

FRIENDS OF PLEISTOCENE GEOLOGY

EASTERN SECTION

22nd REUNION

May 16 and 17, 1959

London, Ontario

Field Trip Guide

By A. Dreimanis and R. Packer

First day..... page 1

Second day..... page 19

Proposed local stratigraphy of the Wisconsin
glacial stage in the area south of London,
Southwestern Ontario

By A. Dreimanis..... page 24

Contribution of the
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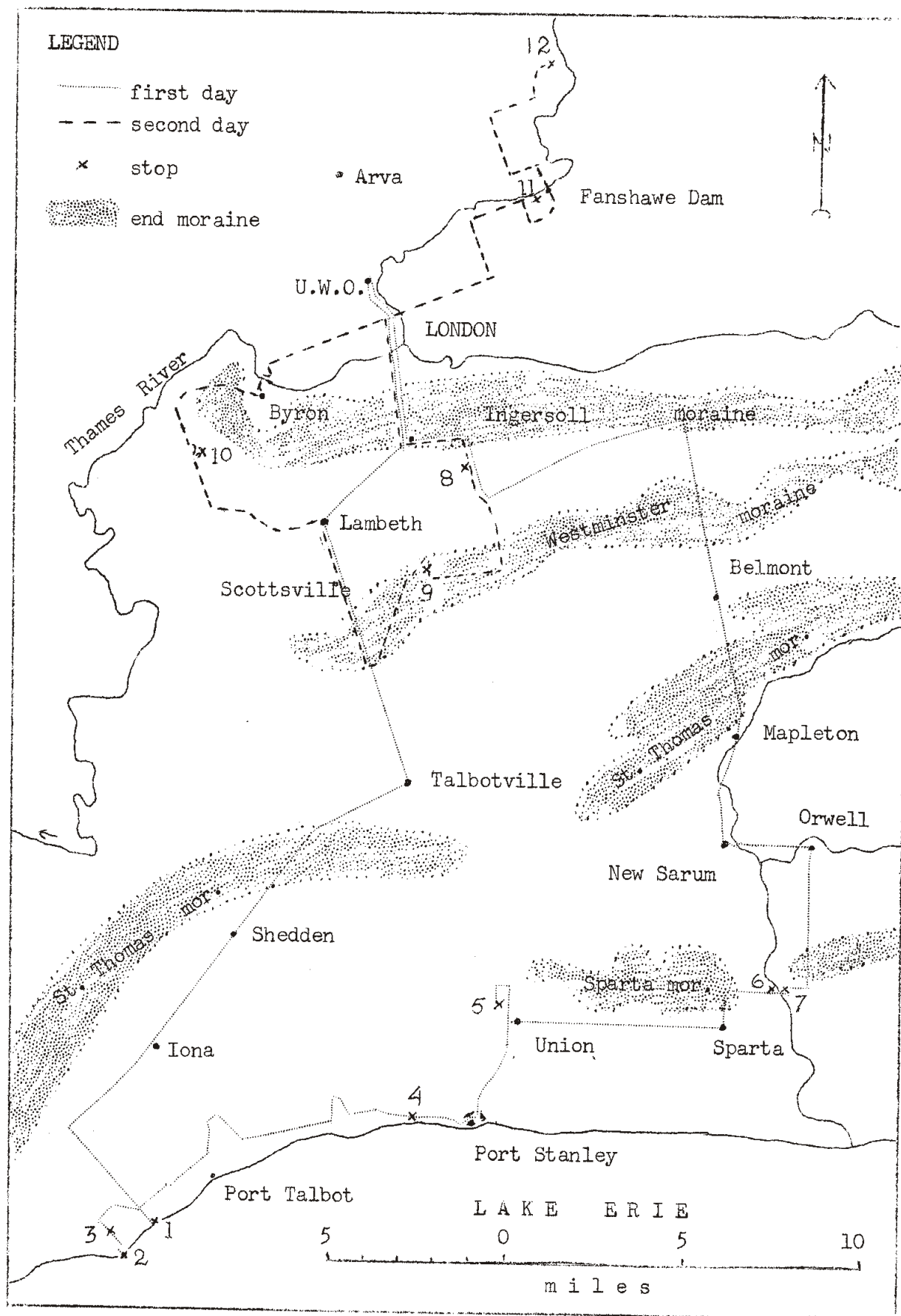


Fig. 1. Field trip routes and endmoraines (after Chapman and Putnam, 1951).

FIRST DAY - SATURDAY, MAY 16, 1959

0.0 mi. Parking place - Huron College, University of Western Ontario (in the London township, Lucan map, W. half).
The U. W. O. campus is near the N. W. edge of the 2-6 miles wide Thames valley, which in turn has been occupied by meltwater lakes and drainage channels at the end of the Wisconsin glaciation. An excavation along Western road in front of Huron College (elevation approximately 840 ft.) exposed the following layers in 1951:

- (c) 2 feet lacustrine silt (thicker in the U. W. O. campus)
- (b) 2 feet gravel and sand (variable thickness in the U. W. O. campus)
- (a) more than 5 feet lacustrine silt and clay

At the Engineering building, at Medway creek and Thames River, these layers are underlain by till. The layers (a), (b) and (c) are tentatively correlated with the Lake Maumee time. The lake level during deposition of the layer (c) was at approximately 900 ft. Evidences: a) levelling of the top of the morainic ridge at Brescia Hall (0.5 mile S. W. of Huron College), with beach gravels deposited in several places at elevation of approximately 880 ft. on the ridge, b) shore line at 905 feet 1 to 2 miles NNE of Brescia Hall (Axford, 1950) and another at 890 feet south of London, at Westminster Hospital, 4-5 miles SE of Brescia Hall (Axford, 1950).

Turn right and proceed south on Western Road, descending into Thames valley.

- 0.3 mi. Note an old gravel pit 1/3 mi. W. of Western road, on the flat top of the moraine S. of Brescia Hall.
- 0.2 mi. N. W. edge of one of the main sandy terraces, elevation 810-825 ft.
- 0.6 mi. Descend on another still lower sand and gravel terrace (795 ft.), enter the St. Thomas map, W. half; proceed through the W. side of London, following Wharncliffe Road. Cross the Thames River. The area N. of the bridge is protected by dykes from flood-waters. The area below the dykes was flooded in 1937 and 1947 to a height of the eaves of the gas stations. From the River Thames ascend the corresponding terraces on the South side of the valley train, which occupies the wide Thames drainage channel.
- 3 mi. Ascend the Ingersoll endmoraine (formed by the Erie-Ontario lobe, probably during the Lake Maumee time). Note for the next mile, that the crest of the moraine (900-925 ft.) is nearly level, while those portions of the moraine (S. E. of Byron) which are above 950 ft., are hummocky. The Ingersoll moraine is probably waterlaid, with the lake level (London ponding or embayment of Lake Maumee) approximately 920 ft. and higher. The waterlaid portion of the Ingersoll moraine is built of heavy clay till (approximately 50% clay, 30% silt, 20% sand and pebbles), underlain by lacustrine clay and silt at a depth of 30-100 ft. The clayey till (approximately 40% carbonates) is leached 1-2 ft., mostly 1.5 ft. Limestone (50%) and dolomite (25%) dominate among pebbles. Till fabric: SE→NW or SSE →NNW.

- 1.0 mi. The Wharncliffe Road continues S. W. as highway 2 on ground moraine, covered by a veneer of lacustrine deposits in some places.
- 3.1 mi. Lambeth (beach gravels, covered by lacustrine silt, probably of Lake Maumee; elevation approximately 850 ft.). Turn left on highway 4 and proceed south across Dingman creek.
- 1.4 mi. Cross an offshore bar N. of Scottsville, probably formed in Lake Maumee. Elevation approximately 850 ft.
- 1.0 mi. Ascend the waterlaid Westminster moraine, the next youngest after the Ingersoll moraine.
- 1.5 mi. While crossing the overpass over the divided highway 401, note the Lake Whittlesey shore line, south of highway 401, particularly towards the S. E. Elevation approximately 820 ft. The soil type here changes from the Guelph loam above the shore line to the less fertile London loam (Conover loam), as shown by the poorer farms. Proceed across Lake Whittlesey plain to Talbotville.
- 3.8 mi. Turn right on highway 3. Note lacustrine clay and clayey till in ditch at the E. edge of Talbotville.
- 3.8 mi. Ascend the waterlaid E-W trending St. Thomas endmoraine, capped by offshore sand and gravel deposits, at the Frome cemetery and traverse it for about a mile. After another mile enter the Port Stanley map area, W. half.
- 2.9 mi. Shedden. The topographically inconspicuous Lake Warren shore-line, marked by sandy beach deposits, is crossed here (elevation 737-740 ft., according to MacLachlan, 1939). The Lake Warren plain is dissected by numerous creeks farther southwest. Clayey till and lacustrine clay are exposed in road cuts and gullies.
- 29.5 mi. Turn left on gravel road. In this block between the gravel road and Wallacetown (on your right) a nearly complete skeleton of mastodon was found in one of the muck-filled depressions below the Lake Warren shore. According to the farmer, who dug out the bones, they were at a depth of a "couple of feet" on the contact of muck and the underlying clay.
- 3.1 mi. Turn right on Talbot Road (one of the earliest roads in this area)
- 0.1 mi. Turn left, entering the private road of the Grand View Beach.
- 0.6 mi. STOPS 1a, 1b, 1c - at the Grand View Beach: park cars at the cabins, without blocking the road. We will be here for approximately 2 hours, including lunch after discussions.

Legend: 1—till (a), 2—till (f), 3—silt (e), 4—gyttja (in c), 5—sand, 6—gravel, 7—"lower till" (g), 8—"upper till" (h) and (j), g—lacustrine clay (b), (e), (i) and (k), 10—slump.

STOP 1a - Lake Erie bluff at Grand View Beach: the Port Talbot interstadial site (see fig. 2). Comments for fig. 2:

1. Early Wisconsin sandy till (a) with a S.E. → N.W. fabric; dolostones (35%) and limestones (33%) dominate among pebbles; 43% carbonates in matrix, mostly dolomite; garnets rare among heavy minerals, but tremolite and actinolite abundant.

2. Mid-Wisconsin till (f₁) with a S. → N. fabric; lithology similar to the lower Main Wisconsin till (g).

3. Mid-Wisconsin interstadial silt (c) } Port Talbot
4. Mid-Wisconsin interstadial gyttja (c) } interstadial
deposits

Radiocarbon dates: L-370A > 40,000, L-217A > 39,000,
L-185A > 38,000, W-100 > 32,000
S-7 > 25,000

Spruce and pine dominate among pollen grains (see fig. 4)

5. Sand: (d) - top portion of the Mid-Wisconsin interstadial deposits
in(g) - a sand lens

6. Gravel: in (f) and at the base of (g)

7. Lower Main Wisconsin sandy till (g); limestones (50%) and dolostones (25%) dominate among pebbles; 38% carbonates in matrix, with dolomite slightly exceeding calcite; abundance of garnets (20-30%), particularly the red variety among heavy minerals; tremolite and actinolite also abundant (12-18%); fabric and striae on boulder pavements in till (g):

at "459": ESE → WNW

at "462" and 7 ft. above "1161": NE → SW

at "461": E → W

at "464" and "1161": SE - NW

8. Upper Main Wisconsin clayey tills (h) and (j), with SE → NW striae on boulders along the base of (h) and ESE → WNW fabric in (j); black Devonian shale dominates among pebbles; 33% carbonates in matrix, with more calcite than dolomite; garnets abundant (20-25%) among heavy minerals, with the purple variety dominating, tremolite and actinolite also abundant (20%); principal source of the heavy minerals is the Grenville province.

9. Lacustrine clays:

(k) - probably younger than Lake Maumee

(i) - probably a Lake Maumee deposit

(e) - deposited during the Mid-Wisconsin glacial advance (40% carbonates, dolomite/calcite = 1.6)

(b) - varved, deposited during the Early Wisconsin glacial retreat (44% carbonates, dolomite/calcite = 4)

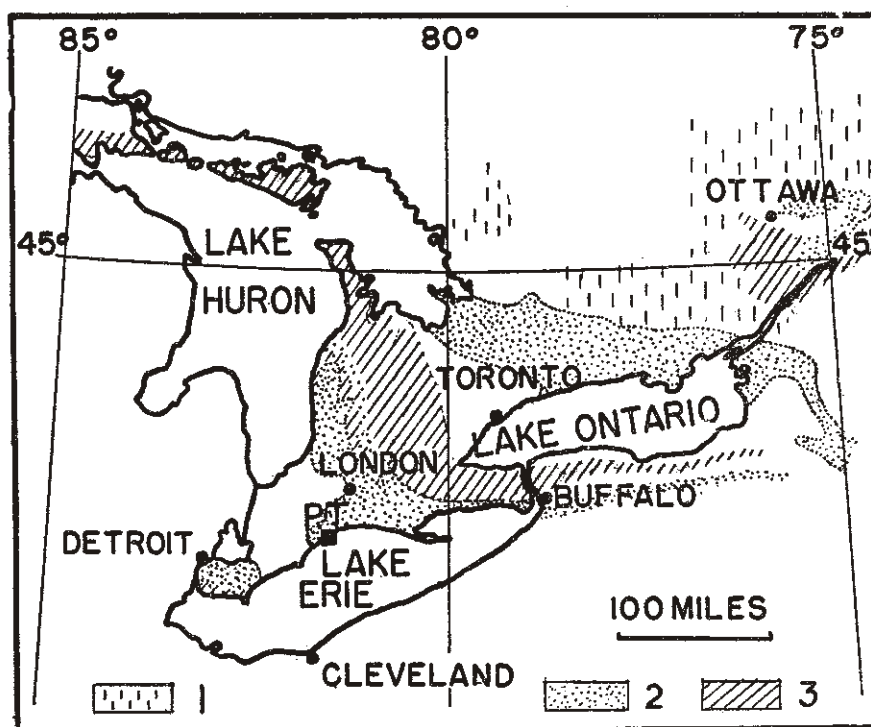


Fig. 3. Southern Ontario, with Port Talbot (PT) and the principal areas of carbonate bedrock: 1—Precambrian marble in scattered exposures, 2—Paleozoic limestone, 3—Paleozoic dolostone.

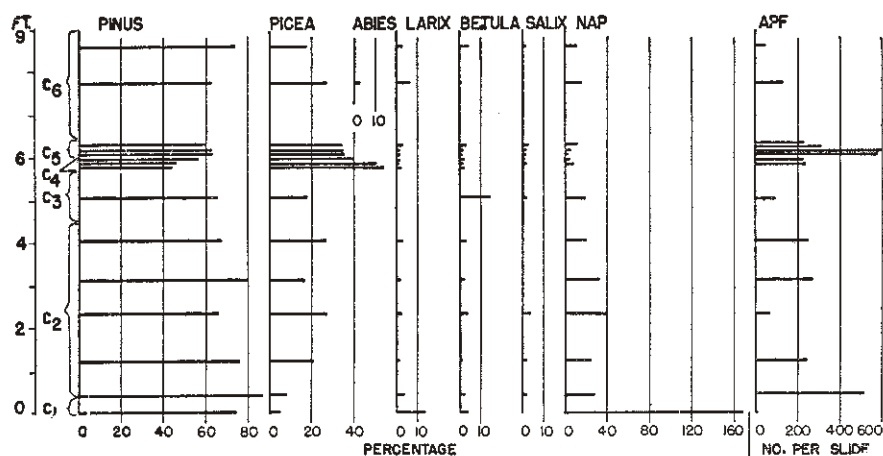


Fig. 4. Pollen diagram of the Port Talbot interstadial section. NAP—non-arboreal pollen, APF—number of arboreal pollen grains per slide. Gyttja: c-4 and c-5, other layers—silt.

Lake Erie level: approximately 570 ft. above sea level.

Folds: axes of glacial thrust folds below the till (g) trend mostly E-W or ESE-WNW, and some of them are overturned northward. A few folds are with SW-NE axes, close to the base of the overlying till (g). The E-W trending folds have been formed probably by glacial thrust from the south, the SW-NE trending folds - by a later glacial movement from SE.

The boulder pavement with WNW-ESE striae at "464" (and several others west of the gully, now covered by slump) are in the till "g".

STOP lb - The lower 10 feet of the Lake Erie bluff 300 feet N. E. of la. A sedimentary "dike", 1-2 feet thick cuts across horizontally bedded layers, corresponding to (c), (d) and (f) of la. Its strike is N-S, dip 50°W (see fig. 5). Composition: stratified silt, sand and till, with lithology resembling the overlying drift, or a mixture of the overlying and underlying materials.

STOP lc - Lake Erie bluff 300 feet N. E. of lb. General section (approximate figures):

- (6) 15 feet lacustrine clay (= k of la)
- (5) 15 feet clayey till (= j)
- (4) 5 feet lacustrine clay (= i)
- (3) 5 feet clayey till (= h), with SE → NW striae on boulders at its base
- (2) 50 feet sandy till (= g), interbedded with gravel and sand, particularly at its base; N85°E striae on a short boulder pavement 40 ft. above lake
- (1) 10 feet Mid-Wisconsin drift (= f), the base is slump-covered.

The Mid-Wisconsin drift (f) is here at least 8 feet thick (its top is 9-10 ft. above lake), consisting of very bouldery till, interstratified with ice-contact gravels and lacustrine clay. A few feet high NE-SW striking folds, overturned northward, and a short boulder pavement with S → N striae were visible at the base of the cliff in 1952. A mastodon tusk and wood were found in 1957 8 feet above lake in the Mid-Wisconsin till. Radiocarbon dates:

L-440: > 29,500, probably 33,000 ± 3000 (four from five counts)
S-46 : > 34,000

These dates may mark the end of the Port Talbot interstadial.

Among boulders and pebbles along the Lake Erie shore in the area of la to lc Precambrian tillites and jasper conglomerates may be found, they are absent in shore areas with only the upper clayey till exposed. Note also flat rounded cobbles of compressed peat, which may derive from a peat layer below the lake level.

Lunch at the Grand View Cabins.
After lunch return to the Lake Road.

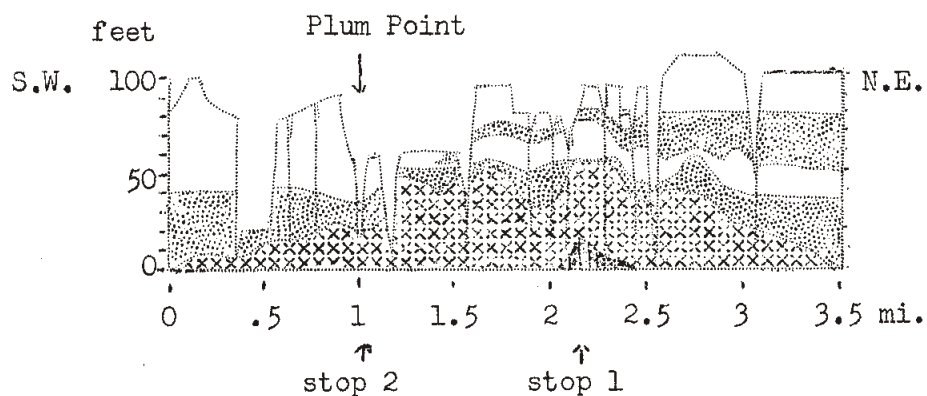


Fig. 5. Lake Erie cliff in the area of stops 1 and 2.

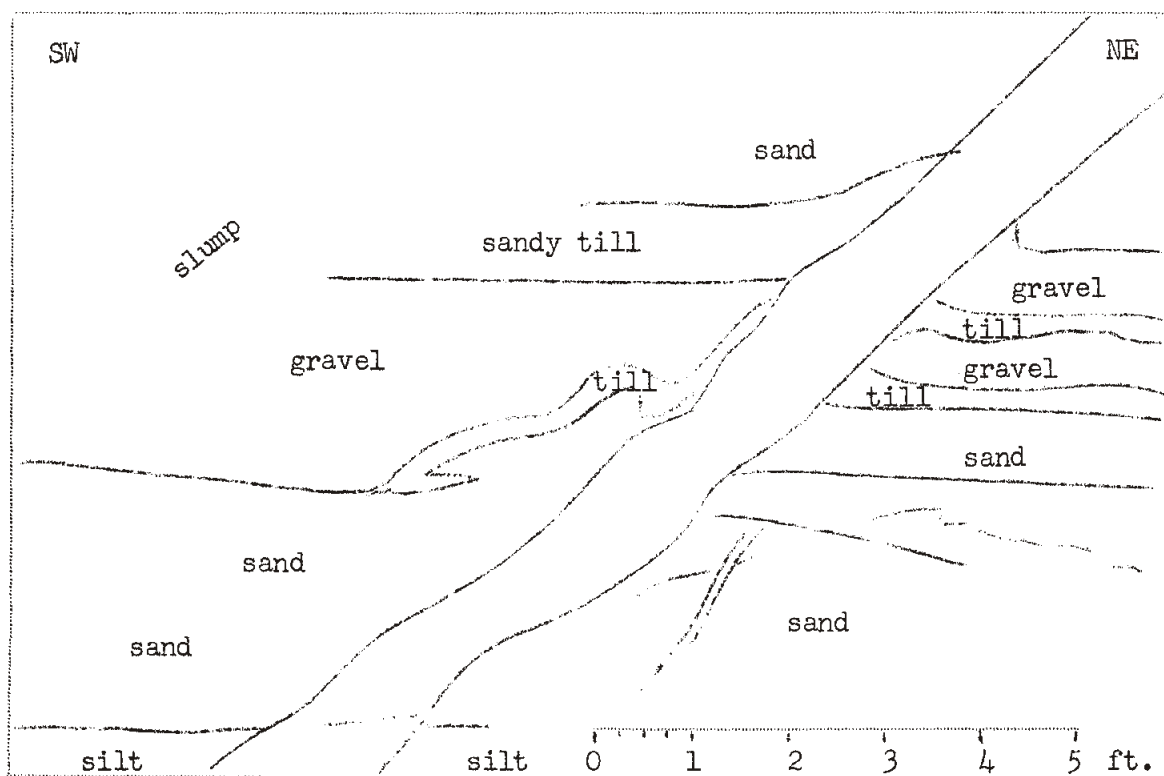
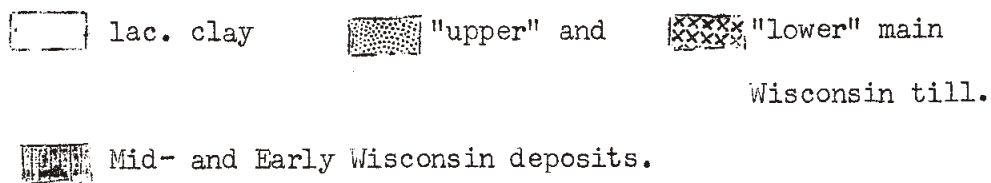


Fig. 6. Vertical section through the sedimentary "dike" at stop 1b.

- 0.6 mi. Turn left on Talbot Road.
- 0.7 mi. Left turn in a gully to gravel road, leading to Plum Point.
- 0.5 mi. Another left turn.
- 0.2 mi. Note stratified calcareous (31%) sand (more than 6 feet thick), in road cut on the right side. It may be Lake Grassmere beach deposit (elevation 680 according to the topographic map). Carbonates are leached out to a depth of 3.5 - 4 feet.
- 1.1 mi. Plum Point fisheries. Park cars on the small parking lot and along the road. Stops 2a and 2b.

STOP 2a - Lake Erie bluff east of Plum Point. General section:

- (3) 25 ft. lacustrine clay (= i and k in 1a)
- (2) 18 ft. clayey till (= h)
- (1) 20 ft. sandy and silty till (= g), with SE → NW and ESE → WNW (N55°W) fabric, lithology same as in (g) of stop 1a. Two pieces of larch and spruce wood were found in this till 6-8 feet above lake. Radiocarbon dates:

larchwood - L.185B: 28,200 ± 1500
W-177 : 27,500 ± 1200

Spruce wood - L.217B: 24,600 ± 1600

Note "shearing" through most of the silty till (1). Thin discontinuous laminae of silt or more silty till than that above or below mark the nearly horizontal "shear planes" (see fig. 7).

Were the "shear planes" formed by plastering of drift underneath the moving glacier, or in the basal portion of the glacier?

At the east end of the exposure, near the creek, note drag folds (overturned towards N. W.) in the top portion of the sandy till (1). A larger fold (fig. 3) 6 x 8 feet in section, was exposed in 1952 in the now slump-covered base of the bluff.

STOP 2b - Lake Erie bluff west of Plum Point. General section:

- (3) 40 ft. lacustrine clay (= 3 of 2a)
- (2) 15-17 ft. clayey till (= 2 of 2a), with a boulder pavement (ESE-WNW striae) at its base; note that the clayey till continues also underneath some of the boulders.
- (1) 21-28 ft. contorted sandy till (= 1 of 2a), lacustrine silt and sand; see fig. 8 for the general pattern of the ice-thrust distortions, formed by glacial pressure from the east.

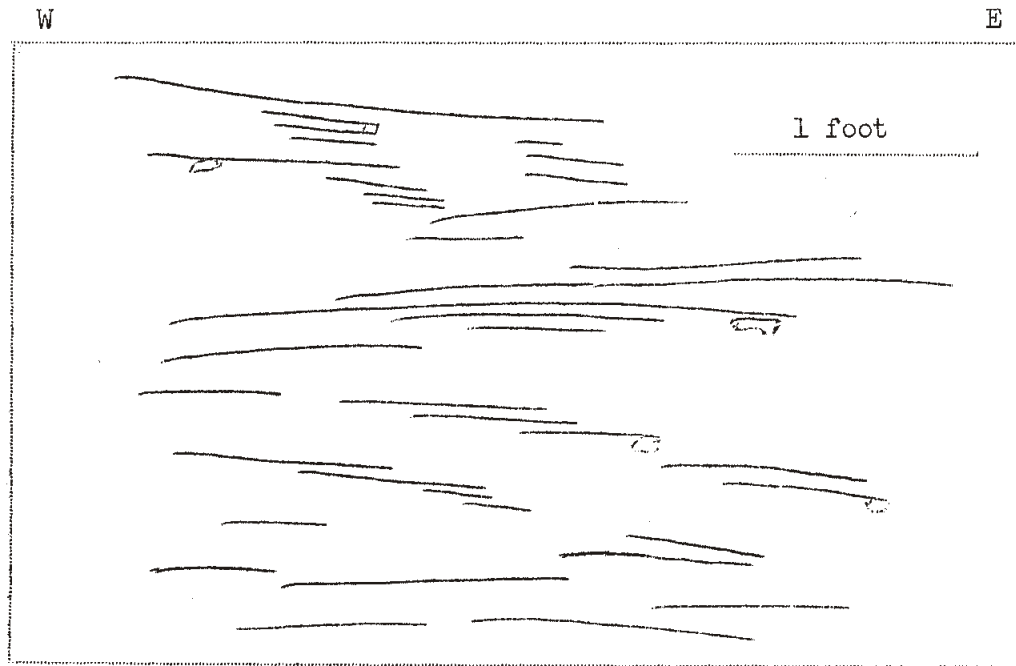


Fig. 7. Streaks of silt and silty till in silty and sandy "lower" till, stop 2a. Pebble alignment: N55°W.

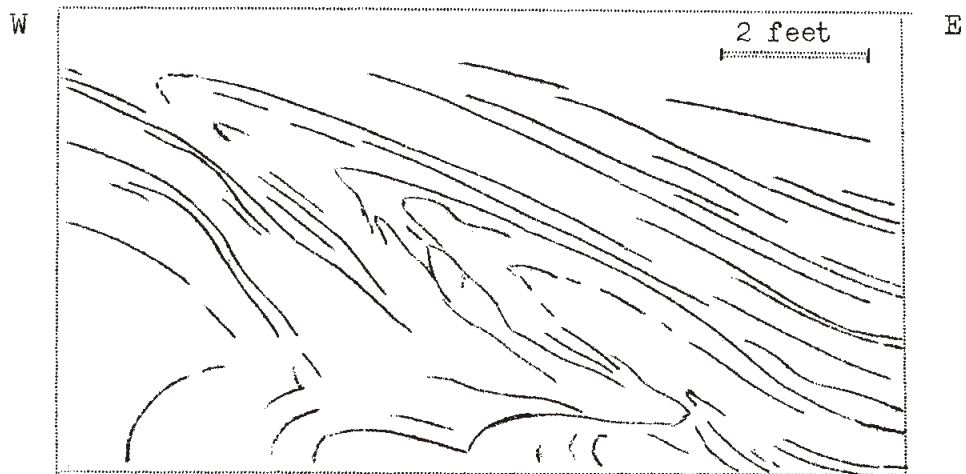


Fig. 8. Fold in the "streaky" lower till at the base of the E. end of stop 2a.

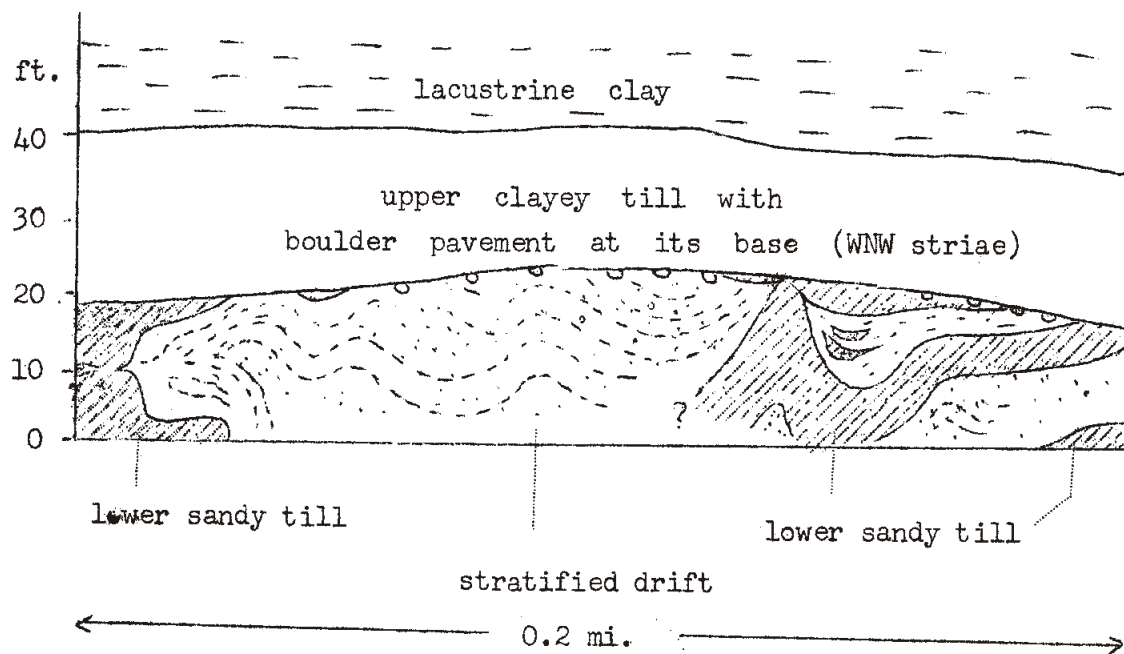


Fig. 8a. Geologic section (measured in 1952) west of the Plum Point Fisheries (Stop 2b)

Looking west, note that the contact of the sandy "lower" till (1) and the overlying "upper" clayey till (2) slopes down to the lake level. The "lower" till (g) and older Pleistocene deposits form a broad anticline (3.5 miles across) in the area between Port Talbot and a creek one mi. W. of Plum Point. It may be a buried end-moraine (see fig. 5).

Retrace the gravel road back to Stop 3.

1.0
mi.

STOP 3 - road cut.

Stop to examine soil profile. Soil is of the Haldimand Silt Loam developed under a mixed forest of conifers and hardwoods. This is the only area in Ontario where this classification is used. It is a more silty variant of the Haldimand Clays developed on the lacustrine deposits further east. The characteristic reddish brown colour is shown in the B₁ horizon. Carbonates (33%) are leached approximately 3 feet¹ down to the base of the B horizon. Continue back to Talbot Road, turn right. For comparison: where the upper clayey till (with 26-32% carbonates) is exposed on surface in this area (below the Lake Warren shore), it is leached to a depth of 1-2 feet.

5.3
mi.

Talbot Estate (Malahide Farms) to the right. This is the site of the original settlement of Col. Thomas Talbot in 1802. It was from here by a feudal system of land tenure that the clearing of the forest began.

Cross the Talbot Creek. Port Talbot (burnt down and abandoned now) is at its mouth. Two clayey till layers (= h and j), separated by lacustrine silt and clay (i) and capped by the lacustrine clay (k), are exposed along the valley sides and the Lake Erie cliff in this area. The sandy till (g) is below the lake level (see fig. 5).

1.7
mi.

Turn right and after .3 mi. right again. Continue along the Lake Road east, with several sharp turns.

Note the low sandy bar between the road and the lake shore for a couple of miles (elevation about 680 ft. This sand bar was formed during one of the phases (Lake Grassmere?) after the Lake Warren time. The same two clayey tills and two beds of lacustrine clay as in Talbot creek are exposed in the gullies, crossed by the road. Note slumping and soil erosion along gullies.

Change to the east half of the Port Stanley map.

6.4
mi.

STOP 4 - at a gully 1.5 miles West of Port Stanley. General section:

- (5) 25 feet lacustrine clay (= k)
- (4) 25 feet clayey till (= j) with an ESE → WNW fabric
- (3) 5-22 feet stratified sand }
- (2) 10-40 feet lacustrine clay } = (i)
- (1) 30-40 feet clayey till (= i), with an intercalated layer
of silt (0-10 feet) in its lower portion; till
fabric ESE → WNW.

Black shale dominates among pebbles and coarse sand size particles in both clayey tills ("the upper tills"). Numerous sharp folds, 2-10 feet high, with their axes striking mostly NE-SW (perpendicular to the glacial movement) were exposed in the lower 10 feet of the cliff in 1952. They are covered by slump now. Larger folds are in the layers (2) and (3) (see figure 9), with springs in the synclines of sand. These springs, and seepages along the silt layer in the till (1) are among the major causes of heavy earth slumping along this portion of the Lake Erie shore. The river terraces to the north side of the road reveal the extent of the recent shore erosion. These are not rejuvenation terraces in the normal sense of the work; they are created by shore erosion removing the mouth of the stream. A similar phenomenon E of Port Stanley produces a hanging valley. Chapman and Putnam estimate the retreat to be 10 miles since the establishment of Lake Erie, Wood estimates the rate at 8 feet per year since 1809 at this point. The undercut culvert at the south side of the road shows the effect of the increased gradient on stream flow. The terraces are 50 ft. above the lake level, the average gradient of streams in this area is 10 ft. per mile. This represents a minimum retreat of 5 miles.

Continue east along the Lake Road.

0.8
mi.

Cars will slow to observe a wide valley with SW-NE orientation. The gradient is from S to N but no stream occupies it. Probably the valley of a creek, beheaded by shore erosion. A similar feature is found 1 m west of Port Bruce. The size suggests these were secondary tributaries draining a larger height of land, possibly an endmoraine, later and further south than the Tillsonburg moraine. This moraine, if present in this area, was eroded by Lake Erie.

The geologic section east of Port Stanley (on display in Geology Department, U. W. O.) with sand and another till layer above the till (4) of stop No. 4, indicates oscillation of ice margin. As moraines run WSW-ENE in this area, continuation of this oscillating margin has to be south of the present shore in the area west of Port Stanley.

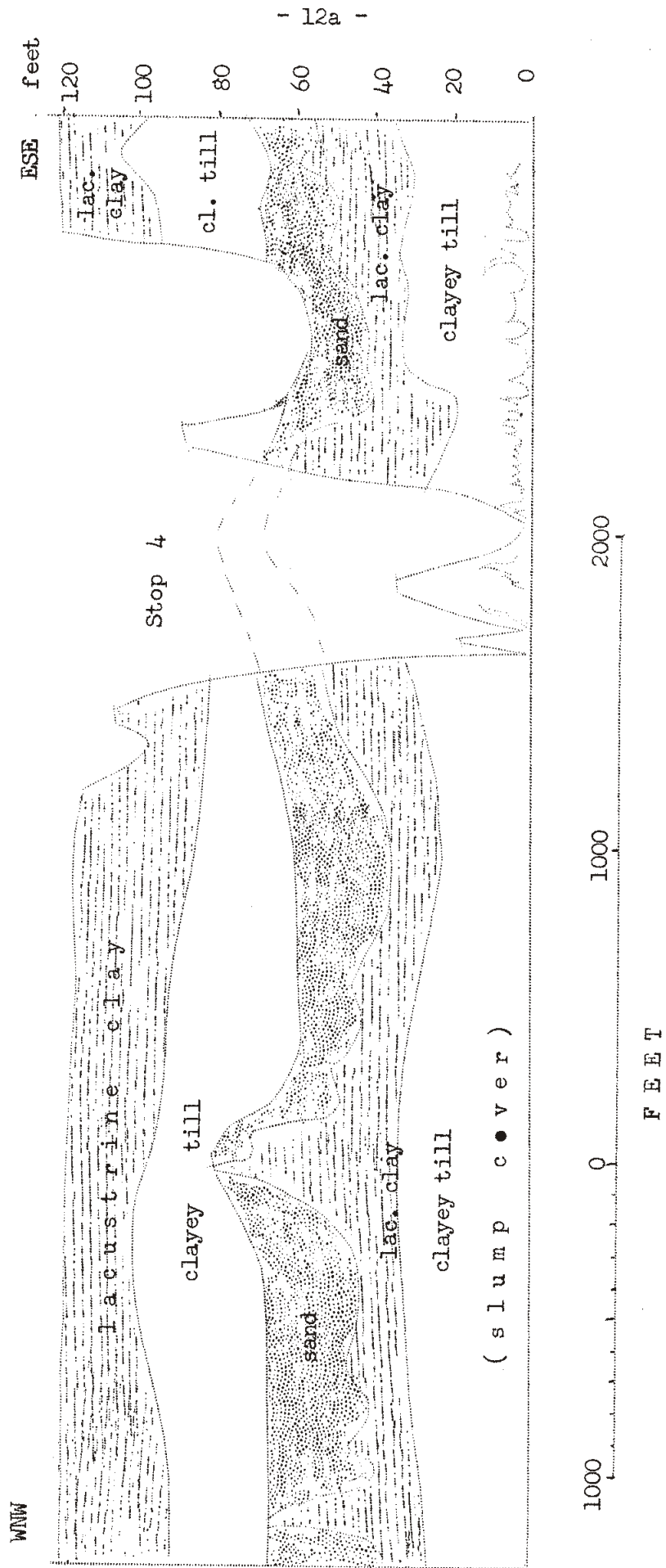


Fig. 9. Lake Erie cliff at Stop 4. Profile measured 1950-1952.

0.6
mi. Enter Port Stanley

This town serves as a combination port and recreation centre for London to which it is connected by an electric/diesel railroad. Wheat, soy beans, coal and fuel oil are the chief commodities. Great Lakes fishing is a secondary industry. Longshore drift builds a sand, gravel beach for recreation but also fills in the harbour which requires dredging to maintain its 20 ft. depth.

0.3
mi. Cross Kettle creek.

0.1
mi. Turn left on highway 4.

1.8
mi. Right side of the highway. An abandoned sand pit with the following section (measured 1953):

15 feet clayey till (probably = j, or next youngest) with a SE → NW fabric; more silty through the lower 5 feet; depth of carbonate leaching 22 in.; 29% carbonates in matrix, with calcite dominating.

25 feet stratified silt and sand.

Continue northeast, ascending from the valley. Erosional topography, mostly in sand.

2.0
mi. Bypass Union (on the right). After crossing a small creek, note gravel pits in the Lake Arkona beach bar on both sides of the highway.

1.3
mi. Turn left, and after 0.5 mi. left again.

0.6 mi.

STOP 5 - White's gravel pit in Lake Arkona beach bar. Top of the bar at approximately 730-735 feet (MacLachlan). The thickness of more than 40 feet of gravel and the considerable size of the deposit may indicate that it was formed during the rise of the Arkona waters. Slopes of the gravel bar are capped by lacustrine silt (with occasional pebbles). Some balls of silt are present also in gravel at the crest of the gravel bar.

An exposure at the south edge of the pit reveals 3 feet of leached silt, underlain by gravel, with one foot at its top also leached. The gravel contains 50-60% carbonates.

1.2
mi. Return to highway 4 and proceed south.

1.3 mi. Union. Turn left and continue east. Between Union and Sparta the road follows a depression between a flat, half a mile wide sand covered bar (730 to 750 feet above sea level) on the south, and the Sparta moraine north of the road. The Lake Warren and Arkona beaches might have been along this sand bar. The Berrien Sands soils of this area are extensively used for flue-cured tobacco. The sands underlain by clay offer better water control than those over gravel which dry out. The curing kilns are characteristic.

The Lake Whittlesey shore is visible as a distinct step approximately half a mile north of the road, particularly closer to Sparta. Most orchards of this area are on the Lake Whittlesey plain.

6.2 mi. Sparta. Turn left.

0.7 mi. Ascend the Lake Whittlesey shore.

0.6 mi. Turn right.

0.4 mi. Descend below the Lake Whittlesey shore (approximately 780 ft.).

0.4 mi. Descend below the Lake Warren shore (730 to 740 ft.), and then into the Catfish creek valley. Drive with care - winding narrow road, and trucks turning into gravel pit on the south side! Park across bridge.

0.5 mi.

STOP 6a -Catfish creek cut, west bank, approximately 500 feet above bridge. General section (top at 730-740 ft.):

(4) Up to 20 ft. - stratified gravel and sand, probably Catfish creek delta of the Lake Arkona or Warren time.

(3) Up to 5 ft. - upper silty till (= h of la?)

(2) Up to 35 ft. - stratified sand and gravel

(1) Approximately 45 ft. - interbedded sandy till, gravel and sand (= g of la?)

Limestones (45%) and dolostones (25%) dominate among pebbles; 40% carbonates in matrix. Among heavy minerals 15-25% are garnets, with red garnets being twice as abundant as purple, indicating a regional glacial movement from N.N.E. Presence of Huronian tillite and jasper conglomerate boulders supports this conclusion. The local glacial movement, as indicated by till fabric (measured 3 and 15 feet above creek) was N5-15°E.

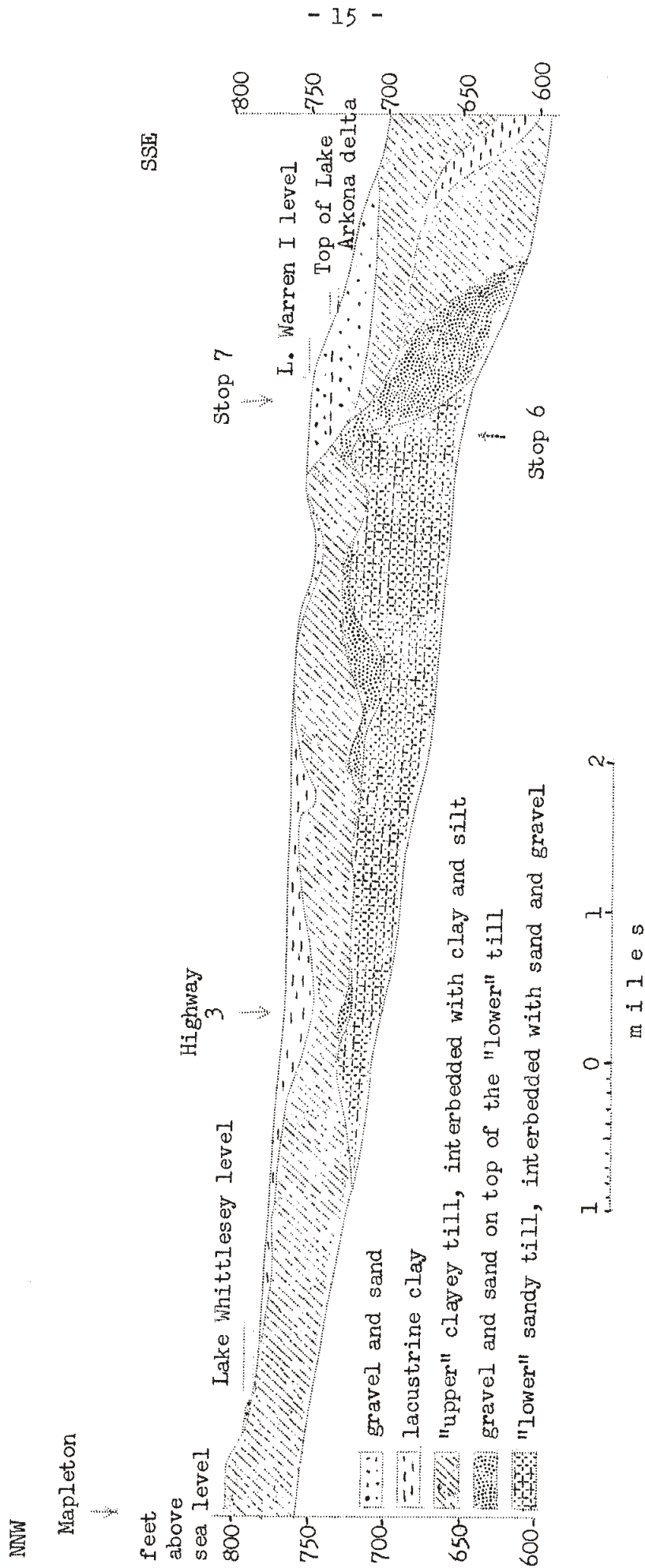


Fig.10. Geologic section along the Catfish Creek between Mapleton and Sparta, Ontario.
The lower line is creek level.

STOP 6b -Abandoned gravel pit between (6a) and the road. General section:

- (4) 15 feet upper clayey and silty calcareous till, interbedded with varved silt and clay (continuation of the layer No. 4 of the stop 6a).
- (3) 1/2-2 feet sand and gravel, cemented by calcite, with stalactite-like pendants into sand No. 2.
- (2) Up to 60 feet stratified sand and gravel (= No. 2 of stop 6a); the floor of gravel pit is in this layer or on top of the layer No. 1.
- (1) 15 to 30 feet sandy lower till, interbedded with gravel and sand (= No. 1 of stop 6a).

Proceed across the valley eastward and park cars above valley, east of the gravel pits (stop 7).

0.8 mi.

STOP 7 - Gravel pits in the eastern valley side, north of the road. General section (top 730-740 ft.):

- (5) 5-12 ft. beach sand (Lake Warren I?), with laminae of garnet and magnetite sand, some pebbles, and snails; carbonates are leached to a depth of 2-3 ft.; (unleached sand contains 30% carbonates); tubes of secondary calcite are visible at a depth of 3-4 feet; a large block of till (3 x 30 ft.) is in the upper half of the sand at the N. E. end of the upper pit.
- (4) 1-3 ft. lacustrine reddish and buff mottled clay (Lake Whittlesey?).
- (3) approximately 20 ft. deltaic gravel, foresets dipping south (Catfish creek delta in Lake Arkona?), well exposed in the upper gravel pit.
- (2) approximately 50 ft. (in road cut below the floor of the upper gravel pit), lacustrine silt, deeper sand (Lake Maumee deposit?).
- (1) more than 5 ft. stratified gravel (bottom of the lower gravel pit).

Proceed east along the Lake Warren sandy shore. Note boulders along the former water line.

0.9 mi. Turn left and ascend the Lake Warren shore again.

0.6 mi. Jaffa.

1.0 mi. Springwater pond on the right side, surrounded by an almost unspoiled natural woodland (500 acres) of white pine, white oak, sugar maple and beech. This area has been acquired by the Catfish Creek Conservation Authority who plan to preserve it as a recreational area, possibly connected with a proposed Great Lakes Parkway.

Enter St. Thomas map, east half.

0.8 mi. An irrigation pond at the tobacco barns on the right. Note medium grained sand, in the excavation. These are deltaic deposits brought in by meltwater streams from NE into Lake Whittlesey.

The tobacco economy uses carefully controlled conditions; young plants are grown in the many greenhouses, rye and barley are rotated in the cropping system, often ploughed in as green manure. Sprinkler irrigation and smudge pots are used as protectors against drought and frost. So much fertilizer used, this might almost be called hydroponics.

1.3 mi. Orwell. Turn left on highway 3.

0.7 mi. Catfish creek valley with lacustrine clay and the underlying clayey till exposed. Lacustrine clay dominates as surface deposit through this area.

1.4 mi. Cross the West Catfish creek. Note sand (= No. 2 in Stop 6), capped by the upper clayey till, exposed in the erosional remnant in the valley south of the highway.

0.2 mi. Ascend the western side of the West Catfish creek valley. Look at the creek cut 0.2 mi. north of highway. The boundary between the clayey upper till and the sandy "lower" till (= No. 1 in stop 6), 20 feet above creek bed is marked by a boulder pavement just below the grass-covered slump.

0.4 mi. New Sarum. Turn right on highway 74 and proceed north through the Lake Whittlesey plain, with thin lacustrine clay and silt deposits on clayey till, visible in creek cuts. Note the Lake Whittlesey shore at distance on your left.

3.1 mi. Ascend the Lake Whittlesey shore after having crossed the West Catfish creek. Note water washed till surface in the road cut. Elevation of the L. Whittlesey shore is approximately 790 ft. at this place.

0.2 mi. Mapleton. Note the rolling till plain in this area north of the L. Whittlesey shore. The ground moraine rises gradually northward, grading into the waterlaid St. Thomas moraine.

1.6 mi. Crest of the St. Thomas moraine (approximately 870 ft.).

1.0 mi. Another branch of the same moraine.

1.6 mi. Belmont.

- 2.3 mi. Crest of the Westminster moraine (940 ft.).
- 3.0 mi. Turn right on highway 401 before reaching the crest of Ingersoll moraine (930 ft.), proceed west along inside of this moraine. Clayey till in ditches, capped by lacustrine silt in a few places.
- 6.2 mi. Leave highway 401 by Wellington road right.
- 1.9 mi. Turn left on con. I/II road, Westminster township. Enter the west half of the St. Thomas map.
- 1.5 mi. Glendale. Turn right on highway 2 and 4 and proceed north, following Wharncliffe road and Western road, to Huron College (5 miles).

- - - - -

Dinner at 7:00 p.m. in the Dining Room of Huron College.

SECOND DAY - SUNDAY, MAY 17, 1959

0.0 mi. Leave 8:30 a.m. from Huron College, going south. Follow the same route as Saturday for the first 5 miles to Glendale. St. Thomas map, W. half.

5.0 mi. Glendale. Turn left and go east along inside of the flat-topped Ingersoll moraine.

1.5 mi. Turn right on Wellington road.

0.4 mi.

STOP 8 - Road cut in ground moraine S. of the Ingersoll moraine (Westminster tp., con. II, middle, west side of the road). More than 8 feet of clayey till, with carbonate leaching 18-24 in. deep; 40% carbonates in till matrix, mostly calcite; limestone dominates among pebbles; granulometric composition 20% sand, 30% silt, 50% clay.

Continue along Wellington road south, cross highway 401 and ascend the Westminster moraine, which is built mostly of clayey till at this place.

3.5 mi. Crest of the Westminster moraine at the Radio Station (920 ft.). Turn right on the con. V/VI road, and follow the hummocky morainic ridge west.

1.2 - Note a shallow tunnel valley, cutting diagonally (SE-NW) across
1.4 mi. the moraine. You will first see a kettle on your left, drained through a narrow valley northward, across the road. Then, farther west, a row of shallow kettles are aligned on your right, leading towards a large deltaic gravel deposit (a stockpile of gravel marks the centre of this deposit). Clayey till is still the main material along the road.

0.6 mi. Turn right. Two kettles in till (water filled). Then numerous dry kettles in gravel, particularly west of the road.

0.3 mi.

STOP 9 - Large gravel pit west of the road, 1.5 mi. S. of White Oak.
General section: (elevation about 900 ft.)

(2) 0-4 feet clayey and gravelly upper till (0.2 mi. farther NW it terminates against contorted gravels).

(1) more than 50 feet deltaic sand and gravel, with foresets dipping mostly towards NE and N (Vick, 1957).

In the shallow gravel pit east of the road the till (2) is capped by a few feet of gravel and, farther downslope towards the north, by stratified sand. Lithology of pebbles in till of Westminster moraine and in gravel is the same with more limestone pebbles than in the Ingersoll moraine. The deltaic gravels (1) were deposited

probably in the Lake Maumee, while the Lake Erie lobe oscillated along the Westminster moraine. Dipping of foresets towards the NE, towards the embayment between the Westminster and the Ingersoll moraines, may indicate a current caused by winds from SW.

Proceed north to highway 401.

0.5 mi. Turn left on highway 401. Caution - this is a high-speed divided highway! Continue southwest.

3.3 mi. Highway 4, turn right and go north.

4.0 mi. Lambeth. Turn left on highway 2. Gravel pits on both sides of Dingman creek north of the highway, with sand and gravel, capped by silt (same as at the stop 10). Elevation: 825-850 ft.

1.3 mi. Beginning with the curve northwest, the highway follows a terrace at an elevation between 825 and 850 feet. Does it belong to Lake Whittlesey or the receding Lake Maumee? This terrace is formed along a low till ridge, capped by Lake Maumee gravel bar.

2.1 mi. Turn right on con. III/IV road, Delaware tp.

1.5 mi. Turn right on private road and park at the gravel pit on your left.

0.3 mi.

STOP 10- Gravel pit and Dingman creek south bank section. Elevation at the gravel pit: approximately 850 ft. General section:

- (6) 3-8 feet lacustrine silt, with carbonates (32%) leached to a depth of 3 feet. This silt was deposited probably by the Lake Maumee III.
- (5) up to 15 feet stratified gravel (offshore bar of Lake Maumee II?). This layer is missing at the creek cut W of the gravel pit. The gravel bar continues SE to Scottsville (S. of Lambeth) for at least 5 miles.

Continuation of the section along the South bank of Dingman creek, W. of the gravel pit.

- (4) 25 feet - clayey and silty upper till of the Erie lobe lithology (probably equivalent to h at stop No. 1), with 48% carbonates in matrix and limestone pebbles dominating.
- (3) 50 feet - stratified lacustrine silt and clay, interbedded with some sand in the middle.
- (2) 8 feet - sandy and silty "lower" till, with E-W fabric and the heavy mineral content indicating a regional flow from NNE: garnets 30%, the red variety twice as abundant as the purple, actinolite and tremolite (10%) more abundant than chlorite-serpentine; 35% carbonates in matrix.

- (1) more than 8 feet - stratified sand and gravel.

Note the thick lacustrine deposits (3) between the sandier lower till (3) and the more clayey upper till (4).

- 0.3 mi. Return to the con. III/IV road, turn right and proceed north. Narrow road, with a one-lane bridge: drive with care!
- 1.8 mi. Turn right on black top road.
- 0.7 mi. Note sandy and gravelly till in the road cut on the south side of road. It has a mixed Huron and Erie lobe heavy mineral lithology, and a NNW→SSE fabric. We are in the zone of overlapping of at least three glacial flows (the Huron lobe, the Erie lobe, the glacial flow from NE).
- 0.5 mi. Crest of a N-S spur of the Ingersoll moraine. Note the Erie lobe clayey till (6-12 feet) in road cuts, underlain by silt and fine sand. This portion of the Ingersoll moraine may be a thrust or push moraine consisting of several tens of feet of silt and fine sand, capped by 5-15 feet of till.
- 0.6 mi. Descend onto wide gravel terraces of the Thames drainage channel and enter Byron. Elevation 800-850 ft. The gravel terraces were formed probably during the Lake Maumee and Whittlesey time.
- 1.0 mi. Turn left and go north past Springbank park on your right.
- 0.3 mi. A flowing well, 100 feet deep, with sulphurous water is in the N. W. corner of Springbank Park at the bridge. (Devonian bedrock is here at a depth of 100 feet.) Cross the one-lane bridge and turn right on Riverside drive.
- 1.0 mi. Turn left on Hyde Park road. Note valley train gravels in the large gravel pit on your left. Elevation of the ground is approximately 850 feet at this place.
- Farther northwest, on your left, is a large and deep kettle (Byron bog). It will be preserved in its natural state.
- 0.9 mi. Turn right on Oxford Street and go east.
- 0.4 mi. Cross a small endmoraine of the Huron lobe, and then descend on the Thames valley train terraces, below 850 ft. Proceed through the northern portion of London. Change from the west half of the St. Thomas map sheet to the east half, and then to the Lucan sheet, east half.
- 5.7 mi. Turn left on Highbury Avenue. This is groundmoraine of the Erie lobe (elevation above 875 feet), which was flooded by a local London ponding during the Lake Maumee time. Lacustrine deposits on top of till are discontinuous.
- 0.7 mi. Deltaic gravels begin to appear in excavations.

0.7 mi. Descend into Thames valley on a 810 ft. terrace.

0.4 mi. Turn right, and after 0.2 mi. ascend onto a higher gravel terrace (about 880 ft.) and a gravel delta of the London ponding (top of the delta is at 895-910 ft.).

2.0 mi. Park at the dead end of the road. We are 1/3 mile below the Fanshawe dam, built in 1951.

STOP 11 - Thames River North branch, south bank 1/3 mile below the Fanshawe dam. General section:

- (4) 5 feet silty, towards the top clayey till, with a boulder pavement at its base (with S30°E → N30°W striae); this till was deposited by the Erie lobe before the more clayey Ingersoll moraine was built. Its heavy mineral content shows characteristics of the Erie lobe.
- (3) 60 feet interstratified sandy till and some layers of gravel, with a NW-SE fabric, Huron lobe heavy mineral lithology; boulder pavement at its base with NNW striae.
- (2) 0-2 ft. gravel.
- (1) 10-12 ft. purplish brown clayey till with NE → SW fabric (and N20°-70°E striae on bedrock underneath it, as seen in 1951 during the Fanshawe dam excavation); the purplish colour is probably from ground Queenston shale; occasional pebbles of Queenston siltstone are found in this till among heavy minerals, garnets are abundant (22-28%), the red garnets slightly dominating over the purple variety; actinolite and tremolite (11-21%) are more abundant than chlorite and serpentine (4%); such a heavy mineral content suggests a regional glacial movement from NE. The purplish till is less slump-covered farther downstream (0.2-0.5 mi.), and it is underlain by lacustrine clay of similar colour on the north side of river, 0.5 mi. downstream.

0.4 mi. Turn around at the end of the road and go WSW for 0.4 mi., then turn left.

0.4 mi. Another left turn. Enter the Fanshawe park area.

0.5 mi. Traffic circle.

0.2 mi. Fanshawe dam.

1.1 mi. Turn left at the gates of the Fanshawe beach.

0.8 mi. Turn right on Clarke side road; we are still on the deltaic gravels, capped by 0-3 feet of clayey silt. Note large kettles in front of us.

- 0.4 mi. Water wells of P. U. C. of the City of London in one of the kettles. Groundwater is recharged in this area by pumping water from Fanshawe dam into other kettles 1/3 - 1/2 mile N.W. of the wells.
- 0.5 mi. Gravel becomes thinner, and till is exposed in ditches.
- 0.8 mi. Ascend an inconspicuous shore line at 925 feet elevation.
- 0.2 mi. Turn right on black top road (con. VI/VII, London tp.). Note till in ditches.
- 1.3 mi. The "925 feet" (approximately) terrace is well developed at the farm south of the road. This may be a shore of the London ponding.
- 0.2 mi. Road bends left, then right and descends towards the North Branch of Thames River.
- 1.3 mi.

STOP 12 - Road cut in the west bank of Thames River, North Branch, 1.3 mi. WSW of Thorndale. General section:

- (5) 3-5 feet clayey and gravelly till, texturally and lithologically similar to the bed (4) of Stop 12.
- (4) 0-1/2 ft. calcareous sand.
- (3) 0-1/2 ft. brown leached sand and partly leached top of till.
- (2) 3-5 ft. very stoney and silty till with NE → SW fabric and a NNE heavy mineral content; 35% carbonates in matrix.

This till may correspond to those sandy "lower tills" of Stops 1, 6a and 10, which had the NE → SW and E → W fabric.

- (1) more than 30 ft. hard sandy till, with boulders at its top; samples of this till have not been studied, but a very similar till on the other side of the Thames river has a Huron lobe heavy mineral content and more than 40% carbonates in matrix.

This section has not been studied in detail, and its fabric was measured only in layer (2) in 1951, before widening of the road. What is the meaning of the leached sand and till top (3)? Is this a paleosol or result of underground water leaching? If this is a paleosol, and if the till (5) corresponds to the clayey "upper till" at Lake Erie, and the till (2) to the "lower till" (g) of the stop 1, then this soil may be formed during the Erie interstadial, proposed by Dreimanis in 1958.

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We are approximately 11 miles NE from the University of Western Ontario (via the road WSW to Arva, then the highway 4 SSE and Western road).

PROPOSED LOCAL STRATIGRAPHY OF THE WISCONSIN GLACIAL STAGE
IN THE AREA SOUTH OF LONDON, SOUTHWESTERN ONTARIO

By Aleksis Dreimanis

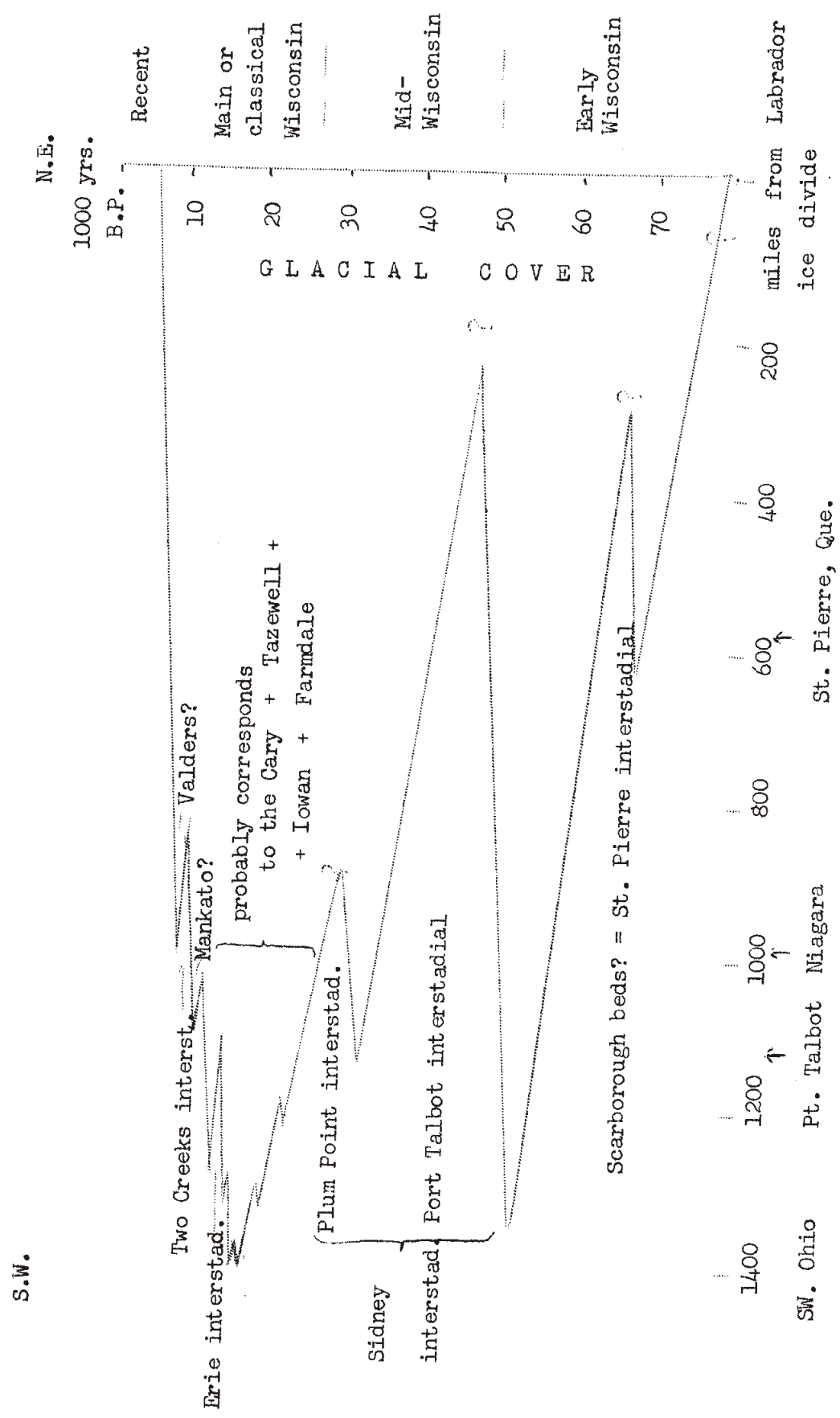
Introduction

Most published studies of Pleistocene deposits of SW Ontario have dealt with the uppermost drift, its physiography, retreat of the last glacier, lake phases (F. B. Taylor, 1913, F. Leverett and F. B. Taylor, 1915, F. Leverett, 1939, A. P. Coleman, 1941, D. F. Putnam, 1943, L. J. Chapman and D. F. Putnam, 1943, 1951, etc.). Feeling that the Pleistocene stratigraphy of this area had to be studied in greater detail, the writer and Professor G. H. Reavely, together with students of the Geology Department of the University of Western Ontario, began a series of such investigations since 1949, supported by grants from the Research Council of Ontario and Geological Survey of Canada. Several techniques have been tested and compared, first in selected areas, and lithologic, granulometric, fabric and palynologic investigations were found very useful besides the routine field observation. Radiocarbon dates and to some extent also raised beaches and depth of carbonate leaching permitted correlations with stratigraphic units of other regions. The work is still far from complete, but investigations of the last ten years permit us already to draw some tentative conclusions.

Those Pleistocene deposits of S. W. Ontario, which are exposed in river banks and lake shore cliffs, or artificial excavations, appear to belong to the last ice age, as no interglacial deposits or paleosols, which may indicate climatic conditions similar to those of the present time, have been found. Interstadial cool climate deposits, older than 40,000 radiocarbon years, suggest that the last ice age extended farther back in time than the Classical Wisconsin. Therefore the writer prefers to apply the name of Wisconsin which means the last ice age in the Great Lakes region, to the entire complex of glacial and interstadial times between the last true interglacial age (with climate as warm or even warmer than at present) and the Recent. In this meaning the Wisconsin is subdivided here in an Early Wisconsin (mostly glacial), Mid-Wisconsin (mostly interstadial) and Main Wisconsin (corresponding to the classical Wisconsin of the Midwestern region of the Great Lakes) - see also fig. .

1. The lowermost sandy till (a) at stop 1, near Port Talbot, is assigned to the Early Wisconsin glaciation (called also the post-Sangamon, pre-classical Wisconsin by R. F. Flint). Matrix of this till is very rich in dolomite (36% dolomite, 7% calcite), with less dolomite (17%) among pebbles. Thus the dolomite should have come from a distant source, probably from the Silurian dolostones W. of Lake Ontario and the Ordovician in the St. Lawrence Lowlands (see fig. 3). The local glacial movement was from the S. E. at Port Talbot. The heavy mineral content is similar to that, found in tills of the Trois Rivieres area, N. E. of Montreal (P. F. Karrow's unpublished Ph.D. thesis). A dolomite-rich till, with heavy minerals typical for the area between Trois Rivieres and Montreal and also very rich in dolostone rock flour, is found at Toronto, overlying the Scarborough beds, and is considered also as an Early Wisconsin till.

TENTATIVE WISCONSIN STRATIGRAPHY OF THE EASTERN GREAT LAKES-ST. LAWRENCE REGION



Lithology of these tills suggests regional glacial movement from ENE from Labrador, via the St. Lawrence Lowland and Lake Ontario, with radial movement out of the Lakes Ontario and Erie (from S.E. towards N.W.), at least along their N. shores.

The oscillating Early Wisconsin glacier traversed the St. Lawrence Lowland E. of Montreal approximately 64,000 years ago, as the radiocarbon age of the St. Pierre interstadial peat is $64,000 \pm 2000$ (Gro 1766) and $67,000 \pm 1000$ (Gro 1711) years old (preliminary dates, personal communication of H. deVries from the Groningen radiocarbon laboratory).

The Port Talbot area was reached at some time more than 40,000 years ago (see radiocarbon dates on p. 5).

2. During retreat of the Early Wisconsin glacier eastward, a proglacial lake developed in the Lake Erie basin. Lacustrine deposits with the same ratio of dolomite to calcite, as in the Early Wisconsin till, were deposited in this lake (e.g. layer (b) at stop 1).

3. Port Talbot interstadial. Retreat of the Early Wisconsin glacier was followed by a cool long interstadial, during which the silt layer (c), intercalated by gyttja, and the sand layer (d) were deposited at stop 1. Palynologic investigation of the layer (c) indicate, that the interstadial began with a short tree-less period, which was followed by immigration of jack-pine, spruce, larch and birch. During the thermal maximum of the interstadial (immediately before deposition of the gyttja) pines with large pollen grains, probably red and white pine, immigrated. They disappeared soon again, probably because of cooling of the climate. The same pollen grains as in the layer (c) are found also in the overlying till (f) at stop 1. The Port Talbot gyttja is more than 40,000 radiocarbon years old, but the end of the interstadial may have been 33,000 - 36,000 years ago (see p. 7 for radiocarbon dates).

It is probable that a lake, with an outlet across the present Niagara peninsula (the buried St. David's channel?) occupied at least a portion of the present Lake Erie basin, with its level below the present one during deposition of the Port Talbot gyttja, but higher towards the end of the interstadial, because of slow uplift of the Niagara peninsula, after having been relieved from the load of the Early Wisconsin glacier.

4. Towards the end of the Mid Wisconsin time (which began with the Port Talbot interstadial), or at the beginning of the Main Wisconsin, a glacial advance blocked the outlet of Lake Erie at its E. end again, and a proglacial lake developed in the Erie basin. Clay (e) of stop 1, with a calcite/dolomite ratio similar to that of the overlying till (more calcite than in the older beds) was deposited in this lake. Then the ice lobe entered the Lake Erie depression. Evidences on glacial movements from S towards N or even SSW towards NNE in the Port Talbot area, and also in Catfish creek, suggest existence of a local centre of glacial outflow in Lake Erie. The till and ice-contact deposits of this glacier are thin along the N. shore of Lake Erie, and none have been found S. of the lake. Quite probably the glacier did not extend far beyond the present boundaries of Lake Erie. Lithology of the till matrix (calcite nearly equal to dolomite, and abundance of garnets, with the red variety dominating over the purple, suggest that this Mid-Wisconsin glacial advance

originated from a centre of glacial outflow farther west than during the Early Wisconsin time.

The purplish till (1) of Stop 11 at London may have been deposited also during this time, as suggested by similarities in heavy mineral content. This assumption still has to be tested.

5. Plum Point interstadial. A temporary glacial retreat followed, probably of a length of a few thousand years, long enough to permit returning of larch, spruce and probably also pine to this area (see p. 9 for radiocarbon dates of wood, incorporated in the till layer, described below. The Sidney interstadial in Ohio probably embraces both the Port Talbot and the Plum Point interstadials and the intervening Mid-Wisconsin glacial advance (event 4) in S. W. Ontario.

6. Sandy "lower till" of the Main Wisconsin containing wood 24,600 \pm 1600 to 28,200 \pm 1500 years old at stop 2, represents a continuous glacial cover of probably a long duration, and with gradual considerable changes of the ice movements:

- 1) first - from SE (with the wood), from the Lake Erie basin (stops 1, 2, near 6)
- 2) then - from E, nearly parallel to Lake Erie (stops 1, 10)
- 3) then - from NE (stops 1, 6, 12), disregarding the underlying topography; this was probably during the maximum of the Main Wisconsin
- 4) finally - from E and SE again, with the ice sheet thinning and resuming the lobate character in SW Ontario (stop 1, 11).

The till lithology, with heavy minerals typical for the North Bay-Ottawa area, and presence of Precambrian tillites, suggests a regional glacial flow from N. or NNE, at least up to the maximum of the glaciation (inclusive). Later local centres of glacial outflow may have been farther south.

Thinning of the ice sheet and resuming of lobal character deglaciated the central higher portion of SW Ontario (NE of London) first. Therefore the last glacial movement (4) is not recorded in till fabric of the lower sandy till at stop 12. A further gradual change of glacial striae was observed in a composite boulder pavement at Fanshawe dam, 4 mi. S. of stop 12 and 0.5 mi. E of stop 12, as illustrated below:

from S25°E
o o o o o o o o o o o o
from S45°E
o o o o o o o o o o o o
from S65°E
o o o o o o o o o o o o

The "lower" Main Wisconsin till will be seen at stops 1, 2, 6, 10, 11, 12.

7. Erie interstadial. Retreat of the Erie lobe at least towards the E end of Lake Erie has been suggested by the textural contrast between the sandy "lower" and the clayey "upper" tills around Lake Erie (White, 1951, Dreimanis, 1951, Shepps, 1953). Apparently deposition of the sandy till was followed by deposition of lacustrine clays and then incorporation of them in the overlying upper till.

No soils have been found, until recently, between these two tills. While preparing this guide-book, a probable paleosol was found at last NE of London, at stop 12, at elevation above 900 ft. No lacustrine beds are between the "lower" sandy and the "upper" clayey till at stop 11 at a similar elevation. Top of lacustrine deposits, sandwiched between these two tills at stop 10, is at approximately 800-825 ft., and at 870-890 ft. in the Westminster hospital area SE of London. For comparison it may be mentioned that the Erie interstadial lake level may have been lower than the highest observed Lake Maumee level in this area.

8. "Upper" clayey till of the Erie lobe (present through the entire field-trip area, except for a narrow zone NW of London, which was covered by the Huron lobe). The clayey "upper" till is found in one to at least three layers, interbedded and covered by lacustrine deposits in most places, with the number of layers increasing from W. towards E. Heavy minerals of this till are similar to those of the "lower" Main Wisconsin till. The upper tills adjacent to Lake Erie differ from the "lower" till by abundance of black Devonian shale in the sand and pebble grades. This is a local rock of the Lake Erie depression, and its abundance suggests a heavy glacial erosion and probably even presence of a local centre of glacial outflow during formation of the moraines adjacent to the lake.

The first layer of the "upper" till was deposited by a glacial readvance reaching up to London and St. Mary's N. of Lake Erie and even slightly beyond the Defiance moraine S.W. of the lake, as found by G. W. White. White correlates this readvance with Late Cary. Radiocarbon dates from Lake Arkona and Whittlesey deposits on top of this till in Ohio and Ontario suggest that it is older than 13,000 years. During the oscillating retreat of the Erie lobe, the Ingersoll, Westminster, St. Thomas and Sparta moraines were built in the field-trip area. In most places they are waterlaid in this area. A conspicuous exception - the up to 1030 ft. high kame cluster at Byron on the Ingersoll moraine.

A local London ponding existed in the area NE of London, while the drainage was blocked by the Erie and Huron lobes, still meeting SW of London. After these lobes split apart, the beach and offshore gravels of the Lambeth and Byron area were deposited at an elevation of up to 855 ft., probably in Lake Maumee II. While the Westminster moraine was formed, the ice margin stood already in a deeper water, probably of Lake Maumee III, as the top of delta at stop 9 is at an elevation of close to 900 ft.

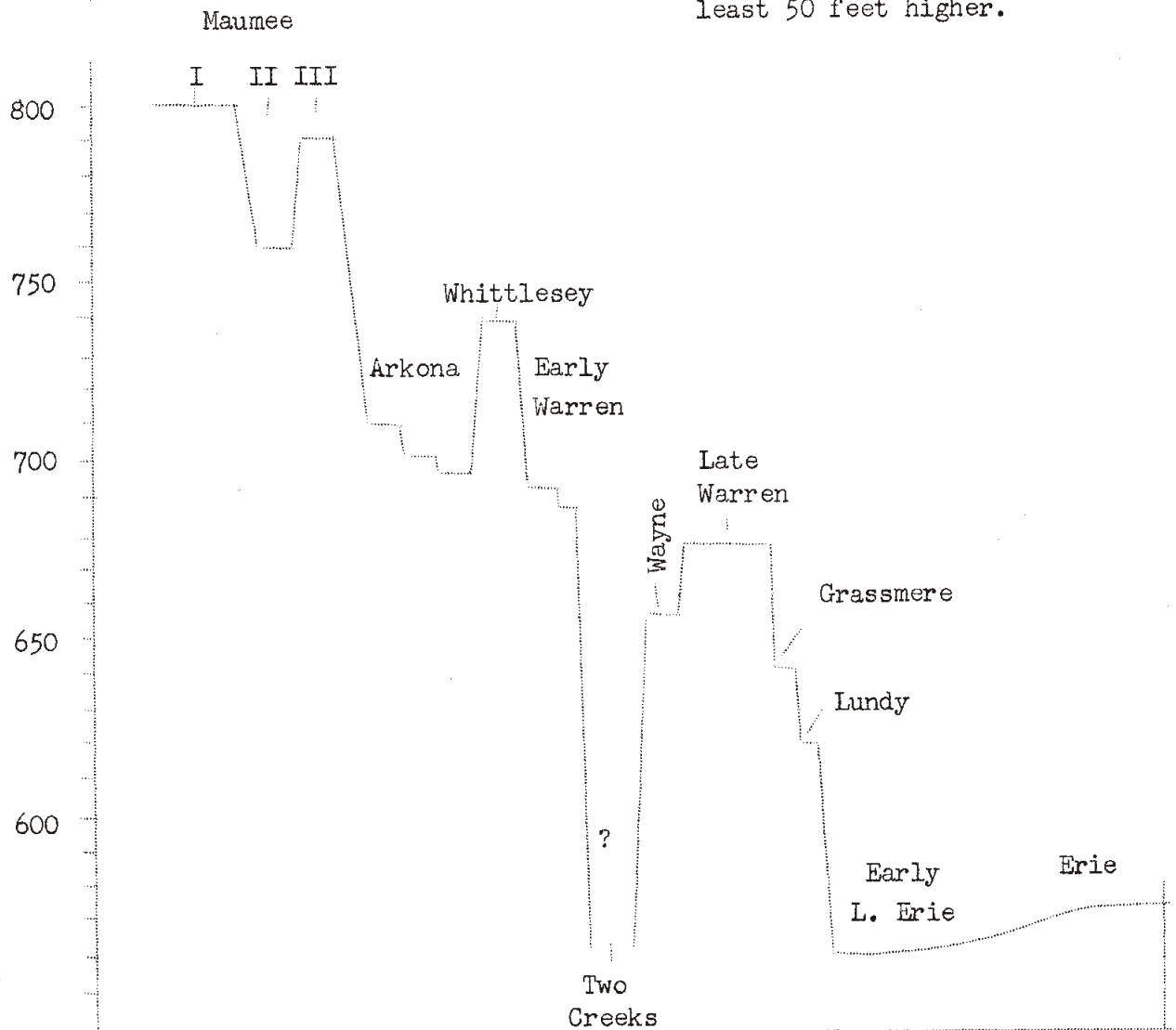
The St. Thomas and Sparta moraines were built also probably during this phase of Lake Maumee, as silt is found on them at levels higher than those of Lake Whittlesey.

*Purple garnets are more abundant than the red variety, indicating shifting of the centre of glacial outflow again towards the east.

9. Lakes Arkona, Whittlesey, Warren I. The Erie lobe had already retreated beyond the eastern boundary of the field-trip area. The ice was still NW, N and E of the land, and the cold proglacial lake waters towards the W, SW and S. Thus the local climate of the land around London may **not** have been hospitable, and it was like an island, surrounded by water and ice. This may explain the absence of wood and shells in beach deposits, except for Ridgetown farther SW (probably driftwood from the S. shore of the lake!).

The relationships between the probable Lake Arkona, Whittlesey and Warren I deposits are outlined briefly in the field guide. No attempt has been made by the writer to contribute to the already existing published data on these lake phases. They have been used here merely as a cross check for the relative age of the underlying till, and most elevations mentioned are approximate, taken from maps.

Lake phases in the Erie basin, with elevations given for its SW end (after J. L. Hough, 1953). In the field trip area the corresponding levels are at least 50 feet higher.



Selected References

- 1) Axford, R. S., 1950, Glacial lake beaches and spillway banks of the City of London: unpublished B.Sc. thesis, U. W. O.
- 2) Chapman, L. J., and Putnam, 1951, The physiography of southern Ontario: Univ. Toronto Press, 284 p.
- 3) Dreimanis, A., 1958, Wisconsin stratigraphy at Port Talbot on the north shore of Lake Erie, Ontario: Ohio Jour. Sci., Vol. 58, p. 65-84.
(Figs. 2, 3, and 4 of the field trip guide are from this paper.)
- 4) Goldthwait, R. P., 1958, Wisconsin age forests in Western Ohio, I Age and glacial events: Ohio Jour. Sci., Vol. 58, p. 209-219.
- 5) Hough, J. L., 1958, Geology of the Great Lakes: Univ. Illin. Press, 312 p.
- 6) MacLachlan, D. C., 1939, Warren shore line in Ontario and in the "Thumb" of Michigan and its deformations: unpublished manuscript.
- 7) Vick, R. M., 1956, The Ingersoll and Westminster end moraines of the London area: unpublished B.Sc. thesis, U. W. O.

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Sorry for not listing other references: they may be found in the Nos. 2, 3, 4 and 5.

FIRST NOTICE

FRIENDS OF PLEISTOCENE GEOLOGY

22nd Reunion

May 16 - 17, 1959

Location - Lake Erie area, Southwestern Ontario, with principal stops and discussions at Lake Erie cliffs (Port Talbot area) and Catfish creek cuts.

Subject: classical Wisconsin and pre-classical Wisconsin, post-Sangamon drifts, and interstadial deposits between them.

Leader: Professor Aleksis Dreimanis, Department of Geology, University of Western Ontario, London, Ontario.

Accommodation: Huron College of University of Western Ontario (single room, \$3.50 per night, including breakfast).

Persons, intending to participate in this gathering or wishing to receive further information, are asked to fill in the enclosed card and mail it before April 1.

Note

General references

Chapman, L. J. and D. F. Putnam, The physiography of Southern Ontario: Univ. Toronto Press, 1951.

Dreimanis, A., Wisconsin stratigraphy at Port Talbot on the north shore of Lake Erie, Ontario: Ohio Jour. Science, V. 58, p. 65-84.

Topographic Maps

1:50,000 (may be obtained from Department of Mines and Resources, Ottawa, Canada at 25¢ per copy).

St. Thomas sheets (40 1/14) east and west halves

Port Stanley sheets (40 1/11) east and west halves

SECOND AND FINAL NOTICE

Friends of Pleistocene Geology

22nd Reunion

London, Ontario meeting: May 16-17, 1959

Subjects:

- a) Classical Wisconsin and pre-classical Wisconsin, post-Sangamon drifts, and interstadial deposits between them; proglacial lakes;
- b) various structural and textural drift features: folds and other deformations, laminations and shearing in till, boulder pavements, alignment of pebbles, a sedimentary "dike", etc;
- c) changes of directions of glacial movements during the last glaciation.
(see the note (b) on page 2)

Leaders:

Professor Aleksis Dreimanis, Department of Geology, The University of Western Ontario, London, Ontario.

Professor Robert W. Packer, Department of Geography, The University of Western Ontario, London, Ontario.

Headquarters:

Department of Geology in the Biology-Geology Building, and Residence of Huron College, The University of Western Ontario (U. W. O. is in the northwestern corner of London, Ontario).

Time: Daylight Saving Time

Accommodations and Meals:

will be at the Residence of Huron College for the nights of May 15/16 and 16/17, with a snack on the evening of May 15, breakfast on May 16 and 17, box lunch and the annual dinner on May 16. The cost of accommodations (single rooms) and meals, including dinner, ten Canadian dollars, or the equivalent in U. S. currency, should be paid in advance to A. Dreimanis. Those, who will stay at the Residence of Huron College, are asked to arrive there before 11:00 p.m. on Friday night, May 15. According to regulations \$1.00 has to be deposited at Huron College on receiving the key of your room. Entrance of the Residence is marked with an arrow on the enclosed plan. Parking - at P.L.

Those who wish to arrange their own accommodations and meals at the local hotels or motels, but will attend the annual dinner, should remit only \$2.00 (Canadian) for the dinner.

Box lunches for May 17 may be ordered at Huron College the evening before.

P. F. Harrow

Informal gatherings on the evening of Friday, May 15:

- a) at the Geology Department, Biology-Geology Building, Room 112, from 6:00 to 8:00 p.m.,
- b) at the Common Room, Huron College, 8:00 to 10:00 p.m., with coffee and sandwiches.

Annual dinner Saturday evening, 7:00 p.m.: Dining Room, Huron College, with Dr. J. D. Ives, Field Director of the McGill Subarctic Research Laboratory in Labrador, as the speaker. He will tell of his observations on the last two glaciations in Labrador.

Saturday field trip: Start at 8:30 a.m. (Daylight Saving Time!) from parking lot of Huron College (P.L. on the enclosed plan). Approximate itinerary: south to highway 2 - Lambeth - hwy 4 to Talbotville - hwy 3 and gravel road to the first stop at Grand View Beach at Lake Erie, 4 mi. east of Wallacetown (the Port Talbot interstadial site). Further stops: at Plum Point, in the Port Stanley-Port Bruce area, and at Catfish Creek east of Sparta.

Transportation - private cars.

Sunday field trip: Start at 8:30 a.m. from parking lot of Huron College. Principal stops will be at Wisconsin drift sections in a radius of 10 miles around London. Trip will end about 1 p.m.

Registration:

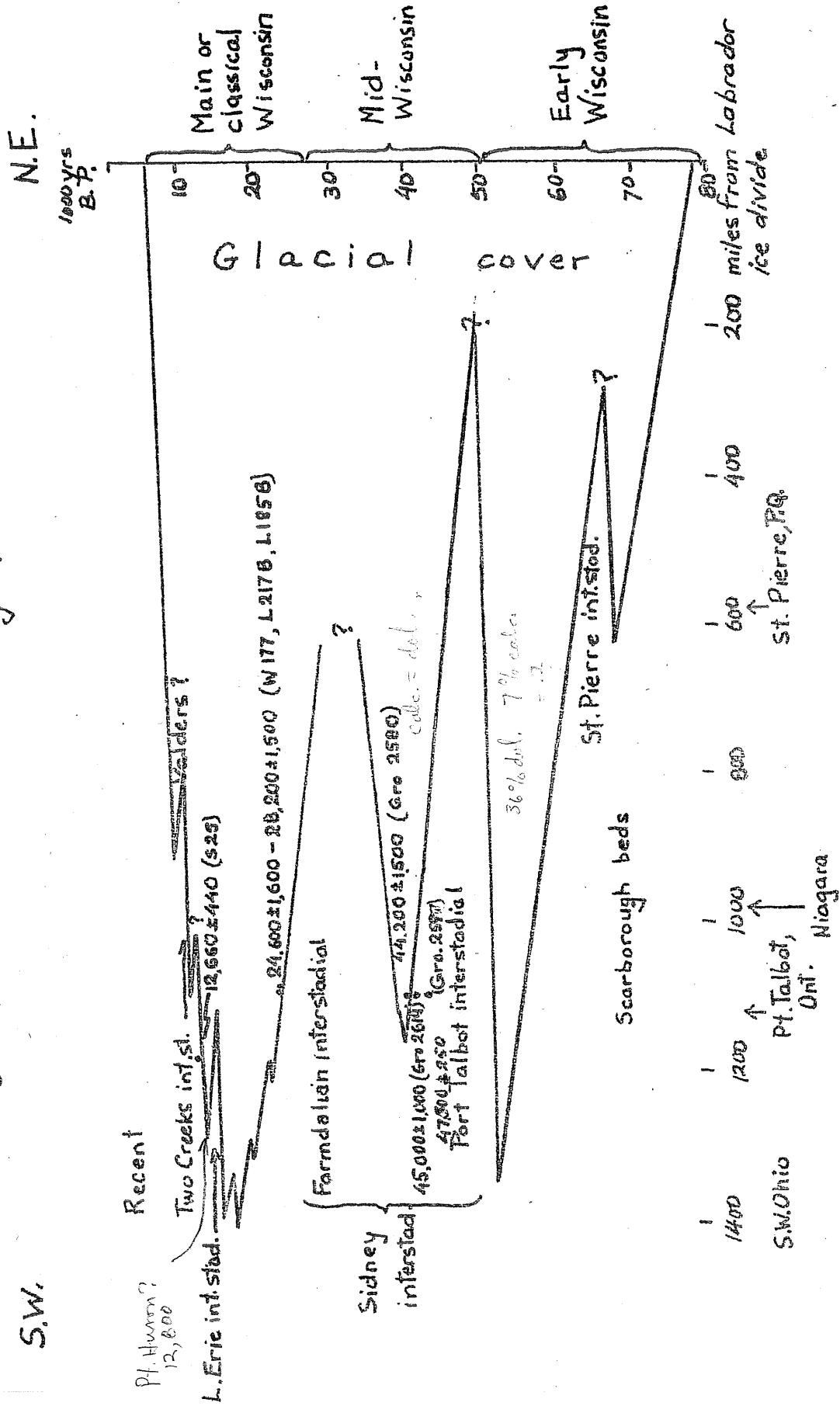
Please fill out the enclosed card and mail it together with Money Order (or a cheque, adding 15¢ exchange for \$10.00, 25¢ - if over \$10.00) to A. Dreimanis, Geology Department, The University of Western Ontario, London, Ontario. If the payment is in U. S. dollars, add 5%, please.

Local topographic maps (six): Lucan, St. Thomas, and Port Stanley sheets, east and west halves of each of them, 1:50,000, may be ordered from the Map Distribution Office, Department of Mines and Technical Surveys, Ottawa, at 25¢ per copy (apologies for the old address in the first notice)

Note:(a) Cards are sent only to those who indicated they would attend the meeting.

(b) A last-minute check of the Lake Erie cliffs revealed that earth slumps have covered extensive portions of sections, and most folds and boulder pavements are not visible any more. Don't expect continuous stratigraphic sections!

Tentative Wisconsin stratigraphy of the eastern Great Lakes - St. Lawrence region



A. Dreimanis, 1960

TABLE 1

WISCONSIN GLACIAL AND INTERSTADIAL DEPOSITS AT
PORT TALBOT, ONTARIO

New Local Stratigraphic Names	C14 Age and Reference No.	Previous Stratigraphic Terms	
		1958(8)	1957(9)
Port Stanley drift		upper tills (h) and (j), lacus- trine clay (i)	clayey upper till No. 4, lacustrine clay
Lake Erie Inter- stadial beds (10)		unconformity (lacustrine deposits else- where)	lacustrine clay and silt
Catfish Creek drift		sandy lower till (g)	sandy lower till No. 3
Plum Point Inter- stadial beds (not in situ)	24,600±1,600 (L-217B) 27,500±1,200 (W-177) 28,200±1500 (L-185B)	Plum Point interstadial wood, (reworked)	Plum Point interstadial
Southwold drift		clayey gravel (f ₂), till (f ₁), lacustrine clay (e)	gravelly lower till No. 2; gravel, lacus- trine clay
Port Talbot Interstadial beds	44,200±1500 (GRC2580) 47,600±262 (GRC2597/2601) 47,000±2,500 (GRC2570)	Port Talbot interstadial gyttja and silt (c)	Port Talbot interstadial gyttja and silt
Dunwich drift		lowermost till (a) and varved clay (b)	sandy lower till No. 1 and varved clay

equivalent to
Fennoscandian
of
Frye & Williams

subsequent examination showed that the sample was unsuitable because recent rootlets were present. We took a new sample, a monolith of about 25 pounds of gyttja, at the type section of the Port Talbot interstadial in July 1959 [6 ft inside the base of the cliff, at the 56-ft point of the geologic section, as shown in Fig. 2 of (4)]. The silt and gyttja surrounding the monolith were checked carefully, and no rootlets were found.

The first date, obtained from an un-enriched sample of the gyttja (Gro-2570), was $47,000 \pm 2500$ years before the present (B.P.) (5). The final date (Gro-2597 and Gro-2601), after enrichment, was in very good agreement: $47,500 \pm 250$ years B.P.; the error of ± 250 is the statistical error in the activity only, and does not include the errors in the enrichment factors (6).

The new finite dates refer to the second half of the Port Talbot interstadial,

for a palynological study (7) suggested that the gyttja was younger than the thermal maximum of this interstadial. The underlying silt, deposited during the first half of the interstadial, contained only a few organic remains, not enough for radiocarbon dating.

New fragments of wood were found in 1959, also in the till (f_1) which overlies the Port Talbot interstadial beds. Wood from this area has been previously dated (samples S-46 and L-440), also giving infinite dates. The new finite date (Gro-2580) is $44,200 \pm 1500$ B.P. (8). It is in very good agreement with the dates of the stratigraphically older gyttja, indicating the time when the Port Talbot interstadial deposits became overridden by a glacial advance in the central portion of Lake Erie basin.

The new Groningen radiocarbon dates make it possible to outline the preclassical Wisconsin stratigraphic units in southwestern Ontario more ac-

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DEPARTMENT OF GEOLOGY
UNIVERSITY OF WESTERN ONTARIO
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Finite Radiocarbon Dates of the Port Talbot Interstadial Deposits in Southern Ontario

Abstract. Three new finite radiocarbon dates suggest that (i) the thermal maximum of the Port Talbot interstadial occurred prior to 47,000 years before the present and (ii) the interstadial deposits were overridden by a glacial advance approximately 44,000 years before the present. To facilitate correlations with other areas, new rock-stratigraphic names are proposed for the Port Talbot type section.

New stratigraphic divisions of the last ice age, several of them older than the classical Wisconsin glacial stage, have been proposed by Dreimanis (1) since 1957. Unfortunately the radiocarbon dates of the principal new unit, the Port Talbot interstadial, were not finite. These dates (samples L-185A, L-217A, L-370A, L-440, W-100, S-7, and S-46; see 1, 2) ranged from older than 25,000 to older than 40,000 years. Therefore, several readers of the articles cited (1) and participants of the Friends of the Pleistocene 1959 field conference (3) have expressed doubt that this interstadial is younger than the last, or Sangamon, warm interglacial.

H. de Vries considered it worth while to try to obtain new radiocarbon dates, beyond the previous range of dating, at the Radiocarbon Laboratory of the University of Groningen. We collected gyttja from the Port Talbot interstadial site in the summer of 1958, but

Table 1. Wisconsin glacial and interstadial deposits at Port Talbot, Ontario.

New local stratigraphic names (with comments on C^{14} ages)	C^{14} Age and reference No.	Previous stratigraphic terms	
		1958 (11)	1957 (12)
Port Stanley drift		Upper tills (h) and (j), lacustrine clay (i)	Clayey upper till No. 4, lacustrine clay
Lake Erie interstadial beds (13)		Unconformity (lacustrine deposits elsewhere)	Lacustrine clay and silt
Catfish Creek drift		Sandy lower till (g)	Sandy lower till No. 3
Plum Point interstadial beds (not <i>in situ</i> - C^{14} dates of wood from the Catfish Creek drift)	$24,600 \pm 1,600$ (L-217B) $27,500 \pm 1,200$ (W-177) $28,200 \pm 1,500$ (L-185B)	Plum Point interstadial wood (re-worked)	Plum Point interstadial
Southwold drift		Clayey gravel (f_2), till (f_1), lacustrine clay (e)	Gravelly lower till No. 2; gravel, lacustrine clay
Port Talbot interstadial beds		Port Talbot interstadial gyttja and silt (c)	Port Talbot interstadial gyttja and silt
a) end of the interstadial: wood in the Southwold drift	$44,200 \pm 1500$ (Gro-2580)		
b) second half of the interstadial: gyttja	$47,500 \pm 250$ (Gro-2597 and Gro-2601) $47,000 \pm 2500$ (Gro-2570)		
Dunwich drift		Lowermost till (a) and varved clay (b)	Sandy lower till No. 1 and varved clay

curately than before. To facilitate correlation with other similar Pleistocene sections, Dreimanis proposes new local rock stratigraphic terms for the drifts overlying and underlying the Port Talbot interstadial beds, as shown in Table 1.

Frye and Willman (9) have recently proposed a revised classification of the Wisconsin stage of the Lake Michigan lobe, suggesting that the Farmdalian substage was a major interval of glacial withdrawal. Comparison of radiocarbon dates indicate that the Plum Point interstadial may be correlated with the Farmdalian. Only one glacial substage (the Altonian), older than the Farmdalian, has been proposed for the Lake Michigan lobe by Frye and Willman. The Port Talbot section suggests at least two glacial substages and one interstadial Wisconsin substage in the Lake Erie lobe area of southwestern

Ontario before the Farmdalian (10).

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References and Notes

1. A. Dreimanis, *Science* **126**, 166 (1957); *Ohio J. Sci.* **58**, 65 (1958); *Contrib. Dept. Geol. Univ. Western Ontario No. 25* (1959), pp. 24-30.
2. E. A. Olson and W. S. Broecker, *Am. J. Sci.* **257**, 1 (1959).
3. A. Dreimanis, *Science* **130**, 392 (1959).
4. ———, *Ohio J. Sci.* **58**, 67 (1958).
5. H. de Vries, letter of 10 Oct. 1959.
6. ———, letter of 23 Nov. 1959. H. de Waard (12 Jan. 1960) mentions another reference number (Gro-2597/2601) with the same date.
7. A. Dreimanis, *Ohio J. Sci.* **58**, 74 (1958).
8. H. de Vries, letter of 24 Oct. 1959.
9. J. C. Frye and H. B. Willman, *Illinois State Geol. Survey Circ. No. 285* (1960).
10. This report grew out of correspondence between Hessel de Vries and me in 1959, and the first draft was on its way from Canada to the Netherlands when de Vries died. I assume responsibility for the wording of the report, hoping that opinions of the late Hessel de Vries have been expressed correctly. I appreciate very much the cooperation of H. de Waard, who is continuing de Vries' work at Groningen and who supplied the following additional information in a letter dated 8 March 1960:
A peat ball which I found on the Lake Erie shore at the Port Talbot interstadial type location has been dated $44,900 \pm 1000$ years B.P. (Gro-2619). This date is in good agreement with de Vries' dates for the Port Talbot interstadial deposits. De Vries suggested also redating of the Plum Point larchwood (see W-177 and L-185B in Table 1). The new date reported by de Waard is $27,250 \pm 130$ years B.P. (Gro-2625). It is in excellent agreement with the other two dates, and more accurate.—A. D.
11. A. Dreimanis, *Ohio J. Sci.* **58**, 82 (1958).
12. ———, *Science* **126**, 167 (1957).
13. These deposits are called the "Erie interstadial" in A. Dreimanis, *Contrib. Dept. Geol. Univ. Western Ontario No. 25* (1959), p. 28.
* Deceased.

1 February 1960