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Marine Geology Unit
Internal Report

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M. I. A. S.
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(WORMLEY)

Cruise Report on 6th Leg
of
mv WHITETHORN
Cruise 83/02
22 June to 6 July 1983
by
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1. Summary Log

1. INTRODUCTION

(a) Objective

Routine sampling of Dogger, 55/02 and 55/03, in UK waters followed by work on Swallow Hole, 55/00 and 55/01, if possible to complete the cover of both sheets. This followed completion of the reconnaissance grid geophysics cover of both sheets by mv GORSETHORN by 10 June 1983, although further high resolution seismics may be attempted later this year.

(b) Summary

The loss of a week's sampling by WHITETHORN on Leg V due to the mini-submersible successful Boomer recovery followed by a gale made it unlikely that the time loss could be made good on Leg VI. In the event further time was lost on Leg VI due to gales and persistent swell and the necessity of landing Dr Cameron at Whitby on July 4 with a severe attack of shingles. By the end of Leg VI 39 vibrocore sites and 109 gravity core sites remained unsampled on Swallow Hole.

2. PERSONNEL

See Table 2

Miss Dunlop a third year student of the University of North Carolina was carried at the request of Dr McManus of Dundee University where she was on semester. Her cruise was arranged by Dr Fannin to further her interest in soils engineering.

3. Equipment (IGS)

6.10 Vibrocorer system

1.65 m 4" x CS barrel gravity core system and winch.

Shipek grab with winch

4. Ship's performance

Very minor time loss due to anchor wires caught on the sponsons, the Rolls generator fuel supply and anchor winch running were experienced, totalling a down-time of less than 0.5%. Weather downtime was only 6%, though some bad weather and swell conditions were used to move closer inshore for protection from the swell and to be nearer to Whitby, since it became evident that Dr Cameron despite medical advice on the VHF would have to be landed eventually.

The Racal computer - Decca track-plot interfaces performed outstandingly and much reduced the work of the Bridge Surveyor as well as improving siting accuracy and reducing the work of the ship's officers. Direct Lat/Long conversions are a great advance for site positions. The Apple computer carried on Leg V had been taken off.

5. I.G.S. Equipment

(a) Vibrocorer

Good performance throughout with safe routine operation. Still slow penetration ceasing after ca. 1 metre in clean sands or gravels. Core recovery excellent and drilling disturbance generally minor. Minor problems with interference on penetrometer records. On one occasion all the bolts retaining the barrel came free (? vibration or shearing) and a loose barrel had to be recovered which was moderately bent : only 1.1 hours were lost to this recovery and subsequent repairs to the guillotine structure.

(b) Gravity coring

No problems but only 35 recoveries were made in 117 drops due to sand bottoms.

(c) Shipek grab system

Faultless operation with no losses though one drop out of 172 failed to recover a sample.

(d) Core extraction and processing

Routine operation throughout though the electric drive to the VE hydraulic ram failed and the screw was substituted until a direct electric drive to the Rolls

was hooked up allowing the hydraulic ram to resume operation. 4 out of 55 VE cores were not cut, being kept for shoreside processing, as were most G.Ss.

5. Geological Results

(a) Sampling

172 stations were occupied on Leg VI as follows:

	Sheet	Stations	(Total)	CS	GS	VE
Dogger	55/03	12-62	(51)	4	51	11
	55/02	145-208	(64)	12	64	18
Swallow Hole	55/01	97-111	(15)	2	14	6
	55/00	130-171	(42)	17	42	20
TOTALS			172	35	171	55

(b) Findings

(i) DOGGER, waters deeper than 50 metres - see Map 2.

The sea-bed sediments are exclusively of olive grey fine sand with minor finely comminuted shell debris; generally less than 0.4 m thick though rarely to some 1.0 metres. The surface sands rest on a basal shell hash in coarser sand often with whole bivalves thought to represent the base Flandrian transgression. Beneath the shell hash only Quaternary (? Pleistocene) sediments were proved in 10 cored sections from 0.1 to 6.0 metres long. Five sections of clean sand were proved; five of clean mud or clay, one of which had harder than till parameters and may be 'older' Pleistocene; and two sections were respectively of mud with sand laminae and sand with mud laminae. All these cored sections could be attributed to intertidal or supratidal deposition as follows: outer sand flats; sand with mud laminae (inner sand flats); mud with sand laminae (outer mud flats); saltings and fenland (lagoonal) mud and clays. In two of the longer cores several of these facies were represented: as in 55/02/178:

—	shell hash
1.9 m	buttery clay (as Fenland)
4.0 m	clay with clay clasts and rare pebbles and shell fragments
0.2 m +	clean sand

(ii) The Dogger Bank (Waters shallower than 50 m to 20 metre least depths on the southern part of Dogger and the south-east part of Swallow Hole).

Here the sea-bed sediment is fine olive grey sand, generally slightly muddy, to some 0.3 m exceptionally to 1.2 metres. This rests on a basal shell hash as in the deeper water, which is pebbly on Swallow Hole, but an in-variant 0.1 to 0.2 m thick. Beneath the shell hash below an upper burrowed surface only Quaternary deposits were found of which 40 cored sections were obtained: more than one facies in eight of the cores, where burrowing below the interfaces was evident.

The following facies were proved in cored sections:

- (1) 26% sand, shelly with evidence of cross-stratification
— ? outer tidal sand flats or tidal flat channels.
- (2) 7% medium to coarse sands or sandy gravels with subrounded to rounded lithic pebbles — ? beach face deposits.
- (3) 17% Sand with mud laminae — ? inner sand flats with channels.
- (4) 19% mud with sand laminae — ? outer intertidal mud flats.
Mud pellets a notable component of the deposits. In one core these rested on 0.15 m of peat.
- (5) 24% clay or mud often with fine organic clasts and evidence of rootlets — ? salt marsh clays, inner mud flats or fenland (lagoonal) clays. In one core these muds over lay 0.05 m sand with peat fragments on 0.03 m of peat.
- (6) 7% till, medium-grey overconsolidated clay with clasts of lithic pebbles and shell: in one case underlain by mud with sand laminae (softer), and in another beneath normally consolidated mud/clay the upper surface of the till being burrowed.

Units 1 to 5 are all attributable to intertidal deposition which is further indicated in that up to three of these components were found in some cores. Furthermore 2 of the 3 cored sections of till on the Dogger Bank were associated with tidal flat deposits.

In part, but not wholly, these findings suggest that the Dogger Bank Formation, see Geophysics Cruise Report (Geological Findings) 83/GR/03/Leg 2, is in part a till and the finding of original disturbance structures in two cored sections confirms that the Unit contains ice-push structures.

The intertidal deposits varied from soft to hard, in the latter cases often harder than the few over-consolidated tills proved, and as on Farne in 1982 variations in hardness within clays occurred in a single section: such that overconsolidated clays overlay less consolidated material.

(iii) Swallow Hole (water depths 60 to 85 metres)

Sea-bed sediments are generally sands, fine grained and muddy, dark olive-grey with variable amounts of shell debris. However a number of grabs proved sandy gravels and others muddy sands, while two were of muddy gravel. These surface deposits were generally to 0.3 m thick and in extreme cases to 0.8 m; and rested on a pebbly coquina of 50% rounded lithic gravel and angular flints and 50% shell hash. The pebbly coquina, which was always distinct even in sandy gravel and sand sequences, was up to 0.2 m thick and is presumed to represent the Flanderian transgression. Below a weathered or burrowed surface below the pebbly coquina Pleistocene deposits were proved except in one core in the extreme south-west which penetrated yellow-white Chalk below flints.

The following Pleistocene sections were cored (33) :

- (1) 15% Medium to coarse sands (part clean) and sandy gravel — beach face deposits
- (2) 12% sand with mud laminae with evidence of bioturbation and channel reworking — ? inner sand flats
- (3) 18% Clay with sand laminae — ?outer mud flats
- (4) 6% Muds or clays — salt marsh, inner mud flats or fenland (lagoonal) clays.
- (5) 48% Till, red-brown, over consolidated, varying to brown and deep

red, with unsorted clasts of chalk, Permo-Trias redbeds and other lithics.

Unlike the other areas sampled on Leg VI in this region nearly half the cored sections proved till and the other Pleistocene deposits, while all attributable to intertidal disposition, are normally consolidated and thus probably post-till (Late Devensian ?). The wide-spread finding of intertidal, late Pleistocene, sediments indicates that sea-level was down to at least 85 metres during their deposition compared to present mean sea level. During the time of their intertidal deposition the Dogger Bank would have been dry land.

Two cores in area (iii) are particularly noteworthy:

55/00/154

Seabed marine sand	to 0.10 m	Seabed marine sand	to 0.30 m
Pebbly Coquina	to 0.15 m	Pebbly coquina	to 0.35 m
Sand, cross-stratified	to 1.15 m	Sand with clay laminae	to 0.75 m
Clay, soft plastic with occasional sand laminae	to 4.65 m	Clay with sand laminae, firm to stiff	to 2.90 m
		<u>Angular contact</u> with pebbles/shells	to 3.10 m
		Sand with mud, peat and shell clasts	to 3.70 m T.D.

6. Conclusions

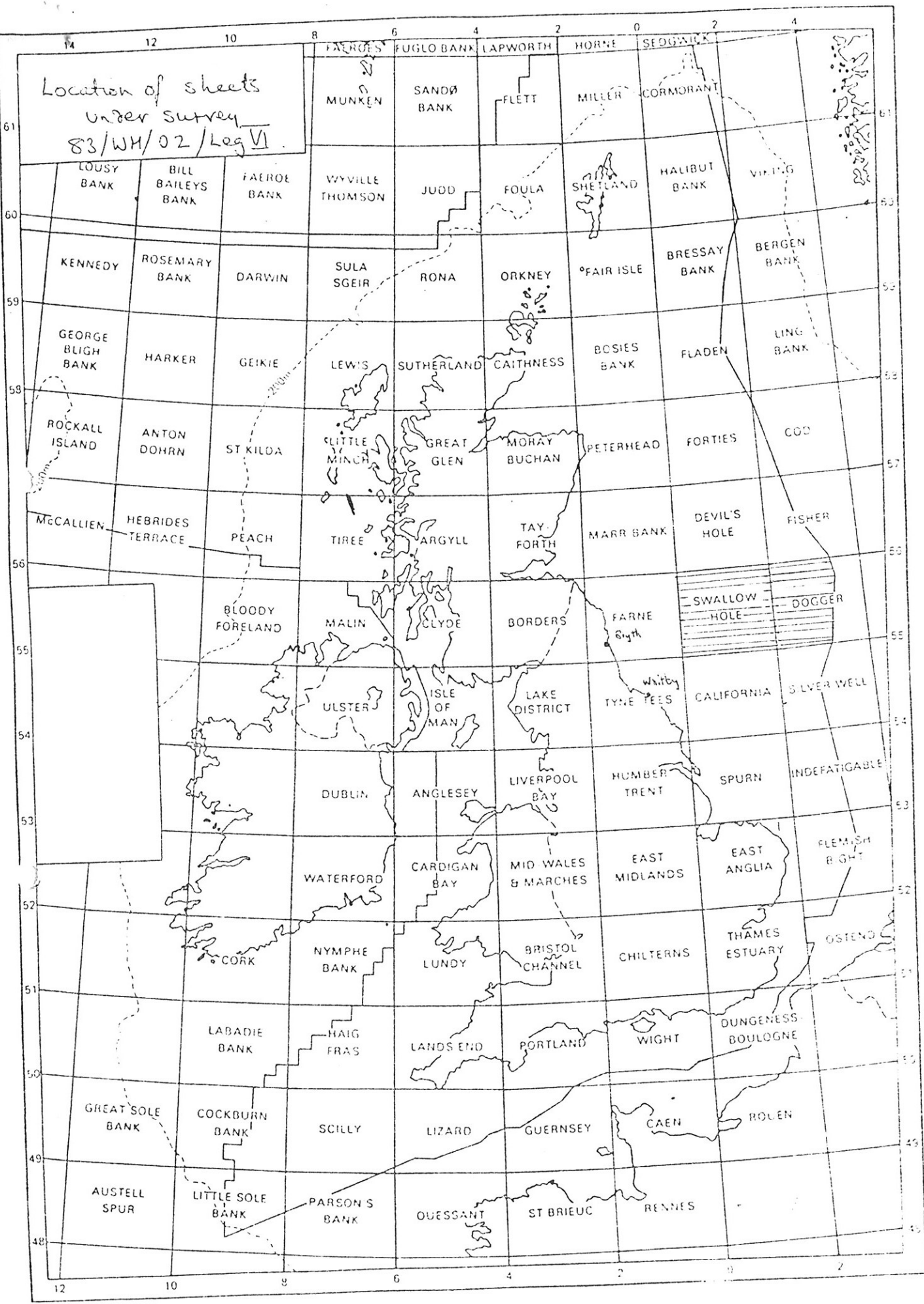
1. Indifferent weather and swell and the necessity to land a sick man delayed completion of Swallow Hole sampling.
2. Both in shallow and deep waters, on and off the Dogger Bank the present seabed deposits are generally sands, with variations only in the west, which rest at some 0.35 m, exceptionally to 1m, on shell hash, which becomes pebbly westwards. Below the shell hash Pleistocene deposits are almost exclusively intertidal in origin even in to 85 m of water though till is commonly found on western Swallow Hole and on rare occasions on the Dogger Bank. These findings suggest that Pleistocene intertidal deposits are disproportionally preserved in relation to possible subaerial or fully marine deposits; though it may be noted that 2 thin sections of peats were cored respectively at 3.5 and 4.0 metres below sea-bed on the Dogger Bank.

(3) The variation of hardness from soft to overconsolidated of the clays sectioned on Dogger suggests that a range of ages of Pleistocene sediments were cored close to sea-bed.

7. Recommendations

1. Some 39 VE/GS sites and 109 GS/GS sites picked remain to be sampled on Swallow Hole: these should take some 8 to 10 days of a leg to sample in good weather.
2. During a further leg devoted largely to Swallow Hole, but also doing some 2 days vibrocoring for Mr Jeffery on Silver Well in the Outer Silver Pit, a multi-site moor should be attempted up the side of the small (? un-named) pit at circa $55^{\circ} 40'N/00^{\circ} 26'E$ on NW Swallow Hole. This pit is similar to the Swallow Pit itself to 159 m on the extreme NW of Swallow Hole, which was sampled by a multi-site moor on 82/WH/05/Leg IX, except that the un-named pit only descended to a maximum depth of 104 metres in a general sea-floor at 75 metres. It is located on the relevant Admiralty Chart.
3. These operations, even allowing for some weather downtime, should complete sampling of Dogger Swallow Hole and Silver Well in a single leg in 1983.

Location of sheets
 under survey
 83/WH/02/Log VI



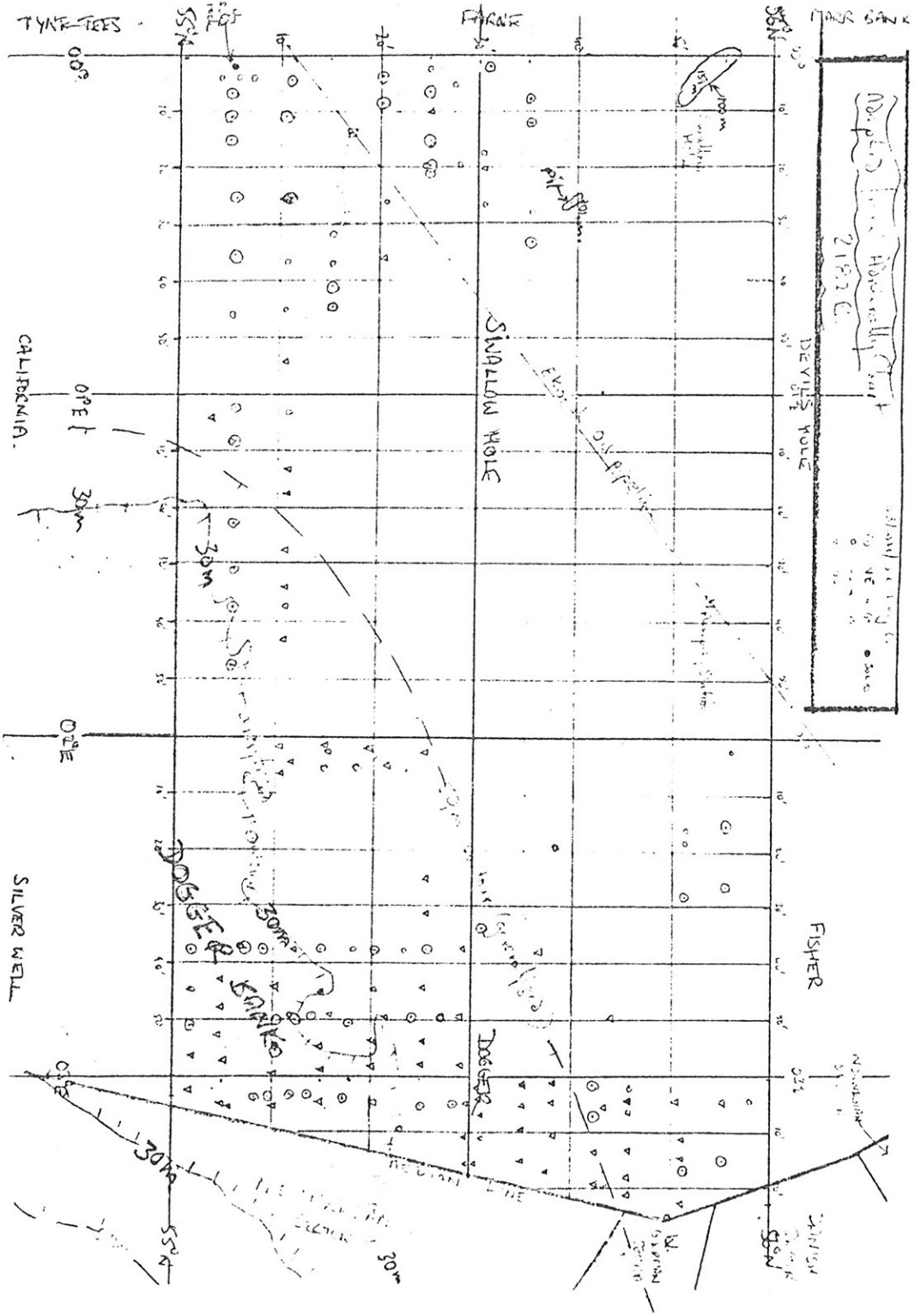


TABLE 1

SHIP: WHITETHORN DATES: June 22 to July 6 LEG NO. 83/02 Leg 6 SHEET NOS. 22/6 to 6/7
1983

	DATE	NOON						NOON						TOTALS			
		W 22/6	Th 23/6	F 24	Sa 25	Su 26	M 27	Tu 28	W 29	Th 30	F 1 Jul	Sa 2	Su 3	M 4	Tu 5	W 6	H
Working Time	In Port	12.0	18.2										3.5		6.0	39.7	11.8
	On Passage		5.8	12.7								6.1	11.1	0.9	6.0	42.6	12.7
	Traversing			5.1	12.3	12.5	10.3	11.4	16.6	16.4	14.9	9.1	11.1	2.6	9.9	132.2	39.3
	Anchoring			2.6	4.2	5.2		3.4	3.1	3.3	4.8	2.8	6.6	2.6	5.5	44.1	13.1
	On Station			3.4	5.6	6.8	6.3	2.1	2.6	4.4	4.4	4.1	3.6	6.3	3.6	6.6	54.3
Down Time	Weather						11.6	6.7				2.4				20.7	6.2
	<u>SHIP</u>																
	Propulsion																
	Power Supply					0.1										0.1	0.03
	Anchoring				0.7						0.2			0.6		1.5	0.4
	Handling Systems																
	Lifeboat Drill			0.15												0.20	0.06
	<u>IGS</u>																
	Camera																
	Grab																
	Gravity Corer																
	Vibrocorer												0.6	0.5		1.1	0.3
	Rock Drill																
Other																	
Winches																	
Power Cables																	
No. of Stations	Grab			7	15	20	18	7	19	21	17	10	15	6	16	171	
	Rock Corer																
	Sediment Corer			1	2	2	1	4	3	1	4	1	6	3	7	35	
	Vibrocorer			4	7	7		3	4	4	6	3	7	3	7	55	
	Drill																
Other						finish	Dogger			X		Start	Swallow Hole				

Complete to nearest 0.1 hour (6 min)

REMARKS

Note (1) visit to Whitby to drop sick man on Monday July 4

Note (2) Sat 2nd July passage west towards shelter from swell
and to close Whitby re landing sick man