

TSMV Cape Shore - West Shetland Survey

LEG 1

18th April - 5th May

78/CS/06

by

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TSMV Cape Shore - West Shetland Survey: 78/CS/06, Leg 1

Duration: Tuesday 18th April-Friday 5th May

1. Introduction and Location of Area

The area selected for work by Cape Shore during Leg 1 was to the west of the Shetlands defined between latitudes  $60^{\circ}\text{N}$  and  $61^{\circ}\text{N}$  and longitudes  $1^{\circ}\text{W}$  and  $2^{\circ}\text{W}$ . This area extends between the island of Foula and the mainland and includes two 1:100,000 Sheets, namely  $60^{\circ}\text{N } 02^{\circ}\text{W}$  and  $60^{\circ}30'\text{N } 02^{\circ}\text{W}$ . Water depths in this region average 100m and in the north-west of the area may reach 200 metres.

Work in the above survey area during Leg 1 took place from Saturday 29th April to Thursday 4th May - a total of five days. The earlier part of the leg was spent in mobilisation at Great Yarmouth, ship modifications in Leith and equipment trials in the Firth of Forth (see appendix II).

2. Objectives

Previous geophysical work in the area has been carried out during MGU Survey 76/4. The purpose of this survey was firstly to systematically sample the area to map out the surface sediment distribution and investigate the Quaternary, using vibrocorer, gravity sediment corer and shipek grab, at selected sites, and secondly, to complete the solid geological interpretation using the 1m rock drill and gravity rock corer at selected sites. Geochemical analysis involving EH/ph measurements were also made on the surface sediments and by Quaternary cores.

In the time available it was anticipated that the above work could not be completed during Leg 1 and the completion of the survey of this area was to be undertaken during Leg 5., ,

### 3. Personnel

J A Chesher	(Chief Scientist)
N Fannin	(Night Geologist)
H Allen	(Night Navigation and Laboratory Assistant)
W Lonie	(Technical)
J McGuigan	(Day Laboratory)
R Sutherland	(Night Laboratory)
H Robertson	(Video Systems, TV and Night Navigation)
C Graham	(Day Navigation)
M Thatcher	(Day Laboratory assistant)
A Davies	(Geochemistry)

The above personnel were on board for the Shetland part of Leg 1 together with J Drabble as an agent for Sub Sea Surveys Ltd.

### 4. Equipment

The following equipment was used aboard the TSMV Cape Shore, a 184ft +100A1 Ice Class modified Rig Supply Vessel.

- IGS 1m rock drill
- IGS Electric vibrocorer
- Gravity corer
- Shipek Grab
- MS 47 Kelvin Hughes transit sonar
- Kelvin Hughes M 26 Echo Sounder
- Decca MK 12 and MK 21 main chain navigator and track plotter
- Sub Sea television systems and national panasonic videotape recorder
- Radar

## 5. Cruise Results

The table below summarises the number of stations occupied and equipment used during Leg 1.

	No. of stations	Shipek Grab	Sediment Corer	Vibro- Corer	Rock Corer	Midi Drill
Firth of Forth Trials	3	3	1	3	-	-
West Shetland Area	61	61	44	7	11	6
	—	—	—	—	—	—
Total	64	64	45	10	11	6

Daily time analysis plots for the above equipment were kept correct to the nearest 0.1 hour, and are available on file.

During the period of the survey in the West of Shetland, weather was good and the 1m drill and vibrocorer were able to be deployed with ease. The limited time available for the first leg in this area was a direct result of the time spent on ship modifications in Leith that became evident as essential for successful regional survey. trials in the Forth.

## 6. Geological results

Previous geological summaries of the area are given in MGU Report 76/4. The results of the present survey are summarised on the following maps:

- 1) Cruise sheet  $60^{\circ}\text{N } 02^{\circ}\text{W}$  - showing sample station location, equipment used at each station, and summary of geological result at each station.
- 2) Cruise sheet  $60^{\circ}30'\text{N } 02^{\circ}\text{W}$  - showing data as above.
- 3) Sediment distribution  $60^{\circ}\text{N } 02^{\circ}\text{W}$  - showing sediment distribution, colour, grain size and shell content after Folk 1969.

- 4) Sediment distribution 60°30'N 02°W - showing data as above.
- 5) Solid geology 60°N 02°W - showing seismic sketch sections, areas of rock outcrops and solid cores recovered.
- 6) Solid geology 60°30'N 02°W - showing data as above.
- 7) Quaternary geology 60°N 02°W - showing thickness of Quaternary, and nature of Quaternary stations occupied.
- 8) Quaternary geology 60°30'N 02°W - showing data as above.

The following assessment of the geology is only provisional, based on the samples obtained to date, but should give an idea of the general geology of the area.

#### Surface Sediments

Sediment type in the West Shetland area consisted mainly of pure shell sands except in the deeper water, greater than 100m, areas to the north-west where the sediment graded into a fine quartz, lithic sand with little shell debris. In the north of the area deposits of clean well rounded gravels were frequently encountered but as yet have not been mapped out in detail. Large areas of clean rock pavement between Foula and the mainland are also present, completely devoid of surface sediments, presumably as a result of strong bottom current activity.

#### Quaternary

Quaternary deposits, apart from the surface sediments, appear to be largely absent in the coastal areas and between Foula and the mainland, large areas of rock pavement being present. Such Quaternary deposits that occur are present mainly in the NW of the area where both compact pebbly, hard grey tills occur and also softer plastic reddish brown clays with only rare pebbles. The distribution of these sediment types has not been accurately defined.

### Solid geology

The solid geology of the West Shetland area consists of mainly ORS strata lying on Pre-Cambrian basement rocks. These basement rocks occur to the east of the West Shetland fault and also form a ridge from Foula to Vee Skerries. To the west of the West Shetland fault, presumed Mesozoic and Tertiary strata is faulted against the basement.

Drilling with the 1 metre rock drill proved the continuation of basement gneisses and granulites between Foula and Vee Skerries and also proved the extension of the Muckle Roe granite to the west into St Magnus Bay. Gravity coring in the northern part of the area recovered soft sandstones of presumed ORS age, although they were of NRS aspect.

Appendix I

Ship's Log : T.M.S.V. Cape Shore

Tuesday 18th April

0000-2400 Ship mobilisation and refit at Great Yarmouth by IGS and Offshore Marine.

Wednesday 19th April

0000-2400 Ship mobilisation and refit at Great Yarmouth by IGS and Offshore Marine.

Thursday 20th April

0000-0100 Spooling starboard stern quarter anchor wire completed, but 4 hours still required for splice to anchor to harden. IGS mobilisation.

0100-0710 Ship mobilisation by IGS and continuing minor work on ship e.g. welding eye pads and strengthening to funnel A frame and to ladder on A frame.

0710-0745 Steaming to bunkering berth.

0745-1105 Bunkering.

1105-1135 Steaming back to Offshore Marine quay to load IGS gear remaining and fit ship's anchors to sponsons.

1135-1700 Completing loading IGS gear, welding modifications to A frame, loading of ship's stores, fitting ship's anchors at stern into sponsons. Only 1 cook and 1 steward aboard, additional steward requested as per contract. Extra steward to be put aboard at Leith if IGS have port visit. 1500 - delay on board ship due to engines overheating and need to clean engine coolers due to mud blockage. Sailing at 1600hrs. New EDT 1800hrs.

1700 IGS mobilisation complete - awaiting ship readiness, namely engine colling system blockage.

1700-2215 Awaiting ship engine repair to cooling system.

2215-2400 Steaming out of Great Yarmouth en route to Leith. Swinging compass en route.

Friday 21st April

0000-1430 Steaming en route to Leith.

1430-1930 Anchor trials off Hartlepool. Starboard stern anchor winch brake faulty and unable to free fall winch due to brake not holding. Pay out rate for winch slow. Spooling out port stern anchor and tensioning 50 minutes (laying anchor - 15 minutes; recovery - 35 minutes). Spooling



forward bow anchor and tensioning (paying out anchor - 20 minutes; recovery - 10 minutes).  
NB Check amount of wire on port stern anchor, according to Decca only 2500 ft was paid out with 1½ layers left on drum which is far less than minimum specification of 1350m on drum (4500 ft).

1930-2400 Steaming to Leith.

Saturday 22nd April

0000-0700 Steaming to Leith.  
0700-0730 Entering Leith docks and mooring alongside quay to load penetrometer system.  
0730-1110 Loading penetrometer vibrocorer.  
1110-2400 Repairs to ship stern starboard winch, involving stripping of brake pads and roughing surfaces and reassembling. Ship's voltage not up to specification - only 390v.  
NB 1) Gravity corer winch not free falling due to tight bearings.  
2) Vibrocorer non functional due to too low voltage.  
3) Penetrometer end foot unit full of sea water.  
4) Penetrometer activator switch questionable whether functional.  
5) Vibrocorer pot very tight in upper part of frame etc.

Sunday 23rd April

0000-2400 In port Leith awaiting repairs to ship's winch.

Monday 24th April

0000-2000 In port Leith awaiting repairs to ship's starboard stern winch. IGS modifications to gear put in hand with Robb Caledons. Starboard winch repairs completed at 1630hrs, but not tried at sea.  
2000-2100 Awaiting pilot Leith.  
2100-2230 Steaming to Aberlady Bay.  
2230-2400 Tensioning starboard anchor stern wire 1hr 15mins to raise anchor.

Tuesday 25th April

0000-0700 At anchor, Aberlady Bay.  
0700-0730 Manoeuvring onto station in Aberlady Bay.  
0730-0840 Laying anchors. 0750 Paying out starboard stern anchor. 0755 Paying out port anchor, lifted again in at 0759 due to dropping before turn

to cruise for bow anchor. 0804 drop port anchor. 0816 drop bow. 0824 heaving into position and tensioning anchors to position. Radius of anchors 1500 ft.

0840-1030 Preparing gravity corer for launch and vibrocorer and shipek grab.

1030-1040 Lowering vibrocorer to seabed.

1040-1100 Vibrating motor.

1100-1110 Lifting vibrocorer aboard.

1110-1220 Lifting anchors.

1220-1320 Steaming to station.

1320-1430 Laying anchors in Aberlady bay, tide and holding problems.

1430-1700 Gravity coring and vibrocorer trials.

1700-1730 Vibrating vibrocore on seabed.

1730-1745 Bringing vibrocorer aboard.

1745-1830 Raising anchors.

1830-1930 Steaming to lie off Granton to collect additional personnel.

1930-2100 At anchor off Granton awaiting personnel in pilot boat for trials.

2100-2200 Steaming to Aberlady Bay.

2200-2400 At anchor Aberlady bay in position for trials in morning.

Wednesday 26th April

0000-0600 At anchor Aberlady Bay.

0600-0630 Raising ship's anchors.

0630-0650 Manoeuvring ship onto position for vibrocorer.

0650-0930 Anchoring ship, but necessary to raise anchors due to port anchor spooling going slack.

0930-1100 Steaming to next station near May Island.

1100-1130 Streaming out port stern anchor and marking off length of wire: 3600 feet and 1 layer on drum. Check that this is less than specification quoted.

1130-1600 Laying anchors at station off May Island. Problems with bow anchor dragging due to tide swinging bow and resulting in stern to tide. Starboard anchor flukes caught on port anchor wire.

1600-1650 Steaming to station in Aberlady Bay.

1650-1715 Laying anchors.

1715-2030 Testing vibrocorer, examination by divers, Ruckley, Owens, Chesher, Holmes. Depth 40 feet. Testing 1m drill.

2030-2100 Raising anchors.

2100-2130 Steaming to Leith to modify hydraulics for stern anchors to give more drum revs/min. (increase from 5 to 10 rpm). Also replace trough for grvaity corer.

2130-2400 In port Leith for anchor hydraulic modifications.

Thursday 27th April

0000-2230 In port Leith, modification to ship's hydraulics, fitting new gravity corer shute, fitting MS47 and eye pads to deck. 1430 ship's winches modification to hydraulics complete.

2230-2400 Steamed from Leith to avoid impeding dock strike and headed for anchorage in Aberlady bay to shelter from easterly gale.

Friday, 28th April

0000-0900 At anchor Aberlady Bay.

0930-2400 Weighing anchor and steaming en route to Shetlands.

Saturday, 29th April

0000-0830 Steaming en route to Shetland.

0830-1000 Laying anchors S of Skelda Ness, W Shetland.

1000-1055 Preparing rock drill and lowering to seabed.

1055-1135 Drilling 10cm penetration - very slow.

1135-1200 Raising rock drill - no recovery - top lock not barred.

1200-1250 Preparing rock drill.

1250-1300 Lowering rock drill to seabed.

1300-1400 Drilling and recovery - 0.8m depth, no sample.

1400-1615 Lifting anchors. Grey schistose rock on anchor (bow).

1615-1700 Steaming to next station.

1700-1800 Laying anchors station W of Shetland.

1800-1853 Lowering rock drill and drilling on sandy sea floor.

1853-2000 Lifting rock drill and gravity coring.  
2000-2037 Raising anchors.  
2037-2400 Gravity coring and shipek grabbing.

Sunday 30th April

0000-0630 Routine sampling.  
0630-0730 Laying anchors E of Foula.  
0730-0745 Lower 1m drill to seabed.  
0745-0815 Drilling.  
0815-0930 Recovered drill - no penetration after 30 mins -  
drilling on rock? no weight on bit. Testing  
drill and recovering loose anchor buoy.  
0930-1015 Lowering drill to seabed. Drilled down ? side  
of boulder and jammed. Liften aboard.  
1015-1045 Lowered drill to seabed for 3rd attempt. Drilling  
30 mins. Drive belt broke but obtained rock  
sample.  
1045-1050 Lifted drill aboard.  
1055-1130 Raising anchors.  
1130-1230 Steaming to site N of Foula.  
1230-1330 Laying anchors.  
1330-1400 Preparing and lowering drill to seabed.  
1400-1500 Drilling and recovery of rock drill. Very  
strong currents. Ship swinging and cables taut.  
1500-1615 Lifting anchors. Problems due to ship swinging  
in tide and stern anchor wires crossed.  
1615-1650 Steaming to next station.  
1650-1735 Laying anchors.  
1735-1800 Lowering drill to seabed.  
1800-1930 Drilling - 0.4m penetration in 1½ hrs into gneiss.  
1930-2000 Lifting drill.  
2000-2100 Lifting anchors.  
2100-2400 Routine sampling N of Foula.

Monday 1st May

0000-0710 Routine sampling.

0710-0830 Laying anchors off Ve Skerries.

0830-0835 Lowering drill to seabed.

0835-1010 Drilling - no recovery only 10cm penetration.

1010-1035 Lifting drill and lowering into water for 2nd attempt.

1035-1115 Drilling. Drill stopped rotating after 45 mins.- broken drive belt.

1115-1130 Recovering drill.

1130-1210 Lifting anchors.

1210-1300 Steaming to next station.

1300-1430 Laying anchors in St Magnus Bay, problems holding.

1430-1600 Lifting and relaying anchors only bow and stern holding.

1600-1630 Drilling.

1630-1645 Lifting anchors.

1645-1715 Steaming to next station.

1715-1750 Laying anchors.

1750-1850 Lowering drill to seabed and drilling.

1850-1900 No penetration, lifted drill aboard.

1900-1950 Lowered drill to seabed, bent barrel due to drill slipping on boulders.

1950-2000 Lifted drill aboard and replaced barrel, 3cm. of core recovered.

2000-2400 Lowered drill on same station, 3rd attempt to obtain better core.

Tuesday 2nd May

0000-0600 Routine sampling.

0600-0630 Approaching site for drilling.

0630-0730 Laying anchors site +60 -02/50.

0730-0800 Lowering drill to seabed.

0800-1000 Drilling.

1000-1100 Lifting drill aboard. Broken belt on main drive. Manoeuvring vibrocorer into position.

1100-1130 Lowering vibrocorer to seabed.  
1130-1200 Lifting vibrocorer.  
1200-1300 Steaming to next site.  
1300-1400 Laying anchors.  
1400-1500 Vibrocoreing W of Esta Ness.  
1500-1540 Lifting anchors.  
1540-1615 Steaming to next station.  
1615-1720 Laying anchors.  
1720-1740 Preparing vibrocorer and launching to seabed.  
1740-1800 Vibrating.  
1800-1830 Lifting anchors.  
1830-2400 Routine sampling NW of Shetland.

Wednesday 3rd May

0000-0700 Routine sampling NW of Shetland.  
0700-0800 Laying anchors W of Herwa Ness.  
0800-0830 Vibrocoreing.  
0830-0840 Lifting vibrocorer.  
0840-0920 Lifting anchors.  
0920-1000 Steaming to next station.  
1000-1145 Laying anchors and extracting boulder jammed  
in forward anchor flukes (30 mins. work).  
1145-1200 Lowering vibrocorer to seabed.  
1200-1240 Vibrating.  
1240-1250 Lifting vibrocorer aboard.  
1250-1340 Lifting anchors.  
1340-1400 Steaming to next station.  
1400-1500 Laying anchors. NB Unable to make link call  
due to insufficient power from flat batteries.  
1500-1600 Vibrocoreing.  
1600-1635 Lifting anchors.  
1635-1710 Steaming to next station.  
1710-1750 Laying anchors.

1750-1900 Vibrocoreing.  
1900-2000 Lifting anchors.  
2000-2400 Routine sampling NW Shetland.

Thursday 4th May

0000-0230 Routine sampling NW Shetland.  
0230-1015 Steaming to Lerwick.  
1015-2400 In port Lerwick.

Friday, 5th May

0000 - Port Lerwick.

## Appendix II

### Equipment Performance

#### 1. Mobilisation

The initial mobilisation in Great Yarmouth went about as programmed taking 2 days to mobilise. The estimated time of 1½ days could have been met had the crane been fully available and not committed to ship stability trials and testing the A frame. Additional delays in Great Yarmouth were a direct result of mud in the ship's cooling system which had to be removed.

#### 2. Ship Performance

The ship proved somewhat 'lively' at sea, prone to roll, but this was compensated by a very good handling system for the equipment. The anchoring of the ship was satisfactory once the hydraulics of the winches had been modified in Leith to give an increase in speed to the winches from 5 to 10 revs/min. The lack of any spooling gear on the winches however, meant hard spooling which proved slower, less satisfactory in that slack bights often occurred in the wires, and a dangerous system of blocks, pulleys and wires on the deck which negated any work on deck whilst laying or lifting anchors. Accommodation on board ship was good although the ship's plumbing was less than satisfactory with regard to toilets, hand basins and showers. Although £6 per day per man was the agreed figure for payment to the ship the master stated that the ship only received £3 per man per day, a substantial difference from the agreed figure. The ship's crew were also not on any overtime greater than a 12 hour working day although it was stated by Sub Sea



Surveys during contract meetings that the crew would be on full overtime to cover the 16 hour daylight work period. This may well prove a problem in future legs.

3. Vibrocorer

This worked satisfactorily. The penetrometer system however was not available during this leg due to problems with the switch. The Consub cable handling device proved excellent.

4. Gravity Corer

It was necessary to build a small davit from the A frame to give a clear run to the gravity corer wire, but once this was completed the gravity corer proved satisfactory. The Sykes winch however, proved difficult to start and freefall. Although the sediment NX barrels were fully tightened on the base plates several barrels were lost and 3 base plates damaged. The reason for this has not yet been resolved.

5. Shipek Grab

Proved satisfactory although the electric winch must be given time to reach engaged speed otherwise it will trip out.

6. Midi Drill

This worked reasonably well but used several main belt drive boards during its operation. It also proved exceptionally slow when drilling gneissose-type basement rock taking at least 1½ hours for 10cm penetration. The Sub Sea television system worked well, although the ship's voltage fluctuations often caused banding across the screen, but not sufficient to inhibit use.

