

**I.O.S.**

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(BIBLON)

RV EDWARD FORBES CRUISE 8/75

16 MAY-3 JUNE 1975

SEDIMENT TRANSPORT, SWANSEA BAY, USING  
RADIOACTIVELY LABELLED TRACER METHODS

CRUISE REPORT NO 28

1975

NATURAL ENVIRONMENT  
INSTITUTE OF OCEANOGRAPHIC SCIENCES  
RESEARCH COUNCIL

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Institute of Oceanographic Sciences  
Taunton  
Somerset

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Figure 1 Chart showing position of wave recorders, recording current meters and tracer injection site; also limits within which tracer and grab sampling were carried out.

Figure 2 Track for CSP survey

LIST OF SCIENTIFIC PERSONNEL

IOS (Taunton)      A P Carr.                    ) Senior Scientists  
                         M W L Blackley                )  
                         A D Heathershaw  
                         P Hooper  
                         K Reeves  
                         F Wardle  
                         D E C Whiteway  
                         R Gleason and J Humphery were on board during some part  
                         of the cruise as day visitors

IOS (Barry)            T Fitton  
                         G W J Miller and P Taylor were on board for the first  
                         day as day visitors

AERE Harwell         T Parsons  
                         R Paske

LIST OF SHIP'S OFFICERS

D Pye, Master  
S Jones, First Officer  
K Moore, Second Officer  
J Richardson, Chief Engineer

- 18 May Locked out. Commenced background radioactivity survey. Anchored near SWIG buoy.
- 19 May Continued background survey. Locked in Swansea. Loaded radioactive tracer container.
- 20 May Locked out mid-day after preparation for injection. Monitored dumpsite on Kenfig Patches after injection. Locked in 1800.
- 21 May Unloaded tracer container and implements directly onto AERE lorry. Locked out 1300 hours approximately. Carried out first tracer search until 0245 22 May.
- 22 May Commenced second tracer search, together with some additional background survey.
- 23 May Completed second tracer search, together with some additional background survey. Locked in Swansea 1845.
- 24 May In port. During afternoon and evening Hunttec CSP Mk 2 and side-scan was prepared for use. Break discovered in sidescan cable so not used on this cruise.
- 25 May Locked out Swansea 0800 - commenced CSP work using a Decca Lane grid. Hunttec CSP Mk 2 gave trouble in late afternoon with feint and torn records. Rest of day spent checking apparatus.
- 26 May Continued CSP work, conditions deteriorated towards end of day.
- 27 May RV Edward Forbes to Swansea outer dock to calibrate HiFix. Commenced third radioactive tracer study.
- 28 May Completed third tracer survey. Locked in Swansea.
- 29 May In port. (From Thursday 29 May until the end of the cruise the originally adopted programme had to be modified because of the threatened single tide working at Swansea. In the event these alterations were unnecessary because the lock maintenance schedule was delayed until after 3 June but it proved impracticable to reinstate the original programme).
- 30 May Locked out Swansea 0730 - replaced Scarweather Waverider and moorings without incident. Commenced R/A tracer work to find western extent of movement using Decca Lanes. 1200 hours - fault developed in R/A tracer apparatus - instrument failed to give low background reading in water. Detector, winch and recording unit replaced but trouble persisted.
- 31 May R/A equipment tested and seemed to be working properly but was upset after ship's winches had been used. The Port Talbot and Kenfig wave recorders were then both lifted and replaced after magnetic tapes and batteries had been renewed. CSP then deployed to finish off cover of area and to replace some of the original bad records.

- 1 June Winds 2-5 westerly so it was decided to retrieve both current meter rigs. Both lifts went smoothly. The dan buoy on the Kenfig current meter frame had been run into at some time during the fortnight. The fault in the R/A equipment then righted itself. Possibly either faulty connections somewhere in power lead on back of R/A recorder or interference by ship's power supply.
- 2 June Weighed anchor at 0630 - forecast was for winds force 7 westerly veering NW, commenced R/A tracer in vicinity west of Scarweather Bank. Conditions too rough to work safely so turned for more sheltered water. Gale force 8 forecast imminent so decided to head back to Barry. Arrived Barry at 1415 and unloaded equipment. Because of the onset of gales the last day of the cruise (3 June) was abandoned.

## REPORTS OF PROJECTS

### (a) Tracer studies

As noted earlier the radioactive tracer work represented the main purpose of the May-June 1975 Edward Forbes cruise. Some 20 curies of radioactive Scandium-46 with a mean particle size of 170  $\mu$  and a specific gravity closely approximating to the indigenous sand fraction, were utilised in the study. The 685 gms of tracer were contained in 38 ampoules. A background radioactivity survey was undertaken on 18 and on the morning of 19 May.

Tracer was injected satisfactorily on Kenfig Patches on 20 May (for location see Fig 1) and the injection site monitored. Following the unloading of the tracer container on the morning of 21 May, a detailed search was undertaken at half-lane HiFix intervals. By 0245 on 22 May (when this search was completed) dispersal had extended over a distance of 6.7 km with an average width of 100 m. On 22 and 23 May the background survey was extended (but not sufficiently because of the rapidity of transport towards the W). By 23 May radioactive tracer had extended over 11 km E-W although the path width was still only 100-200 m. Sampling was at one lane HiFix intervals. A similar pattern was observed on 27-28 May although towards the end of the cruise, (when using Decca main-chain) a broadening out of labelled sediment was evident. Because of the rapidity of transport (even without wave activity) the tracer dominated the other aspects of the cruise.

The tracer study proceeded with very few problems (but see below) and the way in which transport appeared independent of the sedimentary structures was an interesting and important feature.

## OBJECTIVES

Cruise 8/75 was one of three planned for 1975 with RV Edward Forbes in the Swansea Bay area. While its purpose was 7-fold it is with (a) below that the main emphasis was concentrated, as planned.

- (a) To inject simulated sediment (with a mean particle size of  $170 \mu$ ), labelled with approximately 20 curies of radioactive Scandium-46 on Kenfig Patches, Swansea Bay, and to follow the dispersal of this tracer.
- (b) To deploy two self-contained pressure wave recorders.
- (c) To deploy and recover two Plessey recording current meters.
- (d) To obtain additional sidescan and CSP records.
- (e) To undertake a limited grab sampling programme to calibrate existing sidescan records and the further CSP and sidescan obtained during the cruise.
- (f) To replace the mooring for the Waverider buoy situated near Scarweather Sands.
- (e) To obtain DRCM data, especially in relation to the periodic submersion of the Waverider buoy.

## NARRATIVE

- 15 May The necessary equipment and personnel were transported from Taunton to Barry. With the assistance of MSES, Barry, the instruments, mooring sinkers etc. were put on board RV Edward Forbes and made ready.
- 16 May RV Edward Forbes locked out at Barry at 0900 and sailed for Swansea Bay. During the day the two Plessey MO 21 recording current meters were deployed, together with two self-contained wave recorders at adjacent sites. Ten grab samples were obtained. The ship was anchored overnight off SWIG buoy and the inflatable used to take the IOS (Barry) staff to Swansea Docks and collect a HiFix plan from the Harbourmaster's Office.
- 17 May With the exception of three sites all the other grab samples were obtained by 1530. There followed an attempt to take DRCM readings near the Waverider buoy situated approximately 1 km east of Scarweather light vessel. While the DRCM performed adequately the ship was unable to anchor satisfactorily because the last two shackles of chain were of the wrong link length. Locked in at Swansea. R Paske (Harwell) joined ship.

Future searches will, hopefully, show the broader pattern of sediment circulation within the Bay, the effect of wave transport, and give an indication of the proportion of tracer which remains on or near the bank on which it was injected.

(b) Deployment of self-contained pressure wave recorders.

The opportunity was taken to lay two wave recorders (Fig 1). These use cassettes and electronics housed in NBA cases. The latter are held in semi-circular clamps, the whole assembly being placed in a rectangular based pyramid of galvanised angle-iron framing. The recorders were deployed on 16 May and serviced on 31 May. Subsequent servicing will be undertaken during the next two Forbes cruises and thereafter by other vessels. Comparisons will be made with Waverider data offshore.

During most of the cruise period there were virtually no westerly or southerly winds, so, while the equipment operated satisfactorily, wave heights were generally negligible at the coastal locations selected.

(c) Deployment and recovery of Plessey recording current meters.

The two rigs were deployed on 16 May and collected on 1 June. No serious problems arose although one dan buoy had clearly been run down and damaged during the 16 days on station. There was a suggestion on recovery that the rig nearest Port Talbot had been lying on its side although this has not been proved by the data obtained. The IOS (Taunton) rigs are really too high in relation to their length and width. New ones of more satisfactory proportions are planned, with IOS (Barry), for later work.

(d) Geophysical survey

Satisfactory CSP records were obtained over an area extending from the dredged channel, Port Talbot in the North to Scarweather Sands in the South. Several problems were encountered with the Huntec Mk 2. To start with the endless loop electrode failed to rotate. This resulted in uneven wear and encouraged chart tearing. There were also triggering problems with firing occurring only every five sweeps instead of every three sweeps, with the result that all gains had to be turned up fully and the paper rate slowed down for over-printing. This also contributed to the chart tearing.

(e) Grab sampling programme

Nearly all the 40 samples needed to confirm the interpretation of earlier sidescan records were obtained at the beginning of the cruise. In general, they corroborated the interpretation in the northern half of the



research area (to approximately N Kenfig Patches) but indicated a much greater proportion of sand than anticipated in the channels around Kenfig Patches, Hugo Bank and Scarweather Bank, in spite of the fact that on some samples pebbles lodged in the jaws of the van Veen grab and permitted sand and silt to escape.

(f) Replacement of mooring and Waverider buoy, Scarweather.

This operation, now beginning to become almost routine to J Humphery, was carried out without difficulty near slack water on Friday 30 May.

(g) Collection of DRCM data.

An attempt was made, on the afternoon of 17 May, to gether DRCM data using a Plessey MO 27/2 meter and readout. Apart from the high threshold velocity characteristic of the equipment the instrument appeared to perform satisfactorily. However, the principal intention of the DRCM programme was to gain information under varying tidal conditions near the Waverider site and to see under what tidal velocities the buoy went beneath the water surface (ie through the waves) and whether it would be possible to adjust the wave records obtained for the attenuation in wave height. Because of an inadequate length of anchor chain with links compatible with the ship's gipsy it was not possible to use the intended site. Furthermore the rapid tracer dispersal meant that virtually all time and resources, including part of the time allocated to geophysics, had to be diverted to that aspect instead. (Relevant data will now be obtained during a major deployment programme of recording current meters scheduled for autumn 1975 and summer 1976).

#### STATION LIST

The location of sea bed pressure wave recorders, the Waverider, and recording current meters are shown in Figure 1 which is taken from part of Hydrographic Office chart 1165. Also indicated is the tracer injection site: the overall area sampled during the background investigation and actual tracer search, and the geographical limits of the grab sampling programme.

Figure 2 shows the track chart for the CSP.

#### EQUIPMENT PERFORMANCE

(i) AERE.

There were really no problems with Harwell's instrumentation, except near the end when, for reasons which remain obscure, the counter readout

appears to have been affected by the ship's power supply/hydraulics for a time.

(ii) IOS(Barry)

Apart from the triggering mechanism of the CSP and some temperament with the HiFix there were no real difficulties. One HiFix receiver tended to lose lock when the ship's winch was in use and there was another occasion when the two receivers locked onto different values. (Comments were attached to the low sensitivity receiver in order that it was serviced prior to further use).

(iii) IOS (Taunton)

Sidescan cable was faulty as supplied, being defective at armoured/flexible join.

#### SHIP PERFORMANCE

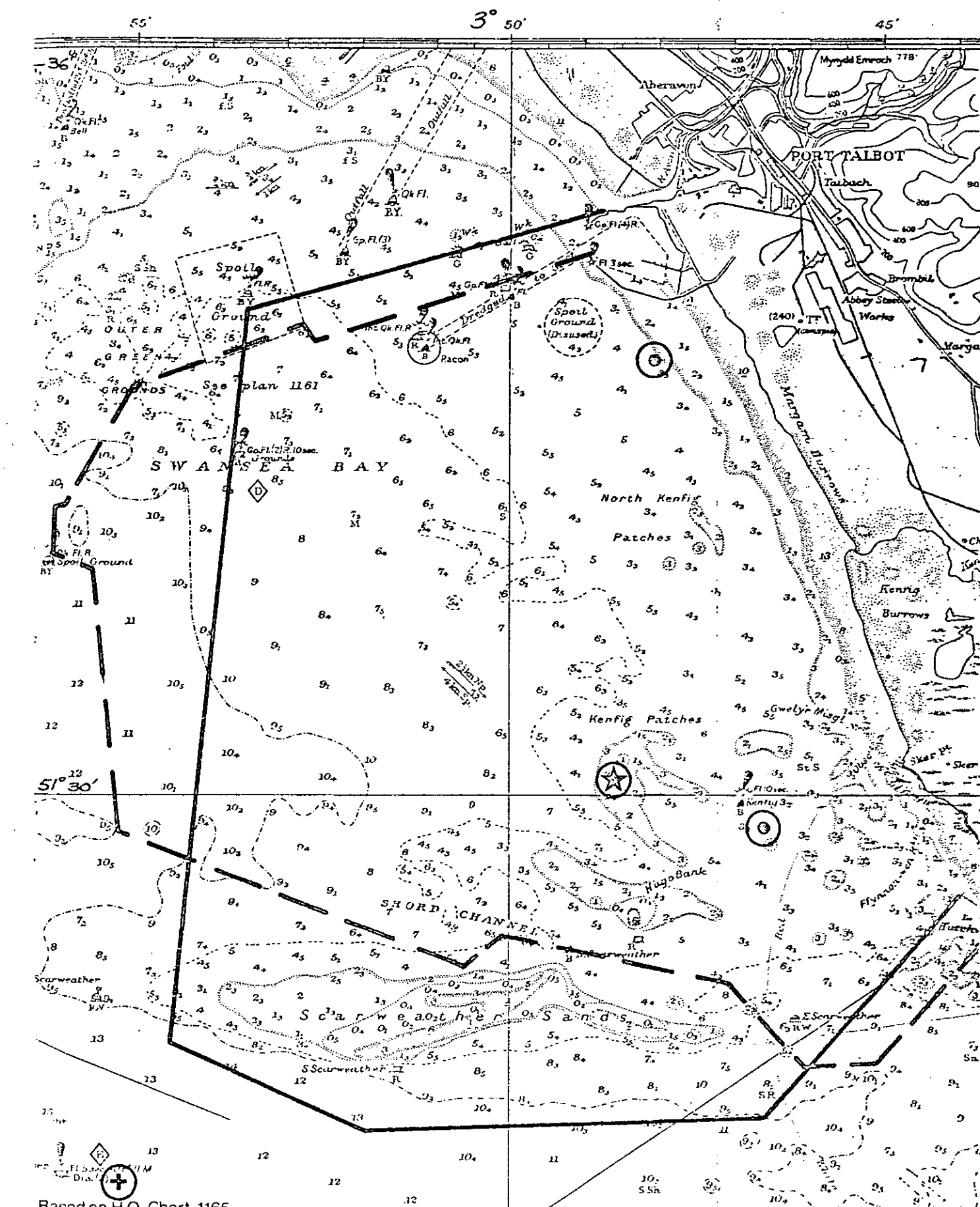
Thanks to John Richardson troubles were dealt with without any dislocation of the cruise programme. However, there are 4 points which should be mentioned:

- (i) Ship's 3-phase supply. After interchanging the pump, this improved. However, when waves occurred, because of the low fuel supply (and the consequent small displacement) the water intake was often above the sea water level. This resulted in over-heating and the operation of the thermal cut out. The fuel tanks should be full at the beginning of a cruise even when the existing reserve is sufficient for the distance likely to be covered.
- (ii) The inability to use the last 2 shackles of anchor chain because of the wrong link length.
- (iii) The unsatisfactory state of the ship's echo-sounder. It is unreasonable to expect the ship's officers to operate in an area of drying banks with only the back up MS36 in the lab working effectively. (This is not a reflection on RVB - rather on the Decca service engineers at Barry and Swansea who could not provide the necessary spares).
- (iv) The Evinrude outboard on the RV Edward Forbes is not really adequate for the job it is asked to do.

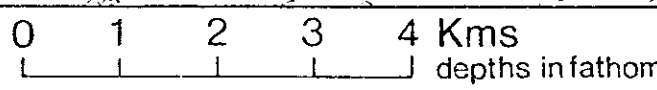
Despite a number of minor difficulties from various directions, a very successful and rewarding cruise, in large measure brought about by the enthusiasm and helpfulness of all the ship's officers. While it would be invidious to single out anyone in particular, especial thanks are due to David Pye, the ship's master.

A P CARR

} Senior Scientists



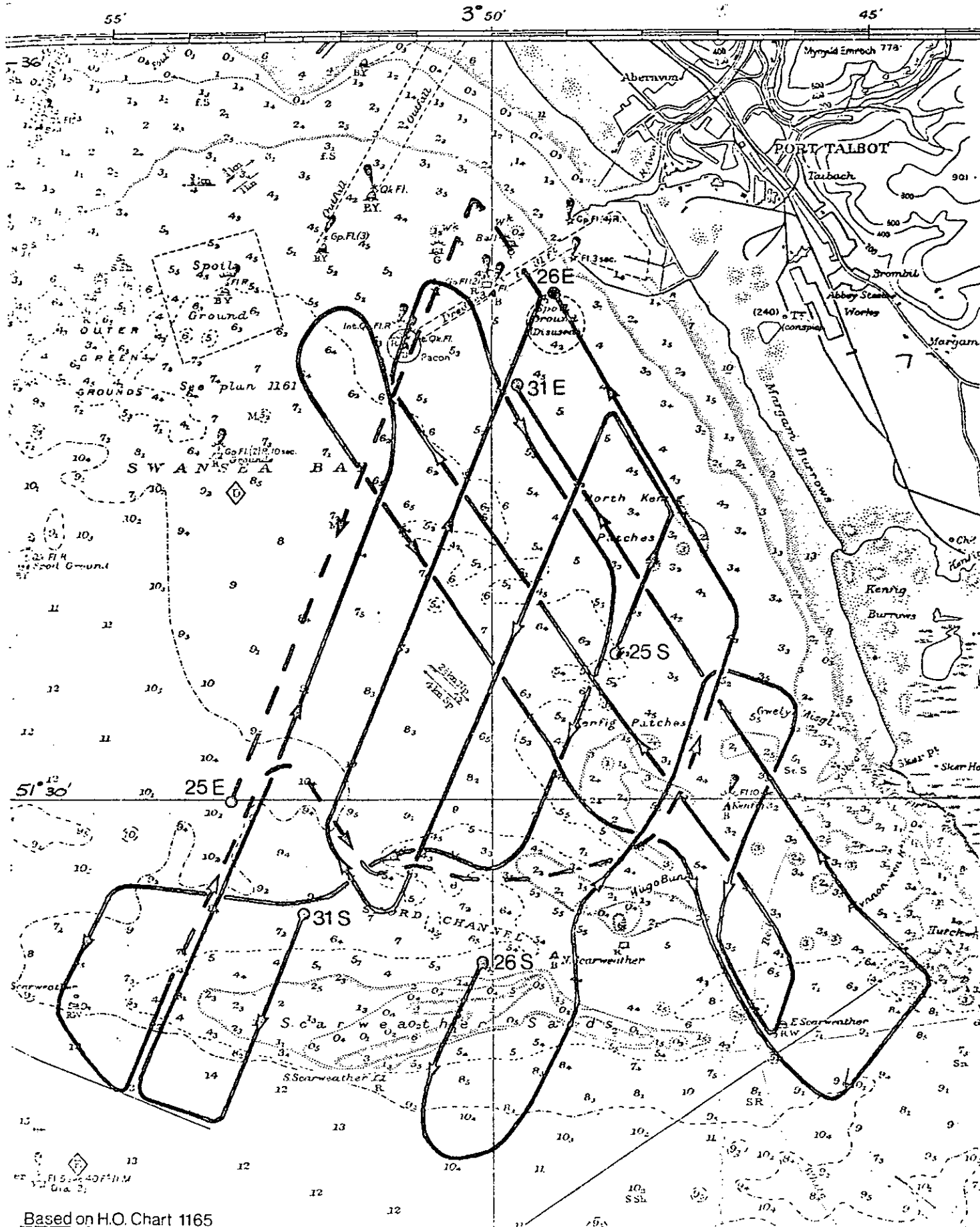
Based on H.O. Chart 1165



- Seabed pressure wave recorder & Plessey MO21 current meter site
- ★ Tracer injection site
- ⊕ Existing waverider

- Approx. limit of composite background survey
- Approx. limit of grab sampling

FIG 1



CONTINUOUS SEISMIC PROFILING

————— Recording trace satisfactory  
 - - - - - " " poor

0 1 2 3 4 Kms

depths in fathoms

C.S.P. runs made on 25, 26 & 31 May 1975. S.... Start, E.... End

FIG 2