REPORT ON ATLANTIC GEOSCIENCE CENTRE PARTICIPATION IN CSS BAFFIN CRUISE 86-023

by

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BIO CRUISE:	86-023
VESSEL:	CSS Baffin
MASTER:	N. St. C. Norton
HYDROGRAPHER-IN-CHARGE:	V. J. Gaudet
AGC REPRESENTATIVE:	D. B. Praeg
AREA SURVEYED:	Eastern Bylot Island Offshore
SURVEY DURATION:	August 26 to September 10
DATA COLLECTED:	1370 line-km 3.5kHz and 12kHz subbottom profiles 10 grab samples 4 gravity cores

CRUISE SUMMARY

Atlantic Geoscience Centre participation in cruise 86-023 was initiated as part of the Northern Oil and Gas Action Program, with the intent of collecting geological data on seabed sediments in the Arctic Island channels during Canadian Hydrographic Service operations in Norwegian Bay - Belcher Channel. One AGC representative was included in CSS Baffin's contingent on departure from BIO July 31. However, on arrival in the channels on August 14 pack ice was encountered, which ultimately prohibited access to Norwegian Bay through western Jones Sound. On August 25, CHS decided to move their program to the open water region offshore eastern Bylot Island. During CHS operations in this region from August 26 to September 10, AGC was able to collect both samples and shallow seismic profiles (Figure 1; Tables I and II). The AGC representative returned to BIO September 10 via Pond Inlet, preparatory to CSS Baffin's departure from the area en route south.

EQUIPMENT

3.5 kHz Seismics: (high resolution)	O.R.E. 10 kW Transceiver O.R.E. 'Pollywog' - Towfish with 4 Transducers Hull Mounted Raytheon Transducers (array of 9) EPC Models 4100 and 4603 Precision Graphic Recorder
12 kHz Echosounding:	Raytheon Programmable Transmitter Receiver Hull Mounted Edo-Western Transducers (set of 2) Raytheon Line Scan Recorder
Sampling:	Benthos Gravity Corer (3m total length, 200 lbs of weights) Van Veen Grab Sampler

DATA COLLECTION

It was clear prior to the start of 86-023 that fuel limitations imposed in 1986 would largely restrict CSS Baffin's activity to movement between CHS launch or helicopter way-points, and therefore restrict data collection by AGC. Consequently, AGC agreed to provide up to 50 tons of fuel for collection of geophysical and sample data in the Norwegian Bay area, and authorized use of up to 5 tons of this fuel in peripheral areas, such as the Baffin Shelf. These 5 tons were not used in the Bylot Island area as all data were collected in the course of CHS operations.

The pattern of CHS operations proved strongly dependent on weather conditions. In calm weather, launches were sent out for day-work and ship's activity was restricted to movement between way-points near Bylot Island, while in rougher weather, the ship ran sounding lines. AGC was therefore able to collect samples and short seismic lines near Bylot Island in calm weather, and long seismic lines in rougher weather. Fortunately for AGC rough weather was plentiful, and a grid of seismic lines was collected across an area 7000 km^2 east of Bylot Island (Figure 1; Table I).

The data obtained could not have been collected without the ready cooperation of the CHS, and many thanks are due V. Gaudet and W. Burke for their courtesy, and their indulgence of requests that more than once took them out of their way. The help of CHS staff in aspects of watch-keeping was also indispensable, and is gratefully acknowledged. Thanks are also due Captain N. St. C. Norton and the officers and crew of CSS Baffin for their cooperation and expertise.

EQUIPMENT ASSESSMENT

The 3.5 kHz and 12 kHz transceivers, transducers and their recorders all functioned well and presented no major problems. The 3.5kHz 'pollywog' towfish provided excellent subbottom records when used in calm seas at survey speeds of 6 knots or less. However, at the high speeds (up to 11 knots) at which the CHS sounding lines were run, usually in other than calm weather, the records were dominated by noise. This may have been due in part to the short tether (10m) used with the towfish. The 3.5 kHz hull-mounted transducers provided records which were comparable to the towfish in calm seas, and less noisy in rough seas, and so were used the majority of the time. These also had the advantage of not requiring deployment, and so could be used on an incidental basis, and during sampling. In the roughest weather encountered, return signals to the hull-mounted transducers could be obscured by bubbles under the hull; for the 12 kHz records this was avoided by lowering the RAM part way through the survey.

The Benthos gravity corer had a long barrel in comparison to previous years, making it awkward to manoeuvre in the winch room. A system was devised whereby it was deployed nose first, with a handybilly running from the head to the deck for stability; this worked quite well. However, the corer proved too heavy for Baffin's oceanographic winch, accelerating it during payout to produce a rhythmic grinding; there was no problem with recovery. The first 3 cores were payed out at high speed (50 m/minute or more), but subsequent lowerings were at half speed

which reduced the grinding noise; on the last station two of the five 40lb weights were removed as well. Despite these problems the corer was very successful, providing maximum penetration and 1-2m cores at all stations save the last, which was in coarse-grained sediment (Table II). The Van Veen grab worked well in water depths up to 620m, but during two attempts at Station 13 in 980m depth, the grab failed to trip and no sample was obtained. On all sampling stations, especially deeper ones, the lack of a metre-block was keenly felt. No sampling operation should be without one.

Navigational positioning for the data was either by bridge radar fixes, or in the case of geophysical data collected along CHS sounding lines, by CHS's Siledas positioning system. The former provided accuracy within 100's of metres, the latter within 10's of metres.

GEOLOGICAL RESULTS

The geophysical data collected provide up to 20m subbottom penetration into the unconsolidated seabed sediments off Bylot Island. Three sediment units are recognized: (1) uppermost acoustically transparent (=muddy) sediments, with a smooth surface and weak to no stratification, up to 3m thick, (2) underlying less transparent, weakly to strongly stratified sediments, up to 10m thick, and (3) lowermost unstratified sediments, with an irregular surface of constructional relief, up to at least 15m thick. Samples were collected from the upper 2 units, which consist of mud, and gravelly sandy mud, respectively. The 3 units are considered stratigraphically correlative to similar units defined on the Baffin Shelf to the south, where they are interpreted as uppermost post-glacial basinal mud, underlying glacial marine sediments, and lowermost glacial till.

The uppermost mud unit forms the seabed over most of the area below 600-700m depth, although it thins above 900m in the north. The middle unit underlies the mud unit everywhere, and is exposed on the Baffin and

Bylot Island slopes above 600-700m depth; it extends up to at least 400m depth, above which subbottom resolution is poor on steep slopes. The lowermost unit is penetrated only locally, but its characteristic surface relief is recognised at the base of the middle unit over a large area; in particular, a series of moraine-like ridges are observed extending approximately southeast from the mouth of Lancaster Sound, the crests of which are approximately outlined by the 900m isobath in Figure 1.

On the Bylot Island shelf and slope above depths of 200-300m no subbottom penetration is observed on the geophysical records. Samples from 120-220m depth indicate a coarse-textured seabed, consisting of a thin (10cm) primarily gravelly and/or sandy surface veneer overlying somewhat gravelly sand and mud. These sediments may reflect current modification of the two lower units, and/or ice-rafted deposition.

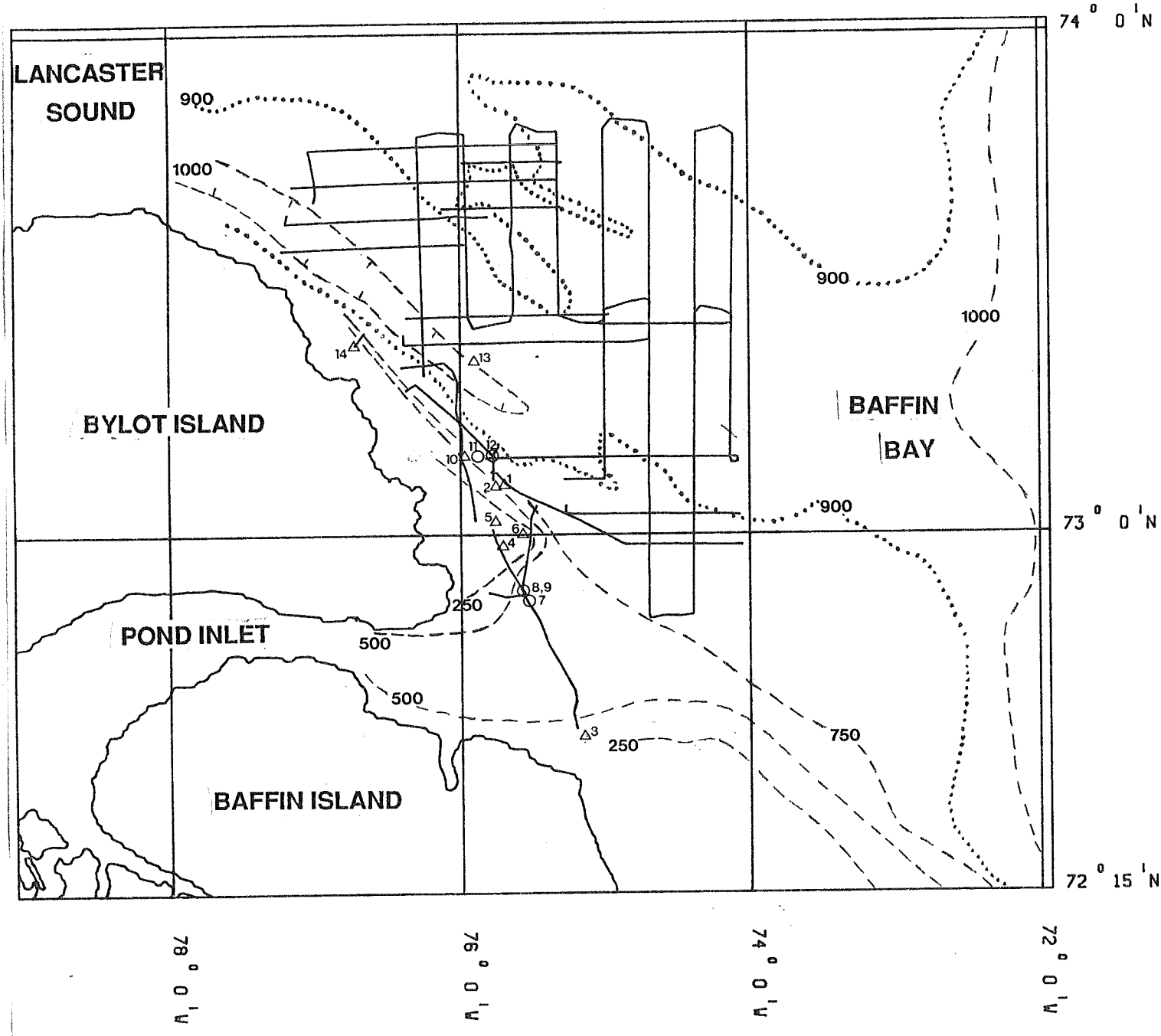

Figure 1- 86-023 geophysical tracks and sample stations (triangles = grabs, circles = cores). See Tables I & II for record and sample information. Bathymetry from the geophysical tracks and from CHS Chart 7220.

TABLE I

GEOPHYSICAL PARAMETER RECORDING INTERVALS

AND ROLL NUMBERS

START (GMT)	END (GMT)	3.5KHZ ROLL(S)	12KHZ ROLL(S)	NOTES
239/1400	239/1500		1	STN. 1
239/1600	239/1700		1	STN. 2
240/0100	240/0630	1	1	AGC LINE BETWEEN CHS WAY-POINTS
240/1345	240/1500		1	STN. 4
240/1615	240/1645		1	STN. 5
241/1245	241/1355		1	STN. 6
241/1815	241/2145	1	1	STNS. 7-9 AND AGC LINE TO CHS WAY-POINT
242/1200	243/1104	2-3	2-3	AGC LINES ALONG CHS N-S LINES
243/2210	244/0045	3	3	AGC LINE ALONG CHS E-W LINE
244/0500	244/1010	3	3	AGC LINES ALONG CHS E-W LINES
244/1930	244/2020	3	3	AGC LINE TO CHS WAY-POINT
245/1100	245/1510	3	3	STNS. 10-12 AND AGC LINE TO CHS WAY-POINT
245/1810	245/2055	4	4	AGC LINE BETWEEN CHS WAY-POINTS
246/2100	246/2200	4	4	AGC LINE TO CHS WAY-POINT
247/1140	248/1130	4-5	4-5	AGC LINES ALONG CHS N-S LINES
248/1522	248/2300	5	5	AGC LINE ALONG CHS E-W LINE
249/0235	249/0500	5	5	AGC LINE ALONG CHS E-W LINE
249/1630	249/1800		6	STN. 13
250/1230	250/1330	6	6	STN. 14 AND AGC LINE TO E
251/1205	251/1413	6	6	AGC LINE ALONG CHS E-W LINE
251/2120	252/0010	6	6	AGC LINE ALONG CHS E-W LINE
252/0200	252/0330	6	6	AGC LINE ALONG CHS E-W LINE
252/1530	252/1910	6	6	AGC LINE ALONG CHS E-W LINE
252/2235	252/2400	6	6	AGC LINE ALONG CHS E-W LINE
253/0545	253/1010	6	6	AGC LINE ALONG CHS E-W LINE

TABLE 2
86023 SAMPLE STATIONS

Station #	Day/Time GMT	Latitude Longitude	Depth (m)	Sample Type	Core App. Penet. (cm)	Core Length (cm)	Station Notes
1	2391424	73° 05.6' 75° 40.0'	619	GRAB	--	--	-Pebble in jaws, small sample of olive green sandy mud with gravel (large pebbles and 1 cobble, angular, clean surfaces indicate exposure at seabed). Numerous twig-like worm tubes. Soupy consistency may reflect exposure to water due to open jaws.
2	2391613	73° 05.3' 75° 41.8'	444	GRAB	--	--	-Full grab - fairly sticky olive green sandy mud with some gravel (pebbles, 1 cobble; angular to rounded). Numerous twig-like worm tubes, 1 spiral shell, 1 worm? with flagella. Sediment soupy where exposed to water on the way up. Gravel not a surface layer.
3	2400034	72° 34.8' 75° 09.0'	350	GRAB	--	--	-Full grab - sticky olive green sandy mud, with a few (<5%) large pebbles and cobbles (angular). Numerous twig-like worm tubes. Gravel not a surface layer.
4	2401355	72° 58.0' 75° 42.8'	123	GRAB	--	--	-Small pebble in jaws, but sample appears unmodified. -Gravelly surface (pebbles) overlies soupy olive green muddy sand with some gravel. Gravel subangular to subrounded. Brittle stars 3-10cm diameter. Surface and subsurface mixed when grab opened - 1 bagged sample.
5	2401615	73° 01.2' 75° 44.0'	153	GRAB	--	--	-1st attempt: cobble in jaws, small sample of 3 small cobbles (unstained) over olive green muddy sand with some fine gravel. One fussy orange brittle star and a cohesive lump of grey sandy mud. -2nd attempt: full grab - surface layer of pebbles (angular) and worm tubes (agglutinated) overlies olive green muddy ned-cse sand with granules and pebbles (shell halves, brittle stars), which in turn overlies olive green fairly cohesive sandy mud with granules (few pebbles), 1 clam and grey area of organic decay. All gravel angular. Layers gradational - coarsening up sequence.
6	2411253	73° 00.5' 75° 32.3'	220	GRAB	--	--	Jaws partly open, small sample. Surface layer of muddy sand (cse) and gravel (granules to cobbles, angular) with numerous long worm tubes, appears to overlie olive green mud & sand (fine-med) with some gravel (granules and pebbles). Layers gradational. Two bagged samples.
7	2411902	72° 52.6' 75° 33.2'	644	CORE	250	190	Mud on barrel to weights. Core top: soft olive green silty clay. Bottom: soft light and dark grey clay. Water in top 1/3 of core between sediment and liner difficult to drain.

TABLE 2 (continued)
86023 SAMPLE STATIONS

Station #	Day/Time GMT	Latitude Longitude	Depth (m)	Sample Type	Core App. Penet. (cm)	Core Length (cm)	Station Notes
8	2411945	72° 53.6' 75° 35.3'	576	GRAB	--	--	Grab taken to check bottom prior to Stn. 9 (core). Full grab - fairly cohesive (sticky) olive green sandy silty clay with rare pebbles, with a surface veneer (cms) of gravelly mud (pebbles). One bagged sample.
9	2412001	72° 53.4' 75° 34.7'	592	CORE	180	105	-Core top: olive green cohesive pebbly sandy silty clay. -Bottom: firm grey slightly sandy silty clay.
10	2451203	73° 09.0' 75° 58.9'	393	GRAB	--	--	-Jaws slightly open but full sample. Fairly sticky olive green sandy mud with some gravel (pebbles, 1 cobble; angular to subrounded), two large worms hanging out of jaws (30cm long, 1-2cm thick), few small twig-like worm tubes.
11	2451237	73° 09.3' 75° 52.4'	654	CORE	240	180	-Mud to bottom of weights. -Core top: cohesive (sticky) olive green slightly sandy silty clay with 1 pebble. -Bottom: stiff grey sandy mud with gravel (granules and pebbles).
12	2451319	73° 09.7' 75° 46.2'	836	CORE	240	145	-Mud to bottom of weights. -Core top: slightly sticky olive green silty clay. -Bottom: sticky grey sandy mud with gravel (granules, pebbles).
13	2491750	73° 20.4' 75° 54.0'	980	GRAB	--	--	-1st attempt: didn't trip. -2nd attempt: didn't trip. Veneer of olive green clay on edge of one jaw and plastered on outside face. Mud scraped into plastic vial.
14	2501249	73° 23.2' 76° 43.0'	405	GRAB	--	--	-Grab attempted after corer failed - veneer of sand on inside and outside of cutter. -Full grab - surface veneer of muddy sand (med-cse) with gravel (3 cobbles, pebbles, granules) grades down into fairly cohesive olive green mud and sand (fine-med) with some gravel (granules, pebbles) and slender twig-like worm tubes. -3 cobbles and 1 pebble put in separate bag - 3 are pitted, highly eroded limestones, stained and encrusted on one side