

**COMPILATION OF SURFICIAL GEOLOGICAL DATA FROM THE  
UPPER SCOTIAN SLOPE  
(150 TO 500 METRES BELOW SEA LEVEL)**

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A joint project of Petroleum Research Atlantic Canada, the Geological Survey of Canada  
(Atlantic) and the Department of Oceanography, Dalhousie University

Geological Survey of Canada Open File # 4622

**2004**



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## **GEOLOGICAL SURVEY OF CANADA**

### **OPEN FILE # 4622**

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Open files are products that have not gone through the GSC formal publication process.

## INTRODUCTION

The upper continental slope off Nova Scotia extends from the 150 m to 500 m isobath and is generally an area of hard seafloor with a discontinuous cover of sand and gravel (Piper and Campbell, 2002). Increased industrial interest in this area has created the need to address some of the issues related to upper slope sediment transport. For example, if deep-water discoveries of oil or gas are made off Nova Scotia, pipelines will have to cross the upper slope in order to bring the gas onshore or to shelf based processing stations. As a preliminary step to addressing some of the geological issues in the area, a database which includes all relevant resources contained within the collection of the Geological Survey of Canada (Atlantic) has been created. This collection, housed in the facilities at the Bedford Institute of Oceanography, contains both physical sediment samples and paper and digital seismic records. To keep the database to a manageable size and to accommodate the data needs for the area of interest, this database has been restricted to the upper Scotian Slope (figure 1). The database is accessible to the general public in a portable (compact disc) format to be used with either ESRI's ArcView 3.X or ArcExplorer. Additional interpretation was done of the seabed sediments and morphology in the area with relevance to previous work completed on this topic (Hill and Bowen, 1983).

## DATA PROVIDED WITH THIS REPORT

The database includes all surficial geological data on the region of the upper Scotian Slope located between Northeast Channel and Laurentian Channel. These data include seabed photography, current meter locations, surficial grain size information, as well as the locations of seabed samples and geophysical survey lines. The compilation was focused on the upper slope/outer shelf region between 150 and 500 metres water depth. While information at depths greater than 500 metres water depth is included, this region was not researched as thoroughly and therefore may not be as complete. The ArcView database provides location information and corresponding data accessible either as "hotlinked" images (i.e., seabed photos) or as references to ASCII and Microsoft Excel data tables (i.e., grain size and current meter data). For geophysical survey data and other station information, this project can be used in

conjunction with the Geological Survey of Canada (Atlantic) Expedition Database (ED) and the GeoCollections database (accessible online through [www.gsca.nrcan.gc.ca/ed](http://www.gsca.nrcan.gc.ca/ed) and [www.gsca.nrcan.gc.ca/geocol](http://www.gsca.nrcan.gc.ca/geocol) ) when requesting access to physical samples and geophysical data.

## **GRAIN SIZE**

Grain size data exists as Microsoft Excel spreadsheets and ASCII text files which are referenced to the sample location in the ArcView project. The grain size database includes:

- the expedition number
- the station number (the most recent station number available)
- the type of sample
- the lab or sub-sample number
- the latitude and longitude
- the water depth
- the sample interval
- the phi breakdown with accompanying frequencies or weight percents, and in cases with sufficient information the cumulative frequency and/or the simplified phi breakdown (gravel, sand and mud).

Most of the grain size information was retrieved from a database available at GSC(A). The remaining data were compiled through the use of cruise reports and sub-sample reports. The grain size analysis presented in this report are limited to subsamples extracted from the upper 30 cm of core.

## **CORE AND GRAB STATIONS**

Core and grab station locations and details were originally obtained from the Expedition Database. This information was verified by comparing it with the hard copy cruise reports. Discrepancies between ED and the information contained in the cruise file were verified and corrected. Stations are organized based on the most recent station numbers only and

eliminating stations which represented failed attempts.

This report provides meta-data with respect to the core and grab stations. The physical samples, core descriptions (including photography), and physical properties data are available by request from GSC(A). The categories of core and grab station meta-data included in the database are as follows:

- the cruise number
- the new and old station numbers
- the water depth
- the latitude and longitude
- the station date
- the station type
- the chief scientist for the cruise
- any addition information pertaining to the core and or cruise. All information is specific to individual stations which can be accessed through the map.

## **GEOPHYSICAL RECORDS**

The seismic component of the database was limited to include only the seismic lines that transect the outer shelf/ upper slope. The information was obtained from ED and run through an ArcInfo routine which converts the text formatted ED navigation data to an ArcView compatible file. The geophysical tracklines are presented as polyline segments as well as points with each point representing a GPS fix at one-minute intervals. High resolution geophysical records housed at GSC(A) are referenced by date and time, and therefore the one minute GPS fixes can be used to request records from data archives. The following types of seismic data have been collected in the study area:

- *sidescan*- undifferentiated sidescan sonar system
- *SAR*- high resolution deep-towed sidescan sonar system
- *SeaMARC*- high resolution sidescan sonar system
- *sparker*- hi-resolution seismic reflection system using a sparker source
- *v-fin sparker*- ultra high resolution seismic reflection system

- *Seistec*- ultra high resolution seismic reflection system
- *Seabed*- deep-towed ultra high resolution seismic reflection system
- *Huntec DTS*- ultra high resolution seismic reflection system (sparker or boomer source)
- *reflection*- undifferentiated high resolution seismic reflection (typically airgun or sleeve gun source)
- *airgun*- undifferentiated high resolution seismic reflection system
- *3.5 kHz*- high resolution sub-bottom sonar system
- *bathymetry*- undifferentiated bathymetric profiler (usually 12 kHz source)
- *Sonobuoy*- surface floated seismometer
- *refraction*- undifferentiated seismic refraction system

### ***BOTTOM PHOTOGRAPHY***

GSC(A) archives thousands of seabed photographs. On the upper slope the photos provide direct observation of the seabed but are limited in geographic coverage. All photos in the database are linked to the ArcView map and can be displayed by using the hotlink tool (lightning bolt symbol).

## HOW TO USE THE DATABASE

The contents of the CD are organized into the following directory structure:

(your cd drive):\ - contains this document (OF4622\_upper\_slope\_data\_compilation.pdf), the Arc View project file (of\_4622.apr), the installation software for Arc Explorer (ae2setup.exe), cd liner and cover files (cd\*.pdf), GSC end user agreement for digital data (licence\_e.pdf) and an ascii readme file with some directions (readme.txt).

(your cd drive):\bottom\_photos\ - contains the seabed photos in the database in jpeg format.

(your cd drive):\current\_meters\ - contains the data tables in Excel and ascii format for current meter readings in the study area as well as jpegs of the data tables.

(your cd drive):\grain\_size\ - contains the grain size data tables in Excel and ascii format for grain size analysis from samples within the study area.

(your cd drive):\ of\_4622-files\ - contains the Arc View extension files and the database files for the Arc View project.

The database was developed using ArcView GIS 3.2 (ESRI) and works best with this software package. To open the database, open ArcView and open the project file on the CD (of\_4622.apr). If ArcView prompts you for extension files, navigate to (your cd drive:\of\_4622-files \) and select the appropriate file. There is only one View in the project, and it should show a map of the regional bathymetry for the study area (figure 2). The top two themes (CORE STATIONS and GRAB STATIONS) contain information on samples from the study area, including a reference field which indicates the file name containing grain size information, or if no grain size information is available (figure 3). The third theme (CURRENT METER MOORING SITES) contains information on current meters in the study area, with the actual current meter data appearing in the data table in the current\_meters folder. The current

meter data are cross-referenced by the *Event\_spec* field value in ArcView and the *Event Id* value in the Excel or ascii tables (figure 4). The next seven themes present the location of seafloor photographs and each point is hotlinked to the corresponding photograph in jpeg format. The next 30 themes display the geophysical data coverage and are classified based on type, presented as both tracklines and day/time fix locations. The last theme is a bathymetric base derived from publicly available data from NOAA.

In the event that the user does not have access to ArcView, the installation software for ArcExplorer (ae2setup.exe) has been included on the cd. ArcExplorer is a free data viewer by ESRI and can be used to display and query the database. It does not support hotlinks to files, but the file name and path for hotlinked files is included in the data tables of the themes, making it possible to manually open the file. The theme names and coinciding file names are shown in Table 1.

## **ACKNOWLEDGEMENTS**

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## **REFERENCES**

- Piper, D.J.W. and Campbell, D.C. 2002. Surficial geology of the Scotian Slope, eastern Canada. Geological Survey of Canada, Current Research 2002-E15, 10 p.
- Hill, P.R., and Bowen, A.J. 1983. Modern sediment dynamics of the shelf slope boundary off Nova Scotia. *in* the Shelfbreak. Critical Interface on Continental Margins, (ed.) D.J. Stanley and G.T. Moore. Society of Economic Palaeontologists and Mineralogists, Special Publication no. 33, p 265-276.

## APPENDIX:

***A RE-EXAMINATION OF 13 CORES FROM THE STUDY AREA***

A limited amount of interpretation of the surficial sediments of the upper Scotian Slope was undertaken. This included some interpretation of Hunttec DTS lines that cover shallower areas of the slope and also down core plots of described cores around the 500m isobath.

The core descriptions are from the 78-005 cruise and were re-examined before being compiled into down core plots (figure 5). The cores were chosen from 2 distinct areas on the slope approximately 60 km apart. There are 3 dominant colours which are constant throughout many of the cores. These colours are yellowish brown, olive grey, and greyish/olive brown. They are repeated in a grey-brown-grey pattern. Greyish/olive brown is present non-repetitively in thin layers. In all cores a sandy top layer was present. These sandy layers seem to correspond with the olive grey colour while the yellowish brown occurs in the finer grained layers. Some cores also have a fine grained olive grey layer that occurs directly before or after the muddy (fine grained) yellowish brown layer. Few unconformities were recognised within the selected cores, most maintain the consistency of coarse-fine-coarse with their corresponding olive grey-yellowish brown-olive grey pattern.

The sandy top layer that is prevalent in the cores may be represented in the Hunttec profiles as an incoherent top layer that seems to be in-filling shallow channels (figure 6). Within the sandy surface layer there are indications of sediment waves. The waves are represented, in the Hunttec records by small parallel discontinuities in near-seabed reflections. The sediment waves are discontinuous but appear to be widespread. However on the Hunttec interpretations there is another classification of sediment structures. These structures are faint and less repetitive than the more distinct sediment waves. The origin of these faint structures is unknown.

Table 1: ArcView theme name and corresponding file name and data type.

<b>Theme Name</b>	<b>File Name</b>
CORE STATIONS	coretable.shp {Point}
GRAB STATIONS	slopegrabs.shp {Point}
CURRENT METER MOORING SITES	slope_current_meter_data.shp {Point}
BOTTOM PHOTOS 2000-042	2000042pics.shp {Point}
BOTTOM PHOTOS 2000-036	2000036pics.shp {Point}
ROPOS R643 PHOTOS	pics_r643.shp {Point}
ROPOS R644 PHOTOS	pics_r644.shp {Point}
ROPOS R645 PHOTOS	pics_r645.shp {Point}
ROPOS R646 PHOTOS	pics_r646a.shp {Point}
ROPOS R647 PHOTOS	pics_r647.shp {Point}
PISCES IV DIVE TRACK	piscesiv_divetrack.shp {Arc}
TOWED CAMERA	slopetowedcameraa.shp {Arc}
TOWED CAMERA	slopetowedcamera.shp {Point}
SIDESCAN	slopesidescana.shp {Arc}
SIDESCAN	slopesidescan.shp {Point}
SAR	slopesara.shp {Arc}
SAR	slopesar.shp {Point}
SEAMARC	slopeseamarca.shp {Arc}
SEAMARC	slopeseamarc.shp {Point}
SPARKER	slopesparkera.shp {Arc}
SPARKER	slopesparker.shp {Point}
V FIN	vfintrack_82004.shp {Arc}
SEISTEC	slopeseasteca.shp {Arc}
SEISTEC	slopeseastec.shp {Point}
SEABED	slopesabeda1.shp {Arc}
SEABED	slopesabed.shp {Point}
HUNTEC	hunteca.shp {Arc}
HUNTEC	slopehuntec.shp {Point}
REFLECTION	slopereflectiona.shp {Arc}
REFLECTION	slopereflection.shp {Point}
AIRGUN	slopeairguna.shp {Arc}
AIRGUN	slopeairgun.shp {Point}
3.5kHz	slope35khza.shp {Arc}
3.5kHz	slope35khz.shp {Point}
BATHYMETRY	slopebathymetrya.shp {Arc}
BATHYMETRY	slopebathymetry.shp {Point}
SONOBUOY	slopesonobuoya.shp {Arc}
SONOBUOY	slopesonobuoy.shp {Point}
REFRACTION	sloperefractiona.shp {Arc}
REFRACTION	sloperefraction.shp {Point}
Noaa_bathy.shp	noaa_bathy.shp {Arc}

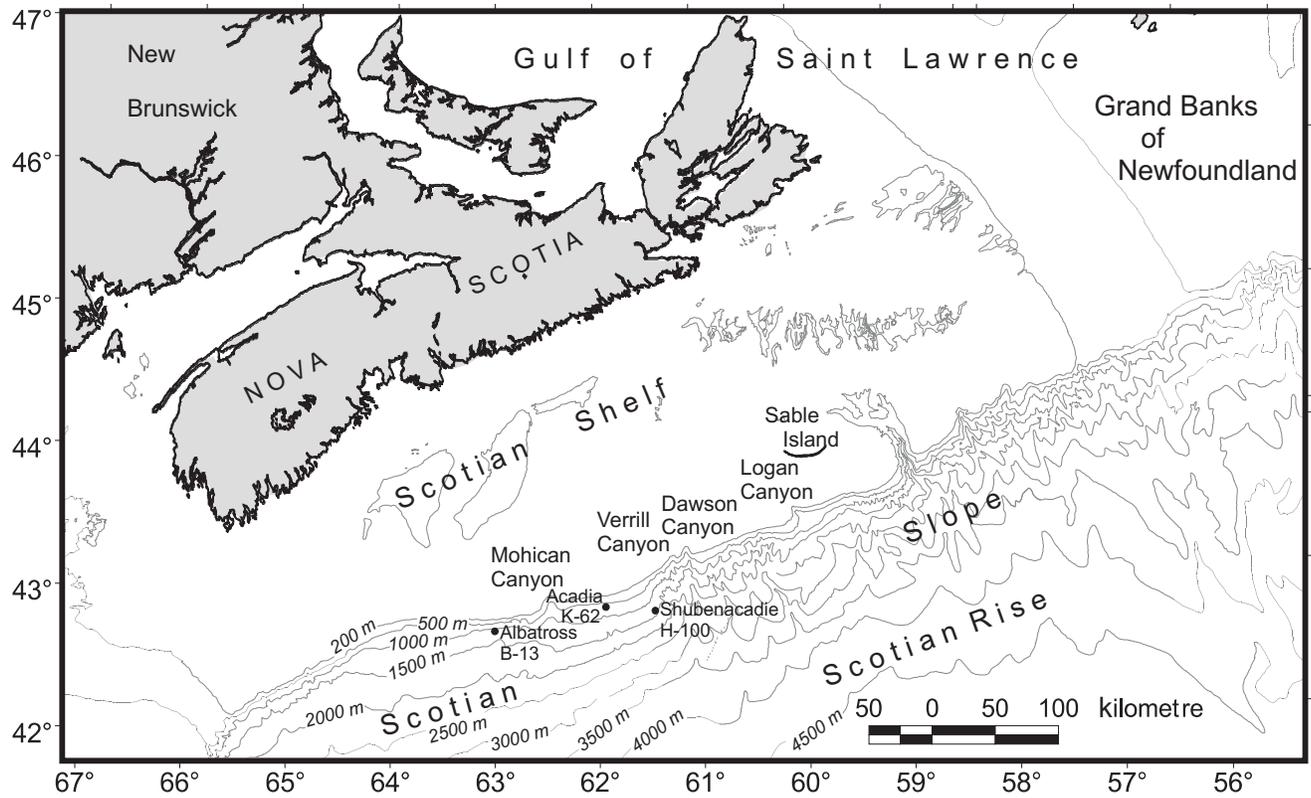


Figure 1: The continental shelf and slope off Nova Scotia. The study area is restricted to the area of seabed between 150 m and 500 m below sea level.

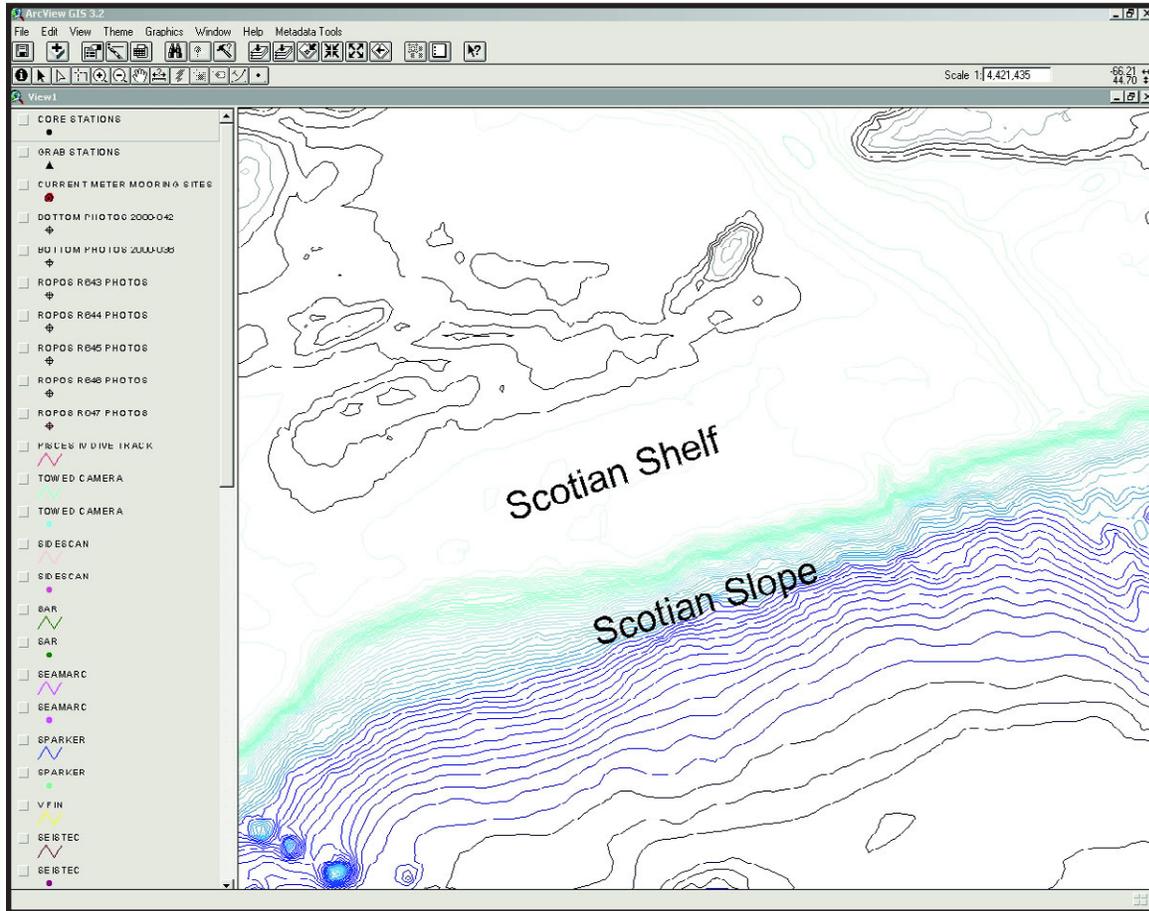


Figure 2: Screen capture of the ArcView GIS project included with this report.

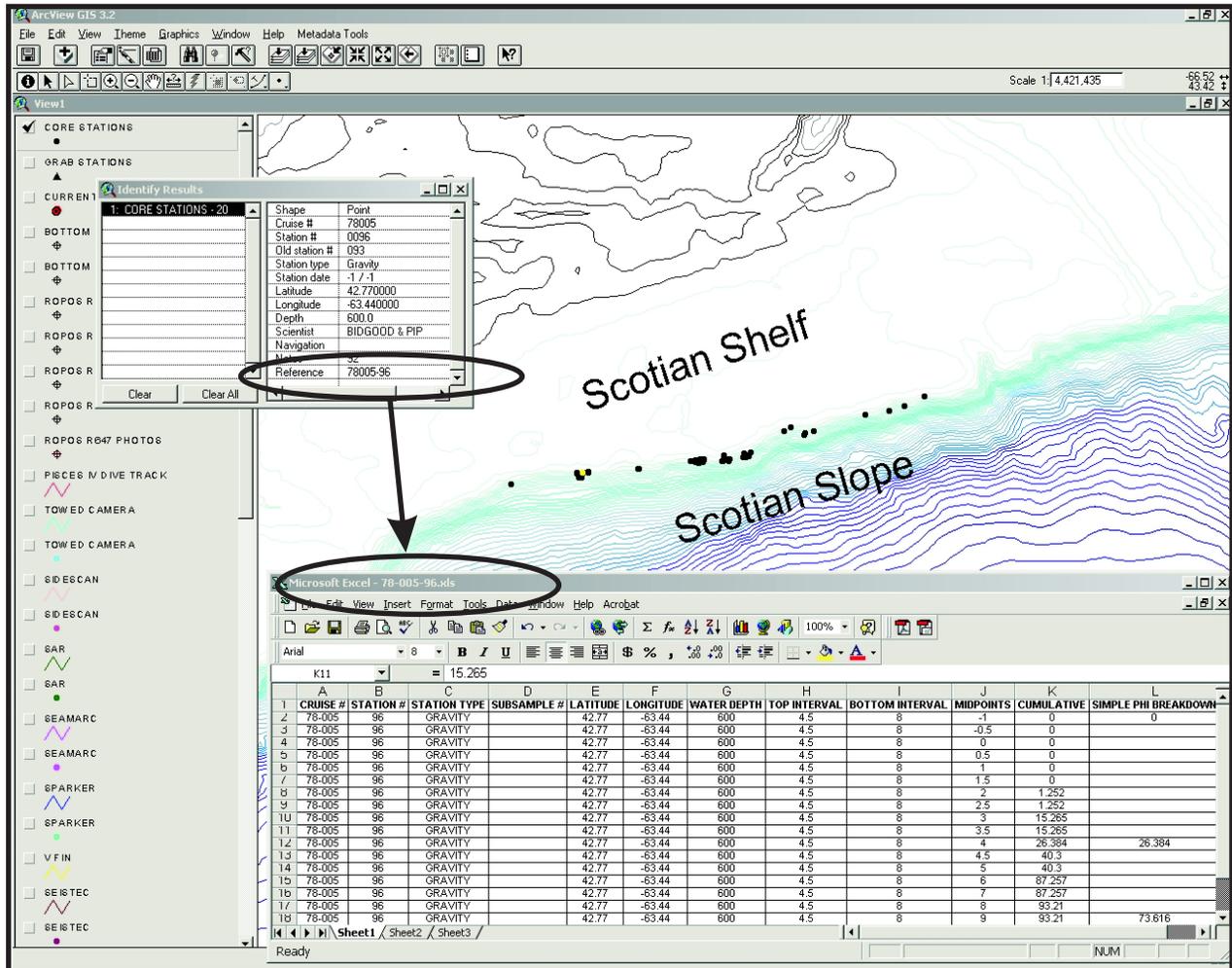


Figure 3: Cross reference of ArcView database of sample locations and grain size data in Excel format.

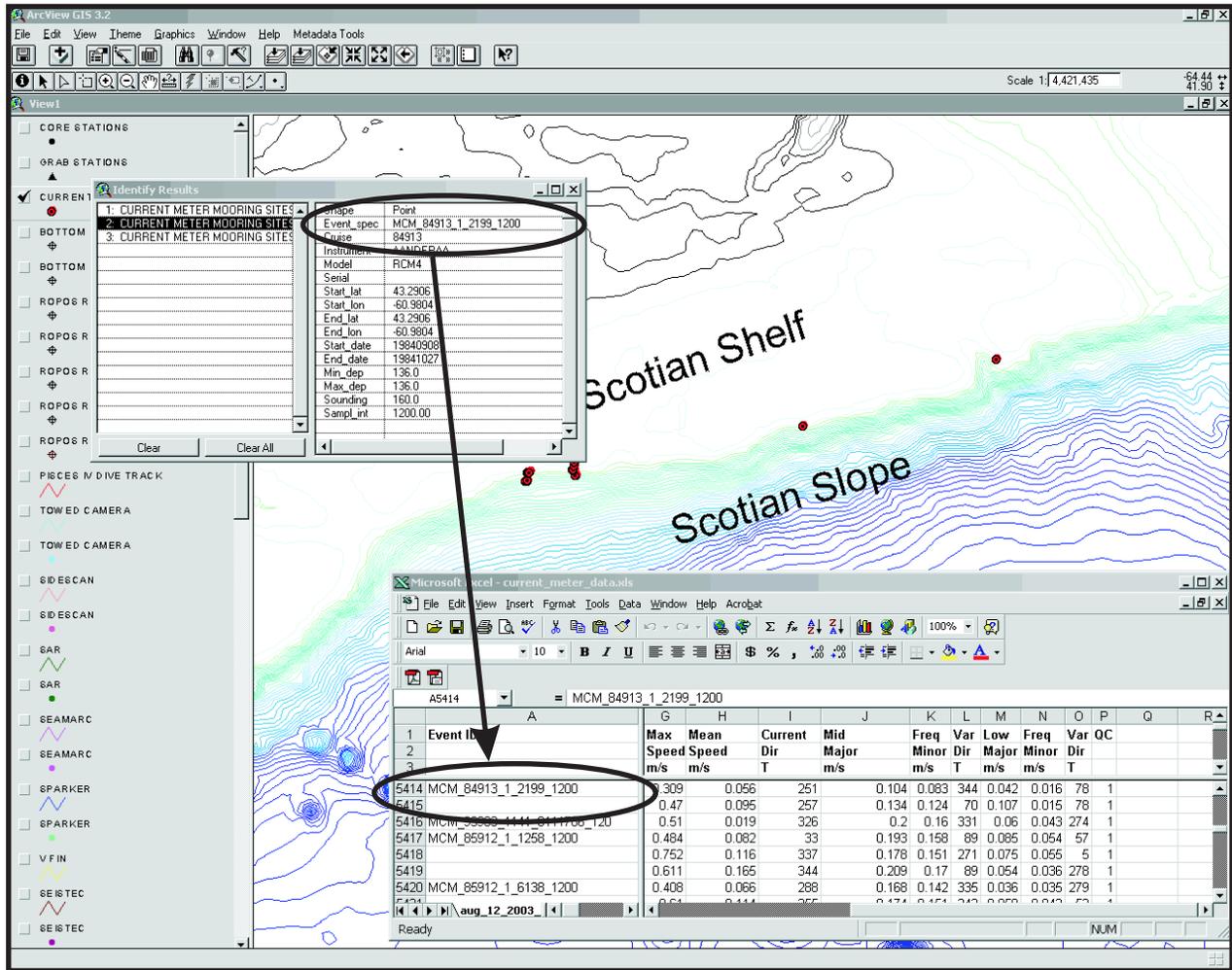


Figure 4: Cross reference of ArcView database of current meter locations and current meter data in Excel format.

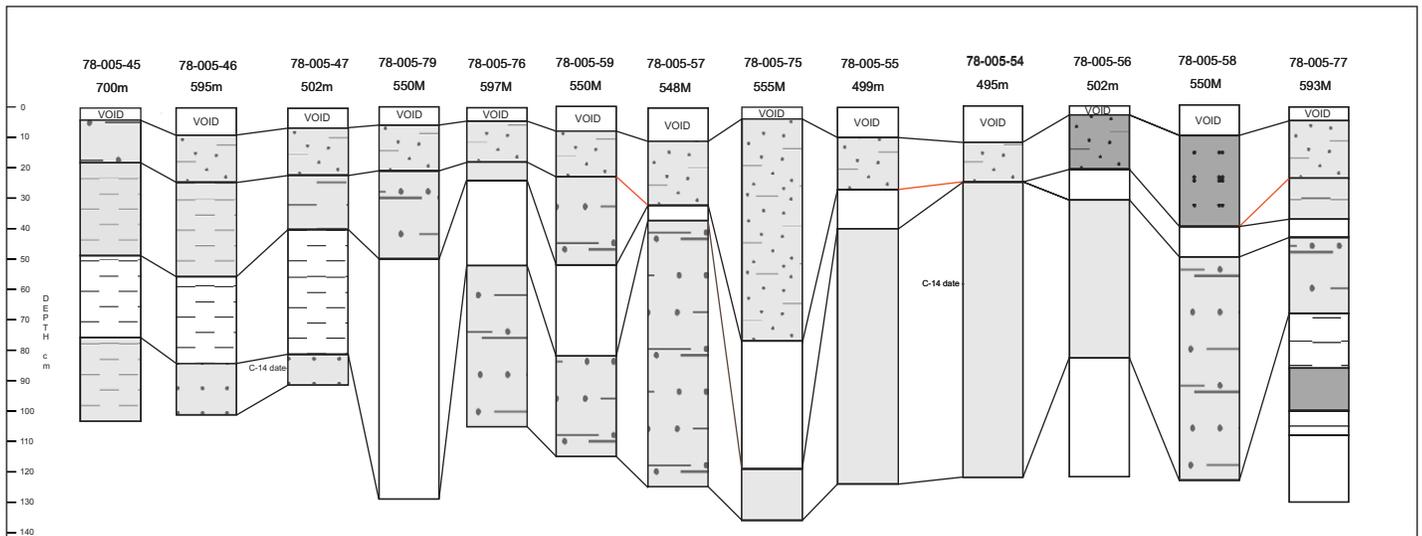
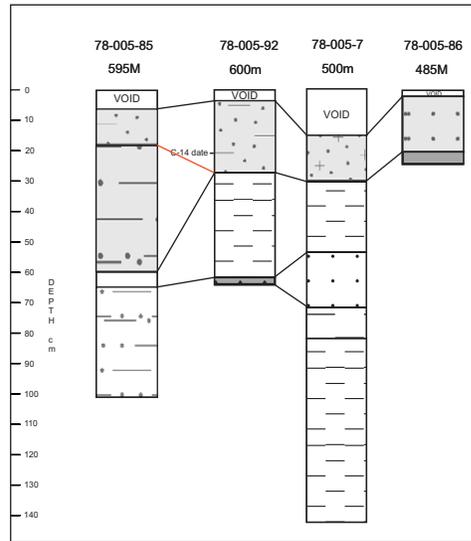
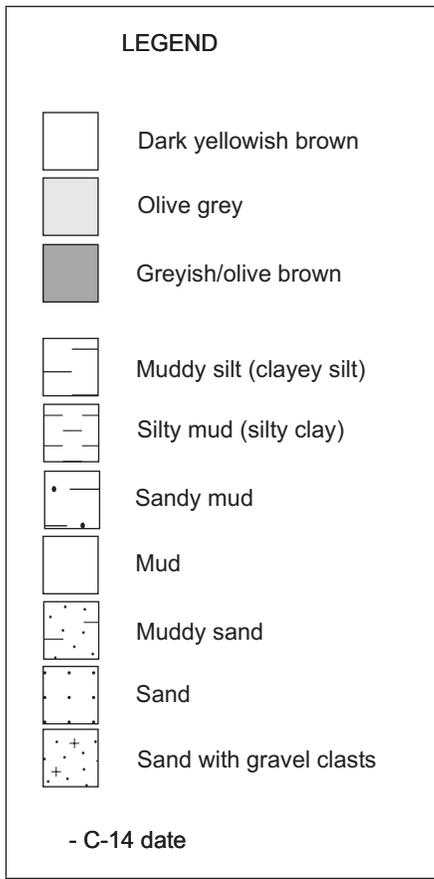


Figure 5. Downcore lithological plots of 17 cores that were re-examined. See ArcView database for core locations.

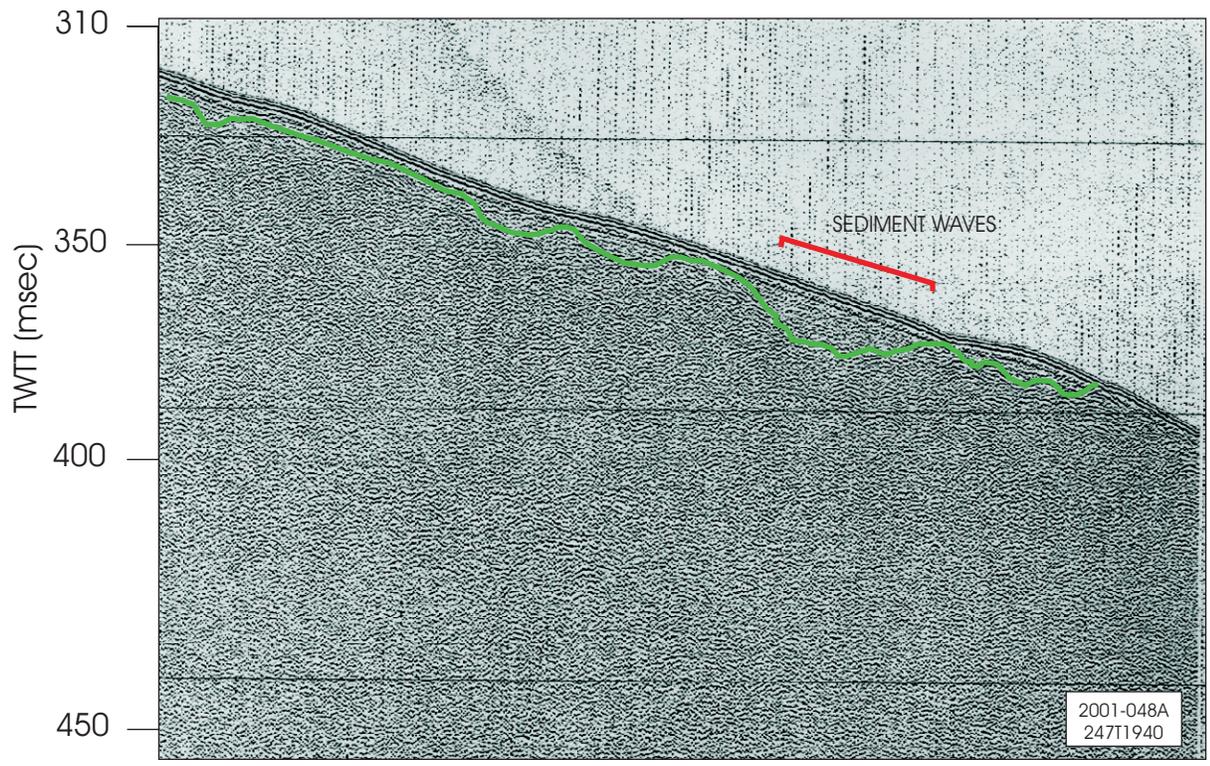
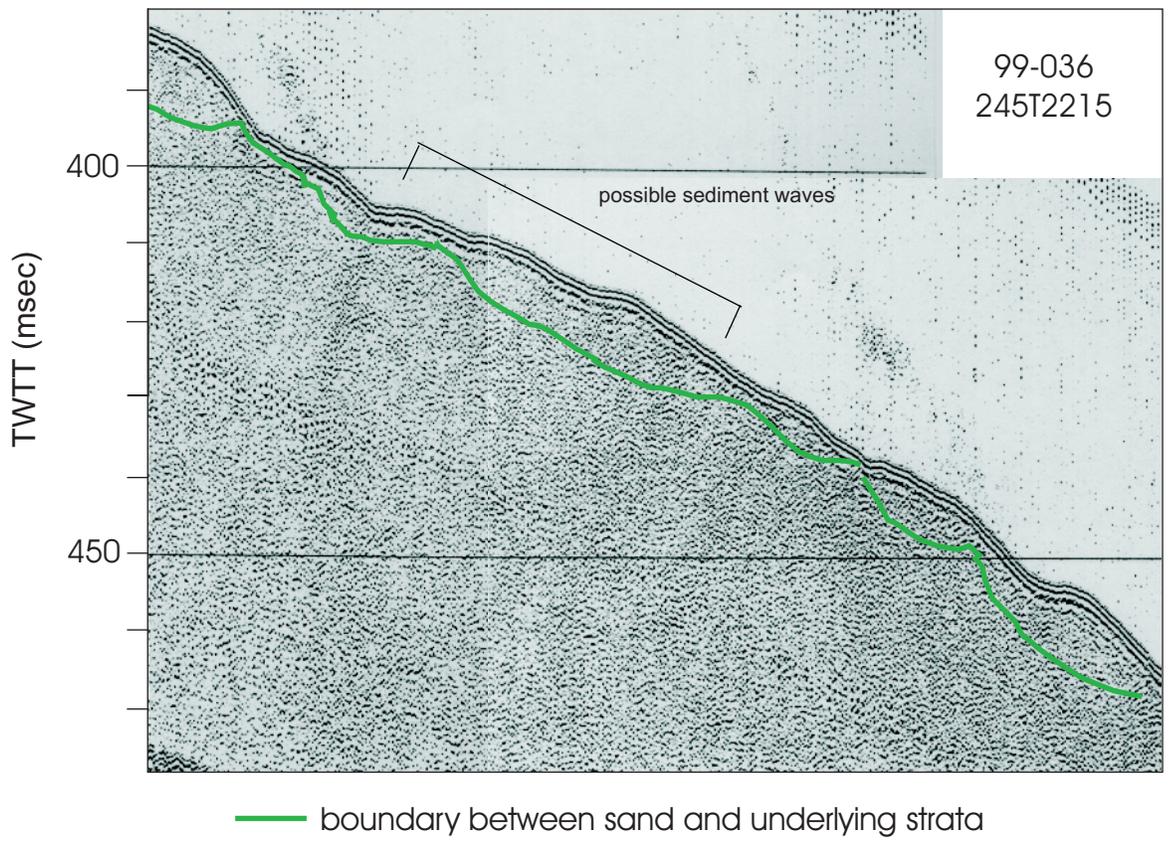


Figure 6. Hunttec DTS seismic reflection profiles showing possible sediment waves and a shallow sand layer.