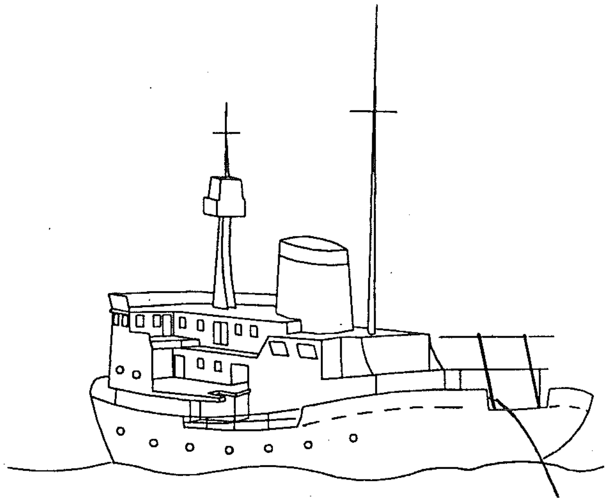

Geological Survey of Canada

Commission géologique du Canada

HUDSON 94-027
Cruise Report
Geological Survey of Canada Open File No. 2999

Edited by:

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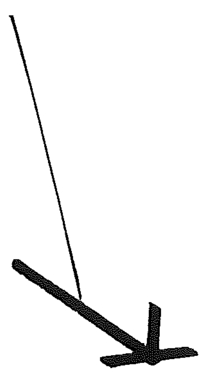
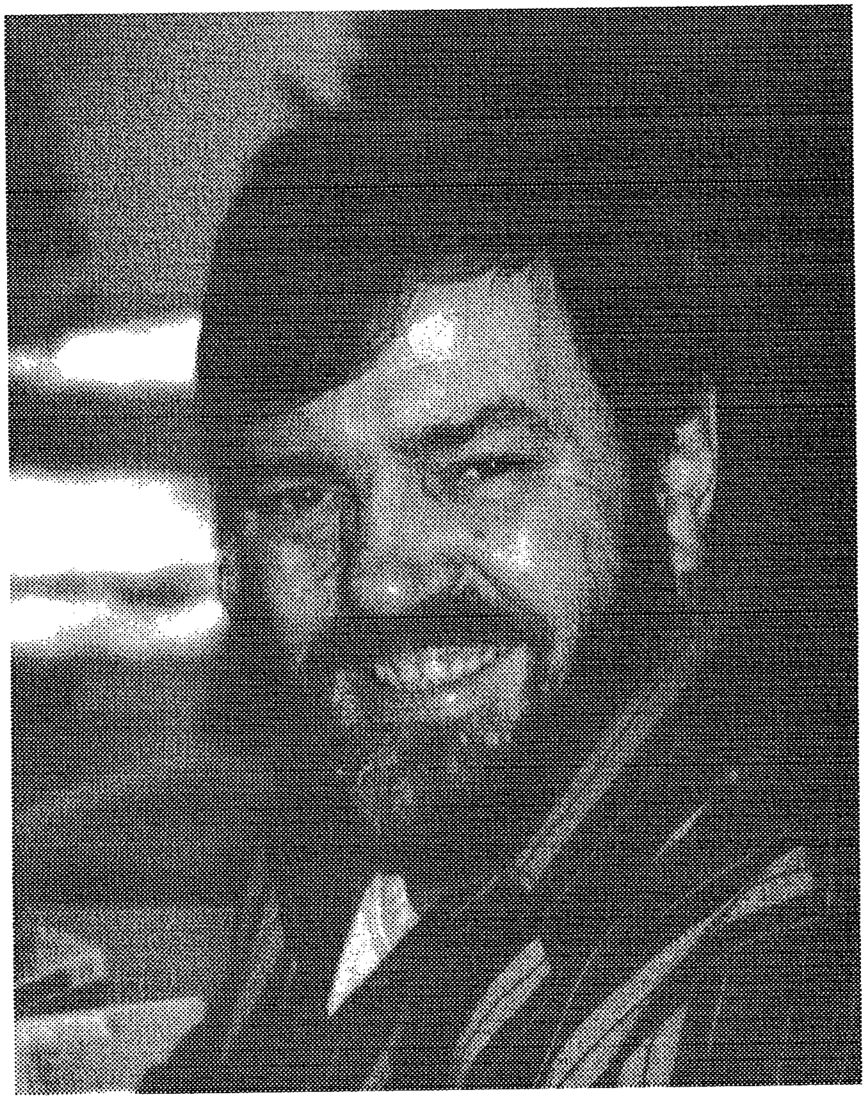


Natural Resources Canada

Ressources Naturelles Canada



THIS IS CRUISE NUMBER **100** FOR JES NIELSEN!!

One-hundred cruises represents an enormous contribution to marine geoscience in Canada. In particular, Jes has been a principal force in the implementation of refraction and reflection seismic surveys by the Bedford Institute of Oceanography since the early 1970's, from crustal refraction experiments involving large charges of high explosives to routine profiling with small air guns. His expertise in the care and use of explosives, air compressors, air guns, winches, cables, hydrophones, engines, motors, etc, etc, is unsurpased, and much valued.

Thank you, Jes, and congratulations on this achievement,
from your many shipmates

CRUISE SUMMARY

HUDSON 94-027

Dates: August 15, 1994 to September 2, 1994

Area of Operations: Southern Laurentian Channel, 44.5 to 45.5N

Master: Capt. A. Croft

Chief Scientist: A. Grant

Operations: M. Morrison

Responsible Agency: Atlantic Geoscience Centre

CRUISE PERSONNEL

Capt. A. Croft	Master, HUDSON
A. Grant	Chief Scientist, AGC
M. Avery	Geochemical Technician, AGC
K. Bentham	Photographer, DFO
J. Chaffey	Physicist, Student, Acadia
B. Chapman	Electronic Technician, AGC
R. Currie	Computer Scientist, AGC
K. Desroches	Geologist, Student, Dalhousie
S. Ellis	Geophysicist, Student, Dalhousie
M. Ferguson	Medical Doctor, Volunteer, Dalhousie
I. Hardy	Head of Curation, AGC
D. Heffler	Electronics Engineer, AGC
A. Jackson	Data Technician, AGC
K. Jarrett	Geotechnical Technologist, Contract, AGC
S. King	Geologist, Student, Dalhousie
B. Leblanc	Geochemical Technician, AGC
M. MacDonald	Secretary, AGC
M. Morrison	Geologist, SEA Contract, AGC
B. Murphy	Sampling Technician, AGC
T. Newell	Computer Scientist, Student, Acadia
J. Nielsen	Seismic Technician, AGC
T. Schell	Geologist, Student, Dalhousie
R. Sparkes	Data Technician, AGC
M. Uyesugi	Electronics Technician, Huntec Contract, AGC

CONTENTS

CRUISE SYNOPSIS

OBJECTIVES

The primary objective of this cruise was to map and sample pockmarks in southern Laurentian Channel and to evaluate processes involved in their formation. A primary challenge was to sample pockmarks in 400 m of water. The cruise is part of a joint research project with Mobil Oil Canada, Calgary, who are particularly interested in determining whether the pockmarks may reflect escape of liquid and gaseous hydrocarbons leaking from deeply buried traps.

THE SURVEY

The study area (Fig. 1) is one of the least explored parts of the continental shelf of Eastern North America, because it is within the former Moratorium Block south of St. Pierre and Miquelon. We conducted an acoustic survey with airgun, Huntec deep tow and sidescan sonar systems (Figs. 2 & 3), and sampled the seafloor in and adjacent to pockmarks with the AGC large diameter corer, Videograb, box corer and IKU grab (Fig. 4).

RESULTS

The acoustic survey instruments yielded excellent data, at tow speeds averaging four knots in 400 m of water. We found numerous pockmarks, mostly small (several metres) but some larger (50 metres+), and determined approximate limits for their occurrence. We concentrated on a zone of larger pockmarks for sampling, and installed a "Multibeacon" transponder there for Short Baseline (SBL) and Long Baseline (LBL) navigation systems to control a sidescan mosaic grid. This mosaic (Fig. 5) was the basis for accurate sampling of the pockmarks.

Core, grab, and videograb samples were processed extensively at sea, and further analyses will be carried out on shore. The Videograb worked well, and was used to obtain several video transects of the seafloor (Fig. 6) as well as sediment samples.

The SBL navigation system worked beyond expectations, tracking the sidescan fish to 1600 m and yielding 10 m accuracy on sampler positions. The sidescan mosaic entailed a 3 x 3 km survey at 150 m line spacing. The AGC-DIG program was refined during the cruise to send sidescan data to workstations immediately so that mosaics are available within hours.

CONDITIONS

The Captain, Officers and Crew of the HUDSON extended excellent cooperation and hospitality, resulting in a successful and pleasant cruise. Weather conditions were near-perfect. We spent 2.5 days in travel to Sydney to pick up the gas chromatograph and repair the sidescan sonar winch.

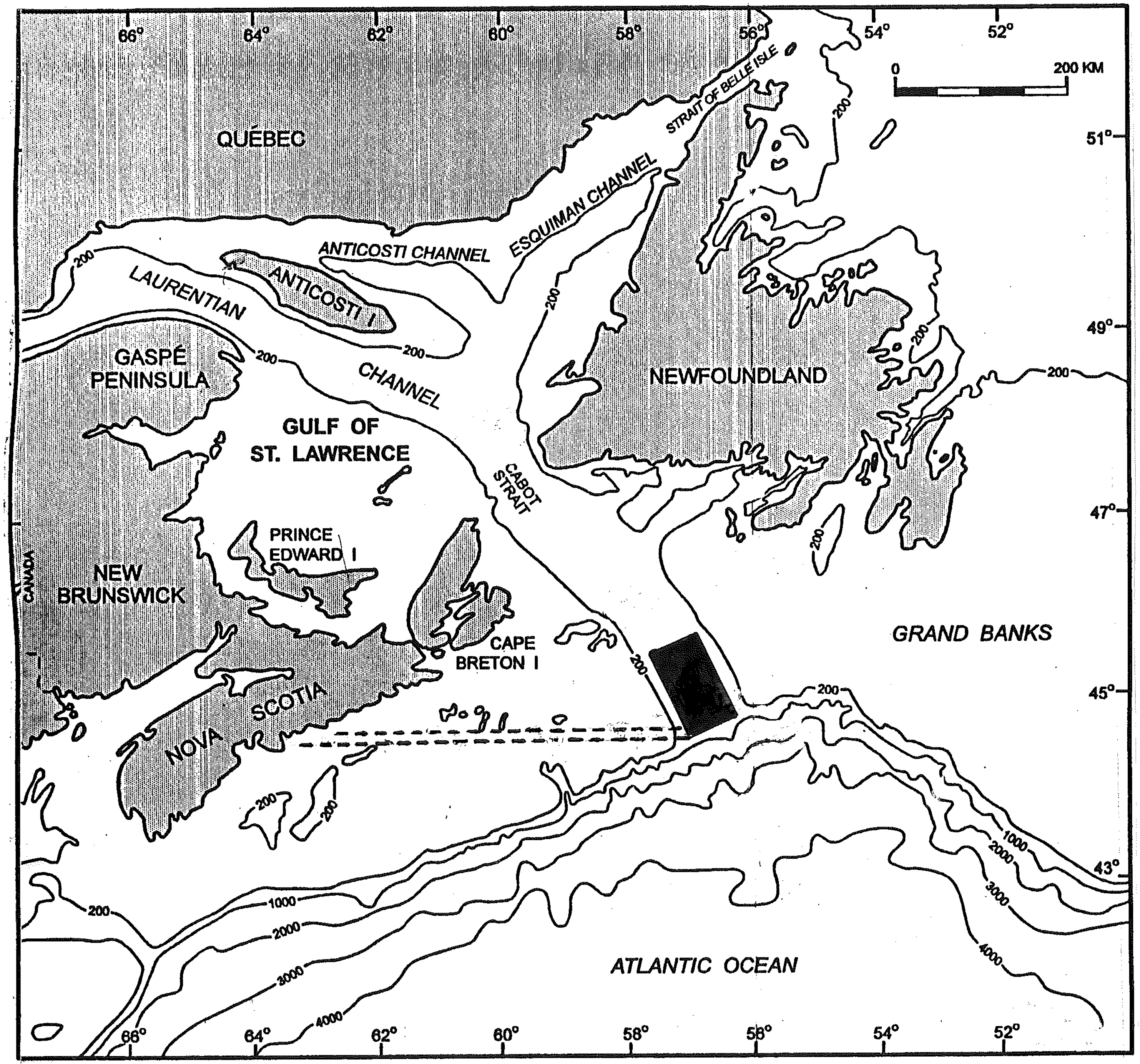


FIGURE 1
Study Area (Black), Cruise HUDSON 94-027
August 15 - September 2, 1994

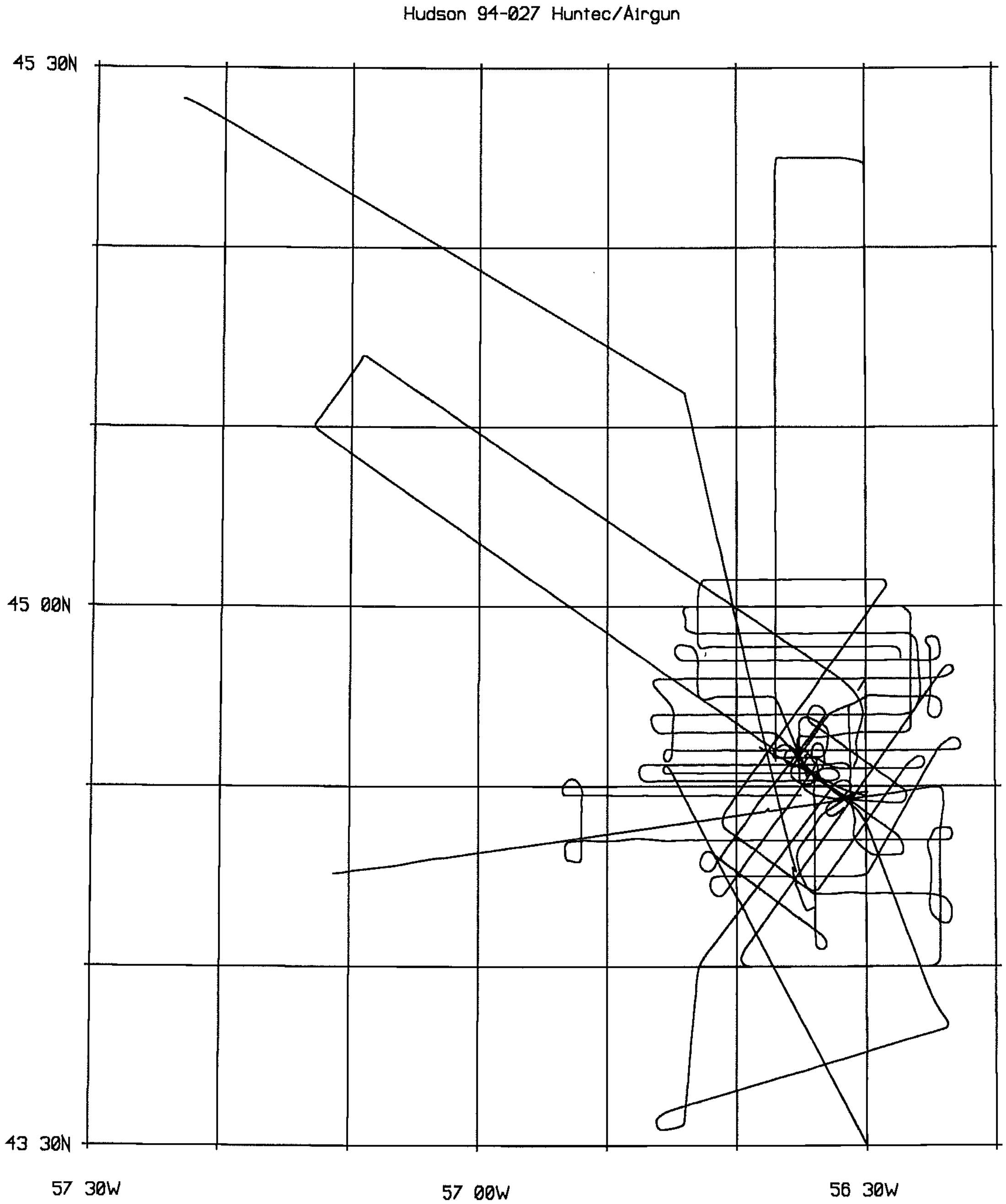


FIGURE 2
Huntec Deep Tow and Airgun Seismic Coverage

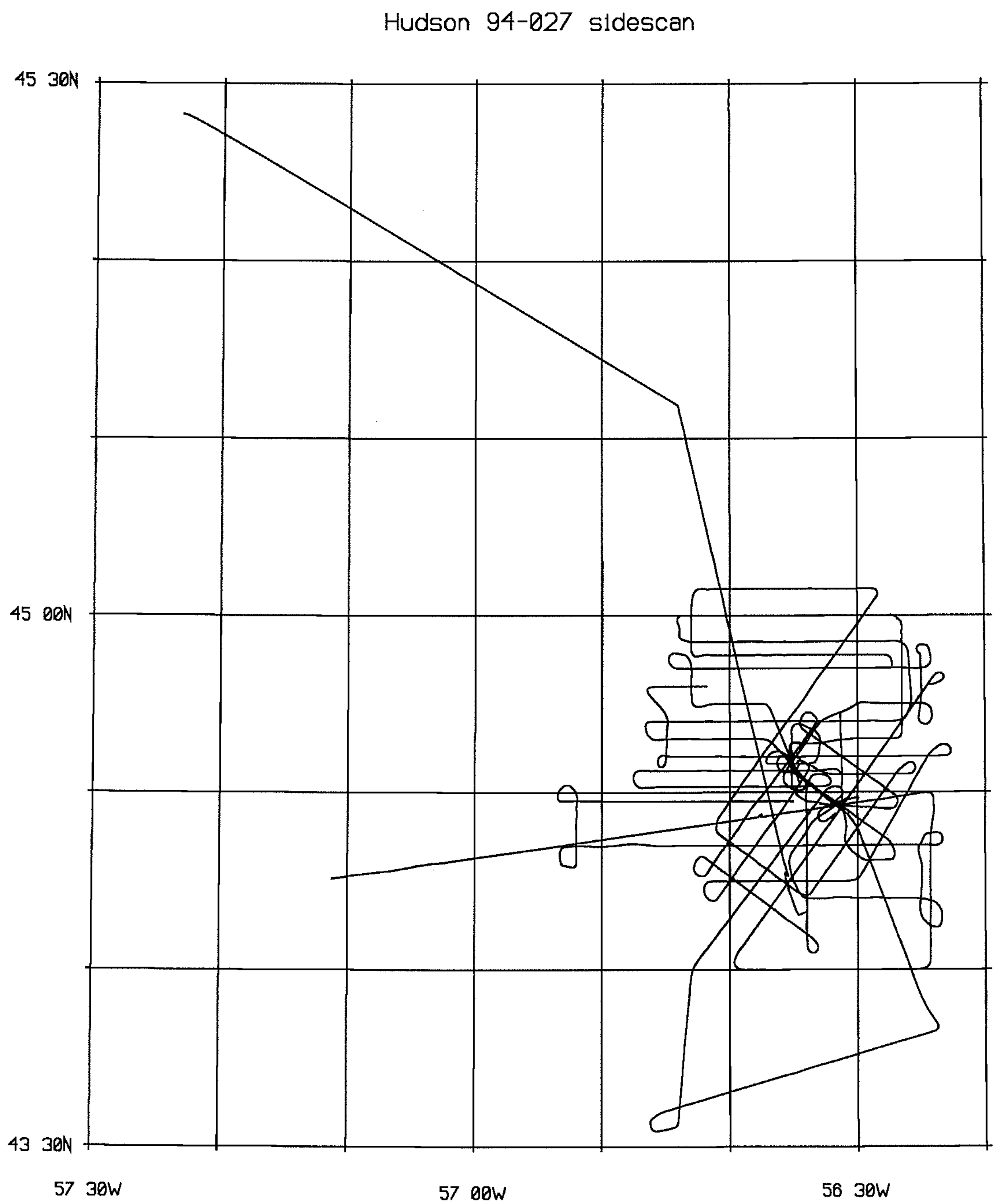


FIGURE 3
Sidescan Sonar Coverage
(Minus Mosaic Grid, Figure 5)

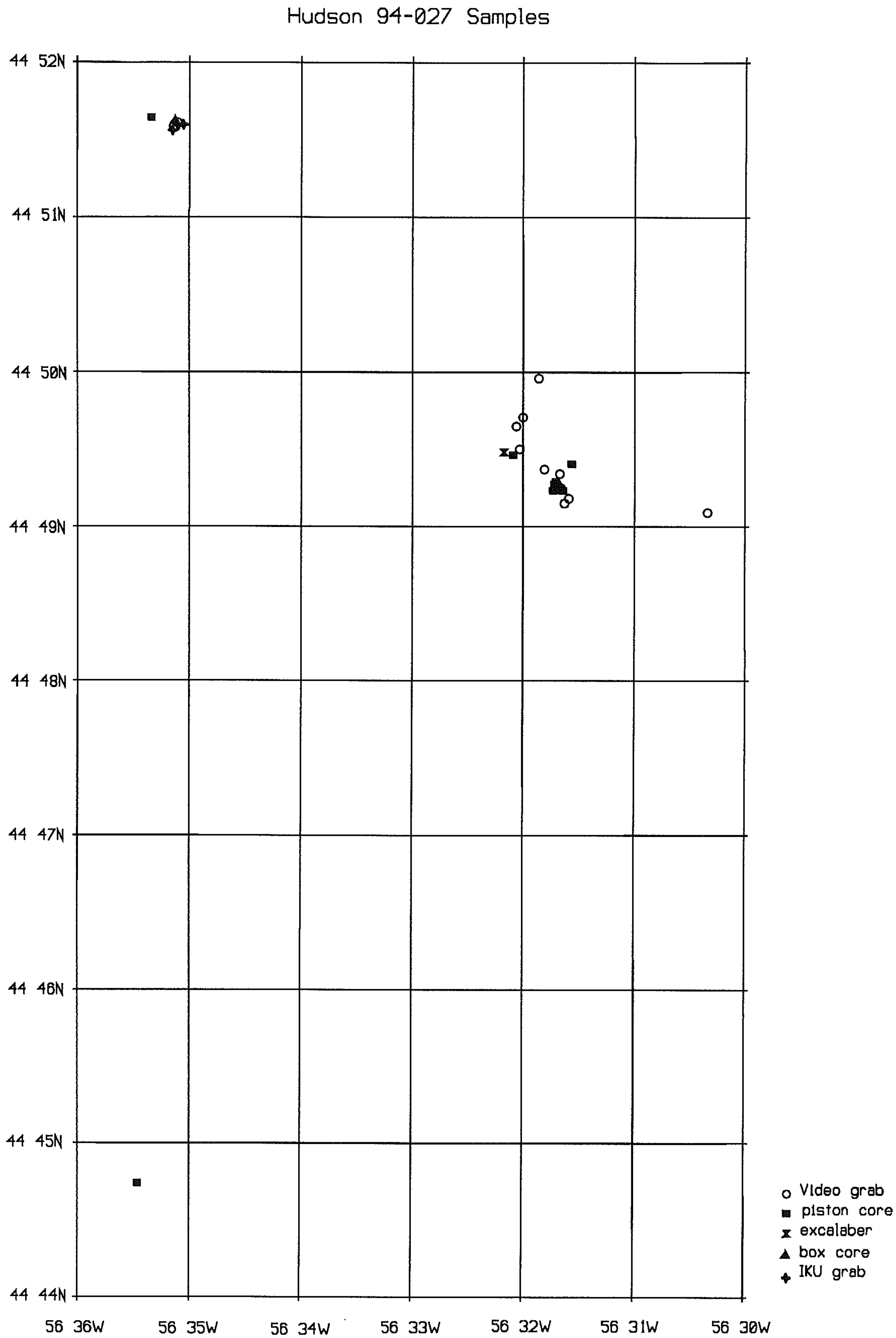


FIGURE 4
Sample Locations: 15 Videograbs, 10 Piston Cores, 2 Box Cores, 2 IKU Grabs, 1 Excalibur

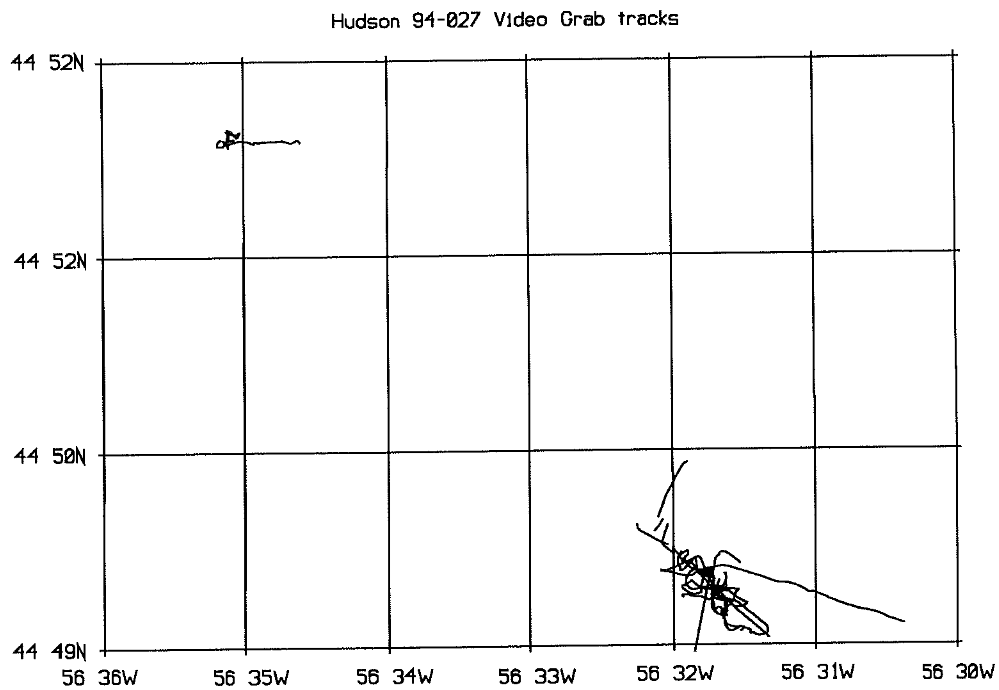


FIGURE 6
Videograb Transects

LOG OF OPERATIONS

Day	Summary of Activities
227 - Aug. 15	Depart BIO and steam to study area in southern Laurentian Channel.
228 - Aug. 16	Arrive study area 1800 and commence acoustic survey with airgun, Huntec and sidescan sonar.
229 - Aug. 17	Continue acoustic survey.
230 - Aug. 18	Continue acoustic survey. Deploy multibeacon transponder at 1600.
231 - Aug. 19	End acoustic survey. Videograb transect and sample Stn. 1, and core sample Stn. 2. Acoustic survey overnight.
232 - Aug. 20	Excaliber deployment Stn. 3. Excaliber electronics case flooded and this instrument out of service for remainder of cruise. Videograb transects and sample Stns. 4 and 5, and core Stn. 6. Acoustic survey overnight.
233 - Aug. 21	Videograb transect and sample Stn. 6. Depart study area 1800 for Sydney.
234 - Aug. 22	Arrive Sydney 0800 to pick up gas chromatograph and repair sidescan winch.
235 - Aug. 23	Complete winch repairs at 1600 and depart for study area.
236 - Aug. 24	Resume acoustic surveying at 0800 and continue overnight.
237 - Aug. 25	Videograb transect and sample Stn. 8. Acoustic survey overnight.
238 - Aug. 26	Core sample Stn. 9 and Videograb transects and sample Stns. 10 - 12. Acoustic survey overnight.
239 - Aug. 27	Core sample Stn. 14 and Videograb transects and samples at Stns. 15 and 16. Recover multibeacon transponder. Acoustic survey overnight.
240 - Aug. 28	Core samples Stns. 17 and 19 and Videograb transects and sample Stns. 18 and 20. Acoustic survey overnight.
241 - Aug. 29	Core sample Stn. 21, Videograb transects and sample Stns. 22 and 25, and IKU Grabs 23 and 24. Acoustic survey overnight.
242 - Aug. 30	Core sample Stn. 26 and Boxcore samples Stns. 27 and 28. IKU grab sample Stn. 29. Excaliber case immersed to 350 m to test for leakage. Acoustic survey overnight.
243 - Aug. 31	Core samples Stns. 30 and 31. Acoustic survey overnight.
244 - Sep. 1	Pull in acoustic survey gear and depart study area for BIO.
245 - Sep. 2	Arrive BIO.

DATA RECOVERED

Sample Inventory

Cores	10
Trigger cores	10
Box cores	2
Videograbs	14
IKU grabs	3
Excaliber	1

Kilometres Data

Airgun Seismic	1560.65 km
Huntec Deep Tow	1560.65 km
Sidescan sonar	1142.02 km
3.5 kHz Bathymetry	1560.65 km

Photographic

Videograb transects	7 two-hour video tapes
Still photos	60 Black & White
	300 Colour Film

AGC SEISMIC OPERATIONS (TECHNICAL)

Borden Chapman
Jes Nielsen

During Hudson 94-027 AGC/PSS supplied the equipment necessary to collect seismic reflection profiles. The main acoustic components of this system included the BI-44 Air Compressor, a Haliburton Geophysical sleeve gun, with a 40 cubic inch chamber, and various recording electronic systems. The compressor delivered 1500 PSI of compressed air to the sleeve gun which was fired at a three second repetition rate. The gun was towed from the starboard side aft rail, and deployed using a small winch located in #17 container. Towing depth was 1 metre below the surface and this depth was controlled using a small Norwegian float.

The reflected sleeve gun signal was received on the 25 foot and the 100 foot sections of the port SE eel array, and the NSRF tapered eel array. These signals were routed through standard AGC processing electronics.

Both the 25 foot and 100 foot sections of the SE array were fed to respective differential eel amplifiers. The signal from each amp was sent to channel one (100 foot section) and channel 2 (25 foot section) of the AGC time varying gain unit (TVG), then to Krohn-Hite model 3323 band pass filters, with the band pass set for 100-3500 Hz for the 25 foot array, and 100-650 Hz for the 100 foot array. The signals were then displayed on two EPC 8300 graphic recorders operating in the start/ stop mode. The shot trigger and delayed triggers for the EPC's and TVG Units was supplied by the Master Interval Timing Unit (MITS). Suitable delays were selected for water column removal.

The NSRF eel signal was amplified by the NSRF "Blue Box" and fed into a Krohn-Hite filter with wide open filter settings but a signal gain setting of 40 dB. During the final days of the program the NSRF eel signal was displayed on the EPC 8300 graphic recorder which had been previously used for the 25 foot SE array. The band pass setting for the filter (from 100- 3500 Hz) remained the same as the 25 foot array.

The 100 foot array was displayed at a 1 second sweep rate for most of the program, while the 25 foot array, and the NSRF array was displayed at a 0.5 second rate.

The Beta test version of MITS (Master Interval Timing System) supplied the timing control for the firing of the sleeve gun, the 3.5 Khz sounder, and the Huntec system. This provided the ability to mask out the Huntec shot pulse, and thus the sleeve gun return signal in the Huntec record. The result was a greatly improved "cleaner" record. A second advantage was realized, that being the problem of the usual drift of the time bases used to fire the two sound sources. No cross interference between the Huntec and sleeve gun occurred.

SHIPCLOCK supplied, at a five minute rate, trigger pulses used to initiate the write times for two record annotation units. The annotators provided date and time annotation to all paper records.

The seismic and timing signals were recorded on standard VHS type tape using the TEAC XR5000 analogue tape recorder. Channel one and three (both DR format) of the XR5000 were used to record the raw SE eel signal from the Eel amplifier and the NSRF eel signal from the "blue Box" was recorded on channel 8. Channel two (FM format) of the XR5000 was used to record the master trigger from the MITS computer. A total of seventy-seven VHS data tapes were used during the cruise.

Bathymetry was collected during the survey using an ORE model 140 transceiver, an EPC 4800 recorder set at a 0.5 second sweep rate, and the 16 transducer array mounted in the ship's hull. Timing control and water column removal delays originated from the MITS system. The unit was operated at a one second rep rate throughout the cruise.

Repairs required before the next cruise are:

1) TEAC XR5000 tape recorder problems still persist. Complete shut down of recorder occurred with the failure of the display package which indicates the recording parameters.

2) Repairs to the spare NSRF eel are required. The eel seems to have very low gain, possibly pre-amplifier problems.

HUNTEC DEEP TOW

Martin Uyesugi

The DTS system was part of the geophysical survey program, which consisted of the Huntec Deep Tow, AGC Seismic System, (with a 40 cubic inch HGS sleeve gun and single channel streamer), Simrad 100/500 Khz side scan sonar, ORE Model 140 3.5 khz profiling system, and Geoacoustics SE880 sonar enhancement system. These systems collected data simultaneously along selected lines in the study area.

A total of 225 hours of DTS data was collected in the Laurentian Channel. The DTS performed well and collected very good quality data. There was not any equipment down time to report. The Geoforce technician supervised the installation, operation and maintenance of the DTS system.

DESCRIPTION OF EQUIPMENT

Deep Tow Seismic System

The Huntec Deep Tow Seismic (DTS) system is a high resolution, sub-bottom profiler with the acoustic source, energy supply, heave sensor, and two receiving hydrophones housed in an underwater towed body. The AGC #3 Deep Tow system has a maximum power output of 1000 joules (60 mfd storage capacitance) with an ED 10 F/C Boomer source. An LC10 single element hydrophone mounts inside the tow fish beneath the boomer. A fifteen foot, ten element NSRF tapered streamer array is towed behind the fish. The optional multi-tip sparker source was fitted for this survey.

The deck equipment consists of a HydroMac Oceanographic winch, which includes a multi-way NSRFslip ring and a 600 metre, 21 conductor, armoured tow cable. The winch is powered by a 440 VAC, 50 HP hydraulic pump unit. The tow cable is handled by a 36 inch diameter sheave block.

The lab instrumentation consists of the Huntec Systems Console and DC high voltage power supply (PCU). The Systems Console houses the Bottom Motion Compensator circuits, the +24 volt fish supply, and modules for signal processing and tape outputs. The Huntec Mk III PCU provides DC power to the boomer to switchable ranges from 2 to 6 kilovolts.

Graphic Display, Signal Processing and System Key

The DTS system normally utilizes two thermal EPC 9800 graphic recorders. The EPC 9801 recorder on loan from the navy could not be used due to print problems. Both the internal LC10 hydrophone and the external NSRF streamer were displayed on a single EPC 9800. The Adaptive Signal Processor (ASP) module processed the signal for the internal hydrophone. The streamer signal was processed by a second ASP console.

The Adaptive Signal Processors for both channels were set to Fixed Gain (20 Db.) mode with the bottom tracking turned off. This gain setting produced the most consistent record quality.

The PC based MITS system triggered the DTS, ORE, and AGC seismic systems. The MITS system allows several systems to be run using a common time base. The MITS masking feature significantly reduces acoustic interference by inhibiting the coincidental triggering of interfering system(s). Each source has two independent, adjustable delayed trigger outputs for keying of graphic recorders and annotators.

Tape Recording

The DTS data was logged on the fifteen track Teac XR5000 analog tape deck. The following table details the configuration of the recording channels. Tape speed was 2.4 cm/second for the entire survey.

Channel	Type	Description
4	DR	Internal LC10 hydrophone
5	FM	Master trigger +5 volt
6	DR	External NSRF streamer

Equipment List

Unit Description	Serial Number
Tow Fish Body	1017
ED10F/C Boomer Source	2023
MK4-2 Attitude Sensor Unit	5010
S1000 Energy Storage Unit	1203
Internal LC 10 Hydrophone	--
External NSRF Streamer	NA
HydroMac Oceanographic Winch and Power Pack	--
Sheave Block 36" Diameter	--
Power Control Unit Mk III	120-1
PCU Filter	120
Systems Console	109
EPC 9800 Graphic Recorder	134
Second ASP Console	101

EQUIPMENT SETTINGS

The following equipment settings were used for the majority of DTS survey lines:

Parameter	Setting
MITS - Fire rate - Masking	0.5 - 1.0 seconds (depth dependent) ON (where feasible)
PCU power setting	5 kilovolts (240 joules)
BMC (motion compensation)	Pressure Mode
ASP	Fixed +20 db Mode (both channels)
Filter Setting - internal - external	2000-6000 hertz 1000-6000 hertz

Processor Gain (System Console)	5 KV (both channels)
Krohn-Hite gain (streamer)	0 db gain
EPC sweep speed	62.5 to 250 milliseconds (depending on water depths)
EPC print polarity	positive
Tow fish depth	90-150 metres

EQUIPMENT PERFORMANCE

Overview

The DTS collected approximately 225 hours of data with a utilization rate of 52.5%. Operationally the Deep Tow Seismic system performed very well, with no equipment down time during the cruise. Due to problems reported during the MORESBY cruise, the sparker coil and systems console from AGC #2 were tested during the HUDSON cruise and found to be fully operational. Overall, the DTS data quality was deemed to be very good.

Pre-cruise Sparker Repairs

The sparker did not work during the MORESBY cruise in July. The sparker coil was returned to Geoforce for inspection and repair. The coil was measured and the resistance, capacitance and inductance were found to be within specification. The cables into the coil were examined closely, previous repairs (seal split in cable jacket) still appeared to be intact. No obvious reason could be found that would explain why the sparker did not work.

A small amount of water was found in the sparker feed thru connector. Although the water leak did not explain the inability of the sparker to work, it was possible that the water had leaked in under pressure and possibly into the coil itself. Without any other feasible explanation and under time constraints to repair the sparker in time for HUDSON, Geoforce decided to proceed with plans to pot the existing coil within a watertight mould. In addition, new feed thru connector caps were installed. The new caps compensated for the difference in diameter between the sparker cable and the standard DTS cable.

The feed thru modifications and coil mould were completed in time for the HUDSON mobilization. Prior to sailing August 15th, Geoforce Technician Martin Uyesugi talked with Bob Courtney, Senior Scientist on the MORESBY, regarding the sparker problem. Discussions revealed that during troubleshooting on MORESBY, the ESU scr's were seen to glow red. This would indicate that the scr's were triggered but held high. The PCU transformer was reported to be under heavy load and blowing fuses.

From these comments, it appeared that the power system was being loaded down by a sparker that could not discharge. A possible explanation was that the sparker tips did not have enough power to short the gap to ground with an explosive discharge, instead the power supply system was being loaded down. It was subsequently confirmed that the PCU on MORESBY was set to the minimum 2 KV power setting (60 joules). This meant that each tip had only 3 joules of energy, far too low to discharge reliably. The PCU power should be set to 4 KV or 250 joules (minimum) for reliable sparker operation. This will provide 12 joules of energy per tip at a one second fire rate.

Sparker Tests at Sea

The AGC sparker coil was installed into the tow fish and tested on several survey lines (day 239 to 240). No problems were experienced and good data was collected. Lead weight (approximately 7 kilograms) was added to the nose of the tow fish to compensate for the added weight of the coil.

Sparker Interference

The DTS sparker produced high levels of acoustic and electrical interference on some of the other survey systems. The ORE 3.5 Khz record was acoustically masked by what appeared to be the direct output or return from the sparker. The 12 Khz sounder had high levels of what was possibly electrical noise. The scope trace for the seismic streamer had a large amplitude noise spike, although this noise was effectively masked out by the MITS trigger system. The Simrad side scan did not appear to be affected. Due to the interference, the Senior Scientist instructed the sparker to be disconnected the following day.

Hydromac Winch/Pump

The hydromac Deep Tow winch had been serviced last winter to find the cause of the jerking movement of the drum. At the start of this season the jerking continued to be a problem, although DTS survey operations were not affected. The unscheduled service visit by Fernand Boisjoly to repair the side scan winch presented the opportunity to address the DTS winch problems. A valve was found to be sticking and was burnished to remove scratches. The winch hydraulics were reassembled and tested. Winch operation were smooth in both directions.

Graphic Recorders

One EPC 9801 (serial #121) on loan from the Navy could not be used due to problems with low print gain. Both hydrophone signals were displayed on a single EPC 9800 recorder (serial #134). The external NSRF streamer was displayed on Channel A and the internal LC10 on Channel B.

This EPC print setup did not significantly affect data quality, in fact the DTS profiles were displayed using expanded vertical scale (62.5 msec sweep) in shallow water. This is a testament to the stability and fine print resolution of the new generation thermal recorders and the recent introduction of the MITS master trigger system. In critical applications or where the bottom sediments are soft and thick, two EPC recorders would still be the preferred setup.

Tow Cable/Strumming

Approximately twenty metres of ZipperTube fairing was added to the tow cable to reduce cable strumming. The 36 inch diameter sheave was borrowed from MUN as it is less destructive to the fairing than the AGC roller cluster. With average survey speeds kept below 5 knots, there was no repeat of the tow cable problems reported last year on HUDSON and earlier this summer on MORESBY.

Parts Consumed

Parts consumed or taken from spares are listed below:

DTS parts		2 - junction box O rings
		8 - neoprene #93 bushings
	**	1 - Crouse Hinds connector (side scan)
	**	1 - PT07-14-15S connector
	**	1 - MS3102-3S connector
	**	2 - stainless feed thru connectors (ESU)

** parts taken from spares for shear wave experience or boomer calibration as per Russ Parrott.

OPERATION SUMMARY

DATE	J.D.	SURVEY	STANDBY	DOWN TIME	TOTAL
15/08/94	227	0.0	9.5	0	9.5
16/08/94	228	2.75	21.25	0	24.0
17/08/94	229	24.0	0.0	0	24.0
18/08/94	230	20.0	4.0	0	24.0
19/08/94	231	12.5	11.5	0	24.0
20/08/94	232	15.25	8.75	0	24.0
21/08/94	233	14.0	10.0	0	24.0
22/08/94	234	0.0	24.0	0	24.0
23/08/94	235	0.0	24.0	0	24.0
24/08/94	236	12.0	12.0	0	24.0
25/08/94	237	18.5	5.5	0	24.0
26/08/94	238	16.0	8.0	0	24.0
27/08/94	239	17.75	6.25	0	24.0
28/08/94	240	16.5	7.5	0	24.0
29/08/94	241	17.0	7.0	0	24.0
30/08/94	242	16.25	7.75	0	24.0
31/08/94	243	15.5	8.5	0	24.0
01/09/94	244	7.0	17.0	0	24.0
02/09/94	245	0.0	11.0	0	11.0
TOTALS		225.0	203.5	0	428.5
PERCENT		52.5%	47.5%	0%	

RECOMMENDATIONS

(1) The DTS sparker can not be operated below 10 joules per tip. For the standard twenty tip sparker this means a PCU voltage of 4 KV at a 750 millisecond fire rate. Reducing the number of sparker tips would allow operation at lower power (or faster trigger rate). For instance, a 10 tip sparker could be used at 3 KV or 4 KV at two shots per second.

(2) The DTS tow cables are over 10 years old. If average survey speeds are allowed to exceed 5 knots, you can expect ongoing cable problems as experienced earlier this year on the MORESBY and last year on HUDSON.

(3) Zippertube fairing is field installable and effectively combats cable strumming below 6 knots. At speeds over 6 knots it is difficult to keep the fairing on the cable. More Zippertube fairing should be purchased for next field season.

(4) Following the service visit by Fernand Boisjoly, the HydroMac winch is working satisfactorily.

(5) Sparker systems can cause acoustic and electrical interference on other survey systems. In certain instances, the interference problem can be overcome by grounding and/or isolating the affected systems on separate power lines. Geoforce has used the DTS sparker on other survey vessels, running simultaneously with profilers, sounders and seismic systems. Getting all systems running together simultaneously can be a trial and error process.

Geoforce always installs the DTS system with separate ground lines to ship's hull and we rarely experience electrical interference problems. The HUDSON lab setup does not use separate ground lines. If scientists want to use the DTS sparker, then AGC staff must be willing to consider changing the way they set up or ground their systems, otherwise it is not worth the effort to hook up the sparker.

(6) The DTS system on HUDSON is currently fully operational. Some rewiring of the Junction Box and deck cables will be necessary to accommodate the shear wave experiment. The parts consumed should be replenished.

SIDE SCAN OPERATIONS - TECHNICAL

Borden Chapman
Jes Nielsen

The Simrad MS-992 side scan sonar was used during the Hudson 94-027 cruise. Standard to AGC operations, the system consisted of the following items:

(1) Simrad MS992 Colour Enhancement Dual Beam Sonar, AGC System "A"
(2) Dual frequency, 120kHz, and 330kHz towed body (fish)
(3) Hawbolt winch with 2000 metres of cable
(4) SE-880 digital logging system
(5) Standard '486 PC for AGCNAV display
(6) Tektronix model 2230 dual channel oscilloscope for data quality monitoring.
(7) Alden Hard Copy thermal printer.

The data logger, SE-880 was used to log side scan data. All four channels were used during all side scan operations. Port 110 kHz signals were recorded onto channel 1, Starboard 110 kHz signals to channel 2, Port 330 kHz signals to channel 3, and Starboard 330 kHz signals to channel 4. System trigger was recorded on trigger channel 1. A total of 21 Exabyte data tapes were used.

During the program, various side scan lines were run using the listed equipment and no lost survey time occurred as a result of major technical problems apart from winch repairs as discussed below.

Hard copy paper records were collected using an Alden thermal printer on all the survey lines.

Data quality was judged by the operator to be fair to good.

Some repair/adjustment was required to the Hawbolt winch and the newly installed winch remote control. The problem presented difficulty in the recovery of the fish, especially if a large amount of cable was deployed. Proper repairs were carried out by contract personnel during a two day port stop in Sydney, Nova Scotia.

SIDESCAN DATA ACQUISITION

Randy Currie

SE880

Sidescan sonar data were collected and digitized from the Simrad 992 Sidescan system. The analogue was digitized on a GeoAcoustics SE880 digital acquisition system. Lines were stored on 2 gigabyte Exabyte tapes in a SEGY format. The channels on the system were configured to store the digital data in the following format:

Channel: 0	Simrad 110 Khz data (port)
Channel: 1	Simrad 110 Khz data (starboard)
Channel: 2	Simrad 330 Khz data (port)
Channel: 3	Simrad 330 Khz data (starboard)

We attempted to store individual lines as separate files on the tapes. There were several occasions the SE880 "hung". The system was re-booted and the EXABYTE tape replaced. The average swath width was 200m per side. These data were then processed using the Digital Initiative processing suite (see Processing Digital Sidescan Data).

AGC-DIG

The AGC Digitizer system was tested on HUDSON 94-027. The system was developed as part of a project to study the feasibility of building a "cheap PC-based" digitizer. AGC-DIG is a PC-486 computer running a REAL TIME DEVICES Analogue to Digital converter, a SCSI board and an Ethernet board. The software was developed at AGC. During the cruise the software was upgraded to write the data in SEGY format, and to output directly to EXABYTE tape.

Using the Ethernet board and the Hudson Ethernet, we were able to digitize data on AGC-DIG and output directly to the HP workstation for processing. This had a significant time saving as the data were accessible at the termination of each line.

The system performed without any errors during the entire cruise. AGC-DIG was configured identically to the SE880.

Processing Digital Sidescan Data

Digital data processing was done on an HP 720 workstation running HP/UX version 9.0, Motif 2.0 and the Digital Initiative processing suite. The system is configured with 64 megabytes of memory and 5 Gigabytes of disk storage.

Processing Flow:

Import Digital data (from tape)
Decimate the data set
View the data set
Perform a manual selection of the first bottom return
Update the file

Merge the navigation data
Apply Slant/Range and beam corrections
Mosaic the file to place it on a geo-referenced grid

Output the mosaic to hardcopy

AGC-DIG was used in "network" mode. The digital data were transferred across the network directly to the HP workstation. (This method saves hours in processing, because we eliminate the need of having to copy the data from the Exabyte tape.) We were able to collect the data from a survey line, and process the data before the ship was on the next line.

We used the system to generate several detailed mosaics. These mosaics were used in selecting sampling locations.

Navigation problems:

The weakest part of the system is adequate navigation processing tools. During parts of the survey, the navigation systems output large spikes in the data sets. Software was written to perform filtering. The Digital Initiative software does not provide any tools for processing/filtering/smoothing the navigation data. It will have to be addressed for future cruises.

AGC LARGE DIAMETER CORER

Bob Murphy

The piston coring system used on this cruise was a large diameter (11 cm ID) system with the capability of 30 metres of penetration. This system was modified for shipboard use on the CSS HUDSON. Corer components consist of the following:

(1) Core head: 3 cm long, 0.6 m diameter
(2) Core pipe: 4.25" I.D. with 3/8" and 3/4" wall thickness
(3) Couplings, straight and reduced for connecting barrels
(4) CAB liner
(5) Split piston
(6) Core catcher and cutter
(7) Trip arm
(8) 4.25" diameter gravity corer, used as trigger weight
(9) 3/4" diameter wire cable (6000 m long) and end termination.
(10) Associated hardware such as set screws, etc.

Due to the size of the corer, (maximum 30 m long weighing approximately 4300 lbs) a special handling system was installed on the HUDSON. This system consists of the following:

(1) Rotating core cradle
(2) Outboard support brackets
(3) Monorail transport system
- Trolley
- Chain hoists
(4) Lifting winches
(5) Process container which consists of storing, cutting, and handling facilities for the core pipe and sample.

Performance

The corer worked well in soft sediments but was not effective in sampling till.

VIDEOGRAB

Kelly Bentham

There was a total of seven (7) two-hour video tapes (S-VHS) taken for station numbers 1,4,5,7,8,10,11,12,15,16,18,20,22 & 25. At those stations there were 60 black and white still photos taken as well as 300 colour slide photos.

The video tapes have LTC time code imprinted on channel 2 and will have latitude and longitude titles at each station. The still photos have GMT imprinted on the film.

There was a total of two and one-half (2 1/2) hours footage taken of the general ship activities.

<u>Performance</u>

The videograb worked excellently until a problem with the cable stopped operations.

IKU

The IKU grab sampler was used three times, and functioned perfectly.

EXCALIBUR

The Excalibur pore fluid sampler was used once, and the instrument case flooded. Recovered a sample of water.

NAVIGATION

Dave Heffler

The Navigation on Hudson 94-027 may have been our most ambitious attempt at positioning seafloor features and the instruments used to sample them (Figure 7). It involved a combination of Differential GPS (DGPS) and a Short Base Line (SBL) acoustic navigation system. It was hoped to add a Long Base Line system as well. Time restrictions and acceptable performance of the SBL prevented the LBL system from being implemented. The LBL was partially tested and, in spite of many obstacles, appeared close to working.

Differential GPS

The differential corrections for the GPS were supplied by a geosynchronous satellite link with Long Island N.Y. supplied by Seaforth Engineering Group. The system proved very accurate except for the night of 236/237 and during the day of 237, it completely failed. Several Inmarsat calls revealed a power failure on Long Island as the cause and we could temporarily change to a Duluth WI station which was slightly less accurate. When the Long Island Station was restored (237/2100 UT) it was extremely quiet for the remainder of the cruise.

Seaforth supplied a spare receiver which did not appear to function well. The gyro stabilised receiver worked without problems.

The Magnavox MX4200D GPS receiver was used for DGPS. It was configured with a PC running

Magnavox's 4200.EXE version 2.23. The MX4200 was then reconfigured using MIRROR with a script file which automatically sends a small ascii file to reduce the quantity of output data. The file is:

```
$PMVXG,007,,1,,,,,,,
$PMVXG,007,001,0,1,,1,4,,,
$PMVXG,007,011,0,1,,1,,,
$PMVXG,007,021,0,1,,1,,,
```

Which causes the MX4200 to output

```
$PMVXG,001,085544,4528.393,N,05722.510,W,00015.6,5*59
$PMVXG,011,253.4,012.0,,,,,,,,*4B
$PMVXG,021,377743.96,4528.3935,N,05722.5100,W,00015.6,-009.8,-005.9,-001.8,05*6F
```

every second.

This computer has 4 critical batch files which can be called from any directory (They are in c:\bat to which there is a path)

4200 Starts the Magnavox CDU program to control the MX4200. The MX4200 Control Port (2) must be plugged into COM1 of the PC before invoking the program. This changes the codes which the 4200 outputs so after this, you should run AUTO.

AUTO Runs MIRROR with a script file which reconfigures the 4200 output and then exits.

TALK Runs MIRROR to display the output of the 4200.

(The MX4200 must be connected to COM1 for all three of these.)

AGCNAV Starts AGCNav. The rebroadcast data from the bridge must be connected to port 2.

A Trimble 10X non differential GPS was also on line as a fall back position. It is also a vital component of the log and gyro feed to the navigation computers.

The serial Multiplexers (MUX's)

The data from the T10X, the MX4200 and several other sources were combined with a Baytech Multiport Controller (MUX)(sn 460771) in the nav centre. The MUX accepts data on 8 ports and sends each complete line out on the "HOST" port. It prefixes each line with a single character to define to port on which the line was received.

An additional MUX (sn 477131) was installed in the GP lab to combine the data from the SBL and the Sidescan fish attitude sensor. (It was also intended to include data from the LBL and the Knudsen sounder but neither of these were implemented). This MUX appears to follow the line with line feed, port identifier, carriage return.

This combined data stream was routed to Port 1 of the AGCNav computer on the bridge. Most of the data were in NMEA format which permits any characters to precede the $. For these sentences, AGCNav can easily ignore the extra digits sent by the MUX's. However, the SBL outputs a fixed format sentence which AGCNav is programmed to decode. The preceeding character causes AGCNav to ignore the SBL data.

At the start of the cruise, a small TattleTale computer was used to discard the prefix from a single MUX. When the second MUX was added, the Tattletale program would no longer work. We wrote a program (TRACKFIL.C) which ran on a laptop computer in the nav centre. This fixed the MUX problem and also discarded SBL lines with serious error codes. However this computer would hang once or twice a day and needed to be manually restarted. When it failed, AGCNav on the bridge, and all around the ship, would freeze.

AGCNav (Version 3.00 and 3.01)

AGCNav version 3.00 was used on Hudson for the first time. It had several new features and revealed several new problems. The key feature which is new in version 3.00 is the "Broadcast" capability. One computer (for this cruise, the one on the bridge) serves as the Master. It can accept data on one or both serial port inputs. It will then rebroadcast all of these data on one port. The output of that port was distributed around the ship with the ship's twisted pair wiring system (as RS-232 signals at 9600 baud). Hence all other AGCNav sites required only one port. The Master was also programmed to broadcast waypoint and survey line data as well. When a waypoint or survey line was entered on the bridge, it instantly appeared on all the remote sites. This was generally a great advantage. (On a few occasions, it causes a remote site to suddenly loose it's active waypoint and the screen display to suddenly change.)

Version 3.00 also gives some control of the screen colours and this proved advantageous on the bridge at night. The optimum colours have not yet been selected.

Version 3.00 also has chart datum offset control and can send text messages from the master to the remote units but these functions were not used on this cruise.

AGCNAv version 3.00 proved very robust on this cruise. About 1 or 2 failures per day of the bridge computer were probably caused by the TRACKFIL program failing on the demux laptop. AGCNav never failed before this was installed. AGCNav at the remote sites never failed. When bad data crashes the master it dies before rebroadcasting it to the remote units.

One remote was setup in the nav centre to act as the logger and control PC for the MX4200. During sidescan or sampling operations (most of the cruise), most of the data were logged at full rate, generating about 20 Mbytes per day. This was offloaded via the ethernet to the HP workstation at least once a day. The file could be ftp'd to any PC from that site. (AS a backup, the entire navigation stream, about 45 Mbytes per day, were logged in daily files on the VAX.)

Another remote was used in the nav centre to log short sections of data. It would be started (i.e the existing log file was renamed to something else) just before a station. At the end of the station, the short (1 Mbyte or so) file was renamed and copied via floppy or ethernet to another site. This facilitated processing short segments of the data.

AGCNav version 3.00 does not give any choice of file name, only of the directory in which the data will be logged. AGCNav forces the log file to follow the AGC navigation file name standard of:
ssssddda.yyE where

ssss	4 character ship name
ddd	day of the year (1 to 366)
a	file sequence character (A-Z)
yy	year (94)
E	signifies raw NMEA data format.

Unfortunately, in the DFO licensed version, the ship is called CSS-HUDSON. and this cannot be changed. Hence the file names are CSS-dddA.94E instead of HUDSdddA.94E. This should be fixed in the future.

At the end of the cruise, I generated an AGCNav version 3.01 which should solve the problem with the multiplexers by:

(1) removing 1 or 2 digits before an ORE line
(2) Ignoring the line length check
(3) If an error code between 1 and 49 appears, change the sentence ident to POREX so it can be logged but AGCNav will not use it for plotting.

Since this was done with the GSC version, the ship name can be changed to HUDSON and the file names will be more appropriate. This version must be used throughout the ship to properly decode the broadcast messages. On the night of 243/244, several of the remotes experienced some crashes. There may be a problem with 3.01.

Sidescan Fish Flight Parameters

The Simrad sidescan sonar outputs fish attitude information on a serial port. Tim Newell generated a PC program called SONARCTL which decodes this data and displays it in real time and also reformats it in an NMEA like string and outputs it on the serial port. This string is of the form

$SMFAT,time,compass,depth,altitude,roll,pitch,temperature

It is fed via the GP Lab MUX to the nav stream and can be logged with other navigation data. The fish depth and fish heading may be useful in future processing of the sidescan data. One should be able to add the depth and altitude and create a digital depth along the track. The heading data should be useful for mosaicing the data and the height data could be used to aid in automatic bottom picking of the data. This is the first time that these data have been logged with AGCNav and we know nothing of its accuracy or reliability.

The Short Base Line system

The ORE Trackpoint II was used as the SBL on this cruise. The control box was mounted in the GP lab and the hydrophone mounted on the RAM in the GP Lab. The SBL acoustically tracks a transponder in the water, outputting the slant range and bearing relative to the ship. If the ship's position, heading and transponder depth are known, the absolute position of a towed, lowered or bottom mounted instrument can be measured every few seconds. Corrections must be made for the location of the GPS antenna and the SBL hydrophone with respect to the centre of the ship.

AGCNav was specifically designed to accept Trackpoint II data. It must be configured with these offsets. The values used are:

GPS 4 m to starboard of the centre line
6 m forward of the centre

ORE 1 m to stbd of the centre line
21 m aft of the centre
7 m below waterline.

The SBL was used in two different modes on this cruise.

1) It was used to position the sidescan fish which was towed at a depth of about 250 m and a range of 800 to 1600 m. In this mode, the bearing with respect to the ship was 180° +/- 30°. The ranges were very stable in spite of operating beyond the maximum specified range of 1000m. The bearings were slightly noisy but filtering the positions before generating sidescan mosaic reduces this problem. In this mode, the hydrophone was ahead of the wake and the ship was run at 3 to 5 knots, aiding reception. When accurate positioning was required on the

detailed survey, the ship was slowed to about 3 knots, allowing the fish to reach a depth of 350 m with only 800 m slant range. The signals at 800 m are better than at 1200 m or more. In future operations of this nature, a depressor on the sidescan cable will help to get the fish down with less wire out. The system should not be expected to operate much beyond the 1600m used on this cruise.

2) The SBL was also used to position the various samplers used to sample the seafloor. These included the piston core, the video grab, the IKU grab, the box core and Excalibur. The water depth was about 390 m for all sample locations. The SBL data were used by AGCNav to show sampler position in real time. The logged data were also reprocessed to reduce the effects of noise.

There was a persistent apparent error in the SBL positions as displayed by AGCNav. The sampler appeared to be about 20 to 30 forward of its likely position. It was as if the -21m ORE hydrophone offset was not in effect. However, when the system gave a zero range and when I hung a transponder from the bow (in port), the position was displayed correctly.

Late in the cruise, I discovered that the problem was not a horizontal one but a vertical problem. AGCNav corrects for the ORE transducer depth in doing the position calculation. The Trackpoint can use 3 depth modes, telemetered, manual input and calculated. The first two of these use the sea surface as reference. In calculated mode, the Trackpoint uses the depression angle and the slant range to calculate the depth. This only works for depression angles greater than 45°. It is the mode used for most of the sampler fixes. The depth in this mode is with respect to the transducer and the 7m transducer depth should not be subtracted from the beacon depth in calculating the position.

The typical geometry on this cruise was a depth of 400 m and a horizontal distance from the ORE transducer to the beacon of about 50 m (GP lab to fore deck crane). An error of 7 m in depth causes Mr. Pythagoras to give an horizontal range error of 29 m. If AGCNav is configured for ORE depth = 0 m this problem is solved.

Of course, leaving the ORE depth =0 will introduce an error in the calculated position of the towed fish if its depth is entered manually. The geometry of towing the sidescan has a much greater horizontal range than depth and the horizontal error due to a 7m error in the depth is only 2m. The estimated depth of the beacon may not be accurate anyway.

AGCNav has no way to know if the depth reported by the ORE is with respect to the transducer or the sea surface. It is probably better to assume the depth is below the transducer and live with the small errors when it is not. That is, set the ORE depth to 0m in AGCNav.

Navigation Reprocessing

Navigation data were processed for two reasons on Hudson 94-207.

The major problem in creating sidescan mosaics is in determining an accurate fish position. This requires both ship position (DGPS) and positions of the fish with respect to the ship (SBL). Although the DGPS was generally excellent, there was excessive noise on the night of the accurate sidescan survey (236/237). The data appear to be accurate with many obvious glitches.

The positions of the various sampling tools were recalculated immediately after the station to give an improved target for the next sample. This involved considerable effort at the start but was almost routine by the end of the cruise.

AGCNav logs the raw SBL data ($POREB) and the beacon positions that it calculates in real time ($POREP). If the raw data are modified (smoothed, depth adjusted or ...) AGCNav can read this new file and recalculate the beacon positions. However this runs very slowly (about real time) and is not practical.

I wrote REDO_ORE.C which reads a raw "E" file and calculated the position for a specified beacon. The output is in "A" format (time, lat, long). (It current appends the depth in metres (from the POREB line) to each fix.) REDO_ORE reads the gyro from the $LGVHW lines, the time and ship's position from the $PMVXG,201 lines and the beacon slant range, azimuth and depth from the $POREB lines. It has the GPS antenna and ORE hydrophone positions built in and must be recompiled to change these. (In it's present form, the ORE Depth is 0, for "calculated depth" data.) The usage is:

REDO_ORE infile outfile -B b (where b is beacon number (1-6))

Smoothing the raw data was more problematic. I wrote SMOOTH.C to interactively smooth the range, bearing and depth data. This reads an "E" file and stores the three parameters in arrays. (It is memory limited to 1400 values of each or about 1 -2 hours of data at a time.) Each array is plotted with a segmented line which is automatically fitted to the data. The user can adjust the fit, specify a tolerance and then instruct the program to discard values outside of the tolerance. This is replotted and then the user can specify a time constant for a smoothing filter. The filter with a simple low pass recursive (IIR) passed in both directions so it is phase shift free.

Once all range, azimuth and depth are smoothed, the "E" file is copied to a new one with the smoothed values inserted. The syntax is similar to that for REDO_ORE

SMOOTH infile outfile -B

(where both files are "E" files).

This process was done with a batch job that excluded several sentence types that are unused, smoothed the data and recalculated the beacon positions. This batch job assumes several file naming conventions.

For each sample, the main AGCNav "E" file is clipped (see CLIPE) to a short (.1 to 2 Mbyte) "E" file named
xxxxdddA.94E where xxxx is the station identifier (SS23 for sidescan line 23, VG18 for Video Grab 18 ...).

This had several unused lines removed and called xxxdddB.94E. The smoothed version is called xxxdddS.94E which REDO_ORE converts to xxxxdddS.94A.

APLOT is used to view the resultant A file.

ETOA can be run on xxxxdddB.94E to show the ship's track. The resultant xxxdddB.94A file should be renamed HUDSdddB.94A. Then run REDO_ORE on xxxxdddB.94E to produce xxxxdddB.94A, a plot of the beacon positions with no smoothing.

Any A file can be plotted with Art Jackson's Trackplot software. Use INTA to interpolate the A file at a 5 second interval. (This also removes the comment lines.) Then insert a single line 94027 at the top of the file. Edit PL_DIR.DAT, run DXFMAP and ECAD to plot it. We made a 1:1000 plot of the sampler positions.

CLIPE

I wrote a small program (CLIPE.C) which is useful in clipping a small section from a large E file. It compiles on both a PC (in TC 3.0) and on the HP workstation. The usage is

CLIPE infile outfile start_time end_time
where both times are in the form hhmmss. (It does check that the times are reasonable.)

If you want several pieces clipped form the E file make a cliplist file in the form

file1 hhmmss hhmmss
file2 hhmmss hhmmss
...

Where file1, file2.. are the names of the desired files. The times must be reasonable and in order.

Then call

CLIPE infile -l listfile

SMOOTH and NAVSMTH operation:

SMOOTH is used to smooth the SBL data. It reads an E file and stores all the range, true bearing and depth data in three arrays. It then calls a curious function called big_smoothie on each of the arrays. big_smoothie first fits a segmented line to the data (at about 20 points) and displays a plot of the data and the fitted line. One vertex of the fitted line is circled. User interaction is by undocumented character keys (where case is important).

The l and k move the selected vertex right and left. The a and s keys move the selected vertexes slowly left and right along the data and the w and z keys move the point up and down (by and amount called tweak). the e key will cause the new vertex to snap to the raw data. If the data have noise glitches, which cause the fitted line to deviate from what is the obvious correct line, move to that vertex, shift it right or left (a or s) to where the is no noise and hit e (or drag it with w and z). Once the fitted line is correct, estimate the tolerance you will accept and adjust the tolerance value on the screen with T or t.

If the text overwrites the data, move it with a U or u. When you hit Enter, it will clip all values of the array one tolerance away from the fitted line And plot the new values.

It is now asking for a smoothing constant. 0 means no smoothing. A smoothing constant of 10 represents significant smoothing. You need to practice with how much smoothing to apply. Remember that the appearance on the screen is governed by the length of the arrays. If there are only 200 points in the array, a smoothing of 5 will appear substantial. If there are 1400 points, the same smoothing appears less as the displayed time scale is different, but is the same amount of smoothing.

When the data are smoothed, it asks to redo (r), quit the program (q) or carry on (Enter). When all three arrays are done, SMOOTH rewinds the input file and copies it to the output file, substituting the smoother values from the array.

NAVSMTH works in the same way for the latitude and longitude from the PMVGX,021 lines.

The Long Base Line System (LBL)

An Oceano LBL system was borrowed from PGC. This included a new program called Seascape borrowed from DFO at IOS. The LBL consisted of the following parts:

An Acoustic Module (AM) installed on a RAM under the bow. (A spare AM was also on board). There is a permanent cable in Hudson between the ASDIC space and the GP Lab.

Two Receiver Modules (RM's) which control the AM and interface to a computer on IEEE 488. There was only one power supply for these RM's so only one could be used at a time.

Four transponder/releases to serve as the bottom array. We had enough train wheels and rigging for 11 deployments.

Two transponders configured as "Relays", which could be attached to a sample and tracked.

A TT unit and hydrophone which is used to command the release of the transponders.

A PC (from AGC) with a Digiboard from PGC and a IEEE-488 board bought by AGC for this application.

A program called Seascape. This is a new product of Software Engineering Associates (Seattle) (SEA) and is owned by DFO in IOS.
Before the cruise, I talked to PGC, IOS and SEA in preparing the system. Several components arrive immediately before the cruise. The computer could not be made to talk to the RM until after we sailed.

While at the dock in Sydney, I tested the RM, one transponder hung from the starboard waist and one relay hung from the port quarter. The computer finally appeared to talk to the RM which can control the frequency of the AM. The ranges measured by the RM could be read by the Seascape program in the PC. I wrote a program (NAVSPLIT.C) which ran on another PC and split the AGCNav stream into two ports to feed GPS position and ship's head to the LBL PC via the digiboard.

Before the port call in sydney, we deployed a "multibeacon". This consisted of an Oceano transponder/release with a 2 sphere buoyancy package, floating 40 m above a single train wheel. An ORE SBL beacon and a Datasonics sidescan transponder were also attached. The intention was to use this a tie point between the SBL, the LBL and the sidescan records. The SBL beacon worked and its position was logged during most of the sampling in the area of "Great Pock".

After the port call I was too busy with the SBL system to continue work on the LBL, in spite of the apparent success at the dock. Nothing more was done with the LBL system except to recover the multibeacon on day 239.

In summary, the LBL system was not used because

(1) The pockmarks we found were large targets.
(2) The SBL seemed to be sufficiently accurate.
(3) The limiting factor in sampling small targets was in ship handling, not in positioning.
(4) There was insufficient time for me to complete the configuration of the LBL and deploy and calibrate the field array.

CHATS and PAL - The Piston Core Instrumentation

CHATS (Core Head Acceleration and Tilt System) and PAL (Piston Acceleration Logger) were installed on the piston corer for all deployments. CHATS 1 was mounted on the core head and CHATS 2 was mounted on the trigger core head. PAL 1 was in the upper part of the split piston and PAL 2 in the lower. These instruments were virtually as used on previous cruises. New pressure transducers with a full scale range of 2000psi were fitted and the pressure signal gain was doubled to give a range of 0 to 600 m and a resolution of about .15 m in CHATS and 1.6 m in PAL. The program was modified slightly to enable easier time setting and also to trigger high speed logging on "depth only".

CHATS and PAL normally log data at 100 scans per second and only have enough memory for 3 minutes (6 minutes in PAL). Hence the logging must start just before the corer is triggered. IN the past this was done by lowering the corer almost to the seafloor, pulling it up 50 m and then down again. The computers in CHATS and PAL sensed the "down-up-down" and started their logging. This complication was required as the pressures sensors did not have a reliable absolute calibration.

On this cruise, we could not do the "down-up-down" as it would interfere with attempts to hit a small target. Luckily, all the cores were at the same water depth and, after an initial calibration, the instruments could be triggered on "depth only". On the first deployment, they were set for 5 scans per second, giving a logging time of more than an hour. The data were scanned for the reading at a known depth and accurate calibrations were determined for each sensor.

A summary of the data gathered is

Core	Head	Trigger	Upper Piston	Lower Piston
0002	5/s ok	5/s ok	5/s ok	5/s ok
0006	10/s ok	10/s ok	10/s ok	10/s ok
0009	100/s ok	100/s ok	may be a little late	ok
0014	ok	ok	too early	too early
0017	ok	ok	ok	ok
0019	ok	ok	no piston used	
0026	all ok			
0030	all ok			
0031	all ok			

The data have not been analyzed. A cursory look suggests that the cable was not slack enough and the motion of the ship caused several strong tugs on the piston when the corer was in the sediment.

The data and support software have all been zipped to a file on a single floppy. To use, create a directory called CHATS and PKUNZIP -d a:hud94.zip. This will recreate the directory structure on your hard disk. There are 4 batch jobs to view the data (c1,c2,p1,p2); call any with a 2 digit station number and scanvu will show the data.

The KEL 320B sounder

A newly acquired sounder, the Knudsen Engineering Limited 320B "Black Box Sounder" was tested. This is a digital black box which is controlled by a PC via a serial port. The depth data can be automatically tracked and output on this serial port. In addition, the actual digitized bottom return can be logged on a PC via a SCSI port. AGC already owns a 320M, which has a traditional front panel and paper record. The 320B was delivered the day the cruise started. The software for the control was not ready so the company supplied a front panel from a 320M. The SCSI program for this cruise was in a very crude form. These are dual frequency sounders and our new 320B was configured for 3.5kHz and 12 kHz. There was no documentation re the front panel of the cabling.

Luckily the operation was similar to the 320M which I remembered how to operate. Borden Chapman disassembled the unit and determined the transducer connector pinout. The SCSI board and software supplied by KEL was installed in a PC and the system operates. It was connected to the 3.5 Khz array and gave a weak, noisy bottom on the screen. The signal was too poor for the digital tracking to follow.

We "'scoped" the signal on the transducer and it looks like a random bit pattern, not a 3.5 burst. We logged a little data and transferred to the workstation. Randy Currie wrote a program to convert it to SEGY and view it with DIVIEW but this did not improve the appearance.

We connected it to 12 Khz and although the 'scope on the transducer looked better, no signal at all could be seen on the PC display. The system was repacked for shipment back to KEL.

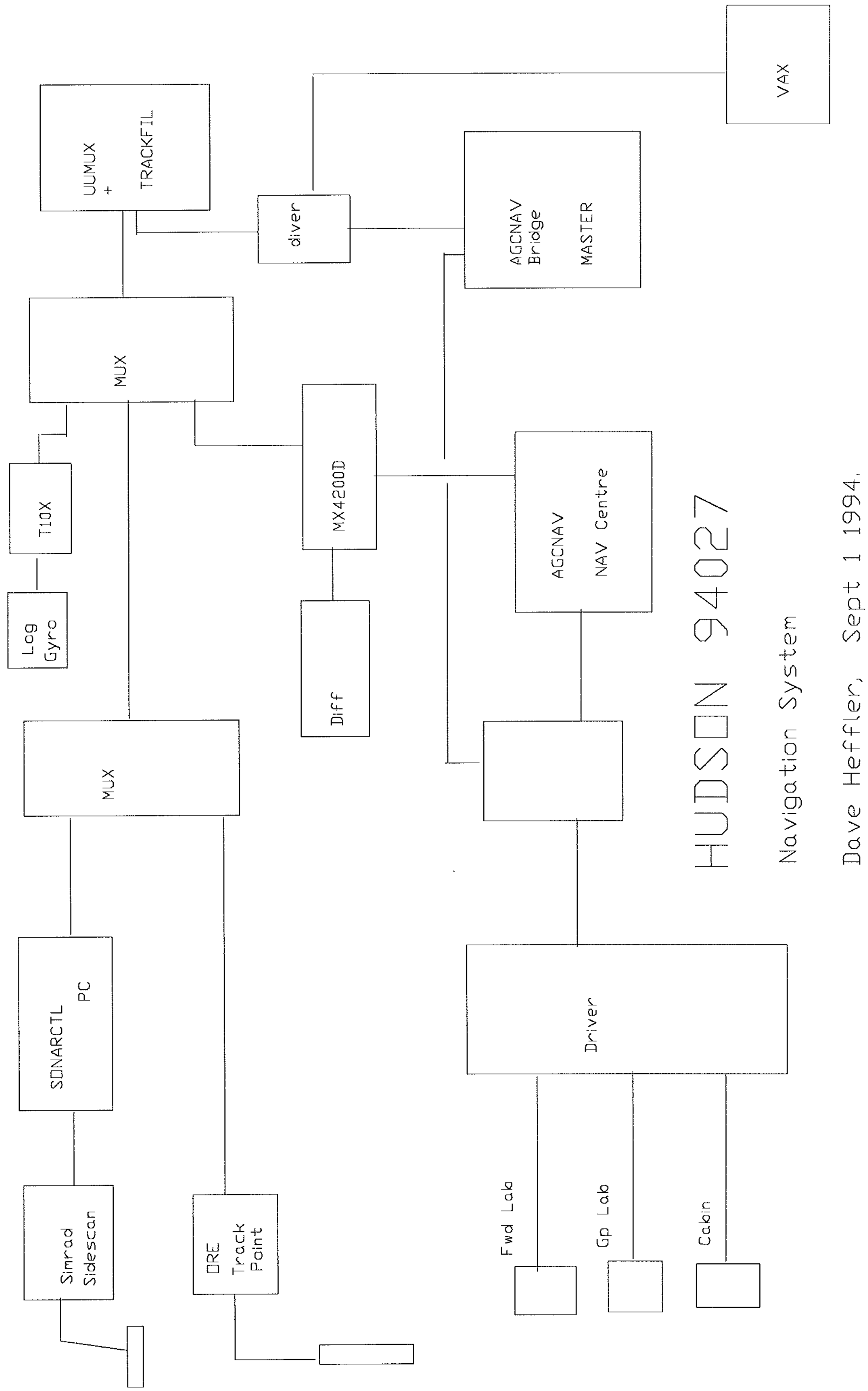


FIGURE 7

NAVIGATION SYSTEM, HUDSON 94-027

LABORATORY CORE PROCESSING: DETAILS OF OPERATION

Iris Hardy
Kate Jarrett
Marilyn Ferguson

During this cruise all AGC long cores, pushcores and video grabs were processed onboard. Processing included Multi-Sensor Track (MST) measurements (see section on Physical Property testing below), sediment description, split core photography as well as a variety of geochemical subsampling for post-cruise laboratory measurements (see geochemistry section below). All core processing was performed following those procedures established in the Atlantic Geoscience Centre (AGC) sampling manual (GSC Open File #1044) and as per Figure 8.

Initial core procedures included orientation of the core liners, capping and labelling, in the starboard half-height container. Core sections were maintained in an upright manner within the AGC refrigerated container #18 until processed.

Prior to sampling, each core had a pre-designated sampling schedule. This permitted subsampling to proceed as per cruise program requirements (Figure 9). All subsampling performed has been documented and annotated in the Program Support Subdivision's database FINSS for eventual downloading to the master Sample Information Database (SID). This dBase III + based inventory system handles the storage and report generation of all samples, records and tapes collected during the cruise. A full inventory generated by FINSS of all collected data is included at the end of this report.

After initial processing of whole round cores on the MST, each core was then split longitudinally on the AGC Duits core splitter into working and archive halves. The archive halves were consistently photographed downcore at 20 cm intervals against a Munsell Chart, Kodak grey scale and colour control patch. A visual core description was then made on the archive half. Once completed the Minolta CM-2002 Spectrophotometer was applied to archive core at 5 cm intervals downcore. Working core halves were subsequently subsampled according to sampling requirements pre-determined for each core including: grain size, bulk density, diatom determination, redox potential, porewater plus nutrients, carbon, water content and salinity.

Physical Property Testing

Unsplit sections of core not taken for geochemical, permeability or triaxial testing were taken from the refrigerated container and run through the computer controlled MST at a 1 cm sampling interval. The MST consists of:

(1) A pair of compressional wave transducers to measure the uncorrected velocity of compressional waves in the sediment.

(2) A gamma ray source and Sodium Iodide detector for measuring the attenuation of gamma rays through the sediment.

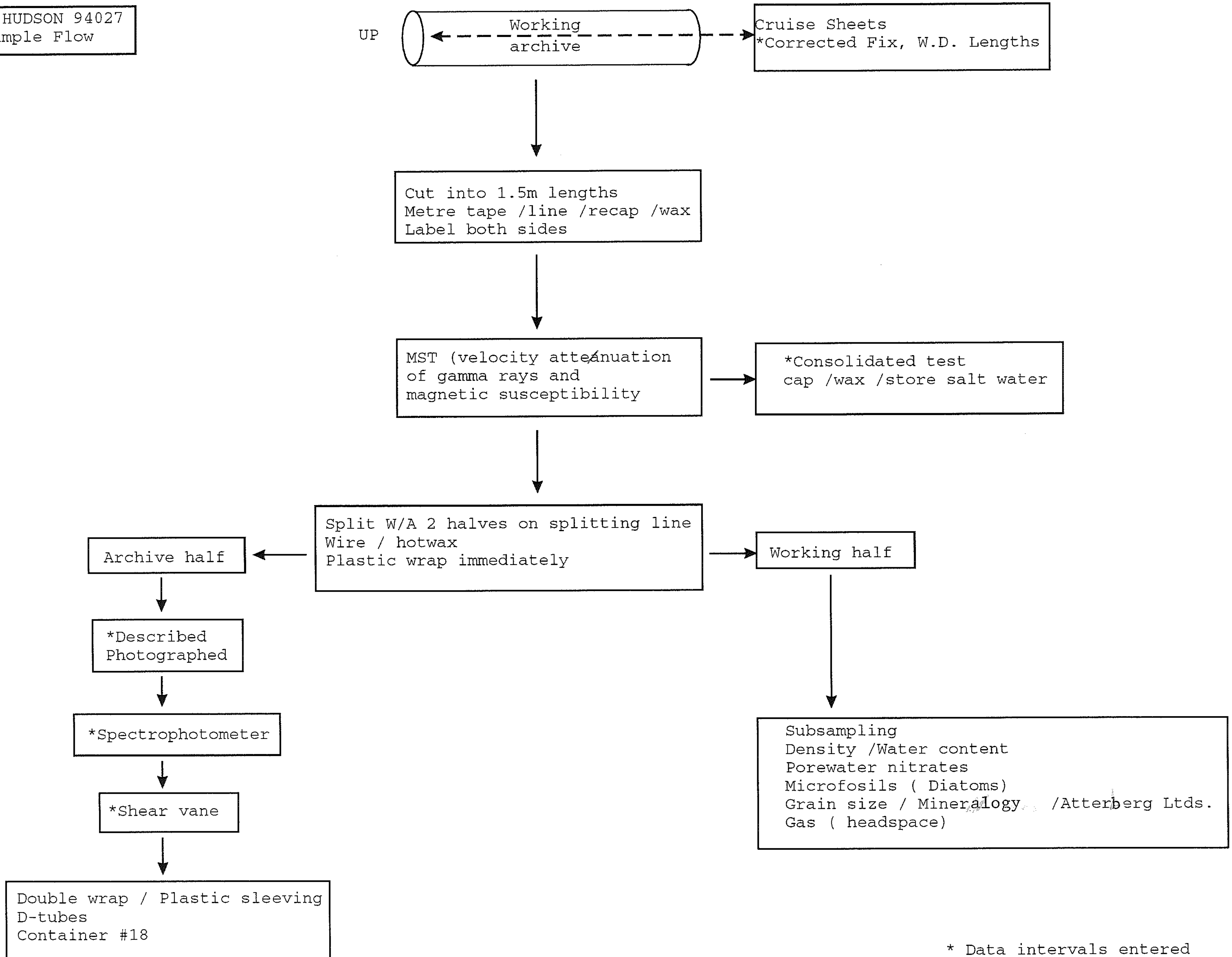
(3) A Bartington Magnetic Susceptibility Meter and Coil to determine the amount of magnetic material present in the sediment.

In addition the diameter of the core is measured using a pair of displacement transducers which enables the compressional wave velocity and bulk density, from the gamma ray attenuation measurements, to be accurately calculated.

A piece of aluminium of two different diameters in core liner and a section of liner filled with desired distilled water were run through the MST at regular intervals as a calibration check.

AGC CURATION

CSS HUDSON 94027
Sample Flow



* Data intervals entered into FINS

FIGURE 8
CORE PROCESSING PROCEDURES

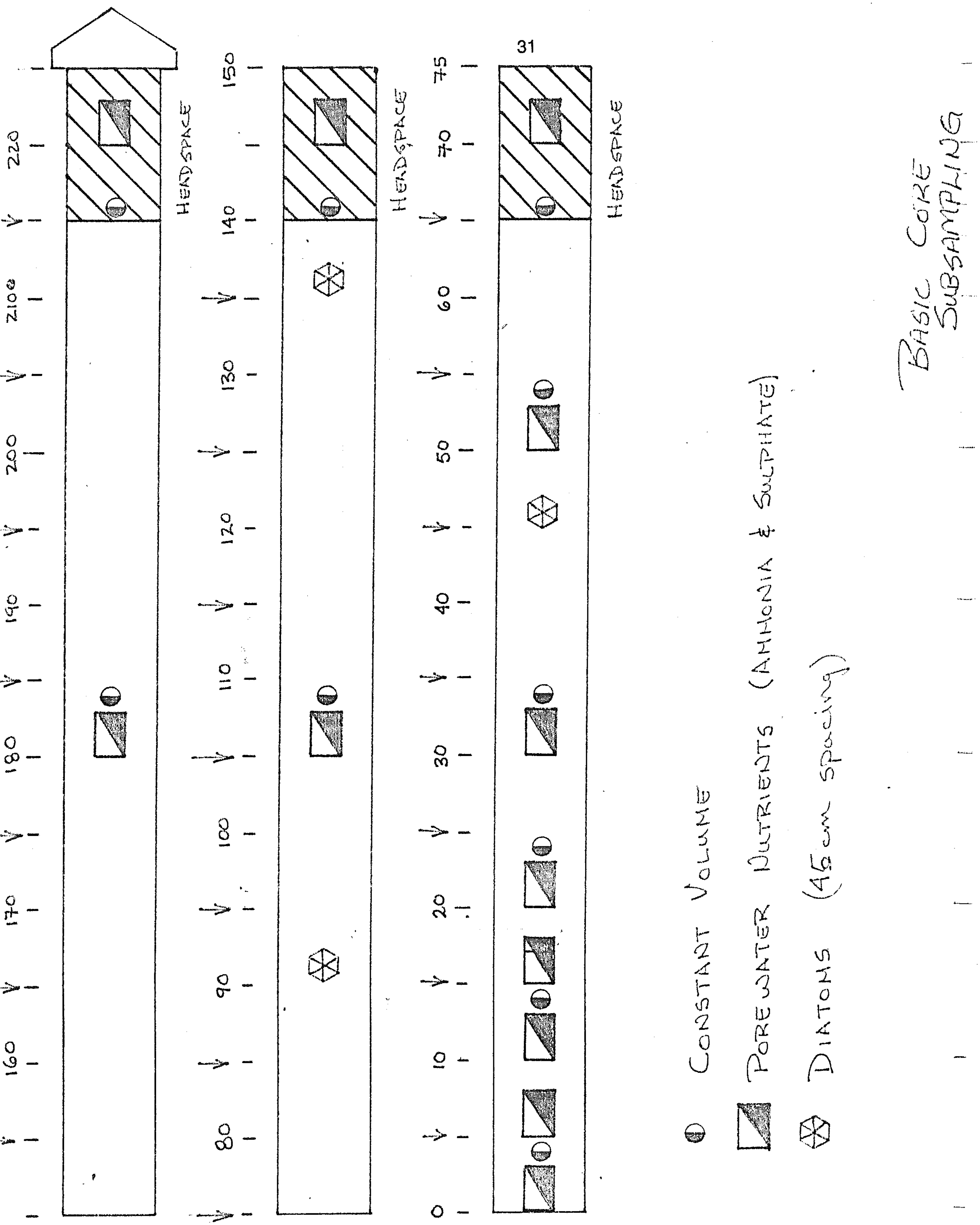


FIGURE 9
CORE SUBSAMPLING PROCEDURE

The whole core sections were not allowed to reach ambient temperature prior to running through the MST due to the geochemical sampling requirements, therefore corrections for drift are required for the magnetic susceptibility measurements and further temperature corrections are required for the compressional wave velocity measurements.

This was the first use of the MST at sea and it worked well in the sea conditions on this cruise.

Split sections of core were measured for undrained shear strength using a modified Wykeham-Farrance motorized miniature vane shear device at a strain rate of 60°/minute and recorded digitally. Peak and residual strength measurements were taken every 10 cm and remolded strength measurements were taken every 60 cm. Constant volume subsamples were taken for calculation of water content and bulk density. This bulk density data will be used as a further calibration of the MST bulk density data.

Summary

Over a 17 day period, more than 22 cores and 14 video grabs, recovered more than 55 metres of unconsolidated sediment (Table 2). More than 350 subsamples were recovered for porewater nutrient (ammonia and sulphate), water content and bulk density measurements, diatom identification together with headspace gas chemistry samples for microbial and thermal diagenesis. After gas extractions these same samples will be reused for grain size determination.

Six cores taken during this program encountered distinct marine red (7.5YR3/4) clay/silt sediment beds contained within the surrounding gray-olive (5Y4/2 to 5Y4/3) coloured sediments. This unit varies from a few centimeters in thickness to intervals up to 200 cm thick (94027026). The upper contact with the gray to olive coloured sediment is often gradational over a few centimetres, caused by bioturbation (ie. 94027026, 031). The lower contact is commonly quite sharp giving way to a diamicton. Most often red pigment is attributable to a hematite clay fraction within the till. The till encountered within these same cores is considered to be late Wisconsinian in age. Core 94027002 penetrated two diamict units separated by 40 cm of the distinctive red clay (a chronohorizon?). Ice flow pattern and directions may be further determined by x-radiography utilizing the AGC Philips constant potential x-ray system MG161. Composition should be determined from the magnetic susceptibility and carbon measurement results.

Recommendations for General Purpose Lab
(in order of priority - see also Figure 10):

(1) Air Conditioner: The corner unit located port side of the vessel is an area which can easily accommodate the MST. Build-up of condensation due to a low point in the overhanging ductwork resulted in water leakage upon the system's maincomputer. This may have resulted in extensive mechanical failure if it were not for the observations made by ship's people who brought this situation to our immediate attention and prevented the loss of a $75 k piece of equipment upon which this program depended. The situation, however, is not rectified. A large 4 ml piece of plastic and bucket for water buildup is not acceptable.

(2) Particulate Fallout: Flakes of paper-based material have been observed falling over equipment, computers and samples over the duration of the cruise. Core processing staff have also complained of dry eyes and throats, which may also be related to exposure to this material over long periods of time. This situation may jeopardize results and cause subsequent failure to computer equipment.

(3) GP Lab Deterioration: Past cruise documentation has identified this same problem. General maintenance of the lab is poor. Drawer bottoms remain broken. The port side doorway has exposed ship's metal and no insulation.

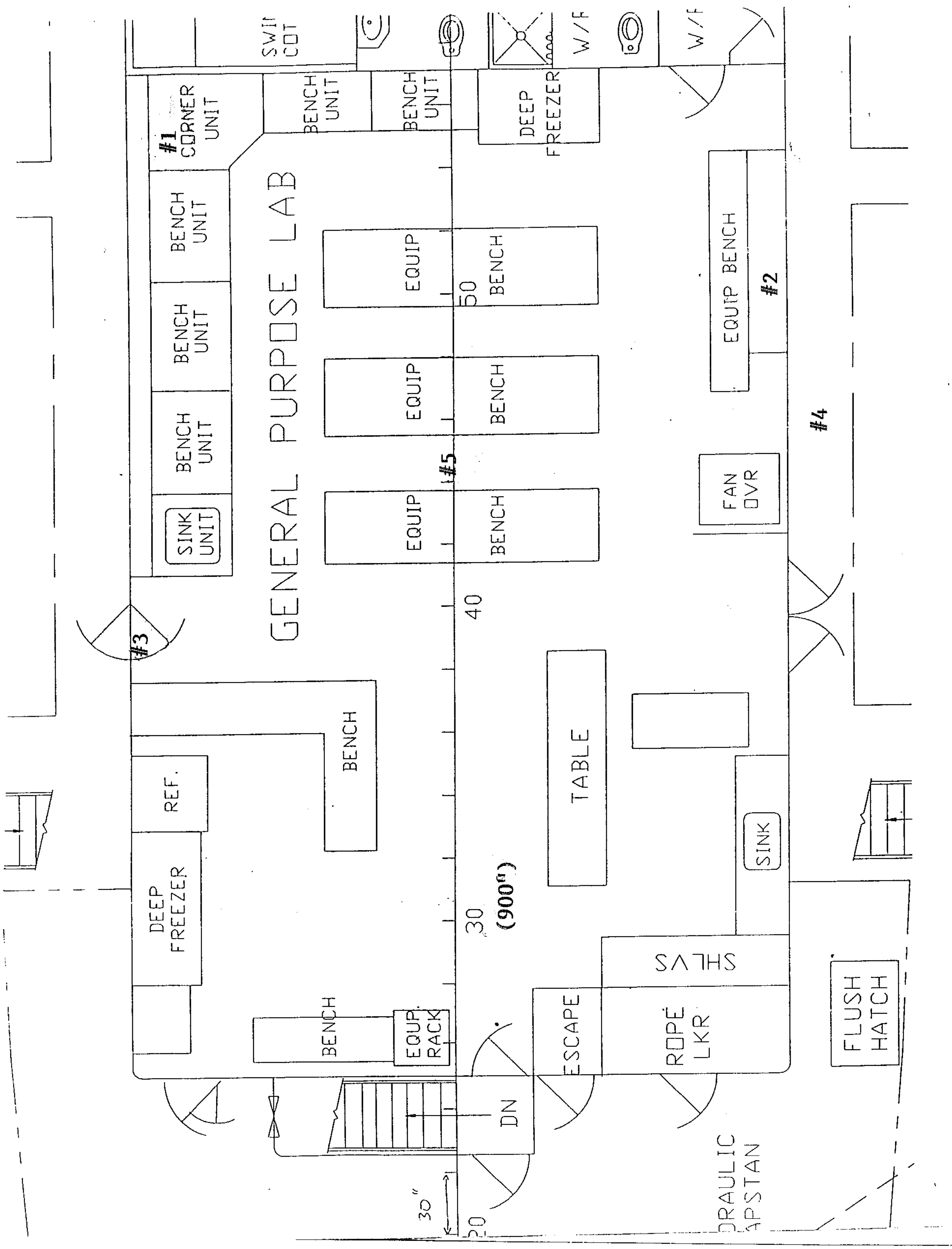


FIGURE 10
LAYOUT OF GENERAL PURPOSE LAB WITH SITES OF DEFICIENCIES NOTED

(4) Outside Drain: An overhead pipe for an air conditioning unit drips water directly overhead when trying to gain access to the AGC container #18. Perhaps the pipe could be extend further.

(5) Power supply outlets: increase the number of the 110 outlets across the central ceiling beams.

Minolta Spectrophotometer

General observations about the operation of the Minolta CM2002 Spectrophotometer and, its particular use for measurements on core samples at sea, and in a variety of weather and sea conditions.

(1) The instrument is relatively easy to operate and the controls are generally well placed. In rough seas, the placement of the "measurement button" on the same side as the support strap can result in inadvertently depressing the button. This error is easily corrected by using the "delete #x" option.

(2) The use of the target mask in conjunction with the hard core liner is somewhat complicated. The mask is deeper (front to back of instrument) than the core liner is wide. If the sample being read is wet, has a very uneven surface, or the end caps or styrofoam end packers are not flush with the sample surface, the aperture does not come in close contact with the surface. During this cruise, notes were made for any measurement that might have been affected by "Stray rays". In several instances readings were not taken because of uneven surfaces. In most of those cases this resulted in a loss of no more than 2 consecutive readings (data was mainly collected at 5 cm intervals so no more than 10 or 15 cm went unsampled in this way).

The target mask is useful for keeping the orientation of the aperture consistent for each reading. One solution might be to change the orientation of the 90° markings on the mask so the instrument is held "sideways" along the length of the core. This was not considered an option because several sets of data were collected before the problem presented itself.

(3) A related problem is the use of the instrument on the "naked" surface of the slit core rather than with a clear wrap or translucent cover. It was suggested we try white calibration with and without wrap, and there was a "fudge factor" with the wrap on. Subsequent readings were all done without wrap and earlier runs were redone without the wrap, with the readings collated with each other.

On occasion, the target mask was removed altogether in an attempt to avert problems as in (2) above. This was done infrequently because the mask was useful in keeping the flange around the aperture from being immersed in the mud. This was sometimes difficult even with the mask in place because of the fluidity of the sample surface, and unanticipated pitches and rolls of the ship in heavy weather.

Even though this aperture appears to be about 3 or 4 cm from the lens system, it was our impression that the chamber beyond the aperture "integrating sphere" should be kept as dirt and moisture free as possible.

(4) Eventually it was decided that keeping the instrument vertical at all times during a given sampling day would be the best solution for avoiding dirt inside this housing. This was not possible in very heavy weather when the instrument was placed on its side and taped down while not in use.

The two obvious solutions would seem to be a) a simple "cage" for the instrument that could be bolted to the lab bench when the meter is not in use, but when another sampling run was anticipated, and b) a cable or bungee cord secured in a track on the ceiling so the instrument could be rested for a few seconds between readings to allow recording data or preparing the sample surface for the next reading (ie, pulling back wrap for a few cm).

This way the flange around the aperture, the target mask (which is very easily removable), and the support legs can all be cleaned once or twice a day rather than between readings or after each run (which would be very inefficient and delay movement of the core sample along for other sampling techniques).

(5) The final suggestion would be a more complicated apparatus which might hold the instrument on a track that would ride along the surface of the split core and could allow the instrument to be locked in position if necessary. This with the ceiling track might be the ideal solution for combining protection of the instrument and coping with surface irregularities.

(6) Cleaning appears to be easily accomplished with distilled water and kimwipes, but a fine spray nozzle to clean the target mask would be ideal. A "Caliper" type device to remove any dried mud inside the aperture flange would be helpful. The white calibration cap should be protected from marring by wrap or a small reusable disc inserted into the cap before it is replaced on the CM2002.

GEOCHEMISTRY

William LeBlanc

Pore water analyses were done to provide shipboard chemical data to determine nutrient concentrations and depth profiles on samples taken within a pockmark and compare them to those taken outside a pockmark.

Approximately 200 mL sediment samples were sealed in "mason" jars fitted with septa for headspace gas analyses. A flow chart (Figure 11) describing the sampling is attached.

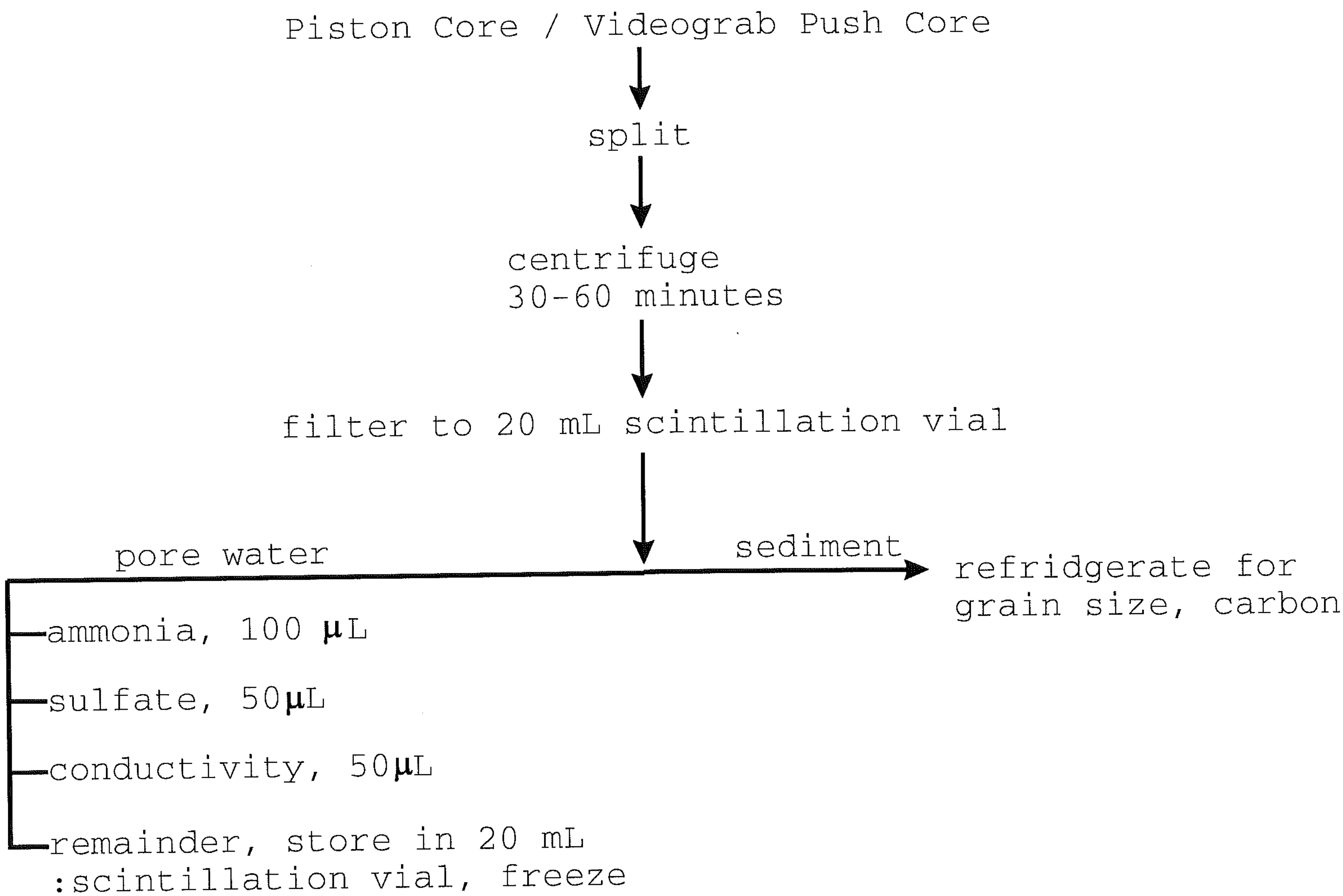
Sediment Subsampling and Pore Water Collection

Approximately 40 mL portions of wet sediment were removed from the split core and placed in 50 mL centrifuge tubes. Pore water was extracted by centrifuging the samples with 2 table-top centrifuges (IEC-HN-SII) at 2500 rpm for 30-60 minutes. Pore water recovery varied from often less than 1 mL to 18 mL, however, this was enough for ammonia, sulfate and conductivity analyses. The centrifuge tubes containing sediment were stored at 4°C for subsequent geochemical analyses at the Bedford Institute of Oceanography. The pore water was decanted into a syringe and filtered through a 1.2 micron nylon filter.

Dissolved Ammonia Analyses

Dissolved ammonia was measured by colorimetric absorbance of the oxidized nitrogen complex in a nitroprusside solution. Absorbance was measured at 640 nm with a hand-held Spectronic Mini 20 analyzer (manufactured by Milton Roy Inc.). This detector was very reliable if warmed up for a few minutes prior to measurements. The precision and accuracy of the method is 10%, (based on the method used by ODP).

Hudson 94-027 (August / September 94)
Laurentian Channel Expedition



Geochemical Processing

5 cm resolution - top 30 cm
20cm resolution - next 50 cm
35 cm resolution - to bottom

FIGURE 11

FLOW CHART FOR GEOCHEMICAL SAMPLING

Dissolved Sulfate Analyses

A 50 yL aliquot of pore water was placed in a 15 mL test tube, to which 50 yL of 300 mM barium chloride solution was added. The sulfate combines with the barium to form a fine cloud of barium sulfate precipitate. This was diluted with 4 mL of de-ionized water (DIW) and the resultant turbidity of the solution was determined using the Mini20 fitted with a nephelometer attachment. The turbidity meter was calibrated with surface seawater collected during the sampling program. The precision and accuracy of this method is 10%.

Conductivity Analyses

Salinity/conductivity was determined by diluting 50 yL of sample with 250 yL of DIW, mixing and injecting 75 yL into a miniature conductivity meter, (Horiba model C-173). Surface seawater was also used to calibrate the meter.

Gas Analyses

Approximately 200 mL sediment samples were sealed in "mason" jars fitted with septa for headspace gas analyses. The jars were completely filled with DIW and the headspace was achieved by injecting helium through one of the septa forcing some of the DIW out through an exit port. The samples were then heated and sonified in a Branson 3200 ultrasonic cleaner for 1 hour. A sample of the gases released into the headspace were injected into an SRI 8610 Gas Chromatograph (Mandel Scientific Co.) and resultant chromatograms were achieved. The instrument was equipped with 2 detectors, 2 ovens and 2 columns to separate and identify different groups of natural gases. A standard gas mixture containing hydrogen, oxygen, nitrogen, carbon dioxide and hydrogen sulfide was used to calibrate 1 column and a mixture of methane, ethane, propane, n-butane, and n-pentane was used to calibrate the second column.

MACROFAUNAL SAMPLING REPORT

T.M. Schell

MACROFAUNA SAMPLING
Procedures

Biological samples were obtained by four methods:

(1) Videograb
(2) IKU Grab
(3) Boxcore
(4) Push cores, as subsamples from the videograb and boxcore

All pushcore (or subsample cores), polychaetes (critters or greeblies) and coarse and fine sieve residues have been placed in a solution of 10% buffered Formalin.

Shells and fragments have been stored in seawater.

Delicate grabsample specimens, such as the gastropods, have been placed in small glass and plastic vials and refrigerated.

In total, 4 boxes (@12 bottles per box) and 2 4L buckets containing the smaller vials were collected and have been placed in cold storage in the Repository.

Grab samples were rudimentally sorted on the basis of:

(1) Polychaeta, etc. (Critters or Greeblies)
(2) Shells and fragments
(3) Rocks
(4) Coarse sieve fraction
(5) Fine sieve fraction

Three pushcores were taken from each Videograb (the smaller diameter tube):

(1) Archival
(2) Biological
(3) Geochemical

The Biological core was then divided into 3 sample volumes - 0-10 cm, 10-20 cm, and 20+ cm. A 500 micrometre sieve was chosen for all samples due to the paucity of macrofauna and the relatively fine nature of the substrate. Further detailed sedimentary description (ie., grain size, sponge spicules, forams, etc.) will be available with post-mission lab analysis, and may also be noted as the relative fractions retained in the sieve residues.

Originally, all samples were stored in 250 ml Mason jars, but due to the small sample volumes retrieved, after the first few stations the smaller samples were stored in glass and plastic vials to reduce unnecessary storage space.

SUMMARY AND EVALUATION

A.C. GRANT

The acoustic survey instruments (airgun, Huntec deep tow and sidescan sonar) yielded excellent data, at survey speeds averaging four knots in water depths averaging 400 m. Our transects of Laurentian Channel found numerous pockmarks, mostly small (several meters) but some larger (50 m+). Subsequent survey lines established approximate limits for pockmark occurrence within the Mobil study area. We focused on a zone of larger pockmarks, and installed a "Multibeacon" transponder for Short Baseline and Long Baseline navigation systems to control a sidescan mosaic grid. This mosaic was the basis for the sampling accuracy necessary to assess the seafloor pockmarks. The Short Baseline navigation system worked beyond our expectations, tracking the sidescan fish to 1600 m and yielding 10 m accuracy on sampler positions.

The Videograb sampler worked very well, and was used extensively in "survey mode" to obtain video transects of the seafloor, as well as sediment samples. The visual information provided by the Videograb about seafloor conditions and processes greatly enhances the value of the core and grab samples.

This cruise demonstrated new levels of survey capability in speed, accuracy and water depth of operations for BIO vessels and equipment. These advances are the result of careful preparation in the extensive backup facilities ashore, and the dedicated teamwork of the ships crew and scientific staff at sea.

Survey coverage in the eastern part of the Mobil study area was limited by the French "corridor" extending south from St. Pierre. Negotiations for permission to survey in this corridor should be undertaken well in advance of projected cruise dates.

APPENDIX

TABLE 1

LINE NUMBER START/STOPS

LINE NUMBER	START DAY/TIME	STOP DAY/TIME
1	228/2125	228/2245
2	228/2315	229/0946
3	229/1000	229/1200
4	229/1213	229/1430
5	229/1445	229/1736
6	229/1737	229/1930
7	229/2000	230/0019
8	229/0029	230/0121
9	230/0147	230/0459
10	230/0505	230/0700
11	230/0735	230/0930
12	230/1008	230/1150
13	230/1200	230/1334
14	230/1400	230/1438
15	230/1438	230/1509
16	230/2110	230/2258
17	230/2217	231/0429
18	231/0453	231/0800
19	231/0830	231/1010
20	231/2100	232/0300
21	232/0303	232/0416
22	232/0421	232/1108
23	232/2010	233/0417
24	233/0423	233/0523
25	233/0521	233/1200
26	233/1850	233/2030
SS1	236/1405	236/1432
SS21	236/1515	236/1536
SS3	236/1616	236/1647
SS23	236/1715	236/1737
SS5	236/1814	236/1842
SS25	236/1915	236/1936
SS7	236/2008	236/2033
SS9	236/2209	236/2230
SS11	236/2359	237/0019
SS31	237/0057	237/0120
SS19	237/0151	237/0225
TT3	237/0331	237/0353
TT1	237/0444	237/0510
TT2	237/0511	237/0600
SS33	237/0613	237/0639
SS13	237/0709	237/0736
SS35	237/0807	237/0830
SS15	237/0906	237/0935
SS37	237/1002	237/1023
SS17	232/1100	232/1123

TABLE 1

LINE NUMBER START/STOPS

LINE NUMBER	START DAY/TIME	STOP DAY/TIME
SS39	237/1159	237/1220
TT6	237/1318	237/1342
30	237/2015	237/2313
31	237/2317	238/0112
33	238/0152	238/0504
34	238/0505	238/0800
35	238/0805	238/0816
S1	238/0817	238/0833
36	238/1930	238/2330
37	239/0013	239/0043
38	239/0130	239/2133
39	239/0637	239/0720
40	239/0818	239/0950
41	239/0950	239/1146
42	239/1902	239/2123
43	239/2120	239/2157
44	239/2157	239/2355
45	240/0047	240/0242
46	240/0319	240/0513
47	240/0559	240/0830
48	240/0903	240/1023
POCK CENTER	240/1023	240/1139
SPN	240/2055	240/2132
SPW	240/2236	240/2311
SPNW	240/2338	241/0000
SPNE	240/0040	241/0112
49	241/0150	241/0217
50	241/0226	241/0322
51	241/0408	241/0435
52	241/0518	241/0826
53	241/0909	241/0924
54	241/0924	241/1018
55	241/1018	241/1122
56	241/2006	241/2103
57	241/2110	241/2244
58	241/2244	242/0143
59	242/0154	242/0205
60	242/0215	242/0430
61	242/0430	242/0604
62	242/0604	242/0856
63	242/0933	242/1034
CORE 26	242/1034	242/1125
64	242/1916	242/2001
65	242/2059	242/2251
66	242/2304	243/0036
67	243/0052	243/0423

TABLE 1

LINE NUMBER START/STOPS

LINE NUMBER	START DAY/TIME	STOP DAY/TIME
68	243/0432	243/0659
69	243/0659	243/0746
70	243/0746	243/1024
71	243/1953	244/0255
72	244/0256	244/0656

ATLANTIC GEOSCIENCE CENTRE | TABLE 2 | CRUISE NUMBER = 94027
DATA SECTION | | CHIEF SCIENTIST = AL GRANT
-SHIP- REPORTING PACKAGE | TOTAL SAMPLE INVENTORY | PROJECT NUMBER = 840083

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DAY/TIME	SEISMIC DAY/TIME	LATITUDE	LONGITUDE	DEPTH (M)	GEOGRAPHIC LOCATION
001	GRAB	2311409		44 49.710	56 32.000	386.0	LAURENTIAN CHANNEL
002	CORE	2311753		44 49.460	56 32.090	380.4	LAURENTIAN CHANNEL
003	EXCALIBUR	2321236		44 49.480	56 32.170	386.0	LAURENTIAN CHANNEL
004	GRAB	2321708		44 49.650	56 32.0600	386.0	LAURENTIAN CHANNEL
005	GRAB	2321918		44 49.960	56 31.8600	386.0	LAURENTIAN CHANNEL
006	CORE	2321354		44 49.400	56 31.5600	396.0	LAURENTIAN CHANNEL
007	GRAB	2331727		44 49.090	56 30.3400	388.0	LAURENTIAN CHANNEL
008	GRAB	2371650		44 49.370	56 31.810	387.0	LAURENTIAN CHANNEL
009	CORE	2381238		44 49.230	56 31.640	380.0	LAURENTIAN CHANNEL
010	GRAB	2381420		44 49.250	56 31.660	387.0	LAURENTIAN CHANNEL
011	GRAB	2381716		44 49.180	56 31.590	387.0	LAURENTIAN CHANNEL
012	GRAB	2381838		44 49.150	56 31.630	282.0	LAURENTIAN CHANNEL
014	CORE	2391330		44 49.230	56 31.740	378.0	LAURENTIAN CHANNEL
015	GRAB	2391546		44 49.500	56 32.030	357.0	LAURENTIAN CHANNEL
016	GRAB	2391738		44 49.200	56 31.700	379.0	LAURENTIAN CHANNEL
017	CORE	2401244		44 49.280	56 31.710	396.0	LAURENTIAN CHANNEL
018	GRAB	2401606		44 49.340	56 31.670	387.0	LAURENTIAN CHANNEL

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 2

TOTAL SAMPLE INVENTORY

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DAY/TIME	SEISMIC DAY/TIME	LATITUDE	LONGITUDE	DEPTH (M)	GEOGRAPHIC LOCATION
019	CORE	2401711		44 49.290	56 31.710	374.0	LAURENTIAN CHANNEL
020	GRAB	2401844		44 49.250	56 31.690	387.0	LAURENTIAN CHANNEL
021	CORE	2411249		44 51.610	56 35.100	383.0	LAURENTIAN CHANNEL
022	GRAB	2411503		44 51.590	56 35.140	386.0	LAURENTIAN CHANNEL
023	GRAB	2411606		44 51.590	56 35.100	395.0	LAURENTIAN CHANNEL
024	GRAB	2411657		44 51.560	56 35.150	395.0	LAURENTIAN CHANNEL
025	GRAB	2411855		44 51.590	56 35.080	387.0	LAURENTIAN CHANNEL
026	CORE	2421244		44 51.640	56 35.330	395.0	LAURENTIAN CHANNEL
027	BOXCORE	2421422		44 51.620	56 35.130	391.0	LAURENTIAN CHANNEL
028	BOXCORE	2421657		44 49.230	56 31.650	398.0	LAURENTIAN CHANNEL
029	GRAB	2421835		44 51.598	56 35.052	396.0	LAURENTIAN CHANNEL
030	CORE	2431216		44 57.740	56 30.010	373.0	LAURENTIAN CHANNEL
031	CORE	2431653		44 44.740	56 35.460	398.0	LAURENTIAN CHANNEL

TABLE 3

GRAB SAMPLES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
001	VIDEO GRAB	2311409	44 49.710 56 32.000	386.0	1	3	LAURENTIAN CHANNEL	A PUSH CORE SAMPLE TAKEN FROM THE GRAB BUCKET. FLEW FOR APPROX. 20 MIN. PRIOR TO SAMPLING. GRASSED SURFICIAL VENEER. 5Y4/2 FINE CLAY, FEW PLOYCHETES, 1% FISH SCALES*, WORM CASTS * ON BIOLOGICAL EXAM "SCALES" APPEAR TO BE SEA SCALLOPS.VIDEO NOTES - TAPE 1 TIME ON BOTTOM 1409:26 UTC TIME OFF BOTTOM 1410 UTC PUSHCORES EXTRACTED AT 45 DEG. ANGLE FROM THE GRAB SURFACE. HOMOGENEOUS CLAY
004	VIDEO GRAB	2321708	44 49.650 56 32.0600	386.0			LAURENTIAN CHANNEL	VIDEOGRAB IN WATER 232/1646, SAW BOTTOM AT 1701. HOLES SEEN ON BOTTOM APPROX. 50 CM ACROSS.TOOK A COUPLE OF MINUTES BEFORE TOTALLY CLOSED GRAB (232/1708). TAKEN IN AN AREA WITH DIFFERENT FEATURES (MORE INTERESTING BIOTA). NOTE: SAMPLE DOOR LEFT AJAR;SEDIMENT WASHED OUT UPON RETRIEVAL;SMALL PIECE RED TILL AND SOME LEHAVE OLIVE CLAY BAGGED.
005	VIDEO GRAB	2321918	44 49.960 56 31.8600	386.0	2	3	LAURENTIAN CHANNEL	VIDEO STATION FAILED TO RECOVER SEDIMENT VIDEO IN WATER AT 232/1842; SAW BOTTOM AT 1856, BOTTOM COVERED WITH SEA CUCUMBERS, SEAPENS. SURFICIAL VENEER 5Y5/3 <.5CM THICK,UNCONSOLIDATED SOUPY, UNDERLAIN BY 5Y4/2 HOMOGENEOUS CLAY,NO MACROBENTHOS ON SURFACE. SUBSAMPLES:PUSH CORE-GEOCHEM., PUSH CORE A=ARCHIVE, PUSH CORE B= BIOLOGICAL.
007	VIDEO GRAB	2331727	44 49.090 56 30.3400	388.0			LAURENTIAN CHANNEL	TAPE #2, IN WATER AT 1550, BOTTOM IN SIGHT AT 1610. BOTTOM AS VG2 & VG5 1618 - 1212 ROCKY BOTTOM, 1620 - 1357 MUDDY BOTTOM, 1727-0122 ON BOTTOM. GRAB JAMMED, DUMP AND TRY AGAIN. ROCKY SEDIMENT, ABUNDANT SHELL DEBRIS. 1803 - 0156 ON BOTTOM - GOOD SITE, RECOVER TO SURFACE.; 1822 - SURFACE. CORE SPLIT HOMOGENOUS,5Y4/3 GREEN-GRAY CLAY(0-35CM) SLIGHT SULFER ODOUR.
008	VIDEO GRAB	2371650	44 49.370 56 31.810	387.0	02	02	LAURENTIAN CHANNEL	DRIED MUD FLAKES WHEN LOWERED INTO WATER 1607-1614 GRAVEL LAYER,MANY FRAGMENTS; SLIME MOUNDS,SEA PEAS OUTER EDGE. 1619 SEA ANEMONIES. PUSHCORE: 0-49 CM;34-39 CM REMOVED FOR GAS. 0-39 CM 5Y4/2 SILTY CLAY GRADING TO HOMOGENEOUS CLAY;CORE WAS NOT HEAVILY BI BIOTURBATED AND NO ODOUR. CORES TAKEN FROM WITHIN POCK.

TABLE 3

GRAB SAMPLES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
010	VIDEO GRAB	2381420	44 49.250 56 31.660	387.0		03	LAURENTIAN CHANNEL	IN WATER 1343;180 M. ZOOPLANKTON ACTIVITY;1358 AUTO RECORD;1359 SEE SEE BOTTOM;NUMEROUS FRY,BRITTLE STARS. 1419 LARGE POCK. GRAB 75M SOUTH OF CORE SITE. PUSHCORE C 0-31 CM GAS SAMPLE 31-41 CM.
011	VIDEO GRAB	2381716	44 49.180 56 31.590	387.0		05	LAURENTIAN CHANNEL	MUD SEEN ON SCREEN;TAPE STOPPEED AT 1640;NEW TAPE STARTED AT 1640;ROCKS AT 1659;GRAB AT 1700 BUT WON'T CLOSE-DRAGGING ON BOTTOM. GRAB AT 1704,SOME ROCKS,~100M FISH,STILL DIDN'T CLOSE;DUMPED IT,WILL TRY AGAIN. GRAB AT 1716 100M E-SE OF NEW POCK-SOME ROCK CLASTS VISIBLE PUSHCORE 011C 0-33CM GAS SAMPLE 33-43 CM
012	VIDEO GRAB	2381838	44 49.150 56 31.630	282.0	01	05	LAURENTIAN CHANNEL	VIDEO GRAB TAKEN AT 1838 A=ARCHIVE, B=BIOLOGY, C=CHEMISTRY, D=GRAINSIZE, GAS SAMPLE BOTTOM 0 CM PUSHCORE 012C 0-33 CM GAS SAMPLE 33-43 CM
015	VIDEO GRAB	2391546	44 49.500 56 32.030	357.0	01	04	LAURENTIAN CHANNEL	1532 GRAB IN WATER, WORM BORROWS/FISH ON BOTTOM AT 1546, ON SURFACE AT 1626 THIN VENEER 5Y4/2 , SILTY VENEER OVER LAG DEPOSIT A=PUSHCORE C=PUSHCORE B=PUSHCORE D=TEXTURE PUSHCORE 0-33 CM GAS 33-43 CM
016	VIDEO GRAB	2391738	44 49.280 56 31.700	379.0			LAURENTIAN CHANNEL	1702 GRAB IN WATER, 1716 VIDEO GRAB APPROACHES BOTTOM, OBJECTS SEEN ON THE MONITOR - BRITTLE STARS,FLATFISH,RED FISH, VEGETATION, MANY FORROWS, SHELL FRAGMENTS. 1741 GRAB OF BOTTOM 1759 GRAB TO SURFACE. ROCK SAMPLES BAGGED, BIOLOGICAL SPECIMENS FROZEN.
018	VIDEO GRAB	2401606	44 49.340 56 31.670	387.0	02	04	LAURENTIAN CHANNEL	1332 IN WATER, 1341 SEE BOTTOM OBJECTS SEEN-SEA PENS,FISH FRY,FLOUNDER, ANGLE FOOTPRINTS,SLIME;25M AWAY HAVE ANENOMES. 13M CHANGE TO CENTER, BOULDERS FAUNA A=ARCHIVE, B=BIOLOGICAL, C=CHEMISTRY D=GRAINSIZE PUSHCORE HIGHLY DISTURBED 1626 GRAB AT SURFACE.

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TABLE 3

GRAB SAMPLES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
020	VIDEO GRAB	2401844	44 49.250 56 31.690	387.0			LAURENTIAN CHANNEL	1758 IN WATER, 1811 SEE BOTTOM OBJECTS SEEN-BRITTLE STARS,SEA ANENOMES FISH, SEA PEN. 1844 GRAB ON BOTTOM SEA ANEMONES/FILTER FEEDERS SAMPLED FOR ISOTOPE WORKUP ON NUTRIENTS. 1853 GRAB AT SURFACE
022	VIDEO GRAB	2411503	44 51.590 56 35.140	386.0	02	04	LAURENTIAN CHANNEL	ROCKS,MUD LOOKS DIFF.;FISH E OF SP (~20M);GRAVEL(01:46), MUD AGAIN,FISH 50M SW OF SP; TOP OF SP, MUD WITH SMALL HOLES.NEW TAPE ROCKS AT 00:03 GRAB AT 00:03, GRAB DOESN'T CLOSE PROPERLY. TRY FOR ANOTHER SAMPLE GRAB SAMPLE TAKEN AT 1503;1504 GRAB OFF BOTTOM 1518 GRAB TO SURFACE
023	IKU	2411606	44 51.590 56 35.100	395.0	01		LAURENTIAN CHANNEL	1556 GRAB IN WATER 1606 GRAB ON BOTTOM 1616 GRAB ON DECK 5Y4/1 GLACIAL CLAY FEW BROKEN SHELLS,SEA PEN SUBSAMPLES - 1/3*2 DREDGE BUCKETS 2-1 GAL BUCKETS
024	IKU	2411657	44 51.560 56 35.150	395.0			LAURENTIAN CHANNEL	1641 GRAB IN WATER 1657 GRAB ON BOTTOM 5Y4/2 SILTY CLAY WITH FEW POLYCHAETES AMPHIPODS SUBSAMPLES - 1-BUCKET
025	VIDEO GRAB	2411855	44 51.590 56 35.080	387.0			LAURENTIAN CHANNEL	1734 GRAB IN WATER 1739 SQUID IN WATER COLUMN 1747 GRAB ON BOTTOM ANGLE FOOTPRINTS,SLIME,OPEN MOUNDS RED FISH, VIDEO#18:31 SEA PENS,EEL 1815 CENTRE POCK
029	IKU GRAB	2421835	44 51.598 56 35.052	396.0			LAURENTIAN CHANNEL	1825 IKU IN WATER BUCKET SAMPLE ONLY,-WASHED ONBOARD FOR TEXTURE, BIOLOGICAL SPECIMENS

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TABLE 4

CORE SAMPLES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840003

SAMPLE NUMBER	SAMPLE TYPE	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (MTRS)	CORER LENGTH (CM)	APP. PENN (CM)	CORE LENGTH (CM)	NO OF SECT	GEOGRAPHIC LOCATION	NOTES
002	AGC LONG CORE	2311753	44 49.460 56 32.090	380.4	912	900	491	3	LAURENTIAN CHANNEL	TWC GAS SAMPLE SECTION 280-290,290-283 (A-B) #148108 TWC GAS SAMPLE SECTION 206-216 (C-D) #148109 GAS SAMPLE SECTION 132-142 (E-F) #148110 GAS SAMPLE SECTION 58-68 (G-H) #148111 GAS SAMPLE SECTION IN PASTIN CORE NO A/B; GEOCHEM., B/C 378-288 #148112 E/D 304-314 #148113, G/F 230-240 #148114 I/H 148-158 #148115, K/J 74-84 #148116
006	AGC LONG CORE	2321354	44 49.400 56 31.5600	396.0	912		610	8	LAURENTIAN CHANNEL	PISTON CORE SECTION: Q-P 0-73, GAS P-0 73-83,0-N 83-148, GAS N-M 148-158,M-L 158-222, GAS L-K 222-232 K-J 232-297,GAS J-I 297-307,I-H 307-377, GAS H-G 377-387,G-F 387-451.
009	AGC LONG CORE	2381238	44 49.230 56 31.640	380.0	912		525	07	LAURENTIAN CHANNEL	TWC-MUD TO TOP ON OUTSIDE BARREL; PC-MUD UP OVER HEAD ON RETRIEVAL; GAS SAMPLE TWC A/B 130-140 WORKING COMPLETELY SAMPLED FOR PORE WATER. C/D 53-63 CM., PC A/B 10YR4/2 CLAY WITH BLACK MOTTLING C/D 10YR5/2 CLAY;PYRITIZED WORM TUBES < 10%;F/E 10YR5/2 CLAY FEW PYRITIZED TUBES SHELL FRAG AT TOP; G/H 10YR5/2 CLAY, MOTTLED;SHELL FRAG; I/J 10YR4/1 MOTTLED CLAY SHELL FRAG; K/L 10YR4/1 MOTTLED CLAY 10YR4/1 CLASTS THROUGH OUT; M/N SILTY (<10%) CLAY 10YR4/2
014	AGC LONG CORE	2391338	44 49.230 56 31.740	378.0	912		322		LAURENTIAN CHANNEL	BAGGED OUTSIDE CUTTER (PC), SHELL AT BOTTOM A/B SAMPLED. TWC GAS SAMPLE A/B, 5Y4/2 CLAY HOMOGENOUS, SHELL VALVE @ 5CM DOWN SECTION WHOLE VALVE AT TD PC A/B DAMICT 7.5YR5/3, C/D STIFF BIO. CLAY 7.5YR4/2,E/F STIFF BIOTURBATED CLAY 7.5YR4/2,G/H STIFF BIO. CLAY 7.5YR4.2
017	AGC LONG CORE	2401244	44 49.280 56 31.710	396.0	912		0000	03	LAURENTIAN CHANNEL	TWC-BAGGED OUTSIDE CUTTER, STIFF COHESIVE 5Y4/1. NO RECOVERY W/30' CORER;CLAY VERY COHESIVE;ALL MATERIAL THROUGHOUT CORE BARRELS PLUS FINGERS;20CM RECOVERED FROM TWC ONLY. BAGGED SEDIMENT FROM OUTSIDE PC BARREL-7.5YR4/2 DIAMICTON 2 BAGGED SAMPLES;1 SPLIT TWC 0-20CM

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TABLE 4

CORE SAMPLES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

SAMPLE NUMBER	SAMPLE TYPE	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (MTRS)	CORER LENGTH (CM)	APP. PENN (CM)	CORE LENGTH (CM)	NO OF SECT	GEOGRAPHIC LOCATION	NOTES
019	GRAVITY	2401711	44 49.290 56 31.710	374.0				03	LAURENTIAN CHANNEL	GRAVITY CORE- 1 WAY VALVE-NO PISTON PC CATCHER, CUTTER BAGGED
021	AGC LONG CORE	2411249	44 51.610 56 35.100	383.0	912				LAURENTIAN CHANNEL	CORE REMOVED/DISTURBED, PHOTOGRAPHED ONLY.
026	AGC LONG CORE	2421244	44 51.640 56 35.330	395.0	912				LAURENTIAN CHANNEL	TWC-A/B GAS SAMPLE OUTSIDE TILL ON BARREL BAGGED A/B 5Y4/2 HOMOGENEOUS CLAY;SHELL FRAG. C/D 5Y4/2 CLAY E/F 5Y4/2 CLAY HOMOGENEOUS BIOTURBATED FEW WORMS CATCHER FOR PC BAGGED PC-A/B (10CM), C/D PERMEABILITY (15CM) E/F GAS (10) 5YR4/2 G/H PERMEABILITY (15), I/J (10) K/L (15) PERM., M/N (1) 10YR3/2 HOMO CLAY
030	AGC LONG CORE	2431216	44 57.740 56 30.010	373.0	912		598	03	LAURENTIAN CHANNEL	I/J PISTON IMPLODED (65 CM) K/K SLIGHTLY IMPLODED PC TO 569 + CUTTER CATCHER=569-598 CM
031	AGC LONG CORE	2431653	44 44.740 56 35.460	398.0	912		292		LAURENTIAN CHANNEL	TWC A/B 7.5Y4/3 SLI. SILTY CLAY, C/D 5Y4/1 HOMOGENEOUS STRUCTURLESS CLAY E/F 5Y4/1 HOMOGENEOUS BIOTURBATED CLAY G/H 5Y3/2 HOMOGENEOUS CLAY PC A/B 5YR4/2 GRITTY CLAY WITH CLAY CLASTS 5YR4/2 C/D PERMEABILITY E/F GAS 0-3 CM 5YR5/1, RED ZONE GRITTY CLAY, SHARP CONTOUR WITH UNDERLYING GRAY 7.5YR4/1 CATCHER 298-320, FINGER CUTTER INVERTED

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TABLE 5

BOXCORE SAMPLES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

SAMPLE NUMBER	TYPE OF BOXCORE	JULIAN DAY/TIME	LATITUDE LONGITUDE	DEPTH (MTRS)	NO OF ATMTS	NO OF SUBS	NO OF CORES	PHOTOS TAKEN	GEOGRAPHIC LOCATION	NOTES
027	BOXCORE	2421422	44 51.620 56 35.130	391.0			6		LAURENTIAN CHANNEL	BOX CORE IN SMALL POCK, FALL AT 1421 6 PUSHCORES 2,B,C,D,E,F BAGGED REMAINING SAMPLE FOR TEXTURE SURFICIAL VENEER 0-5 CM, SILTY 5Y4/2
028	BOXCORE	2421657	44 49.230 56 31.650	398.0			6		LAURENTIAN CHANNEL	28 (C) 0-36 CM, GAS SAMPLE (26-36CM) SUBSAMPLE - SIEVED REMAINING SAMPLE

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TABLE 6

SEISMICS/SIDESCAN/HUNTEC COMBINED VHS TAPES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

TAPE NUMBERS	START DAY/TIME	STOP DAY/TIME	GEOGRAPHIC LOCATION	CHANNEL INFORMATION	
1	2282145	2290045	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
2	2290048	2290339	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
3	2290340	2290643	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
4	2290644	2291054	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
5	2291054	2291350	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
6	2291352	2291640	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
7	2291641	2291930	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
8	2291930	2302221	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
9	2292221	2300017	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
10	2300117	2300411	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
11	2300435	2300730	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
12	2300730	2301022	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
13	2301022	2301315	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
14	2301318	2301611	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
15	2301616	2302243	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
16	2302245	2310138	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
17	2310139	2310426	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.

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SEISMICS/SIDESCAN/HUNTEC COMBINED VHS TAPES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

TAPE NUMBERS	START DAY/TIME	STOP DAY/TIME	GEOGRAPHIC LOCATION	CHANNEL INFORMATION	
18	2310428	2310720	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
19	2310720	2311014	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
20	2312058	2320003	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
21	2320003	2320256	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
22	2320257	2320601	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
23	2320602	2320905	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
24	2320909	2322055	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
25	2322055	2322351	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
26	2322301	2330252	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
27	2330253	2330545	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
28	2330546	2330943	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
29	2330843	2331135	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
30	2331135	2361400	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
31	2361400	2361651	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
32	2361652	2361942	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
33	2361942	2362231	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
34	2362332	2370127	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.

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SEISMICS/SIDESCAN/HUNTEC COMBINED VHS TAPES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

TAPE NUMBERS	START DAY/TIME	STOP DAY/TIME	GEOGRAPHIC LOCATION	CHANNEL INFORMATION	
35	2370122	2370413	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
36	2370414	2370708	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
37	2370709	2371001	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
38	2371001	2371254	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
39	2371254	2372108	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
40	2372109	2380006	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
41	2380008	2380302	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
42	2380303	2380556	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
43	2380559	2380850	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
44	2380851	2382002	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
45	2382002	2382257	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
46	2382258	2390149	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
47	2390150	2390443	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
48	2390444	2390738	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
49	2390738	2391034	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
50	2391036	2392005	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
51	2392005	2392303	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.

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SEISMICS/SIDESCAN/HUNTEC COMBINED VHS TAPES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

TAPE NUMBERS	START DAY/TIME	STOP DAY/TIME	GEOGRAPHIC LOCATION	CHANNEL INFORMATION	
52	2392303	2400159	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
53	2400200	2400500	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
54	2400501	2400750	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
55	2400753	2401048	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
56	2401048	2401156	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
57	2401939	2402230	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
58	2402231	2410132	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
59	2410132	2410425	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
60	2410427	2410719	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
61	2410719	2411012	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
62	2411012	2412112	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
63	2412112	2420003	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
64	2420004	2420255	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
65	2420255	2420600	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
66	2420600	2420850	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
67	2420851	2421134	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
68	2421920	2422211	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.

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TABLE 6

SEISMICS/SIDESCAN/HUNTEC COMBINED VHS TAPES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

TAPE NUMBERS	START DAY/TIME	STOP DAY/TIME	GEOGRAPHIC LOCATION	CHANNEL INFORMATION	
69	2422211	2430106	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
70	2430107	2430356	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
71	2430358	2430657	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
72	2430657	2430952	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS 100' SE, CH4-HUNTEC INT. CH6-HUNTEC EXT.
73	2430952	2432136	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS TRIGGER, CH4-HUNTEC INT. CH6-HUNTEC EXT.
74	2432136	2440026	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS TRIGGER, CH4-HUNTEC INT. CH6-HUNTEC EXT.
75	2440027	2440322	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS TRIGGER, CH4-HUNTEC INT. CH6-HUNTEC EXT.
76	2440324	2440627	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS TRIGGER, CH4-HUNTEC INT. CH6-HUNTEC EXT.
77	2440628	2440656	LAURENTIAN CHANNEL	CH1-SEISMICS 25'SE,CH2-SEISMICS TRIGGER CH5-HUNTEC TRIGGER	CH3-SEISMICS TRIGGER, CH4-HUNTEC INT. CH6-HUNTEC EXT.

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TABLE 7

DIGITAL TAPES

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

REEL NUMBER	NARC NUMBER	START DAY/TIME	STOP DAY/TIME	LINE NUMBERS	PARAMETER	GEOGRAPHIC LOCATION	DIGITAL TAPE NOTES
1		2290219	2290022	2	SIDESCAN	LAURENTIAN CHANNEL	
2		2290855	2291500	2-5	SIDESCAN	LAURENTIAN CHANNEL	
3		2291539		7-9	SIDESCAN	LAURENTIAN CHANNEL	
4		2292323	2300443	7-9	SIDESCAN	LAURENTIAN CHANNEL	
5		2300450	2300932	9-11	SIDESCAN	LAURENTIAN CHANNEL	
6		2301043	2301506	12-15	SIDESCAN	LAURENTIAN CHANNEL	
7		2361941	2362348	SS7,SS9,SS11	SIDESCAN	LAURENTIAN CHANNEL	
8		2362356	2371002	SS11,SS31,SS19 TT3,TT1,TT2,	SIDESCAN	LAURENTIAN CHANNEL	
9		2371152	2381103	SS17,SS39,TT6, 30-35,S1	SIDESCAN	LAURENTIAN CHANNEL	
10		2381921		36,37	SIDESCAN	LAURENTIAN CHANNEL	
11		2390036	2390931	37-40	SIDESCAN	LAURENTIAN CHANNEL	
12		2390945	2400443	40-46	SIDESCAN	LAURENTIAN CHANNEL	
13		2400514	2401948	47,48, POCK CENTER	SIDESCAN	LAURENTIAN CHANNEL	
14		2401000	2402047		SIDESCAN	LAURENTIAN CHANNEL	
15		2402051	2042309	SPN,SPW	SIDESCAN	LAURENTIAN CHANNEL	
16		2402340	2410212	SPNW,SPNE,49	SIDESCAN	LAURENTIAN CHANNEL	
17		2410323	2410711	50-52	SIDESCAN	LAURENTIAN CHANNEL	
18		2410826	2420218	52-60	SIDESCAN	LAURENTIAN CHANNEL	
19		2420234	2422201	60-63,CORE 26, 64,65	SIDESCAN	LAURENTIAN CHANNEL	
20		2422250	2431007	65-70	SIDESCAN	LAURENTIAN CHANNEL	
21		2431012	2440656		SIDESCAN	LAURENTIAN CHANNEL	

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TABLE 8

HUNTEC RECORDS

CRUISE NUMBER = 94027
CHIEF SCIENTIST = DR. A. GRANT
PROJECT NUMBER = 840003

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	HYDROPHONE	LINE NUMBERS	RECORD TYPE	GEOGRAPHIC LOCATION	RECORDER	HUNTEC SYSTEM
1	2282105	2291155	EXTERNAL	1-3	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
2	2291200	2301625	EXTERNAL	4-15	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
3	2302000	2311020	EXTERNAL	16-19	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
4	2312055	2320400	EXTERNAL	20-21	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
5	2320405	2321110	EXTERNAL	21-22	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
6	2322011	2331200	EXTERNAL	23-25	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
7	2331845	2370125	EXTERNAL	26,SS1,SS3,SS23 SS5,SS25,SS7,	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
8	2370130	2371350	EXTERNAL	SS19,TT3,TT1, TT2,SS33,SS13	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
9	2371925	2381100	EXTERNAL	30-35, S1	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
10	2381925	2391145	EXTERNAL	36-41	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
11	2391825	2392140	EXTERNAL	42,43	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
12	2392146	2401140	EXTERNAL	43-48, POCK CENTER	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
13	2401920	2411125	EXTERNAL	43-48 POCK CENTER	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
14	2411930	2421140	EXTERNAL	56-63,CORE 26	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
15	2421915	2431105	EXTERNAL	64-70	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)
16	2431950	2440700	EXTERNAL	71,72	COMBINED	LAURENTIAN CHANNEL	EPC9800	HUNTEC DTS (AGC 3)

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TABLE 9

SEISMIC RECORDS

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	HYDROPHONE	LINE NUMBERS	RECORD TYPE	GEOGRAPHIC LOCATION	RECORDER	SYSTEM / SOUND SOURCE
1	2282145	2301620	SE 100 FT	1-15	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
2	2282305	2301620	SE 25 FT	1-15	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
3	2301950	2311015	SE 100 FT	16-19	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
4	2301950	2311015	SE 25 FT	16-19	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
5	2312058	2321110	SE 100 FT	20-22	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
6	2312058	2321110	SE 25 FT	20-22	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
7	2322000	2331200	SE 100 FT	23-25	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
8	2322000	2331200	SE 25 FT	23-25	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
9	2331850	2332030	SE 100 FT	26	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
10	2331855	2332030	SE 25 FT	26	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
11	2361310	2371350	SE 100 FT	SS1,SS21,SS3, SS23,SS5,SS25	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
12	2361315	2371350	SE 25 FT	SS1,SS21,SS3, SS23,SS5,SS25	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
13	2371910	2381055	SE 100 FT	30-35, S1	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
14	2371910	2381055	SE 25 FT	30-35, S1	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
15	2381915	2391145	SE 100 FT	36-41	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
16	2381915	2391145	SE 25 FT	36-41	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
17	2391825	2401140	SE 100 FT	42-48	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN

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TABLE 9

SEISMIC RECORDS

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	HYDROPHONE	LINE NUMBERS	RECORD TYPE	GEOGRAPHIC LOCATION	RECORDER	SYSTEM / SOUND SOURCE
18	2391834	2401140	SE 25 FT	42-48	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
19	2401925	2411125	SE 100 FT	42-55,SPN,SPW, SPNW,SPNE	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
20	2401925	2411125	SE 25 FT	42-55,SPN,SPW, SPNW,SPNE	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
21	2411936	2421130	SE 100 FT	56-63,CORE 26	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
22	2411936	2421130	SE 25 FT	56-63,CORE 26	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
23	2421940	2431105	SE 100 FT	65-70	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
24	2421940	2431105	SE 25 FT	65-70	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
25	2431950	2440705	SE 100 FT	71,72	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN
26	2431950	2440707	SE 25 FT	71,72	SINGLE	LAURENTIAN CHANNEL	EPC 8300	AGC SEISMICS AIRGUN 40 CU IN

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TABLE 10

3.5 KHZ RECORDS

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	LINE NUMBERS	GEOGRAPHIC LOCATION	RECORDER	SYSTEM / SOUND SOURCE
1	2282250	2300630	1-10	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
2	2300640	2301645	10-15	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
3	2301750	2311722	16-19	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
4	2312055	2312210	20	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
5	2312216	2321236	20-22	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
6	2322005	2331845	26	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
7	2331850	2371350	26,SS1,SS21,SS3 SS23,SS5,SS25	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
8	2371420	2371905	ON STATION	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
9	2371910	2390730	30-35, S1 36-41	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
10	2390735	2401655	SPN,SPW,SPNW, SPNE,49-58	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
11	2401940	2420025	SPN,SPW,SPNW, SPNE,49-58	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
12	2420035	2430425	58-67	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
13	2430445	2440555	67-72	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED
14	2440600	2440715	72	LAURENTIAN CHANNEL	EPC 4800	HULL MOUNTED

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TABLE 11

SIDESCAN RECORDS

CRUISE NUMBER = 94027
CHIEF SCIENTIST = AL GRANT
PROJECT NUMBER = 840083

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	LINE NUMBERS	RECORD TYPE	GEOGRAPHIC LOCATION	RECORDER	SIDESCAN SYSTEM
1	2290045	2290945	1-2	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
2	2290945	2291804	3-6	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
3	2291830	2291957	6	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
4	2292330	2300930	7-11	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
5	2300935	2301615	11-15	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
6	2361355	2361945	26,SS1,SS21,SS3 SS23,SS5,SS25	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
7	2361950	2362230	SS7,SS9	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
8	2362235	2370125	SS11,SS31	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
9	2370130	2370245	SS31,SS19	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
10	2370320	2370935	TT3,TT1,TT2, SS33,SS13,SS35	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
11	2370940	2371345	SS37,SS17,SS39, TT6	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
12	2371920	2381100	30,31,33,34,35	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
13	2381915	2382300	36	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
14	2390000	2391146	37-41	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
15	2391830	2401035	42-48	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
16	2401040	2401140	POCK CENTER	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
17	2401930	2410030	SPN,SPW,SPNW	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
18	2410035	2411120	49-55,SPNE	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
19	2411935	2420655	56-62	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
20	2420700	2421125	62,63,CORE 26	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
21	2421915	2431105	64-70	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
22	2432005	2440325	71,72	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ
23	2440330	2440655	72	SINGLE	LAURENTIAN CHANNEL	ALDEN 9135	BIO SIDESCAN (70 KHZ