UNIVERSITY OF WATERLOO RADIOCARBON DATES I

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The radiocarbon dating laboratory is part of the Department of Earth Sciences, University of Waterloo. The natural level radio-isotope facility, built in the spring of 1974, was built primarily for dating ground-water and a combustion line for organic samples was added in 1975.

The method employed is liquid scintillation counting on synthesized benzene in a refrigerated *Intertechnique SL-30* counter. Four grams of sample, diluted with reagent grade benzene, if necessary, are weighed into an Amersham nylon vial containing 40mg of solid Butyl PBD scintillator. Ten vials, selected for their low backgrounds, are used repetitively, alternating sample analysis with background determinations. Each vial has a discrete background (range 3.25 to 3.44cpm) and was therefore given an identifying letter. Samples are counted for 1500 to 2500 minutes depending on their size and activity. Backgrounds, standards, and samples are counted sequentially at 100-minute intervals.

Radiocarbon dates in this list are based on 95% activity of NBS oxalic acid as modern standard, using the Libby half-life (5568 ± 30) with a 2-sigma counting error including variations in the sample and background. Current oxalic acid standard value is normalized for $\delta^{13}C = -19.0\%_c$ PDB according to Craig (1961). Carbon-13 determination for each sample is done on a Varian Mat GD-150 mass spectrometer or more recently on a Micromass 602D-TWIN.

Sample types include 1) $BaCO_3$, obtained by precipitating the total inorganic carbonate in water samples with $BaCl_2 \cdot 2H_2O$ in an alkaline medium (pH~12), achieved with carbonate free NaOH, 2) rock carbon, 3) organic matter in sediment samples, and 4) "pure" organic matter such as peat and wood. CO_2 is produced from the barium carbonate and rock samples with 50% H_3PO_4. No pretreatment is required.

Pretreatment of combustible samples consists of removing all visible contaminants as well as hot NaOH and HCl rinses to remove humic compounds and inorganic carbon. Samples are dried overnight at 110°C. Carbon dioxide is produced by direct combustion in a stream of purified oxygen. Gas contaminants are removed as the CO_2 is passed through a MnO_2 and CuO (500°C) furnace and $KMnO_4$ and H_2O bubblers. A dry-ice methanol cooled trap dessicates the carbon dioxide and two liquid nitrogen cooled traps collect the CO_2. Carbon dioxide is further desiccated by sublimation from the collection traps at methanol-dry-ice temperatures. The CO_2 of all samples is transformed to acetylene by Li_2C_2. Trimerization takes place on a catalyst of Mobil Durabead 1 which has been activated at 250°C under vacuum overnight.

Measurements presented below were determined during 1975-1979. Only the organic sample results are published. Results after WAT-318

have been normalized to a $\delta^{13}C = -25‰$ PDB. The descriptions of the samples are based on information provided by the submitters.

I. INTERLABORATORY CHECK SAMPLES

A. France

18,400 ± 2000
WAT-40.   Biscaye Gulf $\delta^{13}C = +0.78‰$

Rock sample subm 1974 by J C Fontes, Paris, France. Age given by Fontes was 10,350±350. Waterloo lab crushed sample to --140 mesh, whereas Paris lab did not. This difference in sample preparation is possible reason for incompatible dates.

B. Britain

WAT-64.   Broxbourne, Hertfordshire   **8640 ± 200**
See Birm -343 (R, 1973, v 15, p 465).

C. United States

WAT-57.   Wisconsin   **11,870 ± 170**
Wood from cliff face cut in shore on W side of Lake Michigan at junction of Kewaunee and Manitowoc Co (44° 17′ N, 87° 34′ W). Subm by A V Morgan, Dept Earth Sci, Univ Waterloo. Geological Survey of Canada determined age at 11,810±100 (GSC-2166: Lowdon and Blake, 1979). *Comment* (AVM): date agrees with sample run by GSC and is almost identical with series of samples tested by Broecker and Farrand (1963) from Two Creeks Forest Bed.

11,440 ± 200
WAT-244.   Wisconsin $\delta^{13}C = -26.3‰$
Wood from Two Creeks Forest Bed (44° 19′ 38″ N, 87° 32′ 15″ W). *Comment:* ISGS-264: A-11,790±80, A-11,640±90 (unpub).

4020 ± 30
WAT-72.   Ausable River, Michigan $\delta^{13}C = -25.1‰$
Wood from enclosing material of silty clay 12km W of Oscada, Michigan (44° 25′ N, 83° 28′ W). Subm by A V Morgan. *Comment* (AVM): date agrees well with log taken from same sec (I-8736: 4130±90; Elias, Morgan, and Morgan, 1981). Date is approx for river deposits grading into Lake Nipissing.

WAT-117.   Mahomet, Illinois

$$19,320 \pm 1000$$
$$\delta^{13}C = -23.4‰$$

Wood from 4km SW of Mahomet (40° 9′ 21″ N, 88° 26′ 20″ W). See ISGS-79 (R, 1973, v 15, p 78).

WAT-176.   Otto, New York $>45,000$

Cattaraugus Co, for lab test run of an old sample. Coll and subm 1975 by D P Schwert, Dept Earth Sci, Univ Waterloo. *Comment* (P F Karrow): date agrees with previous dates (Muller, 1964).

WAT-311.

$$>45,000$$
$$\delta^{13}C = -27.3‰$$
$$-27.5‰$$

CO_2 combined from two combustions. See WAT-176.

WAT-463.

$$>45,000$$
$$\delta^{13}C = -28.9‰$$

See WAT-176.

D. Canada

WAT-119.   British Columbia

$$20,570 \pm 300$$
$$\delta^{13}C = -23.0‰$$

GSC -1802 wood from E side of Rocky Mountain Trench 3.2km SE of confluence of Columbia, Canoe, and Wood Rivers (52° 07′ N, 118° 24′ W). Coll 1972 by R J Fulton; subm 1972 by Weston Blake, Jr, Geol Survey Canada, Ottawa, Ontario.

General Comment: GSC-173: 21,500±300 (R, 1965, v 7, p 32); GSC-1258: 21,700±240 (R, 1971, v 13, p 294); I-773: 22,900±1500 (R, 1966, v 8, p 175).

WAT-130.

$$18,450 \pm 670$$
$$\delta^{13}C = -23.4‰$$

See WAT-119. Sample washed again.

WAT-199.

$$25,320 \pm 400$$
$$\delta^{13}C = -22.5‰$$

See WAT-119. Combusted without auxiliary oven.

WAT-76.

$$8250 \pm 230$$
$$\delta^{13}C = 26.9‰$$

Wood exposed by erosion from Amable du Fond R, North Bay, Ontario (46° 11′ N, 78° 57′ W). Coll 1968; subm 1975 by J E Harrison, Geol Survey Canada, Ottawa. *Comment:* GSC-1097: 8640±140 (Lowdon and Blake, 1975).

WAT-202.

$$8860 \pm 120$$
$$\delta^{13}C = -25.2‰$$

See WAT-76.

II. GEOLOGIC SAMPLES
A. Canada

Lake Ontario series

Silty clay lake sediment core samples from Lake Ontario, Ontario (43° 30.2′ N, 76° 55′ W); dated to determine sedimentation rates. Coll

1973 by A W L Kemp, Canada Center for Inland Waters, Burlington, Ontario. Subm 1975 by A W L Kemp and R J Drimmie, Dept Earth Sci, Univ Waterloo. *Comment* (RJD): dates were much older than expected.

WAT-134. E-30

2220 ± 180
$\delta^{13}C = -27.5‰$

Sample from 0 to 10cm depth.

WAT-144. E-30

2080 ± 120
$\delta^{13}C = -27.8‰$

Sample from 10 to 15cm depth.

WAT-136. E-30

1450 ± 300
$\delta^{13}C = -28.3‰$

Sample from 15 to 20cm depth.

WAT-140. E-30

2330 ± 100
$\delta^{13}C = -28.0‰$

Sample from 20 to 25cm depth.

WAT-120. E-30

2940 ± 200
$\delta^{13}C = -28.6‰$

Sample from 40 to 45cm depth.

WAT-142. E-30

2920 ± 120
$\delta^{13}C = -27.9‰$

Sample from 55 to 60cm depth.

WAT-143. E-30

2950 ± 170
$\delta^{13}C = -28.1‰$

Sample from 65 to 70cm depth.

WAT-156. E-30

2910 ± 150
$\delta^{13}C = -28.0‰$

Sample from 70 to 80cm depth.

WAT-128. E-30

2290 ± 180
$\delta^{13}C = -26.6‰$

Sample from 80 to 85cm depth.

WAT-217. E-30

3240 ± 180

Sample from 85 to 90cm depth.

WAT-145. E-30

3840 ± 190

Sample from 90 to 95cm depth.

WAT-116. E-30

4270 ± 60
$\delta^{13}C = -29.1‰$

Sample from 105 to 110cm depth.

WAT-138. E-30

5300 ± 300
$\delta^{13}C = -27.9‰$

Sample from 120 to 125cm depth.

WAT-98.   E-30

4940 ± 50

$\delta^{13}C = -28.2\%_0$

Sample from 125 to 135cm depth.

$-29.1\%_0$

CO_2 combined from three combustions.

$-28.9\%_0$

WAT-93.   E-30   **6260 ± 120**

Sample from 140 to 150cm depth.

Lake Erie series

Silty clay lake sediment core samples from Lake Erie, Ontario (45° 39.5′ N, 79° 39.5′ W); dated to determine sedimentation rates. Coll 1973 by A W L Kemp; subm 1975 by R J Drimmie. *Comment* (RJD): dates were much older than expected.

WAT-190.   M-32

3000 ± 90

$\delta^{13}C = -27.2\%_0$

$-29.7\%_0$

Sample from 0 to 25cm depth.

$-26.8\%_0$

WAT-250.   M-32

4400 ± 170

$\delta^{13}C = -28.2\%_0$

$-28.1\%_0$

Sample from 30 to 55cm depth.

$-29.2\%_0$

WAT-251.   M-32

3710 ± 180

$\delta^{13}C = -27.8\%_0$

$-27.8\%_0$

Sample from 60 to 85cm depth.

$-28.3\%_0$

WAT-225.   M-32

5100 ± 140

$\delta^{13}C = -27.9\%_0$

$-23.5\%_0$

Sample from 90 to 115cm depth.

$-24.7\%_0$

Gage Street, Kitchener series

Samples from Gage Street, Kitchener, Ontario (43° 26′ 48″ N, 80° 31′ 35″ W); dated to establish chronology for beetle stratigraphy. Site was severely disturbed stand of swamp composed of *Thuja occidentalis* L. Coll from an excavated face. Coll and subm 1975 by D P Schwert, Depth Earth Sci, Univ Waterloo.

WAT-166.   **20,580 ± 1300**

Marl with included plant organics at depth 4.5 to 4.64m. Acid added for five hr to obtain date based on calcite/dolomite. *Comment* (DPS): expected date: 12,300 yr.

WAT-169.

17,200 ± 760

$\delta^{13}C = -0.5\%_0$

See WAT-166. Acid added for nine min to obtain date based on calcite fraction.

7870 ± 470

WAT-249. $\delta^{13}C = -28.7\%_0$

Plant detritus from depth 1.04 to 1.14m. Enclosing material was marl. *Comment* (DPS): expected date: 6900.

8830 ± 150

WAT-263. $\delta^{13}C = -27.8\%_0$

Plant detritus from depth 2.26 to 2.36m. Enclosing material was marl. *Comment* (DPS): expected date: 8800.

6890 ± 130

WAT-265. $\delta^{13}C = -28.5\%_0$

Peat with wood from depth 0.74 to 0.84m. *Comment* (DPS): expected date: 6900.

11,140 ± 280

WAT-287. $\delta^{13}C = -34.6\%_0$

Plant detritus from depth 3.68 to 3.79m. Enclosing material was saturated marl. *Comment* (DPS): expected date: 11,200.

7830 ± 300

WAT-298. $\delta^{13}C = -27.5\%_0$

Plant detritus from depth 3.28 to 3.38m. Enclosing material was saturated marl. *Comment* (DPS): expected date: 10,700.

5840 ± 100

WAT-297.   Blackwell $\delta^{13}C = -25.9\%_0$

Wood from Bear Gravel pit, 2.4km SW of Blackwell, Ontario (43° 01′ N, 82° 20′ 40″ W). Sample from 3m depth in sand of Lake Nipissing Bar recovered during sand extraction by pit operator. Dated for time of construction of Nipissing Bar. Coll 1975 and subm 1977 by P F Karrow, Dept Earth Sci, Univ Waterloo. *Comment* (PFK): age reasonable for Lake Nipissing (Dreimanis, 1958; Lewis, 1969).

5160 ± 100

WAT-301. $\delta^{13}C = -25.6\%_0$

See WAT 297.

5440 ± 90

WAT-307. $\delta^{13}C = -26.6\%_0$

See WAT-297. *Comment* (PFK): age reasonable for Lake Nipissing.

>45,000

WAT-310.   Guelph $\delta^{13}C = -26.5\%_0$

Organic silt from E outskirt of Guelph, Ontario (43° 33′ N, 80° 14′ W). Dated because paleosols are rare and buried (sub-till) organics are unusual. Coll 1975 and subm 1977 by P F Karrow. *Comment* (PFK): date places peat in middle Wisconsinan or older age range as expected and negates possibility of severe contamination.

>45,000

WAT-367. $\delta^{13}C = -27.7\%_0$

See WAT-310.

WAT-343. Cootes Paradise, Hamilton

$$4400 \pm 50$$
$$\delta^{13}C = -20.7\text{‰}$$

Wood from Cootes Paradise, Hamilton, Ontario (43° 17′ 20″ N, 79° 53′ 50″ W). Sample found 18.6m below water surface and 18.1m below sediment surface. Measured to date aggradation during isostatic raising of lake Ontario outlet. Coll 1969 by R C La Forge; subm 1977 by P F Karrow. *Comment* (PFK): result is consistent with earlier dates from Burlington Bar at similar levels (Karrow, Clark, and Terasmae, 1961).

WAT-493. Minesing

$$10,280 \pm 100$$
$$\delta^{13}C = -27.5\text{‰}$$

Wood from sand and gravel deposit, Minesing, Ontario (44° 11′ N, 79° 57′ W). Sample 1 to 2m below buried woody peat deposit, which was in turn buried by 1m alluvial sand-silt. Coll and subm 1979 by W D Fitzgerald, Dept Earth Sci, Univ Waterloo. *Comment* (WDF): dated to provide max age of overlying peat deposit and enable correlation of pollen diagram with other pollen diagrams in S Ontario. Age was very close to expectation.

WAT-507. Minesing Swamp

$$6170 \pm 70$$
$$\delta^{13}C = -25.3\text{‰}$$

Wood from Minesing Swamp, Ontario (44° 30′ N, 79° 47′ W). Coll 1978 by W D Fitzgerald from borehole at depth 3.4m, composed of wet silty clays, shells and organics. Subm 1979 by W D Fitzgerald. *Comment* (WDF): dated to aid pollen correlation, sedimentation rate of material above sample, and age of shells for correlations with shell assemblages of other sites. Age corresponds with hemlock (Tsuga) peak in pollen diagram, considered ca 6000 to 7000 yr.

WAT-559. Minesing site

$$4230 \pm 70$$
$$\delta^{13}C = -8.9\text{‰}$$

Clam shells from edge of road in ditch; 2.3km WSW of village of Minesing, Ontario (44° 26′ N, 79° 52′ W). Cochina of shell from ground surface to ca 0.6m below in sandy soil matrix. Coll and subm 1979 by P F Karrow, W D Fitzgerald, and R F Miller to date shells for data on paleobiogeography. *Comment* (PFK): dates lake stage in Minesing basin equivalent to Nipissing stage of Lake Huron.

WAT-567. Richmondville

$$5270 \pm 70$$
$$\delta^{13}C = -24.7\text{‰}$$

Wood from Richmondville Quad, Lake Huron Shorecliff, 1.6km S of Richmondville North Center, Ontario (43° 33′ 30″ N, 82° 35′ 10″ W). Sample from wet green silt underlying 2.3m stratified sand and gravel. Silt is 1.5m thick with 3.6m slump covered sec below to beach level. Coll 1979 by P F Karrow and D F Eschman, Dept Geol, Univ Michigan; subm 1979 by P F Karrow. *Comment* (PFK): overlying sand contained shells *(Goniobasis livescens);* Nipissing age was expected and confirmed by date.

Manitoulin Island, Greenbush Swamp, 5th Concession series

Samples from Greenbush Swamp, dist Manitoulin, Ontario (54° 56′ N, 82° 00′ 30″ W). Coll and subm 1979 by B G Warner, Dept Biol, Univ Waterloo. *Comment* (BGW): all dates seem reasonable and agree well with regional history and pollen stratigraphy (R, 1961, v 3, p 49). Dated to understand vegetational history, paleoecology, and wetland succession of Greenbush Swamp, Manitoulin I.

WAT-571.

7570 ± 170
$\delta^{13}C = -22.8‰$

Gray gyttja from core; total length, 150cm. From extreme E side of swamp along road. Deposit was 142 to 148cm below surface at base of gyttja unit.

WAT-574.

6790 ± 100
$\delta^{13}C = -22.3‰$

Coarse fibrous sedge peat from gyttja unit in stratigraphy, at 175cm below surface. Sample taken from bulk samples extracted from hand-dug pit. Total depth of core is 305cm. Sample located along extreme W side of swamp along road.

WAT-579.

9930 ± 90
$\delta^{13}C = -20.8‰$

Gyttja from same core (pit) as WAT-574 at 235cm below surface immediately overlying sandy gravel deposit that is at least 70cm thick.

Loon Lake series

Gyttja from Loon Lake, Ontario (46° 44′ N, 81° 36′ W) ca 55km NW of Sudbury, Ontario. Coll 1977 by K B Liu and A M Davis; subm 1979 by K B Liu and A M Davis, Dept Geog, Univ Toronto.

WAT-550.

3280 ± 150
$\delta^{13}C = -32.6‰$

Iron-rich laminated gyttja. *Comment* (AMD): sediment is black, non-calcareous. and rich in iron. Vivianite $(Fe_3(PO_4)_2 \cdot 8H_2O)$ occurs sparingly throughout laminated parts of core. Varves consist of alternating pale and dark laminae and are distinctly preserved. Deposition should have taken place under strongly reducing and anaerobic conditions in monimolimnion. Age, ca 1650 BP, was expected from sample based on varve counting and estimate of sedimentation rate for upper 77cm of unlaminated sediments. [14]C date is apparently too old.

WAT-545.

6320 ± 130
$\delta^{13}C = -30.7‰$

Iron-rich, laminated gyttja (varves). *Comment* (AMD): sediment was so rich in iron that rusty crust of ferrous oxide formed on outside of core upon oxidation. Otherwise, same as WAT-550. Sample comes from base of varved sec which should date beginning of varve formation. [14]C date is younger than varve date by ca 1000 yr, but is generally consistent with date obtained from top of same core (WAT-547).

WAT-546.

8630 ± 130
$\delta^{13}C = -32.7‰$

Black unlaminated gyttja. *Comment* (AMD): sediment is non-cal-careous and should have been deposited under anaerobic conditions. ^{14}C date is stratigraphically consistent and acceptable.

WAT-547.

4190 ± 90
$\delta^{13}C = -31.4‰$

Iron-rich, laminated gyttja (varves). *Comment* (AMD): age of ca 5000 yr is expected based on varve counting and estimate of sedimenta-tion rate for unlaminated upper part of core. Thus, ^{14}C date is younger than expected.

WAT-548.

10,230 ± 200
$\delta^{13}C = -39.4‰$

Black unlaminated gyttja. *Comment* (AMD): sediment is non-cal-careous and should have deposited under anaerobic conditions. Loon Lake is on Cartier I Moraine (Boissonneau, 1968) and lies within narrow belt that was deglaciated between ca 11,000 to 10,000 BP according to Saarnisto (1974). Sample comes from base of organic sediment and should yield min date for ice retreat from area. ^{14}C date of 10,230±200 is consistent with regional deglaciation chronology.

WAT-549.   Lake #6, Timmins

6970 ± 100
$\delta^{13}C = -34.7‰$

Gyttja from Lake #6 (48° 23′ 53″ N, 81° 19′ 28″ W) ca 8km S of Timmins, Ontario. Coll and subm 1979 by K B Liu and A M Davis to obtain min date for draining of Glacial Lake Barlow-Ojibway in this area. *Comment* (AMD): date agrees with other dates reported from adjacent areas (Terasmae and Hughes, 1960).

WAT-563.   Pike Lake

8080 ± 70
$\delta^{13}C = -27.2‰$

Gyttja from Pike Lake, Ontario (43° 57′ N, 80° 49′ W). Coll 1977 and subm 1979 by R A Penney, Dept Geog, Univ Toronto. Measured to date decline in pine pollen percentage, generally at ca 7300 to 7500 yr in S Ontario. *Comment* (RAP): date is acceptable particularly if hard water correction is used (surface standard at Edward Lake is 580 yr).

WAT-568.   Pike Lake

3780 ± 70
$\delta^{13}C = -24.7‰$

Marl measured to date recovery of Tsuga pollen (Tsuga rise). See WAT-563. *Comment* (RAP): expected date, 3300 to 3500 yr. Date of 3780±70 is a bit old but hard-water effect may be responsible.

WAT-360.   Chilhil Lake

7750 ± 180
$\delta^{13}C = -29.2‰$

Gray-brown clay gyttja from Chilhil Lake in Three Lakes Valley near Lillooet, British Columbia (50° 39′ N, 121° 48′ W). Lake bottom sediments were taken with 5cm diam piston corer. Coll 1977 by R W Mathewes and D McLennan; subm 1979 by R W Mathewes, Dept

Archeol, Simon Fraser Univ, British Columbia. Dated for basal date in lake core analyzed for pollen (White, Mathewes, and Mathews, 1979).

WAT-361. Boone Lake

$>$**30,000**
$\delta^{13}C = -26.3\%_0$
$-26.9\%_0$

Clay with organic content from basal clay of lake sediment core from Boone Lake, 19km N of Valhalla in Grande Prairie, Alberta (55° 34′ N, 119° 26′ W). Coll 1978 by J M White, Dept Archeol, Simon Fraser Univ, British Columbia and subm by R W Mathewes for basal date for lake core in area which may not have been covered by ice during late Wisconsinan, nor inundated by glacial Lake Peace in early Holocene.

WAT-362. Boone Lake

10,740 ± 400
$\delta^{13}C = -28.0\%_0$

See WAT-361. Sample taken from lake core 4.93 to 4.99m below modern sediment surface, just below clay lens 3cm thick. Sample is expected to date beginning of short period of inundation of lake by waters carrying heavy load of glacial sediment. This might represent meltwater from late ice advance from W.

WAT-406. Boone Lake

17,470 ± 4890
$\delta^{13}C = -26.7\%_0$

Gray clay with sand and minor organic fraction. *Comment* (JMW): date may have been made older by contamination with radiogenically dead carbon included in clay sediment as cretaceous-age organic detritus. Sample size was also very small.

WAT-408.

12,650 ± 320
$\delta^{13}C = -26.3\%_0$

See WAT-406.

Fiddlers Pond series

Samples from Alberta Plateau 4.5km NE of Peace R-Halfway R confluence (56° 15′ 15″ N, 121° 24′ 24″ W). Pond sediment subm to obtain basal date of sediment core for pollen analysis. Coll and subm by J M White.

WAT-380.

7250 ± 120
$\delta^{13}C = -29.2\%_0$

Silty clay with organic fraction and some sand. *Comment* (JMW): date was expected to define final date of withdrawal of Glacial Lake Peace from Alberta Plateau and to fall in range $>$10,000 yr. It is now thought that formation of pond reflects some climatic event.

WAT-551.

5170 ± 60
$\delta^{13}C = -26.4\%_0$

See WAT-380. *Comment* (JMW): sample subm to control sedimentation rate in pond.

WAT-552.

$$1210 \pm 60$$
$$\delta^{13}C = -26.5\%$$

Fibrous limnic peat with some sand. *Comment* (JMW): subm for controlling sedimentation rate in pond.

WAT-300. Kingston

$$4840 \pm 360$$
$$\delta^{13}C = -26.0\%$$

Wood from Kingston Landfill site, Ontario (44° 12′ N, 76° 30′ W) from core of Cataraqui R bottom. Sample from 130cm depth below peat, overlying clay. Coll and subm 1976 by S K Frape, Dept Geol, Queen's Univ, Kingston, Ontario. *Comment* (SKF): dated to establish age of wood layer found throughout river bottom at this point. Wood layer is discontinuous but always found between clay and peat, and is believed to correspond to rise in Lake Ontario flooding of area, ca 4000 yr.

WAT-345. Medway Creek

$$490 \pm 40$$
$$\delta^{13}C = -28.5\%$$

Wood from W bank of Medway Creek, 100m S of W end of bridge on Hwy 22, NW London, Ontario (43° 01.2′ N, 81° 18.3′ W). Sample coll 2m below ground level from fresh, frozen face. Coll and subm 1978 by S R Hicock and Alexis Dreimanis, Dept Geol, Univ Western Ontario, London. *Comment* (SRH & AD): sample coll from wood layer within sandy pebble gravel, 1.5m thick, containing abundant mollusks. Gravel underlies 0.5m organic silt and peat (probably flood basin deposits) which is capped by 1m silty diamicton (probably mudflow deposit). Subm to learn if gravel is beach deposit assoc with Plum Point Interstadial, in which case it would have dated between 25,000 and 35,000 yr. However, in view of above date it appears to merely represent local creek bed deposit, at about same level as present. This indicates that Medway Creek shifted its bed laterally but accomplished negligible downcutting of its valley in past 1300 yr. It is presently a stable stream, near maturity, supported by sinuous meandering shape of its channel.

WAT-248. Parkhill

$$15,780 \pm 780$$
$$\delta^{13}C = -27.0\%$$

Spruce needles and some seeds from Borehole 234-75 at Parkhill, Ontario (81° 45′ 25″ W, 43° 10′ 45″ N, Grid Ref 392.826). From depth 7.6 to 7.8m below ground level in borehole. *Comment* (AVM): *Chara* oögonia in sample; subm to date advance of Lake Algonquin into Thedford embayment.

WAT-392. Parkhill

$$5410 \pm 110$$
$$\delta^{13}C = -25.9\%$$

Macerated plant debris from Parkhill, Ontario, from Borehole 234-75 at depth 4.17 to 4.34m. Coll Sept 16, 1975 and subm July, 1978 by A V Morgan. *Comment* (AVM): *Chara* oögonia in sample; subm to provide min age for Lake Nipissing in Thedford embayment.

B. United States

>40,000

WAT-258. Muskoda, Minnesota $\delta^{13}C = -26.3‰$

Wood from drainage ditch in gravel pit in Muskoda (46° 54′ 29″ N, 96° 24′ 28″ W). Coll and subm 1976 by Steve Moran, Univ North Dakota. *Comment* (SM): tills above and below sample are both probably of Late Wisconsinan age. Date should confirm this and give age of minor readvance during late Wisconsinan retreat.

+4000

33,800

−10,000

WAT-243. $\delta^{13}C = -26.1‰$

See WAT-258.

3840 ± 60

WAT-554. Harbour Beach $\delta^{13}C = -0.47‰$

Shells *(Goniobasis livescens)* from small stream bank ca 1m deep and 10 to 20cm in from face in Harbour Beach, Michigan (43° 46′ N, 82° 36′ 10″ W). Dated to determine if shells were of Nipissing age. Coll 1978; subm 1979 by P F Karrow. *Comment* (PFK): date confirms Nipissing age of deposit.

C. Britain

Stafford series

Samples from Stafford (SJ.92.926.234) dated to understand development of paleoenvironment of Stafford region. Coll Aug 1975 and subm 1977 by A V Morgan.

13,240 ± 290

WAT-255. $\delta^{13}C = -27.1‰$

$-27.9‰$

$-27.5‰$

$-31.0‰$

Blue gray clay, pronounced detrital organic band at depth 18.9 to 18.95m in Core 'C'. *Comment* (AVM): age fits relatively well with sample run from same horizon (BIRM-150). Indicates approx time for start of deposition of organic debris at Stafford, following late Devensian ice retreat.

12,070 ± 220

WAT-262. $\delta^{13}C = 30.8‰$

$-31.6‰$

$-31.0‰$

$-31.0‰$

Blue gray clay with detrital organics at depth 18.85 to 18.9m in Core 'C'.

9680 ± 140

WAT-266. $\delta^{13}C = -8.1‰$

Chara stalks at depth 13.95 to 14m. *Comment* (AVM): sample by gas evolution and acid digestion.

WAT-267.

$$11,480 \pm 260$$
$$\delta^{13}C = -32.9\text{‰}$$
$$-32.8\text{‰}$$

Uniform green gyttja at depth 17.95 to 18.05m in Core 'C'.

WAT-268.

$$2790 \pm 120$$
$$\delta^{13}C = -32.0\text{‰}$$
$$-31.7\text{‰}$$
$$-31.0\text{‰}$$
$$-32.2\text{‰}$$
$$-30.7\text{‰}$$

Yellow green silty gyttja from depth 5.95 to 6.1m in Core 'C'. *Comment* (AVM): repetition of pollen and diatom data suggests slumping. Sample is too young.

WAT-269.

$$3040 \pm 120$$
$$\delta^{13}C = -31.0\text{‰}$$
$$-30.5\text{‰}$$
$$-31.5\text{‰}$$

Yellow-green silty gyttja at depth 3.95 to 4.1m in Core 'C'.

WAT-274.

$$4760 \pm 120$$
$$\delta^{13}C = -30.5\text{‰}$$
$$-32.5\text{‰}$$
$$-31.1\text{‰}$$

Dark green-brown silty gyttja at depth 9.95 to 10.1m in Core 'C'.

WAT-275.

$$1390 \pm 70$$
$$\delta^{13}C = -28.9\text{‰}$$
$$-29.1\text{‰}$$
$$-29.6\text{‰}$$

Fibrous *Typha* peat from depth 1.95 to 2.1m in Core 'C'.

WAT-396.

$$10,590 \pm 310$$
$$\delta^{13}C = -33.7\text{‰}$$

Green-yellow silty gyttja at depth 18.5 to 18.6m in Core 'C'. *Comment* (AVM): date is too young when compared with pollen stratigraphy.

WAT-397.

$$6190 \pm 190$$
$$\delta^{13}C = -34.8\text{‰}$$

Alternating carbonate and organic rich bands at depth 13 to 13.15m in Core 'C'.

WAT-398.

$$3590 \pm 60$$
$$\delta^{13}C = -29.9\text{‰}$$

Dark green-brown silty gyttpa at depth 6.85 to 7m in Core 'C'.

WAT-399.

$$9650 \pm 400$$
$$\delta^{13}C = -33.2\text{‰}$$

Uniform green gyttja at depth 17 to 17.1m in Core 'C'. *Comment* (AVM): date is too young when compared with pollen stratigraphy.

III. ARCHAEOLOGIC SAMPLES
A. Canada

WAT-189.   Burlington, Ontario   −12 ± 50

Direct combustion of wood charcoal (N midden). It was predicted that careful excavation would show Woodland component over possibly sparse, Archaic component. Sample from Richardson Farm, Dundas, Ontario (43° 23' 55" N, 79° 49' 55" W); coll and subm 1976 by Arthur Roberts, Dept Geog, York Univ, Downsview, Ontario.

WAT-188.   730 ± 50

Wood charcoal from S midden. See WAT-189.

L'anse aux Meadows site series, Newfoundland

Buried peat from L'anse aux Meadows (55° 32.1' N, 51° 35.7' W). Coll 1976 and subm 1978 by Brigitta Wallace, Parks and Recreation, Ottawa.

WAT-496.
160% modern
$\delta^{13}C = -27.0‰$

Base of peat, measured to date Pollen Zone A.

WAT-497.
240% modern
$\delta^{13}C = -27.8‰$

Sample measured to date Pollen Zone A from S profile of Trench 4A715, 18m W of House D.

WAT-506.
5990 ± 960
$\delta^{13}C = -28.7‰$

Sample measured to date Norse level from E profile of Trench 4A71K, 3m W of House D.

WAT-409.
2190 ± 200
$\delta^{13}C = -27.9‰$

Peat, 0 to 20cm from base of Monolith 17; measured to date high pollen concentration in Pollen Zone B.

WAT-410.
1840 ± 290
$\delta^{13}C = -26.6‰$

Peat from base of Monolith 14; measured to date McAndrews A zone.

WAT-411.
160% modern
$\delta^{13}C = -27.0‰$

Peat from base of Monolith 15; measured to date McAndrews A zone.

WAT-420.   1630 ± 70

Charred wood measured to date House D. *Comment* (BW): it is very possible that sample was contaminated with ancient carbon from oil derivatives.

WAT-306.   Gwillim Lake, British Columbia   3430 ± 110

Charcoal from Gwillim Lake in NE British Columbia (55° 21' 06" N, 121° 23' 46" W). From fourth stratigraphic layer (48cm depth). Coll

1977 by R Blacklaws; subm 1977 by B F Ball, Simon Fraser Univ, Vancouver, British Columbia. Measured to estimate age of archaeol site. *Comment* (RB): area appears to have been subjected to forest fire. Good portion of roots existed in soil along with sample.

WAT-341.   **190% modern**

Burned bone from Gwillim Lake (see WAT-306.) Sample found in first stratigraphic layer of excavation, 0 to 10cm deep, in archaeol site.

WAT-561.   Point Roberts Peninsula,   **2810 ± 70**
Delta, British Columbia $\delta^{13}C = -15.8‰$

Bone from Point Roberts Peninsula, Delta, British Columbia (49° 02′ 05″ N, 123° 04′ W). From Beach Grove site at 40cm depth showing no previous disturbance. Matrix was gray, black soil mixed with finely crushed sea shell. Coll and subm 1979 by B F Ball. *Comment* (BFB): expected age indicated by artifactual materials 2500 to 3000 yr BP. Sample measured to confirm estimates from artifact comparison and at request of local Indian band.

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