PROCEEDINGS OF THE BEAUFORT SEA GRANULAR RESOURCES WORKSHOP

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PART 2

REPORTS ON NOGAP R & D STUDIES

Geotechnical and Geophysical Data Bases

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1.0 Introduction

In 1988, EBA Engineering Consultants Ltd. (EBA) compiled a geotechnical report catalogue and a data base of 1,288 borehole logs completed in the Canadian Beaufort Sea between 1973 and 1987. In 1989, the data base was expanded to include 1,053 surficial sediment corehole logs completed prior to 1988 and 46 borehole logs completed in 1988. In 1991, the geotechnical data base compiled by EBA was expanded and a geophysical data base compiled in 1988 by McElhanney Geosurveys Ltd. was expanded. Logs compiled in 1991 include 80 relatively deep boreholes or coreholes and 334 surficial sediment samples. To date (as of 1991), a total of 2,801 logs have been compiled in the data base. The assignments were carried out for Indian and Northern Affairs Canada (INAC), under funding provided by the Northern Oil and Gas Action Program (NOGAP).

Amoco Canada Petroleum Ltd. (Dome/Canmar), Esso Resources Canada Ltd., Gulf Canada Resources Ltd., the Geological Survey of Canada (GSC), Indian and Northern Affairs Canada and the Canadian Hydrographic Service (CHS) have provided valuable data for the data base. Although the data base now includes over 2,800 log entries, it is not yet complete. Five borehole logs from the GSC data base, which were incomplete, were not included in the data base. Twelve logs are available from Amoco which have not yet been included. Also, there are estimated to be several hundred more shallow corehole logs available at GSC from the 1970 and 1971 M.V. Hudson Surveys which should be included in future additions to the data base. Several geophysical reports were not obtained; one from Gulf (1990 program) and the remaining reports from Esso. The now-defunct organizations Arctic Petroleum Operators Association and Beaufort-Delta Oil Project Ltd. also have numerous reports which, thus far, have not been obtained or checked for relevant information.

Including work done in 1991 by Indian and Northern Affairs Canada, the data bases now comprise a report catalogue, an ESEBase borehole data base and a source data base which describes specific sources of granular materials. These data bases are linked by use of common granular source numbers, study numbers and UTM locations. Information contained in the data bases can be (and has already been) used to evaluate as much as possible of the available geophysical and geotechnical data in the Canadian Beaufort Sea,

primarily with respect to quantifying the locations and volumes of proven, probable and prospective granular resources. Some evaluation projects conducted to date using the data bases are presented at this seminar/workshop including the Isserk and Erksak Borrow Site study programs (presented by John Lewis of Lewis Geophysical Consulting) and a regional surficial geology program for the South Central Beaufort Sea region (presented by Steve Blasco of the Atlantic Geoscience Centre).

Table 1 summarizes the numbers and type of logs compiled in each year of the project. Table 2 summarizes the numbers of reports reviewed in each year and the range of dates of the reports.

It is our understanding that the report catalogue is available from INAC on an as-requested basis in digital or paper format. The ESEBase borehole data base has a more restricted distribution. A sub-set of the ESEBase borehole data base has been extracted by INAC for borehole location mapping purposes and consent was obtained from the operators for use of this general information. The detailed information remains protected and confidential, with the exception of future by the Geological Survey of Canada (GSC), whose purpose is scientific.

2.0 Project Outline

2.1 Objectives

The primary objective of the work has been to compile, in a standardized (ESEBase) format, a data base of surficial sediment core and deep borehole data from the Canadian Beaufort Sea. The data base is intended for use in the evaluation of granular resources for construction materials. The data base logs are intended to be accurate, stratigraphic and textural interpretations of the originals; however, some detailed engineering (for example, strength, consolidation, etc.) data has been omitted.

A second significant part of EBA's work has been to compile a bibliography or report catalogue of the various operator and consultant reports containing sub-surface geotechnical information. In 1991, existing geotechnical and geophysical report catalogues (compiled in 1988 by EBA and McElhanney, respectively) were updated to reflect additions made to the data base in 1989 and 1991.

2.2 Data Presentation

A report catalogue sample entry is presented as Figure 1. Geotechnical and geophysical information for the data bases was obtained from a total of 148 reports. This number is

somewhat misleading as some reports cover larger geographic areas than others. For example, some reports may contain only one or two boreholes at a single site, others may contain over 200 holes dispersed over a large area. Therefore, in order to facilitate searching for this data, the catalogue of field activities includes 179 entries with separate entries for 'sub-projects' from smaller geographic zones.

3.0 Data Base Description

The Beaufort Sea data base was originally prepared with ESEBase Version 3.0. ESEBase Version 4.0 is now available. All files created with Version 3.0 are upwardly compatible, with a one-time conversion when the data base is first used. Figure 2 presents a typical borehole log, as produced by the ESEBase program.

The difficulty in preparing a large data base or series of data bases from almost 150 different reports is with standardization. The original format, numbering system, datum, etc., were generally not consistent for the raw borehole data received for many logs; thus, some modifications were required to standardize the logs to ESEBase format for inclusion in the present data base. There was also a need to standardize borehole name formats for coding into the system. Thus, as shown in Table 3 and Figure 3, a borehole code would include a code for area location, year drilled, type of sample and borehole number. Borehole logs themselves were standardized according to sample types (for example, core, SPT, Shelby tube), datums were referenced to seabed, soil description (order of priority of terms), soil classification and ground ice descriptions.

3.1 Soil Description

The stratigraphic information on the logs includes the following components (also summarized as Figure 4) where available.

- Principal component (e.g., clay, sand, silt, etc.).
- Unified Soil Classification (USC).
- Principal component modifier(s) (e.g., silty, some sand, etc.).
- Particle shape.
- Structure.
- Moisture.

- Consistency.
- Plasticity.
- Colour.
- Ground ice description.

It should be noted that soil strength parameters were generally not included in the original versions of the ESEBase data base, except in a few cases where the original borehole logs were already in ESEBase or ESELog and required little modification to standardize. However, at the request of Indian and Northern Affairs Canada, some original borehole logs including strength data were provided (May, 1988) after data base completion. Therefore, the strength data is readily accessible for addition to the data base at some later time.

3.2 Soil Classification Data

Moisture content, Atterberg Limits, limited grain size analyses and Unified Soil Classification (USC) data have been included in the data base. Atterberg Limits and grain size analyses were used to check and provide Unified Soil Classification System (USC) classifications. All available grain size data has been included in the data base. 'D50' data was not available for the logs and was not calculated due to time constraints. This data would be a valuable addition to the logs. Silt and clay contents are presented in separate fields in the 'Basic Soil Characteristics Data' file.

3.3 Ground Ice Description and Sample Temperature

The ground ice description standard used for this data base follows the guidelines established by NRC. Where available and readily interpreted, ground ice information and soil temperature has been recorded in the ESEBase borehole data base.

4.0 Computer Data Handling Routines

For some similar on-shore data bases, computer data handling routines were required to extract data from ESEBase files and update the granular resource (source) data base maintained by INAC. All data for boreholes, testpits or exposures for a given source/study number was extracted from ESEBase files. The parameters needed for the source data base were then calculated and the source data base record was either updated (for existing

entries) or created (for new entries). When the granular sources and their boundaries are better defined, the same operation can be done for the Beaufort Sea data bases to create a source data base.

5.0 Use of the Data Bases

The report catalogue is useful for determining what has been done in a specified area. For example, in dBase, a listing of all reports with a specified UTM zone, minimum and maximum northing and easting can be made, and/or a report catalogue summary sheet can be printed for each relevant report. The report catalogue summaries give information regarding contact names for the project, study type, size and quality of data, level of detail and so on. The researcher could then refer to ESEBase borehole data base for further details or obtain the original reports themselves.

In ESEBase, print-outs of actual logs from a specified area can be made, as well as profiles or stratigraphic cross-sections through the area, maps of borehole locations and plots of laboratory data. Or, for example, if one wanted a plot of all areas with a soil of gravel content of 20% or more, ESEBase could sort and select the required boreholes for plotting. One can also sort boreholes by operator.

When constructed, a source data base could be used similarly. For example, for a specified area, further details on soils in the area including numbers of boreholes, type and thickness of overburden, details on proportions of gravel/sand/fines in the granular resource and test result summaries can be obtained. This data base will summarize data found in the ESEBase borehole data base.

Plots can also be made in conjunction with other software programs, for example, inFOcus and Quikmap are used. Further development is being undertaken for easier use of these programs in conjunction with ESEBase. John Peters' presentation discusses this aspect further.

6.0 Closure

In total, 2,801 corehole, borehole and surficial sediment logs from the Beaufort Sea have been summarized in a data base intended to allow interpretation of the distribution of granular resources and restrictions on their development. In the future, logs not yet included in the data base could be added. Regular maintenance of the data base by updating annually with new borehole data will provide a reliable source of data on Beaufort Sea granular resources.

It should be realized that some errors in the data bases are inevitable. Also, the data can only be as good as the original data source, which may vary according to weather and/or sampling conditions. Therefore, use should be for information purposes only and confirmation of original reports or independent confirmation should take place as required on a project specific basis.

Table 1
Summary of Boreholes and Surficial Sediment Samples

Year of Compilation	Number of Boreholes/Samples For Each Operator							
	Amoco	Esso	Gulf	GSC	INAC	Chevron	Sunoco	Total
1988	302BH	816BH	165BH	-	5BH	(147BH)		**1288**
1989	45SS	460SS	387SS 46BH	114SS 46PC 1BH			**1099**	
1991	99SS	13BH	235SS	65CH				**414**
TOTAL	**446**	**1289**	**835**	**226**	**5**			**2801**
Total Not Included	12BH		2BH* 6GC*	5BH& MV HUDSON#		147BH		172

*• Gulf data not released for use.
& Boreholes with insufficient data.
# Number of M.V. Hudson cores unknown, not included in total.

Abbreviations in order of appearance in table:

BH	Borehole	SS	Surficial Sediment Sample
PC	Piston Core	CH	Corehole
GC	Gravity Core		

Table 2 - Summary of Reports Reviewed

Year	Number of Reports	Year of Reports
1988	87	(1973-1987)
1989	17	(1981-1988)
1991	44	(1970-1990)

Table 3
Exploration Block Names and Abbreviations (Portion of)
(Includes 1988, 1989 and 1991 Work)

Block Name	Abbreviation
Aagnerk	AA
Adlartok	AD
Amauligak	AE, AW, AF, AM
Akpak	AK
Alerk	AL
Angasak	AN
Aok	AOK
Arnak	AR
Amerk	AS
Baillie Island	BI
Nerlerk (Borrow)	BNR
Blow River	BR
Tingmiark (Borrow)	BTN
Tarsiut (Borrow)	BTAR
East Amauligak	EA
Arksak Borrow	EK
Ernerk	ERK
Irkaluk (Foundation)	FIRK
Natiak (Foundation)	FNAT
Nerlerk (Foundation)	FNR
Garry Island	G, GI
Herschel (Borrow)	HB
Herschel Island	HI
Hooper/Pelly Region	HP
Isserk (Borrow)	IB
Isserk (I-15)	IR, 1SRK
Issigak (Borrow)	IBS, IK, ISGK
Immerark	IE
Igaluk	IG

BEAUFORT SEA
INDIAN AND NORTHERN AFFAIRS CANADA
CATALOGUE OF GRANULAR RESOURCE-RELATED INFORMATION

STUDY NUMBER: D-82-002 MONTH: 7 YEAR: 1982

SPONSOR : AMOCO CANADA PETROLEUM CO LTD. (DOME,CANMAR)
JOB NO : CONTACT: K. Hewitt
CONTRACTOR : EBA Engineering Consultants Ltd. and McClelland Engineers, Inc.
JOB NO : 101-3605 CONTACT: MR. KEVIN JONES
REPORT TITLE: 1982 OFFSHORE GEOTECHNICAL SITE INVESTIGATION, BAILLIE ISLAND GRAVEL SEARCH, BEAUFORT SEA

COORDINATES :	MINIMUM	CENTRE	MAXIMUM
UTM: ZONE:	8	0	8
EASTING:	512180	0	584090
NORTHING:	7765050	0	7885520
OR: LATITUDE:	0.00000		0.00000
LONGITUDE:	0.00000	0.00000	0.00000

LOCATION:

	GENERAL LOCATION	SITE PLAN
NAME :		Baillie Island
NUMBER:	1,A.1,A.2	1,A.1,A.2
SCALE :	1:2272727	1:2272727,270270,675
FORMAT:		
ARCHIV:		
DIG NO:		

SOURCE NUMBER(S):

SURVEY LINES / LOCATION DETAILS:

DESCRIPTION OF STUDY AND SURVEY DETAILS:
TYPE : dredging
SCOPE: 1 site
LEVEL: stratigraphy, delineation

SIZE : 22 clam-shell samples
SURVEY PATTERN: random
SURVEY SPACING: random
SEASON: summer PROGRAM LENGTH:

EQUIPMENT : clam-shell sampler, bucket dredge sampler

PENETRATION: seabed surface

RESOLUTION : good

INFORMATION ON SAMPLES OR SURVEY RECORDS:
RATE : N.A.
QUALITY: disturbed
TYPE : clam-shell samples
SIZE : 22 grab

LEVEL OF DETAIL: INTERPRETATION/ANALYSIS/REPORTING:
INTERP : grain distribution
REPORT : summary/data compilation report
DISTRIB: sponsor/contractors
OTHER :

ARCHIVING OF INFORMATION:
REPORT :
DATA : sponsor/contractors

DATA COMPILATION AND UPDATING:
COMPILED BY:
DATE : 88/03 COMPILATION PROJECT NO.:
UPDATED BY : EBA ENGINEERING CONSULTANTS LTD.
DATE : 91/03/27 UPDATE PROJECT NO.: 0306-34693

REPORT CATALOGUE SAMPLE FORM

FIGURE 1

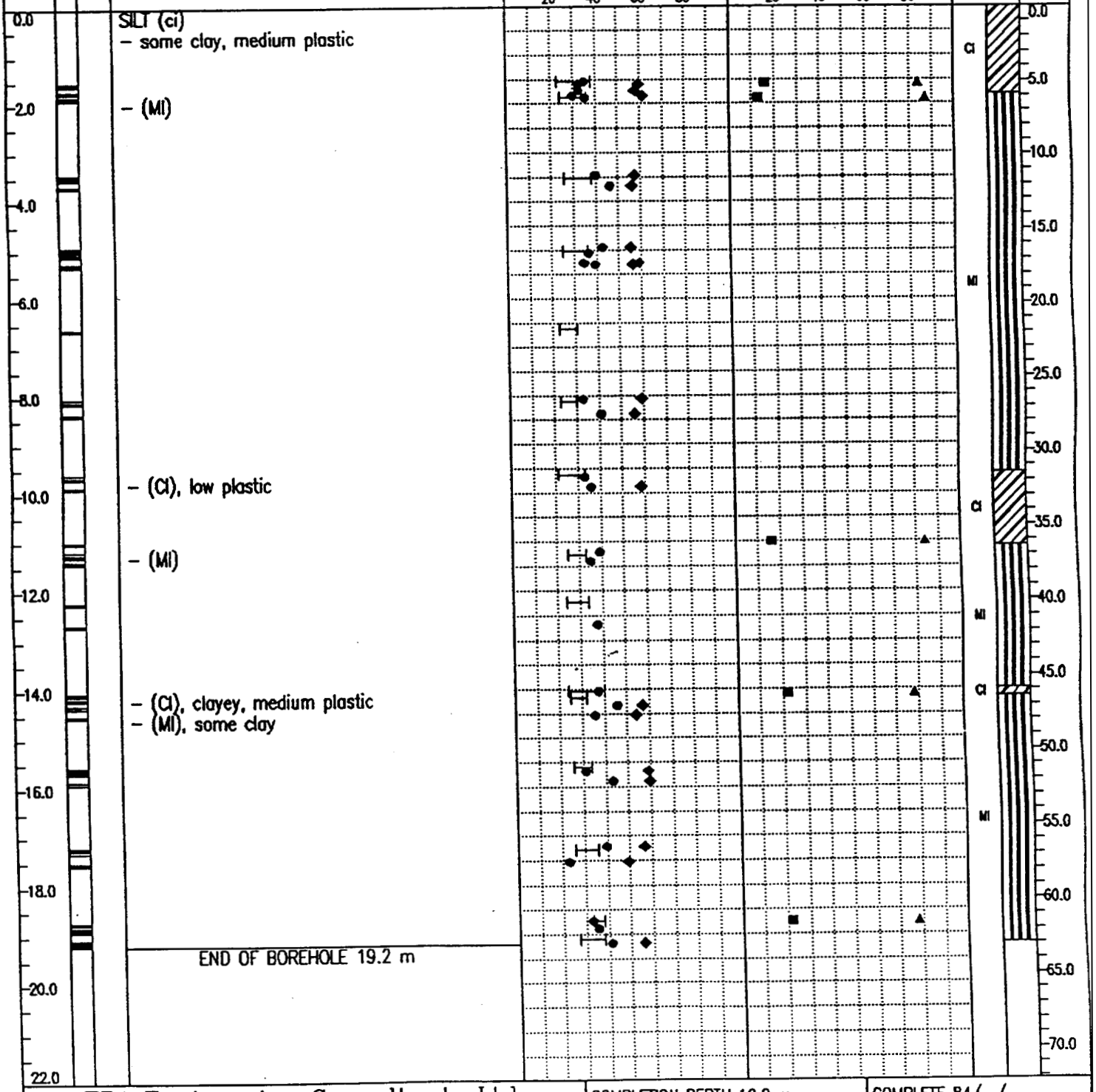
TYPICAL ESEBASE BOREHOLE LOG

FIGURE 2

BELUGA BAY 1984	DEPTHS ARE REFERENCED TO SEABED.	TESTHOLE No. UK84TT01
GEOLOGICAL SURVEY OF CANADA	WATER DEPTH – UNKNOWN	Project No:
ORIGINAL BOREHOLE NO. BH 0 + 00	UTM ZONE: 8 N7728586.00 E516967.00	ELEVATION 0.00 (m)

SAMPLE TYPE: SHELBY TUBE; NO RECOVERY; SPLIT SPOON; CORE; SHIPEK GRAB; GRAVITY CORE

DEPTH (m) | SAMPLE TYPE | SAMPLE NO | SOIL DESCRIPTION | BULK DENSITY (mg/m3) 0.6 1.2 1.8 2.4 | TEMPERATURE CELCIUS −3 −1 1 3 | PLASTIC M.C. LIQUID 20 40 60 80 | GRAVEL (%) 20 40 60 80 | SAND (%) 20 40 60 80 | SILT (%) 20 40 60 80 | CLAY (%) 20 40 60 80 | USC | DEPTH (ft)



EBA Engineering Consultants Ltd. Calgary, Alberta	COMPLETION DEPTH 19.2 m	COMPLETE 84/ /
	LOGGED BY	DWG NO.	Page 1 of 1

FIGURE 3 TYPICAL BOREHOLE/COREHOLE/SAMPLE NUMBER

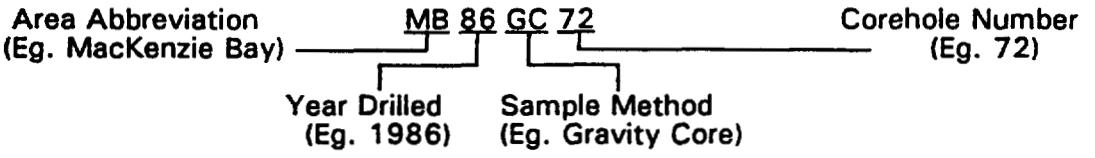


FIGURE 4 SOIL DESCRIPTION

- principal component (e.g. CLAY, SAND, SILT, etc.)
- Unified Soil Classification (USC)
- principal component modifier(s) (e.g. silty, some sand, etc.)
- particle shape
- structure
- moisture
- consistency
- plasticity
- colour
- ground ice description