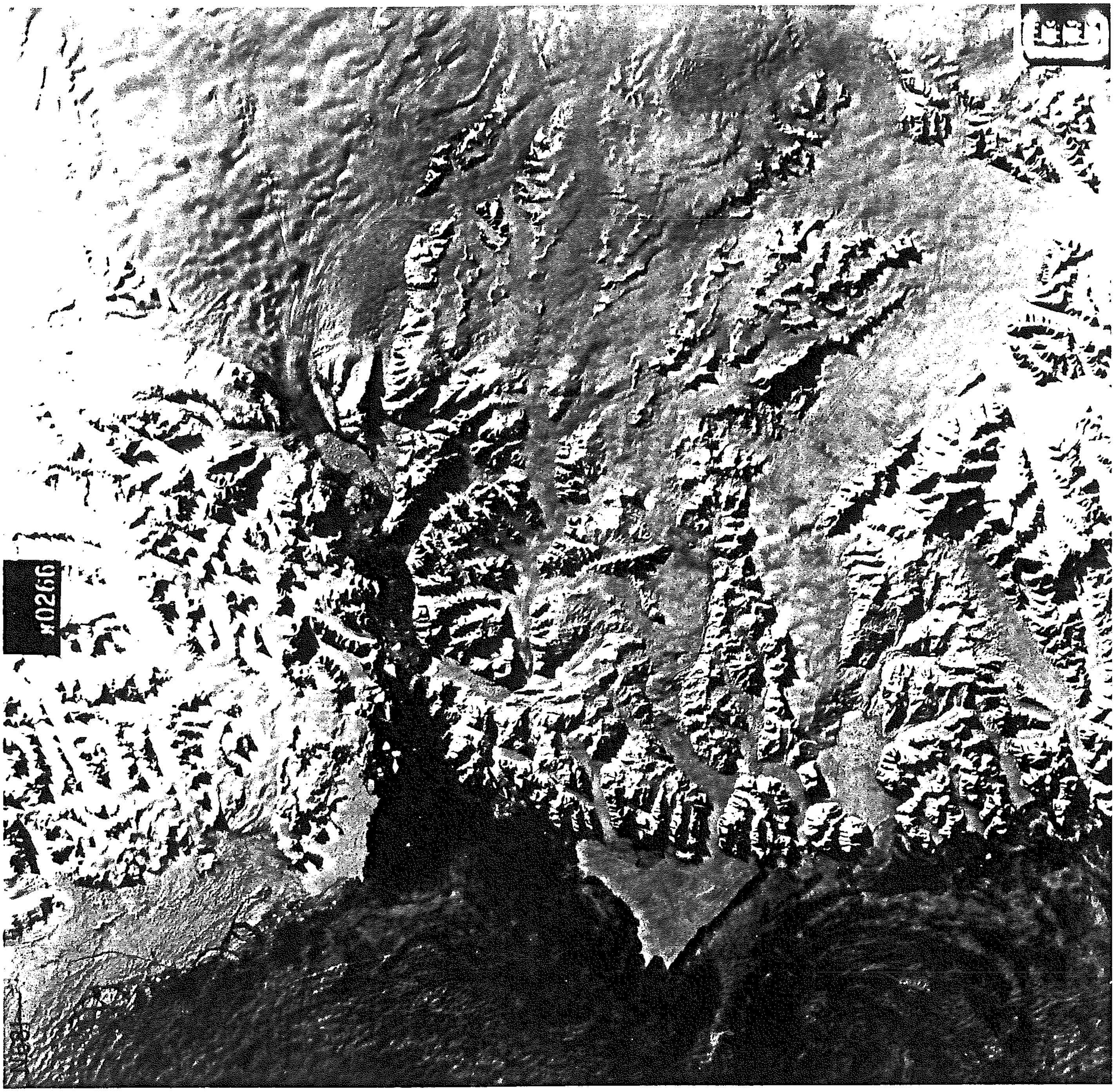


CANAM-PONAM Cruise HU93030: West Iceland to East Greenland

K.W. Asprey, J.P.M. Syvitski, J.T. Andrews and J.A. Dowdeswell

Energy, Mines and Resources, Canada

Énergie, Mines et Ressources, Canada

Geological Survey of Canada

Commission géologique du Canada

CANAM-PONAM Cruise HU93030: West Iceland to East Greenland

K.W. Asprey[1], J.P.M. Syvitski[1], J.T. Andrews[2] and J.A. Dowdeswell[3]
(compilers)

1. Geological Survey of Canada, Atlantic Geoscience Centre, Bedford Institute of Oceanography, Dartmouth NS, Canada
2. Institute of Arctic and Alpine Research, University of Colorado, Boulder CO, USA
3. Scott Polar Research Institute, Cambridge University, Cambridge, UK

Geological Survey of Canada Open File Report No. 2824

CONTENTS

Cover: Kangerdlugssuaq Fjord and adjacent areas of east Greenland. Image from a high-altitude (80km) photograph collected by a Russian satellite.

CRUISE SUMMARY C.S.S. HUDSON 93-030

Between Sept. 4 and 16, 1993, scientists from Canada, United States and the United Kingdom gathered geological and geophysical data between Iceland and Eastern Greenland. The cruise continues the efforts of a larger team of scientist from Geomar (Germany), Danish Geological Survey, Icelandic Marine Institute, Virginia Institute of Marine Sciences (US), Institute of Arctic and Alpine Research, (US), Office of Naval Research (US), the University of Calgary (Can), Institute de Oceanologie (Can), and the Geological Survey of Canada. The cruise represents efforts on behalf of: (1) the Canadian and American (CANAM) contribution to the larger European Science Foundation effort "PONAM" (Polar North Atlantic Margins); (2) COLDSEIS, the INQUA working group on high-resolution seismic investigations of glacigenic continental shelves; (3) the Paleoclimate of Arctic Lakes and Estuaries (PALE) project part of the IGBP PAGES Global Change investigation; and (4) an attempt to locate and study an analogue environment of the Eastern Canadian margins during the past glaciations (GSC mandate).

The cruise collected less data than expected because of hull damage to the C.S.S. Hudson working within heavy ice conditions, leading to the early termination of the cruise. The Danish Navy supported Canadian efforts to ascertain damage and obtain port repair. Their support included helicopter survey of ice free corridors, diver inspection of the impact site and escort from Kang. Fjord to Iceland by the naval frigate Triton. Earlier, staff personnel on the Hudson helped a Danish Inuit hunting party with a small boat engine that needed repair.

The cruise collected excellent data making significant contributions to all four research programs. Cruise achievements include collecting long sections of the seafloor through a combination of box core, LeHeigh core, trigger weight and piston core, supported by high quality seismic-stratigraphic profiles and seafloor photographs. Survey areas included the SW Icelandic Shelf, the Denmark Strait, the East Greenland Shelf (Kang. Tough), and Kangerdlugssuaq Fjord. Cruise scientists feel that data collected should help resolve rates and pathways of sediment transport from continental ice sheets. Oceanographic measurements on the water masses in these environments, their sediment content, and currents also support these efforts. A sediment trap mooring could not be retrieved after hull damage.

Scientific highlights include (1) emphasizing the role of turbidity currents and debris flows in fjord sediment transport within an environment where deltas are not present; (2) revealing the role of "sikkussaq's" or iceberg/sea ice shelves fronting the larger tidewater glaciers and their affect in controlling sedimentary processes within the fjords; (3) revising our understanding of the role of iceberg calving and rafting on sediment accumulation distal from the ice margins; (4) collecting diverse data that will help define the role of subglacial sediment transport through a fjord and onto the continental slope during periods of ice sheet expansion.

Much data remains to be obtained from laboratory analysis based on samples returned to home laboratories. This is particularly true of suspended particle studies based on water and camera studies, bottom camera studies, and detailed core investigations based on X-radiography, XRD, size and organic carbon content, geotechnical studies, micropaleontological studies, and pollen counts. Some systems and investigations were not carried out due to ice, weather or ship damage. These include launch work (seistec, sidescan, ROV) near ice margins, shore parties to investigate glacial deposits and processes, detailed seismic surveys within the fjord system. Trials with the new AGC nav system and digital seismic systems proved very useful in defining both their scope and limitations.

STAFF LIST: (including affiliation)

AGC Personnel

SENIOR SCIENTIST: James P. M. Syvitski DEMR/GSC/AGC
Bob Courtney (seismic & sidescan processing)
Dave Heffler (navigation, Floc Camera, LCF)
John Shaw (coastal surveys)
Claudia Currie (sampling and data)
Susan Merchant (data)
Austin Boyce (Sidescan and launch)
Darryl Beaver (watch leader: navigation, Floc camera, moorings, CTD, water)
Bob Murphy (sampling)
Borden Chapman (Seismics and Electronics)
Kumiko Azetsu-Scott (Floc camera, CTD and water)

Non AGC Personnel

Martin Uysegi (GeoForce) DTS Operations
Peter Simpkin (INRS-Oceanologie) Seistec Operations
Kevin Wagner (XIO Digital) Airgun Operations
John Andrews Co-Chief Scientist (INSTAAR, Boulder Co)
Kirstin Williams (INSTAAR, Boulder Co)
Nancy Weiner (INSTAAR, Boulder Co)
Francis Hein (University of Alberta)
Julian Dowdeswell (Scott Polar Institute)
Nigel Barringer (Scott Polar Institute)
Robert Whittington (Univ. of Aberystwyth)
John Butler (Scott Polar Institute)
Kate Jarrett (A.K. Geoservices)
Kelly Bentham (DFO)

Remote Operated Vehicle (ROV) INVESTIGATIONS OF EAST GREENLAND TIDEWATER GLACIER MARGINS

J.A. Dowdeswell, R.J. Whittington, N. Barringer and L. Butler

Aims

The aims of this project were to investigate in detail: (i) the morphology of tidewater glacier margins and their interface with the sea floor, and (ii) the glaciological, sedimentary and oceanographic processes taking place at tidewater glacier margins. Several models of the ice-ocean interface and its sedimentary regime have been proposed, but detailed observations in modern glacier-influenced waters immediately proximal to tidewater ice cliffs are very few. A primary question concerning ice masses in the relatively cold glacial and oceanographic setting of East Greenland was to assess the significance of subglacial meltwater as a sediment source, relative to that of iceberg rafting.

An ROV was selected for this study because of the logistical difficulties inherent in working close to the margins of ice masses which calve icebergs at intervals. Using an ROV, the ice-ocean interface could be observed in detail by an operator located at a distance of several hundred metres from the terminal cliff. The ROV operated via an umbelical cord supplying power from, and downloading a data stream to, a remote operations centre.

Equipment and Methods

A Phantom ROV was hired from Rovtech Ltd., a company based in Barrow-in-Furness, U.K., together with an experienced pilot. The navigation systems were hired from Seatronics Ltd from Aberdeen, and were set up by an experienced operator. Two umbilicals were brought with the ROV, one of 1,000' and the other of 1,500'. The drag of the umbilical through the water has a significant effect on ROV performance as distance from the control centre increases, and the two lengths were brought in order to provide flexibility in terms of ROV handling relative to the safety of operating at varying distances from tidewater ice cliffs.

ROV operations were planned to take place from the ship's launch of the C.S.S. Hudson. The launch, named Merganser, was a 24' vessel with both open deck space aft and an enclosed cabin forward. An enclosure was essential for the consoles used to control the ROV and for ancilliary navigational and scientific equipment. This size of launch represents a minimum possible operating size of vessel for use with an ROV weighing up to 75 kg when fully configured, and with an umbilical of 1,000' or greater. Future operations would benefit from deployment from a larger vessel. Power was supplied at 220 v by a 3.5 kW generator mounted on the roof of the launch cabin.

The basic Phantom ROV was configured with the following equipment for scientific operations.

- Video camera
- CTD meter (Sensordata SD200)
- Side scan sonar towfish (C-Max CM800)
- Turbidity meter (Seabird)
- Sector scan imaging system (Mesotech)
- Navigation beacon (Simrad HP800)
- Depth sensor

Navigation was based on a Trimble Pathfinder Plus GPS located on the launch. A Simrad HP800 system was used to range from the launch to the ROV. A transmitter was mounted in the water from the launch on a simple frame. X, y, and z coordinates of the ROV relative to the launch were acquired and logged on a 486 PC. A depth sounder also measured the distance from the ROV to the sea floor. These data were integrated with GPS positions to generate absolute locations for the ROV. The Mesotech sector scan was intended for use by the ROV pilot as a navigational aid. However, this instrument interferred with side scan operations and was not used.

Video camera data were viewed in real time by the ROV pilot and recorded on VCR. Side scan sonar data were also viewed in real time, and recorded on optical disc via a fibre optic cable strapped to the ROV umbilical. CTD and water turbidity data were not available in real time, but were logged internally within each instrument and downloaded to disc after ROV recovery.

Operations in East Greenland

The ROV was intended for deployment from the launch of C.S.S. Hudson. However, it was not deployed in this mode for two reasons: (i) in the early part of the cruise, ice conditions and dense fog meant that the lauch could not be lowered for safety reasons; (ii) later in the cruise the C.S.S. Hudson sustained significant damage which precluded further launch work. Despite these logistical problems, the ROV was operated on several occasions from the Hudson, using the launch in its davits as a control centre. In this mode, power came from the ship's supply at 220 v.

Two pieces of work were undertaken: (i) investigations of the underside of sea ice and icebergs; (ii) observations of the hull of the Hudson to assist in the assessment of underwater damage due to contact with ice.

The observations of sea ice and icebergs were brief, but video film and CTD data were collected from the edge of the sikussak (an amalgamation of multi-year sea ice and icebergs) at the head of Kangerdlugssuaq Fjord. Observations of the ship's hull were also made on a systematic basis, and video film of the damage to the starboard side of the Hudson close to the keel will be forwarded to Canadian officials and to Lloyds at the request of the ship's Captain.

Conclusions

While it was disappointing that logistical problems beyond our control constrained the scientific work that the ROV was able to undertake during the cruise, some major benefits did accrue.

- First, we have gained considerable experience in the configuration of an ROV for work at the ice-ocean interface, and of the types of equipment that are best suited to such operations. This experience will be a major asset in future ROV investigations of tidewater glacier margins.
- Secondly, the ROV proved to be a useful tool in the inspection of the ship's hull after damage was sustained, and it was a particular advantage that the ship's officers were able to view the area of interest and report on this to officials in Canada.

COASTAL GEOMORPHOLOGY

John Shaw

INTRODUCTION

The Kangerdlugssuaq region has a fjord coastline, with very high relief and numerous glaciers, many of which are tidewater. Unlike temperate fjord regions such as, for example, the south coast of Newfoundland, this area provides an opportunity to study coastal processes which are dominated by the action of both sea ice and, in particular, glacier ice. These processes presumably operated on a similar scale in fjord regions of Atlantic Canada between 13,000 and 10,000 yrs BP. The degree of wave exposure increases towards the outer coast where, in some locations, glacial deposits are being substantially modified by wave processes. In Atlantic Canada the formation of coastal landforms such as beaches, spits and forelands is entirely dependent on (Late Wisconsinan) glacial sediment sources.

Of particular interest in the study area are the prominent lateral and terminal moraines which are generally located a short distance from glaciers, often at the coast or projecting into the water. These probably formed during the Little Ice Age. No evidence has been collected from the study area to test this hypothesis, but in this report these bouldery gravel deposits are referred to as Little Ice Age moraines.

OBJECTIVES

The objectives of this component of cruise 93-030 were (1) to map the coastal geomorphological characteristics in the vicinity of Kangerdlugssuaq Fjord, Greenland, and in particular to determine the extent to which glacial deposits at the coast are being reworked by wave action, and (2) to collect data on postglacial changes in relative sea level. The work would be closely coordinated with shore observations by a glaciologist (J.T. Andrews).

METHODOLOGY

It was intended that data would be collected by a shore party consisting of two persons - J. Shaw and J.T. Andrews. Work areas would be selected using 1: 25,000 scale colour air photographs of parts of the outer coast flown in August 1973 (for Dr. W. McBirnie, University of Oregon). After some discussion it was agreed that the shore party would attempt to work in the same general area as the geophysical launch, for several reasons: (1) to focus onshore and offshore research on selected target areas; (2) as a precaution against accidents; (3) to guard against polar-bear attack; and (4) as a precaution against weather changes such as sudden high winds, or fog.

A two-person field party would go ashore in an outboard-powered Zodiac deployed from the forward deck. The equipment to be used comprised (1) A Magellan GPS receiver for accurate positioning; (2) a height/range finder to determine the height of distant features, for example, morainic ridges; (3) an altimeter to check the elevation of terraces, ice faces, etc.; (4) Emery poles, tape measure, and clinometer to be used for beach profiling

ACHIEVEMENTS

The coastal geomorphology program was effectively curtailed due to damage to the vessel. Nevertheless, the objectives were furthered in several ways, namely (1) air-photograph analysis, and (2) documentation of coastal morphology by visual observation and photography from the Hudson.

Air-photograph analysis

Several days of analysis en route from Reykjavik resulted in the selection of three areas as favourable for shore work. In order of importance these are:

Mikis Fjord

This fjord appears to have a strong gradient in wave energy levels. In the more exposed areas spits and gravel beaches are common, but at the head of the fjord moraines are unmodified by wave action. Some glaciers are located at the coast while others are set back a short distance. All have clearly identifiable Little Ice Age moraines and have experienced similar amounts of retreat, except for one glacier which shows retreat an order of magnitude greater than the rest; its moraine appears to be located beside a raised (marine?) terrace. The glaciers are shown on Fig. 1.

M1 This glacier lies behind an elongate and narrow Little Ice Age moraine which has been breached by streams. These have formed an alluvial fan which has spread onto a delta formed by meltwater from a glacier well inland (M 10).

M2 The M2 glacier lies inland. Together with glacier M1 and the stream which drains M10 it has a turbid plume. M2 has a prominent, double-arc Little Ice Age moraine located in the fjord, behind which are several additional arcs, almost completely submerged. A prominent medial/lateral moraine extends inland - this (perhaps) formed the boundary between M2 and M3.

M3 M3 is at the coast. It has a vertical ice front and a small turbid plume which is probably derived from lateral streams. On the north side is a fresh gravel zone, blended in with a scree apron. Upon first inspection M3 does not appear to have a prominent Little Ice Age moraine. However, it is possible that the arcuate ridge at the tip of the M2 moraine continues under water, and is part of a largely submerged moraine.

M4 The Little Ice Age moraine of the M4 glacier is very small, and is hard to see on the air photograph. It is inland from the coast.

M5 M5 is a tidewater glacier with a vertical ice face and small turbid plumes which are derived from lateral streams. The Little Ice Age moraine (if present) formed in deep water. It has two projecting subaerial lobes, the western lobe is medial with the moraine of M6.

M6 Glacier M6 adjoins M5. It has two Little Ice Age morainic lobes. The eastern lobe is medial with M5. No turbid plumes can be seen on the photograph.

M7 The terminus of this glacier lies well inland, and has an extensive, low apron of Little Ice Age morainic gravel. An incised meltwater stream drains to the fjord, forming a small delta fringed by beaches. This part of the fjord is exposed to ocean waves moving from the south.

M8 The Little Ice Age moraine of this small glacier is a lobe of gravel spread over steep slopes. The moraine has been dissected by meltwater streams which form alluvial fans at the coast. Several prominent meltwater plumes stream northwards. Erosion due to relatively high wave-energy levels has trimmed the alluvial fans, forming a recurved spit at the end of the north-trending coast, where bedrock relief is low and the water immediately offshore is relatively shallow. The moraine has thus been modified by wave erosion and a northward-directed littoral drift. The spit may be underlain by a subaqueous, sandy spit-platform.

M9 The M9 glacier lies a short distance inland. It has a fringe of Little Ice Age morainic gravel which terminates at the coast in high gravel bluffs. There is only a faint indication of a projecting lateral moraine. A meltwater plume extending northward originates from a stream. A second channel has no plume. The water here is too deep to allow formation of a spit platform, as at M8. There may be a submarine wave-modified morainic bank.

M10 This glacier is located well inland, in the Sødalen valley. It lies behind a lake enclosed by an arcuate moraine which has been breached by a stream. The distance from the moraine to the present ice is approximately 2 km. The stream has an alluvial plain downstream of the breach, and yet farther downstream it is contained in a bedrock gorge. It debouches into Mikis Fjord, forming a relatively large delta adjacent to the Little Ice Age moraine of M2.

The inner part of the arcuate moraine has a pitted surface; the outer part comprises a sloping terrace which has been heavily dissected by fluvial action. Two hypotheses might account for the terrace. Firstly, it may be the remnant of a former outwash fan. The sediment which was removed (perhaps by periodic lakebursts) forms a lower-level alluvial plain and a delta in Mikis Bay. The second hypothesis is that the terrace was formed by ice standing in a body of water, perhaps seawater, so that the terrace surface marks a marine limit. If this is true, then perhaps ice-free areas existed in this region during the Late Wisconsinan.

Kangerdlugssuaq Fjord

A group of glaciers at the entrance to the fjord, on the east coast, have well-developed Little Ice Age moraines. Some glaciers are tidewater; others terminate inland.

K1 (Hammer Glacier)

This is a tidewater glacier. Small turbid plumes appear at the mouths of two meltwater streams on the west side of the ice. The water directly in front of the calving ice face is turbid. The margin of the Little Ice Age moraine lies mainly on the west side of the glacier. Where it crosses the coast a gravel spit is attached. Some of the sediment in the spit is derived from the moraine, and some from gravel beaches which extend southwest to the unnamed headland at the mouth of the bay.

K2 (Tinde Glacier)

This glacier is close to the sea at present - it is fronted by a gravel beach. A morainal veneer is located on the north side.

K3 (Brødre Glacier)

K3 is set back a short distance from the sea, but on a 1930 oblique aerial photograph it is seen to extend into the water. The moraines are more extensive than around K2, and have been trimmed somewhat - they are fringed by a gravel beach.

K4 (Basis Glacier)

Very dark morainal material, underlain by ice, extends to the coast. Small turbid plumes are present. On the west side is a relatively thick Little Ice Age moraine, and thin veneer of moraine spread across a bedrock ridge. A prominent medial moraine on the south side of the glacier separates K4 ice from a small ice lobe branching from K3. A small barrier at the east side of K4 appears to be derived from reworking of this medial moraine and moraine at the north side of K3. A 1930 oblique aerial photograph shows the K4 glacier extending into the water, with a lobe of ice wrapped around the bedrock ridge at the north side. The medial moraine is prominent, and also extends into the bay. It separates K4 ice from a branching lobe of K3.

K5 (Forbindelses Glacier)

This glacier has two distinct lateral moraines. These terminate in small fan deltas which are discharging turbid plumes into the bay. The ice front is mostly on bedrock but a small section is standing in water. This part has a vertical face and is bounded by bedrock headlands. It is unclear whether turbid water is issuing from this face or whether it is part of the plume from the southern delta. The Little Ice Age moraine is a small fringe of sediment on the northern flank of the glacier. No little ice-age morainic ridges are seen- they may be submerged. The 1930 oblique aerial photograph shows the glacier standing in water with a cliffed ice front.

Watkins Fjord

This fjord has very low wave energy levels.

W1 (Dobbelt Glacier)

The W1 system is complex. Several prominent morainal arcs enclose two freshwater ponds with high levels of suspended sediment. Large lateral moraines extend inland, perhaps ice-cored. Faint submerged arcs extend from the Little Ice Age Moraines to an island. Their origin is unclear. Gravel beaches may be present at the coast.

J.C. Jacobsen Fjord

This area was given a low priority because the fjord has not been charted, and the chances of entry by Hudson were considered low. However, it was considered worthy of investigation for several reasons: (1) some glaciers have Little Ice Age morainic lobes in the sea; (2) one glacier terminates in sea; (3) there is evidence for a marine limit; and (4) wave-energy levels are moderate.

J1 This relatively large glacier is highly distinctive on account of (1) the large retreat, which is about an order of magnitude larger than elsewhere (but similar to the retreat of M 10); and (2) the presence of a series of narrow, arcuate moraines. These have been dissected by meltwater streams and are partly buried by alluvial sand and gravel. One section of the moraine is wider and smoother than the rest. This may be due to its position, abutting the bedrock ridge to the southwest. Large lateral moraines are present.

The outer part of the arcuate series of moraines appears to have overridden a dissected terrace which extends along the north coast. This terrace is presently being reworked to form a small spit in one location. Farther west and inland it abuts the alluvial plain which postdates the moraine system. The uppermost terrace sediments perhaps mark the Late Wisconsinan marine limit. If so, this site has a high priority for investigation in the future.

J2 The glacier is inland. An arcuate Little Ice Age moraine projects seaward, partly submerged. A small alluvial fan abuts the west side of the Little Ice Age moraine.

J3 The very small glacier is inland. The Little Ice Age Moraine is a lobate structure which barely reaches the coast.

J4 The glacier reaches the coast, and terminates in an ice cliff. An arcuate feature to the west side is part of the Little Ice Age moraine. The east side of the glacier is out of the photograph.

Visual observations of coastal processes and morphology in Kangerdlugssuaq Fjord

Notes and accompanying photographs were taken during survey operations at the head of the fjord, and during the transit south. In addition, video records were collected by the cruise photographer. Most of the length of the fjord is a conduit for glacier ice from the Kangerdlugssuaq Glacier. Local glaciers have Little Ice Age moraines, sometimes dissected streams. Damping of waves by sea ice and icebergs, and extensive abrasion of the coast by moving ice, reduce the effect of waves at the coast to a minimum.

At the head of the fjord the glacier front is obscured by a wide sikkussaq - a shelf of crumpled and crushed sea ice and icebergs. A large lead in front of the sikkussaq contained mainly sea ice, but with several high (~55 m) tabular bergs. Fresh moraines could been seen at either side, sloping down to sea level from about 50 m.

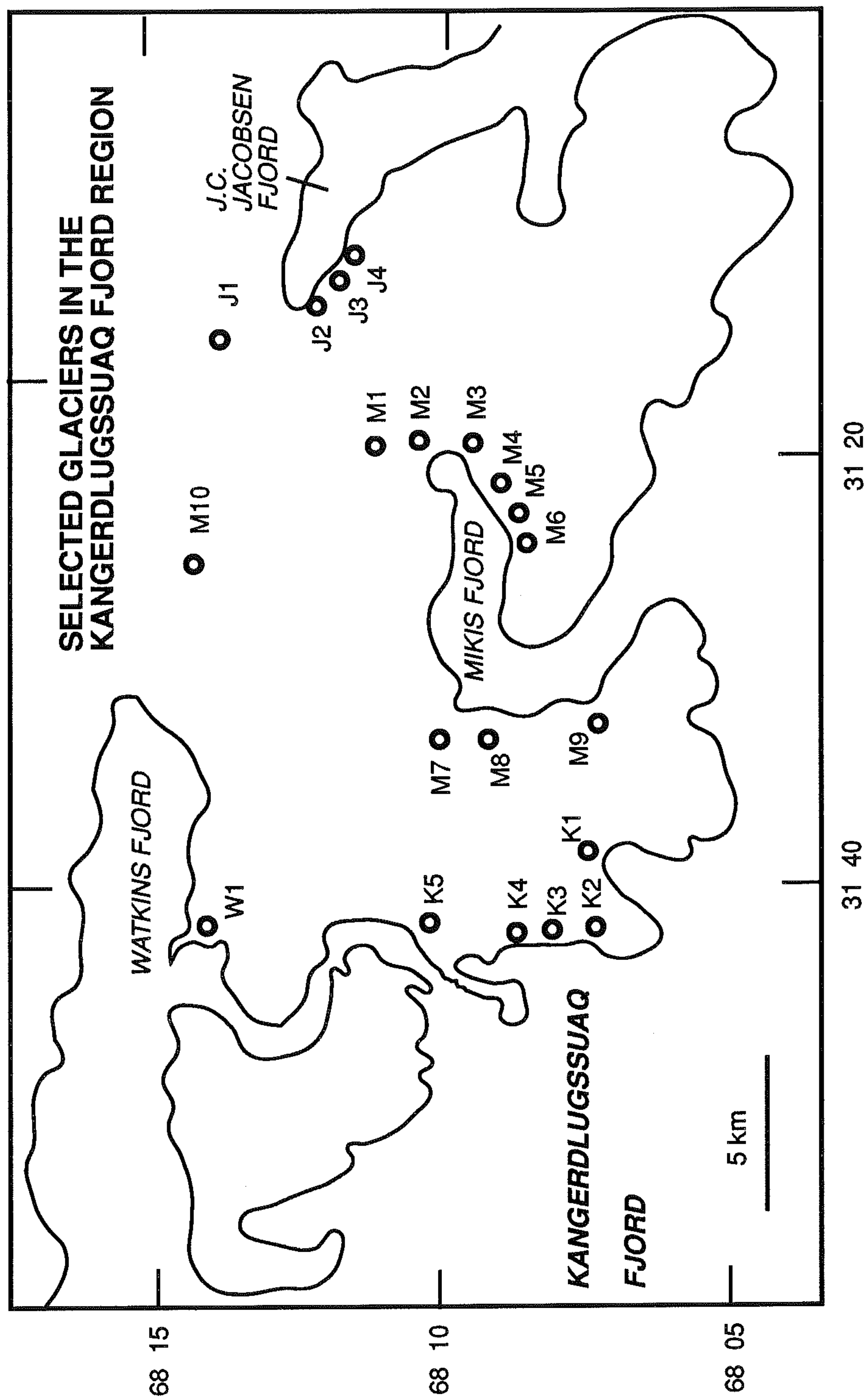


Figure 1 Coastal Geomorphology - Glaciers mentioned in text.

DEEP TOW OPERATIONS:

Martin Uysegi
Geoforce Consultants Ltd.

1.0 INTRODUCTION

This report is a technical review of the Deep Tow Seismic (DTS) operations aboard C.S.S. Hudson, during Atlantic Geoscience Centre cruise #HN93-030. Survey operations were conducted in the Denmark Strait and Kangerdlugssuaq Fjord, Greenland, September 3 - 17, 1993. This report does not attempt any discussion of the data collected, geologic interpretation of the DeepTow records will be covered by the participating scientists.

The primary objectives of the geophysical survey program were to ...

a) map the seafloor materials and establish shallow seismic stratigraphy for parts of the study area

b) to support the bottom sampling program in the selection of core sites

Dr. James Syvitski (AGC) was Senior Scientist of the field program. Geoforce Consultants provided technician Martin Uyesugi, under contract to the University of New Brunswick/Office of Naval Research. The Geoforce technician supervised the installation, operation and maintenance of the DTS system.

A total of 54.05 hours of DTS data was collected, mainly in the Denmark Strait. Heavy ice cover restricted survey operations in Kangerdlugssuaq Fjord to two short lines. The scientific program was terminated due to hull damage to the vessel, forcing its premature return to Reykjavik, September 17, 1993.

1.1 DAILY SUMMARY

A daily summary of operations follows. All times are UTC unless otherwise noted.

Date	JD	Event
1/ 9/93	244	Geoforce technician departs Halifax airport 1450 hours (AST) with AGC survey staff.
2/ 9/93	245	Staff join C.S.S. Hudson, Reykjavik harbour 0800 hours. Commence installation of DTS.
3/ 9/93	246	DTS installation completed by 0430 hours, system testing reveals problems with BMC signals (see service note below). ** COMMENCE FIELD PROGRAM HN93-030 ** Ship sails 1700 hours for work area in Denmark Strait. Service Note: Various problems with BMC signals (spurious 380 m. depth reading, pitch and heave meter readings offset, also no seismic signals) traced to an intermittent short between fish ground

		and ASU supply. A solder connection to the ASU accelerometer was shorted to the accelerometer case. DTS tested and operational at 2330 hours.
4/ 9/93	247	Deploy DTS and seismic gear at 0720 hours in the Denmark Strait. Survey lines # AB 0728 - 0801 (rec'd on SE880) # CD 0813 - 0841 " # EF 0908 - 0936 " Recover DTS at 09 40 hours.
5/ 9/93	248	Deploy DTS at 0130 hours, Denmark Strait. Survey lines # 5 0147 - 0414 (rec'd on SE880) # 6 0422 - 0746 " # 7 0850 - 1030 " Recover DTS at 1045 hours. Service Note: Lost bottom signal at end of line #7. Problem traced to failure of the HV return connector on the ESU/Boomer connection. Replaced Brantner connector set from spares. Repairs completed, DTS operational at 1600 hours. Deploy DTS at 2330 hours. Survey lines # 8 2349 - 0000
6/ 9/93	249	Survey lines # 8 0000 - 0410 (continued) # 9 0417 - 0624 #10 0631 - 0927 #11 0935 - 1200 Recover DTS at 1215 hours. Deploy DTS at 2100 hours. Survey lines #12 2111 - 0000
7/ 9/93	250	Survey lines #12 0000 - 0051 (continued) #13 0054 - 0748 #14 0756 - 1000 Recover DTS at 1007 hours. Deploy DTS at 1450 hours. Survey lines #17 1455 - 1753 Recover DTS at 1800 hours. Deploy DTS at 2330 hours. Survey lines #18 2339 - 0000 (rec'd on SE880)
8/ 9/93	251	Survey lines #18 0000 - 0415 " #19 0423 - 0806 " Recover DTS at 0814 hours. Proceed to Kangerdlugssuaq Fjord.
9/ 9/93	252	Standby in Kangerdlugssuaq Fjord. Heavy ice conditions in fjord.
10/ 9/93	253	Deploy DTS for short core site survey at 1816 hours. Survey lines #21 1816 - 1916 Recover DTS at 1916 hours.

11/ 9/93	254	Vessel sustains ice damage. Standing by in Kangerdlugssuaq Fjord.
12/ 9/93	255	Inspection of hull by Danish navy divers. Standing by in Kangerdlugssuaq Fjord.
13/ 9/93	256	Decision made to depart fjord. Deploy DTS at 1804 hours. Survey line #22 1804 - 2055 (Rec'd on SE880) Recover DTS at 2055 hours.
14/ 9/93	257	Recover mooring and proceed to Reykjavik.
15/ 9/93	258	In transit to Reykjavik. Deploy DTS at 1830 hours. Survey line #50 1840 - 2006 Records too noisy at 7+ knots, recover DTS at 2010 hours.
16/ 9/93	259	In transit to Reykjavik.
17/ 9/93	260	Arrive Reykjavik harbour 1300 hours.

TABLE 1 - OPERATIONAL SUMMARY

Date	J.D.	Survey	Standby	Downtime	Total
3/ 9/93	246	0.0	7.0	0	7.0
4/9/93	247	2.3	21.7	0	24.0
5/9/93	248	9.75	13.75	0.5	24.0
6/9/93	249	15.0	9.0	0	24.0
7/9/93	250	13.5	10.5	0	24.0
8/9/93	251	8.1	15.9	0	24.0
9/9/93	252	0.0	24.0	0	24.0
10/9/93	253	1.0	23.0	0	24.0
11/9/93	254	0.0	24.0	0	24.0
12/9/93	255	0.0	24.0	0	24.0
13/9/93	256	2.8	21.2	0	24.0
14/9/93	257	0.0	24.0	0	24.0
15/9/93	258	1.6	22.4	0	24.0
TOTALS		54.05	240.45	0.5	295.0
PERCENT		18.3 %	81.5 %	0.2 %	

2.0 DESCRIPTION OF EQUIPMENT

A) DEEPTOW SEISMIC SYSTEM

The Huntec DeepTow Seismic (DTS) system is a high resolution, sub-bottom profiler with the acoustic source, energy supply, heave sensor, and two receiving hydrophones housed in a tow fish body. The DTS system (AGC #3) owned by the Atlantic Geoscience Centre is configured for 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 streamer hydrophone tows behind the fish.

The deck equipment consists of a HydroMac Oceanographic winch, NSRFslip rings, a 800 metre, 21 conductor, tow cable, and hydraulic pump unit. 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 in switchable ranges from 2 to 6 kilovolts.

B) GRAPHIC DISPLAY AND SIGNAL PROCESSING

The DTS system utilizes two EPC graphic recorders. An EPC 9800 (master) provides the system's key pulse and displays the signal from the internal LC10 hydrophone. A second EPC 9800 recorder (slave) displays the external NSRF tapered streamer array.

The Adaptive Signal Processor module processed the signal for the master EPC recorder. The streamer signal was processed by the second ASP, then band filtered by a Krohn-Hite 3700R.

Water depths ranged from 80 to 2200 metres. In deep water, there were often several shots in the water column, and the system's TVG circuits were not properly synchronized with the corresponding return signal. The Adaptive Signal Processors for both channels were set to Fixed +20 Db. gain mode with the bottom tracking turned off. These settings produced more consistent record quality.

C) DATA 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. On selected lines, the DTS data was recorded on the Ferranti SE880 Sonar Enhancement System. Configuration of the SE880 was supervised by R. Courtney (AGC).

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

D) 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 c/w 600 m tow cable	---
Roller Cluster 36" Dia.	---
Power Control Unit Mk III	120-1
PCU Filter	120
Systems Console	109
EPC 9800 Graphic Recorder (Master)	126
EPC 9800 Graphic Recorder (Slave)	134
KrohnHite 3700R	1760
IKB Technologies SPA-2 Processor	---
Second ASP Console	101

2.1 EQUIPMENT SETTINGS

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

Parameter	Setting
Fire rate	0.5 - 1.0 seconds (depth dependent)
PCU power setting	4 kilovolts (560 joules)
BMC (motion compensation)	Pressure Mode
ASP	Fixed +20 db Mode (both channels)
Filter Setting - internal	1400-6000 hertz
- external	1000-6000 hertz
Processor Gain (System Console)	4 KV (both channels)
Krohn-Hite gain (streamer)	0 db gain
EPC sweep speed	250 or 500 msecs.
EPC print polarity	positive

The DTS was part of the geophysical program which consisted the following equipment systems.

* Huntec Deep Tow Seismic boomer profiling system
* AGC seismic system (with a 40 cubic inch HGS sleeve gun and single channel streamer)
* Klein Model 595 Dual Frequency side scan sonar
* Ferranti Model SE880 Sonar Enhancement System
* ORE Model 140 3.5 Khz profiling system

2.2 EQUIPMENT PERFORMANCE

The DTS collected 54.05 hours of data with a survey utilization rate of 18.3 %. The high standby percentage is explained by the heavy ice conditions in the fjord and the cancellation of geophysical survey operations due to hull damage to the Hudson. When called on, the DTS collected good quality data.

The DTS required servicing at the outset of the cruise. Fortunately, the problems were repaired during standby periods, resulting in minimal survey downtime. The first DTS problem (ASU telemetry problems) was discovered shortly after the system was hooked up in Reykjavik harbour. An intermittent short of the accelerometer lead (+ supply) to the chassis is thought to have occurred during the overland transit to St. John's. The wiring connections were rerouted and insulated to prevent this problem from occurring again.

The second DTS problem involved the HV connectors at the ESU. The Brantner (HV return) connector shorted to sea water. Both male and female connectors were replaced from spares. The Brantner connectors have a history of failure, so the their failure did not come as a complete surprise. The basic problem is the connectors are rated for only 600 volts d.c. and are being subjected to over 5000 volts.

Equipment Servicing and Status

The DTS system was fully operational at the completion of the cruise. It was uncertain if the MacLean cruise in Hudson Strait would also be cancelled. The DTS system was left wired up with the exception of the tow fish. The tow cable was disconnected and the sheave block was stowed.

Parts Consumed

DTS parts consumed	3 - Junction box O rings
	1 - Brantner HV connector set (male & female)
	1 - 82A1 splice kit
	1 - Epoxy kit and silicon grease

3.0 CONCLUSIONS

During this cruise DTS records were collected in water depths ranging from 80 to 2200 metres. In recent years there has been an requirement to use the DTS system in deeper water. While originally designed for shelf depths, the DTS has been successful in collecting data in water depths over 3500 metres. There are certain physical limitations when using the DTS in deep water (s/n ratio, sea state, ship's speed), however, the records could be improved significantly with some minor changes to the DTS.

In order to retain the resolution capabilities of the DTS, its is necessary to set the graphic recorder for a fast trigger and display sweep. This means there are multiple shots in the water column at any given time. The problem arises when the return signals being displayed are out on synchronization with the systems TVG circuits. Currently, spreading loss correction is built into the System's Console signal processing. In deep water it would be preferable to disable the spreading loss correction. The signals coming up the tow cable could be intercepted prior to the

System's Console processors and then fed to an external, adjustable signal amplifier/band pass filter unit. In deep water, this would simplify the adjustments required to set the proper gain level. The newer model digital KrohnHite filters have multiple channels with adjustable gain levels.

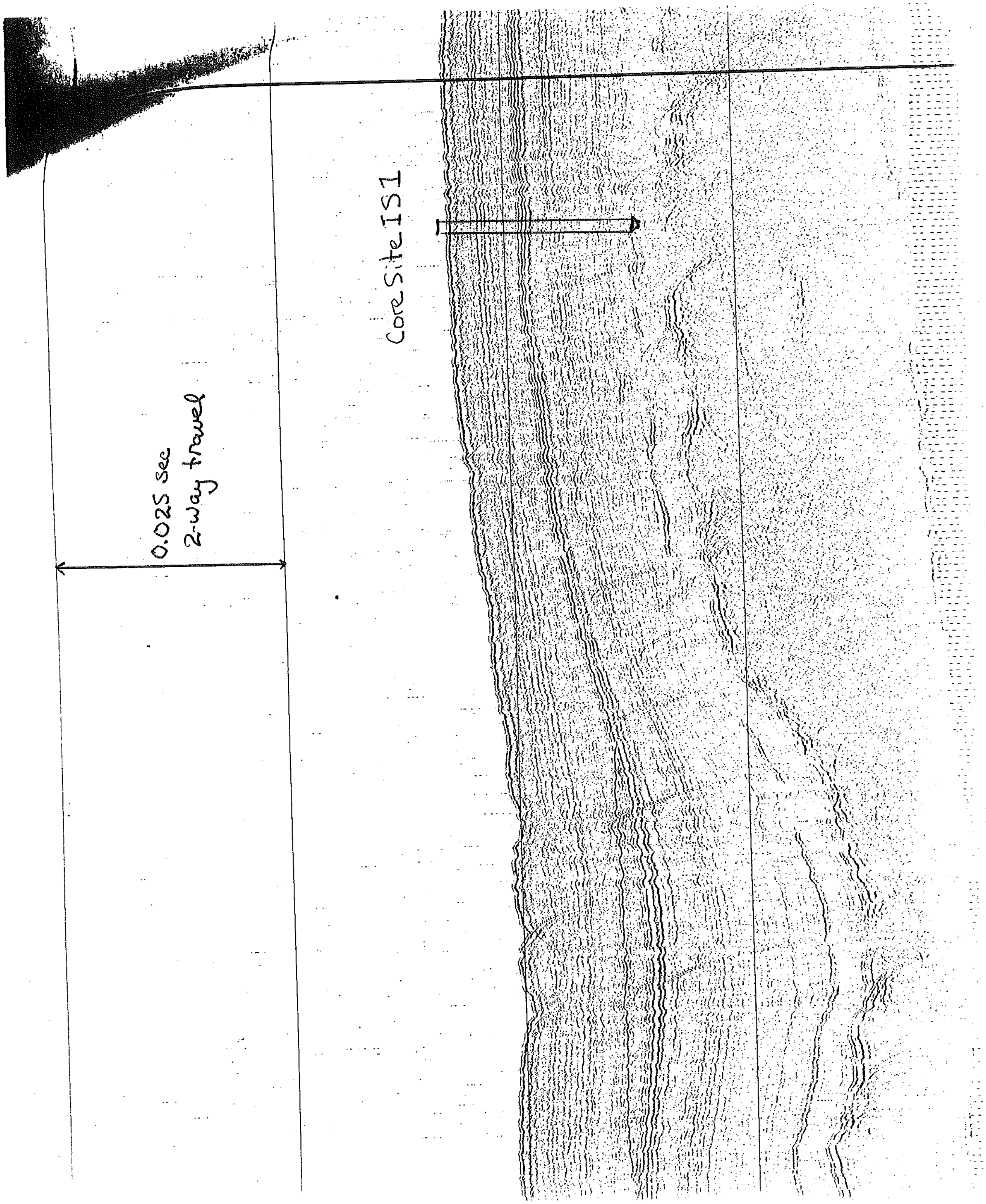
The other half of the display quality problem is acoustic interference. Over the years, AGC has invested in new equipment systems to improve the quality of data. Sleeve guns, digital side scan and the forthcoming digital DTS, all represent significant advances. The old problem of acoustic interference between systems still remains.

Ultimately, a master trigger box is required which can control all the survey systems on the same time base, with independently selectable source triggers and independent delayed print trigger. Phasing or trigger/print inhibits could eliminate most of the acoustic interference. For the short term, a simple DTS trigger box with selectable output triggers and delayed print triggers would improve DTS record display. During this cruise, IKB Technologies SPA-2 Dual Channel Processor was available for use with the DTS. The SPA-2 has a suitable range of output triggers, plus an adjustable print delay output. In standard configuration the print delay of the SPA-2 is inadequate (9 x 20 = 180 msecs). If the range could be increased (ie 9 x 100 = 900 msecs), the SPA-2 would be ideal for use with the DTS.

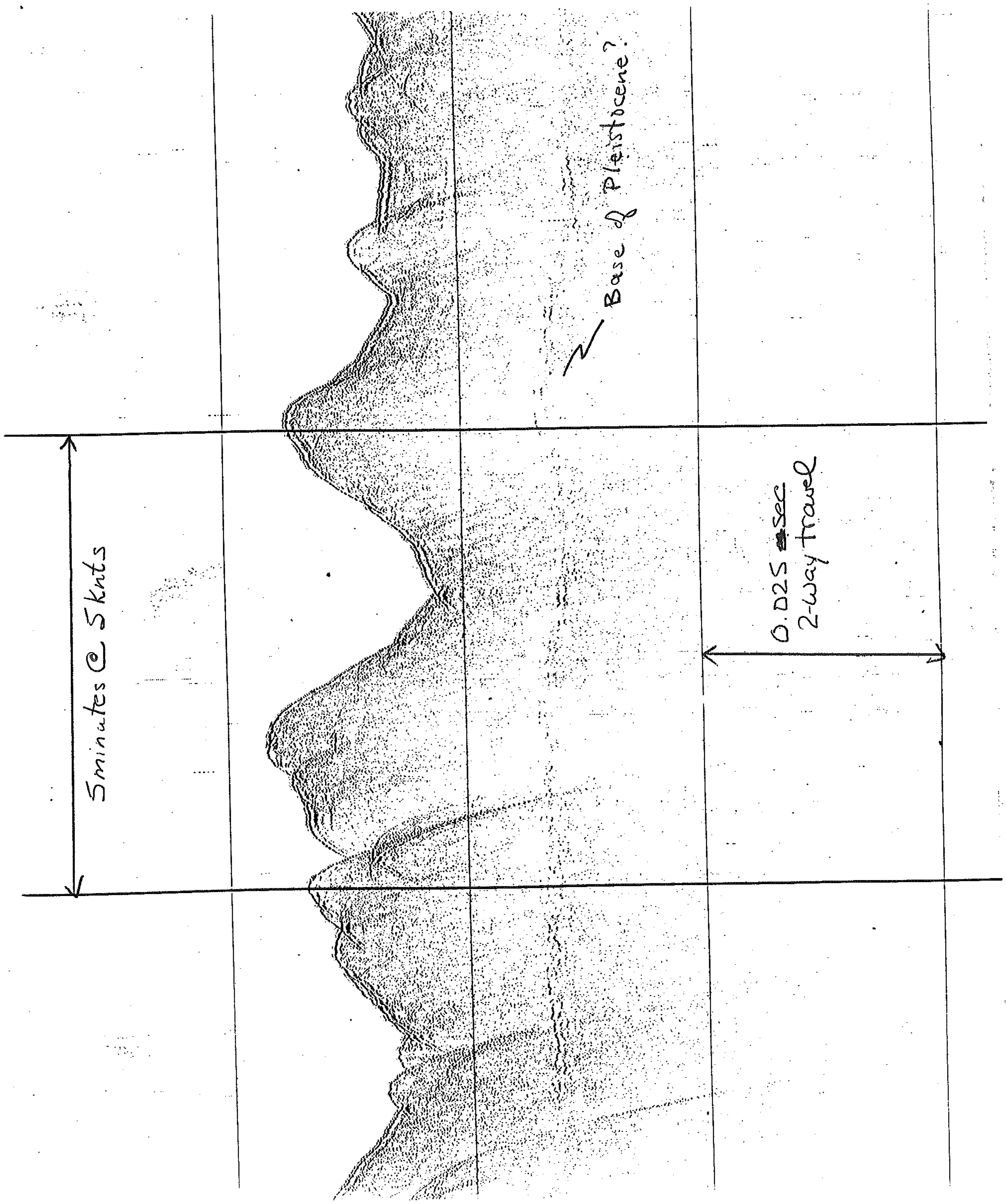
The DTS was deployed on two occasions in fairly thick ice coverage. Operations in the ice did not prove to be a problem, as long as certain safety precautions were maintained. These included instructions to the bridge to notify the seismic watch of potential obstacles and a special deck watch to standby in the event of emergency equipment recovery.

The one technical problem that should be mentioned is the failure of the Brantner high voltage connectors. The Brantner connectors are being used at voltages far in excess of their rating, so the failure of these units from time to time is not unexpected. The reason for the continued use of the Brantner connectors was the lack of a better replacement. This may no longer be the case. Geoforce has a data sheet of a special high amperage connector made in Norway. Initial review of the connector specification is promising. It is recommended that a set of these connectors be purchased. Geoforce can conduct a long term reliability test. If these tests are successfully passed, the ESU end cap would have to be modified to accept the new connector.

The HydroMac winch was repaired by Hydraulic Systems prior to this cruise. The primary problem was a motor leak, however, some changes to the internal setup of the Haaglunds motor were made. During this cruise the HydroMac winch would pay out in jerks at any speed above the minimum speed. Operation while winching in was not affected. The hydraulic lines were bled, but this did not improve the situation. It is not certain if the changes made by Hydraulic Systems caused this problem, we do know this problem was not evident before the service work. The winch can be operated "as is" for the balance of the season, however, the winch should be inspected during the winter refit.



Example of HUNTEC® DTS boomer record from the Icelandic Shelf & over core site I.S.1



Morainal ridges near the shelf-slope break of the Kangerdlugssuaq Trough HUNTER® DTS record.

Scale as in previous Huntec DTS plate.
Example of morainal bank(?) covered by glaciomarine sediments. Site is inner Kangerdlugssuaq Trough

SEISTEC OPERATIONS:

Peter Simpkin, INRS-Oceanology

Preamble

My involvement in this program was in support of two seismic programs:

a) As one watchkeeper of the Huntec Deep Tow seismic system during the routine geophysical/seismic program

b) In charge of the seismic program to collect seismic (SEISTEC) and sidescan data from the launch Merganser several sites in the fiord adjacent to selected glaciers.

Due to the ice damage to the Hudson program b) was cancelled before any seismic data was collected from the launch. However, a small amount of SEISTEC data was collected during shakedown tests at site 26, at the fiord entrance in water depths of approximately 875m.

Results

It was hoped that this program would enable the SEISTEC system to be evaluated in both shallow and deep water using both the internal hydrophone (line in Cone) and the eel. This system had been configured with a dual channel preamplifier and dual signal processor designed specifically for this purpose.

The Merganser was to be used for both the inshore geophysical program and as a platform for the ROV/Under Water Camera, Scanning and sidescan sonar package provided by Cambridge University. Initially, the Merganser was fitted out with the ROV control equipment and the sidescan control unit for trials. Some of this equipment was removed for the geophysical trials which were to precede the ROV program.

The collection parameters for Figure 1 were as follows:

Boomer Firing rate 0.5 Sec.

Boomer Energy 175 J.

Display Sweep EPC 1600 at 1/4 Second

Display Delay 100 ms

Display 25 ms / division = 18.23 m/division

Display - 5th cycle - Bottom arrival time 1.2 seconds

Bottom depth 875.19 m using a time averaged sound speed of 1458.65 m/s calculated from CTD information HD93030-26.

The section shows very fine layering in the top 20m of sediments with individual reflectors having separations of less than 0.5m. The fine detail shown on this section indicates that in this area, the seafloor is extremely flat and smooth with little surface relief and little or no variation in the thickness of the seismic units in the top 20m. Although this test section was not recorded on tape it may be possible to extract relative reflectivity information from the scanned image for correlation with the magnetic susceptibility data gathered from the core collected at this site.

This small section represents the deepest water operation of SEISTEC to date. The quality of the data is surprisingly good considering that only minimum power was used in the very deep water. The conditions were ideal except for the fact that it was below freezing and snowing at the time. The sea was very smooth with no swell or wave activity. The Merganser was moving slowly in a circle avoiding the bergy bits. Unfortunately, technical problems as well as several hours exposure to the elements shortened this trial and no further data were collected.

Equipment Preparation

Once the SEISTEC was removed from storage it was immediately obvious that a complete service was required. Before problems with the electrical system were addressed, two mechanical problems had to be rectified. First, the cone reflector was found to be loose and had to be re-clamped. Secondly, the floats had to be removed so that six rubber washers could be fixed to the (6) supports. This was necessary so that the floats were held more securely by the float clamps.

During initial testing of the electronics it was discovered that the dual preamplifier in the catamaran was not operational on one channel and the gain change did not function. Following inspection, one integrated circuit (074) and the drive transistor and associated diode were replaced but the cause for the failure was not immediately obvious. Subsequently the boomer was tested for leakage to ground with a 1000V Megger before being connected to the Geopulse Power Supply. A reading of 200kΩ indicated a leakage problem. The boomer was removed from the frame and opened to reveal that sea water had indeed leaked behind the plate. Continued use in this state during an earlier program had caused the mylar sheet covering the coil to come free and the rubber spacers to become detached from the plate. It is felt that this failure may have been the cause of the electronic problems in the pre-amp. A new mylar sheet was procured and fixed to coil with Scotcast epoxy. The rubbers were fixed to the plate with 5 minute epoxy.

It is felt that this failure was due to relaxing of the rubber in use and it is recommended that all boomers be checked both electrically (Megger between electrical connectors and plate- insulation to be better than 10 MΩ) and mechanically after use and re-torqued if necessary. Re-torquing is particularly relevant to the four supporting bolts which also apply pressure to the rubber seal.

Other Comments.

Most of the other seismic equipment is now reasonably reliable but the ship is in need of a multichannel controller to enable several systems to run together with a minimum of interference.

Conclusions.

Although the ice front program did not take place we feel that the SEISTEC would have produced the highest quality data available due to the combined directional responses of the boomer source and line-in-cone receiver. We did however collect a sample of very high resolution data in 875m of water from a shallow seismic system.

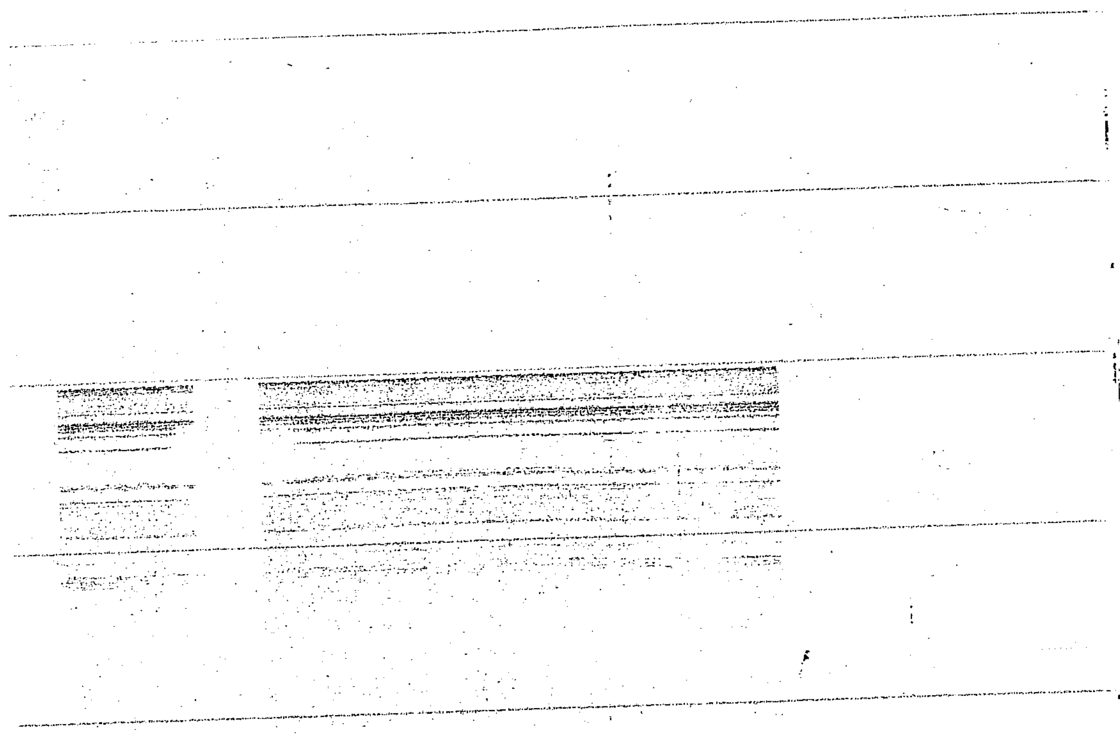


Figure 1 Three minutes of SEISTEC data collected from the launch during trials at site 26.

OCEANOGRAPHY

Kumiko Azetsu-Scott (AGC/BIO)

Objectives:

There were two objectives in this cruise in oceanography. One was to study particle distribution and dynamics in Kangerdlugssuaq Fjord as well as water mass structure and particle distribution on the Iceland Shelf, Denmark Strait and East Greenland Shelf. The other was to understand the glacial melt water dynamics and the response of oxygen isotopic composition in the planktonic and benthic foraminifera.

(1) Particle distribution and their characteristics along the fresh water plume

Particle distribution and water structure were measured using a CTD/Transmissometer system. Salinity and turbidity will be calibrated with water samples that were taken at the same stations. Changes of size and chemical composition of particles are expected along the fresh water plume. Particle size will be studied using the Floc Camera results and comparing them with the disaggregated, inorganic size distribution obtained from the filtered samples. High biological activity has been reported at the ice margins and along the halocline in some polar seas. Chl.a and nutrient measurements will help to understand the contribution of phytoplankton population in particle distribution and flocculation processes. CHN measurements also provide the chemical composition change of particles along the plume and with depth.

CTD/Transmissometer results generally showed high particle concentration at the very surface water, with a moderate peak at the haloclines. Very strong intermediate nepheloid layers were observed around 250-300 m deep at the fjord head. Low Brunt-Vaisalaa frequency in this layer suggests that the turbulent water with high turbidity was laterally transported.

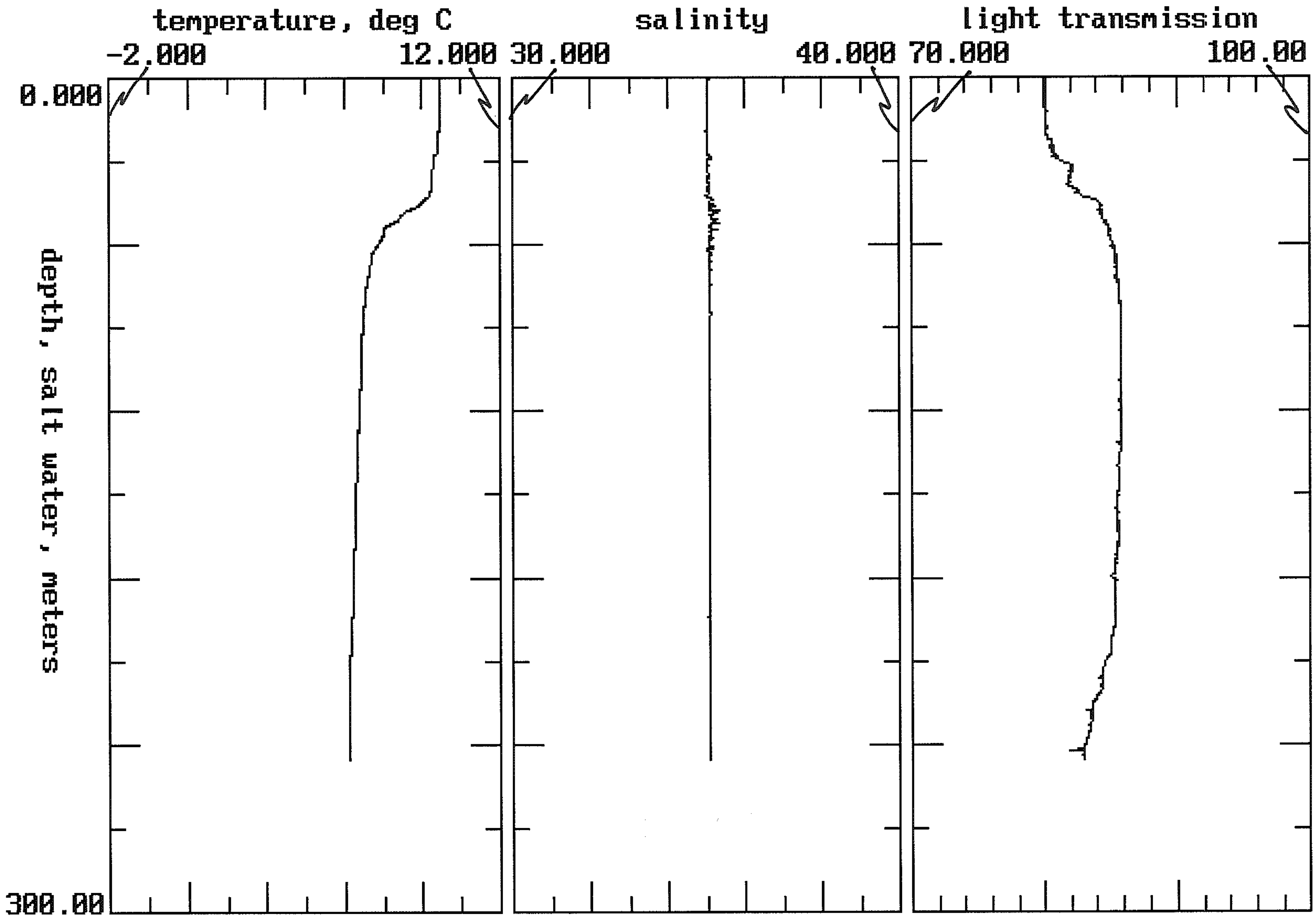
(2) Particle distribution and chemical composition at Iceland Shelf, Denmark Strait and East Greenland Shelf

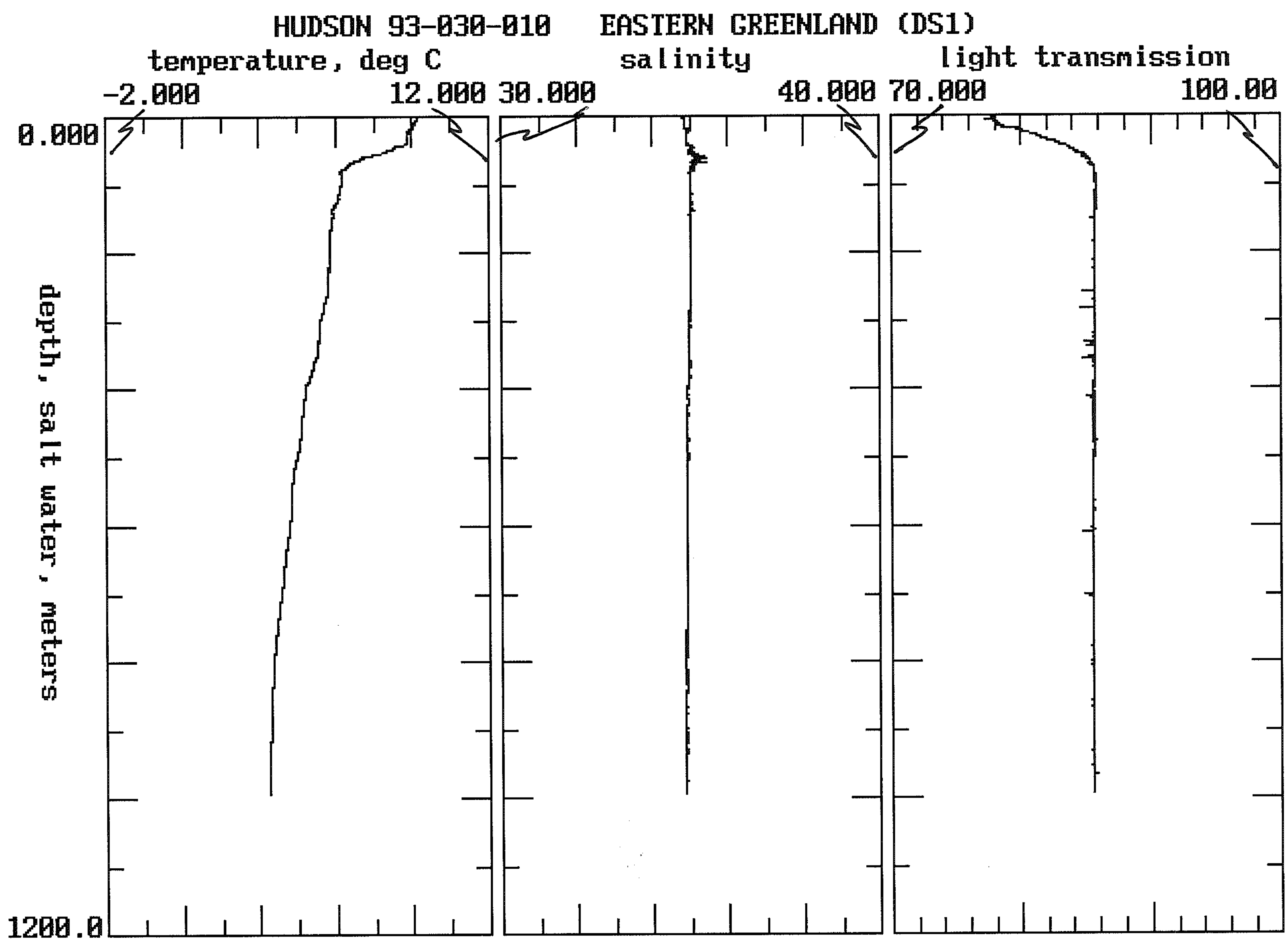
Warm saline Irmingar Current and cold fresh East Greenland Current are encounterred in Denmark Strait. Surface temperature change is abrupt at the front, from 1.5 degree centigrade to more than 10 degree centigrade within 10 km. Horizontal and vertical changes in particle characteristics are expected as well as the particle concentration and the size.

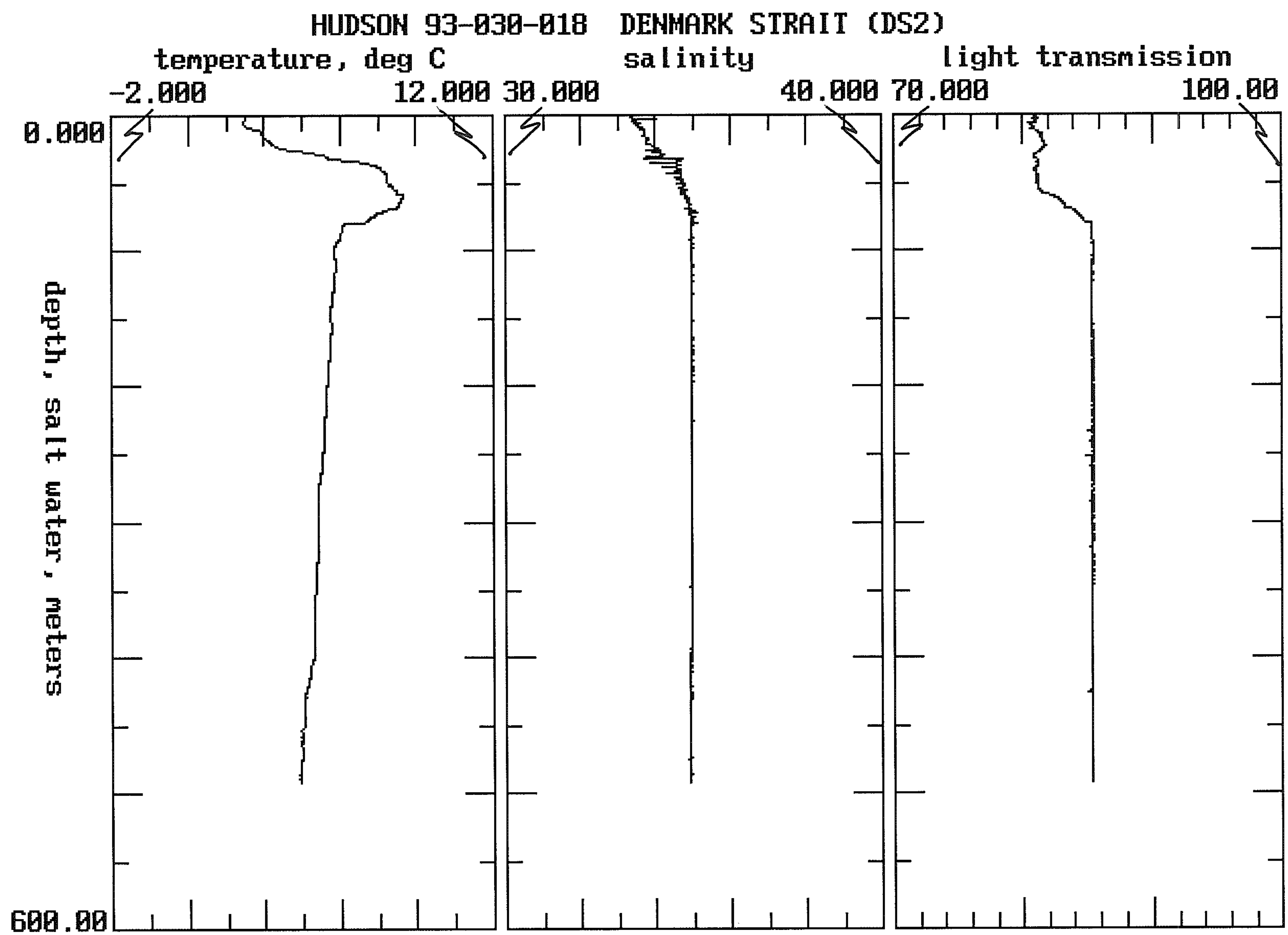
(3) Oxygen isotope distribution in Kangerdlugssuaq Fjord and its implication for the geological record

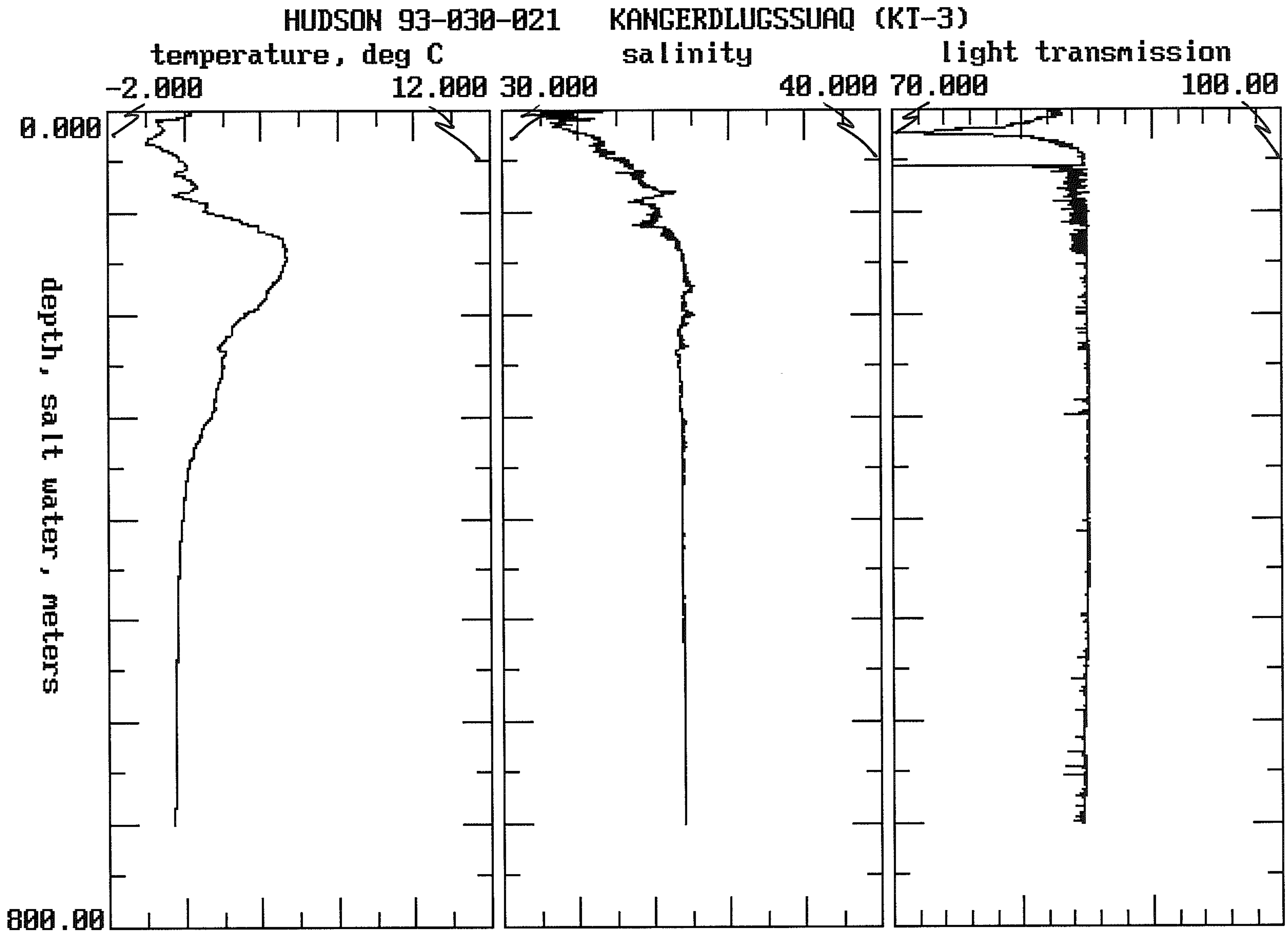
Oxygen isotope stratigraphy has become a major tool in correlating Quaternary marine sequences as an indicator of "continental ice-volume" signal. Oxygen isotopic changes in foraminifera have been considered to be synchronous in deep-sea settings, however, few studies have been done in marginal seas, especially in regions under the influence of glacial melt water. The hypothesis, "delta 18O in planktonic foraminifera is directly affected by delta 18O distribution in the glacial melt water along the plume and delta 18O in benthic foraminifera also is influenced by the surface glacial melt water through the estuarine circulation." will be tested.

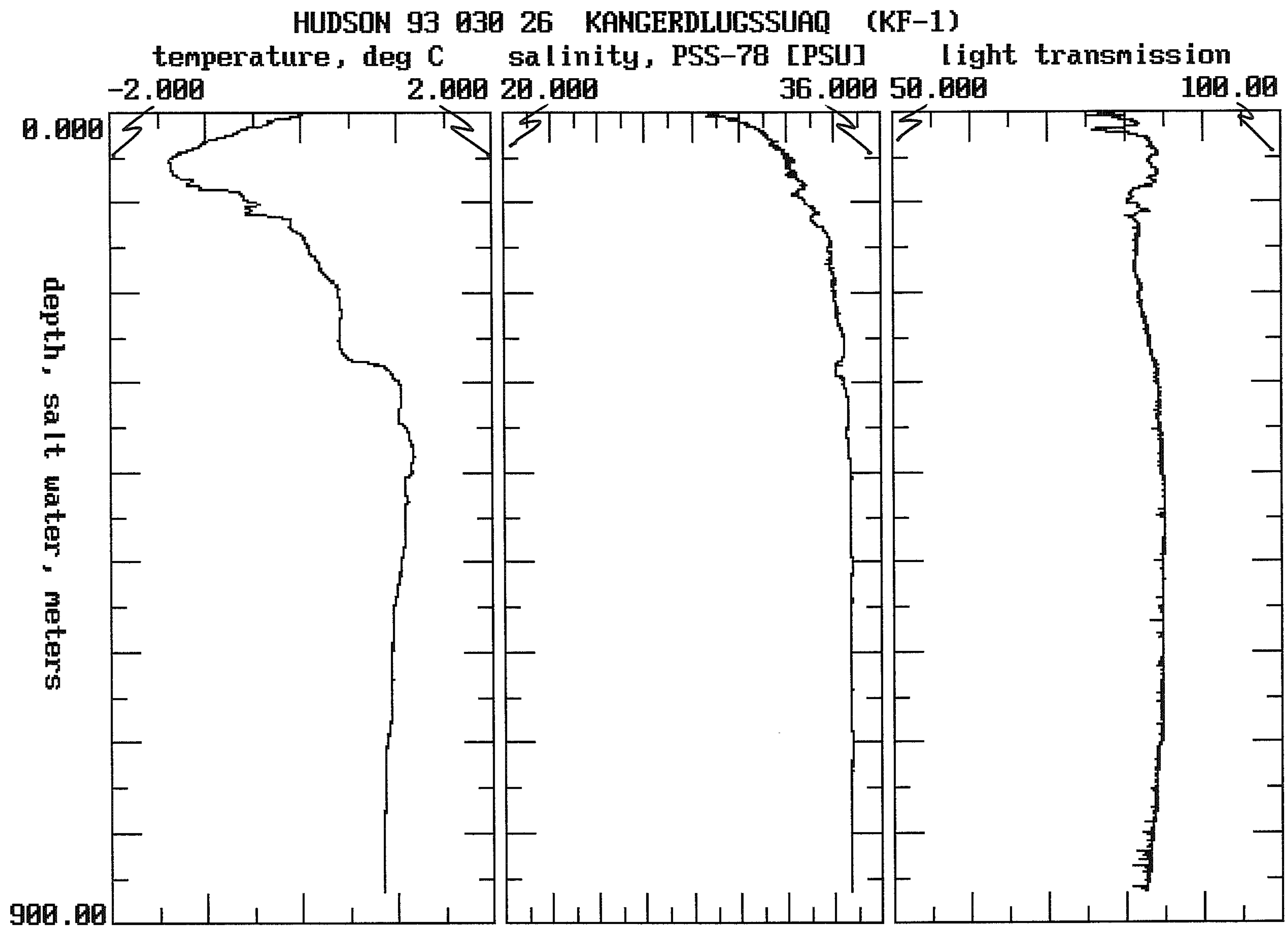
HUDSON 93-030-001A ICELAND SHELF (IS1)



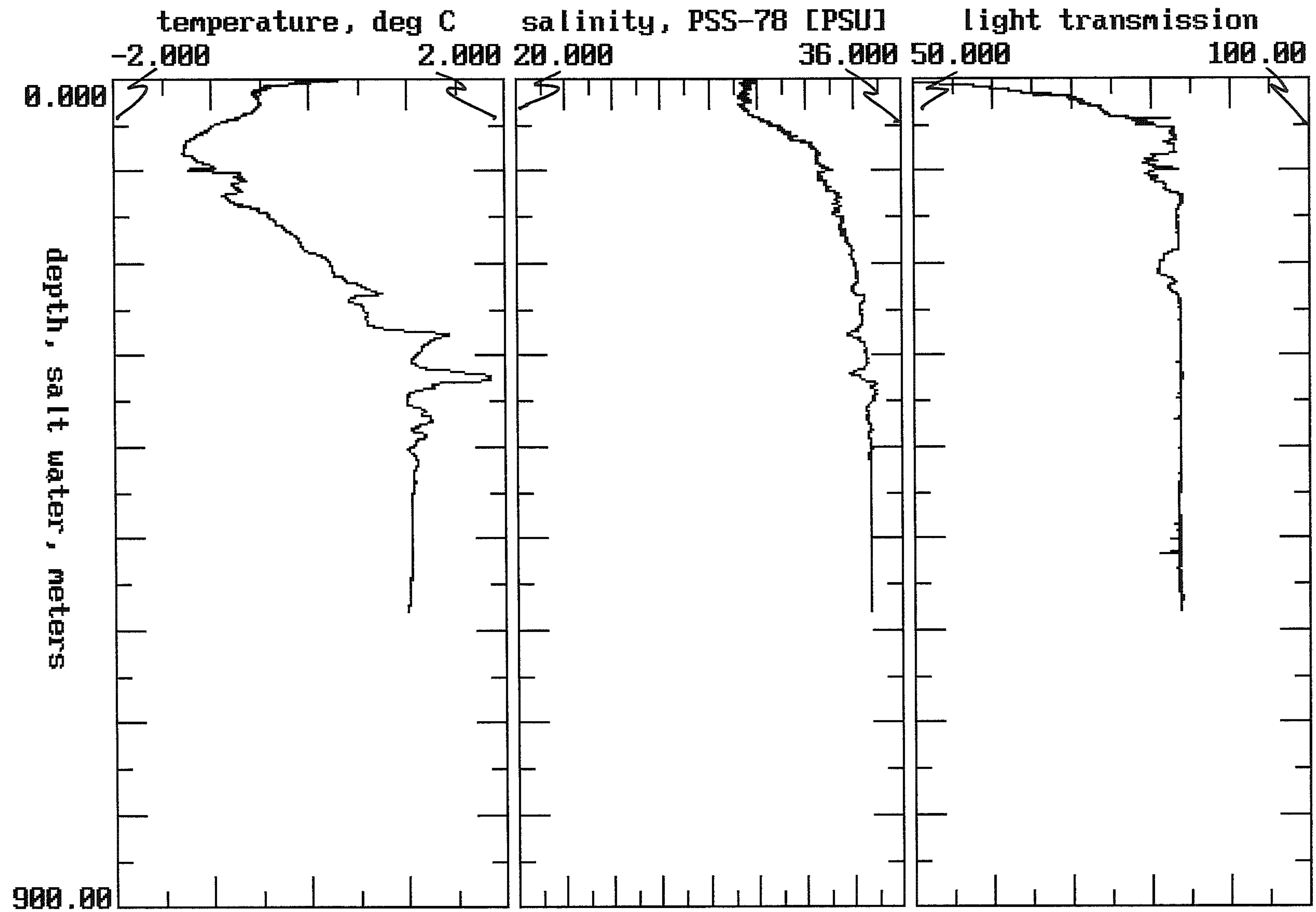

HUDSON 93-030-010 EASTERN GREENLAND (DS1)
temperature, deg C
salinity
light transmission
-2.000
12.000
30.000
40.000
70.000
100.00
0.000
1200.0
depth, salt water, meters

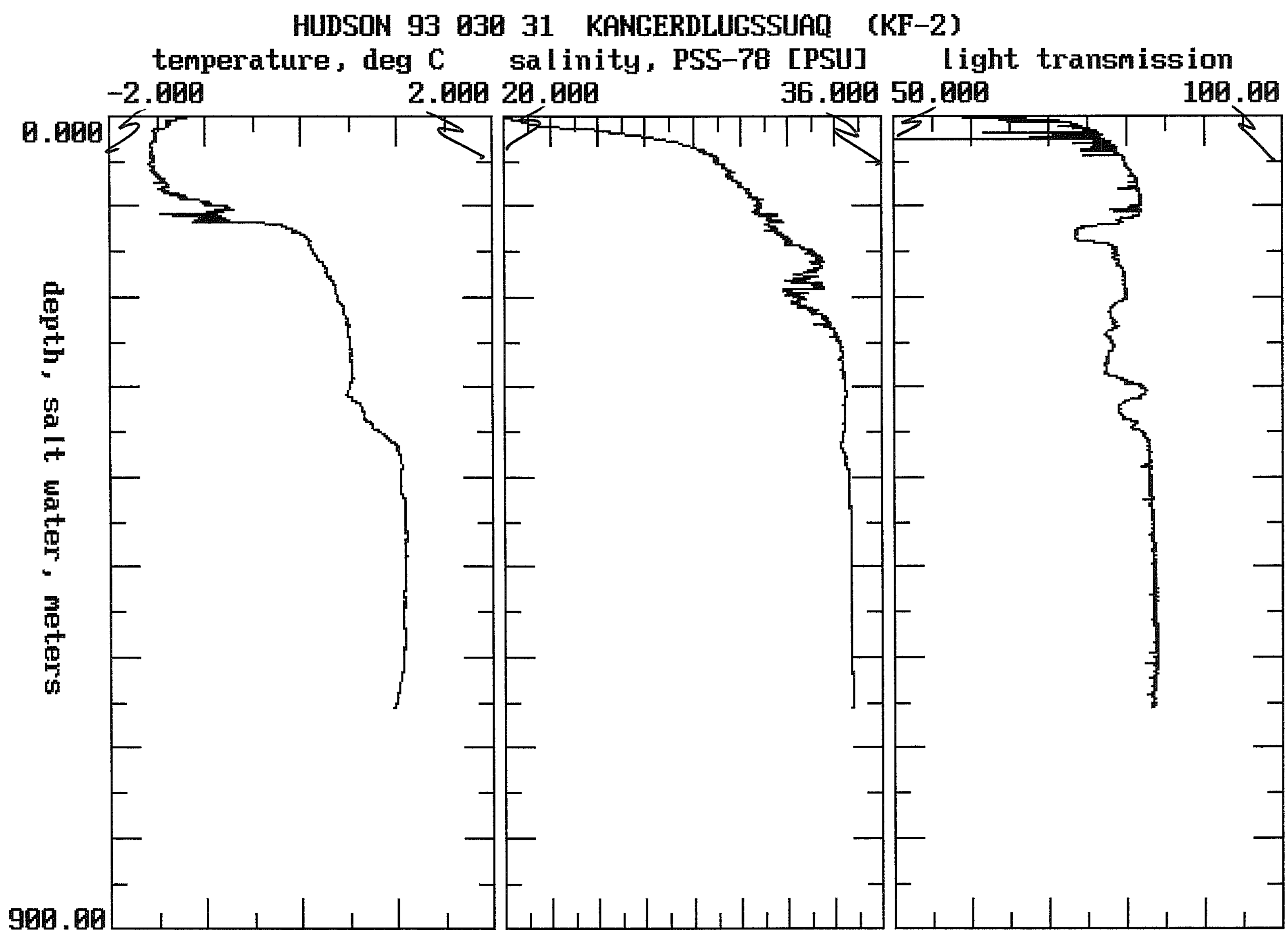

HUDSON 93-030-018 DENMARK STRAIT (DS2)
temperature, deg C
salinity
light transmission
-2.000
12.000
30.000
40.000
70.000
100.00
0.000
600.00
depth, salt water, meters

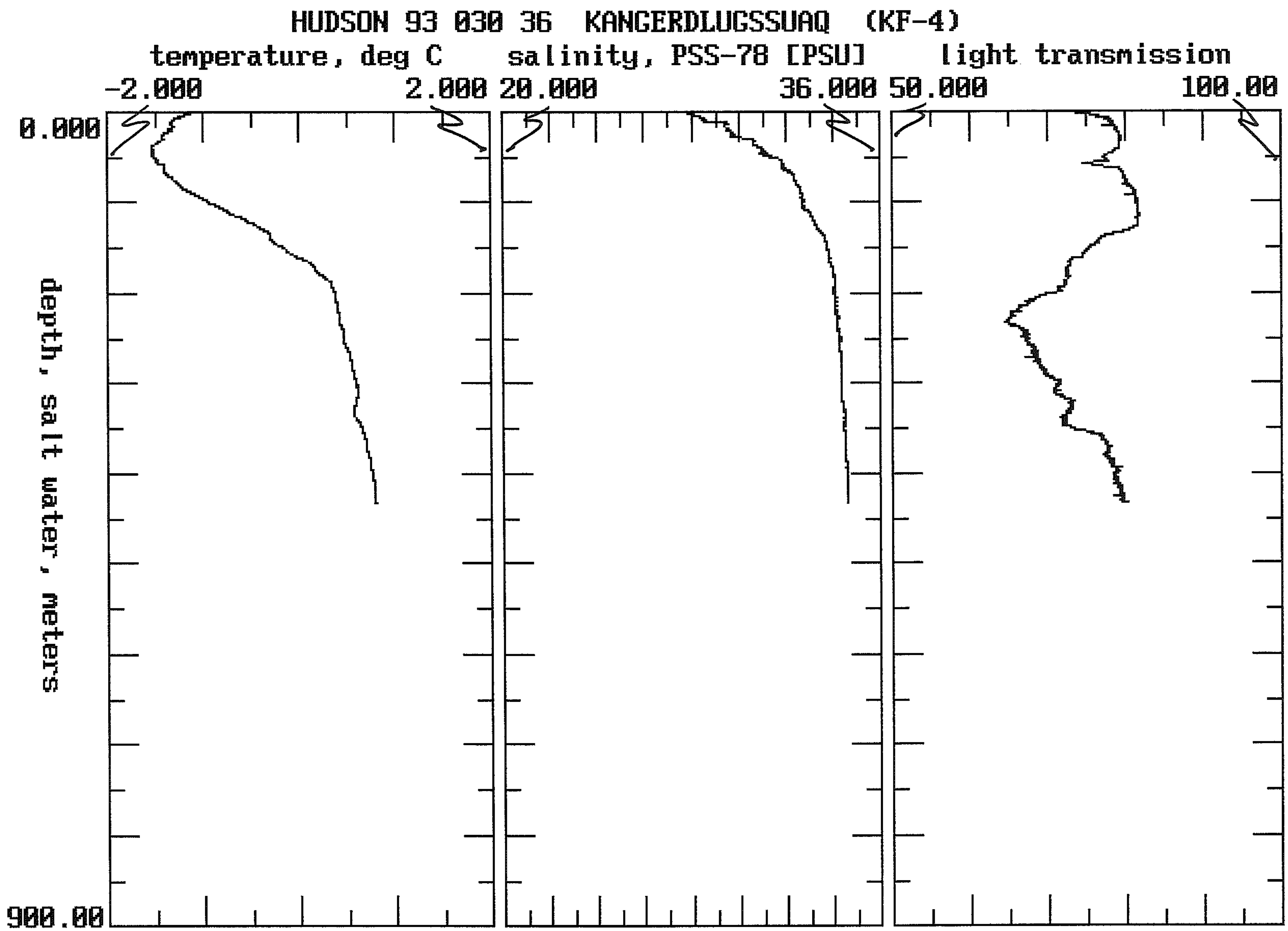

HUDSON 93-030-021 KANGERDLUGSSUAQ (KT-3)
temperature, deg C
-2.000
12.000
salinity
30.000
40.000
light transmission
70.000
100.00
0.000
depth, salt water, meters
800.00

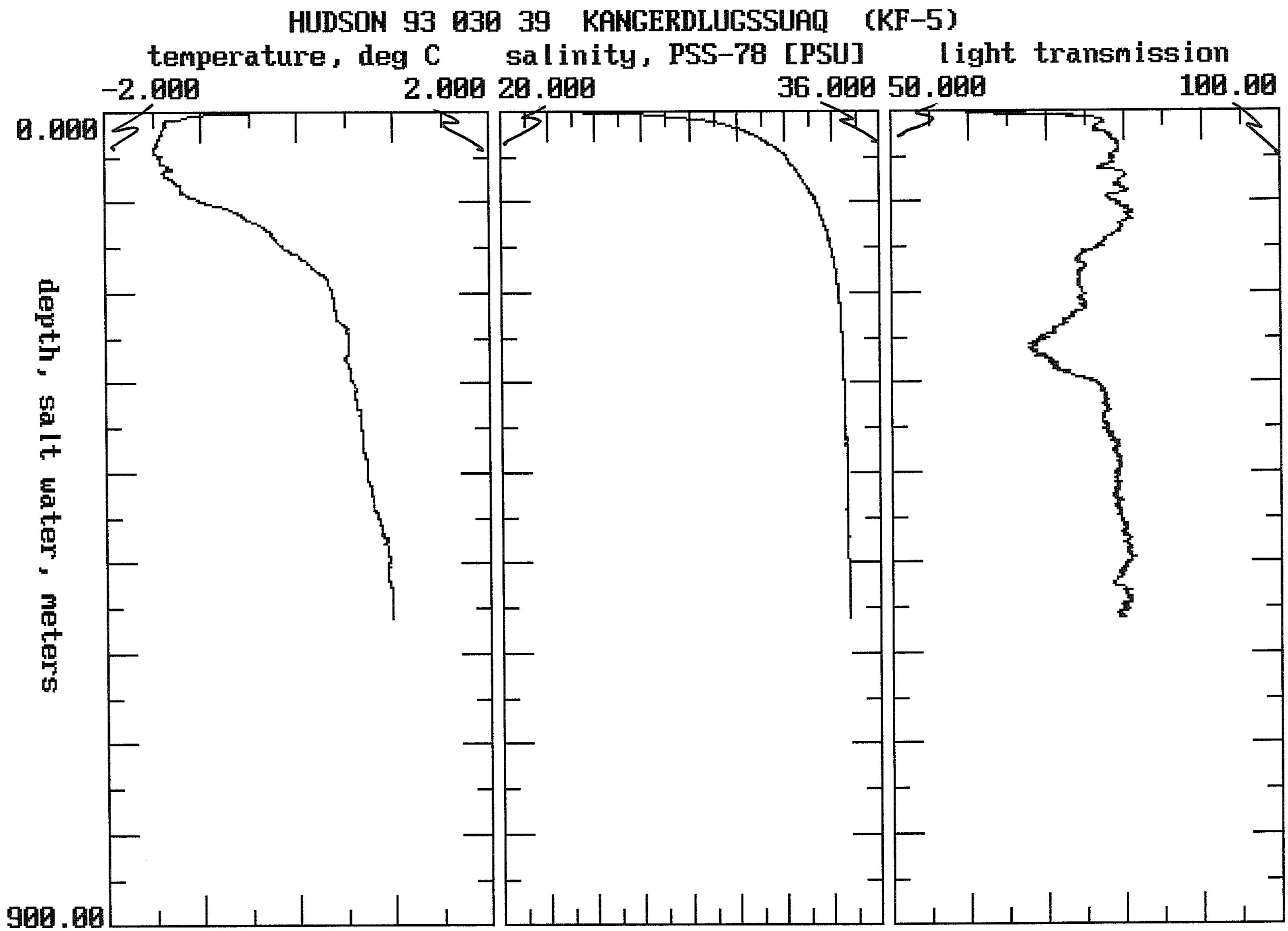

HUDSON 93 030 26 KANGERDLUGSSUAQ (KF-1)
temperature, deg C
salinity, PSS-78 [PSU]
light transmission
-2.000
2.000
20.000
36.000
50.000
100.00
0.000
900.00
depth, salt water, meters

HUDSON 93 030 41 MOUTH OF KANGERDLUGSSUAQ




HUDSON 93 030 31 KANGERDLUGSSUAQ (KF-2)
temperature, deg C
salinity, PSS-78 [PSU]
light transmission
-2.000
2.000
20.000
36.000
50.000
100.00
0.000
900.00
depth, salt water, meters


HUDSON 93 030 36 KANGERDLUGSSUAQ (KF-4)
temperature, deg C
salinity, PSS-78 [PSU]
light transmission
-2.000
2.000
20.000
36.000
50.000
100.00
0.000
900.00
depth, salt water, meters


HUDSON 93 030 39 KANGERDLUGSSUAQ (KF-5)
temperature, deg C
salinity, PSS-78 [PSU]
light transmission
-2.000
2.000
20.000
36.000
50.000
100.00
0.000
900.00
depth, salt water, meters

FLOC Camera

D.E. Heffler

The Floc camera was used at 7 stations on HUD93030. The Seabird CTD was physically mounted on the FLOC camera frame but logged data independently and will not be discussed in this section.

The FLOC camera photographs flocculated sediment in the water column. It was developed at AGC over the last 13 years. It uses 3 35 mm still cameras in separate pressure cases. A shrouded flash illuminates a thin slice (2 cm thick) about 75 cm from the cameras. The two outer cameras have 50 mm lenses and produce a stereo pair of an area about 20 x 30 cm. The central camera has a 200 mm lens to give higher resolution of a small area. Two calibration rods are mounted in the illuminated volume 5 cm apart.

The cameras are numbered 1 to 3 from the left. Each has a data back which imprints day, hour and minute on the film. Camera #1 was set for UT-1 hour, #2 for UT and # for UT+1 hour. Als. The long lens was focused to predetermined settings. The slow shutter speed was required to ensure that all shutters were fully opened at the flash instant.

On several of the first deployments, TMAX 100 black and white film was loaded so on-board processing would allow identification of problems. All cameras appear to have functioned correctly on remaining deployments. The color films could not be processed until arriving home.

Deployment summary

At all stations, the computer was programmed to take the first photo at 10 m. The increment was set to 10,20 or 30 m to fill a 36 exposure film in the depth. The camera was lowered until the meter block read about 5 to 10 m less than the sounding. Data was dumped from the computer after each deployment and called FLOCnnnn.RAWl The three databacks were set within 1 second before station 10 and were still within 3 seconds after station 41.

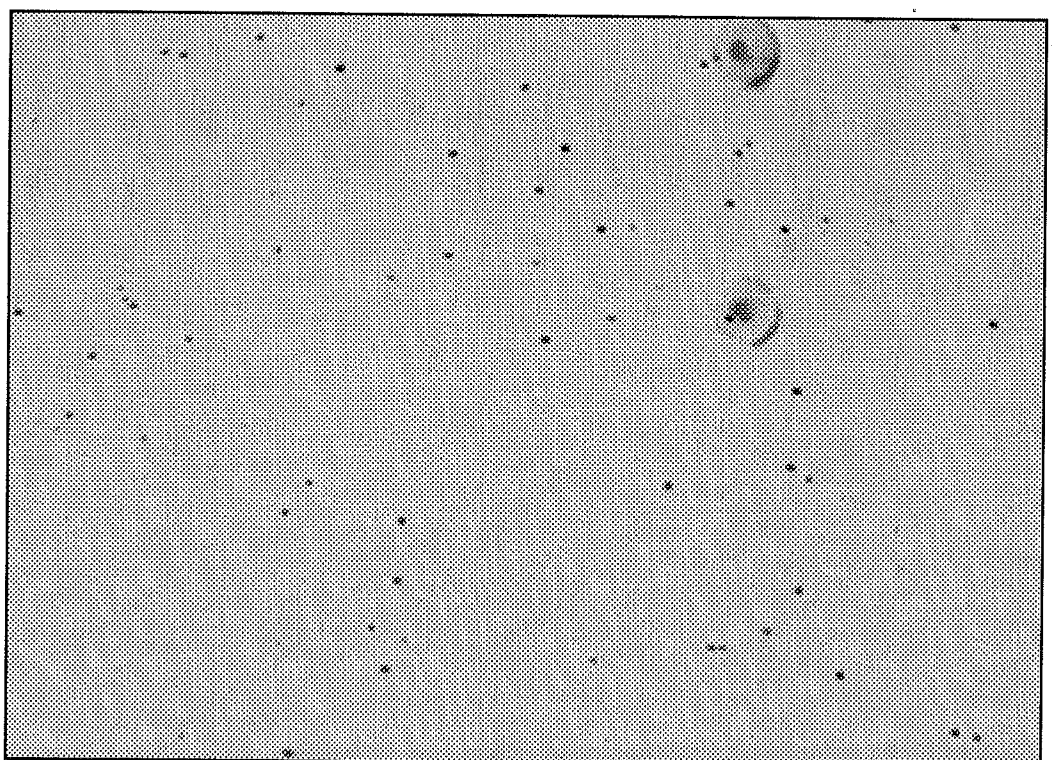
On the first drop, Station 1, an error in the program caused the depth to be over estimated by the computer and all photos were taken near the surface. The shutter speeds were set to 1/15 second which did not ensure synchronization with the flash. Also the camera data backs were not properly configured. After the drop, the main cable failed and the cameras would not operate. I fixed the cable. On this cruise, the FLOC camera was configured for profile mode, taking a picture every n meters as it was lowered slowly (20 m/min). The first photo was set for 10 m depth and subsequent photos were taken at 10, 15 or 20 m intervals, depending on the total depth. 36 exposure films were used.

The camera setting were 1/4 second shutter speed and f8 for the 50 mm lens and f4 for the 200 mm. Ektachrome 400 film was used. The 50 mm cameras were focused in air to 52.5 cm from the front of the len. The data shows the depth and time of each frame.

The depth measurement is made with a 0-1500 psi pressure gauge whose 5 volt output is sampled by the 12 bit A/D converter in the FLOC computer (a Tattletale 4A). This is divided by 4 to give almost exactly 1 A/D count per metre. I compared the FLOC camera depth with the CTD depth on drops 11, 31 and 36 and determined that the FLOC depth should be multiplied by .992 (+/- .001).

Station	**depth**	**max depth**	**films**	**comments**
1			1E,2T	general failure
10	30	1000	1E,2T	
17	15	489	2E,1T	
21	20	690	3E	
26	25	860	3E	
31	20	650	1E	camera 2 and 3 failed
36	15	590	3E	
41	20	569	3E	

In addition to the data gathered, I have worked on programs to analyze the digital files produced by the new Kodak PhotoCD process with the FLOC photos. The following picture is a digital image which has been digitized from the 35mm slide and stored on a CD then transfered to Corel Draw.



→ UP →

Example of a FLOC camera image at KF4

Floc station 1

Frame number	Time hr/min/sec	Depth metres	Computer volts	Flash volts
1	0 14 14	13	11.81	4.55
2	0 14 25	20	11.81	5.59
3	0 14 51	31	11.81	4.53
4	0 15 05	39	11.81	4.52
5	0 15 17	48	11.81	4.51
6	0 15 33	61	11.81	4.52
7	0 15 44	69	11.81	4.50
8	0 15 53	80	11.81	5.58
9	0 16 03	92	11.80	5.61
10	0 16 12	101	11.81	4.49
11	0 16 23	111	11.80	4.50
12	0 16 30	120	11.80	4.48
13	0 16 43	131	11.80	4.50
14	0 16 51	139	11.80	4.49
15	0 17 01	150	11.81	4.49
16	0 17 10	161	11.80	4.49
17	0 17 19	170	11.80	5.82
18	0 17 27	183	11.80	4.48
19	0 17 35	189	11.80	5.57
20	0 17 47	199	11.80	4.50
21	0 17 58	212	11.80	4.63
22	0 18 04	219	11.80	4.47
23	0 18 16	232	11.80	5.86
24	0 18 24	240	11.80	4.49
25	0 18 33	258	11.80	4.49
26	0 18 42	260	11.80	4.49
27	0 18 54	269	11.80	4.72
28	0 19 04	281	11.80	4.50
29	0 19 12	289	11.79	4.48
30	0 19 21	301	11.80	4.49
31	0 19 29	311	11.80	4.48
32	0 19 39	322	11.79	4.48
33	0 19 47	331	11.79	4.64
34	0 19 57	342	11.79	4.49
35	0 20 04	349	11.80	4.48
36	0 20 14	360	11.79	4.49

Floc station 10

Frame number	Time hr/min/sec	Depth metres	Computer volts	Flash volts
1	18 13 15	11	11.51	5.59
2	18 15 10	40	11.50	4.53
3	18 16 48	69	11.49	4.53
4	18 18 28	100	11.49	4.53
5	18 20 00	129	11.48	4.53
6	18 21 35	160	11.48	4.52
7	18 23 13	190	11.47	4.52
8	18 24 46	220	11.47	4.53
9	18 26 16	250	11.46	4.52
10	18 27 44	280	11.46	4.52
11	18 29 12	310	11.46	4.51
12	18 30 42	340	11.46	4.52
13	18 32 11	370	11.45	5.16
14	18 33 40	400	11.45	4.52
15	18 35 08	430	11.44	5.62
16	18 36 30	460	11.44	4.51
17	18 37 53	490	11.44	4.52
18	18 39 17	519	11.43	4.52
19	18 40 44	550	11.43	4.52
20	18 42 10	580	11.43	4.52
21	18 43 34	610	11.42	4.52
22	18 45 01	640	11.42	4.51
23	18 46 22	670	11.42	4.50
24	18 47 40	700	11.41	5.57
25	18 49 01	729	11.41	5.58
26	18 50 20	759	11.41	4.44
27	18 51 41	789	11.41	4.50
28	18 53 02	820	11.41	4.50
29	18 54 20	850	11.40	5.57
30	18 55 37	880	11.40	4.50
31	18 56 51	910	11.40	4.50
32	18 58 11	940	11.40	4.51
33	18 59 29	970	11.40	4.50
34	19 0 46	1000	11.39	4.50
35	0 20 04	349	11.80	4.48

Floc station 17

Frame number	Time hr/min/sec	Depth metres	Computer volts	Flash volts
1	18 7 6	11	11.41	5.54
2	18 8 9	25	11.41	4.48
3	18 9 15	39	11.41	4.48
4	18 10 16	55	11.41	4.47
5	18 11 26	70	11.40	4.49
6	18 12 39	85	11.40	4.48
7	18 13 45	100	11.40	4.47
8	18 14 45	115	11.40	4.47
9	18 15 46	130	11.39	4.47
10	18 16 46	145	11.39	4.46
11	18 17 32	160	11.39	4.45
12	18 18 20	175	11.39	4.47
13	18 19 20	190	11.39	4.44
14	18 20 45	205	11.39	4.47
15	18 22 27	220	11.39	5.53
16	18 23 12	235	11.39	4.47
17	18 23 54	250	11.38	4.46
18	18 24 41	265	11.38	4.46
19	18 25 38	280	11.38	4.46
20	18 26 36	295	11.38	5.53
21	18 27 43	309	11.37	4.45
22	18 28 51	325	11.37	5.84
23	18 30 15	340	11.37	4.46
24	18 31 21	355	11.36	4.47
25	18 32 10	370	11.36	4.45
26	18 32 48	385	11.37	4.45
27	18 33 34	399	11.36	5.54
28	18 34 29	414	11.36	5.52
29	18 35 32	429	11.36	5.53
30	18 36 27	445	11.36	4.46
31	18 37 23	459	11.35	5.52
32	18 38 22	475	11.36	4.46
33	18 39 41	489	11.35	4.46

Floc station 21

Frame number	Time hr/min/sec	Depth metres	Computer volts	Flash volts
1	21 2 36	11	11.37	4.48
2	21 3 15	30	11.36	4.47
3	21 3 54	50	11.37	4.47
4	21 4 48	70	11.36	4.47
5	21 5 59	89	11.35	4.47
6	21 6 57	109	11.35	4.46
7	21 8 3	130	11.34	4.46
8	21 9 14	150	11.34	4.46
9	21 10 23	170	11.33	4.46
10	21 11 39	190	11.33	4.46
11	21 12 57	210	11.33	4.45
12	21 14 18	229	11.33	4.46
13	21 15 38	250	11.32	4.53
14	21 17 0	269	11.31	4.46
15	21 18 25	289	11.31	5.51
16	21 19 54	311	11.30	4.46
17	21 21 19	329	11.30	4.71
18	21 22 44	350	11.30	5.82
19	21 24 12	369	11.29	4.45
20	21 25 41	390	11.29	4.46
21	21 27 9	410	11.29	4.45
22	21 28 34	430	11.28	4.44
23	21 29 59	449	11.28	4.45
24	21 31 34	470	11.27	4.40
25	21 33 6	490	11.27	4.44
26	21 34 32	510	11.27	4.43
27	21 36 1	530	11.27	4.44
28	21 37 34	550	11.25	4.44
29	21 39 12	569	11.26	5.48
30	21 40 46	590	11.25	4.28
31	21 42 11	610	11.24	4.40
32	21 43 33	630	11.24	4.43
33	21 44 55	649	11.25	5.48
34	21 46 24	670	11.24	4.43
35	21 47 50	690	11.24	4.43

Floc station 21

Frame number	Time hr/min/sec	Depth metres	Computer volts	Flash volts
1	21 2 36	11	11.37	4.48
2	21 3 15	30	11.36	4.47
3	21 3 54	50	11.37	4.47
4	21 4 48	70	11.36	4.47
5	21 5 59	89	11.35	4.47
6	21 6 57	109	11.35	4.46
7	21 8 3	130	11.34	4.46
8	21 9 14	150	11.34	4.46
9	21 10 23	170	11.33	4.46
10	21 11 39	190	11.33	4.46
11	21 12 57	210	11.33	4.45
12	21 14 18	229	11.33	4.46
13	21 15 38	250	11.32	4.53
14	21 17 0	269	11.31	4.46
15	21 18 25	289	11.31	5.51
16	21 19 54	311	11.30	4.46
17	21 21 19	329	11.30	4.71
18	21 22 44	350	11.30	5.82
19	21 24 12	369	11.29	4.45
20	21 25 41	390	11.29	4.46
21	21 27 9	410	11.29	4.45
22	21 28 34	430	11.28	4.44
23	21 29 59	449	11.28	4.45
24	21 31 34	470	11.27	4.40
25	21 33 6	490	11.27	4.44
26	21 34 32	510	11.27	4.43
27	21 36 1	530	11.27	4.44
28	21 37 34	550	11.25	4.44
29	21 39 12	569	11.26	5.48
30	21 40 46	590	11.25	4.28
31	21 42 11	610	11.24	4.40
32	21 43 33	630	11.24	4.43
33	21 44 55	649	11.25	5.48
34	21 46 24	670	11.24	4.43
35	21 47 50	690	11.24	4.43

Floc station 26

Frame number	Time hr/min/sec	Depth metres	Computer volts	Flash volts
1	22 54 47	11	11.36	4.43
2	22 55 53	35	11.35	4.43
3	22 57 9	59	11.35	4.46
4	22 58 30	85	11.34	4.51
5	22 59 15	115	11.33	4.43
6	23 1 14	135	11.32	4.42
7	23 2 37	160	11.31	4.41
8	23 4 10	185	11.31	4.41
9	23 5 47	209	11.31	4.42
10	23 7 27	235	11.30	5.49
11	23 9 4	259	11.29	5.46
12	23 10 42	285	11.28	4.40
13	23 11 47	310	11.28	4.40
14	23 12 54	335	11.28	4.40
15	23 14 1	360	11.27	4.40
16	23 15 10	385	11.27	4.40
17	23 16 16	410	11.27	4.40
18	23 17 25	435	11.27	4.40
21	23 20 46	510	11.26	4.40
22	23 21 56	535	11.27	4.40
21	23 20 46	510	11.26	4.40
22	23 21 56	535	11.26	4.38
23	23 23 5	560	11.25	5.30
24	23 24 13	585	11.25	4.38
25	23 25 19	610	11.25	4.39
26	23 26 26	634	11.24	4.38
27	23 27 34	660	11.24	4.38
28	23 28 41	685	11.24	4.37
29	23 29 46	709	11.24	4.38
30	23 30 53	735	11.24	4.38
31	23 32 1	760	11.23	4.37
32	23 33 11	785	11.23	4.38
33	23 34 14	810	11.23	4.37
34	23 35 21	835	11.23	4.37
35	23 36 35	860	11.22	4.37

Floc station 31

Frame number	Time hr/min/sec	Depth metres	Computer volts	Flash volts
1	22 58 57	11	11.32	4.39
2	22 59 46	30	11.32	4.63
3	23 0 36	50	11.31	5.45
4	23 1 27	70	11.30	4.38
5	23 2 16	91	11.29	4.37
6	23 3 00	109	11.29	4.37
7	23 3 45	129	11.29	4.37
8	23 4 32	149	11.29	4.36
9	23 5 19	170	11.28	5.44
10	23 6 0	190	11.27	4.36
11	23 6 45	210	11.27	4.35
12	23 7 30	229	11.27	4.36
13	23 8 14	250	11.26	4.25
14	23 8 54	270	11.26	4.35
15	23 9 39	290	11.26	5.42
16	23 10 28	310	11.26	5.43
17	23 11 09	330	11.25	5.43
18	23 11 50	350	11.25	4.34
21	23 13 44	410	11.25	4.23
22	23 14 23	430	11.25	4.34
21	23 13 44	410	11.25	4.23
22	23 14 23	430	11.24	4.35
23	23 15 02	450	11.24	4.42
24	23 15 42	470	11.24	4.34
25	23 16 19	490	11.23	4.34
26	23 16 57	510	11.23	5.42
27	23 17 38	529	11.23	5.42
28	23 18 20	550	11.23	4.36
29	23 18 59	570	11.23	5.41
30	23 19 40	590	11.23	4.20
31	23 20 24	610	11.22	5.41
32	23 21 06	630	11.22	5.41
33	23 21 44	650	11.22	4.33

Floc station 36

Frame number	Time hr/min/sec	Depth metres	Computer volts	Flash volts
1	20 51 12	11	11.18	4.35
2	20 52 28	25	11.17	4.34
3	20 53 18	40	11.17	4.33
4	20 53 57	55	11.16	4.33
5	20 54 32	70	11.16	5.40
6	20 55 04	85	11.15	5.39
7	20 55 37	100	11.15	4.31
8	20 56 11	115	11.15	4.31
9	20 56 46	130	11.15	4.31
10	20 57 20	145	11.15	4.47
11	20 57 53	160	11.14	4.31
12	20 58 25	174	11.14	4.30
13	20 58 57	189	11.14	4.30
14	20 59 34	205	11.14	5.39
15	21 0 12	220	11.13	4.30
16	21 0 52	235	11.13	5.39
17	21 1 33	250	11.13	4.30
18	21 2 7	264	11.13	4.30
19	21 2 38	280	11.13	4.29
20	21 3 10	295	11.12	4.29
21	21 3 45	309	11.12	4.29
22	21 4 20	325	11.12	5.52
23	21 4 52	340	11.12	4.29
24	21 5 22	355	11.12	4.28
25	21 5 52	370	11.11	4.30
26	21 6 21	385	11.11	4.28
27	21 7 21	400	11.11	4.29
28	21 7 53	415	11.11	4.28
29	21 8 23	430	11.11	4.28
30	23 19 40	590	11.23	4.20

Floc station 41

Frame number	Time hr/min/sec	Depth metres	Computer volts	Flash volts
1	18 17 17	11	11.25	5.34
2	18 18 30	29	11.24	4.26
3	18 19 46	50	11.24	4.26
4	18 20 59	70	11.23	4.25
5	18 22 1	90	11.22	4.24
6	18 23 2	109	11.21	4.26
7	18 24 5	130	11.20	4.24
8	18 25 0	150	11.21	4.24
9	18 25 51	170	11.19	5.57
10	18 26 38	190	11.19	5.59
11	18 27 19	210	11.19	4.22
12	18 28 7	230	11.19	4.23
13	18 28 52	249	11.18	4.22
14	18 29 34	270	11.18	4.22
15	18 30 18	290	11.18	4.18
16	18 31 2	310	11.17	4.21
17	18 31 49	330	11.18	4.21
18	18 32 33	350	11.17	4.21
19	18 33 15	370	11.17	4.20
20	18 33 57	390	11.16	5.32
21	18 34 42	410	11.17	4.20
22	18 35 19	430	11.16	4.21
23	18 35 57	450	11.16	4.20
24	18 36 33	470	11.16	4.21
25	18 37 15	490	11.16	4.20
26	18 38 00	510	11.15	4.20
27	18 38 42	530	11.16	4.19
28	18 39 26	550	11.15	4.19
29	18 40 14	569	11.15	4.20

Current Meter Deployment 1154

Day 251 Sept. 8, 1993 **Deployment:**

Checked current meters for cycling every five minutes

#3392 started at 0823hrs reading 0030

#7137 started at 0838hrs reading 0026

#7124 started at 0843hrs reading 0030

- Checked cycling until 0918 and placed them in pressure containers. Completed mooring log book.
- Deployment was according to the figure of mooring 1154.
- Conditions during deployment: calm seas, low visibility with fog, lots of icebergs, bergy bits, grease and pans.
- Deployment at: Day 251 1558 68 01.82N 31 46.56W water depth 594m.

Retrieval:

- Hudson steamed to deployment site, current meter buoys were sighted 1.5nm (estimated by Captain) from the deployment position.
- Conditions during retrieval were: calm seas, sunny and clear, with 6-7 tenths ice coverage
- Mooring array 1154 was retrieved at 1632 hrs on Sept. 14, 1993 at 68 02.54N 31 49.14W.
- Water depth (noted at the floc/camera station 30m away) 597m.
- The fairey float, viny packages and glass bub packages were floating adjacent to a dirty bergy bit. The stainless wire caught in several instances around the berg. After freeing the wire from the berg, the remaining mooring was heavily tangled but brought on deck by careful manipulation of HUDSON's deck crew.
- Current meters #7137 and #7124 were recovered 3392 was lost.
- Damage included severed clamp and cotter pin for current meter 3392, one glass bub had sustained damage to the hardware in between the two hardhats.
- Current meter #7137 was reading 11150 at 1836 hrs
- Current meter #7124 was reading 11142 at 1836 hrs
- The meters and the thermistor were turned off at this time and packed away

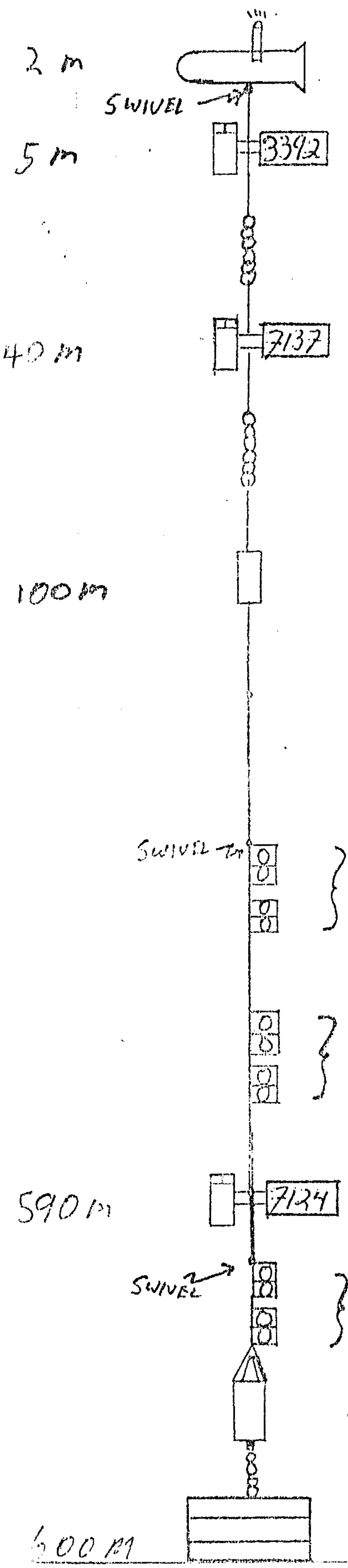
Sediment trap deployment #1155

- Deployment of sediment trap 1155 as shown in figure 1 occurred Sept. 9 at 1745 hrs.
- Position was 68 08.95N 31 53.74W
- Conditions at the time of deployment were foggy and lots of bergs, bergy bits, pans, etc.
- At the time of deployment each "A" trap had 5L of seawater mixed with concentrated NaCl an HgCl poured in before final deployment.

Recovery - Sept. 14, 1993, HUDSON returned to recover the sediment trap.

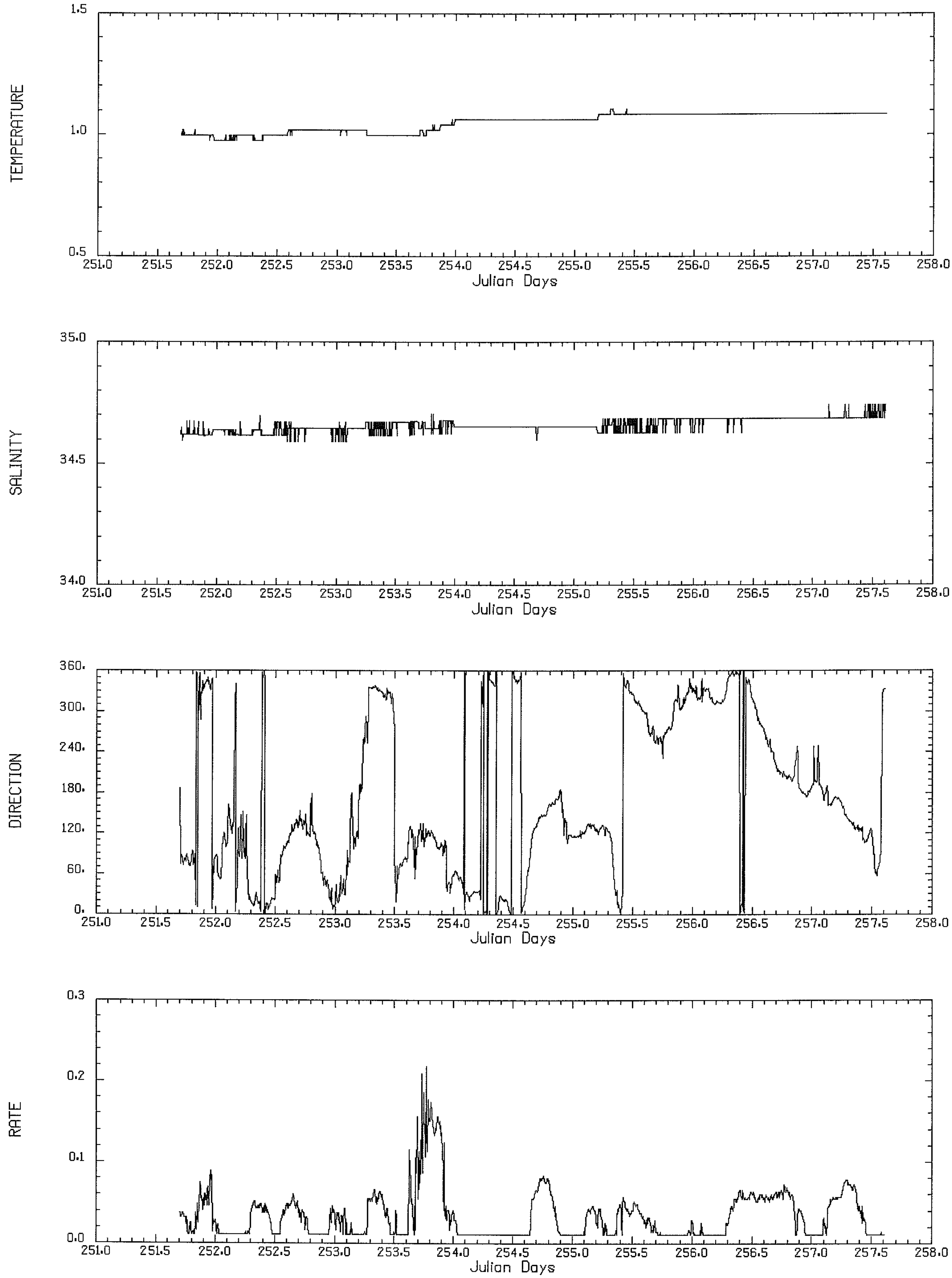
- A large iceberg was sitting over the position the bridge estimated the deployment site was.
- No recovery was possible at that time

MOORING # 1154 SYVITSKI EASTERN GREENLAND SEPT 1993

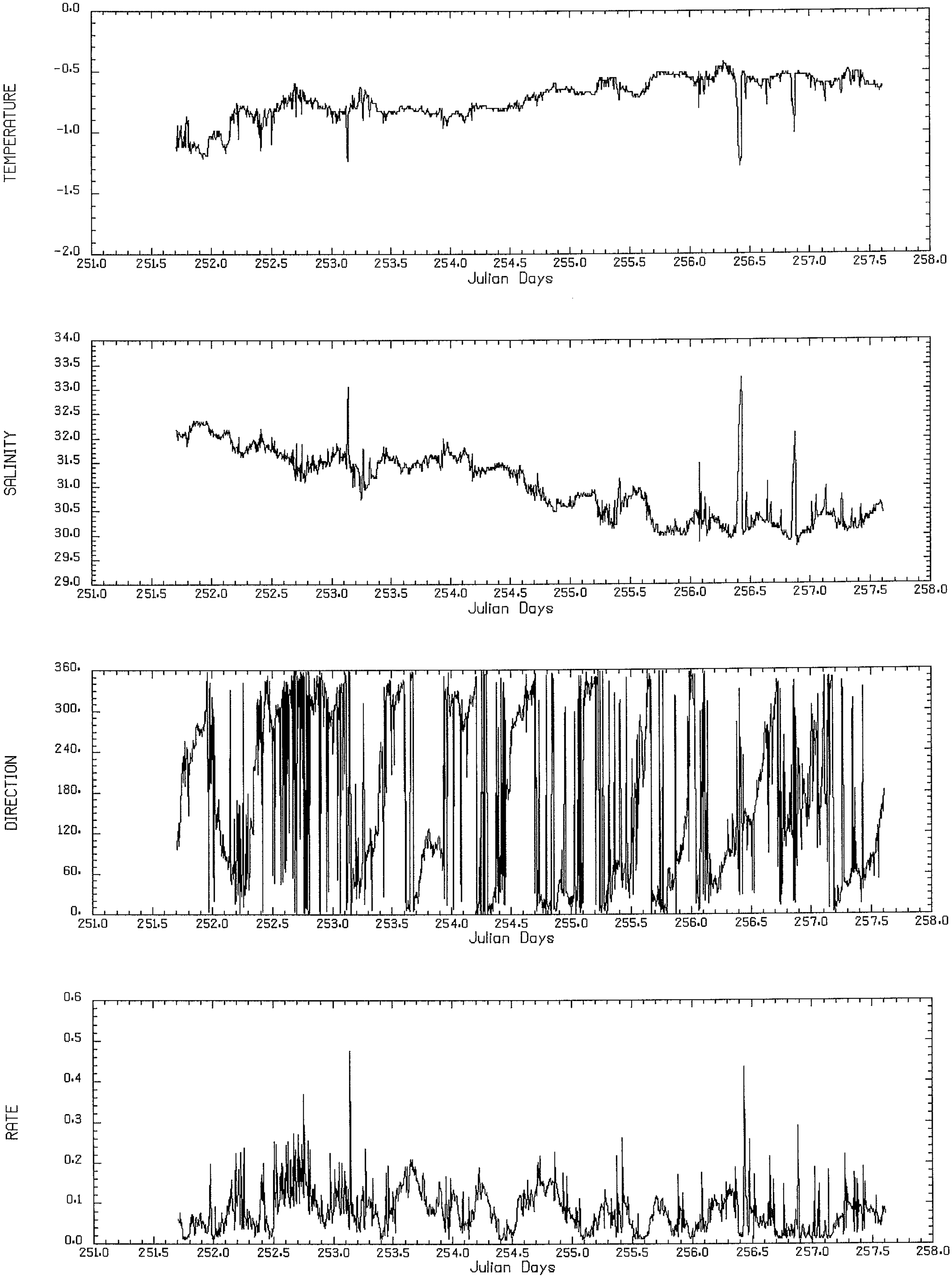


SUBSURFACE LIGHT
FAIREY FLOAT
2 m 3/16" STAINLESS STEEL WIRE
AANDERAA CURRENT METER
15 m 3/16" STAINLESS STEEL WIRE
2 VINY PACKAGES
16 m 3/16" STAINLESS STEEL WIRE
AANDERAA CURRENT METER
22 m 3/16" STAINLESS STEEL WIRE
2 VINY PACKAGES
24 m 3/16" STAINLESS STEEL WIRE
AANDERAA THERMISTOR CHAIN
102 m BLACK JACKETED WIRE WITH TEMP. CHAIN ATTACHED
184 m 3/16" STAINLESS STEEL WIRE
2 GLASS BUB PACKAGES
98 m 3/16" STAINLESS STEEL WIRE
2 GLASS BUB PACKAGES
100 m 3/16" STAINLESS STEEL WIRE
AANDERAA CURRENT METER
6 m 3/16" STAINLESS STEEL WIRE
2 GLASS BUB PACKAGES
ACOUSTIC RELEASE
1/2 m 5/8" GALVANIZED CHAIN
3-WHEEL ANCHOR

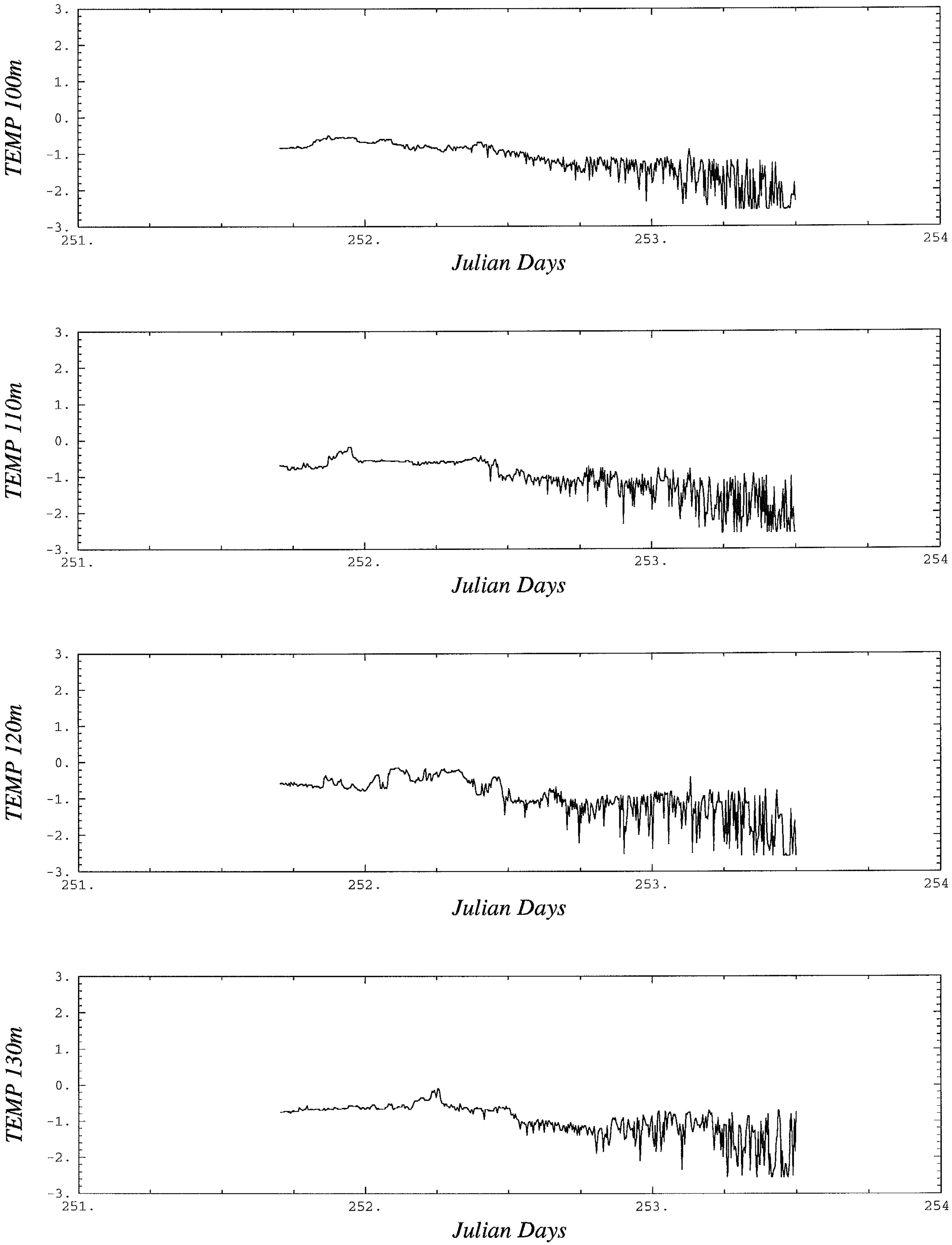
DENMARK STRAIT 93030 CM7124



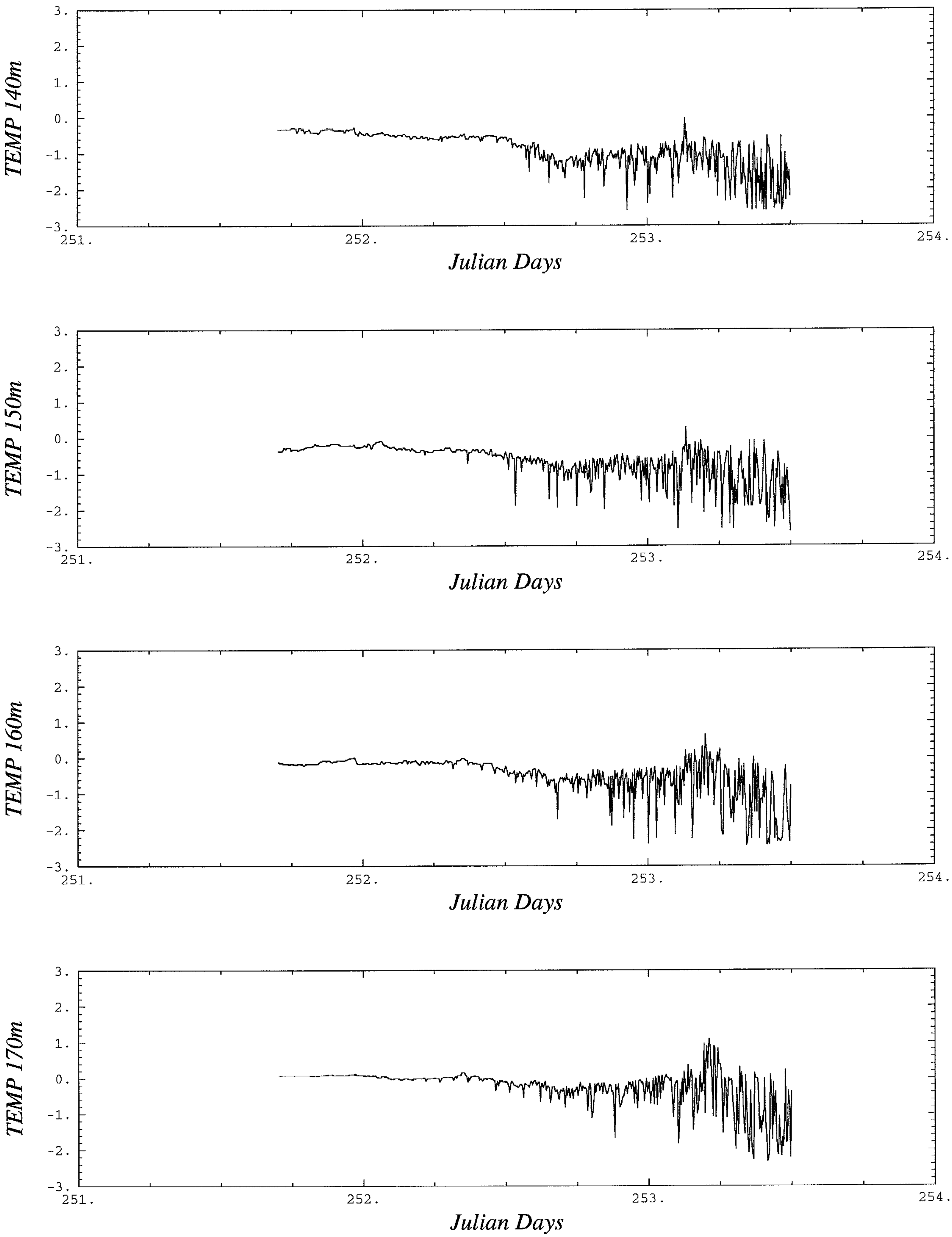
DENMARK STRAIT 93030 CM7137



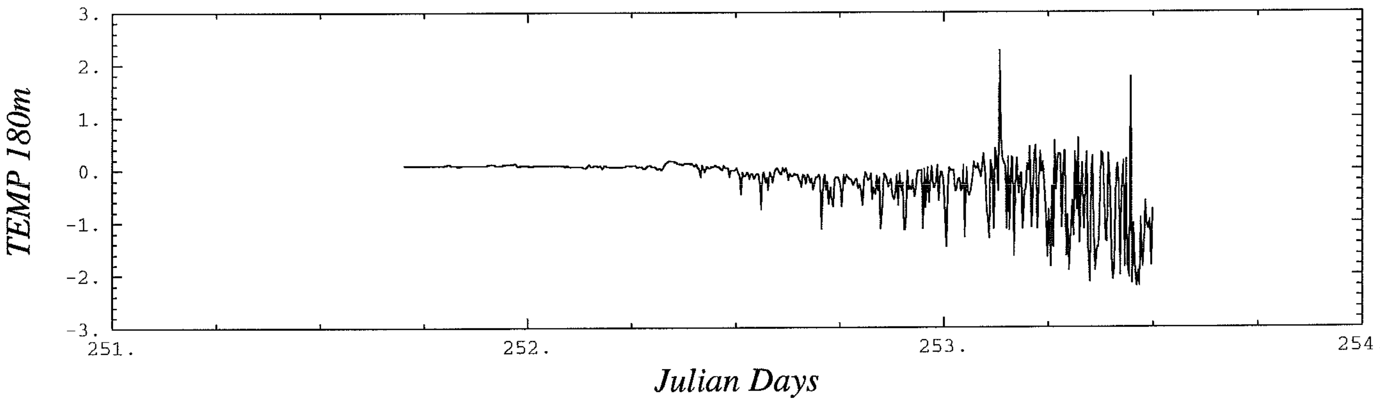
Denmark Strait 93030 tc414

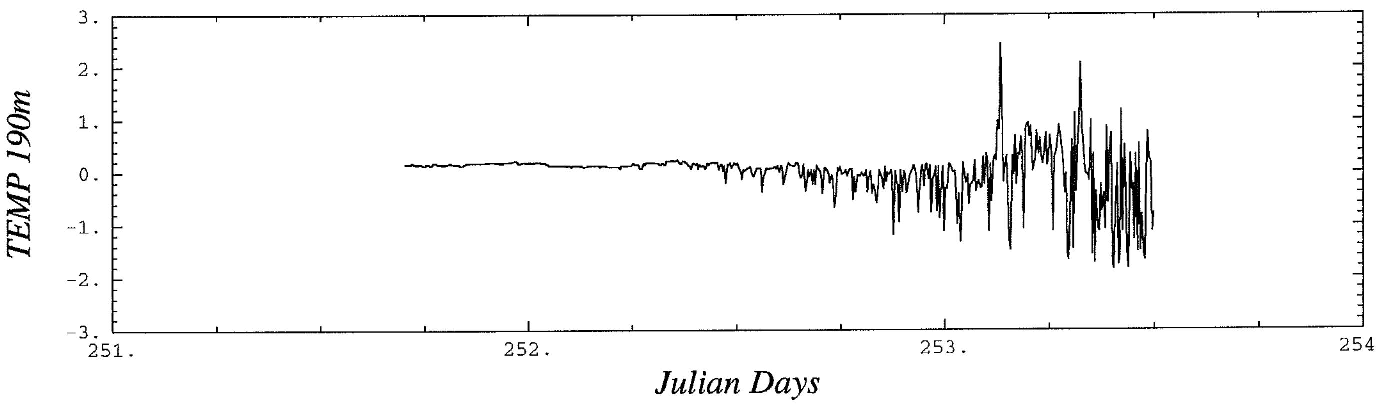


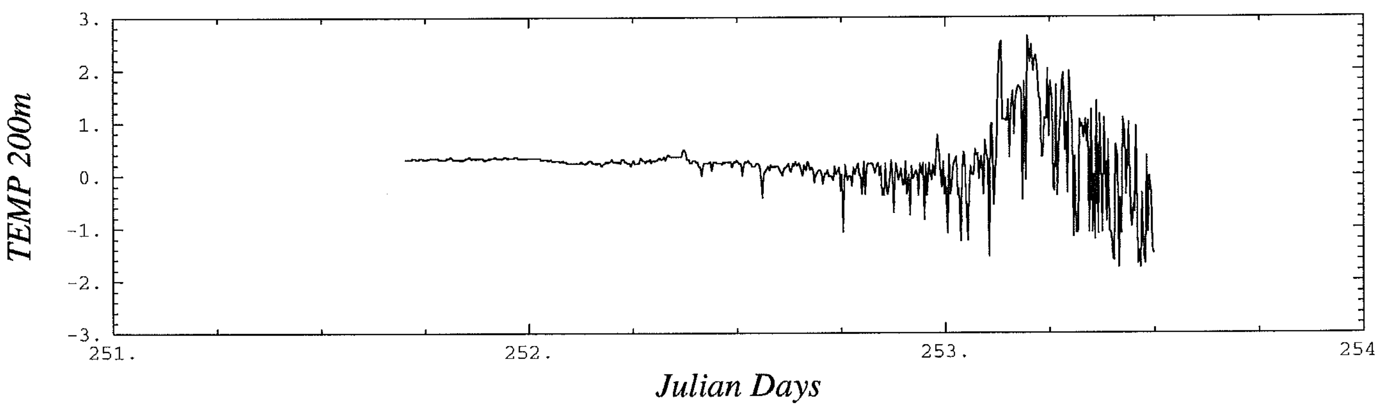
Denmark Strait 93030 tc414



Denmark Strait 93030 tc414







Navigation

Dave Heffler

AGCNav version 2.32 was used on the bridge, GP lab and Drawing office. One crash was caused by a newly discovered bug. If the waypoint created by hitting the F key (a fix) is not edited (as it usually is to rename it) and is used to create a survey line, the line will be corrupt and attempting to select it active will crash the computer. This can be circumvented by entering the waypoint editor on the fix, even if no changes are made.

AGCNav version 2.34 operated in the fwd lab with no problems (it still has the "fix" bug).

A suggested improvement

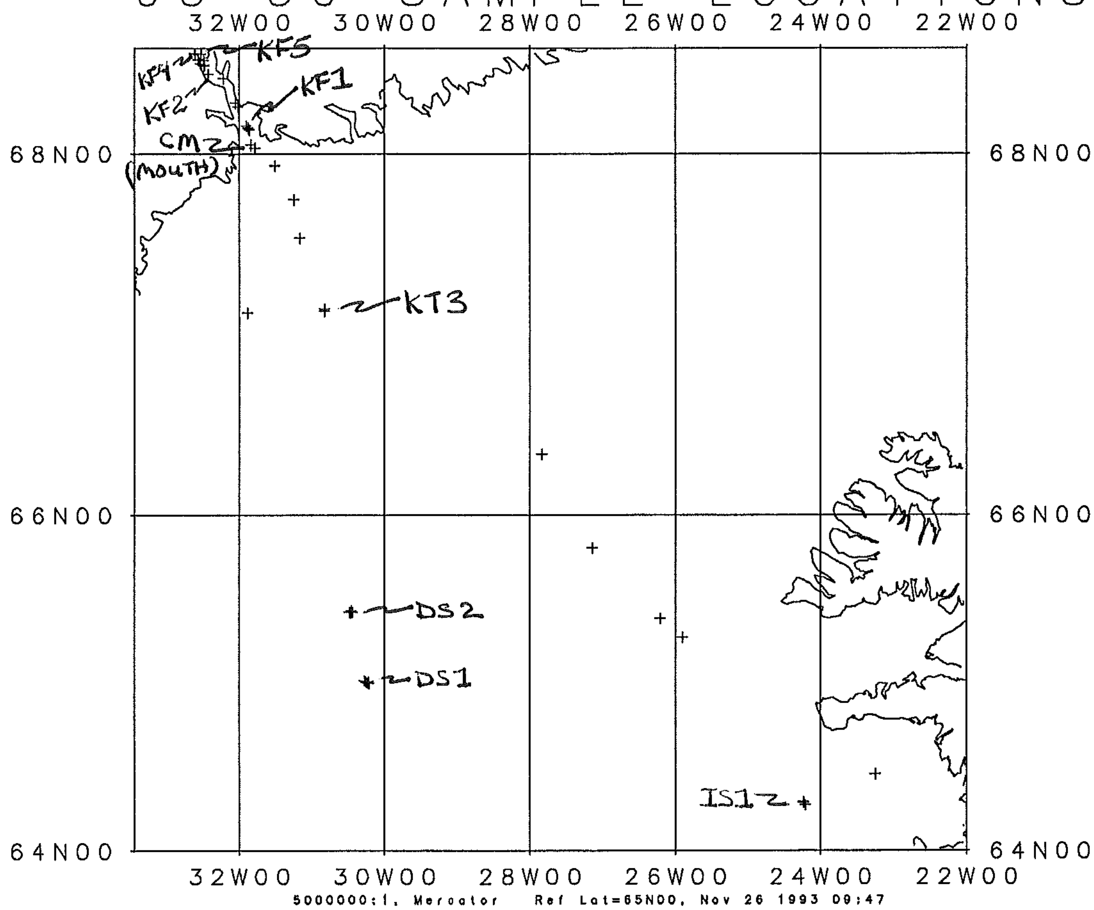
The logged data files should be closed at midnight and a new file using the AGC standard file name HUDNdddA.93A should be opened. If this standard is followed, the Time waypoint feature could be made to work over several day's track. Currently it will give an erroneous position if the current data file is older than one day.

It is a major inconvenience that the waypoint data base defined on the bridge is not available to AGCNav running at other sites on the ship. We had hopped that implementation of a LAN on the ethernet wiring would offer a solution. However, I now feel that such networks are too complicated to be reliable at sea with limited technical assistance. I have devised a method to distribute waypoint information from one master unit (the bridge) to all of the other units on the ship. This will require modest program changes and no additional wiring. It will ensure that all slave sites will operate with only one serial port. It will also facilitate logging waypoint data in the navigation log file. I will pursue this after the cruise.

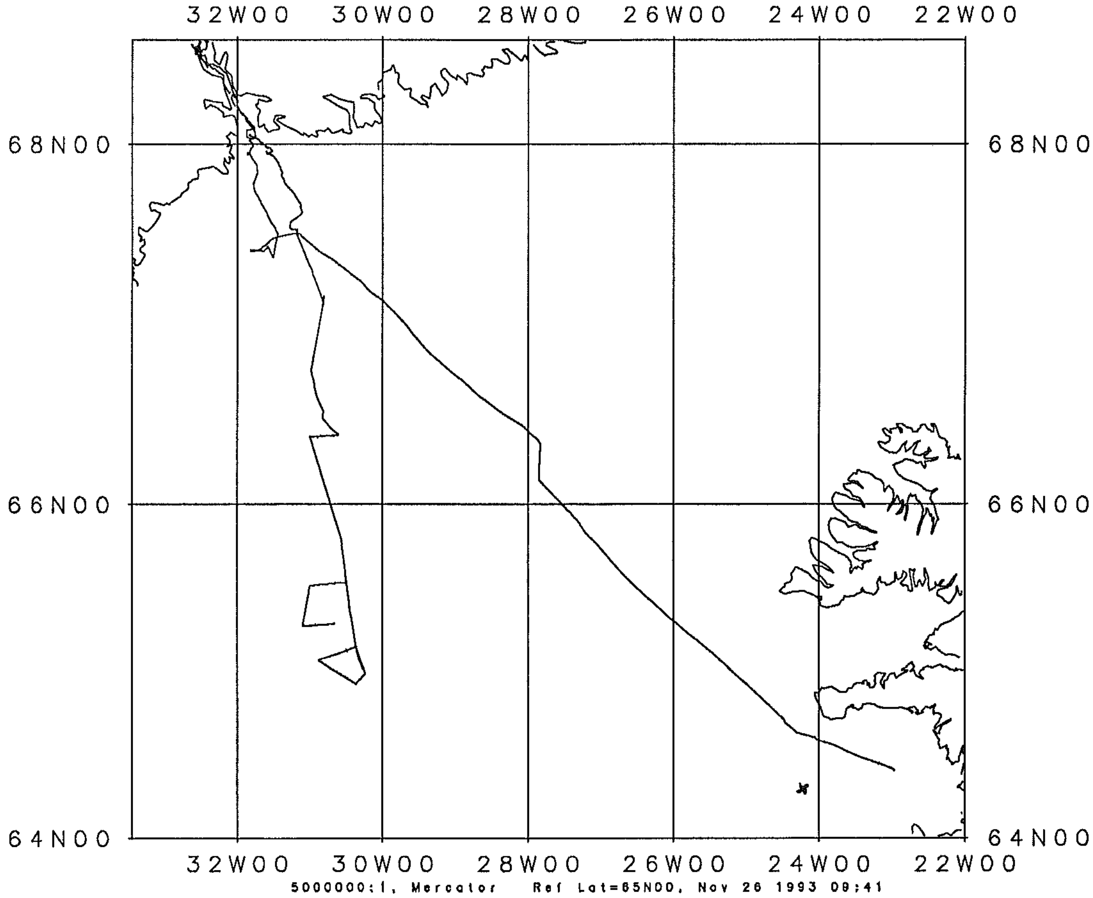
There was some confusion during the recovery of the current meter mooring. This was caused by revisiting the site planned for the mooring, not the site where the mooring was actually deployed. All personnel using AGCNav should become accustomed to using the F key to define a waypoint where things actually happen. Also, since position is now being logged continuously, it is most important to note the time things happen, the location can be ascertained later.

The large time display on AGCNav seems to have supplanted the need for a ship's master clock display. This time may be late by several seconds if the GPS receiver is not programmed to send data every second. This time is not suitable for activities that require synchronization to better than one second.

93-30 SAMPLE LOCATIONS



93-30 TOTAL TRACKS



AGC Seismic Operations:

Borden Chapman and Kevin Wagner

During Hudson 93-030 AGC/PSS supplied the equipment necessary to collect seismic reflection profiles. The main acoustic components of this system included a four stage model W-2 electric Price compressor, a Pacer VF 200 motor speed controller, a rotation of two Haliburton Geophysical sleeve guns, one with a 40 cubic inch chamber, and the other with a 10 cubic inch chamber and various recording electronic systems. The compressor delivered 1900 PSI of compressed air to the sleeve gun which was fired at a three second repetition rate.

The sleeve gun signal was received on a 25' foot section of the starboard SE eel array. This signal was sent to a differential eel amplifier, and from there was split into two analogue signals. The first signal was sent to channel one of the AGC time varying gain unit, (TVG), then on to a Krohn-Hite model 3323 band pass filter, with the band pass set for 80-1200 Hz. The signal was then displayed on a Raytheon LSR1811 graphic recorder operating in the start/ stop mode. The delayed trigger output from this LSR supplied the trigger for the other graphic recorder and both TVG channels . The delay was used for water column removal.

The second eel signal was fed into channel two of the AGC time varying gain unit (TVG) and passed through a second Krohn-Hite model 3323 filter with band pass set for 150-1500 Hz. The filtered seismic signal was displayed on a Raytheon LSR1811 graphic recorder.

Both graphic recorders were set for a 1 sec sweep rate.

SHIPCLOCK provided the master shot pulse and timing control for the sleeve gun firing. It also supplied, at a five minute rate, trigger pulses used to initiate record annotation from the TSS record annotator. The annotator 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. A total of 35- three hour tapes were recorded for a total of 105 hours (approx) of seismic data collected. Channel one and three (both DR format) of the XR5000 were recorded with the raw SE eel signal from the Eel amplifier, and channel two (FM format) of the XR5000 was used to record the master trigger from the SHIPCLOCK.

Bathometry was recorded during the survey using a EPC 4100 recorder set at a 0.5 second sweep to trigger the ORE model 140, 3.5 kHz hull mounted transducer system. It should be noted that fire rate, and delay times were changed to accommodate the changing ocean depth.

The seismic survey could be considered a success, for good quality data was obtained without any loss of survey time due to equipment failure. During the last transit across the Denmark Strait ship speed was kept at 6.5 to 7.5 knots. Data quality diminished somewhat due to increased towing speed. The increased drag on both the sleeve gun and the hydrophone array tended to float each to the surface causing noise on the hydrophone and reducing the amount of energy transferred through the water column by the sleeve gun.

A list of consumables used in Hudson 93-030 include:
3 rolls of EPC paper (electro write)
4 rolls of EPC thermal film paper
5 EPC stylus
2 rolls of LSR paper
4 LSR stylus
40 VHS cassettes
1 rolls of bulldog tape
1 assortment of electronics components went to repair the SPA-2 IKB Technologies Signal Processor
1 gallon varsol (SE eel repair)
3 rolls electrical tape (for Huntec repair)

Repairs required/ undertaken on the cruise were:

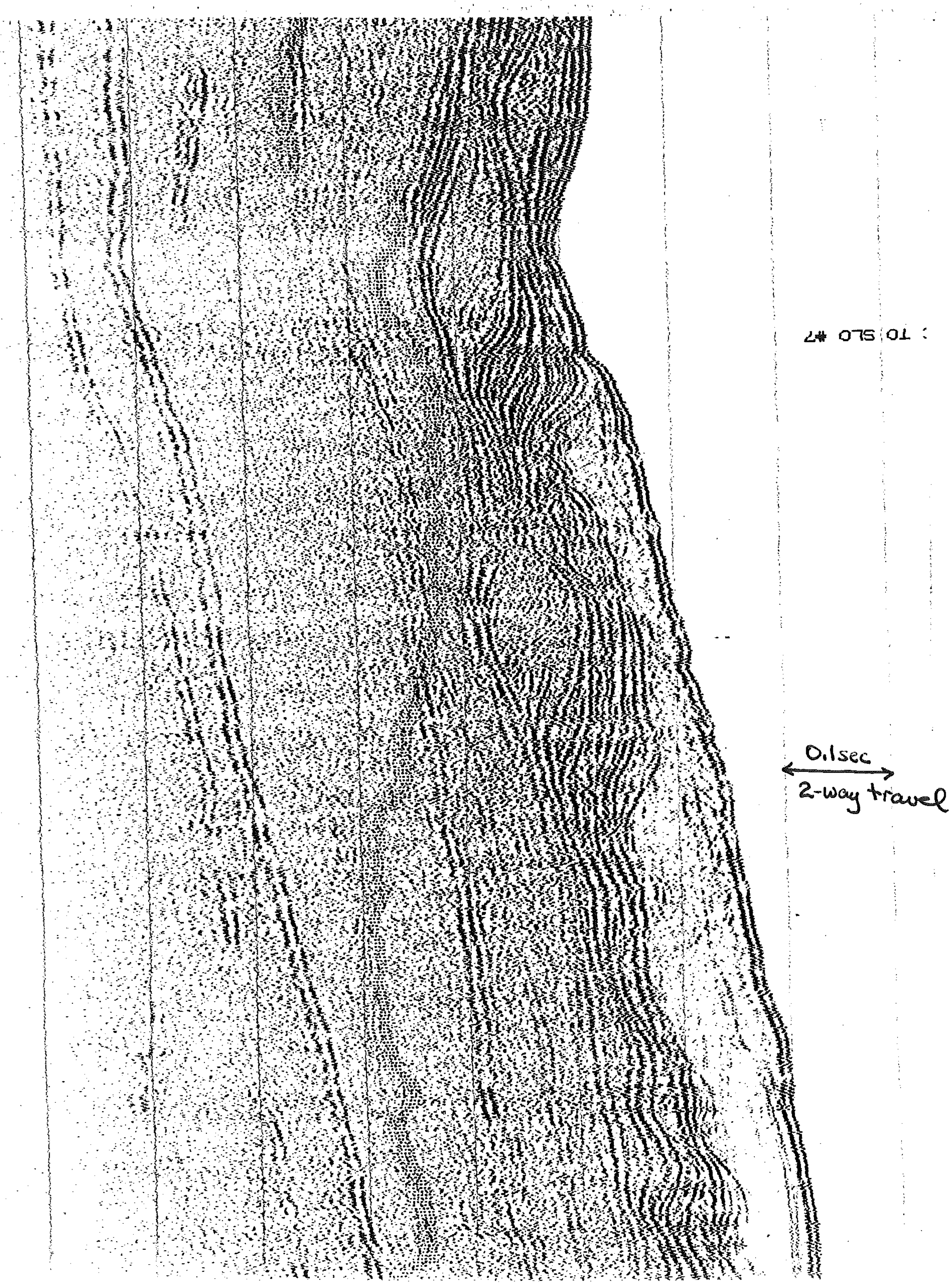
1) SE Eel repair; both the port and starboard arrays need factory service in the future.

2) Metrox Block; sensor problems are recurrent, and should be completed before the next field program.

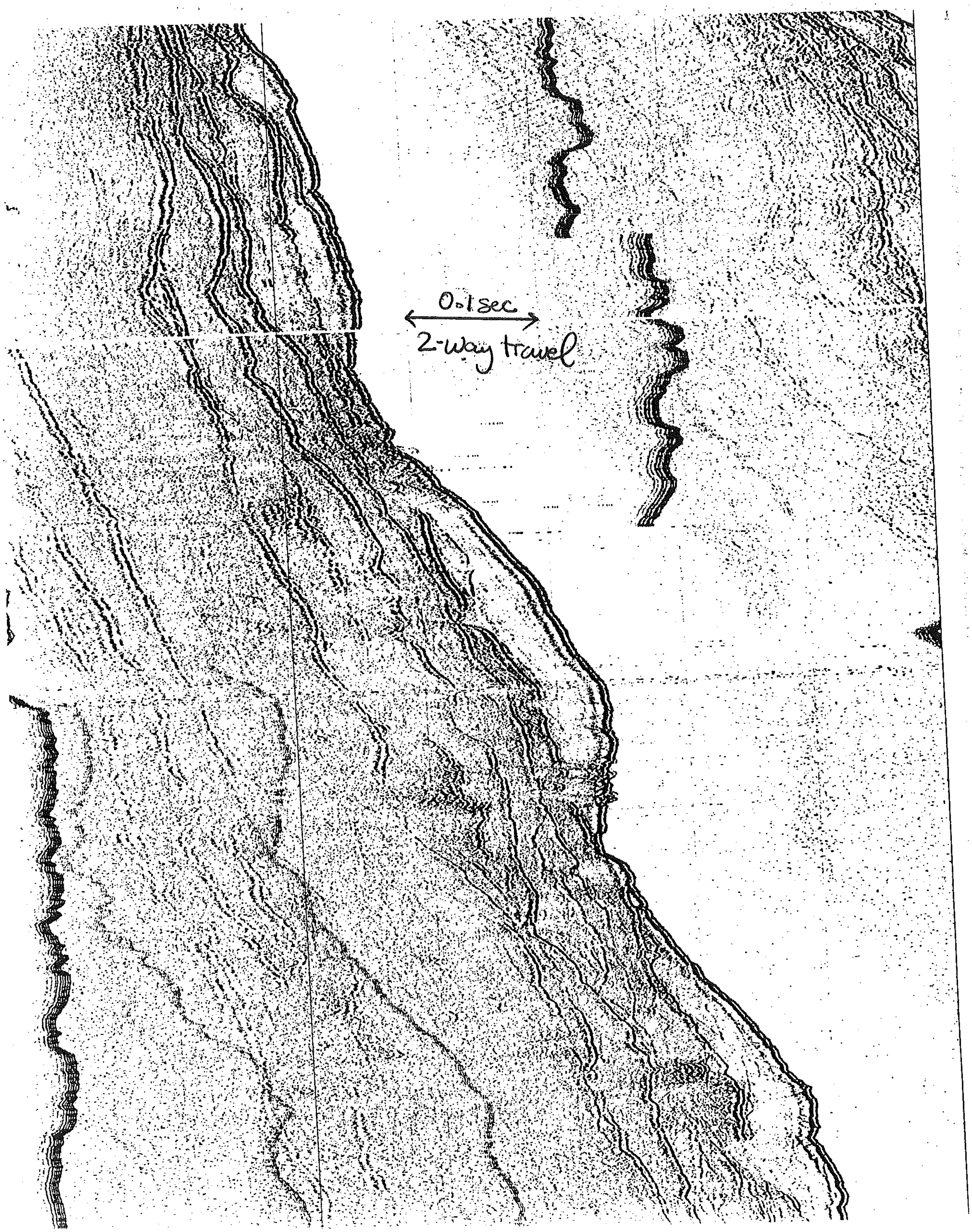
3) TEAC XR5000 tape recorder problems still persist. Complete shut down of recorder happened several times, with partial loss of pre-programmed memory.

4) SE-880 digital logging system; intermittent loss of display monitor sync from video card of the SE-880. Monitor and card should be replaced. Channel '0' will not log.

2 pages of examples



Demark Strait - KANG Slope in 2 km of water
Sleeve Gun $10^{\prime\prime 3}$ seismic record
Glacigenic debris flow sediments overlying
turbidite-contourite sediments



Kangerdlugssuaq Slope in 1.5 km of Water
Showing amalgamated glacigenic debris
flows. Sleeve Gun seismic record

SIDE SCAN SONAR SYSTEMS:

W.A. Boyce

HU93-30 Cruise contained three Side Scan Sonar Systems:

1) the BIO Side Scan with two towfish and Klein 521 recorder;

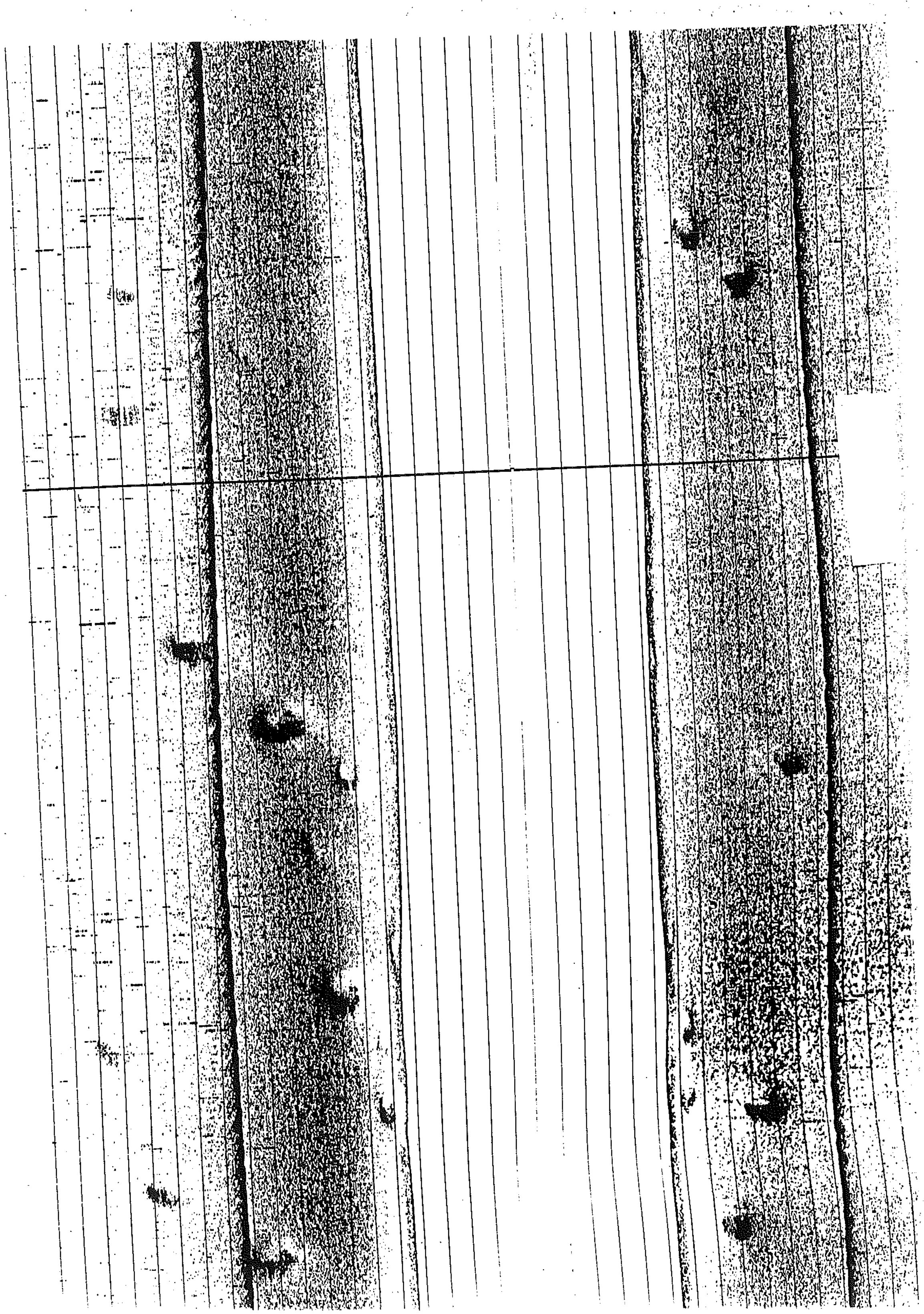
2) the Klein 595 System with dual 100/500 Khz towfish

3) the Klein 421T System with long range "toneburst" 100Khz towfish and two Kevlar hand towcables (80 & 160 m.).

The Hudson deck contained one only towing winch with 750 meters of new four channel towcable, shared between the BIO SS towfish and Klein 595 SS towfish. The Klein 421T was intended for the launch "Merganser" but due to space requirements for the "Phantom S" ROV. Systems, the Klein 595 was set up instead as it takes less bench space and can more easily be removed, making room for the "C-MAX 800" ROV. Side Scanning System. The Launch systems including the SEISTECH profiler were all tested with good results and no interference...however no real launch surveying was accomplished.

The BIOSS System was tested and modified for hardcopy outputing to either the EPC 9800 two channel recorder or the Klein 595 Recorder set up on "tape monitor" mode so thermal paper imaging could be accomplished instead of the Klein 521"Wet"paper hardcopy recording. However the BIOSS Towfish was not deployed this cruise.

The Klein 595 dual 100/500 Khz towfish with K-Wing II depressor was deployed on the edge of the Greenland Shelf area to search for iceberg furrows. The towfish was towed at 2.5 to 2.8 Knots to a depth of 250 meters with all the 750 meters of towcable put out. On a 300 meter range and altitudes of 30 to 90 meters, no "classic" iceberg furrow features were seen for the short time it was deployed..however data quality was good. This was the only Side Scan deployment this cruise.



Klein 595 side scan sonar image of pockmarks on the Icelandic Shelf swath is 750m.

DIGITAL SEISMICS:

R.C. Courtney

(I) Introduction :

This section covers the operation of digital seismic collection and processing during the CSS Hudson cruise HU9330. Seismic data were digitized on the Geoacoustics SE880 and they were processed and replotted via an HP9000/720 UNIX workstation using software developed by the Digital Initiative Project members of AGC. This report will detail the various aspects of this activity ranging from data recording, to the set up of data processing facilities, the reprocessing of data, and to digitization of data from analog tape.

(II) Digitization of seismic data in real time

Two types of seismic data were recorded real time on the SE880 during the cruise: 10 cu. in. sleeve gun data and Huntec DTS data. Typically, the fire rate of the sleeve gun was 3 sec/shot with record lengths of about 1 sec and delays ranging from 0.3 to 1.5 sec depending of the water depth. These data were prefiltered on an analog KrohnHite with a pass band between 100 and 1500 hz. The sample rate on the SE880 was set to 200 usec (corresponding to 5000 hz, roughly three times the value of the upper limit of the pass band). A 1 to 2 sec window (between 5000 and 10000 samples per shot trigger) was digitized for one channel. The data acquisition rate was ~25 Mbytes/channel/hr, yielding 80 potential hours of recording time for a single channel system on each Exabyte digital tape. In practice however, the tape were changed daily to reduce the chance of overwriting previous files.

The Huntec DTS was fired at variable intervals as the water depth changed, mainly however at 0.5 and 0.75 sec periods. The Huntec external channel was subjected to a 1000-6000 kHz band pass filter in the Huntec processing module; the internal hydrophone signal was passed through a Kronhite with a 1-6 khz pass band. These data were digitized at 50 usec (20 Khz) with a data window of 400-500 msec (between 8000 and 10000 samples per trigger). At a 0.5 sec firing rate the data acquisition rate was ~288 Mbytes/hr, yielding a 7 hr duration of an Exabyte tape for two channels or 14 hr for a single channel.

With the Huntec system in "deep" water, multiple shots were in the water column and seabed arrivals could be offset from their true transit time by a multiple of the shot rate time. A TVG spreading loss correction is applied to DTS data, referenced to the shot instant, resetting on each shot. The Huntec operator adjusted the delay on his graphic recorder to search for the multiple that fell within the "appropriate" part of the TVG ramp. For example, if the water depth was 1200 msec and the firing rate was 500 msec, then three shots returning from the seabed arrived at 200, 700, and 1200 msec. The operator usually used a delay of ~100 msec to focus on the first arrival. As the water depth changes, so might the delay. If the water depth changed to 900 msec, then seabed arrivals came in at 900 and 400 msec, with higher amplitudes in the latter part of the TVG ramp. This effect caused significant difficulties for data processing. Firstly, the seabed was often not properly time-referenced, as it was displaced in time by a multiple of the shot period. Secondly, the recovery of true, or relative, amplitudes was difficult as the time of arrival of the seabed return did not fall predictably in the TVG ramp. It is imperative that the Huntec operator should note both changes in delay on the graphic recorder in his log as well as changes in the shot rate. He should also ensure that the delays used on the graphic recorder are applied to the SE800 as well. Software to correct for shot multiplicity should be added to the suite of digital processing tools.

The watchkeepers had not been adequately trained in in the setup and operation of the digital loggers.They need to know what sampling rates are needed for a given seismic system and how to set appropriate input signal levels. Some data tapes will have to be redigitized from analog tapes, as some recorded during the cruise were not properly done.

A four channel, signal preconditioning box should be constructed in order to treat the signals before digitizing so as to optimize signal to noise ratios. Each channel should have a separate control for signal gain ranging from -30 to + 30db. Each channel should have the option of separately applying a spreading loss TVG (simply signal x time in sec) to the incoming signal triggered by the shot key pulse.

(III) Digitization of seismic data from analog tapes

Only one SE880 was available for the cruise, and either the sleeve gun or the Huntec signals was digitized. Huntec data was routinely digitized, except on days 249 and 248 when the sleeve gun signal was digitally recorded. Sleeve gun data from days 247,248, and 251 was digitized from analog tape by the SE880. Since the sleeve gun produces moderately low frequencies (< 1500 hz), it was possible to replay the seismic data from tape at 4 and 8 times real time. A typical TEAC analog source tape contains up to 3 hr of data, so the time to digitized each tape ranged from 22.5 to 45 min depending on the replay speed.

As was the case for the recording of data directly from the streamer in real time, antialiasing filters were applied to the taped input. A typical sleeve gun pass band from 75 to 1500 hz scales to 300 to 6000 hz at 4x speed, and 600 to 12000 hz at 8x speed. The sample rate on replay was set to 50 usec (20 khz) for the 4x speed and 25 usec (40 khz) for the 8x mode. It was found that for some sections of analog tape, the slower replay speed was more reliable as the faster speed replay tended to produce more misaligned triggers.

Huntec data cannot be practically redigitized at higher speeds and more care has to be taken to ensure that the problems associated with multiple shots in the water column are accommodated. If a choice has to be made on ship whether to choose to digitize in real time Huntec data or air/sleeve gun data, it is more sensible to leave the air gun data for later digitization from analog tape.

(IV) Data processing setup

An HP9000/720 workstation was shipped from Halifax in July 1993 to load the Hudson in St. John's. The workstation was equipped with 64 Mbytes RAM, one 300 Mbyte internal disk and two 1.3 Gbyte external disks. An Exabyte tape drive and an Alden recorder were included along with appropriate cabling.

Before departure from Reykjavik , the workstation components were assembled and, on initial power up, the system failed with a boot disk error. It was found that the cumulative length of the SCSI cables connecting the external devices was too long. Fortunately, a shorter, backup SCSI cable had been brought and it solved the problem.

The IP number of the workstation was changed to 142.2.1.5 so that it could interconnect with other computers on Hudson TCP/IP network. Local gateways and routers are not locally supported so the old AGC network number (142.2.34.5) address could not be used. A suite of updated Digital Initiative seismic and sidescan processing software was downloaded from tape on /dsk1 and soft linked to the appropriate positions on the root disk. The ALDEN pgm printer driver code found on the distribution tape was old and had to be modified to run on this workstation. Other small fixes were applied to the DI software to resolve a few bugs; but generally the software was usable.

(V) Data processing software

The DI release of software should provide a complete suite of tools for the on-ship processing of digital seismic and sidescan data. However, the treatment of data on this cruise required some procedures not included in the release. Some programs were developed during the cruise to satisfy these requirements. The following list details the names and usage of these procedures :

etoa :

Converts GPS NMEA "E" files to a formatted time-lat-long position file ("A" file format).

Usage : etoa FILENAME.93E

Notes : Converted from a PC based version written by E. Coldwell to UNIX.

closest:

Reads an "A" formatted file, queries the console for a fix and returns the position in the "A" file closest to the input position.

Usage : closest FILENAME.93A

(prompted for user input)

Notes : Used to find core location on seismic site survey lines.

segyheader:

Reads a SEG_Y formatted digital seismic file and produces a list of the digitization rate, shot delay, digitization window, mean trace energy, shot day, hour, minute and second as a function of the shot number. List is stored in a file called "info.dat".

Usage : segyheader <segyfilename>

Notes : Used to check contents of digital files downloaded from tape.

segyinfo:

Reads all SEGY files with the extension ".dec" in the current working directory and produces a list of the start and stop times for each of these files. The output list is stored in a file called "DEC.LOG" in the current directory.

Usage : segyinfo

fixtimes:

Used to correct seismic data files that were made by digitizing analog data from tape. The routine applies appropriate speed corrections to the sample delay and sample rate. It also changes the day, hour, minute and second fields in the SEGY header to reflect the times of the seismic survey.

Usage : fixtimes input_file output_file
(user is prompted for speedup factor, nominal shot repeat rate during the survey and the start day, time, hour, minute and second of the survey).

combinesegy:

Combines multiple segy files together into one large file suitable for plotting.

Usage: combinesegy output_file input1 input2 ..... inputn

Notes: Often when digitizing data from analog tape, a new file is created for each tape. A survey line often spans more than one analog tape. For plotting it is best to have a single file for the entire survey line.

plt2pnm :

Converts and scales an versatec plot file from "diseismic" into a bitmap or gray scale file suitable for printing on the alden recorder.

Usage : plt2pnm versatec_file_name <scale>

Notes : The scale parameter is optional. If it is set to less than 1.0, then the output file will be a gray scale image with the file name versatec_file_name.pgm, otherwise the output file is a bitmap image with the name versatec_file_name.pbm. A scale equal to 0.47 will allow a full wodth veratec plot file to be printed on a single width of the Alden recorder.

(VI) Processed Seismic Sections

The DI software program "diseismic" was used to produce section plots of the seismic sleeve gun data from day 247 to day 251. A section plot was produced for each survey period from directly recorded data when available and post-real time digitized data. Each seismic section was printed on the Alden continuous gray scale recorder with a trace density of 425 shots per inch (roughly 20 min of survey line or 3 km per inch). On all section plots, time lines are repeated every 100 msec. No filtering or deconvolution of the data was performed other than an automatic gain control to boost signal amplitude where the signal is low. Navigation plots were made for each section using the X-Y UNIX plotting program "xmgr" using navigation data derived from AGCNAV logging. Postscript plots from "xmgr" were then rasterized with "ghostscript" and merged with the section plots for storage and printing. Sections were printed on the Alden recorder as gray scale images (PGM files). It was found that if the gray scale files were converted to bitmap files using "pgmtopbm", then the resulting PBM files were of near comparable quality and would plot in a small fraction of the time needed for the PGM files.

A small section of Huntec data was processed from day 251. The data was properly recorded but the problem with multiple shots in the water column (see section II) precluded a batch style processing of the entire line. It is recommended that software be written to preprocess huntec data to remove these effects. Until that time, deep water huntec data replay will involve considerable problems.

(VII) Digital Products

The digital products of the cruise include real time and post-real time tapes of mainly 10 cu. in. sleeve gun data. For days 249 to 252 inclusive, all sleeve gun data was replayed onto the workstation and reduced scale plots were produced. In addition, TIFF image files were produced for each of these section plots. An Exabyte digital tape containing all these data with gray scale file for section plotting and TIFF files has been submitted for archival storage. The following list details the contents of the archive tape.

CONTENTS OF DIGITAL ARCHIVE TAPE

To extract use "dd if=/dev/rmt/0m bs=51200 | tar xvf - data"

Under subdirectory ./data the following files will be found.

DAY247/

DAY247.pgm - PGM print file
DAY247.scf - diseismic control file
DAY247.tif - TIFF file containing seismic section image and navigation plot
DAY247.xmgr - navigation plot control file used in "xmgr"
DEC.LOG - ".dec" summary from program segyinfo
SEIS247A.93A - "A" format navigation file
SEIS247A.93E - GPS navigation file
seis11.dec - 10 cu in sleeve gun digital data 247 07:30 to 247 09:38

DAY248/

DAY248.pgm
DAY248.scf
DAY248.tif
DAY248.xmgr
DEC.LOG
SEIS248A.93A
SEIS248A.93E
seis126.dec - 10 cu in sleeve digital data 248 01:58 to 248 10:27

DAY249/

DAY249.pgm
DAY249.scf
DAY249.tif
DAY249.xmgr
DEC.LOG
SEIS249A.93A
SEIS249A.93E
hu9330tape2.dec - 10 cu in sleeve digital data 249 00:35 to 249 13:22

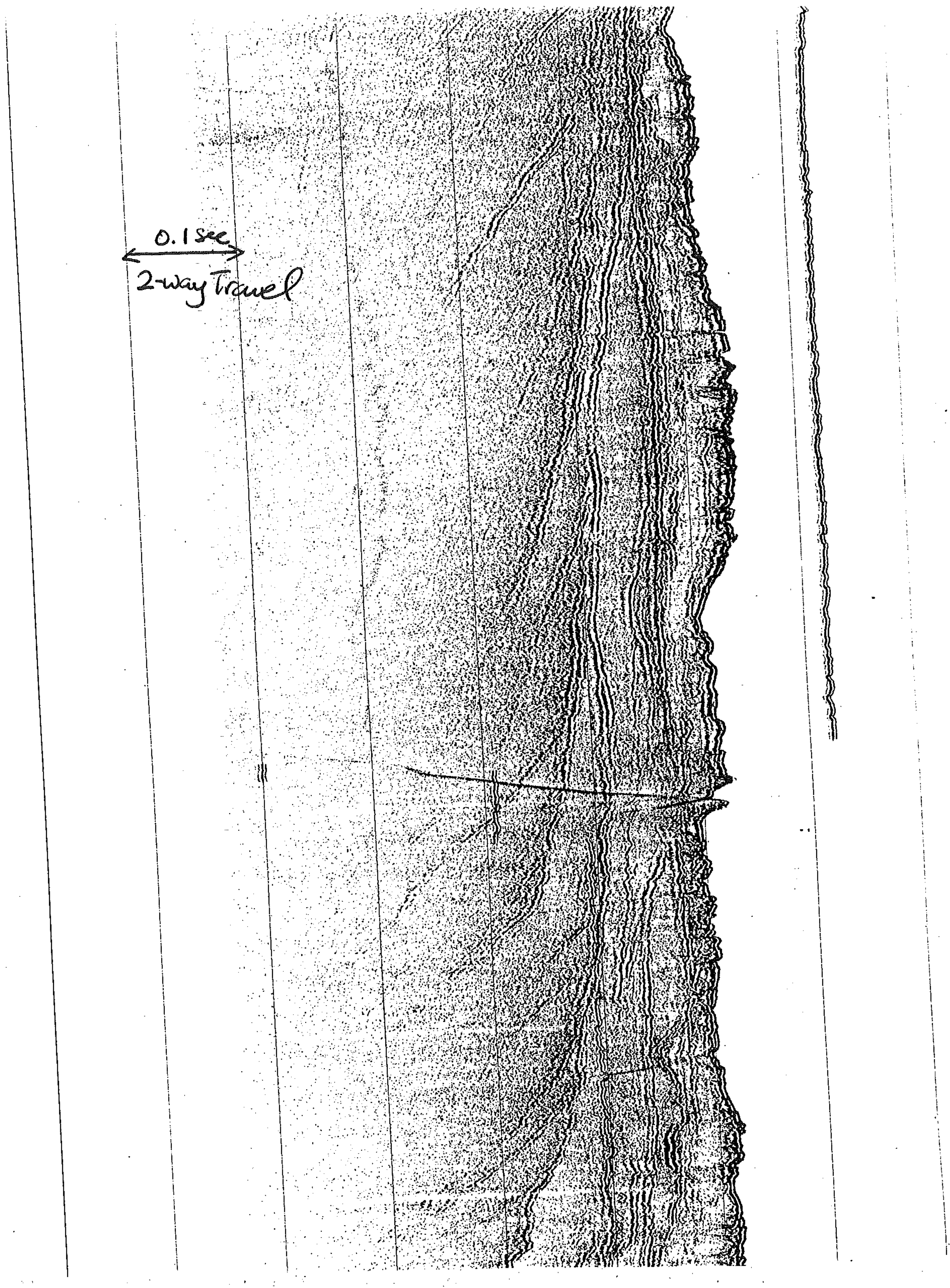
DAY250/

DAY250.pgm
DAY250.scf
DAY250.xmgr
DEC.LOG
SEIS250.dat
SEIS250E.93A
SEIS250E.93E
hu9330tape31.dec - 10 cu in sleeve gun data 249 22:23 to 250 17:52

DAY251/

DAY251.pgm
DAY251.tif
DAY251.xmgr
DEC.LOG
SEIS251A.93A
SEIS251A.93E
SEIS251A.dat
seis2.dec - 10 cu in sleeve gun data 250 23:55 to 251 10:03

An example of a digitally processed sleeve gun seismic record of Tertiary? shelf prograding wedges mantled with Quaternary sequence



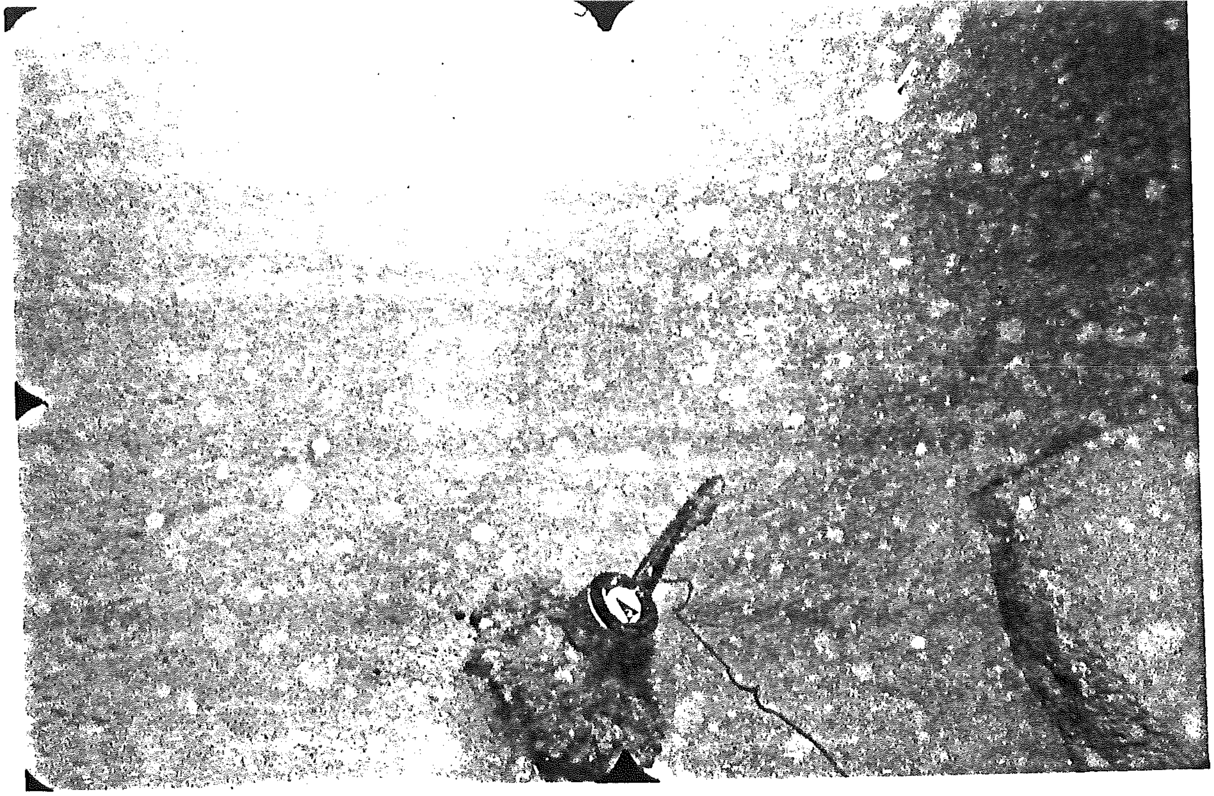
Bottom Photography

Kelly Bentham

Two camera systems were taken on this cruise. The Nikon and UMEL under water systems. The Nikon system had a limitation of 500 metres therefore the UMEL system was used for all but one of the seven camera stations as it has full ocean depth capacity. The camera system worked well and bottom photographs were of an excellent quality. The UMEL system likely has one more field season left before it is due for retirement.

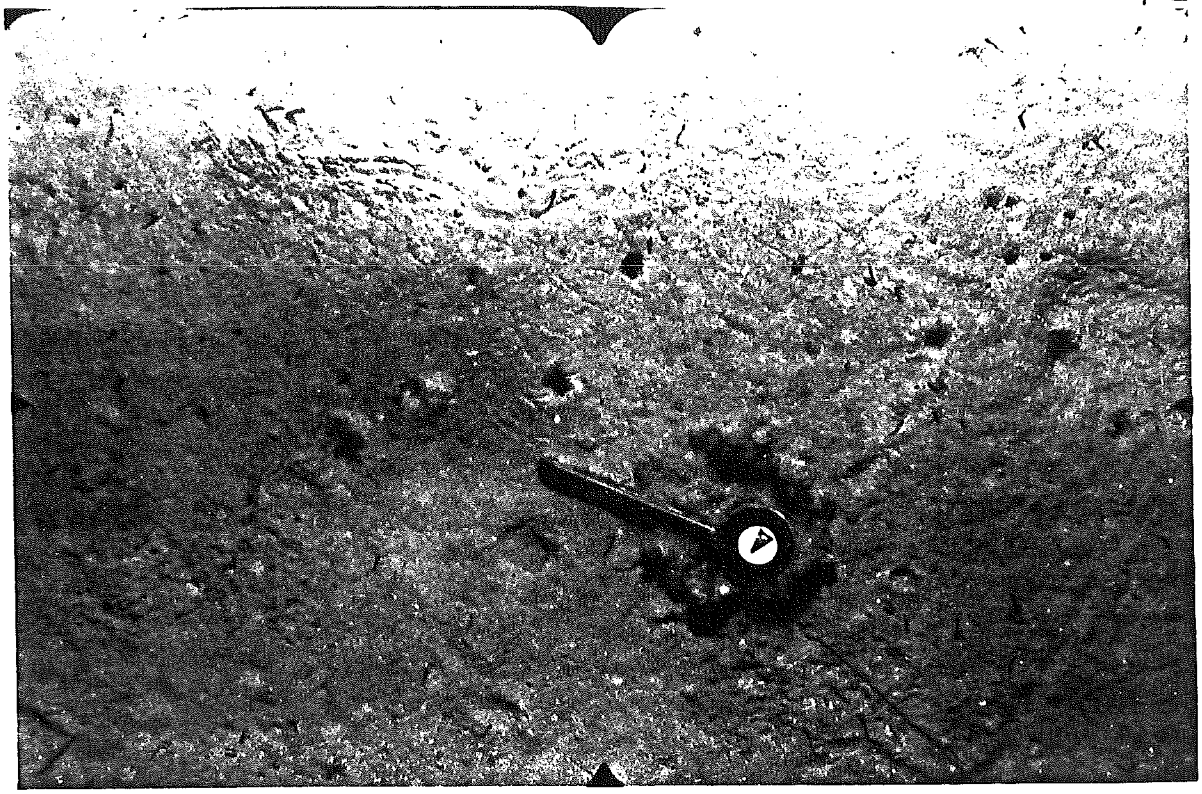
Film:	400 ASA Black and White
F Stop:	F8
Distance off bottom:	1.5m
Trip weight:	16 inch compass vane

General Photography: shots were taken of several box core samples as well as about 10 rolls slide film taken of regular ship board photos. These slides have been entered in the Department of Fisheries Slide Collection at the Bedford Institute of Oceanography.

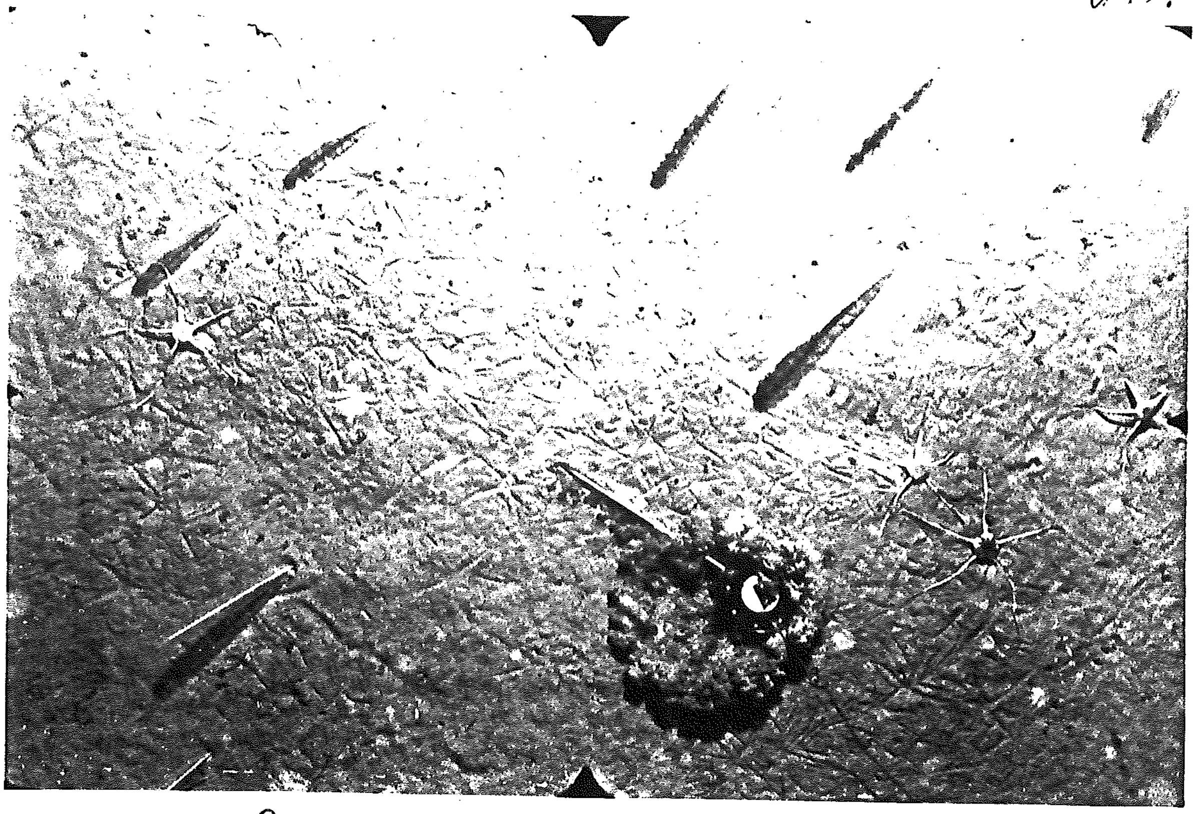


10A Turbid-water soupy bottom of KF4

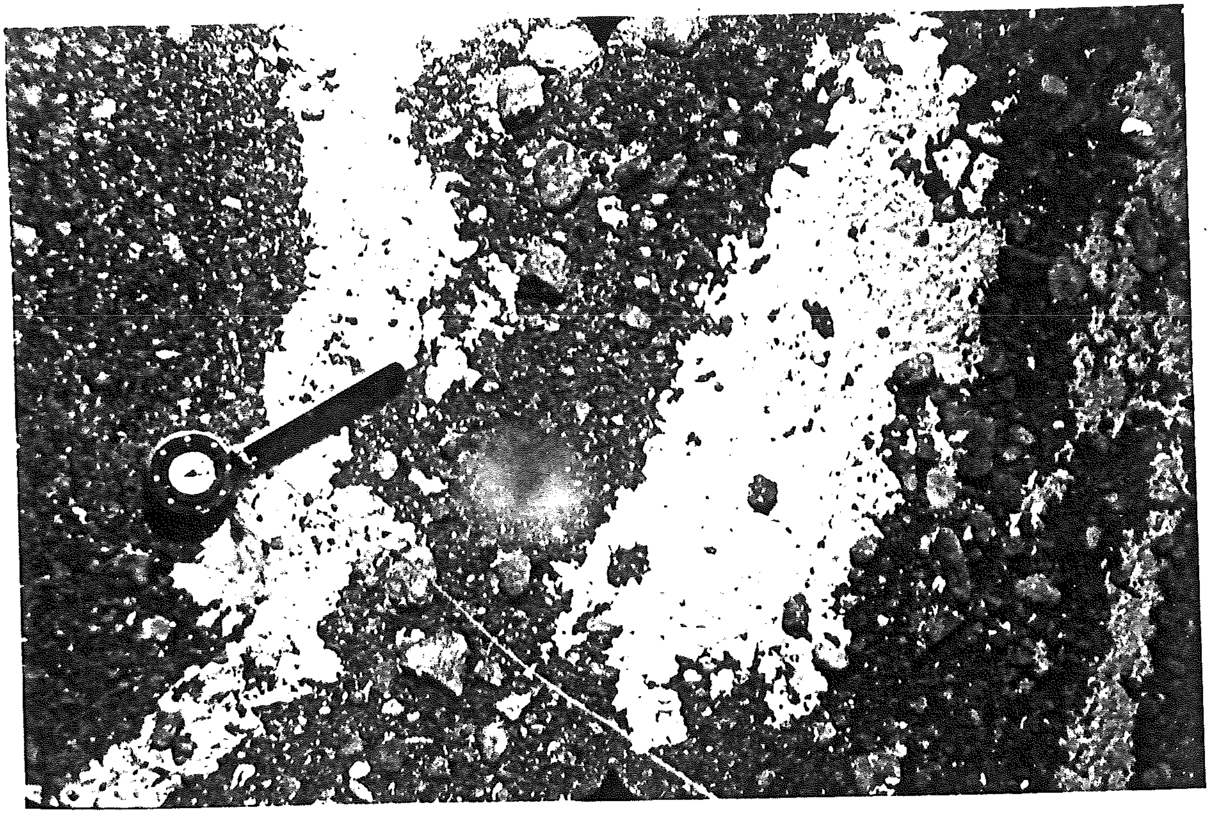
Hard mud bottom of KT3



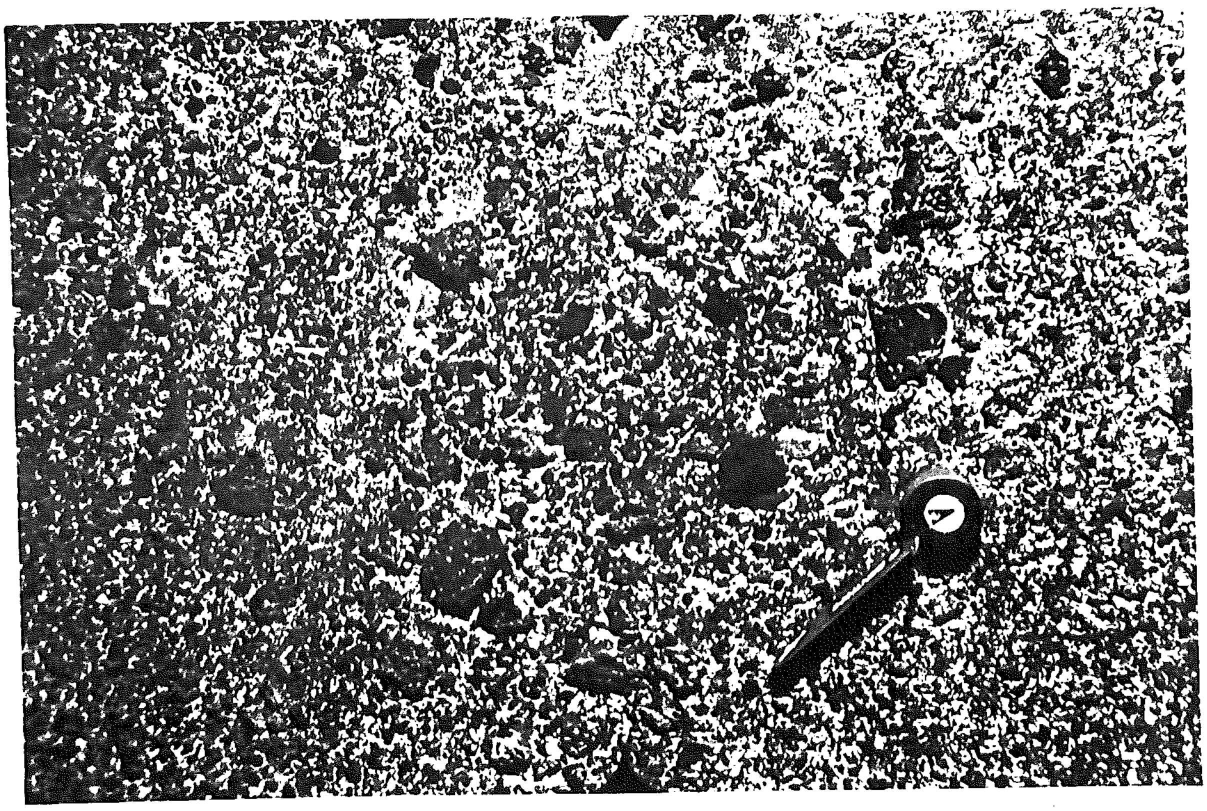
Infauna dominated bottom of KF2



Epifauna dominated bottom of KF1



37A Sandy gravelly debris flow overlying hard mud on continental slope DS1



32A Winnowed ice-rafted or glacigenic debris with shell hash at DS2

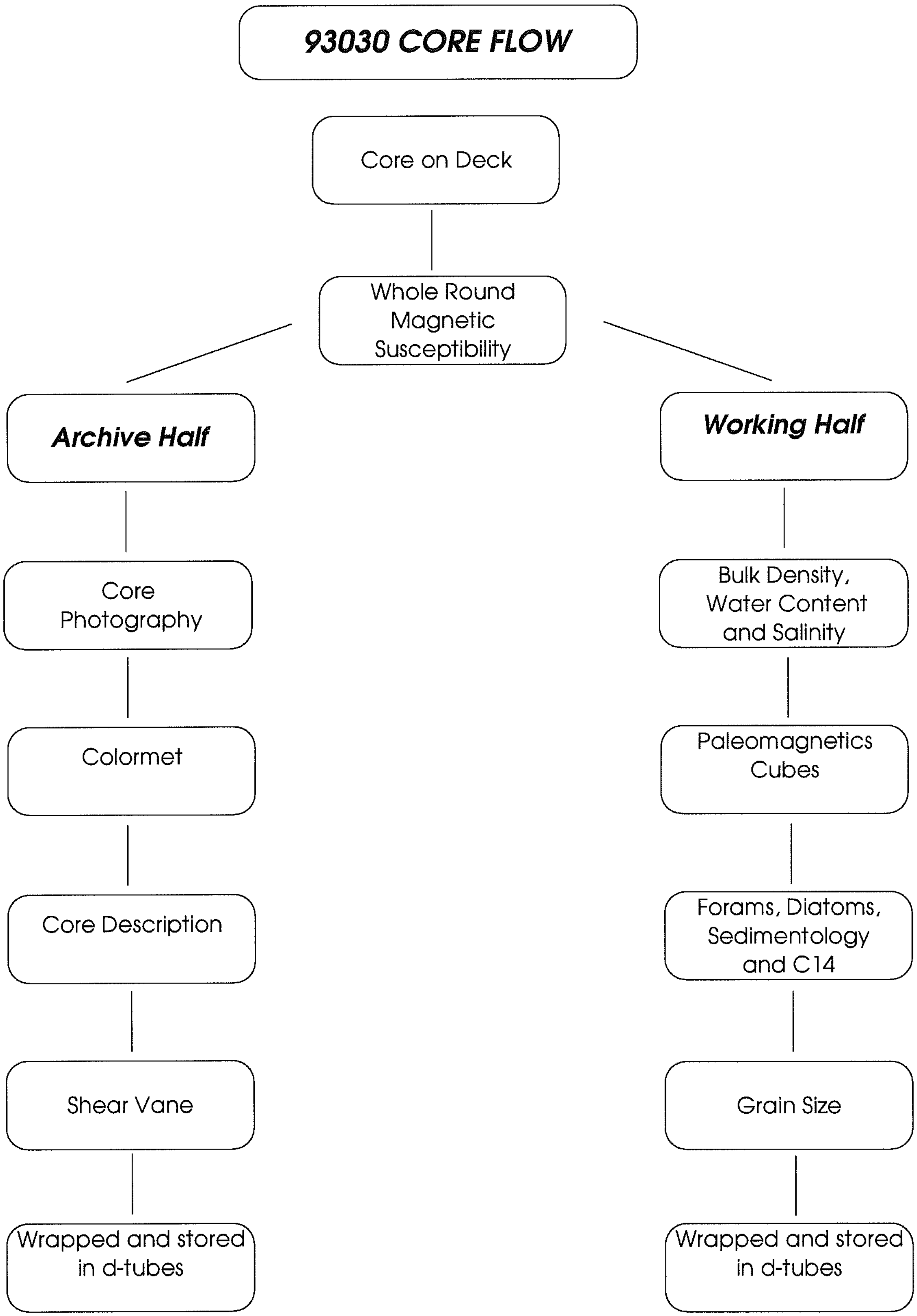
Core Processing:

Andrews, Hein, Jarrett, Merchant, Williams and Weiner

The Core Processing Team (CPT) worked extremely well and efficiently. Core barrels were brought into the GP Laboratory and stored vertically. A flow chart for core processing tasks was initially developed by Jarrett and Andrews and subsequently modified as the CPT became proficient. The following steps describe our methodology:

1. The whole core was measured in the magnetic susceptibility system by Andrews;
2. The core was then split and measured and labelled as the archive-half or working-half. At this point the two halves followed different paths;
3. The archive-half had a 4-part processing:
    a) The core was photographed in 30 cm lengths (Jarrett);
    b) The core was then processed through the Colormet system (Andrews);
    c) Shear vane measurements were taken (Jarrett); and
    d) The core was described and logged in detail (Hein).
4. The working-half was systematically sampled as follows:
    a) Samples for density/water content and salinity were taken (Jarrett, Merchant);
    b) Samples for rock magnetic properties and sedimentology, diatoms, and foraminifera were taken (Williams, Weiner);
    c) Samples for 14C dating were selected and sampled (Andrews, Williams, Weiner);
    d) After core logging Hein selected grain-size samples which were then extracted by William and Weiner;
    e) The various samples were then given identification numbers of Merchant to be entered into the cruise data base with the labels attached to each sample.
5. The two core-halves were then wrapped, placed in a plastic sleeve, and stored in D-tubes in the Cold Room.

The CPT was able to process 1 to 1.5 m core section in 1 to 1.5 hrs working flat out. The CPT would like to mention that the quality of the cored sediment retrieved by the Murphy Corer and the AGC Corer was exceptionally good with very little evidence for distortion or disturbance.


93030 CORE FLOW
Core on Deck
Whole Round Magnetic Susceptibility
Archive Half
Working Half
Core Photography
Colormet
Core Description
Shear Vane
Wrapped and stored in d-tubes
Bulk Density, Water Content and Salinity
Paleomagnetics Cubes
Forams, Diatoms, Sedimentology and C14
Grain Size
Wrapped and stored in d-tubes

Coring Electronics - CHATS

Dave Heffler

CHATS 1 was installed on the core head for 6 piston core stations. It was unmodified from last year. CHATS 2 was mounted on the trigger core with an experimental mud sensor. The main problem in interpreting past data from CHATS and PAL was in determining the exact location of the seafloor. The pressures transducers are not accurate enough and the massive core head is not much effected when the cutter first enters soft sediments. A mud detector on the main corer is difficult as it would require an electrical cable from the head to the cutter. However, a sensor on the trigger core is practical. A CHATS can be mounted on the top of the trigger core and a simple sensor taped to the core pipe just above the cutter. The relative timing of the signals on CHATS and the two PAL's can be estimated within 10 ms by cross-correlation of the acceleration signals before trip.

I built a crude infra-red photo interrupter with a pathlength of about 2 cm. This was taped to the side of the trigger core 50 cm from the cutter. A short cable connected to the multipin connector on CHATS2. This signal was substituted for one of the tilt sensors so no reprogramming of CHATS was needed.

CHATS1 was used on the core head on six deployments.
Core

6CHATS1 only - worked perfectly

7CHATS1 on the head - worked
CHATS2 on the trigger, no mud sensor - worked

13CHATS1 on the head
CHATS2 with mud sensor on trigger
The water depth was less than expected so a "down-up-down" was not done and neither CHATS triggered. The trigger core did not penetrate. It tipped over and was dragged with no significant damage to the mud sensor.

28CHATS1 on the head - worked
CHATS2 with mud sensor. The computer was reset so it gathered no data. The trigger core was mud covered to the top. The mud sensor was full and intact.

32CHATS1 triggered too early (by 2 seconds). The core triggered to long after the "down-up-

down".
CHATS2 worked (almost missed the trigger event). The trigger core did not penetrate so no mud detection. Undamaged. The clock was reset but the data were valid.

33CHATS1 worked
CHATS2 computer reset and had no data. Mud sensor full and intact.
Conclusion. It appears that a simple mud sensor can withstand the rigours of the trigger core. CHATS2 has a electrical/mechanical fault. A special housing for a CHATS on the trigger core should be built and a more permanent mud sensor designed. The premature cancelation of coring on this cruise prevented successful testing of the mud sensor.

The Shear Vane Interface

Some minor changes to the Shear Vane Interface program were made. (SHEAR version 1.0 was changed to version 1.1). The summary file name extension was changed from .STR to .SUM. A separate directory is created for each core. Core names can now have letters in them.The shaft of one the shaft encoders broke due to excess belt tension. It was repaired crudely and was serviceable with a very slack belt for the remainder of the cruise.

SAMPLING EQUIPMENT

R. J. Murphy

AGC LARGE DIAMETER CORER

The piston coring system used was the large diameter corer with 3/8th core barrels, clear CAB tubing, a 3000 pound core head and a split piston. The big corer was tripped with a gravity core and free fell fifteen feet. The four cores that were recovered were of good quality and it appeared there was little disturbance.There were four barrels and four cutters either damaged or destroyed.

BOX CORER

The standard benthos boxcorer was used with good recovery. From the three boxcores collected, each was subsampled for diatoms, forams, organic carbon, grainsize, ostracods and clay mineralogy. They were then sampled with 5 pushcores, using the vacuum pump system.

MURPHY CORER

The Murphy corer is a modified Lehigh using thin walled aluminum pipe, cutter and catcher instead of 4 inch pvc pipe. The corer weighed 300 pounds and used the same liner as in the AGC large diamater corer. There were two Murphy cores collected, and it worked very well on its test run.

SEDIMENT CORES:

BIOGENIC COMPONENTS (DIATOMS AND FORAMINIFERA)

Kerstin M. Williams

The area between Iceland and Greenland (Denmark Strait) is one of the climatically most sensitive areas in the world. The sea floor sediment has the potential for monitoring the changing composition of surface water outflow from the Arctic Ocean. Over the past 30 + years a couple of separate and anomalous "freshwater" events have been detected, when unusually severe sea ice conditions prevailed in the Denmark Strait. During those events the northern coast of Iceland was directly impacted by abnormal amounts of ice and low salinity surface water.

In the past we infer that similar events may have occurred - sea ice records are available from Iceland from as far back as ca. 1200 AD, in anecdotal form at first, and later in more reliable format. These records show that sea ice intensity has varied from what we have come to interpret as "normal" to very heavy sea ice.

Kangerdlugssuaq Fjord and Trough cut across the East Greenland shelf. This fjord is the largest ice berg producer along the coast, channeling bergs from both the Greenland Ice sheet (via Kangerdlugssuaq glacier) and innumerable outlet and tidewater glaciers into Denmark Strait. The varying extent of the glaciers is marked by various types of moraines, but is also evident in the changing composition of the sediment.

The biogenic component in the sediment core samples has been shown to indicate changes in glacial ice extent, both spatially and temporally, in the fjord and in Denmark Strait over the past 14000 years, as well as variations in surface and bottom water characteristics (Jennings and Helgadottir, in press; Williams, 1990; 1993).

The purpose of our sample collection during this cruise is thus to analyze and interprete changes in the biogenic components in the sediment cores through time, and infer surface water and bottom water temperature and salinity variations. This information will then be used to assist in elucidating mechanisms for hemispheric/ global ocean circulation changes with the concomitant impact on climate.

Methods

We will use standard methods for foraminifera and diatoms sample preparation. The sediment cores are of three types: box cores, Murphy cores, LCF cores with TWC cores.

Box cores: Sampled every 1 cm for the first 10 cm, every 2 cm between 11 and 20 cm, and every 5 cm thereafter. The samples between 0 and 20 cm have been stained with Rose Bengal and preserved in a 60% alcohol - water solution. The sediment/ water interface has also been sampled and stained, to allow for determining live foraminifera in the sediment.

In addition to the on-board sampling we also bring back to INSTAAR an unopened push core from each box core, which will be used for high resolution studies on biogenic variation over the past couple of thousand years. This core will be used to get C-14 AMS dates and perhaps O-18 analysis on unstained foraminifera.

Murphy and LCF cores: Sampled at varying intervals, depending on core stratigraphy and sediment composition. Shorter cores (Murphy cores) usually sampled every 5 - 10 cm, longer at 20 - 40 cm intervals. AMS C-14 dates on foraminifera will provide chronologic control - we hope to be able to date several levels in each core.

Cores to be analyzed at INSTAAR for biogenic sediment components:

93-030	003	Box core
	004	Murphy core
	006	TWC and LCF cores
	007	LCF cores
	019	Box core
	023	Box core
	024	Murph core
	028	TWC and LCF cores
	034	TWC and LCF cores

SEDIMENT CORES: SEDIMENTOLOGY

Frances J. Hein

Introduction

My role in this cruise was to do detailed lithofacies logging of cores recovered on the cruise, with the aim of developing a lithofacies model for sediments deposited in the sites sampled. Detailed core logging was also done to allow for future regional correlations between cores from different basins and fjord sites, as well as to allow for detailed sedimentological analysis and modelling of sediment gravity flows operative in front of ice-margins and glaciers.

Methods

Cores were initially run through the magnetic susceptibility prior to splitting, were then split, photographed, and analyzed using Colormet, subsampled for bulk density and water content, vane shear tested, subsampled for micropaleontological and grain size analysis, and logged. In the core-logging phase, sediment consistency was described in a relative sense and the degree of core disturbance was noted. Colour of the sediment was estimated using the Munsell Colour Charts for soils, with most of the sediment falling into the dark to medium olive-gray categories, 5Y/, with less commonly brown (10YR) sediment. Cores were logged on a bed-by-bed scale, with the exception of the very fine laminated successions (mm scale) that were grouped as graded-laminated successions, in which the colour and apparent grain size layering was noted on the core logs. Samples for future grain size analyses were taken at regular intervals downcore where there was little variation in facies character, or at intervals corresponding to facies changes in cores for which there was significant facies variation. Notes were taken on standard AGC core logging sheets by hand (archived at AGC), and were then transcribed into the Applecore Program core logging program. Summary sheets for each core were printed out at a 1:5 scale, with text annotation and header notes. These Applecore summary sheets were archived with the AGC cruise log sheets and also were submitted for the cruise report. Preliminary summary core sections were drawn at the 1:50 scale for a preliminary regional correlation chart of all of the cores (available from F. J. Hein, Dept of Geology and Geophysics, University of Calgary, Calgary, AB, T2N 1N4). Subsequent work on the micropaleontological and grain size subsamples will hopefully help in the regional correlations.

Results

Detailed core logs were made of push cores taken from the box cores: 003i, 019B, 023C; from LeHigh (with Murphy modification) cores: 004, 024; and from Long Core Facility (or AGC Wide) cores: 006, 007, 013, 028, and 034; and from the Trigger Weight cores with some of the Long Core Facility cores: 006, 028, and 034. Preliminary results of the core analysis show that near the head of Kangerdlugssuaq Fjord (KF3, core 034, Latitude: 68 29.19, Longitude 32 29.12), a large debris flow is overlain by a slide - thin turbidite succession, that is capped by varve "laminites" associated with glacial meltwater or glaciofluvial discharge plumes. At the outer end of Kangerdlugssuaq Fjord (KF1, core 028, Latitude: 68 08.05, Longitude 31 52.08), sediments are predominantly turbidites, that show synsedimentary faults at the base of the cored section (as a possible slide section), that is oterlain by a succession of thick fine-grained turbidites. Upcore the turbidites become thinner and finer-grained, and as shown by the box cores are capped by a thin hemipelagic and fine/thin turbidite zone. Outer Kangerdlugssuaq Trough KT3, cores 019B (Latitude: 67 08.73, Longitude 30 49.34) and 023C (Latitude: 67 08.19, Longitude 31 52.62) is characterized by mottled hemipelagic clays with minor siltier intervals. The Eastern Greenland (DS2) core 013 (Latitude: 65 26.35, Longitude 30 28.8) recovered very little sediment, the seafloor was mainly a biogenic lag deposit of "coral" debris overlying a thin silty clay, which from the seismic data appears to be a thin veneer upon basement. The Eastern Greenland (DS1) core 007 (Latitude: 65 01.39, Longitude 30 14.81) is mainly bioturbated sandy-silty-mud with dropstones throughout, and appears almost as a bioturbated stratified diamict, and probably is the only core recovered that truly represents iceberg meltout sedimentation. The Western Iceland Shelf (IS1) site is characterized by a bioturbated hemipelagic and fine-grained turbidite succession, that is succeeded by thick fine-grained turbidites, within which the degree of bioturbation increases upsection. Macroscopic coiled foraminifera were recovered in Trigger Weight Core 006. Trigger weight, the top of the LeHigh, and Box cores from this site all have hemipelagic clays, that are mainly bioturbated with minor silty phases.

Preliminary correlation of the long core results with the available high resolution seismics suggest that there is a correspondence between some of the reflections and sandier intervals (See Figure). Regional correlations suggest that the thick turbidites from 028LCF probably relate to the Debris Flow - Slide event in 034LCF. There are two possible coarse-grained marker horizons that correlate across the region from the Western Iceland Shelf and the Outer Kangerdlugssuaq Fjord, and that may relate to either regional seismic events or regional climate influences. Preliminary correlations have to be substantiated by further grain size, geotechnical and micropaleontological analyses.

Magnetic susceptibility core measurements

J.T. Andrews

A Bartington Magnetic Susceptibility Meter, model MS#2, was used to measure the volume susceptibility of box push cores, Murphy, and Atlantic Geoscience long cores. The meter was operated with 12.5 cm diameter loop. All cores were measured at a 5 cm sampling interval. Experiments on board indicated that the loop has an effective scanning interval of +/- 10 cm, thus individual core sections are "patched" to minimize an artificial low magnetic susceptibility due only to measuring the core tops or bottoms. The units of measurement are x 10-5 Sl units (dimensionless).

In addition to the onboard whole core measurements, all cores were sampled with 5 cc palaeomagnetic plastic containers for later work on a full suite of rock magnetic parameters (SIRM, ARM, and mass magnetic susceptibility). However, at this stage the sampling interval was much coarser than the 5 cm whole-core scan, averaging 25-30 cm, and more focussed on sampling the range of different lithostratigraphic units.

Results:

All the AGC long cores showed considerable variability in the MS signal, indicating large-scale changes in either sediment source and/or grain size. The interpretation of several of these changes, especially those from the cores off Iceland and Denmark Strait will require radiocarbon dates before they can be adequately interpreted, but in Kangerdlugssuaq at 93-030-028 the magnetic susceptibility record consistently defines the scale of the various turbidites that are a feature of this record (see core description, F. Hein). It may be possible to plot on the same depth scale the MS record from 028 and the detailed seismic analog from the Seistec towed system.

The most variable record is 93-30-007 from Denmark Strait where the color changes are mimicked by changes in the susceptibility. This core appears to reflect deposition from two major sediment sources.

Table 1 Files that are available and some basic descriptive statistics for each.

Descriptive statistics for whole-coring magnetic susceptibility (units x 10-5 SI)

Core ID	No. Samples	Mean	sd	Mx	Min	Coeff. Variation
003 Box	11	196	19	213	151	9.5
004Murphy	46	224	29	227	175	11.8
006TW	36	234	25	277	197	10.6
006AGC	233	707	352	1310	100	49.8
007TW	NA					
007AGC	85	854	274	1441	205	32.1
019	9	139	13	152	109	9.3
023	10	350	39	417	262	11.0
024	45	371	62	473	150	16.7
028TW	18	343	55	472	247	16.7
028AGC	287	491	175	1466	247	35.6
034TW	36	364	70	516	247	19.2
034AGC	121	600	208	1214	241	34.7

Colormet measurements on cores

J.T. Andrews and Kate Jarrett

The Colormet system was used to quantify changes in sediment surface color. The system was used in the L*a*b* mode: in this mode all colours are represented within the 3 axes of the system. The L* axis spans the white to black range (100 to 0); the a* axis measures the Red (+) to blue (-) range, whereas the b* axis measures yellow (+) to blue (-). When a* and b* are both zero the color ranges between white, grey, to black. The 3-part measurement can be converted to the standard Munsell colours. The instrument reads sediment colour across a 2 cm by 1 cm oval; thus in the cores the readings represent a 1 cm "depth" of the core taken across the central 2 cm.

The measurements were taken every 5 cm on all cores. The split core was overlain by "Resinite" wrapping and the head of the instrument positioned on top of the wrap. The standard white calibration disk was also covered in Resinite to normalise the measurements. The instrument's calibration was measured at the beginning and end of each core section and recalibrated when necessary. Our experience indicated that the instrument remained stable over long periods and required relatively few recalibrations.

The system claims a design criteria so that a difference of 1 unit in any of the 3 values is "noticeable" (Colormet manual, 1989). Thus our measurements can be converted to "delta-E" which is a "straight-line distance between two points in three-dimensional color space and is always a positive number" (Colormet manual, 1989, p.10)

Legend

Physical Structures

	ASCII code
small current ripples	200
trough cross-bedding	201
horizontal planar lamination	204
low angle planar lamination	206
convolute bedding	212
graded, fining upwards	215
graded, coarsening upwards	216
fault	217
pebble - granule horizon	251
rip-up clasts	267
shell fragments	270
bioturbation	323
coiled forams	366

LITHOLOGY

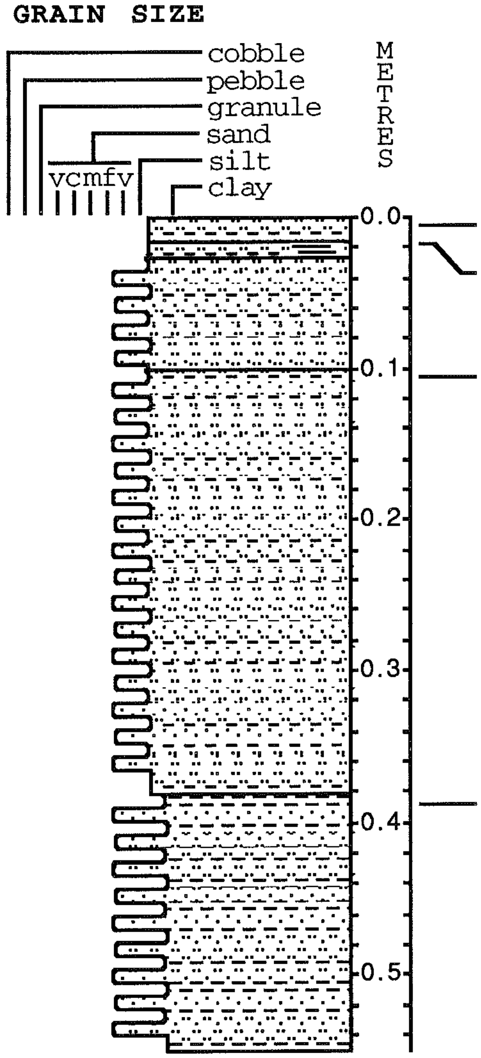
1286	SAND/SANDSTONE
1287	silty sand
1288	shaly sand
1289	SILT/SILTSTONE
1290	sandy silt
1291	clayey silt
1292	SHALE/MUDSTONE
1293	silty shale
1294	sandy shale
1295	clay/claystone
1298	intrbed. sd-sh
1299	intrbed. slt-sh
1300	conglomerate
1301	breccia
1302	Xstln basement
1303	LOST CORE
1316	Coquina

93-030 003I Push Core in Box Core
Offshore Western Iceland

Date logged: September 4, 1993

Logged by: F.J. Hein

Remarks: Colormet A13 erroneously taken for next core, redone



0 - 2 cm: slumped, very soft, tan-gy (5Y5/3), silty mud, structureless

2 - 10 cm: soft, med-dk gy (5Y4/1), sandy silty mud, vague lamination

10 - 38 cm: soft, lt - med gy (5Y5/1), sandy silty mud, structureless

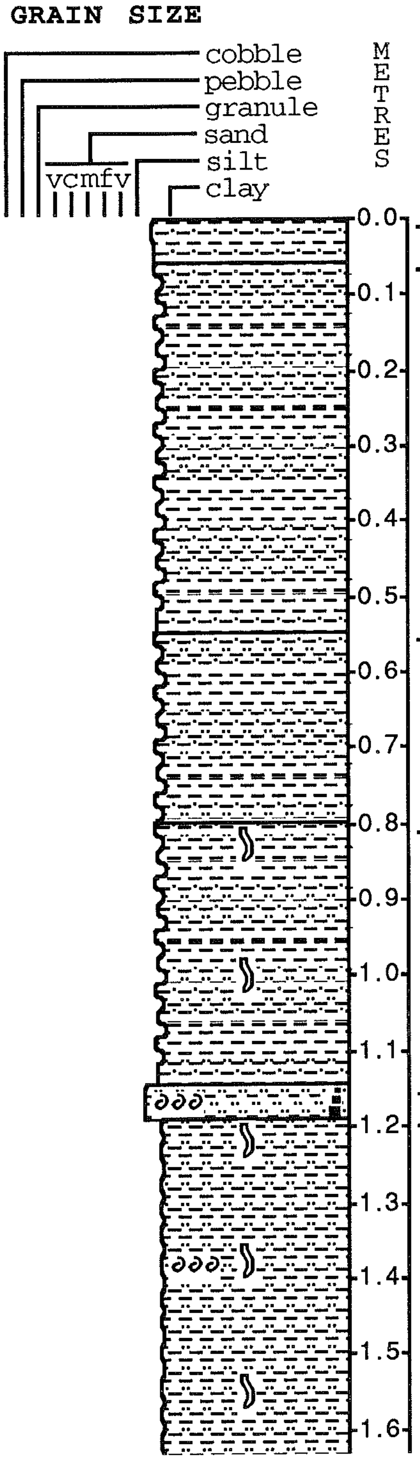
38 - 55 cm: soft, lt - med gy (5Y5/1), sandy silty mud, structureless

93-030 004 LeHigh Core
Offshore Western Iceland

Date logged: September 4, 1993

Logged by: F.J. Hein

Remarks: Top missing, 60 - 75 cm disturbed when split. Sediment too soft and failing right away.



0 - 6 cm: very soft, med-dk gy (5Y 3/1) muddy sand/ sandy mud, slumped (?), possibly graded turbidite sand.

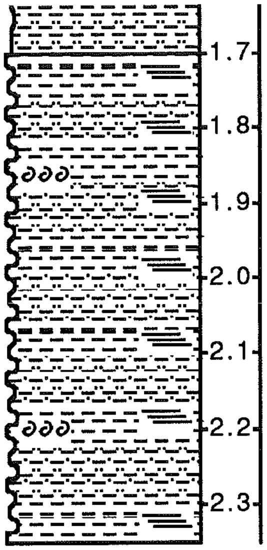
6-55 cm: soft, dk-med gy (5Y4/1) with mottles of black (5Y 2.5/1) vague lamination; sandy silty mud; ? extensively bioturbated and mottled, difficult to discern original structures

55-80 cm: clotted during split; dk-med gy (5Y4/1) sandy silty mud; surface is pitted and clotted due to disturbance with splitting; is now structureless

80 - 115 cm: medium soft, dk - med gy (5Y3/1) sandy silty mud with open burrow holes; structureless

115 - 118 cm: soft, dark gy (5Y2.5/1) sandy silty mud grading into silty mud, with shell debris at the base; internally structureless (? turbidite)

119-170 cm: medium soft, dark gy (5Y3/1) sandy mud/ muddy sand bioturbated. Shell debris @ 120 and 138 cm.



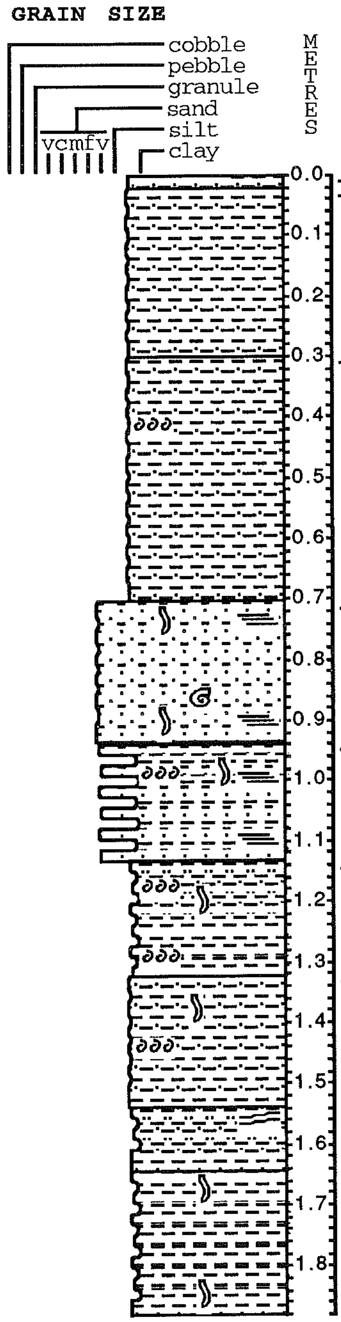
170 - 235 cm: medium soft, sandy silty mud/sandy mud, with bioturbated graded sandy - mud couplets, each 4 - 8 cm thick, as graded-laminated (? turbiditic) layers. Lighter tan sandy intervals are 2 - 3 cm 5Y4/3 or 5Y5/3 alternating with darker gy mud 3 - 4 cm 5Y 4/1. Shell debris @ 120, 138, 186 and 220 cm depth.

93-030 006 Trigger Weight Core
Offshore Western Iceland

Date logged: September 4, 1993

Logged by: F. J. Hein

Remarks: @ 98 cm whole shell (Astarte sp. (? borealis) for C14 date
Delete Colormet C28 done in error during recalibration. 28 - 70 cm section a little disturbed by splitting, soft sediment.



0- 2 cm: slumped, very soft, dk olive gn (5Y 4/4) sandy silty mud, structureless

2-10 cm: very soft, dk gy (5Y 3/1) sandy mud, structureless with dispersed medium to coarse sand throughout

30-70 cm: disturbed (clotted during split), soft to very soft, dk gy (5Y 3/2) sandy mud with dispersed coarse to very coarse sand and minor scattered shell debris. Irregular broken upper and lower contacts.

70 - 93.5 cm: soft, sandy mud with scattered calcareous worm tubes in lower few cm (in situ), coiled foraminifera (macroscopic 0. 3 - 0. 2 mm diam) scattered throughout, vague parallel lamination and bioturbated. Lamination best preserved in lowest 10 cm and topmost few cm.

93.5 - 98 cm: medium consistency, dk- gy (5Y 3/1) stratified muddy sand and sandy silty mud with shell debris and calcareous worm tubes, coarser laminate are about 1 cm thick of medium-coarse sand alternating and grading into slightly siltier and muddier upper sand caps, graded-laminated facies.

113 - 132 cm: medium consistency, dk gy (5Y 3/1) sandy silty mud, possibly extensively bioturbated, with dispersed medium sand and minor scattered shelly debris throughout

132 - 154 cm: medium consistency, dk gy (5Y 3/1) muddy sand/ sandy mud, structureless, perhaps bioturbated, with dispersed medium to fine sand throughout and minor dispersed shelly debris

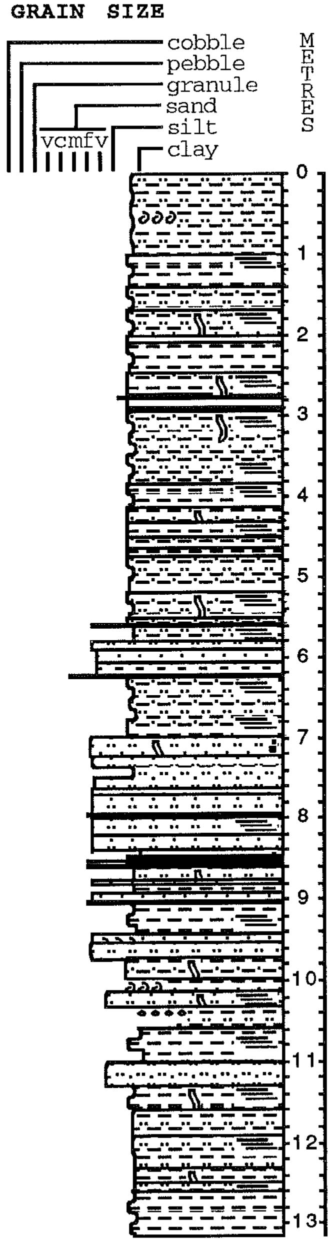
154-164 cm: medium consistency, dark olive gn/gy (5Y 4/3), possibly crossbedded or low angle discordance due to core disturbance, with vague lamination parallel to the low-angle sandy parting discordance.

164-188 cm: medium, dk olive gn/gy (5Y 4/3) sandy silty mud, bioturbated, structureless

93-030 006 LCF Long Core Facility
Offshore Western Iceland

Date logged: September 5, 1993

Logged by: F. J. Hein



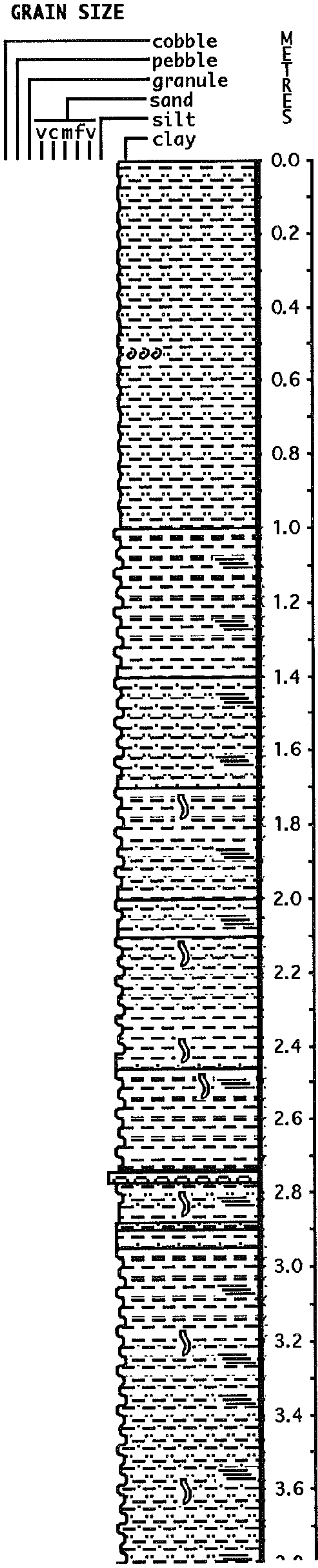
93-030 006 LCF Long Core Facility

Offshore Western Iceland

Date logged: September 5, 1993

Logged by: F. J. Hein

Remarks: Top 100 cm disturbed, whole section slumped and sloshed back and forth on deck. No original structures preserved.



0 - 100 cm: Extensively disturbed, very soft and soupy to medium consistency, med - dk gy (5Y3/2 to 5Y3/1) sandy silty mud, structureless, shell fragment at 52 cm. Core sloshed back and forth within liner on deck.

100 -140 cm: med- dk gy (5Y 3/1) sandy silt mud, dominantly structureless, with vague wispy lamination

140 - 170 cm: sandy silty mud with alternating bands of wispy laminated and possibly bioturbated, with dk-med gy (5Y 3/1) sandy silty mud, 0.3 - 1 cm thick bands, alternating with slightly more olive dk-med gy (5Y 3/2) sandy silty mud, in 1 - 4 cm thick bands. Minor graded-laminated intervals.

As above, but banding is on a broader scale, with darker (5Y 3/1) bands 2 - 3 cm thick alternating with more light olive (5Y 3/2) bands 4 - 5 cm thick. Minor burrow structures.

As above

210 - 246 cm: soft - med consistency, dk gy (5Y 4/2), structureless and bioturbated/mottled sandy silty mud with shell debris at 220 cm

246-254 cm: as above, with vague stratification preserved within the burrowed interval

254-274 cm: medium soft, dk gy sandy silty mud with stratification bands consisting of a lighter (5Y 4/2) gy to slight olive sandy silty mud alternating with darker (5Y 3/2 to 5Y 2.5/1) sandier silty mud. Bioturbated.

274-275 cm: dispersed dropstones associated with laminite

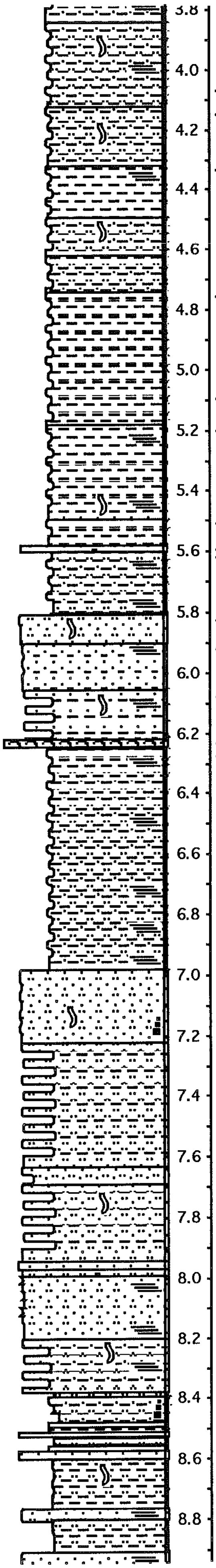
275-288 cm: as unit above dropstones with vague lamination preserved

Dropstones 288 - 290 cm lamination more pronounced 275-295 cm dropstones are subround to angular, black volcanic rock fragments up to about 3 cm

down to 312 cm: wispy laminated and bioturbated sandy silty mud, with laminations less distinct towards base

312 - 350 cm: med firm, dk gy (5Y 3/2) mottled sandy silty mud which at top grades downcore into a silty mud overall interval is inversely graded. Minor burrow structures at 340 - 342 cm. Vague wispy lamination throughout, but is best defined in topmost 10 cm.

350 - 383.5 cm: vaguely banded dk gy - med lt gy (5Y 4/2) sandy silty mud alternating with silty mud (5Y 4/1), at about a 3 - 5 cm scale, with minor burrowing throughout.



405-413 cm: med firm, med dk gy (5Y 4/1) sandy silty mud with a slight burrowed/mottled textgure, minor open burrows

413-432 cm: mod firm, as above but with slightly more mottled texture. 5Y 5/1 mottled with 5Y 4/1. At base loaded/flamed into underlying unit.

432 - 448 cm: As above with minor wispy lamination texture in lowest

474 - 508 cm: dk gy (5Y 4/1) sandy silty mud, massive with large longitudinal and secondary bedding-parallel cracks forming during logging. No discernable sedimentary structures, small "pin holes," which along with the cracks may be associated with gas escape from the core.

508-518 cm: dk gy (5Y 3/1) medium sand, structureless, slightly silty on split surface, more sandy below split. Silt may have been elutriated associated with either fluid escape or gas escape from the core, and remains as a coating on the split surface.

518 - 550 cm: vaguely banded, 5Y 5/1 alternating with 5Y 5/2, sandy silty mud and muddy sand as individual units of stacked graded couplets, that are internally structureless. Lamination is better defined where the unit is sandier. Basal few cm are bioturbated into underlying darker mud.

550 - 558 cm: firm, dk gy (5Y 4/1) sandy silty mud, structureless

Bioturbated base of overlying bed, lt gy (5Y 6/1) silty sand

560 - 580 cm: Firm, vaguely banded dk gy silty mud (5Y 3/1) alternating with lighter colored sandy silty mud (5y 4/2). Minor burrow holes or pinhole gas escape foles. Banding on the scale of 4 - 5 cm wide. Large (0.5 cm x decimetre-scale) longitudinal cracks, and smaller transverse cracks throughout this interval, perhaps associated with gas escape. Cracks form and continue to propagate during core logging phases.

580-590 cm: Firm, dk gy (5Y 4/1) mottled, very sandy, silty mud with vague lamination or banding preserved.

590 - 605 cm: Firm, dk gy (5Y 4/1) sands, 3 - 4 mm thick, alternating with sandy silty mud, 2-3 cm thick. Lamination is less distinct in the lower half of this unit.

605 - 622.5 cm: Firm, dk gy (5Y 4/1) vaguely banded, sandy silty mud, isolated open burrows. Longitudinal cracks throughout.

622.5 - 623 cm: white, granule lag of shells and possibly calcareous worm tube fragments. Very well sorted and somewhat rounded. Storm deposit, possibly resedimented from the more shallow shelf environment.

623 - 698 cm: Firm, dk gy (5Y 4/1) vaguely banded, sandy silty mud, banding spaced about 4 - 5 cm apart.

698 - 709 cm: Slightly lighter coloured (5Y 5/1) silty sand/ sandy silt, vaguely banded as above.

709-723 cm: Firm, dk gy (5Y 3/2) sandy silty mud, occassional burrows, otherwise structureless, sandier than overlying unit, slight normal grading.

723 - 764 cm: 5Y 4/1 alt with lighter 5Y 4/2 , broadly banded sandy silty mud with lighter coloured slightly more silty intervals alternating with slightly darker coloured sandy intervals, spacing of laminations 4.5 cm

764 - 767 cm: Firm, lighter (5Y 4/2) massive sandy silt cap to thick normally graded unit

770 - 796 cm: Firm, vaguely banded lighter and darker colored intervals of sandy silty mud. Minor burrow structures. upsection is normally graded, and becomes sandier downsection, with concentrated dark medium sand at the base. Lamination is 3 - 4 cm apart.

795-796 cm: 5Y 4/1 dark medium sandy base of normally graded bed

796 - 801 cm: Inverselyt graded, sandy silty mud to silty sand, with colours changing from 5Y 5/2 to 5Y 4/1 at top. Minor burrrow structures.

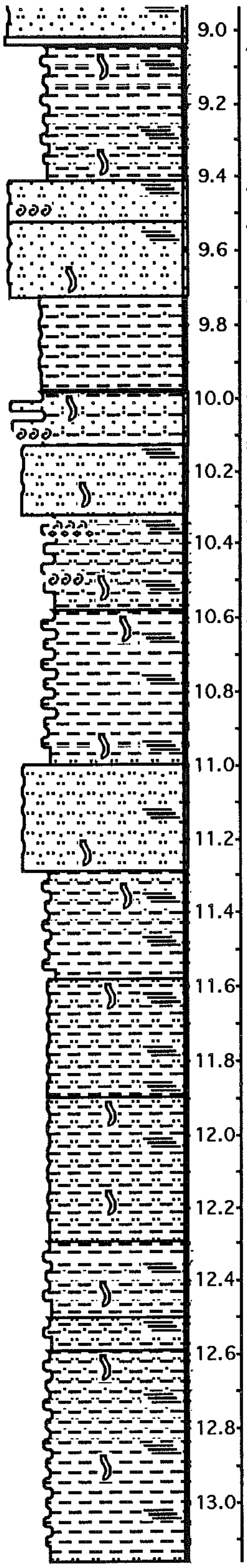
801 - 840 cm: vaguely banded, sandy silty mud, darker colored (5Y 4/1) alternating with lighter and more olive colored (5Y 4/2) siltier units, at a 4 - 5 cm spacing. Graded-laminated units. Minor burrowing throughout.

840 - 842 cm: lt-med gy (5Y 5/1) silty mud with internally loaded contact with underlying unit

842-851 cm: darker gy (5Y 4/2) sandy silty mud

851-852: dk med sand grading into overlying units are all one graded bed.

852-854 and 854 - 863 cm: Graded beds of sand - silty mud - mud, otherwise structureless aside from grading. Uppermost bed grades from 5Y4/1 to 5Y4/2 sand to mud, the lower bed 5Y4/1 to 5Y 4/2 sand to mud. Minor bioturbation in upper bed portions.



863 - 904 cm: very firm to stiff, dark gy (5Y 4/2 alt w/ 5Y 4/1), sandy silty mud. Vague lamination on 1 scale well developed from 879-885 and from 895-904 as alternating dark and lighter sandy silty laminae; otherwise irregularly mottled with vague wispy lamination in upper bed portions. Individual graded beds. At the base from 902-904 dark gy (5Y3/1 to 5Y 4/1) laminated sand.

907-943 cm; firm to stiff, dark gy (5Y4/2) vague laminated and bioturbated sandy silty mud with pronounced longitudinal cracks emerging from subsampled areas.

943-953 cm: as above, but sandier. At 953 cm: sand- to granule filled burrow comprised mainly of shell debris.

953-973 cm: very firm, dark gy (5Y 4/2 to 5Y 4/1), vague laminated and burrowed/mottled sandy silty mud with concentrated sand-infilled burrows. Dispersed shell debris from 958m - 968 cm. Remnant lamination, moderate degree of bioturbation.

973-998 cm: less sandy interval than overlying unit, banding is less pronounced, bioturbated, possible compression folds associated with coring oriented transverse to core axis.

998-1013 cm: Very stiff, lighter gy (5Y 5/1), sandy silty mud, bioturbated, with dispersed shell debris at 1010 cm.

folded at base due to core disturbance

1013 - 1032 cm: very stiff, gy (5Y 5/1) silty sand, mottled, with possible "transverse" folds or lamination top few cm . Isolated shell debris at base of 'laminated' interval.

1032 - 1058 cm: well laminated interval of graded dk gy/ med gy (5Y 5/1) sand alternating with lighter siltier sandy laminae (5Y 6/1, 5Y 6/2). Topmost laminae are better defined with scattered dropstones and shell debris. Downcore laminae is vague and interrupted by bioturbation. Dropstones up to 1 cm+, subangular to angular, dominantly volcanic.

1058 - 1100 cm: bioturbated, inversely graded interval, with a sandier upper bed section above 1080 cm. Moderate to heavy bioturbation, vague lamination structure preserved. med - dk gy (5Y 4/1, 5Y 5/1)

1100 - 1128 cm: as above, with more sand preserved as remnant laminae and burrow fills. Mod-heavy bioturbation. Dk gy mottles (5Y 3/1) in lighter gy (5Y 4/1) more silty background sand.

1128 - 1158 cm: dk gy to very dk gy (5Y 3/1) massive sandy silty mud with vague lamination and moderate bioturbation/. Basal 8 cm has medium-fine sand dispersed throughout.

1158 - 1167 cm: stiff to plastic, dk gy, bioturbated massive silty mud, bulged at side due to core disturbance.

1167 - 1190 cm: well defined laminated sandy intervals separating bioturbated sandy silty mud, dk gy (5Y 3/1)

1190 -1229 cm: lighter (5y 2/1) gy silty mud, with less apparent burrows and vague lamination throughout, very stiff and uniform texture

1229 - 1240 cm: dk gy (5Y 4/1), very stiff, extensively bioturbated sandy silty mud with vague wispy lamination preserved

As above but slightly lighter coloured (5Y 5/2), with swirled internal texture due to bioturbation and slightly sandier.

1250 - 1259 cm: stiff, dk gy (5Y 3/1) grading upsection to lighter gy (5Y 4/1) siltier interval at the top. Graded laminae of sand silt - silt mud, that are bioturbated and spacies 2 - 3 cm apart, separated by 2 - 3 mm silty caps. Base is convoluted and possibly bioturbated.

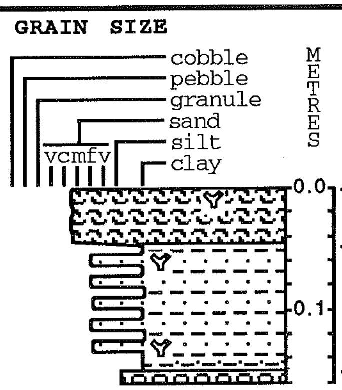
1260 - 1316 cm: bioturbated light gtay sandy silty mud, grading in colour fro, 5Y 5/1 at the base to 5Y 4/1 or 5Y 4/2 at the top. Bioturbation is moderate to heavy, with wispy lamination preserved from 1280 - 1295 cm, elsewhere lamination is vague within a dominantly mottled texture. Siltier from 1295 to 1316, and sandier from 1295 to 1260 cm.

93-030 013TWC Trigger Weight Core
Mouth Kangerdlugssuaq Trough DS1

Date logged: September 6, 1993

Logged by: F. J. Hein

Remarks: Cutter of trigger weight core, no real depth penetrated.

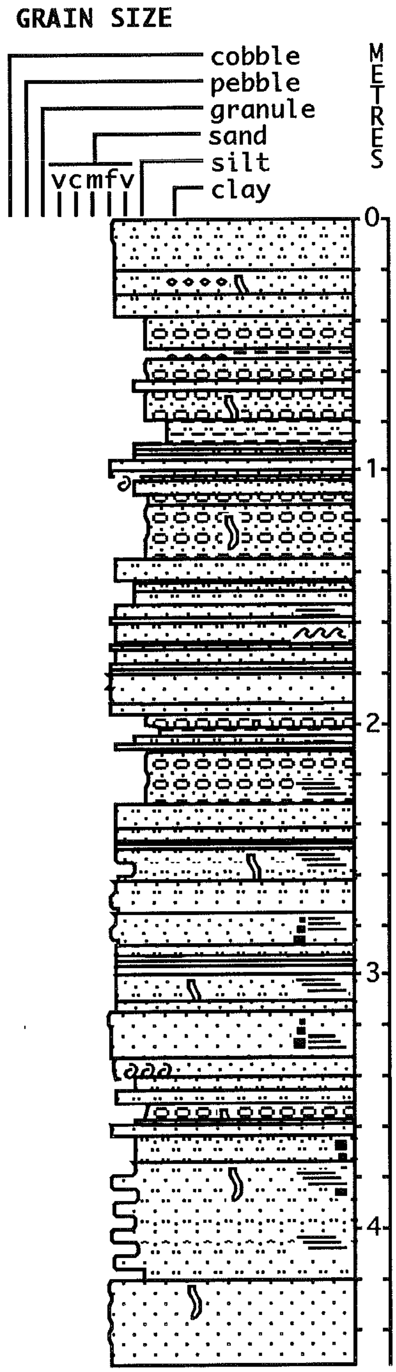


0 - 5 cm: loose coral or bryozoa-like debris, coarse sand to gravel size, along with loose pieces of tan silty mud. Originally (before cored) a well-washed coquina lag on top of silty mud.

5 - 15 cm: tan (2.5Y5/2) sandy silty mud, with scattered admixed coral or bryozoa-like fragments

15 - 16 cm: as above, with dropstones, including one that is encrusted with barnacles, diameter 4+ cm of stones, and appear to be dark volcanics (not removed from core).

93-030 007 LCF Long Core Facility
Mouth Kangerdlugssuaq Trough

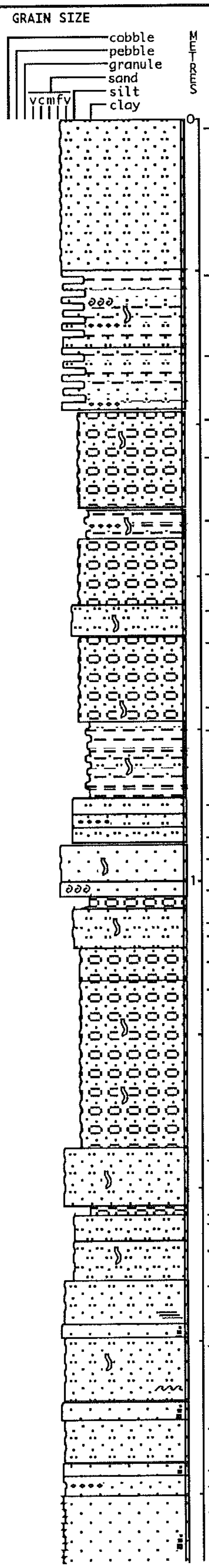


93-030 007 LCF Long Core Facility
Mouth Kangerdlugssuaq Trough

Date logged: September 6, 1993

Logged by: F. J. Hein

Remarks: In the second core section: gritty sediment, container may not be entirely full and/or some sediment may have been lost on extruding. 303 - 310 cm not full in liner, 343 cm crack in sediment.



0-20 cm: Firm, ochre/tan (2.5Y5/4, 2.5Y6/4) silty granule sand. At 9 - 13 cm internal fold of black sand (2.5 Y3/2) with ochre-tan silty sand, ? associated with drag along with coring or an original synsedimentary fold.

20 - 30 cm: tan brown/ gy brown (2.5Y3/0, 2.5Y3/2) 1 cm-thick sands graded into light tan (2.5Y 6/2, 2.5Y5/2) 0.5 - 0.3 cm thick silty sand caps. Scattered shells and granules.

30 - 38 cm: tan (2.5Y6/4), gy (2.5Y4/0) and brown (2.5Y4/2) deformed, folded and churned silty sand with gy clay interbeds and dropstones at the base. ? deformed by coring or original feature.

38 - 44 cm: graded, med gy (2.5Y4/0) granule to granule silty sand, bioturbated.

44-51 cm: bioturbated graded-laminated dark sand (2.5Y4/) to light tan (2.5Y5/0) siilty sand with isolated and scattered drop granules.

Graded-laminated beds, with colour grading up from 2.5Y4/0 - 2.5Y5/0 - 2.5Y6/2, averaging 3 cm thick separated by 0.5 - 1 cm hemipelagics that are bioturbated. Depths of graded sands 51-54, 54-57, 57-59 cm.

59 - 64 cm: graded dark tan-gy (2.5Y3/0) granule sand to lighter tan (2.5Y5/2) silty sand, bioturbated/mottled throughout.

64-67 cm: light gy (2.5Y5/2) silt, with dispersed coarse sand/granule, mottled.

69 - 75 cm: light tan (2.5Y6/2) sandy silt with massive, ochre-tan square angular silt intraclasts and 'pelleted' intraclasts throughout and scattered coarse sand-granule grains (? glacial ice meltout)

75 - 79 cm: well graded dark black-gy (2.5Y3/1) - gy/TAN (2.5Y4/1) sand base to overlying silt with dispersed intraclasts. All one graded bed.

79 - 89 cm: bioturbated graded laminated dark black - gy sand (2.5Y3/1) tgo tan/gy (2.5Y4/1) silty sand, with isolated angular silt intraclasts. Depth of graded beds: 79-82, 82-85, 85-87, 87-89 cm.

89 - 93 cm: graded-laminataed sandy silt, with isolated dropstone pebble at 91 - 93 cm, bioturbated.

93 - 95 cm: as above, with angular silt intraclasts

95 - 100 cm: gy tan (2.5Y4/1) mottled sandy silty mud with dispersed gy-tan silt intraclasts.

100 - 103 cm: graded red (2.5YR5/2) granule to tan gy (5Y6/2) sand, sandy silt to silt. Bioturbated base and isolated shell fragments at top of bed.

103 -105 cm: dk gy (2.5Y6/1) sandy silt with dispersed tan to light gy silt intraclasts.

105-108 cm: dark sand with dispersed angular silt intraclasts and granules. Bioturbated base.

108 -113 cm: firm, tan (5Y5/1) silty sand/ sandy silt with dispersed granules.

113 - 135 cm: soft, dark sand (5Y4/1 to 5Y3/1) alternating with light gy-tan (5Y5/1) sandy-silt silty sand. Bioturbated/mottled with dispersed dorp granules and coarse sand. Graded intervals of dark sand, 1- 3 cm thick, alternate with medium gy (3-4 cm thick) silty intervals. Dispersed angular to subrounded silt intraclasts in both coarse and finer intervals.

135 - 142 cm: dark and light gy (5Y4/1, 5Y3/1) sandy silt, silty sand, vague lamination and grading, bioturbated throughout.

142 - 143 cm: dk gy (5Y3/1) granule-pebble, granule sand, with larger outsized pebble (? dropstone). Bioturbated top and base.

144 - 147 cm: light tan (5Y6/1) sandy silt, bioturbated.

147 - 152 cm: 5Y6/1 with 5Y3/1 mottles, mottled dark sand as burrow fills within lighter silty sand, vague lamination and silt angular to subround intraclasts.

152-160 cm: firm black (5Y2.5/1) to light gy (5Y4/1), well graded sand from med-coarse at the base to silty sand at the top. Basal half is laminataed. Turbidite BD type. Bioturbated top.

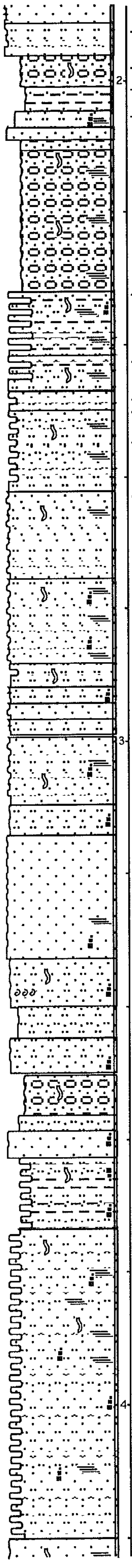
160 - 169 cm: firm dk gy (5Y2.5/1) well graded sand with medium-coarse sand basal few cm to lighter colored (5Y4/1) convolute laminated and bioturbated silty sand.

169 - 176 cm: Dk gy-bl (5Y3/1) silty sand to tan/gy (5Y4/1) sandy silt

176 - 178 cm: Med-dk gy (5Y4/1), graded thin (1 cm thick) sand-silty sand

178 - 180 cm: Firm, dk gy (5Y5/2) graded sand to silty sand w/ dropstones

180 - 191 cm: dk gy (5Y4/1) normally graded, medium-coarse sand - medium silty sand - sandy silt, with distribution grading, otherwise structureless.



191 - 196 cm: Med consistency, med dk gy (5Y4/1) silty sand, with irregular basal contact (possibly associated with core drag)

196 - 200 cm: Med consistency, med dk gy (5Y4/1), silty sand with dropseone granules throughout and a bioturbated/mottled texture.

200 -210 cm: firm, black (5Y2.5/1) granule silty sand graded to granular silty sand that fines up to md-dk gy (5Y6/2. 2.5Y6/2) bioturbated in yellow ochre sand silt.

210 - 232 cm: firm, yellow ochre with dark med gy sand (2.5Y7/2 to 2.5Y6/2) bioturbated and mixed. Large dropstone at 218 cm, subround, 3 cm, dark volcanic rock fragment.

232 - 242 cm: dk-gy/black (5Y2.5/1, 5Y6/2) graded-laminated intervals of sand to silty sand alternating with gy/ochre (2.5Y6/2) silty sand. Bioturbated and mixed.

242 - 247 cm: black (2.5Y3/1) sand graded to yellow-brown (2.5y6/4) silty sand, as graded laminated intervals few cm thick, bioturbated.

247 - 250 cm: yellow tan (2.5Y6/2) sandy silt, bioturbated with burrow fills of black (2.5Y3/1) medium - coarse sand at the base.

250 - 255 cm: bioturbated coarse black (2.5Y3/0) sand as burrow fills within brown (2.5Y6/2) silty sand.

255 - 262 cm: becomes more silty and better laminated as burrowing density decreases downcore.

262 - 275 cm: gy (2.5Y5/2) with black (2.5Y3/0) mottles of medium - coarse sand inmixed by bioturbation within a gy silty sand. Lamination becomes more apparent in the lowest few cm, spaced 1 - 3 cm apart.

275 - 288 cm: black sand (2.5Y3/0) med-coarse grained, 0.5 cm thick, at the base of graded couplets, capped by tan (2.y5/2) silty sand intervals. Minor disruption due to bioturbation (not overwhelming).

288 - 292 cm: ochre-tan (2.5Y6/2) silty sand/sandy silt, bioturbated.

292 - 295 cm: graded black (2.5Y2/0) sand grading into tan gy (2.5Y5/0) silty sand, well graded.

292 - 302 cm: deformed by coring, medium to coarse black (2.5Y2/0) sand graded to tan-gy (2.5Y4/0) medium sandy silt.

300 - 310 cm: Soft, graded-laminated black sand and gy silty sand, with bioturbated intervals as above.

310 - 314 cm: Soft, dk gy (5Y3/11) normally graded med-coarse sand to silty medium sand, no sedimentary structures.

314 - 320 cm: soft, dk gy (5Y3/1) normally graded coarse to medium sand graded upwards to silty medium sand, otherwise structureless.

320 - 333 cm: Soft, dk gy (5Y3/1) , normally graded coarse- medium sand at base, to medium sand within silt at the top. Vague silty interlaminae near base (? amalgamated beds).

333 - 340 cm: Meiudm consistency, med gy (5Y4/1), bioturbated sandy silt/ silty sand (sand is mixed by bioturbation down from the upper bed into the silt). Gradual colour changes at upper and lower bed contacts, reflecting mixing by bioturbation.

340 -356 cm: Firm, well graded, from dark gy (5Y3/1) granule sand at the base, to medium gy (5Y4/1) silty sand, to light tan (5Y7/1) sandy silt at the top. Isolated gy silt intraclast. Bioturbated/mottled throughout.

356 - 360 cm: Firm, graded dk gy (5Y3/1) medium sand, graded to light tan (5Y7/1) sandy silt at the top. The base is loaded and/or bioturbated, with vague parallel lamination in lower bed portions.

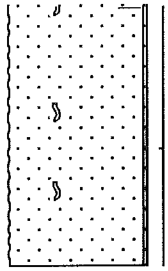
363 - 373 cm: Plastic, ochre tan/yellow tan (5Y6/1) normal to inversely graded, sandy silty mud. At the base and top the unit is bioturbated into sands on either side of the more silty interval.

373 - 379 cm: Firm, graded-laminated black (5Y3/1) coarse sand to gk gy (5Y5/1) silty medium sand. Uppermost part of bed becomes sandy again due to bioturbation mixing from bed above.

380 - 400 cm: Firm, graded black sands (5Y3/1) to tan gy (5Y5/1) silty sands, as graded laminated units. Basal sands average 0.5 cm thick, with more silty caps 1 - 3 cm thick. Bioturbated/mottled throughout.

400 -420 cm: Firm, somewhat disturbed, black to dk gy coarse sand, grading into interlaminated black sand/light gy silty sand. Colours as above unit. Difficult to discern structures due to core disturbance. Appears to be a normallly graded-to graded-laminated unit.

420 - 454 cm: Firm, black to dk gy (5Y4/1), structureless, possibly dewatered, medium to fine sand. A bit coarser grained at 430 cm depth. Uppermost 10 cm has



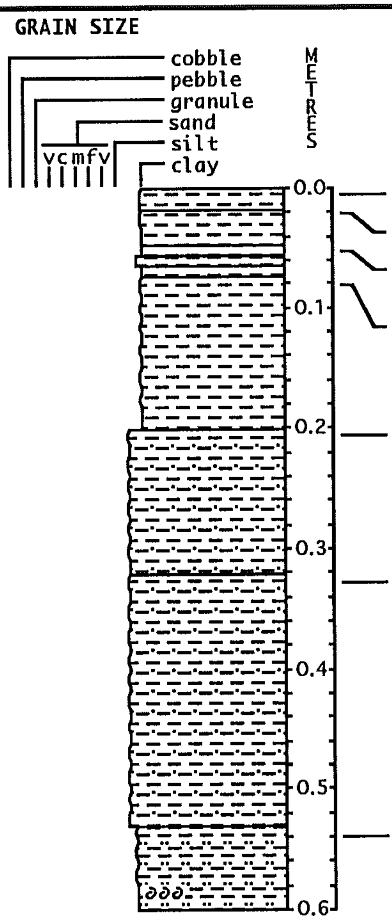
vague more silty banding.

93-030 019B Push Core in Box Core
Kangerdlugssuaq Trough KT3

Date logged: September 8, 1993

Logged by: F. J. Hein

Remarks: Colormet F13 is a calibration reading



0 - 2cm: Very soft, dark tan brown (2.5Y5/6) clay, bioturbated and bioturbated irregular base.

2 - 5cm: Very soft, medium light gy (5Y5/2) clay

5 - 8 cm: Very soft, irregular tan brown (2.5Y5/6) silty clay as an interbed/burrowed within a gy (5Y5/2) clay

8 - 20 cm: Very soft, medium gy (5Y5/2) clay

20 -32cm: Very soft, slightly darker gy clay (5Y4/2) with black mottles (5Y3/1). The mottles are black fine-medium grained.

32 - 53 cm: Soft, gy (5Y5/1) sandy clay with dark black (5Y3/1) sand as burrow fills.

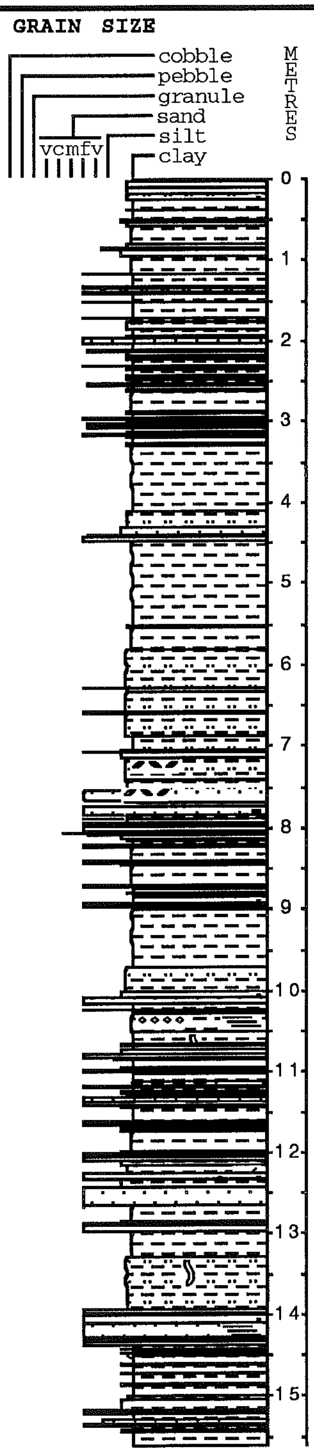
53 - 60 cm: Soft, lighter gy (5Y4/2) sandy silty clay, with minor burrow fills of sand. Small bivalve shell, 3 mm diameter, at 58.5 cm depth.

93-030 028LCF Long Core Facility
Kangerdlugssuaq Fiord KF1

Date logged: September 9 & 10, 1993

Logged by: F. J. Hein

Remarks: 0 - 23 cm. Section disturbed when split open. Core section split with hot knife, 0 - 60 cm. slightly disturbed. Cracked vertically in center from 315 - 329, 650 - 660 , 665 - 679, 721 - 731, 840 -920, 940 -945cm. Most of cracking associated with liner fle

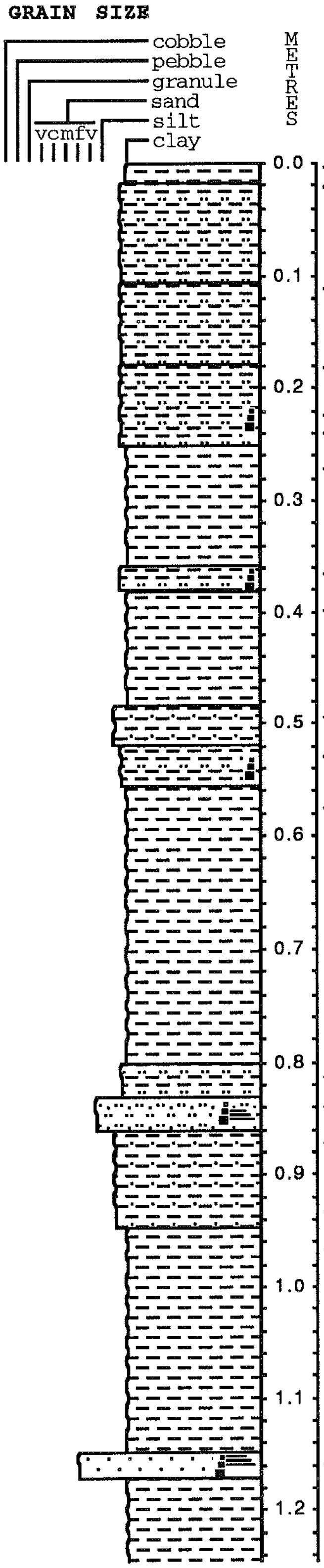


93-030 028LCF Long Core Facility
Kangerdlugssuaq Fiord KF1

Date logged: September 9 & 10, 1993

Logged by: F. J. Hein

Remarks: 0 - 23 cm. Section disturbed when split open. Core section split with hot knife, 0 - 60 cm. slightly disturbed. Cracked vertically in center from 315 - 329, 650 - 660 , 665 - 679, 721 - 731, 840 -920, 940 -945cm. Most of cracking associated with liner fle



0 - 2cm: Soupy, dark brown/yellow tan (2.5Y5/4) clay

2 - 11cm: Soupy, medium dark tan-brown (2.5Y5/2) silty mud

11 - 18cm: Soupe, dark gy (2.5Y5/2) sandy silty mud with dispersed fine to very fine black (2.5Y5/0) sand

18 - 23cm: Soupy, dark to light gy (2.5Y6/2 to 2.5Y5/2) silty clay.

Sandy at base with good normal grading.

23 - 25cm: Soft, light gy (2.5Y6/0) slightly silty clay, bioturbated base. Base of graded bed.

25 - 36cm: Soupy, light tan gy (5Y6/2) clay

36 - 38cm: Soupy, medium dark gy (5Y5/1) silty clay. Base of bed.

38 - 48cm: Very soft, medium gray (5Y6/2) clay.

48 - 52cm: Very soft, medium gray (5Y6/2) sandy silty clay, normally graded. Base of bed.

52 - 56cm: Very soft, medium gray (5Y5/11) silty clay.

56 - 80cm: Very soft, light tan gray (5Y5/2) clay.

80 - 83cm: Very soft, light tan gray (5Y5/2) silty clay. Near base of bed.

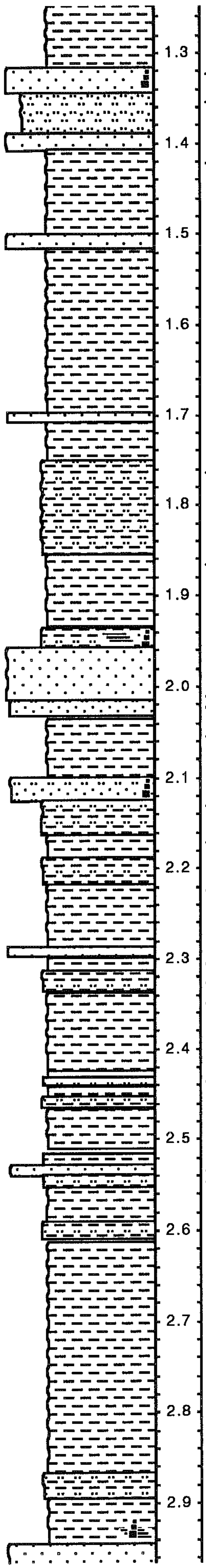
83 - 86cm: Soft, medium dark gray (5Y5/1) medium to fine (silty) sand with vague lamination and well graded.

86 -92 cm: Soft, medium dark gray (5Y5/1) sandy silty clay. Diamict.

92 - 95cm: Soft, light gray (5Y6/1), sandy silty clay, more silty, otherwise as above.

95 - 134cm: Soft, light tan (5Y5/2), mainly massive clay, witgh dark sand partings atg 117 and 134cm. At 134cm the sand parting occurs at a 10 - 15 degree angular discordace sloping down to the right with the core barrell.

117cm: Base of possibly amalgamated bed. Minor graded-laminated black sand alternating with lighter gy silty sand, each laminae about 1 - 2 mm thick.



134cm: Base of bed. Minor scour-and-fill cut down about 2 cm into the underlying bed. Scour is infilled with normally graded fine to very fine black sand.

134 - 141cm: Soft, tan gray (5Y5/2) slightly fining up bed of dispersed fine silty sand to very fine sand, overlain by dispersed fine sand in clay.

141 - 175cm: Soft, tan gray (5Y5/1), clay, massive with very fine and fine sand partings at 152 and 170 cm, otherwise structureless.

175 - 186cm: Soft to Medium Soft Consistency, gray (5Y4/1) slightly silty clay.

186 - 201cm: Medium soft consistency, gray (5Y6/2) clay underlain by well graded-laminated dark gray/black (5Y5/1 alternate with 5Y3/1) sand. Laminae are 1 - 2mm thick. Clay inverval is slightly silty at the base. Maximum grain size at the base of tghe med is coarse to medium sand.

Base of bed.

201 - 202cm: "triplet" of normal-to-inversely graded, dark (5Y5/1) silty sand to light (5Y7/2) sandy silt to dark (5Y5/1) silty sand.

202 - 211.5cm: Soft, graded dark (5Y5/1) sand to light gray (5Y6/2) sandy/silty clay to clay

211.5 - 216cm: Soft, dark gray (5Y5/1), inversely graded clay to silty clay.

216 - 222 cm: Soft, normally graded medium gy/tan (5Y6/1) 1 cm thick silty sand, graded to silty clay, and light gy (5Y7/1) clay. Bioturbated base.

222 - 230.5 cm: Soft, medium tan (5Y6/2) clay with a thin (0.5 mm) thick, dark black sand parting at the base.

230.5 - 231cm: light blue-steel-gray clay cap (2.5Y6/2), normal hemipelagic clays from the basin.

231 - 234cm: Soft, medium gray (5Y5/1) ungraded sandy silty clay, bioturbated base.

234 - 242cm: Soft, medium tan (5Y6/2) clay

242 - 246cm: Soft, dark gy (2.5Y4/0), dark (2.5Y7/0) and light (5y5/2) gray clay/silty clay. At the top is a "triplet" of dark (2.5Y7/0) sandy silt to ligh (2.5Y7/0) clay to dark (2.5Y4/0) sandy silt, that is normally to inversely graded, over a very thin 0.5 cm interval, overlying a slightly normally graded sandy silt, with a bioturbated base.

242 - 253cm: Soft, dark and light alternating clay and sandy silty layers. At the base is a dark sand-light tan silt-dark sand tripled (5Y6/2 with 5Y4/1) gradomg omtp a 0.5 cm silty clay, capped by a bioturbated and interlaminated, normally graded sandy silt to clay.

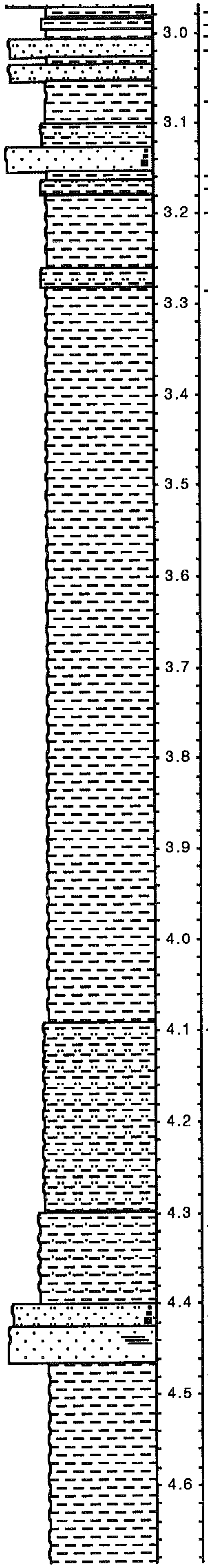
253 - 256cm: Soft dark and light medium brown (5Y5/0 and 5Y6/0) samdy silt to graded light clay, representing seasonal varves?

256.5 - 261cm: Soft, gray (5Y6/1) graded sandy silt to silt clay, well graded with bioturbated base.

261 - 297cm: Soft, medium tan/gray (5Y6/1) clay with minor sandy to silty interlaminate at 287 cm.

base of amalgamatged bed?

Graded-laminated base, from fine-to medium dark sand at the base to fine to very fine sand alternating with silty clay laminae in the next overlying few cm, overlain by graded silty clay, medium gray in colour (5Y5/1). Bioturbated base of sand.



297 - 298cm: Light steel-gray (2.5Y7/0) clay layer, normal hemipelagics of the "basin".

298 - 299cm: normal to inversely graded "triplet" of a graded dark sand parting, overlain by a lighter silty sand, that is inversely graded into a dark sand.

299 - 301cm: Medium tan gy clay (5Y6/2).

301 - 306cm: Graded-laminated couplets of dark sand (5Y4/1) graded into silty clay (5Y4/2) and clay (5Y4/1), each is about 2 - 4 cm thick, with bioturbated base.

306 - 315cm: graded dark gray to light gray (5Y4/1 to 5Y5/1 to 5Y6/2), fine to medium dark sand, to medium gray sandy silt, to light gran tan clay.

315 - 315.5 light steel- gray (2.5Y7/0) clay cap, hemipelagic basin facies.

315.5 - 317cm:Medium gray sandy silt (2.5y6/2) graded into a light gray (2.5y6/0) clay. Loaded and bioturbated base.

317 - 328cm: Normally graded-laminated from a sandy silty at the base, with alternations of sand and sandy/silt, abruptly grading into a bioturbated graded sandy silt to silt, capped by a light tan brown clay.

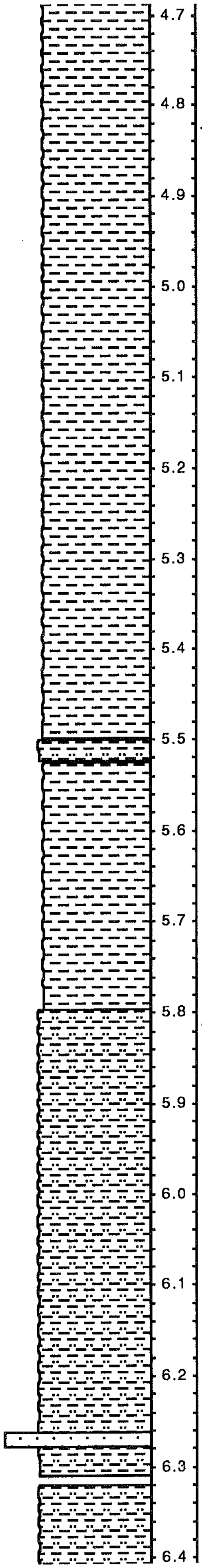
328 - 410cm: Medium light tan-gray (5Y5/2) clay, massive with no apparent grading.

410-430 cm: 5Y4/1 dark gray mottles in lighter medium gray 5Y6/2. Silty clay with mottles of dark fine sand as burrow infills, that are up to 0.5 cm in diameter. Normally graded throughout.

430 - 440cm: Medium gray (5Y5/2), sandy silty clay, massive.

440 - 446cm: Medium gray (5Y5/2) silty clay with laminae of dark (5Y4/1) sand. Sands at the base are graded-laminated medium to fine sand alternating with silty sand, graded over 2 cm, and within a small-relief (cm scale) scour fill. Loaded/scoured base.

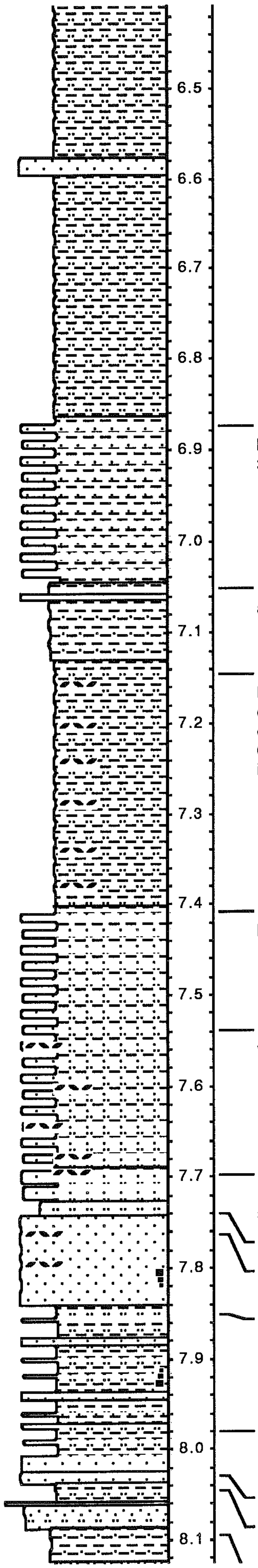
446-481 cm: Light to medium tan-brown/gray (5Y6/1 to 5Y5/1, intermediate in colour between these two designations on the Munsell Colour Chart), clay, massive.



481-550 cm: Firm, light tan brown (5Y5/1) clay, massive, top of very thick turbidite.

580 - 686 cm: Light tan gray brown (5Y5/1) silty mud, structureless aside from thin vague banding or lamination from 625-632, and a minor sandier interval at 657cm depth.

vague banding and lamination, otherwise stsructureless.



686 - 704cm: Light gray (5Y5/1) with darker streaks (5Y6/1) (? mottles) and darker (? coarser-grained) (5Y4/1) laminae. Graded sand-silty clay laminae as graded couplets. The sands are 0.3 - 0.5 cm thick alternating with silty clay 3 - 4 cm thick. Sand laminae become more apparent and thicker downcore.

704-713cm: graded dark to light gray (5Y5/1 to 5Y6/2), normally graded sandy silty clay to silty clay. Possibly amalgamated beds with a more sandy interval half-way upcore. Irregular scoured or loaded base of bed.

713 - 740cm: tan, light brown silt clasts (5Y6/3) within a dark to medium tan gray (5Y5/1) sandy silty clay, vague banding or lamination throughout, with about a 1 cm spacing to maximum 3 cm. Silt clasts are soft, 0.3 - 2 cm long, often convoluted and deformed, rounded to subrounded with the rare blocky and very angular, rectangular-shaped, clast (no evidence of water transport by a moving current). A medium to fine sand occurs at the base, maximum of 0.7 cm thick. The silt intraclasts may have originated as intraclasts within turbidity currents, by meltout of debris laden ice, or due to disarticulation and resedimentation of laminated sand and silt interbeds.

740 - 752cm: graded laminated, dark sand (5Y4/1) alternating with silty sand and sandy silt (5Y5/2 AND 5Y5/3). Well laminated and well graded couplets 0.5 to 1 few cm thick.

752 - 769cm: 5Y4/1(dark) alternate with 5Y5/2 (light), silt intraclasts (5Y5/3). Stratified sand and sandy silt as above with light brown sand intraclasts up to 3 cm long throughout the interval. Some of the intraclasts appear to be "deformed caps" of graded-laminated beds. Perhaps this is a slide or "incipient" slump deposit.

770 - 773cm: Medium gray (5Y5/1) convoluted sand, with medium to coarse sand interbedded with light tan brown (5Y5/3) silt interbeds and intraclasts, many of which are convoluted and deformed, and appear to be an incipient slump.

Deformed, possibly synsedimentary faulted and/or folded silt intrabed

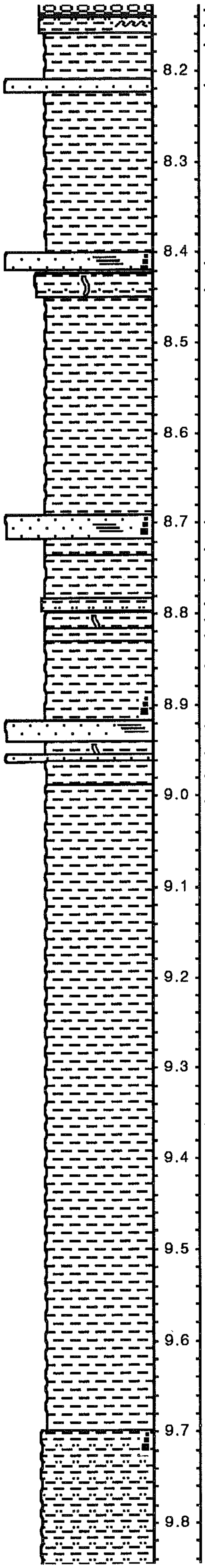
780 - 784cm: inversely graded fine-medium sand at the base to coarse sand at the top with dispersed silt intraclasts throughout, especially in upper bed portions. Base of possible debris flow/slide succession.

784 - 797cm: Soft, medium gray/tan brown (5Y5/1) sandy silty clay with vague sand laminae at 788 and 794 cm.

797 - 803cm: Soft, graded laminated dark sand (5Y4/1) alternate with sandy silty clay (5Y5/1) as graded-laminated coupled that start with coarse/medium sand, to fine sand to sandy silty clay, which are all well graded. At the base the coarser interlaminae are 0.7 cm thick, at the top 0.3 cm thick. Coarse sand at base of succession, fine sand at the top.

Graded-laminated sandy base.

803-809cm: Soft, graded-laminated dark silty sand (5Y5/1) alternating with lighter gray (5Y6/1) sandy silt. Grain size of sand is medium to fine.



809 - 812.5cm: Firm, ddark gray (5Y6/1) sandy silty clay

812.5 - 813.5cm: granule parting, volcanic rock, quartz and feldspars

813.5 - 815.5cm: Convoluted coarse sand and sandy clay.

815.5 - 872cm: Firm, tan (5Y5/2) clay, generally massive with minor dark sand partings and sandy clay partings.

dark sa - lt silt/cl - dk sand "triplet" 0.5 cm thick

843cm: 1.5 cm thick fine sand partings, graded laminated of fine to medium sand, grading into clay at top.

Bioturbated gray tan sandy clay at the base of the graded-laminated sand due to mixing by bioturbation of sand into the underlying beds.

872: At base of thick clay is a graded-laminated succession upwards to 865cm core depth of interlaminated dark and light silts (10YR5/3 and 5Y5/2) above a dark (5Y5/1) sandy base of medium to fine dark sand.

872 - 873cm: Light, steel-gray (5Y7/0) bioturbated clay, hemipelagic sed.

873 - 878cm: Light tan (5Y5/2) clay

878.5 - 879.5cm: at base, dark (5Y4/1) - light (5Y5/1) - dark (5Y4/1) sand - silt -sand.

879.5 - 881.5cm: bioturbated light gray (2.5Y7/0, normal hemipelagic) and light tan (5Y6/1, top of turbidite) clays and silty clay.

881.5 - 883cm: alternating dark fine sand (5Y5/1) and light (5Y4/6 or 2.5Y7/0) silty clay and clay hemipelagics.

883 - 894cm: tan (5Y5/2) clay

Basal cm or so, graded laminated dark sand into dark and light silty sand and silt, normally graded into overlying clay.

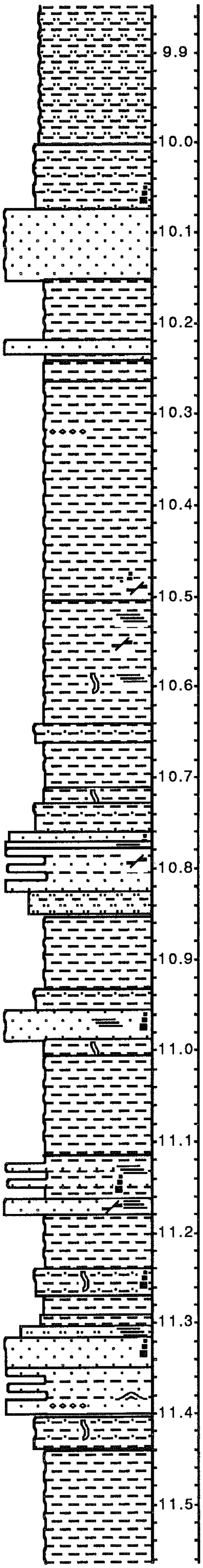
894 - 897cm: dark and light gray (5Y5/2 and 5Y5/1) graded-laminated sand (fine to medium) to silty clay and clay, bioturbated.

897 - 898cm:Very firm, bioturbated dark turbiditic and light hemipelagic clay (5Y5/1 and 2.5Y7/0)

898 - 935cm: Very firm, light tan (5Y5/1) clay

935 - 970cm: Very firm, massive light gray-tan (2.5Y4/2) clay.

970 - 1000 cm: mottled and vaguely laminated light (2.5Y5/2) and dark (2.5Y4/2) gray tan silty clay. As above, but siltier with slight sandier dark mottles due to bioturbation mixing of formerly graded-laminated sand/silty clay.



1000 - 1015cm: Soft, graded dark medium gray (5Y4/1) at base to medium gray (5Y4/2) at top of this interval. Well graded from a medium to fine sand at the base, grading upwards into a silty fine sand near the top of this interval. Base is scoured and loaded, with an isolated flute cast seen in core.

1015 - 1023cm: Firm, light tan (2.5Y5/2) well graded, at the base is a .3 cm thick dark medium to fine grained sand that is graded over 1.5 cm into the overlying clay. Base of sand is irregular due to faulting in underlying bed.

1023 - 1023.5cm: Firm, light gray clay (2.5Y6/1) gray clay cap, faulted base, interpreted as synsedimentary faults (probably associated with earthquake loading, or reactivation along faults perhaps associated with glacial rebound).

1023.5 - 1024.5cm: Firm, light tan (2.5Y5/2) graded from a dark sand parting at the base to a light tan clay, that is bioturbated at the top. The topmost clay is a much lighter gray (2.5Y6/1), 2 - 3mm thick, and is possibly a normal hemipelagic basinal clay.

1024.5 -1027cm: light tan-gray (2.5Y5/0) clay, underlain by
1027 - 1032 cm: bioturbated light tan/dark gray clay laminae (2.5Y5/2).

At 1032: large 2cm+ dropstone in a massive tan clay.
1032 - 1050cm: Firm, tan clay (2.5Y5/2) which towards the base grades down into light and dark gray (2.5Y5/2 lt, 2.5Y4/0 dk) graded-laminated sand and silty sand in the lowest 2 - 3 cm. Very base is marked by synsedimentary faults, with mm of offset along individual lamina.

1050 - 1071cm: Firm, graded-laminated clay, silty clay, with minor sandy silty clay, that is locally bioturbated, and shows some synsedimentary faulting along bases of beds. Laminae as follows:
1050 - 1051.5: lt gy (2.5Y6/0) bioturbated clay cap, faulted
1051.5 - 1051.8: dark/lt/dk silty cl - cl - cl (2.5Y6/0, 2.5Y5/2) "triplets"
1051.8 - 1055: tan clay (5Y5/2), with faulting at 1055
1055 - 1062.5: bioturbated, interlaminated dark (2.5Y4/2) and lt (2.5Y6/0) clay
1062.5 - 1064.5: tan gy (5Y5/2) clay
1064.5 - 1067.5: dark med gy sandy silty clay diamict
1067.5 - 1071cm: lt tan (2.5Y6/0) hemipelagic and lt tan-gy (2.5Y5/2) turbiditic clay

1071 - 1073: lt tan-gy (2.5Y5/2) turbiditic clay, bioturbated.

1073 - 1077cm: Firm, graded-laminated fine-medium dark sand at base, into dark and light silty sand to sandy silty mud at top, that is bioturbated.

1077 - 1082cm: interlaminataed dark med gy silty clay and dark sands, mm scale thick partings, with synsedimentary faults.

1082 - 1090cm: Firm, medium tan (2.5Y5/2) clay and silty clay at the top; the boundary between the two is at a 20 - 30 degree angular discordance and possibly represents a dislocation surface.

1090 - 1099cm: Very firm, graded at base from dark gray (5Y4/1) to light tan gray (5Y5/1). Basal sand is scoured and infilled, with graded-laminated sand - silt. Medium to fine sand grades upwards to silty fine sand.

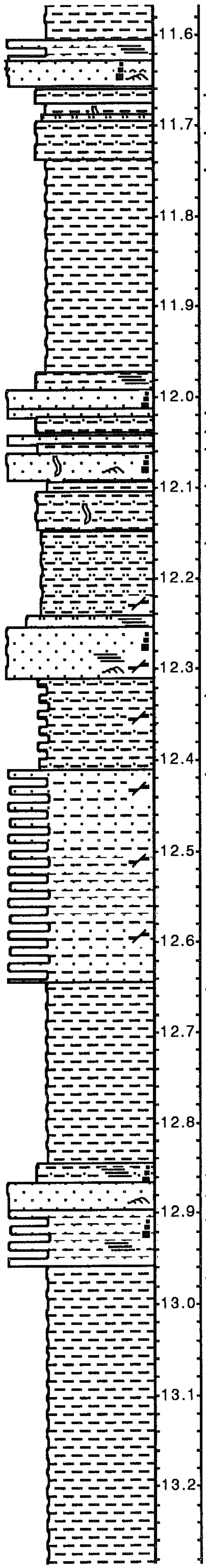
1099 - 1119cm: Very Firm, graded at base from 10YR5/1 to 10YR6/1 at top with mottled burrow fills of 10YR7/1 or 10YR6/1. Base of the graded unit appears to be a faulted and/or scour-and-fill contact, with very abrupt contactg that is near-vertical on the sides, and lightly bowed to the left side. Relief is minor (cm scale). Infilled with graded-laminated sand-silty sand. A .5 cm thick dark gray medium to fine sand is overlain by 4 cm of laminations are very fine sand, 3 - 4 mm thick, alternate with very fine sandy silt, 1.5 - 0.3 mm thick. Very top of unit is a lighter coloured ochre clay (hemipelagic basinal facies) that is bioturbated , and infilled with turbiditic more sandy silty material.

1119 - 1126cm: graded from 10YR5/1 at base - 10YR6/1 - 10YR5/1 at top. Lower part is a dark gy brown sandy silty clay diamict that grades over 2 cm into a light gy brown (10YR6/1) clay. The base of the bed is bioturbated.

1126 - 1135.5cm: Very firm, graded from 10YR5/1 at base - 10YR6/1 upcore. Base is graded-laminated ovr 2 cm thickness from dark sand to slight gray clayey silt.

1135.5 - 1140cm: alternating dark (10YR6/1) and light (10YR7/1) sand and clay (originally graded-laminates), now draped around a dropstone that is centered around a gouge in the core. Disturbance is not associated with coring, but rather draped or folded around the dropstone clast.

1140 - 1165cm. Very firm, graded from 10YR5/1 to 10YR6/1 at base to 10YR5/1 with 10YR7/1 mottles at top. Base is deformed or folded medium to fine sand, graded to laminated over 5 cm, with alternating parallel laminated fine sand to very fine sandy silt, overlain by a light tan clay, which at the top becomes a coarser sandy clay due to burrow mixing from above bed.



1165 - 1170cm: dark (10YR5/1) - light (10YR6/1) - dark (10YR5/1) "triplet" of bioturbated sandy silty clay normally graded to clay, inversely graded to bioturbated sandy silty clay.

1170 - 1174cm: graded from light gray (2.5Y5/2) to light tan (2.5Y6/) bioturbated clay with coarse sand as burrow fills, boundaries are irregular, possibly loaded, and bioturbated at the base and the top with surrounding beds.

1200 - 1201cm: Stiff, inverse to normally graded sand, from fine to fine-med-fine base of bed that grades into overlying units.

1201 -1205cm: Stiff, graded laminated coarse to very coarse sand at the base, graded-laminated into bioturbated silty clay. Scoured base.

1205 - 1209cm:graded rippled to laminated, medium to fine sand at the base, grading up into bioturbated sandy silty clay. Scoured base.

1209 - 1210cm: light (2.5Y6/0) amd dark (2.5YR5/2) alternating clays, bioturbatged/loaded.
1210 - 1212cm: bioturbated dark clay (10YR5/1), slightly normally graded at the base into sandy silty clay.
1212 - 1214cm: bioturbated top of bed below that is a coarser sandy silty clay due to mixing of coarse material down from bed above.

1214 - 1231cm: graded, rippled to laminataed dark tan brown (10YR5/1) sand at the base, grading up into lighter tan brown (10YR7/1) rippled very finhe sand and silt, then into light tan parallel laminated silt. The base of the bed and the rippled interval appears to be synsedimentary faulted.

1231 - 1241cm: Stiff, graded from sandy clay to clay intervals that were graded-laminated, but now distorted due to synsedimentary faulting of altgernating light (10YR6/2) sandy clay and dark (10YR5/1) sand. Base is mainly a dark (5Y6/1) deformed dark-medium gy sandy clay. Faulting is obviously synsedimentary and not due to core disturbance.

1241 - 1264cm: Stiff, synsedimentary faulted, graded interlaminated dark (5Y6/1) sandy silty/ silty sand, medium gray (5Y6/1) sandy silty clay, and llight tan (2.5Y6/1 to 2.5Y7/1) clay. Originally graded-laminated beds that are now presently deformed due mainly to synsedimentary faulting (possibly associated with earthquake shock, or due to reactivation along pre-existing faults perhaps with glacial unloading and rebound). FOR DETAILS SEE CORE SHEETS.

1264 - 1284cm: Stiff, light tan (2.5Y5/2) clay

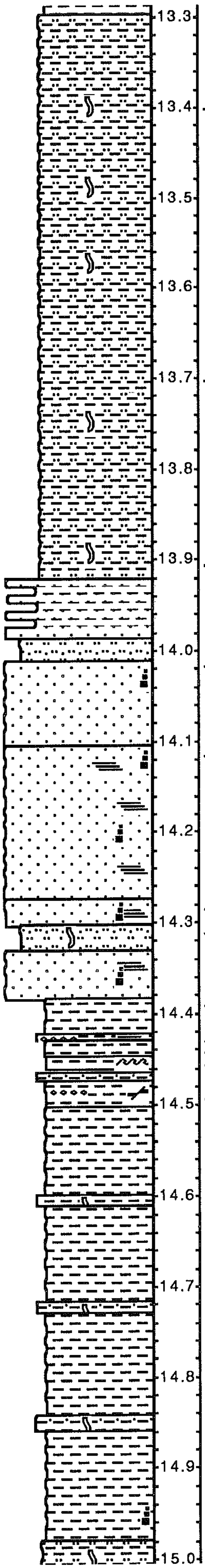
1284 - 1286cm: Stiff, medium gray (5Y6/1) sandy silty clay.

1286 - 1290cm: Stiff, well graded-crossbedded-laminated medium coarse sand 1 cm thick at base, overlain by rippled or folded/drape of medium to dark gray silty sand/ sandy silt. Scoured/loaded base.

1291 - 1296cm: Stiff, alternating and graded-rippled medium to fine sand and sandy silty clay, with clay caps and one very light gray (2.5Y6/1 to 2.5Y7/1) normal hemipelagic basinal clay interbed. Minor distortion due to possible loading from above associated with emplacement of overlying turbidite bed.

1296 - 1402cm: Stiff to medium firm, thick graded interval of well graded clay, to silty clay, to sandy silty clay overlying a graded-laminated sand interval. At top clay is 2.5Y5/2 to 2.5Y6/2 from 1300 - 1340cm as a slightly lighter tan color.

1300 - 1340cm: slightly darker coloured silty clay (2.5Y6/2)



1340 - 1392cm: mottled bioturbated throughout.

1370+cm: coarse to medium sand finely dispersed within silty clay.

1392 - 1401cm: Medium firm, medium to dark gray (5Y4/1 alternate with 5Y6/1) vague banded lighter coloured sandy silty clay alternating with darker medium to fine sand interlaminae.

1401 - 1412cm: Medium soft, medium gray (5Y6/1) well graded, gray medium sand at 14112 to silty sand at 1401cm.

1412 - 1428cm: Moderate soft, medium gray (5Y6/1)sand . Graded and stratified, with well developed grading and stratification, from medium to coarse sand at the base, alternating with fine sand at the top. Coarser sand laminae are 2 -3 mm thick, alternating with fine silty sand 1 cm thick.

1428 - 1430cm: Base of thick graded sany turbidite. Base is scoured, which is slightly bioturbated into bed below. Scour infilled with black (5Y3/1)/ gray (5Y5/1) graded-laminated sand, that is medium to coarse-grained at the base, grading up quickly into medium coarse sand that alternates with fine-medium sand. Laminae range from 1 mm coarse to 5mm for fine sands.

1430 - 1438cm: Medium soft, black to dark gray (5Y3/1 to 5Y5/1) graded sand silt, which is inversely graded at the top due to admixing of sand from the above bed due to bioturbation. Very well graded - laminated from medium to coarse sand at the base to bioturbated silty very fine sand at the top. Scoured base.

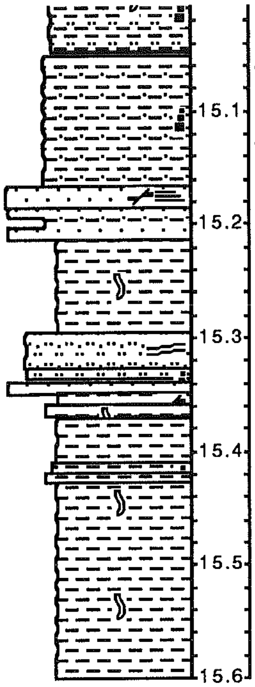
1438 - 1442cm: Firm, tan brown (10YR5/2) clay

1442 - 1443cm: Firm, medium gray brown (10YR5/2) laminated sandy silty clay with "dropstone" granules.

1443 - 1445cm: Firm, tan (10YR5/2) clay

1445 - 1446cm: convoluted, ?folded/loaded light gy (2.5Y6/0) clay.
1446 -1447cm: medium gray (10YR5/2) silty sandy clay.
1447 - 1448cm: tan, sandy silty clay
1448 - 1450cm: fault rotated blocks of medium dark gray clay with angular granule dropstone pebble and sandy mottles.

1450 - 1505cm: light tan gray (10YR5/2) clay with occassional pockets (3 - 4 cm diameter) of more sandy zones, mottled/bioturbated.



1515 - 1518cm: Firm, well graded, vague laminated, medium gray (5Y4/) fine to very fine silty sand and sandy silt.

irregular contact at base, ? internal load structure, or amalgamation of beds.

Firm, graded laminated black-dark gray (10YR5/1 to 5Y4/1) coarse to medium sand, graded and laminated, fining upcore to medium-gray (5Y4/1 to 10YR5/1) fine to very fine sand at the top. Base is faulted and/or scoured.

1518 - 1521cm: Firm, medium gray (5Y4/1 to 10YR5/1)graded sand to light gray (10YR6/1) silty clay at the top of individual beds. Loaded and faulted at the base of beds in particular. Synsedimentary faults.

1521 - 1530cm: Stiff, medium gray to light gray (10YR6/1, 10YR6/2) clay, vague bioturbation

1530 - 1533cm: Stiff, medium gray (10YR6/2) silty sand with vague lamination, possibly crossbedded. Scoured base.

1533 - 1535cm: Stiff, graded-laminated dark gray sand to bioturbated sandy-silt, within graded laminae coarse sand and granules within basal units.

1535 - 1535.5cm: light gray (10YR7/2) clay cap interbed, that is rotated or faulted and/or bioturbated. Normal basinal hemipelagics.

1535.5 - 1537cm: Stiff, medium dark, bioturbated sandy silty clay.

1537 - 1543cm: Stiff, graded medium gray sandy silty clay to light tan (10YR5/1) clay. Possibly disturbed by coring at base.

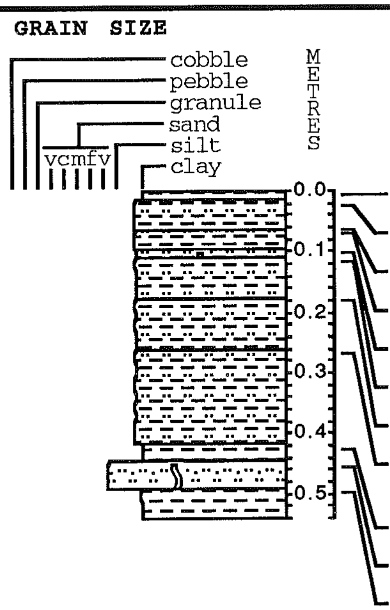
1544 - 1560cm: Core cutter sample: medium tan (10YR5/2) clay, with vague bioturbation.

93-030 023C Push Core in Box Core
Kangerdlugssuaq Fiord Mouth KF1

Date logged: September 9, 1993

Logged by: F. J. Hein

Remarks: Very soupy, difficult to keep intact during removal from box core and during split. 0 - 20 cm slightly disturbed when splitting. Very soupy especially top 10 cm.



0 - 2 cm: Soupy, yellow tan (5Y6/3) clay

2 - 7 cm: Soupy, lt gy (5Y6/2) silty clay

7 cm: at base black (5Y2.5/1) medium-fine sand parting

8 - 10cm: Very Soft, light gy (5Y6/2) silty clay

10 - 11.5cm: Very soft, yellow tan (5Y6/3) bioturbated silty clay

11.5 - 18cm: Very soft, light gy (5Y6/1) silty clay

18 - 26cm: Very soft, light gy (5Y6/1) silty clay with minor black fine sand as burrow fills.

26 - 42cm: Very soft, dk gy, black mottles (5Y6/3) in lt gy (5Y6/1), sand burrow infills within a bioturbated silty clay.

42 - 44cm: Very soft, light gy (5Y6/1) clay

44 -49cm: Very soft, light gy (5Y6/2) sandy silty clay, burrowed mottled

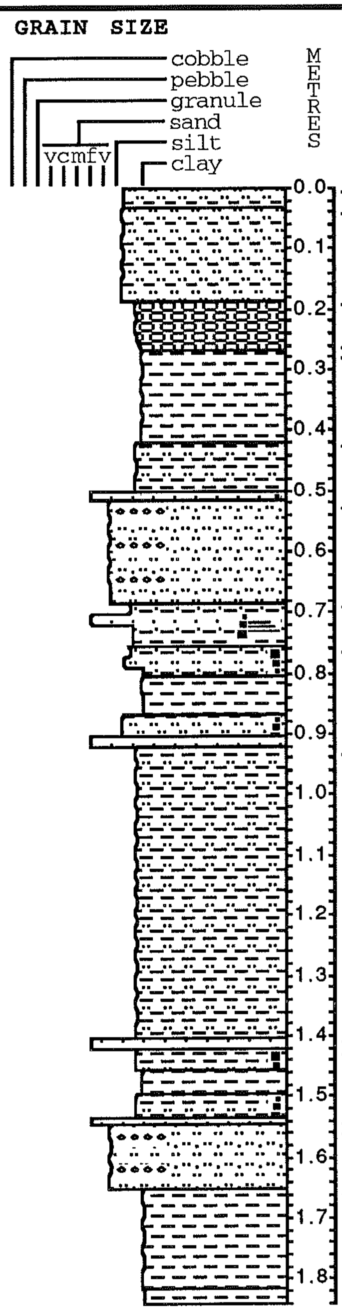
49 - 54cm: Very soft, light gy (5Y6/2) burrowed clay

93-030 028TWC Trigger Weight Core
Kangerdlussuaq Fjord KF1

Date logged: September 9, 1993

Logged by: F. J. Hein

Remarks: 0 - 20 cm soupy and disturbed.



0 - 3 cm: Very soft, dk brown/tan (2.5Y5/2) silty clay, massive

3 - 19cm: Very soft, lt med gy tan (5Y6/2) silty clay, massive

19 - 27cm: openwork, cohesionless, granule-coarse sand with large pebbles, 7 cm+ long. OLarger clasts are dominantly subrounded dark volcanic rock fragments. Granules and granule sand is K-feldspar-rich arkosic sandstone, with subrounded to angular dark volcanic, quartz and feldspar clasts. No obvious grading or internal structures. ? All dropstone meltout from debris laden ice, or from on top of floating ice.

Very irregular, ? loaded base.

27 - 42cm: lt med gy tan (5Y6/2) clay at the top 1cm, underlain by slightly darker med-gy tan (5Y5/1) clay below.

42 - 52cm: Soft, slightly lighter coloured brown/gy (5Y6/1) silty clay with dark black sand partings at 52 cm. Minor parallel lamination within the silty clay. The basal sand is abruptly-graded and laminated into the overlying silty clay.

52 - 68cm: Soft, slightly darker, medium tan gray (5Y6/2) sandy silty clay diamict. Very irregular base, perhaps loaded with scattered drop granules and coarse sand pockets throughout.

68 - 76cm: Soft, amalgamated graded beds of light to medium gray (5Y6/1) interlaminated with clay silty clay and grading up at the base from a dark black fine to medium sand. The contacts are irreular, and perhaps loaded and/or bioturbated at the base of this unit.

76-92.5cm: graded dark (5Y5/2) to light (5Y6/1) to dark (5Y5/2) gy tan silty clay - clay -silty clay, in a succession of normally to inversely graded, with the finest grained and lightest coloured clays in the centre. Perhaps representing large scale seasonal fluctuations of sediment input. The base is slightly more sandy and is normally graded into the overlying clay, which is then fairly uniform, then inversely graded into the overlying more sandy interval near the top at the base of the next bed.

92.5 - 142cm: Medium soft, medium tan-brown (5Y5/2) silty clay, massive

Basal few cm of this interval is fine to medium dark sand in graded-laminated units alternating with fine sand/silt interlaminae; that overall grades up into silty clay.

142 - 155cm: graded dark (5Y5/2) to light (5Y6/1) to dark (5Y5/2) gy tan silty clay - clay -silty clay, in a succession of normally to inversely graded, with the finest grained and lightest coloured clays in the centre. (see interval from 76 - 92.5 cm).

At 155cm: medium to fine dark sand break

155 - 165cm: Medium firm, medium gy (5Y5/2), fine-medium coarse sand and isolated dropstone pebbles several cm in diameter, angular to very angular, to subround, dominantly volcanic rock fragments within a medium gy sandy silty clay.

165 - 182cm: medium dark tan-gy-brown (2.5Y6/2) clay

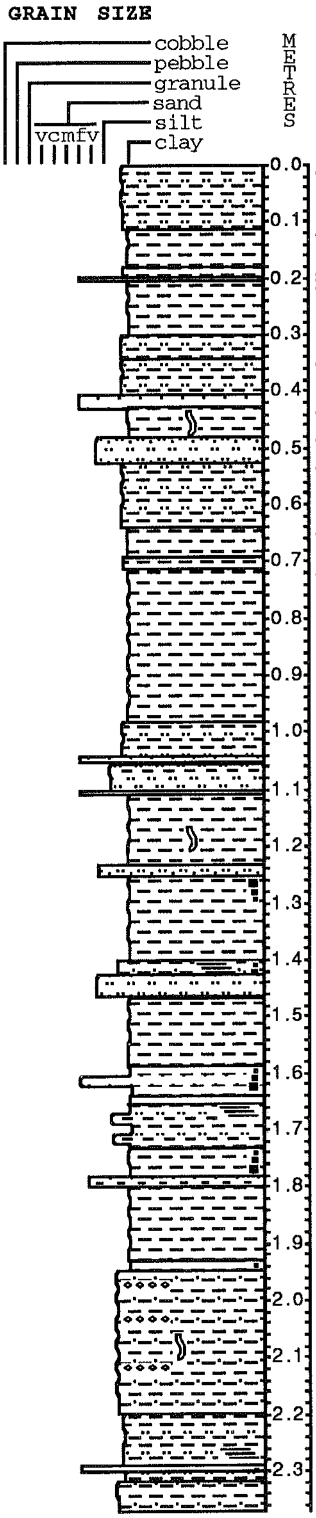
As above, but somewhat distirbed by coring.

93-030 024 LeHigh Core
Outer Kangerdlugssuaq Fiord KF1

Date logged: September 9, 1993

Logged by: F. J. Hein

Remarks: Top section disturbed during splitting, edge of core from 85 - 115 cm fell out and had to be put back in. Core cracked 140 - 160 cm.



0 - 12cm: Soft, light med gy (5Y5/2) massive (silty) clay

12-18 cm: Soft, light gy (5Y6/1), well-graded clay in upper bed portions

18 - 20cm: med gy/brown (5Y5/2) sandy silty clay

20 - 20.5cm: black (5Y3/1) laminated sand at base of bed

20.5 - 34cm: med gy to lighter gy/brown (5Y5/2 , base, to 5Y6/2, top), clay (silty), slightly graded with minor bioturbation, loaded or bioturbated base.

34 - 43cm: lt gy (5Y6/1) clayey silt, well graded, near base, at about 40 cm, laminated lt gy (5Y6/1) sandy silty (clay) that graded downcore into a better laminated dk gy (5Y4/1) fine sand parting at the base. Bed is well graded throughout.

43 - 48cm: Moderate soft, medium gy (5Y5/2) clay, massive and bioturbated.

48 - 53cm: More firm, slightly darker med gy (5Y5/1), sandy silt with dispersed fine to very fine sand

53 - 64cm: Firm, darker med gy (5Y5/1), slightly silty clay, disturbed or bioturbated.

64 - 71cm: graded med dark gy (5Y5/1) to med gy (5Y5/2), well graded silty clay at the basal 2 cm, overlain by fairly structureless clay

71 - 106.5cm: med gy (5Y5/2), graded silty clay. At the base of the unit is a laminated black sand alternating with gy silt, 0.5 cm thick interval.

106.5 - 111 cm: Soft, gy-tan (5Y5/2) well graded from a fine sand parting at 116 cm top an overlying slightly silty clay.

116 - 123cm: Soft, med-light gy (5Y5/1) clay, possibly bioturbated.

123 - 144cm: Mod Firm, med gy clay (2.5Y5/2) which at the base is normally graded from a black sand dispersed within a silty clay; and at the top is inversely graded to a sandy clay.

minor vague stratification at the base

144 - 154 cm: Mod firm, tan gy (5Y5/2) clay, graded top to bed

154 - 159cm: graded-laminataed base of bed, with vague sand laminae and partings, each 5 mm or less in thickness.

159 - 160.5cm: light gy (2.5Y6/0) clay, bioturbated with perhaps a loaded base.

164 - 167cm: graded-laminated couplets of medium tan (2.5Y5/2) silty clay overlain abruptly by light gy (2.5Y6/0) clay. Appear to be varve-like. Individual laminae are each about 1 cm thick

167 - 172 cm: well graded, darker medium tan (2.5Y5/2) sandy clay with dispersed black sand grading into a medium tan (2.5Y6/2) clay.

186 - 220cm: tan-gy (2.5Y5/2) silty clay, generally massive, with scattered pockets of coarse to granule sand and fine to medium sand. Possibly "dropstone" sediment from glacial ice. Minor bioturbation structures.

220 - 229cm: Moderately firm, medium tan (2.5Y6/2) slightly silty clay

229 - 230 cm: base of graded bed, laminated med tan (2.5Y6/2) and dk black (2.5Y3/0) and dk gy (2.5Y4/0) very fine sand and silty sand/sandy silt. Each lamina is 0.3 - 0.2 cm thick, alternating in cycles.

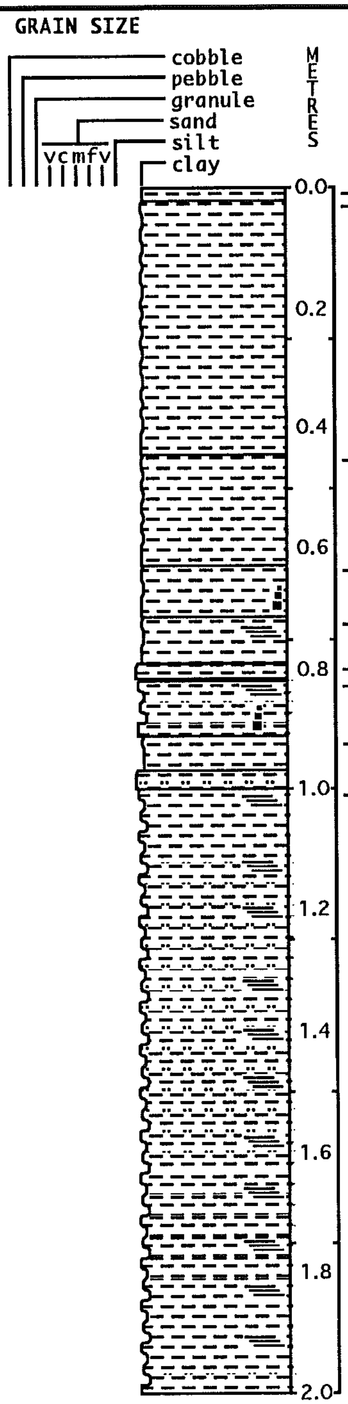
230 - 237.5cm: Moderately firm, medium tan (2.5Y6/2) silty clay/clay.

93-030 034TWC Trigger Weight Core
Head Kangerdlugssuaq Fiord KF3

Date logged: September 14, 1993

Logged by: F. J. Hein

Remarks: Top section split with a hot knife. Vertical cracks 108 - 122, and 145 - 153cm.



0 - 2cm: Watery, light olive gray (5Y6/2) clay

2 - 45cm: Watery, medium light olive gray (5Y6/3) clay grading down into soupy/ very soft clay.

45 - 63cm: Very soft, medium olive gray (5Y5/2) clay

63 - 72.5cm: Very soft, medium olive-tan gray (5Y5/2) grading to slightly less tan (5Y4/2) in the lowest 2.5+cm, clay possibly normally graded at the base, although not discernable in split core.

72.5 - 79cm: Soft, medium gray (5Y5/1) clay, graded and banded.

79 - 82cm: more tan (5Y5/2 to 5Y5/3), slightly silty clay

82 - 91cm: Soft, medium tan olive (5Y5/3) clay (0.7 - 1cm thick) alternatively banded wtih more gray (5Y5/ and slightly silty clay (1 - 1.5 cm thick) as graded couplets from the silty gray clay to the more tan olive clay a the top.

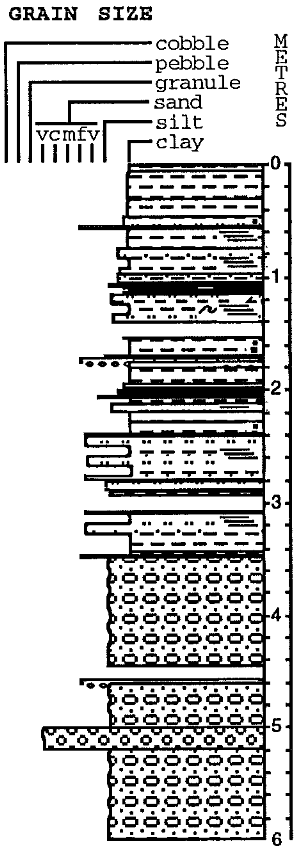
91 - 100cm: Soft, graded from 5Y5/1 to 5Y5/2 silty clay to 5Y5/3 more olive clay at top.

100 - 200cm: graded-couplets ("varves") of light gray (5Y5/1) silty clay (lt gy) grading into more live light gray (ol lt) (5Y5/2) clay, with rare occurrences of dark brown (2.5Y5/2) normal basinal hemipelagic clay. For details of colour and grain-size variation see the cruise sheet notes. These were described on a "bed by bed" basis.

93-030 034LCF Long Core Facility

Kangerdlugssuaq Fiord Head KF3

Remarks: Shear vane not done on 120 and 130 cm due to excellent details of fine sedimentary laminations. Excellent core, with superb preservation of <mm scale to cm scale, graded laminations with absolutely no distortion. Ignore Colormet L35 reading.

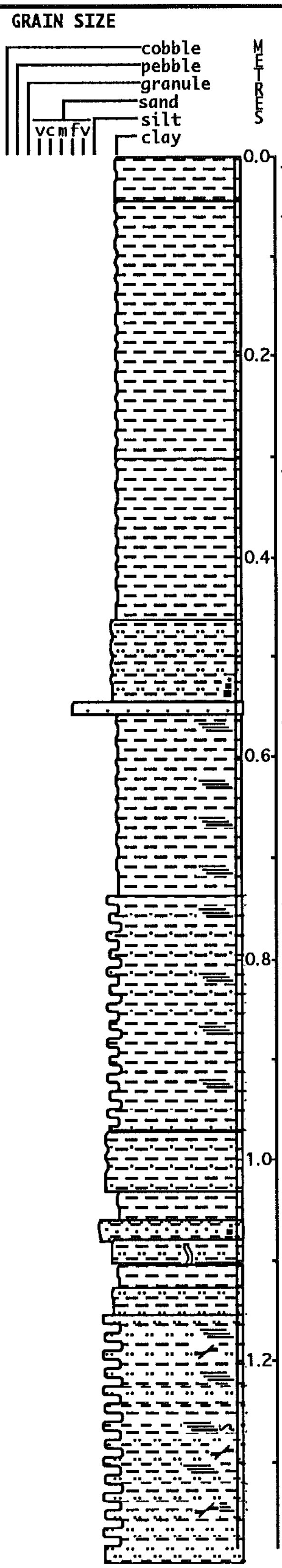


93-030 034LCF Long Core Facility
Kangerdlugssuaq Fiord Head KF3

Date logged: September 26, 1904

Logged by: F. J. Hein

Remarks: Shear vane not done on 120 and 130 cm due to excellent details of fine sedimentary laminations. Excellent core, with superb preservation of <mm scale to cm scale, graded laminations with absolutely no distortion. Ignore Colormet L35 reading.



0 - 5cm: Watery to soft, light olive (5Y5/2) clay

5 - 30cm: Soft, light olive gray (5Y5/2) clay

30 - 56cm: Soft, very slightly darker (5Y5/2) (silty) clay, especially lowest 0.1cm, with sand parting at the base. Normally graded in lowest 10cm medium to fine sand (quartz, volcanic rock fragments, and feldspars).

56 - 74cm: Vaguely banded, medium dark (5Y4/2) clay alternating with light olive (5Y5/2) clay, with a dark-light-dark "triplet" at the base. See cruise log descriptions for thickness and colour variations.

74 - 97cm: light olive (5Y5/2) clay alternating with medium dark gray (5Y4/2) sandy silty clay and medium dark gray (5Y4/2) silty clay, as graded intervals ("varving"), with minor lamination within the lowest 2 cm of this interval. Laminae at the base are dark (5Y5/2) sandy silty clay alternating with light gray (5Y5/1) silty clay on a mm scale. See cruise log sheets for details of lamination and colour variation.

97 - 103.5cm: Soft, medium dark gray (5Y5/1) silty clay.

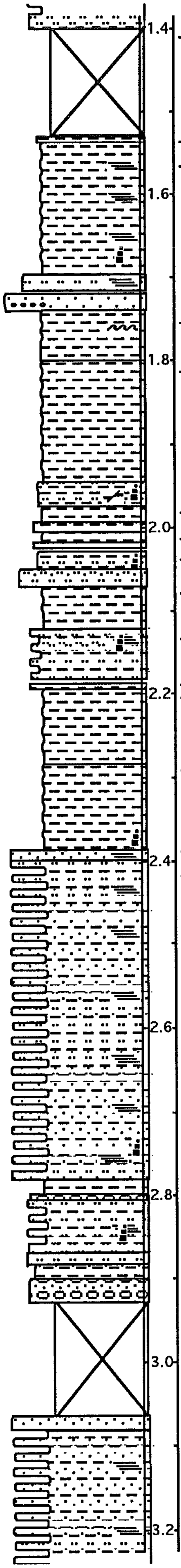
103.5 - 105.5cm: Soft, medium to light olive gray (5Y5/1) clay

105.5 - 108cm: Normally graded, coarse granule sand parting fining up abruptly into overlying light olive gray (5Y5/2) clay.

108 - 110.5cm: Medium brown-gray (10YR5/1) clayey silt, bioturbated base.

110.5 - 115cm: Graded, dark (5Y4/2) slightly silty clay overlain by lighter gray (5Y5/2) clay.

115 - 140cm: Medium firm, graded units of medium dark gray (5Y5/2) silty clay alternating with lighter coloured, olive-gray (5Y5/2) , very light olive-gray (5Y6/2), and less common brown (10YR5/2) clay interlaminae. Graded couplets vary in thickness as drawn on the cruise sheet logs, and most of the beds show synsedimentary faults along the coarser-grained lower bed contacts. From about 125 -128cm. is an isoclinally-folded, "bedding" parallel anticlinal fold nose and axis. This section probably represents the top of a slide and/or slump deposit.



140 - 153cm: Full-round subsample (whole core) taken for consolidation testing.

153-154cm: Soft, light gray-olive (5Y5/2) slightly silty clay capl to bed below.

153 - 174cm: Soft, light olive (5Y5/2) clay with medium-dark (5Y5/1) silty, and towards base, sandy clay. Overall unit is normally graded, with grading most pronounced in lowest 3 - 4 cm in which there are large pebbles at the base (? dropstones or part of flow) (3cm+ volcanic rock fragment), overlain by stratified sandy silty/ silty sand, grading abruptly into overlying clay. Perhaps loaded base.

174 - 180cm: Soft, dark-light-dark (5Y5/1 - 5Y5/2 - 5Y5/1) clay laminae bent or convoluted, overlain by dark medium gray (5Y5/1) clay. Convolution associated with loading from above bed, or emplacement of pebbles/granules as dropstone impacts.

180 - 197cm: Soft, medium gray (5Y5/2) clay, bioturbated upper few cm.
Basal few cm is normally graded -laminated from dark gray (5Y5/1) silty clay and light gray (5Y5/2) clay. Synsedimentary faults at the base.

197 - 201.5cm: Soft, graded-laminated in basal 0.5cm of darker medium gray (5Y5/1 to 5Y4/1) silty clay and clay, grading up into lighter gray (5Y5/1) clay. Synsedimentary fault at the base.

201.5 - 203.5cm: graded-laminated, from dark olive silty clay (5Y5/2) at the base to light olive gray (5Y4/2) clay at the top.

203.5 - 207cm: Moderately firm, graded from dark brown (10YR4/1 to 10YR3/1) silty clay within the basal cm or so, to slightly lighter brown (10YR4/1) clay.

212 - 218cm: Moderately firm, light olive gray (5Y4/2 at top grading downcore to 5Y5/2) slightly normally graded clay.

212 - 218cm: Moderately firm, graded-laminated, with vague lamination (0.5cm scale) of light olive gray silty clay and clayey silt.

218 - 220cm: graded, dark gray (5Y4/1) silty clay to lighter gray (5Y5/2) clay.

220 - 228cm: Moderately firm, light olive gray (5Y4/2) clay. At the base is an angular discordance with the underlying unit. Difficult to tell if it is scoured or not. Perhaps this surface represents an amalgamation of beds, or internal load structure.

228 - 239cm: Moderately firm, light olive gray (5Y5/2) clay.

239 - 240cm: Moderately firm, graded-laminated base of bed, that grades into the overlying clay. Base is dark gray (5Y5/2 to 5Y5/1) laminated sandy - silty - clay, that is well graded into overlying clay interval.

240 - 278.5cm: thinning- and fining-upward unit, of graded-laminated couplets ("varves") of medium dark (5Y5/1) silty clay that grades up into lighter olive-gray (5Y5/2) clay, as possible turbidite flows from either glaciofluvial discharge cycles reflecting climate variation, or else a series of retrogressive flow-failures further upslope.

278.5 - 281.5cm: graded bed from sandy granular silt at the base, to silty clay and clay, medium to dark (5Y5/1) gray.

287 - 289cm: laminted granule sand and sand (on working half) as perhaps a scour fill within sandy silty clay. Perhaps loaded base. This appears to be the base of a thicker turbidite, graded-laminated interval.

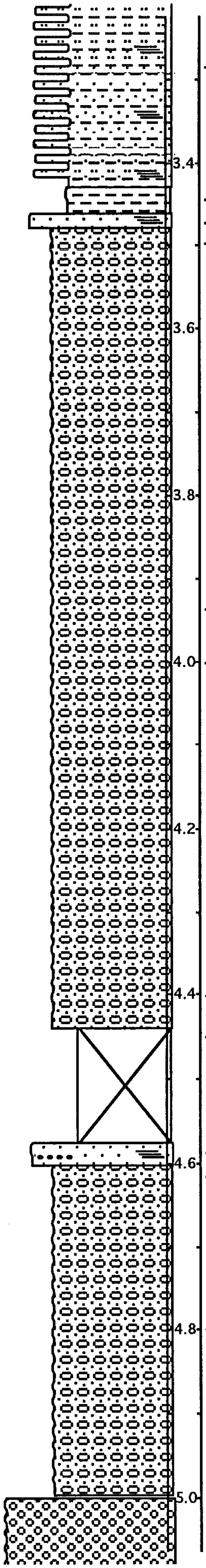
289 - 290cm: Medium Firm, loaded, sandy silty clay at base of stratified granule bed. ? deformed by loading or by coring.

290 - 293cm: slumped out of core during subsampling for consolidation test, saved as a bagged sample CC', granule sandy silty mud.

293 - 307cm: Whole core subsampled and removed for consolidation test.

307 - 308cm: Medium firm, medium gray (5Y4/1) silty sand base of bed that was sampled for consolidation test.

309 - 346cm: Medium firm, graded interlaminated, medium dark gray (5Y4/2, 5Y4/1, 5Y5/1) silty clay to lighter gray (5Y4/1, 5Y6/1) clay with rare, isolated rippled formset sands from 337 - 336.5cm. For details of colour, thickness and grain size variation see the cruise log sheets. Appear to be thin turbidites, with perhaps some minor "varving" associataed with seasonal variations in discharge plumes from 328 - 332cm.



328 - 332cm: possible seasonal "varves" associated with variations in sediment plumes.

343.5 - 346cm: Medium firm, light olive gray top 1/2 grading down into a lower silty clay.

346 - 348cm: poorly sorted medium to fine, laminated sand.

348 - 392cm: More firm, diamict, medium dark gray (5Y5/1 to 5Y5/2) silty sand-clay with scattered large pebbles, up to 3cm+, perhaps a debris flow, slumped till or till deposit.

392cm+: Slightly more stiff, diamict, medium to fine silty sand, with dispersed pebbles throughout, with maximum clast size at the base up to 7 cm.

400 - 440cm: Stiff to very stiff, dark gray (5Y5/1 to 5Y4/1) diamict.

440 - 444cm: Very stiff diamict.

444 - 458cm: Whole core removed for consolidation testing.

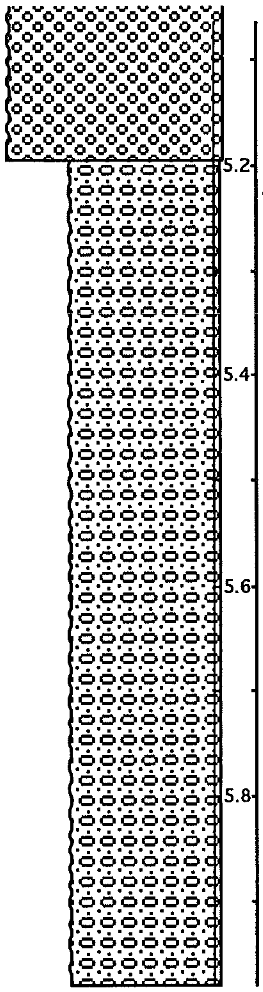
458 - 460cm: top 2 cm is very stiff, vaguely banded/stratified coarse granular sand.

460 - 470cm: Medium soft, medium to dark gray (5Y5/1 to 5Y4/1) coarse granular sand with scattered silt intraclasts and pebbles throughout. Diamict has a silty clay matrix and isolated clasts on split core half up to 2 cm long.

460 cm+: diamict as above, lacking stratification.

470 - 500cm: Medium soft to firm, medium dark gray (5Y5/1 to 5Y4/1) , diamict, comprised of medium to coarse sand with a silty clay matrix, scattered pebbles and granules throughout.

500 - 520cm: Firm to very firm, medium to dark olive gray (5Y5/1, 5Y5/2 to 5Y4/1)diamict as above, but with a silty-clay matrix that has increased in proportion to the coarser-grained component of the diamict. This unit also seems to be more dominated by granular and fine pebble material, than the coarser clasts that are more abundant in the over- and underlying units.

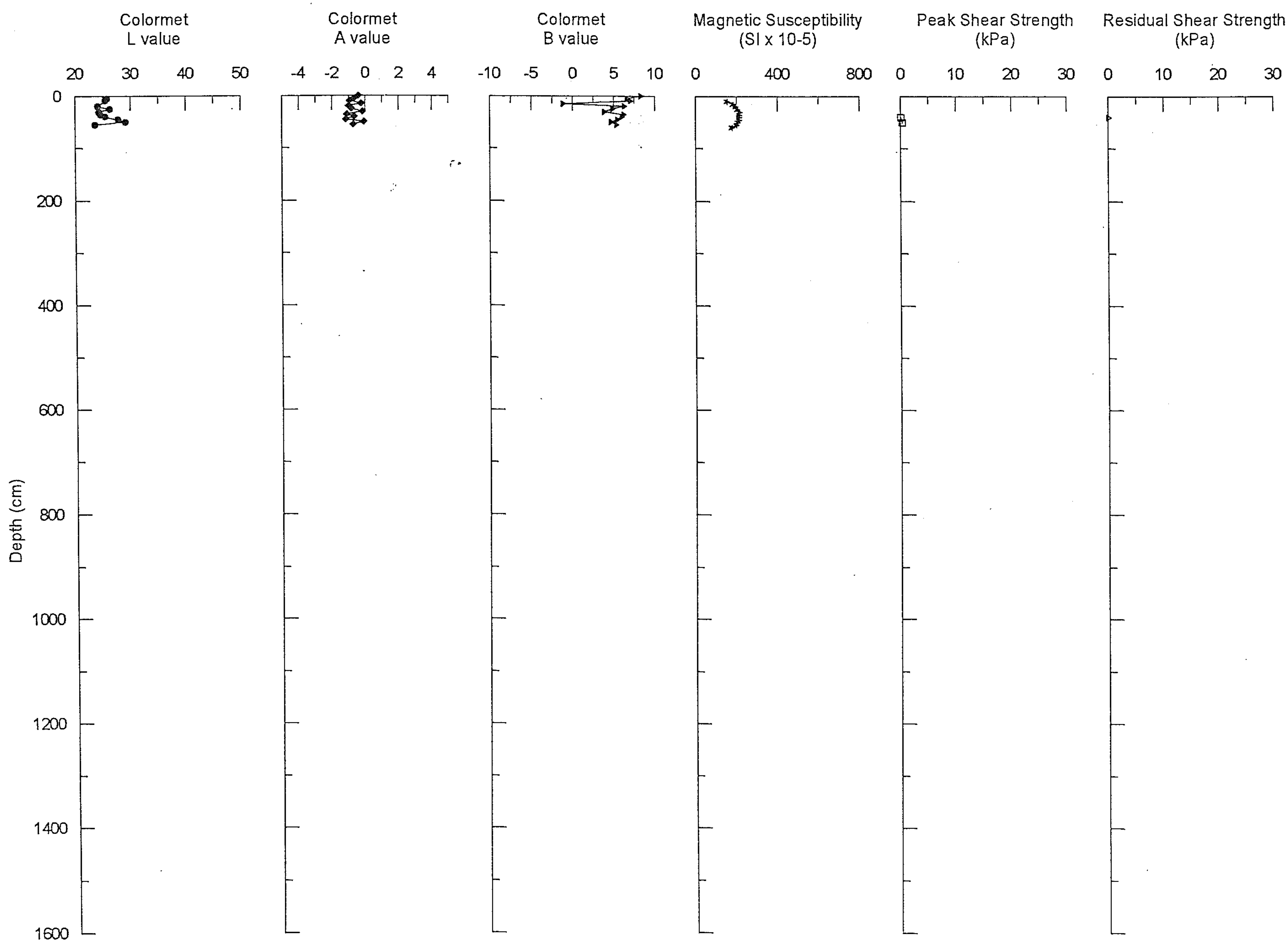


520 - 589cm: Stiff, compact to brick hard on split core, dark olive gray (5Y5/1 to 5Y4/1), silty sandy pebbly diamict. Largest clast at the base is 8cm+ recovered 575-584cm, consisting of a rounded igneous rock fragment (coarse crystalline gabbro), and further upcore smaller, volcanic rock fragments. The percentage of pebble/cobble-size material increases from 520 cm to the base of the core.

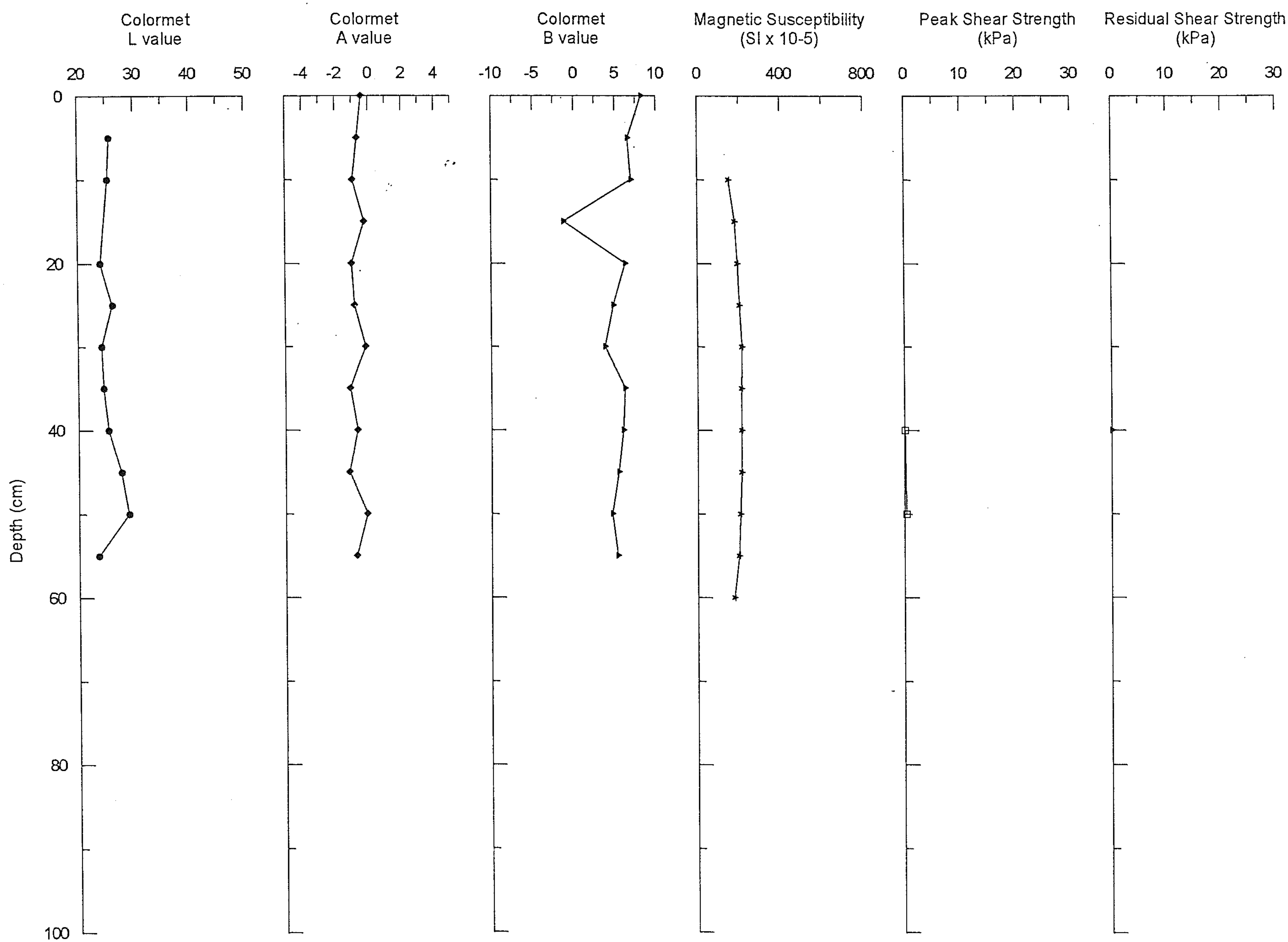
Largest clast recovered here, gabbro 8cm+

582 - 589cm: possible convoluted load structure at the base, consisting of irregularly laminated/convoluted siltier zones, surrounded by more sandy diamict at the base of the large cobble.

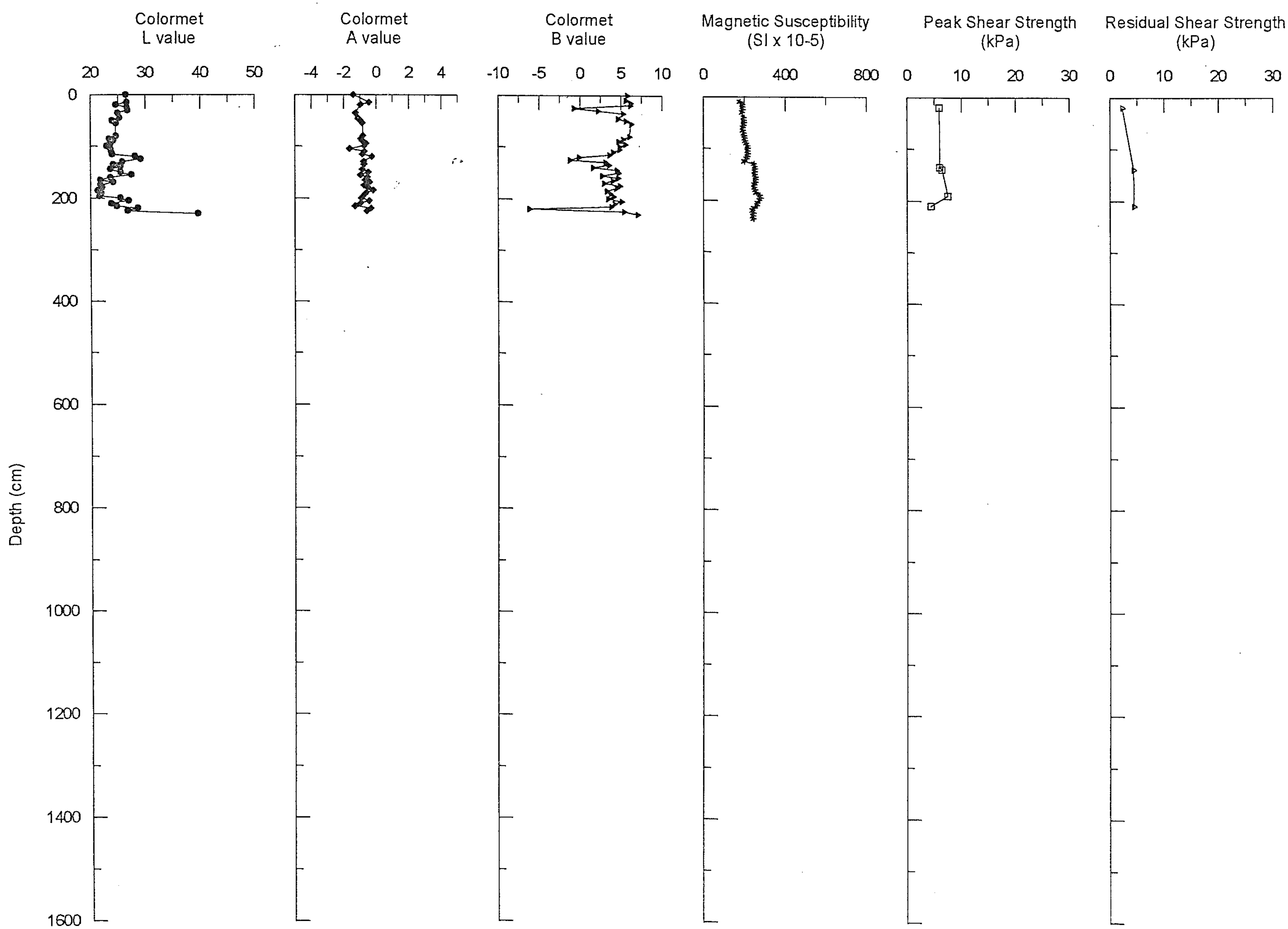
93030 003I Box Core



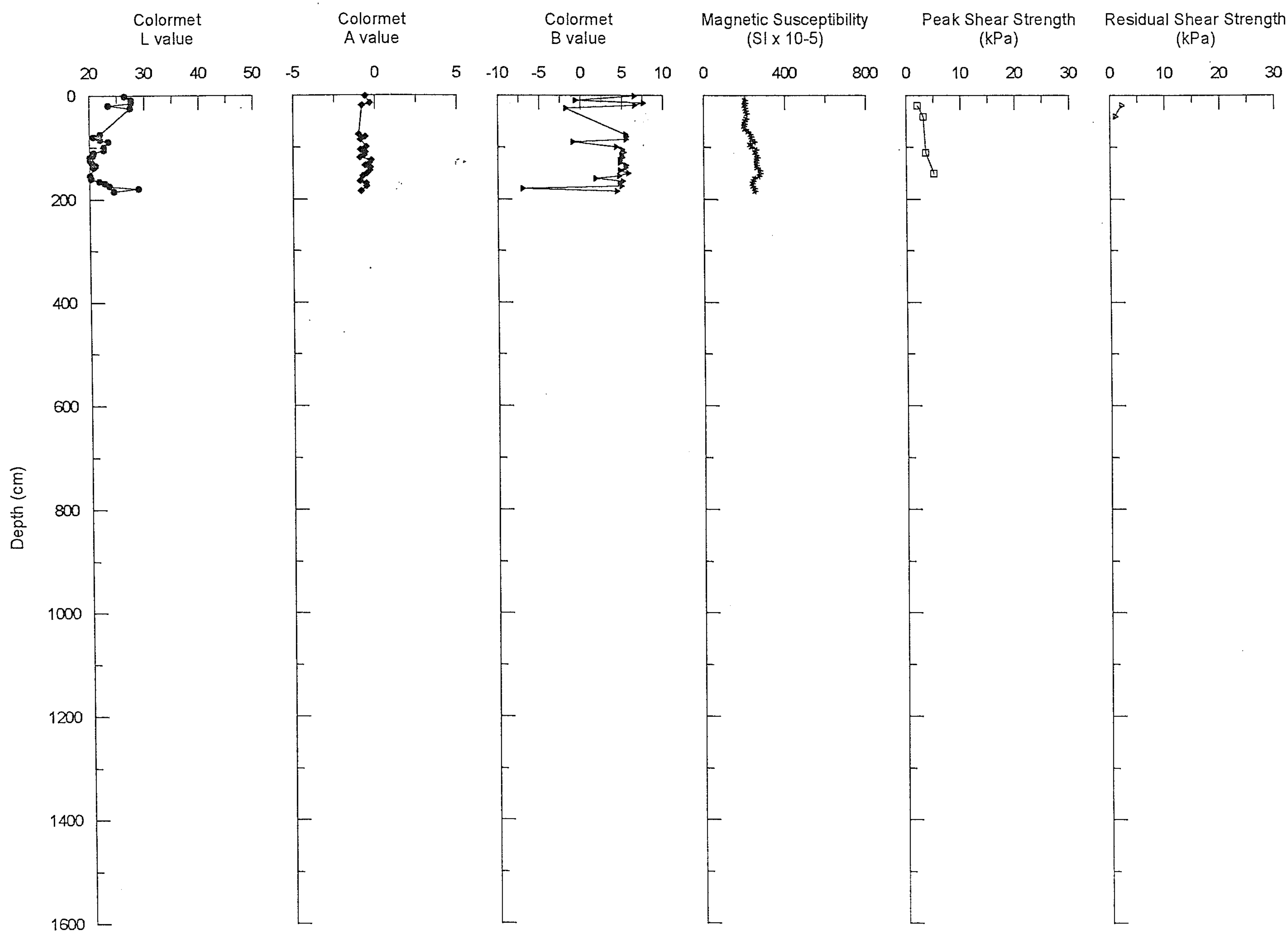
93030 003I Box Core



93030 004 Murphy Core

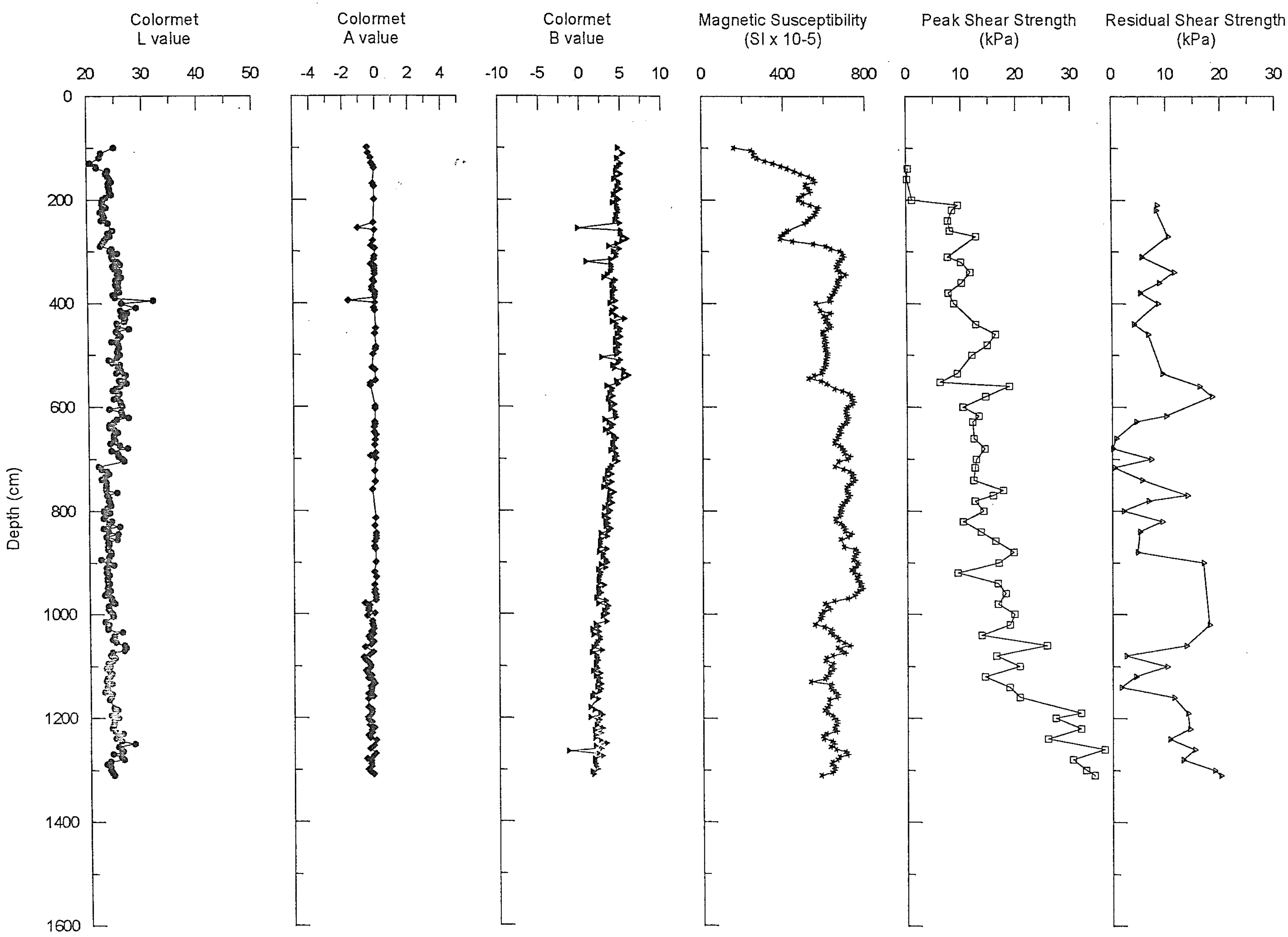


93030 006 Twc



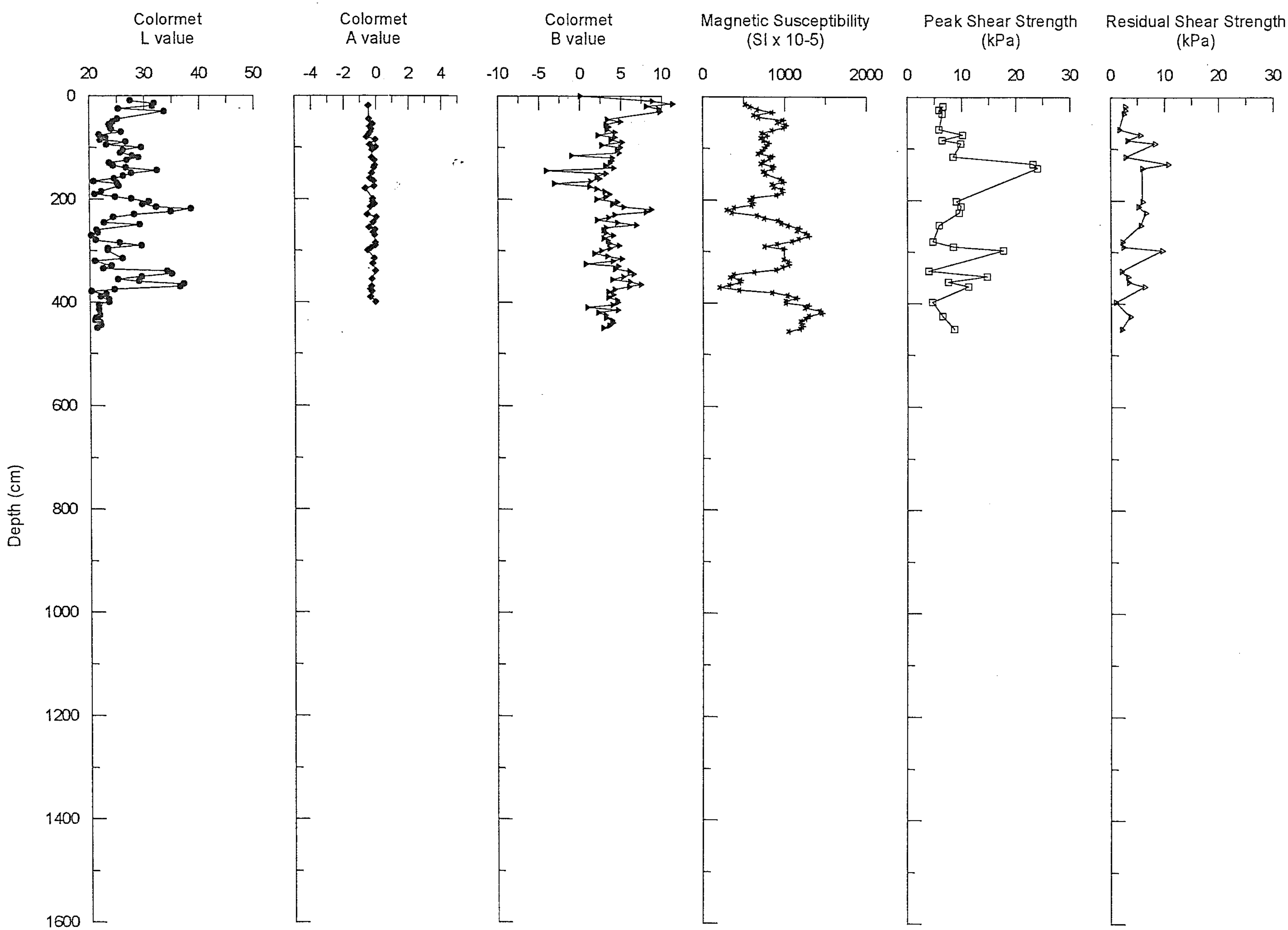
151

93030 006 Lcf

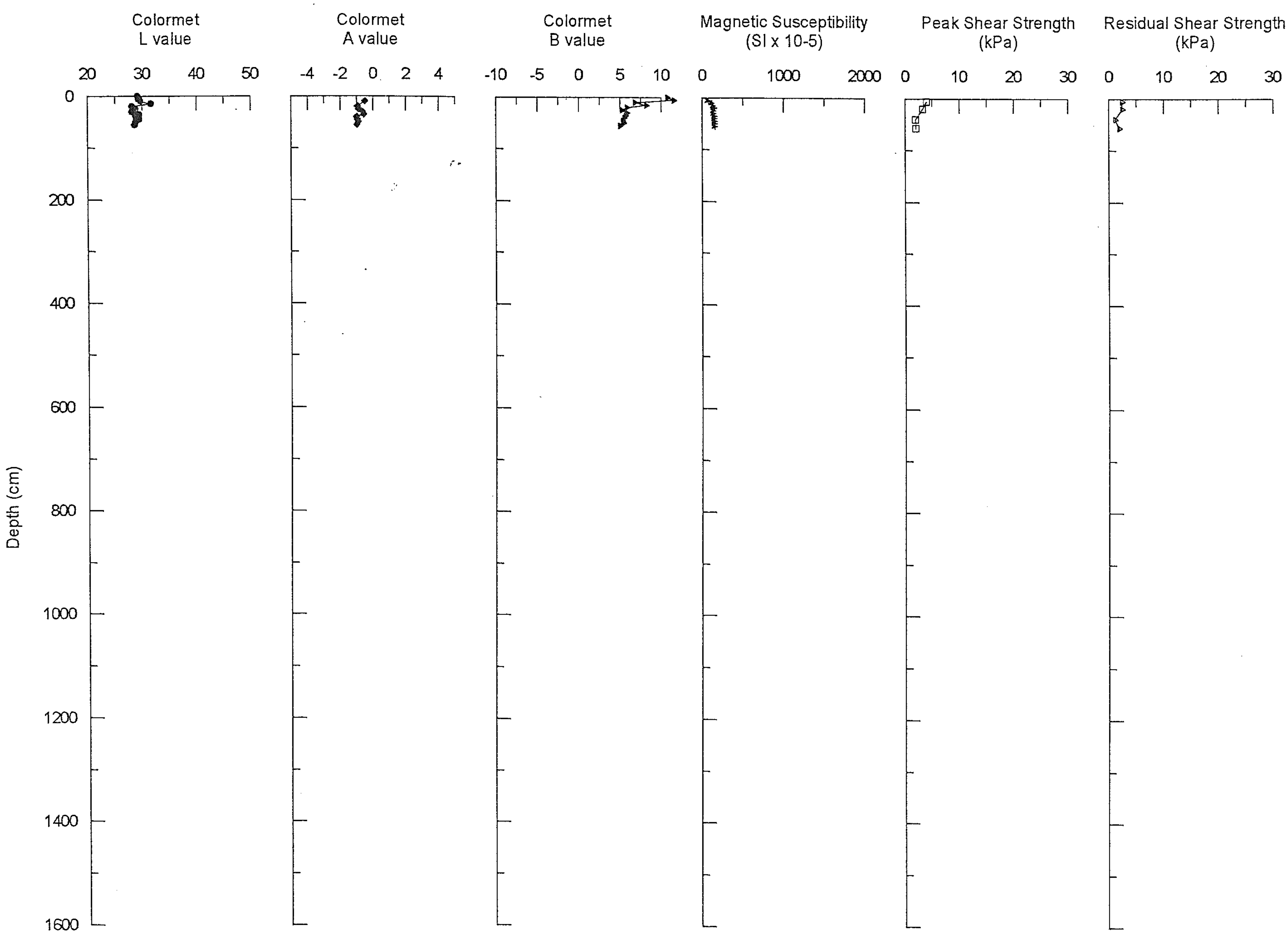


DS1

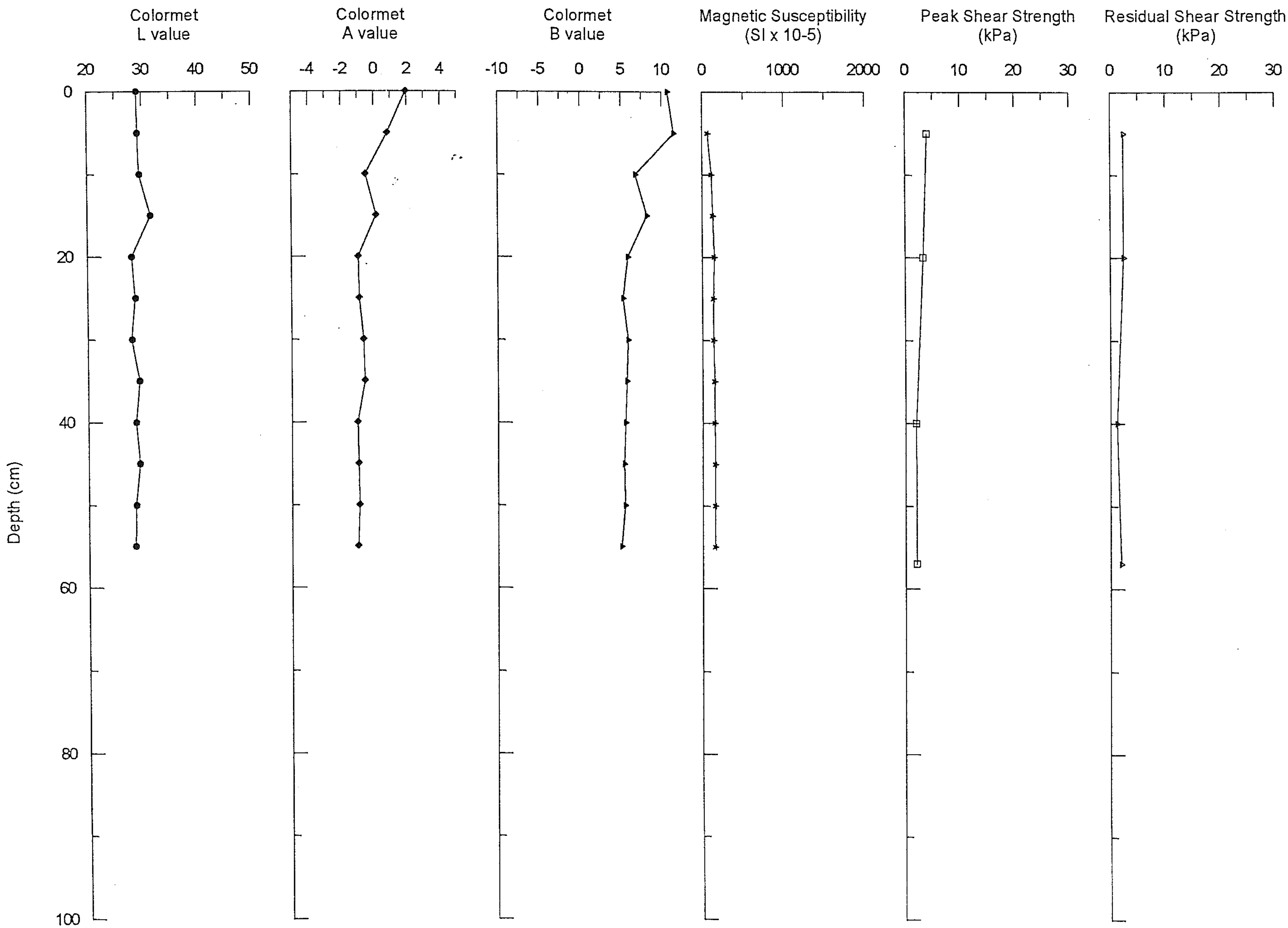
93030 007 Lcf



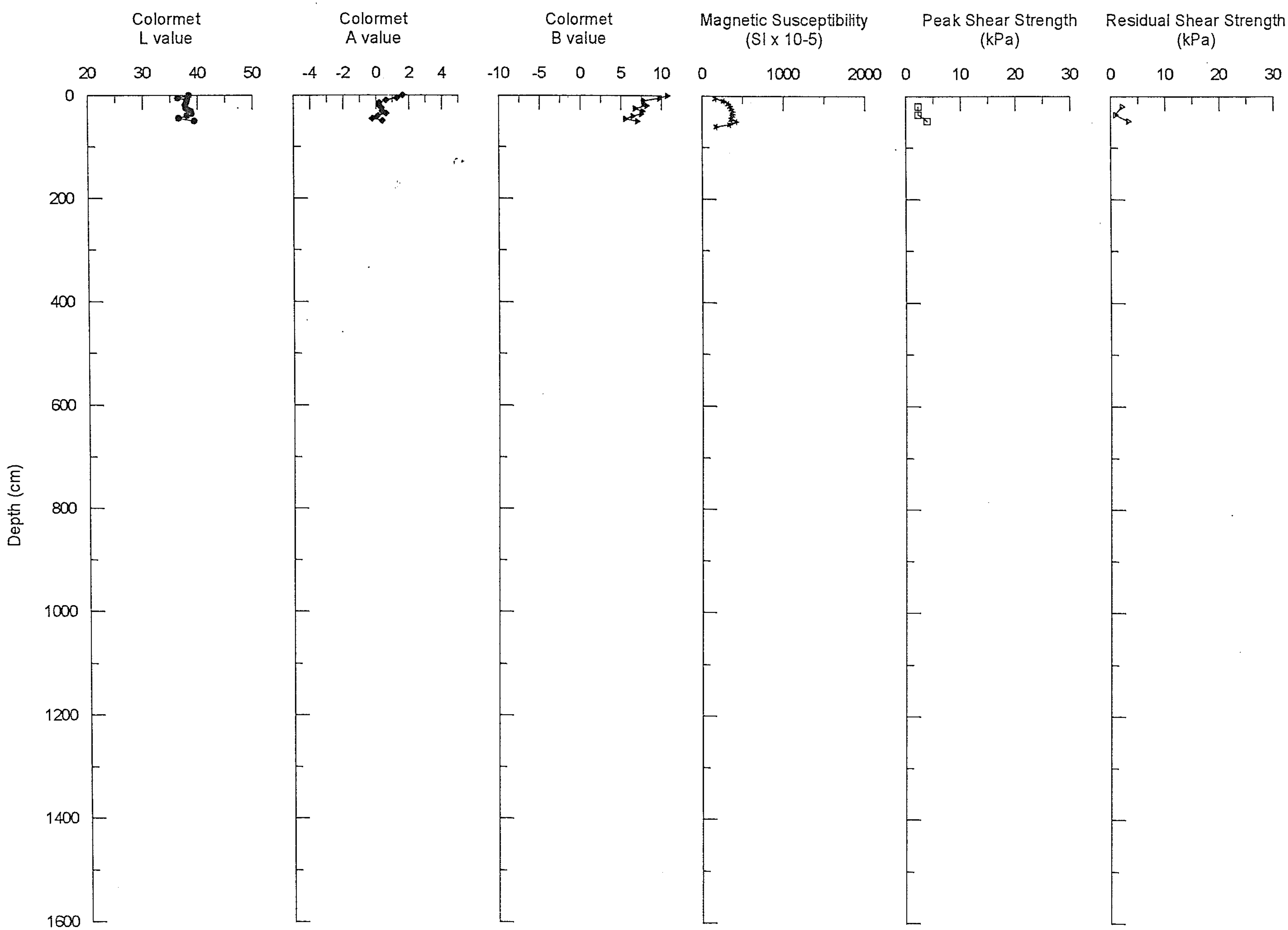
93030 019B Box Core



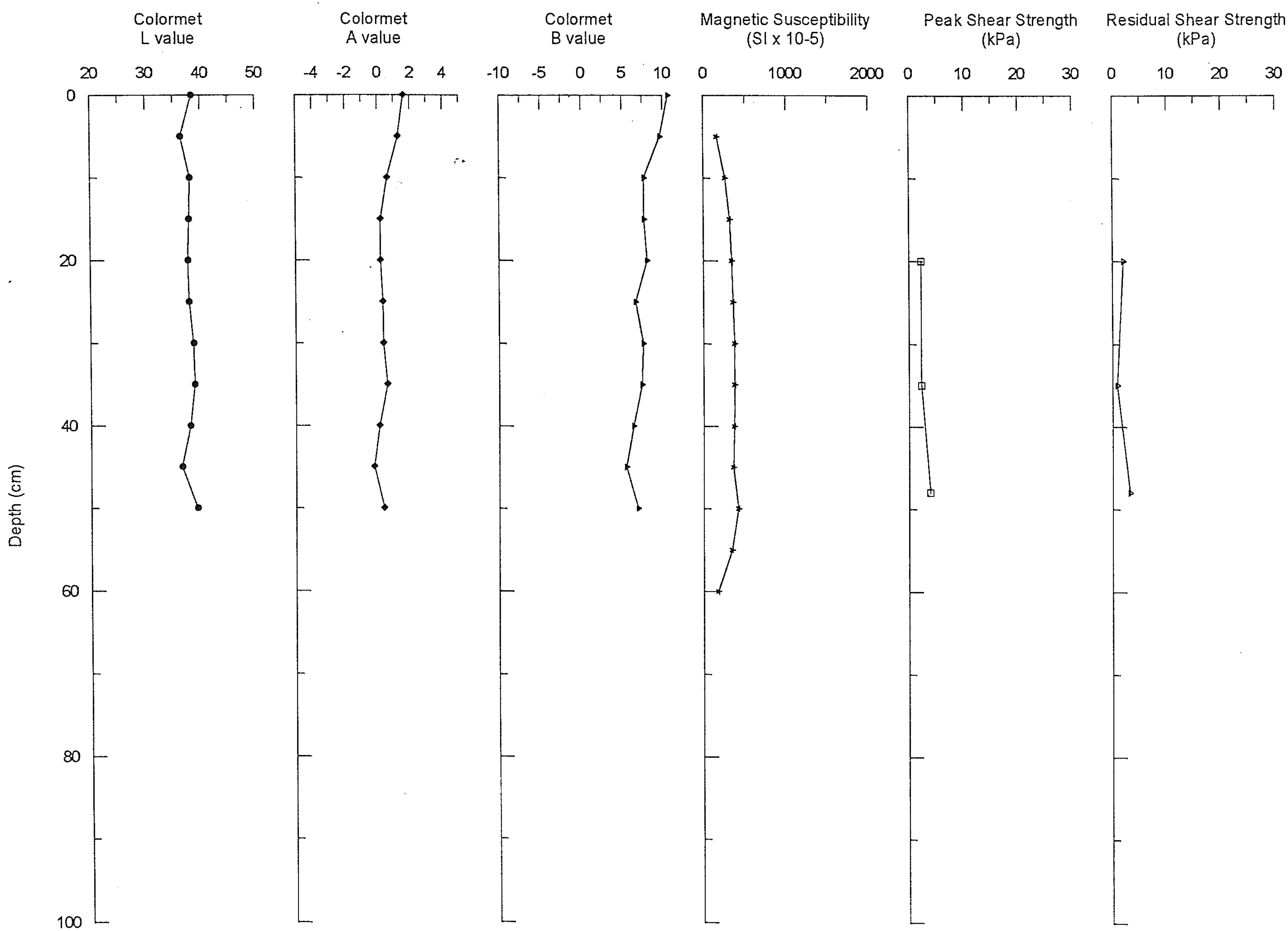
93030 019B Box Core



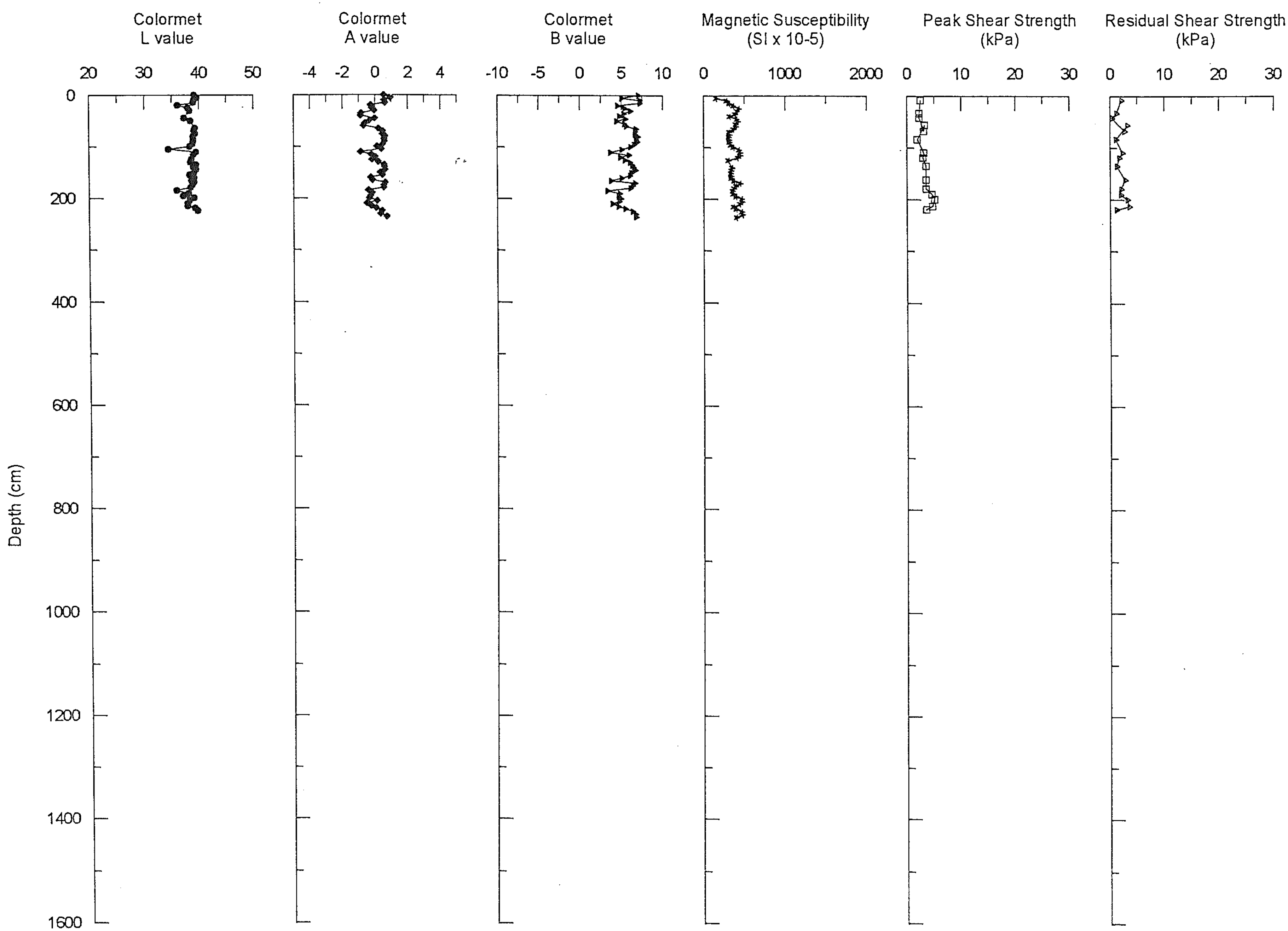
93030 023c Box Core



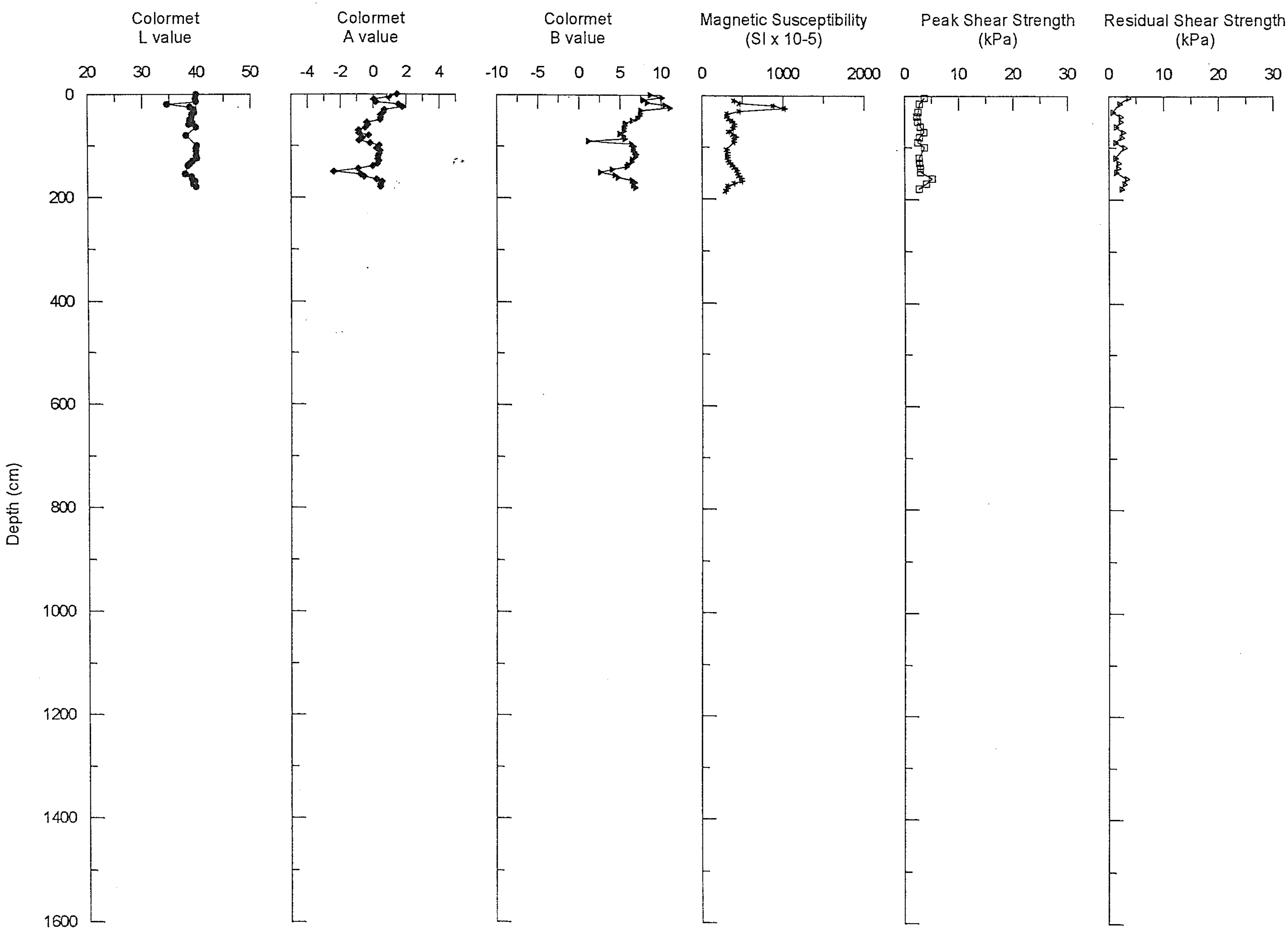
93030 023c Box Core



93030 024 Murphy Core

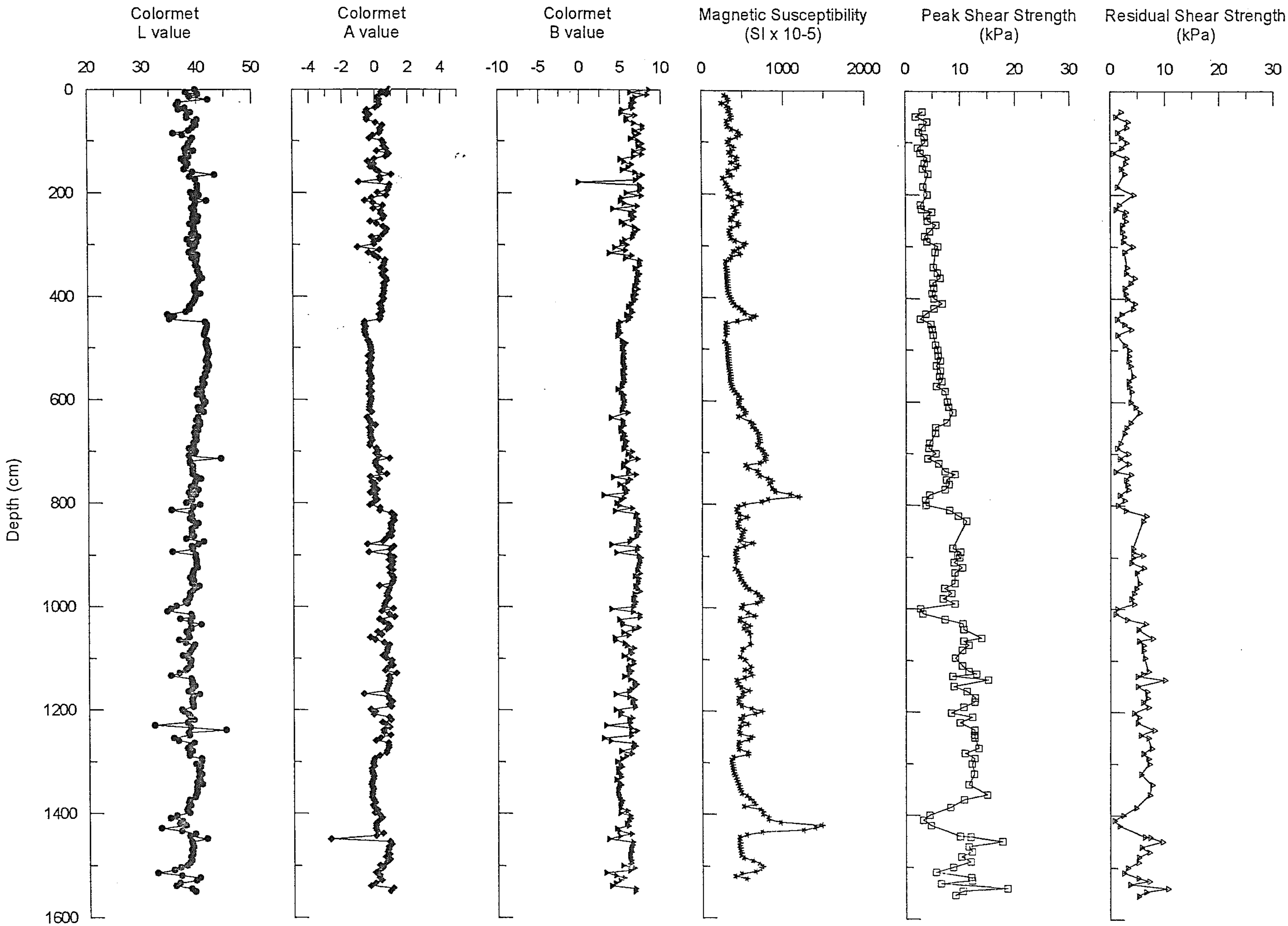


93030 028 Twc



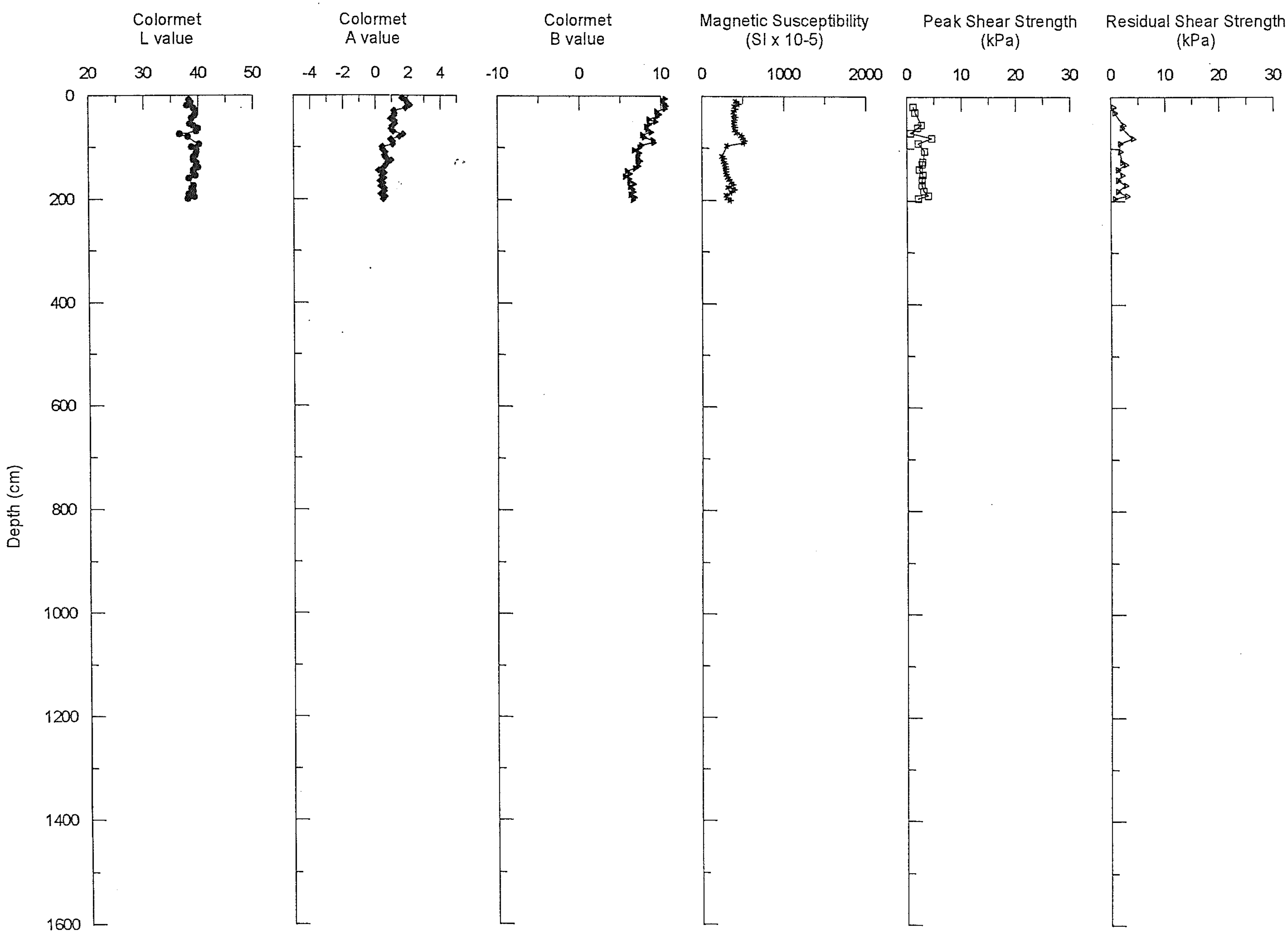
KF1

93030 028 Lcf



KF3

93030 034 Twc



93030 034 Lcf

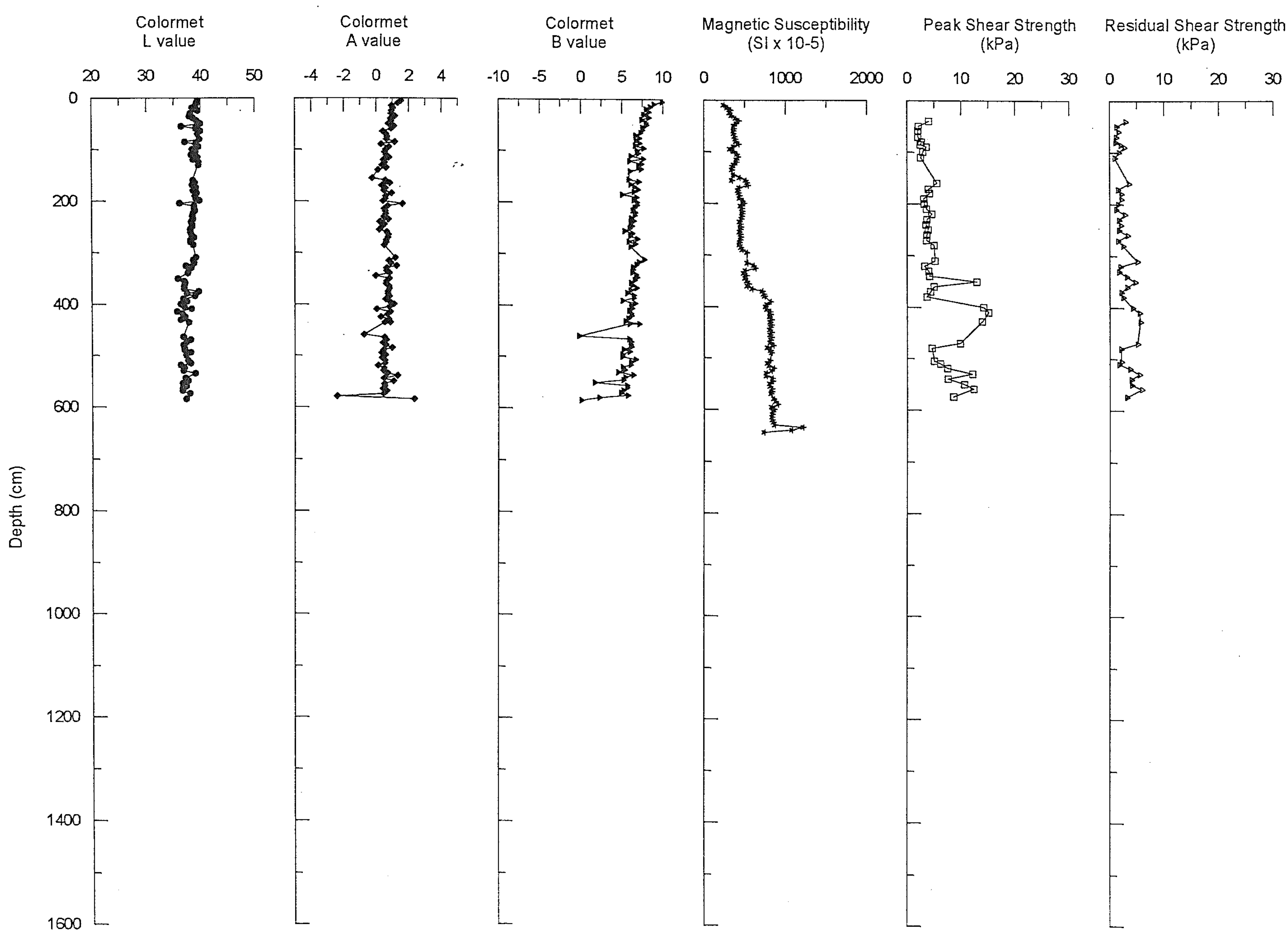


TABLE 14

HUDSON 93030

LINE NUMBER START/STOP TIMES

LINE #	START	STOP
A-B	247/0726	247/0800
C-D	247/0813	247/0841
E-F	247/0908	247/0936
5	248/0147	248/0414
6	248/0422	248/0746
7	248/0851	248/1030
8	248/2338	249/0410
9	249/0417	249/0624
10	249/0631	249/0924
11	249/0935	249/1200
12	249/2059	250/0051
13	250/0100	250/0730
14	250/0757	250/0957
15	250/1016	250/1110
16	250/1110	250/1330
17	250/1400	250/1753
18	250/2339	251/0416
19	251/0423	251/1129
20	251/1129	251/1405
21	251/1303	251/1405
22	253/1727	253/1920
23	254/0800	255/1630
24	256/1810	256/2055
25	257/0800	260/0439

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 1

TOTAL SAMPLE INVENTORY

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DAY/TIME	SEISMIC DAY/TIME	LATITUDE	LONGITUDE	DEPTH (M)	GEOGRAPHIC LOCATION
1A	WATER	2470047		64 17.93	24 13.84	250	ICELAND SHELF
1	CAMERA	2470014		64 18.01	24 13.73	250	WESTERN ICELAND SHELF (IS1)
2	WATER	2470222		64 17.99	24 13.83	250	WESTERN ICELAND SHELF (IS1)
3	BOXCORE	2470333		64 18.00	24 13.90	250	WESTERN ICELAND SHELF (IS1)
4	CORE	2470448		64 17.99	24 14.09	254	WESTERN ICELAND SHELF (IS1)
5	CAMERA	2470534		64 18.14	24 14.24	253	WESTERN ICELAND SHELF (IS1)
6	CORE	2471110		64 17.06	24 12.42	247	WESTERN ICELAND SHELF (IS1)
7	CORE	2481246		65 01.39	30 14.81	1802	EASTERN GREENLAND (DS1)
8	GRAB	2481519		65 01.69	30 16.31	1802	EASTERN GREENLAND (DS1)
9	CAMERA	2481700		65 01.49	30 15.09	1802	EASTERN GREENLAND (DS1)
10	CAMERA	2481811		65 00.82	30 12.69	1821	EASTERN GREENLAND (DS1)
11	WATER	2482007		65 01.57	30 13.36	1823	EASTERN GREENLAND (DS1)
12	WATER	2482120		65 01.14	30 13.49	1822	EASTERN GREENLAND (DS1)
13	CORE	2491350		65 26.35	30 28.8	430	EASTERN GREENLAND (DS2)
14	ROV	2491538		65 26.79	30 27.36	430	EASTERN GREENLAND (DS2)
15	GRAB	2491636		65 26.29	30 28.42	525	EASTERN GREENLAND (DS2)
16	CAMERA	2491713		65 26.31	30 28.71	525	EASTERN GREENLAND (DS2)
17	CAMERA	2491806		65 26.28	30 26.31	541	EASTERN GREENLAND (DS2)
18	WATER	2491926		65 26.28	30 27.81	529	EASTERN GREENLAND (DS2)
19	BOXCORE	2501851		67 08.73	30 49.34	713	KANG TROUGH (KT3)
20	CAMERA	2502021		67 08.86	30 49.19	713	KANG TROUGH (KT3)
21	CAMERA	2502103		67 08.87	30 48.97	713	KANG TROUGH (KT3)
22	WATER	2502300		67 09.37	30 49.23	704	KANG TROUGH (KT3)
22A	WATER	2511558		68 01.82	31 46.56	594	OUTER KANGERDLUGSSUAQ FJORD (KF1)
23	BOXCORE	2511930		67 08.19	31 52.62	878	OUTER KANGERDLUGSSUAQ FJORD (KF1)
24	CORE	2512100		68 08.23	31 52.20	870	OUTER KANGERDLUGSSUAQ FJORD (KF1)
25	CAMERA	2512216		68 08.36	31 52.29	870	OUTER KANGERDLUGSSUAQ FJORD (KF1)
26	CAMERA	2512255		68 08.21	31 52.43	873	OUTER KANGERDLUGSSUAQ FJORD (KF1)
27	WATER	2520056		68 07.64	31 51.34	873	OUTER KANGERDLUGSSUAQ FJORD (KF1)
28	CORE	2521142		68 08.05	31 52.08	874	HEAD OF KANGERDLUGSSUAQ FJORD (KF1)
29	WATER	2521745		68 08.95	31 53.74		MOUTH OF KANGERDLUGSSUAQ FJORD (KF1)

TABLE 1

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

TOTAL SAMPLE INVENTORY

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DAY/TIME	SEISMIC DAY/TIME	LATITUDE	LONGITUDE	DEPTH (M)	GEOGRAPHIC LOCATION
30	CAMERA	2522228		68 27.72	32 28.85	666	HEAD OF KANGERDLUGSSUAQ FJORD (KF2)
31	CAMERA	2522258		68 27.68	32 28.73	666	HEAD OF KANGERDLUGSSUAQ FJORD (KF2)
32	CORE	2531025		68 31.31	32 36.26		HEAD OF KANGERDLUGSSUAQ FJORD (KF2)
33	ROV	253		68 31.44	32 36.85		HEAD OF KANGERDLUGSSUAQ FJORD (KF5)
34	CORE	2531555		68 29.19	32 29.12	616	HEAD OF KANGERDLUGSSUAQ FJORD (KF3)
35	CAMERA	2532024		68 31.24	32 36.66	462.7	HEAD OF KANGERDLUGSSUAQ FJORD (KF4)
36	CAMERA	2532051		68 31.23	32 36.56	453.5	HEAD OF KANGERDLUGSSUAQ FJORD (KF4)
37	WATER	2532204		68 31.23	32 36.71	430	HEAD OF KANGERDLUGSSUAQ FJORD (KF4)
38	WATER	2532253		68 31.21	32 36.59	429	HEAD OF KANGERDLUGSSUAQ FJORD (KF4)
39	WATER	2541915		68 31.17	32 31.64	574.6	HEAD OF KANGERDLUGSSUAQ FJORD (KF4)
40	WATER	2551800		68 29.38	32 34.24	464	HEAD OF KANGERDLUGSSUAQ FJORD (KF5)
41	CAMERA	2571817		68 02.81	31 49.97	597	HEAD OF KANGERDLUGSSUAQ FJORD
42	WATER	2552345		68 28.19	32 31.95	SURFACE	KANGERDLUGSSUAQ FJORD
43	WATER	2561306		68 25.02	32 25.59	SURFACE	KANGERDLUGSSUAQ FJORD
44	WATER	2561815		68 23.69	32 13.05	SURFACE	KANGERDLUGSSUAQ FJORD
45	WATER	2562114		68 16.02	32 03.07	SURFACE	KANGERDLUGSSUAQ FJORD
46	WATER	2570848		68 14.77	32 00.83	SURFACE	KANGERDLUGSSUAQ FJORD
47	WATER	2571435		68 01.91	31 46.54	SURFACE	KANGERDLUGSSUAQ FJORD
48	WATER	2581007		67 56.16	31 30.07	SURFACE	KANGERDLUGSSUAQ FJORD
49	WATER	2581344		67 45.26	31 14.71	SURFACE	KANGERDLUGSSUAQ FJORD
50	WATER	2581750		67 32.90	31 09.59	SURFACE	KANGERDLUGSSUAQ FJORD
51	WATER	2601009		66 20.92	27 49.90	SURFACE	DENMARK STRAITS
52	WATER	2601514		65 48.52	27 08.53	SURFACE	DENMARK STRAITS
53	WATER	2601931		65 24.09	26 12.38	SURFACE	DENMARK STRAITS
54	WATER	2602059		65 17.27	25 54.39	SURFACE	DENMARK STRAITS
55	WATER	2610824		64 28.23	23 14.68	SURFACE	DENMARK STRAITS

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 2

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

CAMERA STATIONS

SAMPLE NUMBER	TYPE OF CAMERA	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (MTRS)	FRAMES SHOT	DIST OFF. BOTT	STEREO	COLOR1 COLOR2	ASA1 ASA2	FSTOP1 FSTOP2	FOCUS1 FOCUS2	FILM1 FILM2	GEOGRAPHIC LOCATION
5	NIKON F4	2470534	64 18.14 24 14.24	253	20	240	N	B-W	400	8	150	TMY	WESTERN ICELAND SHELF (IS1)
9	UMEL	2481700	65 01.49 30 15.09	1802	20	150	N	B-W	400	8	150	TMY	EASTERN GREENLAND (DS1)
10	FLOC/CTD	2481811	65 00.82 30 12.69	1821	36		N	B-W B-W	100 100		32	TMAX TMAX	EASTERN GREENLAND (DS1)
16	UMEL	2491713	65 26.31 30 28.71	525	30	150	N	B-W	400	8	150	TMY	EASTERN GREENLAND (DS2)
17	FLOC/CTD	2491806	65 26.28 30 26.31	541	36			COLOR B-W	400 100	8 4	32	EKTACHROME T-MAX	EASTERN GREENLAND (DS2)
1	FLOC/CTD	2470014	64 18.01 24 13.73	250				B-W B-W	100 100		32 32	TMAX T-MAX	WESTERN ICELAND SHELF (IS1)
20	UMEL	2502021	67 08.86 30 49.19	713	30	150	N	B-W	400	8	150	TMX	KANG TROUGH (KT3)
21	FLOC/CTD	2502103	67 08.87 30 48.97	713				COLOR B-W	400 100	8 4	32	EKTACHROME T-MAX	KANG TROUGH (KT3)
25	UMEL	2512216	68 08.36 31 52.29	870	20	150	N	B-W	400	8	150	TMY	OUTER KANGERDLUGSSUAQ FJORD (KF1)
26	FLOC/CTD	2512255	68 08.21 31 52.43	873					400 100	8 4	32	EKTACHROME T-MAX	OUTER KANGERDLUGSSUAQ FJORD (KF1)
30	UMEL	2522228	68 27.72 32 28.85	666	21	150	N	B-W	400	8	150	TMY	HEAD OF KANGERDLUGSSUAQ FJORD (KF2)
31	FLOC/CTD	2522258	68 27.68 32 28.73	666	36			COLOR COLOR	400 400	8 4	32	EKTACHROME EKTACHROME	HEAD OF KANGERDLUGSSUAQ FJORD (KF2)
35	UMEL	2532024	68 31.24 32 36.66	462.7	28	150			400	8	150	TMY	HEAD OF KANGERDLUGSSUAQ FJORD (KF4)
36	FLOC/CTD	2532051	68 31.23 32 36.56	453.5					400 100	8 4	32	EKTACHROME T-MAX	HEAD OF KANGERDLUGSSUAQ FJORD (KF4)
41	FLOC/CTD	2571817	68 02.81 31 49.97	597	36			COLOR COLOR	400 400	8 4	32	EKTACHROME EKTACHROME	MOUTH OF KANGERDLUGSSUAQ FJORD

TABLE 3

WATER STATIONS

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

SAMPLE NUMBER	SAMPLE TYPE	JULIAN DAY/TIME	LATITUDE LONGITUDE	DEPTH (MTRS)	BOTTLE VOLUMN	SAMPLE DEPTHS (1-10)	GEOGRAPHIC LOCATION	NOTES
1A	WATER	2470047	64 17.93 24 13.84	250			ICELAND SHELF	2ND LOWERING OF CTD AS DESCRIBED ON CTD SAMPLE 1
2	WATER	2470222	64 17.99 24 13.83	250		5 10 30 50 100 240	WESTERN ICELAND SHELF (IS1)	CAST AWAY AT 0145 64 18.02 24 13.77
11	WATER	2482007	65 01.57 30 13.36	1823	5	5 10 30 50 100 800	EASTERN GREENLAND (DS1)	20:37 BROUGHT UP FIRST SET OF BOTTLES AT 65 01.32N 30 14.32W
12	WATER	2482120	65 01.14 30 13.49	1822	5	1 20 40 300 500 1000	EASTERN GREENLAND (DS1)	THIS IS A SECOND BOTTLE CAST, MADE AT SAME LOCATION AS BOTTLES 207-212. 21:30 WINCH BLOWS HYDRAULIC LINE (383 M) 21:50 WINCH REPAIRED. DEPTH SHALLOWS TO 1811 WHEN OPERATIONS RESUME AFTER WINCH.
18	WATER	2491926	65 26.28 30 27.81	529	5	1 10 30 50 100 400	EASTERN GREENLAND (DS2)	PROBLEMS WITH MESSENGERS. CTD ADDED TO WATER SAMPLER DUE TO FAILURE OF 18.
22	WATER	2502300	67 09.37 30 49.23	704	5	5 30 50 100 150 650	KANG TROUGH (KT3)	23:22 ALL BOTTLES RECOVERED.
27	WATER	2520056	68 07.64 31 51.34	873	5	5 20 50 100 200 800	OUTER KANGERDLUGSSUAQ FJORD (KF1)	
29	WATER	2521745	68 08.95 31 53.74				MOUTH OF KANGERDLUGSSUAQ FJORD (KF1)	DEPLOYMENT OF SEDIMENT TRAP 1156 UNRECOVERABLE.
37	WATER	2532204	68 31.23 32 36.71	430	5	1 10 60 100 220 420	HEAD OF KANGERDLUGSSUAQ FJORD (KF4)	DEPTH NOTED AT END OF CAST (RECOVERY OF BOTTLES) WAS 457 M.
38	WATER	2532253	68 31.21 32 36.59	429	5	5 20 30 40 80 380	HEAD OF KANGERDLUGSSUAQ FJORD (KF4)	
39	WATER	2541915	68 31.17 32 31.64	574.6			HEAD OF KANGERDLUGSSUAQ FJORD (KF4)	HEAVY ICE CONDITIONS. CTD BACK ON BOARD AT 1935
40	WATER	2551800	68 29.38 32 34.24	464			HEAD OF KANGERDLUGSSUAQ FJORD (KF5)	SAMPLED: SURFACE WATER, SEA ICE, FROM THE SEA WATER TAP IN FORWARD LAB.
22A	WATER	2511558	68 01.82 31 46.56	594			OUTER KANGERDLUGSSUAQ FJORD (KF1)	CURRENT MOORING #1154 TOP: 3392, MID: 7137, BOT: 7124 HEAVY ICE ALL AROUND THE SEA. CALM (SEA ICE, BERGS, BERGY BITS). OVERCAST FOG/ STRATUS. NO WIND RETRIEVED 257/1632; 68 02.54, 31 49.14 TOP CURRENT METER 3392 LOST. 7137, 7124 AND THERMISTOR ALL RECOVERED. DAMAGE ON THE HARD HAT CONNECTOR.
42	WATER	2552345	68 28.19 32 31.95					
43	WATER	2561306	68 25.02 32 25.59					BUCKET, TAP AND SEA ICE SAMPLES TAKEN
44	WATER	2561815	68 23.69 32 13.05					BUCKET AND TAP SAMPLES TAKEN
45	WATER	2562114	68 16.02 32 03.07					BUCKET AND TAP SAMPLES TAKEN
46	WATER	2570848	68 14.77 32 00.83					BUCKET AND TAP SAMPLES TAKEN

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 3

WATER STATIONS

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

SAMPLE NUMBER	SAMPLE TYPE	JULIAN DAY/TIME	LATITUDE LONGITUDE	DEPTH (MTRS)	BOTTLE VOLUMN	SAMPLE DEPTHS (1-10)	GEOGRAPHIC LOCATION	NOTES
47	WATER	2571435	68 01.91 31 46.54					BUCKET AND TAP SAMPLES TAKEN
48	WATER	2581007	67 56.16 31 30.07					BUCKET AND TAP SAMPLES TAKEN
49	WATER	2581344	67 45.26 31 14.71					BUCKET AND TAP SAMPLES TAKEN
50	WATER	2581750	67 32.90 31 09.59					BUCKET AND TAP SAMPLES TAKEN
51	WATER	2601009	66 20.92 27 49.90					
52	WATER	2601514	65 48.52 27 08.53					
53	WATER	2601931	65 24.09 26 12.38					
54	WATER	2602059	65 17.27 25 54.39					
55	WATER	2610824	64 28.23 23 14.68					

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 4

CORE STATIONS

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

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
4	MURPH CORE	2470448	64 17.99 24 14.09	254	12		234	2	WESTERN ICELAND SHELF (IS1)	APPARENT PENETRATION IS OVER THE TOP. CUTTER SAMPLE (15-20 CM LONG) TAKEN AND BAGGED. HIGHLY DISTURBED. CORE MAY HAVE PENETRATED TOO FAR AND LOST SURFACE.
6	AGC WIDE CORE	2471110	64 17.06 24 12.42	247		1600	1520	5	WESTERN ICELAND SHELF (IS1)	SEDIMENT NOTED ON TOP OF COREHEAD WHEN COMING TO SURFACE. CUTTER ON BIG CORE DAMAGED (MAY HAVE HIT TRIGGER CORE). CATCHER BAGGED. G-H EVIDENCE OF START OF AN IMPLOSION (GROOVE IN LINER). PROBLEMS GETTING LINER FROM BARRELS FOR THIS SECTION TOTALLY DISTURBED. WATER WASHED THROUGH PISTON.
7	AGC WIDE CORE	2481246	65 01.39 30 14.81	1802	30	600	474	3	EASTERN GREENLAND (DS1)	
13	AGC WIDE CORE	2491350	65 26.35 30 28.8	430					EASTERN GREENLAND (DS2)	PROBLEM WITH DETERMINING WATER DEPTH. FM TO M CONFUSION. CHATS WAS NOT INVOKED. CORE ENTERED THE BOTTOM PREMATURELY. THE BOTTOM BARREL, CUTTER AND COUPLING ARE GONE. THE 3RD BARREL DOWN AND THE COUPLER ARE BENT, PARTLY BROKEN AND THE LINER IS BROKEN. TOP TWO BARRELS AT 1ST GLANCE APPEAR INTACT.
24	MURPH CORE	2512100	68 08.23 31 52.20	870			220		OUTER KANGERDLUGSSUAQ FJORD (KF1)	
28	AGC WIDE CORE	2521142	68 08.05 31 52.08	874		2100	1744	7	HEAD OF KANGERDLUGSSUAQ FJORD (KF1)	OBSERVATIONS OF WIRE: 2 JIGS ON WIRE INDICATING THAT THE CORE MAY HAVE FALLEN OVER AND USUALLY RESULTS IN BARREL DAMAGE. SOFT SOUPY SEDIMENT. FERRO-MAG ON TOP. VERY BLACK. CATCHER IN BAG. CUTTER HAS TOP.
32	AGC WIDE CORE	2531025	68 31.31 32 36.26		1525			5	HEAD OF KANGERDLUGSSUAQ FJORD (KF2)	NO CORE SAMPLE. CUTTER HEAVILY DAMAGED. BARRELLS ARE BENT. PHOTOS TAKEN BY K. BENTHEM. CUTTER HAS LARGE COBBLES AND SOME SANDY SILTY OLIVE MUD AROUND IT. CATCHER AND BOTTOM PART VERY RUNNY AND SOUPY - POURED INTO A BAG AND LABELLED CATCHER.
34	AGC WIDE CORE	2531555	68 29.19 32 29.12	616	0915		800	5	HEAD OF KANGERDLUGSSUAQ FJORD (KF3)	CATCHER AND CUTTER SAMPLE BAGGED. 1 CM FELL OUT OF CORE AT C-C - BAGGED. SHORTENED TRIP WIRE LOOP, WAS SHORTENED FROM 15 TO 11 FEET. CUTTER DISTROYED - CATCHER FINGERS INVERTED.

TABLE 5

BOXCORE SAMPLES

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

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
19	BOXCORE	2501851	67 08.73 30 49.34	713	1	6	5	N	KANG TROUGH (KT3)	SURFACE IS LIGHT OLIVE BROWN, SOFT, MUD WITH SOME DARK BROWN ORGANIC DETRITUS. MANY WORM TUBES, SPONGE SPICULES. A FEW WHITE SHELL FRAGMENTS (UP TO 5MM) AND ONE SEA CUCUMBER JUST BELOW SURFACE. BOX CORE DID NOT TRIP ON 1ST ATTEMPT. TRIPPED AT 1852. A: INSTAAR, B: SPLIT, C: ARCHIVE, D: ICELAND, E: GEOTECH. BELOW SURFACE OF BOX CORE IS SOFT, GRAY, CLAYEY MUD. AA: 3 VIALS - ORGANIC CONTENT, GRAINSIZE. 1 VIAL FOR DIATOMS BB: 1 VIAL FOR FORAMS EE: 1 PLASTIC BAG FOR OSTRACODS
23	BOXCORE	2511930	67 08.19 31 52.62	878	1	6	5	N	OUTER KANGERDLUGSSUAQ FJORD (KF1)	BOX CORE TOTALLY FULL. GOOD CONDITION ON SURFACE. SOFT GREYISH GREENISH BROWN SEDIMENT. APPROXIMATELY 5 WORM BURROWS ON THE SURFACE HEAVY ICE CONDITIONS, FOG, CALM SEAS. BERGS AND BERG BITS, PANS AND GREASE. E: ARCHIVE (LOST A LITTLE OUT OF BOTTOM OF CORE. A: INSTAAR, C: SPLIT, I: GEOTECH, G: ICELAND. CC: DIATOMS, FORAMS - INSTAAR EE: ORGANIC CARBON - SYVITSKI DD: GRAIN SIZE - SYVITSKI HH: CLAY MINERALOGY - SYVITSKI, HH: OSTRACODS - B. BRIGGS
3	BOXCORE	2470333	64 18.00 24 13.90	250		3	5	N	WESTERN ICELAND SHELF (IS1)	GREENISH (OLIVE) SURFACE - SMALL WORM TUBES OUTCROP SURFACE. SURFACE HAS SMALL POCKMARKS ABOUT 1CM DIAMETER E - GEOTECH I - SPLITTING C - ICELAND G - ARCHIVE H - INSTAAR EE - DIATOMS/FORAMS II AND DD - OSTRACODS

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 6

ROV SURVEYS

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

SAMPLE NUMBER	DIVE NUMBER	SURVEY NUMBER	LATITUDE LONGITUDE	START/END TIMES	TOTAL TIME	MAX DEPTH	VIDEO TAPE NUMBER	GEOGRAPHIC LOCATION	NOTES
14			65 26.79 30 27.36					EASTERN GREENLAND (DS2)	ROVTECH TEST
33			68 31.44 32 36.85					HEAD OF KANGERDLUGSSUAQ FJORD (KF5)	ROV STATION FROM SHIP

TABLE 7

GRAB SAMPLES

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
8	VAN VEEN	2481519	65 01.69 30 16.31	1802	1	5	EASTERN GREENLAND (DS1)	GRAB HAD SMALL SAMPLE INCLUDING COBBLE/GRAVEL ANGULAR TO SUBANGULAR VOLVANIC LOOKING ROCKS. ALSO 50-60 PERCENT GRANULE SIZE AND SAND. ALL BLACK IN COLOR INTERMIXED WITH LIGHTER COLOR.
15	VAN VEEN	2491636	65 26.29 30 28.42	525	1	6	EASTERN GREENLAND (DS2)	GRAB 1/8TH FULL. BLACK PREDOMINATELY, SANDY, GRANULES, GRAVEL, COBBLES: 10X10X2 CM. LOTS OF CORAL BROKEN AND ABUNDANT SHELL HASH. GRAINS ARE SUBANGULAR, ANGULAR GRAINS. VERY LITTLE SILT. CORAL FRAGMENTS UP TO 3 CM X 0.7CM BLEACHED WHITE APPEARANCE. VERY POORLY SORTED. MOST LARGE CLASTS ENCRUSTED IN PART.

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 8

SEISMIC RECORDS

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	HYDROPHONE	LINE NUMBERS	GEOGRAPHIC LOCATION	RECORDER	SYSTEM / SOUND SOURCE
6A	2531835	2531915	NSRF	21	KANGERDLUGSSUAQ FJORD (KF4)	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
6B	2561810	2561835	NSRF	24		LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
7A	2561810	2562055	NSRF	24		LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
7B	2561900	2562055	NSRF	24		LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
2A	2480150	2481035	SE 25 FT	5, 6, 7	DENMARK STRAIT (DS1)	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
2B	2480205	2481035	SE 25 FT	5, 6, 7	DENMARK STRAIT (DS1)	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
3A	2490015	2491210	SE 25 FT	8, 9, 10, 11	OUTER KANG TROUGH DENMARK STRAIT (DS2)	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
3B	2490015	2491210	SE 25 FT	8, 9, 10, 11	OUTER KANG TROUGH DENMARK STRAIT (DS2)	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
4A	2492220	2501750	SE 25 FT	12,13,14,15,16, 17	KANG TROUGH KT3	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
4B	2492220	2501750	SE 25 FT	12,13,14,15,16, 17	KANG TROUGH KT3	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
5A	2502350	2511410	SE 25 FT	18, 19, 20	KANG TROUGH KT3	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
5B	2502350	2511413	SE 25 FT	18, 19, 20	KANG TROUGH KT3	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
8A	2581845	2600435	SE 25 FT			LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
8B	2581845	2600435	SE 25 FT			LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
1B	2470725	2470940	SE 100 FT	A-B, C-D, E-F	WESTERN ICELAND SHELF (IS1)	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN
1A	2470725	2470940	SE 25 FT	A-B	WESTERN ICELAND SHELF (IS1)	LSR 1811	AGC SEISMICS SLEEVE GUN 10 CU IN

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 9

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

HUNTEC RECORDS

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	HYDROPHONE	LINE NUMBERS	GEOGRAPHIC LOCATION	RECORDER	HUNTEC SYSTEM
1B	2470801	2470940	EXTERNAL	C-D, E-F	WESTERN ICELAND SHELF (IS1)	EPC9800	HUNTEC DTS (AGC 2)
4B	2492110	2500955	EXTERNAL	12, 13, 14	KANG TROUGH (KT3)	EPC9800	HUNTEC DTS (AGC 2)
5B	2501500	2501730	EXTERNAL	17	KANG TROUGH (KT3)	EPC9800	HUNTEC DTS (AGC 2)
6B	2510010	2510800	EXTERNAL	18, 19	KANG TROUGH (KT3)	EPC9800	HUNTEC DTS (AGC 2)
7B	2531820	2531915	EXTERNAL	21	KANGERDLUGSSUAQ FJORD (KF4)	EPC9800	HUNTEC DTS (AGC 2)
8B	2561815	2562050	EXTERNAL			EPC9800	HUNTEC DTS (AGC 2)
9A	2561815	2562055	EXTERNAL			EPC9800	HUNTEC DTS (AGC 2)
9B	2581845	2582000	EXTERNAL			EPC9800	HUNTEC DTS (AGC 2)
10A	2581845	2582005	INTERNAL			EPC9800	HUNTEC DTS (AGC 2)
1A	2470801	2470940	INTERNAL	C-D, E-F	WESTERN ICELAND SHELF (IS1)	EPC9800	HUNTEC DTS (AGC 2)
2A	2480140	2481030	INTERNAL	5, 6, 7	DENMARK STRAIT (DS1)	EPC9800	HUNTEC DTS (AGC 2)
2B	2480140	2480930	INTERNAL	5, 6, 7	DENMARK STRAIT (DS1)	EPC9800	HUNTEC DTS (AGC 2)
3A	2482349	2491010	INTERNAL	8, 9, 10, 11	OUTER KANG TROUGH DENMARK STRAIT (DS2)	EPC9800	HUNTEC DTS (AGC 2)
3B	2482349	2491200	INTERNAL	8, 9, 10, 11	OUTER KANG TROUGH DENMARK STRAIT (DS2)	EPC9800	HUNTEC DTS (AGC 2)
4A	2491015	2491210	INTERNAL	11	OUTER KANG TROUGH DENMARK STRAIT (DS2)	EPC9800	HUNTEC DTS (AGC 2)
5A	2492110	2500955	INTERNAL	12, 13, 14	KANG TROUGH (KT3)	EPC9800	HUNTEC DTS (AGC 2)
6A	2501450	2501745	INTERNAL	17	KANG TROUGH (KT3)	EPC9800	HUNTEC DTS (AGC 2)
7A	2510005	2510805	INTERNAL	18, 19	KANG TROUGH (KT3)	EPC9800	HUNTEC DTS (AGC 2)
8A	2531820	2531915	INTERNAL	21	KANGERDLUGSSUAQ FJORD (KF4)	EPC9800	HUNTEC DTS (AGC 2)

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 10

3.5 KHZ RECORDS

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	LINE NUMBERS	GEOGRAPHIC LOCATION	RECORDER	SYSTEM / SOUND SOURCE
001	2470106	2470940	A-B, C-D, E-F	WESTERN ICELAND SHELF (IS1)	EPC4100	HULL MOUNTED
002	2480305	2481040	5, 6, 7	DENMARK STRAIT (DS1)	EPC4100	HULL MOUNTED
003	2482255	2491210	8, 9, 10, 11	OUTER KANG TROUGH DENMARK STRAIT (DS2)	EPC4100	HULL MOUNTED
004	2492110	2502330		KANG TROUGH (KT3)	EPC4100	HULL MOUNTED
005	2502340	2531930		KANG TROUGH (KT3) & KANGERDLUGSSUAQ(KF3)	EPC4100	HULL MOUNTED
006	2540815	2550330			EPC4100	HULL MOUNTED
007	2550430	2590035			EPC4100	HULL MOUNTED
008	2590045	2600435			EPC4100	HULL MOUNTED

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 11

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

SIDESCAN RECORDS

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	LINE NUMBERS	GEOGRAPHIC LOCATION	RECORDER	SIDESCAN SYSTEM
001	2470725	2470950	A-B, C-D, E-F	WESTERN ICELAND SHELF (IS1)	TDU-1200	KLEIN
002	2491519	2492200	12	KANG TROUGH (KT3)	TDU-1200	KLEIN

TABLE 12

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

SEISMICS/SIDESCAN/HUNTEC COMBINED VHS TAPES

TAPE NUMBERS	START DAY/TIME	STOP DAY/TIME	GEOGRAPHIC LOCATION	CHANNEL INFORMATION	
001	2470728	2480231	WESTERN ICELAND SHELF (IS1 AND DS2)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ, CHAN 9-100KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG LEFT , CHAN 8-KLEIN SONAR TRIG,
002	2480233	2480526	DENMARK STRAIT (DS1)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ LT	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR TRIG, CHAN 9-100 KHZ
003	2480528	2480822	DENMARK STRAIT (DS1)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG/SYNC CHAN 8-KLEIN SONAR, CHAN 9 100K
004	2480824	2481041	DENMARK STRAIT (DS1)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100KHZ
005	2490017	2490300	OUTER KANG TROUGH DENMARK STRAIN (DS1)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
006	2490306	2490601	OUTER KANG TROUGH DENMARK STRAIT (DS1)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
007	2490601	2490856	OUTER KANG TROUGH DENMARK STRAIT (DS1)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
008	2490857	2491151	OUTER KANG TROUGH DENMARK STRAIT (DS1)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
009	2491152	2492340	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
010	2492341	2500231	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
011	2500232	2500526	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
012	2500526	2500719	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
013	2500720	2501015	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
014	2501017	2501313	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
015	2501314	2501600	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
016	2501600	2510055	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
017	2510050	2510330	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
018	2510357	2510700	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
019	2510700	2510951	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
020	2510954	2511256	KANG TROUGH (KT3)	CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
021	2511303	2511405		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ	CHAN 4-DTS INT , CHAN 5 DTS CHAN 8-KLEIN SONAR, CHAN 9 100K
022	2531809	2561829		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
023	2561830	2562055		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
024	2581845	2582135		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
025	2582135	2590029		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
026	2590030	2590325		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
027	2590325	2590620		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
028	2590620	2590914		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
029	2590916	2591210		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
030	2591214	2591506		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
031	2591507	2591759		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K

TABLE 12

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

SEISMICS/SIDESCAN/HUNTEC COMBINED VHS TAPES

TAPE NUMBERS	START DAY/TIME	STOP DAY/TIME	GEOGRAPHIC LOCATION	CHANNEL INFORMATION	
032	2591759	2592054		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
033	2592054	2592348		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
034	2592348	2600241		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K
035	2600242	2600439		CHAN 1-NSRF RAW, CHAN 2-SEISMICS CHAN 6-DTS EXT , CHAN 7 KLEIN 100 KHZ,	CHAN 4-DTS INT , CHAN 5 DTS TRIG CHAN 8-KLEIN SONAR, CHAN 9 100K

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 13

CRUISE NUMBER = 93030
CHIEF SCIENTIST = DR. J. SYVITSKI
PROJECT NUMBER = 860026

DIGITAL TAPES

REEL NUMBER	NARC NUMBER	START DAY/TIME	STOP DAY/TIME	LINE NUMBERS	PARAMETER	GEOGRAPHIC LOCATION	DIGITAL TAPE NOTES
001		2470732	248		EXABYTE		
002		249			EXABYTE		
003		2492253	2501751		EXABYTE		
004			2510806		EXABYTE		
005		2510855			EXABYTE		
006		2531816			EXABYTE		
007		256			EXABYTE		
008					EXABYTE		

ATLANTIC GEOSCIENCE CENTRE — ANALYSIS TOTALS FOR SEPTEMBER — CRUISE NUMBER = 93030 DATA SECTION

-FINS- REPORTING PACKAGE — CHIEF SCIENTIST = DR. J.P.M. SYVITSKI — PROJECT NUMBER = 860026

CRUISE	SAMPLE NO.	ANALYSIS TYPE	ANALYSIS TOTALS	TOTAL ANALYSIS FOR THIS SAMPLE
93030	003I	BULK DENSITY	5	
93030	003I	CLAY MINERALOGY	1	
93030	003I	FORAMS	21	
93030	003I	GRAIN SIZE	1	
93030	003I	LOGGED	1	
93030	003I	MAG SUSCEPTABIL	1	
93030	003I	MINATURE SHEAR	5	
93030	003I	ORGANIC CARBON	1	
93030	003I	SPLIT	1	
				37
93030	004	BULK DENSITY	17	
93030	004	C14, FORAMS	1	
93030	004	GRAIN SIZE	8	
93030	004	LOGGED	2	
93030	004	MAG SUSCEPTABIL	2	
93030	004	MINATURE SHEAR	23	
93030	004	PHOTOGRAPHY	2	
93030	004	SPLIT	1	
				56
93030	006	BULK DENSITY	62	
93030	006	C14, FORAMS	2	
93030	006	COLOURMET	8	
93030	006	DIATOMS	63	
93030	006	FORAMS	64	
93030	006	GRAIN SIZE	41	
93030	006	LOGGED	9	
93030	006	MAG SUSCEPTABIL	8	
93030	006	MINATURE SHEAR	67	
93030	006	PALEOMAG, PLUG	59	
93030	006	PHOTOGRAPHY	9	
93030	006	SALINITY	8	
93030	006	SEDIMENTOLOGY	61	
93030	006	SPLIT	9	
				470
93030	006TWC	BULK DENSITY	11	
93030	006TWC	C14, FORAMS	1	
93030	006TWC	GRAIN SIZE	18	
93030	006TWC	LOGGED	2	
93030	006TWC	MAG SUSCEPTABIL	2	
93030	006TWC	MINATURE SHEAR	10	
93030	006TWC	PALEOMAG, PLUG	10	
93030	006TWC	PHOTOGRAPHY	2	
93030	006TWC	SPLIT	2	
				58
93030	007	BULK DENSITY	32	
93030	007	C14, FORAMS	3	
93030	007	COLOURMET	3	
93030	007	DIATOMS	23	
93030	007	FORAMS	23	
93030	007	GRAIN SIZE	42	
93030	007	LOGGED	3	
93030	007	MAG SUSCEPTABIL	3	
93030	007	MINATURE SHEAR	24	
93030	007	PALEOMAG, PLUG	23	
93030	007	PHOTOGRAPHY	3	
93030	007	SALINITY	5	
93030	007	SEDIMENTOLOGY	21	
93030	007	SPLIT	3	
				211
93030	013TWC	BULK DENSITY	1	
93030	013TWC	LOGGED	1	
93030	013TWC	MINATURE SHEAR	1	
93030	013TWC	PHOTOGRAPHY	1	
93030	013TWC	SPLIT	1	
				5

ATLANTIC GEOSCIENCE CENTRE — ANALYSIS TOTALS FOR SEPTEMBER — CRUISE NUMBER = 93030 DATA SECTION
-FINS- REPORTING PACKAGE — CHIEF SCIENTIST = DR. J.P.M. SYVITSKI
PROJECT NUMBER = 860026

CRUISE	SAMPLE NO.	ANALYSIS TYPE	ANALYSIS TOTALS	TOTAL ANALYSIS FOR THIS SAMPLE
93030	019B	BULK DENSITY	5	
93030	019B	C14, FORAMS	1	
93030	019B	COLOURMET	1	
93030	019B	DIATOMS	23	
93030	019B	FORAMS	23	
93030	019B	GRAIN SIZE	6	
93030	019B	LOGGED	1	
93030	019B	MAG SUSCEPTABIL	2	
93030	019B	MINATURE SHEAR	3	
93030	019B	PHOTOGRAPHY	1	
93030	019B	SALINITY	1	
93030	019B	SPLIT	1	
				68
93030	023C	BULK DENSITY	5	
93030	023C	COLOURMET	1	
93030	023C	DIATOMS	22	
93030	023C	FORAMS	22	
93030	023C	GRAIN SIZE	5	
93030	023C	LOGGED	1	
93030	023C	MAG SUSCEPTABIL	1	
93030	023C	MINATURE SHEAR	4	
93030	023C	PHOTOGRAPHY	1	
93030	023C	SALINITY	1	
93030	023C	SPLIT	1	
				64
93030	024	BULK DENSITY	11	
93030	024	C14, FORAMS	1	
93030	024	COLOURMET	2	
93030	024	DIATOMS	15	
93030	024	FORAMS	15	
93030	024	GRAIN SIZE	22	
93030	024	LOGGED	2	
93030	024	MAG SUSCEPTABIL	2	
93030	024	MINATURE SHEAR	15	
93030	024	PALEOMAG, PLUG	15	
93030	024	PHOTOGRAPHY	2	
93030	024	SALINITY	6	
93030	024	SEDIMENTOLOGY	15	
93030	024	SPLIT	2	
				125
93030	028	BULK DENSITY	82	
93030	028	C14, FORAMS	1	
93030	028	COLOURMET	11	
93030	028	DIATOMS	55	
93030	028	FORAMS	55	
93030	028	GRAIN SIZE	144	
93030	028	LOGGED	11	
93030	028	MAG SUSCEPTABIL	11	
93030	028	MINATURE SHEAR	140	
93030	028	PALEOMAG, PLUG	54	
93030	028	PHOTOGRAPHY	11	
93030	028	SEDIMENTOLOGY	56	
93030	028	SPLIT	11	
				642
93030	028TWC	BULK DENSITY	11	
93030	028TWC	COLOURMET	2	
93030	028TWC	DIATOMS	12	
93030	028TWC	FORAMS	12	
93030	028TWC	GRAIN SIZE	14	
93030	028TWC	LOGGED	2	
93030	028TWC	MAG SUSCEPTABIL	2	
93030	028TWC	MINATURE SHEAR	17	
93030	028TWC	PALEOMAG, PLUG	12	
93030	028TWC	PHOTOGRAPHY	2	
93030	028TWC	SEDIMENTOLOGY	12	
93030	028TWC	SPLIT	2	
				100

ATLANTIC GEOSCIENCE CENTRE

-FINS- REPORTING PACKAGE

ANALYSIS TOTALS
FOR
SEPTEMBER

CRUISE NUMBER = 93030 DATA SECTION
CHIEF SCIENTIST = DR. J.P.M. SYVITSKI
PROJECT NUMBER = 860026

CRUISE	SAMPLE NO.	ANALYSIS TYPE	ANALYSIS TOTALS	TOTAL ANALYSIS FOR THIS SAMPLE
93030	034	BULK DENSITY	33	
93030	034	C14, FORAMS	2	
93030	034	COLOURMET	4	
93030	034	CONSOLIDATION	3	
93030	034	DIATOMS	21	
93030	034	FORAMS	21	
93030	034	GRAIN SIZE	48	
93030	034	LOGGED	4	
93030	034	MAG SUSCEPTABIL	4	
93030	034	MINATURE SHEAR	48	
93030	034	PALEOMAG, PLUG	21	
93030	034	PHOTOGRAPHY	4	
93030	034	SEDIMENTOLOGY	21	
93030	034	SPLIT	4	
				238
93030	034TWC	BULK DENSITY	12	
93030	034TWC	COLOURMET	2	
93030	034TWC	DIATOMS	11	
93030	034TWC	FORAMS	11	
93030	034TWC	GRAIN SIZE	21	
93030	034TWC	LOGGED	2	
93030	034TWC	MAG SUSCEPTABIL	2	
93030	034TWC	MINATURE SHEAR	20	
93030	034TWC	PALEOMAG, PLUG	11	
93030	034TWC	PHOTOGRAPHY	2	
93030	034TWC	SEDIMENTOLOGY	11	
93030	034TWC	SPLIT	2	
				107