GEOLOGICAL SURVEY OF CANADA
OPEN FILE 4992

Cruise Matthew 2002066 Geophysical Surveys and Sampling Operations in the Middle Shoal Area, Cape Breton Island, NS, 19 -30 October 2002

D.R. Parrott

2010

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Background

Survey Matthew 2002066 was conducted from 19-30 October 2002 near Middle Shoal, in the approach to Great Bras d'Or, which forms the northern entrance to the Bras d'Or Lakes of Cape Breton Island. Geophysical data, seafloor samples, and seafloor photographs and videos were collected from the CCGS *Matthew* (Fig. 1a). Multibeam bathymetry data were collected with a Simrad EM3000 system, mounted in the survey launch Plover (Fig. 1b). These data were used to provide information on the character and distribution of seafloor sediments, and the geological and oceanographic processes which have affected the seafloor over three offshore marine disposal sites which received material from dredging the channel through Middle Shoal. The three offshore disposal sites were located near Table Head, Bird Islands, and Little River as shown in Figure 2. During times of inclement weather in the Middle Shoal area, operations were shifted to Sydney Harbour and the Baddeck area in the Bras d'Or Lakes.

a)

b)

Figure 1. The geophysical survey and seafloor sampling program were performed using (a) the CCGS *Matthew*. Multibeam bathymetry was conducted using the survey launch Plover (b) equipped with a Simrad EM3000 multibeam bathymetry system.

Geophysical equipment used during the survey consisted of a Simrad MS992 dual frequency (120 and 330 kHz) sidescan sonar system, and an IKB Seistec sub-bottom profiler. Sediment samples were collected with a vanVeen grab sampler and a small gravity corer, and bottom photographs were taken along transects through the survey area. A track plot showing lines where geophysical data collected, in the Middle Shoal area and in Sydney harbour during survey Matthew 2002066 is shown in Figure 2.

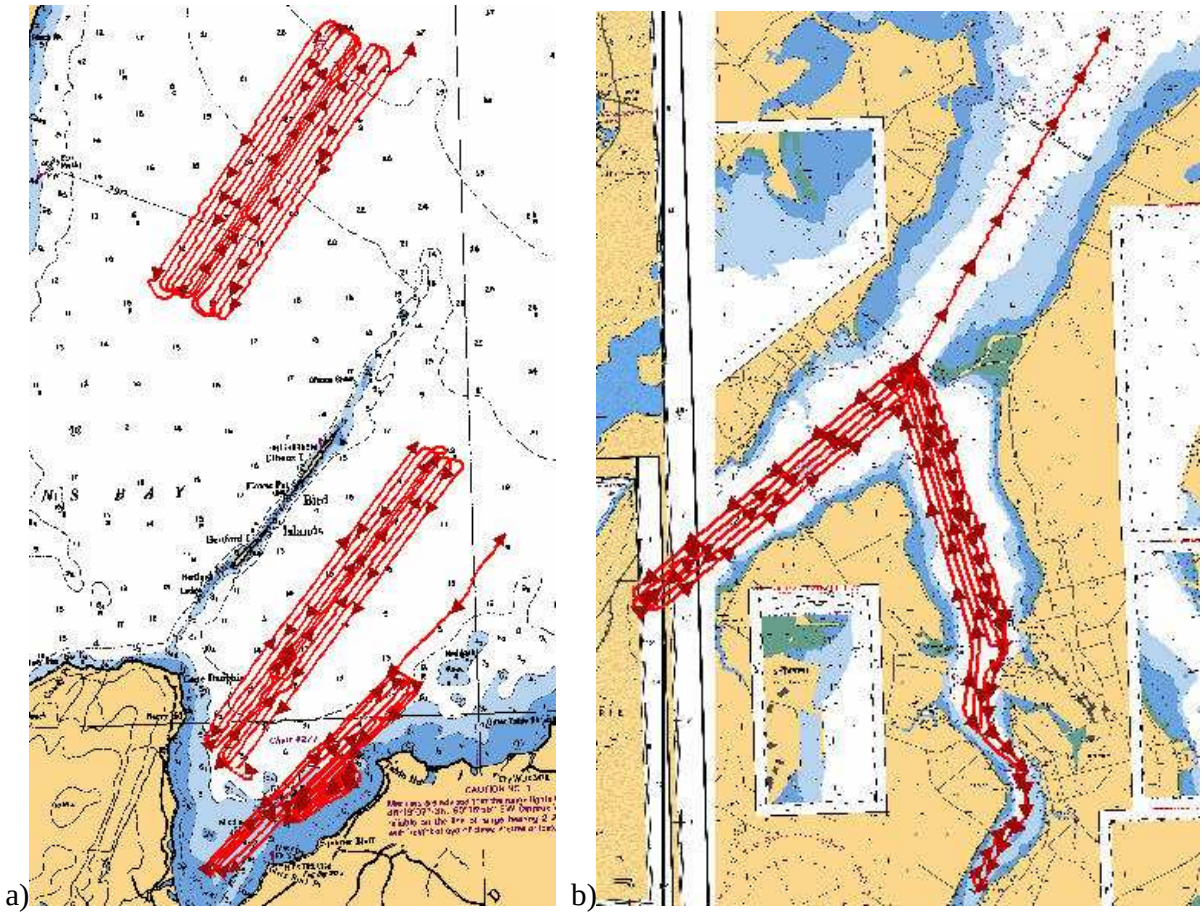

Figure 2. Trackplot showing lines where geophysical data were collected a) in St. Ann's Bay and near Middle Shoal in the approach to Great Bras d'Or channel and b) in Sydney harbour, during survey Matthew 2002066.

Data Acquisition and Processing

The following geophysical and sampling equipment was used during survey Matthew 2002066:

- Simrad MS992 sidescan sonar system in a neutrally-buoyant tow configuration
- IKB Seistec high resolution sub-bottom profiler
- AGCDIG 4 channel digital geophysical data acquisition system
- ORE TrackPoint II ultra short baseline towfish positioning system
- Regulus survey navigation package with input from differential GPS
- Simrad EM3000 multibeam bathymetry system
- Linux workstations running GRASS with GSCA extensions
- Caris HIPS multibeam bathymetry data cleaning software running on Windows NT
- GSCA icehole camera
- vanVeen grab sampler
- Small gravity corer

Sidescan Sonar

High-resolution, acoustic images of the seabed were produced with a Simrad MS992 dual frequency (120 and 330 kHz) sidescan sonar system mounted in a neutrally-buoyant towbody and deployed 13 metres behind a dead weight depressor (a 120 kg iron blister weight on a swivel) as shown in Figure 4. The towfish was deployed about 50 metres behind the vessel. This configuration was chosen to reduce artifacts seen on the sidescan sonar records due to vessel-induced heave, and thereby improve resolution. The sidescan sonar system was capable of resolving objects as small as about 0.15 m. An ORE TrackPoint II acoustic position system was used to position the towfish. A hardcopy graphic record of the 330 kHz portion of the sidescan sonar data was produced on an Alden 9315CTP thermal recorder set at a fixed speed of 1.7 knots. This produced records with a 2 to 1 aspect ratio at the slowest survey speeds of 3.5 knots. A hardcopy graphic record of the 120 kHz portion of the sidescan sonar data was produced on an EPC Labs GSP1086-2 thermal recorder.

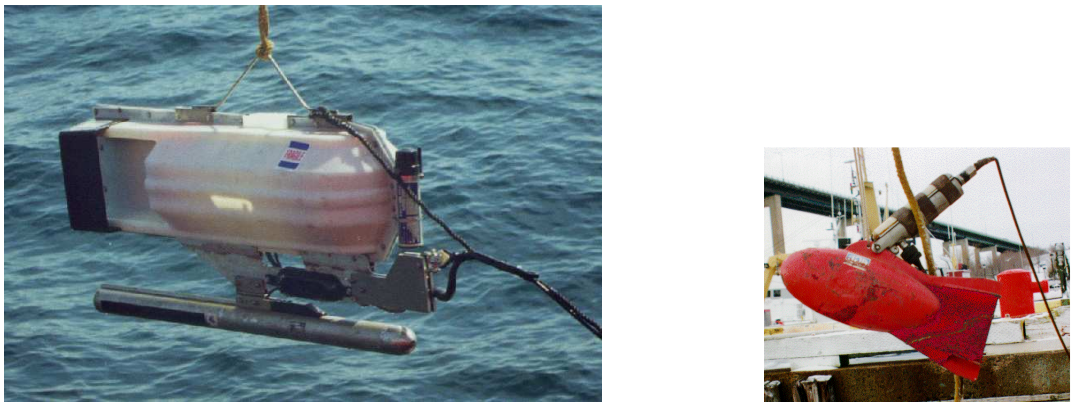

Figure 4 Neutrally buoyant sidescan sonar towfish (shown on the left) and deadweight depressor used by GSCA. The towfish was towed about 13 metres behind the deadweight depressor. The TrackPoint II beacon is visible on the front of the towfish.

The sidescan sonar data were collected at 100 metre range for lines near the disposal sites and at 200 metre range for lines outside the primary disposal sites. This provided swaths of 200 and 400 metres respectively. Lines run at the 100 m range were typically 75 or 100 metres apart, with a 300 metre spacing used for the 200 metre range lines.

Sidescan sonar data from survey Matthew 2002066 (both 120 and 330 kHz) were collected digitally using an AGCDIG digitizer with version 2.3 software. A sample interval of 80 microseconds was used. 3400 samples per ping were collected at 200 metre range and 1700 samples at the nominal 100 metre range setting. Digital gain settings for the sidescan sonar system and digitizers were logged on field sheets. During the survey, data were imported into a Linux workstation at a resolution of 0.35 metres (across track). The seafloor was detected and slant range and beam corrections were applied to the raw data to remove geometric distortions present in sidescan sonar data. The data were integrated with navigation and imported into the GRASS GIS system at 0.5 metre resolution for data near the disposal site and 1.0 metre resolution for regional data. The sidescan sonar data from adjacent survey lines were integrated to produce a sidescan sonar mosaic. A variable layback, based on towfish positions from the TrackPoint II positioning system, was applied to the sidescan sonar data.

IKB Technologies Seistec Sub-bottom profiler

An IKB Technologies Seistec high-resolution, sub-bottom profiler system was used to map the thickness and structure of materials on the sea floor and provide information on the genesis of the sediments. The system uses an electrodynamic (boomer) source to produce a repeatable impulse-like output providing a vertical resolution of 0.25 metre or better. The Seistec system was equipped with an internal line-and-cone array and an external streamer. The boomer and line-and-cone array are contained in a small catamaran as shown in Figure 5. The external streamer was attached to the front of the catamaran, so that the lead-in section of the streamer was positioned under the boomer and line-and-cone array with the receiving elements trailing behind the catamaran. The catamaran was deployed by crane on the starboard side of the vessel and towed on the port side at the surface. The system was fired 2 times per second, or faster, and graphic records were displayed on a thermal graphic recorder. The power supply to the boomer was operated at a nominal setting of 175 Joules. Graphic records were printed on an EPC9800 recorder set for 125 millisecond scans in two channel mode. Data were sampled at a 38 microsecond interval for 124 milliseconds to provide 3845 samples per channel. Bandpass filtered signals were recorded. External steamer data were filtered at 1000 to 7000 hertz.

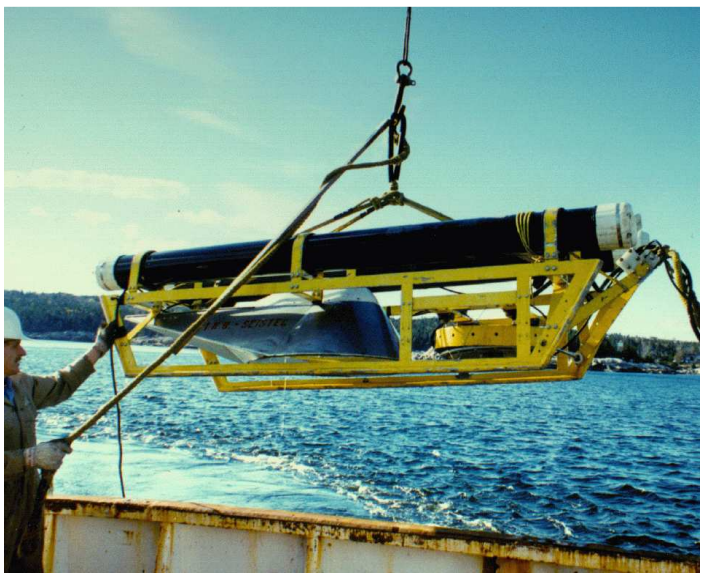

Figure 5. Seistec sub-bottom profiler showing the catamaran used to tow the boomer and line-and-cone array at the surface. Power and signals are contained in the tow cable bundle on the front of the catamaran.

Digital Data Acquisition
The sidescan sonar and sub-bottom profiler data were digitized and logged on an AGCDIG digital data recorder, developed by the Geological Survey of Canada (Atlantic), running version 2.3 software. The clock in the AGCDIG was synchronized to the GPS time signal. No gains or corrections were applied to the raw logged data during digitization. Channel configurations for the logged data were:

Sidescan sonar - 80 microseconds sample interval

Channel	Use
0	120 kHz port
1	120 kHz starboard
2	330 kHz port
3	330 kHz starboard

Sub-bottom profiler – IKB Seistec - 38 microseconds sample interval

Channel	Use
0	STB Seistec line cone receiver
1	STB GF10/15P streamer hydrophone

Navigation
Navigation was provided by a Global Positioning System utilizing differential corrections broadcast by the Canadian Coast Guard. Accuracy of the navigation was about 4 m. Tracks and survey lines were run with the Regulus navigation package by ICAN Limited, Mount Pearl, NF.

Multibeam Bathymetry
Multibeam bathymetric data were collected using a Simrad EM3000 multibeam bathymetry system mounted in the hydrographic survey launch Plover (Figure 1b). The EM3000 system uses 300kHz transducer with 127 beams with a beamwidth of 1.5^o x 1.5^o. The system provides a depth resolution of 1 cm with an accuracy of 5 cm RMS. Each beam insonifies an area of approximately 1.35 m^2 at 50 metres water depth.

Each vessel used an Applied Analytics Corporation POS-MV 320 attitude sensing system with integrated differential GPS navigation system to determine the position and attitude. The systems integrate data from an inertial measurement unit and differential GPS signals. A positional accuracy 0.5 to 4 metres can be obtained using the phase differential of the GPS carrier frequency when using DGPS, and of 0.02-0.10 metres when using an RTK source. This survey was performed using DGPS data for an accuracy of 0.5 to 4 metres. A heading aiding accuracy of 0.1^o - 0.5^o can be obtained from the raw GPS data. A Kalman filter is used to improve the heading estimate to 0.05^o - 0.1^o. Vessel attitude is measured using an inertial measurement unit to provide an accuracy of 0.0003^o for pitch, roll and heading. More information on this system can be found at www.applanix.com.

Survey lines were run at a various spacing throughout the survey area to provide 200 percent coverage of the seafloor in water depths greater than about 20 metres. During the survey, data were processed using version 5.0 of the HIPS data cleaning program (CARIS by Universal Systems Limited, Fredericton, NB) on a Windows NT workstation to remove spurious soundings and navigation data and to correct for tidal variations. Data were also imported into a Linux based workstation and processed using the MBTools software developed by the Lamont-Doherty Institute. The processed

data were imported into the GRASS GIS system where shaded-colour relief images were generated and overlaid on scanned bathymetry maps of the area.

Tidal corrections were made using predicted tides for Table Head and measured tides from the tide gauge in Sydney, NS provided by the Canadian Hydrographic service.

Multibeam Backscatter

The strength of an echo from the seafloor is known as the acoustic backscatter intensity. Acoustic backscatter intensity values are controlled by the physical properties of the seafloor sediments such as the velocity of sound, the density and roughness of the sediment. Backscatter generally increases as the sediments on the seafloor become denser and less porous, and increase in grain size. Mapping the distribution of backscatter provides valuable information on the character and distribution of sediments within an area.

Seafloor Photographs

Figure 6. GSCA Icehole camera showing the flash on the left of the frame, the pinger in the centre and the camera case on the right of the frame.

Photographs were taken at 47 camera stations near Middle Shoal, and in Sydney Harbour (about 300 photographs in total) with the Icehole camera developed by GSCA (shown in Figure 6). Images were obtained on transects through the disposal site and surrounding area using 200 ASA colour print film. The photographs were processed, digitized, and stored on CD-ROM. Locations for all camera stations are and provided in Appendix IV. The photographs are shown in Appendix VI. A copy of a CDROM with the images was archived at the Geological Survey of Canada offices in Dartmouth, NS.

Seafloor Grab Samples

Figure 7. Samples were collected during Matthew 2001030 with a VanVeen grab sampler.

A 0.1 cubic metre van Veen grab sampler was used to collect sediment samples in the survey area (Figure 7). The sample locations are provided in Appendix IV. Digital images of the grabs, are incorporated as 'hotlinks' in an ArcView GIS database to provide geographically referenced access to the images. Low resolution copies of all available grab sample images are presented in this report in Appendix V. A copy of a CDROM with the images was archived at the Geological Survey of Canada offices in Dartmouth, NS.

Tides and Currents

During the survey, tides and currents for the survey area were calculated using the program Tides and Currents Pro by Nautical Software Inc. As shown in Figures 8 and 9, a tidal range of about 1 metre was predicted for Table Head, near Middle Shoal, during the survey with currents of about 0.4 knots predicted for Big Bras D'Or. A tidal range of about 1 metre was predicted for North Sydney.

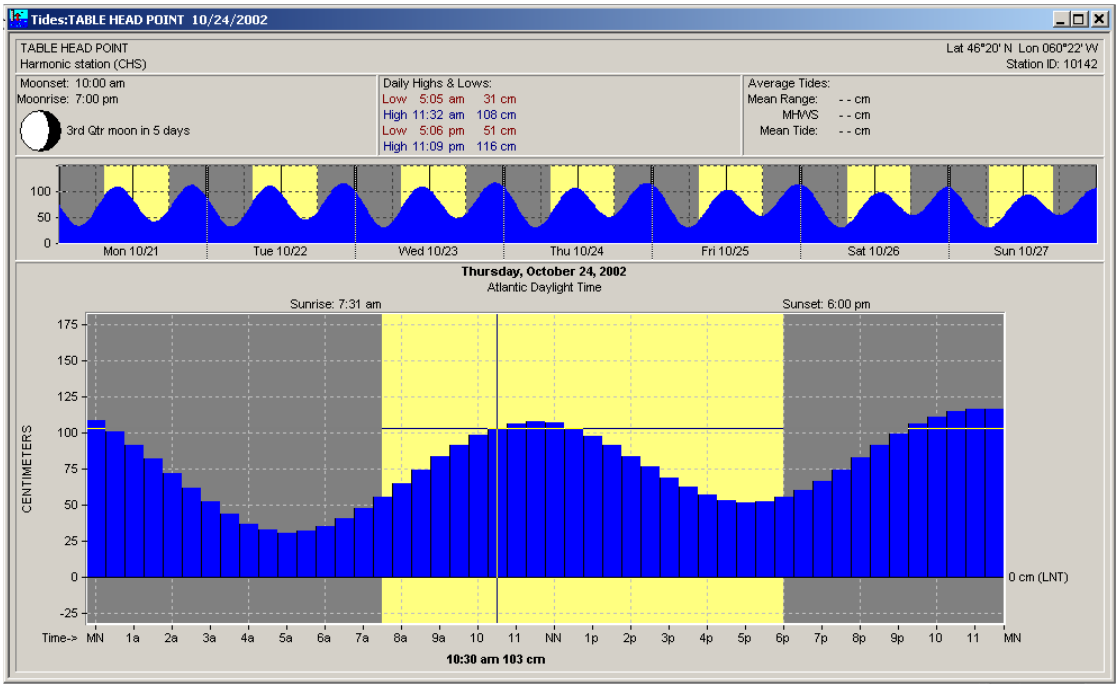

Figure 8. Predicted tides for Table Head, near Middle Shoal, Cape Breton Island for October 2002.

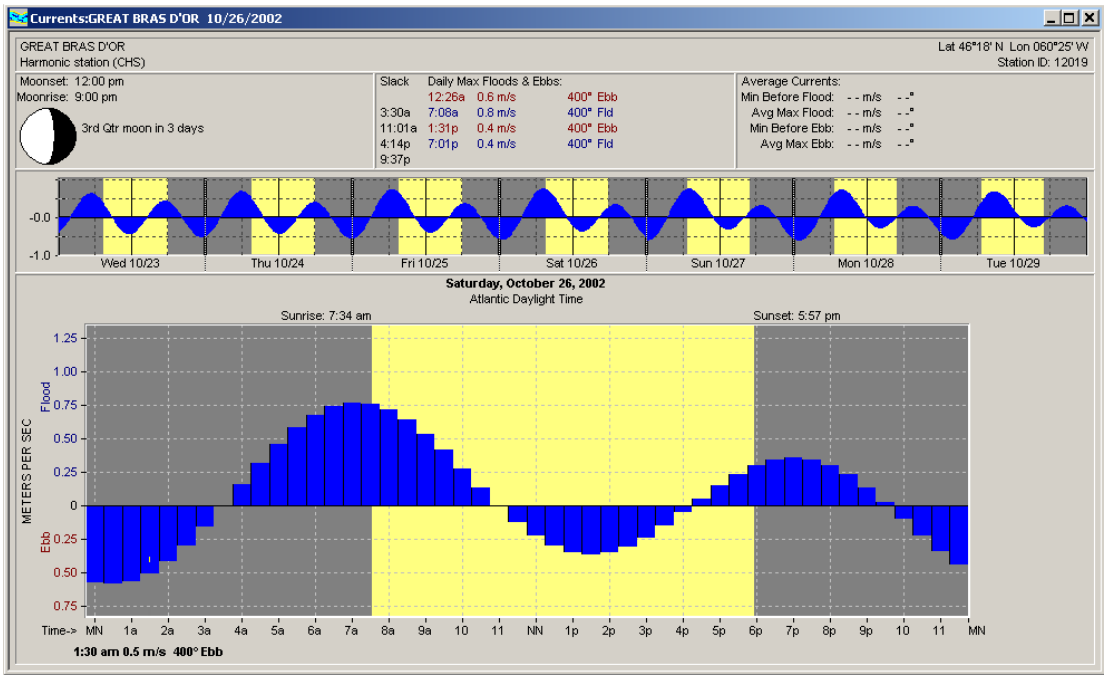

Figure 9. Predicted currents for Great Bras d'Or area during the Matthew 2002066 survey.

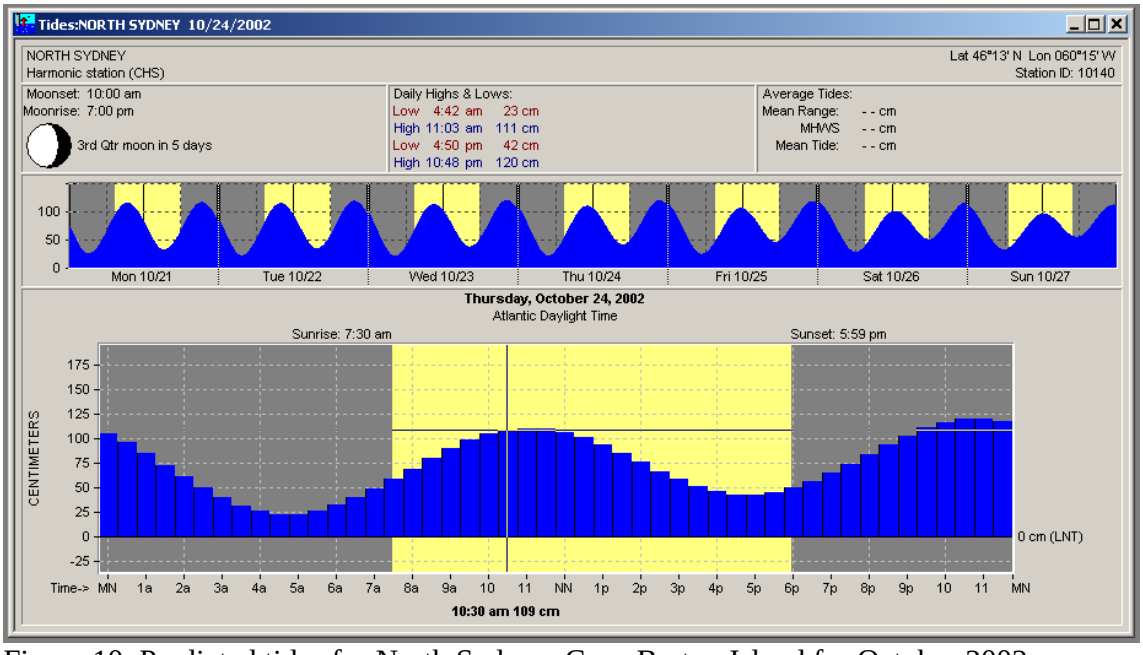

Figure 10. Predicted tides for North Sydney, Cape Breton Island for October 2002.

Preliminary Results

Middle Shoal, Cape Breton Island, Nova Scotia

A suite of data consisting of sidescan sonar, sub-bottom profiler, seafloor photographs, and grab samples were collected in St. Anns Bay and near Middle Shoal in the approach to Great Bras d'Or channel over disposal sites A, B and C during cruise Matthew 2002066. Multibeam bathymetry and backscatter data were collected over Sites A and B. A shaded colour-relief image generated from the multibeam bathymetry data shows a large cluster of dredge spoils near the centre of Site A in about 27 metres water depth, and a long linear accumulation of spoils in about 8 metres water depth in Site B (Figure 11). These dredge spoils were dumped in approved offshore disposal sites.

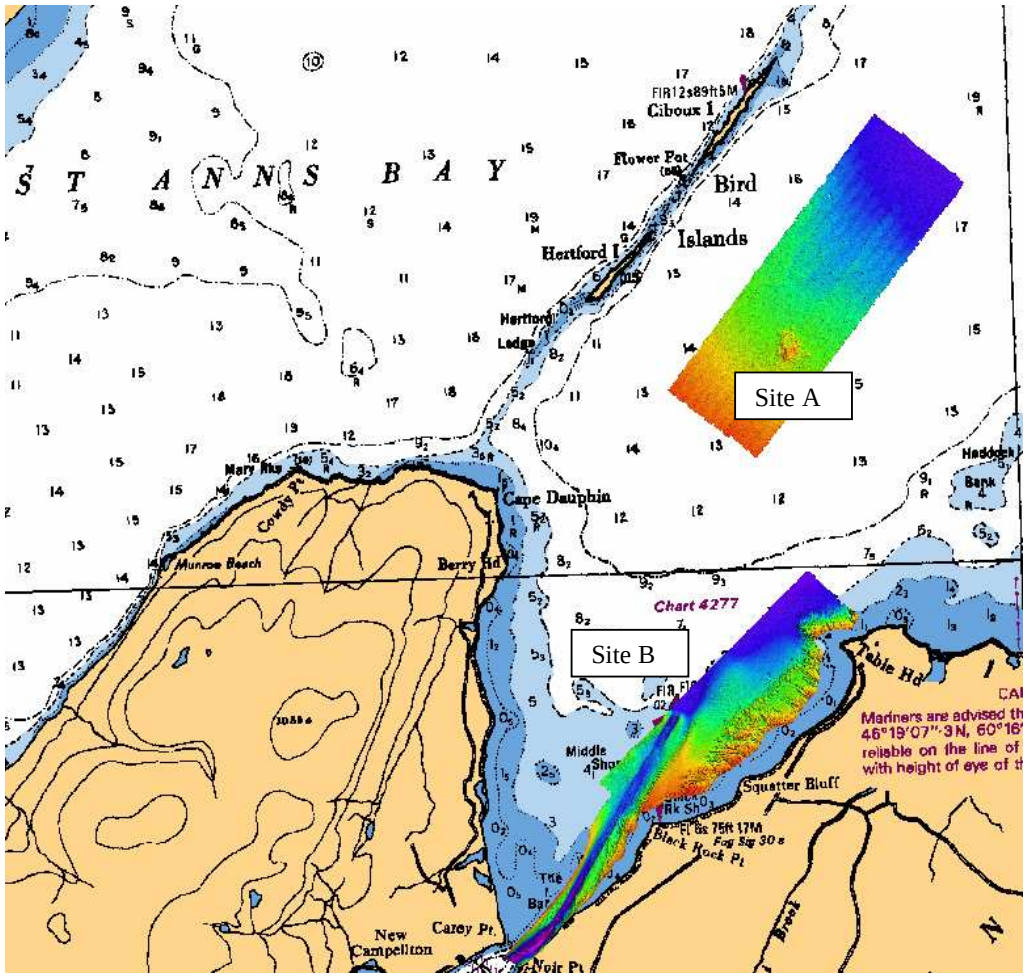

Figure 11. Coloured shaded relief image generated from multibeam bathymetry data collected near Middle Shoal in the approach to Great Bras d'Or channel over disposal sites A and B during October 2002 on survey Matthew 2002066.

Multibeam bathymetry data were processed to extract backscatter intensity values and used to generate a mosaic (shown in Figure 12). The dredge spoils are visible in the central portion of Site A and along the southeast edge of Site B.

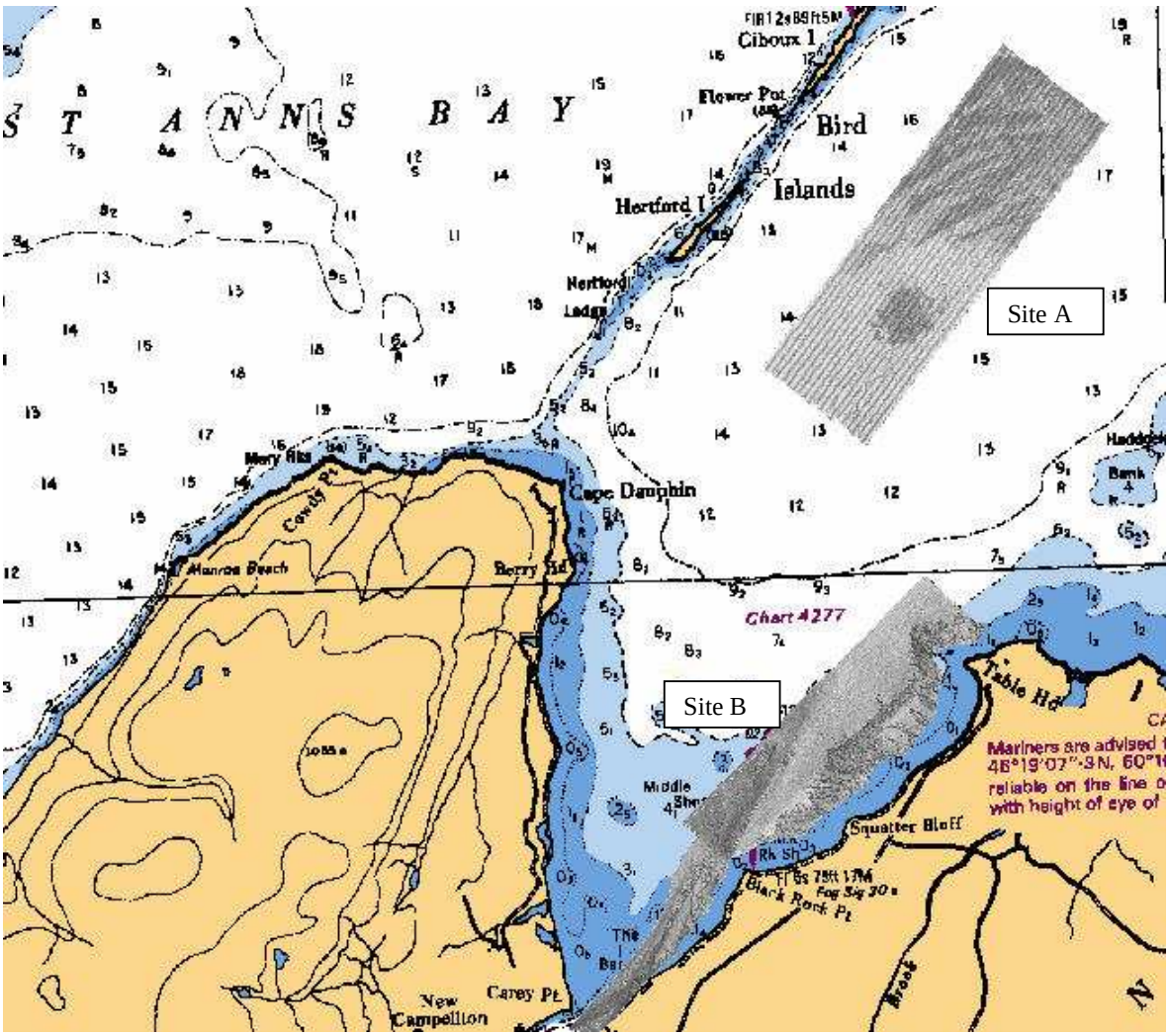

Figure 12. Backscatter intensity calculated from multibeam bathymetry collected near Middle Shoal in the approach to Great Bras d'Or channel over disposal sites A and B during October 2002 on survey Matthew 2002066

Sidescan sonar data collected over disposal sites A, B, and C were processed and used to generate mosaic (shown in Figure 13). The dredge spoils are visible in the near the center of the mosaic collected over area A and along the southeast side of the mosaic over site B. Only a small amount of material was dumped in Site C, and a small area of dredge spoil was detected.

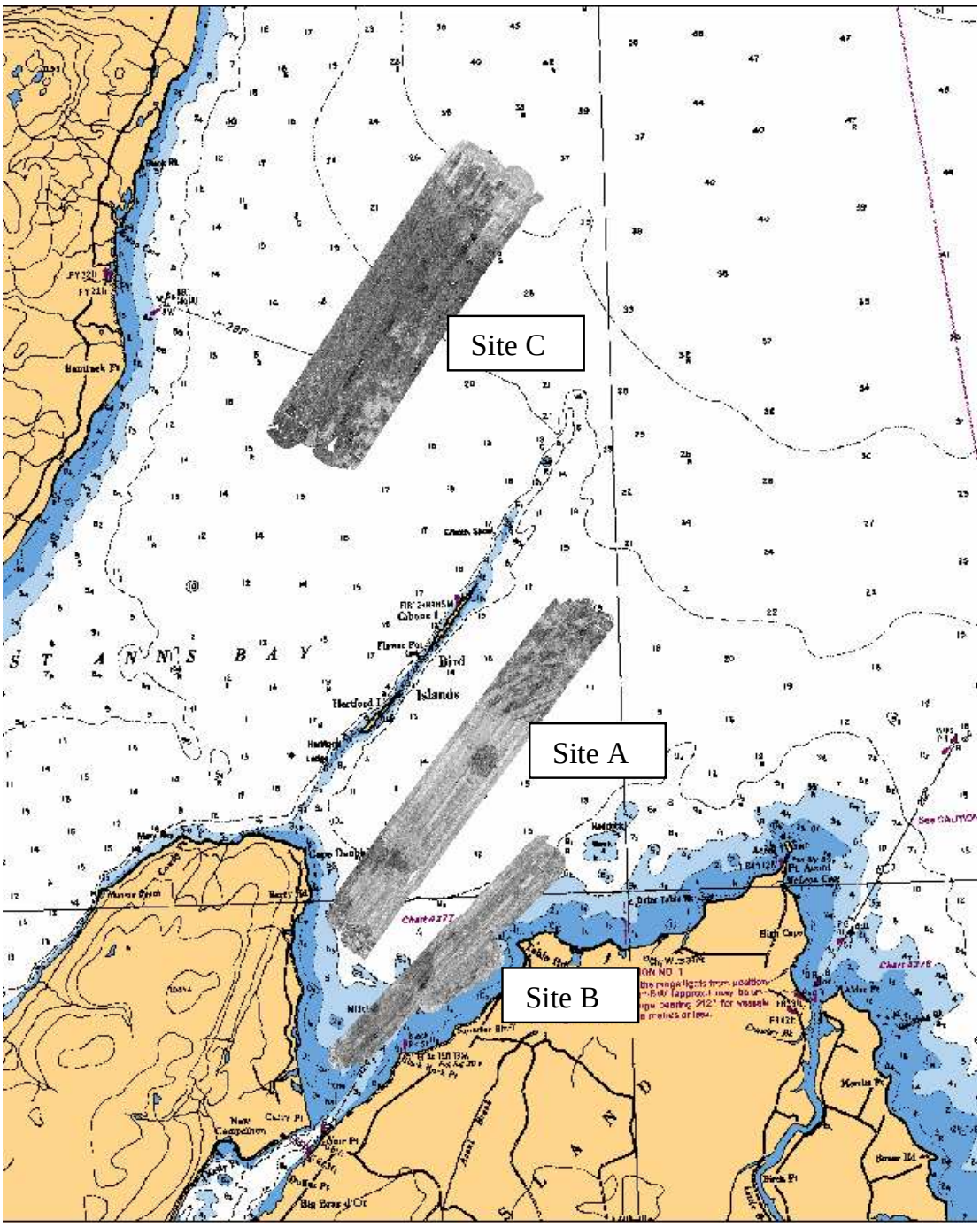

Figure 13. Sidescan sonar mosaic of data collected in St. Ann's Bay and near Middle Shoal in the approach to Great Bras d'Or channel over disposal sites A, B and C during survey Matthew 2002066.

Sydney, Cape Breton Island, Nova Scotia

During times when it was not possible to survey in Middle Shoal because of weather conditions, a suite of data consisting of sidescan sonar data, multibeam bathymetry and backscatter, sub-bottom profiler data, and seafloor photographs were collected in Sydney harbour. Figure 14a shows the ships tracks where sidescan sonar and sub-bottom profiler data were collected. The sidescan sonar data were processed to correct for geometric factors, combined into a mosaic, and overlaid on a chart. Figure 14b shows the sidescan sonar mosaic and locations where seafloor photographs were taken in Sydney. Locations for all camera stations are provided in Appendix IV. The photographs are shown in Appendix VI.

a) b)

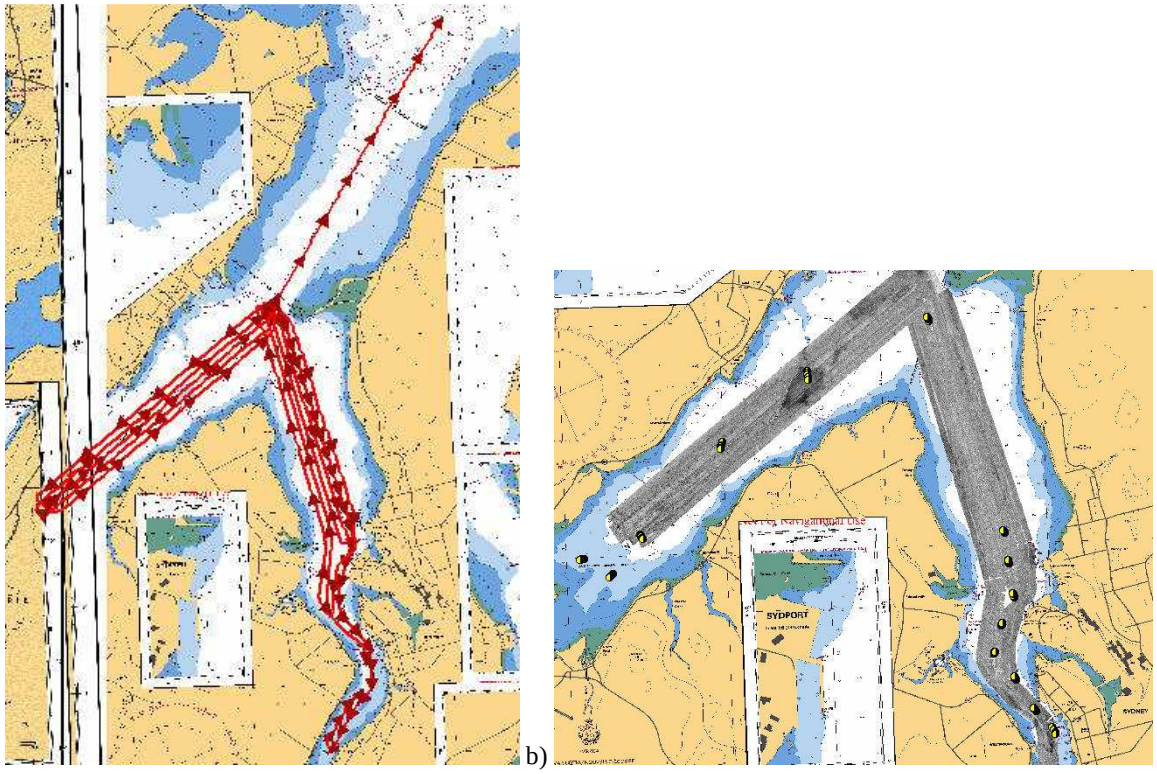

Figure 14. Location of a) ship's tracks and b) a mosaic of sidescan sonar data showing seafloor photograph locations in Sydney Harbour taken during October 2002 on survey Matthew 2002066.

Multibeam bathymetry and backscatter intensity data were collected in the shallow water portions of Sydney harbour to complement data previously collected by the Canadian Hydrographic Service. The new data were integrated with previously collected data the the amalgamated data set shown in Figure 15.

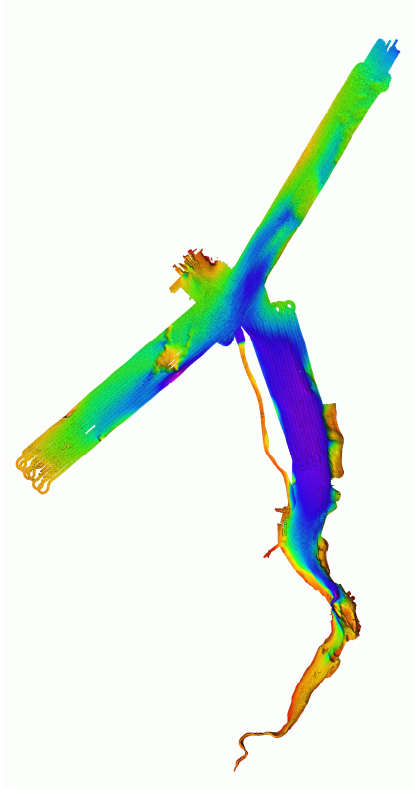

Figure 15. Multibeam bathymetry data were collected during October 2002 on survey Matthew 2002066 and integrated with existing data

Bras d'Or Lakes, Cape Breton Island, Nova Scotia

Also, during times when it was not possible to survey in Middle Shoal because of weather conditions, a suite of data consisting of sidescan sonar, sub-bottom profiler, seafloor photographs, and gravity core samples were collected near Baddeck, in the Bras d'Or Lakes. Multibeam bathymetry and backscatter data were collected in Baddeck Harbour and along a transit through St Patricks Channel to complement data previously collected by the Canadian Hydrographic Service. A shaded colour-relief image generated from the multibeam bathymetry data (Figure 16). A large sinkhole, with a depth of about 30 metres, is evident in the northeast corner of the data.

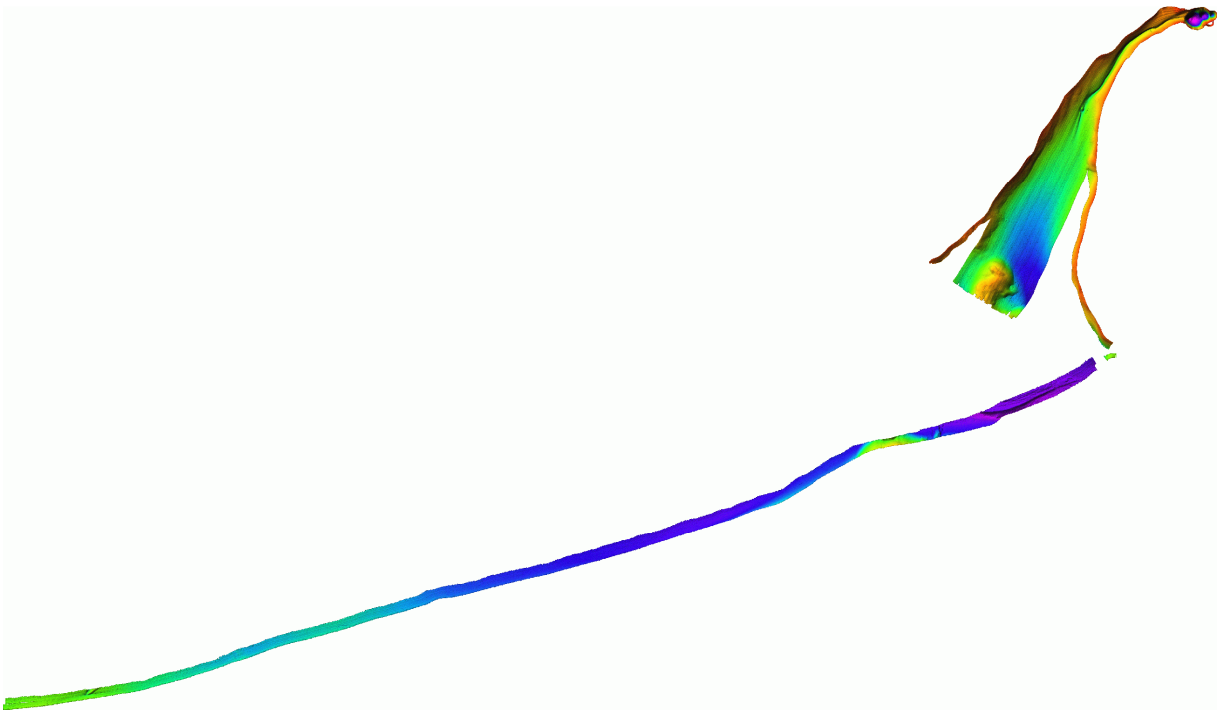

Figure 16. Coloured shaded relief image generated from multibeam bathymetry data collected in Baddeck Harbour and along a transit through St Patricks Channel during October 2002 on survey Matthew 2002066.

Sidescan sonar data and sub-bottom profiler data were collected along a transect through St. Andrews channel to Iona and back to Baddeck as shown in Figure 17. Core samples were taken in St Patricks channel.

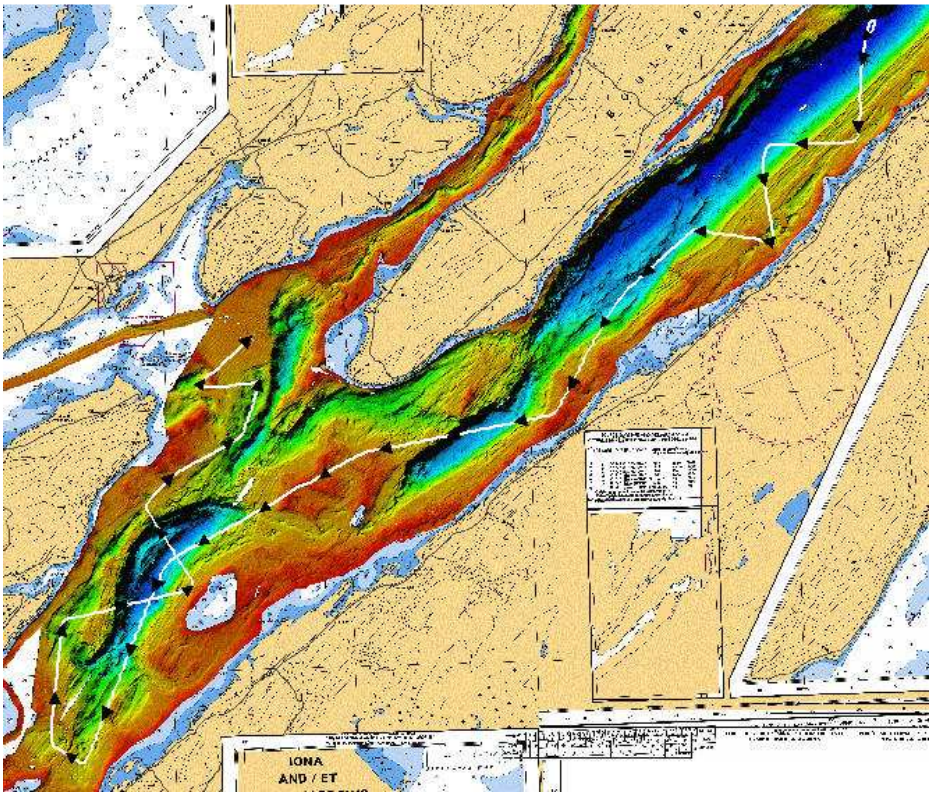

Figure 17. Sidescan sonar and sub-bottom profiler data were collected a transect through St. Andrews channel to Iona and back to Baddeck during survey Matthew 2002066.

Access to Data and Samples

The sidescan sonar, sub-bottom profiler, multibeam bathymetry, photographs, and grab samples collected during this survey are archived at the Geological Survey of Canada - Atlantic, in Dartmouth Nova Scotia. For access to the geophysical data and samples contact the senior scientist for the survey, Russell Parrott (902-426-7059) or Susan Merchant of the GSCA. Digitally processed sidescan sonar mosaics, ExaByte tapes containing the sidescan sonar data in SEG-Y format, CD-ROMs containing the sidescan sonar and sub-bottom profiler data in SEG-Y format, and ExaBytes tapes of the raw data are available for viewing.

Acknowledgements

We would like to thank the officers, crew onboard the CCGS *Matthew* for their assistance in the various surveys and in collecting and delivering the sediment samples.

References

Nautical Software Inc, Tides and Currents 4.2, http://www.tides.com

Appendices

Appendix I - Survey Particulars

Name of Vessel:	CCGS Matthew
Vessel captain:	Robert Gray
Dates of Survey:	19-30 October 2002
Area of Operation:	Middle Shoal Area, Cape Breton Island, Nova Scotia
Senior Scientist:	Russell Parrott, GSC

Appendix II - Survey Personnel

Geological Survey of Canada Atlantic

Russell Parrott	Senior Scientist
Anthony Atkinson	Electronics Technologist
Robert Murphy	Sampling/photography
Darrel Beaver	Multibeam bathymetry data collection/multibeam data processing
Paul Girouard	Navigation/database entry/computers
Angus Robertson	Navigation/database entry/sampling
John Shaw	Marine Geologist

Others

Walli Rainey	Geophysical watckkeeping and record keeping
Lori Cook	Geophysical watckkeeping and record keeping

Appendix III - Summary of Activities (all times in GMT)

Day 290 – Thursday 17 October 2002 – Mobilization

GSC personnel commence mobilization of gear on CCGS Matthew at BIO.

Day 291 – Friday 18 October 2002 – Mobilization

GSC personnel continue with mobilization of gear on CCGS Matthew at BIO.

Day 292 – Saturday 19 October 2002 – Mobilization and Transit to survey site

11:00 GSC personnel continue with mobilization of gear on CCGS Matthew at BIO.
16:00 CCGS Matthew departs BIO en route to North Sydney, NS.

Day 293 – Sunday 20 October 2002 – Mobilization and start surveys

10:00 GSC personnel depart BIO en route to North Sydney, NS.
13:00 CCGS Matthew arrives North Sydney, NS.
17:00 GSC personnel arrive North Sydney, NS and join CCGS Matthew. Complete connection of survey equipment in laboratory and set up computer network.
23:30 Lab set up complete.

Day 294 – Monday 21 October 2002 – Geophysical surveys

08:00 CCGS Matthew departs North Sydney, NS for survey site.
11:10 Deploy launch Plover for Survey of near shore area near Table Head - Site B.
11:45 Deploy sidescan sonar, Seistec sub-bottom profiler and TrackPoint system and run a series of lines on Site B, near Table Head, east of the dredged channel in Middle Shoal, Great Bras D'Or. 100 metre range (each side), 150 metre line spacing.
14:09 Recover launch for lunch. Continuing with geophysical surveys.
15:36 Deploy launch.
20:13 End of survey at Site B. Recover geophysical gear.
20:26 Recover launch.
21:31 Deploy geophysical gear for survey of Site C.
23:59 Continuing with sidescan sonar and sub-bottom profiler survey of Site C.

Day 295 – Tuesday 22 October 2002 – Survey and sampling Middle Shoal

00:01 Continuing with sidescan sonar and sub-bottom profiler survey of Site C.
11:17 Deploy multibeam launch for continuation of survey of disposal Site B – Table Head
12:28 Recover geophysical gear and steam to Site B.
13:57 Commence seafloor photographs and grab stations at SiteA B near Table Head in Great Bras D'Or channel. Digital pictures taken at of samples at grab sites.
14:45 Recover multibeam launch for lunch.
15:26 Deploy multibeam launch. Continue with samples and photography.
20:15 Recover multibeam launch.
21:00 Finish sampling. Anchor behind Bird Island for night.

Day 296 – Wednesday 23 October 2002 – Survey and sampling

10:37 Deploy multibeam launch for continuation of survey of disposal Site B – Table Head.
10:45 Deploy geophysical gear for survey of site A – near Bird Islands.
11:18 Plover recovered. Problems with the velocimeter.
16:52 Deploy launch after re-termination of velocimeter cable
20:17 Recover multibeam launch.

22:35 Recover geophysical gear and steam towards Middle Shoal.
23:30 Proceed through Great Bras D'Or channel and anchor for night.

Day 297 – Thursday 24 October 2002 – Survey and sampling, Sydney Harbour

10:30 Deploy multibeam launch for continuation of survey of disposal Site A.
10:45 Proceed through Great Bras d'Or channel to survey site. Strong northerly winds make site unsuitable for survey operations.
11:30 Recover multibeam launch and transit to Sydney.
13:04 Deploy multibeam launch to collect data near Muggah Creek.
13:15 Deploy geophysical gear for survey in Sydney Harbour. Run sidescan sonar and sub-bottom profiler lines in South Arm.
14:58 Recover launch for lunch.
15:49 Deploy launch.
20:10 Recover multibeam launch. Continue with geophysical surveys in Northwest Arm Sydney.
22:45 Recover geophysical gear.
23:00 Tie up at government wharf in North Sydney (near Newfoundland Ferry Terminal) for the night.

Day 298 – Friday 25 October 2002 – Survey and sampling, Sydney Harbour

11:00 Discuss bathymetry coverage available for Sydney Harbour with Jon Griffin of CHS currently surveying in Sydney harbour with the CCGS Creed.
12:30 Deploy multibeam launch for continuation of survey near Muggah Creek
12:42 Commence camera stations in South Arm for a series of stations between Muggah Creek and the steel mill.
14:45 Recover launch.
15:34 Deploy launch – continue with photograph stations in South Arm and Northwest Arm.
17:00 Deploy geophysical gear for survey in Sydney Harbour. Run sidescan sonar and sub-bottom profiler lines in Northwest Arm.
20:30 Recover multibeam launch. Continue with geophysical surveys in Northwest Arm Sydney.
22:30 Recover geophysical gear and transit to Middle Shoal disposal Site C.
23:45 Start Grab sample at Site C

Day 299 – Saturday 26 October 2002 – Survey and sampling, Middle Shoal

00:00 Continue with sampling and photographs.
03:05 Finish sampling and photographs of Site C.
10:41 Deploy multibeam launch to start survey of Site A near Bird Island at Middle Shoal.
10:53 Start photographs of Site A, including a transect through the disposal pile.
14:15 End camera transects, start grab samples at Site A.
14:32 Recover launch Plover.
15:23 Deploy launch.
15:29 Continue with grabs.
17:16 Start camera stations at Site B.
19:51 Finish camera stations.
19:57 Recover Plover and steam to Baddeck. Winds of 40-50 knots forecast.
22:00 Arrive Baddeck and tie to wharf. John Shaw arrives and come aboard
22:30 Creed arrives. Disconnect Track point transducer from starboard side to allow Creed to tie up alongside.

Day 300 – Sunday 27 October 2002 – Standby in Baddeck

00:00 Tied to wharf in Baddeck due to forecast winds of 45-50 knots.

11:00 Murphy and Beaver to Sydney and retrieve van, then to BIO to get 3 metre core barrels for corer. Heavy seas overtopping causeway encountered when crossing Canso Causeway by van. Shaw picks sample sites.

Day 301 – Monday 28 October 2002 – Survey and sampling

12:07 Plover deployed for survey of Baddeck Bay.

12:37 Start gravity core program in St Patrick's Channel.

14:40 Recover launch Plover.

15:15 Deploy launch. Continue with gravity cores.

19:45 Finish gravity core program and steam to Baddeck. Shaw picks survey lines.

Day 302 – Tuesday 29 October 2002 – Survey and sampling

11:35 Plover deployed for survey of Baddeck Bay. Steam to St. Andrew's Channel.

13:08 Deploy sidescan and Seistec to determine nature of features identified on multibeam bathymetry. 30-40 knot winds. Heave on Seistec records. Much of seafloor in shallow water is quite hard with little penetration. Pockets present filled with surficial sediment. Sidescan sonar kept about 7 metres below surface to provide records on bank tops only.

20:00 Recover launch Plover in Baddeck.

21:00 Tie up at wharf in Baddeck.

22:00 Creed tied up alongside Matthew. Fred Jodrey arrives with passenger van for return trip to Halifax.

Day 303 – Wednesday 30 October 2002 – Transit from Baddeck to Halifax

11:35 Load van with computers and grab samples.
Depart Baddeck. CCGS Matthew departs Baddeck for Kelly's Cove to wait for favourable weather conditions for transit around Cape Breton Island.
Arrive BIO and unload gear.

Day 305 – Friday 2 November 2002 – Demobilize gear

CCGS Matthew arrives Halifax. GSC personnel demobilize geophysical gear.

Appendix IV - Sample and Camera Station Locations

Camera Stations

Station	Type	Exp.	Day/Time	Latitude	Longitude	Depth	Geographic Location
1	Camera	1	295135800	46.322168	-60.373733	11.1	Middle Shoal, Gulf of St. Lawrence
1	Camera	2	295140000	46.322353	-60.373487	11.1	Middle Shoal, Gulf of St. Lawrence
1	Camera	3	295140100	46.322633	-60.373253	11.1	Middle Shoal, Gulf of St. Lawrence
1	Camera	4	295140200	46.322818	-60.372830	11.1	Middle Shoal, Gulf of St. Lawrence
1	Camera	5	295140400	46.323192	-60.371785	11.1	Middle Shoal, Gulf of St. Lawrence
2	Camera	1	295142600	46.321807	-60.374178	11.2	Middle Shoal, Gulf of St. Lawrence
2	Camera	2	295142723	46.322083	-60.373940	11.2	Middle Shoal, Gulf of St. Lawrence
2	Camera	3	295142810	46.322227	-60.373657	11.2	Middle Shoal, Gulf of St. Lawrence
2	Camera	4	295143015	46.322617	-60.372833	11.2	Middle Shoal, Gulf of St. Lawrence
2	Camera	5	295143102	46.322753	-60.372513	11.2	Middle Shoal, Gulf of St. Lawrence
3	Camera	1	295153723	46.324175	-60.372502	11.7	Middle Shoal, Gulf of St. Lawrence
3	Camera	2	295153811	46.324042	-60.372063	11.7	Middle Shoal, Gulf of St. Lawrence
3	Camera	3	295153855	46.323962	-60.371800	11.7	Middle Shoal, Gulf of St. Lawrence
3	Camera	4	295153936	46.323885	-60.371568	11.7	Middle Shoal, Gulf of St. Lawrence
3	Camera	5	295154021	46.323820	-60.371338	11.7	Middle Shoal, Gulf of St. Lawrence
4	Camera	1	295155030	46.322020	-60.370082	7.0	Middle Shoal, Gulf of St. Lawrence
4	Camera	2	295155114	46.322078	-60.369567	7.0	Middle Shoal, Gulf of St. Lawrence
4	Camera	3	295155158	46.322165	-60.369230	7.0	Middle Shoal, Gulf of St. Lawrence
4	Camera	4	295155255	46.322313	-60.368888	7.0	Middle Shoal, Gulf of St. Lawrence
4	Camera	5	295155341	46.322470	-60.368678	7.0	Middle Shoal, Gulf of St. Lawrence
5	Camera	1	295160549	46.320905	-60.370230	8.4	Middle Shoal, Gulf of St. Lawrence
5	Camera	2	295160646	46.320898	-60.370043	8.4	Middle Shoal, Gulf of St. Lawrence
5	Camera	3	295160738	46.320932	-60.369667	8.4	Middle Shoal, Gulf of St. Lawrence
5	Camera	4	295160818	46.320942	-60.369455	8.4	Middle Shoal, Gulf of St. Lawrence
5	Camera	5	295160902	46.320980	-60.369213	8.4	Middle Shoal, Gulf of St. Lawrence
6	Camera	1	295162252	46.320177	-60.373378	8.8	Middle Shoal, Gulf of St. Lawrence
6	Camera	2	295162341	46.320195	-60.372638	8.8	Middle Shoal, Gulf of St. Lawrence
6	Camera	3	295162424	46.320337	-60.372450	8.8	Middle Shoal, Gulf of St. Lawrence
6	Camera	4	295162500	46.320460	-60.372303	8.8	Middle Shoal, Gulf of St. Lawrence
6	Camera	5	295162545	46.320623	-60.372115	8.8	Middle Shoal, Gulf of St. Lawrence
23	Camera	1	298124200	46.139990	-60.200457	11.0	South Arm, Sydney area, CB
23	Camera	2	298124322	46.139612	-60.200023	11.0	South Arm, Sydney area, CB
23	Camera	3	298124436	46.139282	-60.199770	11.0	South Arm, Sydney area, CB
23	Camera	4	298124506	46.139140	-60.199702	11.0	South Arm, Sydney area, CB
23	Camera	5	298124542	46.138922	-60.199690	11.0	South Arm, Sydney area, CB
24	Camera	1	298130007	46.142417	-60.203533	18.0	South Arm, Sydney area, CB
24	Camera	2	298130052	46.142535	-60.203705	18.0	South Arm, Sydney area, CB
24	Camera	3	298130140	46.142642	-60.203862	18.0	South Arm, Sydney area, CB
24	Camera	4	298130220	46.142747	-60.203947	18.0	South Arm, Sydney area, CB
24	Camera	5	298130258	46.142833	-60.204020	18.0	South Arm, Sydney area, CB
25	Camera	1	298131542	46.147060	-60.207530	16.0	South Arm, Sydney area, CB
25	Camera	2	298131618	46.147128	-60.207612	16.0	South Arm, Sydney area, CB
25	Camera	3	298131705	46.147233	-60.207705	16.0	South Arm, Sydney area, CB
25	Camera	4	298131746	46.147335	-60.207785	16.0	South Arm, Sydney area, CB
25	Camera	5	298131832	46.147462	-60.207848	16.0	South Arm, Sydney area, CB
26	Camera	1	298133217	46.150917	-60.211827	0.0	South Arm, Sydney area, CB
26	Camera	2	298133255	46.150977	-60.211832	0.0	South Arm, Sydney area, CB
26	Camera	3	298133342	46.151052	-60.211810	0.0	South Arm, Sydney area, CB
26	Camera	4	298133430	46.151132	-60.211723	0.0	South Arm, Sydney area, CB
26	Camera	5	298133514	46.151195	-60.211583	0.0	South Arm, Sydney area, CB
27	Camera	1	298134644	46.154860	-60.210170	0.0	South Arm, Sydney area, CB
27	Camera	2	298134728	46.154963	-60.210112	0.0	South Arm, Sydney area, CB

27 Camera	3	298134814	46.155040	-60.210017	0.0	South Arm, Sydney area, CB
27 Camera	4	298134900	46.155125	-60.209925	0.0	South Arm, Sydney area, CB
27 Camera	5	298134943	46.155217	-60.209882	0.0	South Arm, Sydney area, CB
28 Camera	1	298141027	46.158848	-60.207160	18.0	South Arm, Sydney area, CB
28 Camera	2	298141128	46.159032	-60.207247	18.0	South Arm, Sydney area, CB
28 Camera	3	298141214	46.159173	-60.207320	18.0	South Arm, Sydney area, CB
28 Camera	4	298141258	46.159318	-60.207408	18.0	South Arm, Sydney area, CB
28 Camera	5	298141350	46.159467	-60.207505	18.0	South Arm, Sydney area, CB
29 Camera	1	298142448	46.163828	-60.208148	19.0	South Arm, Sydney area, CB
29 Camera	2	298142532	46.163985	-60.208205	19.0	South Arm, Sydney area, CB
29 Camera	3	298142619	46.164115	-60.208235	19.0	South Arm, Sydney area, CB
29 Camera	4	298142705	46.164225	-60.208253	19.0	South Arm, Sydney area, CB
29 Camera	5	298142748	46.164303	-60.208265	19.0	South Arm, Sydney area, CB
30 Camera	1	298143652	46.168287	-60.208693	20.0	South Arm, Sydney area, CB
30 Camera	2	298143733	46.168427	-60.208783	20.0	South Arm, Sydney area, CB
30 Camera	3	298143815	46.168512	-60.208910	20.0	South Arm, Sydney area, CB
30 Camera	4	298143900	46.168572	-60.209042	20.0	South Arm, Sydney area, CB
30 Camera	5	298143942	46.168613	-60.209190	20.0	South Arm, Sydney area, CB
31 Camera	1	298154821	46.199205	-60.223057	17.0	North West Arm, Sydney area, CB
31 Camera	2	298154907	46.199358	-60.223082	17.0	North West Arm, Sydney area, CB
31 Camera	3	298154950	46.199495	-60.223178	17.0	North West Arm, Sydney area, CB
31 Camera	4	298155034	46.199617	-60.223255	17.0	North West Arm, Sydney area, CB
31 Camera	5	298155122	46.199738	-60.223333	17.0	North West Arm, Sydney area, CB
32 Camera	1	298160546	46.192563	-60.248645	13.0	North West Arm, Sydney area, CB
32 Camera	2	298160638	46.192267	-60.248625	13.0	North West Arm, Sydney area, CB
32 Camera	3	298160725	46.192032	-60.248593	13.0	North West Arm, Sydney area, CB
32 Camera	4	298160831	46.191667	-60.248557	13.0	North West Arm, Sydney area, CB
32 Camera	5	298160924	46.191357	-60.248530	13.0	North West Arm, Sydney area, CB
33 Camera	1	298162816	46.182758	-60.266822	15.0	North West Arm, Sydney area, CB
33 Camera	2	298163027	46.182273	-60.266980	15.0	North West Arm, Sydney area, CB
33 Camera	3	298163126	46.182092	-60.267055	15.0	North West Arm, Sydney area, CB
33 Camera	4	298163218	46.181917	-60.267138	15.0	North West Arm, Sydney area, CB
33 Camera	5	298163309	46.181753	-60.267238	15.0	North West Arm, Sydney area, CB
34 Camera	1	298164516	46.169827	-60.284448	12.0	North West Arm, Sydney area, CB
34 Camera	2	298164604	46.169670	-60.284357	12.0	North West Arm, Sydney area, CB
34 Camera	3	298164658	46.169507	-60.284238	12.0	North West Arm, Sydney area, CB
34 Camera	4	298164754	46.169325	-60.284093	12.0	North West Arm, Sydney area, CB
34 Camera	5	298164848	46.169138	-60.283940	12.0	North West Arm, Sydney area, CB
35 Camera	1	298170000	46.164335	-60.290453	9.0	North West Arm, Sydney area, CB
35 Camera	2	298170105	46.164152	-60.290603	9.0	North West Arm, Sydney area, CB
35 Camera	3	298170155	46.164015	-60.290742	9.0	North West Arm, Sydney area, CB
35 Camera	4	298170246	46.163898	-60.290893	9.0	North West Arm, Sydney area, CB
35 Camera	5	298170338	46.163788	-60.291053	9.0	North West Arm, Sydney area, CB
36 Camera	1	298171410	46.166592	-60.296265	9.0	North West Arm, Sydney area, CB
36 Camera	2	298171458	46.166623	-60.296467	9.0	North West Arm, Sydney area, CB
36 Camera	3	298171550	46.166592	-60.296717	9.0	North West Arm, Sydney area, CB
36 Camera	4	298171649	46.166502	-60.296977	9.0	North West Arm, Sydney area, CB
36 Camera	5	298171738	46.166408	-60.297178	9.0	North West Arm, Sydney area, CB
43 Camera	1	299014233	46.421997	-60.395425	37.0	Middle Shoal, Gulf of St. Lawrence
43 Camera	2	299014330	46.422000	-60.395550	37.0	Middle Shoal, Gulf of St. Lawrence
43 Camera	3	299014426	46.422017	-60.395675	37.0	Middle Shoal, Gulf of St. Lawrence
43 Camera	4	299014518	46.422033	-60.395792	37.0	Middle Shoal, Gulf of St. Lawrence
43 Camera	5	299014606	46.422040	-60.395920	37.0	Middle Shoal, Gulf of St. Lawrence
44 Camera	1	299015847	46.427937	-60.400912	36.0	Middle Shoal, Gulf of St. Lawrence
44 Camera	2	299015939	46.427985	-60.401115	36.0	Middle Shoal, Gulf of St. Lawrence

44 Camera	3	299020019	46.428035	-60.401175	36.0	Middle Shoal, Gulf of St. Lawrence
44 Camera	4	299020103	46.428085	-60.401167	36.0	Middle Shoal, Gulf of St. Lawrence
44 Camera	5	299020150	46.428132	-60.401100	36.0	Middle Shoal, Gulf of St. Lawrence
45 Camera	1	299021417	46.435350	-60.387157	42.0	Middle Shoal, Gulf of St. Lawrence
45 Camera	2	299021503	46.435368	-60.387108	42.0	Middle Shoal, Gulf of St. Lawrence
45 Camera	3	299021547	46.435383	-60.387122	42.0	Middle Shoal, Gulf of St. Lawrence
45 Camera	4	299021652	46.435388	-60.387222	42.0	Middle Shoal, Gulf of St. Lawrence
46 Camera	1	299022956	46.446977	-60.377228	46.0	Middle Shoal, Gulf of St. Lawrence
46 Camera	2	299023046	46.447050	-60.377107	46.0	Middle Shoal, Gulf of St. Lawrence
46 Camera	3	299023125	46.447102	-60.377010	46.0	Middle Shoal, Gulf of St. Lawrence
46 Camera	4	299023217	46.447138	-60.376853	46.0	Middle Shoal, Gulf of St. Lawrence
47 Camera	1	299024243	46.455595	-60.370823	53.0	Middle Shoal, Gulf of St. Lawrence
47 Camera	2	299024335	46.455552	-60.370660	53.0	Middle Shoal, Gulf of St. Lawrence
47 Camera	3	299024442	46.455503	-60.370452	53.0	Middle Shoal, Gulf of St. Lawrence
47 Camera	4	299024532	46.455478	-60.370287	53.0	Middle Shoal, Gulf of St. Lawrence
47 Camera	5	299024622	46.455468	-60.370118	53.0	Middle Shoal, Gulf of St. Lawrence
48 Camera	1	299025757	46.462752	-60.361078	68.0	Middle Shoal, Gulf of St. Lawrence
48 Camera	2	299025844	46.462762	-60.361087	68.0	Middle Shoal, Gulf of St. Lawrence
48 Camera	3	299025928	46.462758	-60.361108	68.0	Middle Shoal, Gulf of St. Lawrence
48 Camera	4	299030020	46.462798	-60.361075	68.0	Middle Shoal, Gulf of St. Lawrence
48 Camera	5	299030104	46.462840	-60.360992	68.0	Middle Shoal, Gulf of St. Lawrence
49 Camera	1	299105507	46.377588	-60.348190	36.0	Middle Shoal, Gulf of St. Lawrence
49 Camera	2	299105546	46.377423	-60.348060	36.0	Middle Shoal, Gulf of St. Lawrence
49 Camera	3	299105631	46.377238	-60.347973	36.0	Middle Shoal, Gulf of St. Lawrence
49 Camera	4	299105709	46.377090	-60.347932	36.0	Middle Shoal, Gulf of St. Lawrence
49 Camera	5	299105749	46.376930	-60.347880	36.0	Middle Shoal, Gulf of St. Lawrence
50 Camera	1	299110810	46.375882	-60.352120	35.0	Middle Shoal, Gulf of St. Lawrence
50 Camera	2	299110857	46.375738	-60.352192	35.0	Middle Shoal, Gulf of St. Lawrence
50 Camera	3	299110959	46.375570	-60.352233	35.0	Middle Shoal, Gulf of St. Lawrence
50 Camera	4	299111045	46.375432	-60.352242	35.0	Middle Shoal, Gulf of St. Lawrence
50 Camera	5	299111138	46.375257	-60.352262	35.0	Middle Shoal, Gulf of St. Lawrence
51 Camera	1	299112143	46.369767	-60.357542	34.0	Middle Shoal, Gulf of St. Lawrence
51 Camera	2	299112240	46.369542	-60.357785	34.0	Middle Shoal, Gulf of St. Lawrence
51 Camera	3	299112327	46.369373	-60.358020	34.0	Middle Shoal, Gulf of St. Lawrence
51 Camera	4	299112441	46.369127	-60.358390	34.0	Middle Shoal, Gulf of St. Lawrence
51 Camera	5	299112540	46.368932	-60.358685	34.0	Middle Shoal, Gulf of St. Lawrence
52 Camera	1	299113536	46.361897	-60.364705	29.0	Middle Shoal, Gulf of St. Lawrence
52 Camera	2	299113624	46.361740	-60.364845	29.0	Middle Shoal, Gulf of St. Lawrence
52 Camera	3	299113716	46.361590	-60.364977	29.0	Middle Shoal, Gulf of St. Lawrence
52 Camera	4	299113829	46.361390	-60.365155	29.0	Middle Shoal, Gulf of St. Lawrence
52 Camera	5	299113928	46.361230	-60.365327	29.0	Middle Shoal, Gulf of St. Lawrence
53 Camera	1	299115141	46.361075	-60.374530	31.0	Middle Shoal, Gulf of St. Lawrence
53 Camera	2	299115229	46.360845	-60.374472	31.0	Middle Shoal, Gulf of St. Lawrence
53 Camera	3	299115309	46.360672	-60.374493	31.0	Middle Shoal, Gulf of St. Lawrence
53 Camera	4	299115409	46.360417	-60.374550	31.0	Middle Shoal, Gulf of St. Lawrence
53 Camera	5	299115506	46.360150	-60.374607	31.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	1	299122743	46.360512	-60.367472	31.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	2	299122826	46.360385	-60.367513	31.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	3	299122914	46.360192	-60.367523	31.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	4	299123011	46.359992	-60.367458	31.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	5	299123127	46.359752	-60.367398	31.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	6	299123230	46.359582	-60.367432	31.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	7	299123320	46.359418	-60.367435	31.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	8	299123406	46.359248	-60.367415	31.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	9	299123449	46.359100	-60.367383	31.0	Middle Shoal, Gulf of St. Lawrence

54 Camera	10	299123530	46.358968	-60.367342	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	11	299123616	46.358828	-60.367323	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	12	299123658	46.358712	-60.367357	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	13	299123738	46.358617	-60.367422	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	14	299123841	46.358463	-60.367562	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	15	299123924	46.358347	-60.367595	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	16	299124013	46.358167	-60.367550	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	17	299124053	46.358017	-60.367472	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	18	299124138	46.357863	-60.367393	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	19	299124214	46.357745	-60.367332	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	20	299124301	46.357578	-60.367213	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	21	299124400	46.357372	-60.367075	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	22	299124502	46.357162	-60.366962	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	23	299124558	46.356970	-60.366842	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	24	299124656	46.356793	-60.366720	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	25	299124754	46.356595	-60.366633	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	26	299124856	46.356382	-60.366552	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	27	299124958	46.356162	-60.366442	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	28	299125100	46.355940	-60.366278	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	29	299125147	46.355778	-60.366135	28.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	30	299125246	46.355562	-60.365933	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	31	299125346	46.355353	-60.365712	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	32	299125437	46.355163	-60.365520	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	33	299125526	46.354987	-60.365328	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	34	299125609	46.354858	-60.365150	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	35	299125654	46.354710	-60.364962	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	36	299125732	46.354593	-60.364807	30.0	Middle Shoal, Gulf of St. Lawrence
54 Camera	37	299125817	46.354467	-60.364610	30.0	Middle Shoal, Gulf of St. Lawrence
55 Camera	1	299132618	46.355870	-60.363663	30.0	Middle Shoal, Gulf of St. Lawrence
55 Camera	2	299132717	46.355672	-60.363463	30.0	Middle Shoal, Gulf of St. Lawrence
55 Camera	3	299132815	46.355488	-60.363198	30.0	Middle Shoal, Gulf of St. Lawrence
55 Camera	4	299132855	46.355365	-60.362998	30.0	Middle Shoal, Gulf of St. Lawrence
55 Camera	5	299132928	46.355270	-60.362832	30.0	Middle Shoal, Gulf of St. Lawrence
56 Camera	1	299134428	46.351082	-60.377278	28.0	Middle Shoal, Gulf of St. Lawrence
56 Camera	2	299134517	46.350978	-60.377168	28.0	Middle Shoal, Gulf of St. Lawrence
56 Camera	3	299134559	46.350907	-60.377117	28.0	Middle Shoal, Gulf of St. Lawrence
56 Camera	4	299134648	46.350822	-60.377053	28.0	Middle Shoal, Gulf of St. Lawrence
56 Camera	5	299134728	46.350740	-60.376978	28.0	Middle Shoal, Gulf of St. Lawrence
57 Camera	1	299135737	46.345660	-60.381403	26.0	Middle Shoal, Gulf of St. Lawrence
57 Camera	2	299135831	46.345533	-60.381163	26.0	Middle Shoal, Gulf of St. Lawrence
57 Camera	3	299135907	46.345455	-60.381062	26.0	Middle Shoal, Gulf of St. Lawrence
57 Camera	4	299135950	46.345363	-60.380968	26.0	Middle Shoal, Gulf of St. Lawrence
57 Camera	5	299140043	46.345227	-60.380842	26.0	Middle Shoal, Gulf of St. Lawrence
58 Camera	1	299141211	46.340223	-60.391852	26.0	Middle Shoal, Gulf of St. Lawrence
58 Camera	2	299141253	46.340078	-60.391812	26.0	Middle Shoal, Gulf of St. Lawrence
58 Camera	3	299141343	46.339865	-60.391715	26.0	Middle Shoal, Gulf of St. Lawrence
58 Camera	4	299141420	46.339723	-60.391637	26.0	Middle Shoal, Gulf of St. Lawrence
58 Camera	5	299141456	46.339592	-60.391563	26.0	Middle Shoal, Gulf of St. Lawrence
70 Camera	1	299171818	46.338170	-60.356852	22.0	Middle Shoal, Gulf of St. Lawrence
70 Camera	2	299171924	46.338023	-60.356773	22.0	Middle Shoal, Gulf of St. Lawrence
70 Camera	3	299172008	46.337908	-60.356775	22.0	Middle Shoal, Gulf of St. Lawrence
70 Camera	4	299172048	46.337802	-60.356822	22.0	Middle Shoal, Gulf of St. Lawrence
70 Camera	5	299172121	46.337733	-60.356902	22.0	Middle Shoal, Gulf of St. Lawrence
71 Camera	1	299173031	46.337433	-60.370888	22.0	Middle Shoal, Gulf of St. Lawrence
71 Camera	2	299173115	46.337353	-60.371157	22.0	Middle Shoal, Gulf of St. Lawrence

71 Camera	3	299173157	46.337263	-60.371383	22.0	Middle Shoal, Gulf of St. Lawrence
71 Camera	4	299173237	46.337167	-60.371580	22.0	Middle Shoal, Gulf of St. Lawrence
71 Camera	5	299173316	46.337080	-60.371760	22.0	Middle Shoal, Gulf of St. Lawrence
72 Camera	1	299174553	46.331187	-60.366993	16.0	Middle Shoal, Gulf of St. Lawrence
72 Camera	2	299174633	46.331230	-60.366895	16.0	Middle Shoal, Gulf of St. Lawrence
72 Camera	3	299174714	46.331328	-60.366812	16.0	Middle Shoal, Gulf of St. Lawrence
72 Camera	4	299174754	46.331447	-60.366742	16.0	Middle Shoal, Gulf of St. Lawrence
72 Camera	5	299174836	46.331570	-60.366698	16.0	Middle Shoal, Gulf of St. Lawrence
73 Camera	1	299175858	46.326723	-60.375002	15.0	Middle Shoal, Gulf of St. Lawrence
73 Camera	2	299175937	46.326693	-60.374937	15.0	Middle Shoal, Gulf of St. Lawrence
73 Camera	3	299180014	46.326643	-60.374895	15.0	Middle Shoal, Gulf of St. Lawrence
73 Camera	4	299180134	46.326465	-60.374765	15.0	Middle Shoal, Gulf of St. Lawrence
73 Camera	5	299180225	46.326373	-60.374663	15.0	Middle Shoal, Gulf of St. Lawrence
74 Camera	1	299181338	46.319520	-60.376880	10.0	Middle Shoal, Gulf of St. Lawrence
74 Camera	2	299181418	46.319495	-60.376733	10.0	Middle Shoal, Gulf of St. Lawrence
74 Camera	3	299181504	46.319468	-60.376618	10.0	Middle Shoal, Gulf of St. Lawrence
74 Camera	4	299181542	46.319433	-60.376515	10.0	Middle Shoal, Gulf of St. Lawrence
74 Camera	5	299181624	46.319402	-60.376410	10.0	Middle Shoal, Gulf of St. Lawrence
75 Camera	1	299183556	46.322032	-60.380725	11.0	Middle Shoal, Gulf of St. Lawrence
75 Camera	2	299183657	46.322032	-60.380613	11.0	Middle Shoal, Gulf of St. Lawrence
75 Camera	3	299183737	46.322055	-60.380590	11.0	Middle Shoal, Gulf of St. Lawrence
75 Camera	4	299183818	46.322075	-60.380537	11.0	Middle Shoal, Gulf of St. Lawrence
75 Camera	5	299183857	46.321937	-60.380390	11.0	Middle Shoal, Gulf of St. Lawrence
76 Camera	1	299184945	46.327780	-60.387735	15.0	Middle Shoal, Gulf of St. Lawrence
76 Camera	2	299185023	46.327773	-60.387873	15.0	Middle Shoal, Gulf of St. Lawrence
76 Camera	3	299185101	46.327735	-60.388085	15.0	Middle Shoal, Gulf of St. Lawrence
76 Camera	4	299185147	46.327600	-60.388195	15.0	Middle Shoal, Gulf of St. Lawrence
76 Camera	5	299185229	46.327463	-60.388368	15.0	Middle Shoal, Gulf of St. Lawrence
77 Camera	1	299190356	46.323345	-60.398522	15.0	Middle Shoal, Gulf of St. Lawrence
77 Camera	2	299190442	46.323430	-60.398795	15.0	Middle Shoal, Gulf of St. Lawrence
77 Camera	3	299190524	46.323502	-60.398922	15.0	Middle Shoal, Gulf of St. Lawrence
77 Camera	4	299190606	46.323500	-60.399100	15.0	Middle Shoal, Gulf of St. Lawrence
77 Camera	5	299190648	46.323533	-60.399333	15.0	Middle Shoal, Gulf of St. Lawrence
78 Camera	1	299191937	46.319718	-60.386012	14.0	Middle Shoal, Gulf of St. Lawrence
78 Camera	2	299192022	46.319698	-60.386275	14.0	Middle Shoal, Gulf of St. Lawrence
78 Camera	3	299192059	46.319693	-60.386628	14.0	Middle Shoal, Gulf of St. Lawrence
78 Camera	4	299192148	46.319787	-60.387012	14.0	Middle Shoal, Gulf of St. Lawrence
78 Camera	5	299192231	46.319892	-60.387237	14.0	Middle Shoal, Gulf of St. Lawrence
79 Camera	1	299193033	46.316053	-60.390272	12.0	Middle Shoal, Gulf of St. Lawrence
79 Camera	2	299193158	46.316432	-60.390148	12.0	Middle Shoal, Gulf of St. Lawrence
79 Camera	3	299193232	46.316520	-60.390172	12.0	Middle Shoal, Gulf of St. Lawrence
79 Camera	4	299193320	46.316618	-60.390303	12.0	Middle Shoal, Gulf of St. Lawrence
79 Camera	5	299193407	46.316665	-60.390453	12.0	Middle Shoal, Gulf of St. Lawrence
80 Camera	1	299194857	46.310940	-60.399060	9.0	Middle Shoal, Gulf of St. Lawrence
80 Camera	2	299194930	46.310848	-60.399238	9.0	Middle Shoal, Gulf of St. Lawrence
80 Camera	3	299195008	46.310750	-60.399452	9.0	Middle Shoal, Gulf of St. Lawrence
80 Camera	4	299195046	46.310613	-60.399690	9.0	Middle Shoal, Gulf of St. Lawrence
80 Camera	5	299195124	46.310468	-60.400067	9.0	Middle Shoal, Gulf of St. Lawrence

Gravity Cores

Station	Type	Day/Time	Latitude	Longitude	Depth	Location
81	Core	301123800	46.087438	-60.713972	20.0	Bras D'Or Lakes, Baddeck Bay
82	Core	301130600	46.087513	-60.712412	20.0	Bras D'Or Lakes, Baddeck Bay
83	Core	301133900	46.077503	-60.779187	18.5	Bras D'Or Lakes, St. Patrick's Channel
84	Core	301135700	46.076082	-60.779258	17.1	Bras D'Or Lakes, St. Patrick's Channel
85	Core	301141400	46.076597	-60.782318	17.3	Bras D'Or Lakes, St. Patrick's Channel
86	Core	301144500	46.063063	-60.817675	16.2	Bras D'Or Lakes, St. Patrick's Channel
87	Core	301150900	46.062847	-60.833183	15.3	Bras D'Or Lakes, St. Patrick's Channel
88	Core	301153300	46.061313	-60.872918	12.5	Bras D'Or Lakes, St. Patrick's Channel
89	Core	301154600	46.061068	-60.874573	11.2	Bras D'Or Lakes, St. Patrick's Channel
90	Core	301165344	46.060597	-60.875853	13.0	Bras D'Or Lakes, St. Patrick's Channel
91	Core	301171315	46.054058	-60.884973	11.0	Bras D'Or Lakes, St. Patrick's Channel
92	Core	301174804	46.046768	-60.916823	9.3	Bras D'Or Lakes, St. Patrick's Channel
93	Core	301180438	46.045883	-60.918308	12.0	Bras D'Or Lakes, St. Patrick's Channel
94	Core	301181558	46.045438	-60.918873	11.8	Bras D'Or Lakes, St. Patrick's Channel
95	Core	301182726	46.044133	-60.920842	10.1	Bras D'Or Lakes, St. Patrick's Channel
96	Core	301183908	46.043640	-60.922358	11.8	Bras D'Or Lakes, St. Patrick's Channel
97	Core	301185905	46.027307	-60.947560	9.7	Bras D'Or Lakes, St. Patrick's Channel
98	Core	301191047	46.027373	-60.948395	9.0	Bras D'Or Lakes, St. Patrick's Channel
99	Core	301194352	46.060895	-60.874598	12.0	Bras D'Or Lakes, St. Patrick's Channel

Grab Samples

Station	Type	Day/Time	Latitude	Longitude	Depth	Location
7	Grab	295165000	46.319967	-60.372637	7.8	Middle Shoal, Gulf of St. Lawrence
8	Grab	295170500	46.321782	-60.373903	7.4	Middle Shoal, Gulf of St. Lawrence
9	Grab	295172200	46.324343	-60.371002	11.0	Middle Shoal, Gulf of St. Lawrence
10	Grab	295174900	46.322253	-60.370147	8.7	Middle Shoal, Gulf of St. Lawrence
11	Grab	295181000	46.320403	-60.370265	7.9	Middle Shoal, Gulf of St. Lawrence
12	Grab	295182600	46.319835	-60.376790	9.4	Middle Shoal, Gulf of St. Lawrence
13	Grab	295183500	46.322398	-60.381495	11.8	Middle Shoal, Gulf of St. Lawrence
14	Grab	295185200	46.319882	-60.386533	14.2	Middle Shoal, Gulf of St. Lawrence
15	Grab	295190800	46.316060	-60.390472	12.6	Middle Shoal, Gulf of St. Lawrence
16	Grab	295192600	46.310800	-60.399682	8.3	Middle Shoal, Gulf of St. Lawrence
17	Grab	295194500	46.323295	-60.397588	13.9	Middle Shoal, Gulf of St. Lawrence
18	Grab	295195600	46.327403	-60.387545	14.3	Middle Shoal, Gulf of St. Lawrence
19	Grab	295200900	46.326665	-60.374127	13.6	Middle Shoal, Gulf of St. Lawrence
20	Grab	295202000	46.331355	-60.366663	15.6	Middle Shoal, Gulf of St. Lawrence
21	Grab	295204000	46.338487	-60.356388	21.4	Middle Shoal, Gulf of St. Lawrence
22	Grab	295205700	46.337178	-60.371063	21.4	Middle Shoal, Gulf of St. Lawrence
37	Grab	299000008	46.460825	-60.360293	67.0	Middle Shoal, Gulf of St. Lawrence
38	Grab	299002400	46.455315	-60.371583	52.0	Middle Shoal, Gulf of St. Lawrence
39	Grab	299003700	46.446468	-60.377938	46.0	Middle Shoal, Gulf of St. Lawrence
40	Grab	299005000	46.435122	-60.387118	42.0	Middle Shoal, Gulf of St. Lawrence
41	Grab	299010300	46.427875	-60.400943	36.0	Middle Shoal, Gulf of St. Lawrence
42	Grab	299011900	46.421032	-60.394492	36.0	Middle Shoal, Gulf of St. Lawrence
59	Grab	299142500	46.340465	-60.391803	27.0	Middle Shoal, Gulf of St. Lawrence
60	Grab	299153000	46.346038	-60.381622	26.0	Middle Shoal, Gulf of St. Lawrence
61	Grab	299153800	46.350872	-60.377140	28.0	Middle Shoal, Gulf of St. Lawrence
62	Grab	299155000	46.355943	-60.363783	31.0	Middle Shoal, Gulf of St. Lawrence
63	Grab	299155800	46.357530	-60.368787	29.0	Middle Shoal, Gulf of St. Lawrence
64	Grab	299160600	46.358985	-60.367773	29.0	Middle Shoal, Gulf of St. Lawrence
65	Grab	299161400	46.361278	-60.374788	30.0	Middle Shoal, Gulf of St. Lawrence
66	Grab	299162300	46.362605	-60.364725	32.0	Middle Shoal, Gulf of St. Lawrence
67	Grab	299163300	46.370135	-60.357090	34.0	Middle Shoal, Gulf of St. Lawrence
68	Grab	299164000	46.376412	-60.351692	35.0	Middle Shoal, Gulf of St. Lawrence
69	Grab	299164800	46.378132	-60.348190	36.0	Middle Shoal, Gulf of St. Lawrence

Appendix V - Grab Sample Photos

Matthew 2002066 Grab Sample Photos

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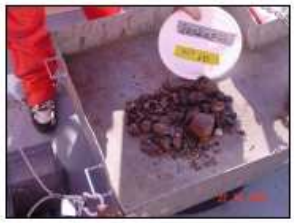
2002066_008.GIF

2002066_009.GIF



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2002066_018.GIF

2002066_019.GIF

2002066_020.GIF

2002066_021.GIF

2002066_022.GIF

2002066_037.GIF

2002066_038.GIF

2002066_039.GIF

2002066_040.GIF

Matthew 2002066 Grab Sample Photos

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2002066_042.GIF

2002066_059a.GIF

2002066_060a.GIF

2002066_061a.GIF

2002066_062a.GIF

2002066_063a.GIF

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2002066_065a.GIF

2002066_066a.GIF

2002066_067a.GIF

2002066_068a.GIF

2002066_069a.GIF

Appendix VI - Seafloor Photographs

Matthew 2002066 Seafloor Photographs


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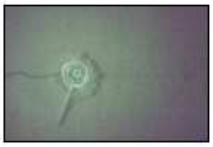
Matthew 2002066 Seafloor Photographs



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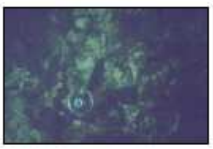

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Matthew 2002066 Seafloor Photographs

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Matthew 2002066 Seafloor Photographs

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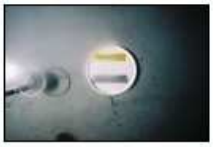

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Matthew 2002066 Seafloor Photographs

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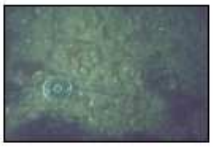

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Matthew 2002066 Seafloor Photographs

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Matthew 2002066 Seafloor Photographs

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Appendix VII - Geophysical Records and Tapes

Record Number	Day	Time		Line Number
		Start	End	
SEISTEC				
1	294	11:43	17:47	201-204, 206, 208
2	294	17:49		207, 209-211, CL1-CL4, 301-314
	295		12:27	
3	296	10:58	22:11	102-110
4	297	13:24	22:34	402-407, 409-412
5	298	17:38	22:14	401, 408, 413, 414
6				
120 KHz SIMRAD				
1	294	11:27		201-204, 206-211, CL1 – CL4, 301-305
	295		02:25	
2	295	02:28	12:19	303, 306-314
3	296	10:47	22:12	102-110
4	297	13:29	15:24	405, 409, 410
5	297	15:29	22:33	402-404, 406, 407, 410-412
6	298	17:43	22:14	401,408,413,414

Day	Tape Number		Time	
	SEISTEC	120 KHz SIMRAD	Start	End
294	1	1	11:43	20:06
	2	2	21:49	
295	2	2		12:26
296		3	10:49	22:12
	3		10:53	15:20
	4		15:20	19:35
	5		19:35	22:12
297	6	4	13:30	22:32