INSTITUTE OF GEOLOGICAL SCIENCES
MARINE GEOLOGY UNIT
Internal Report No. 80/9

Cruise Report on 1st Leg of Whitethorn Cruise No 80/WH/04

16 May 1980 - 19 June 1980

by

N.G.T. FANNIN

CONTENTS

1. Introduction

The objective of Leg 1 of Cruise 80/WH/04, after completing initial equipment trials, was to collect samples on the continental shelf area of the Foula Sheet (60^{o}-61^{o}N, 2^{o}-4^{o}W) and as a pilot study, to collect some samples from deep water in the north-western part of the area (Fig. 1). It is intended that the sampling of this deep water area will be completed during the 1981 season.

Weather conditions were good during the cruise and only one day was lost because of bad weather. Some additional time was lost however because of equipment problems.

A total of 241 stations were occupied during the cruise, 48 of which were vibrocore sites.

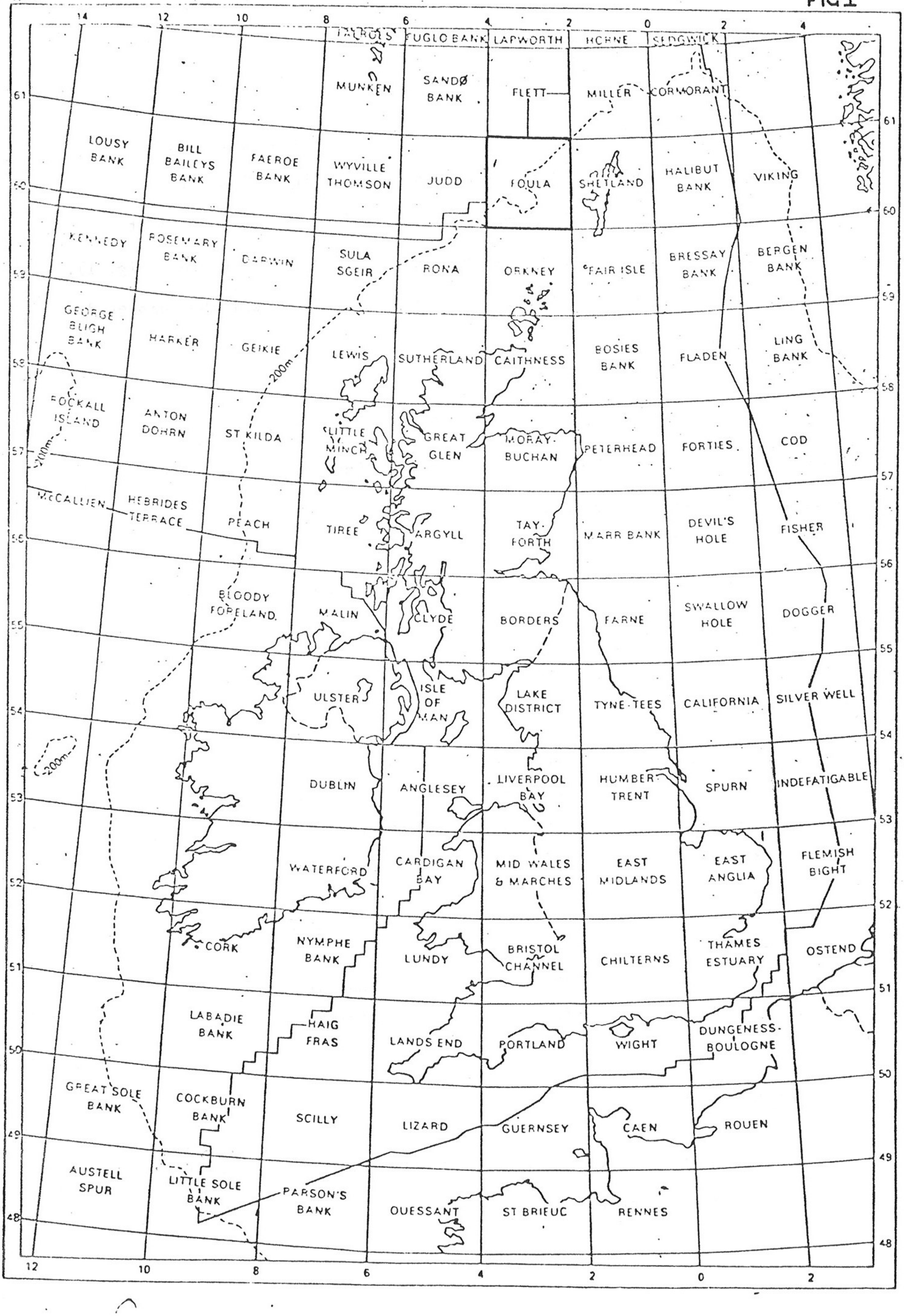
2. Personnel

N G T Fannin	IGS	CSNU	Senior Scientist
J A Chesher	IGS	CSNU	Day Lab/Deck
N A Ruckley	IGS	CSNU	Surveyor
C Graham	IGS	CSNU	Night Lab
A Fyfe	IGS	CSNU	Night Deck
B Tait	IGS		Night Lab/Deck
D Long	IGS	EGU	Day Lab
W Lonie	IGS	CSNU	Technical
N Campbell	IGS	CSNU	Technical

3. IGS Equipment

1. Six metre vibrocorer with retraction system and recording penetration meter.

FIG 1



TAROLS
FUGLO BANK
LAPWORTH
HORNE
SEDGWICK
MUNKEN
SANDØ BANK
FLETT
MILLER
CORMORANT
LOUSY BANK
BILL BAILEYS BANK
FAEROE BANK
WYVILLE THOMSON
JUDD
FOULA
SHETLAND
HALIBUT BANK
VIKING
KENNEDY
ROSEMARY BANK
DARWIN
SULA SGEIR
RONA
ORKNEY
FAIR ISLE
BRESSAY BANK
BERGEN BANK
GEORGE BLIGH BANK
HARKER
GEIKIE
LEWIS
SUTHERLAND
CAITHNESS
BOSIES BANK
FLADEN
LING BANK
200m
ROCKALL ISLAND
ANTON DOHRN
ST KILDA
LITTLE MINCH
GREAT GLEN
MORAY-BUCHAN
PETERHEAD
FORTIES
COD
McCALLIEN
HEBRIDES TERRACE
PEACH
TIREE
ARGYLL
TAY-FORTH
MARR BANK
DEVIL'S HOLE
FISHER
BLOODY FORELAND
MALIN
CLYDE
BORDERS
FARNE
SWALLOW HOLE
DOGGER
ULSTER
ISLE OF MAN
LAKE DISTRICT
TYNE-TEES
CALIFORNIA
SILVER WELL
DUBLIN
ANGLESEY
LIVERPOOL BAY
HUMBER-TRENT
SPURN
INDEFATIGABLE
WATERFORD
CARDIGAN BAY
MID WALES & MARCHES
EAST MIDLANDS
EAST ANGLIA
FLEMISH BIGHT
CORK
NYMPHE BANK
LUNDY
BRISTOL CHANNEL
CHILTERNS
THAMES ESTUARY
OSTEND
LABADIE BANK
HAIG FRAS
LANDS END
PORTLAND
WIGHT
DUNGENESS-BOULOGNE
GREAT SOLE BANK
COCKBURN BANK
SCILLY
LIZARD
GUERNSEY
CAEN
ROUEN
AUSTELL SPUR
LITTLE SOLE BANK
PARSON'S BANK
OUESSANT
ST BRIEUC
RENNES

2. Gravity corer with 1.5 and 3m barrels.
3. Shipek grabs
4. Atlas Deso echosounder.
5. One metre rock drills and television system
6. Video camera system.

4. Ship's Performance

a) Anchoring: Following initial problems with the anchor winches adjustments to the hydraulics improved the performance slightly but the winching in rate remained slow and the brakes required continual adjustment throughout the cruise. A functional hand brake is urgently required for the anchor winches.

The Bruce anchors proved a considerable success and were proved capable of holding the ship with less than 1.5 times the water depth of cable.

b) A frame and vibrocorer winch hydraulics: These proved troublesome throughout the trip, working only at slow speed. Complete failure of the system at one point during operation required the use of the IGS divers in recovering equipment and necessitated a port call for a shore based hydraulics engineer. The system requires further attention.

c) Rolls Royce/Wardpower Generator: Initial problems with the power supply to the IGS equipment were traced to faulty wiring from the generator to the IGS switch boxes. This again required a port call and attention from shore based engineers. The initial installation was inherently dangerous and there was clearly a failure to understand the power requirements of the IGS switchboard system.

d) Atlas Deso Echosounder: At the beginning of the cruise this system was working intermittently and unreliably. The echosounder chassis was found to be live and the charging unit incorrectly wired. Later in the cruise the system appeared to function satisfactorily but this system also clearly requires further attention.

e) General: Despite the technical problems noted above the overall ship performance was excellent. In particular thanks are due to the co-operation of the officers and crew who contributed considerably to the success of the leg. During the course of the cruise it became apparent that the efficiency of the deck operation and the anchoring system were now such that vibrocoring operations in darkness hours were a practical proposition. Some stations were occupied during such darkness hours as prevailed and no handling problems were encountered. Clearly with adequate ship and IGS crewing twenty-four hour vibrocoring is feasible and consideration should be given to planning future sampling operations around such a programme.

5. IGS Equipment Performance

a) Laboratories and stores: The layout and general deck arrangement of the ship was excellent. Undoubtedly this year we have had the best working platform so far achieved.

b) Lebus gravity coring winch: This proved extremely successful in combination with the braided nylon rope. Provided the gravity coring trough was left carefully maintained there was little abrasion of the braided line. The winch remote control proved a considerable success and if the bowsing winch control were also converted with a similar remote device an otherwise two-man operation could be reduced to a one man system. Limitation of pre-set valves in the winch controls prevented use of the winch as a vibrocorer hoist. This should be overcome by changing these valves.

One problem however associated with the use of braided line is that the stretch of the rope makes use of the metering block inaccurate and causes the spooling gear to eventually run out of phase with the winch.

c) Lebus shipek winch: This winch also performed excellently and the accuracy of the metering block was particularly impressive. A slight problem with the shipek system is caused by the height above water which means that an extremely careful watch is required during recovery to avoid catching the winch on the side of the ship even in the most gentle of swells. A useful addition would be an extension arm in the control lever allowing the operator to stand by the side of the ship. The control lever locking nut is not required and should be removed.

d) Vibrocorer System: Launch and recovery of the system were particularly efficient and provided no problem during the cruise. At the beginning both the retraction system and the penetrometer required considerably attention. The hydraulics of the retraction system were completely rebuilt and this is described in Appendix II. The penetrometer also required attention. Both the horizontal and vertical scales of the chart recorder were incorrectly calibrated and the absence of a specific target for the echosounder meant that as the pot moved towards the transducer the effective target moved gradually from the crown of the vibrocorer part to the rim making both calibration and interpretation of the recorder trace difficult.

e) One Metre Rock drills: An attempt was made to operate this system late in the cruise. Severe bottom current problems were encountered at all sites, hampering the use of the drill. However serious technical problems were also encountered and the viability of this equipment requires careful consideration. In addition there were some problems in the operation of the television systems.

f) Video Camera System: This equipment was to be used for recording training film of operational practice. Again stability problems were encountered during recording and the system requires checking and maintenance.

6. Scientific Results

Significant new data was obtained during this cruise concerning the recent sediments and Quaternary successions. The interpretation developed from geophysical data during the 1979 work has largely been supported. The area is everywhere blanketed by sands which are high in carbonate content, particularly adjacent to the rock outcrops. On the bathymetric highs the lithic gravel content increases considerably reflecting the winnowing of the underlying tills. The tills are extremely stiff and locally very stoney. Till colour varies from red to grey and it is not at the moment clear whether this reflects local variation (the reddish tills are found in the south eastern part of the area adjacent to the red beds of the Fitful Basin which lies to the south east of the Foula Sheet area) or whether there are two quite distinct tills present. Further study is required to resolve this point. Hollows in the till surface are filled with very soft brown clay without any apparent microfauna and these may represent winnowed lacustrine deposits. The clays are overlain by fine sands.

A series of samples collected in deep water suggest that gravelly sands are present on the seabed at least to depths of 500m. These are underlain by very soft silty clays.

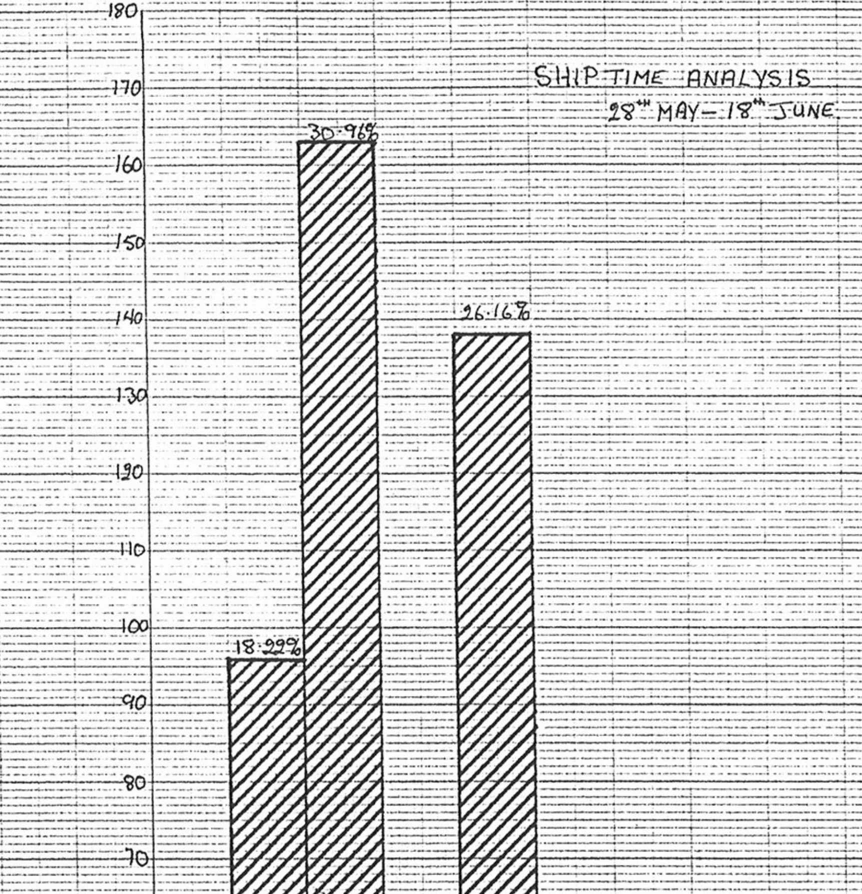
Sand ribbons near the shelf edge aligned parallel to bottom contour currents appear to be composed of relatively better sorted and finer sands separated by coarser and less well sorted pebbly and shelly sands.

"Solid" rock samples collected by gravity coring support the interpreted ORS platform around Foula but an enigmatic black shale of "Jurassic appearance" was recovered SW of Foula. Further sampling is required to clarify the significance of this specimen.

7. Conclusions

Despite considerable technical problems early in the leg the cruise was largely successful. The relatively high steaming time reflects the widely spaced stations (Fig. 2).

FIG 2


SHIP TIME ANALYSIS
28th MAY – 18th JUNE
HOURS
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
4·45%
18·29%
30·96%
10·13%
26·16%
1·53%
7·44%
1·04%
0·07%
IN PORT
ON PASSAGE
TRAVERSING
ANCHORING
ON STATION
WEATHER
EQUIPMENT
SHIP
OTHER
DOWNTIME

APPENDIX I

SUMMARY LOG

16.5.80

1300	Complete mobilisation. Cast off from Fleetwood for anchor trials
1608	Bearing housing shatters during first test (Port Quarter anchor). Trials abandoned. Anchor and wire lost.
1730	Begin dragging for lost anchor and wire
2008	Anchor wire lifted and buoyed off. Steam towards Fleetwood.

17.5.80

0200	Alongside in Fleetwood. Departure postponed until anchor winch modifications complete

27.5.80

1040	Cast off from Fleetwood to repeat anchor trials and vibrocorer trials
1130	Begin vibrocorer trials. Faulty retraction system
1330	Complete vibrocorer trials
1425	Begin anchor trials
2300	Complete anchor trials
2315	Drop P.J. Wiggins and H.S. Robertson by pilot boat off Fleetwood

28.5.80

0000	Ship On Charter. Steam towards Foula
1815	Deep water anchor tests off Islay. Echosounder working intermittently.
1935	Complete anchor trial
2016	Run out braided hoist rope (3000m) and respool under tension
2220	Complete respooling - steam towards Stornoway.

29.5.80

1645 Anchor in Stornoway Bay and pick up J. Pheasant and R. Cook for repairs to vibrocorer

2245 Steam towards Foula

30.5.80

0645 Ship breakdown - engine failure

0840 Repairs complete - resume passage

1950 On station off Foula. Vibrocorer trials - retraction failure conducting repairs

31.5.80

0025 Begin gravity coring programme

0800 Repairs to penetrometer and vibrocorer winch continuing. Continue gravity coring

1.6.80

1430 Test penetrometer

1620 Complete penetrometer tests and continue sampling

1900 Further vibrocorer tests indicate cable fault. Braided rope damaged 50m rope lost and new splice made.

2.6.80

0700 Splice complete. Gravity coring resumed.

1300 Vibrocorer repairs complete awaiting repair of vibrocorer winch. Continue gravity coring

3.6.80

0430 Complete gravity coring and steam to Scalloway

0730 Anchor off Scalloway to test vibrocorer. Winch and A frame fail with vibrocorer over side. Vibrocorer lowered to seabed and line attached by divers (J.A. Chesher and N.A. Ruckley).

1055 Hydraulic power restored and vibrocorer recovered

1330 Engineer from Command Hydraulics arrives to repair A frame and vibrocorer winch.

1845	Repairs complete. Steam to site off Scalloway to test system
2215	Complete testing hydraulics system and vibrocorer. Steam to Scalloway
2245	Land Command Hydraulics engineer by Zodiac and steam towards Foula.

4.6.80

0230	Begin gravity coring programme
0730	Begin vibrocoring
1050	Retraction wire snaps
1400	Raise moorings
1430	Lay anchors and redeploy vibrocorer
1630	Kintech plug fails and relay box damaged due to water ingress
2100	Retest vibrocorer
2330	Complete calibration. Raise moorings

5.6.80

0150	Begin gravity coring
0620	Complete gravity coring and begin vibrocoring programme
2010	Shipek snags on bilge keel and weight shaft snaps - grab lost.
2350	Complete vibrocoring programme

6.6.80

0040	Begin gravity coring
0420	Complete gravity coring. Steam to Scalloway
0800	Anchor off Scalloway
1000	J. Pheasant and Robin Cross put ashore by Zodiac
1100	Steam towards sampling site
1415	Begin vibrocoring
2300	Complete vibrocoring

7.6:80

0045	Begin gravity coring
0500	Complete coring

0645	Begin vibrocoring
2400	Continue vibrocoring

8.6.80

0050	Complete vibrocoring
0155	Begin gravity coring
0645	Complete gravity coring
0730	Begin vibrocoring
2400	Complete vibrocoring

9.6.80

0005	Complete vibrocoring - fault in vibrocorer cable
0045	Begin gravity coring
0200	Complete repairs on cable
0635	Complete gravity coring
0730	Begin vibrocoring
2230	Complete vibrocoring
2310	Begin gravity coring

10.6.80

0335	Complete gravity coring
0740	Begin vibrocoring
2215	Complete vibrocoring, begin gravity coring

11.6.80

0455	Complete gravity coring, steam to Scalloway
0930	Alongside Scalloway to collect spares
1200	Steam towards sampling area
1800	Begin vibrocoring
2130	Water leak in relay box
2350	Abandon vibrocoring

12.6.80

0014	Begin gravity coring
1430	Complete gravity coring. Vibrocorer repaired, begin vibrocoring

13.6.80

0045	Complete vibrocoring, begin gravity coring
0830	Complete gravity coring begin vibrocoring
2045	Complete vibrocoring
2317	Begin gravity coring

14.6.80

0700	Shipek wire snags in davit and snaps. Shipek lost with 500m wire
1145	Complete gravity coring and steam to Foula
1915	Deploy rock drill. Drill will not decend- conducting repairs

15.6.80

0030	Begin gravity coring
0430	Abandon gravity coring in deteriorating weather. Steam to St. Magnus Bay
0800	Anchor in St. Magnus. Vibrocorer trial using buoyant cable. Cable hauling wheel burnt out during cable recovery. Continue rock drill tests.

16.6.80

0400	Raise moorings and steam towards sampling area
0730	Begin vibrocoring
1845	Ship's rudder temporarily jammed. Automatic steering fails Ship controlled by hand steering.
1930	Abandon vibrocoring in deteriorating weather. Begin gravity coring.

17.6.80

0825	Complete gravity coring
1050	Anchor on rock drill site. Drill dragged away in tide.

	Abandon site
1300	Steam to Scalloway to land a sick seaman
1620	Alongside in Scalloway
1800	Cast off and steam to sampling site
2030	Anchor on rock drill site. Drill again dragged in tide Hydraulics hose damaged.
2235	Steam to gravity coring site
<u>18.6.80</u>	
0220	Begin gravity coring
0700	Complete gravity coring
0745	Anchor at drill site. Drill fails again
1150	Abandon drill site. Steam towards Aberdeen
<u>19.6.80</u>	
0830	Alongside in Aberdeen

APPENDIX II SPECIALIST'S REPORTS

Survey Data

Navigation: Navigation throughout Leg 1 was by Decca Chain 6c using a Decca Navigator MK21 in conjunction with a Decca Trackplotter. Chain 6c proved reliable except for one period of an hour when atmospheric conditions were poor. The trackplotter was used on scale 2 for anchoring sites and scale 1 for routine gravity core sampling.

Echosounder: An Atlas Deso 10 echosounder was used for determining depths up to 280m. For the first week it proved to be unreliable due to the poor state of the four batteries, which had to be charged 24 hrs. a day. Constant heat and fumes were given off. The echo sounder proved of limited use as about half the work area was in depths in excess of 280m.

Plotting and Sampling: Sampling sites were located on geophysics lines plotted on 1:250,000 scale. Cruise sheets on a 1:100,000 scale and a 1:250,000 sample location map was produced. 261 stations were occupied 48 (18.4%) were vibrocore stations. The new "Bridge" plotting sheets provided by Coes were very useful.

Time analysis sheets were kept and a summary is given in Fig. 2. Downtime was difficult to calculate due to the diversity of equipment used at any one time. For the purpose of the T.A. sheets downtime was taken either when the ship was on site and no sampling was taking place, or when the ship was stopped between stations to test equipment.

Recommendations: i) The echosounder should be powered off the ships supply.
ii) An echosounder with a range of up to 1500m should be considered.

An accurate depth is essential for best use of I.G.S. sampling equipment.

N. A. Ruckley

Operational Report

The operational objective of this leg was to rectify any initial equipment problems following the mobilisation and installation of new equipment, and then to follow on from last year's trials using the retraction vibrocorer system in a 'live' ship mode by use of a floating nylon braidline hoist cable and a buoyand power cable.

A detailed technical account of equipment performance is given in a separate report. However, to summarise, the new shipek and gravity corer winches proved to be a considerable improvement, in terms of winch speed and ease of operation, over winches used in previous years. The gravity corer winch was, however, not capable of lifting the vibrocorer, but the hydraulic pressure system should be capable of being boosted to rectify this problem. The use of a nylon braidline floating hoist cable for gravity coring was also successful in that it did not kink as did wire, neither did the splice need very frequent remaking. In addition it was immediately apparent when the gravity corer reached the seabed, which proved particularly advantageous in deep water.

After initial hydraulic and electrical problems the retraction vibrocorer system finally reached a working state, although reliability remained suspect due to repeated water leakage into the bottom relay box thought to be caused by the Kintec plugs. It was due to this problem and the problem of lifting the vibrocorer with the Lebus winch that the system was not used in a 'live' ship mode.

The midi drills proved unsuccessful partly due to mechanical faults but also due to faulty television system.

In conclusion this leg was marked by a higher level of equipment problems than would have been anticipated.

J. A. Chesher

I.G.S. Equipment

After lots of electrical faults on sailing from Fleetwood it was found that we had three phase and earth when we should have had three phase and neutral coming up from the ship's generator to our electrical lab. After this was repaired the earth leakage units functioned correctly. We still had some electrical faults such as faulty B.I.W. bulkheads on the cable drum and after lowering the vibrocorer to 110m we had an earth trip, the cause was water in the Hydraulic pack (the oil filter was crushed). After stripping down the hydraulic pack we found the pressure compensation bag had burst and also found that it had been wrongly plumbed. The hydraulic pack was rebuilt and the Pilot operated check valve ommitted. We then tested hydraulic pack in the lab with pressure gauge on open circuit to see that the solinoids operate correctly. We gave the hydraulic pack a depth pressure test by lowering over the side to 100m. Then we connected it to the Staffa Motor and vented all the air out of the system. The hydraulic pack then worked correctly.

There were still some electrical faults, it was found that the outer sheath on the B.I.W. power cables were very thin and some cuts in cables were examined and found to be letting water in. Also the Kintec plugs and sockets did not seem strong enough for the job. It was thought on two occasions that the Kintec bulkhead leaked water into the bottom electrical box, and the threads on the plastic and metal bulkhead seemed not to be the same.

The Penetrometer system was very hard to calibrate and seems to be affected by the switching on and off of the main three phase power. It also seems to give a good indication of water in the cable and bottom electrical box.

The Midi Drill operated correctly on deck but when on the seabed it did not penetrate. The hole in the shuttle valve was opened up by 0.015 in. and new free wheel fitted and a lead weight fitted to the carriage. We still did not get any penetration. The carriage frees itself from the top nut and the bit comes down on to the seabed and stops.

The Gravity Corer and Shipek Grab both worked well.

Conclusion: After lots of problems the vibrocorer worked well, the hydraulic retraction system worked very well. The Kintec plugs and bulkheads need looking into. The penetrometer has to be made more reliable and free from any interference from the three phase power. The problems with the Midi Drill needs looking into in greater detail, cycle free wheels do not seem to be the ideal thing for the job.

W. G. Lonie

Night Shift Sampling

198 sites were occupied using the shipek grab and the gravity corer.

Shipek Grab: In general recovery was good, 188 shipek samples were obtained and most of these provided enough sediment to permit subsampling for particle size and microfaunal analysis. The success of the grab is probably due to the shipek winch which allows a controlled rate of descent to the sea floor.

Problems occurred with the shipek davit, the main one being the wire coming off the outboard pulley wheel during recovery. This was caused by:- 1) driving the winch too fast before strain came on the wire

2) streaming of the wire due to poor station holding in bad weather

3) excessive swing of the bucket between sea level and the deck.

Fitting the wire onto the pulley wheel proved to be difficult and at times a potentially dangerous operation.

Over most of the area samples, the sea bed sediments consisted of olive/olive brown/yellowish brown, poorly sorted, very coarse to fine, pebbly, shelly, sands. Deep water sites recovered olive, pebbly, silty sands while sites near to areas of rock outcrop recovered coarse shell sands and gravels.

Gravity Corer: 156 sediment cores and 15 rock cores were obtained. Core recovery varied greatly depending on the nature of both the superficial sediment and the underlying material. At several sites little or no recovery was recorded due to the core material being 'washed' out during recovery operations. To overcome this problem a polythene sheath was fitted over the catcher. Although limited tests proved inconclusive it is probable that at a number of sites the sheath did prevent the core being washed out.

A test was conducted to find the best height above the sea bed at which to free fall the corer. (see Table 1). The water depth was 62m and the sediment recovered consisted of a silty, shelly coarse to very fine sand.

TABLE 1

Height Above Sea Bed (m)	Core Recovered	
	NX	4"
5	5cm	
10	5cm	
20	7cm	
59	25cm	29cm

not tested

These figures indicate that the corer can free fall from a height of over 50m and remain in a vertical position. During rock coring, samples were obtained by free falling from a height of 60m.

A 10' x 4" sediment barrel was used to sample deep water sites on the continental slope. No problems were encountered using this barrel and several cores of over 2m were recovered.

Most of the sediment cores consisted of a topmost sand layer similar to that of the shipek sample but retaining a larger amount of 'fines'. (these are probably washed out of the shipek bucket during recovery). The base of the core (where it penetrated the superficial layer) consisted of either 1) very soft, olive/olive grey/brown, silty clays or 2) stiff, reddish brown/brown/dark olive grey, pebbly, sandy tills.

In some cores this boundary was distinct while in others the top layer apparently graded into the underlying one.

A record of the depth to sea bed, as measured by the gravity core and shipek winches, was kept for some of the deep water sites to measure the amount of stretch in the braided rope used for gravity coring (see Table 2).

TABLE 2

DEPTHS IN METRES

Shipek Winch	315	416	508	582	692	748	895	995
Gravity Core Winch	300	404	490	560	660	720	830	940

These values give an average stretch factor of approximately 4.5%.

One of the NX sediment cores recovered fresh rock beneath a layer of sand. It is thought that this rock - a black micaceous mudstone may be a sample of outcrop, possibly of Mesozoic age.

Rock coring proved unsuccessful during the early part of the leg, however in the last few days reasonable samples were obtained by free falling the corer from greater heights than had been used previously. Weathered ORS, micaceous silstone and biotite/hornblendic metamorphic rock were recovered using this method from the Roula Ridge and the surrounding area.

Coring on the West Shetland Ridge was unsuccessful, the sites occupied consisted of pebble and shell gravels.

C. Graham

Geotechnical Testing

To provide further information of the sediments recovered, various engineering geological tests were undertaken to obtain values for a variety of geotechnical parameters. Tests were performed and sub-samples taken of suitable material at the base of gravity cores, (usually only when such cores were longer than 50cm), and at one metre intervals along the length of the recovered vibrocore samples.

Tests were performed to determine values for undrained shear strength and compressive strength, using pocket handvanes (Soil Test CL 600 with adaptors CL602 and CL604) and pocket penetrometer (Soil Test CL700 and adaptor CL701). A fall-cone liquid limit device was adapted to a falling cone penetrometer with the intention of providing more precise values of undrained shear strength particularly of very soft sediments. A comparison of hand vane and falling-cone derived values for undrained shear strength will be made on the return to Edinburgh to determine the accuracy and potential future use of the latter instrument.

A small sample of known volume was taken when the strength measurements were made, and sealed in a tin. The tins will be weighed on return to Edinburgh and values for moisture content and density determined. A further sub-sample was taken and stored in a plastic bag to be used later to determine Atterberg Limit values and possibly specific gravity.

The sediments retrieved and tested give values of very soft to very stiff (c. 1kPa ->250 kPa), and of varying plasticity, showing a wide variety of sediment types frequently between sites very close to each other. Detail values of measurements taken on board ship and the initial laboratory investigation will be presented in an E.G.U. internal report in due course.

D. Long

Geochemical Sampling

Several methods, including gravity core, shipek grab and vibrocore were used to obtain surface and near surface sediment and rock samples, from most parts of the area apart from the extreme north-west.

Grab samples and some core samples were freeze-dried, sieved in the case of the grab samples, and both coarse and fine fractions retained for trace and minor element analysis at the Geochemical Divisions laboratories. Measurements of pH and eH were made on the ship before drying took place. Although pH and eH measurements were not of primary concern, it was decided to make them in view of the considerable variety of sediment types and the desirability of continuity of these measurements from a previous year. The fact that some correlation is observed between lithology and depth of sediment and its pH and eH indicate that these measurements were of some value. It would be useful, however, to differentiate between the chemical conditions in interstitial waters and in the sediments themselves, particularly as some washing of the sample with surface sea-water may take place during recovery.

Measurements on core samples were made wherever work patterns allowed, and apart from indicating a more reducing environment than at the surface of the sediment, the results did not appear to show any correlation with the depth of core at which the measurement was made. There was a fairly large scatter of data due to probe/sediment contact problems, which may mask more subtle correlations. Further measurements of the cores, including those of interstitial waters, and of trace elements, would be useful in helping to establish the chemical environment and depositional history of the sediments.

Equipment used in freeze drying and in making chemical measurements worked well, with a new Orion digital pH meter being convenient to use; although a malfunctioning pH electrode caused some data to be lost.

Altogether some 400 samples were prepared with pH and eH measurements being made. The data appears to be of some significance in deeper water areas, although their value is doubtful in the shallower rock platform areas immediately west of Shetland. Further, work on eH and pH measurement methods would increase their value, while trace element analyses of appropriate elements in core sediments, as well as surface material, might throw further light on their depositional history.

B. A. R. Tait