G U I D E B O O K

FRIENDS OF PLEISTOCENE GEOLOGY FIELD TRIP

TORONTO - BARRIE, ONTARIO

May 22nd and 23rd, 1948

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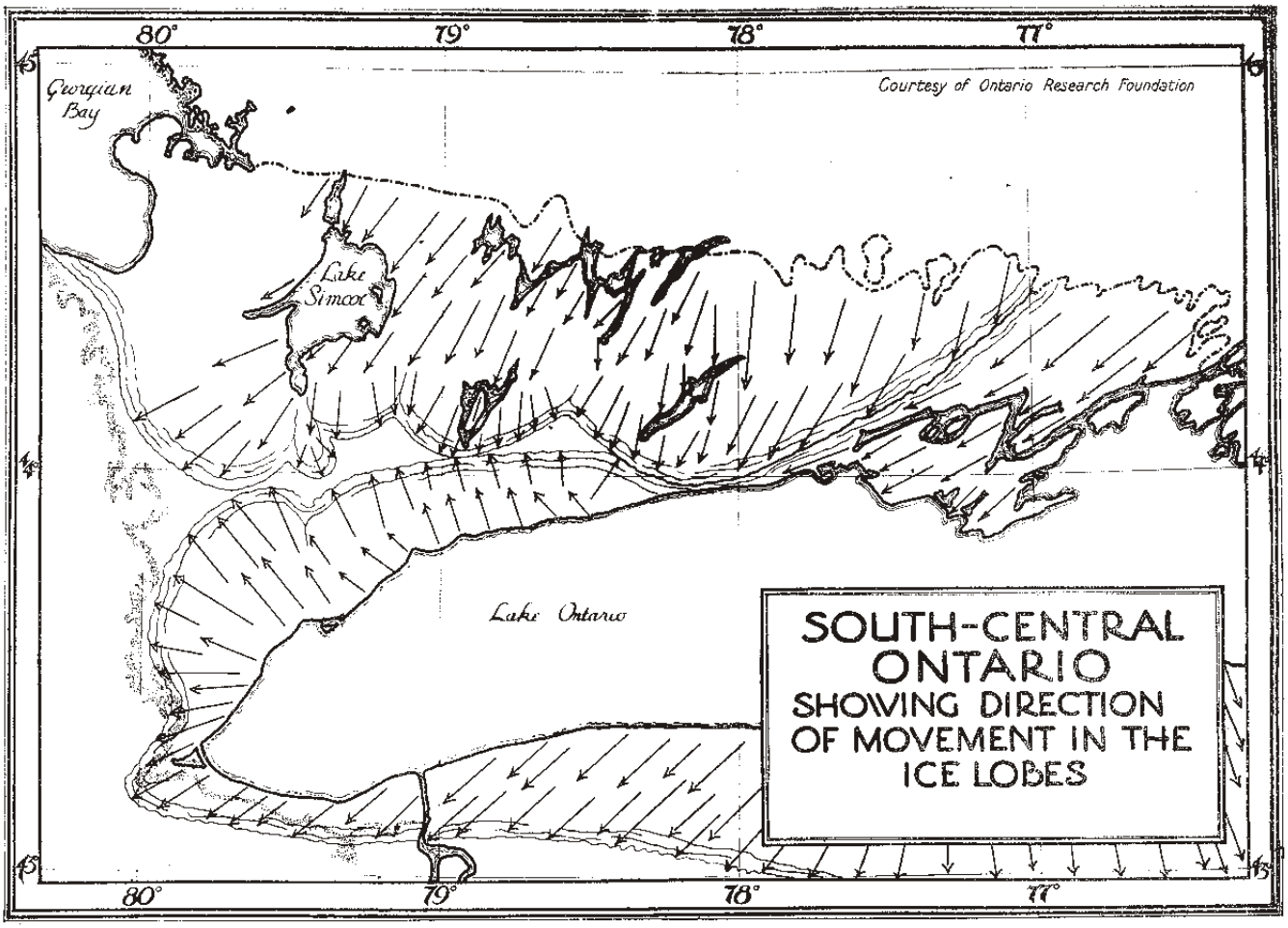
Prepared by the committee:

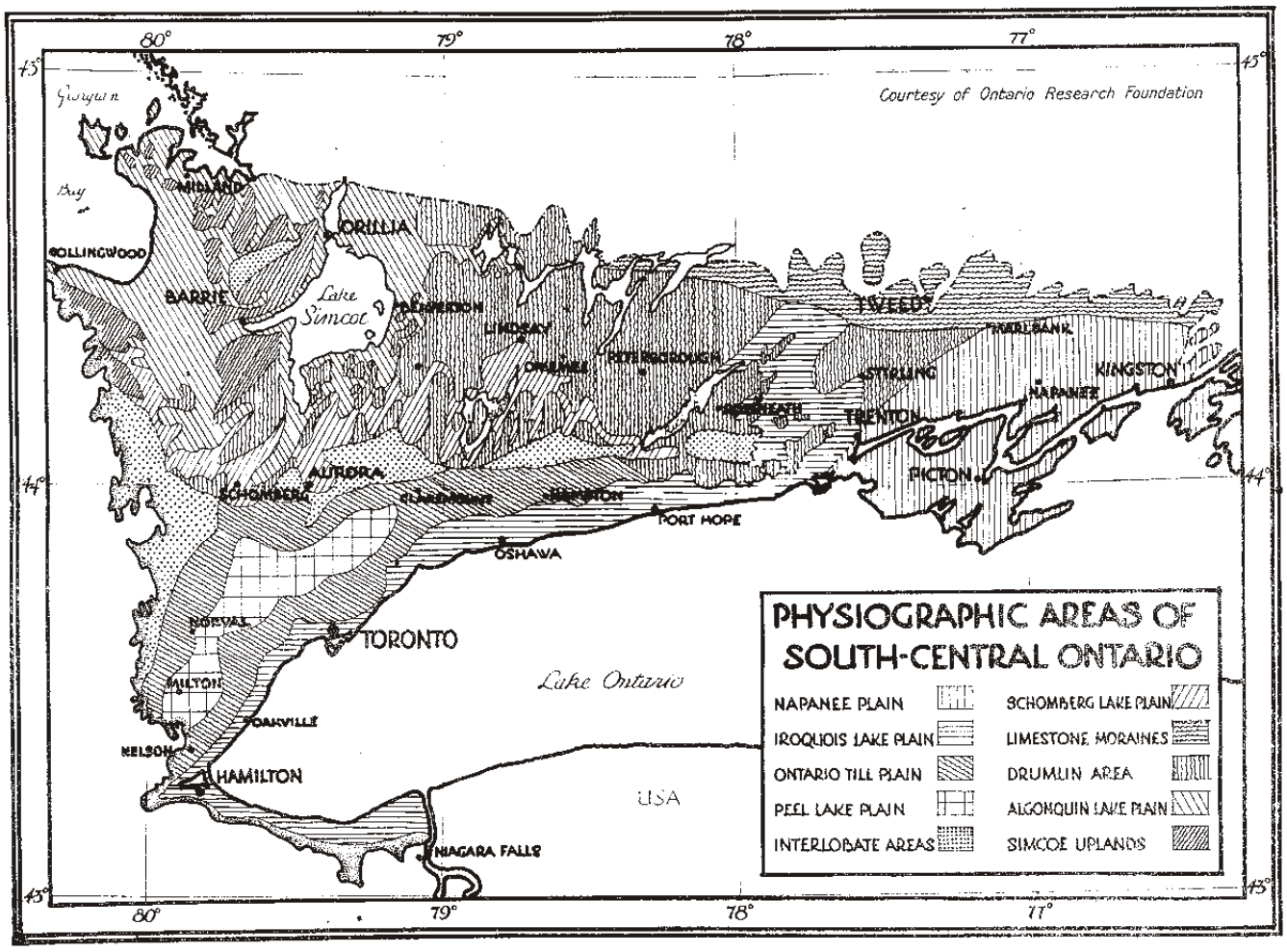
D. F. Putnam - Chairman
A. K. Watt - Secretary
R. E. Deane
W. M. Tovell

INTRODUCTION

The Guide Book has been prepared in two parts. PART I presents the itinerary of the trip, with the mileages and the approximate elapsed times at and between scheduled stops. Brief references are made to features at which 'slow downs', but no Stops, will be made. PART I also contains the general plans of the trip relating to meeting place, lunches, banquet, etc. PART II is headed Geological Notes, and is given to provide a background and summary of the principle features to be observed at each of the Stops to be made on the Field Trip. References are made in PART I to the appropriate section in PART II for each Stop.

The illustration at the front of the Guide Book (referred to as frontispiece) illustrates the general glacial features of Southern Ontario. Figure 1 gives on a small scale, the route of the excursion. Figures 2 and 3 will be found between PART I and PART II of the Guide Book. Throughout the text dates and names in parentheses refer to the BIBLIOGRAPHY section appearing at the end of the Guide Book. The bibliography gives more references than are actually quoted. Following the BIBLIOGRAPHY are blank pages that may be used for personal notes.


80°
79°
78°
77°
45°
Georgian Bay
Courtesy of Ontario Research Foundation
Lake Simcoe
Lake Ontario
SOUTH-CENTRAL ONTARIO
SHOWING DIRECTION OF MOVEMENT IN THE ICE LOBES


80°
79°
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Georgian Bay
Courtesy of Ontario Research Foundation
MIDLAND
ORILLIA
COLLINGWOOD
BARRIE
Lake Simcoe
FRANKFORD
LINDSAY
OMEMEE
PETERBOROUGH
TWEEDS
MARLBANK
STIRLING
KINGSTON
NAPANEE
TRENTON
PICTON
AURORA
SCHOMBERG
CLARKSBURG
BRIGHTON
PORT HOPE
OSHAWA
NORVAL
TORONTO
MILTON
OAKVILLE
NELSON
HAMILTON
Lake Ontario
USA
NIAGARA FALLS
PHYSIOGRAPHIC AREAS OF SOUTH-CENTRAL ONTARIO
NAPANEE PLAIN
IROQUOIS LAKE PLAIN
ONTARIO TILL PLAIN
PEEL LAKE PLAIN
INTERLOBATE AREAS
SCHOMBERG LAKE PLAIN
LIMESTONE MORAINES
DRUMLIN AREA
ALGONQUIN LAKE PLAIN
SIMCOE UPLANDS

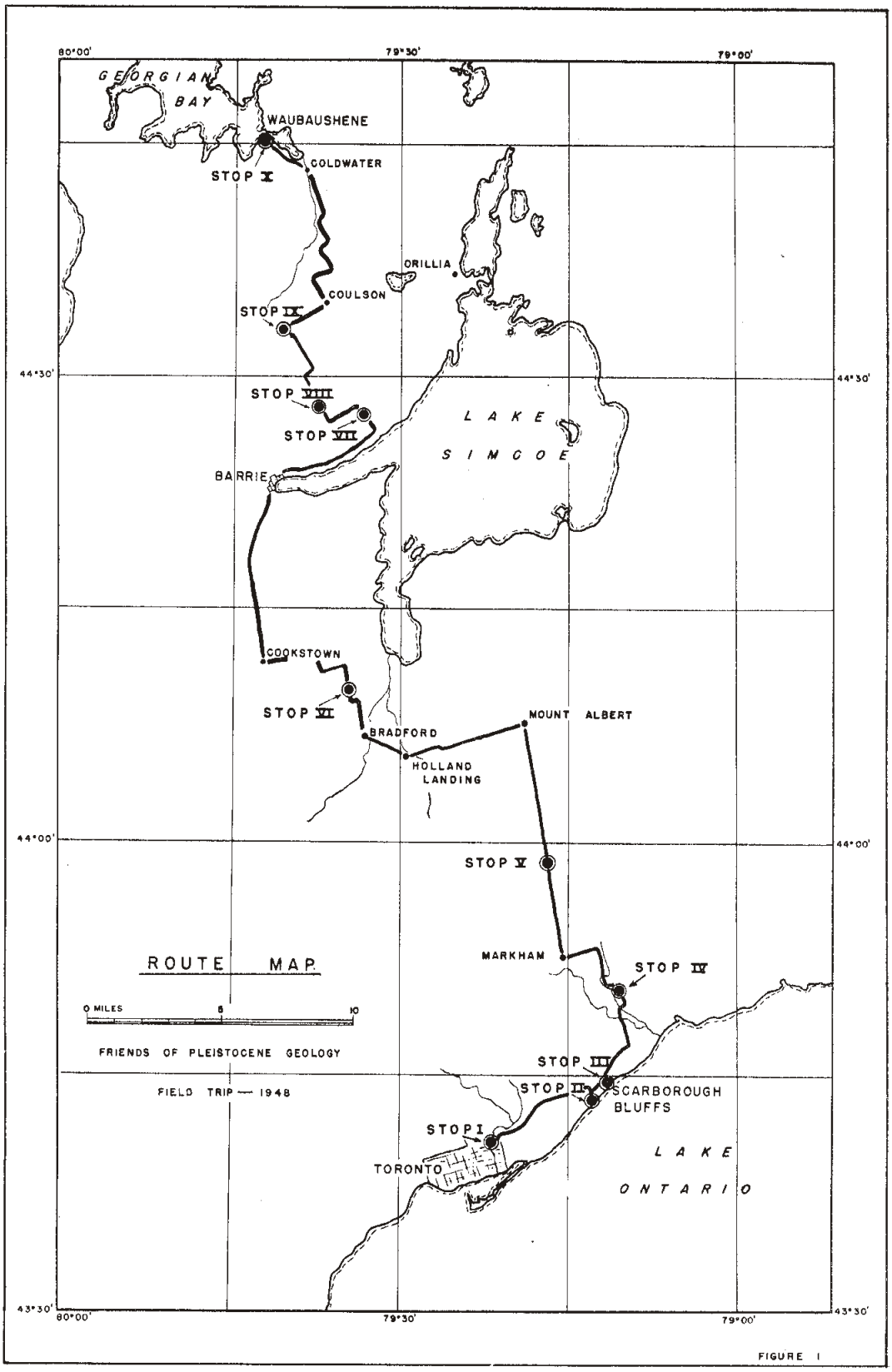
80°00'
79°30'
79°00'
44°30'
44°00'
43°30'
GEORGIAN BAY
WAUBAUSHENE
COLDWATER
STOP X
ORILLIA
COULSON
STOP IX
STOP VIII
STOP VII
LAKE SIMCOE
BARRIE
COOKSTOWN
STOP VI
BRADFORD
MOUNT ALBERT
HOLLAND LANDING
STOP V
MARKHAM
STOP IV
ROUTE MAP
0 MILES 5 10
FRIENDS OF PLEISTOCENE GEOLOGY
FIELD TRIP — 1948
STOP III
STOP II
SCARBOROUGH BLUFFS
STOP I
TORONTO
LAKE ONTARIO

FIGURE 1

PART I

ITINERARY

May 22nd

The party will meet at The Don Valley Brickyard.

Stop I - The Don Valley Brickyard

Arrive 8.45 a.m. - Depart 10.30 a.m.
Leader A. K. Watt

130-foot section of glacial and interglacial formations, and a view of the Iroquois Bluff at Leaside. See Geological Notes p. 1 and Figure 2.

En route Stop I to Stop II

The route can be followed on Map No. 41g, 'The Pleistocene of Toronto and Vicinity' by A. P. Coleman.

Miles	Cumulative	
0		The Don Valley Brickyard.
3.2	3.2	Woodbine Avenue Viaduct over a branch of the Don River.
1.2	4.4	Poorly developed bluff of Lake Iroquois.
		Up to this point the route has been traced over the Lake Iroquois plain, which slopes gently southward. The route now traverses a flat ground moraine above the Iroquois Plain.
1.6	6.0	General Engineering Corporation Plant.
		In this vicinity note the very shallow linear depressions. See Geological Notes p. 5.
1.5	7.5	Turn right (South)
		To the left is a view of the 'Scarborough Moraine'. This feature will be discussed at Stop IV. See Geological Notes p. 5.
1.7	9.2	Traffic Light. Cross Highway No. 2 and continue south bearing to the left after crossing the Highway.

0.5	9.7	The road descends the strongly developed Iroquois bluff at this point. Buff Wisconsin till is poorly exposed.
0.2	9.9	Stop II.

Stop II - The Dutch Church - Scarborough Bluffs

Arrive 11.00 a.m. - Depart 11.20 a.m.
Leader A. MacLean

A view of the erosion and stratigraphy of the Scarborough Bluffs at this point. See Geological Notes p. 2 and Figure 2.

N.B. The party will not descend the bluffs at this point.

En route Stop II to Stop III

0		The Dutch Church. Retrace route to Highway No. 2.
0.7	0.7	Highway No. 2. Turn right (east) and follow the signs to The Guild Inn.
2.6	3.3	Turn to the right off the highway just before the highway bridge over the Railway tracks.
		The highway crosses the Iroquois Bluff just before this point. The road to The Guild Inn runs over the Iroquois Plain.
1.0	4.3	Stop III - The Guild Inn. Cars should be parked where convenient and the party will assemble at the bluff, on the south side of The Guild Inn.

Stop III - The Scarborough Bluffs at the Guild Inn

Arrive 11.30 a.m. - Lunch 1.00 p.m. - Depart 2.00 p.m.
Leader W. M. Tovell

158-foot section consisting mainly of Interglacial sands and clays. See Geological Notes p. 3 and Figure 2.

N.B. Those wishing to descend the Bluffs at this point may do so.

En route Stop III to Stop IV

0		The Guild Inn. Retrace route to Highway No. 2.
1.0	1.0	Highway No. 2. Turn right onto highway No. 2 over bridge.

2.6	3.6	Highland Creek Overpass. Turn right, then left over the overpass.
0.9	4.5	Meadowvale Road. Turn left (north).
1.9	5.4	A thick section of Glacial Till can be seen in the cut to the left as the Rouge River is crossed. The till is sandy in the main, but the sand content varies. At the top is a thin veneer of Iroquois deposits, locally developed.
0.6	6.0	A bay mouth bar formed in Lake Iroquois is passed at this point.
0.7	6.7	Little Rouge Creek. Exposures of till overlain by varved clays occur in the small outcrops along the banks of the creek.
0.2	6.9	The high bluff to the east (right) is the Iroquois Bluff in this area.
		The road, after leaving the valley of the Little Rouge Creek, crosses an area of undulating ground moraine. Note particularly the linear development of some of the depressions.
1.7	8.6	Stop IV

Stop IV - Glacial Grooves

Arrive 2.40 p.m. - Depart 3.00 p.m.
Leader D. F. Putnam

A view of a linear valley in ground moraine attributed to grooving by ice advancing from the Lake Ontario lobe. A discussion of the 'Scarborough Moraine'. See Geological Notes p. 5 and Frontispiece.

0		Glacial Grooves.
1.1	1.1	The Little Rouge Creek.
1.5	2.6	The road crosses the northern extension of the groove seen at Stop IV.
1.0	3.6	Highway No. 7. Turn left (west).
2.5	6.1	Markham. Turn right (north).
		Various developments of Drumlins can be seen along the road north of Markham.

		N.B. The route can now be followed on the Markham Sheet. (Sheet 30 M/14 - Scale 1 inch to 1 mile).
6.7	12.7	Ringwood. Jog to right, then continue North.
1.7	14.4	Enter The Oak Ridges Moraine.
		N.B. The route can now be followed on the Newmarket Sheet. (Sheet 31 D/3 - Scale 1 inch to 1 mile).

Stop V - The Oak Ridges Moraine

Arrive 3.30 p.m. - Depart 3.50 p.m.
Leader D. F. Putnam

A view and discussion of The Oak Ridges Moraine.
See Geological Notes p. 5 and Frontispiece.

5.3	19.7	Enter Kame area.
		Note numerous erosion scars on the hillsides, resulting from poor farming practice in the light sandy soil.
2.9	22.6	Re-enter Interlobate Moraine.
2.0	24.6	Mount Albert. Turn left (west).
6.4	31.0	Sharon. Turn right (north), then left (west).
3.1	34.1	Holland Landing. Turn right onto Highway No. 11.
		N.B. The route can now be followed on the Alliston Sheet (Sheet No. 31 D/4 - Scale 1 inch to 1 mile).
4.2	38.3	Bradford. Turn right (north) following No. 11 Highway.
		Bradford is a thriving market gardening community developed on the soils of the Algonquin Plain. The Algonquin bluffs are very poorly developed in this area. See Figure 3 for extent of Lake Algonquin in the general Lake Simcoe area.
3.5	41.8	Turn left (west)
2.0	43.8	Turn right (north)
0.7	44.5	Stop VI

Stop VI - The Hollows

Arrive 4.30 p.m. - Depart 4.50 p.m.
Leader D. F. Putnam

A view of a topographic depression enclosed by kame deposits.
See geological notes p. 7.

N.B. If the party arrives at this point later than 4.45 p.m. no stop will be made.

En route Stop VI to Barrie

0		The Hollows.
6.9	6.9	Cookstown. Turn right (north) onto No. 27 Highway.
		N.B. The route can now be followed on the Barrie Sheet (Sheet 31 D/5 - Scale 1 inch to 1 mile). See also Preliminary Map 47-21A of the Canadian Geological Survey by R. E. Deane.
8.0	14.9	Between eight and eleven miles north of Cookstown note the flat plain of outwash material. This is at an elevation of about 1000 feet, which is above the level of Lake Algonquin.
7.1	22.0	Barrie. Arrive 5.30 p.m. The party headquarters will be at the Queen's Hotel. Cars may be parked in the lot at the back of the building. The banquet will be held in the dining room of the Queen's Hotel at 7.00 p.m.

May 23

The party will assemble in the Parking Lot of the Queen's Hotel at 9.00 a.m. Lunch will be carried, and can be obtained from the Queen's Hotel.

En route Queen's Hotel to Stop VII

0		Queen's Hotel Parking Lot.
		The bluff to the north is the Algonquin Bluff which is well developed in this area. The route will follow this bluff to just before Stop VII. See Figure 3.

N.B. The route can be followed on the Barrie Sheet (Sheet 31 D/5 - Scale 1 inch to 1 mile). See also Preliminary Map No. 47-21A of the Canadian Geological Survey by R. E. Deane.

2.5	2.5	Gravel pits to the left show well stratified sand and gravel, and are considered to be kame terraces. Some pits also occur above the Algonquin bluff.
3.7	6.2	Boulder pavement below the Algonquin Bluff.
0.9	7.1	Shanty Bay.
4.3	11.4	Stop VII.

Stop VII - The Oro Spillway or Beach

Arrive 9.25 a.m. - Depart 9.45 a.m.
Leader R. E. Deane

A discussion of the features of the Algonquin Stage of the Great Lake development in this area. See Geological Notes p. 7.

0		Stop VII
0.7	0.7	Boulder pavement to the right (east) is 30 feet above the Oro Beach or Spillway.
0.1	0.8	Highway No. 11. Turn left (southwest).
2.7	3.5	Turn right (north).
0.2	3.7	The Algonquin shore line is crossed at this point.
1.3	5.0	Stop VIII.

Stop VIII - Ice Block Ridges

Arrive 9.55 a.m. - Depart 10.15 a.m.
Leader R. E. Deane.

The examination and discussion of deposits from stagnant ice, forming closed topographic depressions with elevated rims. See Geological Notes p. 7.

En route Stop VIII to Stop IX

0	Stop VIII.

N.B. The route can now be followed on the Orillia Sheet (Sheet 31 D/N.W. - Scale 1 inch to 2 miles).

2.4	2.4	Turn right (east)
0.8	3.2	Turn left (north)
1.5	4.7	Turn right (east)
3.8	8.5	Turn left (north)
1.5	10.0	Coulson. El. 909. Turn right (east)
1.7	11.7	Turn left (north)
0.8	12.5	Stop IX

Stop IX - The Coldwater Valley

Arrive 10.25 a.m. - Depart 10.45 a.m.
Leader R. E. Deane

A view of the Coldwater Valley
See Geological Notes p.8

En route Stop IX to Stop X

1.6	1.6	Algonquin Bluff shows three distinct terraces
4.6	6.2	Highway No. 12. Turn left (north)
0.8	7.0	The hill to the right was an island in Lake Algonquin. The gravel pit shows beach deposits from a low Algonquin stage.
2.7	9.7	Coldwater. Turn left over bridge.
1.4	11.1	To the right is one of the numerous springs that are found in the Coldwater Valley.
1.1	12.2	The terraces to the left belong to the Algonquin and Nipissing Stages of the Great Lakes.
1.6	13.8	The Nipissing bluff and outcrop of Ordovician (Lower Black River) limestone.
1.6	15.4	Waubaushene
0.9	16.3	Stop X.

Stop X - Payette, Cedar Point, and Penetang Beaches of Lake Nipissing Stage

Arrive 11.45 a.m. - Depart 12.30 p.m.
Leader R. E. Deane.

An examination of three well developed Nipissing beaches exposed in one bluff. See Geological Notes p. 9.

Following the examination of the beaches, the party will proceed to Elmgrove Park in Waubaushene for lunch. Coffee or cold drinks may be obtained there. The Party will disband at Elmgrove Park.

Those members wishing to return via Eastern Ontario should take Highway No. 12 and Highway No. 7 to Lindsay.

Those members wishing to return to Toronto can either return on Highway No. 12 to Orillia, and then south on Highway No. 11 through Barrie to Toronto, or proceed to Waverly then south on Highways No. 93 and No. 11 to Barrie and Toronto.

Any member interested in visiting additional localities en route to Toronto should consult with either R. E. Deane or D. F. Putnam.

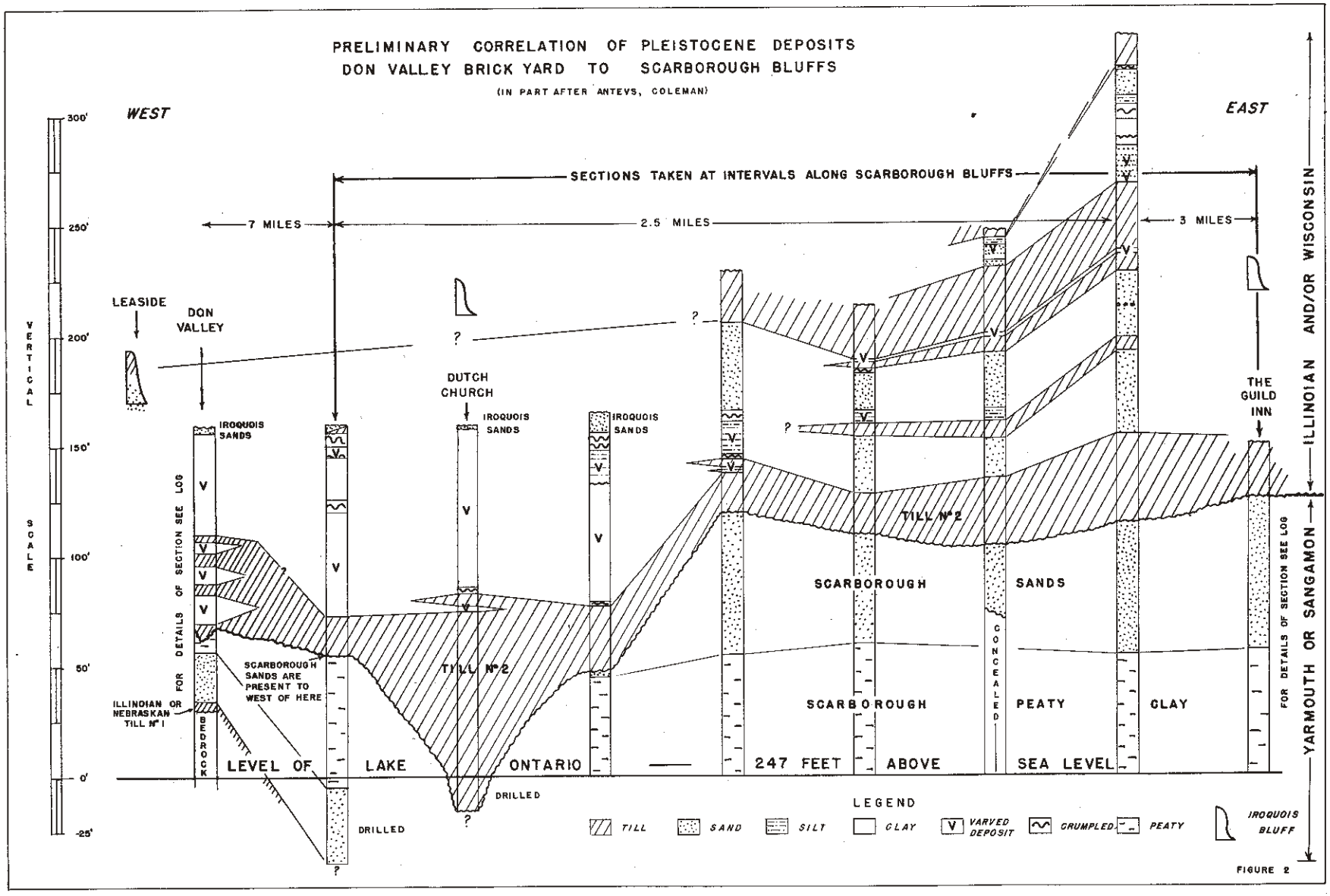
PRELIMINARY CORRELATION OF PLEISTOCENE DEPOSITS
DON VALLEY BRICK YARD TO SCARBOROUGH BLUFFS
(IN PART AFTER ANTEVS, COLEMAN)
WEST
EAST
SECTIONS TAKEN AT INTERVALS ALONG SCARBOROUGH BLUFFS
7 MILES
2.5 MILES
3 MILES
VERTICAL SCALE
300'
250'
200'
150'
100'
50'
0'
-25'
LEASIDE
DON VALLEY
DUTCH CHURCH
THE GUILD INN
IROQUOIS SANDS
IROQUOIS SANDS
IROQUOIS SANDS
FOR DETAILS OF SECTION SEE LOG
BEDROCK
ILLINOIAN OR NEBRASKAN TILL Nº 1
SCARBOROUGH SANDS ARE PRESENT TO WEST OF HERE
TILL Nº 2
TILL Nº 2
SCARBOROUGH SANDS
SCARBOROUGH PEATY CLAY
CONCEALED
LEVEL OF LAKE ONTARIO 247 FEET ABOVE SEA LEVEL
DRILLED
DRILLED
ILLINOIAN AND/OR WISCONSIN
YARMOUTH OR SANGAMON
LEGEND
TILL
SAND
SILT
CLAY
VARVED DEPOSIT
CRUMPLED
PEATY
IROQUOIS BLUFF

FIGURE 2

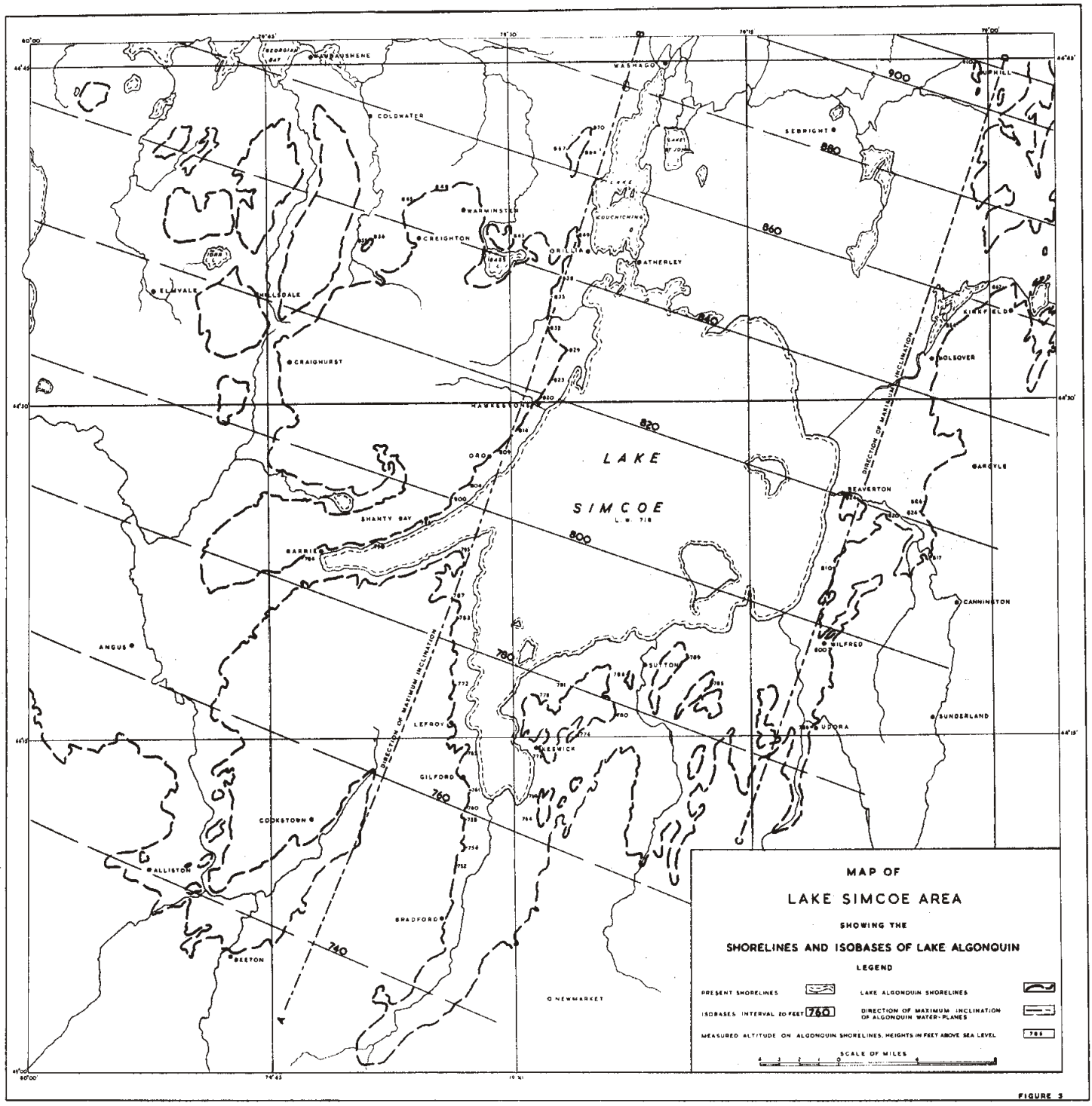
MAP OF
LAKE SIMCOE AREA
SHOWING THE
SHORELINES AND ISOBASES OF LAKE ALGONQUIN
LEGEND
PRESENT SHORELINES
LAKE ALGONQUIN SHORELINES
ISOBASES INTERVAL 20 FEET 760
DIRECTION OF MAXIMUM INCLINATION OF ALGONQUIN WATER-PLANES
MEASURED ALTITUDE ON ALGONQUIN SHORELINES, HEIGHTS IN FEET ABOVE SEA LEVEL 785
SCALE OF MILES
LAKE SIMCOE
L. W. 718
DIRECTION OF MAXIMUM INCLINATION
WASHAGO
COLDWATER
SEBRIGHT
WARMINSTER
CREIGHTON
ORILLIA
RAMARA
ELMVALE
CRAIGHURST
KIRKFIELD
GOLSOVER
ORO
SHANTY BAY
BARRIE
BEAVERTON
GARGYLE
CANNINGTON
ANGUS
WILFRED
SUTTON
LEFROY
UDORA
SUNDERLAND
GILFORD
COOKSTOWN
ALLISTON
BRADFORD
BEETON
NEWMARKET
900
880
860
840
820
800
780
760
740

FIGURE 3

PART II

GEOLOGICAL NOTES

Stop I - THE DON VALLEY BRICKYARD

The section given below was measured by Mr. A. K. Watt during the summer of 1947. Elevations given are at the top of the major units, and thicknesses are to the nearest foot. The units are arranged in descending order with the oldest beds at the bottom of the table. Numbers in parentheses refer to notes at the end of the section.

Late Wisconsin - Iroquois Sands. El. 401. Thickness 3 feet.
Yellow brown sand.

Early Wisconsin or Illinoian - Till-Varved Clay Complex. El. 398. Thickness 92 feet
- 46' - Grey to buff varves of clay and silt; some sand layers
- 3' - Clay till composed mostly of broken up varves (Till No. 2D)(1)
- 5' - Finely varved clays, contorted in places
- 6' - Grey 'schistose' till (Till No. 2C)(1)
- 8' - Varved clays with inclusions of clay and stones
- 5' - Very clayey, light to medium grey till (Till No. 2B)(1)
- 13' - Varved clays of irregular thickness; many small stones
- 6' - Interlayered clay and till (Till No. 2A)(1)

Sangamon or Yarmouth - Toronto Formation - El. 306 - Thickness 29 feet.

Scarborough Member - El. 306. Thickness 7 feet(2)
Dark brown stratified clays. Peaty in places. Fossils rare.

Don Member - El. 299. Thickness 22 feet(3)
- 4' - Coarse brown sand; greenish basal layer
- 2' - Medium grey clay with silty layers and partings
- 0.1' - Gravel
- 6' - Yellowish brown stratified sand with interbedded layers of reddish clay
- 1' - Grey sand and peaty layer
- 1' - Grey clay with fine layers of grey sand
- 0.5' - Coarse sand and gravel
- 2' - Grey and yellow stratified sands with gastropod shells
- 1' - Clay and thin layers of sand
- 4' - grey to yellow sand with some clay layers

Illinoian or Kansan - Till - El. 277. Thickness 2 feet
Tough blue grey till containing boulders of Palaeozoic shales and limestone and Precambrian rocks (Till No. 1)(4)

Palaeozoic (Ordovician) Dundas Shale. El. 275. This elevation is 28 feet above the level of Lake Ontario.

Notes

(1) Antevs (1928) shows only two tills in a section from this locality within the Till-Varved Clay complex. Coleman (1932) shows three tills in the same unit.

Till No.2C in the above section can be seen to pinch out to the north; thicknesses vary slightly from those given above. It would appear therefore, that the distribution of the tills in this portion of the section is irregular.

(2) The Scarborough beds vary from 7 to 22 feet in thickness at this locality. No Scarborough sands are present. This is associated with the disconformity present between the Till-Varved Clay Complex and the underlying Toronto Formation. (See Figure 2).

(3) The Don interglacial clays and sands contain a varied flora and fauna which indicate a climate four or five degrees warmer than the present climate in the Toronto area. Extensive lists of the fossils of the Don beds are given in Coleman (1932). The Don beds are believed to be widely distributed within and around the Toronto region.

(4) This is the only exposure of Till No. 1 that can be identified with certainty in the Toronto area. It has been reported from excavations and borings over a considerable portion of the Toronto area.

Leaside Section north of Don Valley Brickyard

From the top of the Don Valley Brickyard section, a view is obtained of the Leaside area, showing the Iroquois Bluff. The material at the top of the bluff is buff till; at present no good exposures of the material in the lower part of the bluff can be seen. At Leaside Coleman (1932) described and photographed sands separating what he considered Wisconsin till from the Till-Varved Clay Complex which he referred to the Illinoian. No fossils have been found in the sands at this locality. Sands found about two miles west of Leaside contained a few fossils, and were correlated by Coleman with the Leaside sands, and were considered by him to represent the Sangamon Interglacial.

Stop II - THE DUTCH CHURCH

The section exposed at this locality consists of a few feet of Iroquois Sands underlain by about 75 feet of varved clays, portions of which have been directly correlated by Antevs (1928) with some of the varves of the Till-Varved Clay Complex at the Don Valley Brickyard. The varved clays are underlain by a clayey till. A well dug at the foot of the Dutch Church shows the till to extend for at least 16 feet below the level of Lake Ontario. This well is believed to have been finished in Don Sands (Coleman, 1932).

The till and varved clays accumulated in an old river valley about 1200 feet wide that was cut at some time following the deposition of the Scarborough Sands and Scarborough Clays and before the deposition of Till No. 2. This locality affords a striking indication of the disconformable relationship of the Till-Varved Clay Complex with the Toronto Interglacial Formation when this section is compared with those to the east and west of it (see Fig. 2).

Stop III - THE GUILD INN

The section given below was measured in the east wall of the gully south of the Guild Inn on November 3, 1947 by D. F. Putnam, R. E. Deane, W. M. Tovell and A. K. Watt. Elevations are at the top of the units. The thicknesses are to the nearest foot. The units are arranged in descending order with the oldest beds at the bottom. Numbers in parentheses refer to notes at the end of the section.

Recent - Sandy Soil. El. 400. Thickness 4 feet.

Early Wisconsin or Illinoian - Till. El. 396. Thickness 23 feet.

5' - Brown till, sandy lenses; probably weathered portion of underlying grey till.
18' - Dark grey till; whitish to buff weathering. Sandy lenses with zones up to 1.5' of apparently stoneless till.

Sangamon or Yarmouth - Toronto Formation. El. 373. Exposed thickness 126 feet.

Scarborough Member - El. 373. Exposed thickness 126 feet

Scarborough Sands - Thickness 62 feet

8' - Grey-yellow cross-bedded sands.
0.3' - Brown silt and sand.
5' - Grey, yellow medium grained sand, partly cross-bedded.
0.3' - Weak brown sand with silt.
3' - Sand with clay nodules. Nodules vary in size. Give 'pillow' or contorted appearance to the sand; leaves and woody fragments in some whorls.
4' - Light brown to grey sand, not well stratified.
2' - Grey to brown sand, stratified with thin light and dark layers.
2' - Fine black sand with 'peaty' layers.
5' - Brown sand containing inclusions of 'sand pebbles and boulders'. Contorted appearance similar to bed above.
0.2' - Fine sand or silt.
2' - Horizontally bedded yellow and grey sands, finely laminated in places, with garnitiferous sand.
6' - Contorted cross-bedded yellow and grey sands badly mixed up; wood fragments and twigs.
5' - Fine sand or silt, dark grey; upper half faintly laminated; twigs.
1' - Brown to yellow medium grained sands; cross-bedded; iron oxide layers and nodules.
10' - Silt; fine-grained cross-bedded inclusions; appears faintly laminated in a rough fracture, with bottom 1.5' well stratified.
6' - Massive grey silt; buff weathering. Sandy inclusions. Harder than overlying silt.
2' - Fine to medium grained sand with some layers of silty clay.

Scarborough Clays - Exposed thickness 64 feet.(1)

22' - Stratified clays and silts; sandy layers along with silt and are cross-bedded. 'Peaty' layers.
1' - Massive grey silt.
1' - Stratified clay and silt with thin iron stained layers.

9' - Fine massive grey silt; very dense. Small twigs and no apparent stratification.
17' - Stratified clays; interbedded sands and silts with iron nodules and partings.
2' - Massive grey silt; buff weathering.
11' - Grey stratified clay; appeared varved in places.
LAKE ONTARIO - El. 247.

Notes

(1) The top of the Scarborough Clays is placed here as it appears to be the top of the beds that are composed mainly of fine silt and clay. The thickness conforms with other published sections. It is felt that further work will form the basis of a more satisfactory subdivision than the two-fold classification now used.

SUMMARY OF PLEISTOCENE HISTORY OF THE TORONTO AREA

Nebraskan (?), Illinoian (?)

1. Glaciation with deposition of Till No. 1 seen at the Don Valley Brickyard.

Yarmouth (?), Sangamon (?)

2. Warm interglacial climate with the deposition of the Don Sands present at the Don Valley and Scarborough Bluffs. Water over 50' above Lake Ontario.
3. Cool interglacial climate with the deposition of the Scarborough Clays in a body of water over 80' above the level of Lake Ontario.
4. In cool climate also, deposition of the Scarborough Sands in water 130' above the level of Lake Ontario. Whether there was erosion or deposition at the Don Valley Brickyard at this time is not known.
5. Cutting of the river channel at the Dutch Church. Water level dropped to at least 16 feet below level of Lake Ontario.

Illinoian (?), Wisconsin (?)

6. Glaciation with deposition of Till No. 2 (see Fig. 2), which includes the thick till seen at the Dutch Church.
7. Local advances and retreats of the ice-front with the deposition of the Till - Varved Clay Complex, which includes Tills Nos. 2B, 2C, 2D.

Sangamon (?), Wisconsin Inter-stage (?)

8. Retreat of the ice with the development of an interglacial or interstage sand, as evidenced at Leaside.

Wisconsin

9. Glaciation and deposition of tills.
10. Retreat of ice front and the development of Lake Iroquois contemporaneously with Lake Algonquin.
11. Evolution of Lake Iroquois to Lake Ontario through Lake Frontenac, representing a drop of approximately 150' in water level.

Stop IV - GLACIAL GROOVES by D. F. Putnam

The face of Ontario is well marked by drumlin fields containing upwards of 7,000 oval hills oriented with respect to the movement of ice in the various ice lobes (Putnam and Chapman, 1943). While, in some cases, these drumlin fields bear a perfectly obvious relationship to some recognizable segment of the moraines of the Wisconsin era, there are other places where the drumlins die away into an undulating till plain. In some cases these areas are marked by scattered elongated low till ridges but in other cases a reconnaissance on the ground disclosed no particular pattern.

It is otherwise when viewed from the air. Till plains bordering recognizable drumlin fields are seen to be incipiently drumlinized to an extent not suspected on the ground. Even where no ridges are visible the till is scored by shallow grooves oriented in the same general direction as the drumlins of the neighboring field. In some cases it is apparent that the shallow grooves are superimposed upon a pre-existing relief, the long shallow troughs running up and down grade in almost straight lines across an undulating till plain.

The territory selected for examination in Scarborough township displays a number of these features ranging from shallow and almost unrecognizable linear depressions to sharply cut grooves up to 20 feet in depth. An example of the former may be noticed near the wartime plant of the General Engineering Corporation while the latter may be seen near the Rouge River (Stop IV). Apart from the deep valleys of the Rouge River System the drainage of the township is controlled to a remarkable extent by these grooves.

F. B. Taylor (1913) drew his Scarborough terminal moraine through this area. There has for years existed in the writer's mind a considerable doubt on this point. The clarity with which these grooves appear on the aerial photographs, beginning at the top of the bluffs and running well inland, together with the absence of any recognizable morainal patterns, now lead to the conclusion that Taylor's interpretation in this area is in error. Above the bluffs, the face of Scarborough township is characterized by ice-moulded till, ground moraine and not terminal moraine. It is therefore further suggested that the term Scarborough moraine is invalid as applied to the low ridge of clay till recognizable at some points between Toronto and the Niagara Escarpment.

Stop V - THE OAK RIDGES MORAINE by D. F. Putnam

The Oak Ridges Moraine stands out as one of the most distinctive physiographic units in Southern Ontario (see Frontespiece). Its general altitude is about 1,000 feet above sea level and it extends from the Niagara Escarpment to the Trent River, forming the height of land dividing the Lake Ontario drainage from that of Georgian Bay, Lake Simcoe and the Trent River. Over 100 miles in length, with a width varying up to eight miles, it occupies an area of 200 square miles. In three places, it narrows almost to the point of extinction and, whether by accident or design these saddles are crossed by three provincial highways, Nos. 27, 7 and 28. It is also crossed by No. 11 highway where it is somewhat wider. Our own route

Stop VI - THE HOLLOWS by D. F. Putnam and R. E. Deane

A peculiar feature is present in the northern part of Gwillimbury West Township (Concessions XII and XIII, Lots 10-12). It is an oval basin about 2 miles long by 1¼ wide with its floor at a level about 175 feet below the rim. There are two deep notches in the western rim connecting the basin with the wide swamp floored valley of Innisfil Creek. The floor of the basin is of stratified sand while sandy till is exposed in the fringing bluffs.

In spite of the two sharp notches it does not seem that this basin is due to post-glacial erosion, the limits of which seem fairly sharply marked. It is suggested that the basin has resulted from the burial and subsequent melting of a large ice block. If so it is larger than most of the observed kettles in other parts of Southern Ontario.

Stop VII - THE ORO SPILLWAY OR BEACH by R. E. Deane

The road from Barrie along the north shore of Kempenfelt Bay follows the base of the main Algonquin Bluff to the overhead railway bridge, then continues along the top of the bluff. West of the overhead bridge the bluff is pronounced, rising to a height of 80 feet. The material in the bluff is mainly stratified sand and gravel, probably kame terrace in origin. East of the overhead bridge the material is till and the bluff is low.

At Stop VII, 500 yards west of the road is a well developed bluff. The base of the bluff is slightly boulder strewn and at an elevation of about 900 feet, or 100 feet higher than the main Algonquin Bluff. The area below the bluff, continuing both to the east and west, is relatively flat and composed mainly of sand and clay. One mile to the east of Stop VII, the bluff ends in a spit of sand and gravel. It is suggested that this bluff marks a temporary, earlier water plane than that of Lake Algonquin. It is probable that at this time the Lake Simcoe basin was filled with ice, in which case the bluff here, was the shore of a spillway.

The elevation of this bluff is the highest of any found around Lake Simcoe, but numerous deposits of sand and gravel in the form of spits and bars occur at elevations of between 900 feet and 1000 feet, suggesting pre-Algonquin lake stages of short duration. A good example of the type of evidence suggesting this development occurs one quarter of a mile north of Stop VII on the right hand side of the road, where the bluff of a wave-washed terrace with boulder pavement below it can be seen. The elevation of the base of the terrace is 930 feet.

Stop VIII - ICE BLOCK RIDGES by R. E. Deane

The ridges seen at this locality are conspicuous features extending to the north and south. The ridges may be either circular or elliptical, forming closed basins; or sinuous and branching. Both types may be seen at Stop VIII. The general alignment of the ridges is northeast-southwest, that is parallel to the regional direction of ice-movement.

The material in the ridges is a sandy or clayey till and differs little from the material surrounding the ridges. The elevation inside and outside the ridges is about the same. The suggested origin of these features is that the area in which the ridges are found was covered with stagnant ice near the close of Wisconsin glaciation. The ice was broken into large blocks, whose general orientation was with the long axis parallel to an ice lobe. The ice is thought to have contained a large amount of englacial and superglacial material. As melting progressed, the material sloughed off the sides of the block. With the disappearance of the ice block, slumping gave the ridges their present form.

Ridges similar to those at this locality are best developed in low areas, but they occur on hillsides and hilltops. Many similar ridges occur at a lower elevation than that of the base of the bluff seen at Stop VII, substantiating the idea that the bluff there is a spillway feature or a lake level of very short duration, otherwise the small ridges below that elevation would have been destroyed, or obliterated by lacustrine deposits.

Stop IX - THE COLDWATER VALLEY by R. E. Deane

The Coldwater Valley is one of several large north-south trending valleys in this area, which present an interesting problem as to origin. Are the valleys the result of erosion by the present streams? The result of ice movement? Or a reflection of pre-glacial valleys?

The valleys are continuous features; they persist beyond the headwaters of one stream to become occupied by a stream flowing in the opposite direction. Most of the streams in the present valleys are small and the gradient is low. In addition there are at least nine water planes of the Algonquin, Lower Algonquin, and Nipissing Great Lake stages intermittently developed throughout the course of most of the valleys. These are evidenced by terraces notched in the valley walls. It is obvious, then, that the valleys were not carved by the present streams.

The material on the walls of the Coldwater Valley is mainly sand and gravel, underlain by till. The sand and gravel, exclusive of the beach deposits, appears to be of kame terrace origin. Bedrock is at the surface close to the mouth of the Coldwater river. Upstream the valley is floored with thick deposits of sand, silt, and clay. From the deepest well drilled in the valley, at Carley Station (El. 775) the driller reported sand from 0 to 60 feet, a cedar log 2 feet thick at 60 feet, and sand containing abundant clam shells to the bottom of the hole at 180 feet. Bedrock was not reached. From information gathered from other wells, both in and out of the valley, it is concluded that the Coldwater Valley occupies in general a pre-glacial valley, but a portion of the present relief of the valley must be attributed to the thick deposits of drift on the highlands. A well (El. 1100) drilled near Mount St. Louis penetrated 400 feet of drift without encountering bedrock.

The sequence of events in the formation of the Coldwater Valley appears to be as follows: the first advance of the ice of the Pleistocene glaciers

was along a south flowing tributary of the Laurentian River. The retreat left a valley with little or no drift bordered by a drift covered highland. In all probability a glacial fluvial lake occupied the valley during the retreat of the ice from the valley. Subsequent glaciations repeated this cycle with the development of increased relief. The valley lobes of the glaciers would tend to remove deposits that would accumulate during both glaciation and deglaciation. After the final retreat of the ice, deposits from the waters of Lake Algonquin and successive stages accumulated and were preserved beneath the valley floor. As the water level dropped during these stages successive levels of terraces were cut in the materials of the valley walls.

Stop X - WAUBAUSHENE by R. E. Deane

The best developed water planes of some of the Lower Stages of Lake Algonquin are displayed at this locality. The three water planes are, from top to bottom, the Cedar Point, Payette, and Nipissing (Stanley, 1936, 1937).

The important factors contributing to this remarkable development are the nature and location of the materials in which they are preserved. It is the till of a drumlin which was exposed to a large body of water. It is to be noted that the middle terrace, the Payette, is missing at the east end of the bluff, where it has been eroded by waters of the lower, Nipissing, plane. Of interest too, is the disappearance of the strong upper (Cedar Point) terrace to the west where it breaks into three indistinct terraces. Varved clays form a part of the Nipissing Bluff. On the south side of the drumlin are sand and gravel deposits left by the Penetang Stage, the stage above the Cedar Point.

A well developed 5 to 8 foot bluff on the north side of the road 500 yards east of Stop X marks a lower stage of Lake Nipissing, the Waubaushene stage (Deane unpublished thesis).

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ADDITIONAL NOTES