectives of this cruise were successfully achieved.

The initial tracer dispersion pattern was of the predicted form although the travel distance was not as great as had been anticipated.

From the results of these radioactive tracer studies it is hoped to be able to calculate likely long and short term sediment transport rates and directions and thereby assist with the overall assessment and quantification of the sediment budget in the Swansea Bay area.

ACKNOWLEDGEMENTS

It is a pleasure to record again our thanks to the Officers and Crew of the RV Edward Forbes for their willing co-operation throughout this cruise and also to thank the AERE Harwell staff for their valuable assistance with the injection of the radioactive tracer.

A D Heathershaw
IOS Taunton
November 1976

APPENDIX I

NARRATIVE

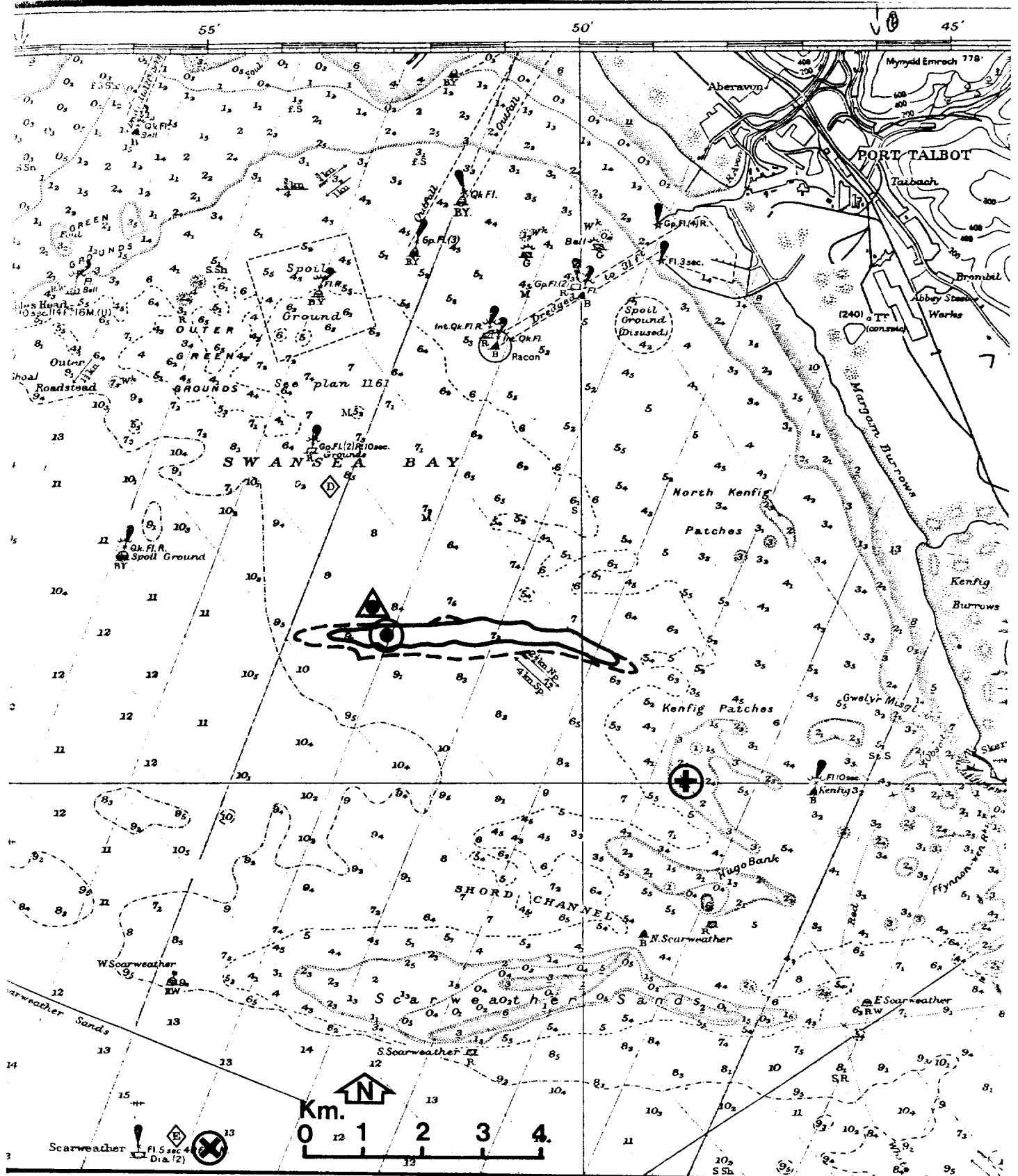
Wednesday 28 April IOS Taunton and AERE Harwell personnel travelled to Barry. Loaded radioactive tracer containers and injection and monitoring equipment. Se up HiFix equipment.

Thursday 29 April 0645 Scientific party joined ship
0700 Ship sailed from Barry for the Swansea Bay area.
Film badges issued to scientists and crew.
1140 Calibrated HiFix receivers at Port Talbot.
1230 Ship anchored on tracer injection site.
1250 Plastic injection tube assembled over side of ship.
1310 One van Veen grab sample taken to establish nature of bottom sediments.
1332 Commenced injection (LW slack 1316).
1355 Stopped injection due to breakage in plastic tubing.
1427 Recommenced injection.
1455 Completed injection.
1530 Ship weighed anchor.
1550 Started initial monitoring of area around injection site.
1750 Survey work stopped due to fault on detector electronics.
Due to the anticipated delay in repairing this it was decided that the ship should proceed to Swansea to put scientific personnel ashore.
1848 Ship alongside outer jetty Swansea. M Ivanovich, D B Punter and A Madgwick put ashore.
1940 Continued with tracer survey.
2025 Broke off from tracer survey due to fault on detector electronics and proceeded to overnight anchorage.
2100 Ship anchored SE of Mumbles.

Friday 30 April 0800 Weighed anchor
0833 Started tracer survey work.
0958 Minor delay due to repair to ship's engine.
1535 Fire drill
2341 Completed tracer survey work for day and proceeded to overnight anchorage SE of Mumbles.

Saturday	0800	Weighed anchor
1 May	0856	Started tracer survey work
	1044	Re-calibrated one HiFix receiver (against a second).
	1145	Tracer detector hand winch seized up and was replaced with with detector 4 and electronics 'B'.
	1352	Continued with tracer survey work.
	1820	Further survey work abandoned due to poor weather conditions.
	2020	Ship berthed in King's Dock, Swansea.
Sunday	0740	Sailed from King's Dock.
2 May	0915	Calibrated HiFix at outer jetty.
	1030	Commenced tracer survey work.
	1555	HiFix receiver 957 'lost lock' and could not be recalibrated.
	2045	Completed survey work and proceeded to overnight anchorage SE of Mumbles.
Monday	0730	Weighed anchor.
3 May	0832	Started tracer survey work. HiFix receiver 957 'locked in'.
	1527	Completed tracer survey work for day and proceeded to Swansea to exchange scientific personnel.
	1806	Ship entered locks in Swansea.
	1900	Ship berthed in King's Dock. A Heathershaw and A Soleman leave ship and return to Taunton. M Blackley and J Humphery join ship (M Blackley assumes responsibilities of Senior Scientist).
Tuesday	1330	Departed Swansea and proceeded to Waverider buoy position (E of Scarweather Light Vessel).
4 May	1445	Arrived on Waverider buoy station.
	1450	Commenced deploying Waverider buoy.
	1600	Anchored on Outer Green Grounds, waiting to enter Swansea.
	1900	Weighed anchor and proceeded to Swansea.
	1930	Alongside outer jetty. M Blackley, J Humphery and C Puckett put ashore; A D Heathershaw and B Lees joined ship.
	1945	Left Swansea for overnight anchorage SE of Mumbles.

Wednesday	0800	Weighed anchor and proceeded to tracer survey area.
5 May	0856	Commenced tracer survey work.
	2015	Completed tracer survey work.
	2040	Anchored overnight SE of Mumbles.
Thursday	0730	Weighed anchor and proceeded to tracer survey area.
6 May	0818	Commenced tracer survey work.
	0900	Link call RVB regarding high activity levels on deck of ship and possible arrangements for AERE staff to monitor levels when ship returns to Barry.
	1030	Second link call from RVB and a further call from R Paske (AERE Harwell) confirming arrangements for someone to meet ship in Barry.
	2250	Completed survey work. Due to a fault on the ship's main engine it was decided to proceed to Barry overnight at reduced speed (about 4 - 5 knots).
Friday	0945	Arrived at Barry. AERE Harwell isotope containers and detectors unloaded. Radiation levels on ship checked by Harwell staff but not found to constitute any danger to health. IOS Taunton personnel and equipment returned to Taunton.
7 May		



- | | | | |
|---|----------------------|-------|---------------------------------|
| ⊗ | Waverider Buoy Site. | ▲ | Long Term Current Meter Mooring |
| + | 1975 Injection Site. | — | Dispersal after 2-3 Days |
| ⊙ | 1976 " " " | - - - | " " " 5-6 " |

RADIOACTIVE TRACER INJECTION SITES AND INITIAL DISPERSION PATTERNS (APPROXIMATE ONLY). FIG. 1

INSTITUTE OF OCEANOGRAPHIC SCIENCES

RV EDWARD FORBES CRUISE 11/76

2 - 9 JUNE 1976

Sedimentological sampling and studies of sediment
movement using radioactive tracer in Swansea Bay

(C)

CRUISE REPORT NO 50

1976

Institute of Oceanographic Sciences
Crossway
Taunton

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SCIENTIFIC STAFF

A P Carr (Principal Scientist)	2 - 9 June
M W L Blackley	2 - 9 June
J O Malcolm	5 - 9 June
G Yielding	2 - 5 June
Day visitors: A Soleman	5 June
R Price (UCS Swansea)	7 June

SHIP'S OFFICERS

B Chapman (Master)
P Tilbury (1st Mate)
M Putman (2nd Mate)
C Phillips (Chief Engineer)

OBJECTIVES

- (a) To assess the amount of movement of the radioactive tracer that had occurred since its release on an earlier cruise (see Edward Forbes cruise 8/76; 29 April 1976).
- (b) To use the box corer to determine the sedimentological variation of the sea bed occurring with depth in:
- (i) an area of one square kilometre
 - (ii) along 2 lines of section, one parallel and the other at right angles to the shore
 - (iii) a T-shaped series of sites west of Swansea Bay on behalf of the University College of Wales (UCW), Swansea, in conjunction with their IOS Research Contract.

These objectives form part of a larger study being carried out in the Swansea Bay area, by IOS (Taunton), which is directed towards identifying and possibly quantifying those processes responsible for erosion of the foreshore along the E side of the bay.

This cruise report is the third in a series of three describing work undertaken from the RV Edward Forbes between April and June 1976 (Cruise Nos 6/8/11 - 1976).

EQUIPMENT AND METHODS

Detailed use of the AERE Harwell equipment and the Reinceck pattern box corer has been dealt with in the Cruise Report 'A' for RV Edward Forbes Cruise No 6/76.

RESULTS

A total of 579 radioactivity counts were measured between 2 June and 6 June, thus enabling the spread of the tracer to be recorded. The east-west distribution was essentially the same as that recorded on cruise 8/76. Some dispersal had occurred though, in a southerly direction. This represented a maximum movement of approximately 1 km between surveys.

Box coring (see Fig 1) was begun on the afternoon of 5 June in an area thought, as a result of earlier sampling, to be free of gravel and boulders. It was proposed to take 25 box cores in an area measuring about 1 sq km, and a further 15 on 2 lines of section running at right angles to one another near the east shore of Swansea Bay. Unfortunately at the third station the box corer struck a boulder that damaged both the sample box and the swinging blade assembly. This meant that the sampling programme had to be postponed until either the blade could be mended or a replacement obtained (see Appendix II).

The box corer was in operation again by 8 June. From then on grab samples were taken prior to the lowering of the box corer in order to minimise the risk of further damage. All the IOS sample stations were successfully completed. The rubber seal on the cutting blade was only damaged once by gravels but the time needed for its replacement had the effect that the sampling of sites in the Oxwich Bay area for UCW Swansea had to be curtailed.

At the same time as Cruise 11/76 was under way, the RV Ocean Crest (UCW Swansea research vessel) was being used by A D Heathershaw (IOS Taunton) for the deployment of current meters. Due to problems with the RV Ocean Crest this programme fell behind schedule and a clash of bookings arose. As the tracer survey had been completed and the box corer was being repaired it was agreed between the Senior Scientist and the Master of the RV Edward Forbes that the vessel should be made available to Mr R Price of UCW Swansea for CSP work in the Scarweather area on 7 June. This would enable the RV Ocean Crest to complete the deployments on that day and let Mr Price take advantage of the mid-day spring tides. CSP records were successfully obtained over the Scarweather Sands, Hugo Bank and Kenfig Patches.

EQUIPMENT PERFORMANCE

1. AERE Harwell - The tracer equipment worked satisfactorily except for the initial blowing of the 4 amp fuse in the back of the electronic box.
2. IOS Barry (MSES) - All the equipment worked well except that in spite of the efforts of the HiFix engineer at Barry, Receiver 934 continued to give trouble on this cruise (see cruise report 'A' of the series, re RV Edward Forbes cruise 6/76). There were also minor problems with one aerial lead and an aerial matching unit.
3. IOS Taunton - See Appendix II: Box coring report. All other equipment operated satisfactorily.

SHIP'S PERFORMANCE

There were no equipment difficulties which affected the scientific programme. The A frame was operating within its design specification which minimised the time during which the box-corer had to be restrained from swinging free. The batteries for the Harwell equipment had to be charged up for periods of 17 hours at a time and this occasionally caused the 3-phase power supply to cut out due to overheating.

CONCLUSIONS

On the whole the objectives of the cruise were successfully achieved.

Sufficient activity measurements were obtained in order to cover the area of spread of the tracer while the box cores retrieved will yield valuable information on the vertical structures in the sediments, when X-rayed.

ACKNOWLEDGEMENTS

We would like to thank the Ship's Officers and crew for their willing and cheerful co-operation throughout the cruise. We would also like to express our appreciation for Dr Skinner's help over a weekend in arranging for a supply of spare parts for the box corer and to Mr David Tennent of MAFF Lowestoft for ensuring their rapid delivery.

M W L Blackley

IOS Taunton

November 1976

APPENDIX I

NARRATIVE

Wednesday 1030 AERE Harwell and IOS Taunton equipment to Barry and loaded
2 June on ship. Decca HiFix equipment installed.

1115 Sailed Barry and proceeded to Swansea Bay. Set up R/A
tracer equipment using AERE batteries. Found to have
no aerial cable or signal splitter for 2nd HiFix receiver
although this should have been installed by the HiFix
service engineer.

1215 R/T call from Hydrographer, Port Talbot, to say Pattern 1
off air.

1330 Pattern 1 back.

1340 'Locked on' HiFix using Port Talbot dolphin and started
R/A tracer work.

2100 Ceased work and anchored for night.

Thursday 0800 Weighed anchor and proceeded to Port Talbot.
3 June 0900 HiFix calibrated.

0930 Began R/A tracer survey near Kenfig Patches

2035 Completed R/A tracer search, checked HiFix and proceeded
to anchorage.

Friday 0800 Weighed anchor, as HiFix still locked on proceeded to
4 June N of Patches.

0830 Began R/A search.

1905 Completed R/A search and proceeded to Swansea.

2010 Checked HiFix calibration at Swansea.

2045 Locked in

Saturday 0800 Proceeded to set up 2nd HiFix aerial.
5 June 1220 Locked out with Ali Soleman as observer and headed for
detailed box coring area.

1348 Commenced box coring.

1435 At third station box corer blade and arm severely damaged
by boulder. Contacted RVB.

Saturday	1520	L Skinner (RVB) contacted Edward Forbes to say MAFF would
5 June		send replacement blade and arm to arrive Monday pm /Tuesday am.
(continued)	1600	Ali Soleman put ashore at Swansea Jetty.
	1708	Commenced R/A tracer search to West of area.
	2015	Completed R/A search.
	2055	Anchored for night.
Sunday	0835	Weighed anchor but some delay because of fog.
6 June	0930	Calibrated HiFix (one receiver found to have slipped one lane on each pattern) and proceeded to N of Kenfig Patches.
	0953	Commenced R/A tracer search.
	1454	Completed R/A tracer search for this cruise.
	1545	Locked in.
	1700	Damaged box corer parts removed for repair. The Uniboom from UCS loaded for CSP work the following day.
Monday	0430	Locked out with R Price on board.
7 June	0700	Proceeded to Scarweather area for CSP work on Mainchain Decca.
	0810	CSP equipment deployed.
	0845	Fault developed in CSP cutout switch.
	0900	CSP equipment brought in board, proceeded to fix positions of current meter moorings deployed by RV Ocean Crest.
	1010	Fault in CSP equipment rectified and deployed again.
	1550	CSP runs over the banks completed and proceeded to Swansea.
	1700	Locked in.
	1800	Repaired box corer cutting arm returned but cutting blade found to be welded on the wrong way round - to be re-welded and returned at midnight.
	1825	R Price and equipment offloaded.
	2000	Replacement arm from MAFF required.
	2345	Cutting arm of IOS box corer returned.
Tuesday	0645	Locked out, calibrated HiFix, and position fixed the remaining
8 June		2 current meter moorings near the Mixon buoy.
	0850	Proceeded to Port Talbot to check HiFix.
	1000	Commenced box-coring in the kilometre square area.

Tuesday	1310	Pattern 2 HiFix off air. Moved nearer coast to box core on lines of section using Decca main chain.
8 June		
(continued)	1355	Pattern 2 HiFix back on air, entered Port Talbot for calibration and proceeded to Sker Point for inshore line of box cores.
	1435	Recommended box coring.
	2000	Finished box coring.
	2125	Anchored in Oxwich Bay. HiFix still locked in but marginal.
Wednesday	0700	Weighed anchor
9 June	0730	Proceeded to box core in Oxwich Bay area.
	0830	Damaged rubber seal on cutting plate. Repaired damage whilst heading for kilometre square grid area.
	1000	Commenced box coring.
	1134	Finished box coring and proceeded to Barry.
	1415	Arrived Barry.
	1500	Entered outer basin.
	1700	Alongside RVB.

APPENDIX II

Box Coring Report (IOS Project S113)

Swansea Bay: 5 - 9 June 1976

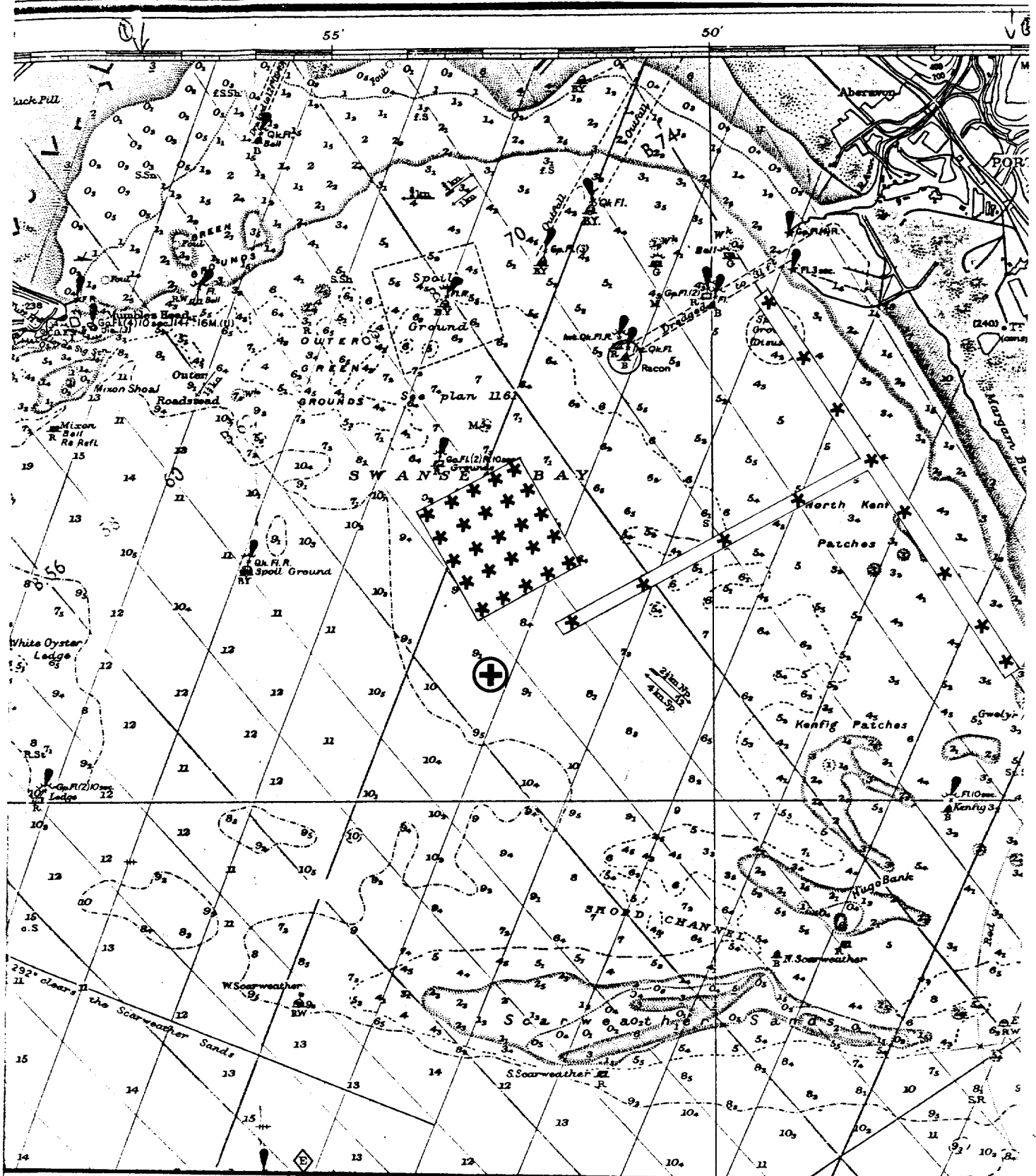
Although severe damage to the blade occurred on the first day (Saturday) of the box-coring programme which resulted in limiting the coring to Tuesday 8th and Wednesday 9th (am), the programme was virtually still completed.

The corer was operating well in the soft sediments but on the third station a large boulder tore the welds off the sides of the blade rendering it inoperative. As no stainless steel welding equipment is carried on Edward Forbes, the blade assembly was re-welded in Swansea on Monday 7th. Coring was resumed on Tuesday 8th.

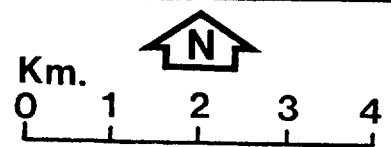
The modifications carried out in the light of operational experience during the April cruise proved very beneficial. The safety bar through the stem speeded up the deck handling considerably but the greatest improvement was from the steel strip holding the leading edge of the rubber seal down. Normally in the course of taking 40 cores this rubber pad would have been replaced four or five times. Other than the broken blade replacement the pad was replaced only once and that as a result of damage by a large pebble. At the end of the cruise the replacement pad was still in a serviceable condition.

One other modification needs to be added to those recommended in the previous report. This is the provision of either bolt-on replaceable blades or two or three spare complete blade assemblies. This would ensure the continuation of any coring programme should damage occur as on the cruise described here.

Most of the modifications listed in Appendix II of Cruise Report A had been carried out or were due to be completed before the corer was used again on the East Coast in September 1976.



- * Box core site
- ⊕ R/A tracer injection site



Depths in Fathoms. Based on H.O. Chart 1165

Showing position of box core sites
Fig. 1

CRUISE REPORTS

CRUISE No. and/or DATE REPORT No.

R.R.S. "DISCOVERY"		
1	(International)	Published and distributed by the Royal Society
2	(Indian Ocean)	
3	(Expedition)	
		NIO CR ¹
4	February – March 1965	4
37	November – December 1970	37
38	January – April 1971	41
39	April – June 1971	40
40	June – July 1971	48
41	August – September 1971	45
42	September 1971	49
43	October – November 1971	47
44	December 1971	46
45	February – April 1972	50
46	April – May 1972	55
47	June – July 1972	52
48	July – August 1972	53
49	August – October 1972	57
50	October 1972	56
51	November – December 1972	54
52	February – March 1973	59
53	April – June 1973	58
		IOS CR ²
54	June – August 1973	2
55	September – October 1973	5
56	October – November 1973	4
57	November – December 1973	6
58	December 1973	4
59	February 1974	14
60	February – March 1974	8
61	March – May 1974	10
62	May – June 1974	11
63	June – July 1974	12
64	July – August 1974	13
65	August 1974	17
66	August – September 1974	20
68	November – December 1974	16
73	July – August 1975	34
74	Leg 2 } Sept. Oct. 1975	33
74	Leg 1 & 3 }	35
75	October - November 1975	43

¹ NIO CR

National Institute of Oceanography, Cruise Report.

² IOS CR

Institute of Oceanographic Sciences, Cruise Report.

CRUISE REPORTS

CRUISE No. and/or DATE REPORT No.

R.R.S. "CHALLENGER"

August – September 1974 IOS CR 22

R.V. "EDWARD FORBES"

October 1974 IOS CR 15*
January – February 1975 IOS CR 19
April 1975 IOS CR 23
May 1975 IOS CR 32
May – June 1975 IOS CR 28
July 1975 IOS CR 31
July – August 1975 IOS CR 36
August – September 1975 IOS CR 41

R.R.S. "JOHN MURRAY"

April – May 1972 NIO CR 51
September 1973 IOS CR 7
March – April 1974 IOS CR 9
October – November & December 1974 IOS CR 21
April – May 1975 IOS CR 25
April 1975 IOS CR 39
October – November 1975 IOS CR 40
August – October 1975 IOS CR 42

N.C. "MARCEL BAYARD"

February – April 1971 NIO CR 44

M.V. "RESEARCHER"

August – September 1972 NIO CR 60

R.V. "SARSIA"

May – June 1975 IOS CR 30
August – September 1975 IOS CR 38

R.R.S. "SHACKLETON"

August – September 1973 IOS CR 3
January – February 1975 IOS CR 18
March – May 1975 IOS CR 24
February – March 1975 IOS CR 29
July – August 1975 IOS CR 37
June – July 1976 IOS CR 45

M.V. "SURVEYOR"

February – April 1971 NIO CR 38
June 1971 NIO CR 39*
August 1971 NIO CR 42*

D.E. "VICKERS VOYAGER" and "PISCES III"

June – July 1973 IOS CR 1