GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA

PAPER 77-7

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J.A. LOWDON
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Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

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available by mail from

Printing and Publishing
Supply and Services Canada,
Hull, Québec, Canada K1A 0S9,

and

The Geological Survey of Canada
601 Booth St., Ottawa, K1A 0E8

or

Through your bookseller.

Catalogue No. M44-77/7
ISBN - 0-660-01528-5

Price: Canada: $2.50
Other Countries: $3.00

Price subject to change without notice

CONTENTS

The present date list, GSC XVII, is the sixth to be published directly in the Geological Survey's Paper series. Lists prior to GSC XII were published first in the journal **Radiocarbon** and were reprinted as GSC Papers. The lists through 1967 (GSC VI) were given new pagination, whereas lists VII to XI (1968 to 1971) were reprinted with the same pagination.

Tables

Original manuscript received: 1977-12-14
Approved for publication: 1978-1-16

GEOLOGICAL SURVEY OF CANADA RADIOCARBON DATES XVII

Abstract

This list includes 124 radiocarbon age determinations on 120 geological samples made by the Radiocarbon Dating Laboratory. They are on samples from various areas as follows: Newfoundland (17); Nova Scotia (1); Gulf of St. Lawrence (3); New Brunswick (1); Quebec (13); Ontario (26); Manitoba (10); Alberta (6); British Columbia (11); Yukon Territory (10); Northwest Territories, Mainland (8); Northwest Territories, Arctic Archipelago (18). Details of background and standard for the 2-litre and 5-litre counters during the period from August 5, 1976 to August 31, 1977 are summarized in Tables 1 and 2; Table 3 gives the number of counts used to determine the average background and standard counting rates; and Table 4 lists the number of different background and standard gas preparations used for counting.

Résumé

Ce rapport présente les résultats de 124 datations effectuées sur 120 échantillons géologiques par le Laboratoire de datation au radiocarbone. Ces échantillons proviennent des régions suivantes: Ile de Terre-Neuve (17); Nouvelle-Ecosse (1); golfe du Saint-Laurent (3); Nouveau-Brunswick (1); Québec (13); Ontario (26); Manitoba (10); Alberta (6); Colombie-Britannique (11); Yukon (10); Territories du Nord-Ouest, continent (8); Territoires du Nord-Ouest, archipel Arctique (18). Les valeurs du mouvement propre et de l'étalonnage des compteurs 2 litres et 5 litres, pour la période allant du 5 août 1976 au 31 août 1977, sont présentées dans les tableaux 1 et 2; le tableau 3 donne le numbre de coups utilisés pour déterminer la moyenne des taux d'impulsions du mouvement propre et de l'étalonnage; et, le tableau 4 donne le nombre de préparations de gaz pour le mouvement propre et pour l'étalonnage utilisées pour le comptage.

INTRODUCTION[1]

During the period covered by this introduction (August 1976 to August 1977), both the 2-litre counter (Dyck and Fyles, 1962) and the 5-litre counter (Dyck et al., 1965) were operated for the entire 13 months. The 2-litre counter was operated at 2 atm and the 5-litre at 1 atm except for April, May, June, and August, when it was operated at 4 atm.

Average background and standard counting rates for the periods used for computerized age calculations are shown in Tables 1 and 2, respectively. On a period basis, counting rates were within statistical limits.

Table 1

Background (c/m)* for Periods Used for Age Calculations
August 5, 1976 to August 31, 1977

PERIOD	2-LITRE COUNTER (2 atm)	5-LITRE COUNTER (1 atm)
August 1976	1.045 ± 0.018	2.159 ± 0.026
September	1.059 ± 0.018	2.113 ± 0.025
October	1.096 ± 0.018	2.136 ± 0.024
November	1.099 ± 0.021	2.130 ± 0.049
December	1.104 ± 0.019	2.183 ± 0.032
January 1977	1.113 ± 0.018	-
February	1.108 ± 0.015	2.200 ± 0.022**
March	1.128 ± 0.018	-
April	1.112 ± 0.020	-
May	1.110 ± 0.019	2.946 ± 0.016***
June	1.127 ± 0.018	-
July	1.134 ± 0.018	2.184 ± 0.038
August	1.175 ± 0.019	2.995 ± 0.055***

*c/m = counts per minute.

**Average background for period January 19 to March 28.

***5-L counter operating at 4 atm. The value 2.946 ± 0.016 is the average background for period March 30 to June 21.

Table 2

Standard, N_o*, (c/m) for Periods Used for Age Calculations
August 5, 1976 to August 31, 1977

PERIOD	2-LITRE COUNTER (2 atm)	5-LITRE COUNTER (1 atm)
August 1976	19.577 ± 0.106	28.102 ± 0.169
September	19.415 ± 0.122	28.022 ± 0.120
October	19.332 ± 0.191	28.319 ± 0.115
November	19.253 ± 0.097	28.187 ± 0.128
December	19.166 ± 0.307	28.208 ± 0.121
January 1977	19.517 ± 0.097	-
February	19.593 ± 0.101	28.359 ± 0.096**
March	19.583 ± 0.101	-
April	19.442 ± 0.101	-
May	19.580 ± 0.099	106.567 ± 0.122***
June	19.623 ± 0.107	-
July	19.676 ± 0.111	28.210 ± 0.123
August	19.592 ± 0.099	105.778 ± 0.234***

*N_o = 0.95 x net counting rate of the NBS oxalic acid standard.

**Average standard for period January 19 to March 28.

***5-L counter operating at 4 atm. The value 106.567 ± 0.122 is the average standard for period March 30 to June 21.

Table 3 lists the number of daily counts used to determine the average background and standard counting rates that were utilized for age calculations during the periods listed. Table 4 lists the number of different background and standard gas preparations used for counting during the same periods.

Since January 1972 age calculations have been carried out by a C.D.C. 6400 computer. Calculations are based on a ^{14}C half-life of 5568 ± 30 years and 0.95 of the activity of the NBS oxalic acid standard. Ages are quoted in radiocarbon years before present (B.P.) where "present" is taken to be 1950.

[1] Prepared by J.A. Lowdon and I.M. Robertson. The date list has been compiled by W. Blake, Jr. from descriptions of samples and interpretations of age determinations by the collectors and submitters.

Table 3

Number of Counts Used to Determine Average Background and Standard Counting Rates for Periods Listed

PERIOD	2-LITRE BACKGROUND	5-LITRE BACKGROUND	2-LITRE STANDARD	5-LITRE STANDARD
August 1976	4	4	3	3
September	4	4	3	3
October	4	4	3	3
November	4	4	3	3
December	4	3	3	2
January 1977	4	-	3	-
February	5	7*	3	4*
March	4	-	3	-
April	4	-	3	-
May	4	13**	3	12**
June	4	-	3	-
July	4	3	3	3
August	4	4	3	3

*Number of counts used for period January 19 to March 28.

**Number of counts used for period March 30 to June 21.

Table 4

Number of Different Background and Standard Gas Preparations Used for Counting for Periods Listed

PERIOD	2-LITRE BACKGROUND	5-LITRE BACKGROUND	2-LITRE STANDARD	5-LITRE STANDARD
August 1976	2	2	2	2
September	4	3	2	2
October	3	2	2	2
November	2	2	2	2
December	3	3	2	2
January 1977	2	-	2	-
February	2	3*	2	3*
March	2	-	1	-
April	3	-	2	-
May	1	2*	1	1*
June	2	-	1	-
July	2	2	2	1
August	1	1	1	1

*Number of different preparations used for period January 19 to March 28.

**Number of different preparations used for period March 31 to June 21.

Since January 1973 the error assigned to each age has been calculated using only the counting errors of sample, background, and standard, and the error in the half-life of ^{14}C (Lowdon et al., 1974; Lowdon and Blake, 1973). Prior to 1973 an error term to account for the average variation of ± 1.5% in the ^{14}C concentration of the atmosphere during the past 1100 years had been incorporated in the age error calculation. This last error term had been used mainly as a result of the work done on Douglas fir (**Pseudotsuga menziesii**) tree rings (Dyck, 1965, 1966, 1967) and sequoia (**Sequoia gigantea**) tree rings (Willis et al., 1960). More recent work on bristlecone pine (**Pinus aristata**), mainly by the University of Arizona but also by the University of Pennsylvania and other laboratories, has shown that the concentration of ^{14}C in the atmosphere has varied by as much as 15% over the past few thousand years. Sufficient data are now available to provide a conversion table from radiocarbon years to tree ring (calendar) years for the last 7500 years if the user so desires (Olsson, 1970; Damon et al., 1972). These data take into account the variations in the ^{14}C concentration in the atmosphere. For this reason it was decided to omit the correction for fluctuations in the concentration of atmospheric ^{14}C from GSC radiocarbon dates, starting in January 1973. The omission of this error term in no way affects the date produced, but it does reduce the error assigned to a date. Finite dates are based on the 2σ criterion (95.5% probability) and "infinite" dates on the 4σ criterion (99.9% probability).

Purification of bone samples (i.e., complete removal of electronegative impurities) prior to counting always has created problems in the laboratory. The final step in the routine CO_2 gas purification process (Lowdon et al., 1969) is to pass the gas over hot copper wire and silver wool. Whereas the CO_2 produced from samples of wood, shell, etc. required only between two and six passes to obtain complete purity, up to thirty passes, on occasion, were required to obtain the same degree of purity for bone samples. This was a time consuming and tedious process. For this reason, during the past year it was decided to find a simpler method of CO_2

preparation which would eliminate all or most of the impurities prior to the final purification step. This has been accomplished and a detailed description of this new method is in preparation. Briefly, the method consists of burning the organic sample in a stream of oxygen and absorbing the CO_2 produced in potassium hydroxide solution. After combustion is completed the resulting potassium carbonate solution is treated directly with phosphoric acid and the CO_2 gas produced is collected in the routine manner (Lowdon et al., 1969). Carbon dioxide gas from bone samples produced by this method now requires only approximately four passes through the copper-silver furnace to achieve the desired purity. Starting with sample GSC-2409 (prepared in October 1976), this method of sample preparation and purification has been used routinely for all organic samples.

No changes have been made in the routine pretreatment of samples. Carbon dioxide gas proportional counting techniques have been discussed by Dyck (1967).

Where $^{13}C/^{12}C$ ratios are available, a correction for isotopic fractionation has been applied to the date and the $\delta^{13}C$ value reported. Related to the PDB standard, the "normal" values used for correction are $\delta^{13}C = 25.0$ ‰ for wood, other terrestrial organic materials, and bones (terrestrial and marine), and 0.0‰ for marine shells. All determinations were made on aliquots of the same sample gas used for age determination. Except for the samples listed below, all $^{13}C/^{12}C$ ratios were determined by the GSC Geochronology Section (Head, R.K. Wanless): GSC-1623, -1748-2, -2016, -2026, -2161, -2185, -2272, and -2311 were determined at the Department of Earth Sciences, University of Waterloo, Waterloo, Ontario, under the supervision of Prof. P. Fritz (Contract OSU5-0167, OSU76-00126, and OSU77-0021); GSC-1146 and -1149 were determined at Isotopes Inc., Westwood, New Jersey.

Acknowledgments

J.A. Lowdon would like to express special thanks to I.M. Robertson for his conscientious effort in keeping the laboratory functioning efficiently during the nine month absence of the former on a French Language Training course. Thanks are extended also to Mrs. S.M. Chartrand (until June 1976) and J.E. Tremblay for assistance in the preparation and purification of samples in the laboratory; K. Santowski for the GSC $\delta^{13}C$ determinations; R.J. Mott and Mrs. L.D. Farley-Gill for wood identifications and palynological determinations; Dr. M. Kuc for the identification of macroscopic organic remains; A. Roberts of the X-ray Diffraction Laboratory for the identification of mineral constituents in shells; and Mrs. G. Mahony and R.J. Richardson for assistance in compilation. Dr. A.H. Clarke, Jr. and Mrs. M.F.I. Smith, National Museum of Natural Sciences, Ottawa (Clarke is now at the Smithsonian Institution, Washington, D.C.) and Dr. F.J.E. Wagner have assisted in the identification of molluscs.

GEOLOGICAL SAMPLES

Eastern Canada

Newfoundland

Postglacial Emergence Series, Northern Peninsula (II)

GSC-1600. Flat Pond 12 600 ± 160

Shells (sample GS/71-41; 53.3 g; **Mytilus edulis;** identified by D.R. Grant[1]) at an altitude of ca. 110 to 120 m from a densely packed stratum of intact individuals forming a "mussel bank". This was intercalated in inclined foreset beds of gravel 2 to 3 m below the surface of a fossil barrier exposed in a borrow pit alongside the main interior forest haulage road 0.8 km northwest of the shore of Flat Pond, 16.9 km southeast of the village of River of Ponds, Newfoundland (52°24.03'N, 57°16.15'W). Collected 1971 by D.R. Grant.

GSC-1485. Zinc Lake 12 400 ± 360

Shells (GS/69-360; 18.5 g; whole valves and fragments of **Hiatella arctica;** identified by D.R. Grant) associated with **Mya truncata, Macoma calcarea,** and probably **Mytilus edulis** (identified by W. Blake, Jr.) at an altitude of 106 m and exposed in a shallow (0.5 m) excavation in a mantle of marine sand, 30 m below marine limit near the west side of Zinc Lake, 10 km northeast of Daniels Harbour, Newfoundland (50°17.75'N, 57°28.05'W). Collected 1970 by Brian Young, COMINCO; submitted 1970 by D.R. Grant.

GSC-1601. Eastern Blue Pond 12 000 ± 170

Whole valves of **Mya truncata** (sample GS/71-55; 40.0 g; identified by D.R. Grant) at an altitude of ca. 90 m; sample culled from a mixture of fragments of **Chlamys** sp. and **Hiatella arctica** occurring in gravelly marine veneer near marine limit just below an unmodified end moraine at an altitude of 110 m, along a forest road, 6.4 km west of the shore of Eastern Blue Pond, Newfoundland (50°27.83'N, 57°10.80'W). Collected 1971 by D.R. Grant.

GSC-1605. River of Ponds 12 000 ± 160

Marine shells of **Mya truncata** (sample GS/71-50; 41.8 g; identified by D.R. Grant) occurring ca. 1 m below the surface; shells are intact and in growth position at an altitude of ca. 85 m in inclined sandy gravel beds of an emerged beach or bar deposit exposed in a borrow pit just below marine limit along a forest access road southwest of Hawke Bay, 12 km east of River of Ponds village, Newfoundland (51°31.00'N, 57°13.20'W). Collected 1971 by D.R. Grant.

GSC-1762. Parsons Pond 8650 ± 140

Marine molluscs (sample GS/72-406; 48.5 g; **Mytilus edulis;** identified by D.R. Grant) perfectly preserved in growth position at an altitude of ca. 8 m in "mussel banks" and enclosed in arched sandy gravel beds of an emerged foreland with surface terraced at 13, 8, and 5 m; the foreland is truncated by coastal cliffs 1 km southwest of the mouth of Parsons Pond, Newfoundland (50°01.47'N, 57°43.48'W). Collected 1972 by D.R. Grant.

GSC-1470. Main Brook 8530 ± 150

Shells (sample GS/69-121; 51 g; **Mya truncata;** identified by D.R. Grant) occurring articulated and in growth position at an altitude of ca. 30 m. The shells are exposed in a borrow pit in inclined beds of an emerged gravel bar, 1.6 km south of Main Brook, Newfoundland (51°10.57'N, 56°02.20'W). Collected 1969 by D.R. Grant.

GSC-1472. Pistolet Bay 8400 ± 150

Shells (sample GS/69-99; 26.5 g; **Venericardia borealis;** identified by D.R. Grant) at an altitude of ca. 15 m occurring as a winnowed surface concentration on stony estuarine mud. This material is exposed on the floor of a shallow pond in an artificially drained peat bog along the right-of-way of Highway 73, 1.2 km southeast of the junction with Cooks Harbour road, near the southwest head of Pistolet Bay, Newfoundland (51°31.90'N, 55°56.55'W). Collected 1969 by D.R. Grant.

GSC-1763. Western Brook 8340 ± 150

Marine molluscs (sample GS/72-603a; 49.15 g; **Mytilus edulis;** identified by D.R. Grant) in growth position and lustrous but friable, at an altitude of 4 m; the sample was concentrated in a layer 2 m below the surface of an emerged coastal barrier formed of arched strata exposed in a borrow pit beside Highway 73, 0.2 km south of the bridge over Western Brook, Newfoundland (49°49.7'N, 57°51.3'W). Collected 1972 by D.R. Grant.

[1] All persons referred to as collectors or submitters of samples or cited as sources of data are with the Geological Survey of Canada unless otherwise specified.

GSC-1768. Lafontaine Point 8300 ± 200

Marine shells (sample GS/72-622; 16.0 g; fragments are probably **Mya pseudoarenaria;** identified by W. Blake, Jr.) exposed at the top edge of a modern sea cliff cut in the sand which makes up emerged marine terraces, where modern wind action is deflating the peat cover, at an altitude of 8.7 m (7.6 m above high tide); site is 0.4 km south of Lafontaine Point and 27.2 km north of Daniel's Harbour, Newfoundland (50°28.3'N, 57°28.6'W). Collected 1972 by D.R. Grant.

GSC-1527. Big Brook 3490 ± 140
$\delta^{13}C = -3.8$ ‰

Calcareous marine algae (sample GS/69-60; 60.5; ?**Lithothamnion** sp.; identified by D.R. Grant) in various-sized clumps 1 m below the surface at an altitude of 6 m (5.2 m above present high tide); the collection was made in a shallow borrow pit in a raised beach ridge near the mouth of a small unnamed stream crossed by Highway 73, 1.3 km west of the bridge over Big Brook, Newfoundland (51°31.25'N, 56°10.48'W). Collected 1969 by D.R. Grant.

GSC-2040. Wild Bight 3400 ± 220

Marine shells (sample GS/73-1; 26.5 g; **Mytilus edulis;** identified by D.R. Grant) 6 to 7 m above high tide (altitude ca. 7.6 m), intact and in growth position, 0.5 m below the surface of a sandy raised beach – the most recent of a large complex of 10 ridges at more or less the same elevation, standing above a lower plain of multiple sand ridges – exposed in a borrow pit on the road between Cooks Harbour and Boat Harbour, 0.4 km east of the hamlet of Wild Bight, Newfoundland (51°36.50'N, 55°53.25'W). Collected 1973 by D.R. Grant.

GSC-1552. Nameless Cove 3200 ± 130
$\delta^{13}C = +3.8$ ‰

Marine gastropods (sample GS/69-55; 46.1 g; **Thais lapillis;** identified by A.H. Clarke, Jr., then at the National Museum of Natural Sciences, Ottawa, now at Smithsonian Institution, Washington, D.C.), wave abraded but still internally lustrous, at an altitude of 5.2 m (4.5 m above high tide) in the lower layers of a 0.5 m thick pebble gravel emerged spit-like formation, and wedged in crevices of the underlying dolomite bedrock ridge, exposed in a shallow (1 m) roadcut along the peninsula forming the north shore of Nameless Cove, Newfoundland (51°18.76'N, 56°43.48'W). Collected 1969 by D.R. Grant. An interlaboratory determination on this sample, carried out at the Department of Geological Sciences, Brock University, yielded an age of 3189 ± 57 years (BGS-50; Melville, 1972).

GSC-2057. Raleigh 1590 ± 260

Marine shell (sample GS/69-85; 6.3 g; single fragment of **Mya arenaria;** identified by D.R. Grant) associated with fragments of other pelecypods and **Thais lapillis,** at an altitude of 3.6 m (2 to 3 m above high tide), 0.5 m below the surface of topset beds of a sandy terrace forming a tombolo which joins Burnt Island to the mainland, 0.8 km southwest of the crossroads in the village of Raleigh, Newfoundland (51°33.15'N, 55°44.75'W). Collected 1969 by D.R. Grant.

GSC-1602. Eddies Cove West 990 ± 130

Fragments of marine shells (sample GS/71-61; 40.0 g; **Mytilus edulis;** identified by D.R. Grant) from concentrated pockets 0.5 m below the surface, exposed in a borrow pit in limestone pebble gravel composing the first major, composite raised beach 2.5 m a.s.l. (1.5 ± 0.5 m above modern high tide) on an unnamed headland 2.4 km northeast of the settlement of Eddies Cove West, Newfoundland (50°46.04'N, 57°09.15'W). Collected 1971 by D.R. Grant.

GSC-2086. L'Anse aux Meadows I 2170 ± 130

Marine shells (sample GS(VIKING)-1974-1; 27.0 g; 45 fragments of **Mytilus edulis;** identified by D.R. Grant) occurring intact and clustered with limpets and periwinkles as if in a mussel bank, at an altitude of 1.5 m a.s.l. (0.75 ± 0.05 m above high tide) at a depth of 0.5 m in a raised beach ridge on the west side of the road to Colbornes Point hamlet, 1 km north of the archeological site in L'Anse aux Meadows National Historic Park, Newfoundland (55°35.98'N, 55°32.20'W). Collected 1974 by D.R. Grant.

GSC-2136. L'Anse aux Meadows II 940 ± 60

Marine shell fragments (sample GSv/74-8 (4A210A3); 26.1 g; **Mytilus edulis;** identified by D.R. Grant) occurring as broken and whole valves 0.2 m below the surface in loose pebble gravel of a raised beach ridge at an altitude of 2.8 m. The raised beach is the fourth ridge above present high tide and is just below the terrace surface on which the Norse settlement is located 0.5 km south-southeast of L'Anse aux Meadows National Historic Park, Newfoundland (51°35.89'N, 55°32.20'W). Collected 1974 by Bengt Schönback for Parks Canada at the request of D.R. Grant.

Comment (D.R. Grant): With a few exceptions the samples are believed to come from sediments deposited near sea level, and accordingly they appear to document a declining rate of relative sea level fall caused by postglacial isostatic crustal rebound. The trend of the emergence has been figured by Grant (1972a) using these and other dates previously published in Lowdon and Blake (1973), and it shows that the sea initially receded at about 4.3 m/century compared to 0.1 m/century recently. Raised beaches at the terminal part of the Northern Peninsula are slightly younger at any given elevation than those farther south on the west coast, presumably because of the delayed deglaciation there. A single long end moraine was formed on the northern lowlands since 11 000 years B.P. (Grant, 1969) whereas on the western piedmont, several successive end moraines were abandoned in the sea prior to 12 600 years B.P. This is indicated by beaches on both sides of the moraines near the marine limit (GSC-1485, -1600, -1601, -1605) as shown in Grant (1972b). The Pistolet Bay sample (GSC-1472) is incongruous because the enclosing muddy sediment was deposited at some depth below the sea level corresponding to its age. On the western piedmont, however, three dated levels (GSC-1762, -1763, -1768) on apparently littoral facies are also in the 8000 year range and yet are far older than expected for their low elevation. It is possible that although the coastal lowland was ice free relatively early, ice persisted on the Long Range plateau, causing delayed rebound. In support of this hypothesis are shells as young as 9230 ± 140 years (GSC-1630; in GSC XIII, 1973, p. 8) in emerged stony (ice-rafted?) mud near St. Pauls. Dates on the youngest raised beaches in the Pistolet Bay – L'Anse aux Meadows area are inconsistent with dates at comparable levels on the Strait of Belle Isle coast, although the limits of resolution are approached when comparing differences of a few metres or centuries. However, GSC-2086 is unaccountably too old considering that it is just above high tide. Dates on driftwood at the base of a peat bog covering the younger beaches and dates at various levels in the bog (Kuc, 1975) are 600 to 2500 years old, proving that the beaches above 3 m were emerged by 2000 years B.P. Either the shell material was reworked from older layers or was contaminated with glacially transported carbonate debris from the dolomite area to the west. Alternatively, shorelines are tilted up to the west towards the Labradorean ice centre (Grant, 1975a).

Comment (W. Blake, Jr.): Samples GSC-1472, -1768, -2040, and -2057 each mixed with dead gas for counting. Determinations for GSC-1472, -1600, -1605, and -1762 each based on one 3-day count in the 5-litre counter; GSC-1470,

-1552, -1601, -1602, and -1763 each based on two 1-day counts in the 5-litre counter, and GSC-1527 is based on one 1-day count in the 5-litre counter. Determinations GSC-1768, -2057, and -2136 each based on two 1-day counts in the 2-litre counter; GSC-2040 and -2086 each based on one 2-day count in the same counter. Determination GSC-1485 is based on two 1-day counts in the 1-litre counter.

GSC-2179. Little Codroy River 3520 ± 50

Wood (sample LCR-2; 11.1 g; **Picea** sp., identified by L.D. Farley-Gill) from the wood-rich base of a peat layer exposed along the coast west-northwest of the mouth of Little Codroy River and 3.5 km west-southwest of St. Andrews, Newfoundland (47°45.85'N, 59°19'W), at an altitude of ca. 4.5 m. Wood is from the lower 30 cm of a peat layer some 90 cm thick which overlies glacial drift and is overlain in turn by 5 to 60 cm of bedded brownish grey sand interpreted as being a residual of a "subrecent" dune. Collected 1972 by W.D. Brückner, Memorial University of Newfoundland, St. John's.

Comment (W.D. Brückner): The forest-peat layer from which this sample was taken could have formed at any time between the end of early postglacial permafrost/solifluction conditions and the formation of "subrecent" beaches and related coastal dunes (Brückner, 1969).

Comment (W. Blake, Jr.): According to Brookes (1977) the shoreline in the Codroy Lowland probably has been submerging for about the last 11 000 years; the highest raised marine features are only 5 to 10 m above present sea level. Date based on one 3-day count in the 5-litre counter.

Nova Scotia

GSC-2128. Green Bay 4170 ± 80

Sapropel (sample 510-74-54; 130 g) obtained by Dietz-Lafond grab sampler in a water depth of 14 m on a sandy bottom at the entrance to Green Bay, Nova Scotia (44°11.4'N, 64°26.1'W). Sample should assist in dating the postglacial rise of sea level. Collected 1974 by D.J.W. Piper, Dalhousie University, Halifax.

Comment (D.J.W. Piper): This date appears unusually young compared with dates obtained on wood stranded at high water mark and now at depths of 8 to 12 m in Chezzetcook Marsh (Scott, pers. comm.), 100 km to the northeast, and by Grant (1970). This suggests contamination of the terrestrial sample by marine organisms, confirmed by the presence of some marine algae found in the bryological examination by M. Kuc, then with the Geological Survey of Canada.

Comment (W. Blake, Jr.): NaOH leach omitted from sample pretreatment. Although much of the sample disappeared during the HCl leach, 55.2 g were burned, but the low yield of gas (10.14 cm) necessitated mixing with dead gas for counting. Presumably the low yield was because the sample was rich in diatoms and sponges, and in addition a significant content of silt was noted by M. Kuc (unpublished GSC Bryological Report No. 307). Date based on one 3-day count in the 2-litre counter. Further data on submergence in the Maritimes can be obtained in Grant (1975b).

Gulf of St. Lawrence

Gulf of St. Lawrence series

Marine pelecypod shells from cores taken at three localities in the southwestern part of the Gulf of St. Lawrence.

GSC-1528. Magdalen Shelf, Gulf of St. Lawrence 10 200 ± 440

Shell fragments (sample BIO-24-67 Stn. 14; 4.6 g; **Macoma** sp.) in grey sandy glaciomarine sediments, beneath a 110 cm thick reddish brown sandy till with pebbles, which is overlain in turn by 40 cm of grey sandy pelite, at a depth of 150 to 170 cm below the seafloor, 80.5 km east of Percé Rock, Gaspé, Quebec (48°33'N, 63°10'W). The sediment core (total length 500 cm) was obtained in a water depth of 198 m with a 7.6 cm diameter piston corer. Collected 1967 by D.H. Loring, Marine Ecology Laboratory, Fisheries and Environment Canada, Dartmouth, Nova Scotia.

Comment (D.H. Loring): The date suggests that the deposition of the till above the shell layer during a late glacial readvance took place after this time (Loring, 1973; Loring and Nota, 1973). This till deposition apparently ceased before ca. 8700 years B.P. (cf. GSC-1608, this series). Sediment cores taken elsewhere in the Gulf of St. Lawrence record a similar stratigraphy to this core and indicate that the till deposition was widespread.

Comment (W. Blake, Jr.): The sample submitted to the laboratory contained, in addition to **Macoma** sp., unidentified pelecypod shell fragments; fragments of **Balanus** sp. and **Yoldia** (?) sp. (identified by W. Blake, Jr.) were also in the collection, but they were not utilized in dating. HCl leach omitted due to small sample size. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-1608. Shediac Trough (I) 8660 ± 290

Whole shells and fragments of marine pelecypods (sample BIO-13-66 Stn. 35; 4.0 g; **Macoma calcarea**; identified by F.J.E. Wagner, Atlantic Geoscience Centre, Dartmouth, Nova Scotia) from reddish brown gravelly pelitic sand (reworked till) in a sediment core at 200 cm depth below the seafloor in the Shediac Trough, 51.5 km east of Miscou Island, New Brunswick (47°55.8'N, 63°44.9'W), in a water depth of ca. 90 m. The sample was obtained just beneath (ca. 10 cm) the contact with grey postglacial pelites. Collected 1966 by D.H. Loring.

Comment (D.H. Loring): The date suggests that Holocene deposition of pelites in the Shediac Trough did not begin until after ca. 8950 to 8370 years ago, when the ice associated with the late glacial advance recorded by GSC-1528 had withdrawn completely from this area.

Comment (W. Blake, Jr.): The **Macoma calcarea** submitted to the laboratory consisted of one pair (one valve intact: 3.6 cm long, 2.7 cm high), one fragmented valve, and three umbonal fragments of other **M. calcarea** valves. All shells were clean but chalky. HCl leach omitted due to small sample size. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-1705. Shediac Trough (II) 8820 ± 230

Marine pelecypods (sample BIO 10-13-16 Stn. 34; 4.9 g; one whole valve of **Serripes groenlandicus** plus parts of two valves (one pair) of **Clinocardium ciliatum**; identified by W. Blake, Jr.) in grey pelite from 115 to 123 cm depth below the seafloor; 48 km east of Miscou Island, New Brunswick (47°53'07"N, 63°44'08"W), in a water depth of ca. 95 m. The shell horizon is overlain by 115 cm of grey pelite and is underlain by nearly 3 m of grey pelite; below 420 cm depth is a red, very sandy pelite (reworked till). Collected 1966 by D.H. Loring.

Comment (D.H. Loring): Date GSC-1705 confirms, assuming the shells are in situ, that the pelites are of Holocene age and that the rate of sedimentation at the core site has averaged ca. 0.013 cm/year.

Comment (W. Blake, Jr.): A younger age might have been expected for this sample, as opposed to GSC-1608 (this series), because it was not at the base of the grey pelite but nearly 3 m above the base. HCl leach omitted due to small sample size. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

New Brunswick

GSC-2185. Central Chaleur Bay 11 500 ± 270
$\delta^{13}C = +1.6$ ‰

Two large calcitic fragments of **Balanus hameri** (sample 74-013-77; 4.6 g; identified by F.J.E. Wagner) from a depth of 443 cm in a piston core from central Chaleur Bay, ca. 6 km north of Grande Anse, New Brunswick (47°56.5'N, 65°11.1'W), water depth 75 m. Collected 1974 on **CSS Dawson** cruise 74-013 by C.T. Schafer.

Comment (W. Blake, Jr.): The submitter states (Schafer, 1977, p. 601) "The ^{14}C date obtained from core 77 suggests that the mean sedimentation rate in this part of the bay during the Holocene was approximately 40 cm/1000 years or about half the rate calculated for the shallower core 34 site." It is also noteworthy that Schafer (1977, p. 604), unlike Loring (1973; cf. GSC-1528, this list) working to the east of Gaspé, does not record a till unit in core 77 above the level of the dated sample, but rather "a seaward shift of the gravelly-sand facies 6000 to 12 000 years ago in central Baie des Chaleurs with erosion and redeposition of fine sediments previously deposited in western Baie des Chaleurs during the earlier period of marine overlap". HCl leach omitted due to small sample size. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

Quebec

GSC-1856. Rivière Pentecôte 8280 ± 80

Whole valves of the marine pelecypod **Mesodesma deaurata** (sample Du-72-26; 47.2 g; identified by F.J.E. Wagner) from a freshly exposed face of sand and clay along the left bank of Rivière Pentecôte at the village of Pentecôte, Quebec (49°45'50"N, 67°10'29"W), at an altitude of 40 m. Site is in a bluff east of Rte. 14 and ca. 300 m west of Rivière Riverin Bridge, behind the North Shore Conservation offices. Collected 1972 by L.A. Dredge.

Comment (L.A. Dredge): The presence of abundant paired valves in stratified foreset sands indicates the contemporaneity of shells with the depositional environment. The shells probably relate closely to a sea level stand which created the extensive delta surface at approximately 48 m. The shell date is older than GSC-1809 (7580 ± 70 years; GSC XV, 1975, p. 10) from the Sept-Iles area (78 km to the northeast), which is at a higher elevation. Since contamination of either sample is unlikely, and both relate to specific sea levels, this age difference suggests that the pattern of isostatic uplift and emergence in the Pentecôte area differed from that in the Sept-Iles area (Dredge, 1976, 1977). Date based on two 1-day counts in the 5-litre counter.

GSC-2311. Lac Ford 6270 ± 100
$\delta^{13}C = +1.3$ ‰

Marine pelecypod shells (sample H.O. 1975-1; 12.7 g; **Clinocardium ciliatum** (Fabr.); identified by A.H. Clarke, Jr.) from the western end of Lac Ford, ca. 240 km northwest of Fort Chimo, Quebec (59°12'N, 70°14'55"W), at an altitude of ca. 105 m. The sample, comprising three left and three right valves, was collected 2.1 m below the surface from the clay bank along Lac Ford, at the point where Rivière au Chien-Rouge enters the lake. The clay is overlain by a bog. Collected 1975 by H. Ouellet, National Museum of Natural Sciences, Ottawa.

Comment (W. Blake, Jr.): The shells relate to a position of the sea estimated to be ca. 100 to 120 m above the present level of Ungava Bay (there is some uncertainty as to the exact elevation of Lac Ford; cf. Blake, 1976). The date indicates that the rate of emergence in this area has averaged between 1.5 and 2 m/century over the last 6000 years, and it also provides a limiting age for the existence of the large ice-dammed lakes in northern Ungava. Due to the small sample size, only the outer 5% was removed by HCl leach. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-1539. Beaupré >39 000

Detrital plant matter (sample Quebec Ser. No. 7; 45.8 g) from fluvial sands underlying varves at Beaupré, Quebec (47°03'00"N, 70°15'18"W), altitude ca. 15 m. The varved sediments underlie a calcareous till, which in the vicinity is overlain by postglacial shallow water marine sediments (Gadd et al., 1972). Collected 1970 by P. LaSalle, Ministère des richesses naturelles, Quebec.

Comment (P. LaSalle): Examination of the plant detritus by M. Kuc (unpublished GSC Bryological Report No. 121; cf. LaSalle et al., 1977) revealed the presence of "plants of entirely different habitats and taxonomic groups". The plant material shows evidence of short-distance transport by water and according to Kuc contains elements (mosses) which "most probably do not grow now in Canada and belong to southern and older floras".

Comment (W. Blake, Jr.): No rootlets were observed in the sample which was collected some 3 m below the ground surface. Because of the fine nature of the plant detritus, the NaOH leach was omitted from the sample pretreatment. Date based on one 3-day count in the 5-litre counter.

GSC-1473. Beauport >37 000

Wood (sample Quebec Ser. No. 4; 11.8 g; probably **Picea** sp. and **Larix** sp.; identified by R.J. Mott) from varves underlying till in a borrow pit near Beauport, Quebec (47°51'42"N, 71°12'12"W), at an altitude of ca. 57 m. The collection site is in a channel-like feature cut in Ordovician limestone; it is probably associated with the bedrock ravine in which the present-day Beauport River flows. Collected 1969 and 1970 by P. LaSalle.

Comment (P. LaSalle): The wood has been transported and the date does not give the time of deposition; the date, however, does provide a limiting age for the emplacement of the varved sediments (cf. LaSalle et al., 1977).

Comment (W. Blake, Jr.): The sample submitted for dating consisted of numerous twigs which ranged in size from pieces ca. 1 mm in diameter and less than 1 cm long to pieces 2 cm in diameter and 4 to 5 cm long. All fragments were worn at corners and along edges, implying transport. Date based on one 3-day count in the 5-litre counter.

GSC-1796. Saint-Félix-du-Cap-Rouge 9730 ± 140

Shells of a freshwater pelecypod (sample 1972-1-Cap-Rouge; 17.1 g; **Elliptio complanatus;** identified by A.H. Clarke, Jr., then at the National Museum of Natural Sciences, Ottawa, now at the Smithsonian Institution (Washington, D.C.), collected from a diamicton, possibly a bed of very coarse ice contact material, approximately 1.6 km northwest of Saint-Félix-du-Cap-Rouge, Quebec (46°45'30"N, 71°22'00"W), at an altitude of 42 m. Collected 1972 by P. LaSalle.

Comment (P. LaSalle): At the time of discovery, the sediment containing the freshwater shells was interpreted as glacial. New cuts indicate that there may have been reworking of the glacial material by fresh or near-fresh waters during an early episode of the St. Lawrence estuarine sedimentation.

Comment (W. Blake, Jr.): Only the single largest valve (7 cm long, 4.8 cm high), which was nearly intact, was submitted to the laboratory for dating. The shell was up to 5 mm thick, and fragments of the ligament were still attached. Due to the small size of the sample, only the outer 10% was removed by HCl. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

Pink Lake series

Organic lake sediment (sample MS-73-1) from a bedrock basin 9.7 km northeast of Ottawa, Ontario, in Gatineau Park, Quebec (45°28'04"N, 75°48'30"W), at an altitude of 162 m, water depth 20 m. A total of 300 cm of soft algal gyttja (which becomes very silty and clayey towards the base) overlies grey clay containing silt and sand layers, some pebbles, and minor organic matter. Collected 1973 by R.J. Mott with a Livingstone corer from the ice.

GSC-2014. Pink Lake, 132-136 cm 3270 ± 260
$\delta^{13}C = -33.6$ ‰

Algal gyttja (68 g wet) from core interval 132 to 136 cm.

GSC-2016. Pink Lake, 222-227 cm 7750 ± 170
$\delta^{13}C = -36.1$ ‰

Algal gyttja (66 g wet) from 222 to 227 cm below the sediment/water interface.

GSC-1956. Pink Lake, 295-300 cm 10 600 ± 150
$\delta^{13}C = -29.3$ ‰

Basal organic sediment (83 g wet) from depth 295 to 300 cm.

Comment (R.J. Mott): Pink Lake is below the maximum marine limit; therefore GSC-1956 is a minimum for isolation of the basin from the Champlain Sea. Pollen analysis revealed nine pollen zones which, from the base upwards, are: herb, aspen/poplar, spruce, pine, hemlock, birch/oak, hemlock/beech, pine/hardwoods, and postsettlement zones (Dickman et al., 1975). GSC-1956 also dates the herb-aspen/poplar boundary. GSC-2016 dates the pine-hemlock boundary and GSC-2014 the birch/oak – hemlock/beech boundary. No free carbonates exist in the sediments, but carbonates are present in the water and crystalline limestone bedrock that borders the lake. It was not possible to obtain a suitable sample from the beginning of the ragweed (**Ambrosia**) rise, marking a datable historic event, which would have provided an estimate of possible error due to the incorporation of old carbonates. NaOH leach omitted from the pretreatment of all samples. GSC-1956 and -2016 mixed with dead gas for counting. Date GSC-1956 based on one 3-day count in the 2-litre counter, GSC-2016 based on one 2-day count in the 2-litre counter, and GSC-2014 based on two 1-day counts in the 1-litre counter.

GSC-1416. Manitou Lake 2400 ± 220

Fine plant detritus at the contact between foraminifera-bearing clay and marl containing abundant freshwater molluscs, from a pit on the north shore of Manitou Lake, Gatineau County, Quebec (45°52'50"N, 75°53'30"W), at an altitude of ca. 140 m. Collected 1968 by E.D. Bickel, then at Ohio State University, Columbus, Ohio; now at Minot State College, Minot, North Dakota.

Comment (E.D. Bickel): The comment made with regard to GSC-1375 (this list) applies here also.

Comment (W. Blake, Jr.): The sample contains fragments of **Carex,** sp. and the moss **Drepanocladus exannulatus** (M. Kuc; unpublished GSC Bryological Report No. 54). NaOH leach omitted from sample pretreatment (only 1.7 g was available for burning). Sample mixed with dead gas for counting. Date based on one 1-day count in the 2-litre counter.

GSC-1375. Lac Laflamme 5980 ± 140

Plant detritus and in situ plant parts (sample DB68: II-37(A); 11.0 g) at the contact between foraminifera-bearing marine clay and marl containing abundant freshwater molluscs, from a pit on the shore of Lac Laflamme, Gatineau County, Quebec (45°46'54"N, 75°59'32"W), at an altitude of ca. 145 m. Collected 1968 by E.D. Bickel.

Comment (E.D. Bickel): The dated littoral marl deposit is much younger than the probable onset of freshwater conditions in Lac Laflamme basin. A long period of erosion or reworking of marine clay apparently occurred prior to the deposition of freshwater marl. Elevations and ages of Champlain Sea fossils in the Gatineau and Ottawa valleys suggest that basins above 140 m had emerged above sea level by ca. 11 000 years B.P. (Bickel, 1970).

Comment (W. Blake, Jr.): Only bark in the sample was submitted to the laboratory for dating. Date based on one 3-day count in the 5-litre counter.

Matagami/Fort George Road series

GSC-1959. Mile 363 6500 ± 90

Marine pelecypod shells (sample SJA/V-3; 28.2 g; **Mytilus edulis;** identified by J-S. Vincent), in situ with joined valves, from a roadcut (west side) at mile 363 (7 km south of LG-2 airport) of the road which joins Matagami to Fort George, Quebec (53°33'04"N, 77°40'19"W), at an altitude of ca. 175 m. Collected 1973 by J-S. Vincent.

Comment (J-S Vincent): Shells were collected from reworked material of the frontal moraine that parallels James Bay and extends from Lake Mistassini to Poste-de-la-Baleine; this moraine is composed of stratified ice contact material. The shells were in littoral sands containing lenses of silty clay, overlain by approximately 4 m of stratified sands and fine gravels. Date gives a very good approximation of the location and altitude of the regressing shoreline of Tyrrell Sea at that time (Vincent, 1977). Date based on two 1-day counts in the 2-litre counter.

GSC-2135. Mile 170 7360 ± 100

Marine pelecypod shells (sample VH-74-101; 22.3 g; **Hiatella arctica;** identified by J-S. Vincent), in situ with joined valves, from a roadcut (west side) at mile 170 (13 km north of the bridge that crosses Rupert River) of the road which joins Matagami to Fort George, Quebec (51°28'12"N, 77°25'50"W), at an altitude of ca. 205 m. Collected 1974 by V.K. Prest and J-S. Vincent.

Comment (J-S. Vincent): Shells were collected in silty marine clay which was overlain by 1.2 m of littoral sands and overlain by marine clay. The sample dates a water plane of the Tyrrell Sea situated a few tens of metres higher than the altitude of the collection site (Vincent, 1977). Due to the small sample size only the outer 10% was removed by HCl leach. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-2161. Mile 177 — 7120 ± 110; $\delta^{13}C = +0.6$ ‰

Marine pelecypod shells (sample VH-74-110; 11.0 g; **Clinocardium ciliatum**; identified by W. Blake, Jr.) embedded in marine clay exposed in a roadcut (west side) at mile 177 (14.5 km south of the bridge that crosses Pontax River) of the road that joins Matagami to Fort George, Quebec (51°36'30"N, 77°23'40"W), at an altitude of ca. 203 m. Collected 1974 by V.K. Prest and J-S. Vincent.

Comment (J-S. Vincent): Shells were collected at the base of a 1.2 m sequence of marine clay which was underlain by 15 to 60 cm of medium to coarse sand and by deformed Barlow-Ojibway glaciolacustrine clays resting on in situ glaciolacustrine clays. The sample dates a water plane of the Tyrrell Sea situated a few tens of metres higher than the altitude of the collection site (Vincent, 1977). Due to the small sample size only the outer 10% was removed by HCl leach. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

Ontario

GSC-2499. Cataraqui River — 3610 ± 60

A 7.6 cm diameter cored section through an apparent tree trunk or large branch (sample 7701043; 11.8 g; **Ulmus** sp. cf. **U. americana**; identified by L.D. Farley-Gill) was obtained from a site about 12 km offshore to the northwest of Belle Island in Cataraqui River near Kingston, Ontario (44°15'14"N, 76°28'46"W). The wood sample was located at the bottom of 1.3 m of peat and gyttja (water depth 1.5 m), in contact with the underlying glaciolacustrine sediment at an elevation of 2.5 m below Lake Ontario datum or 71.5 m a.s.l. Collected 1977 by S.K. Frape, Queen's University and submitted by J.R. Bowlby, Queen's University and T.W. Anderson.

Comment (J.R. Bowlby): The age is possibly indicative of drowning of a deciduous woodland in the Cataraqui embayment correlative with the late-Holocene lacustrine transgression in the Ontario basin. Differential isostatic uplift of the post-Iroquois low water level outlet sills within the St. Lawrence Valley caused the water level in the Ontario basin to rise relative to the rising land surface. In combination with outlet sill adjustments, there may have been a water level increase associated with the transfer of the upper Great Lakes (Late Nipissing Phase) discharge from the North Bay outlet to the Sarnia outlet. Date based on two 1-day counts in the5-litre counter.

GSC-1111. Cookstown Bog — 10 200 ± 150

Basal organics (sample A-1; 145 g damp) from a peat bog on the Algonquin lake plain, 7 km east-northeast of Cookstown, Ontario (44°13'20"N, 79°37'20"W); altitude of bog surface ca. 230 m. Basal 2.5 cm increments from each of four cores were obtained in 1968 with a piston corer (5 cm diam.) at a depth of 153.5 to 156.0 cm by P.F. Karrow, University of Waterloo, Waterloo, and T.W. Anderson.

Comment (P.F. Karrow and T.W. Anderson): The date provides a minimum age for the draining of glacial Lake Algonquin and approximates the spruce-pine transition in the pollen record (Anderson, 1971; Karrow et al., 1975). The date seems a trifle young, however, in relation to the regional pollen record. Pollen and plant macrofossils in the peat and the underlying clay-gyttja show a gradual succession from aquatic to semiaquatic to sedge-swamp environments and thus document the draining phase of Lake Algonquin. NaOH leach omitted from sample pretreatment. Date based on two 1-day counts in the 5-litre counter.

Ballycroy Bog series

Woody peat overlying a shelly marl-detritus-gyttja sequence in a kettle hole in Oak Ridges Moraine, 1.6 km south of Ballycroy, Ontario (43°57'15"N, 79°52'20"W), surface altitude ca. 290 m. Collected 1968 with a 5 cm diameter piston corer by T.W. Anderson and P.F. Karrow.

GSC-1146. Ballycroy Bog, 230-235 cm — 4220 ± 130; $\delta^{13}C = -25.5$ ‰

Fibrous peat (sample A-3; 109 g damp) from 230 to 235 cm depth (5 cm increments from two cores), above shelly marl.

GSC-1143. Ballycroy Bog, 604-609 cm — 10 900 ± 200

Basal gyttja (sample A-2; 14.2 g damp) from 604 to 609 cm depth (5 cm increments from two cores), underlying shelly marl and overlying silty clay.

Comment (P.F. Karrow and T.W. Anderson): The age determinations provide a dated pollen sequence from an upland bog with which to compare the pollen record and radiocarbon date from Cookstown Bog (cf. GSC-1111, this list) and the pollen record at Alliston on the Lake Algonquin plain. GSC-1143 dates the spruce-pine transition (which occurs within the Algonquin sediments at Alliston; cf. Anderson, 1971; Karrow et al., 1975), and GSC-1146 dates the hemlock pollen minimum. GSC-1143 seems slightly old when compared to regional information. NaOH leach omitted from the pretreatment of both samples. GSC-1143 mixed with dead gas for counting; date based on two 1-day counts in the 2-litre counter. GSC-1146 based on two 1-day counts in the 5-litre counter.

GSC-1681. Westdale Ravine, Hamilton — 4330 ± 210; $\delta^{13}C = -20.1$ ‰

Vertebrae and ribs of snakes (sample CSC-PFK; 87 g; **Coluber constrictor** – blue racer; **Elaphe obsoleta** – pilot black snake; and a few from **Crotalus horridus** – timber rattlesnake; identified by C.S. Churcher, University of Toronto, Toronto) from unconsolidated and consolidated bands of $CaCO_3$-cemented shore debris in Westdale Ravine, Churchill Park, Hamilton, Ontario (43°16'N, 79°54'W) at an altitude of 88 m. Collected 1970 and 1971 by P.F. Karrow, University of Waterloo, Waterloo, and C.S. Churcher.

Comment (C.S. Churcher): The date agrees with that previously estimated on the basis of the fauna (Churcher and Karrow, 1963), which suggested the climatic optimum. Date based on two 1-day counts in the 1-litre counter.

GSC-1149. Hofstetter Lake — 11 800 ± 230; $\delta^{13}C = -24.5$ ‰

Basal detritus gyttja (sample TB-68-37; 23 g) from 770 to 777 cm below the mud/water interface in Hofstetter Lake, 11.2 km southwest of Kitchener, Ontario (43°24'N, 80°36.7'W), at an altitude of ca. 365 m. The sample overlies coarse sand and underlies silty clay sand. The lake is situated in a closed depression on the outer limit of Till "H" (Karrow, 1971) of early Cary age. Collected with a modified Livingstone sampler in 1968 by R.J. Mott and T.W. Anderson.

Comment (T.W. Anderson): The date is useful in establishing the late-glacial pollen stratigraphy and chronology of southern Ontario. Preliminary pollen analysis shows that the sample is very high in **Picea** (spruce) pollen. NaOH leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter at 1 atm.

Innerkip Series

Detrital sapropel (organic mud) from a stream bank directly north of the new bridge over Timm's Creek, 3.2 km southwest of Innerkip, Ontario (43°10.5'N, 80°43'W), at an altitude of ca. 300 m. The sapropel is overlain by mollusc-bearing silt and fine sand, then silt to clay till. Pollen analysis (by J. Terasmae, Brock University) indicates subarctic conditions. Molluscs (P.F. Karrow, pers. comm.) in the overlying sediments indicate that the environment was the edge of a pond in a cool or cold interstadial climate. Macrofossils (M. Kuc), indicating mixed (both terrestrial and aquatic) nonarctic habitats, are reworked by water but not stream transported (unpublished GSC Bryological Report No. 245 and 265). Collected 1972 and 1973 by W.R. Cowan, Division of Mines, Ontario Ministry of Natural Resources, Toronto.

GSC-1884. Innerkip (I) >43 000

Sample (WD-341/24-28"; 252.6 g) from 60 to 70 cm below the top of the 90 cm thick organic unit and from approximately the same level as BGS-134b (33 230 ± 610 years).

GSC-2010. Innerkip (II) >42 000
$\delta^{13}C = -27.8$ ‰

Sample (WD-341-S; 304 g) taken from the top 2.5 cm of the organic unit and stratigraphically above BGS-134a (33 670 ± 830 years). After pretreatment 73 g of material was burned.

GSC-2010-2. Innerkip (III) >50 000

Part of the same sample used for GSC-2010 (183.0 g of treated sample WD-341-S remained; two batches of 74.8 g and 107 g were burned).

Comment (W.R. Cowan): Date GSC-2010-2 is one of the oldest for the middle Wisconsinan in southern Ontario (Terasmae et al., 1972; Dreimanis, 1973) and appears to fit earlier initiation of the Port Talbot Interstadial suggested by Dreimanis (1973).

Comment (W. Blake, Jr.): The second collection was made in 1973 in an attempt to resolve the discrepancy between GSC-1884 and the two age determinations made at Brock University (BGS-134a, BGS-134b); these three were published by Cowan (1975), and both GSC-1884 and -2010 were included in Cowan et al. (1975). Date GSC-1884 is based on one 4-day count in the 5-litre counter. Pretreatment of both GSC-2010 and -2010-2 included one hour hot NaOH leach and one hour hot HCl leach; GSC-2010 based on one 5-day count in the 5-litre counter and GSC-2010-2 based on three 1-day counts and one 3-day count in the 5-litre counter at 4 atm.

GSC-2046. Saugeen River (II) 5230 ± 100

Freshwater mollusc shells (sample K-10A; 12.5 g; including **Helisoma** sp; identified by P.F. Karrow) in silt 1.6 m below the top of a terrace on the north bank of Saugeen River at Southampton, Ontario (44°30'N, 81°20'W), at an altitude of ca. 186 m. Collected 1973 by P.F. Karrow, University of Waterloo, Waterloo.

Comment (P.F. Karrow): The terrace is at Nipissing level. A previous date on charcoal from a buried soil below silts at the same site gave a value of 6720 ± 250 years (GSC-1620; GSC XIII, 1973, p. 21). The silts were deposited in rising waters late in the Stanley-Nipissing transition or early in Nipissing I stage (three-outlet stage). This determination was carried out to check the usefulness of freshwater molluscs for dating.

Comment (W. Blake, Jr.): Due to the small sample size, only the outer 10% of shells was removed by HCl leach. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-2077. Port Talbot >43 000

Wood (sample $9^a/74$; 10.6 g; **Picea** sp.; identified by L.D. Farley-Gill) from a fresh exposure (after a storm) in a cliff along Lake Erie, 160 m northeast of the type locality of the Port Talbot Interstadial gyttja and 24 km southwest of St. Thomas, Ontario (42°37'15"N, 81°23'W), at an altitude of 175.5 m. The wood is in lacustrine sand ca. 1 m above lake level and 30 m below the cliff top; lenses of plant detritus from which wood was collected are above a subaqueous erosional unconformity separating the sand from the underlying Port Talbot Interstadial silt. Collected 1974 by A. Dreimanis, University of Western Ontario, London.

Comment (A. Dreimanis): The date provides confirmation that the sand is of Port Talbot Interstadial age. As the sample consists of detrital material, it probably does not date the end of the Port Talbot Interstadial interval; other dates from that interval range from 43 000 to 49 000 years (Dreimanis et al., 1966; Dreimanis, 1973).

Comment (W. Blake, Jr.): The age determination was carried out on the single largest piece of wood in the collection; this piece was 13.5 cm long and had a maximum diameter of 2.0 cm. One end and the stubs of branches were rounded, the other end was fractured. Date based on one 3-day count in the 5-litre counter.

GSC-2126. Plum Point 28 000 ± 370

Wood (sample $11\text{-}C^{111}\text{-}74$; 7.1 g; **Picea** sp; identified by R.J. Mott) from a fresh exposure in a cliff along Lake Erie, 28 km southwest of St. Thomas at Plum Point, Ontario (42°36'30"N, 81°23'40"W), at an altitude of 178 m. Wood is from the waterlaid Catfish Creek Drift ca. 100 m southwest of, and stratigraphically lower than, GrN-2625 (27 470 ± 130 years: Groningen X, 1972, p. 10). Collected 1974 by A. Dreimanis.

Comment (A. Dreimanis): The date is in good agreement with the oldest two Plum Point Interstadial dates: GrN-2625, 27 470 ± 130 years; and L-185, 28 200 ± 1500 years (cf. Dreimanis et al., 1966).

Comment (W. Blake, Jr.): Three pieces of wood were submitted; the age determination is based on the largest of the three: 11 cm long, 2.5 cm wide (maximum), and 1 cm thick. The clean wood was characterized by rounded and smoothed ends, implying transport, and the surface was covered by a network of cracks. Date based on one 4-day count in the 2-litre counter.

GSC-1904. Kincardine 10 800 ± 110

Wood (sample K-6; 6.5 g; **Picea** sp.; identified by R.J. Mott) from grey silt 6 m below the surface of a terrace of Penetangore River which is correlated with the main Algonquin lake level of the Huron basin. The site is 2.2 km south-southeast of Kincardine town hall, Ontario (44°09'N, 81°37'W), at an altitude of ca. 200 m. Collected 1972 by P.F. Karrow and F. Apon, University of Waterloo, Waterloo.

Comment (P.F. Karrow): The date is consistent with others (GSC-1126, 10 500 ± 150 years; GSC-1127, 10 600 ± 160 years; GSC-1842, 11 300 ± 140 years) from the same district for wood included in transgressive sediments of the main Lake Algonquin stage of Huron basin (Karrow et al., 1975).

Comment (W. Blake, Jr.): A cone fragment in the sample was determined to be **Picea mariana** by R.J. Mott (unpublished GSC Wood Identification Report No. 72-69). Date based on one 3-day count in the 2-litre counter.

Eighteen Mile River series

Riverbank exposures in a valley terrace, believed to be estuarine, formed in the mouth of a stream entering glacial Lake Algonquin, ca. 6 m below the regional Lake Warren plain (surface altitude ca. 190 m), 19.3 km southwest of Kincardine, Ontario. Collected 1968 by P.F. Karrow and T.W. Anderson.

GSC-1126. Eighteen Mile River, north — 10 500 ± 150

Wood (sample K-2; 15.0 g; **Picea** sp.; identified by R.J. Mott) in oxidized silt 3 m below the top of a terrace, north bank exposure, 91.4 m west of Highway 21 bridge (44°01'20"N, 81°42'40"W).

GSC-1127. Eighteen Mile River, south — 10 600 ± 160

Wood (sample K-1; 32.4 g; **Picea** sp.; identified by R.J. Mott) in peaty clay 3.6 m below the top of a terrace, south bank exposure, 61 m west of gravel road bridge (44°01'20"N, 81°43'40"W).

Comment (P.F. Karrow and T.W. Anderson): Both dates are on wood believed to be enclosed in Lake Algonquin sediments. Thus they provide a maximum age for the draining of glacial Lake Algonquin. Both dates also approximate the spruce-pine transition of the regional pollen record (Anderson, 1971). Macrofossil analysis of the peat reveals plant assemblages of upland, river and lake-marginal, and aquatic environments (Karrow et al., 1975). Paleobotanical evidence implies climatic conditions not unlike those in the northern Boreal Forest today. GSC-1126 based on one 3-day count and GSC-1127 based on one 2-day count, both in the 5-litre counter.

South Bay series

Samples of plant detritus and mollusc shells from two organic layers in silty clay from South Bay, Manitoulin Island, 3.2 km northeast of South Baymouth and 1.6 km east of McKim Bay, Ontario (45°34.9'N, 81°59.5'W); water depth at coring site, 13 m. Collected 1969 by C.F.M. Lewis with a 1200 lb. piston corer with 6.4 cm plastic liner. Stored wet in liner at 4°C until sampling. Submitted by C.I. Dell, then at Canada Centre for Inland Waters, Burlington.

GSC-1971. South Bay, 324.5 to 332.0 cm — 9260 ± 290

Mollusc shells (sample 69-2-01, PC-3-1; 3.6 g; unidentified) from the lower layer of plant detritus and shells, 324.5 to 332.0 cm below the sediment/water interface, at an altitude of 160.3 m. This organic layer is separated from the upper organic layer by about 50 cm of slightly silty clay.

Comment (C.I. Dell): The sample dates the emergence of South Bay during the fall in water level from the Lake Algonquin to the Lake Stanley stage in the Huron basin (Dell, 1975). A date of 10 150 ± 190 (GSC-1108), obtained for basal organic sediment from Tehkummah Lake near South Bay, is attributed to the same period of post-Algonquin falling water levels (Lewis, 1970). Due to the small sample size, HCl leach omitted from pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

GSC-1979. South Bay, 247.0 to 252.0 cm — 8310 ± 130

Plant detritus (sample 69-2-01, PC-3-2; 94.5 g wet) from the upper organic layer.

Comment (C.I. Dell): The sample dates a second episode of emergence at this site during the low-level Lake Stanley stage. NaOH leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-2186. Blackwell — 4660 ± 60
$\delta^{13}C = -27.2‰$

Charred wood (sample 113/52: 11.0 g; white oak group (**Quercus** sp.); identified by R.J. Mott) from 30 cm below the top of a clay unit exposed at the base of a cliff along the shore of Lake Huron, at Blackwell, Ontario (43°10'30"N, 82°19'W), at an altitude of ca. 175 m. The clay unit is overlain by 5.8 m of crossbedded sand and gravel (in a Nipissing beach bar) and 60 to 90 cm of dune sand. Collected 1952 by A. Dreimanis.

Comment (A. Dreimanis): The date is in good agreement with an earlier determination on the same log of 4650 ± 200 years (S-24; Saskatchewan II, 1960, p. 73-74). Encasement of the log in lacustrine clay at present lake level suggests that the water had risen well above the present level of Lake Huron prior to the deposition of the clay (cf. Dreimanis, 1958).

Comment (W. Blake, Jr.): The new age determination provides a useful check with one of the first dates produced by the Saskatchewan laboratory. Date based on one 3-day count in the 5-litre counter.

GSC-1749. St. Joseph Island — 5860 ± 140
$\delta^{13}C = -23.7‰$

Wood (sample St. Joseph No. 7; 11.6 g; **Thuja occidentalis** L.; identified by R.J. Mott) in a gravel pit at the south end of an esker on the west side of St. Joseph Island, 0.8 km east of Richardson Point, Ontario (46°11'N, 84°03.5'W), at an altitude of 187 m. Collected 1972 by M. Saarnisto, then at Brock University, St. Catharines, Ontario; now at the University of Oulu, Oulu, Finland.

Comment (M. Saarnisto): The wood is from the upper part of a 0.8 m thick wood and detritus layer (interpreted as being a lagoonal deposit) underlying gravel. The stratigraphic sequence is typical for deposits formed during the Nipissing transgression. The limit of the transgression is indicated by a well developed erosion shore above the site at an altitude of 194 m. The date is in harmony with the date of 5500 years B.P. for the Nipissing maximum (cf. Lewis, 1969). Date based on two 1-day counts in the 5-litre counter.

Prince Lake series

Gyttja and clay-gyttja from Prince Lake, 15 km west of Sault Ste. Marie, north of Highway 550 and 5 km north of Gros Cap, Ontario (43°36'N, 84°34'W), at an altitude of ca. 309 m; water depth ca. 4 m. Collected 1972 with a Livingstone corer by M. Saarnisto.

GSC-1919. Prince Lake, 9.31-9.45 m — 6160 ± 80

Gyttja (one 14 cm long increment from one core; ca. 115 g wet) from 5.31 to 5.45 m below the sediment/water interface. Date based on one 4-day count in the 2-litre counter.

GSC-1913. Prince Lake, 10.32-10.44 m — 9000 ± 110; $\delta^{13}C = -28.3‰$

Clay-gyttja (12 cm long increments from duplicate cores; ca. 175 g wet) from 6.32 to 6.44 m below the sediment/water interface. Date based on two 1-day counts in the 2-litre counter.

GSC-1715. Prince Lake, 10.80-10.85 m — 10 800 ± 360

Clay-gyttja (5 cm long increments from cores 4 and 6; ca. 100 g wet) from the basal organic sediment overlying clay. Date based on one 2-day count in the 2-litre counter.

Comment (M. Saarnisto): GSC-1715 is from the end of a local tundra zone beneath the spruce pollen zone. It postdates the deglaciation of the Sault Ste. Marie area and the fall of water level from a high Lake Algonquin stage. The date is supported by a date of 10 650 ± 265 years (Hel-400; Saarnisto, 1974, 1975) from nearby Upper Twin Lake. However, Upper Twin Lake, at a higher level, became isolated from Lake Algonquin earlier than did Prince Lake. This is documented clearly in the pollen stratigraphy, and therefore GSC-1715 seems to be a little too old. The sample had a very low organic content, clearly less than Hel-400. GSC-1913 (published earlier in uncorrected form, 9050 ± 110 years; Saarnisto, 1974, 1975) dates the end of the spruce zone in the local pollen stratigraphy. GSC-1919 allows the rate of sedimentation to be calculated for a quantitative pollen study. It seems to be, however, clearly too young, perhaps because of unsatisfactory sampling. NaOH leach omitted from the pretreatment of all three samples. Each sample mixed with dead gas for counting.

GSC-1731. Roller Lake — 5440 ± 150

Clay-gyttja (5 cm long increment from one core; 90 g wet) from the bottom sediments (18.61 to 18.66 m depth below lake surface) of Roller Lake on the west side of Highway 17, 1 km south of Michipicoten River, Ontario (47°54.5'N, 84°49'W), at an altitude of 210 m; water depth, 17 m. Collected 1972 by M. Saarnisto.

Comment (M. Saarnisto): The sample, 1.5 m below the sediment/water interface, dates the culmination of the Nipissing transgression in the Lake Superior basin. The date is in full agreement with the date of 5500 years B.P. for this event in the Lake Huron basin (cf. Lewis, 1969). NaOH leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

GSC-1851. Alfies Lake — 9070 ± 100; $\delta^{13}C = -33.6‰$

Gyttja (8 cm long increments from duplicate cores; 174 g wet) from basal organic sediment (6.10 to 6.18 m below the sediment/water interface) in Alfies Lake on the east side of Highway 17, 0.5 km south of the northern boundary of Lake Superior Provincial Park, Ontario (47°53'N, 84°52.5'W), at an altitude of 285 m; water depth, 10.1 m. Collected by M. Saarnisto.

Comment (M. Saarnisto): The date is a minimum for the deglaciation of the northeastern Lake Superior area and for the fall of a high level glacial lake; it also gives the age for the end of the spruce zone in the local pollen stratigraphy (cf. Saarnisto, 1974, 1975; in which GSC-1851 was published in uncorrected form, 9210 ± 100 years). It agrees closely with a date from similar stratigraphic position in Last Lake (GSC-1719, 9220 ± 180 years, this list). NaOH leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 5-litre counter.

GSC-1719. Last Lake — 9220 ± 180

Clay-gyttja (5 cm long increments from Wawa I cores C and E; 90 g wet) from the basal organic sediment (8.97 to 9.02 m below the sediment/water interface) in Last Lake on the east side of Highway 17, 1.5 km south of the northern boundary of Lake Superior Provincial Park, Ontario (47°52.5'N, 84°52'W), at an altitude of ca. 276 m; water depth, 4 m. Collected 1972 by M. Saarnisto.

Comment (M. Saarnisto): See GSC-1851, this list. NaOH leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-1906. Wolf Camp Lake — 7860 ± 80; $\delta^{13}C = -27.8‰$

Gyttja (8 cm long increments from duplicate cores; 315 g wet) from basal organic sediment (3.43 to 3.51 m below the sediment/water interface) in Wolf Camp Lake on the north side of Highway 17, ca. 8 km northwest of Marathon airfield, Ontario (48°48'N, 86°26'W) at an altitude of ca. 278 m; water depth, 10.0 m. Collected 1972 by M. Saarnisto.

Comment (M. Saarnisto): The sample dates the rise of white pine (**Pinus strobus**) in local pollen stratigraphy. NaOH omitted from sample pretreatment. Date based on two 1-day counts in the 5-litre counter.

Western Canada

Manitoba

Gods River series

GSC-1736. Gods River (I) — >41 000

Wood (sample KJ-57-72; 6.1 g; **Picea** sp.; identified by R.J. Mott) along the contact of silty peat and overlying till exposed in a bank along Gods River in the Hudson Bay Lowlands of northeastern Manitoba (56°09'N, 92°31'W), at an altitude of ca. 43 m. The peat bed is underlain by till and is overlain by two tills. Collected 1972 by J.A. Netterville; submitted by R.W. Klassen.

Comment (R.W. Klassen): The date and the stratigraphy suggest that the peat bed correlates with the Missinaibi peat beds of the southern Hudson Bay Lowlands (Klassen and Netterville, 1973; cf. Terasmae and Hughes, 1960).

Comment (W. Blake, Jr.): M. Kuc reports (unpublished GSC Bryological Report No. 185) that ecologically the mosses in the peat are a mixture of hydrophytes and xerophytes. Date based on one 3-day count in the 2-litre counter.

GSC-1742. Gods River (II) — 490 ± 140

Wood (sample KJ-58-72; 5.8 g; **Picea** sp.; identified by R.J. Mott) from a gravelly zone overlying the upper clayey till and underlying brown clay beneath recent peat at the same locality as GSC-1736. Collected 1972 by J.A. Netterville; submitted by R.W. Klassen.

Comment (R.W. Klassen): This sample was thought to predate the brown clay considered to be associated with the last marine inundation of this area some 7000 years ago. The age of the wood indicates that the sample was not in place. Sample mixed with dead gas for counting. Date based on one 1-day count in the 2-litre counter.

GSC-1955. Gods River (III) — 6610 ± 100

Marine shells (sample KJ-84 (a & b)-73; 18.0 g; **Mytilus edulis**; identified by W. Blake, Jr.) from a sandy zone 2 to 5 m below the edge of the bank of Gods River, ca. 19 km upstream of its junction with Hayes River in the Hudson Bay

Lowlands, northeastern Manitoba (56°15'N, 92°45'W), at an altitude of ca. 75 m. Collected 1973 by J.A. Netterville; submitted by R.W. Klassen.

Comment (W. Blake, Jr.): The date is compatible with other age determinations on Holocene marine shells from the southwest side of Hudson Bay (cf. Craig, 1969). Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-1745. Lower Hayes River 4890 ± 140

Wood (sample KJ-56-72; 12.0 g; **Picea** sp.; identified by R.J. Mott) from alluvial sand taken 8.2 m below the edge of the bank of Hayes River in the Hudson Bay Lowlands, northeastern Manitoba (56°45'N, 92°42'W), at an altitude of 21 m. Collected 1972 by J.A. Netterville; submitted by R.W. Klassen.

Comment (R.W. Klassen): The date indicates that this part of Hayes River valley is considerably less than 5000 years old (Klassen and Netterville, 1973). Date based on two 1-day counts in the 5-litre counter.

GSC-1738. Recluse Lake 6490 ± 170

Peat (sample KJ-23-72; 21.5 g wet) at the bottom (basal 10 cm core increment) of a perennially frozen bog 1.8 m thick over a clay-veneered till plain adjacent to the upper reaches of Little Churchill River, 88 km northwest of Gillam, Manitoba (56°52'N, 95°47'W), at an altitude of ca. 185 m. Collected 1972 by R.W. Klassen.

Comment (R.W. Klassen): The sample was dated to obtain a more precise time for the drainage of Lake Agassiz in this region and to determine the rate of bog development (Klassen and Netterville, 1973). The age indicates that Lake Agassiz had drained from this area more than 6500 years ago and that the bog developed at a rate of ca. 0.3 m/1000 years. NaOH leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-1958. Kiskitto Lake 4500 ± 120

Peat (sample KJ-30-73; ca. 38 g wet) at the bottom of a perennially frozen bog, 2.6 m thick, forming part of an extensive organic blanket over a lacustrine clay plain north of Lake Winnipeg, Manitoba (54°36'N, 98°34'W), at an altitude of ca. 213 m. Collected 1973 by R.W. Klassen.

Comment (R.W. Klassen): The sample was dated to obtain a more precise time for the drainage of Lake Agassiz in this region and to determine the rate of bog development. The age obtained indicates either that the sample was contaminated or that the bog began to develop long after Lake Agassiz had drained (ca. 8500 years ago); the former is considered most likely. NaOH leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

GSC-1679. Minago Ridge 8310 ± 180

Mollusc horizon containing **Lampsilis radiata** (sample T13K; 13.1 g; identified by R. Green, University of Manitoba, Winnipeg, and A.H. Clarke, Jr., then at National Museum of Natural Sciences, Ottawa; now at Smithsonian Institution, Washington, D.C.) in gravel 3.2 m below ground surface and overlain by coarse beach gravels and windblown silty sand. Sample is from a fresh exposure, 1.6 km east of Highway 6 and south of Minago River, Manitoba (54°10'N, 98°50'W), at an altitude of ca. 245 m. Collected 1971 by S. Ringrose, Manitoba Department of Mines and Natural Resources, Winnipeg.

Comment (S. Ringrose): The date is derived from the lowest known shoreline of Lake Agassiz, which suggests that a minimal terminal date for the draining of Lake Agassiz may coincide more closely with GSC-92 (7720 ± 120 years; marine shells southwest of Churchill; GSC III, 1964, p. 170) than with GSC-896 (8530 ± 220 years; marine shells; GSC IX, 1970, p. 64; cf. Elson, 1967, 1971; Ringrose, 1975).

Comment (W. Blake, Jr.): Only a single broken valve (6+ cm long, 4 cm high) of **Lampsilis radiata** was submitted to the laboratory; it was clean, with no pitting or encrustations, but was chalky and flaky in nature. Due to the small sample size only the outer 5% was removed by HCl leach. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

Duck Mountain series

A 465 cm long core of lake mud from a shallow (1.5 m) unnamed pond in Duck Mountain Provincial Park, Manitoba, tp. 31, rge. 25 (51°39'N, 100°50'W), at an altitude of 700 m. Core collected 1971 by J.C. Ritchie, Scarborough College, University of Toronto.

GSC-1629. Duck Mountain, K3-B 1960 ± 130

Organic lake mud (sample K3-B; 11.7 g burned) at 185 to 202 cm below sediment/water interface; in pollen zone III, dominated by **Picea** (12 to 20%), **Pinus** (6 to 10%), **Betula** (40%), and **Alnus** (20%).

GSC-1625. Duck Mountain, K3-D 4140 ± 140

Organic lake mud (sample K3-D; 40 g wet) at 322 to 338 cm level, in pollen zone II, dominated by **Betula** (50 to 70%), and nonarboreal pollen types (20 to 30%).

GSC-1611. Duck Mountain, K3-F 5310 ± 130

Organic lake mud (sample K3-F; 84.3 g wet) at 455 to 470 cm level, in pollen zone I, dominated by nonarboreal pollen with the exception of one sample (at 460 cm) which had 28% **Picea**.

Comment (J.C. Ritchie): The pollen stratigraphy suggests that this section is truncated below and that roughly 6000 years of sedimentation is absent (Ritchie, 1976). The status of this sample remains uncertain until further sampling has been done.

Comment (W. Blake, Jr.): NaOH leach omitted from the pretreatment of all three samples. GSC-1611 based on one 3-day count in the 5-litre counter; GSC-1625 based on one 1-day count in the 5-litre counter; and GSC-1629 based on one 1-day plus two 1-day counts in the 5-litre counter.

Alberta

GSC-2038. Mariana Lake 11 300 ± 110
$\delta^{13}C = -26.2$ ‰

Basal laminated clayey gyttja (sample MS-73-14; 105 g wet) from 695 to 700 cm below the sediment surface of Mariana Lake, ca. 106 km south-southwest of Fort McMurray, Alberta (55°57'N, 112°01'W), at an altitude of ca. 700 m. Calcareous grey clay, 700 cm below the sediment/water interface in 6 m of water, is overlain by laminated clayey gyttja and algal gyttja. Mariana Lake occupies an elongated depression in an area of hummocky glacial deposits, probably altered somewhat by wave action in the glacial lake that covered the area following deglaciation (Mott, 1974). Collected 1973 by R.J. Mott.

Comment (R.J. Mott): The date is a minimum for emergence of the basin from the glacial lake. The presence of carbonates in the basal sediments raises the possibility that the date may be somewhat anomalous due to the hard water effect. Sample mixed with dead gas for counting. Date based on one 3-day count in the 5-litre counter.

GSC-2162. Longview 10 600 ± 100

Freshwater gastropod shells (sample JJ-RCD-2; 48.5 g; **Stagnicola elodes;** identified by A.H. Clarke, Jr.) obtained from a roadcut 11.2 km west of Longview, Alberta (50°32'30"N, 114°22'30"W), at an altitude of 1320 m. The sample was collected 1.5 m below the surface. Most adhering silt was removed by ultrasonic treatment in distilled water. Collected 1974 by L.E. Jackson.

Comment (L.E. Jackson): The shell-bearing horizon is situated in an apparently filled-in kettle depression in an area of hummocky moraine. The sample was obtained about 1 m above the contact between the base of the silts infilling the former depression and the top of the underlying till. The date is significant in that it places a minimum age on the deglaciation of the foothills segment of Highwood Valley (Jackson, 1977). No other dates are available.

Comment (W. Blake, Jr.): In addition to the ultrasonic treatment mentioned by the submitter, the spires of all individuals making up this collection were broken off to remove the adhering silt which remained. The shells, mainly aragonite but with less than 10% calcite, were given the normal 20% leach with HCl. Date based on one 2-day count in the 5-litre counter.

GSC-2219. Seebe 7690 ± 110

Charcoal (sample JJ-RCD-1; 4.48 g) obtained from an artificial exposure 150 m downstream from Barrier Dam above the right bank of Kananaskis River, 8 km south of Seebe, Alberta (51°02'30"N, 115°03'00"W), at an altitude of 1370 m. The sample was collected 2 m below the surface and ca. 20 m above the bed of Kananaskis River in 1974 by L.E. Jackson.

Comment (L.E. Jackson): The charcoal was obtained from the lowest of a series of fire bands apparently buried in floodplain deposits. The Mazama volcanic ash is located ca. 0.5 m above the charcoal. The dated horizon and the Mazama ash supply time markers by which the recurrence intervals of major forest fires during the period ca. 8000 to 6000 years B.P. may be estimated (Jackson, 1977). Pretreatment included cold NaOH leach for 5 minutes. Sample mixed with dead gas for counting. Date based on one 3-day count in the 5-litre counter.

GSC-2459. Columbia Icefield 6170 ± 100

Charcoal (sample UWO-AB13; 3.7 g) from a 2 cm thick organic horizon of a buried paleosol (Orthic Regosol), at a depth of 104 cm, exposed in a roadcut along the Banff-Jasper Highway and 200 m south of the Icefields Chalet, Jasper National Park, Alberta (52°12'30"N, 117°09'00"W), at an altitude of ca. 2027 m. Collected 1976 by A.J. Bowyer; submitted by R.H. King (both at the University of Western Ontario, London).

Comment (R.H. King): The horizon containing the sample is underlain by a slightly weathered, 4 cm thick layer of Mazama ash. GSC-2459 is therefore a minimum date for the Mazama ash in this area. The exposure also contains the St. Helens Y ash (2 cm thick at a depth of 64 cm) and the Bridge River ash (3 cm thick at a depth of 43 cm), together with a complex stratigraphic sequence comprising six buried paleosols and a number of stratified colluvial deposits, some of which also contain volcanic ash. The identity of the ashes has been confirmed by a comparison of the results of electron microprobe analyses on volcanic glass shards with published data. The stratigraphy of the section is described in detail in Bowyer (1977). NaOH leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-1998. Dollar Lakes 10 200 ± 110

Basal organic sediment (sample MS-73-7A; 40 g wet) from 1363 to 1368 cm below the sediment surface of one of Dollar Lakes, ca. 28 km north of Valleyview, Alberta (55°10'N, 117°12'W), at an altitude of ca. 640 m. Grey, silty clay 1368 cm below the sediment/water interface in 8.5 m of water is overlain by 5 cm of black organic debris and marl and 1363 cm of organic sediment including black and brown gyttja, black laminated gyttja, and laminated buff and brown marl and gyttja. The Dollar Lakes are two small circular lakes that appear to be kettle holes in an area of hummocky ground moraine. The site is below the limit of the glacial lake that covered the area following deglaciation and the subdued character of the terrain may be due to wave action in the glacial lake (Mott, 1974). Collected 1973 by R.J. Mott.

Comment (R.J. Mott): The date is a minimum for isolation of the Dollar Lakes and dates the beginning of organic deposition. Despite the presence of carbonates in the sediments the date seems reasonable, but palynological analysis will be required to assess its validity. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

GSC-2004. Sulphur Lake 11 000 ± 200
$\delta^{13}C = -31.8‰$

Basal laminated clayey gyttja, marl, and clay (sample MS-73-13; 73 g wet) from 1207 to 1215 cm below the sediment surface of Sulphur Lake, ca. 82 km northwest of Peace River, Alberta (56°43'N, 118°19'W), at an altitude of ca. 755 m. Stiff clay 1215 cm below the sediment/water interface in 8 m of water is overlain by 1215 cm of black laminated gyttja that is clayey towards the base with some clay and marl layers. Sulphur Lake occupies a bedrock depression that may have been formed in part by glacial activity and glacial deposits (Mott, 1974). Collected 1973 by R.J. Mott.

Comment (R.J. Mott): The date is a minimum for deglaciation of the area. The presence of carbonates raises the possibility that the date may be anomalous due to the hard water effect. Sample mixed with dead gas for counting. Date based on one 2-day count in the 2-litre counter.

British Columbia

GSC-2163. Yale 7490 ± 70

Small pieces of charred wood (sample F123AW; 11.5 g) from a gravel pit on Highway 1, 2.1 km south-southwest of Yale, British Columbia (49°32'40"N, 121°26'12"W), at an altitude of 92 m. The sample is from coarse sand and gravel in a raised fan delta. Collected 1974 by J.E. Armstrong from 25 cm behind the face of a fresh exposure.

Comment (J.E. Armstrong): Before submitting this material for radiocarbon dating the writer had hoped it would help explain conditions in Fraser Valley at the time that it was occupied by native people following the withdrawal of the ice or the sea. However, as C.E. Borden has reported a midden 9000 ± 150 years old (S-113; Saskatchewan III, 1962, p. 77; cf. Borden, 1960) several kilometres to the north at approximately the same elevation, the question is still not answered. The writer believes that the fan delta was deposited in standing water, suggesting that a lake existed in the area 7500 years ago; however, this conclusion cannot be

supported by geomorphological evidence. Sample pretreatment included 5 minutes cold NaOH leach. Date based on one 3-day count in the 5-litre counter.

GSC-2230. Chilliwack >34 000

Marine shell fragments (sample F76AS; 17.8 g) from the Bailey disposal and gravel pit, 7 km south-southeast of Chilliwack, British Columbia (49°06'20"N, 121°55'20"W), at an altitude of 46 m. The sample is from glaciomarine clayey silt, below but within 15 m of a mammoth(?) tusk locality, overlain by Sumas Drift. Collected 1974 and 1975 by J.E. Armstrong within 20 cm of the surface of a fresh exposure.

Comment (J.E. Armstrong): The >34 000 date obtained on these shells once again proves that lithologic correlations in the Fraser Lowland can be most misleading. As the overlying sand, gravel, and till belong to the Sumas Stade (11 000 to 11 400 years B.P.), the marine clayey silt at the base of the section was considered most likely to be part of the Fort Langley Formation (11 400 to 13 000 years B.P.), for these clayey silts are lithologically similar to many of those included in the Fort Langley Formation. The >34 000 date indicates that a major unconformity exists between the marine clayey silts and the overlying Sumas Drift. This site lies on the southern border of a deep valley (300+ m) filled with fine sediments believed to be mainly marine and glaciomarine. Prior to obtaining this date the writer tentatively had correlated all these fine sediments with the Fort Langley Formation; however, it is now evident that some (probably most) are pre-Vashon in age. A mammoth(?) tusk, lying in the marine clayey silts, was found at the same site by E. Livingston (Water Investigations Branch, Victoria) and collected by E.C. Halstead (Environment Canada, Vancouver). A tentative correlation of the marine clayey silts with Semiahmoo Drift may be made. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

GSC-2193. Websters Corner 12 900 ± 170

Mya truncata L. and **Mya** sp. shell fragments (sample F95A-shells; 12.9 g; identified by W. Blake, Jr.) from a gravel pit 6.5 km north-northwest of Whonnock, British Columbia (49°13'57"N, 122°29'37"W), at an altitude of 154 m. The sample is from stony clayey silt in a late Wisconsin raised marine delta deposited against ice. Collected 1974 and 1975 by J.E. Armstrong from the surface of a fresh exposure.

Comment (J.E. Armstrong): The sample is from the highest elevation at which preserved shells have been found in the Fraser Lowland, and it dates an early stage in the first emergence of the area above the sea (cf. Mathews et al., 1970; Clague, 1975). At this site a probable marine terrace is found at approximately 195 m a.s.l., and it is believed to represent the maximum post-Vashon submergence immediately following the retreat of Vashon ice. This raised delta was deposited against drumlinized Vashon ground moraine, cf. GSC-2177 (12 000 ± 100 years; this list), which is believed to represent a later stage in the first emergence of the land.

Comment (W. Blake, Jr.): The collection also contains **Hiatella arctica, Serripes groenlandicus, Macoma** sp., and **Balanus** sp. The aragonitic **Mya** shells used for dating were chalky and soft; only a few fragments of periostracum remained. The largest whole **Mya** valve was 3.8 cm long. Due to the small sample size only the outer 5% was removed by HCl leach. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

Langley series

GSC-1697. Langley (I) >40 000

Wood (sample ECH 1970-1; 7.1 g; **Pinus contorta – ponderosa** type; identified by L.D. Farley-Gill) from a drillhole 6 km north of Langley, British Columbia (49°08'50"N, 122°40'00"W), at an altitude of ca. 36 m. The cable-tool method was used, and the sample was dumped with a bailer from 36 m depth. Collected 1970 by E.C. Halstead, Environment Canada, Vancouver.

Comment (J.E. Armstrong): This sample occurred in probable glaciomarine stony clayey silt below what may be Vashon Drift (late Wisconsin) and above a second drift unit. It was submitted in the hope of determining the possible age of both the interdrift glaciomarine sediments and the older drift. The >40 000 year date is inconclusive except to prove for the first time that some of the sediments encountered in drillholes are much older than originally suspected. The possibility of the wood originating from material below the second drift cannot be discounted. Armstrong suggests that the second drift unit may be Semiahmoo (mid or early Wisconsin), which is thought to be older than 62 000 years based on QL-194 (^{14}C determination by M. Stuiver, University of Washington, Seattle; cf. Armstrong and Hicock, 1976). GSC-2230 (>34 000 years; this list) is on marine shells from exposed clayey silt 56 km to the east of GSC-1697. The sediment units from which these samples were collected are probably stratigraphic correlatives.

Comment (W. Blake, Jr.): The sample (dry) was 8.5 cm long, 3 cm maximum diameter. The grain of the wood was very contorted, and the sample was rounded at one end. The outside wood and adhering clay were scraped off. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

GSC-2067. Langley (II) >40 000

Wood (sample 1A-1973; 11.2 g; **Abies** sp.; identified by L.D. Farley-Gill) from a drillhole 8 km northwest of Langley, British Columbia (49°11'04"N, 122°40'56"W), at ca. 115 m below sea level. The cable-tool method was used, and the sample was dumped with a bailer from 125 m depth. Collected 1973 by E.C. Halstead; submitted by J.E. Armstrong.

Comment (J.E. Armstrong): This sample is from proglacial(?) sand below till which is overlain by 105 m of marine and glaciomarine sediments. It was submitted in the hope of determining whether the drift is Vashon (late Wisconsin) or older. GSC-1697 (this series) occurred below two drift units 3.2 km to the southeast of this sample and also gave a value of >40 000 years. Correlation of GSC-1697 with the upper or lower drift unit was uncertain and has not been resolved by the >40 000 year date for GSC-2067. If correlation is to be made the most likely is with Semiahmoo Drift (mid or early Wisconsin).

Comment (W. Blake, Jr.): Only the largest piece of wood in the sample was utilized for dating; it was 10 x 2 x 1 cm and slightly curved. Pebbles were imbedded in the exterior, and the wood was hard and brittle. All outside wood and pebbles were removed. Date based on one 3-day count in the 5-litre counter.

Coquitlam Valley series

GSC-2094-2. Coquitlam Valley (I) >49 000

Wood (sample F12AW-1; **Picea** sp.; identified by L.D. Farley-Gill) from a gravel pit 5 km north of Port Coquitlam, British Columbia (49°18'45"N, 122°46'45"W), at an

altitude of 114 m. The sample is from an organic silt layer in a nonglacial unit overlying glaciofluvial(?) cobble-gravel and underlying two glacial sequences. Collected 1974 by J.E. Armstrong from an exposure a few years old. Two determinations were made:

GSC-2094. >44 000
Date based on one 4-day count in the 5-litre counter; sample weight, 12.1 g.

GSC-2094-2. >49 000
Pretreatment (for new material so as to add to gas of GSC-2094) included leaches for one hour in hot NaOH and hot HCl. Date based on three 1-day and one 3-day counts in the 5-litre counter at 4 atm. Weight of additional wood, 27.3 g.

Comment (J.E. Armstrong): The organic silt layer forms part of a nonglacial unit consisting of rusty sand, silt, and minor gravel. This unit is probably the equivalent of the Highbury sediments which occur below Semiahmoo Drift and which are believed to be early Wisconsin or Sangamon in age. The only other sample from beneath deposits of two major glaciations in the Fraser Lowland that has been dated is from the Upper Levels Highway cut in North Vancouver (49°18'N, 123°03'W), and it yielded a value of >52 300 years (GSC-555; GSC VI, 1967, p. 18).

Comment (W. Blake, Jr.): Both determinations are on a single curved, flat piece of wood, rounded at both ends, measuring 39 x 6.5 x 3.0 cm. All wood was removed from the cracked surface of the sample. Some of the blackish part of the wood appeared coaly and brittle.

GSC-2203. Coquitlam Valley (II) 21 600 ± 200

Wood (sample FAB154W; 11.2 g; **Picea** sp.; identified by L.D. Farley-Gill) from the surface of a fresh exposure in a gravel pit on Pipeline Road, 6.5 km north of Port Coquitlam, British Columbia (49°19'49"N, 122°46'38"W), at an altitude of 190 m. The sample is from Quadra Sand, 15 to 20 m below its contact with Vashon Drift. Collected 1975 by J.E. Armstrong.

Comment (J.E. Armstrong): At this locality the sediment correlated with Quadra Sand is about 100 m thick. The date of 21 600 ± 200 years is from the top 20 m, and the age of the sediments towards the base of the unit is unknown; it is possible that some of the sand may be pre-Quadra. In this pit Quadra (or older?) Sand overlies well bedded silt containing wood. These relations can be traced into the next gravel pit to the south where a sample of wood from the silt dated >49 000 years (GSC-2094-2; this list; also Armstrong and Hicock, 1976). In this latter pit the silt lies beneath two glacial sequences.

Comment (W. Blake, Jr.): This age determination is similar to a number of others on wood in Quadra Sand (cf. Clague, 1976, 1977). A single piece of wet wood, 24 cm long and 3.5 cm in diameter, was used for dating; on drying, its weight decreased from 97.7 to 34.7 g. Some bark was still adhering. Date based on one 3-day count in the 5-litre counter.

GSC-2297. Coquitlam Valley (III) 17 800 ± 150

Wood (sample FAB168W; 7.8 g; **Abies** sp. (fir); identified by R.J. Mott) from the surface of a fresh exposure in a natural slide gully 7 km north of Port Coquitlam, British Columbia (49°20'15"N, 122°46'41"W), at an altitude of 214 m. The sample is from rhythmically bedded silts containing scattered boulders which overlie thinly bedded sand and underlie 43 m of rhythmically bedded silt and fine sand; the latter unit is overlain by till and lag gravel. Collected 1976 by S.R. Hicock; submitted by J.E. Armstrong.

Comment (S.R. Hicock and J.E. Armstrong): This date is from near the base of a 50 m thick glaciolacustrine silt sequence and probably marks the lower limit of the Vashon Stade for this area. The silt probably was deposited in a glacial lake occupying Coquitlam Valley when it was dammed by Vashon ice about 18 000 years ago.

Comment (W. Blake, Jr.): The age determination is based on a single piece of weathered wood in which the more resistant parts, such as knots, stood out in relief. Encrusting silt was scraped off; the wet wood measured 19.5 x 2.0 x 1.5 cm before drying in an electric oven. Date based on one 3-day count in the 5-litre counter.

GSC-2177. Coquitlam 12 000 ± 100

Marine shells (sample F14AS: 34.0 g; **Saxidomus giganteus;** identified by A.H. Clarke, Jr.) from the corner of Pine Tree Way and Racetrack Road, Coquitlam, British Columbia (49°17'38"N, 122°47'14"W), at an altitude of 69 m. The sample is from laminated fine sandy silt in a late glacial raised marine delta overlying Vashon Drift. Collected 1974 by J.E. Armstrong from the surface of a fresh exposure.

Comment (J.E. Armstrong): The date helps to establish deglaciation patterns in relation to sea level changes in the Fraser Lowland. Since the Vashon ice retreated, the area has undergone two major submergences and subsequent emergences by the sea (cf. Mathews et al., 1970). This shell sample is found in material believed to represent part of the first emergence. The materials form part of the Capilano Sediments (Armstrong and Hicock, 1976).

Comment (W. Blake, Jr.): Only a single intact valve, 7.5 cm long and 5.2 cm high, was submitted to the laboratory for dating. The adhering clay/silt was scraped off; these aragonitic shells retained both periostracum and internal lustre. Only the outer 10% of shell was removed by HCl leach. Date based on one 3-day count in the 5-litre counter.

GSC-2228. North Burnaby >43 000

Wood (sample FAB151W_1; 11.5 g; identified by L.D. Farley-Gill) from Chevron Oil Refinery tank site on the northwest side of Capitol Hill, north Burnaby, British Columbia (49°17'30"N, 122°59'28'W), at an altitude of 50 m. The sample, from the surface of a fresh face, is from a wood-bearing silty fine sand layer overlain by 7 m of sand and gravel, which in turn is overlain by what has been mapped as Vashon till (late Wisconsin). The silty sand overlies Tertiary bedrock which occurs 5 m below the sample site. Collected 1975 by S.R. Hicock; submitted by J.E. Armstrong.

Comment (J.E. Armstrong and S.R. Hicock): This date presents the same problem in interpretation as many others in the Fraser Lowland. It may represent the lower part of the Cowichan Head Formation or it may be from pre-Cowichan Head sediments. Other localities in the Fraser Lowland also have yielded infinite dates, which may be correlatives of this date, from sediments below one drift unit (cf. Armstrong and Clague, 1977).

Comment (W. Blake, Jr.): Two wood samples were included in the collection; W_1, the dated sample, was fresh appearing, whereas W_3 was lignitized, with conchoidal fractures. W_1 had the bark intact and was 47 cm long and 5.6 cm in diameter; on drying in an electric oven its weight decreased from 463 to 287 g. Date based on one 3-day count in the 5-litre counter.

Northern Canada, Mainland and Offshore Islands

Yukon Territory

GSC-1804. Road River 1960 ± 60

Peaty organic material with woody remains (sample WP21; 250 g wet; **Sphagnum** sp., wood, bark, roots, leaf fragments, **Potamogeton** sp; identified by M. Kuc) taken from beneath the present active layer of an earth hummock. The sample site was on the Peel Plateau just north of Road River, Yukon Territory (66°50'N, 135°23'W) on the upper slope of a morainal knoll at an altitude of ca. 380 m. Collected 1972 by W.W. Pettapiece, Alberta Institute of Pedology, Soil Survey, University of Alberta, Edmonton.

Comment (W.W. Pettapiece): The date indicates that formation of the earth hummock, a cryogenic process, had taken place more than 1900 years ago. It also implies that once formed, an earth hummock may be a relatively permanent entity (Pettapiece and Zoltai, 1974; Pettapiece, 1975). NaOH leach omitted from sample pretreatment. Date based on two 1-day counts in the 5-litre counter.

Palmer Lake (south) series

Organic samples from within and below a silty earth hummock on a 1.5 degree pediment slope in the unglaciated region about 15 km south of Palmer Lake, Yukon Territory (66°05'N, 136°17'W), at an altitude of ca. 455 m. Collected 1972 by W.W. Pettapiece and S.C. Zoltai.

GSC-1861. Palmer Lake (I) 3210 ± 50

Organic silt (sample WP60; 185 g) in the centre of an earth hummock. Pretreatment included 5 minutes cold NaOH leach. Date based on two 1-day counts in the 5-litre counter.

GSC-2006. Palmer Lake (II) 3920 ± 50

Organic silt (sample WP63; 158.5 g) from the base of the active layer, at ca. 50 cm depth beneath an earth hummock. Pretreatment included 5 minutes cold NaOH leach. Date based on one 2-day count in the 5-litre counter.

GSC-2018. Palmer Lake (III) 11 200 ± 100

Organic silt (sample WP62; 195 g) from a continuous peaty horizon below an earth hummock (10 cm below GSC-2006) and having no indication of cryoturbic activity. NaOH leach omitted. Date based on two 1-day counts in the 5-litre counter.

Comment (W.W. Pettapiece): The presence of a continuous organic horizon, with a date of 11 200 ± 100 years (GSC-2018) and underlying a cryoturbed silty surface, supports the hypothesis of widespread loessal deposition in the unglaciated region. The fact that this lower horizon is continuous suggests that cryogenic processes were not active at the time of development. The date of 3920 ± 50 years (GSC-2006) is interpreted as representing the onset of cryogenic activity in the loessal veneer, and the date of 3210 ± 50 years (GSC-1861) from the centre of the hummock suggest some stability in the structure (cf. Pettapiece and Zoltai, 1974).

GSC-2037, Palmer Lake (east) 500 ± 180

Woody remains (sample WP72; 6.5 g) encased in almost pure ice at a depth of 105 cm below the top of an earth hummock. The sample site was about 2 km east of Palmer Lake, Yukon Territory (66°10'N, 136°21'W), at an altitude of 610 m. Collected 1972 by W.W. Pettapiece.

Comment (W.W. Pettapiece): The earth hummock was developed in weathered shale in the unglaciated area. The sample was collected from below the present active layer, and the young date is interpreted as indicating the activity of cryogenic processes. Because the upper soil appears relatively stable it also may indicate that the hummocks almost "float" on the icy upper surface of the permafrost table (Mackay, 1958).

Comment (W. Blake, Jr.): Some of the woody remains had the type of bark typical of **Betula glandulosa** (M. Kuc, unpublished GSC Bryological Report No. 274), and at least one piece of coniferous wood (not used for dating) was present in the sample (R.J. Mott, unpublished GSC Wood Identification Report No. 74-25). Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

Whitefish Lake series

Organic samples from a thick peat deposit at Whitefish Lake, Yukon Territory (67°08'N, 137°25'W), at an altitude of ca. 335 m. Collected by W.W. Pettapiece.

GSC-1874. Whitefish Lake, 245-250 cm 2500 ± 60

Undecomposed and uncompressed sphagnic peat (sample WP120b; 33 g) from 245 to 250 cm depth. An aquatic form of **Sphagnum cuspidatum** is dominant; minor constituents are **Carex** sp. and the mosses **Polytrichum strictum** and **Drepanocladus exannulatus** (M. Kuc, unpublished GSC Bryological Report No. 237).

GSC-1829. Whitefish Lake, 425-450 cm 9530 ± 170

Wood (sample WP120a; 2.15 g; identified as **Salix** sp. by R.J. Mott) from a depth of 425 to 450 cm in black humic basal peat (frozen) overlying lacustrine silts. Fragments of **Picea** sp. needles and **Betula** sp. bark also occur in the sample (M. Kuc, unpublished GSC Bryological Report No. 216).

Comment (W.W. Pettapiece): Whitefish Lake is in a proglacial lake basin and the basal date of 9530 ± 170 years (GSC-1829) should be a minimum date for lake drainage and the beginning of organic accumulation. The fibric sample (GSC-1874) was taken at the base of the "raw" peat section (below this the material was well decomposed), characterized by rapid peat buildup and a very low rate of humification. This is interpreted as representing the encroachment of permafrost into the deposit, suggesting that it is a post-Hypsithermal phenomenon (Pettapiece and Zoltai, 1974). GSC-1829 mixed with dead gas for counting; date based on one 3-day count in the 2-litre counter. GSC-1874 based on two 1-day counts in the 5-litre counter.

Old Crow Flat series

Organic materials within the upper sedimentary sequence in the "square" lakes section of the Old Crow Flats, Yukon Territory (67°54'N, 139°26'W), at an altitude of 305 m. Collected 1972 by W.W. Pettapiece.

GSC-2236. Old Crow Flats, 57-60 cm 4380 ± 120

Twigs from mesic organic material (sample WP121b; 2.9 g) at the base of the surface organic layer, 57 to 60 cm below the surface and ca. 2 m above present lake level.

GSC-2225. Old Crow Flats, 175 cm 6020 ± 140

Small woody plant fragments (twigs) from a black organic layer (sample WP123; 4.1 g), at a depth of 175 cm. This layer is overlain by 115 cm of organic silt and overlies clay.

Comment (W.W. Pettapiece): The "square" lakes in this area appear to be cyclic in nature with many stages apparent at any one time. GSC-2225 underlies 115 cm of organic silts, such as presently are being deposited in these lakes, and lies on a few centimetres of sand over clays which could be glaciolacustrine. This date could represent a minimum date for drainage of the Old Crow basin; but whether this is true or not, it does represent the beginning of a lake cycle. GSC-2236, which overlies the organic silts, marks the end of this particular lake cycle, which was followed by lake drainage, the encroachment of permafrost, and the development of an organic surface horizon — all stages which can be found in the area. That particular lake cycle lasted 1500 years, and the next cycle is underway through active erosion (thermal and wave action) around the perimeter of the present lake. Both samples mixed with dead gas for counting; each date based on two 1-day counts in the 2-litre counter.

GSC-2066. Locality 44, Old Crow >54 000

Wood (sample CR-71-29; 47.8 g; **Picea** sp.; identified by L.D. Farley-Gill) from the upstream end of the bluff at locality 44, Old Crow River, Yukon Territory (68°13.0'N, 140°00'W), at an altitude of ca. 365 m. The sample, which consisted of two pieces of wood (only one was used for dating), was collected from a wood-bearing sandy layer containing shells, ca. 3.7 m above the level of Old Crow River and above the basal clay unit exposed at the site (cf. Lichti-Federovich, 1973). The wood-bearing sand is overlain, in succession, by ca. 18.2 m of brown and grey banded clayey silts, an unknown thickness of laminate lacustrine clay, 5.8 m of yellow-brown silt, and 0.6 m of organic material at the surface. Collected 1971 by C.R. Harington, National Museum of Natural Sciences, Ottawa.

Comment (C.R. Harington): The date is consistent with an estimated Sangamon interglacial age for the fossil zone at Locality 44, and it suggests a possible Illinoian age for the basal clay unit underlying the fossil layer. Horse (**Equus** sp.) and mammoth (**Mammuthus** sp.) bone samples from the fossil zone yielded radiocarbon dates of >39 900 years (I-4233, I-4288; Harington, 1977). Samples of unidentified wood and of spruce (**Picea** sp.) from the same layer yielded radiocarbon dates of >39 900 years (I-3572; Harington, 1977) and >44 000 years (GSC-1593; Lichti-Federovich, 1973), respectively. The date is a minimum age for in situ plant, invertebrate, and vertebrate fossils.

Comment (W. Blake, Jr.): The single piece of wood used for dating was dry, with a fractured surface at the time of submission. It was more than 26 cm long and had a maximum diameter of 5.5 cm; the surface was rusty coloured, and one (if not both) end plus the stubs of branches exhibited some rounding. Date based on three 1-day counts and one 3-day count in the 5-litre counter at 4 atm.

Northwest Territories

Hendrickson Island series

Samples of exposed lake sediments from a section of a collapsed pingo near the northwest coast of Hendrickson Island, Northwest Territories (69°32'N, 133°35'W). The section consists of 160 cm of indistinctly layered, peaty lake mud overlying a bed of sand of unknown thickness and capped by 20 to 30 cm of terrestrial tundra peat. The top of the section is at an altitude of ca. 6 m. Collected 1972 by H. Hyvärinen, University of Helsinki, Helsinki, Finland. Finland.

GSC-1905. Hendrickson Island, 45-50 cm — 3140 ± 60; $\delta^{13}C = -26.5$ ‰

Lake mud (sample 66/MCK-72; 60.5 g dry) from 45 to 50 cm depth below the top of the section and 20 cm below the lake mud/tundra peat contact. Near the base of zone IV, uppermost birch-dominated assemblage.

GSC-1970. Hendrickson Island, 85-90 cm — 3160 ± 60; $\delta^{13}C = -26.4$ ‰

Lake mud (sample 65/MCK-72; 54.5 g dry) from 85 to 90 cm depth. Middle of zone III, birch-alder-spruce assemblage.

GSC-1960. Hendrickson Island, 125-130 cm — 6820 ± 80; $\delta^{13}C = -24.2$ ‰

Lake mud (sample 64/MCK-72; 54.5 g dry) from 125 to 130 cm depth. Zone III/II transition, rise of alder.

GSC-1896-2. Hendrickson Island, 175-180 cm (mud) — 9340 ± 80; $\delta^{13}C = -25.9$ ‰

Lake mud (sample 63/MCK-72; 76.0 g — total original sample) from 175 to 180 cm depth. Zone I, basal birch maximum before the appearance of spruce.

GSC-1896. Hendrickson Island, 175-180 cm (shells) — 9060 ± 100; $\delta^{13}C = +3.0$ ‰

Lake mud sample as above, from 175 to 180 cm depth. The date is based on freshwater shells in the dark brown peaty lake mud.

Comment (H. Hyvärinen): GSC-1970 is stratigraphically inconsistent and apparently does not date the horizon intended; contamination with recent material from above is suspected. The rest of the dates agree with other dates for corresponding pollen horizons from nearby mainland sites and confirm the dating for the regional vegetational sequence previously established (Ritchie and Hare, 1971; Ritchie, 1972; Hyvärinen and Ritchie, 1975). Date GSC-1905 suggests an age between 2000 and 3000 years B.P. for the initiation of pingo growth at the site.

Comment (W. Blake, Jr.): Sample GSC-1896 first was treated with H_3PO_4 in the "shell apparatus"; GSC-1896-2 is based on the organic residue from the same sample, which was treated the same as the three other lake mud samples. GSC-1896 mixed with dead gas for counting; this date, as well as GSC-1905 and -1970, is based on two 1-day counts in the 5-litre counter. GSC-1896-2 is based on one 3-day count and GSC-1960 is based on one 2-day count, both in the 5-litre counter.

GSC-2207. Pasley River >33 000

Wood fragments (sample BNA-74-116; 3.75 g; probably **Salix** sp.; identified by visual inspection by R.J. Mott) in fine quartz sand 2 to 10 cm behind the face of a fresh exposure on the south side of Pasley River and 19 km from its mouth, northwestern Boothia Peninsula, Northwest Territories (70°25'N, 95°33'W), at an altitude of ca. 78 m. Collected 1974 by J.A. Netterville.

Comment (K.A. Drabinsky, now with Ministry of the Environment, Province of British Columbia, Victoria): The sample was obtained from 1 to 1.5 m above the lower of two tills, near the base of a nonglacial sequence consisting of 10 m of thinly bedded fine sand overlain by 7 m of massive to thickly bedded fine to medium sand and minor gravel. The sample provides a minimum date for retreat of the ice from the earlier advance.

A nearby collection of marine shells (sample BNA-74-118; 4.0 g; **Hiatella arctica**; identified by W. Blake, Jr.) was obtained from an exposure located between two stratigraphic control sections 50 m apart. A composite section reveals at least 7 m of till overlain by 40 cm of varved sediments, 26 m of nonglacial interbedded sand, silt, and minor gravel, and an upper till unit ca. 1 to 1.5 m thick. The shells, on the basis of amino acid ratios determined by G.H. Miller (INSTAAR, University of Colorado, Boulder, Colorado) are estimated to be >100 000 years old (AAL-22).

Comment (W. Blake, Jr.): The sample utilized for dating was a single right-angle shaped piece (root?) of **Salix** sp.; maximum thickness, 2.8 cm; lengths of the two arms, 5 cm and 6 cm. The bark was still attached to the sample. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

GSC-2522. Hayes River, north-central Keewatin — 980 ± 70

Organic, peaty material (sample TST-76-24a; 95 g) collected from a pit in a presently active eolian area (25 km^2) on the south side of a tributary to Hayes River, 68 km south-southeast of Darby Lake, Northwest Territories (67°12'45"N, 92°05'10"W), at an altitude of ca. 230 m. A well developed soil profile (peaty phase of a Brunisol; C. Tarnocai, Canada-Manitoba Soil Survey, Winnipeg, pers. comm., 1977) is overlain by 60 cm of eolian sand and silt. The sample, representing the Ao horizon, has been raised to a depth of 34 cm by cryoturbation. Collected 1976 by R.D. Thomas.

Comment (R.D. Thomas): The date gives a maximum age for the initiation of the presently active eolian processes (cf. Thomas, 1977). Moreover, since the soil horizon is within 3 m vertically of the tributary river, the date is also a minimum age for the end of downcutting of Hayes River. A minimum cryoturbation rate of 2.65 mm/year also can be deduced from this date. NaOH leach omitted from sample pretreatment. Date based on two 1-day counts in the 5-litre counter.

Comment (C. Tarnocai): It seems likely that this soil developed in a moist meadow-like situation which could have been periodically wet, and thus minimal peat development occurred on the surface.

GSC-1849. Gilmour Island — 6760 ± 80
$\delta^{13}C = -24.7‰$

Marine algae (sample JTA & GF 16-66 (GBL-277-66); 70 g, which includes some sand) with shells in a stream-cut bank on Gilmour Island, Ottawa Islands, Northwest Territories (59°50'N, 80°00'W), at an altitude of ca. 33 m. The algae are from near the base of an 8 m thick sand unit which is overlain by a 9 m thick unit comprising foreset beds. Collected 1966 by J.T. Andrews and G. Falconer, both then with the Geographical Branch, Department of Energy, Mines and Resources, Ottawa.

Comment (W. Blake, Jr.): The marine algae, among which **Sphacelaria plumosa** was the most abundant species (Illman et al., 1972), are slightly older than **Mytilus edulis** shells from the same unit (GSC-1024; 6450 ± 140 years; Andrews and Falconer, 1969; GSC XI, 1971, p. 308). Sample mixed with dead gas for counting. Date based on two 1-day counts in the 5-litre counter.

GSC-1530. Akpatok Island — 6900 ± 480

Marine pelecypod shell fragments (sample R-1966-1; 2.0 g) from the ground surface (mud boils in beach gravel) near the west coast of Akpatok Island, Northwest Territories (60°26.5'N, 68°19'W), at an altitude of ca. 82 m. Collected 1966 by B. Robitaille, then with Ministère des richesses naturelles, Québec; submitted by W. Blake, Jr.

Comment (W. Blake, Jr.): The shells were the highest found by the submitter on Akpatok Island. The sample submitted to the laboratory comprised fragments derived from a single pelecypod valve, probably **Mya truncata** (judging by its size and the nature of the shell material), although neither the hinge nor the truncated end was present. The date shows that the west coast of Akpatok Island, together with nearby Ungava Bay, was free of glacier ice by the time these molluscs lived, i.e., some time between ca. 7400 and 6400 years ago; cf. GSC-2311, 6270 ± 100 years old (this list), shells from the west side of Ungava Bay at ca. 105 m. Due to the small sample size the HCl leach was omitted. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

Northern Canada, Arctic Archipelago

Baffin Island

GSC-2026. Pritzler Harbour — 9380 ± 790
$\delta^{13}C = +1.7‰$

Brachiopod shells (sample BS-12-65; 2.15 g; **Hemithyris psittacea**; identified by W. Blake, Jr.) from the southeast shore of an unnamed lake 0.5 km north of the head of Pritzler Harbour, Baffin Island, Northwest Territories (62°10'N, 67°22'W), at an altitude of <3 m. Collected 1965 by W. Blake, Jr.

Comment (W. Blake, Jr.): The sample was dated to determine whether the shells were of Holocene age (the large error term is because the sample was extremely small). Pelecypod shells and shell fragments are abundant on the hills to the east of Pritzler Harbour up to an altitude of at least 180 m, and an age determination on one sample (mainly fragments of **Hiatella arctica**) gave a value of 34 800 ± 1100 years (GSC-426; Blake, 1966; GSC VI, 1967, p. 180); examination of other valves of **Hiatella arctica** from the same collection with regard to their amino acid ratios suggested an age of >40 000 years (AAL-150; G.H. Miller, INSTAAR, pers. comm., 1976). The dated brachiopods indicate that this part of the coast of Hudson Strait was free of glacier ice by sometime between roughly 10 000 and 8600 years ago. Due to the small size of the sample the HCl leach was omitted. Sample mixed with dead gas for counting. Date based on one 1-day count, and two separate 2-day counts in the 1-litre counter.

GSC-1641. Eclipse Sound — 5680 ± 170

Marine pelecypod shells (sample G.M-R.-1971; 26.9 g; **Mya truncata**; identified by W. Blake, Jr.) from fine sand and silt in a section exposed along the coast at the Saatut site (PeHa-1) on the west side of Eclipse Sound, Baffin Island, Northwest Territories (72°44'N, 80°14'W), at an altitude of 0 to 35 cm above high tide level. The silt and sand unit is more than 1 m thick and is overlain by sand and gravel. Collected 1971 by Father G. Mary-Rousseliere, Pond Inlet; submitted by G. Falconer, Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa.

Comment (W. Blake, Jr.): It was hoped that the date would provide information on the chronology of deglaciation in the Eclipse Sound area (cf. Hodgson and Haselton, 1974), but the sample is much younger. Other species present include **Hiatella arctica, Serripes groenlandicus, Clinocardium ciliatum,** and **Macoma calcarea.** The sample used for dating comprised five intact pairs of **Mya truncata,** with periostracum in good condition; all were between 4 and 5 cm in length. Date based on two 1-day counts in the 2-litre counter.

Somerset Island

GSC-2272. Fury Beach — 9310 ± 90
$\delta^{13}C = +1.4‰$

Marine shells (sample NJ-75-142; 26.7 g; **Mya truncata**; identified by W. Blake, Jr.) from a sand horizon (and from colluvium less than 2 m downslope of the sand horizon) beneath the surface of a marine sand and silt deposit which is interpreted as being deltaic, 3 km inland from Fury Beach, east-central Somerset Island, Northwest Territories

(72°49'10"N, 92°01'00"W), at an altitude of ca. 90 m (estimated accuracy, ± 10 m). Collected 1975 by J.A. Netterville.

Comment (J.A. Netterville): The dated sample is one of several shell collections from marine sediments at about 90 m above sea level along the east coast of Somerset Island. At many localities along the coasts of northern Somerset and Prince of Wales islands the 90 m contour appears to coincide with the elevation of the highest well developed fossiliferous marine beaches. Lithostratigraphic continuity between the beaches at 90 m elevation cannot be demonstrated. Chronostratigraphic correlation is, as yet, unproven.

Comment (W. Blake, Jr.): The aragonitic shells of **Mya truncata** that were utilized comprised both whole valves and fragments; the largest intact valve was 4.3 cm long and 3.1 cm high. The shells were somewhat chalky and had relatively little internal lustre, but no pitting or encrustations were noted, and all valves retained fragments of periostracum. The dominant species in the collection was **Hiatella arctica;** some **Balanus** sp. also was present. Date based on one 3-day count in the 2-litre counter.

GSC-2339. Stanwell-Fletcher Lake area — 6280 ± 80

Basal moss sedge peat (sample NJ-75-97d; 32 g dry) from a depth of 135 cm in a dissected peat bog in a small stream valley, approximately 8 km north of the mouth of the main river entering (from the north) Stanwell-Fletcher Lake, Somerset Island, Northwest Territories (72°58'N, 94°57'W), at an altitude of ca. 208 m. The peat, moderately decomposed, in permafrost, and overlying gravelly silty sand, was from the central part of a high-centre polygon; the intervening troughs were deeply eroded. Collected 1975 by S.C. Zoltai, Canadian Forestry Centre, Edmonton, and V. Woo, University of Manitoba, Winnipeg; submitted by J.A. Netterville.

Comment (S.C. Zoltai): The date indicates the time that organic accumulation was initiated. As peat accumulation in the area is very slow to nil under present climatic conditions, the sampled peat probably was formed under warmer and possibly wetter conditions than those prevailing at present. A sample from a depth of 32 cm was dated at 6070 ± 100 years (BGS-337). Sample pretreatment included 5 minutes cold NaOH leach. Date based on two 1-day counts in the 5-litre counter.

Cornwallis Island

GSC-1623. Mecham River — 8540 ± 170; $\delta^{13}C = +2.0$ ‰

Marine pelecypod valves (sample McCann-71-200; 9.2 g; **Mya truncata;** identified by W. Blake, Jr.) from the ground surface in silt/sand on the south flank of a small knoll, 10 to 15 m west of Mecham River, Cornwallis Island, Northwest Territories (74°44'N, 94°42'W), at an altitude of 70 ± 15 m (based on the 1:250 000 topographic map, with a contour interval of 100 feet). Collected 1971 by J.G. Cogley, then at McMaster University, Hamilton; now at Trent University, Peterborough; submitted by S.B. McCann, then at McMaster University, Hamilton; now at Atlantic Geoscience Centre, Dartmouth.

Comment (W. Blake, Jr.): Although Cogley's (1975) study dealt with surface runoff, not chronology, the sample is important in that it provides the first truly reliable age determination on marine shells from Cornwallis Island. Shells collected in 1962 from the slopes of Signal Hill, some 6 km to the southwest, were fragments from the ground surface; in some cases, at least, it seems certain that mixing of fragments of different ages has occurred (Blake, 1970). The present sample consisted of a single intact pair of **Mya truncata,** 4.5 cm long and 3.5 cm high; some periostracum still remained on both valves, as well as some greenish stain, probably due to algae. The sample was washed in distilled water to remove the adhering silt/sand, then dried in an electric oven. Most of the greenish material was scraped off; due to the small sample size only the outer 5% was removed by HCl leach. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

Ellesmere Island

South Cape Fiord series (II)

Driftwood and whale bone from the west side of South Cape Fiord, Ellesmere Island, Northwest Territories. Collected 1970 by W. Blake, Jr.

GSC-1748. South Cape Fiord, whale rib, 80.5 m — 9070 ± 90; $\delta^{13}C = -16.8$ ‰

Rib (sample BS-70-228; 1005 g) of a whale, probably **Balaena mysticetus** (determined by C.R. Harington, National Museum of Natural Sciences, Ottawa), from beach gravel on the west side of South Cape Fiord, Ellesmere Island, Northwest Territories (76°25.6'N, 85°03'W), at an altitude of 80.5 m. The entire rib, one of several plus numerous vertebrae at the site, was over 2 m in length.

GSC-1748-2. South Cape Fiord, whale rib, 80.5 m — 8940 ± 90; $\delta^{13}C = -17.1$ ‰

A second determination on the same rib and utilizing an unused portion of the original sample.

GSC-1912. South Cape Fiord, wood, 21.0 m — 5220 ± 80; $\delta^{13}C = -22.7$ ‰

Driftwood log (sample BS-70-222; 12.1 g; **Larix** sp.; identified by R.J. Mott) over 1 m long imbedded in beach gravel on the west side of South Cape Fiord, Ellesmere Island, Northwest Territories (76°25.7'N, 85°00'W), at an altitude of 21.0 m.

Comment (W. Blake, Jr.): These age determinations supplement those reported earlier (GSC XI, 1971, p. 314-315; GSC XIII, 1973, p. 42), and together they permit construction of an emergence curve for the outer part of South Cape Fiord (Blake, 1975a, 1975b). Determination GSC-1748-2, for which the KOH method described in the Introduction to this paper was used, shows good agreement with GSC-1748. Each of the three dates is based on two 1-day counts in the 5-litre counter.

GSC-1656. St. Patrick Bay — 28 100 ± 380

Vascular plants and mosses (sample FG-10-1971 (JHE); 128 g) in foreset beds of finely laminated sand at the marine limit delta 5 km northwest of St. Patrick Bay, Ellesmere Island, Northwest Territories (81°50'N, 64°25'W), at an altitude of ca. 60 m. Collected 1971 by J.H. England; then at the University of Colorado, Boulder, Colorado; now at the University of Alberta, Edmonton.

Comment (J.H. England): All plant remains, except Salix, are considered to be in situ (M. Kuc, unpublished GSC Bryological Report No. 141). Some **Salix** fragments may be of Tertiary or infinite age and are intermixed with younger organic debris causing contamination (W. Blake, Jr., pers. comm., 1972). Tertiary wood fragments have been observed in northern Ellesmere Island (Christie, 1967), and some fragments in the sample appear rounded by transport. Although the sample may not be contaminated, further sampling must be carried out to fix the age of this delta system (cf. England, 1976).

Comment (W. Blake, Jr.): In the Bryological Report referred to above, M. Kuc listed 18 species of mosses and stated, "Paleoecologically, it is a heterogeneous bio-product resulting from a mosaic growth composed of xerophytes and hydrophytes. It develops on alluvium and near streams on stony, loose substrates and low elevated surfaces with a variable microrelief (several flat pebbles still had attached minute colonies of mosses)." This type of material would be derived from "mesic tundra". Because an age of 5500 to 7500 years was expected by the submitter, a second examination of the sample was undertaken by M. Kuc; in addition to the wood with rounded ends referred to above in the comment by J.H. England, bits of brittle wood approaching the consistency of lignite or coal were present, as were a few bits of amber and some poorly preserved parts of plants which are not typical arctic species. Thus there is a valid reason for suspecting that the 28 000 year age for this sample may not represent the age of the delta; in this connection it should be noted that Tertiary rocks outcrop on either side of St. Patrick Bay (Christie, 1976; Christie and Rouse, 1976). Date based on one 3-day count in the 5-litre counter.

Amund Ringnes Island

Amund Ringnes Island series

Marine shells from three locations on Amund Ringnes Island.

GSC-1391. Amund Ringnes (I) 8430 ± 170

Fragments of barnacles (sample Bentley-2; 13.6 g; **Balanus** sp.; identified by W. Blake, Jr.) from the ground surface ca. 0.8 km east of the present coast, northwestern Amund Ringnes Island, Northwest Territories (78°34'30"N, 97°58'W), at an altitude of ca. 35 m (based on a helicopter altimeter). Collected 1968 by N. Bentley, Ottawa; submitted 1970 by W. Blake, Jr.

Comment (W. Blake, Jr.): These shells were the highest seen by Bentley on Amund Ringnes Island, and the date is similar to others on the highest Holocene marine features in the Sverdrup Islands (Blake, 1970); cf. also a date of 8370 ± 200 years (GSC-1846) on **Astarte borealis** from 32.5 ± 5 m on southern Ellef Ringnes Island (GSC XVI, 1976, p. 16). Recently Hodgson (1977) has reported a date of 8900 ± 140 years (GSC-2386; corrected value, 8940 ± 140 years) for **Mya truncata** shells at 43 m on King Christian Island. Due to the small sample size only the outer 10% was removed by HCl leach. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-1834. Amund Ringnes (II) 2900 ± 270

Random loose bivalves (sample 72BAA168; 4.0 g) collected from the slightly undulating bedrock surface (Jurassic-Cretaceous Deer Bay Formation) on the east flank of an unnamed piercement dome, northwestern Amund Ringnes Island, Northwest Territories (78°35'N, 98°04'W), at an altitude of ca. 65 to 70 m. Collected 1972 by H.R. Balkwill.

Comment (H.R. Balkwill): No geological explanation is apparent for the discrepancy in age between this sample and GSC-1391 (8430 ± 170 years, this series), collected nearby. Due to the small sample size only the outer 10% was removed by HCl leach. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-1973. Amund Ringnes (III) 7710 ± 120

Barnacle shells (sample RV72-4-525B; 27.2 g, **Balanus balanus**; identified by W. Blake, Jr.) from a nearly flat bedrock surface approximately 10 km north-northwest of Cape Ludwig, southeastern Amund Ringnes Island, Northwest Territories (78°02'N, 95°14'W), at an altitude of ca. 30 m. Collected 1972 by J.K. Roy; submitted by H.R. Balkwill.

Comment (H.R. Balkwill): Shells were abundant on this lowland surface, which is widely developed in southern Amund Ringnes Island (Roots, 1963; Balkwill et al., 1974).

Comment (W. Blake, Jr.): The sample also contained many whole valves of **Hiatella arctica**, some whole **Astarte borealis**, and a few fragments of **Mya truncata**. The good preservation of the barnacle fragments (sharp edges), and with some intact bases and terga, suggests that no transport has occurred; some of the capitula exceeded 3 cm in length. Date based on two 1-day counts in the 2-litre counter.

Borden Island

GSC-1844. Borden Island >43 000

Peat (sample FG-64-206A; 56.0 g) from ca. 1.8 m below the surface of a post-Beaufort terrace approximately 19 km south of Cape Malloch in the northern part of Borden Island, Northwest Territories (78°35'N, 110°40'W), at an altitude of ca. 27 m. Collected 1964 by J.G. Fyles; submitted 1973 by W. Blake, Jr.

Comment (W. Blake, Jr.): It was hoped to obtain data on the chronology of deglaciation, as no age determinations were available from Borden Island; however, the compact peat is far older. Over 20 species of mosses have been identified in the sample (M. Kuc, unpublished GSC Bryological Report No. 222); frequent species, representing dry tundra, include **Campylium polygamum, Distichium capillaceum** or **D. hagenii, Ditrichum flexicaule, Orthothecium chryseum, Pogonatum capillare,** and **P. alpinum** (cf. Blake, 1974). Date based on one 3-day count in the 5-litre counter.

Banks Island

Eolian series

GSC-2119. Thomsen River 3790 ± 90

Willow wood (sample VH-74-055; 4.8 g; **Salix** sp.; identified by L.D. Farley-Gill and M. Kuc) from a natural section on the left bank of Thomsen River, approximately 3 km north of its confluence with Muskox River, Banks Island, Northwest Territories (73°50'40"N, 119°49'W), at an altitude of ca. 25 m. The accumulation of willow underlies 6 m of organic-rich windblown sands and directly overlies alluvial sands and gravels of the lower terrace of Thomsen River. Collected 1974 by J-S. Vincent.

Comment (J-S. Vincent): The age determination provides a minimum age for the accumulation of eolian sands in this locality as well as a minimum age for abandonment of the lower terrace of Thomsen River (Pissart et al., 1977). The average rate of accumulation of the eolian sands is 1.55 to 1.62 mm/year. Because the surface of the lower terrace is only a few centimetres above the present bankfull stage, the date implies that limited incision has occurred in this reach of the river since ca. 4000 years ago. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

Comment (W. Blake, Jr.): The sample used for dating comprised the single largest stem plus two other stems; maximum diameter ca. 1.5 cm (while damp), length 10+ cm.

GSC-2242. Bernard River 5800 ± 180

Twigs in peat (sample VH-74-038; 2.0 g) from a natural section on the right bank of Bernard River, approximately 21 km south of the major elbow of this river, Banks Island, Northwest Territories (73°14'30"N, 121°40'W), at an altitude

of ca. 60 m. The 40 cm thick peat accumulation underlies 2 m of organic-rich windblown sands and gravels of the lower terrace of Bernard River. Collected 1974 by J-S. Vincent.

Comment (J-S. Vincent): The age determination provides a minimum age for the accumulation of eolian sands as well as a minimum age for abandonment of the lower terrace of Bernard River (Pissart et al., 1977). Since considerable deflation had occurred on the surface of the eolian accumulation, the average rate of accumulation is a minimum and varies from 0.33 to 0.36 mm/year. Because the surface of the lower terrace is only a few centimetres above present bankfull stage, the date implies that limited incision has occurred in this reach of the river since ca. 6000 years ago. NaOH leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on two 1-day counts in the 2-litre counter.

GSC-2419. Sachs River 8430 ± 120

Stem fragments in peat (sample VH-74-028c; 60 g) from a natural section in a gully incised in glacial outwash sediments, approximately 10 km east of Sachs Harbour, Banks Island, Northwest Territories (72°58'25"N, 124°57'45"W), at an altitude of ca. 12 m. The peat accumulation underlies 3.5 m of organic-rich windblown sands and overlies fine glacial outwash sands. Collected 1974 by J-S. Vincent and R.D. Thomas.

Comment (J-S. Vincent): This age determination provides a minimum age for the accumulation of eolian sands that followed deposition of the glacial outwash. The average rate of accumulation of the eolian sands is 2.37 to 2.44 mm/year. NaOH leach omitted from sample pretreatment. Date based on two 1-day counts in the 2-litre counter.

Masik River valley series

GSC-1525. Masik River valley (I) 9730 ± 150

Peat (sample KUC-69-Masik-2; 215 g dry) from a natural old exposure on the south side of Masik River, ca. 12 km east-northeast from its mouth and 67 km southeast of Sachs Harbour, Banks Island, Northwest Territories (71°34.5'N, 123°29'W), at an altitude of ca. 25 m. The sample, from ca. 8 m above river level and ca. 4 m below the top of the section, is from the base of the organic accumulation at this site; it overlies dark unstratified mud with pebbles. Collected 1969 by M. Kuc, then with Geological Survey of Canada.

Comment (W. Blake, Jr.): The twiggy rhizome peat, which was dry when collected, was composed of mesic tundra plants: **Carex** sp., **Hippuris vulgaris, Salix** sp., **Calliergon** sp., **Drepanocladus** sp., **Campylium** sp., **Drepanocladus** sp., and **Scorpidium scorpioides** (Kuc, 1973). The date is similar to two other determinations on another peat sample from Masik River valley, collected by J.G. Fyles in 1960: GSC-4, 10 190 ± 120 years (GSC I, 1962, Table 1, p. 15) and I(GSC)-185, 10 600 ± 320 years (Isotopes II, 1962, p. 37-38). Date based on one 3-day count in the 5-litre counter.

GSC-2078. Masik River valley (II) >16 000

Moss stems (sample MS-68; 1.2 g) extracted from woody and herbaceous plant remains in sand/silt/gravel from ca. 10 m below the surface in an area of intermorainic fill ca. 80 km south-southeast from Sachs Harbour, Banks Island, Northwest Territories (71°33'30"N, 123°24'30"W), at an altitude of 230 to 275 m. Collected 1968 by M. Kuc; submitted 1974.

Comment (M. Kuc): The moss stems were immersed in distilled water for one night after extraction from sand. Later they were washed in distilled water and then were boiled slowly for ca. 6 hours until the moss bodies started to disintegrate. This procedure effectively removed adhering silt and sand, and the moss stems remaining represented approximately 1% of the sample by weight.

Comment (W. Blake, Jr.): The sample, from a site ca. 200 m above Masik River and ca. 20 m below the surface of the adjacent moraines, was expected to be more than 10 000 years old; peat in the bottom of Masik River valley is 9730 ± 150 years old (GSC-1525; this list). NaOH leach omitted due to small sample size; only 0.8 g remained (dry) after the pretreatment with HCl and distilled water rinses. Sample mixed with dead gas for counting. Date based on one 3-day count in the 2-litre counter.

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