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RV EDWARD FORBES CRUISE 11/75

1 JULY–7 JULY

FURTHER INVESTIGATIONS OF SEDIMENT TRANSPORT IN SWANSEA BAY USING RADIOACTIVE TRACER

CRUISE REPORT NO 31

1975

INSTITUTE OF OCEANOGRAPHIC SCIENCES

NATURAL ENVIRONMENT RESEARCH COUNCIL

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Institute of Oceanographic Sciences
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SCIENTIFIC PERSONNEL

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SHIP'S OFFICERS

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D Pilgrim (First Officer)
K Moore (Second Officer)
J Richardson (Chief Engineer)

OBJECTIVES

This cruise was the second of a series of three being undertaken during 1975, in which Radioactive (R/A) tracer has been used to simulate sediment transport in Swansea Bay. The long term aim of these investigations is to examine the sediment budget of the area and to identify those natural agencies involved in the supply and removal of beach material to and from the foreshore between Port Talbot and Sker Point (Fig 1). It is also intended to attempt a possible quantification of some of these processes.

The objectives of this cruise were:

(a) to carry out further delineation of the extent of travel of the tracer (total count measurements);

(b) to examine the relative energy levels in the Scandium radiation spectrum with a view to applying a correction for burial of the tracer (see later);

(c) to service two wave recorders previously deployed during RV Edward Forbes Cruise No 8/75 at positions 'B' and 'C' (Fig 1).

METHODS

The tracer consisted of approximately 700gm of Scandium glass spherules, of diameter approximately 170 μ , irradiated to produce Scandium - 46 having an activity of 20 curies. The half life of this isotope is 84 days. The material was injected at a site on the Kenfig Patches (Fig 1) on 20 May 1975 (see Cruise Report No 28) and monitored more or less continuously up to 30 May. The maximum dispersal recorded on that occasion was in excess of 11km long and in a strip between 0.1 and 3.5 km wide.

Radiation levels were monitored using a scintillation counter. This consisted of a Sodium iodide (Na I) crystal, doped with Thallium (Tl), mounted in front of a photomultiplier tube. The Scandium - 46 gamma radiation was converted to light pulses, by the crystal, which were then converted to electrical pulses by the photomultiplier tube. EHT generation and pulse shaping was carried out in the detector and all power supplies and sampling electronics were situated on the ship.

During this work two types of measurement have been made:-

(a) 'total count' - this measured all detectable energy levels from irradiated material 'on' or 'in' the sea bed. These were made at all locations

(b) 'peak to total' - these were carried out in order to estimate the depth of burial of radioactive tracer. Observations were made with the same detector but with a dual ratemeter unit and discriminator. This enabled a comparison to be made between the total pulse count and the number of pulses occurring above a fixed energy level set by the discriminator. This type of measurement was only completed at stations having a high total count rate.

Both types of measurement could therefore be used to estimate the quantities of radioactive tracer remaining within a prescribed area. All position fixing for R/A tracer measurements was accomplished with Decca HiFix, using the Swansea Bay chain (1900.6 kHz).

SCHEDULE

30.6.75	1500	AERE Harwell and IOS Taunton equipment loaded at Barry. Decca HiFix equipment installed.
1.7.75	0910	Sailed Barry and proceeded to Swansea Bay area. Replacement wave recorder prepared for deployment at Station 'C' (Kenfig). R/A tracer equipment set up (cable replaced with spare due to damage found after sailing). Carried out Cobalt - 60 calibration.
	1315	Arrived area of Station 'C' - Wave recorder surface float not sighted and assumed lost/damaged or submerged by weight of attached chain. Decision taken to carry out search at low water.
	1422	Arrived area of Station 'B' - Wave recorder surface float not sighted and similarly assumed lost/damaged or submerged. Decision taken to carry out search at low water. Proceeded to Port Talbot to 'lock on' HiFix.
	1509	'Locked on' HiFix against S.W.Dolphin, Port Talbot.
	1510	Departed Port Talbot and proceeded to R/A tracer area.
	1553	Started tracer work.
	1636	Sighted surface float on Wave recorder at station 'C'. Broke off from tracer work to recover mooring.
	1646	Alongside buoy but failed to recover. Buoy passed beneath stern of ship and did not reappear on surface. Assumed that this had been punctured and/or fouled on the ship's propeller.
	1725	Tracer work resumed.
	2335	Tracer work completed. Proceeded to overnight anchorage.

2.7.75	0800	Weighed anchor and proceeded to survey area.
	0900	Full speed could not be obtained. Decision taken to return to Swansea for propeller to be inspected by diver.
	1110	Alongside section 25, Swansea Docks diver cleared 2-3 metres of chain and remains of surface float from ship's propeller.
	1225	Departed Swansea
	1307	Started R/A tracer work
	2307	Completed R/A tracer work and proceeded to overnight anchor station.
3.7.75	0655	Weighed anchor and proceeded to area of Wave recorder 'B'.
	0745	In area of Wave recorder 'B', surface float not sighted (low water).
	0750	Abandoned search; proceeded to R/A tracer area.
	0823	Commenced R/A tracer work.
	1134	Completed R/A tracer work and proceeded to Barry. Fault developed on AERE Harwell equipment on last measurement. Changed to spare detector and cable.
	1430	Arrived Barry. APC left vessel.
4.7.75	1226	Departed Barry, MWLB having joined from Taunton.
	1700	Entered Swansea outer harbour to pick up RP (Harwell) and equipment. 'Locked on' HiFix alongside section 31.
	1842	Started R/A tracer work. Equipment operating satisfactorily.
	1914	Faults appeared on AERE Harwell equipment. Attempts made to repair instruments.
	2205	Abandoned any further tracer work and proceeded to overnight anchorage. Two detectors dismantled, faulty connector on one replaced, one set of equipment made operational and tested.
5.7.75	0715	Weighed anchor and proceeded to survey area.
	0805	Started R/A tracer work. Equipment operated satisfactorily.
	2300	Completed R/A tracer work. Proceeded to overnight anchorage.
6.7.75	0730	Weighed anchor and proceeded to survey area.
	0809	Started R/A tracer work.
	1530	Broke off from tracer work and returned to Swansea to put RP and equipment ashore.
	1625	Alongside section 31 Swansea Harbour HiFix 'locked on'.
	1730	Departed Swansea
	1810	Started R/A tracer work
	2128	Completed tracer work and proceeded to overnight anchorage.

7.7.75	0715	Weighed anchor and proceeded to tracer survey area.
	0750	Commenced tracer work.
	1145	Completed R/A tracer work and proceeded to Barry.
	1530	Alongside Barry. Equipment unloaded.

COMMENTS

The principal objectives of this cruise were successfully achieved, excellent weather conditions enabling full utilisation of the available time.

The bulk of the R/A tracer remaining at detectable levels was found in an elongated patch approximately 6.5 km long by 0.5 km wide, orientated in a NW - SE direction corresponding to that of the predominantly rectilinear tidal flow. Whereas the eastern extremity was found to be well-defined, with little apparent dispersion of the material, the western end extended roughly 5 km, beyond the main concentration. These limits were similar to those of the May cruise. However dispersion towards the N from the injection site had increased by about 2.5 km. In these 'dispersed' areas total counts were obtained which were less than a factor of 2 times the background levels. Therefore interpretation of the tracer survey results, in terms of the 'spread' of radioactive material in this area, should be carried out cautiously. In general the perimeter of the survey area corresponded to total count measurements of the same order as the background levels. A total of 606 observations of the 'total count rate' were made and 26 of the 'peak to total ratio'. This latter measurement was made to enable a correction to be applied when calculating the quantities of radioactive material in the area; this is necessary due to burial of the tracer and the attenuation of the Scandium - 46 radiation by overlying and inactive material. These measurements were made only when the total count rate was of the order of 10^2 counts per second or above, due to the long integration time involved for low count rates, at times requiring the ship to remain stationary with respect to the ground for periods of 1 - 2 minutes.

A number of faults developed on the AERE Harwell equipment towards the end of the cruise. These were on the whole confined to the detector and underwater electronics unit and consisted of:-

(a) poor electrical connections between the detector end-cap and electronics;
(b) dry joints (open circuit) on a number of electrical components in the detector electronics;
(c) damaged photomultiplier tube;
(d) broken cable between portable winch and detector.

It was necessary to completely dismantle all three detectors to locate these faults and this would not have been possible without special tools provided by R.P. (Harwell). One complete system (detector and electronics) was made operational and functioned satisfactorily throughout the remainder of the cruise.

The failure to recover the IOS(T) Wave recorders calls into question the suitability of their moorings for recovery by vessels of deep draught operating in shallow waters with a large tidal range. The mooring is shown schematically in Fig 2. It should be noted here that the purpose of the design was to enable recovery from small vessels (it being envisaged that servicing of the Wave recorders would eventually be carried out from the British Transport Docks Board launch 'Soniarus'). It is considered that two features would enable easier recovery from large vessels, should this be necessary, and at the same time facilitate ease of handling from small boats. These are:-

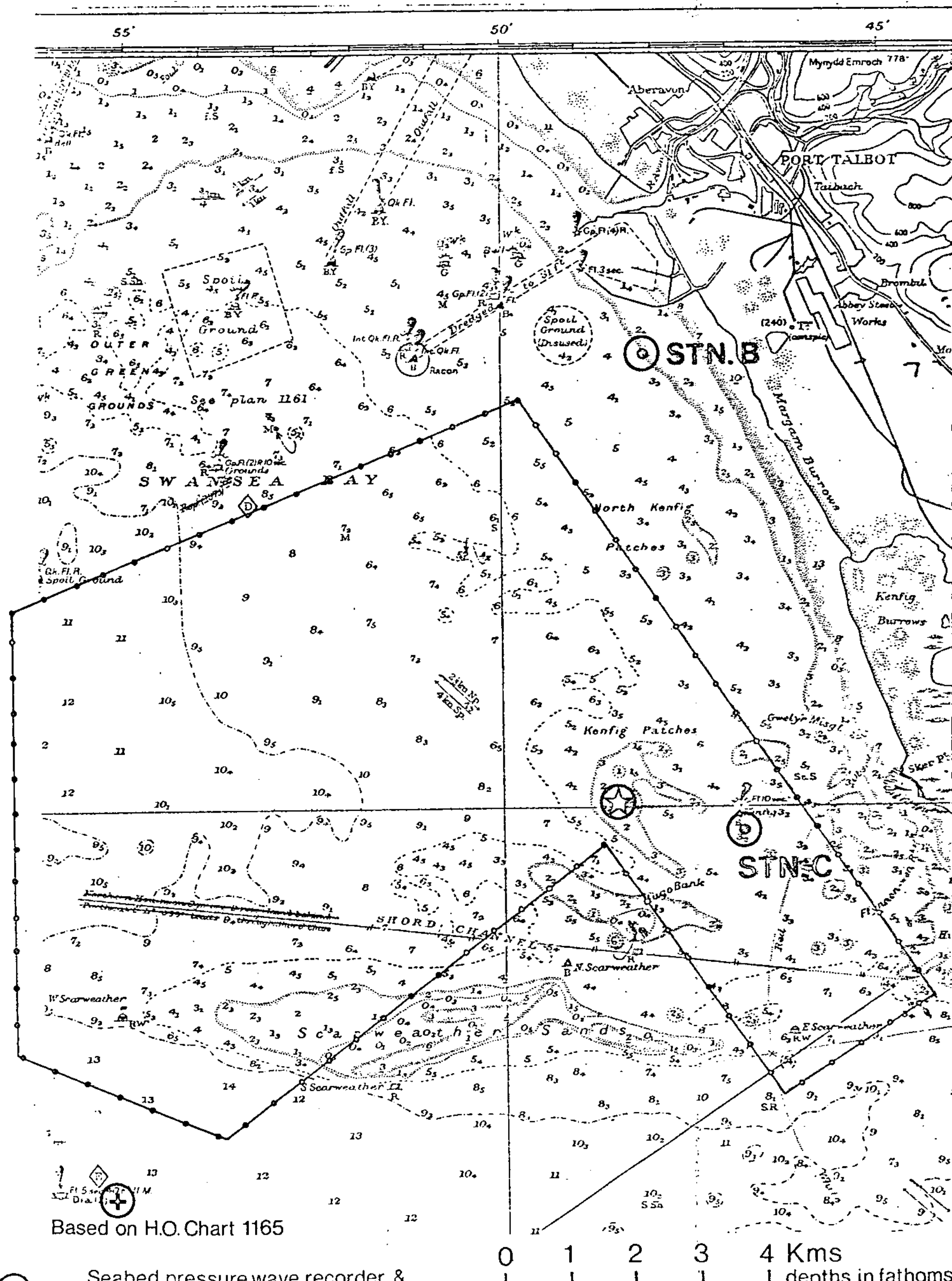
(a) the attachment of a stray line to the surface float;

(b) the use of a larger and more robust surface float, better able to support the weight of the mooring, which should be clearly marked with the name of the Institute and a notice stating that the buoy is being used for scientific purposes.

Further improvements would include the use of a ground line with sinker weight (no heavier than the Wave recorder) from which a line could be taken to a surface float, thereby removing the need for a subsurface float to keep the chain clear of the recorder. In the shallow water at Stations 'B' and 'C' it is quite possible that the subsurface float may have been in danger of becoming fouled on the ship's propeller, as the latter manoeuvred alongside the surface float. This would be more likely to occur at or near times of low water slack.

Position fixing of the ship was accomplished throughout the survey with Decca HiFix equipment. Apart from minor difficulties this operated satisfactorily. However it would not have been possible to manoeuvre the ship within a predetermined grid of stations, often in strong tidal currents and confined waters, without the considerable expertise displayed by the ship's officers. In this respect I would like to thank the Master, D Pye and the First and Second Officers D Pilgrim and K Moore.

A D Heathershaw



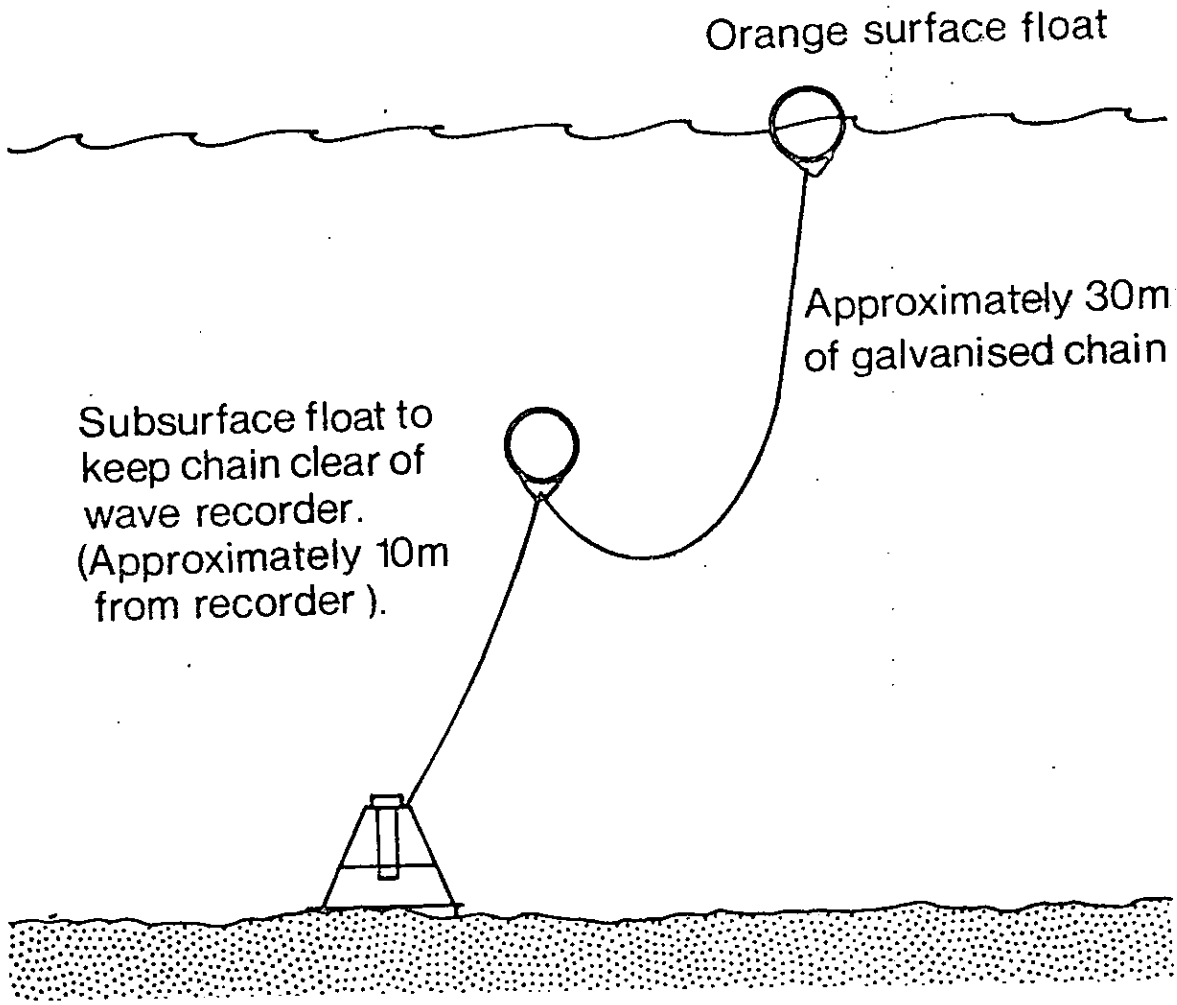
Based on H.O. Chart 1165

Seabed pressure wave recorder & .... Plessey MO21 current meter site

.... Tracer injection site

.... Existing waveride

Approximate area covered by radioactive tracer survey 1st - 7th July 1975



SEA-BED PRESSURE WAVE RECORDER DEPLOYED AT STATIONS 'B' & 'C', SWANSEA BAY.

FIG. 2