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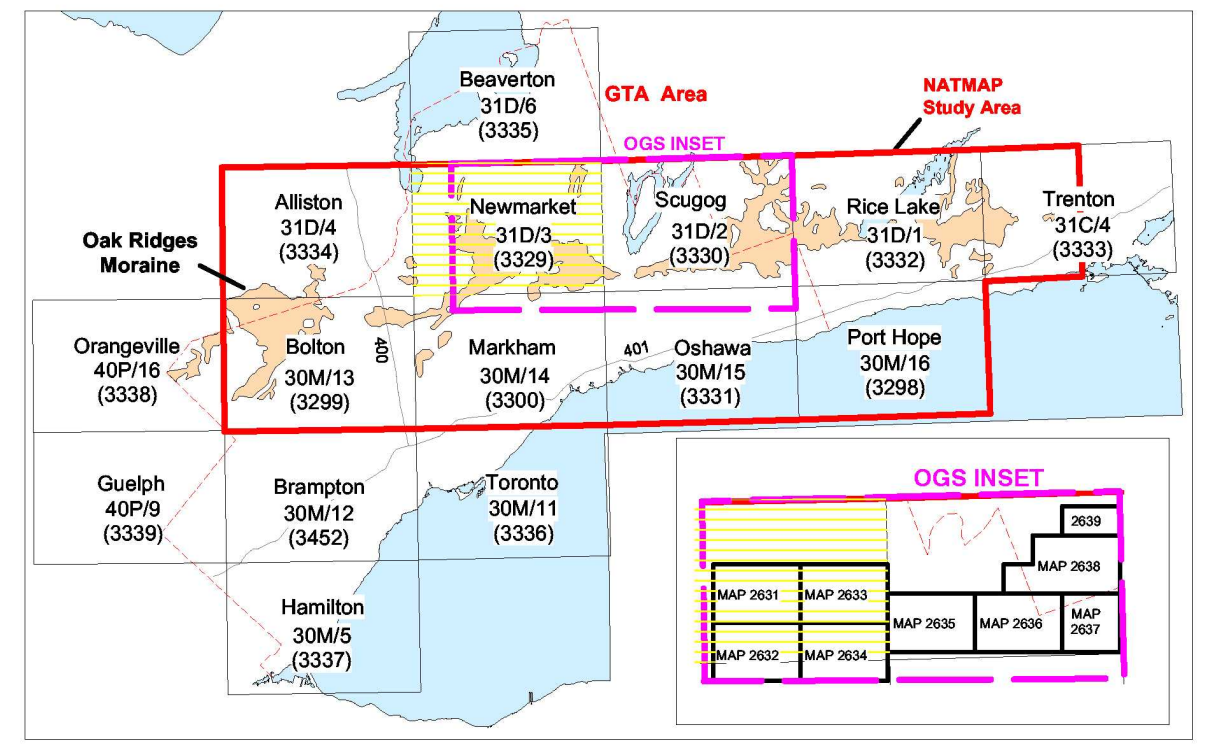
Surficial Geology of the Newmarket Area, NTS 31D/3, southern Ontario

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

Newmarket 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.

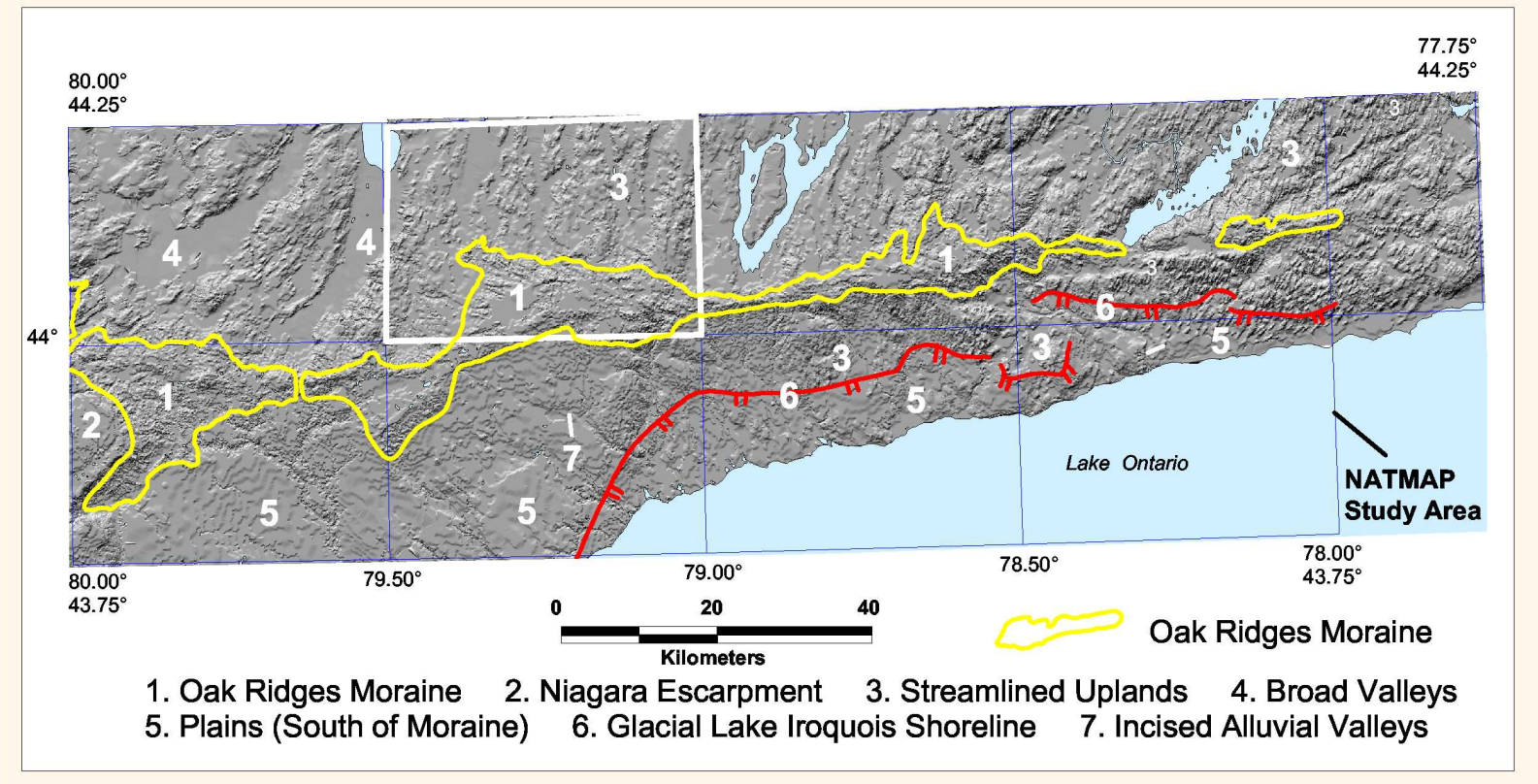

Figure 1. Regional Physiography:
Seven regional landscape elements are shown on a digital elevation model (DEM; Kenny et al., 1996; Skinner and Moore, 1997; Kenny et. al., 1997). Drumlin uplands, channels and the Oak Ridges Moraine are prominent in the Newmarket area.

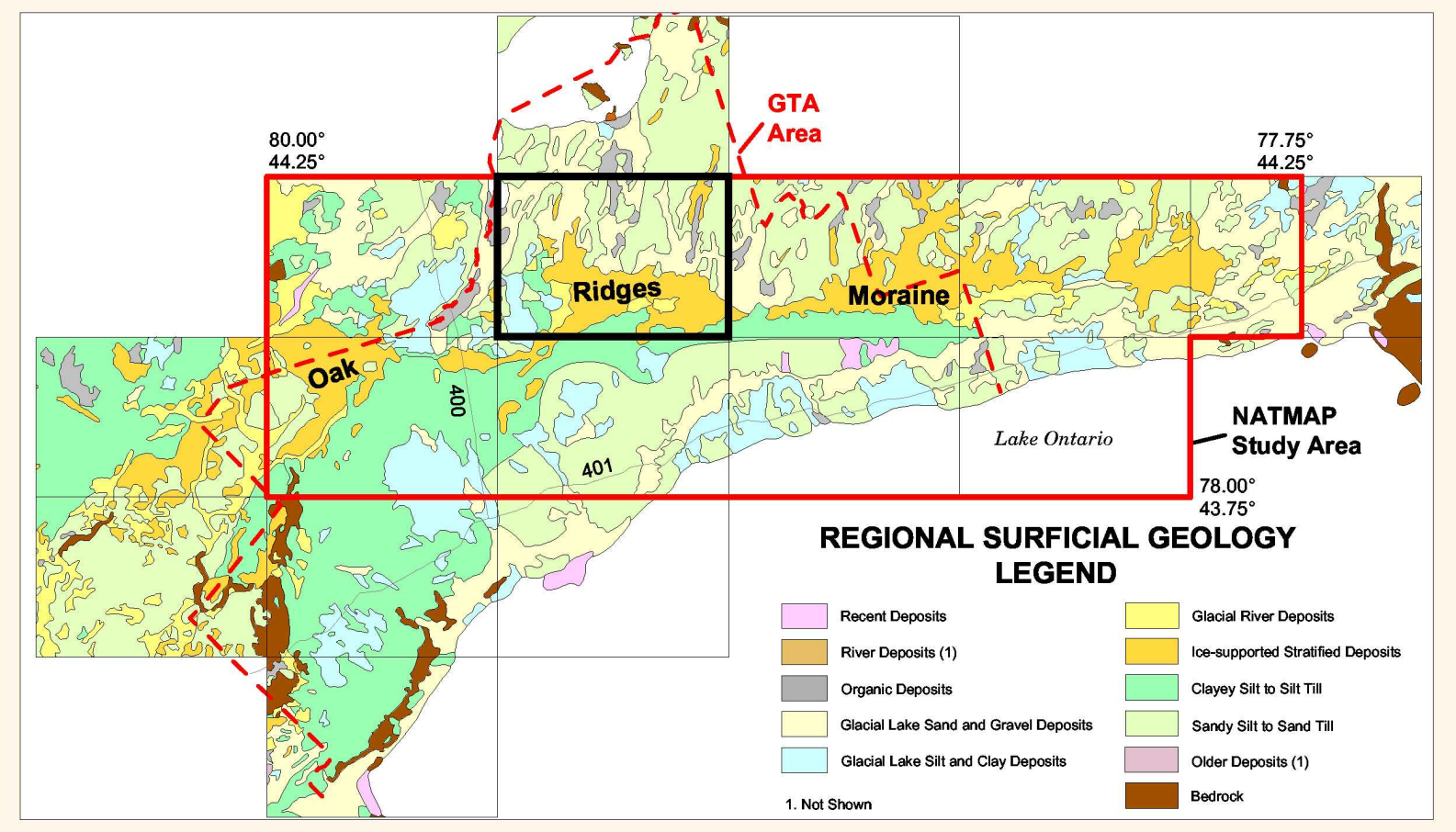

Figure 2. Regional Surficial Geology:
Regional surficial geology showing the Newmarket area in regional context (modified from Barnett et al., 1991). Large areas of Newmarket Till and lake sand are exposed north of the Oak Ridges Moraine in this area. The map legend is the same as that for the main map.

THEMATIC MAPS

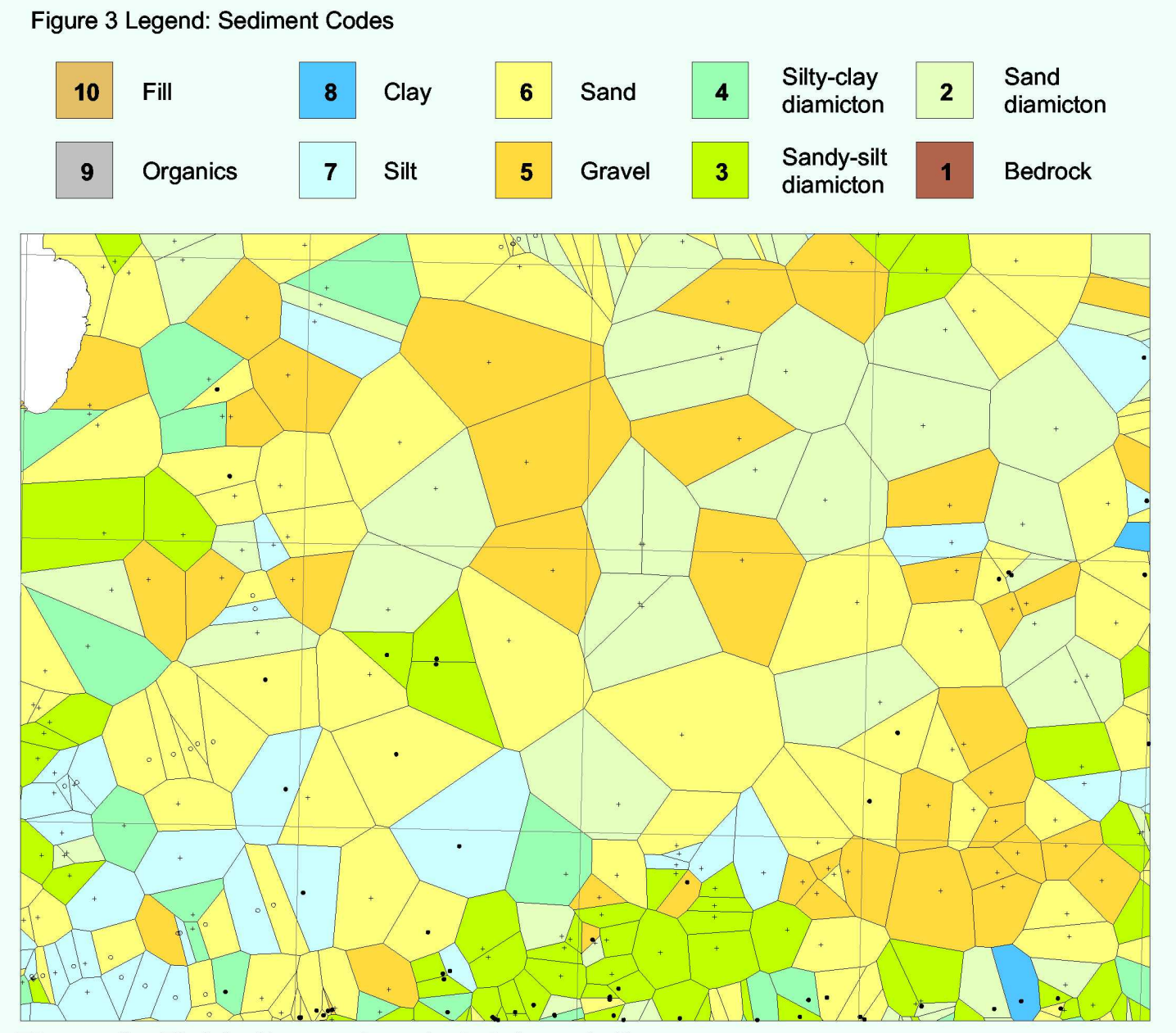

Figure 3. Field sites and material description:
Field sites located at the centre of polygons (Voronoi plot) describe the sediment found and used as ground control for air photo interpretation. Field sites include new OGS data (Barnett - "dots") and archival OGS data (Gwyn "+").

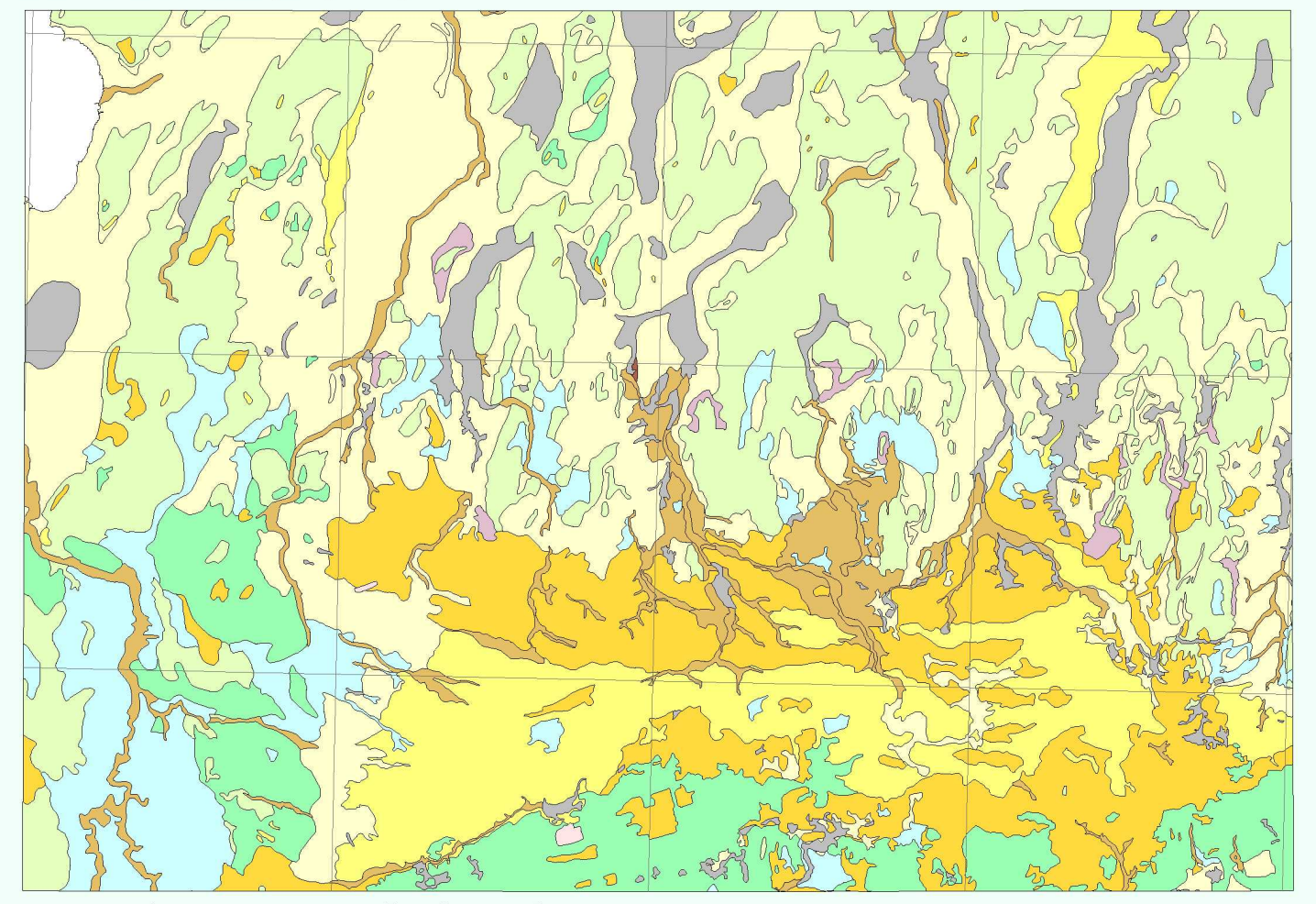

Figure 4. Newmarket Surficial Geology Map:
Surficial geology map of the Newmarket area shown at the same scale as other thematic maps permits ease of comparison with sediment descriptions (Fig. 3) or Digital Elevation Model (DEM) (Fig. 5). Legend is same as main map.

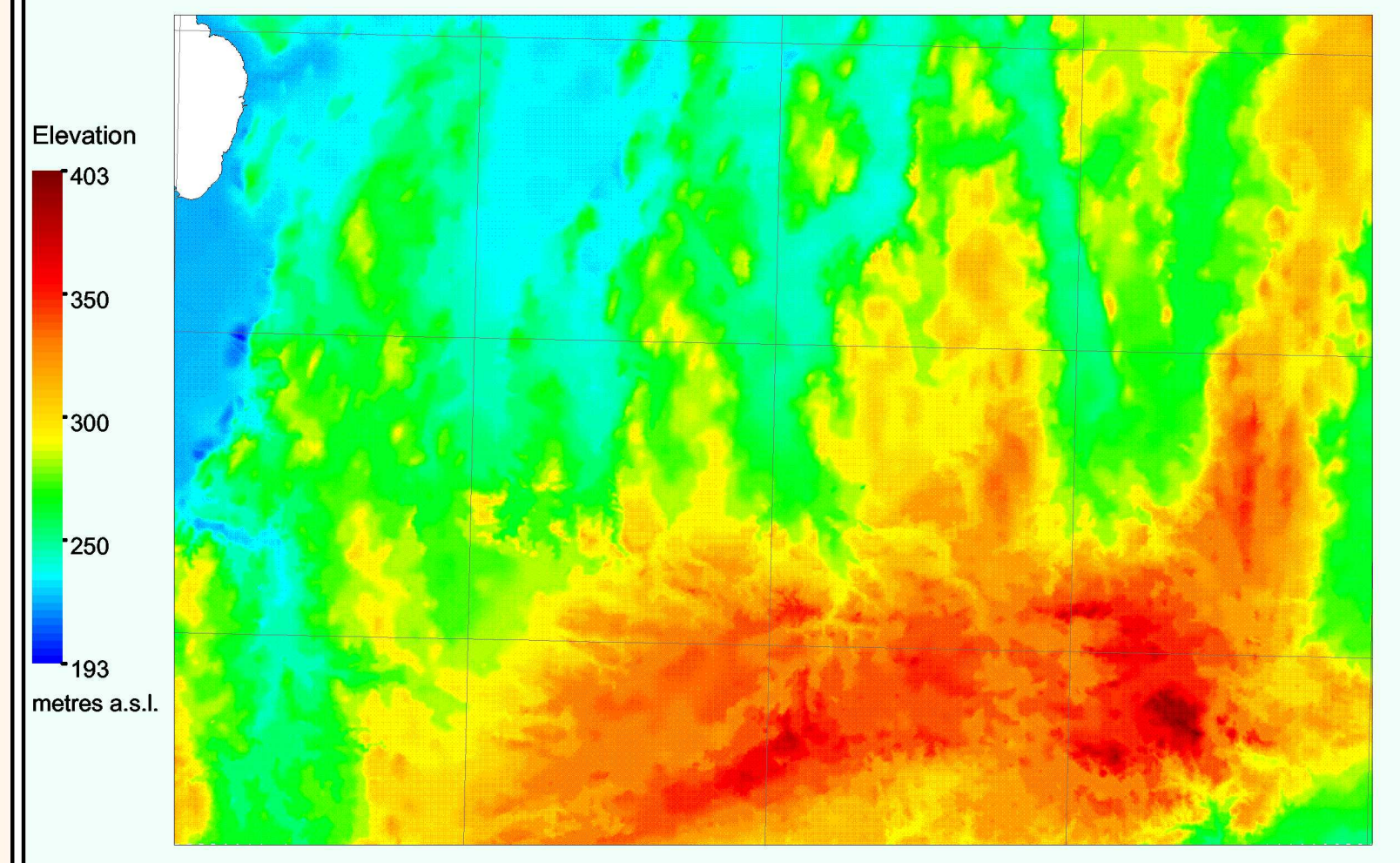

Figure 5. Digital Elevation Model (DEM):
DEM (hill-shaded, colour gradient) showing main elements of the landscape, including the Oak Ridges Moraine (Uxbridge sediment wedge), drumlinized uplands and broad deep tunnel valleys.

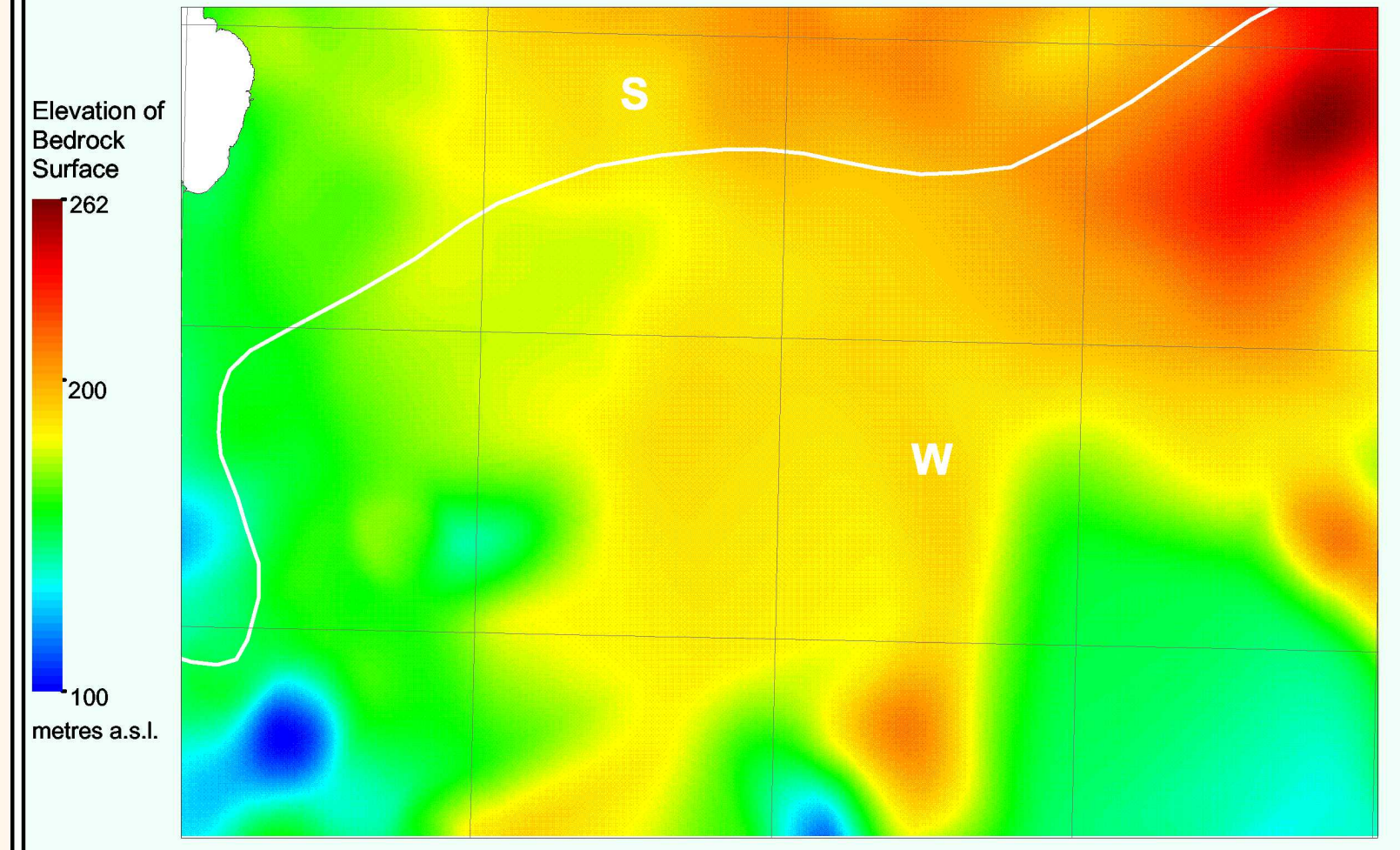

Figure 6. Bedrock topography:
Topographic map of the bedrock surface (from Brennand et. al., 1997) as if all Quaternary-aged sediments were removed. Simcoe Group (S) limestone and Whitby Formation (W) shale are shown.

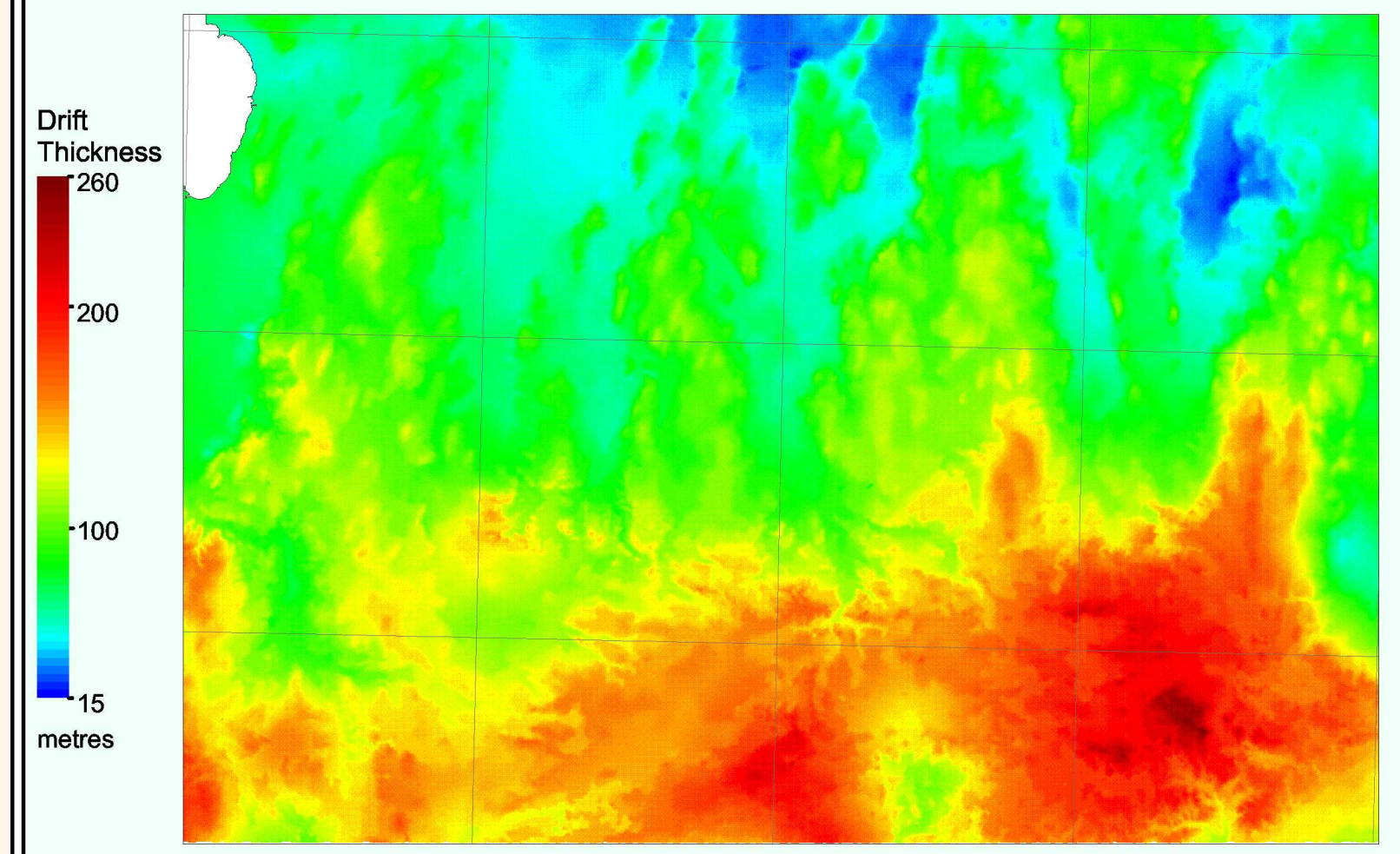

Figure 7. Drift thickness:
Map shows the thickness of Quaternary sediment cover over the bedrock suface (from Russell et. al., 1997). In general these sediments are thickest along the ORM, thick in upland areas and thinnest within the broad tunnel valleys in the Newmarket area.

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)
- Drumlin or fluting
- Esker, direction of flow known
- Trend of moraine crest
- Kettle
- Ice-contact slope
- Small ridges
- Area of hummocky topography
- Area of sand dunes (eolian)
- Base of terraced escarpment (fluvial, glaciofluvial)
- Meltwater flow direction
- Channels
- Base of lake-cut escarpment (abandoned shorebluff)
- Raised shoreline (projected)
- Crest of abandoned beach bar or spit
- Brow of landslide or zone of groundwater sapping
- Sand and gravel pit
- 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
- Streams
- Contour lines (interval 10m)
- Roads (any type)
- Railway lines
- Greater Toronto Area boundary

Note: Selected listing.

Scale 1:50,000 Échelle
0 1000 2000 3000 4000 5000
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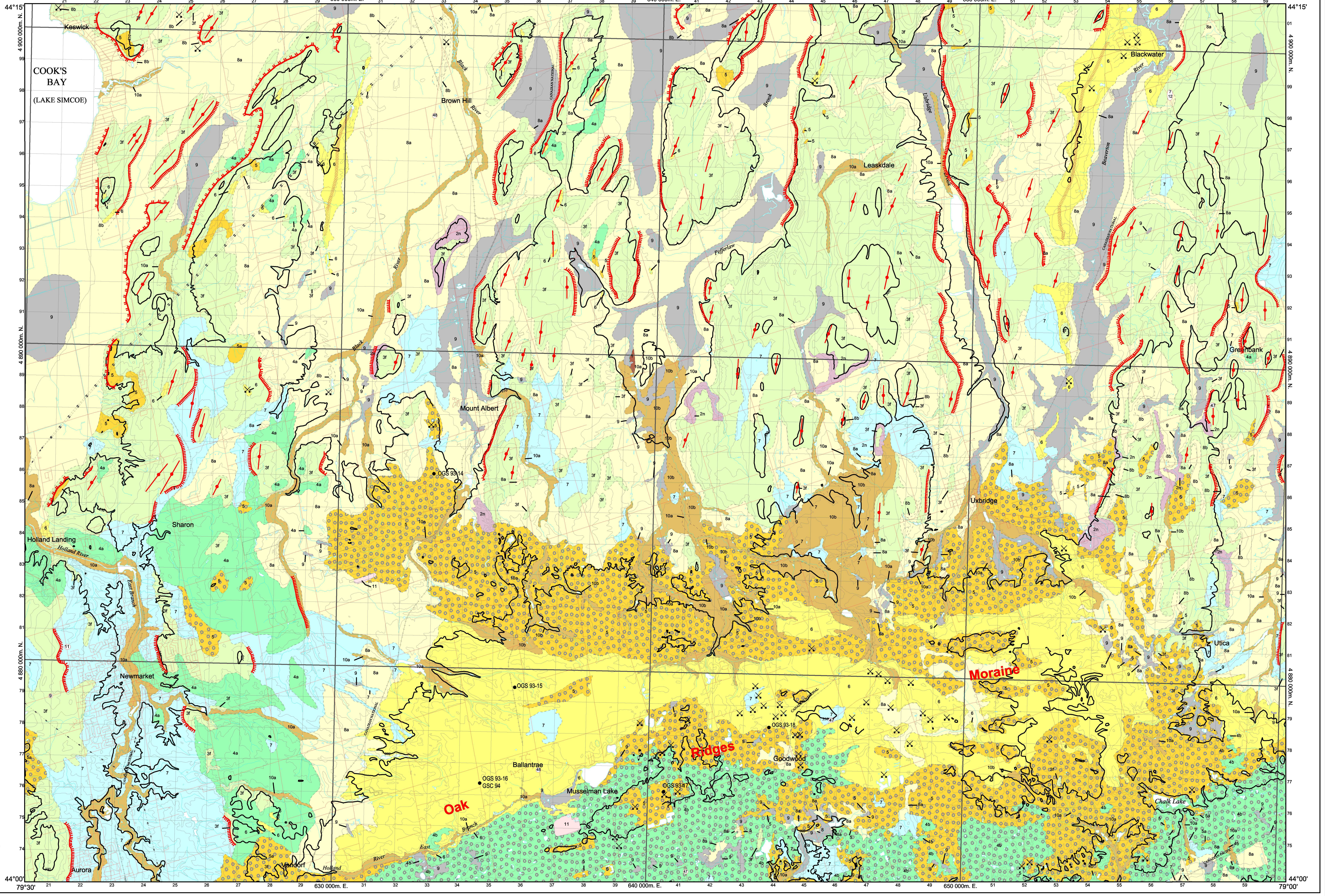
MAP PRODUCTION

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. and Gwyn, Q.H.J., 1997: Surficial Geology of the Newmarket Area, NTS 31D/3, southern Ontario; Geological Survey of Canada, Open File 3329, Scale 1:50 000.

Surficial Geology of the Newmarket Area, NTS 31D/3, southern Ontario



MAP NOTES

This map of the surficial geology of the Newmarket 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 1972 and 1992.

Previously published maps on the glacial geology of the area include: Gwyn and DiLabio 1973, at a scale of 1:50,000 and Barnett 1996, Barnett and Dodge 1996, Barnett and McCrae 1996a,b at a scale of 1:20,000 centered on the Oak Ridges Moraine.

Bedrock Geology, Topography and Drift Thickness:

Bedrock is not exposed within the Newmarket map area. Upper Ordovician shales of the Whitby (Blue Mountain) Formation subcrop in the southern three-quarters of the area and overlie dominantly limestones and minor shales of the upper part of the Middle Ordovician Simcoe Group (Fig. 6). 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 ~ 150m (Fig. 6). It slopes generally in a southwesterly direction into broad low areas along the southern and western margins of the map area. The low area along the western map margin is most likely the eastern edge of the Laurentian valley and the lowermost areas (in blue on Fig. 6), may correspond to southwesterly trending tributary valleys of this ancient preglacial (?) river system. Low areas along the southern margin of the map area likely continue southward toward the main trunk stream located in the Lake Ontario basin.

The bedrock surface is covered by glacial and nonglacial sediments that range between 15 m and 260 m thick (Fig. 2). These sediments are thickest in a west trending zone underlying the Oak Ridges Moraine and beneath the upland area west of Aurora and Newmarket. Sediment cover is commmonly thinnest beneath the broad flat-floored valleys in the north part of the present-day landscape. However, exceptions to this include the southern end of the Holland Marsh and and the valley beneath Newmarket and Aurora.

Physiography and Landforms:

The major landform and physiographic region in the area is the Oak Ridges Moraine (Fig. 1; Chapman and Putman, 1984). It forms the surface water drainage divide between rivers and creeks flowing directly into Lake Ontario and those draining into Lake Simcoe (Fig. 3). The moraine is narrow along the eastern margin of the map area and expands into a broad wedge-shaped form west of Uxbridge (Uxbridge sediment wedge). It bends southward from there and leaves the map area west of Vandorf.

The landscape north of the moraine, consists of upland areas whose surfaces are streamlined 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 discharges of meltwater (jökulhlaup(s), Barnett 1990, 1993).

The northern part of the area has been inundated by several postglacial lakes, the largest being glacial Lake Algonquin. Shoreline deposits and features are common in the northern part of the area. The broad valley in which Aurora and Newmarket are situated, most likely formed in part as the result of postglacial piping and slumping failures in glaciolacustrine silts.

Quaternary Geology: Older Drift and Till:

The distribution of field observation sites and the principle material are shown in the Voronoi material distribution diagram (Fig. 3). Only the uppermost units of the thick package of glacial and nonglacial sediments were observed in the field. The oldest sediment exposed is a pebbly, sandy silt diamicton interpreted as the Bogarttown Till (see Gwyn and DiLabio 1973). It is generally 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).

Till:

The Newmarket Till forms the dominant surface sediment in the upland areas and is associated with drumlins and other streamlined forms. The Newmarket Till is thought to have been deposited by ice advancing across the area toward the south-southwest.

Oak Ridges Moraine

The Oak Ridges Moraine is composed principally of ice-supported stratified sediments of glaciofluvial or glaciolacustrine origin. Silt, sand and gravelly sand are the dominant sediments within the moraine. Areas of gravel coincide with the central core of the moraine, east and south of Musselman Lake, where generally fining-upward subaqueous fan and confined fan sediments occur. Within the Uxbridge wedge, deltaic and glaciofluvial, coarsening-upward sediment packages are built lateral to the core sediments as regional water levels, that controlled deposition along the moraine, fell (Goodwood and Ballantrae areas). Several west-northwest trending sand and gravel ridges, Taylor's (1913) Uxbridge moraines, mark former ice-marginal positions of the receding northern glacier. The Halton Till forms the dominant surface sediment along the southern edge of the Oak Rides Moraine. Here, flow tills of Halton Till are common. Small eskers and subaqueous fans occur north of the Oak Ridges Moraine and provide local sources for sand and gravel. One large esker occurs west of Blackwater.

Glacial Lake and Glacial 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 the area north of the moraine (glacial lakes Schomberg and Algonquin). 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 in glaciolacustrine and lacustrine deposits throughout the 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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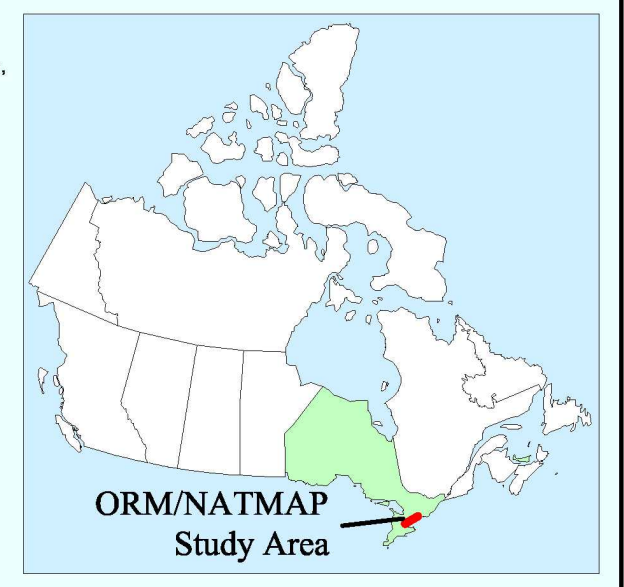

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