

INSTITUTE OF GEOLOGICAL SCIENCES
MARINE GEOLOGY UNIT
Internal Report No 82/9

CRUISE REPORT ON THE FIFTH LEG
OF WHITETHORN, CRUISE NO 82/WH/05

27th May - 9th June 1982

by

J Alan Fyfe

82/9

Geological Summary by D Cameron

10th June 1982

CONTENTS

1. Introduction
2. Personnel
3. Equipment
4. Ship's Performance
5. IGS Equipment Performance
6. Geological Results
7. Conclusions

FIGURES

Figure 1 Location Map

Figure 2 Fair Isle proposed geophysics lines and sample sites

TABLES

Table 1 Time Utilisation Analysis

APPENDICES

Appendix I Survey Log

Appendix II Summary Report

1. Introduction

The objectives of the cruise were twofold: to complete the sampling of the Fladen Sheet and to carry out a reconnaissance survey of the Fair Isle Sheet. For the Fladen area, a computer listing and digitised 1:250,000 and 1:100,000 maps of sample sites had been produced. These sites were chosen by A Skinner to assist the delineation of seismo-stratigraphic boundaries. The Fair Isle sites were planned on board, mainly on intersections on the proposed MGLU seismic grid. Some gravity core sites were chosen on bathymetric features in the southeast of the area.

The weather was excellent during the first ten days of the cruise but then deteriorated, necessitating some changes in the programme. One hundred and sixteen stations were occupied in the Fladen area and 55 stations in the Fair Isle area.

Time utilisation analyses are shown in table 1, a survey log is presented in appendix I and a summary report in appendix II.

2. Personnel

Alan Fyfe	MGLU	Chief Scientist
Don Cameron	MGLU	Day Geologist
Mike Parkin	MGLU	Surveyor
Pete Wiggins	MGLU	Deck Technician
Bill Lonie	MGLU	Maintenance Technician
John Cheshier	MGLU	Night Geologist
Dick Sutherland	HCU	Night Laboratory
Barbara Vickers	ACU	Geochemist
Linda Jobson	MGLU (voluntary)	Day Laboratory
Mike Atkinson	Queen Mary College	Microbiologist

M Atkinson's interest was the collection of samples for Sulphate Reducing Bacteria Analysis.

3. Equipment

The systems of IGS equipment on board were as follows:

- a) 6 metre Vibrocore system
- b) Gravity core system including winch and with rock barrels and both 5ft and 10ft x four-inch sediment barrels (NX barrels were on board but not used).
- c) Shipek grab and winch.

4. Ship's Performance

The ship is now proven useful for our type of survey work. The only major problem was the anchor-holding in areas of very soft mud. In such areas, eg Fladen SW and Fair Isle SE, re-anchoring was necessary on several occasions though, probably because of the excellent weather during most of the leg, no stations had to be abandoned altogether.

5. IGS Equipment Performance

- a) The vibrocore worked well. A few bent barrels were recovered but these were a result of ship drifting while at anchor. The 18mm 180 grade 18 x 7 bowsing wire proved satisfactory though the bowsing winch drum is too small and cannot be seen.
- b) The gravity corer worked well though even using a 10ft barrel few samples longer than 1.5m were recovered. During the second week, one corer was lost while working in marginal conditions. The rope parted at the splice on launching and was repaired with a bowline.
- c) One Shipek Grab was damaged as a result of being caught on the ship's

bilges. The winch developed a nasty 'clunk' during the first week but this was remedied by removing and cleaning the chain guard and lubricating the bearing.

6. Geological Results

During the leg 171 stations were occupied as follows:

Sheet no	Total	Shipek Grab	Sediment corer	Vibrocoer	Rock corer
58/00	44	44	32	12	
58/+01	72	72	45	27	
59/-02	19	19	12	8	2
59/-01	36	36	20	16	

Geological Summary by Don Cameron

All five of the sedimentary facies identified in Fladen by Fyfe (MGLU internal report 81/9) were again sampled to give additional information on this regional distribution and stratigraphic relationships. The units attenuate north-westwards, and in SE Fair Isle are commonly represented in sequence within a single 6m vibrocore section, allowing a stratigraphic succession to be determined for the late Quaternary sediments of the whole area.

Medium to coarse-grained marine sands, slightly gravelly in one core, underlie overconsolidated sandy muds in Fair Isle SE. Their lithology suggests deposition in a high energy shallow marine or beach environment, and they may be pre-Devensian in age. The sandy muds are locally normally consolidated but are typically firm to stiff or very stiff, suggesting glacial overburden, and are presumed to be late Devensian in age. They change in colour north-westwards from dark olive or olive-grey to reddish-

brown, and they may have been mainly derived from adjacent Devonian and Permo-Triassic rocks in the west. The muds are generally less sandy in Fladen, but locally contain stringers and lenses of very fine sand.

Interlaminated very fine or fine to medium-grained sands and muds overlie the sandy clays in Fair Isle, and commonly have a basal bed of mud-pebble conglomerate or sandy gravel. As in Fladen (Fyfe, op.cit.), the sand and mud laminae vary in thickness both vertically and between adjacent stations. In Fair Isle, up to 20% of quartz grains in the sands have an orange, possibly limonitic coating, and the clays commonly have a distinctive pinkish-grey colour, particularly towards the top of the unit. This, plus the occurrence of finely-disseminated plant debris, locally concentrated to 5% of the sediment, suggests a predominantly terrestrial provenience from an adjacent landmass of Permo-Triassic and, or, Devonian outcrops. Rare foraminifera were noted in several cores, and the sediments may have been deposited in an intertidal to shallow marine, post-glacial environment.

The 'monotonous clay facies' (Fyfe op.cit.) was extensively sampled in Fladen SW, and overlies the interlaminated sands and muds in Fair Isle. In Fladen, very soft, structureless olive-grey muds contain rare dropstones, and pass down into grey muds with abundant sulphide, occurring as finely-disseminated grains, diffuse pools and rarely as partings of black sulphide-rich mud. Colour-banded and laminated muds, recovered in four cores, may underlie the sulphide-rich beds. A 2cm layer at 4.9m below sea bed in vibrocore 59/-01/78 yielded abundant fragments of bone, tentatively ascribed to the fins and skeleton of a small fish. The muds were considered by Fyfe (op.cit.) to be late Devensian to early Holocene in age. The surface layer of recent sediments is mostly less than 0.5m thick in both sheets, and comprises olive-green sands, sandy muds or muds, rich in foraminifera.

West of Shetland, the sea bed sediments are pale green gravelly carbonate sands, with up to 95% abraded shell sand and gravel, and are locally greater than 1m thick.

7. Conclusions

- 1) The leg was successful in that the two main objectives, ie completion of the Fladen Sheet and reconnaissance mapping of the Fair Isle Sheet, were both achieved.
- 2) Anchoring in very soft mud is still a major difficulty although the good weather alleviated the problem on this leg.
- 3) The officers and crew were helpful and a good working relationship was achieved throughout the cruise.

8. Recommendations

- 1) In view of the poor anchoring ability in areas of very soft mud it may be worth considering "piggy-back" anchoring for future work in south-east Fair Isle and south Bressay Bank.
- 2) Alternatively non-anchor mode vibrocoreing might be attempted in these areas if the system were to be improved.
- 3) In view of the fact that the gravity coring rope parted at the splice on launching in poor weather, its use as a vibrocore hawser for non-anchor mode working should not be contemplated.

TABLE I TIME UTILISATION ANALYSIS

DATE	IN PORT	ON PASSAGE	BETWEEN STATIONS	ANCHORING	ON STATION	DOWNTIME			NO. V/E STATIONS	NO. GS/CS STATIONS	REMARKS
						WEATHER	EQUIP'T	SHIP			
May 27	20	4									
28		6	5.5	7.5	5.0			6	2		
29			13.2	5.9	4.9			6	10		
30			10.5	6.7	6.8			7	12		
31			16	3	5			3	16		
June 1			10.5	7.5	6			6	8		
2			11.1	6.6	6.3			6	12		
3		3	8.6	6.4	6.0			5	17		
4		1.5	10.5	5.8	6.2			6	7		
5			13.4	4.9	5.7			6	4		
6			17.0	2.8	4.2			3	9		
7			11.1	7.8	5.1			5	7		
8		5.9	10.7	3.8	3.6			4	4		
9	17.5	6.5									
TOTAL	37.5	26.9	138.1	68.7	64.8			63	108		
%	11.2	8.0	41.1	20.4	19.3			0.3 hrs/site av anchoring time			

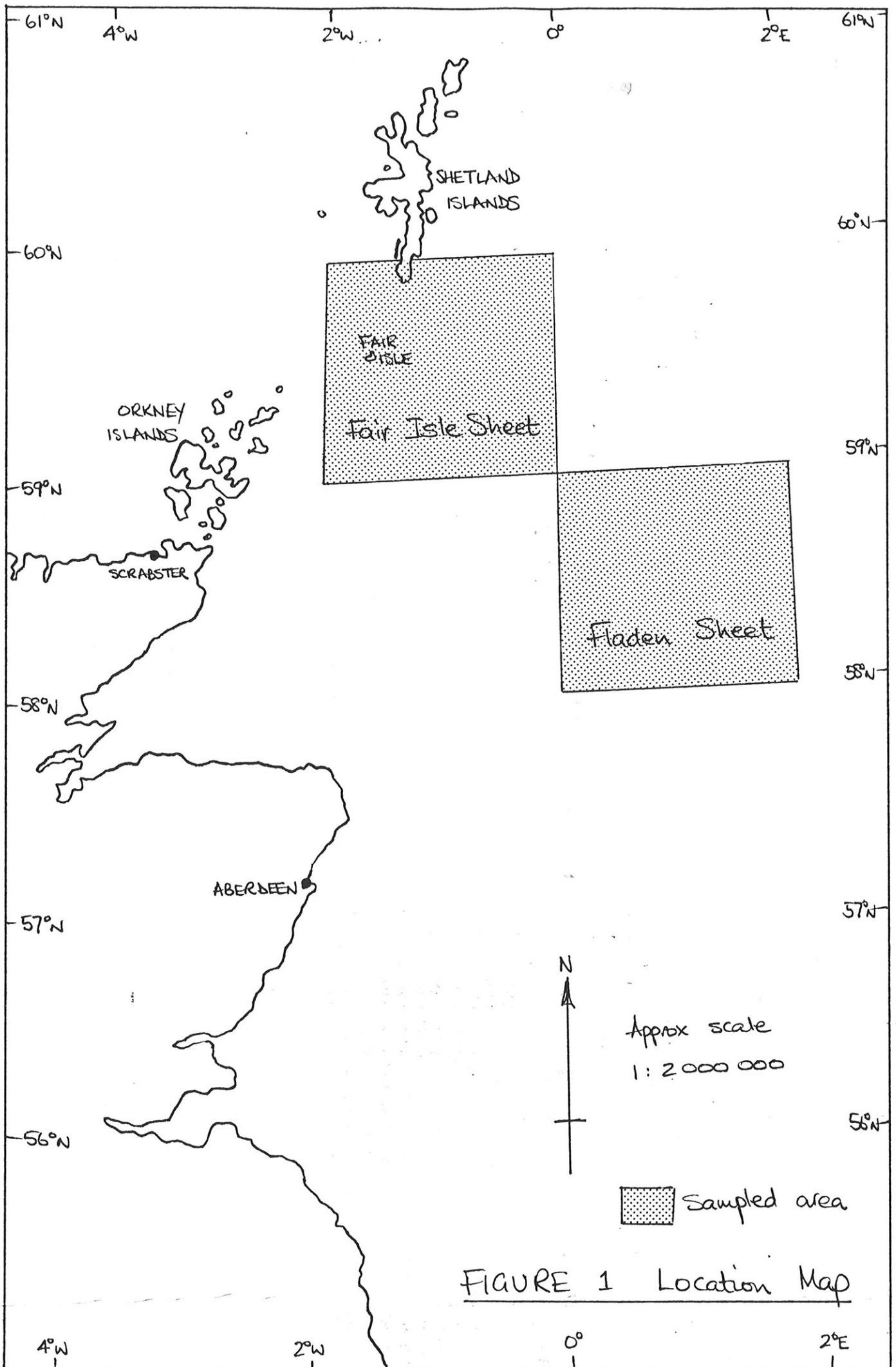


FIGURE 1 Location Map

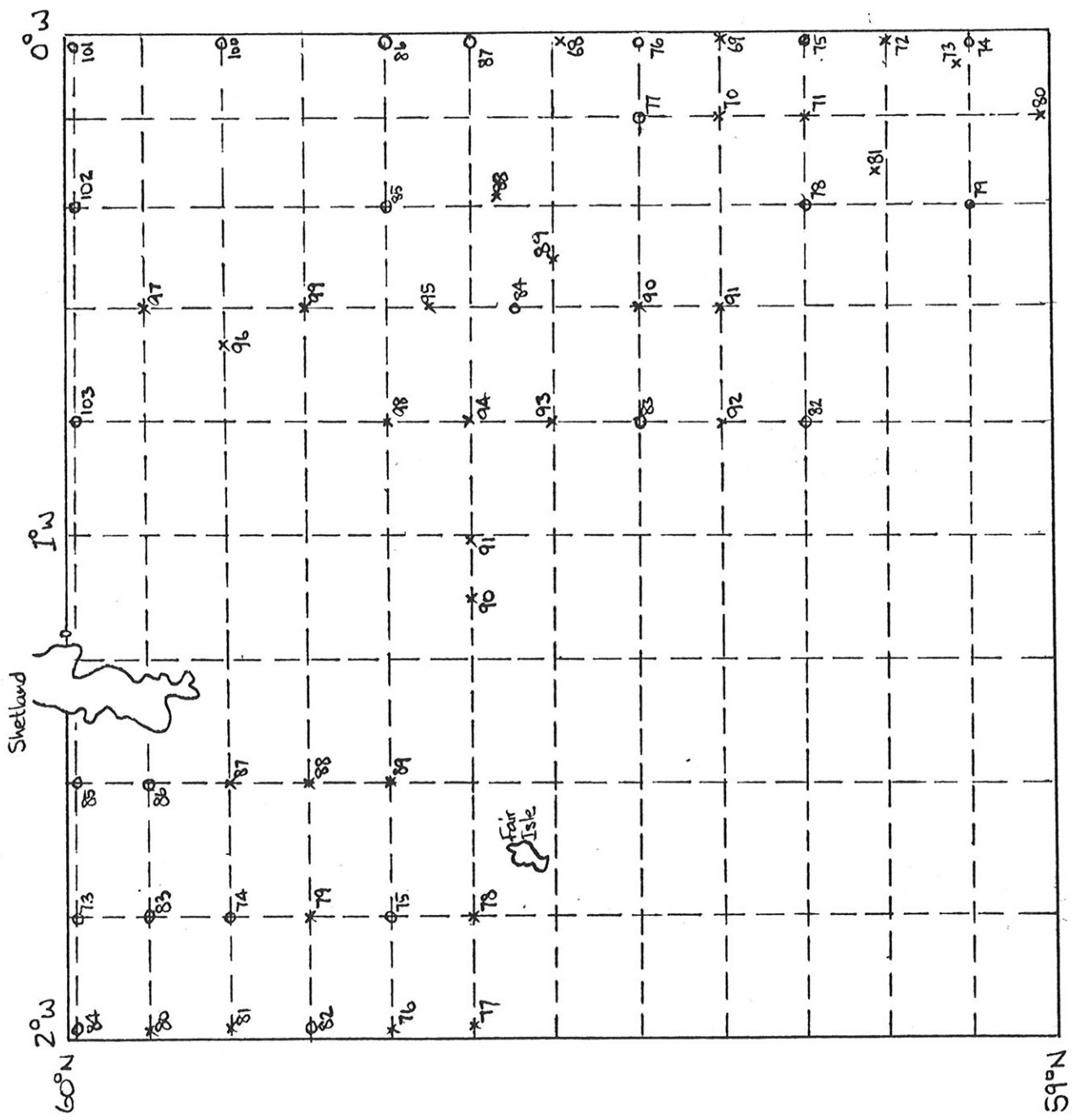


FIG 2 FAIR ISLE. - PROPOSED GEOPHYSICS LINES AND SAMPLE SITES

APPENDICES

APPENDIX I - SURVEY LOG

Thurs 27 May

0001-2000 Alongside at Aberdeen - Routine Port call
2000-2359 On course for Fladen area

Fri 28 May

0001-0600 On course for Fladen area
0600-2200 Vibrocoring, good weather - just as well as anchors not holding well
2200-2359 Gravity coring

Sat 29 May

0001-0530 Gravity coring - total 8 sites overnight
0530-2130 Vibrocoring - good weather, 6 sites
2130-2359 Gravity coring

Sun 30 May

0001-0530 Gravity coring - total 10 sites overnight
0530-2100 Vibrocoring - 7 sites, good weather
2100-2359 Gravity coring

Mon 31 May

0001-0530 Gravity coring - total 11 sites overnight
0530-1300 Vibrocoring in good weather - 3 sites
1300-2359 Start gravity coring in several sites in West Fladen sheets:
5 "day" sites

Tues 1 June

0001-0700 Gravity coring - 12 sites overnight
0700-2300 Vibrocoring - good weather - 6 sites
2300-2359 Gravity coring

Wed 2 June

0001-0730 Gravity coring - 9 sites overnight

0730-2240 Vibrocoring, excellent weather, 6 sites

2240-2359 Gravity coring

Thurs 3 June

0001-0620 Gravity coring - 14 sites overnight

0620-1800 Vibrocoring, excellent weather - 5 sites

1800-2100 Gravity coring - 6 sites

2100-2359 Sailing for Fair Isle area

Fri 4 June

0001-0130 Sailing for Fair Isle area

0130-0630 Gravity coring - 6 sites

0630-2300 Vibrocoring, excellent weather - 6 sites

2300-2359 Gravity coring - 1 site

Sat 5 June

0001-0430 Running Echo Sounder traverse to locate bathymetric deeps identified on Admiralty Chart - unsuccessful

0430-0600 Gravity coring - 1 site

0600-2200 Vibrocoring, good weather but freshening wind on last site - 6 sites

2200-2359 Gravity coring

Sun 6 June

0001-0600 Gravity coring in freshening wind

0600-0730 Sail to vibrocore site to attempt anchoring but sea-state too great

0730-1100 Gravity coring - 2 sites, wind and sea-state steadily deteriorating

1100-1500 Abandon gravity coring in Fair Isle NE area and sail for west of Shetland

1500-2200 Vibrocoring SW of Shetland (Fair Isle Sheet). Last site furthest south, marginal conditions. Gravity core same site - 3 vibrocore sites

2200-2359 Gravity coring Fair Isle NW.

Mon 7 June

0001-0630 Gravity coring SW of Shetland. Marginal conditions in south - lost bomb on launch - total 6 sites overnight

0630-2215 Vibrocoring west of Shetland. Strong tides made weighing anchor difficult in some sites - 5 sites occupied

2215-2359 Gravity coring

Tues 8 June

0001-0600 Gravity coring - 6 sites overnight

0600-1800 Vibrocoring - swell abated, but wind blowing up from E during day

1800-2359 Steaming for Scrabster

Wed 9 June

0001-0630 Steaming for Scrabster

0630-2359 Alongside Scrabster - routine port call - testing drill on quayside etc.

CRUISE NO 82WH05 LEG 05 DATES: FROM 260582 TO 90682

CRUISE AREA FLADEN AND FAIR ISLE

PERSONNEL

Senior scientist	<u>A. FYFE</u>	16	Maint. Techn.	<u>W. LONIE</u>	16
Surveyor	<u>M. PARKIN</u>	32	Night deck	<u>R. SUTHERLAND</u>	32
Day Laboratory	<u>L. JOHNSON</u>	48	Night Lab.	<u>J. CHESHER</u>	48
Day Geologist	<u>D. CAMERON</u>	64	Geochemist	<u>B. VICKERS</u>	64
Deck Technician	<u>P. WIGGINS</u>	80	Other	<u>M. ATKINSON (QMC)</u>	80

SUMMARY ACCOUNT

EXCELLENT WEATHER THROUGHOUT THE LEG ENSURED THAT THE FLADEN SAMPLING WAS OVER AT THE BEGINNING OF THE SECOND WEEK. STRONG WINDS CAUSED SLIGHT CHANGE IN FAIR I

TIME ANALYSIS

% WORKING TIME				% DOWN TIME												'OTHER' Equipment type		
ON PASS	TRAILING	ANCHORING	ON STATION	WEATHER	SHIP				IGS				Drill	Winch	Other			
					PROPEN	POWER	ANCHS	DECK	GS	CAMP G	GRAV C.	VE						
<u>8</u>	<u>4</u>	<u>2</u>	<u>0</u>	<u>19</u>														

RESULTS

Equipment	Shipek G	Camera G	CS	CR	VE (anch)	VE (unanch)	Drill	Other	'OTHER' Equipment (or A/A)	Enter 'A' if 'other' is anchored
No of stations	<u>17</u>	<u>1</u>	<u>108</u>	<u>2</u>	<u>63</u>					

EQUIPMENT PERFORMANCE

Shipek grab PERFORMED WELL, ONE DAMAGED

Camera grab WOULD HAVE BEEN USEFUL ON SEVERAL SITES

Cavity corer PERFORMED WELL, 5FT AND 10FT BARRELS

Vibrocorer PERFORMED WELL

Drills

Winches SHIPEK WINCH DEVELOPED A 'CLUNK'

Other

Ship NO PROBLEMS

GEOLOGICAL SUMMARY

OTHER COMMENTS

ANCHORING PROVED DIFFICULT IN SOFT CLAY, BRUCE ANCHORS MAY BE USEFUL IN SUCH AREAS, IN THE FUTURE, IF 'PIGGY-BACKED'