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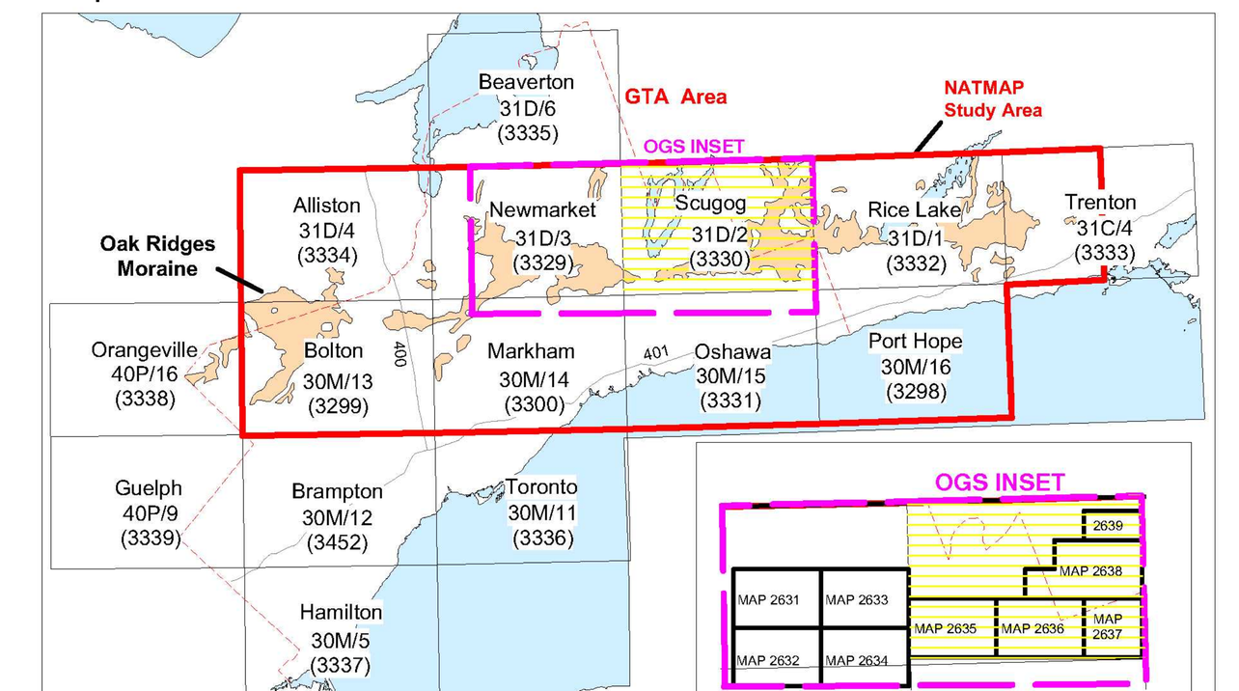
Surficial Geology of the Scugog Area, NTS 31D/2, southern Ontario

Scale 1:50 000

Map Index



Oak Ridges Moraine NATMAP Project
Surficial Geology Series

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INTRODUCTION

NATMAP Oak Ridges Moraine Map series

Scugog is one in a series of 15 digital 1:50,000 maps summarizing the glacial and postglacial deposits of the Oak Ridges Moraine (ORM) and Greater Toronto Area (GTA) (index map). The series is sponsored by the National Mapping Program (NATMAP) of the Geological Survey of Canada in collaboration with the Ontario Geological Survey (OGS). These maps complement a series of 1:20,000 geology maps covering the central area of the ORM, published by OGS. The OGS is also publishing two 1:50,000 sheets (Scugog and Newmarket) using map detail and the expanded legend of the1:20,000 series. A 1:200,000 scale compilation map of the 1:50,000 maps completes the series (Sharpe et al, 1997).

Objectives and Content

The objective of the map series is to synthesize the geology of the ORM study area as a basis for environmental analysis, particularly hydrogeology. Each map consists of 4 coloured panels:
1) title block, series introduction and regional setting, 2) thematic maps, 3) legend, symbols and geology map, and 4) reference material: map notes, stratigraphic table and series bibliography. The layout is designed to allow folds between the first three panels and to allow the main map and legend to be cut off for field use.

Thematic maps and other features

A thematic map series complements the surficial geology map by providing at a common scale:
1) field site locations and Voronoi polygons of sediment descriptions (Fig.3);
2) geologic map (Fig.4) for comparison with other thematic maps;
3) digital elevation model (DEM) (Fig.5) to allow visualization of relief / terrain elements that shows the pattern and control on drift distribution;
4) bedrock topography map with bedrock geology overlay (Fig. 6);
5) sediment thickness map that shows variation in sediment thickness (Fig. 7).

Each map is supplemented with map notes, an explanation of the key geologic terms related to the map unit sequence (stratigraphy) and age relationships, and a series bibliography. The digital map files will be released as part of a CD-ROM data release.

Data sources and structure

The nine maps within the NATMAP area all include new field work complemented by archival field data; combined, most maps have > 1,000 data points. The six maps outside NATMAP and within the GTA (location map) have been re-mapped with a minimum of new field work but include re-assessed archival data. All maps are structured in a Geographic Information System (GIS) with supporting data in a relational database (Russell et al., 1996). This format permits map feature enhancement and analysis (e.g. thematic map series, Figs. 3-7). Surficial geology forms the first layer of a set of regional themes in the area, where Quaternary sediment thickness reaches approximately 200 m. The relational database allows for the digital map files to be easily updated as new data are added.

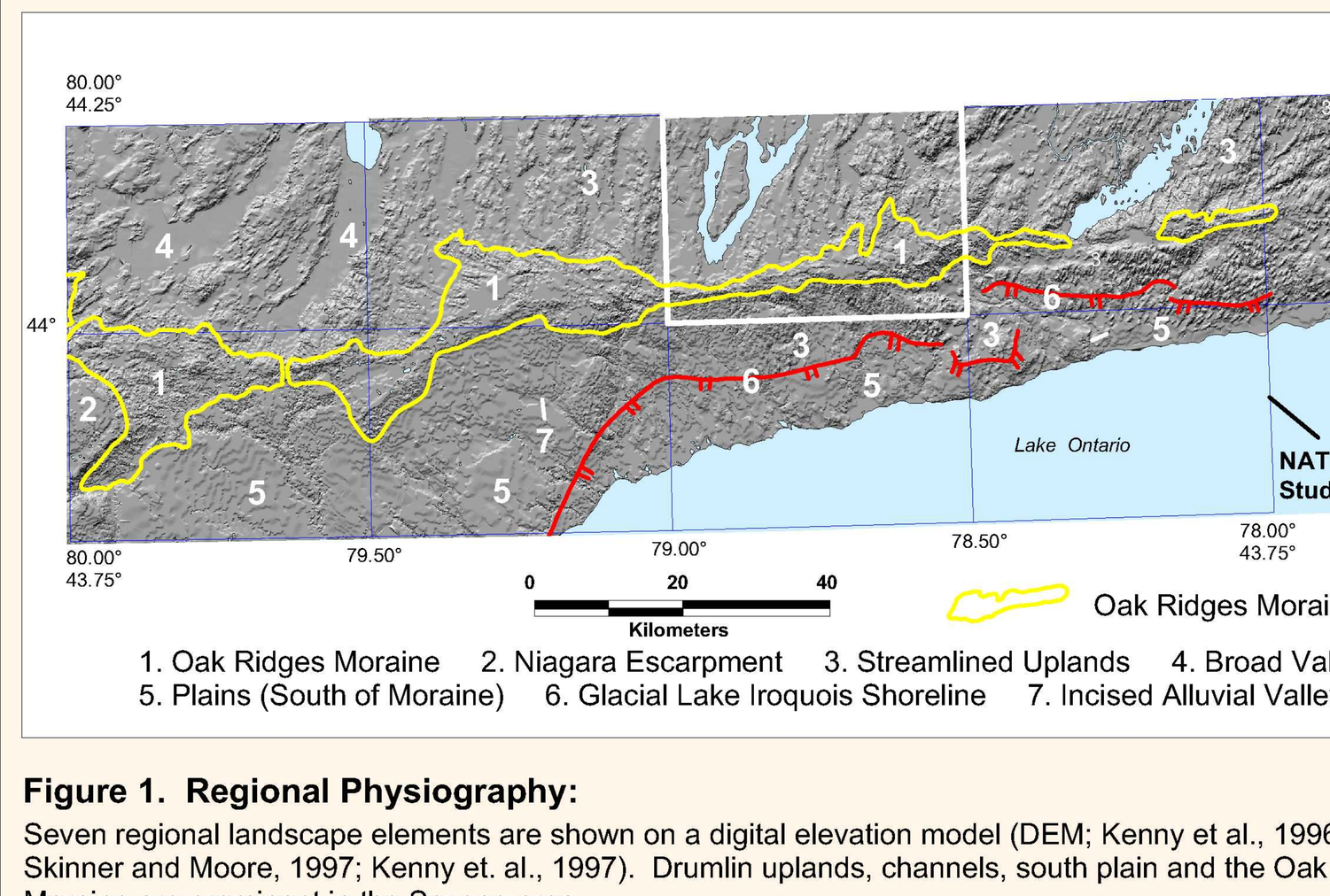


Figure 1. Regional Physiography:
Seven regional landscape elements are shown on a digital elevation model (DEM; Kenny et al., 1996; Skinner and Moore, 1997; Kenny et. al., 1997). Drumlin uplands, channels, south plain and the Oak Ridges Moraine are prominent in the Scugog area.

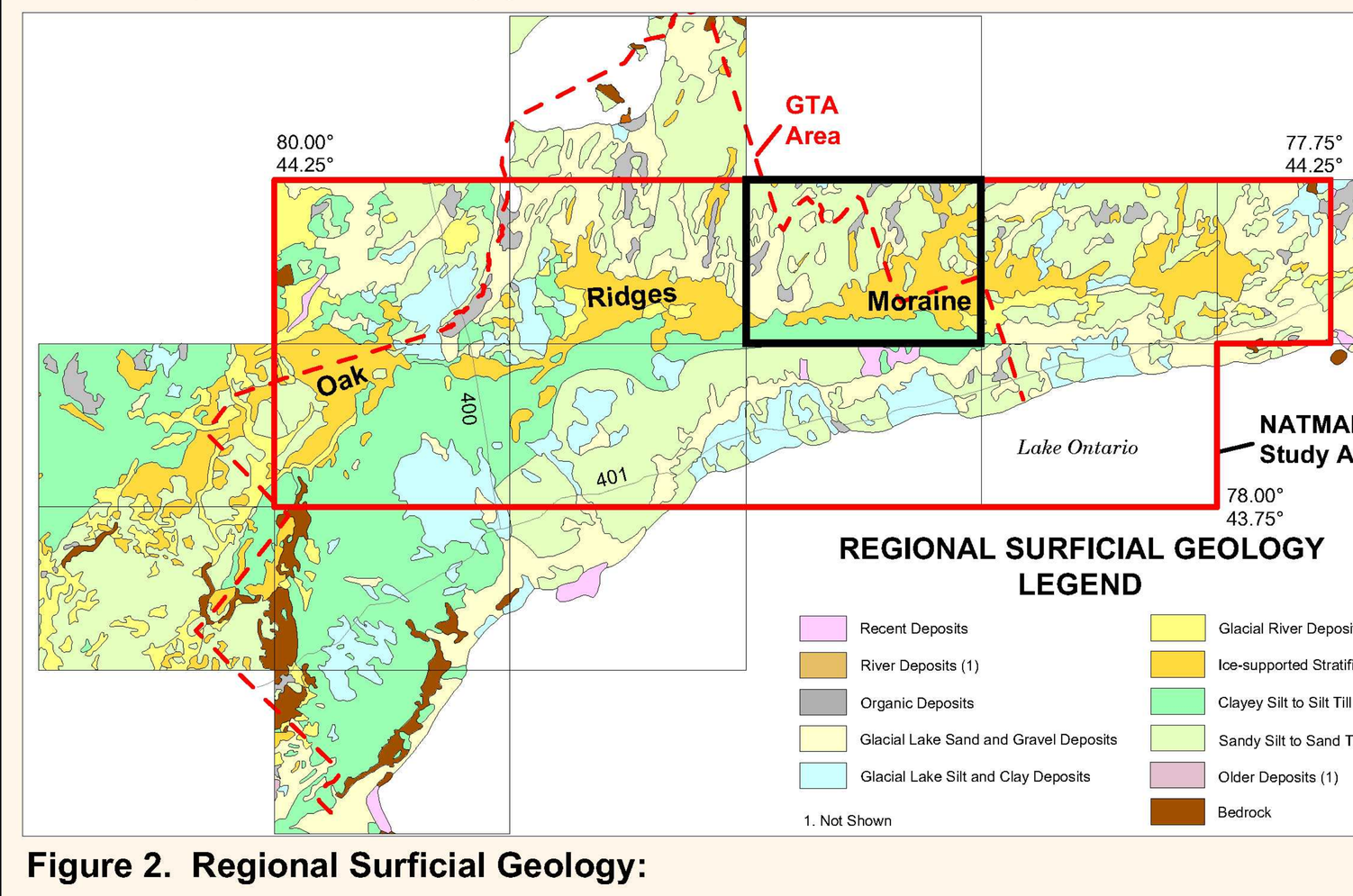


Figure 2. Regional Surficial Geology:
Regional surficial geology showing the Scugog area in regional context (modified from Barnett et. al., 1991) Large areas of Newmarket Till and lake sand are exposed north of the Oak Ridges Moraine in this area. The map legend is the same as that for the main map.

THEMATIC MAPS

Figure 3 Legend: Sediment Codes

10 Fill	8 Clay	6 Sand	4 Silty-clay diamicton	2 Sand diamicton
9 Organics	7 Silt	5 Gravel	3 Sandy-silt diamicton	1 Bedrock

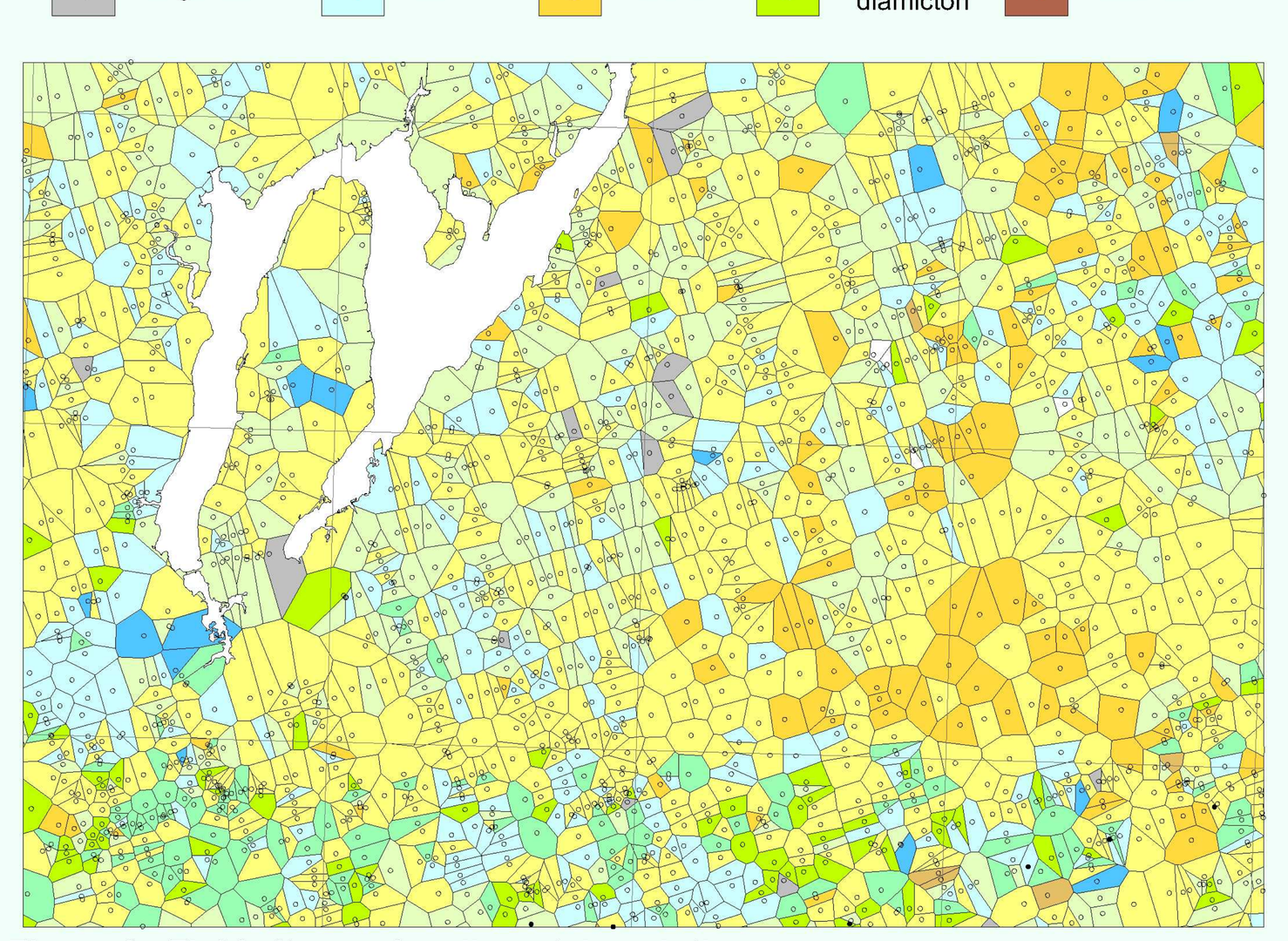


Figure 3. Field sites and sediment description:
Field sites located at the centre of polygons (Voronoi plot) describe the sediment found and used as ground control for air photo interpretation. Field sites are new OGS data (Barnett "dot").

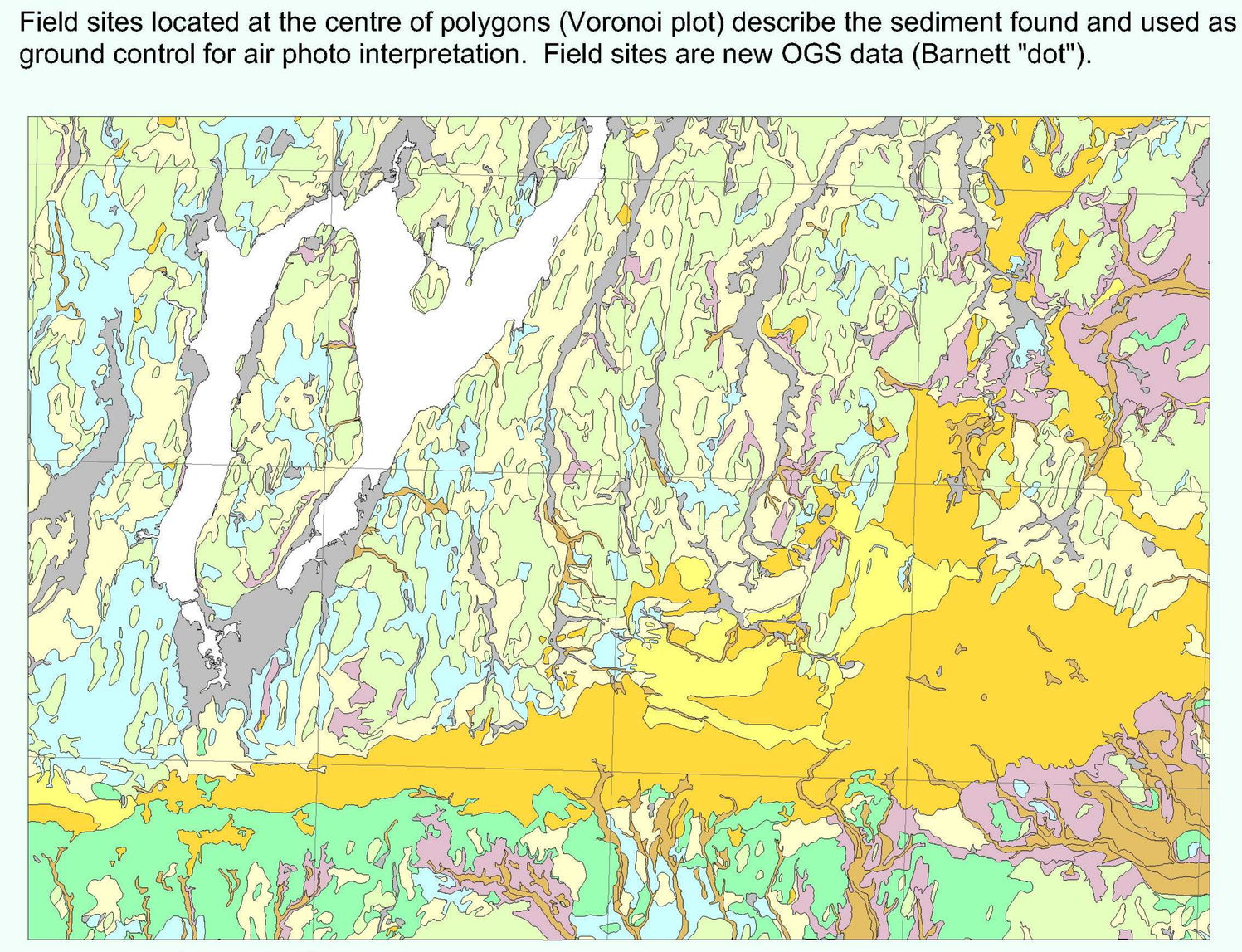


Figure 4. Scugog Geology Map:
Surficial geology map of the Scugog area shown at the same scale as other thematic maps permits ease of comparison with sediment descriptions (Fig. 3) or Digital Elevation Model (Fig. 5). Legend is same as main map.

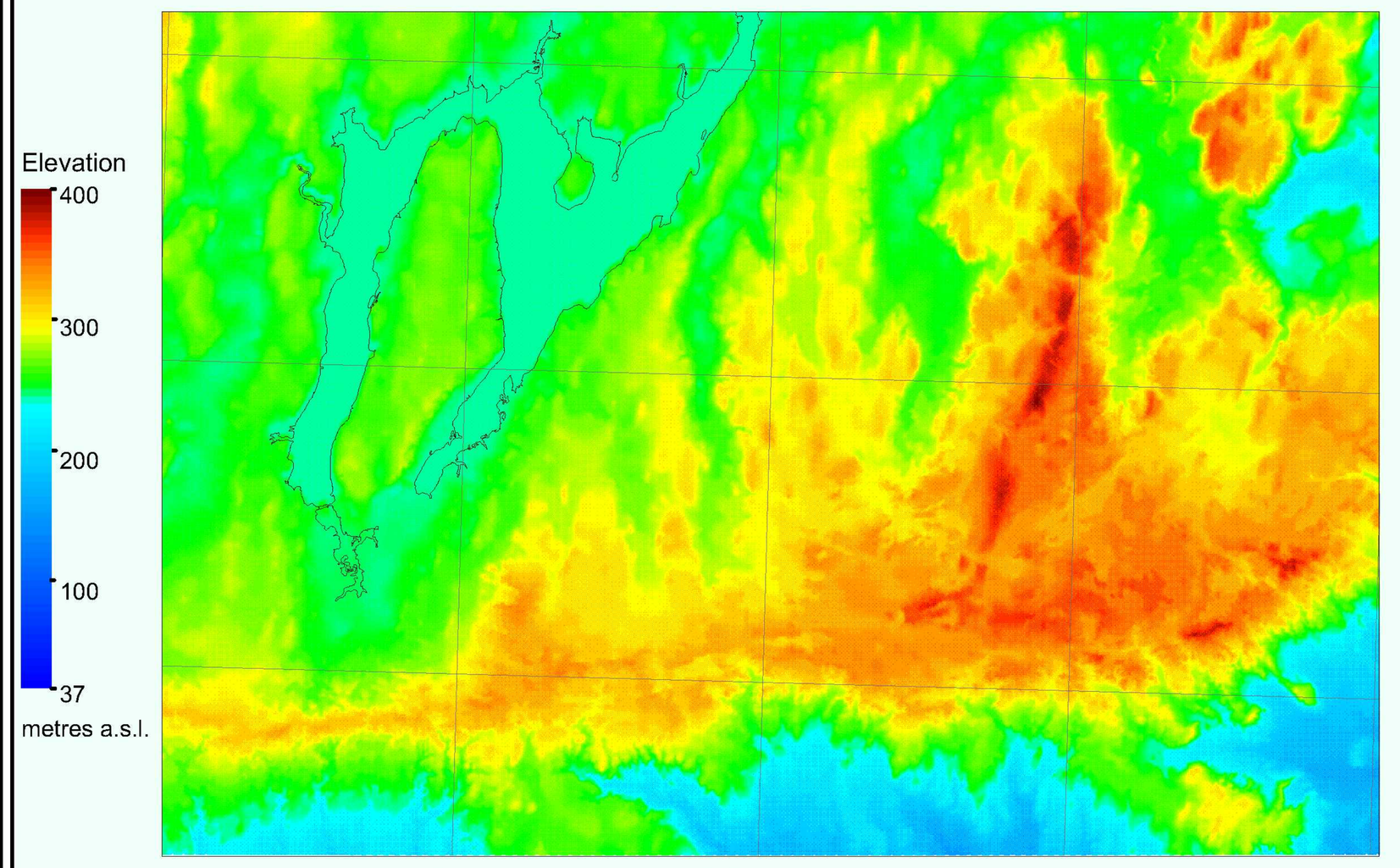


Figure 5. Digital Elevation Model (DEM):
DEM (hill-shaded, colour gradient) showing main elements of the landscape, including the Oak Ridges Moraine (Pontypool sediment wedge), drumlinized uplands and broad deep tunnel valleys (e.g. Lake Scugog).

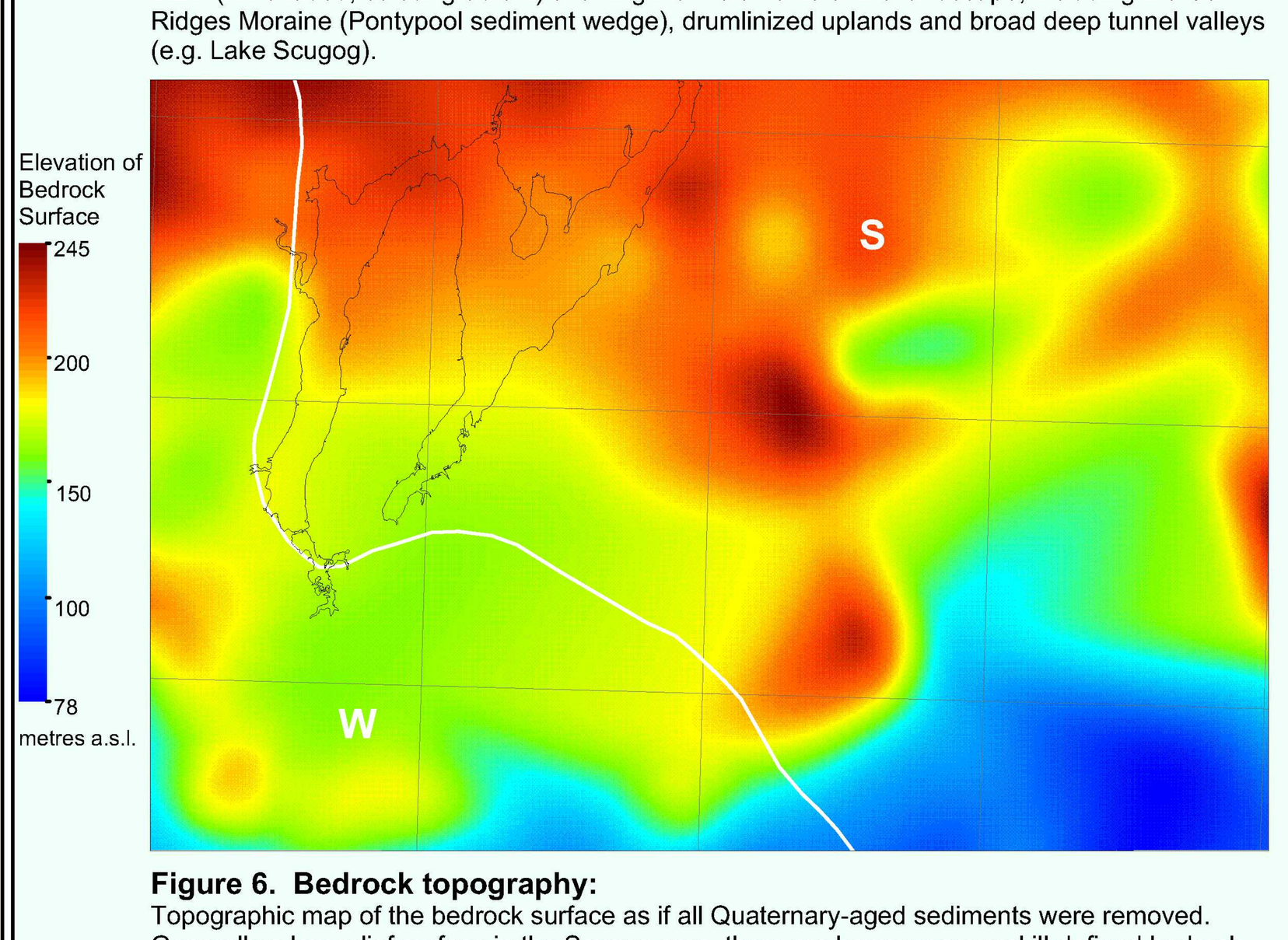


Figure 6. Bedrock topography:
Topographic map of the bedrock surface as if all Quaternary-aged sediments were removed. Generally a low-relief surface in the Scugog area, there are however several ill-defined bedrock valleys in the vicinity of Lake Scugog and east of Pontypool. Simcoe (S) limestone and Whitby Formation (W) shale are shown.

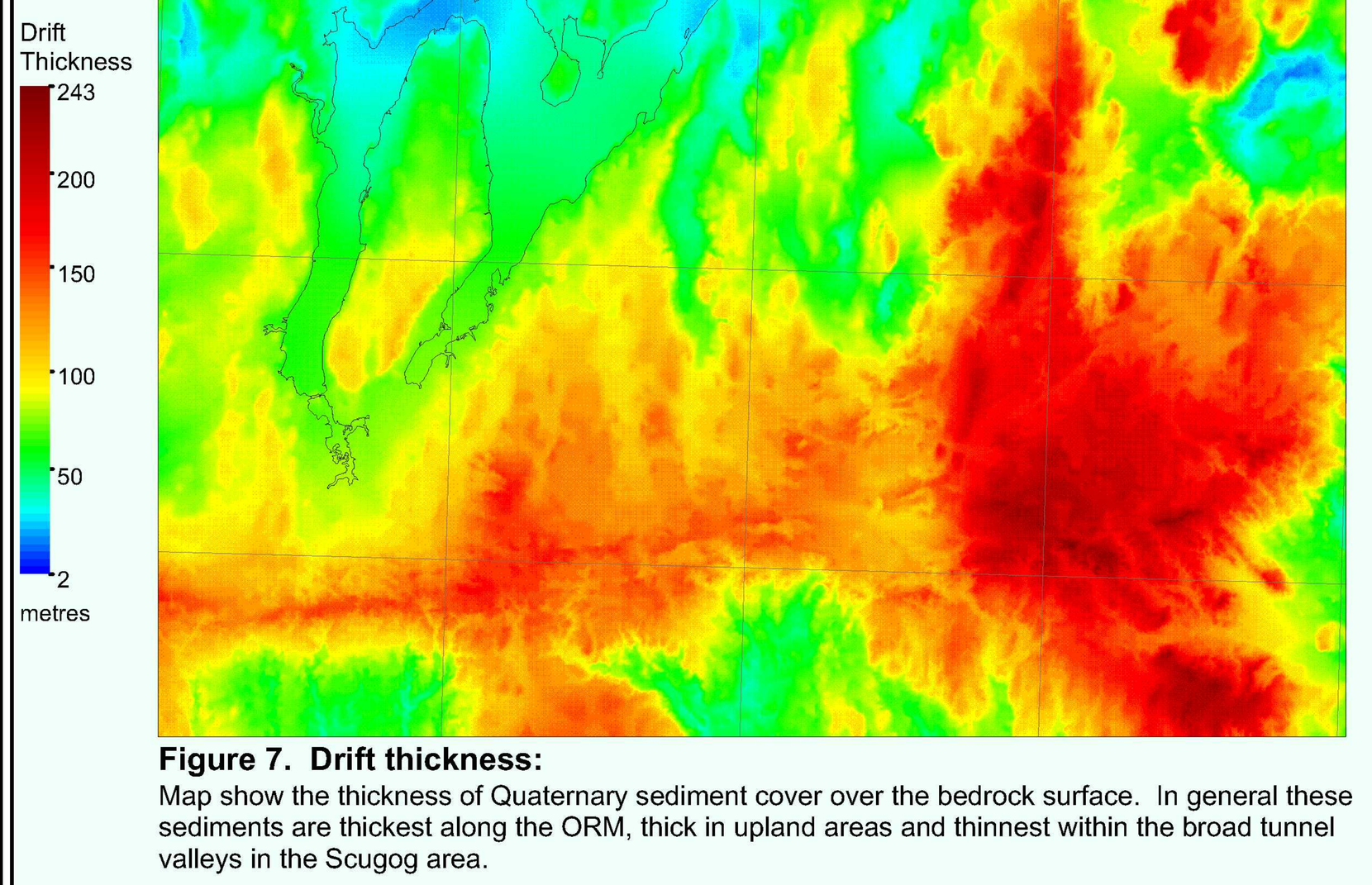


Figure 7. Drift thickness:
Map show the thickness of Quaternary sediment cover over the bedrock surface. In general these sediments are thickest along the ORM, thick in upland areas and thinnest within the broad tunnel valleys in the Scugog area.

LEGEND

SURFICIAL GEOLOGY OF THE
GREATER TORONTO / NATMAP AREA

QUATERNARY PERIOD (~last 2 million years)

11 Recent Deposits: sand, gravel and diamicton: 1 - 3 m thick; includes wind-derived, landslide, slope, groundwater sapping, lakeshore deposits and fill

10 River Deposits: sand and gravel
a. gravel, sand, silt, clay, muck; 1-2 m thick; occurs on modern floodplains
b. gravel, sand, silt, clay; 1-8 m thick; forms river deltas and terraces of early post-glacial age

9 Organic Deposits: peat, muck and marl, 1-7 m thick; occurs in wetlands

8 Glacial Lake Deposits[1]: sand and gravel (minor diamicton)
a. sand and silty sand, 1 to >50 m thick; occurs in basin lows and nearshore flats
b. gravely sand and gravel, 1-5 m thick; raised shorelines or bars

7 Glacial Lake Deposits[1]: silt and clay, massive to laminated
a. silt and clay interbedded with diamicton and some lone stones, 1 -10 m thick; occurs in basins
b. silt and clay; 1-5 m thick; laminations deformed in basin fills

6 Glacial River Deposits[2]: sand and gravel (minor diamicton)
a. sand; 1-15 m thick; occurs as eskers, valley fills and terraces
b. gravel; 1-15 m thick; occurs as eskers, valley fills and terraces

5 Moraine Deposits: fine sand to gravel
a. fine sand, some gravel, minor silt, clay and diamicton; 1-50 m thick; rhythmic beds common
b. medium to coarse sand and gravel and diamicton; 1-20 m thick; channels common
(a and b occur in disorganized hills, depressions and eskers)

4 Glacial Deposits (till): clayey silt to silt, 1-2% stone content; 1 -15 m thick; occurs in till or lake plains often with interbedded fine sand, silt and clay
a. Wildfield / Kettleby[3]
b. Halton
c. Tavistock

3 Glacial Deposits (till): sandy silt to sand, > 3% stone content; stratified interbeds; 1-50 m thick; forms uplands
d. Wentworth
e. Port Stanley
f. Newmarket/northern[4]/Bowmanville

2 Lower (drift) Deposits[5]: till, fine-medium sand, and laminated silt and clay, 1-50 m thick; exposed in bluffs
g. Upper Thorncliffe Formation / Clarke beds; h. Seminary / Meadowcliffe / Bondhead tills;
i. Lower Thorncliffe Formation / Clarke beds; j. Sunnybrook / Port Hope till; k. Scarborough Formation;
l. Don Formation; m. York Till; n.[6] Stratified sediment, dominantly sand; o.[6] Stratified sediment, dominantly silt and clay

Unconformity ____ (interval with no deposits and/or major erosion)

PALEOZOIC (rocks >400 million years in this area)

1 Bedrock: limy mudrock and clastic sedimentary rock
a. bedrock-drift complex
b. clastic (sandstone or shale)
c. carbonate

1. Peel/Schomberg ponds above, Lake Iroquois/Algonquin below raised shorelines
2. Subglacial and/or proglacial outwash
3. Wildfield south of ORM and Kettleby north of ORM; sub units in units 2-4 are listed in stratigraphic order: a-o
4. Northern till is used to indicate a source area to the north; it may have several age assignments (cf. White, 1975)
5. Most units not present as surface units on 1:50,000 maps
6. Age unknown.

Note: The legend is not strictly stratigraphic; attached stratigraphic table explains age relationships and regional terminology. Not all map units appear on each map.

SYMBOLS

Geological boundary (approximate)	Small ridges	Base of lake-cut escarpment (abandoned shorebluff)
Drumlin or fluting	Area of hummocky topography	Raised shoreline (projected)
Esker, direction of flow known	Area of sand dunes (eolian)	Crest of abandoned beach bar or spit
Trend of moraine crest	Base of terraced escarpment (fluvial, glaciofluvial)	Brow of landslide or zone of groundwater sapping
Kettle	Meltwater flow direction	Sand and gravel pit
Ice-contact slope	Channels	Borehole (GSC/OGS)
		Fill

Note: all symbols may not appear on this map.

NTS LEGEND

North American Datum 1983
Universal Transverse Mercator Grid - Zone 17

Lakes and rivers	Contour lines (interval 10m)	Railway lines
Streams	Roads (any type)	Greater Toronto Area boundary

Note: Selected listing.

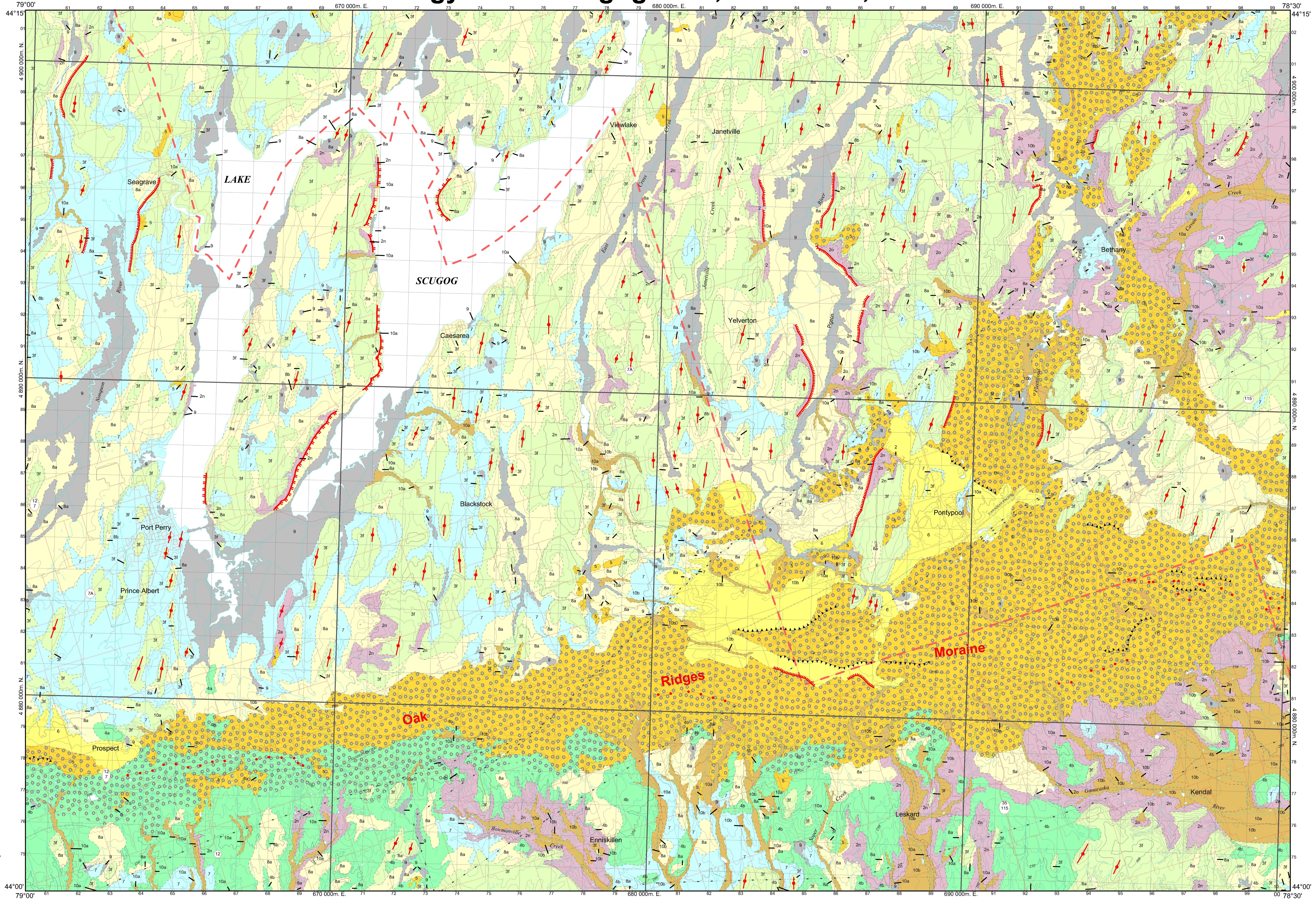
Scale 1:50,000 Échelle
0 1000 2000 3000 4000 5000
Metres Mètres

MAP PRODUCTION

This map has been produced from interpretation of 1:30,000 scale black and white aerial photographs. Individual geological map units have been identified on the basis of landform, surface texture, tonal contrasts and elevation relationships. This interpretation has been verified with both archival and project ground control data (Figure 3). Line work was transferred from photographs to a 1:50,000 NTS topographic map and subsequently to a registered chronoflex base. The chronoflex base was scanned and registered to a NAD 83 Datum in MapInfo. The raster line work was subsequently digitized and an attributed vector file built.

RECOMMENDED CITATION:
Barnett P.J., 1997: Surficial Geology of the Scugog Area, NTS 31D/2, southern Ontario; Geological Survey of Canada, Open File 3330, Scale 1:50 000.

Surficial Geology of the Scugog Area, NTS 31D/2, southern Ontario



MAP NOTES

This map of the Surficial Geology of the Scugog area is a summary of maps produced for the Ontario Geological Survey (OGS) at scales of 1:50,000 and 1:20,000 and thematic maps prepared from a geoscience data base created for the Greater Toronto area (GTA) by the Geological Survey of Canada (GSC). Field work for the material map was undertaken during the summers of 1993, 1994 and 1995. The author was ably assisted in the field by L.A. Henderson and J.E.P. Dodge (senior assistants) and D. Gesink, E. Wilson and C. Deyell (junior assistants). Previously published maps on the glacial geology of the area include: Gravenor, 1954 and 1957; and Barnett et al (1995) at a scale of 1:50,000 or greater and Barnett 1996 a,b,c,d at a scale of 1:20,000 centered on the Oak Ridges Moraine (ORM).

Bedrock Geology, Topography and Drift Thickness:

Bedrock is not exposed within the Scugog map area. Upper Ordovician shales of the Blue Mountain Formation (Collingwood) subcrop in the southwestern corner of the area. They overlie dominantly limestones and minor shales of the upper part of the Middle Ordovician Simcoe (Trenton) Group (Sanford and Baer, 1981). The Simcoe Group rocks directly underlie the cover of Quaternary sediments in the remainder of the map area.
The bedrock surface has a total relief of about 170 m. It forms a surface that generally slopes toward the south-southwest. Two, broad, poorly defined valleys have cut into this sloping surface south of Lake Scugog and east of Pontypool. The two valleys were probably cut by south and southeasterly flowing tributaries of the pre-glacial Laurentian River.
The bedrock surface is covered by glacial and nonglacial sediments that range between >240 m and ~10 m thick (Fig. 7). These sediments are thickest, exceeding 100 m, in a west trending zone underlying the Oak Ridges Moraine and a south trending zone east of Pontypool where the moraine and uplands are superimposed on a broad bedrock valley. They are also quite thick beneath the upland areas. Sediment cover is thinnest, in the order of 10-20 m, beneath the broad flat-floored valleys of the present-say landscape.

Physiography and Landforms:

The major landform and physiographic region in the area is the Oak Ridges Moraine (Chapman and Putman, 1984; Fig. 1). It forms the surface water drainage divide between rivers and creeks flowing directly into Lake Ontario and those draining into Lake Scugog and the Trent River System (Fig.3). The moraine is a narrow ridge in the western part of the area and expands into a broad wedge-shaped form near Pontypool (Pontypool sediment wedge).
The remaining landscape north of the moraine, consists of upland areas whose surfaces are streamined or drumlinized (part of the Peterborough drumlin; Fig. 1) and deep, steep-walled and flat-floored valleys that separate the upland areas. The valleys have been interpreted as tunnel valleys, carved during a catastrophic subglacial discharge of meltwater (jökulhlaup(s)). Barnett 1990, 1993). One large esker, the Omemee Esker is visible on the Digital Elevation Model (DEM) in the northeast corner (Fig.5).
South of the moraine, the south lacustrine/till plain physiographic region occurs (Fig. 1). This area is typified by a gently sloping land surface underlain by fine-grained sediments of glacial or glaciolacustrine origin. Windows of drumlinized uplands and two large valleys, one at Enniskillen and another at Kendal, occur along the south slope. The two large valleys are formed, in part, as the result of postglacial piping and slumping failures. Several of the larger landslide scars are noticeable on the DEM in the southeast corner of the Scugog map (Fig. 5).

Quaternary Geology:

The distribution of field observation sites and the principal sediment encountered are shown in Figure 3, the Voronoi sediment distribution diagram. Correlation of the sediment distribution on the Voronoi diagram with the glacial geology map can be improved by taking into account the strong geomorphic control on sediment distribution and by using airphoto interpretation or the DEM (Fig. 5).

Older Drift and Till:

Only the uppermost units of the thick package of glacial and nonglacial sediments were observed in the field. The oldest sediment exposed is a fine-grained diamicton interpreted as a subglacial till (not shown on this map; see Barnett et al., 1996). It is overlain by a coarsening-upward sequence of glaciolacustrine and glaciofluvial sediments (silt and clay rhythmites to pebbly coarse-grained sand). These units are in turn overlain by a silty sand to sandy silt diamicton interpreted as the Newmarket Till (Gwyn and DiLabio, 1973).
The Newmarket Till forms the dominant surface sediment in the upland areas and is commonly associated with drumlins and other streamlined forms. The orientation of 'bullet-shaped' boulders roughly coincides with the orientation of streamlined landforms and suggests that the ice that deposited the Newmarket Till advanced across the area toward the south-southwest.
The Halton Till forms the dominant surface sediment along the lacustrine/till plain south of the Oak Ridges Moraine, however, "windows" of the older Newmarket Till occur. Flow tills of Halton Till are commonly found associated with the southern edge of the ORM.
The Oak Ridges Moraine is composed principally of ice-supported stratified sediments of glaciofluvial or glaciolacustrine origin. Sand and gravelly sand are the dominant sediments. Areas of gravel coincide with the central core of the moraine, south of Pontypool, where generally fining-upward subaqueous fan and confined fan sediments occur. Within the Pontypool wedge, deltaic, coarsening-upward sediment packages are built lateral to the core sediments as regional water levels, that controlled deposition along the moraine, fell. The narrow part of the moraine south of Port Perry, consists of northward-built subaqueous fan sediments overlain and interbedded with Halton flow tills.
A small ridge of ice supported stratified deposits was mapped trending southeast from Bethany and is interpreted as a recessional moraine. The Omemee Esker, north of Bethany, is also composed of ice-stratified deposits of predominatly gravel and sandy gravel.

Glacial Lake and River Deposits:

Glaciolacustrine fine sands and silts blanket the flanks of the ORM. Glaciolacustrine rhythmically - bedded silts and clays were deposited within deeper basins and distal to the moraine in ice-supported proglacial lakes in both the Lake Ontario basin (Lake Peel) and in the area north of the moraine (Lake Schomberg). Ancestral shorelines of these lakes are represented by abandoned shore bluffs and beach bars and spits of gravel and sand throughout the map area.
The deep broad valleys of the area are filled in part, with glaciolacustrine sand, silt and clay, as well as, sandy alluvial deposits of various ages and wetland deposits of peat, muck and/or marl. Shells of gastropods and small pelecypods have been observed at several locations throughout the Scugog area.

STRATIGRAPHY

Explanation of stratigraphic terms in the ORM NATMAP area

	Stratigraphic unit[1] (youngest on top)	Map units	Explanation / description[2] (reference to stratigraphic name)
Quaternary			Period covering last 2 million years of glacial climates
Recent			Last 10,000 years following glacial climates
	Lake and aeolian deposits	11	Deposits along shore of modern lake
	Alluvium	10a	Sediment deposits by modern rivers in Recent time
	Organic deposits	9	Plant and animal matter accumulated in wetlands
	Older alluvium	10b	Sediment deposited by rivers in terraces and deltas during glacial melt
Pleistocene			Time of advance and retreat of large ice sheets (2 million to ~10 000 years ago)
	Glacial Lake Iroquois / Algonquin deposits	7, 8	Two of the largest postglacial lakes in Lake Ontario / Lake Huron basins
	Glacial Lake Peel / Schomberg deposits	7, 8	Series of lake beds deposited against the ORM as the glacier blocked drainage (commonly >180m asl)
	Glaciofluvial deposits	6	Deposits of high-energy streams or currents issuing from a glacier; may form core of ORM
	Wildfield / Kettleby[3] tills[4]	4a	Interbedded with lake deposits and flanks the ORM (White, 1975; Barnett et al, 1991)
	Halton Till / [Bouchette till][5]	4b	Thick, interbedded till and lake deposits, in Humber Valley; thins to the east (Karrow, 1959)
	Oak Ridges Moraine sediments	5	Thick, mainly glacial lake deposits, resting on eroded Newmarket Till or lower beds (Chapman and Putnam, 1943; Barnett, 1995)
	Wentworth[6]/ upper Leaside tills	3d	May grade upward into HaltonTill (Karrow, 1959; Leaside, Karrow, 1967)
	Port Stanley / Tavistock tills	3e/4c	Port Stanley: Lake Ontario derived till; Tavistock: Lake Huron derived till (Karrow, 1971)
Unconformity	Major erosional [7]episode marked by drumlin formation and channel cutting and scouring; channels produced by subglacial drainage (cf. Barnett, 1990)		
	Newmarket / lower Leaside / Bowmanville till	3f	Thick regional till extending beneath the ORM from Lake Ontario to Lake Simcoe (Gwyn and DiLabio, 1973; Sharpe et al., 1994)
	Upper Thorncliffe Formation / [Clarke beds][8]	2g	Deltaic? /fan beds at Scarborough / Bowmanville bluffs (sand/silt/clay) (Karrow, 1967; Singer, 1974)
	Seminary / Meadowcliffe / [Bondhead] till	2h	Thin lenses separating Thorncliffe and Clarke beds at lake bluffs (clayey, silty till; low stone content) (Karrow, 1967)
	Lower Thorncliffe Formation / [Clarke beds]	2i	Sandy to clayey beds found at Scarborough or Bowmanville bluffs, ~ 30-50,000 years old (Terasmae, 1960; Eyles and Clark, 1988)
	Sunnybrook Till / [Port Hope till]	2j	Forms a regional till sheet and marker bed (clay till with very few stones) (Karrow, 1967; Brookfield et al., 1982)
	Scarborough Formation	2k	Cool-climate (-5° C), lake beds (~122 m asl at bluffs) ~90,000 y BP (clay and sand beds) (Karrow, 1967; Kelly and Martini, 1986)
	Don Formation	2l	Warm-climate (+3° C), raised lake beds with interglacial fossils (sand, silt) (Karrow, 1967)
	York Till	2m	Dense, sandy till from glacial interval prior to last major warm period (Karrow, 1967)
	Older sand[9]	2n	Undifferentiated stratified sediment, dominantly sand, some pebbles
	Older clay, silt[9]	2o	Undifferentiated stratified sediment, dominantly silt and clay
Unconformity		Long interval with no deposits and/or major erosion	
Paleozoic			Period covering~ 230 - 570 million years ago, (Liberty, 1969)
	Bedrock	1	Ancient marine rocks
	a. Bedrock-drift complex	1a	Map unit with thin (<1m) cover of glacial deposits on bedrock.
	b. Clastic (sandstone or shale)	1b	Rocks made from grains of sediment cemented together; e.g. Georgian Bay/Queenston shale
	c. Carbonate	1c	Limestone and dolostone rocks; found respectively east and west of the Niagara Escarpment

1. See Barnett et al. (1991) for stratigraphic scheme of southern Ontario
2. Lithology of older drift is described
3. Wildfield occurs south of ORM; Kettleby occurs north of ORM
4. Till is mixed sediment (sand, silt, clay, stone) deposited by glaciers; till, lower case, indicates local name
5. Units in square brackets refer to names for strata found east of Oshawa (Brookfield et. al., 1982)
6. May correlate with Newmarket Till; Wentworth may have been deposited from retreat phase of "Newmarket ice"
7. Erosional episodes may also be present between and within some units e.g. boulder pavements
8. Unit 2 comprises "lower drift" in regional stratigraphic synthesis (Sharpe et. al., 1996)
9. Uncertain age designation

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