ICE ISLAND SAMPLING AND INVESTIGATION OF SEDIMENTS

FIELD REPORT 1986

P.J.Mudie[1], M.J. Dabros[1] and A. Redden[2]

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2. Acadia University, Wolfville, N.S. B0P 1X0

AGC Open File No. 2211

Ice Island Contribution No. 9

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1. INTRODUCTION

The purpose of this report is to document the 1986 field work carried out in Project ISIS, which is a joint GSC-Canadian University program to study the geology of the surficial sediments in Arctic Ocean areas covered by the drift track of the Canadian ice island, Hobson's Choice. Primary objectives of the 1986 field season are summarized as follows:

1. Obtain sediment cores for sedimentological, paleoecological and geochemical studies of the Canadian Arctic continental margin.

2. Obtain continuous echosounder records for mapping of shelf bathymetry (12 kHz), high resolution profiles of surficial sediments (3.5 kHz), and sparker (10,000J) seismic reflection profiles of the upper ca. 500 metres of sediments.

3. Obtain bottom camera, dredge and grab samples for detailed study of bedforms and the role of benthic fauna in sediment stabilization.

4.Obtain dredge samples of bedrock and gravel for petrological study of the provenance of coarse clastic sediments.

5. Obtain samples of particulate matter in snow, ice and water for study of transport-deposition processes, plankton composition and geochemistry.

6. Obtain water samples for stable isotope studies, including O-18, C-13, N-15.

7. Obtain water column T/S profiles for correlation of surface microfossil distribution and present oceanographic conditions.

2.SPRING CAMP (April 3-June 3)

Personnel: S.A. Macko (MUN)-scientist
M.A. Gorveatt (AGC,PS)-camp manager,senior technician
Mark Chin-Yee (BIO,OSS)-mechanical engineer
Bill MacKinnon (AGC,PS)-mechanical engineer
Paul Moakler (NORDCO contract)-technician
Jay Ardai (Lamont, AGC contract)-engineer

April 3-19 (JD 93-109). Island essentially stationary on the outer Axel Heiberg Shelf, off Bukken Fjord (ca. 80°57'40"N, 97°35'25"W), ca.20 km west of the western end of the 1985 track (Fig.1)

1) Gorveatt and Chin-Yee assembled the 7-ton Hawboldt winch in Resolute, in anticipation of a DND LAPSE drop on the Island in the event that the 3500 ft. runway for the Hercules runway could not be completed before warm weather (-4°C) prevented freezing of the seawater ice surface.

2) Gorveatt and Chin-Yee started repairing the Ice Island coring facilities: the T-3 (Gearhardt-Owen) winch heel-block and base were replaced with steel beams and supports frozen into the ice.

3) Chin-Yee reassembled the underwater camera system for oblique and vertical bottom photographs.

April 19-May 5 (JD 125). Island still stationary off Bukken Fjord.

1) Gorveatt and MacKinnon installed new core-hut gantry supports frozen into the ice; gantry columns were secured with cross-bracing and back-stays. The gantry rigging is now 22 ft. high and should support 5000 lbs.

2) Melter boilers were filled with antifreeze and tested for operation.

3) A Martin-Decker load cell was installed on the T-3 winch and successfully tested up to 3500 lbs which should be ample to raise the 1800 lb piston core head.

4) Construction was begun on wooden housing for the melter hut.

May 5-19 (JD 139). Island still stationary. Ardai and Frank Zemlyak (AOL) remelted the hydrohole in 18 hours.

May 19-31 (JD 151). Island essentially stationary on the outer Axel Heiberg Shelf between 80°57'40"N, 97°35'25" and 80° 57'37"N, 97°35'40"W.

1) Macko and Moakler obtained 4 CTD profiles, 6 horizontal plankton tows (150 micron mesh; 27 cm diam.) and water samples at 30 depths from ca. 50 - 313 m below s.l. Water profile is essentially the same as Spring 1985, with thermocline at 75-125 m. Plankton apparently mostly copepods; no algae, even on the under-surface of the sea ice. Water samples (3) were taken for gas studies by John Whelan (MUN).

2) Macko and Moakler deployed amphipod traps at depths of 293, 287, 282, 233, 173 and 113 m b.s.l. Amphipods (*Anonyx nujax*) caught in the bottom trap only.

3) Macko and Barry Hargrave (MEL) obtained a Ponar grab sample and two gravity cores, using weighted PVC core liner (86200-001,38 cm; 86200-002,61 cm). Cores show ca.20 cm brown mud (10YR 4/2) overlying stiff gray clayey mud with gravel- to cobble-sized clasts.

4) Gorveatt and Moakler started construction of a small hydrohole for the sparker system.

May 31-June 15 (JD 166). Island started moving northeast June 1, 300m/hr at 245° to ca. 80°59'20" N, 97°19'19" W on outer Axel Heiberg Shelf (Fig.2). Navigation was provided by transit satellite positioning (M.J. Schmidt, EPB, Ottawa).

1) Gorveatt installed the 3.5 kHz transceiver in a small hydrohole outside the core hut. Profiles obtained when stationary in 297 m water depth showed 50 m of stratified sub-bottom similar to the shelf off Nansen Sound in Spring, 1985 (Fig.3).

2) Gorveatt completed successful tests of the sparker system, but deployment was delayed because the hydrohole melter needed to be repaired or, possibly, replaced.

3) Gorveatt reamed out the hydrohole in 14 hours and obtained a gravity core (86200-006,132cm) and piston core (86200-007,168 cm; TWC = 98 cm). Piston core pull-out failed at 4200 lb wire tension, but the corer was released ca. 10 mins later, probably due to movement of the Island. Cores were freighted to AGC; initial description shows ca. 10 cm brown carbonate mud (10YR 4/2), ca. 110 cm faintly laminated gray clayey mud, and 48 cm dark gray, stiff sandy,gravelly mud with some large pebbles (Fig. 4). Cutter was dented, suggesting a gravel layer at ca. 2.5m sub-bottom.

3. SUMMER CAMP (June 24-August 5)

Personnel: P.J. Mudie (AGC,EMG)-scientist
J. Avery (Brooke Ocean Tech. Ltd.,AGC contract) chief technician
Paul Moakler (NORDCO Ltd.,contract)-technician
Anna Redden (Acadia U.;AGC COSEP)-field assistant
Mike Schmidt (GSC,Geophysics)-camp manager
Claude Brunet(PCSP)-camp maintenance
A. Overton (GSC,Geophysics)-seismic reflection

June 25-29 (JD 176-180). Island stationary at 80°59'20" N, 97°19'19" W on outer Axel Heiberg Shelf, off Bukken Fjord, in ca. 295 m water.

1) Avery & Brunet tried to repair hydraulic fluid tank for T-3 winch which is leaking 5 gals oil/hr. Metal top and bottom are now too thin to hold patches. Brunet constructed a substitute tank from a 45 gal. fuel drum.

2) Moakler examined 12 kHz system which stopped on June 20 (JD171) with water marks on the surface from a leak in the roof. The problem was found in the automatic shut-off switch for end of paper; the system now works well.

3) Moakler tested the 3.5 kHz system in an attempt to obtain the same profile features recorded by Gorveatt in Spring. The system now works well with a 0.75 sec. sweep rate, firing on every 10th sweep, with power output at 1.4 KW, and a bandwidth of 1.5 kHz. Periodic overcharging, however, caused sporadic gaps in the record. This problem was solved when Moakler checked out and repaired the

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circuit boards. Apparent sub-bottom penetration is 50-75m. When the Island is not moving, sediments are stratified; with slow movement, the top ca. 10m is stratified and deeper layers appear as discontinuous mottling.

4) Bottom camera tests (C09,C14) revealed several problems that Moakler was able to solve. a) As originally set up, the camera frame was in view for vertical shots; for good vertical shots the camera must be mounted on the lower bar holding the flash unit; for oblique views, mount the camera on the upper bar at 35° with the flash at 45°. b) The "new" 510V flash battery heated, leaked, and shorted several circuits (C1,2 & R3). After replacing the battery and wiring, the system appeared to work well, although a minimum of 1 min. is required for recharging between photo frames. The soft bottom shows scattered gravel, amphipod and/or worm traces and rare brittle stars (Heliometra glacialis).

5) Amphipod traps were set on the bottom and at 1m above the seabed. MUN horizontal plankton nets (150 micron mesh) were set on the same line at depths of 262,209 and 136m. The line was left overnight and retrieved after ca. 12 hrs. Amphipods (Anonyx nujax) were caught in the bottom trap only; plankton appears to be mainly copepods.

6) Bottle casts (10-litres) were taken at water depths of 50,125,200 and 269 m. Surface water mass = -1.7°C, 33°/oo; bottom water = -1.6 to +0.17°C, 35 - 35.5 °/oo; oxygen readings = 10.7, - 8.2 ml. A vertical plankton tow (200m) taken with the small AGC net (12 cm diam., 63 micron mesh) recovered mostly copepods.

7) The T-3 winch system was tested with the gravity corer (86200-011),then with the piston corer used in the gravity mode (86200-012). Cores contained 90-115 cm of mud similar to Core 86200-006.

8) Diatom sampling for Lichti-Federovich was started on June 29, using a weighted aluminum pan set in the snow ca. 50m northwest of the core hut (Fig.5).

9) Moakler repaired a corroded circuit board in the MUN CTD system. A CTD profile was then obtained in 272 m water depth.

June 30-July 5 (JD 181-186). On June 30, strong winds moved the Island northeast at 65-100 m/hr, and water depth decreased from 272 to 263 m. After a day of essentially no movement at 81°00'34" N, 97°16'41" W, the Island moved rapidly northeast at 300-460 m/hr, in cold, snowy weather. The travel path apparently crossed a ridge with a minimum depth of 141 m. Movement stopped early on July 3, at 81°16'57" N, 97°35'14" W, in ca. 172 m water depth. The Island is now ca. 10 km from its position at the start of Spring 1986, i.e. it has essentially doubled back on its ca. 35 km southwesterly track. Movement to east/northeast started again early on July 5, with speeds up to 200 m/hr, but becoming stationary by noon, at a water depth of 159 m, 81°05'06" N, 96°55'10"W (Fig.2).

1) Avery and Brunet repaired the trigger arm pressure release system for the piston corer; shear tests were sucessful to ca. 270 m water depth. A piston core (86200-018) with one 3 m barrel recovered 226 cm undisturbed sediment from acoustically stratified sediment at a water depth of 272 m. This core contains ca. 20 cm of brown mud, overlying ca.130 cm of gray clay (5Y 3/1) with faint laminae, and ca. 50 cm unfossiliferous dark gray (5Y 3/2) sandy gravelly mud at the base (Fig.4). Coring with 2 (6 m total length) barrels was attempted in 263 m water, using a trigger weight loaded with only the core liner to reduce the total load. The TWC barrel sheared off and a pressure release valve was lost. The piston corer recovered only 10 cm of mottled brown & gray mud, and sandy mud with coarse angular gravel. Gravity coring at 172 m water depth recovered 10 cm of mud with the Benthos GC (86200-027) and 115 cm of mud with the piston corer used in the gravity coring mode (86200-028). The sediments here appear to be the same as those in the cores from deeper water. At 158 m water depth, the piston corer recovered 55 cm of mud: ca. 15 cm brown mud over 40 cm dark gray, unfossiliferous, fine sandy mud (86200-034).Sand here contains more volcaniclastics and coal fragments than at the previous sites.

2) The 3.5 kHz profiles show variable sub-bottom, probably largely depending on the Island travel speed. When moving upslope at 100 m/hr, discontinuous hyperbolic reflectors appear on profiles of the lower slope (ca. 270-170 m). These hyperbolic reflectors approach the surface at 25 to <5 m sub-bottom, and are then truncated by horizontal reflectors (Fig.6). Some features resemble the distal parts of sediment lobes, but they could be artifacts of side echoes generated by boulders on the seabed. On the outer shelf (ca. 170-140 m), the seabed shows gently rolling relief, with wide (ca. 50 m),low (ca. 5 m) unstratified hummocks separated by troughs in which the bottom tends to be stratified. This pattern appears to indicate buried sand waves or till tongue deposits. Comparison with 3.5 profiles from the same area in 1985, however, show that the lobate structures correspond to gravel ridges/sponge reefs; this indicates the need for calibration of the 3.5 kHz output and recorder settings (see RECOMMENDATIONS, Sect.5).

3) Bottom photographs were taken in water depths from 263 to 141 m. First, however, the flash battery had to be replaced again, and it was noted that the power of the "new" battery dropped from ca. 510 to 465 V during the 30 minute time in the water. The hard bottom at 263 m appears to be sandy mud with rare fine gravel and common brittle star trails. Hummocks from ca. 166-164 m show possible sand ripples and a few trails below 164 m, with dense sponge colonies over the top of the ridge. Hummocks from 152-141 m water depth show a succession from rare brittle stars and sponges to abundant feather stars.

4) Dredge hauls were made at water depths from 228 to 141 m. Haul 1 (86200-022) was 400 m long, from a depth of 228 to 197 m, and was made using a 1" mesh inner liner. This haul recovered mostly brown clayey mud with ca. 10% poorly sorted angular-subrounded gravel- to boulder-sized clasts of variable lithology (mostly granite, with rare limestone). Haul 2 (86200-023) used only the 1.5-

2" chain basket and covered about 400 m of hummocky surface from 162-160 m water depth. Abundant healthy Geodia sponges and < 5% rocks were recovered; some pebble- to gravel-sized clasts (mostly granitic) have thin FeMn coatings. From now on, only the 1.5-2" mesh will be used to avoid excess collection of mud (washing bulky mud samples is a major problem). Haul 3 (300 m long) was made over a relatively flat surface at 147-148 m, between hummocks with relief of 141-147 m; this recovered a few large healthy Geodia and rounded pebbles, heavily coated with FeMn. Oblique camera views from 141-151 m show a sandy bottom with scattered pebbles, and a down-slope succession from brittle stars and sponges to common feather stars/polychaetes.

5) Two amphipod traps were set on the bottom at 262 m: one with a coarse mesh as used by Macko; the other with a liner of cheesecloth mesh. The lined trap caught ca. 19 Anonyx nujax after 4 hours on the bottom; the unlined trap caught only 2 small amphipods.

6) Paired zooplankton nets (150 micron mesh; 27 cm diam.) were towed vertically from 166-0 m; the small AGC plankton net (63 micron mesh; 12 cm. diam.) was sent down closed and towed 3 times, at depths of 166-125, 125-75, and 75-40 m, respectively. The samples recovered abundant large copepods but apparently little phytoplankton (rare chains of centric diatoms, with maximum numbers at 125-75 m).

July 6-July15 (JD 187-196). During this 10-day interval, the island was essentially stationary at 81°05′ 06" N, 96°55′ 10"W, close to its location in Spring 1986. Echosounder and 3.5 kHz profiles showed a slightly undulating bottom with depths ranging from ca. 158 to 164m.

1) The diatom collector was emptied and replaced, and a 1 x 1 m area was flagged for pollen collection southeast of the core hut (Fig.5,#1). Snow was collected from the top 30 cm of the quadrat and from a trench down to the ice base at 89 cm. After back-filling the trench, red glitter was sprinkled over the quadrat to monitor snow accumulation and movement of particulates. During the past 10 days of variable freeze-thaw weather, there has been little change in the depth of the surface marker. It should be noted, however, that during the summer,the aluminum diatom collector tray back-radiates enough heat to evaporate the moisture in the micro-environment above the tray; therefore, water/ice will only be sampled during intervals of extremely heavy precipitation. The design of this collector should be changed: white plastic trays may be more effective.

2) The water column was studied using 10-litre bottle samplers, vertical plankton tows, and CTD profiles. Initial results show stratification to 85 m, with T/S = -1.39 to -1.25°C, 33 °/oo from 50-85 m, -1.53°C, 34 °/oo at 120 m; -0.40°C, 35 °/oo at 155 m. Dissolved oxygen concentrations were ca. 0.5-1.0 mg/L higher than at the deeper (270 m) site sampled in June. Bottom current velocities were measured using a small General Oceanics flowmeter (model # 2030): velocities are lower than the flow rate during deployment of the nets (25 cm/s). Vertical hauls with large nets (47 cm diam., 63

um mesh) recovered abundant copepods and rare, chain-forming cylindrical diatoms in hydrohole samples. Under the sea ice at Seal Point, however, these diatoms were common above 103 m water depth.

3) Sea ice ca. 3m thick was sampled at Seal Point (Fig.4). The surface ice (0-1.3 m) was opaque and contained < $1 mg/m^3$ of fine grained sediment. The bottom 2 m consisted of a slushy mixture of ice and water (frazil ice?) which was brownish in color due to an abundance of a mucilaginous chain-forming cylindrical diatom, provisionally called Georgeus snotii in honour of George Hobson, Director, PCSP (later identified as Melosira arctica).

4) An area of dirty ice was found near the southeast edge of the Ice Island, ca. 200 m south of the AES weather station (Fig.5, #2). This ice contained abundant patches of silty mud with terrestrial plant fragments. A large sample was collected for ^{14}C dating of the organics by Accelerator Micromass Spectometry.

5) Amphipod traps were set on the bottom overnight. The first trap setting failed because the bait was removed by a predator (probably a feather star). Trap doors were then constructed which covered the trap entrances, preventing escape of the predator. Amphipod yields then ranged from 2 specimens in the large mesh (ca. 1 cm^2) MUN trap to ca. 25 in the smaller mesh (ca. 0.5 cm^2) AOL trap. At least 3 species of Anonyx are present in the large sample.

6) Grab samples, cores and bottom photographs showed a variable seabed surface, with relatively small patches of sponge mats separated by areas of mud with common brittle stars. Core recovery was successful only when the Benthos piston corer was used as a gravity coring system, with ca. 7 m free-fall. Core recovery length ranged from 11 to 148 cm, without obvious correlation between core length, water depth or acoustistratigraphic features (Fig.4).The longest cores (86200-53,54) seem to lack the gray clayey mud units B and C which characterise cores from the deeper water (> 270 m) off Nansen Sound and Bukken Fjord; instead, these shelf cores contain a long sequence of dark gray sandy mud (unit D) underlying the brown surface mud layer (unit A). Core 86200-54 (148 cm) also contains a long dark olive gray, fossiliferous silty unit above the dark gray sandy-gravelly unit E found at the bottom of the shelf cores. Most of the cores from the Axel Heiberg Shelf contain only a veneer of soft brown fossiliferous mud (3-6cm) unconformably overlying a hard, gravelly dark brown soil with reddish sandstone clasts or sandy lenses (unit F), which grades to a firm, plastic, dark gray sandy mud with fine gravel (unit G). Units F and G appear to contain abundant mafic and pyroclastic minerals, and small wood fragments are common. No marine microfossils are present in these units; however, fines washed from Core 86200-052 contain common pre-Quaternary bisaccate and triporate pollen, rare Cicatricosisporites, Triprojectipollenites and Pesavis tagluensis; a tentative Late Cretaceous-Eocene age is assigned to these terrestrial sediments which may represent bedrock.

7) Avery constructed a platform for the installation of the large winch to be transported to the Island by LAPSE drop from a

Canadian Airforce Hercules carrier plane. The floor between the coring hut and boiler tent was also constructed, and weather-tight doors were installed for the coring hut.

8) Moakler tested the Sparker system as far as possible without a hole for the hydrophones. The Sparker sled was lowered into a 15-ft deep hole filled with salt water, and was fired in the signal energy range recommended by Gorveatt. The signal was monitored using Overton's hydrophones and recorder. The signal could clearly be discerned from background noise, which indicated that the sound must have travelled through at least 40 m of ice. This implies that the sparker system should work well after proper installation, with hydrophones in the water under the ice. Tests were made to determine the optimum configuration of sound source, hydrophones and recorder, and to determine the minimum distance required between Overton's shot-hole and the sparker hydrophone hole. An effort will be made to construct the hole for the hydrophones using the large melter which has been temporarily repaired by Brunet.

9) Bottom photography was attempted using Ektachrome 400 color film and an oblique camera position. Initial results of film processed at AGC indicate that these trials were successful.

<u>July 16-19</u> (JD 197-200). From July 16, ca. 2000 LT to July 17, 1100 LT, wind increased and its direction changed from predominantly northwest to southeast. During this time, the Island moved at speeds of 100-315 m/hr in a southwesterly direction; however, significant movement then ceased, despite continued brisk winds from the southeast. It appears that further movement was prevented by pack ice. The island was now located at ca. 81°04'43" N, 96°57' 44" W, ca. 300 m inshore from its position on July 3. Water depth varied from 141 to 131 m.

1) During the interval of rapid movement, 3.5 kHz records showed hyperbolic sub-bottom reflectors at depths of ca. 10-20 m, with the uppermost reflector sometimes coming to the surface, then being buried by a 10 m (high/long?) lobe or hummock of transparent surface sediment. Coring at 141 m water depth recovered up to 116 cm of soft brown mud overlying sticky gray sandy mud with minor gravel. At 131 m, the barrel of the corer penetrated only ca. 1.5 m of sediment, and no core was recovered. The cutter was coated with unfossiliferous sticky dark gray, sandy mud, with rare basaltic fine gravel (probably unit G).

<u>July 19-31</u> (JD 200-213). During this interval, ice island movement was sporadic and predominantly oscillatory in direction. From July 19-22, movement was southwesterly at speeds of 10-315 m/hr. From July 22-24, the island was essentially stationary in 148-150 m water depth. On July 24, movement increased to ca. 40 m/hr, then decreased to ca. 6 m/hr until July 27. On July 28, the island moved northeastward at speeds of ca. 125-170 m/hr to a water depth of 132-143 m, then continued more slowly (40 m/hr) in a southwesterly direction. On July 31, sporadic northeasterly movement started at a speed of ca. 80 m/hr, which transported the island into water depths

of 158-172 m.

1) Throughout this interval, 3.5 kHz records showed the same range of surface and sub-bottom features observed from July 2-19. Shipek sampling at water depths of 136-150 m recovered brown sandy mud with rare pebbles, overlying stiff gray mud. Sparse benthic communities of bivalves, feather stars and bryozoans appeared to have a patchy distribution in this area, and few sponges were recovered. Sampling (86200-088) in a depression between hummocks recovered abundant shell, sponge spicules and polychaete tubes, suggesting that ponding of winnowed organic material may occur in this area. Coring at depths of 148-150 m resulted in variable recovery: 86200-081 penetrated only 30 cm of sticky mud that inverted the catcher on pull-out; cores 86200-085,-094,-096 and -102 recovered 29 to 112 cm of brown mud overlying dark gray clayey mud. Bottom photographs of hummocky areas at ca. 147-150 m water depth showed patchy Geodia colonies interspersed with areas of pebbly coarse sediment. A Shipek sample (86200-094) recovered healthy Geodia over a thin mat of spicules and manganese-coated worm tubes. One dredge haul over about 40m of hummocks at depths of 140-150 m recovered ca. 30 kg of boulders and coarse gravel, including fossil wood and highly decomposed reddish volcanic clasts.

2) Moakler and Overton's seismic crew installed a casing of oil drums in the sparker sled hole which was filled with a mixture of 4.5 kg salt and 766 litres of water and glycol (4.5 drums, each 45 gals). Melting of the hydrophone hole was started but the first attempt was discontinued at 25 m when a large hole was encountered that prevented further lowering of the melter hose. A second hole was successfully completed, but initial tests of the sparker failed to produce enough sound to obtain a return signal. More salt was to be added to the sled hole in an effort to increase the conduction of the sound signal.

3) Avery repaired the starter switch for the T-3 winch which needs to be replaced and rewired. The core storage weatherport was realigned and secured tightly. The tower of the core hut was painted and the doors were sealed with weathertape. An inventory of tools was made for AGC/PS.

4) Two sets of plankton tows were made: a) on July 22, vertical hauls with the large (47 cm) 63 um-mesh net at depths of 0-143 m, 0-100 m and 0-75 m; b) on July 31, horizontal hauls with the MUN zooplankton nets at depths of 55, 100 and 145 m towed for 8 hrs during which time the island traveled at ca. 80 m/hr. A CTD profile was made in 135 m water depth on July 30, and amphipod traps were set on the bottom and at +1 m above the seabed. After 12 hrs, the bottom trap contained 25 amphipods of various sizes but the trap at +1 m remained empty. Water samples were obtained on July 31, at depths of 50, 81, 113 and 145 m; profiles appear to be similar to those obtained earlier but the salinity above 81 m was significantly lower (32 ^{0}/oo), presumably reflecting the advance of the meltwater season. It should also be noted that the water in the hydrohole was now extremely dirty and all equipment was coated with oil; SPM and POC samples from this set may be badly contaminated.

4. FALL CAMP (August 1-28)

Personnel: M.A. Gorveatt (AGC,PS)-camp manager, senior technician
Jean Dabros (AGC,EMG)-technician

From August 13-24:
Keith Louden (DAL)-senior scientist;heat flow
Greg Legere (DAL)-technician

August 1-5 (JD 213-217). ISIS staff were exchanged on August 1, at which time Mike Gorveatt also took over management of the camp. During the next 4 days, the island travelled in a large circle around an area already well sampled (Fig. 2), ending up slightly southwest of the start position on August 1. Drift speed varied from 0 to 600 m/hr. Water depths mostly ranged from 163 m to 280 m, with a maximum 335 m encountered during the morning of August 3. The 3.5 kHz records showed an undulating, hummocky bottom during periods of island movement and flat, well stratified sections during slow or no movement. Air temperatures were mild, from $-1^{o}C$ to $1^{o}C$.

1) Gorveatt and Dabros attempted to use all of the coring systems in order to become familiar with the operation of new/modified equipment. A gravity corer at 204m water depth recovered 92 cm of undisturbed sediment with sharp contacts at 58 and 62 cm (86200-109). At 244 m depth, a gravity corer with a plastic liner as a barrel recovered 112 cm of undisturbed sediment (86200-111).When used again in 179 m of water, however, the liner bent and cracked at 1m penetration. Most of the sediment was washed out from the hole in the liner,leaving a 46 cm (86200-112) with firm dark grey gravelly mud at the base. A gravity core was attempted using the piston core head as a weight, in a water depth of 265 m. Core recovery was only 46 cm (86200-114) although apparent penetration was 176 cm; some gravel washed out of the catcher when the corer was raised to the top of the hydrohole. The dart corer was used in 183 m of water where a Shipek grab (86200-115) indicated hard surface sediment. Recovery from this corer (86200-116) was negligible: a small amount of mud fell out of the barrel at the top of the hydrohole but the dart corer appears to have fallen over soon after the barrel hit the seabed.

2) Results of grab sampling were variable in water depths of 181 -238 m. Shipek sample 86200-108 (202 m depth) and Ponar grab 86200-110 recovered 9 cm of soft reddish brown mud with abundant forams, sponge spicules, and polychaete tubes, and rare dropstones on the surface. Shipek grab 86200-115 in 181 m recovered only one stiff mud lump and two pieces of old broken sponge.

3) Two camera stations were run, using black and white film, with the camera in the oblique mode. Series 86200-C113, in 253.5-261.5 m of water, was shot at 5 minute intervals for 15 frames covering 635 m of bottom, during which time the Island travelled at an average speed 530 m/hr on a course of 230^{o}. Series 86200-C117 at 182 m to 194 m depth included 20 frames shot at 2.5 minute intervals when the island moved at an average of 560 m/hr over 440 m of

hummocky terrain on a course of 190°.

4) During mild weather, water accumulated on the core hut roof and leaked in through seams at the base of the derrick. This required frequent bailing to prevent damage to structures or equipment. Long-term repairs are needed (see RECOMMENDATIONS).

August 6 - 20 (JD 218-232). During this period the Island was essentially stationary or oscillating at about 81°02′ N, 97°02′ W. Water depth varied slightly from 163 m to 188 m. On August 13, Gorveatt and Dabros were joined by Louden and Leger from Dalhousie University. Temperatures at this time tended to be cool (0° to -5°C) although a high of 7°C was reached on August 17. Most days were calm and sunny, with occasional fog and a day of rain.

1) Coring facilities were upgraded by enlarging the core hut to accomodate the 7t winch. A hut area 12′ x 16′ was built onto the end of the core hut with the aid of 4 seismic crew members. The melter parcol was taken down and a plywood hut was constructed around the boilers. This melter hut, in addition to providing better protection for the boilers, now provides storage space for geological samples and equipment. Construction of the melter hut walls and roof was completed by the Navigation crew and erection of the pre-fab components was a camp project with every hand available helping to lift and secure the heavy walls.

2) Work was also done on the sparker system, with assistance of the seismic crew, in order to find the correct salinity for the fluid in the sled. Initially, more salt was added in an effort to increase the conductivity of the glycol solution, but it was found that the salt precipitated out of solution when the temperatures approached 0 degrees. Eventually the salt/water/glycol solution was replaced with seawater from the hydrohole which was saline enough for the sparker to build up sufficient charge to emit an audible signal. No seismic record could be obtained, however, apparently due to damage of the hydrophone.

3) In preparation for piston coring, the sizing tool was lowered down the hole on August 8. This tool hung up on the ice at 3 m below sea level line; therefore, the hole had to be reamed. After fueling and starting the boilers, reaming took 17.5 hours to complete, with the reamer being lowered 0.25 meters every 7.5 minutes. The ice at the top of the hole was then cleaned with hot water from the boilers; this job took about one hour to complete.

4) By August 20, a thick layer of hydraulic fluid had accumulated in the hydrohole. Not only was there concern of contamination of water samples by the hydraulic fluid but also equipment was coated with a greasy film which made it difficult to handle. Dabros was therefore lowered down the hole in a crate and the fluid was soaked up with Kim towels which removed most of the surface oil. The next mild day, however, more fluid drained into the hole. This will have to be removed when the camp is opened in the spring.

5) Aerial particulate samples (86200-118,86200-119,86200-123) were collected at irregular intervals depending on the amount of snow accumulation. These samples were melted and filtered through 10 micron mesh and preserved with Lugols solution. Diatom samples were collected, including a sample of rime frost (86200-124) which was only observed on the morning of August 13. Samples of green mucilaginous algae (M. arctica, Coscinodiscus, Thalassosira,etc.) were collected from the hydrophone lines in Overton's shot shacks (86200-126, 86200-127). These algal clumps had to be cut off the weights which hung 50 feet below the base of the Ice Island. Samples were collected an hour after 1 kg dynamite charges had been set off. According to the seismic crew, the presence of this algae was first noticed on about August 1.

6) Louden and Leger conducted seven heat flow experiments (86200-129-135). Tests were made to determine that 1600 lbs of weight is needed on the heat flow probe head for maximum penetration. One test failed because the heat flow pulse failed to go off (86200-132). Several other attempts were aborted when the pinger signal stopped as the heat flow head reached the water below the Ice Island (these were not given station numbers). Maximum penetration was 7 thermistors or 3-3.5 m into the sediment at water depths of 159 - 163 m.

7) A piston core (86200-126) was taken on August 18 in 156 m water depth at approximately the same site of maximum heatflow probe penetration (3.5 m). This corer recovered 208 cm of stiff gray mud. Gravity coring in 166 m of water recovered 53 cm of sediment with a foram rich surface (86200-122). Gravity cores 86200-136 and 86200-137 were taken at heat flow site 86200-135 in 159-163 m of water. The cores contained 39 cm and 33 cm of brown sediment grading down to stiff dark gray mud. Core 86200-137 was taken to Dalhousie University for geotechnical studies by Louden.

8) Grab sampling results were variable. Shipek grab 86200-120 in 73 m depth recovered 9.5 cm of soft brown mud with many large FeMn coated foraminifera. A Ponar grab (86200-121) at the site of gravity core 86200-122 in 161 m water depth penetrated 7.5 cm of stiff reddish-brown mud with a surface forams, molluscs and a ?tube worm covered by 10 cm-long delicate sponge spicules. A Ponar grab in 157 m of water recovered only a little reddish-brown mud and a cobble.

August 21 - August 28 (JD 233-240). During this period the island began to move in a NE direction, slowly at first,then reaching a peak of 1300 m/hr (winds 25 mph gusting to 30 mph) on August 25. Air temperature remained cool (0^{o}C or below, with a low of -7^{o})C but weather was sunny until August 27 when fog and snow caused whiteout conditions.

1) Seven more heat flow experiments were conducted (86200-138, 86200-142, 86200-145 to 148 and 86200-151). Intermittant problems with the pinger continued until Leger rebuilt the circuit board. Penetration averaged 2 - 2.5 m per station, in water depths of 158 - 229 m.

2) Three more samples of mucilaginous algae (86200-139,-140,-141) were collected from the shot shacks three days after the first samples. These samples were preserved in Lugols solution; microscopic examination indicated the presence of many different species of centric and pennate diatoms.

3) Samples of dirty snow (86200-143,-144) were collected from the compression ridge near Seal Point (Fig. 5).The soupy brown mud was stored in plastic bags and shipped back to AGC.

4) A camera station (86200-C149) was run using colour film with coloured tape on the trip weight to monitor colour resolution. The camera was set up in the vertical mode with both the camera and flash mounted on the lower bar of the frame, and with the flash slightly tilted towards the camera (first hole in the angle bar). This set up worked well as the frame is not visible in the photographs when developed.

5) A Shipek grab (86200-150) recovered 7 cm of stiff brownish mud with gravel on the surface. Pull-out of this grab was difficult, suggesting the presence of very cohesive bottom sediment at this site.

6) Two C.T.D.'s were run for M.U.N. The first trial (86200-152) was aborted at a depth of 139 m when the new AGC meter block stopped functioning. After repairing the cogs on the meter block, the second trial (-153) was sucessfully run to a depth of 222 m, at a rate of 0.25 m/sec. Water samples were not taken because of the layer of hydraulic fluid in the hydrohole. Occupation of the Island by a polar bear on August 23 also made it too dangerous to consider sampling through the sea ice at the edge of the Island.

7) Closure of the camp geological sampling facilities was completed. Supplies left outside in 1985, e.g. hydraulic fluid and glycol drums, were chipped out of "ice banks". These drums are now stored on 8"x8" wood blocks in front of or inside the melter hut. The storage tent was de-iced using a Herman-Nelson heater. After removing the water, equipment was stored inside on wooden pallets to prevent freeze-in of supplies and tools. A photographic record showing the location of all equipment was taken to facilitate its location at the start of operations next spring.

Louden and Leger left the Ice Island on August 24, at which time the AOL oceanographers arrived to continue their studies of suspended sediment and biological productivity. The 1986 geological sampling program ended with the departure of Gorveatt and Dabros on August 28.

5. RECOMMENDATIONS

1) In view of the unpredictable rate and direction of ice island movement on the Canadian margin of the Arctic Ocean, it is unprofitable to try and maintain a geological sampling camp throughout the field season. Two operational solutions should be investigated as options to the present inefficient sampling program. A) Co-ordination with the seismic refraction party in sharing Spring helicopter time would allow use of NOGAP field methods for sampling of cross-shelf profiles. B) Establishment of closer liason with oceanographers should be sought, whereby the hydrohole was dedicated to water and grab sampling until sustained movement of the island starts; at this time, a geological party would replace the oceanographers. Periodic water sampling could be continued if required, but it should be noted that the hydrhole water becomes too dirty for suspended sediment and geochemical studies after about 2 weeks of geological sampling. It would be desirable to install a separate hyrohole within about 25 m of the coring hole and maintain this for oceanographic work as well as co-ordinated bottom sampling and photographic studies.

2) The piston coring operation initially requires 3 or 4 staff for setting up the system. When everyone is familiar with all procedures, including use of winches, block and tackles, coring can be carried out by 2 staff. Modification of the method for coupling the barrels to the core head are recommended, however: at present, the barrels have to be inserted at an angle and they have to be held in position for final attachment. This arduous task could be eliminated if an additional block and tackle was used to support the barrel evenly on both sides.

3) During the past two years, several weeks of time on the Island have been wasted because of the difficulty of relocating objects stored outside which inevitably become buried by snow and imbedded in ice. Any gear which must be stowed outdoors should be in contact with a building and its location marked in a record book to be maintaned by the camp manager. There is also some need to ensure that tools which are borrowed are not only returned but are also put back in the same place from which they were borrowed.

4) Continuous operation of 12 kHz system should be carried out with the assistance of the hydrographers, meteorologists and oceanographers who are presently using these bathymetyric data. A digital recorder for the echosounder would facilitate data processing which is presently very tedious and time consuming.

5) There is need to find a coring system for penetration of hard surfaces, e.g. a dart corer. Where till covers soft sediment, a hole might be blasted through this hard layer when the island is stationary; coring into the underlying soft sediment may then be possible.

6) A Van Veen or heavy clamshell-type grab sampler should replace the Shipek for sampling hard bottom; a Ponar grab sampler should be acquired for sampling the soft surface layer. Alternatively, perhaps

a Hesse-type long box corer could replace both these samplers, although the ease of use of the lightweight Ponar grab should remain an important consideration.

7) At present, washing of coring and grab sampling equipment, and cleaning the deck after sampling operations is an arduous and time consuming job. A means should be found for installing a small pump and 1" hose with a spray nozzle to provide water (sea water or freshwater) for the core hut.

8) During mild weather, water accumulates on the core hut roof, at the base of the derrick, and it leaks through seams. The roof must be repaired and sealed in order to prevent further damage to timber and equipment, and a drain should be installed around the derrick. Water also ponds at the base of the A-frame and leaks into the hydrohole; this should be prevented by skirting and/or pumping so that running water does not undercut the floor of the core hut. Hydraulic fluid that has seeped into the ice around the hut must be removed as chunks of ice in the spring in order to prevent further contamination of the hydrohole during the fall melt season.

9) A small winch is needed to permit use of an underwater videocamera for monitoring of the action of coring and grab sampling systems on the seabed. At present it is not clear why apparent penetration of the piston corer is usually good, but core recovery is minimal. Alternatively, it may be more profitable in the long run to contract for the use of a ROV for about one week.

10) The tuning of the 3.5 kHz system (power output, sweep rate, paper advance rate, etc.) needs to be standardised so that accurate comparison can be made between records obtained during different years. When there is need to change the signal and recorder settings, e.g. in areas of softer or harder sediment, there should be at least 3 profile sections that allow for cross-calibration during intervals of rapid, slow and no ice movement. There is also need to investigate the possible use of CHIRP-type high resolution profilers as an alternative to the 3.5 kHz which does not give a meaningful record when the island is not moving.

11) Some indoor recreational facility is required for staff during summer on the island; during this time, outdoor mobility is essentially restricted to those staff who are using the Ski-Doos. When the island is not moving, boredom combined with lack of opportunity for physical recreation becomes a serious problem affecting the morale of the whole camp. It is also recommended that the chief scientist be assigned separate sleeping quarters that can be used for data analysis and report writing; at present, no heated area is available for studies that require freedom from distractions due to work or social activities.

12) The polar bear that has taken up residence at the Ice Island garbage dump is both a potential hazard and a deterrent to work and recreation on the periphery of the island. The presence of the bear is also psychologically threatening as it could unexpectedly advance into the camp or lab buildings. Some decision should be made

regarding removal of this bear before the start of the 1987 field season.

13) Direct-line radio communication between the Island and AGC, as proposed for GSC,Ottawa and ISPG; this direct link will greatly improve co-ordination and camp management problems which are presently at least partly due to the scrambling of messages between their source and their recipient.

14) At present, a significant amount of sampling time is lost because of the lack of opportunity for outgoing staff to report on progress, problems, and the location of equipment. A minimum of one hour between plane unloading and reloading should be scheduled to allow time for this scientific and technical exchange of information. The cost of this hour of aircraft time would be small compared to the costs involved in days of lost sampling time. Exchange of information is also important to ensure safe and efficient operation of new /modified sampling equipment.

15) Valuable sample opportunity is also lost when one of the ISIS staff also has to perform the duties of camp manager. For example, on August 3, the Ice Island drifted into a deep water area not previously sampled, but no geological work could be carried out because managerial duties required constant radio operation to accomodate a plane flight bringing food supplies to the Island. Furthermore, it seems that persons asked to act as camp manager should be provided with free transport and lodging on the Ice Island.

16) As recommended by Hobson, a permanent co-ordinator should be employed for the ice island project, in order to improve logistical operations and for better interfacing of multi-disciplinary scientific teams. In the meanwhile, a workshop should be held in Fall 1986 to plan for better co-ordination of science programs in future years; e.g. to avoid the duplication of work that has resulted from past lack of communication between scientists and PCSP. A good example of this duplication is provided by this year's ice sampling; MUN planned an ice sampling program which commenced last year and was to expand in 1987; they were not notified that PCSP had approved a major ice sampling program for the University of Alaska (Martin Jeffries); in fact, the camp manager was not even aware of the U of A work until this party arrived on the island.

17) Some means must be found to obtain Sparker-type records from the Ice Island. The Geopulse Sparker system used in the NOGAP Leads Program seems to have produced a good record with penetration of greater then 100 m sub-bottom using a pulse strength of 350 J. This system is towed in leads from a Zodiak inflatable raft.

FIGURE CAPTIONS

Figure 1. Location map showing drift track of the ice island from August 1983 to September 1986.

Figure 2. Map with details of drift directions in 1986. Bathymetry is from tentative data provided by Hans Weber, GSC Ottawa.

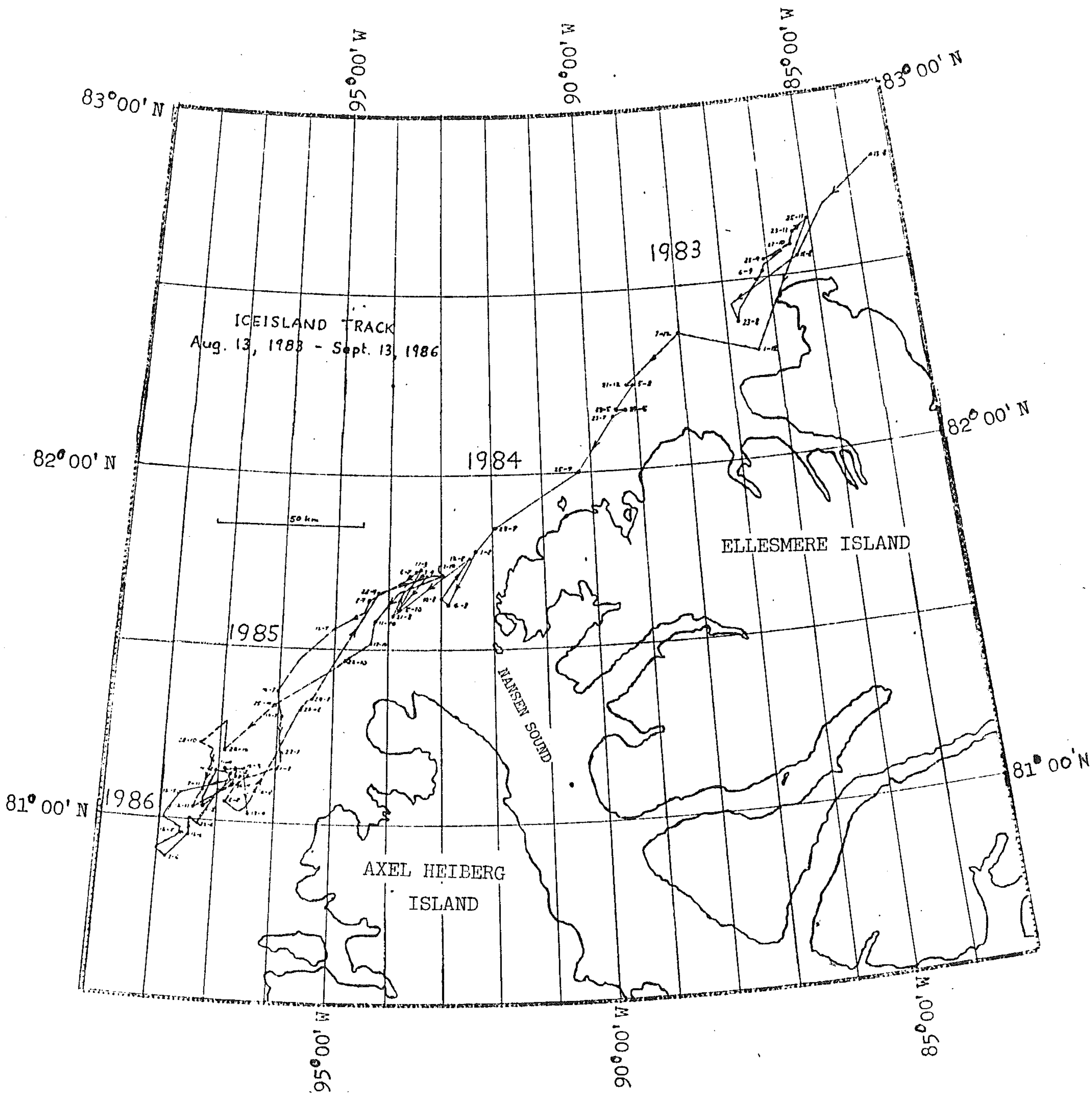
Figure 3. Example of effect of island drift rate on nature of the 3.5 kHz seismic profile. The distance covered is of the order of 5 m, and the surface sediment is essentially homogeneous in character. When the island is moving slowly, the surface 20 m appears well stratified and deeper sediments show discontinuous reflectors ("mottled sub-bottom"). When movement ceases, the sediments appear strongly stratified to a sub-bottom depth of ca. 40 m.

Figure 4. Tentative summary diagram of lithofacies distribution on the shelf and slope from Nansen Channel (85- cores) to Svedrup Channel and the Axel Heiberg Shelf off Bukken Fjord (86- cores), showing the possible correlation between informal sediment units A-G.

Figure 5. Map of the ice island showing locations of snow and ice sample sites. Sites 1,2 & 3 correspond to 1986 sites for samples 86200-036, -060 and -P42, respectively.

Figure 6. Example of 3.5 kHz profile during movement of ca. 300 m/hr on the slope of Axel Heiberg Shelf, at a water depth of ca. 265 m. Hyperbolic reflectors may indicate subsurface structure or may be created by side-echo noise.

FIGURE 1:



95°00' W
90°00' W
85°00' W
83°00' N
83°00' N
1983
ICEISLAND TRACK
Aug. 13, 1983 - Sept. 13, 1986
82°00' N
82°00' N
1984
50 km
ELLESMERE ISLAND
1985
NANSEN SOUND
81°00' N
81°00' N
1986
AXEL HEIBERG
ISLAND
95°00' W
90°00' W
85°00' W

FIGURE 2:

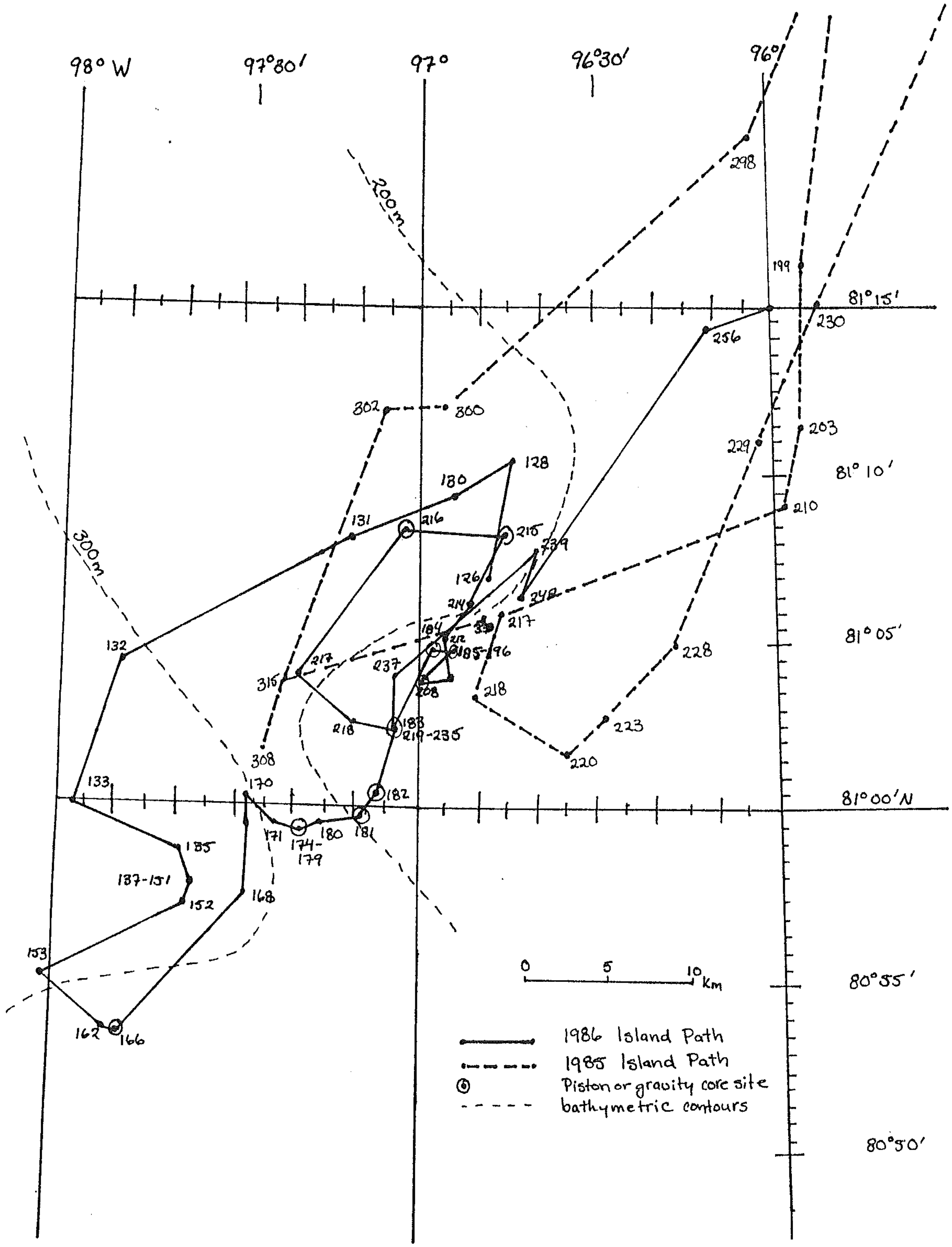
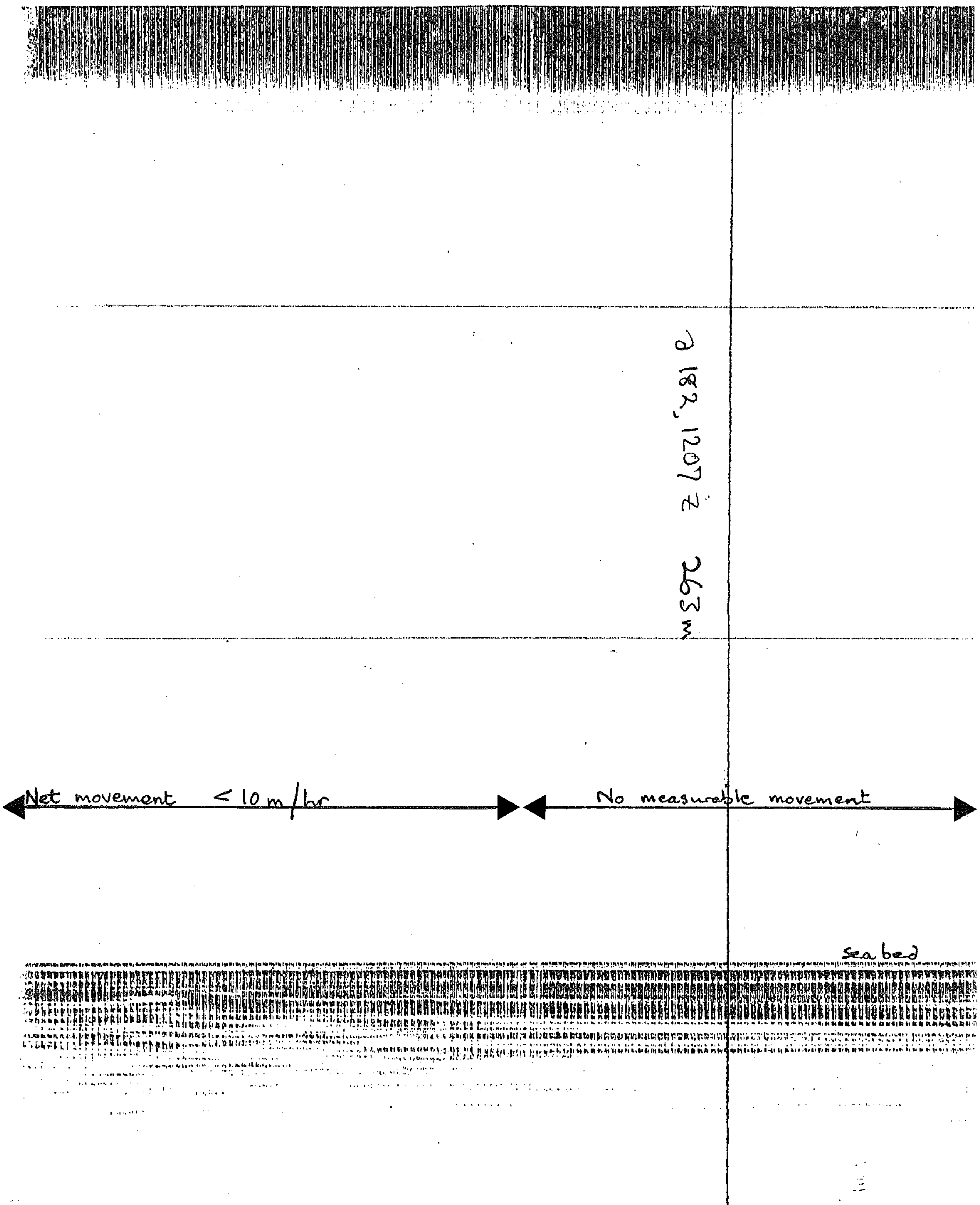

98° W
97°30′
97°
96°30′
96°
81°15′
81° 10′
81° 05′
81°00′N
80°55′
80°50′
200m
300m
0 5 10 Km
1986 Island Path
1985 Island Path
Piston or gravity core site
bathymetric contours

FIGURE 3:


182, 1207 Z 263m
Net movement < 10 m/hr
No measurable movement
sea bed

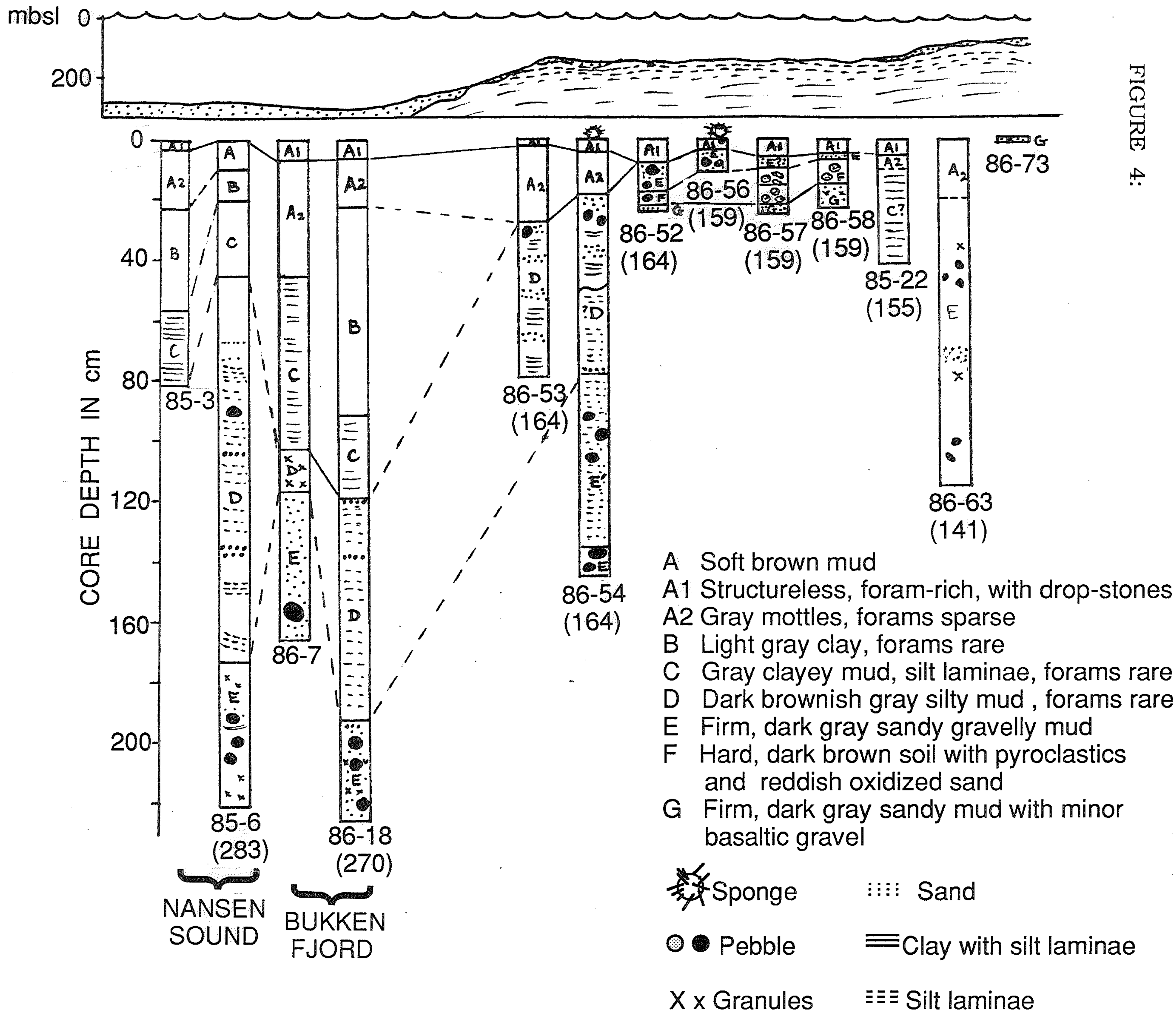

mbsl 0
200
CORE DEPTH IN cm
0
40
80
120
160
200
85-3
85-6
(283)
86-7
86-18
(270)
86-53
(164)
86-54
(164)
86-52
(164)
86-56
(159)
86-57
(159)
86-58
(159)
85-22
(155)
86-63
(141)
86-73
NANSEN SOUND
BUKKEN FJORD
A Soft brown mud
A1 Structureless, foram-rich, with drop-stones
A2 Gray mottles, forams sparse
B Light gray clay, forams rare
C Gray clayey mud, silt laminae, forams rare
D Dark brownish gray silty mud , forams rare
E Firm, dark gray sandy gravelly mud
F Hard, dark brown soil with pyroclastics and reddish oxidized sand
G Firm, dark gray sandy mud with minor basaltic gravel
Sponge
Sand
Pebble
Clay with silt laminae
X x Granules
Silt laminae

FIGURE 4:

FIGURE 5:

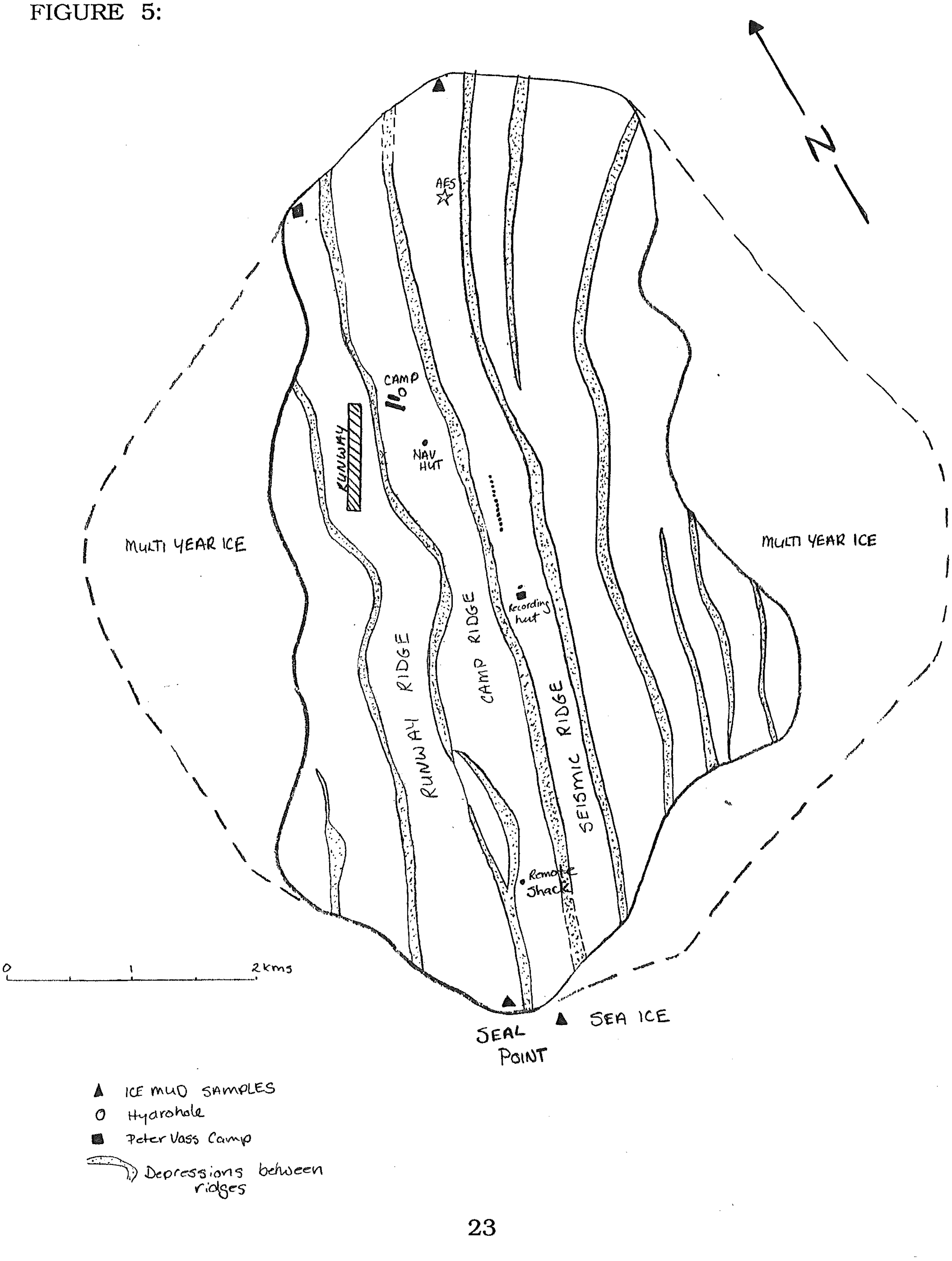

N
MULTI YEAR ICE
MULTI YEAR ICE
AES
CAMP
RUNWAY
NAV HUT
Recording hut
RUNWAY RIDGE
CAMP RIDGE
SEISMIC RIDGE
Remote Shack
0
1
2kms
SEAL POINT
SEA ICE
ICE MUD SAMPLES
Hydrohole
Peter Vass Camp
Depressions between ridges

FIGURE 6:

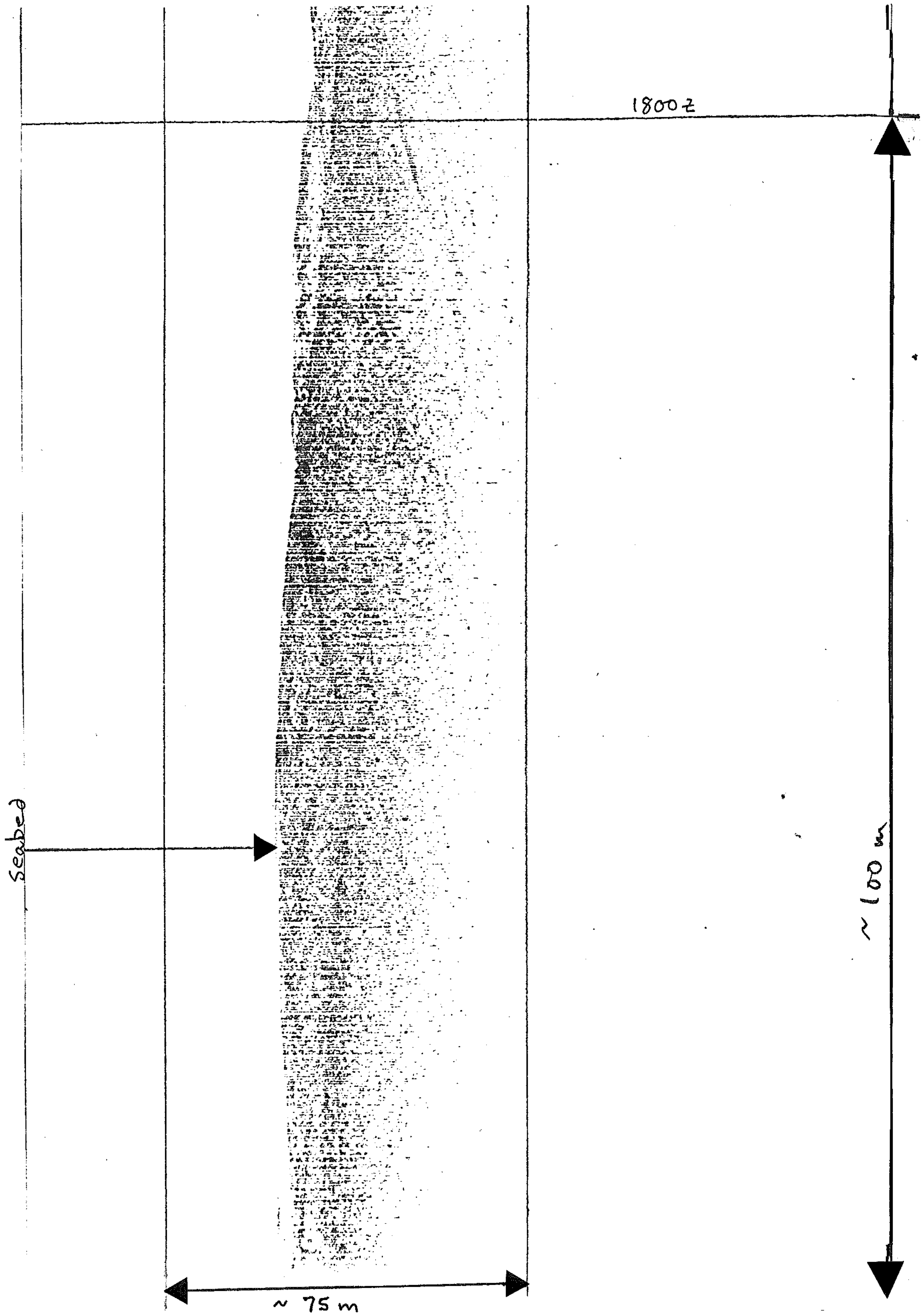


Table 1. Sample stations, Ice Island 1986

Note: Days are Julian Calendar days; time is Greenwich Mean Time (= Resolute + 5hrs); positions are preliminary calculations.

PC/GC = Benthos piston core in gravity mode

Sample No.	Latitude	Longitude	Date	Type	Time	Remarks
86200-P01	80 57'40"	97 35'25"	145	Plankton	ND	MUN file
86200-P02	80 57'40"	97 35'27"	147	Traps	ND	293m
86200-001	80 57'40"	97 35'25"	150	Ponar	1430	313m;good
86200-002	80 57'40"	97 35'25"	150	PVC	1500	313;38cm
86200-003	80 57'40"	97 35'25"	151	PVC	1530	313;61cm
86200-004	80 53'33"	97 49'35"	162	Lehigh grab	2143	297m;good
86200-005	80 53'33"	97 49'35"	163	Ponar	2248	294m
86200-006	80 53'33"	97 49'35"	163	Gravity	1923	297m;132cm
86200-007	80 53'33"	97 49'35"	163	Piston TWC	2038	297m;168cm 98cm
86200-C08	80 59'20"	97 19'19"	177	Camera	1600	274m;test
86200-C09	80 59'20"	97 19'19"	178	Camera	0030	274m;test
86200-P10	80 59'20"	97 19'19"	178-	Traps+ Plank.	0230 1320	274m;set recovered
86200-P10	80 59'20"	97 19'19"	178	Water	1630	274m
86200-P10	80 59'20"	97 19'19"	178	Plank. Water	2000	274m;vert. 125m
86200-011	80 59'20"	97 19'19"	178	PC/GC	2039	274m;90cm
86200-012	80 59'20"	97 19'19"	178	PC/GC	2225	274m;115cm
86200-013	80 59'21"	97 19'24"	179	Shipek	1530	274m;poor
86200-C14	80 59'21"	97 19'16"	180	Camera	1631	272m
86200-015	80 59'21"	97 19'16"	180	Snow	1631	Diatom;set
86200-016	80 59'21"	97 19'16"	180	CTD	2010 2050	272m;start end
86200-017	80 59'46"	97 18'05"	181	Shipek	1819	294m;poor
86200-018	80 59'43"	97 13'10"	181	Piston TWC	1909	289m;226cm TWC 121cm
86200-019	81 00'34"	97 16'41"	182	Piston TWC	1631	263m;10cm TWC 0m
86200-C20	81 00'34"	97 16'41"	182	Camera	2030	263m
86200-P21	81 00'36"	97 16'35"	183	Traps	0036 0430	262m;set 265m;end
86200-022	81 02'00"	97 10'10"	183	Dredge	1447	228-197m
86200-023	81 03'	97 07'	183	Dredge	1830	164-158m
86200-024	81 03'29"	97 04'23"	183	Dredge	2145	147-148m
86200-C25	81 04'00"	97 02'07"	184	Camera	0030	141m
86200-026	81 05'15"	96 59'06"	184	Ponar	1320	172m;6cm
86200-027	81 05'14"	96 59'08"	184	Gravity	1411	172m;10cm
86200-028	81 05'14"	96 59'08"	184	PC/GC	1500	171m;115cm
86200-P29	81 05'12"	96 59'05"	184	Plank.	2100	172m;vert.

Sample No.	Latitude	Longitude	Date	Type	Time	Remarks
86200-P30	81 05'10"	96 59'07"	184	Plank.	2220	169m;vert.
	81 05'09"	96 59'05"	185	Plank.	0038	164m;vert.
	81 05'08"	96 58'51"	185	Plank.	0058	164m;vert.
86200-C31	81 05'05"	96 58'22"	185	Camera	0100	164m;oblq.
86200-032	81 05'05"	96 58'22"	185	Ponar	1503	164m;none
						164m;good
86200-C33	81 05'02"	96 57'00"	186	Camera	0125	164-166m
86200-034	81 05'06"	96 55'10"	186	PC/GC	1445	158m;55cm
86200-P35	81 05'06"	96 55'10"	187	Plank.	1647	160m;vert
86200-036	81 05'06"	96 55'10"	187	Snow	1300	Diatom;set
						Pollen;1m2
86200-P37	81 05'06"	96 55'10"	187	Water	2005	160m
86200-P38	81 05'06"	96 55'10"	188	Traps	0135	160m;set
			188		1345	160m;end
86200-039	81 05'06"	96 55'10"	188	CTD	1621	160m;start
					1642	;end
86200-040	81 05'06"	96 55'10"	188	Ponar	1807	160m
86200-041	81 05'06"	96 55'10"	188	PC/GC	1852	158m;55cm
86200-P42	81 05'06"	96 55'10"	188	Plank.	2100	103m;vert.
86200-043	81 05'06"	96 55'10"	189	Ponar	0037	159m;good
86200-044	81 05'06"	96 55'10"	189	Ponar	0116	158m;good
86200-P45	81 05'06"	96 55'10"	189	Traps	0141	158m;set
					1305	157m;up
86200-046	81 05'06"	96 55'10"	189	Ponar	1352	157m;good
86200-047	81 05'06"	96 55'10"	189	Shipek	1426	157m;poor
86200-C48	81 05'06"	96 55'10"	189	Camera	2000	157m;color
			190		0100	157m;B&W
86200-049	81 05'06"	96 55'09"	190	Dredge	1052	160m;poor
86200-050	81 05'06"	96 55'09"	191	Dredge	1504	162m;none
86200-051	81 05'06"	96 55'09"	191	Ponar	1616	164m;good
86200-052	81 05'06"	96 55'09"	191	PC/GC	1842	164m;23cm
86200-053	81 05'12"	96 55'32"	191	PC/GC	1946	164;74cm
86200-054	81 05'10"	96 55'16"	192	PC/GC	1431	165m;148cm
86200-055	81 05'06"	96 55'07"	195	PC/GC	1405	159m;23cm
86200-056	81 05'06"	96 55'07"	195	PC/GC	1518	158;11cm
86200-057	81 05'06"	96 55'08"	195	PC/GC	1814	159m;25cm
86200-058	81 05'06"	96 55'10"	195	PC/GC	2013	159m;23cm
86200-059	81 05'06"	96 55'12"	196	Traps	0039	159m;set
					1313	159m;end
86200-060	81 05'05"	96 55'08"	196	IceMud	1430	4 samples
						dirty ice
			202	IceMud		suppl.bulk
			212	IceMud		suppl.bulk
86200-P61	81 05'01"	96 56'03"	198	Plank.	1444	154m;HT
86200-062	81 04'43"	96 57'44"	198	PC/GC	1835	141m;86cm
86200-063	81 04'43"	96 57'44"	198	PC&TWC	2045	141m;116
86200-064	81 04'43"	96 57'44"	199	Ponar	1326	136m;good
86200-065	81 04'43"	96 57'44"	199	Ponar	1358	136m;good
86200-066	81 04'43"	96 57'44"	199	Shipek	1440	136m;poor
86200-067	81 04'39"	96 57'39"	199	PC/GC	1534	135m;none
86200-068	81 04'39"	96 57'39"	200	Camera	0212	132m;start
					0223	Color;end

Sample No.	Latitude	Longitude	Date	Type	Time	Remarks
86200-068			200	Camera	1400	132m;start
					1450	Color;end
86200-069	81 04'39"	96 57'39"	200	Ponar	1516	132m;poor
					1531	132m;poor
86200-070	81 04'39"	96 57'39"	200	Shipek	1548	132m;good but small
86200-071	81 04'39"	96 57'39"	200	Shipek	1630	132m;good
86200-072	81 04'39"	96 57'39"	200	Ponar	1820	132m;good
86200-073	81 04'39"	96 57'39"	200	Shipek	1843	132m;good but small
86200-074	81 04'35"	96 58'19"	201	Shipek	1323	138m;poor
86200-075	81 04'35"	96 58'19"	201	Shipek	1405	137m;poor
86200-076	81 04'35"	96 58'19"	201	Shipek	1829	139m;poor
86200-077	81 04'26"	96 59'07"	202	Shipek	0013	136m;poor
86200-078	81 04'19"	96 59'44"	202	Shipek	0056	145m;good but small
86200-079	81 03'44"	97 02'28"	202	Shipek	1405	149m;poor
86200-080	81 03'44"	97 02'28"	202	Ponar	1420	149m;good but small
86200-081	81 03'44"	97 02'28"	202	PC/GC	1503	149m;none
86200-P82	81 03'40"	97 02'19"	203	Plank	1401	148m;2VH
	81 03'40"	97 02'19"	203	Plank	2131	148m;2VH
86200-083	81 03'40"	97 02'11"	204	Ponar	1831	150m;good
86200-084	81 03'40"	97 02'11"	204	Shipek	1851	150m;poor
86200-085	81 03'40"	97 02'11"	204	Gravity	1934	150m;29cm
86200-C86	81 03'41"	97 02'10"	205	Camera	0026	153m;B&W
86200-C87	81 03'43"	97 02'17"	205	Camera	1342	150m;B&W
86200-088	81 03'44"	97 02'29"	205	Shipek	1444	150m;good
86200-089	81 03'45"	97 02'38"	205	Dredge	1509	144-148m
86200-090	81 03'46"	97 02'44"	205	Ponar	1638	149m;good
86200-091	81 03'46"	97 02'27"	205	PC/GC	2038	144m;61cm
86200-092	81 03'43"	97 02'46"	206	Dredge	1558	151-150m
	81 03'43"	97 02'47"	206	(1st)	1813	end;poor
	81 03'42"	97 03'06"	206	Dredge	1842	150-154m
	81 03'41"	97 03'02"		(2nd)	2143	end;poor
86200-093	81 03'41"	97 03'07"	207	Shipek	2213	153m;poor
86200-094	81 03'41"	97 03'25"	208	Shipek	2102	148m;good
86200-095	81 03'41"	97 03'23"	208	Shipek	2146	147m;good
86200-096	81 03'41"	97 03'20"	208	PC/GC	2219	147m;68cm
86200-097	81 03'49"	97 01'03"	209	Shipek	1506	150m;poor
86200-C98	81 03'50"	97 00'54"	209	Camera	1605	152m-144m
	81 03'50"	97 00'20"			1918	end;color
86200-099	81 03'50"	97 00'07"	209	Dredge	2032	142-152m
	81 03'48"	96 59'09"			2353	end;rocks
86200-100	81 04'07"	96 56'48"	210	Ponar	2038	145m;good
86200-101	81 04'07"	96 56'55"	210	Shipek	2055	145m;good
86200-102	81 04'07"	96 56'46"	210	PC/GC	2148	145m;112cm
86200-103	81 04'48"	96 54'49"	212	CTD	0042	138m;set
					0102	138m;end
86200-P104	81 04'48"	96 54'48"	212	Traps	0124	138m;set
	81 04'58"	96 55'09"			1328	151m;end
86200-P105	81 04'58"	96 55'11"	212	Water	1424	152m;set
					1552	152m;end

Sample No.	Latitude	Longitude	Date	Type	Time	Remarks
86200-P106	81 05'07"	96 55'11"	212	Plank	1951	158m;HT
	81 05'08"	96 55'07"	213		0316	162m;end
86200-107	81 05'17"	96 55'34"	213	Ponar	1422	163m;poor
86200-108	81 06'11"	96 52'20"	214	grab	1936	202m;good
86200-109	81 06'15"	96 51'46"	214	gravity	2222	204m;92cm
86200-110	81 08'17"	96 46'42"	215	Ponar	1955	238m;good
86200-111	81 08'33"	96 46'09"	215	gravity	2138	244m; 112cm
86200-112	81 08'11"	97 02'20"	216	gravity	1530	279m;bent; 46cm
86200-C113	81 08'18"	97 04'37"	216	camera	1938	253.5m
to	81 08'05"	97 06'20"			2050	261.5m
86200-114	81 07'57"	97 08'45"	216	PC/GC	2228	265m;46cm
86200-115	81 04'53"	97 16'45"	217	Shipek	1427	181m;poor
86200-116	81 04'23"	97 16'09"	217	dartcore	1530	183m; 0cm
86200-C117	81 04'23"	97 14'58"	217	camera	1621	182m
to	81 04'09"	97 15'13"			1709	194m
86200-118	81 02'36"	97 10'24"	218	aerial	1900	187m
	81 02'20"	97 03'52"	219	part.	1900	
86200-119	81 02'20"	97 03'52"	219	Snow	1900	169m
to	81 02'30"	97 02'06"	223	to	1900	
86200-120	81 02'17"	97 03'13"	219	Shipek	2240	173m
86200-121	81 02'29"	97 02'06"	223	Ponar	1520	161m
86200-122	81 02'29"	97 02'06"	223	gravity	1615	166m; 53cm
86200-123	81 02'29"	97 02'06"	223	Snow	1900	
to	81 07'34"	96 42'10"	239	to	1330	
86200-124	81 02'29"	97 02'06"	225	Rime ice	1500	
86200-125	81 02'23"	97 02'17"	226	Ponar	2240	157m
86200-126	81 02'25"	97 02'07"	230	diatom	1500	160m
86200-127	81 02'25"	97 02'07"	230	diatom	1520	160m
86200-128	81 02'26"	97 02'05"	231	piston & TWC	0110	156m;208cm 8 cm
86200-129	81 02'15"	97 02'09"	228	heat fl.	0118	160m;150cm
86200-130	81 02'15"	97 02'09"	228	heat fl.	0235	160m;225cm
86200-131	81 02'24"	97 02'17"	228	heat fl.	1832	161m;290
86200-132	81 02'26"	97 02'09"	230	heat fl.	1704	159m;330
86200-133	81 02'25"	97 02'04"	231	heat fl.	2132	163m;50cm
86200-134	81 02'25"	97 02'04"	232	heat fl.	0122	161m;95cm
86200-135	81 02'24"	97 02'15"	232	heat fl.	1301	163m;375
86200-136	81 02'26"	97 02'22"	232	gravity	1629	160m;39cm
86200-137	81 02'28"	97 02'12"	232	gravity	1840	159m;33cm
86200-138	81 02'32"	97 02'07"	233	heat fl.	0115	ND
86200-139	81 02'31"	97 03'12"	233	diatom	1600	158m
86200-140	81 02'32"	97 03'06"	233	diatom	1530	158m
86200-141	81 02'32"	97 03'07"	233	diatom	1500	158m
86200-142	81 02'26"	97 02'47"	233	heat fl.	2040	162m;98cm
86200-143	81 02'27"	97 02'44"	234	SnowMud	0110	163m
86200-144	81 02'27"	97 02'49"	234	SnowMud	0130	163m
86200-145	81 02'18"	97 05'08"	234	heat fl.	2009	168m;98cm
86200-146	81 02'15"	97 05'34"	234	heat fl.	2209	177m;230
86200-147	81 02'02"	97 08'58"	235	heat fl.	0345	223m;375
86200-148	81 02'01"	97 10'12"	235	heat fl.	0745	229m;310
86200-C149	81 03'47"	97 02'45"	237	camera	1458	153m
	81 03'48	97 03'11"		to	1540	145m

Sample No.	Latitude	Longitude	Date	Type	Time	Remarks
86200-150	81 03'49"	97 03'29"	237	Shipek	1618	145m
86200-151	81 02'11"	97 06'20"	235	heat fl.	0010	185m;300cm
86200-152	81 07'43"	96 40'54"	239	CTD	0040	227m
to	81 07'43"	96 40'54"	239	to	0055	
86200-153	81 07'46"	96 40'48"	239	CTD	0107	227m
to	81 07'46"	96 40'48"	239	to	0126	

Table 2. Water sample data, Ice Island 1986

Note: Temp. shown as reversing thermometer/room temp. (thermometer no.)

Station No.	Date JD/z	Water Depth(m)	Bottle No.	Temp. (°C)	Salinity (o/oo)	Oxygen (ml)	Vol. (l)
86200 - P10	178/ 1630	50	20	-1.7/ND (21103)	33	10.7	7.0
		125	11	-1.6/15.6 (21098)	35.5	7.9	7.0
		200	20	-1.65 (21103)	35	7.7	7.0
		269	11	+0.17 (21098)	ND	8.2	7.0
86200 - P37	187/ 2005	50	11	-1.39/15.3 (21098)	33	12.2	7.9
		85	20	-1.25/8.9 (21103)	33	9.2	8.0
		120	20	-1.53/11.8 (21103)	34	8.6	7.6
		155	11	-0.40/8.5 (21098)	35	8.5	7.9
86200 -P105	212/ 1424	50	20	-1.5/10.4 (21103)	32	12.1	7.9
		81	11	-1.3/12.5 (21098)	32	9.8	7.9
		113	11	-0.9/14.1 (21098)	35	8.9	7.8
		145	20	-0.5/14.0 (21103)	30	7.8	4.0*

* High SPM concentration - may not be representative of true water conditions (disturbed bottom sediment!?)

Table 3. List of Samples Collected on Ice Island Summer 1986

Note: Days are Julian Calendar days

Codes: F-forams, B-benthos, T-traps, P-phytoplankton, Z-zooplankton
PC/GC - piston corer in gravity mode

SEDIMENT & SPM

Sample No	Day	Sampler & Depth (m)	Description of Sample(s) and Storage
86200-P10	178	Water (274)	2 sieved (<1µm) water samples from depths 125m & 200m in 2-125ml jars with formalin
86200-013	179	Shipek (274)	Surface sediment (0-1cm) for forams in 125ml jar with formalin
86200-015	180	Snow	500mls snow filtered (>10µm) for diatoms in 125ml jar with ETOH
86200-017	181	Shipek (294)	1. Surface sediment (0-1cm) for forams in 125ml jar with formalin 2. 10cc sediment for total carbon in vial 3. 500cc surface sediment (0-1cm) sieved (250 & 1000µm) and dried in 125ml jar
86200-018	181	Piston (289)	2-125cc sediment samples from cutter sieved (63-125µm ; 125-250µm) and dried in 2-125ml jars. Core subsamples washed on 63µm sieve for forams: 6-15cm(15cc), 15-26cm(5cc);26-33cm(5cc);33-40cm(10cc), 40-50cm(20cc);55-68cm(20cc);140-144cm (5cc)
86200-023	183	Dredge (164-158)	1. Sediment sample for forams in 125ml jar with formalin 2. 300 mls sediment sieved (250µm) and dried in 125ml jar, labelled "shell" 3. Rocks in 1gal bucket
86200-024	183	Dredge (147-148)	1. Sediment sample for forams in 125ml jar with formalin 2. Rocks in small bag
86200-026	184	Ponar (172)	1. Surface sediment (0-1cm) for forams in 125ml jar with formalin 2. 10cc sediment for total carbon in vial 3. Surface sediment (0-1cm) for sediment analysis in 125ml jar
86200-P30	184 185	Plank. (169-164)	Phytoplankton tows (63µm,12cm diam) V.H. 40-75m, 75-125m, 125-166m in 3-125ml jars with Lugols
86200-032	185	Ponar (164)	Surface sediment (0-1cm) for forams in 125ml jar with formalin
86200-034	186	PC/GC (158)	20cc sediment from cutter sieved (63µm) and dried in 125ml jar

86200-P35	187	Plank. (160)	Phytoplankton tow (63µm,47cm diam) V.H. 0-150m, sieved out plankton >250µm, in 2-125ml jars with ETOH
86200-036	187	Snow	Snow (1mx1m) melted for diatoms; 0-30cm, 30-89cm in 2-125ml jars with ETOH
86200-040	188	Ponar (160)	Surface sediment (0-1cm) for forams in 125ml jar with formalin
86200-041	188	PC/GC (158)	20cc sediment from cutter sieved (63µm) and dried in 125ml jar
86200-P42	188	Plank. (158)	Collected from Seal Pt.- ice 1-1.5m deep 1. Ice algae (Georgeus snoti)in 2-125ml jars with ETOH and Lugols 2. Melted 36x26x18cm sea ice, sieved (>10µm) in 125ml jar with ETOH 3. Phytoplankton tow (63µm,12cm diam) V.H. 0-103m in 125ml jar with ETOH
86200-043	189	Ponar (159)	1. Surface sediment (0-1cm) for forams in 125ml jar with formalin 2. Rocks in small bag
86200-044	189	Ponar (158)	Surface sediment (0-1cm) for forams in 125ml jar with formalin
86200-046	189	Ponar (157)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; washed gravel in bag
86200-047	189	Shipek (157)	300ml sediment sieved (>500µm) and dried in 125ml jar
86200-051	191	Ponar (164)	Surface sediment (0-1cm) for forams in 125ml jar with formalin
86200-052	191	Piston (164)	Core subsamples dried and sieved: 8-22 cm(50cc); 8-18cm(40cc)
86200-054	192	Piston (165)	Core subsamples washed on 63µm sieve for forams; 0-4cm(10cc);64-66cm(10cc); 76-78cm(10cc);93-99cm(10cc);104-110cm (20cc);120-124cm(10cc);143cm(10cc);144-154 cutter(20cc,10cc). Wet mud (100cc) in bag.
86200-056	195	Piston (158)	Core subsamples washed on 63µm sieve for forams: 0-2cm(20cc); 2-5cm(20cc); 5-8cm (10cc); 8-11cm(20cc). Wet mud subsamples 2-5cm(20cc)
86200-057	195	Piston (159)	Core subsamples washed on 63µm sieve for forams: 6-10cm(40cc); 10-12cm(20cc); 10-14cm(40cc); 23-25cm(10cc). Wet mud sub-samples: 6-10cm(10cc); 10-20cm(40cc);10-14cm(20cc); 14-16cm(40cc);14-17cm(40cc); 19-21cm(20cm); 21-23(40cc);23-25cm(10cc)
86200-058	195	Piston (159)	Core subsamples washed on 63µm sieve for forams: 4-6cm(10cc);6-10cm(40cc);6-12cm (20cc);21-25cm(100cc). Wet mud sub-samples: 4-10cm(5cc);10-13cm(3cc);cutter mud(60cc)
86200-060	196	Dirty Ice	Surface ice-mud from NE edge of island: 9-125ml jars (dried/ETOH), dried samples in foil

86200-060*			Gray mud collected from ice on NE edge of ice island; organics include small red-brown spore chains: 1. 2 vials with formalin; >63 microns, & 10-63 microns 2. Slide in permount
86200-063	198	Piston (141)	Cutter sample washed in sieve (63µm), dried, in 125ml jar
86200-064	199	Ponar (136)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-065	199	Ponar (136)	Surface sediment (0-1cm) for forams in 125ml jar with formalin
86200-066	199	Shipek (136)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-067	199	Piston (135)	Cutter sample washed in sieve (63µm), dried, in 125ml jar
86200-069	200	Ponar (132)	2 attempts:2 bulk mud
86200-070	200	Shipek (132)	Surface sediment (0-1cm) for forams in 125ml jar with formalin
86200-072	200	Ponar (132)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-073	200	Shipek (132)	Surface sediment (0-1cm) for forams in 125ml jar with formalin
86200-074	201	Shipek (138)	Bag of rocks
86200-075	201	Shipek (137)	Bulk mud
86200-076	201	Shipek (139)	Bulk mud
86200-077	202	Shipek (136)	Bulk mud
86200-078	202	Shipek (145)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-079	202	Shipek (149)	Bulk mud
86200-080	202	Ponar (149)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-083	204	Ponar (150)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-084	204	Shipek (150)	Bulk mud
86200-088	205	Shipek (150)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud;>125 µm(50cc,dried), 63-125µm(50cc,dried)
86200-089	205	Dredge (144-148)	Bag of rocks, bulk mud
86200-090	205	Ponar (149)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-092	206	Dredge (151-150)	Bag with 1 rock
86200-093	207	Shipek (153)	Bag of rocks, bulk mud

86200-094	208	Shipek (148)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-095	208	Shipek (147)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-097	209	Shipek (150)	Bulk mud
86200-099	209	Dredge (142-152)	5 gal metal bucket of rocks
86200-100	210	Ponar (145)	Surface sediment (0-1cm) for forams in 125ml jar with formalin; bulk mud
86200-101	210	Shipek (145)	Bulk mud
86200-108	214	Shipek (202)	1. 20cc (0-1 cm) forams in formaldehyde 2. 20cc (0-1 cm) forams, sieved at 250 and 63μ. Dried. 3. 100 cc (0-5 cm) bulk. 4. 100 cc (5-9 cm) bulk. 5. Polychaete tubes picked from bulk surface, in formaldehyde. 6. Bulk in bag.
86200-109	214	gravity (204)	Undisturbed core. 92 cm with 0-58 cm of dark brown mud grading to dark grey with forams at surface. Sharp contact at 58 cm; 58-62 cm reddish brown mud;sharp contact at 62 cm: 62-92 cm dark grey mud
86200-110	215	Ponar (238)	Grab half full, one side slightly disturbed. Reddish brown mud with abundant forams, sponge spicules and polychaete tubes. Rare gravel drop-stones, one lump of dark grey mud (1x 2x1cm) on surface. 1. 40cc in formaldehyde 2. 10cc frozen 3. & 4. push core, 9.5 cm 5. Bulk in bag
86200-111	215	gravity (244)	0-112cm undisturbed core. Cutter and catcher stored in bag.
86200-112	216	gravity (279)	0-46cm. Bent liner at 1m penetration hole in liner at this point - wash out of surface? Gravel in firm grey mud at base. No cutter or catcher.
86200-C113	216	camera (254-262)	Tri-X, B&W, 400 ASA, oblique, 15 frames 5 minute intervals, F-stop 5.0,focus 7.5 ft. velocity;530 m/hr, azimuth; 230 deg., distance;635 m HT
86200-114	216	gravity (265)	PC=GC, 0-46cm Brown mud with forams at surface grading to a thick dark grey mud at base. No cutter or catcher.
86200-115	217	Shipek (181)	Poor recovery, very little hard grey gravelly mud. Broken sponges, pebbles with bryozoa attached. 1. sponges in formaldehyde 2. mud (70cc) sieved at 250 , 125 , and 63 μ, washed and dried.
86200-116	217	dart	Dart core appears to have hit bottom

		(183)	and fallen over. 3cm of mud washed out base on retrieval.
86200-C117	217	camera (182-194)	Tri-X,400 ASA, B&W;oblique.F-stop 5.0, focus 7.5ft.,2.5 minute interval;speed 560m/hr, azimuth 190 deg.;distance 440m HT.
86200-118	218	snow	white plastic bucket, 740 cm x cm area left for 24 hrs. 72ml melted snow. Washed at 10 microns, both fractions kept in jars with Lugols. Av. speed 82 m/hr, Az. 104 deg., distance 1958m
86200-119	219	snow	bucket, 740 cm x cm area, 96 hrs., 1215 ml melted snow, sieved at 10 mic. < 10μ representative fraction kept,>10μ all kept. Preserved with Lugols.
86200-120	219	Shipek (173)	9.5 cm penetration - good. 40cc 0-1 cm in form., 10cc dried 0-1 cm, pushcore 0 - 9.5cm, 70cc bulk forams (washed at 63 & 250 mic.), bag of bulk mud. Abundant large forams on surface, FeMn coated. Sponge spicules in surface layer, above dark greyish brown mud.
86200-121	223	Ponar (161)	7.5 cm penetration. Good surface layer foram rich ooze on surface. Many mollusc shells , sponge on surface with sub-surface "roots" & attached live mollusc. Stiff reddish brown mud 1. 40cc 0-1cm in form.; 2. sponge + mollusc from surface in form.; 3. macro-benthos surface sample in form.; 4. bulk mud
86200-122	223	gravity (166)	53 cm recovered (app. pen 119cm). Surface undisturbed. Foram ooze on surface. 0-27cm reddish brown mud. 27-53cm dark grey mud
86200-123	223 to 239	snow	Precipitation collected in 740 cm xcm bucket. 110 ml of melted snow collected and preserved with Lugols.
86200-124	225	diatom	Rime frost collected from guy wires of AGC core hut. approx. 20' off the ground. Melted in bag in dark at room temp. , preserved with Lugols.
86200-125	226	Ponar (157)	Poor recovery. Large cobble on surface very little reddish brown mud. 1) cobble 2)30cc 0-1cm in form.; 3) bulk mud
86200-126	230	diatom (160)	Ooze collected from shot lines, removed from weights 50' under ice bottom, after charges have gone off. Lines left in holes 5 days since last shot point a. green mucilaginous ooze b. ice scum scraped from wire through ice, Shot Shack #8
86200-127	230	diatom (160)	Ooze collected from weights of Shot Shack #7

86200-128	231	piston & TWC (156)	Good recovery, 208 cm, app. pen. 300 cm TWC only 8cm recovered - in plastic bag Cutter & catcher stored in split core liners in bags. Pull out 4500 lbs.
86200-129	228	heat fl. (160)	Site 1 Station 1. 4 thermistors pen. approx. 2m, 2000 lbs pullout
86200-130	228	heat fl. (160)	Site 1 Station 2. 6 thermistors pen. 3m, 3500 lbs pullout
86200-131	228	heat fl. (161)	Site 1 Station 3. 7 thermistors pen. 3.5m, 2000 lbs pullout
86200-132	230	heat fl. (159)	Site 1 Station 4. no heat pulse Pinger intermittent, 3300lbs pullout
86200-133	231	heat fl. (163)	Site 1 Station 5. 2 thermistors pen. pullout 3500lbs (v. quick)
86200-134	232	heat fl. (161)	Site 1 Station 6. 3 thermistors pen. pullout 4000 lbs
86200-135	232	heat fl. (163)	Site 1 Station 6. 7 thermistors pen. 3500 lbs pullout
86200-136	232	gravity (160)	Used plastic liner as core barrel. 39 cm of apparent pen. 39 cm recovered. Surface fine brown mud grading down to stiff dark grey mud. Gravel clast covered with bryozoa on surface
86200-137	232	gravity (159)	Plastic liner used as core barrel. 33 cm apparent pen. 33cm recovered. Brownish mud on surface grading to stiff dark grey mud. Cutter & catcher not recovered
86200-138	233	heat fl.	Site 1 Station - . Pinger not working brought back to surface
86200-139	233	diatom (158)	Ooze from line of Shot Shack #1, preserved in Lugols.
86200-140	233	diatom (158)	Ooze from line of Shot Shack #3, preserved in Lugols.
86200-141	233	diatom (158)	Ooze from line of Shot Shack #13, preserved in Lugols.
86200-142	233	heat fl. (162)	Site 1 Station 8. Pinger not working Penetration but no results
86200-143	234	dirty snow	Sample taken from compression ridge just south-east of Seal Point.
86200-144	234	dirty snow	Mud taken from compression ice, further south-east then 86200-143. Very soft, soupy, brownish mud.
86200-145	234	heat fl. (168)	Site 1 Station 9. 4 thermistors penetrate. Pullout 3500 lbs.
86200-146	234	heat fl. (177)	Site 1 Station 10. 5 thermistors penetrate. 3700lbs pullout.
86200-147	235	heat fl. (223)	Site 1 Station 12
86200-148	235	heat fl. (229)	Site 1 Station 13
86200-C149	237	camera (153-145)	Colour film, Ektachrome 400 ASA, vertical, 4 ft. focus distance, f11 Camera and flash both located on lower bar of frame, flash on slight angle

		towards camera (1st hole off vertical) Coloured tape on trip.
86200-150	237 Shipek (145)	Poor penetration. 7cm of stiff brownish mud. Two pieces of gravel no surface with bryozoa attached. Hard to pull out. 1. 40 cc. 0-1 cm forams in formaldehyde 2. surface gravel. 3. bulk mud
86200-151	234 heat fl. (185)	Site 1 Station 11. Good penetration 3000 lbs pullout. Pullout by island movement rather then winch.

Table 4. PLANKTON, GEOCHEM. & WATER

Sample No	Day	Sampler	Description of Sample(s) and Storage
86200-P01	145	Plank.	Zooplankton tows (150µm, 26cm diam), horizontal: 60m, 140m, ?m in vials
	148	Plank.	Zooplankton tows (150µm, 26cm diam), horizontal: 56m, 106m, 179m in vials
86200-P10	178	Plank. (274)	Zooplankton tows (150µm, 26cm diam), horizontal: 135m, 209m, 264m split in half (A,B) in 6-125ml jars with formalin
		Plank. (extra)	Phytoplankton tow (63µm, 12cm diam), V.H. 0-200m in 125ml jar with formalin
		Water (274)	Depths 50,125,200,269m; filters in whirlpak; isotope & DIC -A,B,C vials
		Traps (274)	Amphipods only in bottom trap (274m) 1/2 in vial with formalin, 1/2 dried on filter paper, beef bait dried on filter paper, in whirlpak bags
86200-016	180	CTD (272)	Depth=272m
86200-P29	184	Plank. (extra;172)	Zooplankton (150µm, 26cm diam) V.H. 0-166m in 125ml jar with formalin
86200-P37	187	Water (160)	Depths 50,85,120,155m; filters in whirlpak isotope & DIC -A,B,C vials
86200-P38	188	Traps (160)	Amphipods absent from bottom trap (160m) but bait (bacon) shredded; 10 amph. in trap 1m above bottom, dried on filter paper, in whirlpak
	188	CTD (160)	Depth=160m
86200-P61	198	Plank (154)	Zooplankton tows (150µm, 26cm diam), horizontal: 45-50m, 90-95m, 135-140m tow distance about 300m, split in half: (A) in 125ml jars with formalin, (B) filtered & dried, in whirlpak bags
86200-103	212	CTD (138)	Depth=138m
86200-P104	212	Traps (138-151)	Amphipods in bottom trap only (about 25);split, 1/2 in vial with formalin, 1/2 in whirlpak dried; beef bait in whirlpak
86200-P105	212	Water (152)	Depths 50,81,113,145m; filters in whirlpaks; isotope & DIC -A,B,C vials
86200-P106	212	Plank (158-162)	Zooplankton tows (150µm, 26cm diam.) horizontal: 55m,100m,145m - split, 1/2 in vials with formalin, 1/2 in whirlpaks dried. NOTE: With increasing use of the hydrohole the water becomes contaminated with oil, hydraulic fuel, etc. We have been rinsing specimens

			before drying to eliminate foreign residues.
86200-152	239	CTD	Dropped at rate of 4 sec/m to a depth of >139m, at which point the meter wheel stopped working. The run was aborted and the CTD brought back up (4 sec/m).
86200-153	239	CTD	Dropped at rate of 4 sec/m. Stopped at 55 m for 2 minutes due to failure of generator. Depth 227 - CTD depth 222m Start time 0107 GMT, bottom (222m) 0125 GMT, surface at 0136 GMT.

Note: No water sample was taken at the end of August due to a heavy contamination of the hydrohole with hydraulic fluid.

Table 5. BIOLOGICAL SAMPLES

Sample No	Day	Sampler	Description of Sample(s) and Storage
86200-013	179	Shipek (274)	About 500cc sediment sieved - 63, 250,500,1000μm, in 4-125ml jars with formalin
86200-017	181	Shipek (294)	2-50cc sediment samples for 1) organic C & 2) meiofauna ID, in 2-125ml jars with formalin
86200-021	182	Traps	Amphipods captured in cheesecloth lined & unlined traps on the bottom (265m, bacon bait), in vials with formalin
86200-023	183	Dredge (164-158)	Sponge "reef": 95% sponge, 5% mud and rock. Biota in 3-1gal buckets with formalin - sponges and assoc. fauna, brittle star and tunicate. Depth range 158-164m
86200-024	183	Dredge (147-148)	Recovered mostly sponges, dissected & dried 2 sponge sections, in 125ml jar; rest of sponge material in 2-1gal buckets with formalin
86200-P29	184	Plank. (172)	Zooplankton (150μm, 26 cm diam) V.H. 0-166m (paired nets-other sample with Macko, MUN), in 125ml jar with formalin
86200-032	185	Ponar (164)	Sponge mat over fine brown sandy mud. Removed 2-6.5cm diam cores and sectioned Core 1: 0-2cm, 2-4cm in 2-125ml jars with formalin, Core 2: sieved (63μm, 250μm) & dried, in 2-125ml jars. Sponge mat in 1gal bucket with formalin
86200-P35	187	Plank. (160)	Phytoplankton tow (63μm, 47cm diam) V.H. 0-150m, sieved out 63-250μm for Mudie, >250μm in 125ml jar with formalin
86200-040	188	Ponar (160)	Removed 1-6.5cm diam core and split into 0-2, 2-4, 4-6cm sections, in bags with formalin; sediment in bag with formalin; surface macrofauna in 125ml jar with formalin; all samples in 1gal bucket
86200-P42	188	Plank. (188)	Phytoplankton tow (63μm, 12cm diam) V.H. 0-103m, in 125ml jar with formalin (sample collected at Seal Pt. from ice hole 1-1.5m thick - edge of island)
86200-043	189	Ponar (158)	Removed 1-6.5cm diam core and split into 0-2, 2-4, 4-6cm sections, in plastic bags with formalin; biota scraped off surface rocks in small bag with formalin - all in large plastic bag
86200-044	189	Ponar (159)	Very similar to -043. Removed 500mls of sediment (1-5cm deep), sieved with 250, 500 & 1000μm mesh, dried, in 3-125ml jars with formalin

86200-P45	189	Traps (158-157)	Inserted trap doors in both amphipod traps (Brunet vs Redden), set on bottom (158m), bacon bait, 32 amphipods in vial with formalin
86200-046	189	Ponar (157)	1. Tunicate (12cm) on sediment surface, in 125ml jar with formalin 2. 1-6.5cm diam core split into 0-2, 2-4, 4-5cm sections, in 3-125ml jars with formalin 3. 500mls mud (1-5cm deep) sieved 63,250, 500,1000μm mesh (not all 63-250μm sample saved, cobble given to Mudie), in 4-125ml jars with formalin
86200-051	191	Ponar (164)	1. 1-6.5cm diam core split into 0-2, 2-4 cm sections, in 2-125ml jars with formalin 2. 50cc sediment removed for organic C, in 125ml jar with formalin 3. Biota scraped of a surface rock, in vial with formalin
86200-059	196	Traps (159)	Both traps on bottom(159m); 1 amph in wire trap, 22 in plastic, in 125ml jar with formalin
86200-060*	196	Ice mud	(see SEDIMENTS & SPM)
86200-064	199	Ponar (136)	1. minicore: 0-1cm, 1-3cm, 3-4cm in jars with formalin 2. surface white sponge in jar with formalin 3. sponge material in 1-gal bucket with formalin 4. surface sponge yellow-green growth (algae?) in jar with formalin
86200-065	199	Ponar (136)	Sponge mat (0-5cm) over thin layer of soft sandy brown mud 1. White surface sponge on <u>Geodia</u> & 2. Yellow-green alga-like growth : both 1. & 2. in 125ml jars with formalin 3. Sponge mat & associated fauna, in 1gal bucket with formalin
86200-066	199	Shipek (136)	Disturbed sample: 98% mud, 2% sponge mat 1. Surface sponge mat in 1gal bucket with formalin 2. 50 cc sediment for organic C in jar with formalin
86200-070	200	Shipek (132)	Small mud sample with surface macrofauna 1. surface sponge with yellow-green algae 2. 10 cc mud with fauna in jars with formalin
86200-071	200	Shipek (132)	Surface macrofauna only: 1. featherstar 2. sediment sample, with brown ?bryozoan growth on pebbles

86200-072	200	Ponar (132)	Small sediment sample with pebbles 1. 1 minicore (0-2 cm)
86200-073	200	Shipek (132)	Small sample brown mud with pebbles 1. Sediment infauna
86200-074	201	Shipek (138)	Disturbed sample (rock caught in jaws) 1. Gelatinous ?annelid with sandy-mucilaginous surface layer removed - in vial with formalin 2. Sediment & small pebbles in jar with formalin for infauna
86200-077	201	Shipek (136)	Top of hummock: small sample with macrofauna on hard sticky gray mud- 1. featherstar & amphipod in jar 2. sediment with infauna in jar
86200-P82	203	Plank. (148)	Phytoplankton VH tows (63 µm mesh; 47cm diam.) 1. 0-143m; 2. 0-100m; 3. 0-75m (Note: abundant dark green oval bodies ca. 0.5 mm. Organics probably include contamination from hydrohole)
86200-083	204	Ponar (150)	Good recovery (0-7cm): coarse sand & granules on surface- 1. Minicore: 0-2cm, 2-4cm (>4cm too hard & sticky)
86200-088	205	Shipek (150)	Sample from depression between hummocks (see photographs): surface shall layer (0-1cm) over sandy mud with gravel 1. 1 vial of dried surface mud (10 cc, (0-1cm), >63 microns 2. 2 jars (each 50 cc) surface mud & shell
86200-090	205	Ponar (149)	Undisturbed sample (0-8cm), soft sandy gray-brown mud with granules & shell (0-6cm) over gray sticky mud (6-8cm) 1. minicore (0-1cm; 1-3cm) 2. 50cc (0-1cm) organic C
86200-092	206	Dredge (151-150)	Small mud sample with 1 <u>Geodia</u> sponge 3.5cm diam. 1. sponge in jar with formalin
86200-094	208	Shipek (148)	Good recovery (0-8cm), with healthy sponges on a sponge mat overlying Mn-coated calcareous tubes above soft sandy gray-brown mud with Si spicules 1. Sponges & sponge mat in 1gal bucket with formalin 2. minicore (0-2, 2-4, 4-6, 6-8 cm) 3. flat white sponge 4. yellow-green alga from sponge surf.
86200-101	201	Shipek (145)	Small mud sample (0-5cm) 1. 20cc (0-1cm) organic C
86200-107	213	Ponar (163)	Small sample, all preserved 1. rock (10cm) with surface macrofauna in bag with formalin 2. sediment >125 microns, dried in jar

APPENDIX A

Additional Information & Instructions For Ice Island Camera System

1. Loading film and housing camera
2. Light source
3. Set-up for oblique mode
4. Operating camera & flash
5. Removing film, processing

1. Loading film and housing camera:

Follow instructions for loading film as listed in Camera Manual pp 13-16. Before testing, make sure the film is pulled tight and the microswitch is held in towards the takeup cassette. Trigger at least once to make sure micro-switch is working (turn camera to the right and using a screwdriver, connect the terminal to ground terminal (see fig.1) - film will advance into the take-up spool). Make sure the holding arms and rotating wheels (bottom side) are secured in place - one of the wheels often comes loose. If loose, tighten tiny brass screw on side of wheel using jewellers screwdriver - Mike Hughes blue toolbox. Camera batteries are good for 20 rolls of film unless the motor runs continuously as happens when the film is advanced to the very last frame before the camera is removed from its housing. Check camera voltage regularly-discard batteries when voltage <22. Ask electronics technician to handle all battery work for you - especially the FLASH BATTERY!

For Tri-X and Ektachrome color film, 400ASA, we have been using the following setting for oblique shots - distance=7.5 ft, f=5.0, 1/25sec. Wipe camera lens clean with kimwipe and insert camera into housing (vertical position), lens down, holding by black bar, slowly and carefully. If it does not slide in easily, there may be something out of place on the camera unit - remove and adjust, try again. The camera should sit 1.5 inches below the top of the housing with the connector (plug) facing the leads that are taped to the metal frame. The O-ring should be cleaned regularly (every 2 or 3 uses); remove using a jewellers screwdriver tip (#3), being careful not to nick rubber, wipe both ring and ring groove with kimwipe to remove grit, check for nicks and cuts by feeling round ring, coat ring with silicone, replace and each time the lid is put in place, apply an additional thin layer of silicone to outside edge to form watertight seal. Secure cover in place (terminals in plug) and snap down clamps. Wipe window of camera housing.

2. Light source:

Use only 510 volt flash batteries reading a minimum of

440volts when warmed to room temperature - cold batteries show lower voltage on the battery meter so check regularly. If you are not an electronics technician, ask one to handle battery removal and replacement for you - this flash unit has several HOT spots - ask Paul Moakler! These flash batteries are supposed to be good for 300 flashes but we have only been getting 100 or fewer flashes per battery! We advise checking the voltage prior to each camera station and removing the battery when not in use. Be careful when handling! Store batteries in warm place to restore voltage.

When connecting the battery, secure it to the flash unit with electrical tape to prevent possible disconnection. Insert flash unit into housing (positioned vertically), plug in and cover with lid (O-ring and O-ring groove must be clean and greased with silicone for water-tight seal). DO NOT TOUCH TERMINAL ENDS ON HOUSING COVER!!! Switch and synch lines need to be secured with electrical tape prior to each use.

3. Set-up for oblique mode (see fig.2):

Adjust the positions of the camera and light source using the semicircular steel guide on either side of both housings. We have been using the following angles: 35 degrees (4th hole from top) for the camera and 50 degrees (6th hole from top) for the flash unit for a focal distance of 7.5 ft. The vertical mode (1st hole, camera and flash) reduces the focal distance to 6ft.

4. Operating camera and flash:

Prior to lowering the camera system the film must advance in the housing at least 2x: pull down on trigger line, listen for the pinger, hold 15 secs. and release - flash should go off, you can hear the film advance if you place your ear to the camera housing. Wait 20-30 sec. before next advance. Prepare station identification label (about 5x7inches) and photograph 10-12 inches from camera.

Example:

86200-C08
D177
Oblique
B&W f6.0

While lowering in hydrohole, turn off the power switch on the sounder recorder and plug speaker into the sounder PTR unit - AUDIO. Pinger will stop when the trigger weight hits the bottom. Raise about 5m off bottom between frames. When raising system to the surface, unplug speaker and turn sounder recorder back on. Each 36-exp film is good for only about 20 bottom photographs. If taking pictures over variable depths or time intervals, mark frame no. and time on 3.5 Khz chart and record in photographic records book for future reference.

Prior to removing camera from its housing, trigger 2x to advance exposed film into the take-up cassette. Place camera housing in vertical position (remove screws), unsnap clamps with a screwdriver and pull lid up carefully - a vacuum develops inside housing when cold.

5. Removing film, processing:

Remove both supply and take-up cassettes without disturbing the film, put in black camera bag and rewind back into the supply cassette. When film is pulled tight, remove from camera bag and cut taped end of film. Fasten film end into the reel clip and rotate one full turn. Put reel with film, reel container and cover and small pair of sizzors into the camera bag and continue feeding film onto reel. Cut film end and place loaded reel into container and cap tightly - this film can then be processed.

Developer and fixer solutions have been made up and are good for this season only! Used chemicals are stored in 125ml plastic jars. We have been discarding developer after its 3rd or 4th usage (when solution turns blue), and fixer after 5 or 6 films. As we have lots of developer and fixer made up and they have a limited shelf-life, we have been replacing them more frequently than is probably necessary. Keep track of the number of rolls processed per 250 mls of solution on the tape on the jars.

All chemicals and rinse water used should be at the same temperature, preferably 20 degrees C. Warm in dish pan over the water bucket on the stove (Note: the mercury thermometer reads 1 or 2 degrees higher than actual temperature). The 250 ml plastic cups are useful for pouring and draining developer, fixer and rinse water. Follow processing instructions as given by H. Wheeler. Also, if you tap reel container on the counter top after shaking, any bubbles present will surface. We have also been rinsing (filtered water) 6 or 7 times per roll instead of 5 in order to get cleaner negatives. Label film container with station number for B&W developed film and both cassette and container for exposed color film. Keep photographic records (red folder) and when not in use, cover camera and flash unit with plastic.

Note: Cable plugs for camera and flash units should be replaced (they may come loose when not secured with tape).

APPENDIX B Operation of General Oceanics Model 2030 Flow Meter

Flow meter readings indicate that the instrument was not sensitive enough to detect slow current speeds and therefore was not useful as a current meter. When the island was stationary, vertical plankton hauls with the flow meter attached produced the following unit differences when lowered and raised at 0.25 m/sec.:

86200-P82 JD 203 @ 0.25 m/sec

Vertical Haul	Flow Meter Units
143-0m	+ 6482
143-0m	+ 6582
100-0m	+ 4106
75-0m	+ 2643

During obvious island movement (as judged by the 3.5 kHz record), the flow meter was set on two occasions for long periods of time but showed no increase in flow rates. On JD 196, amphipod traps (86200-059) were set on the bottom at 159 with a flow meter attached at 158m during 0039-1313Z. When the meter was retrieved, the difference in before and after readings was only + 5797 units (less then the readings for a 143-0m vertical haul as shown above). On JD 198, also durinf island movement, horizontal plankton tows were taken during 1444-1634 Z with the flow meter set at 53m from the surface. At a lowering and raising rate of 0.25 m/sec, the difference was + 2652 units, similar to the 75=0m vertical haul above. This type of flow meter appears to be designed for use in fast flowing waters (ie. tidal rivers) and on shipboard where horizontal plankton tows are generally taken at speeds of 2-4 knots.

APPENDIX C Preservation Methods

1. Sediment infauna (ie. Foraminifera) were preserved with a 2% buffered formalin solution as described in the GSC/AGC/EMG methods handbook. A 2% concentration of formaldehyde was also recommended by Be and Anderson (1976).

2. Plankton - as above.

3. Sponges and other macrofauna:
   a. small bulk samples were preserved in 2% formalin solution.
   b. individual large sponges were preserved in a 5% formalin solution ; a 2-5% solution was suggested by Eleftheriou and Holme (1984)

Be,A.W.H. and O.R. Anderson. 1976. Preservation of Planktonic Foraminifera and other calcareous plankton. In: Zooplankton fixation and preservation. (ed. H.F. Steedman). Unesco Press, Paris. pp. 250-258.

Eleftheriou, A. and N.A. Holme. 1984 Macrofauna techniques. In: Methods for the Study of Marine Benthos (ed. N.A. Holme and A.D. McIntyre). Blackwell Scientific Publications. Oxford. pp. 140-211