Continental Shelf Northern Unit
Internal Report Series 78/10

Cape Shore Cruise Report

Leg 2

78/CS/06

5 May 1978 - 18 May 1978

by

R Owens

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CAPE SHORE cruise report: Leg 2 (5.5.78-18.5.78)

1. Personnel

R Owens	CSNU	Chief Scientist/geologist (day)
A Skinner	CSNU	Geologist (night)
N Ruckley	CSNU	Navigation (night)
S Paterson	CSNU	Navigation (day)
J McGuigan	CSNU	Laboratory (day)
P Wiggins	CSNU	Technician
N Campbell	CSNU	Laboratory (day)
A Davies	ACU	Laboratory (night)

1.2 Object

The primary purpose of Leg 1 was commencement of the sampling programme in the Cormorant 1:250,000 sheet (61^{o}-62^{o}N; 0^{o}-2^{o}E) area. In the event of weather 'down' time, standby work areas were planned in the Shetland 1:250,000 sheet (60^{o}-61^{o}N; 2^{o}-0^{o}W) area.

Vibrocore sampling was intended as the prime mode of operation, working up to 16 hours per day. At night, or during 'down' time for the vibrocorer, gravity coring stations were planned. Shipek grab samples were required at all stations.

All prime sampling was on a pre-arranged pattern, with sites chosen by the area geologist (A Skinner) following examination of geophysical records. The sites for gravity coring (i.e. night work) were decided following a review of each day's progress and results.

1.3 Equipment

The following operational equipment was available:

i) Vibrocorer - 6m, modified with the fitting of the Aimers McLean 'penetrometer' system.

ii) Gravity corer - useable in sediment or rock coring modes.

iii) Shipek grab

iv) MS47 Transit Sonar

2.1 Cruise Diary

Thursday 4 May 1978

1230	Owens et al aboard in port (Lerwick).
1700	Chesher et al off.
1830	Spooled additional cable to Sykes Winch.
2000	Finished work.

Friday 5 May

2300	Sailed for work area (Cormorant).

Saturday 6 May

0600	In area of first sample station (61+00/3); delay in commencing anchoring owing to errors made with navigation lattices. Sea state 4/5. Large NE swell.
0715	Commenced laying anchors.
0910	Vibrocorer (VE) launched and run.
1000	VE recovered.
1020	Commenced lifting anchors.
1120	Anchors lifted, steaming for next station.
1220	Commenced anchoring on 61+00/4. Sea state 3/4.
1300	Anchors laid and launched VE.
1340	Recovered VE - power cable fault.
1430	Launched VE.
1500	Continued running VE as main warp being tensioned.
1545	Recovered VE.
1600	Commenced lifting anchors.
1650	Anchors lifted; under way to next station.

1745 Commence anchoring on station 61+00/5.

1820 Anchored up.

1830 Launched VE.

1940 VE recovered.

1945 Commenced lifting anchors.

2040 Anchors Up. Stream gravity corer cable to tension whilst moving to first routine sampling station.

Sunday 7 May

0455 Finish routine sampling and steam for first VE station.

0705 Commence laying anchors at 61+00/10.

0800 VE launched (night cable report short circuit on power cable to cable handling winch - repaired by P J Wiggins - conduit needed for protection. A Skinner thinks less than 200m cable on Shipek winch - check.)

0855 VE recovered and barrel removed.

0905 Lifting anchors.

1050 Commenced laying anchors on 61+00/11.

1130 Launched VE. Penetrometer gave appearance of failure.

1250 Commenced VE recovery.

1306 VE recovered.

1315 Commenced lifting anchors.

1400 Under way to 61+00/12.

1440 Commence laying anchors at 61+00/12.

1530 Launched VE.

1545 Power on - VE trips out control board. Recover.

1600 VE on deck. Test cable and locate failure in 7' tail. Replace.

1625 Launched VE, recovered immediately owing to problems with release pin.

1645 Relaunched VE.

1700 Power on, trips out at board.

1730 Test pot on recovery of VE, u/s. Total earth failure. Commence repair by removing pot. Replacement pot on deck tested (megger and power) and found unserviceable. Remove spare from hold and replace in VE.

2000 Repair complete, commence launch.

2030 Power on - working satisfactorily.

2115 VE recovered.

2125 Commence lifting anchors.

2120 Anchors up. Commence running to first night

routine sample station.

Monday 8 May

0030	A Skinner reports loss of gravity corer, complete with 5' NX sediment barrel and 150m of cable. New gravity corer mounted and deployed.
0220	Re-commence routine sampling.
0520	End routine sampling. Procede to first VE site (61+00/18)
0615	Commence anchoring.
0655	VE launched.
0706	VE on;
0745	VE power off.
0800	VE recovered.
0807	Commence lifting anchors. Ship's radio unserviceable.
0840	Anchors home. Sail for next site (61+00/19)
0900	P Wiggins/R Owens test penetrometer system - unserviceable. Dismount for further examination.
0920	Commence anchoring at 61+00/19.
1010	Launched VE.
1110	VE recovered.
1115	Commence lifting anchors.
1155	Anchors up; steam for next station.
1240	Commence anchoring at 61+00/20.
1325	Launched VE.
1420	VE recovered.
1425	Commence lifting anchors.
1515	Anchors up; steam for next station.
1605	VE launched.
1745	VE recovered.
1750	Commence recovering anchors.
1810	Anchors recovered, steam for next station.
1830	Commence anchoring at 61+00/22.
1850	Anchored.
1855	VE launched.
1945	VE recovered.
2000	Commence recovering anchors.
2045	Anchors up. Steam for first routine sampling night station.

Tuesday 9 May

0530	A Skinner reports only remaining NX gravity corer

baseplate now unserviceable. 4" x 5' barrel mounted.

0615 Commenced anchoring at station 61+00/31.

0655 VE launched.

0750 VE recovered.

0805 Commenced recovering anchors.

0840 Anchors home, steaming.

0925 Commenced anchoring at station 61+00/32.

0955 VE launched.

1050 VE recovered.

1100 Commenced recovering anchors. P Wiggins splicing additional 6mm cable onto Shipek winch.

1140 Anchors home, steaming.

1225 Anchoring at station 61+00/33.

1300 VE launched. Shipek winch fails, ship's engineer attempting repair. NB Since VE station 61+00/21 the VE has been launched without the tugger winch, using the main warp, 'A' frame and bowsing lines to the capstan winches. The main winch has also been speeded up approx. x2, considerably improving VE launch and recovery times.

1350 VE recovery.

1450 Anchors recovered. Delay in receiving bow anchor due to trial of new spooling method.

1535 Anchoring at station 61+00/34.

1610 VE launched.

1700 VE recovered.

1740 Anchors recovered and steaming.

1815 Anchoring at 61+00/35.

1847 VE launched.

1950 VE recovered, guillotine damaged. P Wiggins repairing.

2000 Heaving anchors.

2025 Anchors home. Steaming slowly with head to sea while P Wiggins repairs guillotine on VE.

2136 Repairs complete, steam for first routine sampling site.

2200 Shipek winch fails, not considered repairable on board at sea. Alternative arrangements will be made tomorrow.

Wednesday 10 May

0438 Gravity corer cable stranded and corer almost lost.

0615 Commenced anchoring at 61+00/43.

0650 VE launched.

0745 VE recovered.

0755 Commenced lifting anchors.

0830 Steaming for next station.

0915 Anchoring at 61+00/44.

0950 VE launched.

1030 VE recovered.

1110 Anchors home, steaming.

1155 Commence anchoring at station 61+00/45.

1225 VE launched.

1230 Shipek winch repaired, with reduced speed.

1320 VE recovery.

1400 Anchors home, steaming.

1445 Commence anchoring at station 61+00/46.

1510 VE launched.

1600 VE recovered. Problem with core extraction.

1645 Anchors home, steaming.

1725 Anchoring at 61+00/47.

1755 VE launched.

1835 VE recovered.

1925 Anchors home, steaming for first night routine sampling station.

1950 Commence routine sampling.

Thursday 11 May

0230 Routine sampling terminated owing to weather deteriorating (southerly 7,,heavy swell).

0500 Weather southerly 7/8, rough sea and heavy swell.

0630 Forecast Fair Isle S/SW, inc. 7 at times. Course 190° hoping to make Shetlands for radio call (VHF link to N Fannin) and shelter.

0800 Force 8 winds, heavy swell.

1830 4 miles N of Out Skerries, call shore liaison officer (N Fannin) and report position, work and deficiencies, particularly re: vibrocorer and NX baseplates.

1900 Commence preparation for night working gravity coring and grabbing in Shetland NE (60.5°N; 1°W).

Friday 12 May

0600 A Skinner reports: a) outer ring of gravity corer trough damaged (severed) at 0030 hours, coring suspended; b) Shipek winch emitted smoke at 0500 hours. Engineer examined and pronounced

possible terminal failure. Smoking did not recur with continued use.

0633 Forecast Viking/Forties 5 or 6 in E at first, else variable 4; Fair Isle SW veering NW5, inc. 6-7. Decided to work VE sites on Shetland SE sheet. Possibly out to Halibut SW.

0745 Commenced anchoring at 60-01/305.

0825 Launched VE.

0830 Discovered VE cable (power) severed by passing through gap between aft roller and deck. Delay while replacing.

1012 VE recovered.

1035 Commenced lifting anchors.

1125 Anchors home, steaming.

1250 Commence anchoring at 60-01/306.

1330 Launched VE.

1355 Forecast Viking S 7; Fair Isle N 5 or 6.

1425 VE recovered.

1500 Anchors up. Steaming.

1620 Commence anchoring at 60-01/307. Decca problems.

1745 VE recovered.

1840 Anchors up; steaming; forecast Viking S 4 (5 or 6); Fair Isle W or NW 5/6 inc. 7-8.

1920 Anchoring at 60-01/308.

1940 VE launched.

2025 VE recovered.

2115 Anchors up. Steaming for start of night routine sampling. Plan to sample up 5'E from 60°30'-61°N. If weather alright at 0630 will be at ~61°N; 0°10'E.

Saturday 13 May

0600 A Skinner reports outer retaining ring of gravity corer trough damaged and removed.

0633 Forecast Viking E/SE 4 in east, elsewhere 3 or less; Fair Ilse N veering S later E 4 or 5.

0700 Commence anchoring at station 61+00/52.

0730 Launched VE.

0820 VE recovered.

0840 Anchors up, steaming.

0920 Commence anchoring at station 61+00/53.

0955 VE launched.

1040 VE recovered, power cable severed bear pot.

1120 Anchors up, steaming.

1150 Commence anchoring at 61+00/54.

1230 VE launched.

1305 VE recovered. No core as guillotine tripped before reaching seabed; relaunch.

1420 VE recovered.

1512 Anchors up, steaming.

1620 Commence anchoring at 61+00/55.

1700 VE launched.

1810 VE recovered.

1900 Anchors up, commence steaming.

1930 Steaming v. slowly to allow a) ship repairs to starboard aft fairlead, b) gravity core chute repairs. Also removed 30m of stranded gravity core (13mm) cable and re-made eye.

2145 Proceding to start of night routine sampling.

NB P Wiggins advises that the Kevlar VE power cables absorb water over a large length when broken underwater.

Sunday 14 May

0600 A Skinner reports a) only 230m of cable now useable on gravity coring winch, b) Shipek winch unseable, c) a weld on the gravity corer trough has broken.

0630 Commence anchoring at station 61+00/63.

0705 VE Launched.

0800 VE recovered.

0855 Anchors up, steaming.

0945 Commenced anchoring at station 61+00/64.

1020 Launched VE. Examined gravity corer cable, found spare cable (Brunton's) too weak and removed remaining 80m.

1100 Ship's engineer reports Shipek winch now functional.

1115 VE recovered, cable damaged. Cable replaced.

1150 VE launched .

1245 VE recovered.

1320 Anchors up, steaming.

1445 Anchoring at 61+00/65.

1510 VE launched,

1650 VE recovered. Delay on this station due to problems encountered with loading new wire onto gravity corer winch.

1725 Anchors up, steaming.

1755 Commence anchoring at 61+00/66.

1825 VE launched.

2000 VE recovered; delay caused by repair work to gravity corer trough.

2055 Anchors up, steaming for first routine sampling station.

Monday 15 May

0600 A Skinner reports front ring of gravity corer trough lost at 0200 hours, when gravity coring was halted and shift continued Shipek grabbing only.

0615 Commenced anchoring at station 61+00/74.

0650 VE launched.

0750 VE recovered.

0825 Anchors up and steaming.

0920 Anchoring at 61+00/75.

0955 VE launched.

1105 VE recovered.

1145 Anchors up and steaming.

1230 Anchoring at 61+00/76.

1300 VE launched.

1310 VE failed to function.

1340 VE recovered after tests.

1425 VE re-launched after replacing power cable.

1510 VE recovered.

1555 Anchors up and steaming.

1635 Anchoring up at 61+00/77 ($61^{o}38.0'N$ $00^{o}22.2'E$)

1700 VE launched.

1750 Commenced VE recovery. Lifting warp snapped immediately strain came on, falling onto deck. No injuries. VE lost in 204m water. Power cable still attached and functional. Decca readings logged (1800-2020 hours).

1900 Commenced grappling with ship's grapnel; P Wiggins making up a more substantial grappling tool. (NB IGS should carry a range of 'fishing' tools on all offshore cruises).

2040 Ship's grapnel lost.

2100 Commenced fishing with grapnel fashioned by P Wiggins.

2200 Power cable snagged and parted - almost 100% recovered, plus bent ship's grapnel. P Wiggins commences final stage of replacing damaged gravity corer trough.

2240 Agreed 'fishing' work to continue through night. P Wiggins repairing gravity corer trough to 2400 hours.

Tuesday 16 May

0000 Grapnel caught, held then gave on lifting. On

recovering found traces of vibrocorer paint and one fluke of grapnel missing. (This was made of 1¼" high tensile steel). P Wiggins welded on additional flukes and continued repairs to gravity corer trough. Resumed fishing.

1000 Checked safe working load and breaking strain of our 6 x 19;18mm vibrocorer cable (Reeds' Nautical Almanac, p 853 and ship's officers). Calculations for flexible steel wire rope (6 x 24; 18mm being the nearest upward approximation) indicate the safe working load of our warp to be less than 2.2t and the breaking strain less than 13t. At the sample station prior to the loss (61+00/74) the mean shear strength of the sediment was measured at 56kN/m^2. Assuming the remoulded shear strength to be 50%, the pull required to remove the barrel from the seabed is likely to be of the order of 5t. Added to this must be the weight of the pot + barrel (~0.75t), the weight of 200m of 18mm cable (~0.5t) and the pull necessary to break the sediment column. The total, on these rough estimates alone, is of the order of 50% of the breaking strain of the warp.

To attain a safe working load of 5t, a wire rope of 27mm dia. would be required.

Added to the above must be the suspicion that the cheeks of the main sheave on the "A" frame are sharp and could fray a warp.

In summary, the entire aspect of vibrocore loadings etc. required urgent review.

1130 Cease grappling for vibrocorer.

1140 Commence raising anchors.

1205 Anchors up, proceeding to start of gravity coring grid at 61° 48.8'N; 00° 05'E. P Wiggins continuing preparation of gravity corer trough.

1335 Commenced gravity coring.

Wednesday 17 May

1100 Delayed on station due to improperly made gravity corer base plate causing difficulty in fitting barrel.

1120 Resumed sampling.

1425 Outer ring of gravity corer chute breaks. P Wiggins commences repairs. NB a) the metal is only 4mm thick in the tubing used; this appears inadequate, b) the unlaying problem with the gravity corer warp appears to have been resolved by removing the swivel.

2115 A Skinner reports signs of "blowing" cylinder head gasket on Sykes winch. Confirmed on inspection by P Wiggins; oil seen in cooling water. Winch shut down.

There being no useable sampling equipment

remaining, we set sail for Lerwick from 61°N, 00°E at 2120 hours.

Thursday 19 May

0600	Docked at Lerwick.
0930	Commenced extracting VE from hold and erecting on deck.
1730	D Evans et al aboard.
1830	R Owens et al disembark.

2.2 Results

A total of 138 sample stations were occupied (Fig. 1).

The numerical distribution was:

	Total No. of stations	Equipment used on stations		
		Vibrocorer	Gravity Corer	Shipek Grab
Cormorant	114	33	72	58
Shetland	17	4	5	16
Halibut Bank	7	-	3	7

Within the prime work area, 111 stations were occupied in the Cormorant SW (1:100,000 scale) sheet area and 3 in Cormorant SE area.

The samples taken were geologically logged and, where cores of suitable sediment were taken, shear strengths (hand vane) and unconfined compresive strengths (pocket penetrometer) were measured. Eh and pH determinations were made on the grab samples and at 1m intervals down all suitable cores.

~~Subsamples were taken, from grab samples, for micro-~~ palaeotnological and geochemical examination. Live macro-fauna encountered were preserved in a solution of Formalin.

Sketch maps of the main geological parameters recorded

were drawn up and incremented with each sample station.

The following observations are based mainly on the visual assessments made and, particularly in the case of the cores, may be subject to considerable revision following more rigorous laboratory examination.

The superficial sediments in the area sampled (Fig. 2) are of a uniform character, with fine-medium quartzose sand dominant over most of the area. In the shallower water at the south of the area (approx. 130m) an area of medium-coarse shelly sand was encountered. Between $61^{o}21'N$ and $61^{o}40'N$ there is evidence for a zone of more gravelly sand, with lithic clasts up to pebble grade. The evidence for the patches of muddy sediment is based on the tops of core samples and may indicate that the superficial layer has been lost during recovery.

One suprising feature was the absence of a noticeable trend to finer superficial sediments with progression from the shallower water in the south of the area (mean depth approx. 140m) to the deeper water at the north (mean depth 375m).

A distinct northward decreasing trend is seen in the total carbonate content of the superficial sediments (Fig. 3).

Below $61^{o}10'N$ the percentage of carbonate generally exceeds 20%, with values up to 75% (and possibly 90% in an incomplete sample). From $61^{o}10'N$ (approx) to

$61^{o}20'N$ (approx.) the carbonate value decreased from 20% to 10%. North of $61^{o}20'N$ the carbonate value is generally less than 10%, with the exception of an ill-defined area where percentages range from 10% to 25%.

Overall, it would appear that the carbonate content of the superficial sediment shows a relationship to water depth, with high values generally occurring in the shallower water.

Core examination, particularly of vibrocores, revealed two interesting aspects of the area sampled. In Cormorant SW 75% of the area contains an extremely till-like sediment subcropping under the superficial sediment layer (Fig. 4). It is characteristically dark greyish brown in colour, matrix dominant with clasts to 40mm size recorded. Unconfined conpressive strengths in excess of 500 kN/m^2 are recorded and the sediment appears to have a very low moisture content, both indicating a considerable degree of overconsolidation. Striated clasts were occasionally found. Overall, the characteristics are those of a terrestrial, rather than glaciomarine, till.

Cores taken in the remainder of the area sampled were characterised by length (commonly 5-6m) and comprised slightly silty clay subcropping under a thin (0.1-0.2m) superficial sediment layer. Commonly, the clay was almost black (Munsel colour Dark Grey 5Y4/1) and reacted with hydrochloric acid to give a distinct odour of

Hydrogen Sulphide. Through most of their length the cores were overconsolidated, with unconfined compressive strengths occasionally exceeding 500 kN/m^2. Occasional clasts and shell fragments were found.

The overall lithologies are similar to that of the post-glacial Witch Ground Beds, with the notable exception of the presence of overconsolidation. Radio-carbon dating of the top 5m of these sediments may be possible owing to the occurrence of significant quantities of shell material, for example, in core 61+00/76 where both valves of an almost intact Chlamys sp. mollusc were found at 5.73m.

During the time spent in the stand-by work area, (Shetland SW) attention was concentrated on areas of a "pink clay" mapped as occurring in disconnected patches beneath a layer of superficial sediments. Vibrocorer stations 60-01/305 to 308 were sited in an attempt to locate this sediment in areas where is was mapped as absent. Three of the sites proved a reddish grey till, possibly a terrestrial till. At the remaining site a reddish-grey mud was found.

On the basis of this evidence it is suggested that the "pink clay", or its equivalent, forms a continuous subcrop beneath the superficial sediments of this area. Mapping in the areas between the proven occurrences of the "pink clay", has largely been based on gravity corer data. These data are probably incomplete owing to the failure of the gravity corer to completely penetrate the upper

superficial sediment layer.

3. Equipment Performance

3.1 General

The success of this leg of the cruise was constantly jeopardised by damage to, or failure of, equipment, both ship's and IGS. As can be seen from the cruise diary, the effort and competence of the technician (P Wiggins) ensured running repairs to IGS equipment were made, keeping the sampling operation going without recourse to port calls.

The following observations and comments are made:

3.2 Vibrocorer

The 6m electric vibrocorer was modified by the addition of a penetration indication ("penetrometer") system. The proximity switch on which the system was based was delivered to IGS at Edinburgh late on 3.5.78, with the result that problems encountered when fitting it to the vibrocorer on 5.5.78 caused an eleven hour delay in sailing. Extensive modifications were required to a) mount the proximity device and b) render the system operational when mounted.

In operation the penetrometer proved to be an unknown quantity. The heart of the system was the proximity switch, actuated by four equally spaced radial ridges on a pulley wheel, which in turn was driven by a cord attached to the vibrocorer pot. The proximity switch was found to make and break each time its field of sensitivity

was entered or left. Calibration of the counting device was made by running the pot up and down the full length of the frame to simulate coring and retraction.

When in use on the seabed, it was found the counter readings considerably exceeded those readings calibrated as full penetration and has no discernable relationship to actual penetration achieved (with one exception - see below).

It was concluded that the effect of vibration in operation was causing spurious readings by i) oscillating the radial ridges on the pulley wheel in and out of one edge of the field of the proximity switch; ii) rotating the pulley wheel independent of any movement due to penetration or withdrawal. It is also possible spurious signals were generated by the power supply to the vibrocorer motors.

It is ironical that, on the only occasion the penetrometer gave correct readings by indicating no penetration at all, these were ignored. Subsequently, it was found that the vibrocorer had been resting on cobbles and could never have achieved any penetration, precisely what the instruments indicated.

Work with the penetrometer system terminated, after two days' use, on 8.5.78 when the proximity switch failed. It is assumed water penetration was the cause of failure since the switch was very poorly "potted" in epoxy resin.

Normal vibrocoring operations were satisfactory. Good

recoveries were obtained with a standard "power on" time of 30 minutes. Problems were experienced with power cable damage, most of which appear unavoidable.

Replacement of a failed pot (7.5.78) was rendered more difficult by the unserviceable condition of the deck borne spare, necessitating a prolonged operation to obtain a further pot from the ship's hold.

Loss of the vibrocorer on 15.5.78 at $61^{o}38.0'N$; $00^{o}21.2'E$ was caused by failure of the lifting warp at or about the waterline. The calculations on the wire strengths and loadings (cruise diary - 16.5.78) are conservative. A revised value for the loading imferred by the shear strength of the sediment indicates this to have been a likely minimum of 7.5t and possibly as much at 10t. This alone is 60-75% of the computed breaking strain of the warp and exceeds the computed safe working load by a factor of 4-5.

Grappling operations for the vibrocorer were hampered by the need to construct a grapnel of suitable strength. As events showed, the best available materials proved inadequate.

Buoying the vibrocorer on abandonment could not be effected as there were no suitable buoys aboard.

The position of the loss was logged on Decca Main Chain over a period of hours and is known as accurately as the navigation equipment allows.

Immediately prior to the abandonment a test of the pinger on the vibrocorer was made by lowering the search hydrophone into the water. A loud clear signal was heard.

3.3 Gravity corer

Function of the corer was up to normal standards, with the usual irritations of no recovery with obvious penetration. The loss of the gravity corer on 8.5.78 appears to have been caused by weakening of the warp by unlaying. This unlaying persisted even when a complete new warp was fitted and was only eliminated on 17.5.78 by removal of the swivel connecting the warp to the corer. It is surmised that the swivel allowed the warp to unlay when tension was removed on landing the corer on the seabed. Subsequently, the warp did not have sufficient time or tension to re-lay itself whilst the corer was being recovered, leading to cumulative unlaying and consequent stranding.

Considerable trouble was experienced with damage occasioned to the corer trough on recovery of the corer. The damage is the result of a) inadequate strength of construction of the trough, b) difficulty experienced in controlling the corer during the critical moments of re-entry to the trough.

Problems were also encountered with the loss of NX sediment barrels from the NX adaptors, caused by failure of the thread on the adaptor. Similarly, the 4" x 5' barrels required to be carefully selected and manipulated before

a sufficient number of bolts could be inserted to mount them to the gravity corer body.

The eventual termination of operations was caused by the Sykes winch displaying symptoms of a leaking cylinder head gasket.

3.4 Shipek Grab

Problems experienced with this equipment were restricted to the winch and its power supply.

As recorded in the cruise diary, the ship's winch used to operate the grab failed on numerous occasions. Comment from the ship's engineers indicated the winch was old and in very poor condition, requiring a considerable amount of dockyard work to render it serviceable. Another unsatisfactory feature of its performance was the slow rate of operation, which proved to be a significant factor in the time spent on routine sampling stations.

A potentially dangerous feature of this winch was the power supply, rigged as an unprotected rubber coated cable. Damage to this, on 7.5.78, resulted in a short circuit which could have has serious consequences for the winch operator. A length of 2½" liner tube was rigged as a temporary conduit, pending fitting metal conduit in harbour.

3.5 Transit Sonar

This could not be deployed without a considerable reduction in ship's speed. The weakness of the system lay in the large distance between the transducer head and the first

mounting point on the ship's hull. This allowed vibration to develop at speeds greater than 5kt, imposing an unacceptable restriction on speed between stations. Consequently, the transit sonar was never deployed.

3.6 Ship's Equipment

Overall, "Cape Shore" proved to be a very satisfactory working platform. The exceptions were found in the winch systems.

Problems encountered with the Shipek grab winch have been discussed above. The main winch, used with the vibrocorer, also proved problematic. Initially, it was very slow in operation. However, this was improved on 9.5.78 following some work on the hydraulic system by the ship's engineers, when the speed of operation doubled. Even so, the rate of operation was never rapid.

A futher problem was caused by the sheer power of the winch, rated at 150T pulling power. This meant that any "snatch" load, caused by the vibrocorer being firmly implanted in the seabed, was undetectable and may have been a contributory factory in the loss of the vibrocorer.

The ship's three-point anchoring system was built around three wholly unsuitable winches. The main problems were a) slowness of operation, b) lack of spooling gear. Point a) was considerably improved by work on the ship's hydraulics, resulting in a very significant increase in operating speed. Spooling was also improved, but was always "Heath-Robinson" and required a considerable effort

on the part of the ship's personnel.

Overall, anchoring improved to the extent that at many stations, in water depths between 130 and 200m, laying and lifting anchors took only 20 minutes per operation. At times of trouble free operation of all equipment, each station required an average of three hours ship time, including steaming.

4. Conclusions

Despite our experiences in the 1977 sampling season and the conclusion drawn thereon (see CSNU internal report 77/10), once again we commenced a sampling season without a proven "penetrometer" system for the vibrocorer. This must reduce our efficiency and certainly diminished the scientific input from each vibrocorer station. One solution might be to offer the penetrometer project to a university engineering department (preferably a university with offshore interests) as a funded MSc project. The cost would be no more than that already incurred in two abortive attempts and it would have the advantage of a high level of personal involvement for the recipient.

The problems encountered with the gravity coring system, particularly the trough, indicate a need: a) to strengthen and possibly redesign the trough; b) for a much more controllable winch system. The Sykes winch cannot be controlled with the precision necessary to enter the gravity corer to the trough without infering severe

stresses on all points due to violent impact. Similar winch considerations should also be given to the Shipek grab system, where a high rate of operation must be coupled with flexibility of control.

The loss of the vibrocorer and the subsequent post mortem considerations on cable strengths indicate a need for a thorough assessment of the stresses involved in recovering a vibrocorer. Extrapolating from shear measurements made, e.g. vibrocore 61+00/76, it is possible that the pull required to overcome the shear strength of the sediments encountered (assuming 6m penetration) is in excess of 15t. To this must be added the weight of the pot and barrel, and the cable. A further force to consider is that required to achieve the initial "break-off" of the core, since the component and cohesive nature of the sediments recovered make it possible that the initial pull of recovery involves a "lift" against the pressure of the overlying column of water. Certainly, events have shown that a warp with a (computed) safe working load of 2.2t is totally inadequate.

It is likely we will lose further vibrocorers in future. To avoid shipboard improvisation, grappling equipment should be built and carried as part of standard vibrocorer equipment.

The problem of quality control was again encountered on this leg. Its main manifestation was the inadequate threads on the gravity corer NX sediment barrel adapters and the difficulty experienced in mounting the 4" barrels

to the gravity corer baseplate.

In summary, a measure of the overall efficiency of the "Cape Shore" is obtained by comparing the 37 vibrocoring stations occupied in 9 operational days with the 23 vibrocoring stations occupied in 8 operational days on Leg 1 of "Emerald" cruise 77/EM/06. Furthermore, the water depth in the Cormorant area is 50-100% deeper than that experienced during the Forties sampling. Despite encountering many operational problems this leg of the cruise was able to complete the sampling of 35% of the Cormorant sheet.

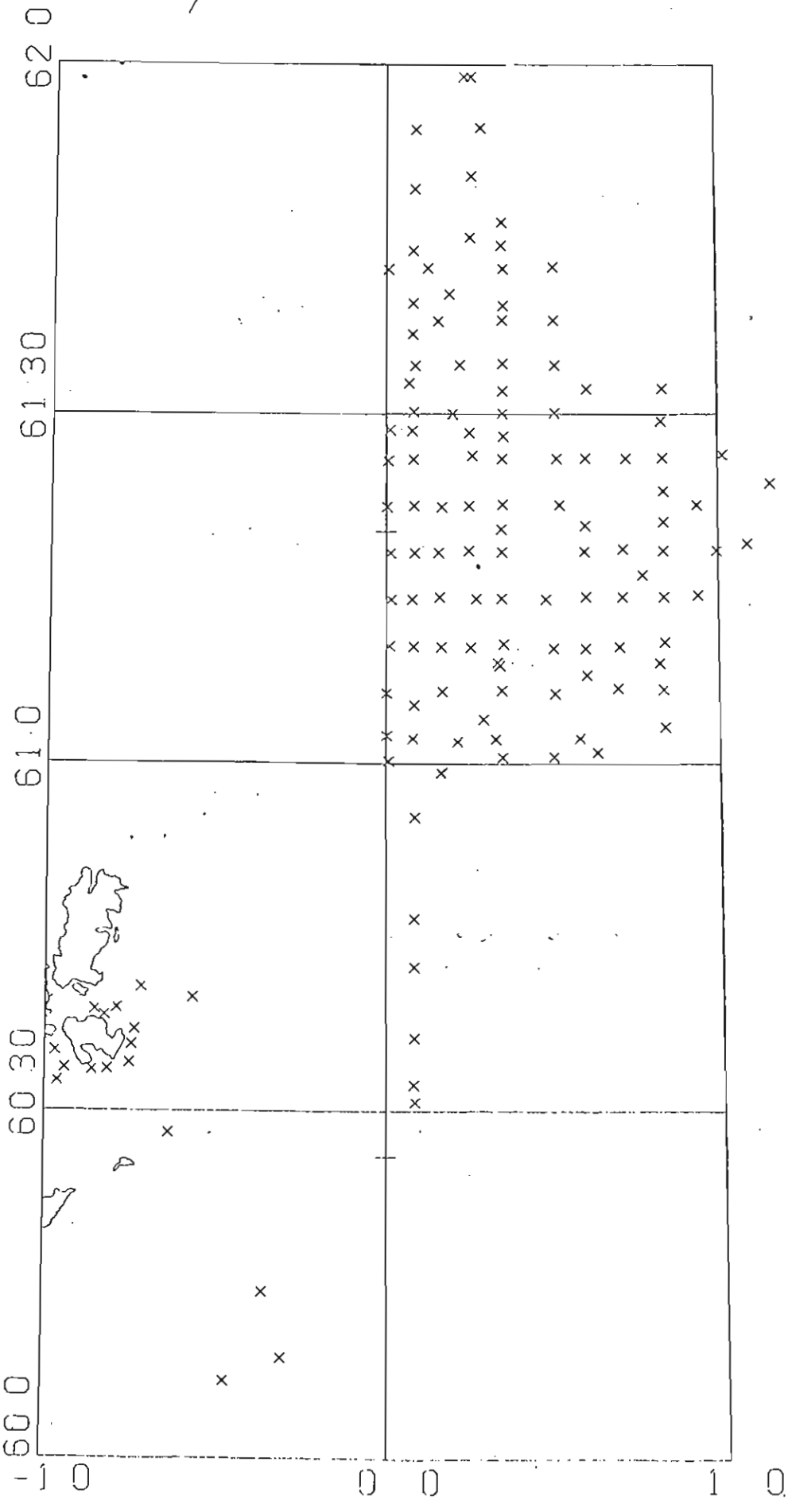

FIG. 1. SAMPLE STATIONS

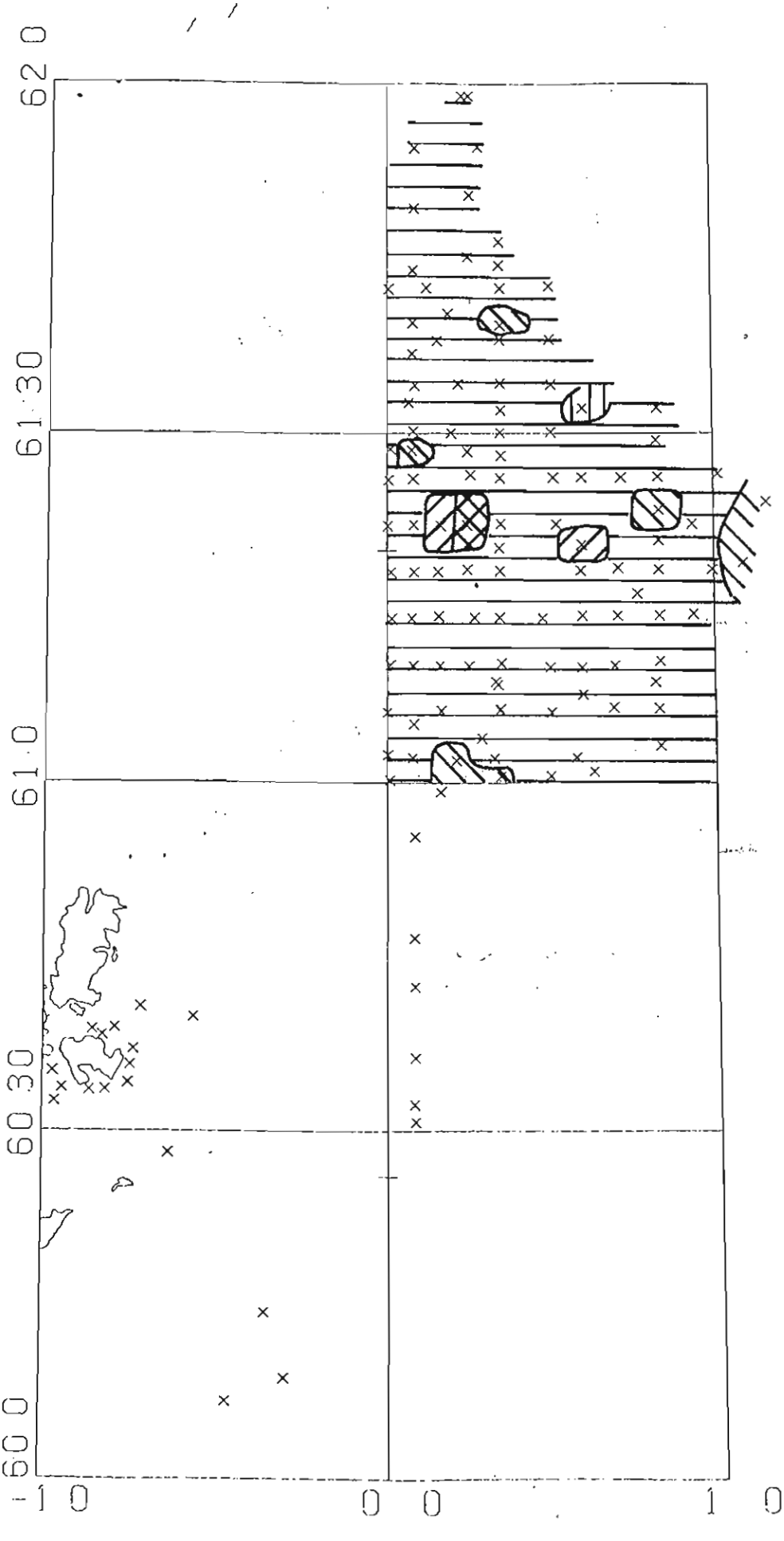

Fig. 2. SUPERFICIAL SEDIMENT TYPE

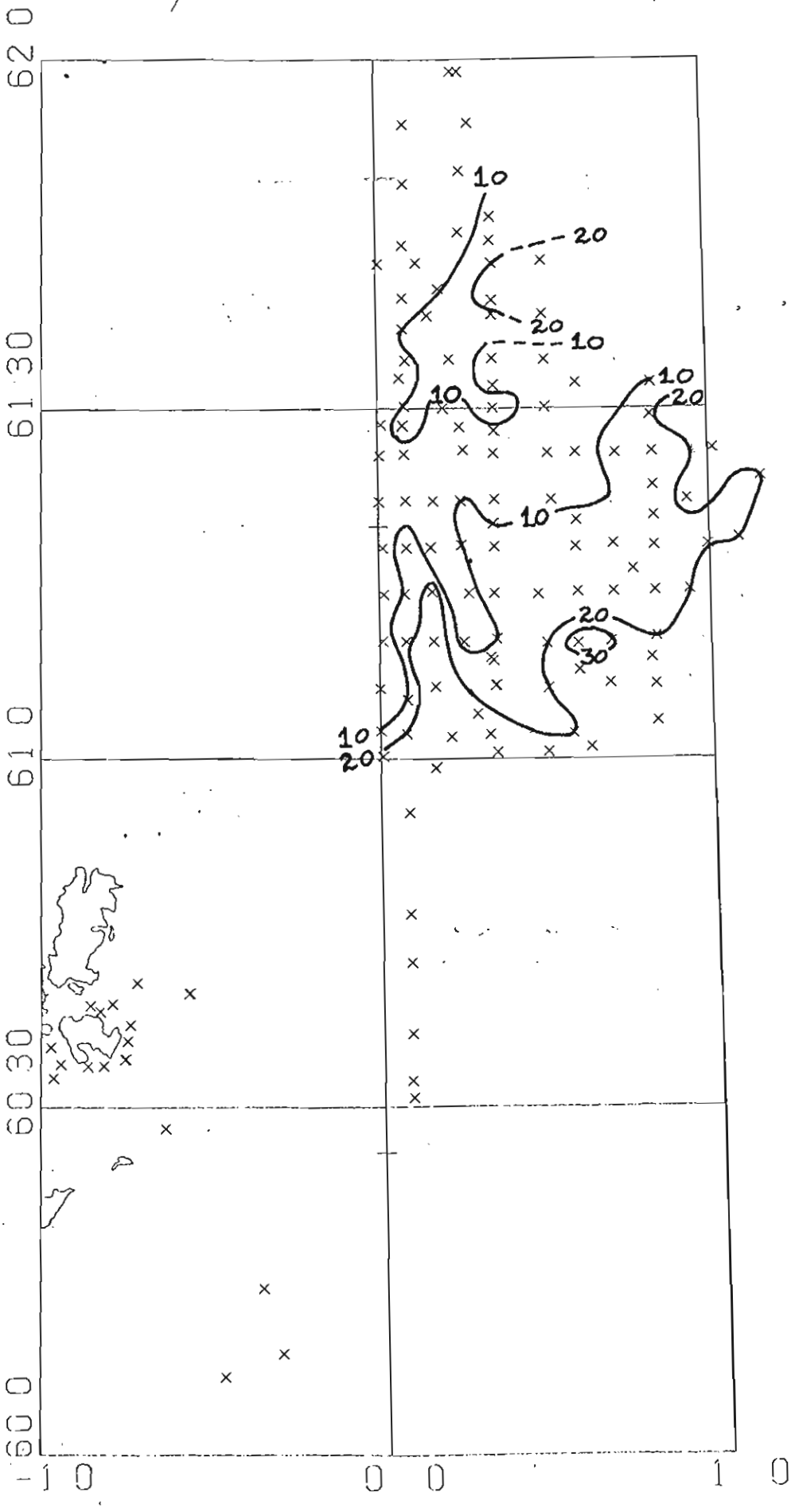

Fig. 3. Carbonate %

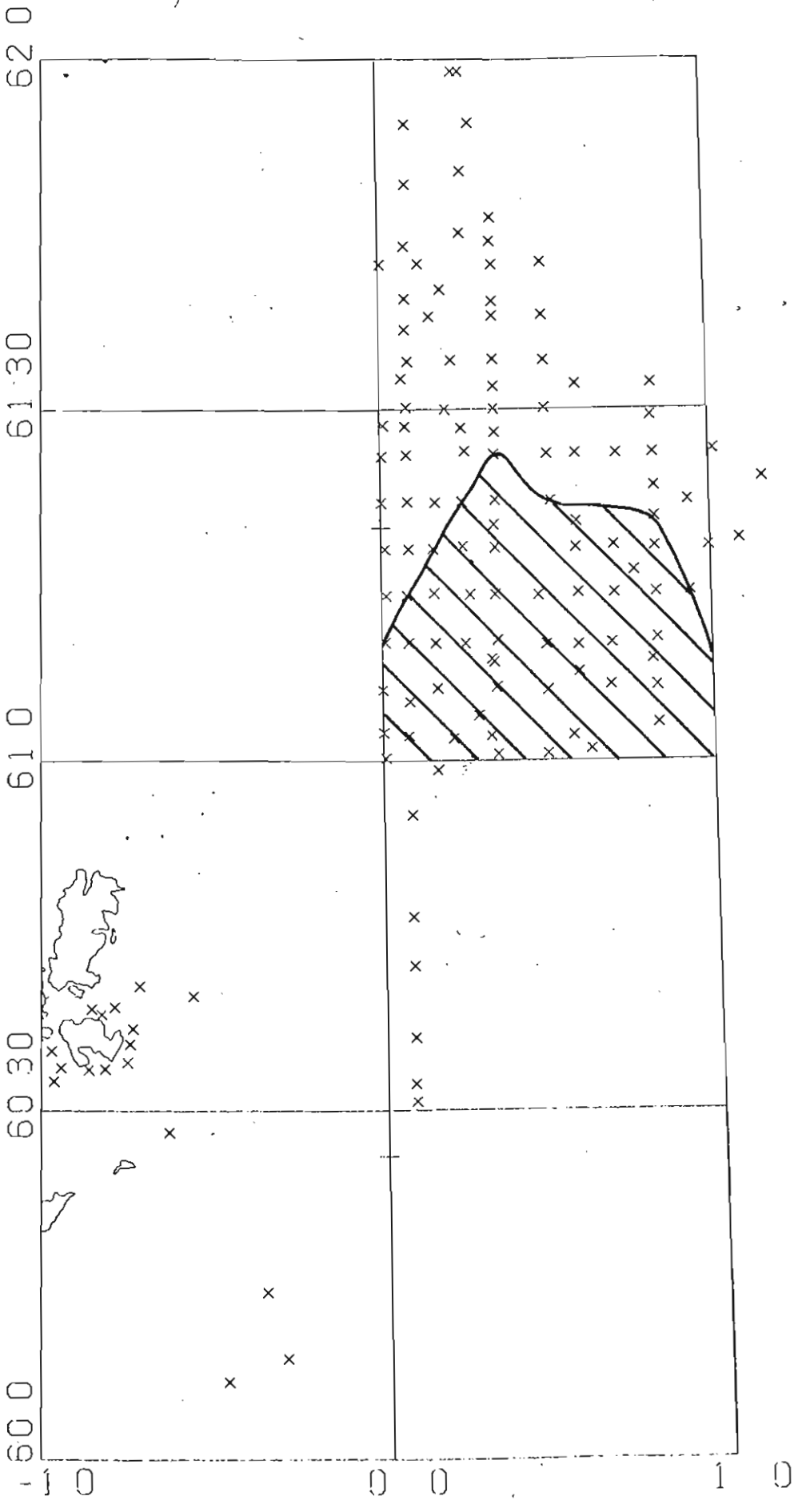

Fig. 4. Area of Till (?) subcrop under superficial sediment layer.