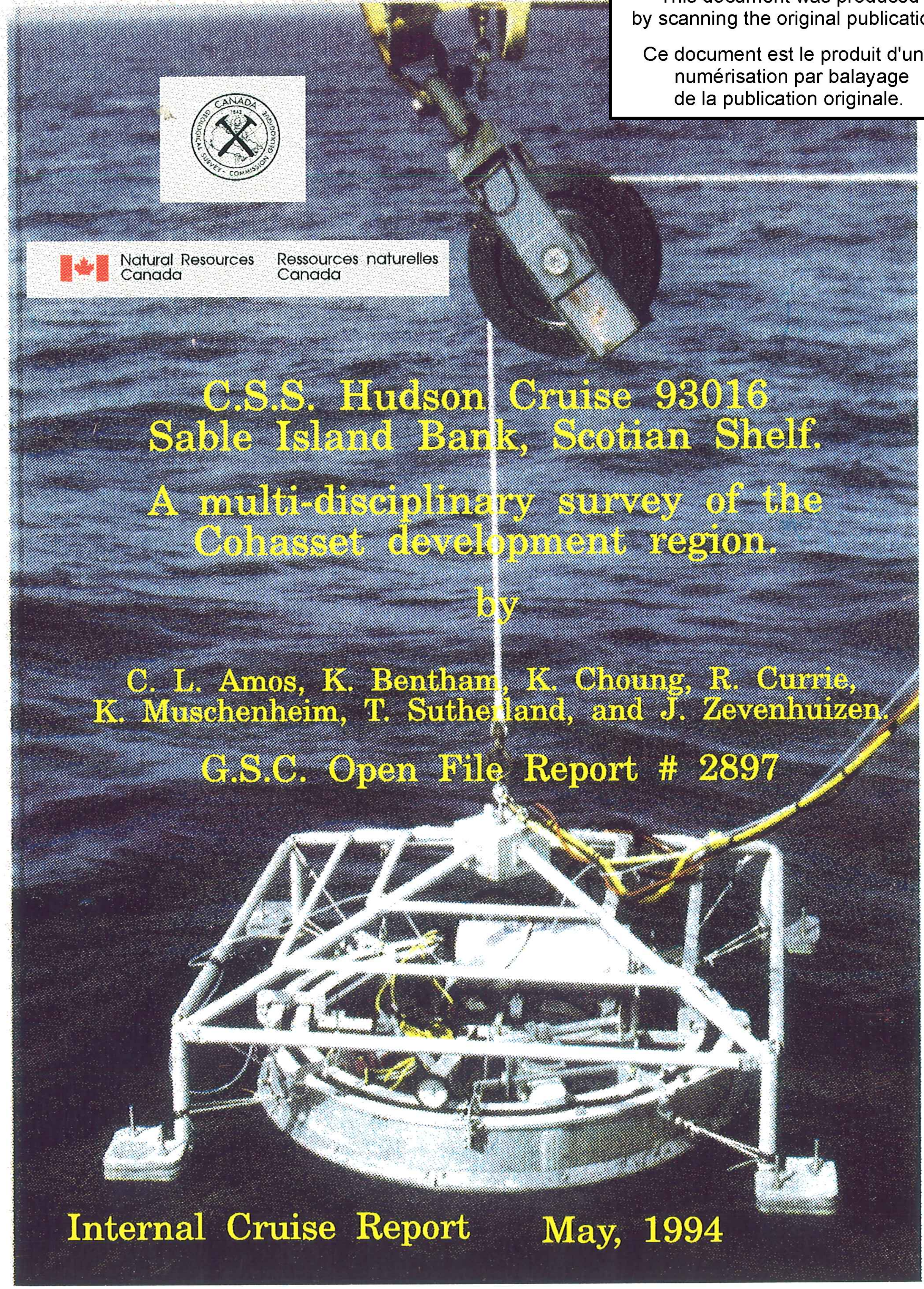

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C.S.S. Hudson Cruise 93016 Sable Island Bank, Scotian Shelf.

A multi-disciplinary survey of the Cohasset development region.

by

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G.S.C. Open File Report # 2897

Internal Cruise Report May, 1994

INTERNAL CRUISE REPORT

CSS HUDSON CRUISE 93016 - SABLE ISLAND BANK, SCOTIAN SHELF

A MULTI-DISCIPLINARY SURVEY OF THE COHASSET DEVELOPMENT REGION

by

C.L. Amos, K. Bentham, K.S. Chung, R. Currie, K. Muschenheim,

T. Sutherland and J. Zevenhuizen

Sponsored by

Geological Survey of Canada
Atlantic Geoscience Centre
Bedford Institute of Oceanography
P.O. Box 1006, Dartmouth
Nova Scotia, CANADA

25 APRIL, 1994

1.0 CRUISE SUMMARY SHEET

SHIP..................	CSS HUDSON
CRUISE DATES...........	10 - 17 JUNE, 1993
CRUISE NUMBER..........	HU93016
CRUISE LOCATION........	Sable Island Bank, Scotian Shelf
SIDESCAN DATA..........	36 hours
SEA CAROUSEL...........	5 stations
GRABS.................	32
BOX CORES.............	13
CAMERA STATIONS........	11
VIBROCORES............	--
BOSS SAMPLES...........	1 time-series (14 hours)
SEDIMENT TRAPS.........	1 time-series (14 hours)

SCIENTIFIC STAFF

C.L. AMOS.............	Senior Scientist (G.S.C.)
M. LI.................	Second Senior Scientist (G.S.C.)
A. ATKINSON...........	Electronics (G.S.C.)
K. BENTHAM............	Photography (D.F.O.)
K.S. CHUNG............	Box coring (Chonnam Uni., S. Korea)
R. CURRIE.............	Navigation (G.S.C.)
W. GRAY...............	Coring/sampling (Cosep student, Dalhousie Uni.)
J. JIANG..............	Watch-keeping (IOAS, Qingdao, China)
J.M. LIRIO............	Watch-keeping (Inst. Arctico Argentino)
D. LOCKE..............	Electronics (G.S.C.)
G. MAXWELL............	Sampling/coring (Uni. Aberdeen, Scotland)
S. MERCHANT...........	Curation/data logging (G.S.C.)
K. MUSCHENHEIM.........	BOSS sampling (D.F.O.)
A. MULLER.............	Watch-keeping (ODU, Virginia, USA)
R. MURPHY.............	Coring/sampling (G.S.C.)
T. SUTHERLAND..........	Biological sampling (Dalhousie Uni., Halifax)
M. UYESUGI............	Huntec operator (Geoforce Consultants Ltd)
Z.J. YANG.............	Watch-keeping (IOAS, Qingdao, China)

PLATE 1. A group photograph of the scientific staff (see Plate 1.1)

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3.0 BACKGROUND AND PURPOSE

The Geological Survey of Canada is undertaking a joint study with LASMO Nova Scotia Limited of seabed stability in the vicinity of the Cohasset/Panuke offshore oil development facility, Sable Island Bank, Scotian Shelf. The main objectives of the study are:

- o to determine the mode, magnitude and direction of free-stream seabed sediment transport around the Cohasset/Panuke facility;
- o to determine the relationship between free stream sediment transport and the associated benthic hydrodynamics;
- o to calibrate a numerical model of free-stream sediment transport (SEDTRANS) for application to the Cohasset/Panuke site; and
- o to monitor and measure scour around seabed installations.

This study, which began in January, 1993, involves six (6) phases of work.

Phase 1 (January - June, 1993), the deployment of instrumentation (RALPH, SOBS, and three InterOcean S4 current meters). The instrumentation will provide us with details of free-stream sediment transport and the hydrodynamic conditions prevalent at the time.

Phase 2 (10 - 17 June, 1993), CSS Hudson cruise to Sable Island Bank to gather geophysical, sample, and geodynamic information in the Cohasset/Panuke region, necessary for setting up the numerical model of the region.

Phase 3 (June - December, 1993), the analysis, formatting and archiving of all data collected during the first two phases of the study. It will also involve the calibration of SEDTRANS, and the production of detailed maps of the Cohasset/Panuke region.

Phase 4 (January - May, 1994), the redeployment of seabed instrumentation around the Cohasset/Panuke site to supplement data collected in phase 1. The set-up of the input grids for the 2-D numerical model of the study region. Development and deployment of scour monitoring instrumentation (DODO's) on the production jacket.

Phase 5: (June - December, 1994), processing of the data from phase 4. The generation of output plots of the numerical model, and the development of a suitable grid for the entire Sable Island Bank.

Phase 6: (January - April, 1995), running the Sable Island Bank sediment transport model, and publication of results.

This cruise was undertaken to meet the objectives of Phase 2 of the study, as well as those of DFO. The objectives of the cruise were as follows:

- to undertake detailed geophysical surveying and mosaicking around the Cohasset/Panuke discovery site in order to derive detailed geological maps for the region. These maps will comprise: bathymetry; bedform distribution; sediment size and texture; and thickness of the mobile layer;

- to recover RALPH, SOBS, and three InterOcean S4's deployed in Phase 1;

- to undertake direct measures of sand transport from anchor stations using BOSS and the Helley/Smith sediment traps, and to determine the time-series of sediment flux;

- to deploy Sea Carousel at strategic sites on Sable Island Bank;

- to collect IKU grab samples for purposes of box coring and the evaluation of internal sedimentary structures;

- to collect Van Veen grab samples to fill knowledge gaps in seabed sediment size and texture;

- to take water samples around the production rig Rowan Gorilla III in order to "fingerprint" discharged drill waste, to discern any aggregation within the discharge plume, and to evaluate the level of microbial activity in the discharge material; and

- to undertake a time-series of near-bed water samples using BOSS in order to evaluate resuspension events, and the presence of a nepheloid layer of drilling mud in order to assess impacts on bethic communities.

4.0 NAVIGATION

The BIONAV integrated navigation system was used throughout the cruise. Input was through a Trimble 10X GPS receiver. All positions were printed by BIONAV at one minute intervals and stored on a Vax computer. Further processing, editing and plotting was carried out using the SHIPAC geophysical processing and display software. Final navigation data files were backed-up onto 8mm data cartridges, and installed on the BIO shore Vax. Thereafter, navigation and bathymetry were transferred to the inhouse DEC5400 and plotted using the multiparameter database system.

5.0 SEISMICS AND SIDESCAN SONAR

5.1 DEEP-TOW SYSTEM (HUNTEC)

The Huntec Deep-Tow System (DTS) AGC No. 2 was used for high-resolution, sub-bottom profiling. This system was equipped with a standard ED10F/C boomer, and a 24 tip mini-sparker source. Two receivers were used: a 5 m, ten-element Benthos MESH 15/10P streamer was towed behind the DTS, while an LC10, single-element hydrophone was mounted inside the fish. The winch used for deployment and recovery was a Huntec model 1000 Oceanographic winch/slip ring system, spooled with 140 m of tow cable. The system was fired at 0.5 second intervals at 240 joules power output. Signals were filtered through a Krohn-Hite filter between 1400 and 6000 Hz (internal hydrophone) and 1000 and 4500 Hz (external hydrophone). The Huntec was towed mid-ships approximately 10 m above the seabed.

Graphic outputs from the internal and external hydrophones were displayed on an EPC 9800 thermal recorder (channels A and B). Records were displayed at a sweep interval of 125 milliseconds. A detailed description of the system configuration and behaviour is given in the Appendix.

5.2 SIMRAD SIDESCAN SONAR

Sidescan mosaicking was undertaken using a Simrad MS992 system. The system works at frequencies of 120 and 320 kHz, and is fully digital. The incoming signals are displayed on a TDU 1200 graphic recorder and colour video monitor. All records were slant-range corrected and the water column was removed. Signals were digitized and logged with a Geoacoustics SE880 Digitizer. A swath width of 300 m/channel was used throughout the survey. The system was deployed from the port side of the ship.

5.3 3.5 kHz HULL-MOUNTED SUB-BOTTOM PROFILER

Bathymetric and sub-bottom profiling were carried out using a hull mounted array of sixteen 3.5 kHz transducers and an ORE 140 Transceiver. The system was triggered by an EPC 4100 graphic recorder (serial # 161) on which both bathymetric and sub-bottom profiles were displayed at a 0.5 second sweep interval. The triggering rate was 0.5 seconds. The system was operated with pulse lengths intervals between 0.2 and 0.5 ms.

6.0 SEABED SAMPLING

6.1 VIBROCORER

We attempted to use the new vibrocorer designed and built by Brook Ocean Technology (BOT). This corer is designed to provide 3 metre long, wide-barrelled samples (Plate 6.1.1). It is equipped with an extensiometer (indicating barrel penetration of the seabed) and a retraction winch. The barrel may be lowered on deck for easy of sample recovery.

6.2 IKU GRAB

Two versions of the IKU grab were used during this cruise: the original 1 m^3 sampler, and a smaller 0.5 m^3 version. The larger version had been modified to ensure proper closure of the bucket jaws.

7.0 SEABED INSTRUMENTATION

7.1 SEA CAROUSEL

Sea Carousel is a benthic annular flume capable of submarine monitoring of seabed erosion (Amos, Grant *et al.,* 1992). The annulus is 2 m in diameter, 0.3 m high and 0.15 m wide (Plate 7.1.1). It is equipped with three optical backscatter sensors to monitor water turbidity, a Marsh-McBirney current meter to monitor azimuthal and vertical flow, a lid rotation sensor and an underwater camera that views the eroding bed through a window in the side of the annulus. Flow was induced by rotation of the lid, to which are attached eight paddles. Azimuthal flow was transformed to bed stress based on velocity gradients derived in a series of field tests. Bed stress was increased in the flume in a series of steps. Erosion rate was defined as the increase in suspended mass through time. Eroded depth was derived assuming constant areal erosion under the flume, and by measures of bulk density made at the site (1800 kg/m^3). The profile of shear strength with depth was derived by assuming that the applied fluid shear stress (τ_o) is equivalent to the shear strength (τ_{ob}) of the sediment when erosion ceases, and that this strength is the critical value (τ_c) at which sediment at that depth will begin to be eroded $\tau_o = \tau_{ob} = \tau_c$. The critical shear stress for incipient erosion of the sediment surface is evaluated as the surface (z = 0) intercept of the best-fit line of shear strength versus depth. See Amos, Grant *et al.* (1992) for a detailed description of the methods and results.

7.2 SEABED PHOTOGRAPHY

An underwater camera package, developed by the Photographic Section, Bedford Institute of Oceanography, was used to photograph the seabed. The package consisted of a Nikon F4S single lens reflex still camera, equipped with a 250 exposure film canister and a data pack. The data pack adds date and time to each photograph. The camera had a 20-mm focal length lens at F2.8. Light was provided by a Metz 45CT3 flash and Quantum Turbo Pack. The camera was triggered by a bottom weight suspended 1.52 m under the camera frame. This produced an approximate field of view of 1.2 x 1.8 m. Ektachrome slide film (200 ASA) was used throughout. Approximately 10 shots were taken at each station. Repetitive triggering was achieved using a 100 kHz pinger that was activated by grounding of the suspended weight. The 100 kHz signal, detected by a regular sounder, was diagnostic of the camera on bottom; loss of signal was diagnostic of camera off bottom.

7.3 BOSS

The Benthic Organic Seston Sampler (BOSS) is a framed array of sampling devices capable of collecting water samples at 0.10 m intervals from the seabed to a height of 1 m (see Plate 7.3.1). The array is composed of syringes that are oriented into the flow by means of a faring. The sampling mechanism is triggered by a trip weight that is delayed to ensure resuspension from the bed after deployment is eliminated. BOSS and the results obtained from it are described in Muschenheim and Newell (1992). BOSS was used to detect sand in resupension near the bed, and for the presence of epi-benthic muds.

7.4 SEDIMENT TRAPS

A Helley/Smith bedload sand trap was used to measure bedload transport over a 12-hour period at stations 013, 041, and 085. These traps have been used extensively in rivers and are well calibrated (Emmett, 1980). This sand trap was constructed twice the size of the original design with mouth dimensions of 0.15 m x 0.15 m. Sample nets were made of a 125 micron mesh. Thus material larger in diameter than fine sand was trapped. A trap door remained open during each of the deployment periods and closed during the retrieval process to prevent loss of sediment. Saltation/suspension fluxes were determined using a modified Helley/Smith sampler (epibenthic; see Amos, Ardiles *et al.* 1992). In this case, the sampler mouth was set at a height of 0.15 m above the sampler base, and sampled from this height to 0.30 m above the bed. The design of the trap was the same as the bedload sampler in all other aspects. Each trap was equipped with a door at the mouth that closed upon deployment and recovery. This ensured no sediment losses.

A rapid technique was adopted to derive sediment mass flux from sand trap saturated samples. Sediment samples were rinsed with freshwater and allowed to settle in a 500 ml graduated cylinder. All supernatant water was then poured off. This procedure was repeated several times to ensure freshwater saturation. The exact volume of the final saturated sample was then determined. Wet sediment mass was determined using a mass balance by weighing the intact sample within the graduated cylinder; thereafter, the tared saturated sample mass was determined. The dry sediment volume (S_v) and mass (S_m) were calculated using the equations:

$$S_v = (B_w - \rho_w B_v)/(\rho_s - \rho_w)$$

$$S_m = \rho_s S_v$$

where $\rho_s = 2650$ kg m^{-3} and $\rho_w = 1000$ kg m^{-3}. The calculated dry sediment mass were plotted against the measured dry mass and a regression coefficient determined. For purposes of comparison, selected sediment samples were dried in an oven at 45° C and the dry weights measured directly (S_{dm}). This provided an alternative measure of the dry sediment weight in transport as bedload. For the methods to be comparable $S_m = S_{dm}$ (Amos and Sutherland, in press).

8.0 RESULTS

A complete list of seabed samples collected during this cruise is given in Table 1. A total of 70 samples were collected. These may be broken down into: eight (8) IKU grab samples (Table 2); thirty-two (32) Van Veen grab samples (Table 2); twenty (20) camera stations (Table 3); four (4) vibrocore stations (Table 4); and two (2) anchor stations (Table 5). In addition to the sampling program, a further 41 hours of 3.5 kHz sub-bottom profiling (Table 6) and Huntec DTS surveying (Table 7) was collected, together with 36 hours of sidescan sonar (Table 9). Also, SOBS (Submersible Observatory of Benthic Stability, see Amos, Ardiles *et al.* 1992), RALPH (Heffler, 1984) and an InterOcean S4 current meter (Plate 8.1) were recovered from site 3 in completion of phase 1 of this program.

8.1 SEISMIC INTERPRETATIONS

A total of 41 hours of surveying was undertaken with the Huntec, covering an approximate distance of 330 line km (Figure 8.1.1; Table 11). The use of a multi-tipped sparker on the Huntec DTS together with an external hydrophone was supposed to yield good penetration through sand. We were attempting to mimic results obtained with the NSRF deep-towed sparker system, that for the same region demonstrated a clear set of cross-stratification within the sand ridges that are present. Despite a series of adjustments to the configuration, filtering, and height of the DTS we were unable to detect the coherent reflectors obtained with the NSRF system. It is clear that the DTS was designed for fine-grained sediments in deep water (> 100 m water depths), and that it is not the right tool for use in shallow water sands. At first glace, the data collected by the DTS shows no evidence of sub-bottom structure.

8.2 SIDESCAN MOSAICKING

A total of 36 hours of sidescan records were collected, covering an approximate distance of 280 line km (Table 11). One transect was made to link deployment sites of seabed instrumentation deployed in Phase 1, and the remaining time was devoted to the surveying of a mosaic east of the Cohasset/Panuke development (Figure 8.2.1). Data were processed on an HP720 Workstation operating with HP-UX version 9.0, Motif, and X-Windows. The mosaic comprised over 2 Gigabytes of data. This data base was decimated by a factor of 8 for plotting. Processing of the data included: importation and decimation; bottom detection; navigation merge; slant range correction; beam pattern correction; gain offset application; conversion to mosaic format. The mosaic encompasses a series of shoreface-connected ridges that pass through the development site. A suite of large shoreface-connected sand ridges underlie the mosaic site. They are oriented NE - SW and also underlie the COPAN site. Although subtle changes in reflectivity can be seen, no major changes are evident. Nor can any obvious geohazards be detected.

8.3 SEABED SAMPLING

A total of 32 Van Veen seabed samples were collected in a regular pattern around the Cohasset/Panuke development site (Table 2). A map of the sample locations is given in Figure

8.3.1. Four sub-samples were collected from each bulk sample: one for archiving; one for grain size analysis; one for organic carbon content (Dalhousie University OPEN study); and one for Habitat Ecology Division (DFO). The AGC samples will be analysed for grain size and sorting, and then used to produce a sediment texture map of the region. A variety of sizes were sampled, varying from muddy, silty sand to medium shelly sand. No clear trends in texture were apparent from the hand samples examined onboard.

8.4 BOX CORING

The large IKU was lost on bottom during its first attempt at recovery. The reason for the loss was a loose bulldog clamp holding the winch wire to the shackle on the grab itself. Thereafter, the smaller IKU was used. This grab was successful at retrieving samples large enough for box coring. A total of 13 box cores were collected using this IKU. From the resin peels produced we observed a wide and rich suite of sedimentary structures diagnostic of sediment transport (Plate 8.4.1). Also, there was more evidence of disturbance due to sampling than was apparent in the larger IKU. Plate 8.4.2 demostrates the flame structures and micro-faulting associated with this disturbance. Nevertheless, many primary sedimentary structures were still evident. Amongst these were 3-D megaripple cross-bedding, and cut-and-fill (Plate 8.4.3).

8.5 SEA CAROUSEL

Five successful deployments of Sea Carousel were achieved (Table 16). Good quality data were collected diagnostic of the onset of bed load transport, the generation of large scale ripples and megaripples, and the onset of saltation/suspension. Good quality video was also obtained. These video tapes will be analyzed for ripple migration rates (bedload transport), the onset of saltation, saltation layer thickness, the reference concentration (at the base of the suspension profile), and the suspended sediment transport (determined from two OBS sensors). It was not possible to pump samples from the Carousel due to the high freeboard of the Hudson. Thus, resuspension of organics is not known. Also, it was not possible to undertake a calibration of the OBS sensors. This will be performed at a later date.

Uncalibrated plots of the data recorded by Sea Carousel at each of the five stations is shown in Figures 8.5.1 to 8.5.5 respectively. Each station lasted approximately 1.5 hours. A range in current speeds was achieved that varied in steps up to 0.6 m/s. The migration of ripples and megaripples, seen in video records, dominates the deployments. We were clearly able to define the traction threshold for onset of ripple generation; the saltation threshold, the thickness of the saltation layer; and the onset of suspension. Also of interest is the burial of the lower OBS by the migrating bedforms which yields a suspended sediment concentration (SSC) in excess of 5000 mg/l. The OBS was able to detect the SSC within the lee eddy of the ripple immediately prior to burial (Plate 8.5.5, 12.9 and 13.0), which may be correlated with the reference concentration at the base of a Rousian suspended sediment distribution profile.

8.6 SEABED PHOTOGRAPHY

The underwater camera operated intermittently during this cruise. Of the twenty camera stations occupied in this cruise good quality results were obtained from 11 stations (st: 2, 3, 6, 8, 12, 13, 17, 20, 22, 23, and 41) while nine yielded no results (st: 45, 48, 51, 54, 57, 60, 65, 67, and 70). Examples of photographs of good quality are shown in Plates 8.6.1 to 8.6.6.

8.7 ANCHOR STATIONS

Two anchor station time-series were undertaken; the first lasting 6 hours (1230 - 1830, 12th June), the second lasting 14 hours (2052, 13th June - 1058, 14th June). The first anchor station (1) was used in order to test and deploy the variety of equipment aboard. The second (2) was used to derive a time-series of sand transport as bedload and in suspension using the sediment traps and BOSS respectively. The results from both BOSS and the bedload traps were disappointing as little, if any, sand was detected in motion. Also, no evidence for a nepheloid layer was found.

8.8 EQUIPMENT RECOVERY

We were able to recover SOBS (from LASMO vessel at site#2), RALPH, and two S4's (one burst sampling, one continuous sampling) at deployment site # 3 (60 m water depth). The S4 data was of good quality and covered several periods of intensive storm activity. The burst meter worked for 30 days, while the continuous mode meter failed after 14 days (due to battery failure). No data was present on RALPH. It appeared to have failed during its deployment, though the reasons for the failure are unknown. SOBS video worked well for approximately 6 days and showed periods of tidal sand motion punctuated by active periods of sand transport as sheet flow during storms. Also, the sand traps on SOBS (at heights above the bed of 0.15, 0.30, 0.53, 0.86 and 1.60 m) were filled with sand and organic material. These samples showed several layers that we presume are diagnostic of a series of storms. The grain size of the sediment caught within the traps is shown in Figure 8.8.1. Notice that there is a rapid decrease in sand size from the seabed to a height of 1 m. While above this height the change is less. This height appears to be the limit of wave resuspension. The masses of material in each trap was converted to a benthic sediment flux (Figure 8.8.2). The flux is greatest near the bed (0.06 m/a) and decreases rapidly to a hemi-pelagic sedimentation rate of 0.005 m/a.

The third S4 was situated at the reference site adjacent to Cohasset (37 m water depth). The cable broke several times upon attempted recovery. An ROV survey carried out by LASMO after this cruise showed the meter to be buried by *circa* 0.8 m of sand. The S4 was ultimately recovered by LASMO, and 14 days of data were downloaded (28th February, 1993 - 13 March, 1993). The S4 was situated on the lee (eastern) flank of a shoreface-connected ridge. The burial of the meter we feel took place during the storm of the 17th March, 1993. This is commensurate with a ridge migration of *circa* 120 m.

9.0 ITINERARY

DATE/TIME (GMT)	OPERATION
10/1300	Leave BIO; steaming for Sable Island Bank
11/0435	Start seismic line 1
11/0926	EOL 1
11/0943	Start seismic line 2
11/1037	EOL 2
11/1413	Recovered RALPH (43 53 N, 60 25 W)
11/1428	Recovered S4-1 (43 51 N, 60 34 W)
11/1440	line break on S4-2 (continuous)
11/1600	Running loop around S4
11/2000	Begin Seismic mosaic NE of Cohasset
12/1000	End seismic mosaic lines
12/1230	Anchor station # 1
12/1239	Vibrocore (sample 1). (43 53.10 N; 60 25.08 W) No sample recovered
12/1345	Camera station (sample 2) (43 53.07 N; 60 25.06 W)
12/1425	IKU station (sample 3). (43 53.07 N; 60 25.06 W) IKU lost, pulled off lifting wire
12/1545	IKU station (sample 4). (43 53.07 N; 60 25.06 W) 2 unsuccessfull attempts for resin peels. Subsampled for grain size
12/1635	Vibrocore attempt (sample 5). (43 53.07 N; 60 25.06 W) No sample recovered
12/1736	Sea Carousel test (43 53.08 N; 60 25.12 W)
12/1754	Camera Station (sample 6) (43 53.08 N; 60 25.12 W)
12/1830	Lifting anchor
12/1900	Begin seismic mosaicking NE of Cohasset
13/1100	End seismic survey
13/1130	Station 4 Vibrocore (sample 7). Barrell empty (GPS not available. Bearing 237, Distance 9.2 - Rig Cohasset)
13/1256	Camera station (sample 8) (43 55.87 N; 60 26.80 W)
13/1316	IKU Grab (sample 9) (43 55.95 N; 60 27.02 W)
13/1407	IKU Grab (sample 10) (43 51.98 N; 60 34.24 W)
13/1449	Vibrocore (sample 11) (43 51.95 N; 60 34.23 W) Some disturbed poor sample recovered in barrel. Not saved.
13/1513	Camera station (sample 12) (43 51.97 N; 60 34.22 W)
13/1612	Sea Carousel SAB1 (43 53 53 N; 60 31.56 W). On board 13/1706
13/1744	Sea Carousel SAB2 (43 55.53 N; 60 32.51 W). On board 13/1858
13/1922	Camera station (sample 013) (43 55.57 N; 60 32.41 W)
13/2052	Anchor station # 2 for Bedload sediment traps and Boss water sampler (samples 14 and 15). Start 13/2052 - End 14/1058

	(43 55.57 N; 60 32.41 W)
14/1123	IKU grab (sample 016) (43 55.56 N; 60 32.39 W)
14/1332	Sea Carousel SAB3 (43 53.15 N; 60 25.15 W). On board 14/1431
14/1520	Camera station (sample 017) (43 54.07 N; 60 31.54 W)
14/1540	IKU grab (sample 018) (43 54.35 N; 60 31.67 W)
14/1608	IKU grab (sample 019) (43 55.66 N; 60 32.58 W)
14/1615	Camera station (sample 020) (43 55.72 N; 60 32.73 W)
14/1645	IKU grab (sample 021) (43 56.56 N; 60 33.43 W)
14/1651	Camera station (sample 022) (43 56.65 N; 60 33.49 W)
14/1821	Sea Carousel SAB4 (44 00.09 N; 60 49.88 W). On board 14/1923
14/1935	Camera station (sample 023) (44 00.05 N; 60 49.79 W)
14/1950	VanVeen grab (sample 024) (44 00.12 N; 60 49.61 W)
15/0353	VanVeen station (sample 025) (43 57.51 N; 60 40.47 W)
15/0415	VanVeen station (sample 026) (43 54.97 N; 60 39.98 W)
15/0445	VanVeen station (sample 027) (43 52.50 N; 60 39.95 W)
15/0517	VanVeen station (sample 028) (43 47.44 N; 60 40.00 W)
15/0536	VanVeen station (sample 029) (43 45.17 N; 60 40.00 W)
15/0613	VanVeen station (sample 030) (43 40.06 N; 60 39.96 W)
15/0649	VanVeen station (sample 031) (43 39.97 N; 60 45.02 W)
15/0724	VanVeen station (sample 032) (43 45.11 N; 60 44.97 W)
15/0747	VanVeen station (sample 033) (43 47.59 N; 60 45.01 W)
15/0810	VanVeen station (sample 034) (43 49.96 N; 60 44.92 W)
15/0830	VanVeen station (sample 035) (43 52.53 N; 60 45.00 W)
15/0857	VanVeen station (sample 036) (43 55.00 N; 60 44.94 W)
15/0926	VanVeen station (sample 037) (43 54.99 N; 60 50.01 W)
15/1001	VanVeen station (sample 038) (43 57.49 N; 60 45.03 W)
15/1057	VanVeen station (sample 039) (43 49.98 N; 60 49.94 W)
15/1217	Sea Carousel SAB5 (44 00.05 N; 60 50.01W). Off bottom 15/1321
15/1338	IKU grab (sample 040) (44 00.07 N; 60 50.01 W)
15/1521	Camera station (sample 041) (43 53.50 N; 60 29.64 W)
15/1534	VanVeen station (sample 042) (43 53.50 N; 60 29.64 W)
15/1548	VanVeen station (sample 043) (43 52.53 N; 60 29.49 W)
15/1625	VanVeen station (sample 044) (43 52.53 N; 60 20.49 W)
15/1634	VanVeen station (sample 045) (43 50.62 N; 60 25.22 W)
15/1708	VanVeen station (sample 046) (43 47.05 N; 60 25.11 W)
15/1731	VanVeen station (sample 047) (43 44.96 N; 60 25.00 W)
15/1740	VanVeen station (sample 048) (43 44.99 N; 60 25.03 W)
15/1822	VanVeen station (sample 049) (43 40.21 N; 60 25.35 W)
15/1857	VanVeen station (sample 050) (43 40.00 N; 60 29.95 W)
15/1908	Camera station (sample 051) (43 39.87 N; 60 29.80 W)
15/2014	VanVeen station (sample 052) (43 45.02 N; 60 30.00 W)
15/2039	VanVeen station (sample 053) (43 47.51 N; 60 29.98 W)
15/2050	Camera station (sample 054) (43 47.81 N; 60 29.98 W)
15/2130	VanVeen station (sample 055) (43 47.47 N; 60 35.02 W)

15/2157	VanVeen station (sample 056) (43 44.98 N; 60 34.99 W)
15/2210	Camera station (sample 057) (43 45.03 N; 60 34.96 W)
15/2255	VanVeen station (sample 058) (43 40.00 N; 60 34.80 W)

10.0 CONCLUSIONS AND RECOMMENDATIONS..

The conclusion of this cruise brought with it a successful completion of phase 2 of this project. We were able to recover the seabed instrumentation deployed in phase 1, and to collect the geological and geophysical data sets to fit the gaps in our existing data bases. The seabed sampling program provides us with a complete sample set from which an accurate map of sediment distribution will be compiled.

Time was lost attempting to retreive the buried S4. The meter was eventually recovered by ROV (by LASMO). In so doing it was discovered that a considerable amount of sand moved (presumeably during the storm of the century - 17th March, 1993) when a sand ridge appears to have moved eastwards *circa* 120 m.

The Huntec (DTS) System did not live up to expectations regarding the quality of data nor the penetration of sand. We were unable to detect internal reflectors in the sand ridges that we know to be there (from the NSRF system).

The vibrocorer was a disappointment as we recovered nothing despite several attempts. We made efforts to improve the core catcher, as well as the period of time in vibration mode; all to no avail. It appears that either the fine-grained nature (fine sand) of the seabed causes liquefaction, or the system is in need of a basic redesign.

Sea Carousel worked very well in all cases yielding excellent results. The new motor provides us with a much greater degree of control over the system, and the cage (Bob) protects it and provides a reaction force to the drag on cables. We can now undertake in situ seabed stability measures to depths of 100 m in continental shelf settings.

11.0 REFERENCES

Amos, C.L., Ardiles, B. *et al.* 1992. CSS Hudson and MV Septentrion cruises - Grande Baleine region, Hudson Bay. A multi-disciplinary survey of the coastal and nearshore regions. Geological Survey of Canada Open File Report 2603: 80p.

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Heffler, D.E. 1984. RALPH - an instrument to monitor seabed sediments. Current Research, Part B, Geological Survey of Canada Paper 84-1B: 47-52.

Muschenheim, D.K. and Newell, C.R. 1992. Utilization of seston flux over a mussel bed. Marine Ecology Progress Series 85: 131-136.

12.0 APPENDIXES AND TABLES...........


Plate 1.1

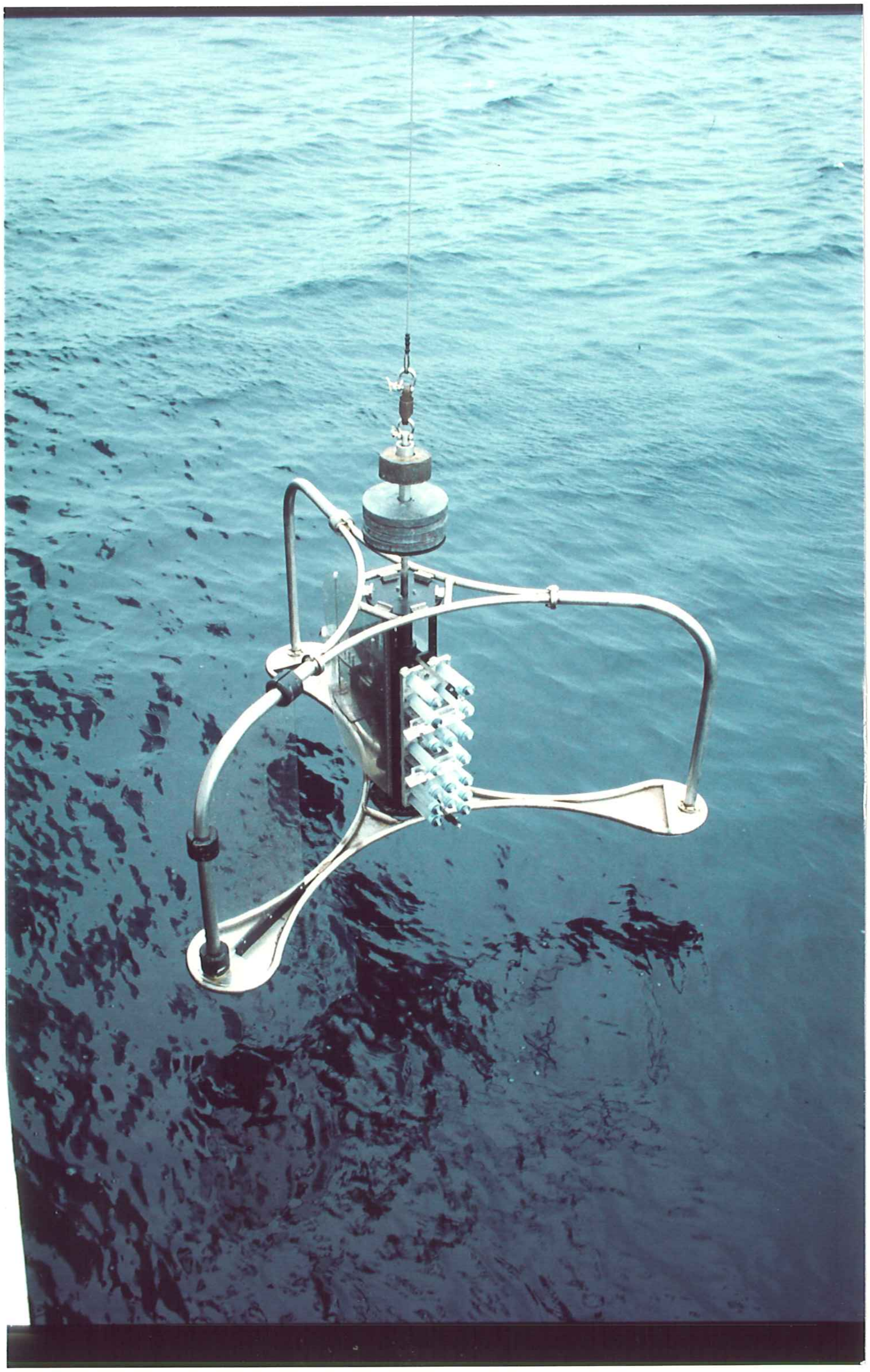


Plate 7.3.1

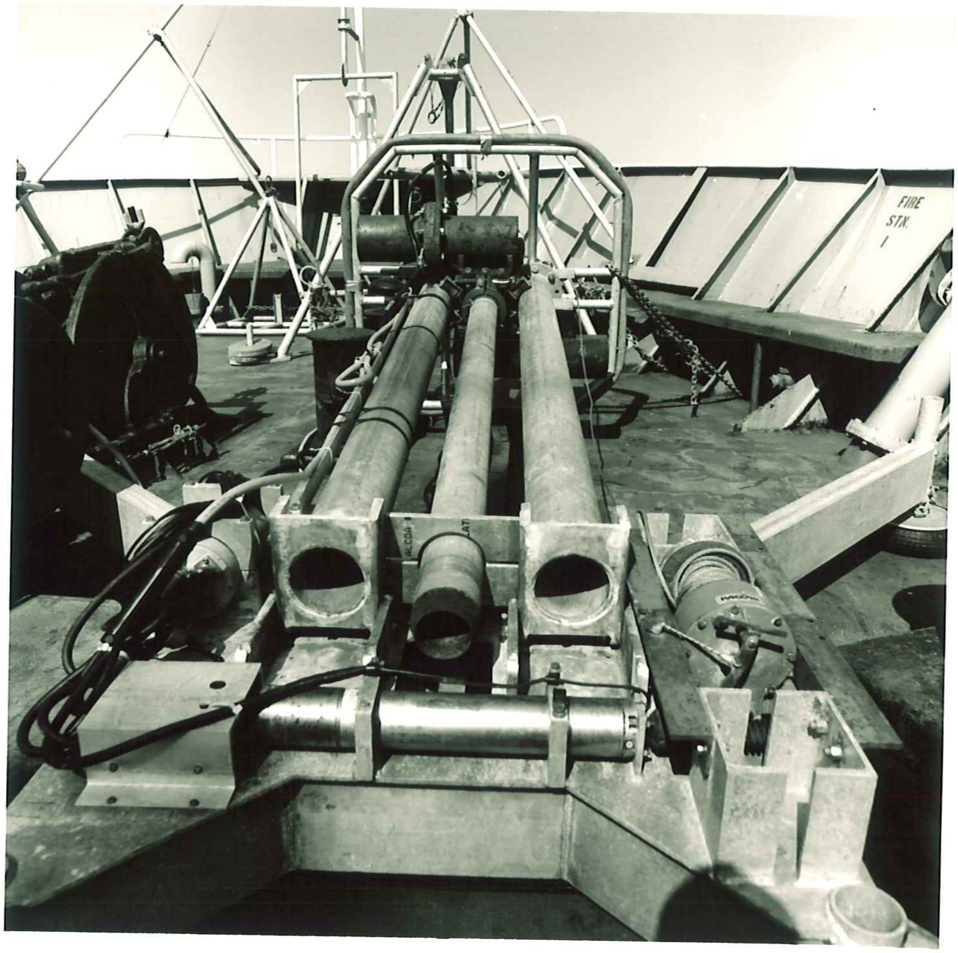


Plate 6.1.1

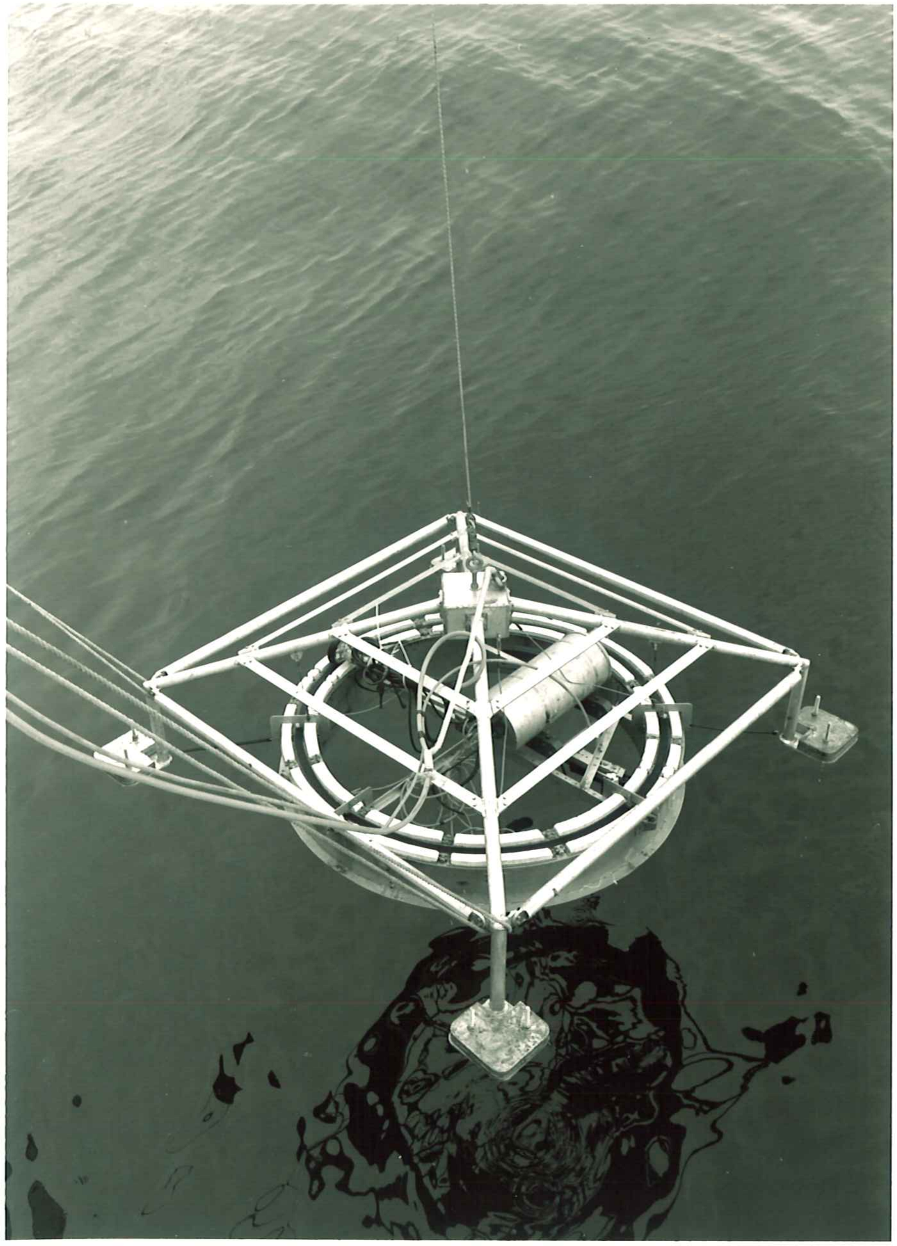


Plate 7.1.1

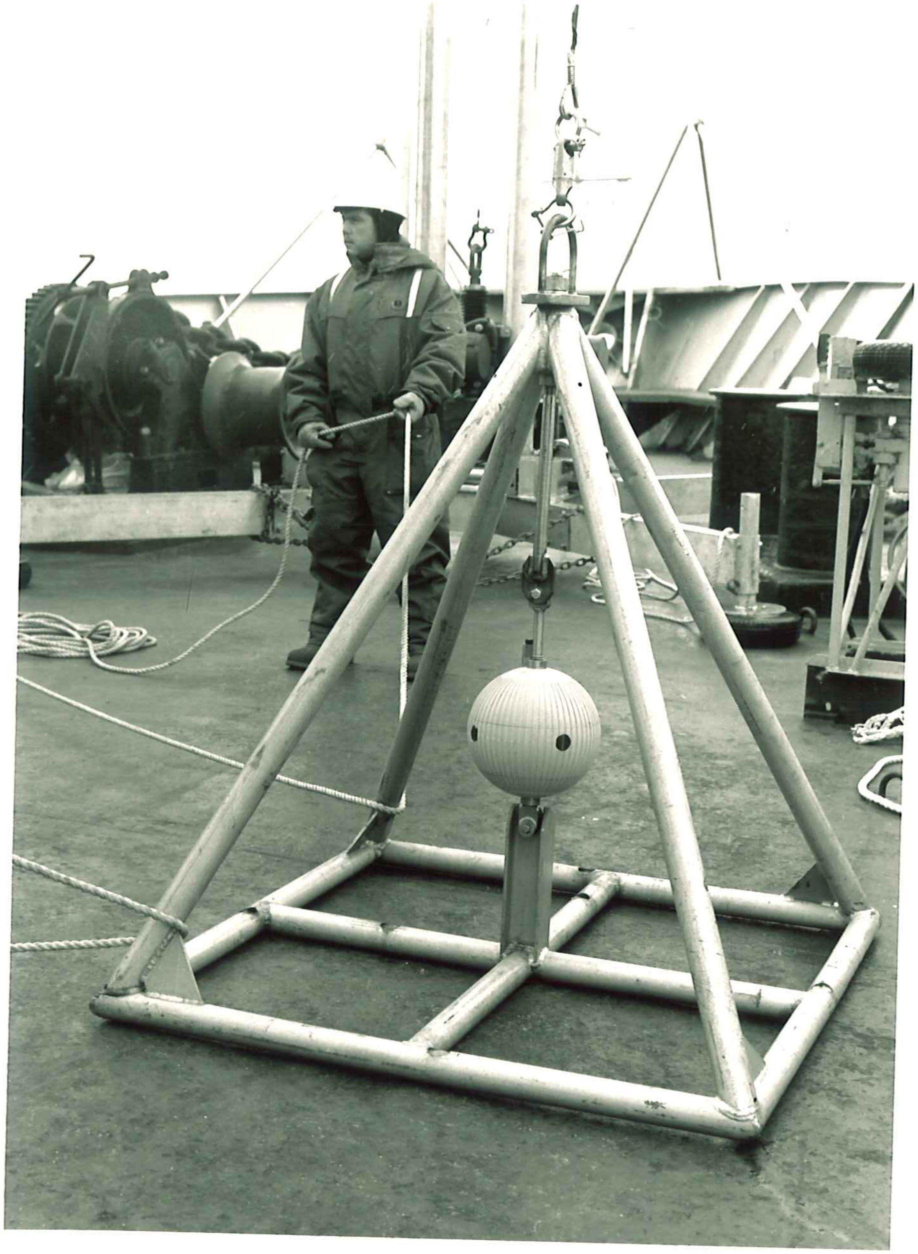


Plate 8.1

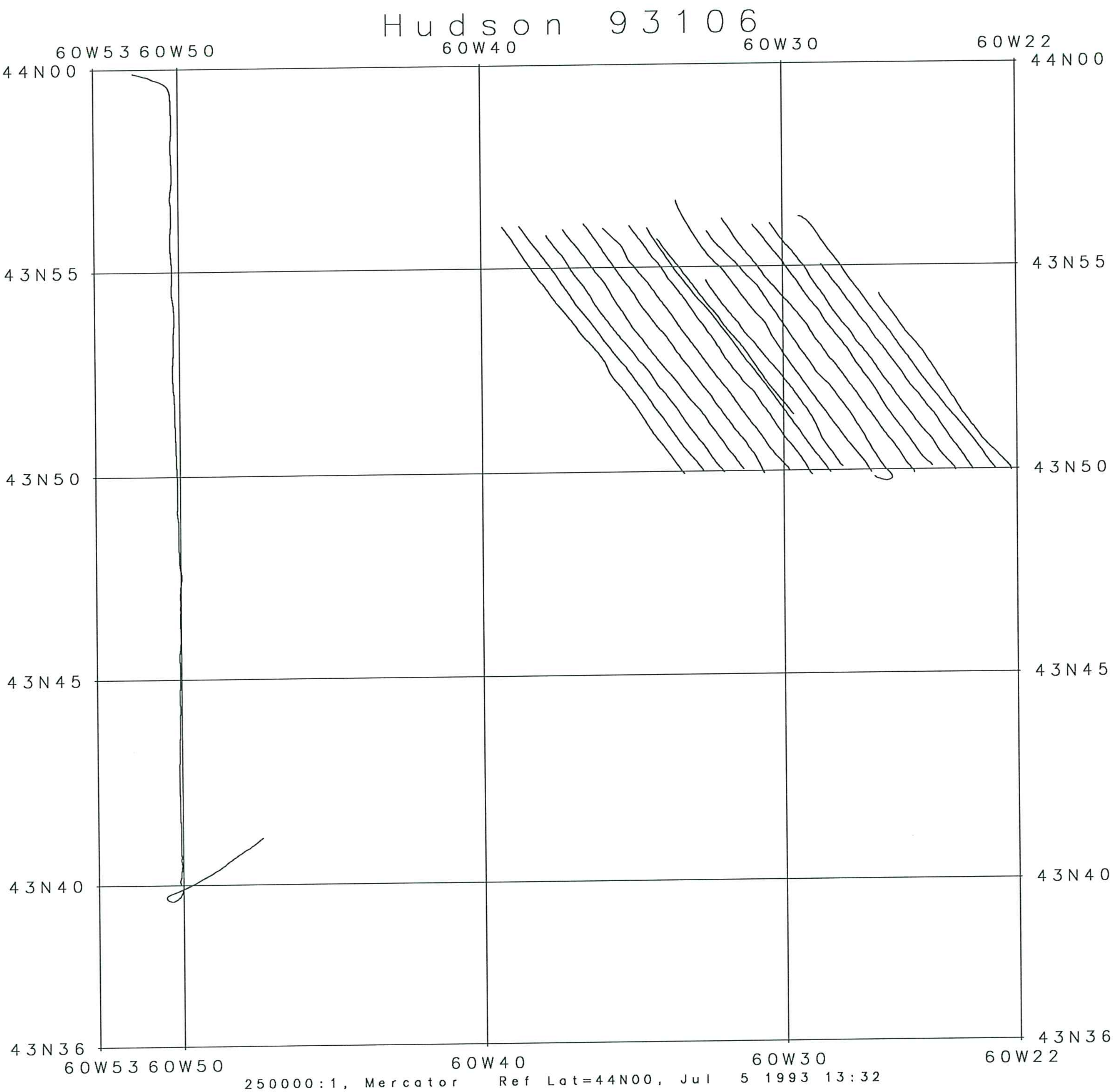

Hudson 93106
60W53 60W50
60W40
60W30
60W22
44N00
43N55
43N50
43N45
43N40
43N36
250000:1, Mercator Ref Lat=44N00, Jul 5 1993 13:32

Figure 8.1.1

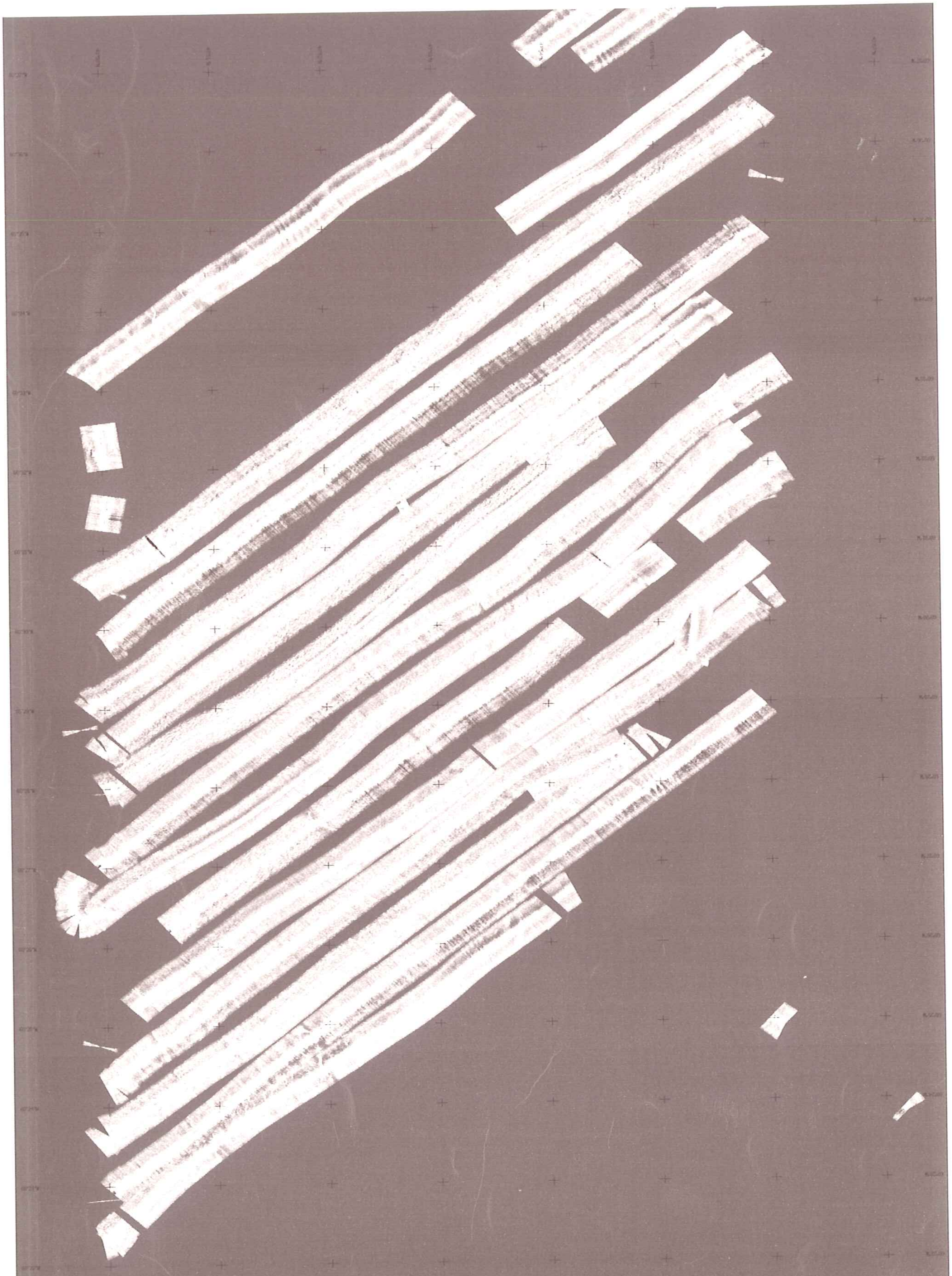


Plate 8.2.1

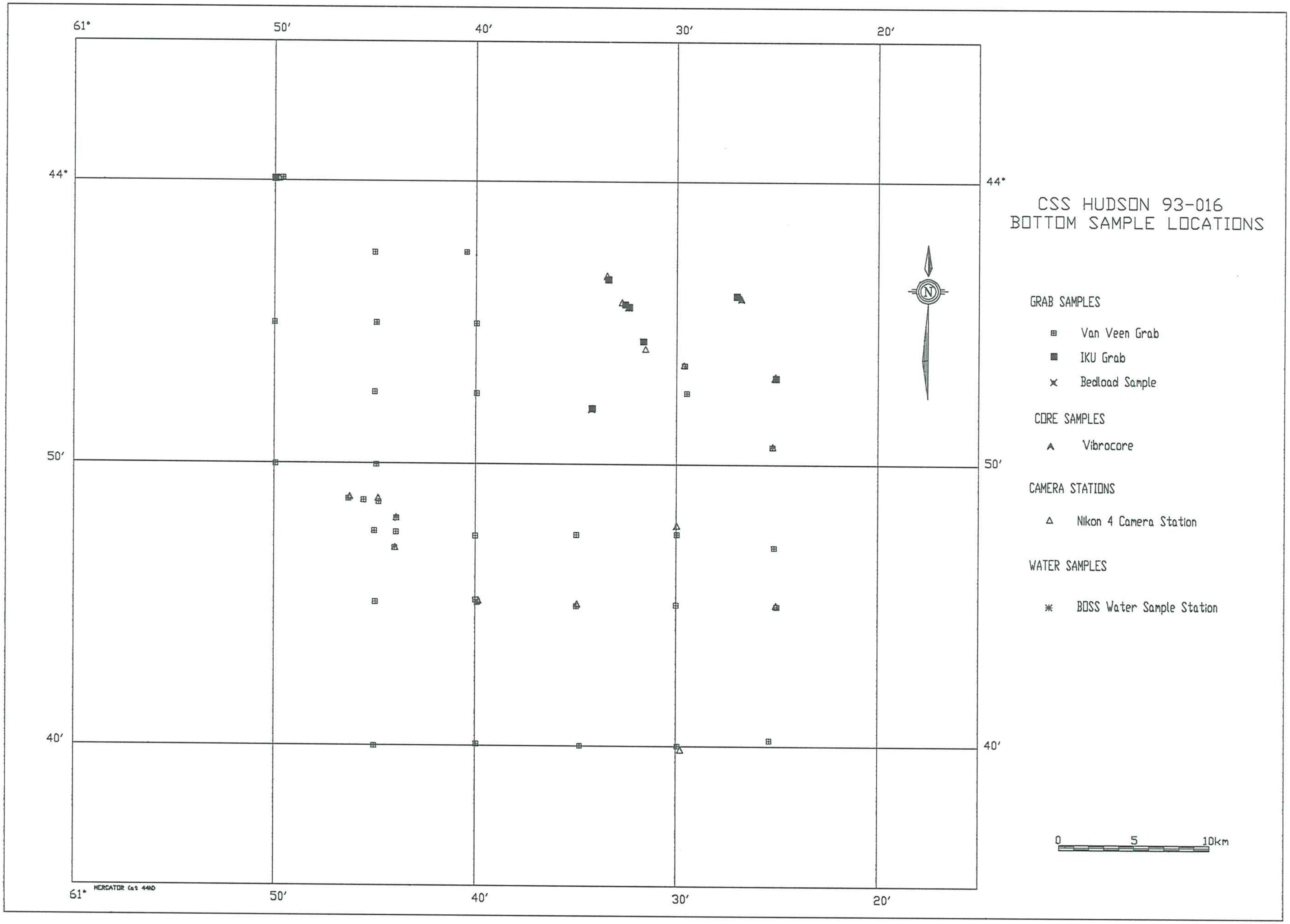

CSS HUDSON 93-016
BOTTOM SAMPLE LOCATIONS
GRAB SAMPLES
Van Veen Grab
IKU Grab
Bedload Sample
CORE SAMPLES
Vibrocore
CAMERA STATIONS
Nikon 4 Camera Station
WATER SAMPLES
BOSS Water Sample Station
0
5
10km
61°
50′
40′
30′
20′
44°
50′
40′
N
MERCATOR (at 44N)

Figure 8.3.1

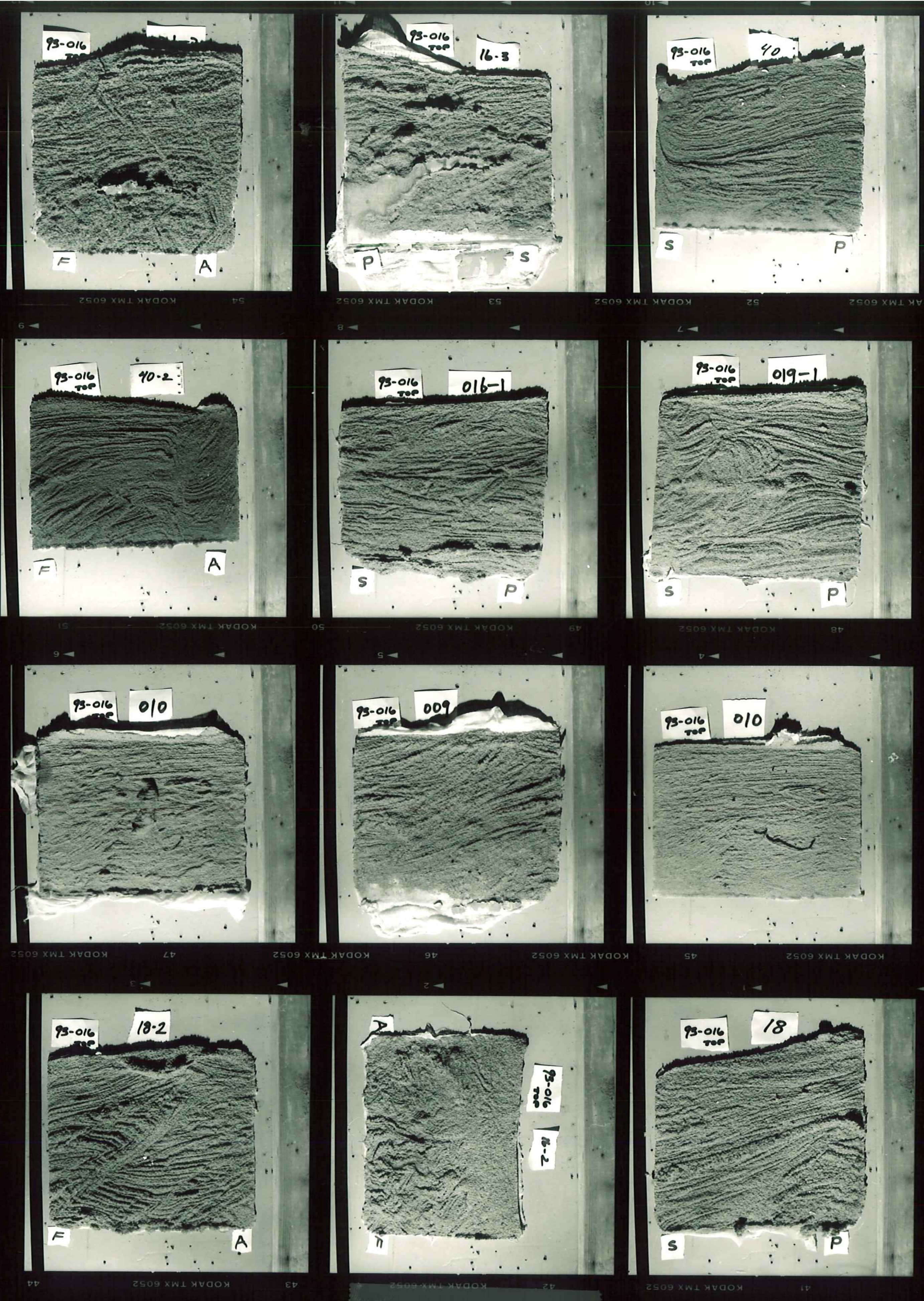

93-016 TOP
F
A
93-016 TOP
16-3
P
S
93-016 TOP
40
S
P
93-016 TOP
40-2
F
A
93-016 TOP
016-1
S
P
93-016 TOP
019-1
S
P
93-016 TOP
010
93-016 TOP
009
93-016 TOP
010
93-016 TOP
18-2
F
A
93-016 TOP
18-2
93-016 TOP
18
S
P

Plate 8.4.1

Plate 8.4.2

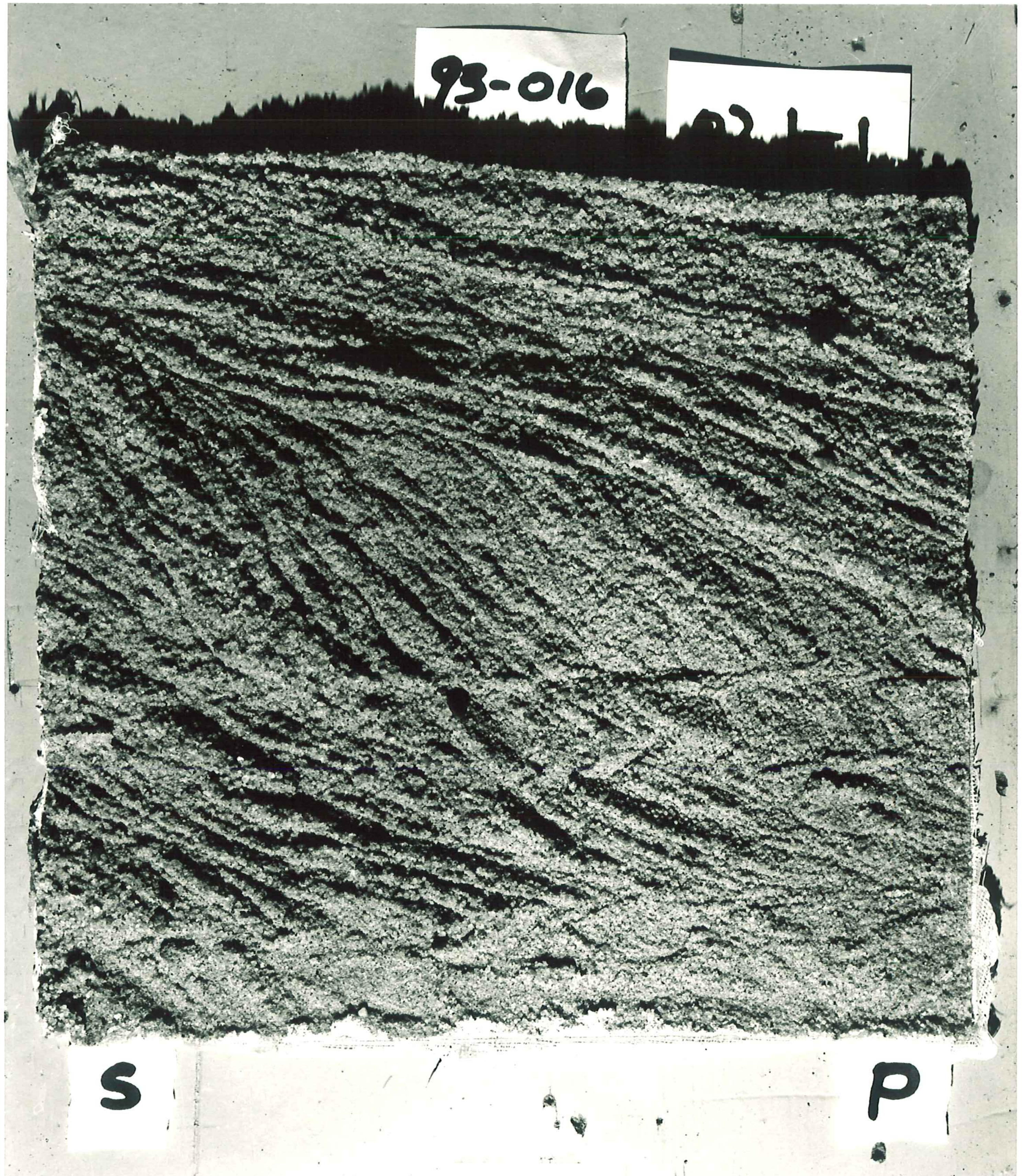


Plate 8.4.3

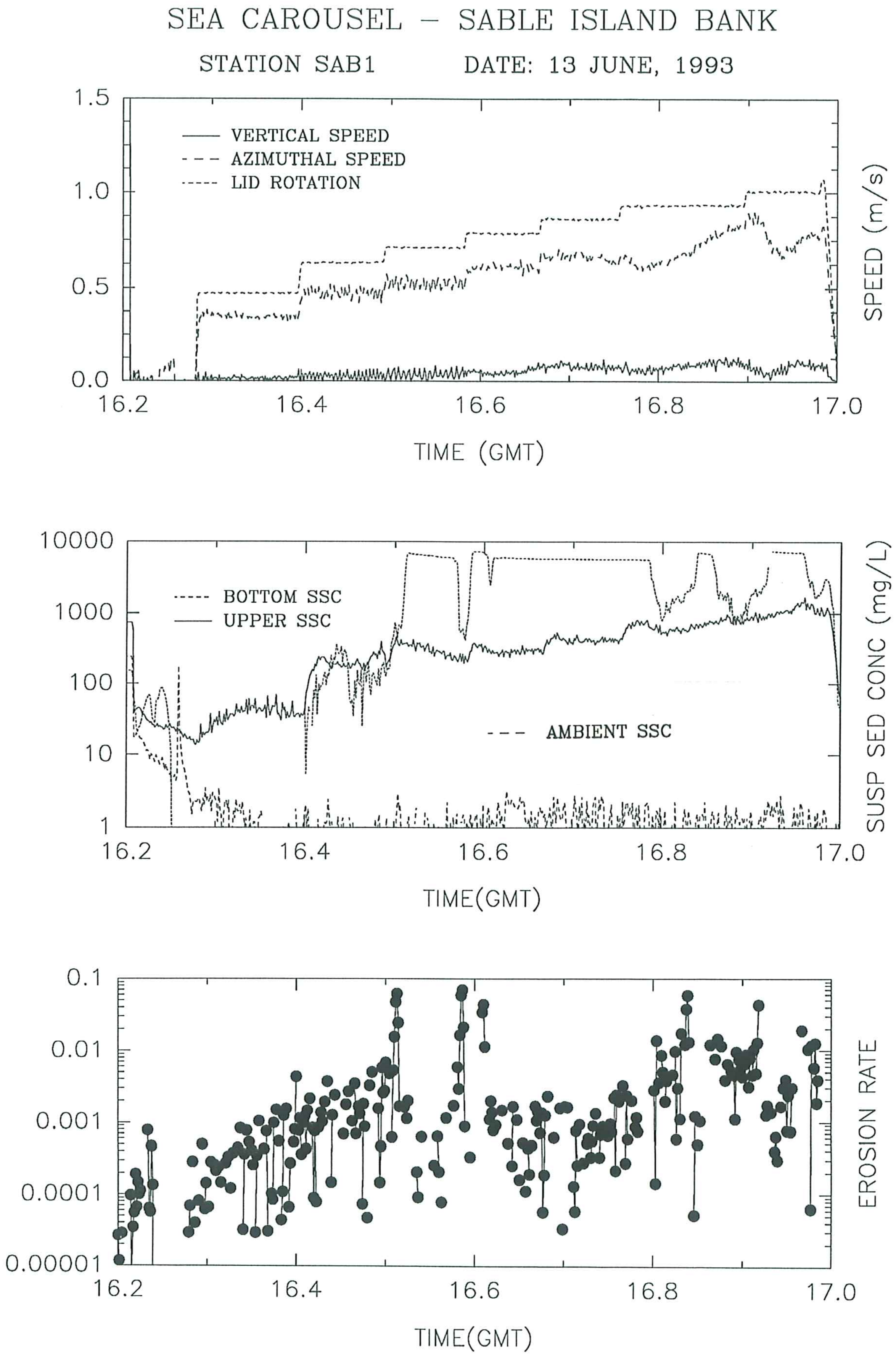
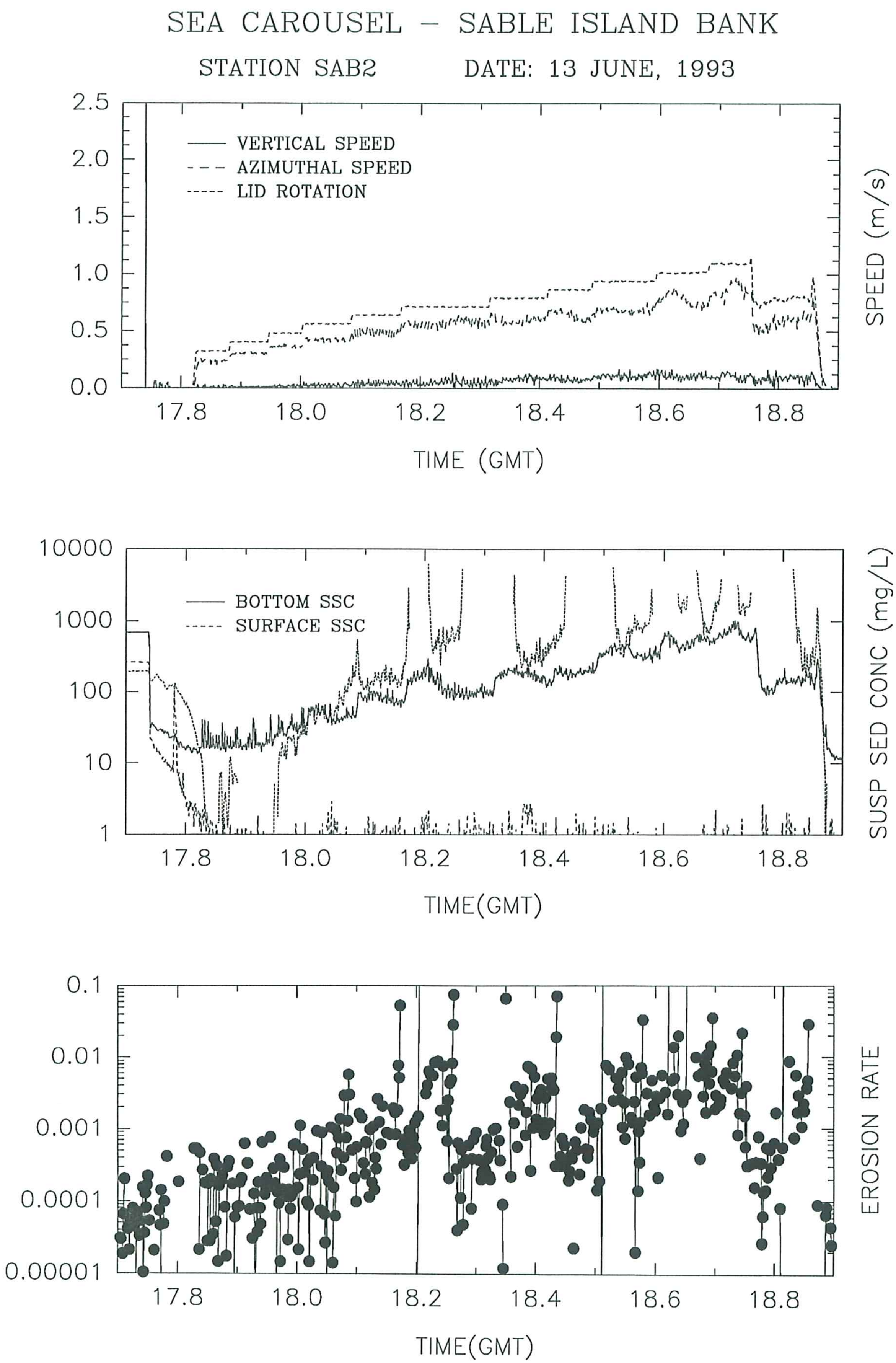

SEA CAROUSEL – SABLE ISLAND BANK
STATION SAB1
DATE: 13 JUNE, 1993
VERTICAL SPEED
AZIMUTHAL SPEED
LID ROTATION
SPEED (m/s)
1.5
1.0
0.5
0.0
16.2
16.4
16.6
16.8
17.0
TIME (GMT)
BOTTOM SSC
UPPER SSC
AMBIENT SSC
SUSP SED CONC (mg/L)
10000
1000
100
10
1
16.2
16.4
16.6
16.8
17.0
TIME(GMT)
EROSION RATE
0.1
0.01
0.001
0.0001
0.00001
16.2
16.4
16.6
16.8
17.0
TIME(GMT)

Figure 8.5.1



SEA CAROUSEL – SABLE ISLAND BANK
STATION SAB2
DATE: 13 JUNE, 1993
VERTICAL SPEED
AZIMUTHAL SPEED
LID ROTATION
SPEED (m/s)
TIME (GMT)
BOTTOM SSC
SURFACE SSC
SUSP SED CONC (mg/L)
TIME(GMT)
EROSION RATE
TIME(GMT)

Figure 8.5.2

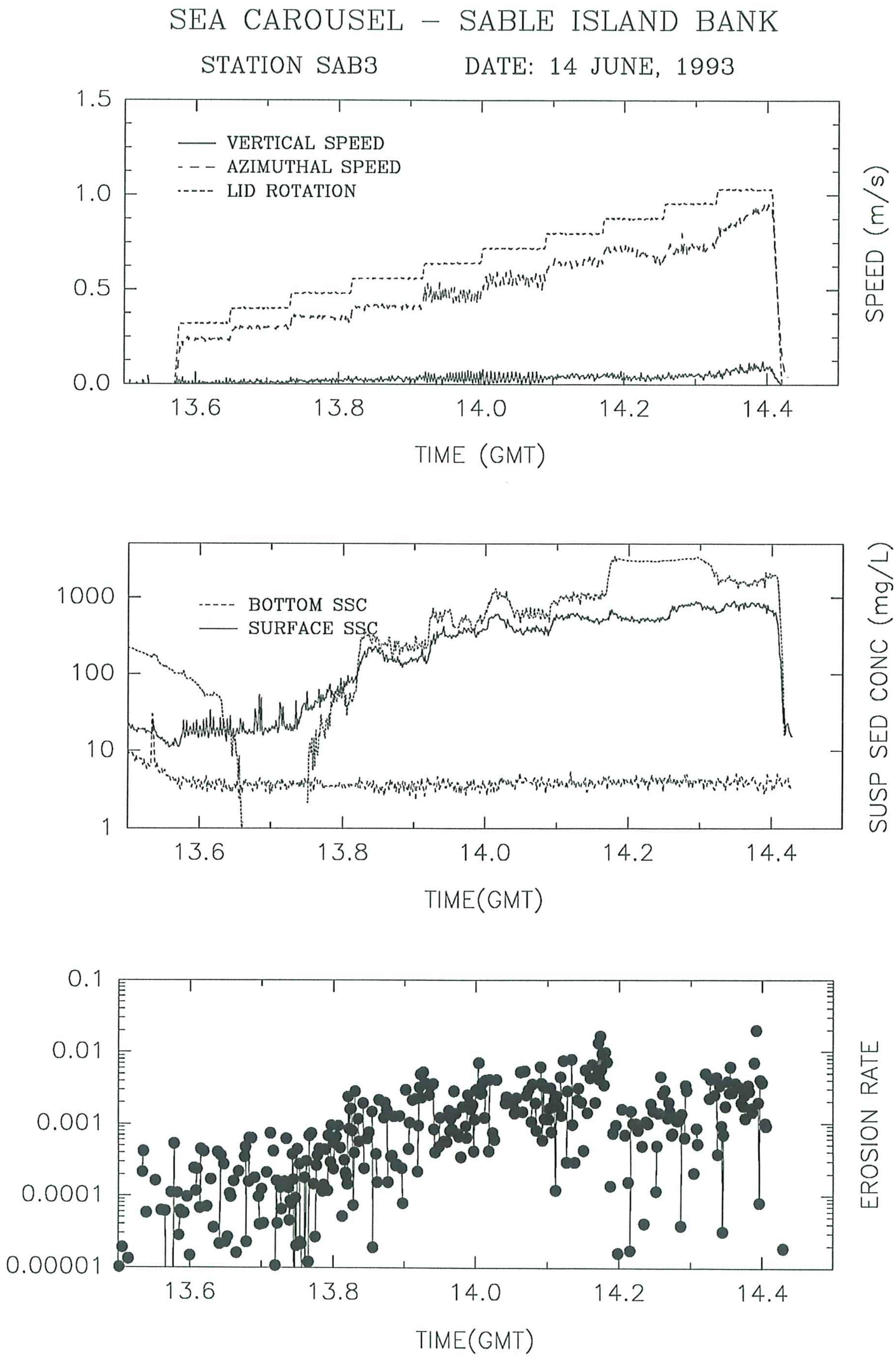

SEA CAROUSEL – SABLE ISLAND BANK
STATION SAB3
DATE: 14 JUNE, 1993
VERTICAL SPEED
AZIMUTHAL SPEED
LID ROTATION
SPEED (m/s)
1.5
1.0
0.5
0.0
13.6
13.8
14.0
14.2
14.4
TIME (GMT)
BOTTOM SSC
SURFACE SSC
SUSP SED CONC (mg/L)
1000
100
10
1
TIME(GMT)
EROSION RATE
0.1
0.01
0.001
0.0001
0.00001
TIME(GMT)

Figure 8.5.3

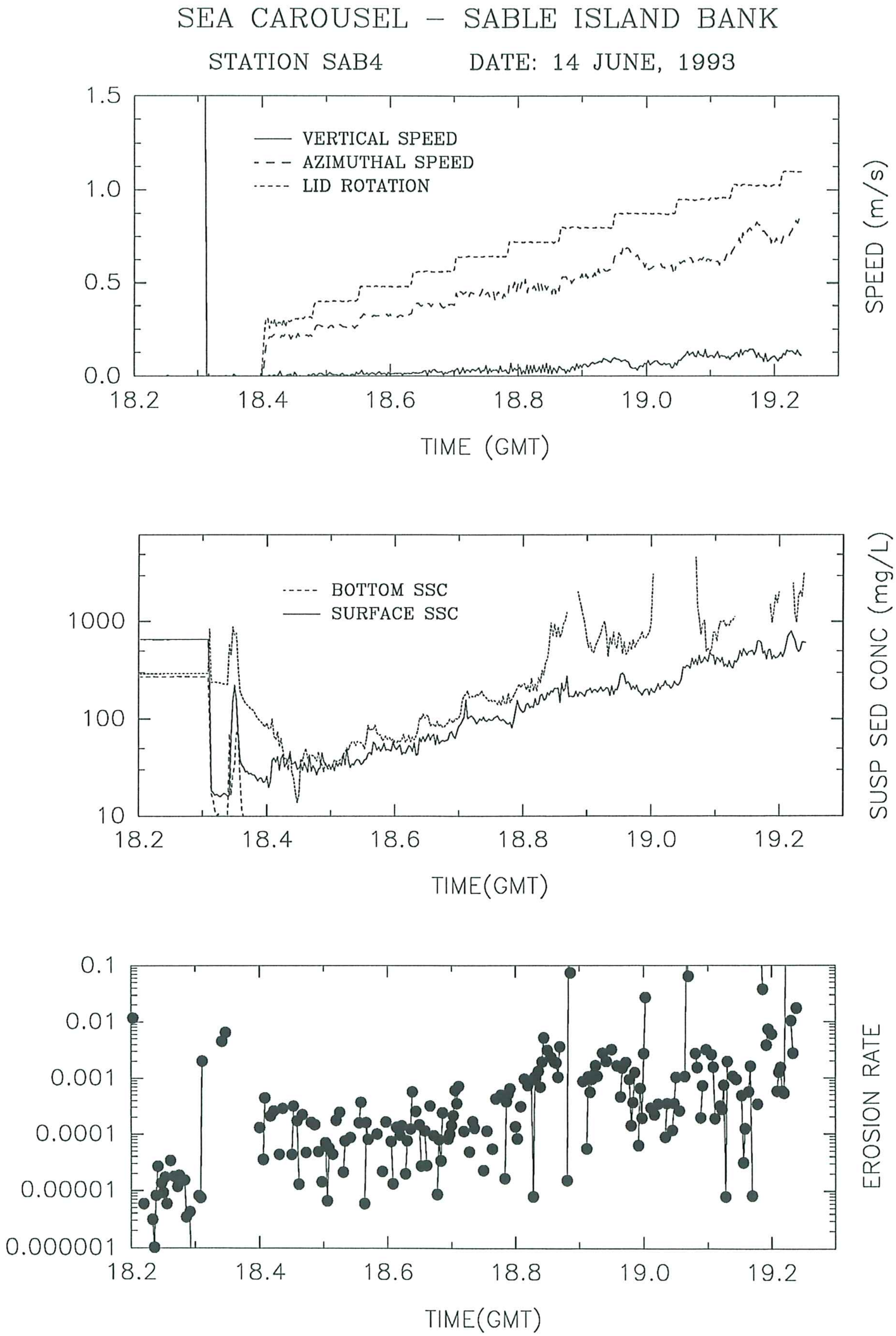

SEA CAROUSEL – SABLE ISLAND BANK
STATION SAB4
DATE: 14 JUNE, 1993
VERTICAL SPEED
AZIMUTHAL SPEED
LID ROTATION
SPEED (m/s)
1.5
1.0
0.5
0.0
18.2
18.4
18.6
18.8
19.0
19.2
TIME (GMT)
BOTTOM SSC
SURFACE SSC
SUSP SED CONC (mg/L)
1000
100
10
TIME(GMT)
EROSION RATE
0.1
0.01
0.001
0.0001
0.00001
0.000001
TIME(GMT)

Figure 8.5.4

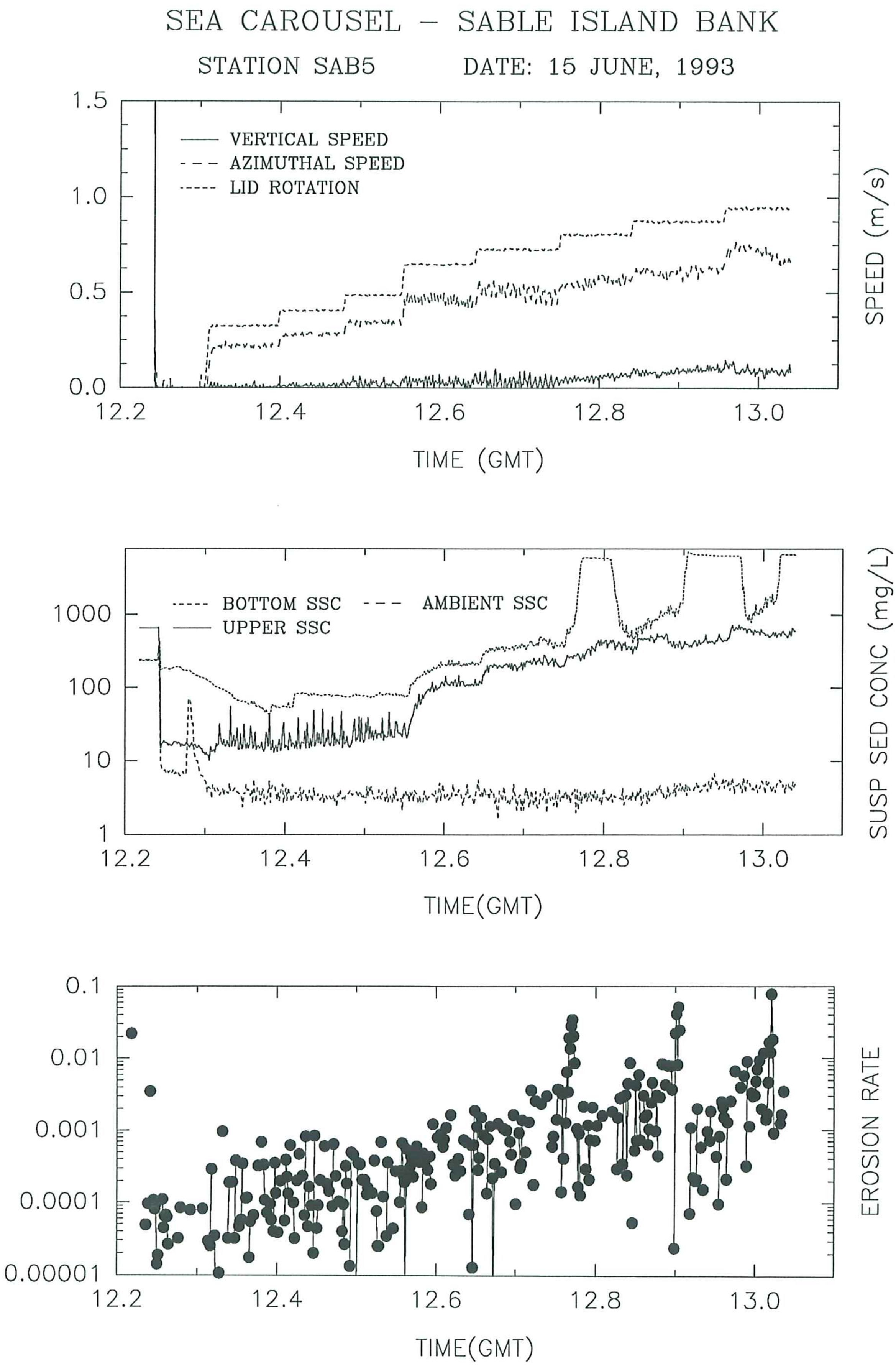

SEA CAROUSEL – SABLE ISLAND BANK
STATION SAB5
DATE: 15 JUNE, 1993
VERTICAL SPEED
AZIMUTHAL SPEED
LID ROTATION
SPEED (m/s)
1.5
1.0
0.5
0.0
12.2
12.4
12.6
12.8
13.0
TIME (GMT)
BOTTOM SSC
AMBIENT SSC
UPPER SSC
SUSP SED CONC (mg/L)
1000
100
10
1
TIME(GMT)
EROSION RATE
0.1
0.01
0.001
0.0001
0.00001
TIME(GMT)

Figure 8.5.5

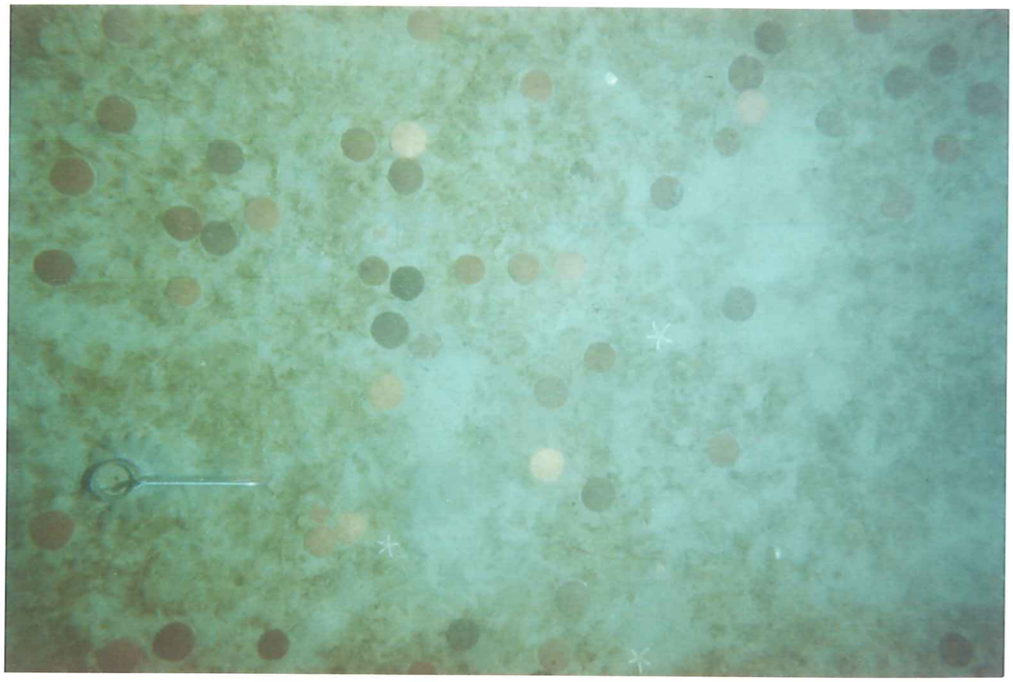


Plate 8.6.1

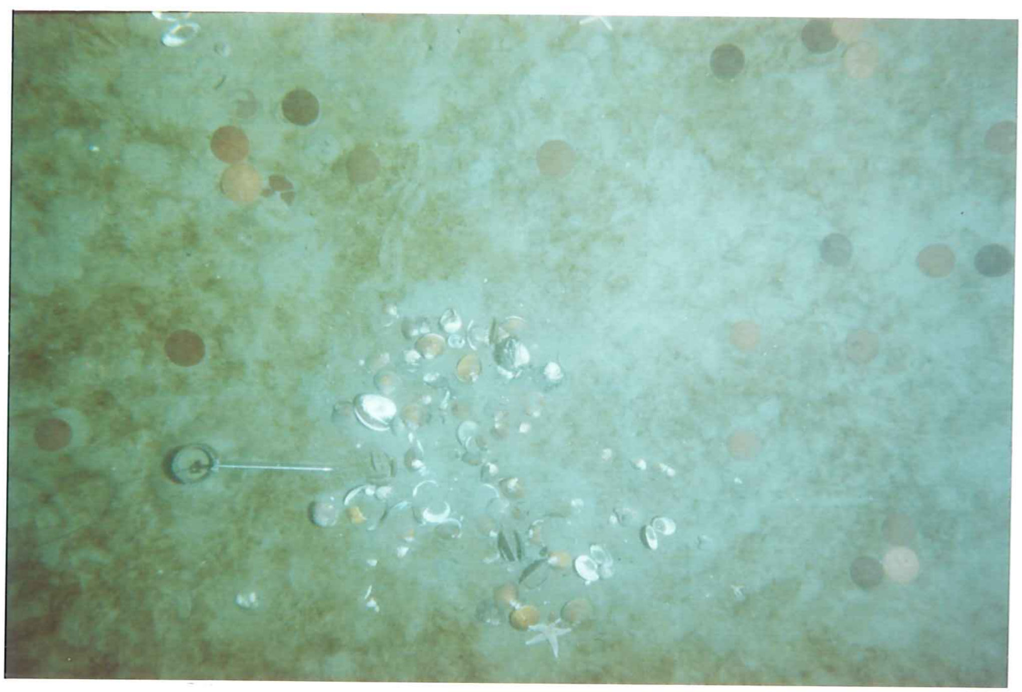


Plate 8.6.2

Plate 8.6.3

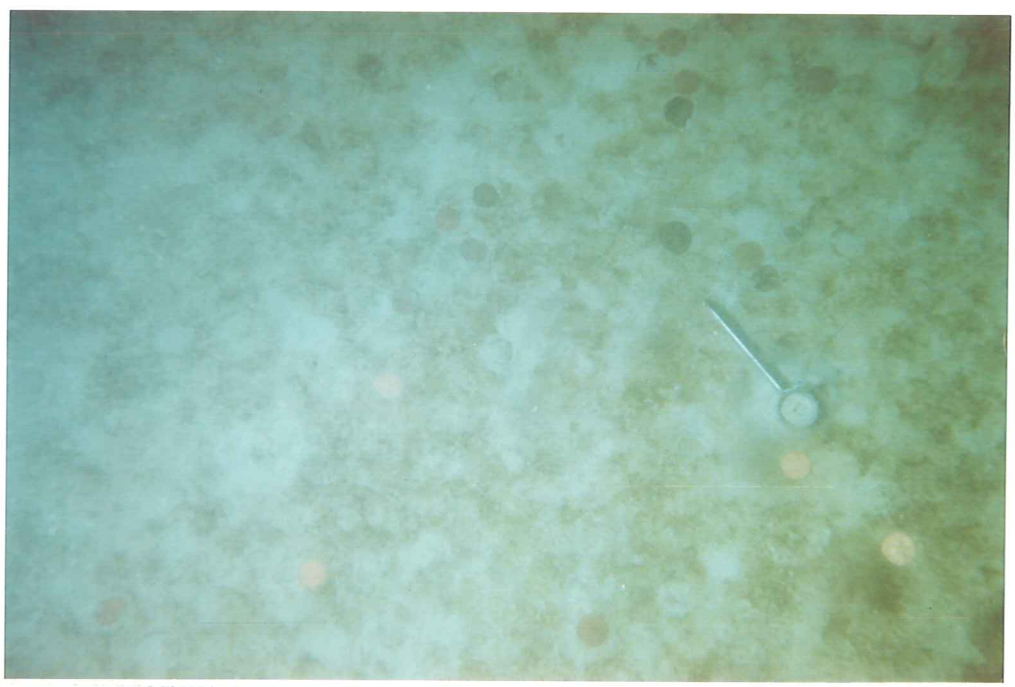


Plate 8.6.4

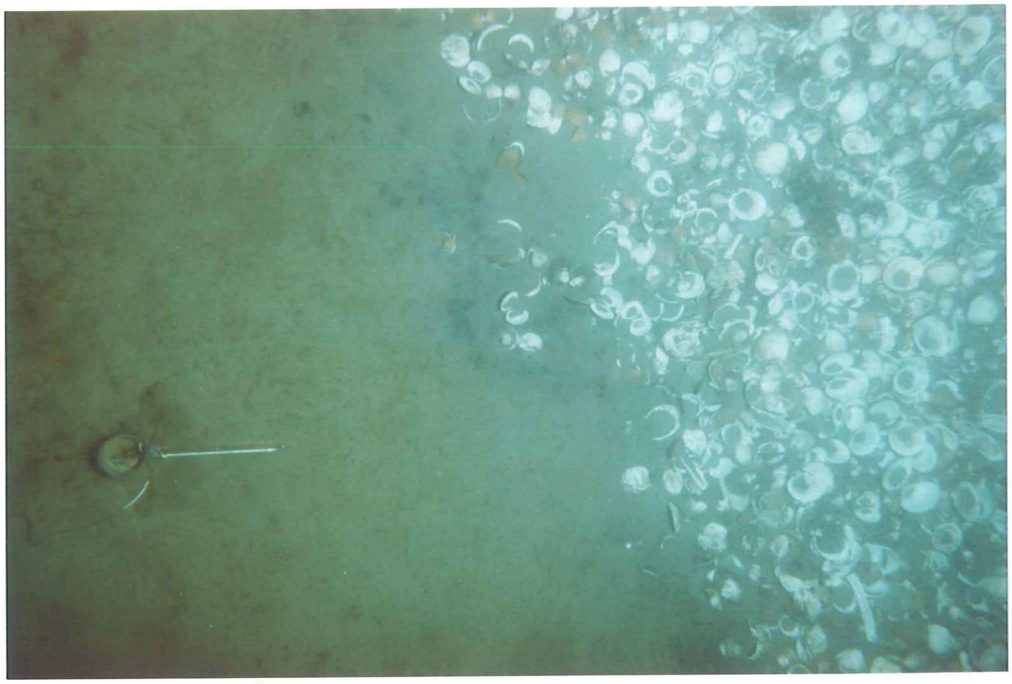


Plate 8.6.5

Plate 8.6.6

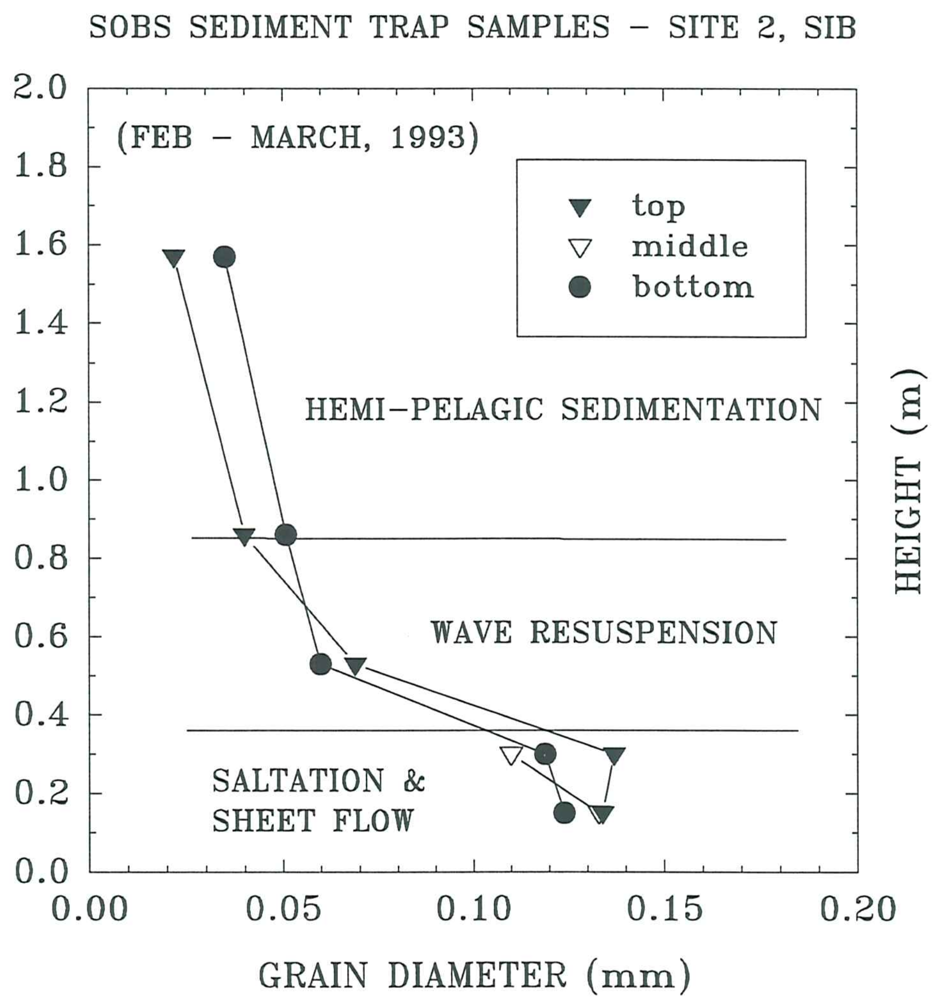

SOBS SEDIMENT TRAP SAMPLES - SITE 2, SIB
(FEB - MARCH, 1993)
top
middle
bottom
HEMI-PELAGIC SEDIMENTATION
WAVE RESUSPENSION
SALTATION &
SHEET FLOW
HEIGHT (m)
GRAIN DIAMETER (mm)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.05
0.10
0.15
0.20

FIGURE 8.8.1

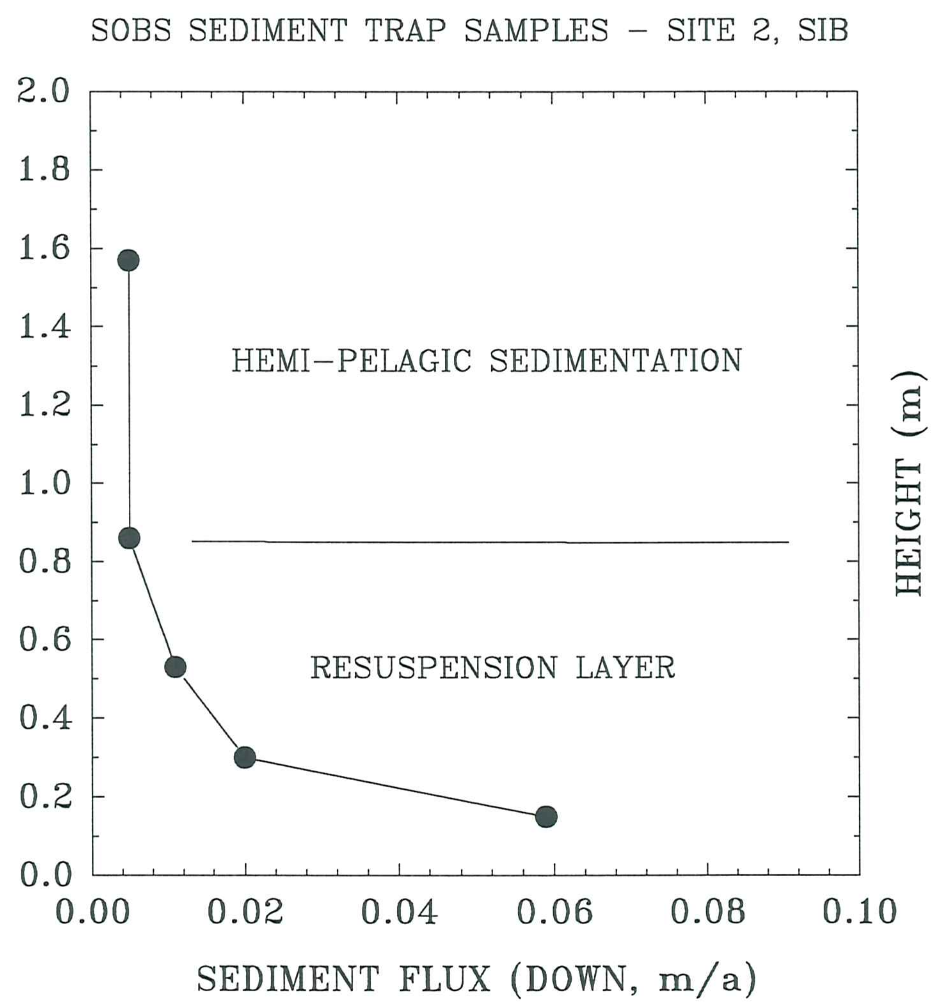

SOBS SEDIMENT TRAP SAMPLES - SITE 2, SIB
HEMI-PELAGIC SEDIMENTATION
RESUSPENSION LAYER
HEIGHT (m)
SEDIMENT FLUX (DOWN, m/a)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10

FIGURE 8.8.2

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 1

TOTAL SAMPLE INVENTORY

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DAY/TIME	SEISMIC DAY/TIME	LATITUDE	LONGITUDE	DEPTH (M)	GEOGRAPHIC LOCATION
001	CORE	1631249		43 53.10	60 25.08	38	SABLE ISLAND BANK
002	CAMERA	1631354		43 53.07	60 25.06	38	SABLE ISLAND BANK
003	GRAB	1631437		43 53.07	60 25.06	38	SABLE ISLAND BANK
004	GRAB	1631542		43 53.07	60 25.06	38	SABLE ISLAND BANK
005	CORE	1631634		43 53.07	60 25.06	38	SABLE ISLAND BANK
006	CAMERA	1631753		43 53.08	60 25.12	38	SABLE ISLAND BANK
007	CORE	1641226				23	SABLE ISLAND BANK
008	CAMERA	1641256		43 55.87	60 26.80		SABLE ISLAND BANK
009	GRAB	1641315		43 55.95	60 27.02		SABLE ISLAND BANK
010	GRAB	1641407		43 51.98	60 34.24	36	SABLE ISLAND BANK
011	CORE	1641449		43 51.95	60 34.23	37	SABLE ISLAND BANK
012	CAMERA	1641513		43 51.97	60 34.22	36	SABLE ISLAND BANK
013	CAMERA	1641922		43 55.57	60 32.41	28	SABLE ISLAND BANK
014	WATER	1642052		43 55.57	60 32.41	28	SABLE ISLAND BANK
015	WATER	1642052		43 55.57	60 32.41	28	SABLE ISLAND BANK
016	GRAB	1651123		43 55.56	60 32.39	29	SABLE ISLAND BANK
017	CAMERA	1651520		43 54.07	60 31.54	28	SABLE ISLAND BANK

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 1

TOTAL SAMPLE INVENTORY

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DAY/TIME	SEISMIC DAY/TIME	LATITUDE	LONGITUDE	DEPTH (M)	GEOGRAPHIC LOCATION
018	GRAB	1651540		43 54.35	60 31.67	28	SABLE ISLAND BANK
019	GRAB	1651608		43 55.66	60 32.58	31	SABLE ISLAND BANK
020	CAMERA	1651615		43 55.72	60 32.73	31	SABLE ISLAND BANK
021	GRAB	1651645		43 56.56	60 33.43	28	SABLE ISLAND BANK
022	CAMERA	1651651		43 56.65	60 33.49	28	SABLE ISLAND BANK
023	CAMERA	1651935		44 00.05	60 49.79	38	SABLE ISLAND BANK
024	GRAB	1651950		44 00.12	60 49.61	38	SABLE ISLAND BANK
025	GRAB	1660353		43 57.51	60 40.47	36	SABLE ISLAND BANK
026	GRAB	1660415		43 54.97	60 39.98	36	SABLE ISLAND BANK
027	GRAB	1660445		43 52.50	60 39.95	33	SABLE ISLAND BANK
028	GRAB	1660517		43 47.44	60 40.00	37	SABLE ISLAND BANK
029	GRAB	1660536		43 45.17	60 40.00	52	SABLE ISLAND BANK
030	GRAB	1660613		43 40.06	60 39.96	59	SABLE ISLAND BANK
031	GRAB	1660649		43 39.97	60 45.02	62	SABLE ISLAND BANK
032	GRAB	1660724		43 45.11	60 44.97	45	SABLE ISLAND BANK
033	GRAB	1660747		43 47.59	60 45.01	37	SABLE ISLAND BANK
034	GRAB	1660810		43 49.96	60 44.92	43	SABLE ISLAND BANK

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 1

TOTAL SAMPLE INVENTORY

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DAY/TIME	SEISMIC DAY/TIME	LATITUDE	LONGITUDE	DEPTH (M)	GEOGRAPHIC LOCATION
035	GRAB	1660830		43 52.53	60 45.00	37	SABLE ISLAND BANK
036	GRAB	1660857		43 55.00	60 44.94	42	SABLE ISLAND BANK
037	GRAB	1660926		43 54.99	60 50.01	42	SABLE ISLAND BANK
038	GRAB	1661001		43 57.49	60 45.03	44	SABLE ISLAND BANK
039	GRAB	1661057		43 49.98	60 49.94	41	SABLE ISLAND BANK
040	GRAB	1661338		44 00.07	60 50.01		SABLE ISLAND BANK
041	CAMERA	1651521		43 53.50	60 29.64	38	SABLE ISLAND BANK
042	GRAB	1661534		43 53.50	60 29.64	38	SABLE ISLAND BANK
043	GRAB	1661548		43 52.53	60 29.49	31	SABLE ISLAND BANK
044	GRAB	1661625		43 50.62	60 25.22	43	SABLE ISLAND BANK
045	CAMERA	1661634		43 50.62	60 25.22	43	SABLE ISLAND BANK
046	GRAB	1661708		43 47.05	60 25.11	59	SABLE ISLAND BANK
047	GRAB	1661731		43 44.96	60 25.00	59	SABLE ISLAND BANK
048	CAMERA	1661740		43 44.99	60 25.03	59	SABLE ISLAND BANK
049	GRAB	1661822		43 40.21	60 25.35	66	SABLE ISLAND BANK
050	GRAB	1661857		43 40.00	60 29.95	65	SABLE ISLAND BANK
051	CAMERA	1661908		43 39.87	60 29.80	65	SABLE ISLAND BANK

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 1

TOTAL SAMPLE INVENTORY

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DAY/TIME	SEISMIC DAY/TIME	LATITUDE	LONGITUDE	DEPTH (M)	GEOGRAPHIC LOCATION
052	GRAB	1662014		43 45.02	60 30.00	49	SABLE ISLAND BANK
053	GRAB	1662039		43 47.51	60 29.98	48	SABLE ISLAND BANK
054	CAMERA	1662050		43 47.81	60 29.98	48	SABLE ISLAND BANK
055	GRAB	1662130		43 47.47	60 35.02	53	SABLE ISLAND BANK
056	GRAB	1662157		43 44.98	60 34.99	52	SABLE ISLAND BANK
057	CAMERA	1662210		43 45.03	60 34.96	52	SABLE ISLAND BANK
058	GRAB	1662255		43 40.00	60 34.80	67	SABLE ISLAND BANK
059	GRAB	1662349		43 45.09	60 39.89	52	SABLE ISLAND BANK
060	CAMERA	1662358		43 45.14	60 39.85	52	SABLE ISLAND BANK
061	CAMERA	1670025		43 47.00	60 44.00	36	SABLE ISLAND BANK
062	GRAB	1670045		43 47.00	60 44.00	36	SABLE ISLAND BANK
063	GRAB	1670058		43 47.56	60 43.94	35	SABLE ISLAND BANK
064	GRAB	1670108		43 48.05	60 43.93	35	SABLE ISLAND BANK
065	CAMERA	1670117		43 48.05	60 43.93	35	SABLE ISLAND BANK
066	GRAB	1670137		43 48.63	60 44.80	35	SABLE ISLAND BANK
067	CAMERA	1670153		43 48.73	60 44.84	35	SABLE ISLAND BANK
068	GRAB	1670207		43 48.69	60 45.55	45	SABLE ISLAND BANK

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 1

TOTAL SAMPLE INVENTORY

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DAY/TIME	SEISMIC DAY/TIME	LATITUDE	LONGITUDE	DEPTH (M)	GEOGRAPHIC LOCATION
069	GRAB	1670216		43 48.75	60 46.31	45	SABLE ISLAND BANK
070	CAMERA	1670224		43 48.78	60 46.23	45	SABLE ISLAND BANK

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 2

GRAB SAMPLES

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
003	IKU	1631437	43 53.07 60 25.06	38	1		SABLE ISLAND BANK	IKU LOST ON BOTTOM. PULLED OF LIFTING WIRE.
004	IKU	1631542	43 53.07 60 25.06	38	2	5	SABLE ISLAND BANK	1ST ATTEMPT: ABUNDANT CLAMS AND SAND DOLLARS, BROKEN SHELLS AND POLYCHAETE WORMS. SOME ORGANIC MOTTLING. MEDIUM GRAINED SAND. 3 SUBSAMPLES: 1 - C. AMOS FOR GRAIN SIZE; 2 - T. SUTHERLAND, DALHOUSIE FOR PRO WATER NUTRIENTS; 3 - K. MUSCHENHEIM FOR GRAIN SIZE. 2ND ATTEMPT: SAMPLE DUMPED BEFORE SURFACE DESCRIPTION COULD BE DONE. 2 SUBSAMPLES FOR C. AMOS FOR GRAIN SIZE.
009	IKU	1641315	43 55.95 60 27.02		1	4	SABLE ISLAND BANK	POORLY SORTED MEDIUM SAND 4 SUBSAMPLES: 1 VIAL - C. AMOS - GRAIN SIZE 1 BAG - T. SUTHERLAND, DAL. - PRO-WATER NUTRIENTS 1 BAG - K. MUSCHENHEIM - GRAIN SIZE 1 TRAY - C. AMOS - RESIN PEEL
010	IKU	1641407	43 51.98 60 34.24	36	1	6	SABLE ISLAND BANK	POORLY SORTED FINE SAND, A FEW GASTRAPODS, SAND DOLLARS AND CLAMS 6 SUBSAMPLES: 1 VIAL - C. AMOS - GRAIN SIZE 3 BAGS - T. SUTHERLAND, DAL. - PRO-WATER NUTRIENTS 1 BAG - K. MUSCHENHEIM - GRAIN SIZE 1 TRAY - C. AMOS - RESIN PEEL
016	IKU	1651123	43 55.56 60 32.39	29	1	7	SABLE ISLAND BANK	MEDIUM GRAINED, POORLY SORTED SAND. 7 SUBSAMPLES TAKEN: 1 VIAL - C. AMOS - GRAIN SIZE 2 BAGS - T. SUTHERLAND, DAL - PRO-WATER NUTRIENTS 1 BAG - K. MUSCHENHEIM, HABITAT ECOLOGY GRAIN SIZE 3 TRAYS - C. AMOS - RESIN PEELS
018	IKU	1651540	43 54.35 60 31.67	28	1	5	SABLE ISLAND BANK	MEDIUM - COURSE SAND. MODERATE SORTING. 5 SUBSAMPLES TAKEN: 1 VIAL - C. AMOS - GRAIN SIZE 1 BAG - T. SUTHERLAND, DAL - PRO-WATER NUTRIENTS 1 BAG - K. MUSCHENHEIM, HABITAT ECOLOGY GRAIN SIZE 2 TRAYS - C. AMOS - RESIN PEELS

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TABLE 2

GRAB SAMPLES

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
019	IKU	1651608	43 55.66 60 32.58	31	1	6	SABLE ISLAND BANK	POORLY SORTED, MEDIUM SAND, LITHIC CLASTS. 6 SUBSAMPLES TAKEN: 1 VIAL - C. AMOS - GRAIN SIZE 2 BAGS - T. SUTHERLAND, DAL - PRO-WATER NUTRIENTS 1 BAG - K. MUSCHENHEIM, HABITAT ECOLOGY GRAIN SIZE 2 TRAYS - C. AMOS - RESIN PEELS
021	IKU	1651645	43 56.56 60 33.43	28	1	6	SABLE ISLAND BANK	COURSE SAND, MODERATELY SORTED. WELL ROUNDED QUARTZ GRANULES AND LITHIC CLASTS. FEW CLAMS. 6 SUBSAMPLES TAKEN: 1 VIAL - C. AMOS - GRAIN SIZE 2 BAGS - T. SUTHERLAND, DAL - PRO-WATER NUTRIENTS 1 BAG - K. MUSCHENHEIM, HABITAT ECOLOGY GRAIN SIZE 2 TRAYS - C. AMOS - RESIN PEELS
024	VAN VEEN	1651950	44 00.12 60 49.61	38	1	4	SABLE ISLAND BANK	MEDIUM - COARSE SAND. MODERATELY TO WELL SORTED. SOME ORGANICS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS 2 SMALL BAGS - T. SUTHERLAND, DAL - PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
025	VAN VEEN	1660353	43 57.51 60 40.47	36	1	4	SABLE ISLAND BANK	MEDIUM - FINE SAND. SAND DOLLARS AND 1 CLAM SHELL. 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL - PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
026	VAN VEEN	1660415	43 54.97 60 39.98	36	1	4	SABLE ISLAND BANK	1 WORM. MEDIUM - FINE GRAINED SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL - PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
027	VAN VEEN	1660445	43 52.50 60 39.95	33	1	4	SABLE ISLAND BANK	FINE - MEDIUM GRAINED SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL - PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
028	VAN VEEN	1660517	43 47.44 60 40.00	37	1	4	SABLE ISLAND BANK	FINE - MEDIUM GRAINED SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS -T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
029	VAN VEEN	1660536	43 45.17 60 40.00	52	1	4	SABLE ISLAND BANK	FINE GRAINED SAND. SAND DOLLARS, 1 WORM 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
030	VAN VEEN	1660613	43 40.06 60 39.96	59	1	4	SABLE ISLAND BANK	FINE SAND AND SILT 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL - PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
031	VAN VEEN	1660649	43 39.97 60 45.02	62	1	4	SABLE ISLAND BANK	FINE SAND. CLAMS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
032	VAN VEEN	1660724	43 45.11 60 44.97	45	1	4	SABLE ISLAND BANK	MEDIUM GRAINED SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE

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GRAB SAMPLES

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
033	VAN VEEN	1660747	43 47.59 60 45.01	37	1	4	SABLE ISLAND BANK	CLEAN MEDIUM GRAINED SAND. 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
034	VAN VEEN	1660810	43 49.96 60 44.92	43	1	4	SABLE ISLAND BANK	FINE - MEDIUM GRAINED SAND. 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
035	VAN VEEN	1660830	43 52.53 60 45.00	37	1	4	SABLE ISLAND BANK	FINE - MEDIUM GRAINED, CLEAN SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
036	VAN VEEN	1660857	43 55.00 60 44.94	42	1	4	SABLE ISLAND BANK	CLEAN MEDIUM GRAINED SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
037	VAN VEEN	1660926	43 54.99 60 50.01	42	1	4	SABLE ISLAND BANK	MUDDY SAND, HYDROGEN SULFIDE PRESENT 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
038	VAN VEEN	1661001	43 57.49 60 45.03	44	1	4	SABLE ISLAND BANK	FINE GRAINED SAND, 1 WORM 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE

TABLE 2

GRAB SAMPLES

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
039	VAN VEEN	1661057	43 49.98 60 49.94	41	1	4	SABLE ISLAND BANK	FINE TO MEDIUM GRAINED SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
040	IKU	1661338	44 00.07 60 50.01		1	6	SABLE ISLAND BANK	POORLY SORTED SAND. MEDIUM TO FINE GRAINS. SMALL FISH (SANDLANCE?) 6 SUBSAMPLES TAKEN: 1 VIAL - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE 2 TRAYS - C. AMOS - RESIN PEELS.
042	VAN VEEN	1661534	43 53.50 60 29.64	38	1	4	SABLE ISLAND BANK	4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
043	VAN VEEN	1661548	43 52.53 60 29.49	31	1	4	SABLE ISLAND BANK	FINE - MEDIUM BROWNISH SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
044	VAN VEEN	1661625	43 50.62 60 25.22	43	1	4	SABLE ISLAND BANK	4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
046	VAN VEEN	1661708	43 47.05 60 25.11	59	1	4	SABLE ISLAND BANK	MEDIUM - FINE SAND. LARGE AMOUNTS OF SHELL FRAGMENTS, 1 WORM AND SAND DOLLARS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE

TABLE 2

GRAB SAMPLES

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
047	VAN VEEN	1661731	43 44.96 60 25.00	59	1	4	SABLE ISLAND BANK	SHELLS, ROCKS. ORGANIC RICH (BLACK). OLIVE GREY. DISARTICULATED SHELLS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAGS - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
049	VAN VEEN	1661822	43 40.21 60 25.35	66	1	4	SABLE ISLAND BANK	COARSE SAND. MIXTURE OF SHELL FRAGMENTS AND GRAVEL 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
050	VAN VEEN	1661857	43 40.00 60 29.95	65	1	4	SABLE ISLAND BANK	VERY FINE SAND, MODERATELY SORTED ABUNDANT ORGANICS. OLIVE GREEN 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
052	VAN VEEN	1662014	43 45.02 60 30.00	49	1	4	SABLE ISLAND BANK	FINE SAND, WELL SORTED. SAND DOLLARS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
053	VAN VEEN	1662039	43 47.51 60 29.98	48	1	4	SABLE ISLAND BANK	SILTY FINE SAND, WELL SORTED. ABUNDANT ORGANICS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
055	VAN VEEN	1662130	43 47.47 60 35.02	53	1	4	SABLE ISLAND BANK	SILTY FINE SAND. SAND DOLLARS AND WHOLE CLAM SHELLS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE

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GRAB SAMPLES

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
056	VAN VEEN	1662157	43 44.98 60 34.99	52	1	4	SABLE ISLAND BANK	FINE TO MEDIUM SAND, MODERATELY SORTED, SAND DOLLARS AND SHELL FRAGMENTS. 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
058	VAN VEEN	1662255	43 40.00 60 34.80	67	1	4	SABLE ISLAND BANK	SILTY FINE SAND, GASTRAPOD, BIVALVE 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
059	VAN VEEN	1662349	43 45.09 60 39.89	52	1	4	SABLE ISLAND BANK	FINE SAND, SHELL FRAGMENTS AND SAND DOLLARS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
062	VAN VEEN	1670045	43 47.00 60 44.00	36	1	4	SABLE ISLAND BANK	MEDIUM GRAIN SAND, MODERATELY SORTED SOME LITHIC FRAGMENTS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
063	VAN VEEN	1670058	43 47.56 60 43.94	35	1	4	SABLE ISLAND BANK	FINE - MEDIUM SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
064	VAN VEEN	1670108	43 48.05 60 43.93	35	1	4	SABLE ISLAND BANK	MEDIUM TO FINE SAND, MODERATE SORTING 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE

TABLE 2

GRAB SAMPLES

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	TYPE OF SAMPLER	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (M)	NO.OF TRIES	NO. OF SUBSAMPLES	GEOGRAPHIC LOCATION	GRAB SAMPLE NOTES
066	VAN VEEN	1670137	43 48.63 60 44.80	35	1	4	SABLE ISLAND BANK	FINE SAND - WELL SORTED. SHELL FRAGMENTS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM
068	VAN VEEN	1670207	43 48.69 60 45.55	45	1	4	SABLE ISLAND BANK	FINE SAND 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE
069	VAN VEEN	1670216	43 48.75 60 46.31	45	1	4	SABLE ISLAND BANK	FINE - MEDIUM GRAINED SAND. SHELL FRAGMENTS 4 SUBSAMPLES TAKEN: 1 LARGE BAG - C. AMOS - GRAIN SIZE 2 SMALL BAGS - T. SUTHERLAND, DAL PRO-WATER NUTRIENTS 1 SMALL BAG - K. MUSCHENHEIM, HABITAT ECOLOGY - GRAIN SIZE

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TABLE 3

CAMERA STATIONS

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	TYPE OF CAMERA	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (MTRS)	FRAMES SHOT	DIST OFF. BOTT	STEREO	COLOR1 COLOR2	ASA1 ASA2	FSTOP1 FSTOP2	FOCUS1 FOCUS2	FILM1 FILM2	GEOGRAPHIC LOCATION
002	NIKON F4	1631354	43 53.07 60 25.06	38	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
006	NIKON F4	1631753	43 53.08 60 25.12	38	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
008	NIKON F4	1641256	43 55.87 60 26.80		12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
012	NIKON F4	1641513	43 51.97 60 34.22	36	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
013	NIKON F4	1641922	43 55.57 60 32.41	28	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
017	NIKON F4	1651520	43 54.07 60 31.54	28	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
020	NIKON F4	1651615	43 55.72 60 32.73	31	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
022	NIKON F4	1651651	43 56.65 60 33.49	28	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
023	NIKON F4	1651935	44 00.05 60 49.79	38	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
041	NIKON F4	1651521	43 53.50 60 29.64	38	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
045	NIKON F4	1661634	43 50.62 60 25.22	43	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
048	NIKON F4	1661740	43 44.99 60 25.03	59	10	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
051	NIKON F4	1661908	43 39.87 60 29.80	65	10	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
054	NIKON F4	1662050	43 47.81 60 29.98	48	10	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
057	NIKON F4	1662210	43 45.03 60 34.96	52	12	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
060	NIKON F4	1662358	43 45.14 60 39.85	52	10	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
065	NIKON F4	1670117	43 48.05 60 43.93	35	10	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK

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TABLE 3

CAMERA STATIONS

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

SAMPLE NUMBER	TYPE OF CAMERA	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (MTRS)	FRAMES SHOT	DIST OFF. BOTT	STEREO	COLOR1 COLOR2	ASA1 ASA2	FSTOP1 FSTOP2	FOCUS1 FOCUS2	FILM1 FILM2	GEOGRAPHIC LOCATION
067	NIKON F4	1670153	43 48.73 60 44.84	35	10	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
070	NIKON F4	1670224	43 48.78 60 46.23	45	10	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK
061	NIKON F4	1670025	43 47.00 60 44.00	36	10	7FT	N	COLOR	200	5.6		EKTACHROME	SABLE ISLAND BANK

TABLE 4

CORE SAMPLES

SAMPLE NUMBER	SAMPLE TYPE	DAY/TIME (GMT)	LATITUDE LONGITUDE	DEPTH (MTRS)	CORER LENGTH (CM)	APP. PENN (CM)	CORE LENGTH (CM)	NO OF SECT	GEOGRAPHIC LOCATION	NOTES
001	VIBRO	1631249	43 53.10 60 25.08	38	300		300		SABLE ISLAND BANK	NO SAMPLE ACQUIRED. PROBLEMS WITH MOTOR GOING ON TO CAMERA STATION, UNTIL VIBRO CORER FIXED.
005	VIBRO	1631634	43 53.07 60 25.06	38	300		300		SABLE ISLAND BANK	NO SAMPLE OBTAINED
007	VIBRO	1641226		23	300	16	300		SABLE ISLAND BANK	GPS NOT AVAILABLE. BEARING 237, DISTANCE 9.2 - RIG COHASSET 1 SUBSAMPLE TAKEN FROM SAND ON BARREL FOR GRAIN SIZE. IN A VIAL IN A BUCKET. REMAINDER OF SAMPLE FROM CORE BARRELL NOT SAVED.
011	VIBRO	1641449	43 51.95 60 34.23	37	300	100	300		SABLE ISLAND BANK	SOME DISTURBED POOR SAMPLE RECOVERED IN BARREL. NOT SAVED.

TABLE 5

WATER SAMPLES

SAMPLE NUMBER	SAMPLE TYPE	JULIAN DAY/TIME	LATITUDE LONGITUDE	DEPTH (MTRS)	BOTTLE VOLUMN	SAMPLE DEPTHS (1-10)	GEOGRAPHIC LOCATION	NOTES
015	WATER	1642052	43 55.57 60 32.41	28			SABLE ISLAND BANK	SAMPLES TAKEN AT AN ANCHOR STATION - BEGINNING 164/2052 AND ENDING 165/1058 8 VIALS AND 1 BAG COLLECTED.
014	WATER	1642052	43 55.57 60 32.41	28			SABLE ISLAND BANK	TAKEN BY K. MUSHENHEIM, HABITAT ECOLOGY. NINE SAMPLES WERE TAKEN AT AN ANCHOR STATION. BEGINNING 164/2052 AND ENDING 165/1058.

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TABLE 6

3.5 KHZ RECORDS

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	LINE NUMBERS	GEOGRAPHIC LOCATION	RECORDER	SYSTEM / SOUND SOURCE
001	1620450	1621024	1, 2	SABLE ISLAND BANK	EPC4100	HULL MOUNTED
002	1622055	1631123	3,4,5,6,7,8,9	SABLE ISLAND BANK	EPC4100	HULL MOUNTED
003	1631920	1640920	10 - 16	SABLE ISLAND BANK	EPC4100	HULL MOUNTED
004	1630930	1641127	17	SABLE ISLAND BANK	EPC4100	HULL MOUNTED
005	1652120	1660315	18, 19, 20	SABLE ISLAND BANK	EPC4100	HULL MOUNTED

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 7

HUNTEC RECORDS

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	HYDROPHONE	LINE NUMBERS	RECORD TYPE	GEOGRAPHIC LOCATION	RECORDER	HUNTEC SYSTEM
001	1620530	1621025	INT/EXT	1, 2	SINGLE	SABLE ISLAND BANK	EPC9800	HUNTEC DTS (AGC 2)
002	1622100	1631123	INT/EXT	3,4,5,6,7,8,9	SINGLE	SABLE ISLAND BANK	EPC9800	HUNTEC DTS (AGC 2)
003	1631930	1632315	INT/EXT	10, 11	SINGLE	SABLE ISLAND BANK	EPC9800	HUNTEC DTS (AGC 2)
004	1632319	1641127	INT/EXT	12 - 17	SINGLE	SABLE ISLAND BANK	EPC9800	HUNTEC DTS (AGC 2)
005	1652147	1660310	INT/EXT	18, 19, 20	SINGLE	SABLE ISLAND BANK	EPC9800	HUNTEC DTS (AGC 2)

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 8

SEISMIC RECORDS

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	HYDROPHONE	LINE NUMBERS	RECORD TYPE	GEOGRAPHIC LOCATION	RECORDER	SYSTEM / SOUND SOURCE
001	1620613	1621024	NSRF 25 FT	1, 2	SINGLE	SABLE ISLAND BANK	EPC9701-UT	HUNTEC
002	1622055	1631115	NSRF 25 FT	3,4,5,6,7,8,9	SINGLE	SABLE ISLAND BANK	EPC9701-UT	HUNTEC
003	1631930	1641127	NSRF 25 FT	10 - 17	SINGLE	SABLE ISLAND BANK	EPC9701-UT	HUNTEC
004	1652200	1660315	NSRF 25 FT	18, 19, 20	SINGLE	SABLE ISLAND BANK	EPC9701-UT	HUNTEC

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 9

SIDESCAN RECORDS

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

ROLL NUMBERS	START DAY/TIME	STOP DAY/TIME	LINE NUMBERS	RECORD TYPE	GEOGRAPHIC LOCATION	RECORDER	SIDESCAN SYSTEM
001	1622109	1630045	3, 4	SINGLE	SABLE ISLAND BANK	TDU-1200	SIMRAD
002	1630135	1631120	5,6,7,8,9	SINGLE	SABLE ISLAND BANK	TDU-1200	SIMRAD
003	1631945	1641125	10 -17	SINGLE	SABLE ISLAND BANK	TDU-1200	SIMRAD
004	1652125	1660315	18, 19, 20	SINGLE	SABLE ISLAND BANK	TDU-1200	SIMRAD

ATLANTIC GEOSCIENCE CENTRE
DATA SECTION
-SHIP- REPORTING PACKAGE

TABLE 10

DIGITAL TAPES

CRUISE NUMBER = 93016
CHIEF SCIENTIST = C. AMOS
PROJECT NUMBER = 820056

REEL NUMBER	MARC NUMBER	START DAY/TIME	STOP DAY/TIME	LINE NUMBERS	PARAMETER	GEOGRAPHIC LOCATION	DIGITAL TAPE NOTES
H1		1620448	1621024		HUNTEC	SABLE ISLAND BANK	
H2		1622058	1620111		HUNTEC	SABLE ISLAND BANK	
H3					HUNTEC	SABLE ISLAND BANK	
H4		1631929	1632316		HUNTEC	SABLE ISLAND BANK	
H5		1640136	1641118		HUNTEC	SABLE ISLAND BANK	
H6		1652148	1660315		HUNTEC	SABLE ISLAND BANK	
SS1		1620451	1621024		SIMRAD	SABLE ISLAND BANK	
SS2		1622105	1630937		SIMRAD	SABLE ISLAND BANK	
SS4		1652121	1660315		SIMRAD	SABLE ISLAND BANK	SWITCHED CHANNELS FILE 3 (SEE TAPE)
V1					VAX	SABLE ISLAND BANK	SHIPAC SAVESET
SS3		1631929	1641127		SIMRAD	SABLE ISLAND BANK	

HUDSON 93016

TABLE 11

LINE NUMBER START/STOP

Line 01:	162/0440-162/0925
Line 02:	162/0927-162/1024
Line 03:	162/2110-162/2255
Line 04:	162/2315-163/0107
Line 05:	163/0133-163/0318
Line 06:	163/0331-163/0519
Line 07:	163/0542-163/0747
Line 08:	163/0756-163/0926
Line 09:	163/0937-163/1100
Line 10:	163/1930-163/2113
Line 11:	163/2115-163/2312
Line 12:	163/2330-164/0120
Line 13:	164/0135-164/0308
Line 14:	164/0328-164/0523
Line 15:	164/0537-164/0715
Line 16:	164/0747-164/0920
Line 17:	164/0938-164/1100
Line 18:	165/2127-165/2251
Line 19:	165/2333-166/0115
Line 20:	166/0132-166/0315

HUDSON 93016

TABLE 12

PARAMETER START/STOP - 3.5 KHZ.

162/0440	-	162/1024
162/2055	-	163/1123
163/1930	-	164/0920
164/1930	-	164/1127
165/2120	-	165/2252
165/2328	-	166/0315

HUDSON 93016

TABLE 13

PARAMETER START/STOP - HUNTEC (INTERNAL/EXTERNAL)

162/0530 - 162/1025
162/2100 - 162/2153
162/2320 - 163/1123
163/1930 - 164/1127
165/2147 - 165/2251
165/2329 - 166/0310

HUDSON 93016

TABLE 14

PARAMETER START/STOP - SIDESCAN

162/2109	-	163/0045
163/0135	-	163/1120
163/1945	-	164/1125
165/2125	-	165/2251
165/2330	-	166/0315

HUDSON 93016

TABLE 16

SEA CAROUSEL

DAYS/TIMES	LATITUDE	LONGITUDE
164/1612-164/1706	43 53.53N	60 31.56W
164/1744-164/1858	43 55.53N	60 32.51W
165/1332-165/1431	43 53.15N	60 25.15W
165/1821-165/1923	44 00.09N	60 49.88W
166/1217-166/1321	44 00.05N	60 50.01W

TECHNICAL REPORT
DEEP TOW OPERATIONS
C.S.S. HUDSON #93-016
JUNE 10 - 16, 1993

Submitted by:

Geoforce Consultants Ltd.
P.O. Box 696
Dartmouth, Nova Scotia
B2Y 3Y9

Prepared for:

Atlantic Geoscience Centre
Department of Energy, Mines and Resources
P.O. Box 1006
Dartmouth, Nova Scotia
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Distribution: A. Boyce (AGC)
Dr. C. Amos (AGC)
Project File #C109-03

Dated: 17 June 1993

TABLE OF CONTENTS

1.0 INTRODUCTION

This report is a technical review of the Deep Tow Seismic (DTS) operations aboard C.S.S. Hudson, during Atlantic Geoscience Centre field program #HN93-016. This geologic site investigation was located adjacent to the Cohasset field, Sable Island. The survey program under the direction of Dr. Carl Amos (AGC), commenced on June 10th and terminated June 16, 1993 at Sidney, Nova Scotia.

Prior to the cruise, the DTS tow fish was fitted with a multi-electrode sparker source. One of the objectives of the DTS program was to evaluate the reconfigured sparker in an area of "acoustically hard" sediments. Specifically, it was hoped that the DTS would be able to delineate the internal structure in the sand formations around Cohasset.

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

* Huntec Deep Tow Seismic boomer/sparker profiling system
* Ferranti Model SE880 Sonar Enhancement System
* ORE Model 140 (3.5 Khz) profiling system
* Simrad Mesotech Side Scan Sonar

Geoforce Consultants Limited provided technician Martin Uyesugi, under the DTS standing offer contract (D.S.S. #23420-93-A009/01-0SC). The Geoforce technician supervised the installation, operation and maintenance of the DTS system.

1.1 DAILY SUMMARY

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

Date	JD	Event
8/6/93	159	Commence DTS mobilization at BIO jetty.
9/6/93	160	DTS system tested on deck 1900 hours. ****Mobilization Completed****

10/6/93	161	**** Commence Field Program****
		Depart BIO jetty at 1600 hours and proceed to work area.
11/6/93	162	Arrive Cohasset work area 0430 hours.
		Deploy DTS and side scan at 0450 hours.
		Survey lines # 1 0450 - 0910 hours
		# 2 0930 - 1024 hours
		Recover DTS at 1030 hours.
		Service Note: *Leak alarm sounded while DTS tow fish was being recovered. Open up Junction Box and discover a small amount of water (1 cc). Source of leak not apparent. Clean out moisture and replace all O rings as a precaution.*
		Deploy DTS at 2050 hours.
		Survey lines # 3 2110 - 2153 hours
		Service Note: *Due to interference between the DTS sparker and Simrad side scan, the DTS fish was recovered and changed over to boomer source for the remainder of the survey.*
		Survey lines # 4 2320 - 0000
12/6/93	163	Survey lines # 4 0000 - 0100 (cont.)
		# 5 0133 - 0317
		# 6 0331 - 0519
		# 7 0543 - 0747
		# 8 0756 - 0926
		# 9 0937 - 1123
		Recover DTS at 1130 hours.
		Deploy DTS at 1910 hours.
		Survey lines # 10 1932 - 2116
		# 11 2125 - 2313
		# 12 2333 - 0000
13/6/93	164	Survey lines # 12 0000 - 0120 (cont.)
		# 13 0134 - 03 08
		# 14 0328 - 0522
		# 15 0536 - 0735
		# 16 0727 - 0920
		# 17 0938 - 1127
		Recover DTS at 1130 hours.

14/6/93	165	No seismic watch, assist with sediment load sampling. ***Service Note:*** *DTS winch would not start. Problem traced to blown fuses in starter box caused by a loose wire. Replace fuses - winch operational.* Survey lines # 18 2147 - 2251 # 19 2333 - 0000
15/6/93	166	Survey lines # 19 0000 - 0115 (cont.) # 20 0133 - 0315 Recover DTS at 0330 hours. No seismic watch scheduled, assist with bottom grabs.
16/6/93	167	Disconnect DTS and pack for demob in Sidney. Arrive Sidney 2000 hours. Unload equipment and return to Bedford Institute by van.
17/6/93	168	Arrive BIO at 0530 hours. **** END OF PROGRAM ****

TABLE 1 - OPERATIONAL SUMMARY

Date	J.D.	Survey	Standby	Down time	Total
10/6/93	161	0.0	8.0	0	8.0
11/6/93	162	7.25	16.75	0	24.0
12/6/93	163	16.25	7.75	0	24.0
13/6/93	164	11.5	12.5	0	24.0
14/6/93	165	2.5	20.5	1	24.0
15/6/93	166	3.5	20.5	0	24.0
16/6/93	167	0.0	20.0	0	20.0
		-------	-------	------	-------
TOTALS		41.0	106.0	1	148.0
PERCENT		27.7 %	71.6 %	0.7 %	

2.0 DESCRIPTION OF EQUIPMENT

A) DEEP TOW SYSTEM

The Huntec Deep Tow Seismic (DTS) system is a high resolution, sub-bottom profiler with the acoustic source, energy supply, heave sensor, and two receiving hydrophones housed in a tow fish body. The AGC #2 DTS system was configured with a standard ED10F/C boomer, plus the optional 24 tip mini-sparker source. The tow fish was on temporary loan from Memorial University.

An LC10 single element hydrophone mounts inside the tow fish beneath the boomer. A fifteen foot, ten element Benthos MESH 15/10P streamer hydrophone tows directly behind the fish. The deck equipment consists of a Huntec Model 1000 Oceanographic winch/slip ring, 140 metre tow cable, and hydraulic pump unit.

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

B) GRAPHIC DISPLAY, SIGNAL PROCESSING and SYSTEM KEY

A single EPC 9800 thermal recorder was used with the DTS system. The EPC 9800 (serial # 134) provided the master +5V key pulse from the Channel A Key Out and displayed both internal hydrophone (channel A) and external streamer (channel B).

The Adaptive Signal Processor module in the Systems Console processed the signal for the internal hydrophone. The streamer signal was band pass filtered by a Krohn-Hite 3700. The water depths in the study area were shallow, generally ranging from 20 to 30 fathoms.

C) TAPE RECORDING

The DTS data was recorded digitally using the Ferranti SE880 Sonar Enhancement System. The following table details the configuration of the recording channels.

Channel	From	Description
0	Ch2 raw	DTS Internal LC10 hydrophone
1	Ch4 raw	DTS External Benthos streamer
2	NSRF out	NSRF streamer (surface towed)
3		Not used

D) EQUIPMENT LIST

Unit Description	Serial Number
Tow Fish c/w	---
ED10F/C Boomer Source	GF-1
M-5 Attitude Sensor Unit	5014
S500-4 Energy Storage Unit	1025
Internal LC 10 Hydrophone	---
External Benthos MESH 15/10P Streamer	NA
Model 1000 Oceanographic Winch c/w 140 m. cable	---
Roller Sheave 36" Dia.	---
Power Control Unit Mk III	105
Systems Console	109
EPC 9800 Graphic Recorder	134
KrohnHite 3700 Filter	2431
Ferranti SE 880 system	105

E) Multi-Electrode Sparker Source

The mini sparker assembly is a 24 tip sparker source designed to connect to the standard ESU H.V. output connections in the tow fish. The sparker source is mounted just aft of the tail fins. The sparker has greater peak acoustic output at a lower frequency spectrum than the boomer.

2.1 EQUIPMENT SETTINGS

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

Parameter	Setting
Fire rate	0.5 seconds
PCU power setting	4 kilovolts (240 joules)
BMC (motion compensation)	Pressure Mode
Gain - internal	Preset
Filter Setting - internal - external	1400-6000 hertz 1000-4500 hertz
Processor Gain (System Console)	4 KV (both channels)
Krohn-Hite gain (streamer)	+20 db gain
EPC sweep speed	125 milliseconds
EPC print polarity	positive

2.2 EQUIPMENT PERFORMANCE

Overview

Operationally, the DTS worked satisfactorily during the cruise. There were two minor problems which resulted in a total of one hour of down time (at the start of line # 18). The fuses in the winch starter box blew on Julian Day 165 resulting in a delay in deploying the DTS tow fish. The problem was traced to a nut which had come loose and shorted the input power leads.

A small water leak (1 cc) in the tow fish Junction Box occurred on Julian Day 162. The source of the leak was not apparent, so all O rings were replaced as a precaution. Although the Junction Box did not leak again, the reason for the original leak is still a mystery. Other than these two minor problems, all the other equipment functioned without problem.

The DTS system collected approximately 41 hours of data with a survey utilization rate of only 27.7 %. In general the data quality was acceptable given the sea state and shallow water depths.

Data Quality

It was hoped that the DTS sparker would be able to provide reflection data in the acoustically hard sand layers around the Cohasset study area. Specifically, the Chief Scientist wanted to see a) internal structure within the sand waves, and b) delineate deeper structure. Here the DTS data was somewhat of a disappointment.

The sparker appeared to be firing perfectly and audibly was judged to generate greater peak acoustic output. Various gain and filter settings were tried, but it appeared that there was insufficient acoustic impedance within the sand waves at this particular survey site. A interface below the surface sand waves was generally mapped, but structure within the sand waves did not stand out as was hoped. Post survey replay on the SE880 at an expanded vertical scale may improve results.

The one major problem with the sparker source was the electrical interference it caused on the Simrad side scan system. The discharge of the H.V. sparker was picked up by the side scan and appeared as 60 hertz noise(?) Due to the interference the sparker source was disconnected on the Julian Day 162 (2320 hours) and the boomer hooked up for the remainder of the survey.

During the first three sparker lines, the general impression of the DTS technician was that the sparker provided deeper penetration than the boomer. The resolution with the sparker was not as sharp as was expected. The lack of resolution may have something to do with the extremely shallow tow depths (5-11 metres). Unlike the boomer, the sparker output is depth dependent. Both the pulse width and peak output decreases with depth. If it had been possible to tow the fish deeper, the resolution would have improved and the bubble pulse would have been reduced.

Limitations of surveying in shallow water

The water depths in the survey area highlighted the special problems of doing seismics in shallow water. While the weather was far from being rough, during the first two days choppy surface conditions did cause significant "wave noise" on the sparker records which degraded resolution and detail particularly at the fast 125 millisecond sweep rates. Increasing the EPC paper speed improved the records slightly due to the "apparent" stretching out of the record horizontally. The DTS technician wanted to increase the fire rate, however the next fastest internal trigger rate provided by the EPC 9800 was 250 milliseconds. A quarter second fire rate is too fast for the sparker, as the system must maintain a minimum 10 joules per tip per shot or risk damage to the ESU. Unfortunately the sparker was not used during the later portion of the survey when sea conditions improved.

Towing the DTS just below the prop wash also causes the external streamer and the entire fish to undulate or hunt through the water. This produced poorer results than normal on the external data channel. Finally, the sparker is an omnidirectional source so the surface return is much stronger. In shallow water, the combination of bottom and surface multiples restricts the clear window for displaying the bottom return.

For all the above problems, the simplest remedy is to tow the fish deeper. Record quality would have improved dramatically with depth. Unfortunately, the shallow water in the study area prevented this option. It may be a coincidence of geology but whenever the depth increased, more structure was evident on the records.

Equipment Servicing and Status

The AGC #2 system is basically ready for the next cruise on the Parizeau. The spare parts consumed (see below) should be replaced.

Parts Consumed

Parts consumed during the survey are listed below.

DTS parts	6 feed thru #93 bushings
	2 O rings #042
	2 O rings #153
	3 C30J fuses
	3 BAF1 fuses
	1 Sparker tip

3.0 RECOMMENDATIONS

1) When used in shallow water (less than 20 metres) the weather conditions must be very good or the DTS records will suffer.

2) It would be worthwhile to conduct an acoustic calibration of the DTS sparker source (at specific depths). Since there is not any acoustic calibration data for the sparker output pulse it is difficult to evaluate or measure the performance of the system.

3) The EPC 9800 is a vast improvement over the old analog EPC 4000 series recorders. Operationally the EPC 9800's are quiet, reliable and very smooth running, particularly at the

faster fire and sweep rates required for optimum DTS data display. The one limitation of the 9800 is the limited trigger and print delay selection (between one quarter and one second). As recommended in previous cruise reports, an independent, external trigger box is required for the DTS system. On this cruise a trigger rate between 250 and 500 milliseconds may have improved the horizontal resolution. When this issue was last discussed, AGC were planning the construction of an integrated, computer-controlled, master trigger box.

APPENDIX A - DTS WATCH LOGS

SEAKEM OCEANOGRAPHY LTD

Argo Building, Bedford Institute of Oceanography
P. O. Box 696, Dartmouth, Nova Scotia, Canada B2Y 3Y9

WATCHKEEPERS LOG

PROJECT: L
DATE: June 11/93
VESSEL: HN93-016
CLIENT: AGC
LOCATION: SABLE ISLAND
SHEET NO.: 1

DATE/TIME		DATA ANNOTATION					ENVIRONMENTAL			PROFILER						SIDE SCAN				COMMENTS
										SOURCE							GAIN SETTINGS			
JULIAN DAY	TIME GMT	DATA LOG	LINE #	TAPE #	~~TAPE~~ ~~SHOT~~ FIX	HDG.	SHIP SPD.	FISH DEPTH	SEA STATE	BM.	SP.	FIRE RATE	PCU KV	PROC. GAIN	RANGE SCALE	INITIAL	MAX	SLOPE		
162	0450																			Deploy DTS SOL #1
	0530		1	1		182	3.9	30	2		✓	1/2	4	4						FIRST FIX
	0600				9540	179	4.5	23	2		✓	1/2	4	4						FIX
	0710				0851	178	4.1	23	2		✓	"	"	"						FIX
	0730		1	1	3229	179	4.1	23	2		✓	"	"	"						FISH ATTITUDE 2-5° ND PITCH 1-2° PD ROLL
	0800		1	1	6843	179	4.1	17	2		✓	"	"	"		-				
	0842		1	1	4289	178	4.2	17	2		✓	"	"	"						FIX RAISE FISH TO GET AWAY FROM SURFACE RETURN
	0910		1	1	7530	179	4.0	23	2		✓	"	"	"						EOL #1 A/C
	0925		1	1																
	0930		2	1	0839	295	3.0	24	2		✓	"	"	"						SOL #2 SE880 FILE #5
	1000		2	1	3950	50	4.4	23	2		✓	"	"	"						~~[illegible]~~
	1024		2	1	~~6895~~	45	3.9	23	2		✓	"	"	"						EOL #2 RECOVER GEAR LEAK ALARM SOUNDS ON RECOVERY

HUNTEC DTS:
- Deep Tow 500J ☑
- 1000J ☐
- Side Scan 50KHZ ☐
- 100 KHZ ☐
- Sparker Option ☑
- Fish Posit. Opt. ☐
- Altim. Opt. ☐

OTHER EQUIP:
- Sparker ☐
- Air Gun ☐
- Sounder ☐
- Side Scan ☑
- 3.5 ORE ☑
- ☐
- ☐

CONSOLE SETTINGS: INT / EXT
- ASP Gain: INT ✓ — Fixed
- Spr.
- Preset
- Adap.
- BMC Mode: ✓ — Pressure
- Heave
- Normal

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	125	125
Hydrophone type	LC10	BENTHOS
Filter - Hz High	1.4 kHz	1.0kHz
-Hz Low	6.0kHz	10 kHz
Print	(+) ± -	(+) ± -

TAPE SETTINGS: SE880
- CH#0 INT
- CH#1 EXT
- CH#2 NORF
- CH#3 ____
- CH#4 ____
- CH#5 ____
- CH#6 ____
- CH#7 ____
- CH#8 ____
- Tape Speed ____

OPERATORS: MSU

SEAKEM OCEANOGRAPHY LTD
Argo Building, Bedford Institute of Oceanography
P. O. Box 696, Dartmouth, Nova Scotia, Canada B2Y 3Y9

WATCHKEEPERS LOG

PROJECT ______ DATE June 11/92
VESSEL HN93-016 CLIENT AGC
LOCATION Sable Island SHEET NO. 2

DATE/TIME		DATA ANNOTATION					ENVIRONMENTAL			PROFILER					SIDE SCAN					COMMENTS
										SOURCE						GAIN SETTINGS				
JULIAN DAY	TIME GMT	DATA LOG	LINE #	TAPE #	TAPE FOOT	HDG.	SHIP SPD.	FISH DEPTH	SEA STATE	BM.	SP.	FIRE RATE	PCU KV	PROC. GAIN	RANGE SCALE	INITIAL	MAX	SLOPE		
																				SERVICE NOTE: WATER
																				IN J. BOX (1 TEASPOON) - NO
																				OBVIOUS REASON - CLEAN OUT
																				REPLACE ORINGS - TEST OK
																				- NOTE: LEAK ALARM GOES OFF
																				JUST BEFORE LAUNCH - ASSUME
																				STRAY DROP WATER - DISCONNECT
																				LEAK ALARM - WILL CHECK
																				AFTER THIS NIGHTS LINES.
																				ADD DRAG TO STREAMER
162	2050		[illegible]	2					1-2		✓	500msec	4	4						DEPLOY DTS
	2110		3	2	FILE #2	324	4.4	18	1-2		✓	500msec	4	4						SOL #3 START FILE #2 SE880

HUNTEC DTS:
- Deep Tow 500J ☑
- 1000J ☐
- Side Scan 50KHZ ☐
- 100 KHZ ☐
- Sparker Option ☑
- Fish Posit. Opt. ☐
- Altim. Opt. ☐

OTHER EQUIP:
- Sparker ☐
- Air Gun ☐
- Sounder ☐
- Side Scan ☑
- 3.5 ORE ☑
- ______ ☐
- ______ ☐

CONSOLE SETTINGS:
- ASP Gain: INT
- Fixed
- Spr. ✓
- Preset ✓
- Adap. ✓
- BMC Mode: Pressure
- Heave
- Normal

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	125	125
Hydrophone type	LC10	BENTHOS
Filter - Hz High	1.4-6.0	1000-6000
-Hz Low		
Print	⊕ ± -	⊕ ± -

TAPE SETTINGS: AS BEFORE
- CH#1 ______
- CH#2 ______
- CH#3 ______
- CH#4 ______
- CH#5 ______
- CH#6 ______
- CH#7 ______
- CH#8 ______
- Tape Speed ______

OPERATORS:
______
______
______

SEAKEM OCEANOGRAPHY LTD

Argo Building, Bedford Institute of Oceanography
P. O. Box 696, Dartmouth, Nova Scotia, Canada B2Y 3Y9

WATCHKEEPERS LOG

PROJECT ______ DATE June 11/93
VESSEL HN93-016 CLIENT AGC
LOCATION SABLE ISLAND SHEET NO. 3

DATE/TIME		DATA ANNOTATION					ENVIRONMENTAL			PROFILER					SIDE SCAN				COMMENTS
JULIAN DAY	TIME GMT	DATA LOG	LINE #	TAPE #	TAPE FOOT	HDG.	SHIP SPD.	FISH DEPTH	SEA STATE	SOURCE BM.	SOURCE SP.	FIRE RATE	PCU KV	PROC. GAIN	RANGE SCALE	GAIN SETTINGS INITIAL	GAIN SETTINGS MAX	GAIN SETTINGS SLOPE	
162			3	2						✓	✓	1/2	4	4					
162	2130		3	2	3940	325	4.5	15	1	✓	✓	1/2	4	4					
	2145		3	2	5690	326	4.2	15	1	✓	✓	1/2	4	4					
	2153																		SHUT DOWN SYSTEM &
																			RECOVER
																			CHANGE OVER TO BOOMER
	2320		4	2	FILE #3	138	4.1	6	1	✓		1/2	4	4					DEPLOY DTS ON LINE #4
	2333		4	2	3	137	4.3	11	1	✓		1/2	4	4					FIX
163	2400		4	2	4692	134	3.4	11	1	✓		1/2	4	4					FIX
163	0033		4	2	8636	133	4.8	11	1	✓		1/2	4	4					FIX
	0100		4	2	11890	138	4.6	11	1	✓		1/2	4	4					FIX 0107 EOL A/C to 4.05
	0130		4	2	2220	323	5.2	11	1	✓		1/2	4	4					FIX
	0133		5	2	2600	324	4.7	11	1	✓		1/2	4	4					FIX SOL#5
	0200		5	2	5810	325	3.8	11	1	✓		1/2	4	4					FIX
	0230		5	2	8400	326	4.1	11	1	✓		1/2	4	4					FIX

HUNTEC DTS:
- Deep Tow 500J ☑
- 1000J ☐
- Side Scan 50KHZ ☐
- 100 KHZ ☐
- Sparker Option ☑
- Fish Posit. Opt. ☐
- Altim. Opt. ☐

OTHER EQUIP:
- Sparker ☐
- Air Gun ☐
- Sounder ☐
- Side Scan ☑
- 3.5 KHz ☑
- ☐
- ☐

CONSOLE SETTINGS:
- ASP Gain ____ Fixed
- ____ Spr.
- ✓ Preset
- ____ Adap.
- BMC Mode ✓ Pressure
- ____ Heave
- ____ Normal

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	125	125
Hydrophone type		
Filter - Hz High	2000	1000
-Hz Low	6000	6000
Print	θ ± -	θ ± -

TAPE SETTINGS: AS BEFORE
- CH#1 ____ CH#5 ____
- CH#2 ____ CH#6 ____
- CH#3 ____ CH#7 ____
- CH#4 ____ CH#8 ____

Tape Speed ____

OPERATORS:

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WATCHKEEPERS LOG

PROJECT ________ DATE June 12/93
VESSEL HN 93-016 CLIENT AGC
LOCATION SABLE ISLAND SHEET NO. 4

DATE/TIME: JULIAN DAY	TIME GMT	DATA ANNOTATION: DATA LOG	LINE #	TAPE #	TAPE FOOT	HDG.	ENVIRONMENTAL: SHIP SPD.	FISH DEPTH	SEA STATE	PROFILER: SOURCE BM.	SOURCE SP.	FIRE RATE	PCU KV	PROC. GAIN	SIDE SCAN: RANGE SCALE	GAIN SETTINGS INITIAL	MAX	SLOPE	COMMENTS
163	0300		5	2	13010	332	3.6	11	1	✓		1/2	4	4					FIX
	0317		5	2	15042														EOL #5 EOF #4 EOT #2
	0331		6	3		130	6.4	10	1	✓		1/2	4	4					SOL #6
	0352		6	3	0000					✓		"	"	"					SOT#3 SOFILE #2
	0400		6	3	0750	145	5.2	11	1	✓		"	"	"					FIX
	0412		6	3	0930														EO FILE#2 / SO FILE #3
	0430		6	3	2189	141	4.3	11	1	✓		"	"	"					
	0500		6	3	5822	140	4.3	11	1	✓		"	"	"					
	0519		6	3	8665														EOL #6 EO FILE #3
	0543		7	3	0156	337	4.2	11	1	✓		"	"	"					SOL #7 SO FILE #4
	0600		7	3	2130	332	3.9	11	1	✓		"	"	"					FIX
	0630		7	3	5721	332	3.7	11	1	✓		"	"	"					FIX
	0702		7	3	9633	331	3.4	11	1	✓		"	"	"					
	0730		7	3	12965														FIX
	0747				14996														EOL #7 END FILE #4

HUNTEC DTS:
- Deep Tow 500J ☑
- 1000J ☐
- Side Scan 50KHZ ☐
- 100 KHZ ☐
- Sparker Option ☑
- Fish Posit. Opt. ☐
- Altim. Opt. ☐

OTHER EQUIP:
- Sparker ☐
- Air Gun ☐
- Sounder ☐
- Side Scan ☑
- 2.5 ORE ☑
- ☐
- ☐

CONSOLE SETTINGS:
- ASP Gain ____ Fixed
- ____ Spr.
- ____ Preset
- ✓ Adap.
- BMC Mode ✓ Pressure
- ____ Heave
- ____ Normal

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	125	125
Hydrophone type	LC10	BGN 7105
Filter - Hz High	1000	600
-Hz Low	6000	3500
Print	+ ± -	+ ± -

TAPE SETTINGS:
CH#1 ____ CH#5 ____
CH#2 ____ CH#6 ____
CH#3 ____ CH#7 ____
CH#4 ____ CH#8 ____
Tape Speed ____

OPERATORS:
____
____
____

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WATCHKEEPERS LOG

PROJECT ______ DATE June 12/93
VESSEL HN93-016 CLIENT AEC
LOCATION Sable Island SHEET NO. 5

DATE/TIME		DATA ANNOTATION					ENVIRONMENTAL			PROFILER					SIDE SCAN				COMMENTS
JULIAN DAY	TIME GMT	DATA LOG	LINE #	TAPE #	TAPE FOOT	HDG.	SHIP SPD.	FISH DEPTH	SEA STATE	SOURCE BM.	SOURCE SP.	FIRE RATE	PCU KV	PROC. GAIN	RANGE SCALE	GAIN SETTINGS INITIAL	GAIN SETTINGS MAX	GAIN SETTINGS SLOPE	
163	0756		8	3	0000	140	5.7	11	1-2	✓		½	4	4					SOL #8 S of FILE #5
	0850		8	3	6464	136	4.6	11	2	✓		½	4	4					FIX
	0926		8	3	10825														EOL #8 END FILE #5
	0937		9	3	0000	334	5.1	11	3	✓		½	4	4					SOL #9 START FILE #6
	1000		9	3	2630	333	4.6	11	3	✓		"	"	"					FIX
	1035		9	3	6880	327	4.7												FIX
	1110		9	3	8605	337	4.7	11	3	✓		"	4	4					FIX
	1123		9	3	—	—				✓									~~[illegible]~~ EOT 3 END FILE #6
																			EOL #9
																			DEPLOY DTS
163	1910																		~~[illegible]~~
	1930				0405	145	4.7	13	3	✓		½	4	4					FIX
	1932		10	4	0592	"				✓		"	"	"					SOL #10
	1950		10	4	2814	163	4.6	13	3	✓		"	"	"					

HUNTEC DTS:
Deep Tow 500J ☐
1000J ☐
Side Scan 50KHZ ☐
100 KHZ ☐
Sparker Option ☐
Fish Posit. Opt. ☐
Altim. Opt. ☐

OTHER EQUIP:
Sparker ☐
Air Gun ☐
Sounder ☐
Side Scan ☐
______ ☐
______ ☐
______ ☐

CONSOLE SETTINGS:
ASP Gain ______ Fixed
______ Spr.
______ Preset
______ Adap.
BMC Mode ______ Pressure
______ Heave
______ Normal

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	____	____
Hydrophone type	____	____
Filter - Hz High	____	____
-Hz Low	____	____
Print	+ ± −	+ ± −

TAPE SETTINGS:
CH#1 ____ CH#5 ____
CH#2 ____ CH#6 ____
CH#3 ____ CH#7 ____
CH#4 ____ CH#8 ____
Tape Speed ______

OPERATORS:
______
______
______

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WATCHKEEPERS LOG

PROJECT ______ DATE ______
VESSEL Hn 93 016 CLIENT AGC
LOCATION Sable Island SHEET NO. 6

DATE/TIME		DATA ANNOTATION					ENVIRONMENTAL			PROFILER					SIDE SCAN				COMMENTS
JULIAN DAY	TIME GMT	DATA LOG	LINE #	TAPE #	TAPE FOOT	HDG.	SHIP SPD.	FISH DEPTH	SEA STATE	SOURCE BM.	SOURCE SP.	FIRE RATE	PCU KV	PROC. GAIN	RANGE SCALE	GAIN SETTINGS INITIAL	MAX	SLOPE	
163			10	4	3989	139	4.8	13	3	✓		1/2	4	4					On Line 10
163	2035		10	4	8180	135	4.6	9	3	✓		1/2	4	4					
	2050				10133														
	2116		10		11240	148	4.3	13	3	✓									EOL 10
	2125		11	4	1140	323	4.3	10	3	✓		1/2	4	4					Soc 11
	2130		″	4	1860	334	4.9	9	3	✓		1/2	4	4					
	2145		11	4	3463	334	4.6	19	3	✓		1/2	4	4					
	2200		11	4	5248	320	3.5	17	2	✓		1/2	4	4					
	2230		11	4	8857	331	4.6	15	2	✓		1/2	4	4					
					10868	309	3.6	10	1	✓		1/2	4	4					
	2300		11	4	12417	322	3.7	11	1	✓		1/2	4	4					
	2313		11	4	14200	327	4.1	9	1	✓		1/2	4	4					EOL# 11
163	2333		12	4	2020	146	4.2	9	1	✓		1/2	4	4					SOL # 12
164	0000		12	4	5220	144	4.4	9	1	✓		1/2	4	4					
	0030		12	4	8820	140	4.2	9	1	✓		1/2	4	4					

HUNTEC DTS:
Deep Tow 500J ☐
1000J ☐
Side Scan 50KHZ ☐
100 KHZ ☐
Sparker Option ☐
Fish Posit. Opt. ☐
Altim. Opt. ☐

OTHER EQUIP:
Sparker ☐
Air Gun ☐
Sounder ☐
Side Scan ☐
______ ☐
______ ☐
______ ☐

CONSOLE SETTINGS:
ASP Gain ______ Fixed
______ Spr.
______ Preset
______ Adap.
BMC Mode ______ Pressure
______ Heave
______ Normal

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	______	______
Hydrophone type	______	______
Filter - Hz High	______	______
-Hz Low	______	______
Print	+ ± -	+ ± -

TAPE SETTINGS:
CH#1 ______ CH#5 ______
CH#2 ______ CH#6 ______
CH#3 ______ CH#7 ______
CH#4 ______ CH#8 ______
Tape Speed ______

OPERATORS:
______
______
______

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WATCHKEEPERS LOG

PROJECT ______ DATE June 12-13/93
VESSEL HN93-016 CLIENT AGC
LOCATION Sable Island SHEET NO. 7

DATE/TIME		DATA ANNOTATION					ENVIRONMENTAL			PROFILER					SIDE SCAN					COMMENTS
JULIAN DAY	TIME GMT	DATA LOG	LINE #	TAPE #	TAPE FOOT	HDG.	SHIP SPD.	FISH DEPTH	SEA STATE	SOURCE BM.	SOURCE SP.	FIRE RATE	PCU KV	PROC. GAIN	RANGE SCALE	GAIN SETTINGS INITIAL	MAX	SLOPE		
164	0100		12	4	12430	141	4.9	9	1	✓		1/2	4	4						ON line # 12
164	0120		12	4	14820	140	4.6	9	1	✓		1/2	4	4						EOL # 12
164	0134		13	5	313	321	4.3	9	1	✓		1/2	4	4						SOL # 13
	0200		13	5	2790	327	5.1	9	1	✓		1/2	4	4						
	0230		13	5	6400	323	4.5	9	1	✓		1/2	4	4						
	0300		13	5	10000	321	4.2	9	1	✓		1/2	4	4						
	0308																			EOL # 13
	0328		14	5	0000	145	5.4	9	1	✓		1/2	4	4						SOL #14 START FILE #3
	0400		14	5	3782	150	4.3	9	1	✓		"	"	"						~~[illegible]~~
	0430		14	5	7410	147	4.3	9	1	✓		"	"	"						FIX
	0505		14	5	11640	142	4.5	9		✓		"	"	"						FIX
	0522		14	5	13575	143	4.4	9	1	✓		"	"	"						EOL #14 END FILE #3
	0536		15	5	0000															SOL #15 START FILE #4
	0601		15	5	2960	321	4.5	9	1	✓		"	"	"						FIX
	0630		15	5				14		✓		"	"	"						

HUNTEC DTS:
- Deep Tow 500J ☑
- 1000J ☐
- Side Scan 50KHZ ☐
- 100 KHZ ☐
- Sparker Option ☑
- Fish Posit. Opt. ☐
- Altim. Opt. ☐

OTHER EQUIP:
- Sparker ☐
- Air Gun ☐
- Sounder ☐
- Side Scan ☑
- 3.5 KHZ ☑
- ______ ☐
- ______ ☐

CONSOLE SETTINGS:
- ASP Gain: Fixed ___; Spr. ✓; Preset ___
- BMC Mode: Adap. ✓; Pressure ___; Heave ___; Normal ___

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	125	125
Hydrophone type	1010	BENTHOS
Filter - Hz High	2000	800
-Hz Low	6000	4000
Print	(+) ± -	(+) ± -

TAPE SETTINGS:
CH#1 ____ CH#5 ____
CH#2 ____ CH#6 ____
CH#3 ____ CH#7 ____
CH#4 ____ CH#8 ____
Tape Speed ______

OPERATORS:
______
______
______

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WATCHKEEPERS LOG

PROJECT ______ DATE JUNE 13/93
VESSEL HN93-016 CLIENT AGC
LOCATION SABLE ISLAND SHEET NO. 8

DATE/TIME: JULIAN DAY	TIME GMT	DATA ANNOTATION: DATA LOG	LINE #	TAPE #	TAPE FOOT	HDG.	ENVIRONMENTAL: SHIP SPD.	FISH DEPTH	SEA STATE	PROFILER: SOURCE BM.	SOURCE SP.	FIRE RATE	PCU KV	PROC. GAIN	SIDE SCAN: RANGE SCALE	GAIN SETTINGS INITIAL	MAX	SLOPE	COMMENTS
164	0700		15	5	10140	0325	4.4	14	1	✓		1/2	4	4					FIX
	0730		15	5	13685	325	4.6	11	1	✓		"	"	"					~~[illegible]~~ ~~[illegible]~~
	0735		15	5	14289														EOL #15 END FILE #4
	0747		16	5	0000	139	4.7	11	1	✓		"	"	"					SOL #16 START FILE #5
	0800		16	5	1507	143	5.1	11	1	✓		"	"	"					FIX
	0830		16	5	5113	141	4.5	11	1	✓		"	"	"					FIX
	0900		16	5	8738	137	4.4	11	1	✓		"	"	"					FIX
	0920		16	5	11022					✓		"	"	"					EOL #16 END FILE #5
	0938		17	5	0000	324	4.7	11	1	✓		"	"	"					SOL #17 START FILE #6
	1000		17	5	2640	324	4.7	10	1	✓		"	"	"					FIX
	1030		17	5	6210	322	4.7	10	1	✓		"	"	"					FIX
	1100		17	5	9819	322	4.7	10	1	✓		"	"	"					FIX
	1118		17	5	11765														EOT #5 END FILE #6
	1127		17	5															EOL #17 RECOVER DTS

HUNTEC DTS:
Deep Tow 500J ☑
1000J ☐
Side Scan 50KHZ ☐
100 KHZ ☐
Sparker Option ☐
Fish Posit. Opt. ☐
Altim. Opt. ☐

OTHER EQUIP:
Sparker ☐
Air Gun ☐
Sounder ☑
Side Scan ☑
3.5KHz ☑
______ ☐
______ ☐

CONSOLE SETTINGS:
ASP Gain ______ Fixed
______ Spr.
✓ Preset
BMC Mode ✓ Adap.
______ Pressure
______ Heave
______ Normal

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	125	125
Hydrophone type	1010	5/10P
Filter - Hz High	2000	800
-Hz Low	6000	4003
Print	⊕± -	⊕± -

TAPE SETTINGS: SE886
CH#0 INT
CH#1 EXT
CH#2 NSRF
CH#3 ______
CH#4 ______
CH#5 ______
CH#6 ______
CH#7 ______
CH#8 ______
Tape Speed ______

OPERATORS:
______
______
______

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WATCHKEEPERS LOG
HUDSON 93-016

PROJECT C109-03 DATE June 14/93
VESSEL HN93-016 CLIENT AGC
LOCATION SABLE ISLAND SHEET NO. 9

DATE/TIME		DATA ANNOTATION					ENVIRONMENTAL			PROFILER					SIDE SCAN				COMMENTS
JULIAN DAY	TIME GMT	DATA LOG	LINE #	TAPE #	TAPE FOOT	HDG.	SHIP SPD.	FISH DEPTH	SEA STATE	SOURCE BM.	SOURCE SP.	FIRE RATE	PCU KV	PROC. GAIN	RANGE SCALE	GAIN SETTINGS INITIAL	GAIN SETTINGS MAX	GAIN SETTINGS SLOPE	
165	2145			6						✓		1/2	4	4					DEPLOY DTS
.	2147		18	6	00	321	3.9	10	1	✓		1/2	4	4					SOL #18 START FILE #2
	2215		18	6	3180	313	4.3	11	1	✓		1/2	4	4					NOTE: BLOW
	2230		18	6	5000	314	4.4	11	1	✓		1/2	4	4					1 FUSE BAF 1 IN WINCH
	2251		18	6	7560	320	4.6	11	1	✓		1/4	4	4					EOL #18 ON STARTUP
165	2329		19	6	90	147	4.4	8	1	✓		1/4	4	4					~~SOL~~ ON LINE 19
165	2333		19	6	640	148	5.2	8	1	✓		1/4	4	4					SOL #19
166	0000		19	6	3750	150	4.7	8	1	✓		1/4	4	4					
	0030		19	6	7360	146	4.5	8	1	✓		1/4	4	4					
	0105		19	6	11580	141	4.4	8	1	✓		1/4	4	4					
	0115		19	6	12870	141	4.3	8	1	✓		1/4	4	4					EOL #19
			▶																SOL #20
	0133		20	6	1851	323	4.9	8	1	✓		1/4	4	4					
	0200		20	6	5100	318	4.6	8	1	✓		1/4	4	4					

HUNTEC DTS:
- Deep Tow 500J ☑
- 1000J ☐
- Side Scan 50KHZ ☐
- 100 KHZ ☐
- Sparker Option ☐
- Fish Posit. Opt. ☐
- Altim. Opt. ☐

OTHER EQUIP:
- Sparker ☐
- Air Gun ☐
- Sounder ☐
- Side Scan ☑
- 3.5KHZ ☑
- ☐
- ☐

CONSOLE SETTINGS:
- ASP Gain: Fixed ___; Spr. ✓; Preset ___
- BMC Mode: Adap. ✓; Pressure ___; Heave ___; Normal ___

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	125	125
Hydrophone type	LC10	15/10P
Filter - Hz High	2000	800
-Hz Low	6000	5000
Print	⊖ ± -	⊕ ± -

TAPE SETTINGS: SE880
- CH#0 INT
- CH#1 EXT
- CH#2 NSRF
- CH#3 ___
- CH#4 ___
- CH#5 ___
- CH#6 ___
- CH#7 ___
- CH#8 ___
- Tape Speed ___

OPERATORS: MSU

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WATCHKEEPERS LOG

PROJECT C109-03 DATE June
VESSEL HN 93-016 CLIENT AGC
LOCATION Sable Island SHEET NO. 10

DATE/TIME		DATA ANNOTATION					ENVIRONMENTAL			PROFILER					SIDE SCAN				COMMENTS
JULIAN DAY	TIME GMT	DATA LOG	LINE #	TAPE #	TAPE FOOT	HDG.	SHIP SPD.	FISH DEPTH	SEA STATE	SOURCE BM.	SOURCE SP.	FIRE RATE	PCU KV	PROC. GAIN	RANGE SCALE	GAIN SETTINGS INITIAL	MAX	SLOPE	
166	0230		20	6	8712	324	4.2	8	1	V		1/2	4	4					ON LINE # 20
166	0300		20	6	12330	323	4.5	8	1	V		1/2	4	4					
166	0315		20	6	14140				1	V		1/2	4	4					EOL # 20 EO FILE 4
																			RECOVER FISH

HUNTEC DTS:
- Deep Tow 500J ☑
- 1000J ☐
- Side Scan 50KHZ ☐
- 100 KHZ ☐
- Sparker Option ☐
- Fish Posit. Opt. ☐
- Altim. Opt. ☐

OTHER EQUIP:
- Sparker ☐
- Air Gun ☐
- Sounder ☐
- Side Scan ☑
- 3.5 KHz ☑
- ☐
- ☐

CONSOLE SETTINGS:
- ASP Gain: Fixed ___ / Spr. ___ / Preset √
- BMC Mode: Adap. ___ / Pressure √ / Heave ___ / Normal ___

PROFILER GRAPHICS:

	INT.	EXT.
Sweep (msec.)	125	125
Hydrophone type	LC10	15/10P
Filter - Hz High	2000	800
-Hz Low	6000	5000
Print	(+) ± -	(+) ± -

TAPE SETTINGS: SE880
CH#0 INT
CH#1 EXT
CH#2 NSRF
CH#3 ___
CH#4 ___
CH#5 ___
CH#6 ___
CH#7 ___
CH#8 ___
Tape Speed ___

OPERATORS:

Technical Report of Hudson 93-016

by

Anthony S. Atkinson

Paul:
This is really still a draft.
Should give you an overview from my angle.
Thanks
Tony

June 1993

Executive Summary and Recommendations

* More engineering is required on the BOT Vibrocorer to retain unconsolidated sands.

* If water samples are required from the Sea Carousel flume then a pump should be mounted on the rig.

* Ralph operations should be simplified

* The BOT Vibrocorer software needs servicing before further use.

Sea Carousel:

* Motor switching transients.. and the motor

The new Empire Magnetics stepping motor generates fast switching transients during its operation that interfere with surface data communications with the, CR10, data logger. Grounding the motor, the data logger pressure case, and one side of the RS232 line reduced this problem to an acceptable level.

* In Situ pump

The In Situ pump was deployed at the sea surface to draw a sediment sample from the carousel's flume during its operation. This allows calibration of the flume data against the SPM of the samples and analysis of benthic fauna present.

The apparatus consisted of 100 m of 1/4" dia tubing leading to a submersible pump the sea surface from the flume. The outlet of the pump went shipboard where samples were collected. The 2 main problems with this arrangement are as follows:

(1) Substantial I^2R loses

The initial cable used was #18/2. The resistance of this cable was far too high to function with the 12 Volt car battery provided. This cable was replaced with #10/2 wire. The ship's 50 Volt 20 Amp battery charger was used power source (variable). With 37 metres of #12/2 feeding the pump from the upper deck cross alley, 30 Volts of supply voltage was needed to operate the pump, that is, to deliver 12 Volts @ 11 Amps to the pump.

(2) Suction Problems

Although hydrostatic pressure brought the sample water to the sea surface, flow was not sufficient to draw even fine sand from the flume through the 100m of 1/4 " ID hose.

Since small SPM samples should be taken in order not to affect the Carousel's "closed system" much, small diameter tubing must be used. Ideally, the pump should be mounted on the flume. This would have been implemented on this cruise but the spare power conductors were unavailable.

* Video Cameras

The Amphibico high resolution camcorder and the Osprey low res surface monitored cameras were mounted at view ports on the inside of the Sea Carousel. They provided an insight in processes the flume.

* Shaft encoder problems

The encoder's shaft was bent when the carousel was bounced along the bottom with the ship at anchor on the first deployment. Many thank are due to the engineer who straightened the shaft. The unit was reassembled and used without further incident.

Sampling:

Large IKU Grab

This unit was not recovered during its initial deployment on Friday June 11. It is believed that the Bulldog Clamps worked loose and allowed the grab to slip off its sheaves.

Small IKU type grab

This unit generally performed well. The sample wasn't always deep enough for vertical subsamples to be taken for peels because sediment washed out the jaws.

Van Veen Grab

A grid of grabs was done for grain size and biological samples on June 15.

Vibrocorer

The BOT corer was unable to retain the samples. Penetration was limited to about 1 metre. No significant samples were recovered.
Initially the software had to be downloaded to the Tattletale computer in the pod. The surface computer software would not use or modify its .CFG file and the extension counter could not be zeroed. The extensometer had to be repaired prior to deployment. It is believed it was flooded last year. NOTE: This unit is only rated for 150 PSI! There were some problems with the winch; it failed to retract on 1 station.

Geophysics:

Simrad MS992

The 4 channel Simrad Side Scan Sonar was recorded on an SE 880 data logger and displayed on the TDU1200 graphic recorder.

Huntec

The Huntec DTS system used the internal and external hydrophones with either a multi-tip sparker or boomer source. The int/ext hydrophones were displayed on an EPC 9800 2 channel graphic recorder using a 1/2 sec rep rate and a 1/8 sec sweep rate. A surface towed NSRFC streamer also displayed the Huntec signal on an EPC 9700 graphic recorder. The internal, external , and NSRFC signals were recorded on an SE880 data logger (2nd one).

ORE 3.5 KHz
The 3.5 KHz was at 1/2 second displayed on an EPC 4100.

Camera:

Intermittent problems with Systems Engineering camera system caused the loss of a few pictures.

Ralph:

Appears to have stopped recording soon after deployment.

S-4 Current Meters:

One current meter was recovered , but the rope parted during recovery of the second unit, and it was lost.

HUDSON 93016

TABLE 15

PARAMETER START/STOP - HUNTEC (NSRF)

162/0613 - 162/0716
162/0725 - 162/1042
162/2055 - 162/2145
162/2322 - 163/1123
163/1930 - 164/1127
165/2200 - 165/2252
165/2333 - 166/0315