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Miscellaneous Release—Data 353

Graphic Logs with Analytical and Geochronological Data from Hand Auger, Probe and Section Sites in the Niagara Peninsula

by A.K. Burt

This publication can be downloaded from
http://www.geologyontario.mndm.gov.on.ca/mndmaccess/mndm_dir.asp?type=pub&id=MRD353

This release provides data resulting from reconnaissance field operations for the Niagara Peninsula three-dimensional (3-D) Quaternary geology mapping project. The study area encompasses approximately 5000 km^2 of the Niagara Peninsula (bounded by Lake Ontario to the north, the Niagara River to the east and Lake Erie to the south) and extends west and north to join with the boundaries of the Brantford–Woodstock 3-D project area (Bajc and Dodge 2011). Field operations were conducted from June to August of 2013 in targeted portions of the area where stratigraphic information required to develop a 3-D model could be obtained.

A total of 130 sites were investigated, including 5 surface observation sites; 3 shallow test pits, ranging from 0.35 to 1 m deep; 24 soil probe sites, ranging from 0.45 to 5 m deep; 64 hand auger sites, ranging from 0.25 to 7.4 m deep; and 34 sections ranging from 1 to 14.5 m high (Figure 1). Burt (2013) describes the regional geology and project field activities and provides graphic composite logs for the study area. This release provides analytical data (carbonate, grain size, pebble and radiocarbon analyses), field data (glacial feature observations), subsurface data (geological descriptions and interpretations; hydrostratigraphic units), 6 location maps and 75 selected field photographs. These data are summarized visually as graphic logs for all 130 sites. The data are available as 9 Microsoft® Excel® (*.xlsx*) files, 211 image (*.tif* or *.jpg*) files and 1 portable document format *(.pdf*) file.

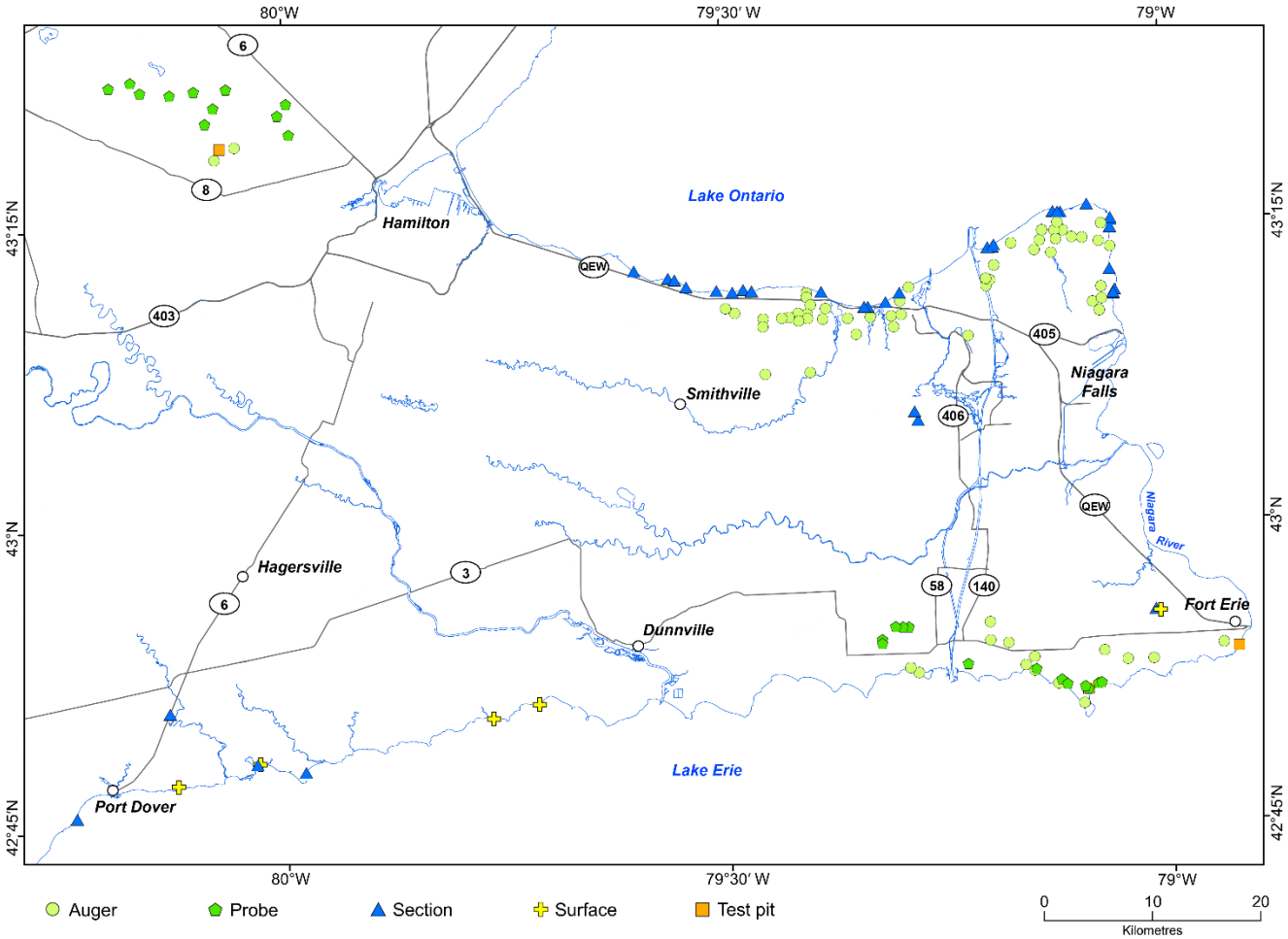

Figure 1. Generalized map of the Niagara Peninsula area showing the locations of sites investigated during the 2013 field season. The legend indicates the work done (i.e., surface, test pit, soil probe, hand auger or section) at each of the sites.

Data are organized in 5 folders:

1. Analytical Data
2. Graphic Logs
3. Photographs
4. Reference Maps
5. Subsurface Data

1. Analytical Data. This folder contains 5 Microsoft® Excel® 2010 (*.xlsx*) workbook files and 1 portable document format *(.pdf*) file. The workbook files contain the results of laboratory carbonate, grain size and radiocarbon analyses, as well as pebble lithologies and striation measurements.

2015 Geo Labs Brochure.pdf describes the analytical methods used at the Ontario Geological Survey Geoscience Laboratories.

Carbonate.xlsx : Chittick analysis was undertaken on diamicton and fine-textured glaciolacustrine samples. The results of all carbonate analyses, including quality-control duplicate samples and standards, have been integrated into a single data file. Duplicate samples are noted by the letters DUP in the sample number. The total percent of carbonate, the percent of calcite and dolomite and the ratio of calcite to dolomite are the key data fields. The columns in the workbook are explained as follows.

Column	Description and Notes
Lab ID	lab number composed of sample number and duplicate notation
Sample Number	original project sample number
Site	site number
From (m)	top of sample interval in metres
To (m)	bottom of sample interval in metres
Chittick 1RDG	first reading taken (mL) after 30 seconds representing the volume of CO_2 evolved due to calcite
Chittick 1CF	correction factor (function of temperature) applied to the volume of Chittick 1RDG
Chittick 1CML	corrected first reading (Chittick 1RDG × Chittick 1CF)
Chittick 2RDG	second reading taken (mL) after an additional 30 minutes representing the volume of CO_2 evolved due to calcite and dolomite (total carbonates)
Chittick 2CF	correction factor (function of temperature) applied to the volume of Chittick 2RDG
Chittick 2CML	corrected second reading (Chittick 2RDG × Chittick 2CF)
Chittick BAR	barometric pressure and is constant at 760 kPa
Chittick CCO2	percent CO_2 evolved from calcite
Chittick DCO2	percent CO_2 evolved from dolomite
Chittick CT	percent calcite
Chittick DOL	percent dolomite
Chittick CDR	calcite:dolomite ratio
Chittick TCARB	percent total carbonate (calcite + dolomite)
Chittick Unit ID	chittick unit that the sample was analyzed on
Chittick WT	weight (g) of sample analyzed
Chittick WTFTR	weight factor used in the calculations

Grain Size.xlsx : Grain size analyses were undertaken on diamicton and stratified sediment samples. The results of all grain size analyses, including quality-control duplicate samples and standards, have been integrated into a single data file. Duplicate samples are noted by the letters DUP in the sample number. The columns in the workbook are explained as follows.

Column	Description and Notes
Lab ID	lab number composed of sample number and duplicate notation
Sample Number	original project sample number
Site	site number
From (m)	top of sample interval in metres
To (m)	bottom of sample interval in metres
Sand (%)	calculated percentage of sand
Silt (%)	calculated percentage of silt
Clay (%)	calculated percentage of clay
Mean Volume (µm)	mean volume diameter in micrometres (µm) obtained directly from particle size analyzer. This is a type of average particle size representing the centre of gravity of the distribution. It is weighted (i.e., strongly influenced) by coarse particles.
Mean Number (µm)	mean number diameter in micrometres (µm) calculated from the volume distribution. This is weighted toward finer textured particles resulting in a smaller number.
Mean Area (µm)	mean area diameter in micrometres (µm) calculated from the volume distribution. This is a type of "average" that is less weighted by the presence of coarse particles that the mean volume.
Calculated Specific Surface Area – (m^2/cm^3)	an indication of specific surface area assuming smooth, solid, spherical particles. Calculated specific surface area does not reflect porosity or unique topographic characteristics of particles.
Standard deviation	this measurement gives the width of the measured particle size distribution
Percentiles	particle size in micrometres (µm) at various percentiles (5, 10, 15, 16, 40, 50, 60, 84, 85, 95)
Percent in Channel	raw data from the particle size analyzer. The 67 column headings give the particle size in micrometres (µm).
Percent Passing	raw data from the particle size analyzer. The 67 column headings give the particle size in micrometres (µm).

Pebble Counts.xlsx : Pebble lithologies were determined for diamicton and gravel samples. The columns in the workbook are explained as follows.

Column	Description and Notes
Sample Number	original project sample number
Site	site number
From (m)	top of sample interval in metres
To (m)	bottom of sample interval in metres
Limestone (%)	percent limestone pebbles
Dolostone (%)	percent dolostone pebbles
Clastics (%)	percent clastic (sandstone, shale, mudstone) pebbles
Other (%)	percent other (chert, gypsum) pebbles
Precambrian (%)	percent Precambrian (mafic crystalline, felsic crystalline, greenstone) pebbles

Radiocarbon Data.xlsx : Accelerator mass spectrometry (AMS) ^{14}C radiocarbon analyses were performed by Dr. Hong Wang of the Illinois State Geological Survey Geochronology Laboratory on organic material obtained from peat samples, and from a few stratified sediment samples. The columns in the workbook are explained as follows.

Column	Description and Notes
ISGS #	lab number
Sample Number	original project sample number
Site	site number
Material	sample type (wood, charcoal)
$\delta^{13}C$	per mil (‰) difference between sample ^{13}C content and the content of the international standard carbonate Vienna Pee Dee Belemnite (VPDB) as a result of natural biochemical processes
Fraction of modern carbon	ratio between the $^{14}C/^{12}C$ ratio in the sample and the $^{14}C/^{12}C$ ratio in modern carbon ($^{14}C/^{12}C$ ratio that would have been measured in 1950 had there been no fossil fuel effect)
±	margin of error
$\Delta^{14}C$	value of $\Delta^{14}C$ (per mil (‰) depletion in sample ^{14}C) that has been normalized according to its $\delta^{13}C$
±	margin of error
^{14}C age	age of sample reported as years before present (present is defined as 1950)
±	margin of error reported in years

Striations.xlsx contains data collected relating to glacial features. The orientation of striations, grooves and crag-and-tail features were measured at sites with exposed bedrock using a liquid-filled magnetic compass with declination set to 0°. The data are grouped according to site, subsite and type of feature measured; an example is shown as Figure 2. An average value and corrected average value are presented below the recorded measurements.

Site	S076-NP-2013				
Subsite	S076-NP-2013-A	S076-NP-2013-B	S076-NP-2013-D	S076-NP-2013-E	S076-NP-2013-E
Feature	Striations	Grooves	Craig-and-tail	P-form	Tool marks in p-form
	252	249	249	238	252
	251	248	253		244
	251	248	253		238
	251	249	248		242
	251	250	250		235
	255	247	249		244
	253	247	251		239
	252	248	247		240
	251	249	248		238
Average	**252**	**248**	**251**	**238**	**241**
Average (corrected for declination)	**262**	**258**	**261**	**248**	**251**

Figure 2. Example of data in the *Striations* workbook. Note that, for the purpose of this example, some columns and rows have been removed.

2. Graphic Logs. This folder contains graphic logs for each of the 130 sites (Figure 3). Note that the logs are presented using 1 of 7 scales (2, 3, 4, 5, 6, 8 and 11 m). Each log (as a *.tif* file) contains the following information.

Plot Item	Description and Notes
Site	Site number
Easting, Northing	UTM co-ordinates in metres using NAD83, Zone 17N
Elevation	Elevation of site (m asl) obtained from the 2015 digital surface model
Type	Method of investigation, i.e., auger, probe, section
Reference Map Number(s)	Map number showing site location (*see* folder "Reference Maps")
Depth	Depth below ground surface in metres
Class	The intervals in this column are the same as the hydrostratigraphic unit column, but have been coloured according to their aquifer–aquitard class. This can be considered a very basic prediction of the sediments anticipated for each hydrostratigraphic unit: aquifers are dominantly silt, sand and gravel; aquitards are dominantly till, clay and silt.
Hydrostratigraphic Unit (text)	This column identifies the interpreted hydrostratigraphic unit by name
Hydrostratigraphic Unit (bar)	This column identifies the interpreted hydrostratigraphic unit using a coloured bar
Interpretation	Interpreted depositional environments
Lithology	Summary of geologic information. The colour of each segment corresponds to the primary material type. The symbols provide information on secondary material types and structure. Green dots indicate ice-rafted debris. Brown arrows mark the depth of material provided for radiocarbon analysis.
Summary description	Summary description of the geologic material
Grain Size	The length of each coloured bar represents the percent of sand, silt and clay for each sample analyzed
Total Carbonate	The length of the coloured bar represents the total percent of carbonate (calcite and dolomite) in the sample matrix
Calcite:Dolomite Ratio	The length of the coloured bar represents the ratio of calcite to dolomite in the sample matrix
Pebble Count	The length of each coloured bar represents the percent of limestone, dolostone, clastic, other sedimentary and Precambrian pebbles

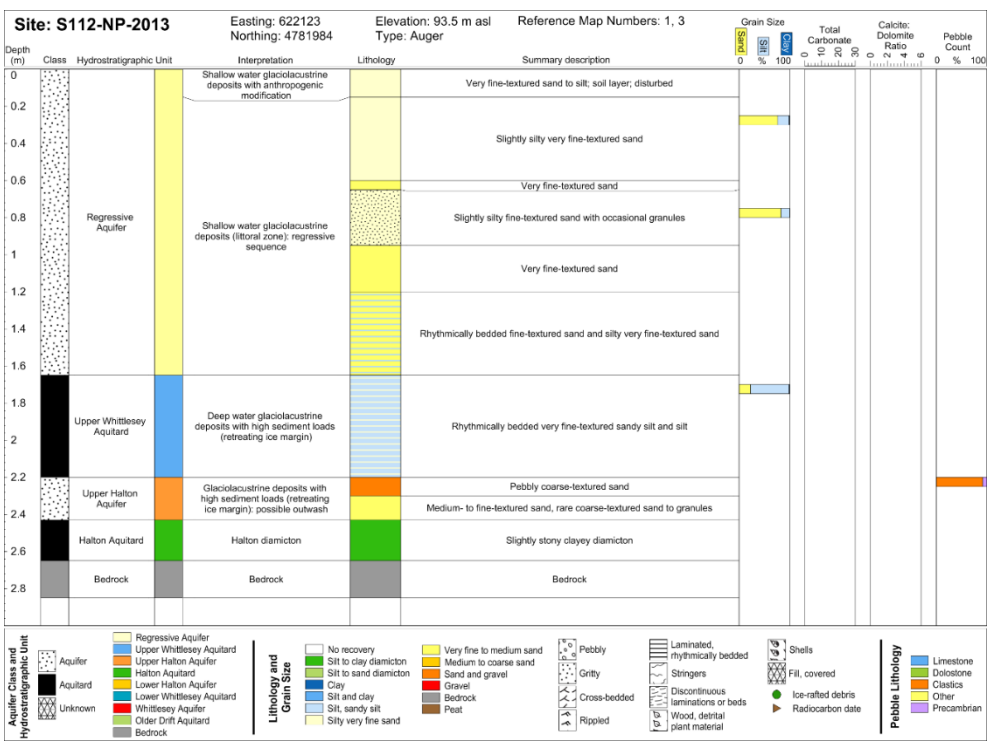

Figure 3. Example of the images in folder "Graphic Logs", which summarize the data visually as graphic logs for each of the 130 sites.

3. Photographs. This folder contains 75 photos (as *.jpg* files) showing field activities, landforms and examples of different geologic materials. Each image is named according to the contents; no additional descriptions are provided.

4. Reference Maps. This folder contains 6 surficial geology reference maps (as *.tif* files) that show site locations. The image *Niagara_Map1_Index* (shown here as Figure 4) presents an overview of the area, with outlines of more detailed map locations.

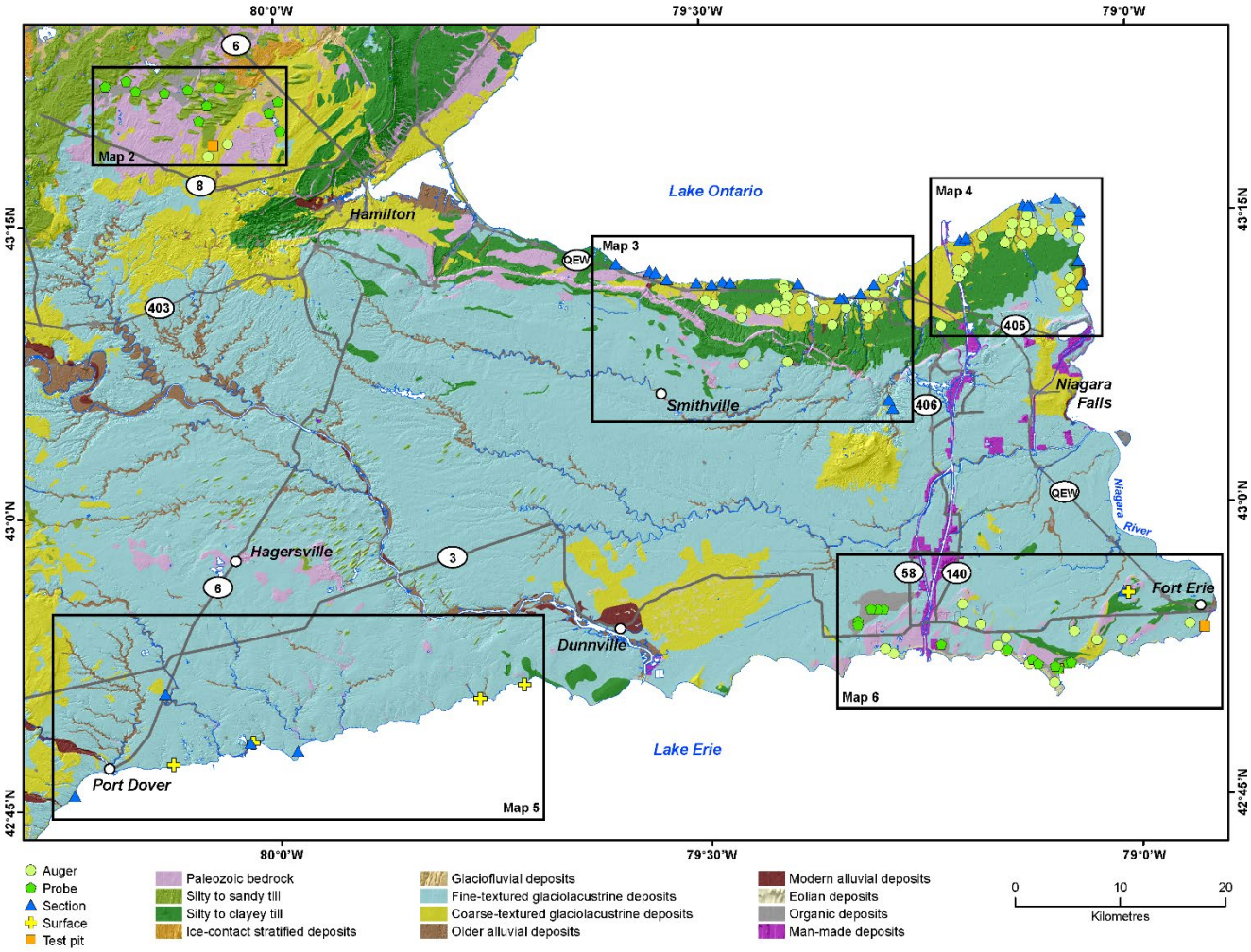

Figure 4. Index map for reference maps Niagara_Map2 to Niagara_Map6, showing the site locations and the type of work done at each site, overlain on both the topography and the Quaternary geology of the Niagara Peninsula study area.

5. Subsurface Data. This folder contains 4 Microsoft® Excel® 2010 (*.xlsx*) files. The workbook files contain site locations, formation descriptions, interpretations and hydrostratigraphic units

Formation.xlsx contains information about the geologic materials encountered at each site. It should be noted that, with the exception of some sections, bedrock was arbitrarily assigned a thickness of 20 cm so that it would show up on the graphic logs. The columns in the workbook are explained as follows.

Column	Description and Notes
Site	site number
From (m)	top of formation interval in metres below ground surface
To (m)	bottom of formation interval in metres below ground surface
From (elevation m asl)	top of formation interval in metres above sea level
To (elevation m asl)	bottom of formation interval in metres above sea level
Summary Description	summary description of the geologic material. This information appears on the graphic log.
Detailed Description	detailed description of the geologic material
Munsell Colour Code	colour code obtained by comparing sediments with published colour chips
Munsell Colour	names associated with Munsell colour codes. *Note that names may be repeated as several codes can translate to the same name
Sample Numbers	samples obtained from each formation. *Note that not all samples have been analyzed.

Hydrostratigraphic Units.xlsx contains information about the hydrostratigraphic units encountered at each site. The hydrostratigraphic units are identified on the basis of age and the sediment characteristics resulting from deposition in different environments (Figure 5). The units typically contain a range of sediment textures as a result of short-term or localized changes in ice-margins, lake levels, sediment sources and water velocities. In practical terms, this means that, while aquifer units will be dominantly sand and gravel, there will also be some finer textured components. It is equally likely that an aquitard composed primarily of lake-bottom silt and clay or glacial till will have localized sand layers. It should be noted that the surficial geology map was used to assign unit boundaries for covered intervals where the upper observed sediments and surficial geology map are the same. The columns in the workbook are explained as follows.

Column	Description and Notes
Site	site number
From (m)	top of unit in metres below ground surface
To (m)	bottom of unit in metres below ground surface
From (elevation m asl)	top of unit in metres above sea level
To (elevation m asl)	bottom of unit in metres above sea level
Hydrostratigraphic Unit	identifies the interpreted hydrostratigraphic unit by name
Aquifer–Aquitard (or Other) Classification	this provides a simplified classification as to whether the unit is an aquifer, an aquitard, fill, bedrock, "covered" or undetermined ("no recovery"). This can be considered a very basic prediction of the sediments anticipated for each hydrostratigraphic unit: aquifers are dominantly silt, sand and gravel; aquitards are dominantly till, clay and silt. "Covered" indicates that this portion of the section is covered with slumped sediments or debris.

Interpretation.xlsx contains interpreted depositional environments for the geologic materials encountered at each site. The columns in the workbook are explained as follows.

Column	Description and Notes
Site	site number
From (m)	top of interpreted interval in metres below ground surface
To (m)	bottom of interpreted interval in metres below ground surface
From (elevation m asl)	top of interpreted interval in metres above sea level
To (elevation m asl)	bottom of interpreted interval in metres above sea level
Interpretation	Interpreted depositional environment

Location.xlsx contains the location information for each site. The columns in the workbook are explained as follows.

Column	Description and Notes
Site	site number
Easting	UTM co-ordinates in metres
Northing	UTM co-ordinates in metres
UTM zone	All co-ordinates are provided using NAD83 in Zone 17N
DSM Elevation	Elevation of site (m asl) obtained from the 2015 digital surface model
Type	Method of investigation, i.e., auger, probe, section
Depth	Depth below ground surface in metres
Reference Map	Map number showing site location (*see* folder "Reference Maps")

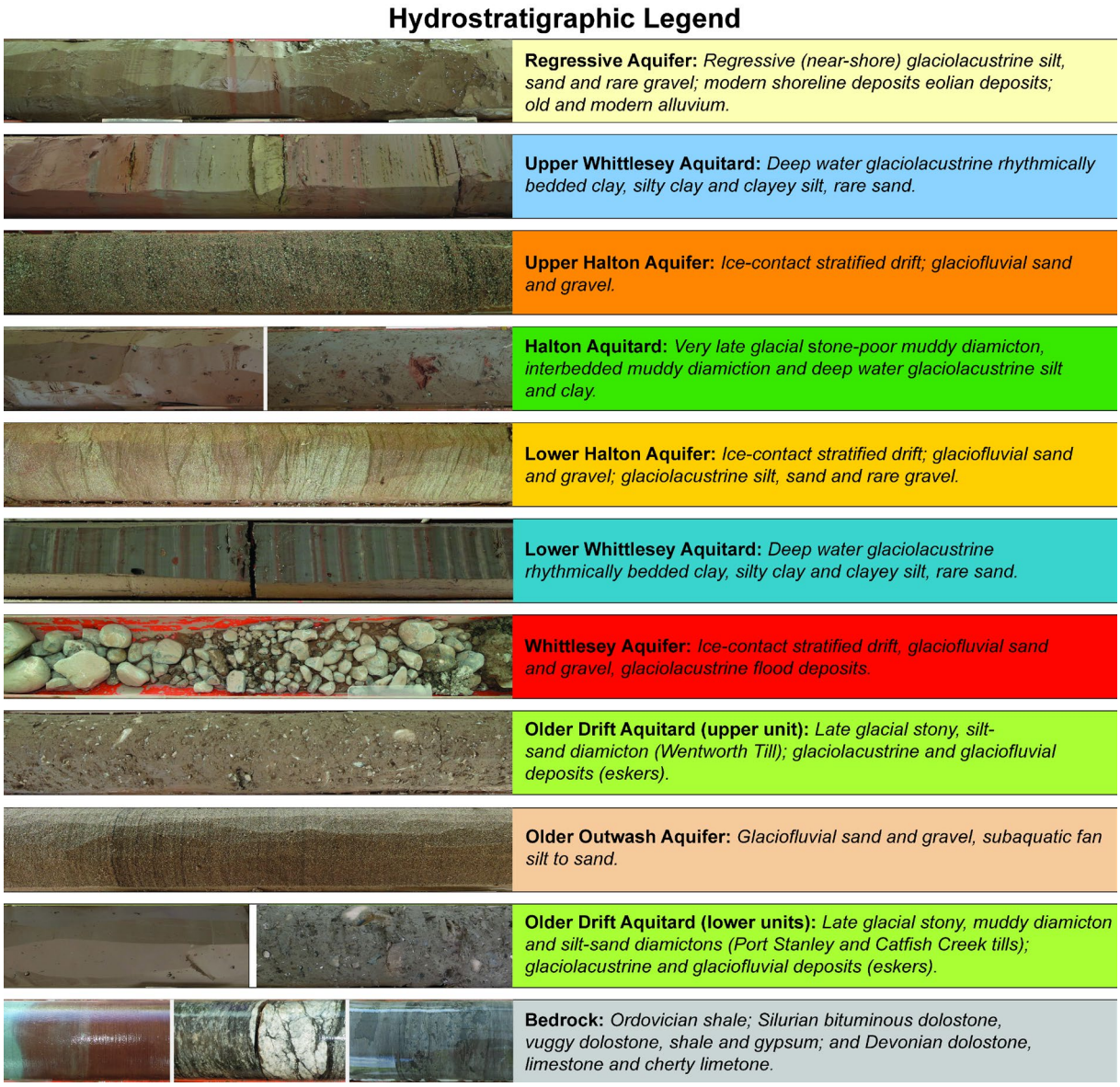

Figure 5. Hydrostratigraphic units within the Niagara Peninsula 3-D sediment mapping area (*modified from* Burt 2016). Unit names, primary sediment types and a representative photo are shown. Note that the unit colours used in this chart are also used in the graphic logs.

Acknowledgments

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Jose Schroeder and the OGS Geoscience Laboratories staff wade through mountains of samples each year providing accurate and timely analytical results.

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——— 2016. The Niagara Peninsula in three dimensions: A drilling update; *in* Summary of Field Work and Other Activities, 2016, Ontario Geological Survey, Open File Report 6323, p.30-1 to 30-13.