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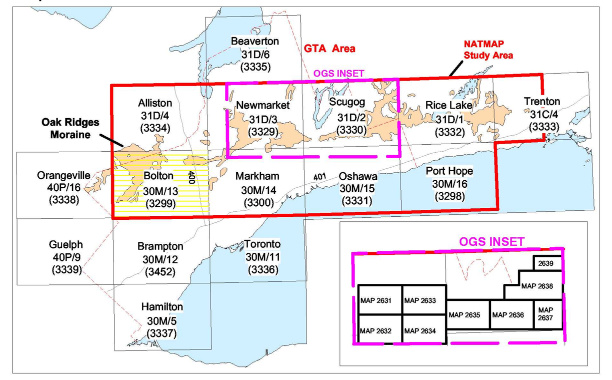
Le Programme national de cartographie géoscientifique du Canada

Surficial Geology of the Bolton Area, NTS 30M/13, 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

Bolton 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.

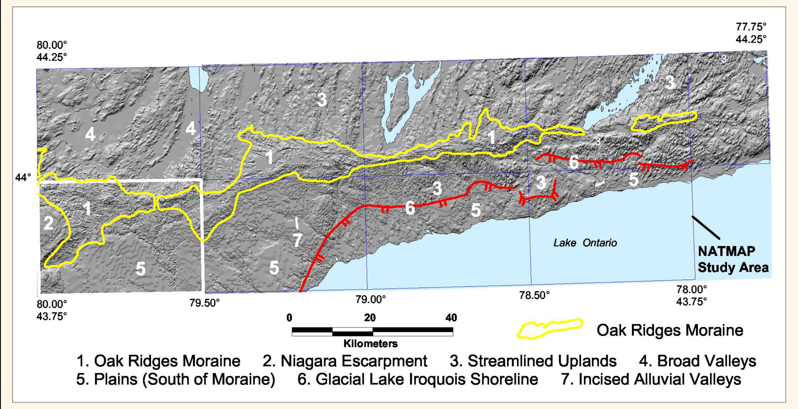

Figure 1. Regional Physiography:
Seven regional landscape elements are shown on a digital elevation model (DEM; Kenny et al., 1996; Skinner and Moore, 1997; Kenny 1997). The Oak Ridges Moraine and the Lacustrine/Till Plains dominate the Bolton area.

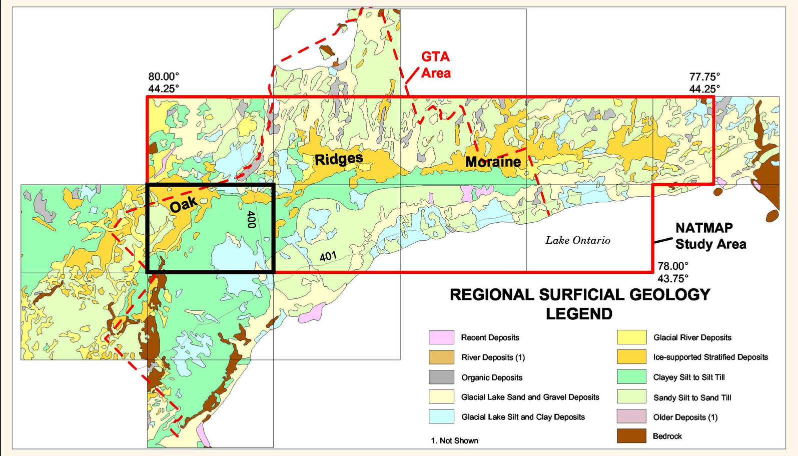

Figure 2. Regional Surficial Geology:
Bolton area shown in context of the regional glacial geology map (modified from Barnett et al., 1991). The Bolton map covers the western most (Albion wedge) of four sediment wedges comprising the ORM (Sharpe et. al., 1994). Map legend is the same as that for the 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

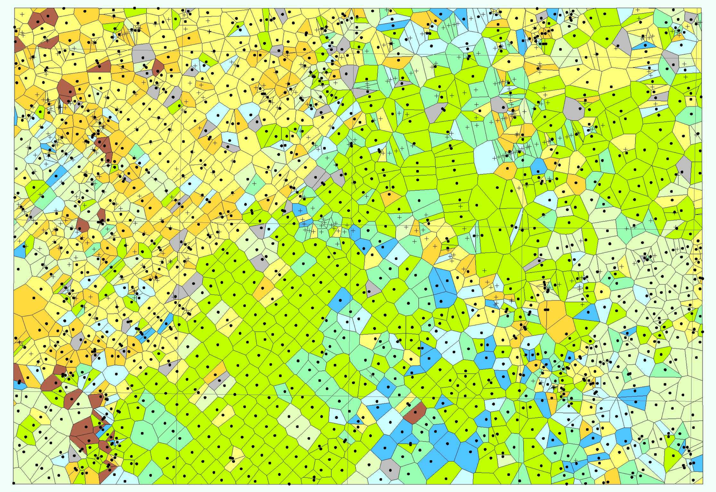

Figure 3. Field sites and sediment description:
Field sites located at the centre of polygons (Voronoi plot) describe the sediment found and used as ground control for air photo interpretation of adjacent geology map. Field sites include new GSC data (Russell, "+") and archival OGS data (White, dot's). Total number of field sites: 2491.

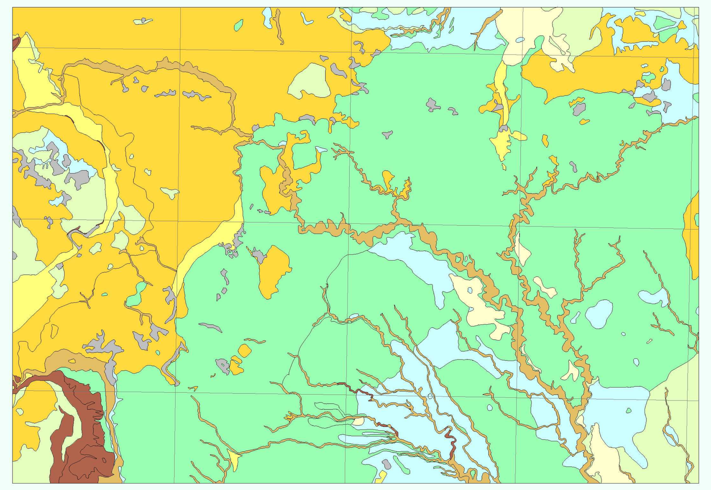

Figure 4. Bolton Geology Map:
Surficial geology map of Bolton area shown at the same scale as other thematic maps permits ease of comparison with sediment descriptions (Fig. 3) or Digital Elevation Model (DEM) (Fig. 5). The link between geology and topography is shown where upland sediment areas coincide with map unit 5 (ORM) which has a distinct surface roughness. Legend is common with main map and Figure 2.

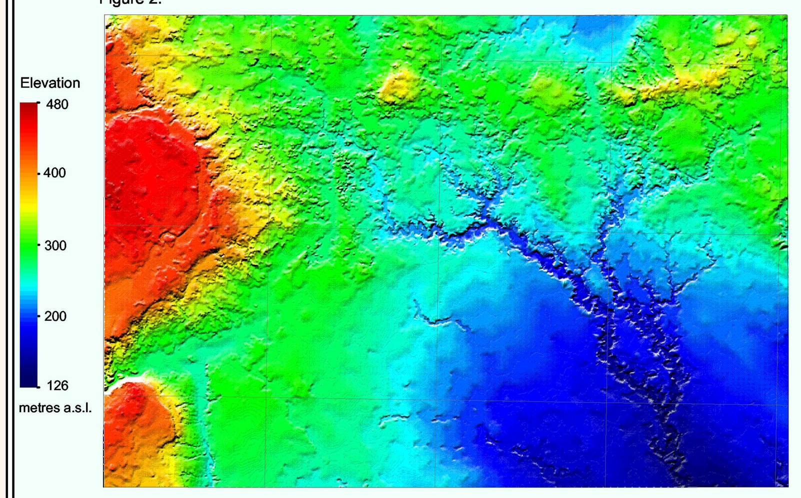

Figure 5. Digital Elevation Model (DEM):
DEM (hill-shaded, colour gradient; Kenny, 1997) showing the Niagara Escarpment on the west side of the map at the sharp red colour ramp. The Humber valley dissects the lowlands (blue).

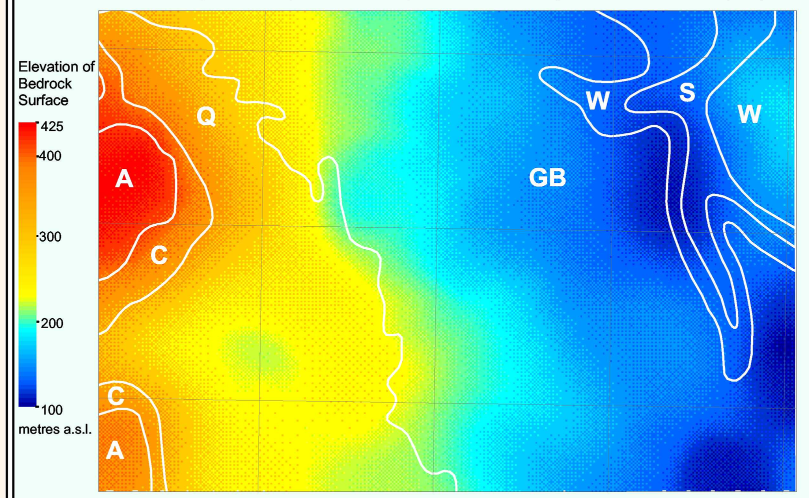

Figure 6. Bedrock topography:
Map shows dissection of Palaeozoic rocks east of the Niagara Escarpment (west side) leading to Laurentian Channel (Spencer, 1881) (rock channel east of Humber valley) cut below present Lake Ontario water levels (Brennand et al., 1997). Simcoe Group (S) limestone, Whitby Formation (W) shale, Georgian Bay Formation (GB) limestone-shale and Queenston Formation (Q) shale, Cataract Group (C) sandstone/shale and Amabel Formation (A) dolostone are shown (Sanford and Baer, 1981).

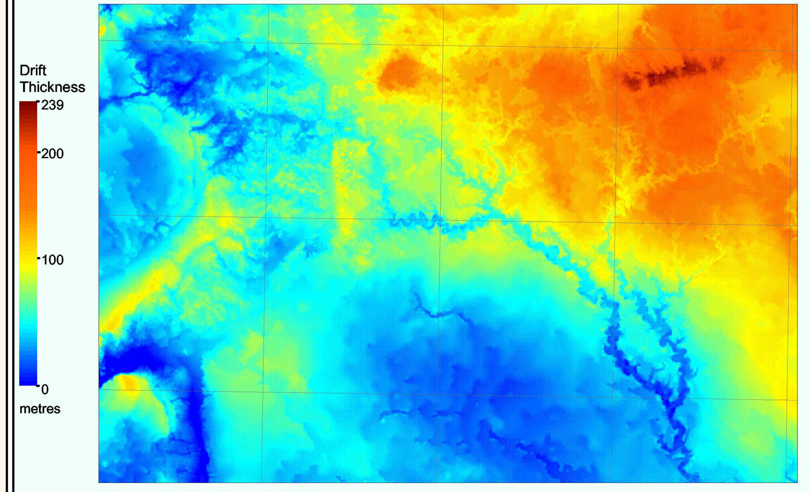

Figure 7. Sediment thickness:
Map shows sediment thickening eastward from the Niagara Escarpment to a maximum of >200 m along the Laurentian Channel (Russell et al., 1997).

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:
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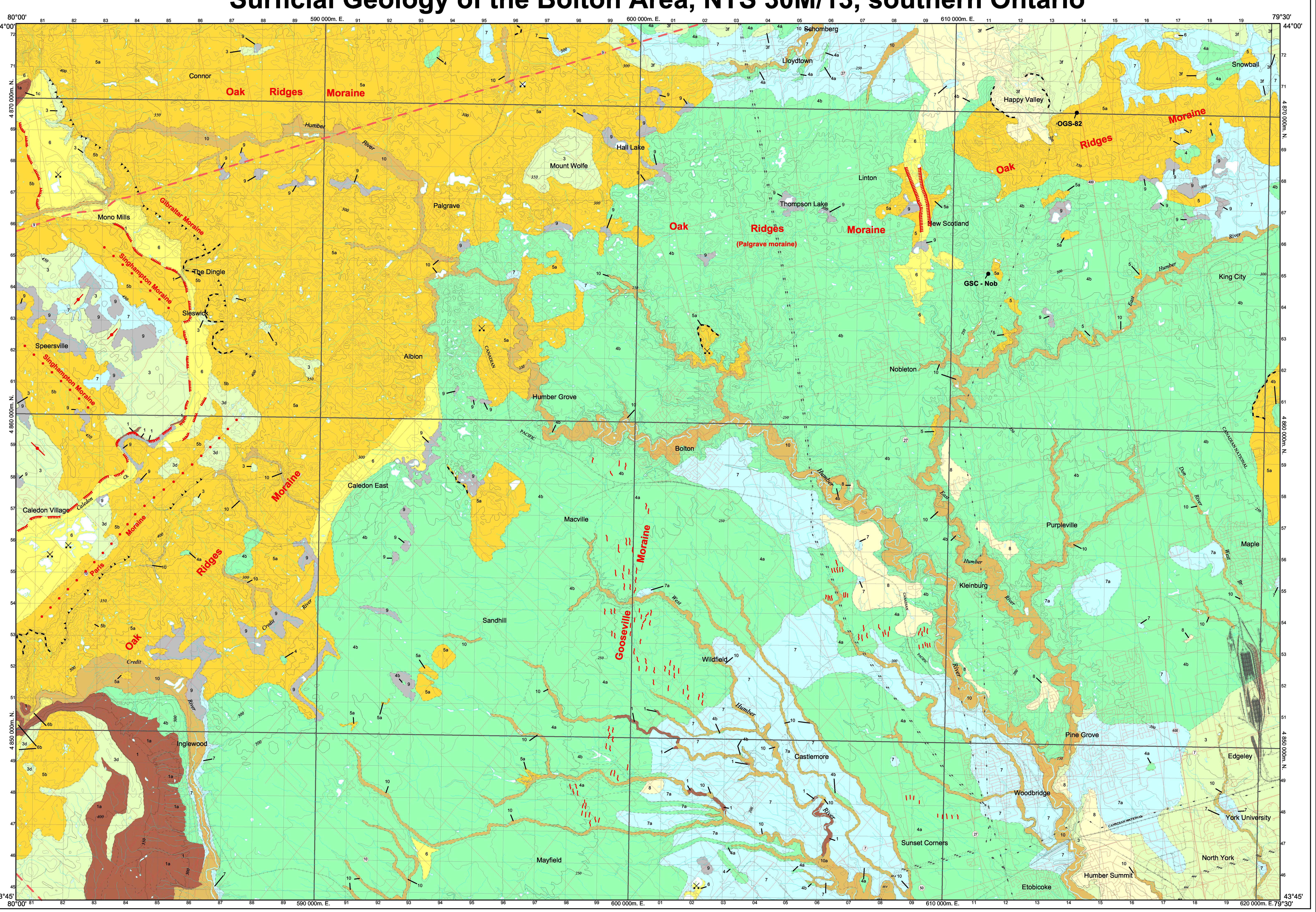
Surficial Geology of the Bolton Area, NTS 30M/13, southern Ontario



MAP NOTES

An understanding of the Quaternary geological history of the study area requires a regional synthesis of the physiography and geology. This synthesis is required as elements of the subsurface geology are better exposed and understood north of the moraine, where younger geological elements are thin or absent (eg. Oak Ridges Moraine, Halton drift) (Figs.1, 2). North of the moraine, northeast trending valleys and drumlinized uplands form a regionally recognizable erosional surface. In the subsurface, this surface has been recognized from seismic imaging and borehole data (Sharpe et al. 1994; Pugin et al. 1996). This integration of newly emerging regional knowledge with additional field work during 1993-1996 adds new and supplemental data to earlier work in the Bolton area (White, 1975).

Bedrock Geology, Topography and Drift Thickness:

Bedrock of Ordovician age, Queenston and Georgian Bay formations (Liberty, 1969), subcrop at the base of the Niagara Escarpment and crop out along the Humber River respectively, (White, 1975). Silurian Amabel Formation and Clinton and Cataract Groups form the Niagara Escarpment (Sanford and Baer, 1981). Quaternary sediments rest on a Paleozoic bedrock surface having a variable topography; the Niagara Escarpment and cuesta, eastward descending tributary valleys, and the Laurentian Channel (Figure 6). The Laurentian Channel is a buried bedrock valley extending from Georgian Bay to Lake Ontario; the Quaternary sediment cover is up to 200 m thick (Fig. 7). The Oak Ridges Moraine, a 160 km long sediment body (Figure 2), is laterally extensive in the subsurface.

Physiography and Landforms:

The Niagara Escarpment occurs along the western margin of the map area and forms a prominent topographic feature at 390 to 440 m (asl) (Fig. 5). Moraines in the vicinity of the Escarpment, the Paris, Singhampton, and the Gibraltar, represent terminal ice positions, related to deglaciation and the influence of the Niagara Escarpment. Areas of hummocky topography are commonly associated with moraine sediments (Unit 5) and these deposits commonly show extensive fluvial dissection. On this map areas of hummocky terrain are identifiable by the number of small closed contours, small ponds and elevation (eg. Singhampton Moraine, Palgrave moraine). The hummocky terrain symbol has not been used. The Oak Ridges Moraine forms the drainage divide between streams flowing to Georgian Bay and Lake Ontario. The Halton Till plain has been incised by post-glacial drainage systems responding to changes in base level associated with Lake Iroquois and subsequent water levels (Fig. 5).

Quaternary Geology:
Tills:

The oldest till is the Newmarket Till, a dense silt-sand diamicton with 10 to 15 % pebbles and cobbles of Palaeozoic origin and minor Precambrian lithologies. Possible correlative facies of the Newmarket occur west of the Niagara Escarpment where the till is characterized by a red matrix and high concentration of Queenston shale pebbles.

The Halton Drift is an interbedded complex of diamicton and sand occurring south of the Oak Ridges Moraine. The till facies is a silt to clay-silt matrix containing 1-2 % pebbles consisting of carbonate, black shale, and granitic gneiss. The Halton Till onlaps the Oak Ridges Moraine and this flanking area is characterised by hummocky topography and kettle lakes - the Palgrave Moraine (White, 1975). South of Bolton, the Wildfield Complex (White, 1975) forms a plain underlain by interbedded glaciolacustrine clay-silt and massive clay-silt diamicton with a low pebble content (<1%).

Oak Ridges Moraine Deposits:

These deposits occur as two bodies of sediment, west and northwest of Bolton (Albion Hills) and north of King City. Exposures are predominately silt, fine to medium sands, and minor gravel. Bedding is well developed with cyclic sequences of ripple-drift cross laminated sands fining upwards to silt. The top of these sequences are frequently capped by 5-10 mm thick clay laminae. Deeper exposures indicate the presence of coarser sediments, coarse sand and pebble gravel.

Glacial River Deposits:

The principal deposits occur along the margin of the Niagara Escarpment from Mono Mills to Caledon, and within a southwest trending channel at East Caledon. The deposits north of Mono Mills and at Caledon form 7 to >25 m thick sequences of bedded sand and gravels. The deposits are cross-bedded to massive with well-developed imbrication in the gravels. The textures range from matrix-supported coarse sand to cobble and open framework pebble gravel

Glacial Lake Deposits:

Fine-grained lake deposits south of the moraine occur as laminated clay and silt, interbedded with Halton and Wildfield Till deposits. North of the moraine the laminated clay and silt deposits occur around Lloydtown and have been referred to as the Schomberg deposits (White, 1975).

Sand deposits of late ice marginal lakes form deposits beside the Humber River, atop the glacial lake-till plain. Deposits 1-2 m thick lack any stratification while deposits 3-4 m thick (White, 1975) are well laminated silts and ripple-cross laminated fine sands.

Alluvial Deposits:

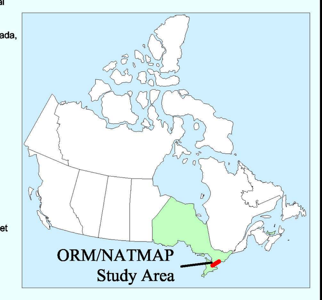
Sand and gravel deposits occur along river valleys as raised terrace deposits and as part of the present flood plain of modern river courses. These deposits are commonly 1-2 m thick.

STRATIGRAPHY

Explanation of stratigraphic terms in the ORM NATMAP area

Quaternary — Recent
Pleistocene
Unconformity
Unconformity
Paleozoic

SERIES BIBLIOGRAPHY



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