

INSTITUTE OF GEOLOGICAL SCIENCES
MARINE GEOLOGY UNIT
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CRUISE REPORT ON THE 13TH LEG
OF WHITETHORN, CRUISE No. 81/WH/08

16th - 30th September, 1981

by
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No. 81/14

30th September, 1981

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1. INTRODUCTION

- a) The objectives of the cruise were twofold. The beginning of the first week was to be spent continuing the basic reconnaissance surface sediment sampling of the northern part of the Sutherland Sheet (Fig. 1 shows location), started in Leg 12 (MGLU Internal Report No. 81/13). The remainder of the time was to be spent surface sediment sampling in the Tiree/Argyll area (See Fig. 1). This was intended to complement the solid sampling to be carried out in Leg 14. The surface sampling in both Sutherland and Tiree areas is part of the IGS regional mapping programme.

- b) Poor weather throughout the cruise meant that fewer sites than had been planned were occupied. Nevertheless, sheltered inshore sites in the Tiree/Argyll area were available to be worked during the day when sampling would otherwise have proved impossible. In all, 117 vibrocore, sediment core and rock core stations were occupied. A Shipek grab was deployed at each station. A survey log is presented in Appendix I while time utilisation analyses are shown in Table I.

- c) Contributors to this report were: Dave Tappin - Summary of Geology and Colin Graham - Recommendation on inshore sampling.

2. PERSONNEL

The following scientific and technical personnel were on board:

<u>Name</u>	<u>IGS Unit</u>	<u>Role</u>
Alan Fyfe	Marine Geology	Senior Geologist
Colin Graham	Marine Geology	Surveyor
Dave Tappin	Marine Geology	Day Geologist
Dick Sutherland	Hydrocarbons	Laboratory
Allan Bell	Marine Geology	Technician - deck operations
Harry Robertson	Marine Geology	Technician - maintenance
Graham Tulloch	Marine Geology	Night Geologist
Andy Britten	Marine Geology	Night deck operations
Mark Ingham	Geochemistry	Geochemist

3. EQUIPMENT

The following IGS equipment was on board and deployed during the cruise:

20 ft. vibrocore system

Gravity core system : 5 ft NX system
: rock coring system

Lebus winch for gravity corer

Shipek grab system including winch

The following equipment was stored on board but not deployed during the cruise:

Back-up vibrocore system

Back-up gravity core system, including 4 bombs

Back-up Shipek grabs, rock and shell dredges

2 Rock (midi-) drills

4. SHIP'S PERFORMANCE

Whitethorn performed well during this leg. In some areas and especially in fresh winds, anchor-holding was poor and this presented problems while using the vibrocorer. Station-holding for gravity core sites was excellent in all but the worst weather. During the second week the Kelvin Hughes radar was out of action. The back-up Seascan radar was of limited use for plotting inshore positions and for anchoring at night in poor weather.

5. IGS EQUIPMENT PERFORMANCE

(a) Vibrocorer system: The 20 ft vibrocorer worked well throughout the leg. The only breakdown occurred when the power cable became entangled in the retraction winch. This was presumably caused by slack cable working down the heaving wire, the slack developing due to cable-streaming in heavy weather while launching.

(b) Gravity corer system: No problems were encountered with the gravity core system and the Lebus winch. Apart from damaged barrels, the only loss occurred when, in stiff substrate, the base-plate bolts sheared and the baseplate, adaptor and barrel were not recovered. During the second week, the sheath on the braided rope frayed through and the corer was held on the braided core. Around 50m of line were lost and the rope had to be respliced.

(c) Shipek grab: One Shipek grab had to be replaced when a knurled bucket-release knob came off. The replacement grab was very stiff to cock (though this eased slightly with use) and the bucket was ill-fitting.

5. GEOLOGICAL RESULTS

a) Equipment deployed during the leg, 117 stations were occupied as follows:

Sheet		Total Stations	Shipek Grab	Vibrocore	Sediment Core	Rock Core
Sutherland	58-06	6	6	1	5	-
	58-05	23	23	10	13	-
Little Minch						
	57-08	2	2	-	2	-
	57-07	7	7	-	7	-
Tiree	56-08	25	25	9	15	1
	56-07	37	37	15	13	9
Argyll	56-06	17	17	-	12	7

b) Summary of Geology

Sutherland Sheet (Figs. 2 and 3)

Sampling revealed a cover of shelly sand and gravel underlain by soft to firm grey brown or grey tills and buttery clays which may represent periglacial deposits. Rarely, eg: 58-05/115 between the glacial and superficial deposits a sand was sampled with a significant component of red-brown lithic and opaque grains. In one instance, 58-05/130, the glacial clays were penetrated and a red sandy mudstone sampled (possibly indicating nearby red-beds). Some of clays, eg: 58-05/216, were dark stained by metal sulphides indicating reducing conditions.

Tiree Area (Figs. 4, 5 and 6)

i) Superficial sediments

The distribution of these is plotted on the map in Fig. 5. The area may be divided, using the Folk Classification into 6 zones:

- A. A central area, south of Tiree and Coll with ?thin shell gravel cover.
- B. An area of shelly sand to the north and south of zone A.
- C. An area of olive grey muds in the north east.
- D. A zone in the south-west of olive coloured clear, fine grained sands.

- E. A north-western area of muddy sands and sandy muds, olive grey to olive with glauconite. A distinctive feature of these sediments is the large number of forams with a chamber infill of glauconite.
- F. An area of fine sands and muds usually olive-grey or dark grey, in Loch Linnhe and its approaches. This area also includes the sediments just to the west of central Mull.

ii) Quaternary

Four main lithologies have been identified and their distribution plotted (Fig. 6).

- A. An olive-grey to grey soft clay, either buttery or slightly silty, with rare exotic clasts (?dropstones) often with dark metal sulphides.
- B. Greenish grey or green soft clays darkened at depths of 3-4m by strong concentrations of metal sulphides.
- C. Green grey to olive clays, muds and muddy sands which have a strong smell of H_2S .
- D. Grey, rarely brown, clays, soft to very firm, occasionally sandy with numerous granule and pebble sized exotic clasts. Rarely overconsolidated.

Lithology A is found in the north east, north west and in Loch Linnhe and its approaches. It possibly represents peri-glacial clay with dropstones from icebergs. Lithologies B and C occur in the central part of the area. Lithology D is found in the south and may represent tills or possibly (again) peri-glacial deposits.

iii) Solid

Three samples of ?solid basalt were sampled using the rock bombs in the area west of Tiree.

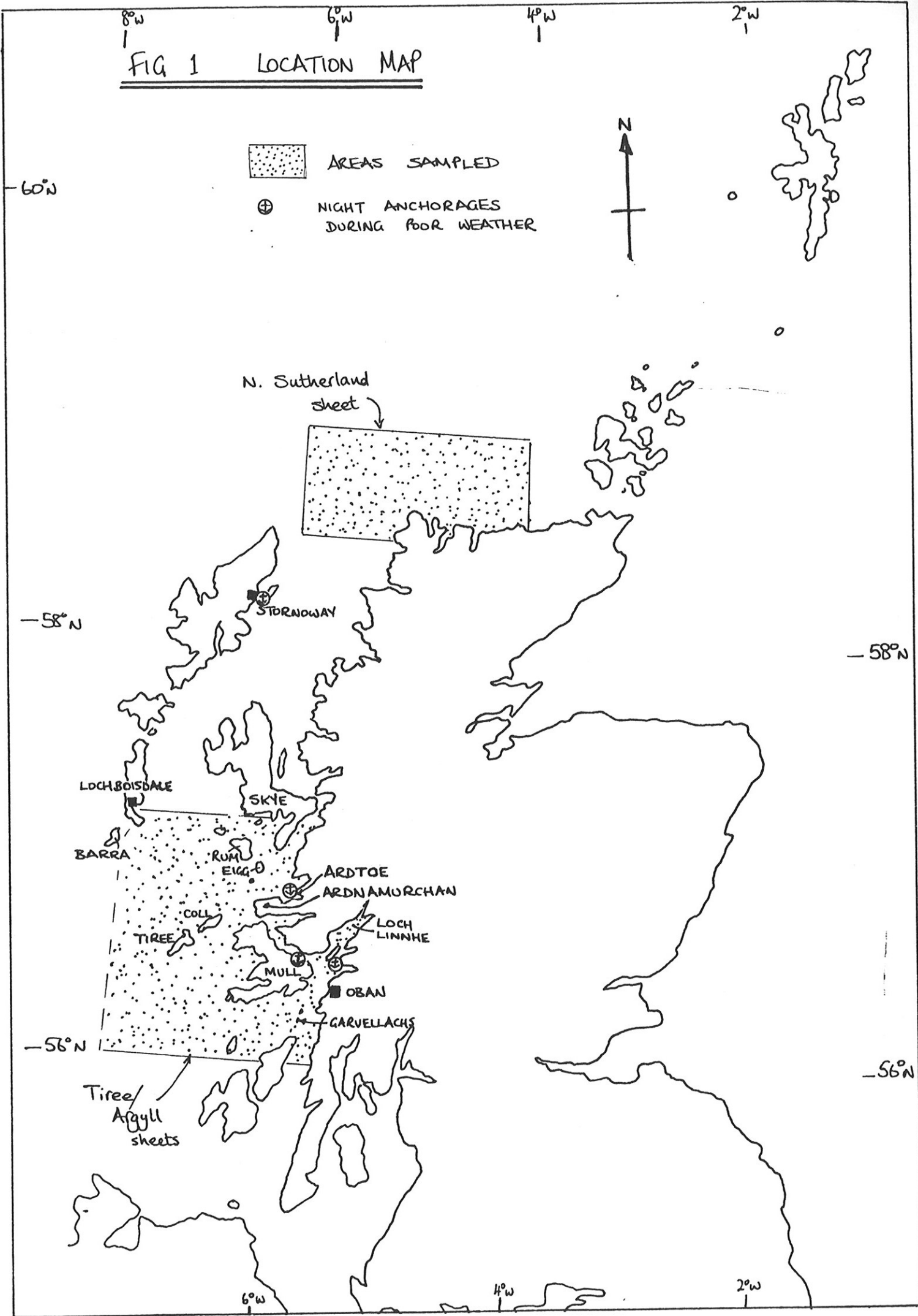
7. CONCLUSIONS

1. The main objectives of the cruise - sampling in the N. Sutherland and Tiree/Argyll areas were not fully achieved due to poor weather.
2. Though poor weather resulted in the loss of around 72 hours working time, 24 of the 31 planned vibrocore stations in the Tiree/Argyll area and all but a few of the sediment gravity core stations were occupied.
3. Though some inshore sites were workable in poor weather during the day difficulties in holding station were encountered and deployment of the rock gravity corer in areas of limited outcrop was largely a waste of time - see below.

8. RECOMMENDATION

The planning and timing of the sampling of inshore rock sites should be given greater priority, because of the accurate navigation and precise ship handling which must be undertaken with little margin for error. As many of the sites are located in areas of shoaling rocks and strong tide races they should only be attempted during times of good visibility, calm weather and slack tides. They should not be treated as merely a stand-by operation to be done in periods of bad weather. Other methods of sampling should also be considered e.g. diving, small-boat survey. Whitethorn is not suited to this type of work as she is too large and unmanoeuvrable. Locally-variable fixed errors and land-effect make Decca mainchain too inaccurate for positioning and location and either radar or transponder navigation should be considered instead.

FIG 1 LOCATION MAP



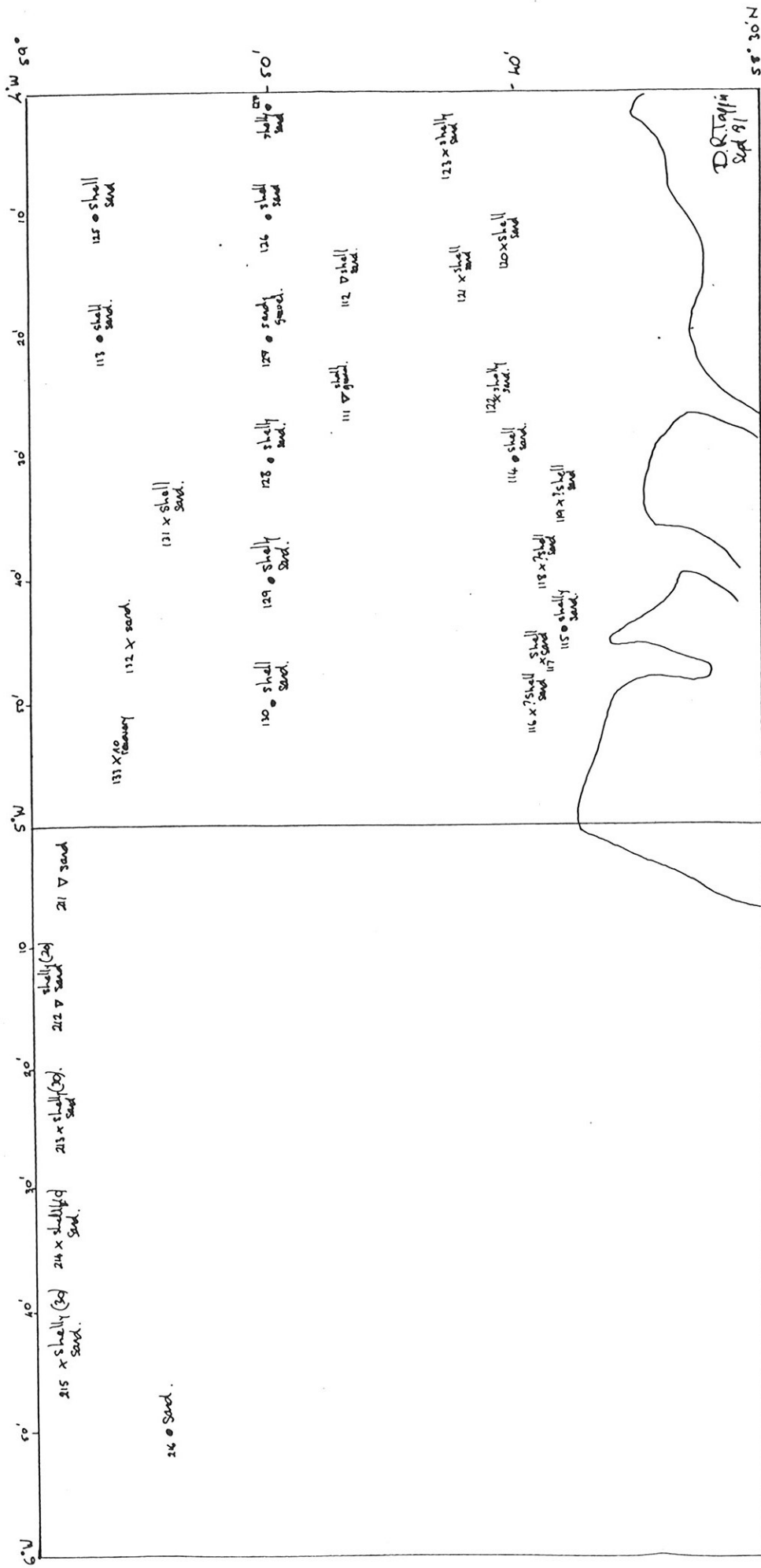


Fig. 2. GRAB SAMPLES. SUTHERLAND SHEET.

KEY	
▽	- GS only
x	- CS, GS
●	- VE, GS

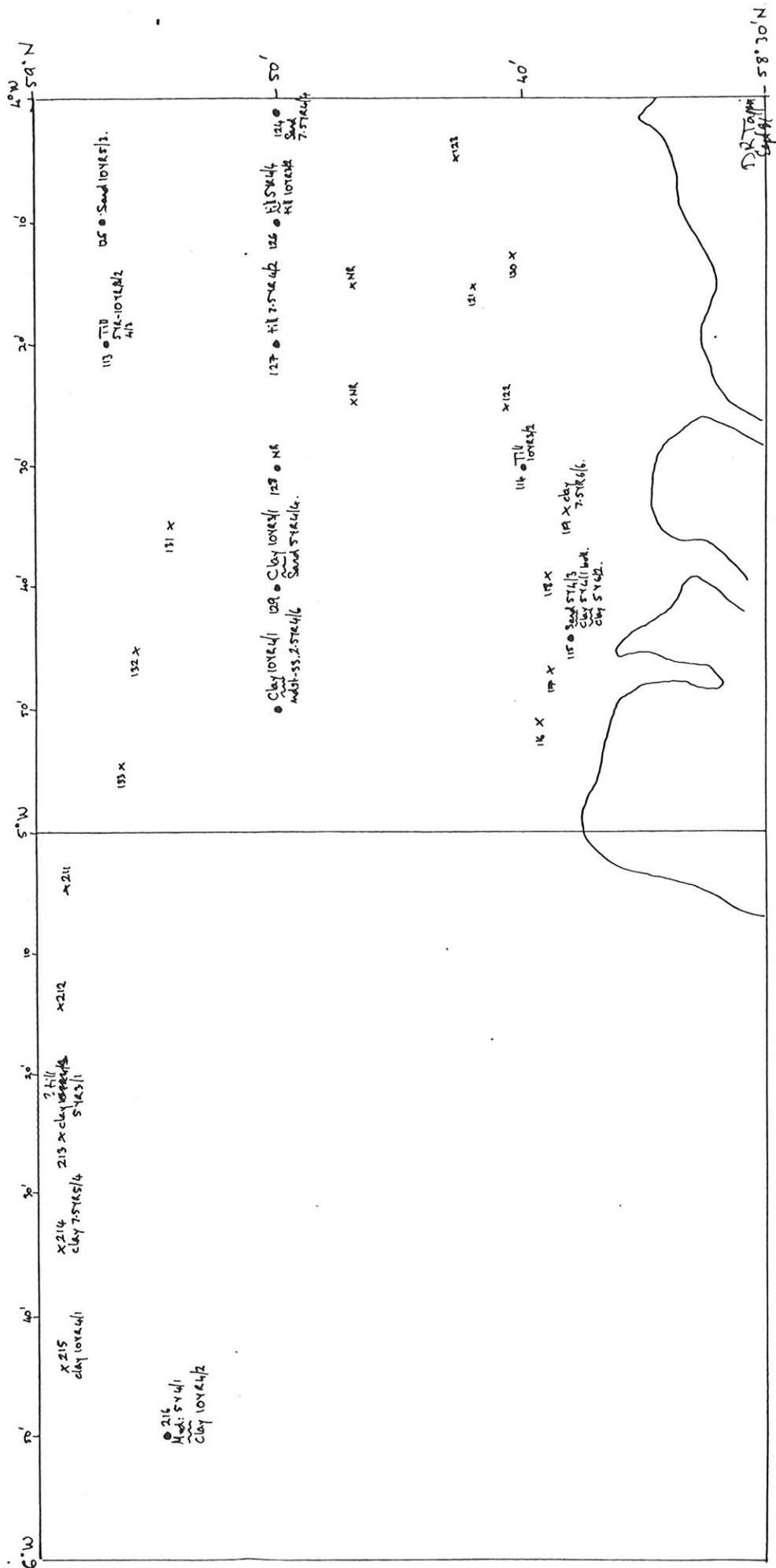


Fig. 3. SUTHERLAND SHEET. SUB-RECENT SAMPLES.

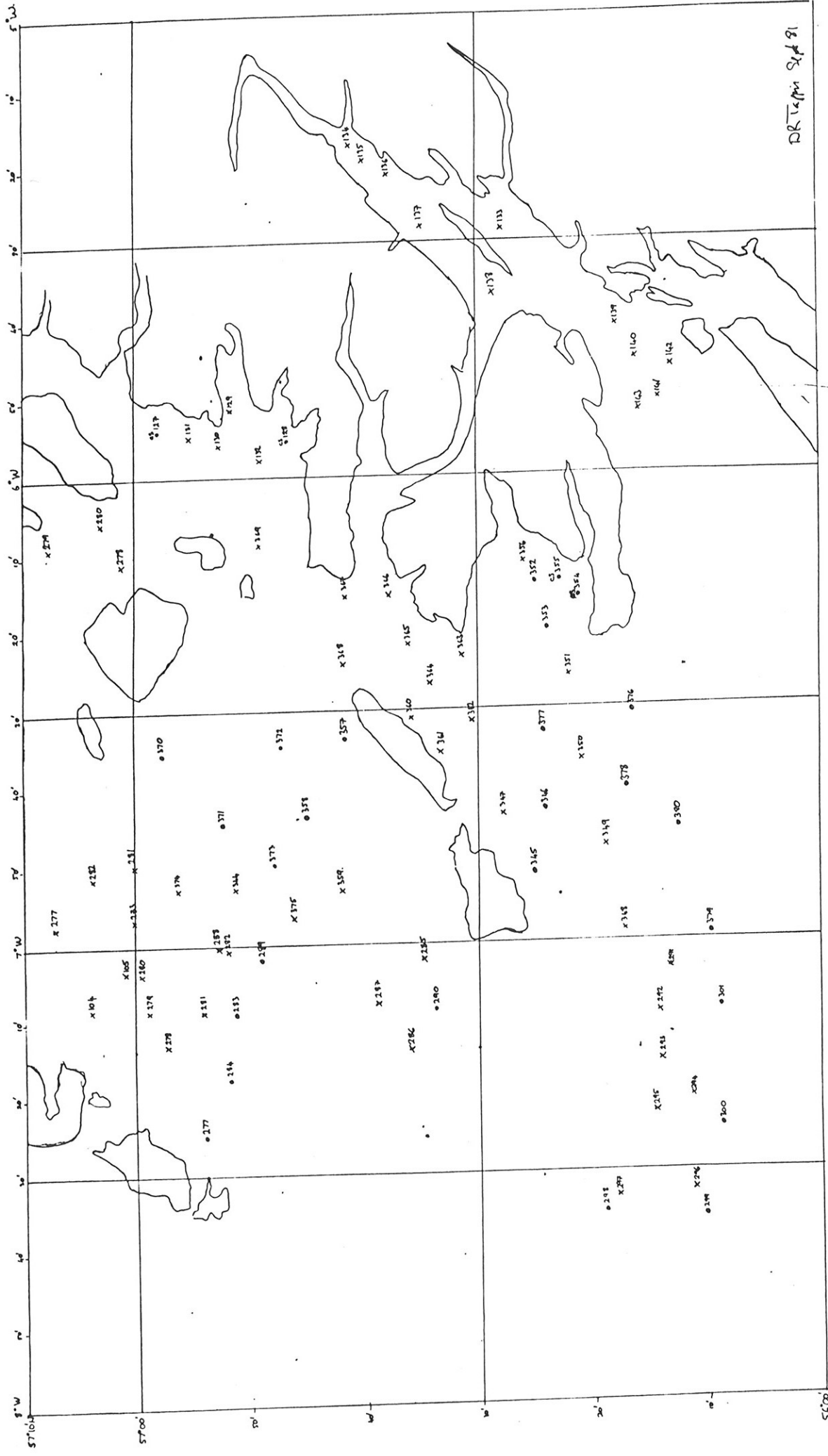


Fig. 4. TIREE AREA SAMPLE POSITIONS.

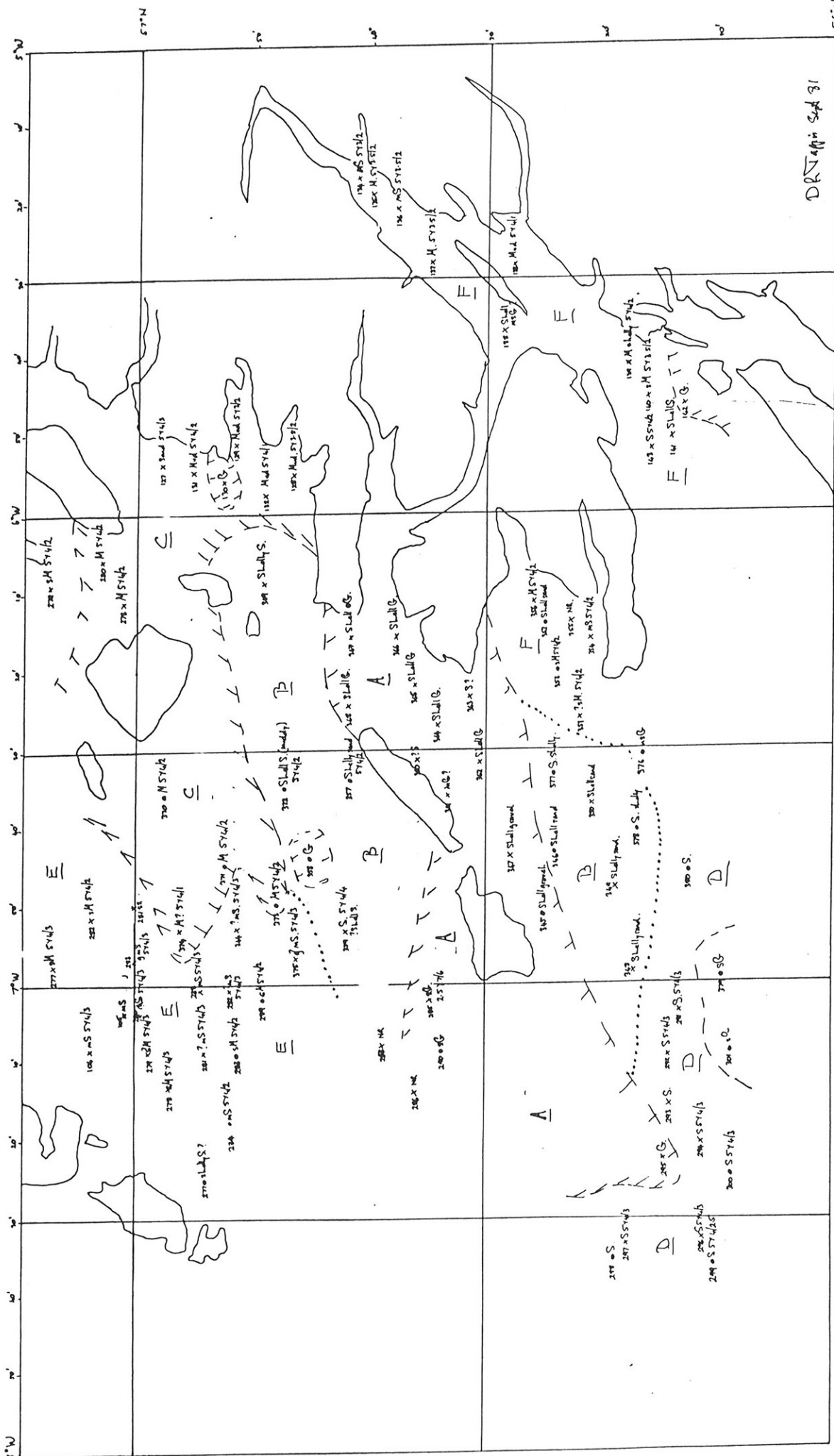


Fig. 5. SUPERFICIAL SEDIMENT DISTRIBUTION

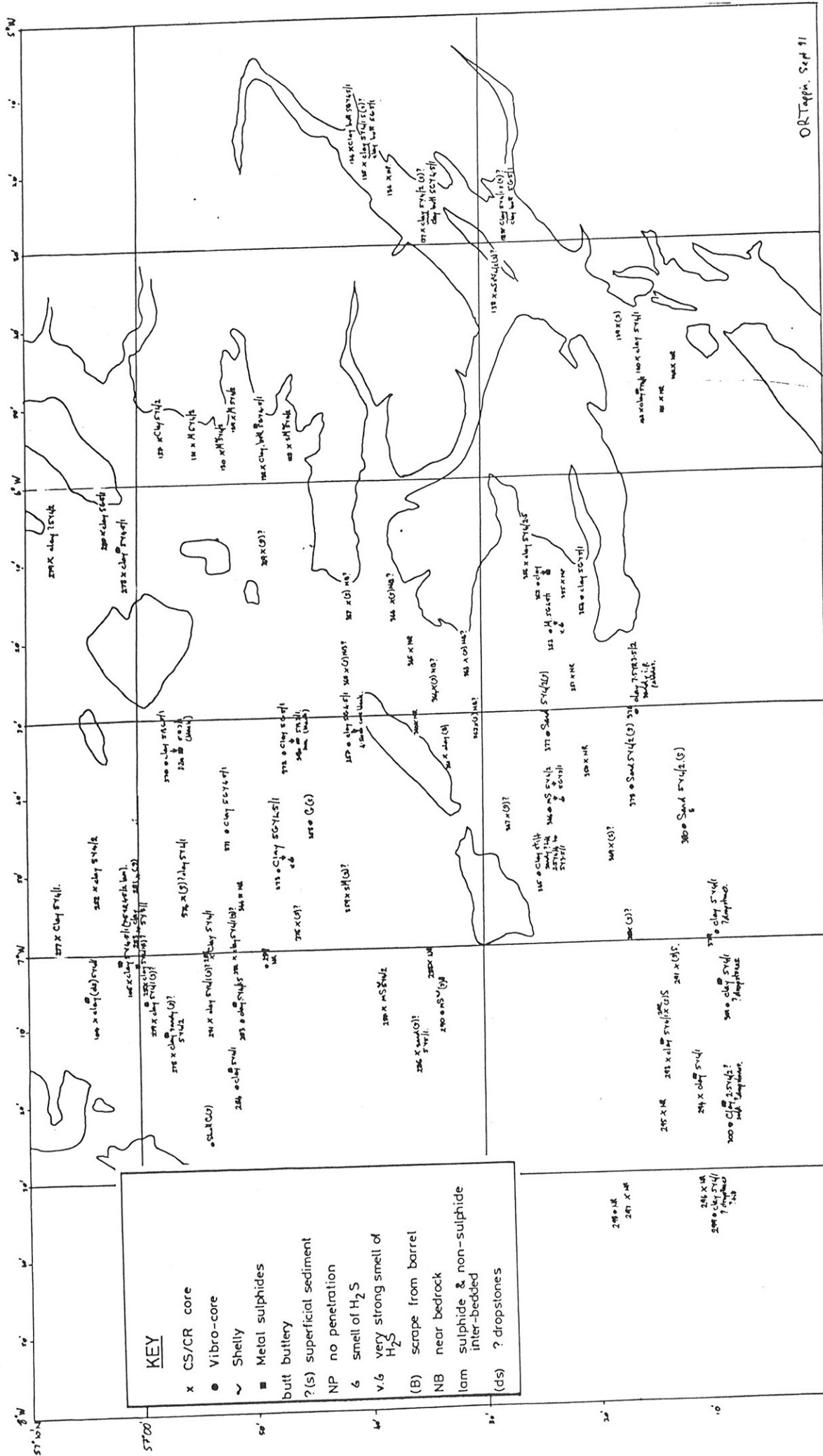


Fig. 6. TIREE AREA QUATERNARY SEDIMENTS

KEY

- x CS/CR core
- Vibro-core
- ~ Shelly
- Metal sulphides
- buttery
- ?(s) superficial sediment
- NP no penetration
- 6 smell of H₂S
- v.6 very strong smell of H₂S
- (B) scrape from barrel
- NB near bedrock
- lam sulphide & non-sulphide inter-bedded
- (ds) ? dropstones

TABLE I TIME UTILISATION ANALYSIS

DATE	IN PORT	ON PASSAGE	BETWEEN STATIONS	ANCHORING	ON STATION	DOWNTIME			NO. VE STATIONS	NO. CS/CR STATIONS	REMARKS
						WEATHER	EQUIP'T	SHIP			
Sept 17	18.0	6.0	8.6	2.8	2.8				3	5	N. Sutherland area
18		2.0						7.8			
19			14.1	4.5	5.4				7	6	
20			6.2	1.3	2.0	14.5			1	7	
21		11.0	3.2	1.0	0.8	8.0			1	2	Steam to Tiree area
22			16.2	4.0	3.8				4	8	
23			16.9	3.0	4.1				4	9	
24			11.2		3.2	9.6				16	
25			10.1	3.5	3.1	7.3			4	6	
26			6.4	1.8	2.0	13.8			2	5	
27			10.3		2.2	11.5				11	
28			12.7	2.1	2.2	7.0			3	3	
29		3.7	11.0	5.2	4.1				6	4	
30	15.5	8.5									
TOTAL %	33.5	31.2	126.9	29.2	35.7	71.7			35	82	117 Sample Stations
	10	9.3	37.8	8.7	10.6	21.3					(0.8 hrs/site average anchoring time)

APPENDIX I

SURVEY LOG

LEG 13 - WHITETHORN12th September - 30th September, 1981Wed 16 Sept

0000-2400 In Stornoway, routine port call

Thurs 17 Sept

0000-1800 In Stornoway, routine port call

1800-2400 Steaming for first night site

Fri 18 Sept

0000-0200 Steaming for first night site

0200-0230 Night operations - GS/CS - 1 site

0230-0500 Stopped for engine repairs

0500-0630 Continue night operations - GS/CS - 1 site

0630-1150 Stopped for engine repairs

1150-2115 Vibrocoring (+GS) Sutherland Northeast - 3 sites occupied.

After first, in northern part of area, wind and sea deteriorated and we came south to occupy inshore sites.

2115-2400 Night operations - GS/CS - 3 sites. Around 2300-2315 several of our number witnessed a display of Aurora borealis with curtains dispersing to a general glow. Interference by moon light ($\frac{3}{4}$ moon).

Sat 19 Sept

0000-0615 Night operations - CS/GS - 5 sites

0615-2215 Vibrocoring (+GS) Sutherland NE 7 sites occupies.

2215-2400 Night operations - 1 site

Sun 20 Sept

0000-0640 Night operations - CS/GS - 6 sites

0640-0930 Occupy 1 vibrocore site in deteriorating weather

0930-1600 Abandon work. Steam for shelter, winds: severe gale 9 - storm force 10, northeast becoming northwest.

1600-2400 Sheltering from NW force 9 in Stornoway Bay

Mon 21 Sept

0000-0800 Sheltering in Stornoway Bay

0800-1600 Steaming to Lochboisdale for shelter to await good weather for sampling on Tiree sheet

1600-1900 Ameliorating weather: steam for vibrocore site Bl

1900-2200 Vibrocoring Tiree NW - 1 site occupied. Another site attempted but anchors not holding

2200-2400 Night operations CS/GS - 2 sites

Tues 22 Sept

0000-0630 Night operations CS/GS - 7 sites

0630-1315 Vibrocoring Tiree NW (2 sites). Attempt site 15 miles SE of Barra but NW wind and sea make anchoring impossible

1315-1915 Steam for site SE of Tiree

1915-2255 Vibrocoring Tiree SE - 2 sites occupied

2255-2400 Night operations CS/GS - 1 site

Wed 23 Sept

0000-0530 Night operations CS/GS - 4 sites

0530-0730 Abandon night operations. Steam to sheltered vibrocore site

0730-1030 Vibrocoring Tiree SE - 2 sites

1030-1310 Weather deteriorating. Gravity sediment coring inshore Mull - 3 sites

1310-1600 Abandon gravity coring. Steam for sheltered sites NE of Ardnamurchan

1600-2105 Weather improved. Steam for vibrocore sites NW of Coll: 2 stations occupied

2105-2400 Night operations: CS/GS - 2 sites

Thurs 24 Sept

0000-0235 Night operations CS/GS - 2 sites no recovery on Shipek
 0235-0715 Abandon operations due to heavy seas. Steam to shelter NE
 of Coll
 0715-1344 Rock gravity coring SE of Coll 9 sites occupied
 1344-2000 Sediment gravity coring inshore Rum, Eigg, Skye, mainland -
 5 sites occupied
 2000-2400 Shelter for night (sites too close to land). Anchor near
 Ardtoe

Fri 25 Sept

0000-0720 Shelter at anchor near Ardtoe
 0720-1100 Continue inshore sediment gravity coring (5 sites)
 1100-2250 Steam west and vibrocore in Tiree NE - 4 sites occupied
 2250-2400 Night operations, CS/GS - 1 site

Sat 26 Sept

0000-0511 Night operations - CS/GS 5 sites
 0511-1045 Vibrocoring Tiree NW - 2 sites
 1045-1300 Freshening NE wind. Steam for sheltered vibrocore sites
 1300-2055 NE gale force winds. Abandon vibrocoring. Steam to Loch
 Linnhe for night anchorage
 2055-2400 Anchored Loch Linnhe

Sun 27 Sept

0000-0630 Anchored Loch Linnhe
 0630-1900 Gravity coring sheltered inshore sites, Loch Linnhe and
 between Mull and the Garvellachs - 11 sites
 1900-2030 Steam for night anchorage
 2030-2400 Anchored Scallastle Bay, Mull

Mon 28 Sept

0000-0700 Anchored Scallastle Bay, Mull, weather ameliorating

0700-1300 Steam west to vibrocore sites
1300-2100 Vibrocoreing Tiree SE - 3 sites
2100-2400 Night operations - 3 sites

Tues 29 Sept

0000-0400 Night operations - 4 sites
0400-0600 Steam to vibrocore site
0600-2020 Vibrocoreing Tiree SW and SE, 6 sites occupied
2020-2400 Steaming to anchor off Oban

Wed 30 Sept

0000-0230 Steaming to anchor off Oban
0230-0700 Lying at anchor
0700-2400 Routine port call Oban