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GEOLOGICAL
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OF
CANADA

DEPARTMENT OF ENERGY,
MINES AND RESOURCES

PAPER 73-7

GEOLOGICAL SURVEY OF CANADA
RADIOCARBON DATES XIII

J. A. Lowdon and W. Blake, Jr.

Price, $2.00

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FOREWORD

The present date list, GSC XIII, is the second 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 GSC VII to XI (1968 to 1971) were reprinted with the same pagination.

CONTENTS

	Page
Abstract/ Résumé	vii
Introduction	1
Acknowledgments	5
Geological samples	6
Eastern Canada	6
Newfoundland	6
Prince Edward Island	9
Nova Scotia	10
Quebec	11
Ontario	19
Western Canada	22
Manitoba	22
Saskatchewan	23
Alberta	24
British Columbia	24
Northern Canada, Mainland	28
Yukon Territory	28
Northwest Territories – District of Mackenzie	31
Northern Canada, Arctic Archipelago	37
Baffin Island	37
Devon Island	38
Ellesmere Island	40
Axel Heiberg Island	43
Melville Island	44
Banks Island	45
Beaufort Sea	46
Alaska	47
England	47
References	48
Index	60

Tables

Table 1.	Monthly background for period October 1, 1971 to December 31, 1972	2
2.	Monthly standard for period October 1, 1971 to December 31, 1972	3
3.	Comparison of results from different counters	4
4.	Effect on sample age obtained by varying length of counting time	5

ABSTRACT

One hundred and fifty-two radiocarbon age determinations made by the Radiocarbon Dating Laboratory on 146 geological samples are reported. They are on samples from various areas as follows: Newfoundland, including Labrador (14); Prince Edward Island (1); Nova Scotia (3); Quebec (25); Ontario (9); Manitoba (4); Saskatchewan (4); Alberta (2); British Columbia (13); Yukon (9); Northwest Territories-Mainland (27); Northwest Territories-Arctic Archipelago (37); Beaufort Sea (2); Alaska (1); England (1). Many of the dates reported have been corrected for isotopic fractionation. Details of background and standard for all three counters during the period from October 1971 to December 1972 are summarized in Tables 1 and 2. Table 3 presents comparative data obtained by counting 11 samples in both the 1-L and 2-L counters, and Table 4 shows the results obtained by counting a single sample for three, six, and ten days.

RÉSUMÉ

L'auteur rend compte de cent cinquante-deux datations au radiocarbone effectuées sur des échantillons par le Laboratoire de datation au radiocarbone. Ces échantillons proviennent de différentes régions: Terre-Neuve, y compris le Labrador (14); Île-du-Prince-Édouard (1); Nouvelle-Écosse (3); Québec (25); Ontario (9); Manitoba (4); Saskatchewan (4); Alberta (2); Colombie-Britannique (13); Yukon (9); Territoires du Nord-Ouest (continent) (27); Territoires du Nord-Ouest (archipel Arctique) (37); mer de Beaufort (2); Alaska (1); Angleterre (1).

Un certain nombre de ces datations ont été corrigées pour tenir compte du fractionnement isotopique. Les détails concernant les données particulières et la norme pour les trois compteurs pendant la période d'octobre 1971 à décembre 1972 sont résumés dans les tableaux 1 et 2. Le tableau 3 porte sur la comparaison des données obtenues par l'analyse de 11 échantillons dans les deux compteurs 1-L et 2-L, et le tableau 4 indique les résultats obtenus par l'analyse d'un échantillon unique pendant trois, six et dix jours.

GEOLOGICAL SURVEY OF CANADA RADIOCARBON DATES XIII

INTRODUCTION*

During the 15-month period covered by this report (October 1971 to December 1972) the 1-L counter (Lowdon et al., 1971) was operated for two months, the 2-L counter (Dyck and Fyles, 1962) for 12 months, and the 5-L counter (Dyck et al., 1965) for the entire 15 months. Neither of the small counters was operated during February 1972. The 1-L counter was operated at 1 atm, the 2-L at 2 atm, and the 5-L at 1 atm, except for December 1971, when it was operated at 4 atm.

Since January 1972, age calculations have been carried out monthly by a C.D.C. 6400 computer. This has replaced the C.D.C. 3100 used previously. Calculations are based on a C^{14} half-life of 5568 ± 30 yrs. 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. In this date list, age errors include: the counting errors of sample, background and standard; the error in the half-life of C^{14}; and an error term to account for the average variation of ±1.5% in the C^{14} concentration of the atmosphere during the past 1100 years. This last error term has been included in all radiocarbon dates reported and published by the G.S.C. radiocarbon laboratory from January 1963, through December 1972, and it was incorporated into the error calculation mainly as a result of the work done on Douglas fir (Tseudotsuga menziessi) tree rings (Dyck, 1965, 1966, 1967) and sequoia (Sequoia gigantea) tree rings (Willis et al., 1960). However, 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 C^{14} 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). This data takes into account the variations in the C^{14} concentration in the atmosphere. For this reason it has been decided to omit the correction for fluctuations in the concentration of atmospheric C^{14} from future G.S.C. radiocarbon dates, starting in January 1973. With the exception of GSC-1903, -1922, -1928, and -1937, this change in policy does not apply to ages reported in this paper. The omission of this error term will in no way affect the date produced, but it does reduce the error assigned to a date, particularly for samples counted in the 5-L counter.

Unless otherwise stated in the sample descriptions, all ages are based on two 1-day counts. Finite dates are based on the 2σ criterion (95.5% probability) and "infinite" dates on the 4σ criterion (99.9% probability). For finite dates, this means that there is a 95.5% chance that the correct age in radiocarbon years lies within the stated limits of error.

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*Prepared by J.A. Lowdon, who operates the laboratory. The date list has been compiled by W. Blake Jr., from descriptions of samples and interpretations of dates by the collectors.

No changes have been made in the routine CO_2 pretreatment, preparation, and purification techniques previously described (Lowdon, et al., 1969; Lowdon and Blake, 1970). Carbon dioxide gas proportional counting techniques have been discussed by Dyck (1967).

Average background and standard counting rates over the 15-month period are listed in Tables 1 and 2, respectively.

TABLE 1

Monthly background (c/m) for period
October 1, 1971 to December 31, 1972

Month	2-L Counter (2 atm)	5-L Counter (2 atm)	1-L Counter (1 atm)
October, 1971	1.449±.034	2.100±.025	
November	1.130±.018	2.030±.024	
December	1.140±.023	2.716±.033*	
January, 1972	1.262±.050	2.012±.023	
February		2.002±.022	
March		1.972±.033	1.070±.022
April		1.985±.021	1.067±.017
May	0.978±.019	1.931±.020	
June	0.960±.025	2.087±.066	
July	0.969±.027	2.148±.021	
August	0.970±.017	2.198±.019	
September	0.898±.025	2.105±.046	
October	0.843±.011	1.997±.026	
November 22nd-December	0.870±.017	2.085±.029	

*5-L counter operating at 4 atm

As can be seen from the Tables, trouble was once again encountered with the 2-L counter (Lowdon et al., 1972). Both the background and standard counting rates varied quite considerably over the first four months. However, on a monthly basis, counting rates were within statistical limits. Although the reasons for the instability of the 2-L counter during this period were not definitely established, the problem was resolved by replacing all the electrical wiring between the different components of the 2-L counter electronic train. Serious trouble was encountered, during July and August of 1972, with the air-conditioning unit in the counting laboratory. High temperature and humidity caused shorting in the transisterized electronic

equipment, which especially affected the 2-L counter due to the higher voltage used. New components for the air-conditioning unit were installed in March 1973.

For the 2-L counter, the monthly backgrounds are the average of four individual daily counts, except for May and August, when the averages were made up of seven and eight individual counts respectively. During the period of operation, three counts were omitted for statistical reasons, and 10 different background preparations were used. With respect to the 5-L counter operating at 1 atm, the monthly backgrounds are the average of four individual daily counts except for August, when seven counts were averaged. One count was omitted and 15 different preparations were used. At high pressure (4 atm), the December 1971 background is the average of nine individual daily counts. One count was omitted for statistical reasons and the same background preparation was used for all counts. For the 1-L counter, the monthly results are each the average of four daily counts. No counts were omitted and three different background preparations were used.

TABLE 2

Monthly standard, N_o*(c/m) for period
October 1, 1971 to December 31, 1972

Month	2-L Counter (2 atm)	5-L Counter (1 atm)	1-L Counter (1 atm)
October, 1971	16.618±.270	28.566±.173	
November	18.701±.093	28.556±.115	
December	18.574±.096	111.274±.186**	
January, 1972	18.693±.175	28.540±.120	
February		28.558±.121	
March		28.550±.130	4.376±.080
April		28.409±.185	4.248±.053
May	18.647±.092	28.170±.162	
June	18.554±.125	28.098±.131	
July	18.360±.151	28.643±.164	
August	18.526±.078	28.563±.125	
September	18.584±.093	28.551±.123	
October	18.408±.087	28.382±.112	
November 22nd-December	18.474±.135	28.438±.120	

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

**5-L counter operating at 4 atm.

For the 2-L and 5-L counters, the monthly standards are the average of three individual daily counts. With respect to the 2-L counter, one result was omitted for statistical reasons, and three individual preparations were used. For the 5-L counter operating at 1 atm, five individual preparations were used and no result had to be omitted. At 4 atm, the monthly standard is the average of five individual daily counts. No results were omitted, and the same oxalic acid preparation was used for all counts. The 1-L counter monthly standards are the average of two individual daily counts for March and three for April. No counts were omitted and three individual preparations were used. With respect to the different oxalic acid preparations used in this period, δC^{13} determinations ranged between -17.5‰ and -19.7‰. These values are in close agreement with the average -19.0‰ value determined by Craig (1961) and show that virtually no fractionation of the carbon isotopes has been introduced by the laboratory in the preparation of CO_2 from oxalic acid.

TABLE 3

Comparison of Results from Different Counters

Sample No.*	Material	Weight Submitted (g)	Length of count (days) 1-L : 2-L	δC^{13} (‰)	1-L (1 atm)	2-L (2 atm)
GSC-1418	marine pelecypods	25.0	3 2		7390±220	7500±160
GSC-1420	Mya truncata	25.2	2 3	+2.5	8010±240 (7970±240)	7760±160 (7720±160)
GSC-1426	Balanus balanus	26.1	2 3	+2.2	8960±280 (8920±280)	8940±160 (8900±160)
GSC-1429	gyttja	25.0	3 3		11,400±280	11,500±180
GSC-1430	Macoma calcarea	26.0	3 2		7550±220	7380±160
GSC-1436	Hiatella arctica	27.1	3 4		7390±240	7280±150
GSC-1446	gyttja	23.0	3 2	-29.1	8580±240 (8640±240)	8590±230 (8660±230)
GSC-1453	Serripes groenlandicus	17.7	1 1		8350±300	8640±230
GSC-1466	gyttja	24.5	3 2	-19.2	8320±250 (8230±250)	8560±250 (8470±250)
GSC-1478	Astarte sp.	2.5	2 4		>19,000	>19,000
GSC-1496-2	whale bone	552	2 2	-13.5	8770±260 (8590±260)	9040±180 (8860±180)

*Detailed descriptions of all samples except GSC-1453 ('Michael River', Labrador) and GSC-1478 (Worth Point, Banks Island) are deferred to a later list.

Table 3 lists a comparison of results obtained from different counters. The figures in parentheses are the uncorrected ages of the samples for which δC^{13} values are given.

Table 4 illustrates the effect of sample age obtained by varying the length of counting time. If the randomness of radioactive decay is taken into account, then a few hours after the start of counting the decay products of a particular sample, the age obtained on that sample should not vary appreciably no matter how long counting is continued. The counting rate will only vary somewhere between the limits of the standard deviation. This is shown in the Table, where there is virtually no difference between a 3-day and a 10-day count. Lengthening the counting time on a sample does, however, improve the standard deviation which, in turn, reduces the error to be assigned to an age.

TABLE 4

Effect on Sample Age Obtained by Varying Length of Counting Time

Sample No.*	Type of sample	Sample weight (g)	Counter	Length of count (days)	Age (yrs. B.P.)
GSC-1764	Largest single shell fragment in collection; probably Mya truncata	3.0	2-L	3	>24,000
				6	>25,000
				10	>25,000

*Detailed description of this sample, MGG-72-35 from Grinnell Peninsula, Devon Island, N.W.T., appears in this date list.

Where C^{13}/C^{12} ratios are available, a correction for isotopic fractionation has been applied to the date (except for terrestrial and freshwater shells, for which the initial C^{14} content is unknown), and the δC^{13} value reported. Related to the PDB standard, the "normal" values used for correction are $\delta C^{13} = -25.0‰$ for wood, other terrestrial organic materials and bones (terrestrial and marine), and 0.0‰ for marine shells. The C^{13}/C^{12} ratios were determined by the G.S.C. Geochronology Section (Head, Dr. R.K. Wanless) on aliquots of the same sample gas used for age determination.

ACKNOWLEDGMENTS

Thanks are extended to the following personnel: I.M. Robertson and Mrs. S. Chartrand for assistance in the preparation and measurement of samples in the laboratory; K. Santowski for the δC^{13} determinations; R.J. Mott and Mrs. L. Wilson for wood identifications and palynological determinations; Dr. M. Kuc for identification of macroscopic organic remains; and Mrs. G. Mahony for assistance in compilation. Dr. A.H. Clarke, Jr. and Mrs. M.F.I. Smith of the National Museum of Natural Sciences, Ottawa, have kindly identified molluscs in numerous samples; Dr. E.L. Bousfield of the same organization has identified barnacles.

GEOLOGICAL SAMPLES

Eastern Canada

Newfoundland

Postglacial emergence series, Northern Peninsula

Dates on marine shells (id. by A.H. Clarke, Jr., Natl. Mus. Nat. Sci., Ottawa) from emerged beaches record pattern of postglacial crustal rebound. Unless otherwise noted, samples coll. 1969 by D.R. Grant* during a study of the surficial geology and Quaternary history of the area (Grant, 1969a; 1969b; 1972a; 1972b; GSC XI, 1971, p. 259-260). Elevations are referred to present high tide.

GSC-1334. St. Anthony — 10,700±170 / 8750 B.C.

Astarte crenata from silty sand beneath beach gravel exposed in cut, alt. 60 m, on road to town water reservoir, 1.6 km west of St. Anthony, Newfoundland (51°22.28'N, 55°37.35'W).

GSC-1343. Quirpon — 10,500±150 / 8550 B.C.

Mya truncata from stony pelite exposed in shallow borrow pit, alt. 17 m, along road to Quirpon, 0.3 km east of sideroad to Raleigh, Newfoundland (51°28.58'N, 55°36.71'W).

GSC-1312. Southwest Brook — 9190±150 / 7240 B.C.

Mya truncata, intact and in growth position, in sand and gravel foreset beds of shallow-marine deposit, 1 m below ground surface, alt. 50 m, in borrow pit along Hwy. 74, 0.5 km east of Southwest Brook and 12.8 km south of Main Brook, Newfoundland (51°04.48'N, 56°05.36'W).

GSC-1307. Pistolet Bay — 8760±150 / 6810 B.C.

Mesodesma deauratum near surface in borrow pit in littoral sand, alt. 30 m, along Hwy. 73, 1.9 km west of road to Cook Harbour, near Pistolet Bay, Newfoundland (51°32.47'N, 55°58.12'W).

GSC-1403. Port au Choix, 6.1 m — 4690±130 / 2740 B.C.

Mya pseudoarenaria, intact and in growth position near surface in sandy berm at alt. 6.1 m, behind hotel in village of Port au Choix, Newfoundland (50°42.5'N, 57°21.5'W). Coll. 1967 by J.A. Tuck, Memorial

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

Univ., St. John's, in excavations in raised beach of ancient Indian cemetery; subm by D.R. Grant. Graves contain human bone 3930 ± 130 yrs. old (Isotopes date, no number; Tuck, 1971) and charcoal; one part of latter is 4290 ±110 yrs. old (I-3788; Isotopes VIII, 1970, p. 122); another part of same sample is 3770 ± 80 yrs. old (Y-2608; Tuck, 1970, 1971).

GSC-1318. Port au Choix, 4.5 m — 3110±130; 1160 B.C.; δC^{13} = +3.4‰

Mya arenaria, intact and in growth position, near surface of raised beach berm at alt. 4.5 m, behind hotel in village of Port au Choix, Newfoundland (50°42.5'N, 57°21.5'W).

GSC-1331. Ice Point — 1790±130; A.D. 160; δC^{13} = +3.7‰

Volsella sp. from top 1 m of gravelly beach berm at alt. 1.75 m, 50 m inland of modern berm, exposed in borrow pit along Hwy. 73, at head of cove on north side Ice Point, Newfoundland (51°13.66'N, 56°47.06'W).

General Comments (D.R.G.): deposits containing dated samples are believed to have formed near sea level, except material enclosing GSC-1343, which is interpreted as deep-water, glaciomarine sediment by its texture, lithology and fragile bryozoan-brachipod fauna. Inferred rate of emergence (uncorrected for eustatic sea level rise) decreased from maximum of 1.5 m per century ca. 11,000 yrs. B.P. to less than 0.1 m per century during last millenium. Northern Peninsula of Newfoundland is probably still emerging, although very slowly, whereas south part of west coast appears to be submerging, judging by drowned forests and peat bogs; (W.B., Jr.): agreement is good between ages of marine shells, human bones, and charcoal, i.e., marine shells in beach material in which cemetery was excavated are older than charcoal and bones buried there, and marine shells from beach 1.6 m lower are younger. GSC-1307, -1312, and -1403 each based on one 3-day count.

GSC-1575. Lomond, Bonne Bay — 10,500±300; 8550 B.C.

Five whole valves of Macoma calcarea (id. by A.H. Clarke, Jr., Natl. Mus. Nat. Sci., Ottawa) from silt and sand rhythmites exposed at alt. 0 to 4 m, in sea cliff 0.8 km south of Lomond, East Arm, Bonne Bay, Newfoundland (49°27.25'N, 57°45.30'W). Shells coll. at alt. 2.5 to 3.5 m. Rhythmites underlie inclined beds that extend to cliff top at 25 m. Coll. 1970 by I.A. Brookes, York Univ., Toronto.

Comment (I.A.B.): assuming shell-bearing beds are coeval with formation of marine limit at minimum alt. of 38 m, date fixes onset of marine overlap at head of East Arm, Bonne Bay. In South Arm, Bonne Bay, and at Trout River on Gulf of St. Lawrence 10 km west, marine overlap is recorded to alt. 70 m, but is not dated. Lower marine limit at Lomond is believed due to late deglaciation of fiord at seaward extremity of corridor that acted as a main channel of ice flow from S.E. Due to small sample size (8.9 g) only outer 5% of shell removed by leaching.

9230±140
GSC-1630. St. Pauls 7280 B.C.

Complete valves of marine pelecypod Mesodesma sp. from gray, compact, sandy-clayey, till-like material at 2.5 to 3.5 m above HHWL in sea cliff, 2.5 km road distance S.W. of bridge at St. Pauls, Newfoundland (49°51.2'N, 57°52.15'W). Coll. 1971 by I.A. Brookes.

Comment (I.A.B.): sample is thought to come from till deposited by piedmont glaciers from the Long Range Mountains (cf. Grant, 1969b), but date is too young. Enclosing material is possibly compacted marine sediment rich in iceberg-dropped clasts. Date based on one 3-day count.

12,000±320
GSC-1462. Little Port 10,050 B.C.

Whole valves and fragments of Mytilus edulis; thin, but well preserved, with inside lustre intact, from inclined gravel beds exposed at alt. 33.5 to 42.7 m in borrow pit 3.9 km W.N.W. of wharf at Lark Harbour, Bay of Islands, Newfoundland (49°06.7'N, 58°24.8'W). Shells coll. at 37.0 m. Gravels extend to 47.0 ± 1 m beneath a sloping terrace surface that abuts against talus at foot of a steep bedrock hill between Little Port and Bottle Cove. Coll. 1970 by I.A. Brookes.

Comment (I.A.B.): dates onset of marine overlap of open Gulf of St. Lawrence at mouth of Bay of Islands, recorded by 47.0 m terrace, and is at least 1000 yrs. younger than expected by comparison with Cox's Cove, 15 km inland on Bay of Islands, where marine limit is dated 12,600 ± 170 yrs. B.P. (GSC-868; Brookes, 1969; GSC IX, 1970, p. 50). This may be due to delayed ice retreat in constricted topographic situation near Lark Harbour. Date based on one 3-day count.

7730±160
GSC-1284. Sandy Point 5780 B.C.
$\delta C^{13} = +3.5‰$

Marine pelecypod whole shells and fragments (mainly Mya arenaria) in silty clay at base of actively eroding sea cliff on north shore of Sandy Point, 16 km N.N.W. of Cartwright, Labrador (53°50'15"N, 57°08'W). Clay unit 1.5 m thick, overlain by 10 m sand. Beach ridges rise to N.W. to alt. 80 m. Coll. 1969 by D. Hodgson.

Comment (D.A.H.): date is minimum for deglaciation at present shoreline; however, time/stratigraphic relationship to highest beaches, and outwash at which they are formed, is not known. Sample mixed with dead gas for counting.

8640±230
GSC-1453. 'Michael River' 6690 B.C.

Marine pelecypod shells (Serripes groenlandicus) in silt at, and below, river level (alt. ca. 2 m) on south bank of 'Michael River', 2 km from mouth and 30 km S.S.E. of Cape Harrison, Labrador (54°41'N, 57°49'W). Coll. 1970 by D.A. Hodgson.

Comment (D.A.H.): date is minimum for deglaciation of coast. Silt unit is overlain by 50 m of fluvial sediments upstream from collection site. As marine limit is ca. 80 m, then 10,000 yrs. ago is considered maximum for deglaciation (Hodgson and Fulton, 1972). Two determinations were made using same gas:

One 1-day count in 1-L counter	8350±300
One 1-day count in 2-L counter (sample mixed with dead gas for counting)	8640±230

GSC-1592. Michikamau Lake — 6460±200 / 4510 B.C.

Mucky silt, containing undeterminable vascular plants plus mosses Tomenthypnum nitens and Calliergon sarmentosum (id. by M. Kuc), from just east of Windbound Lake, at S.E. corner of Michikamau Lake, Labrador (54°00'00"N, 62°59'55"W). Site, at alt. ca. 490 m, is 80 km N.E. of Churchill Falls, Labrador. Coll. 1971 with Hiller sampler by R.J. Fulton.

Comments (R.J.F.): this date agrees in a general way with SM-356 (6400±900 yrs.) which Grayson collected at 'Marymac Lake' (Grayson, 1956; Bray and Burke, 1960; Blake, 1966). It denotes the earliest time at which organic material was being produced and preserved, and it does not necessarily correspond closely to the time of deglaciation; (W.B., Jr.): this date, with a ±200 yr. error term (2σ), was obtained on a 10 cm increment of basal peat. Thus, although the time that elapsed before the accumulation of organic materials began is not known, the date provides more precise information than SM-356, which was obtained on a 30 cm increment at a depth of 2.4 to 2.7 m in 'Marymac Lake' (=Lac Aulneau, which is situated ca. 125 km S.S.W. of the southern end of Ungava Bay). Also, the ±900 yr. error term on SM-356 is a 1σ value. GSC-1592 is far older than any of the dates obtained by Morrison (1963, 1970) close to Churchill Falls, and it indicates that this part of the Lake Plateau of central Labrador-Ungava (Hare, 1959) was free of ice within a few hundred years of 7000 yrs. B.P.

Prince Edward Island

GSC-1494. East Bideford (Ellerslie) Bog — 8000±140 / 6050 B.C.

Basal organic sediment (depth 635 to 640 cm) from bog ca. 4 km N.E. of Ellerslie, Prince Edward Island (46°38'N, 63°54'W), at alt. ca. 7.6 m. Coll. 1968 with Livingstone corer by R.J. Mott.

Comment (R.J.M.): dates onset of organic deposition following emergence of basin from sea, but is younger than other bog-bottom dates from island (GSC VII, 1968, p. 211-212). NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

Nova Scotia

GSC-1486. Canoran Lake — 11,700±160 (9750 B.C.)

Gyttja from 345 to 355 cm depth in Canoran Lake, Lunenburg County, Nova Scotia (44°35.8'N, 64°34.9'W) at alt. ca. 107 m, water depth 4 m. Lake is situated in a central Nova Scotia drumlin field near the periphery of the area believed to have been covered by the South Mountain Ice Cap during late-glacial time (Hickox, 1962; Prest and Grant, 1969). Corer bottomed at 386 cm depth in impenetrable red sand. Coll. 1970, from ice, using square-rod modified Livingstone corer, by J.B. Railton, then Dalhousie Univ., Halifax, now Northern Engineering Services, Calgary.

Comment (J.B.R.): sample gives one of oldest lacustrine dates in Nova Scotia which is not subject to graphite contamination. It dates a vegetation-type transitional to boreal forest and open tundra (Picea-Myrica-Pinus dominants; AP-61%, Shrubs-20%, Herbs-19%). NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.

GSC-1642. Milford — >50,000

Wood (Larix sp., id. by R.J. Mott) from gypsum quarry area near Dutch Settlement, 3.2 km S.S.E. of Milford, Nova Scotia (45°00'20"N, 63°25'10"W) at alt. ca. 23-30 m. Wood is from bulldozed masses of dark grey till and an underlying dark-grey silty clay, both wood-bearing. These deposits overlie and fill karst depressions and low areas in a thick deposit of Mississippian-age gypsum. Coll. 1971 by V.K. Prest.

Comment (V.K.P.): the blackish, gypsiferous till is overlain by a red silty till, followed by buff-red sand and pebbly sand, and another red clayey till. Over most of the quarry area, red till rests directly on the gypsum. The previously dated wood, GSC-33 (>33,800 yrs.; GSC II, 1963, p. 40) was thought to be from the red till complex, which was believed to relate to a single Wisconsin glaciation. Palynological studies by R.J. Mott (unpublished G.S.C. Palynological Report 71-15), on two grab samples of blackish clayey silt and one of organic muck, suggest conditions similar to the southern boreal forest today. The pollen spectra are also similar to some of the presumed Wisconsin interstadial deposits on Cape Breton Island (Mott and Prest, 1967) but is unlike the warm interglacial type of assemblage found at Addington Forks (GSC-1598; this list). The stratified deposits may therefore represent an Early Wisconsin interstadial deposit or, more probably, the cooler part of an interglacial interval (Prest et al., 1972). Pretreatment of 45 g sample included 1 hour in hot 2% NaOH, 1 hour in hot 4N HCl, and 3 distilled water rinses. Date based on one 3-day count and one 1-day count in 5-L counter at 4 atm.

GSC-1598. Addington Forks — >42,000

Wood (Juniperus sp., id. by R.J. Mott) from a deposit of peat with stems and roots of small trees associated with 1+ m of sand and silt beneath 6 m red till in road-cut, 0.8 km north of Addington Forks school, south of the Trans Canada Hwy., and 9.6 km S.W. of Antigonish, Nova Scotia

(45°34'N, 62°06'W), at alt. ca. 40 m. The stratified sediments rest on red till, and hence could be a lens within the same red till. Coll. 1971 by R.H. MacNeill, Acadia Univ., Wolfville.

Comments (V.K. Prest): the peat predates the last glaciation (Prest et al., 1972). However, a previous finite date of $33,700^{+2300}_{-1800}$ yrs. (I-3236; MacNeill, 1969) was suspect on regional grounds; the new age determination confirms the validity of this suspicion. Palynological studies by R.J. Mott (unpublished G.S.C. Palynological Rept. 71-16) indicate deposition in a pond surrounded by a mixed hardwood forest dominated by oak. The assemblage is unlike any found in postglacial time in the Maritimes and does not compare with other exposed buried organic deposits from anywhere in Nova Scotia. It is somewhat similar to the lower organic unit found in a drill core from Leitches Creek, Cape Breton Island (R.J. Mott, unpublished G.S.C. Palynological Rept. 71-10). The pollen assemblage at Addington Forks strongly suggests interglacial conditions with a climate somewhat warmer than the present; (W.B., Jr.): all visible rootlets were removed by hand prior to usual chemical treatment (NaOH, HCl, and distilled water rinses) in laboratory. Only a single piece of wood used for dating. Date based on one 3-day count in 5-L counter.

Quebec

Moisie River series

Samples from section on left bank of Moisie River, Quebec, 13 km upstream from mouth (50°16'15"N, 66°01'50"W). Coll. 1970 by B.G. Thom, then at McGill Univ. Subarctic Res. Sta., Schefferville; now at Australian Natl. Univ., Canberra; subm. by L. Dredge, then at McGill Univ., Montreal; now at Univ. of Waterloo, Waterloo.

GSC-1482. Moisie River, wood	6380±150 4430 B.C.

Wood (Betula sp., id. by R.J. Mott), at alt. 27 m, in deltaic silt and sand beds unconformably overlying marine clay.

Comment (L.D.): age is minimum for delta-building episode at Moisie.

GSC-1522. Moisie River, shells	7060±190 5110 B.C.

Marine shells (Mya sp. and unidentified fragments) in poorly-bedded grey clayey silts, alt. 8 m.

Comment (L.D.): shells were originally thought to correlate with GSC-1337 (9140±200 yrs.; GSC XI, 1971, p. 268). Their younger age suggests that offshore marine conditions persisted along coast for ca. 2000 yrs. Overlying sandy deltaic beds and age of GSC-1482 indicate that character of sedimentation changed rapidly ca. 7000 to 6800 yrs. ago. Sample mixed with dead gas for counting. Date based on one 1-day count.

GSC-1565. Baie-Comeau — 9280±140 / 7330 B.C.

Barnacle fragments (Balanus sp.) from grey clay near surface of marine terrace (alt. ca. 60 m); exposed in road-cut along Hwy. 15 at western entrance to Baie-Comeau, Quebec (49°13'00"N, 68°11'40"W). Shells of pelecypods, gastropods and brachipods (Hemithiris psittacea) were relatively abundant. Coll. 1970 by J.C. Dionne, Forest Research Lab., Environment Canada, Quebec.

Comment (J.C.D.): date is younger than maximum marine submergence in area, which rose to 136 m, but date agrees with I-3868 (9150±150 yrs.) from slightly higher level (63.5 m) at Manic 2 site 17.5 km to N.W. (Sauvé and LaSalle, 1968). Date based on one 3-day count.

GSC-1684. St. Modeste — 10,300±150 / 8350 B.C.

Marine pelecypod shells (Hiatella arctica) from sand pockets interstratified with stony clayey sediments overlying stony glaciomarine clay or reddish clayey till. Shells from 1 m below surface, alt. ca. 130 m, in fresh exposure dug by backhoe in area between St. Antonin Moraine and delta at St. Modeste, 0.8 km north of village of St. Modeste, Quebec (47°50'30"N, 69°24'15"W); unit previously mapped by Lee (1962) as till. Other species occurring at site: Macoma balthica, Macoma calcarea, Mya truncata, Astarte montagui striata, Serripes groenlandicus, Balanus crenatus, Buccinum plectrum, Natica clausa. Coll. 1969 by J.C. Dionne.

Comment (J.C.D.): date is younger than expected. GSC-63 (11,410±150 yrs.; GSC II, 1963, p. 42-43) at St. Epiphane south of St. Antonin Moraine, and at alt. ca. 94 m, gives age for early marine inundation following post-St. Antonin glacial stage. Date based on one 3-day count.

GSC-1500. Tadoussac (Saguenay Co.) — 9820±150 / 7870 B.C.

Barnacle fragments (Balanus hameri; id. by E.L. Bousfield, Nat. Sci., Ottawa) from stratified deposit of grey clay and fine sand with few ice-rafted boulders. Shells from 9 m depth below surface in road-cut (along Hwy. 15) through marine terrace extending along valley of Moulin-à-Baude River, north of Tadoussac, Quebec (48°10'50"N, 69°42'02"W). Surface of terrace at exposure is at alt. ca. 100 m. Fragments of Balanus hameri and shells of Macoma balthica, Macoma calcarea, Hiatella arctica are abundant, often with joined valves. Other common species are: Portlandia arctica, Mya truncata, Serripes groenlandicus, and Chlamys islandicus. Coll. 1970 by J.C. Dionne.

Comment (J.C.D.): date postdates maximum marine submergence which is 136 m in Tadoussac area, but date is correlative with same level at Upper Saguenay River; a sample at 101 m at Ruisseau-Gervais is 9930±190 yrs. old (GX-1497). At Rivière-du-Loup, on south shore of St. Lawrence estuary, Hiatella arctica shells at 100 m are 10,340±130 yrs. old (GSC-61; GSC II, 1963, p. 43).

330±140
GSC-1480. Shipshaw A.D. 1620

Eastern white cedar wood (Thuja occidentalis, id. by R.J. Mott) from 0.3 m-thick peat bed below 3.7 m silty clay to clayey silt on the northern side of Shipshaw Reservoir, Quebec (48°27.1'N, 71°13.3'W), at alt. ca. 53 m. Wood, collected from excavation made following R.F. Legget's instructions (cf. Legget, 1945), had matted and flattened vegetation – twigs, rootlets, and peat – adhering to one side; rootlets were removed and wood dated is from clean side of original sample. Coll. 1970 by P. LaSalle, Ministère des richesses naturelles, Quebec.

Comments (P.L.): the tentative conclusion made by Radforth (1945), that this buried organic layer is of Sangamon age, must be rejected. Rather, the organic layer was buried by silting because of damming of the Shipshaw River by a huge landslide approximately 400 years ago (LaSalle and Chagnon, 1968; LaSalle, 1969); (W.B., Jr.): a piece of this wood has been dated at 416±38 yrs. (BGS-44) by the Brock Univ. Radiocarbon Dating Laboratory (Melville, 1972). Date based on one 3-day count.

12,400±160
GSC-1533. Charlesbourg 10,450 B.C.
$\delta C^{13} = +1.5‰$

Marine shells (Portlandia arctica) collected from a clayey sand unit 0.3 to 0.6 m thick below ca. 3 m of till and above cobble gravel in a quarry ca. 8 km north of Quebec City (46°51.3'N, 71°17.7'W), at alt. ca. 110 m. Shells were well preserved with periostracum intact, and most valves were still articulated at the time of collection. Coll. 1970 by P. LaSalle.

Comments (P.L.): GSC-1533 dates the beginning of the Champlain Sea episode and provides a close approximation for the time of emplacement of the Drummondville Moraine and the draining of Lake Iroquois. GSC-1533 is also a minimum age for the deglaciation of the St. Lawrence estuary east of Quebec City and for the emplacement of the Highland Front Morainic System; it dates a position of the ice front between this moraine and the St. Narcisse Moraine; (W.B., Jr.): due to a mistake in data provided for calculation of age by computer, result was first reported as 13,500±160 years (Gadd et al., 1972; LaSalle, 1973). Sample (36.2 g) mixed with dead gas for counting. Date based on one 3-day count in 5-L counter.

8510±140
GSC-1417. Lac Montagnais 6560 B.C.

Basal peat (containing Carex sp., and mosses Scorpidium scorpioides Drepanocladus exannulatus, D. revolvens, Sphagnum sp.; id. by M. Kuc) at 410 to 420 cm depth in poor fen situated near Lake Montagnais, Laurentides Natl. Park, Quebec (47°54'30"N, 71°10'30"W), alt. ca. 800 m. Coll. 1969 by P. Richard, Faculté de Foresterie et de Géodésie, Univ. Laval, Quebec; now at Univ. de Québec à Chicoutimi, Chicoutimi.

Comment (P.R.): pollen spectra at base indicate open vegetation (Richard, 1971). Correlation with tundra-like pollen spectra registered ca. 80 km south, is not yet possible. NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

GSC-1400. Saint-Raymond de Poutneuf

7970±140
6020 B.C.

Basal sandy peat of bog (550 to 560 cm depth) near Saint-Raymond de Portneuf, Quebec; (46°53'30"N, 71°48'30"W), alt. ca. 170 m. Coll. 1969 by P. Richard.

Comment (P.R.): date suggests that, even if situated at about maximum level of Champlain submergence, paludification of basin with bog was delayed more than ca. 3000 yrs. Pollen spectra, strongly suggestive of open vegetation, seem to correlate with decidedly tundra-like pollen spectra found in a bog near Lake Joncas ca. 75 km to N.E., for which a similar date has been obtained (I-5083; 7140±130 yrs., 35 cm above basal mud; Richard, 1971). NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

GSC-1927. Pierreville

>50,000
$\delta C^{13} = -24.2‰$

Log, probably part of a stump, from stratified buff to brown silty sand (the upper of the St. Pierre Interval units), beneath surface till of the Gentilly Stade in fresh exposure on south wall of gully leading to Rivière Saint-Francois, 2.5 km S.E. of Pierreville, Quebec (46°03'20"N, 72°47'10"W), at alt. ca. 25 m. Wood, id. as Picea sp. by L.D. Wilson, was collected damp and preserved in plastic bag in same state until cut into pieces and dried in electric oven in May, 1973. Coll. 1972 by R.G. Skinner and W. Blake, Jr.

Comment (W.B., Jr.): wood is from unit which overlies compressed peat with wood (the lower St. Pierre Interval unit) at the same locality. The peat has been dated at 66,500±1600 yrs. (GrN-1711) by the Groningen University Laboratory using isotopic enrichment (Vogel and Waterbolk, 1972), and the present date, the first carried out by the G.S.C. on materials relating to the St. Pierre Interval, confirms the very great age of these beds (cf. Gadd, 1971; Gadd et al., 1972 and references cited therein). Pretreatment of 50 g sample included 1 hour in hot 2% NaOH, 1 hour in hot 4N HCl, and 3 distilled water rinses. Date based on one 4-day count in 5-L counter at 4 atm.

GSC-1355. 'Lac Marieville'

10,800±300
8850 B.C.

Basal organic sediment from 1101 to 1111 cm below mud/water interface of small lake in bedrock basin on south side of Rougemont, ca. 9 km E.N.E. of Marieville, Quebec (45°27.5'N, 73°04'W). Coll. 1969 by P. LaSalle, Ministère des richesses naturelles, Quebec, and R.J. Mott.

Comment (R.J.M.): at alt. 145 m, lake is below maximum Champlain Sea limit on Rougemont, and date is a minimum for isolation of basin from sea. NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

GSC-1344. Lac des Bouleaux — 13,000±290 / 11,050 B.C.

Basal organic lake-bottom sediment from 267 to 271 cm below mud/water interface of small lake in bedrock basin on Mont St. Bruno, ca. 2.4 km north of St. Bruno de Montarville, Quebec (45°33'15"N, 73°19'W). Coll. 1969 by P. LaSalle and R.J. Mott.

Comment (R.J.M.): lake, at alt. of 125 m, is below maximum limit of Champlain Sea on Mont St. Bruno (LaSalle, 1966); therefore date is minimum for isolation of basin from sea. Presence of carbonates in mineral sediment beneath organic lake sediment and in some of surrounding glacial deposits suggests possibility of contamination of dated material to produce an anomalously old date. An error of as much as 2000 yrs. is possible if this date is compared with others from below limit of Champlain Sea. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

GSC-1357. Lac Seigneurial — 10,900±330 / 8950 B.C.

Basal organic sediment from 932 to 937 cm below mud/water interface of small lake in bedrock basin on Mont St. Bruno, ca. 1.5 km north of St. Bruno de Montarville, Quebec (45°33'N, 73°19.5'W). Coll. 1969 by P. LaSalle and R.J. Mott.

Comment (R.J.M.): date is minimum for isolation of basin from Champlain Sea, which attained a level well above this lake at alt. 97 m (LaSalle, 1966). NaOH-leach omitted from sample pretreatment.

Beaver Lake series, Montreal

Samples from peat monolith obtained during landscaping to form Beaver Lake (45°30'N, 73°36'W), alt. 166 m, Mount Royal Park, Montreal, Quebec. Peat coll. 1937 in galvanized iron boxes by T.H. Clark and J.D. Cleghorn; stored in basement of Redpath Mus., McGill Univ. for ca. 30 yrs., during which time it desiccated. Pollen stratigraphy studied in 1969 by S. Handa; samples subm. by J.A. Elson, both of McGill Univ., Montreal. Site of peat is ca. 7 m lower than marine shells nearby dated at 11,490±110 yrs. B.P. (GrN-1967; Elson, 1969).

GSC-1423. Beaver Lake No. 5 — 8440±230 / 6490 B.C.

Organic mud from 1.9 m depth at uppermost occurrence of Glaux pollen; at top of Terasmae's (1960) pollen Zone V or Zone A4(b) of New England sequence.

Comment (J.A.E.): Glaux is a halophyte common on tidal flats and other saline areas; it was found in clay deposits of St. Lawrence Lowland by LaSalle (1966). Date represents either last stage of Champlain Sea in vicinity or, more probably, an estuarine episode of St. Lawrence River. NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

GSC-1405. Beaver Lake No. 1 — 10,000±230 / 8050 B.C.

Organic mud (sapropel) from base of monolith, ca. 3.15 m depth, at top of mainly non-organic zone containing a high proportion of non-arboreal pollen, low Pinus, low Picea, and high Abies; apparently in Terasmae's (1960) pollen Zone VI.

Comment (J.A.E.): this oldest datable horizon overlies an older high-NAP zone; a greater age was anticipated. Peat seems to have been collected from side of bog rather than centre, and resedimentation is possible. Sample mixed with dead gas for counting. NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

GSC-1922. Masson — 4620± 80 / 2670 B.C.

White pine wood (Pinus strobus, id. by R.J. Mott) from sandy soil beneath ca. 2 m clay in stream cut, 2 km east of Masson, Quebec (45°31'N, 75°25'W), at alt. ca. 54 m (cf. McKeague et al., 1973). Coll. 1972 by J. Dumanski, Soil Research Inst., Agriculture Canada, Ottawa.

Comment (W.B., Jr.): sandy, wood-bearing soil unit is interpreted by submitter (pers. comm., Oct. 1973) as representing a former ground surface which was buried by clay in landslide from higher area nearby ca. 4600 years ago. Sample (6.1 g) mixed with dead gas for counting. Date based on one 1-day count.

GSC-1741. rue Jumonville, Hull — 120±150 / A.D. 1830

Single piece of white pine wood (Pinus strobus, id. by R.J. Mott) from 10 m depth in borehole (No. 5, Martineau) on natural slope, rue Jumonville, Hull, Quebec (45°27'N, 75°44'30"W), at alt. ca. 73 m. Wood from a saturated clay in "soft" zone of lower shear strengths. Well preserved sample submitted wet in water used in drilling operation; weight decreased from 15.3 to 2.5 g during drying in electric oven. Coll. 1972 by B. Hopkins of Fondex, Ltd., Ottawa; subm. by E.B. Fletcher, Carleton Univ., Ottawa.

Comment (W.B., Jr.): date shows that landslides, in addition to those occurring at present in the Champlain Sea clays of the Ottawa-Hull region, have also occurred in the recent past; cf. GSC-550 (1140±150 yrs.), wood from borehole in apron of "flowslide" on abandoned terrace of Ottawa River, 1.2 km west of Green Creek, Ontario (GSC VI, 1967, p. 160), and GSC-1922 (4620±80 yrs.; this list). Sample mixed with dead gas for counting.

GSC-1646. Cantley — 12,200±160 / 10,250 B.C.

Marine pelecypod shells (Macoma balthica) from silty sand, 4.6 m below ground surface in gravel pit, 1.8 km north of Cantley, Quebec (45°34'N, 75°46'45"W), alt. ca. 194 m. Fossil horizon slopes gently down from sand-covered ridge at ca. 213 m. Coll. 1971 by R. Romanelli, Univ. of Ottawa, Ottawa.

Comment (R.R.): Macoma balthica shells are found articulated and in growth position, associated with Mytilus edulis, Portlandia arctica and Balanus crenatus. Shells are highest and oldest found near N.W. shore of Champlain Sea; they are probably related to a sea level stand at ca. 198 m. Date gives age of early phase of marine invasion in Gatineau River valley and Ottawa area. It agrees well with other dates of early marine invasion from St. Lawrence Lowland: L'Avenir, Quebec, at 122 m, GSC-505 (11,880±180 yrs.; GSC VI, 1967, p. 159-160) and GSC-936 (12,000±230 yrs.; GSC IX, 1970, p. 58); Maitland, Ontario, at 104 m, GSC-1013 (11,800±210 yrs.); and Meach Lake, Gatineau Park, Quebec, at 170 m, GSC-842 (11,600±150 yrs.; both in GSC IX, 1970, p. 59-61). Date based on one 3-day count.

GSC-1772. Martindale — 11,900±160 / 9950 B.C.

Marine pelecypod shells (Macoma balthica) from a gravel pit 0.6 km north of Martindale, Quebec (45°50'29"N, 75°56'40"W), at alt. ca. 176 m. Shells are articulated and in growth position, 0.6 m below ground level, in the transition zone between grey laminated silty clay and overlying coarse gravelly sand. Coll. 1972 by R. Romanelli, Univ. of Ottawa.

Comment (R.R.): shells are from one of the most northerly occurrences in the Gatineau River valley, indicating the presence of marine waters far up the valley during an early phase of the Champlain Sea. The sample probably dates a stand of the sea at ca. 183 m. The date is in good agreement with others from the early incursion of the Champlain Sea, especially GSC-1646 (12,200±160, this list) at Cantley (Rust and Romanelli, ms.), which is from a higher locality some 32 km south of Martindale. Date based on one 3-day count.

GSC-1928. Sakami Lake — 6640±180 / 4690 B.C.

Whole shells and fragments of Hiatella arctica, plus a few fragments of Mya sp. and Balanus sp., from clay at 9.8 m depth below sediment/water interface in unnamed bay at south end of Sakami Lake, Quebec (53°11'N, 76°57'W), at alt. ca. 174 m. Site is 152 km S.E. of Fort George. Coll. 1973 by H.A. Lee, Stittsville, Ontario, from borehole drilled from frozen surface of lake.

Comment (W.B., Jr.): sample is highest dated thus far along east coast of James Bay and Hudson Bay. The exact position of sea level at the time that these pelecypods and cirripeds were living is unknown, but marine waters can reasonably be assumed to have been at least as high as the present level of Sakami Lake, at 185 m. Since sea level 6820 to 6460 years ago was probably some 5 to 10 m below its present level (Curray and Shepard, 1972), uplift at this site has taken place at an average rate of 2.8 to 3.0 m/century for a span of time exceeding 6000 years. Present uplift is presumably similar to that in Richmond Gulf, for which Walcott (1972) postulates a rate that is "probably close to 2 cm/yr.". The collection site in Sakami Lake also lies on the east side of the "demarcation line" of Lee (1968), which he suggested might represent an end moraine. Thus it provides a minimum value for the age of this feature, mapped as a discontinuous end moraine nearly 600 km long by Prest et al. (1968). HCl-leach omitted due to small sample size (4.9 g). Sample mixed with dead gas for counting. Date based on one 3-day count.

Belleterre series

Lake sediment from a small lake in sandy rolling terrain ca. 10 km N.E. of Belleterre, Quebec (47°25'N, 78°35'10"W), alt. 305 to 320 m, water depth 9 m. Coll. 1971 with Livingstone corer by R.J. Mott and J.-S. Vincent.

	9690±230
GSC-1586. Belleterre, 728 to 733 cm	7740 B.C.

Dark brown algal gyttja 728 to 733 cm below mud/water interface. Interval from 733 to 748 cm is gray, stiff, silty clay.

	9630±300
GSC-1585. Belleterre, 748 to 755 cm	7680 B.C.

Brown clayey gyttja, 748 to 755 cm below mud/water interface. Below 755 cm is laminated gray clay and sandy layers.

General comments (R.J.M.): lake is situated at or slightly above highest shoreline of Glacial Lake Barlow-Ojibway; age of basal sediments should be minimum for deglaciation of area. Similar ages of both core increments cannot be satisfactorily explained. Carbonates are not present in sediment, making an anomalous date due to this factor unlikely. Slumping of old sediments from a shallower part of the lake early in its life could be a possible explanation; (W.B., Jr.): if error terms are applied in opposite directions, upper increment may be as much as 470 yrs. younger than basal increment. NaOH-leach omitted from pretreatment of both samples, and both mixed with dead gas for counting. Each date based on one 3-day count.

Lac Louis series

Samples of bottom sediments in Lac Louis, Laverlochère Twp., 29 km east of Ville-Marie, Témiscamingue Co., Quebec (47°17'15"N, 79°07'00"W), alt. ca. 300 m, water depth at coring site 7.6 m. Coll. 1970 with Livingstone corer by R.J. Mott and J.-S. Vincent.

	4260±240
GSC-1491. Lac Louis, 235 to 240 cm	2310 B.C.

Gyttja 235 to 240 cm below sediment/water interface.

Comment (J.-S. V.): sample coincides with boundary of pollen Zones III and II and dates time at which the warm climate of the Hypsithermal had already started to deteriorate. NaOH-leach omitted from sample pretreatment.

	7280±250
GSC-1481. Lac Louis, 410 to 415 cm	5330 B.C.

Gyttja 410 to 415 cm below sediment/water interface.

Comment (J.-S.V.): sample coincides with boundary of pollen Zones III and IV and dates shift from jack pine to white and red pine; i.e., continued warming during the Hypsithermal Interval in the area. NaOH-leach omitted from sample pretreatment.

9090±240
GSC-1432. Lac Louis, 531 to 538 cm 7140 B.C.

Basal silty gyttja 531 to 538 cm below sediment/water interface. Comment (J.-S.V): date is minimum for ice retreat and for formation of highest beach of proglacial Lake Barlow-Ojibway in Little Clay Belt (= area covered by Lake Barlow-Ojibway south of drainage divide; Vincent, 1971; 1973). NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

Ontario

10,000±320
GSC-1553. Russell 8050 B.C.

Marine pelecypods (Macoma balthica and Macoma calcarea) from ca. 1.5 m depth below surface in road-cut in littoral sand deposit of Champlain Sea basin, 4.8 km S.E. of Russell, Ontario (45°13'45"N, 75°18'25"W), alt. ca. 70 m. Sample also contains Hiatella arctica and Portlandia arctica (id. by W.B., Jr.). Coll. 1970 by S.H. Richard.

Comment (S.H.R.): dates late phase of Champlain Sea submergence in Ottawa-St. Lawrence Lowland when sea had receded considerably from marine limit at ca. 167 m. Date is youngest obtained in area from marine fossils of Champlain Sea (cf. Scott, 1972); youngest, previously published dates from Champlain Sea sediments in Ottawa-Hull area are: L-604D (10,200±200 yrs.; shells at 107 m, 3.7 km N.E. of Uplands; GSC I, 1962, p. 17; Mott, 1968; Elson, 1969) and GSC-454 (10,420±150 yrs.; whale bones at 90 m at Uplands; GSC V, 1966, p. 103). Due to small sample size (11.5 g) only outer 10% removed by leaching. Sample mixed with dead gas for counting. Date based on one 3-day count.

11,200±160
GSC-1672. Almonte 9250 B.C.

Marine pelecypods (Macoma balthica; id. by A.H. Clarke, Jr., Natl. Mus. Nat. Sci., Ottawa) from ca. 1.5 m depth in a pit freshly dug in limestone gravel and sand of a raised beach of the Champlain Sea ca. 2.4 km N.E. of Almonte, Ontario (45°14'55"N, 76°10'30"W), at alt. ca. 154 m. Coll. 1971 by S.H. Richard.

Comment (S.H.R.): dates a phase of the Champlain Sea submergence in the Ottawa-St. Lawrence Lowland when sea level had been lowered from ca. 168 m, where it stood earlier in this vicinity. This date is the oldest obtained so far on marine fossils of the Champlain Sea from the region west of Ottawa (Scott, 1973). A similar date of marine pelecypods some 95 km to the N.W. near Pembroke, Ontario is GSC-90, 10,870±130 yrs. at 137 m (GSC II, 1963, p. 44). Date based on one 3-day count.

7720±320
GSC-1631. Warsaw Caves pothole 5770 B.C.

Charcoal fragments (unidentified hardwood, R.J. Mott) in silty clay among boulders 160 cm below sediment surface in pothole in limestone,

Otonabee Conservation Authority, Warsaw Caves Conservation Area, ca. 19 km N.E. of Peterborough, Ontario (44°27'25"N, 78°07'30"W), at alt. ca. 427 m. Pothole is one of several carved in bedrock when Indian River channel was an outlet for Kirkfield Phase of Glacial Lake Algonquin (Prest, 1970). Coll. 1971 by S.A. Mathewson and B.W. Clark, Otonabee Conservation Authority, and R.J. Mott.

Comment (R.J.M.): it was hoped that charcoal would date the end of use of the Indian River channel as an outlet, but deposition of the charcoal occurred much later in time. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.

GSC-1587. Lake McConnell Moraine — 13,200±160 / 11,250 B.C.

Basal organic lake sediment, 560 to 565 cm depth, from small kettle lake in Lake McConnell Moraine, ca. 18 km N.W. of Temiskaming, Quebec, and 5 km N.E. of Lake McConnell, Ontario (46°46'0.5"N, 79°19'W), alt. 312 m, water depth 8 m. Calcareous sand is overlain by 565 cm of marly gyttja and algal gyttja. Coll. 1971 with Livingstone corer by R.J. Mott and J.-S. Vincent.

Two determinations were made:

GSC-1587.	Inorganic portion (marl). (One 3-day count)	13,200±160
GSC-1587-2.	Organic portion, left after sample dissolved in H_3PO_4. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. (One 3-day count)	12,900±420

Comment (R.J.M.): dates on both portions of sample are older than expected. Presence of carbonates in lower organic sediment and underlying sand suggests contamination by old material is possible. An error in the order of 2000 yrs. is expected.

Louise Lake series

Louise Lake, alt. 311 m, 16.1 km N.W. of Durham, Ontario (44°17'N, 80°57'30"W), is a hard-water lake in an ice-block depression in Singhampton end moraine (Chapman and Putnam, 1966). Coll. 1968 by T.W. Anderson and J. Terasmae.

GSC-1648. Louise Lake, surface sediment — 1020±230 / A.D. 930 / $\delta C^{13} = +1.4‰$

Pinkish marl with shells 21 to 25 cm below mud/water interface in 2.6 m water.

Comment (T.W.A.): sample should date rise in Ambrosia (ragweed) pollen equated with European settlement ca. 120 yrs. ago. Date minus 120 yrs., or 900 yrs., provides approximation for amount of contamination of lake water by Paleozoic carbonate. Sample mixed with dead gas for counting.

GSC-1151. Louise Lake, basal organics

13,900±210
11,950 B.C.
δC^{13} = -26.7‰

Plant detritus (mosses: Hygrohypnum luridum and Calliergon giganteum, id. by M. Kuc) in clay 564 to 573 cm beneath mud/water interface.

Comment (T.W.A.): date appears to be almost 2000 yrs. too old from palynologic evidence. Either contamination by old carbonates in groundwater or redeposition of older mosses or a combination of both contributed to anomalous date. After applying Ogden's (1967) correction factor analysis (i.e., date minus amount of carbonate contamination, 900 yrs. in this case), date still seems too old. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.

GSC-1096. Townline Lake

12,800±1230
10,850 B.C.

Gyttja 664 to 673 cm below gyttja/water interface in 0.3 m water in Townline Lake, alt. 241 m, 9.6 km west of Owen Sound, Ontario (44°33'30"N, 81°04'15"W). Lake lies north of major system of end moraines south of Owen Sound (Chapman and Putnam, 1966) and above highest limit of Glacial Lake Algonquin.

Comment (T.W.A.): date may be too old, compared to similar pollen stratigraphic evidence in Kincardine Bog (GSC-1374; unpubl., Anderson, 1971), probably as a result of Paleozoic carbonate contamination in groundwater. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 5-day count in 2-L counter at 1 atm.

GSC-1620. Saugeen River

6270±250
4320 B.C.

Charcoal from top of buried soil profile developed on alluvial sand and gravel terrace, covered by 2 m of fossiliferous silt, north bank of Saugeen River, at Southampton, Ontario (44°30'N, 81°20'W), at alt. ca. 185 m. Coll. 1971 by P.F. Karrow, Univ. of Waterloo, Waterloo.

Comment (P.F.K.): river terrace is at Nipissing level. Soil profile developed on earlier alluvial terrace which was flooded by rising waters of Lake Nipissing. Date is late in Stanley-Nipissing transition as expected. NaOH-leach omitted from treatment of 3 g sample. Sample mixed with dead gas for counting.

Western Canada

Manitoba

GSC-1549. Churchill, *Chlamys islandicus*, 22 m — 5020±140 / 3070 B.C.

Whole shells and fragments of this large pelecypod from ditch in road-cut, est. ca. 1.5 m below original surface, 6.5 km S.E. of CNR station, Churchill, Manitoba (58°44'25"N, 94°04'35"W), alt. 22 m. Coll. 1966 by B.G. Craig.

Comment (B.G.C.): age of this species is ca. 3000 yrs. older than *Mytilus edulis* collected in same area at 22 m (GSC-723, 2120±130; Craig, 1969; GSC XI, 1971, p. 281).

GSC-1424. Neepawa — >37,000

Carbonaceous particles of sand and granule-size in horizontally bedded sand containing some armoured clay balls, in sand-silt sequence underlying ca. 2 m sandy till; exposed in road-cut 4.0 km south of Neepawa, Manitoba, on east side of Hwy. 258 (50°11'20"N, 99°27'12"W), at alt. 377 m. Coll. 1969 by J.A. Elson.

Comment (J.A.E.): sand and silt unit was interpreted as part of earliest Assiniboine River delta deposited in Glacial Lake Agassiz. Deposit may be older than was thought, or more probably organic particles and armoured clay balls are derived from older Pleistocene sediments. NaOH-leach omitted from sample pretreatment.

GSC-1428. Alexander — 10,000±280 / 8050 B.C.

Wood (*Picea* or *Larix*, id. by R.J. Mott) at ca. 9 m depth in borehole in Assiniboine River flats, ca. 8 km north of Alexander, Manitoba, S.W. 1/4 LSD 4, sec. 9, tp. 11, rge. 21, W. 1st mer. (49°54'N, 100°18'W), alt. 354 m. Coll. 1970 by R.W. Klassen.

Comment (R.W.K.): date is minimum for age of alluvium, ca. 18 m thick above bedrock in a late-glacial segment of Assiniboine Valley.

GSC-1279. Zelena — 23,700±290 / 21,750 B.C.

Charcoal from lacustrine silt and marl separating surface till from underlying till, in road-cut on east side of Shell River valley, ca. 1.6 km north and 4.8 km east of Zelena, Manitoba, N.W. 1/4 sec. 17, tp. 28, rge. 27, W. 1st mer. (51°24'N, 101°14'W). Coll. 1969 by R.W. Klassen.

Comment (R.W.K.): date is considerably younger than previous dates on charcoal (GSC-653, 37,700±1500 yrs.) and marl (GSC-711, 28,200±380 yrs.; both in GSC VII, 1968, p. 217) from same units. As suggested earlier, oldest date is considered most reliable, but additional dates are required to establish age range in these interstadial deposits. NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

Saskatchewan

GSC-1342. Runnymede

30,000±490
28,050 B.C.

Humic material from paleosol developed on varved clay and overlain by two tills; exposed along side of Seton Coulee, ca. 1.6 km north of Runnymede, Saskatchewan, S.W. 1/4 LSD 2, sec. 7, tp. 29, rge. 30, W. 1st mer. (51°30'N, 101°42'W). Coll. 1969 by R.W. Klassen.

Comment (R.W.K.): date is younger than stratigraphic position beneath Minnedosa till (?) and Lennard till suggests. Dated material may have been contaminated by modern carbon. NaOH-leach omitted from sample pretreatment. Date based on one 4-day count.

GSC-1431. Togo

1920±190
A.D. 30

Wood (Salix sp., id. by R.J. Mott) from alluvium at 4.9 m depth in new diversion channel ca. 30 m from Assiniboine River channel, ca. 10.4 km west of Togo, Saskatchewan, S.E. 1/4 sec. 11, tp. 28, rge. 31, W. 1st mer. (51°24'N, 101°45'W), at alt. ca. 427 m. Coll. 1970 by R.W. Klassen.

Comment (R.W.K.): date is considerably younger than GSC-280 (6320±140 yrs.; GSC IV, 1965, p. 31) from same depth in diversion channel ca. 86 km farther downstream. Age differences most likely reflect shifts of channel across flood plain although a greater rate of deposition in upstream part may also be indicated.

GSC-1455. Blackwood

4320±220
2370 B.C.

Charcoal from alluvium at 2.4 m depth in drainage ditch ca. 30 m from Qu'Appelle River channel, ca. 3.2 km south of Blackwood, Saskatchewan, S.W. 1/4 sec. 1, tp. 19A, rge. 11, W. 2nd mer. (50°34'N, 103°25'W), at alt. ca. 475 m. Coll. 1966 by R.W. Klassen.

Comment (R.W.K.): date suggests a slower rate of deposition (0.3 m/500 yrs.) along this part of Qu'Appelle Valley than along parts of Assiniboine Valley (0.3 m/100 to 300 yrs.).

GSC-1335. 'Cycloid Lake', 257-262 cm depth

6000±170
4050 B.C.

Organic lake sediment from 257 to 262 cm below mud/water interface of small lake in bedrock depression ca. 19 km north of La Ronge, Saskatchewan (55°15'N, 105°16'W), at alt. ca. 396 m, water depth 2 m. A total of 340 cm of organic lake sediment overlies clay. Basal organic sediment dated previously (GSC-643, 8520±170 yrs.; GSC VI, 1967, p. 167). Coll. 1966 with Livingstone corer by R.J. Mott.

Comment (R.J.M.): dates beginning of rapid Pinus pollen increase indicating migration of pine into area (Mott, 1973). NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

Alberta

Gros Ventre Creek series, Alberta

A-horizon of two buried soils exposed in face of undercut terrace deposit along north side of Gros Ventre Creek, Alberta, in LSD 4, sec. 9, tp. 11, rge. 4, W. 4th mer. (49°53'N, 110°31'W). Terraced alluvial deposit is locally 160 cm thick and contains a humiferous horizon; it rests on till, on which a soil profile was also developed prior to burial by alluvium. Terrace surface alt. ca. 853 m; present stream channel of Gros Ventre Creek has cut 6 m into terrace surface. Coll. 1966 by M. J. J. Bik, then with Geographical Branch, Dept. EMR; now with Environment Canada.

GSC-857. Gros Ventre Creek (I) — 1670±130 A.D. 280

From dark grey (10YR 4/1, dry) clayey silt occurring at 100 to 110 cm depth.

GSC-1001. Gros Ventre Creek (II) — 3600±140 1650 B.C. δC^{13} = -24.3‰

From greyish brown (2.5Y 5/2, dry) hard clay and pebbly, clayey loam occurring at 130 to 150 cm depth.

General comment (M. J. J. B.): GSC-1001 provides ante-quem date for cessation of colluvial reworking of till deposits, which took place after deposition of Mazama ash in southern Alberta (Bik, 1968). GSC-857 provides approx. age of temporary interruption in alluviation of site; together with GSC-1001 it indicates time span during which basal segment of terrace deposits were accumulated. Dates are similar to two on buried soils south of Elkwater, Alberta (GSC XI, 1971, p. 286-287). For both samples humus was concentrated by "gelling" soil sample through addition of pyrophosphate and ultrasonic stirring. GSC-1001 mixed with dead gas for counting.

British Columbia

Chase series

Mucky peat, overlying freshwater marl containing mollusc shells and minor plant material, forming a 320 cm-thick organic deposit in Harper Lake on east side of South Thompson River, 10 km south of Chase, British Columbia (54°44'05"N, 119°43'30"W), at alt. ca. 685 m. Volcanic ash layers occur at 45 and 70 cm depth. Coll. 1970 by R. J. Fulton.

GSC-1487. Chase (I) — 7190±150 5240 B.C. δC^{13} = -0.4‰

$CaCO_3$ fraction of marl-peat mixture from depth 82-86 cm. Sample taken from a dug hole. Marl contains Lymnaea elodes, Promenetus exacuous, Physa jennessi skinneri, Gyraulus parvus, Helisoma campanulatum, and Sphaeriids (id. by M. F. I. Smith, Natl. Mus. Nat. Sci., Ottawa).

GSC-1487-2. Chase (II)

7400±160
5450 B.C.
$\delta C^{13} = -28.0‰$

Plant organic fraction from marl-peat mixture from depth 82-86 cm. This fraction, dominated by aquatic algae (Chara sp., id. by M. Kuc) and by undeterminable plant fragments, remained after sample dissolved in shell apparatus in H_3PO_4.

GSC-1524. Chase (III)

10,500±170
8550 B.C.
$\delta C^{13} = -0.9‰$

$CaCO_3$ fraction of silty marl containing minor peaty material at depth 315-325 cm. Sample collected with Davis sampler.

GSC-1524-2. Chase (IV)

10,500±370
8550 B.C.
$\delta C^{13} = -26.3‰$

Plant organic fraction at depth 315 to 325 cm. This fraction remained after sample dissolved in shell apparatus in H_3PO_4.

Comment (R.J.F.): dates on organic and $CaCO_3$ fractions of both samples were found to correspond closely. This was also true of an earlier series from near Lower Arrow Lake (GSC IX, 1970, p. 71); apparently marl in the interior of British Columbia is a reliable material for C^{14} dating. GSC-1524 is a minimum date for deglaciation of the adjacent part of the South Thompson River valley. GSC-1524-2 was mixed with dead gas for counting; date based on one 1-day count. GSC-1487 based on one 3-day count.

GSC-1433. Hope Slide

9680±320
7730 B.C.

Wood fragments (partially charred) in kame terrace gravel 33 cm (not 33 m as reported in Mathews, 1972; cf. also Mathews and McTaggart, 1969) beneath a podzolic soil buried by prehistoric landslide debris on south margin of 1965 landslide, ca. 19 km south of Hope, British Columbia (49°17'N, 121°15'W). Coll. 1970 by W.H. Mathews, Univ. of British Columbia, Vancouver.

Comment (W.H.M.): wood is interpreted as part of tree root growing on kame terrace prior to prehistoric landslide. Before burial by this landslide debris, easy circulation of groundwater in kame terrace gravel would have encouraged quick decay of wood following death of tree; accordingly it is inferred that prehistoric landslide occurred very soon after quoted date, if, indeed, it was not responsible for killing tree. Date also provides a minimum for deglaciation at site, but new radiocarbon dates (e.g., GSC-1675, 11,600±280 yrs., this list) indicate that ice withdrew from region appreciably before 11,000 yrs. B.P. Pretreatment included cold NaOH-leach.

40,400±1900
GSC-1594. Langley 38,450 B.C.

Organic silt in a gravel lens enclosed in till and exposed in a freshly excavated pit at 32nd Ave. and 208 St., 5 km south of Langley City, British Columbia (49°03'N, 122°38'W), at alt. ca. 84 m. Coll. 1971 by E.C. Halstead and R.J. Fulton.

Comment (E.C.H.): it was thought that the organic silt would give an Everson Interstade date (i.e., in the range of ca. 13,000 to 11,500 yrs. B.P.; Armstrong et al., 1965; Fulton, 1971). It appears, however, that either the organic fraction in the silt was reworked from an earlier deposit or that the till is of pre-Vashon age. NaOH-leach omitted due to finely disseminated nature of sample (700 g).

11,600±280
GSC-1675. Mt. Lehman Road 9650 B.C.

Wood chips from base of Sumas-type till-like material, 2 to 3 m thick, overlying shell-bearing glaciomarine sediment in road-cut on east side of Mt. Lehman Road, 8.8 km N.W. of Abbotsford, British Columbia (49°06'20"N, 122°22'50"W), at alt. ca. 75 m. Another part of same sample previously dated as L-221E (11,000±900 yrs.; Broecker et al., 1956). Coll. 1953 by J.E. Armstrong; subm. by W.H. Mathews.

Comment (W.H.M.): new date is in better agreement than first determination with several other dates from Sumas maximum (11,590 to 11,930 yrs. B.P.; Fulton, 1971, p. 10-11, no. 22-24) and with marine submergence dated by Easterbrook (1963) at ca. 11,800±400 yrs. (I-1037) and 11,640±275 yrs. (W-940). A very short time interval is left between these dates and several new postglacial dates (Mathewes et al., 1972) from the Yale area, 90 km to the N.E., but other new postglacial dates (9990 to 11,000 yrs. B.P.) from interior of British Columbia, still farther N.E. (Fulton, 1971, p. 10, no. 12-16 and 20), also suggest rapid ice retreat from Sumas climax. Date based on one 3-day count in 1-L counter.

6170±150
GSC-1477. Sentinel Glacier 4220 B.C.
$\delta C^{13} = -22.9‰$

Wood (Abies sp., id. by R.J. Mott) embedded in till at alt. 1670 m, in re-entrant near snout of Sentinel Glacier (49°53'N, 122°58'W), 80 km north of Vancouver and 2.4 km south of Garibaldi Lake. Coll. 1970 by O. Mokievsky-Zubok, Glaciology Division, Inland Waters Directorate, Environment Canada.

Comment (O.M.-Z.): wood exposed by glacial retreat is 2 km from glacier's known maximum extent in historical time (near Garibaldi Lake in 1923); its presence confirms existence of forest in presently glacierized area during Hypsithermal time (Mokievsky-Zubok, 1972; cf. also Mathews, 1951). Previous dates in same mountain complex are Y-140 bis (5260±200 yrs.; Yale V, 1960, p. 58) on rooted yellow cedar from east side Mt. Garibaldi at ca. 1869 m alt. and GSC-760 (5950±140 yrs.; GSC VII, 1968, p. 226), on roots of Abies sp. at ca. 2130 m on west side of Mt. Breakenridge.

GSC-1635. Point Grey

26,100±320
24,150 B.C.

Flattened piece of wood (Salix sp., id. by R.J. Mott) in peaty layer within silty clay of Point Grey Formation, part of Quadra intertill sediments. Exposed at base of sea cliff, west tip of Point Grey, University Endowment Lands, Vancouver, British Columbia (49°15'55"N, 123°15'47"W), at alt. ca. 0.3 m. Coll. 1971 by W.R. Danner, Univ. of British Columbia, Vancouver.

Comment (W.R.D.): peat-bearing beds exposed only when unusually high tides erode into base of cliff. Ca. 6 to 7.6 m higher in sea cliff, similar peaty layer is 25,000±600 yrs. old (GSC-109; GSC II, 1963, p. 48; Armstrong et al., 1965). Dates give possible rate of sedimentation in Point Grey beds. Date based on one 3-day count.

GSC-1651. Shearwater

12,210±330
10,260 B.C.

Balanus sp. shell fragments from road-cut near old Standard Oil dock, Shearwater, British Columbia (52°09'N, 128°06'W), at alt. 10.7 m. Sample from base of pebbly clay overlain by 1.5 m silt, 0.7 m sand, and capped by 1.5 m of gravel grading upward to boulders; entire section resembles glaciomarine sediments. Coll. 1971 by J.T. Andrews and R. Retherford, Univ. of Colorado, Boulder, Colorado.

Comment (J.T.A.): shells dated to obtain estimate of deglaciation date for outer coast in area. HCl-leach omitted due to small sample size (5.2 g). Date based on one 3-day count.

GSC-1372. Tide Lake flats

2730±170
780 B.C.
$\delta C^{13} = -21.0‰$

Small wood sample at 45 m depth in 10 m-thick zone of clay, silt and fine sand encountered in well drilled on Tide Lake flats, 1.7 km N.E. of Berendon Glacier, Granduc well field, British Columbia (56°16'N, 130°03'W). The well, one of 7 drilled for water supply for Granduc Mine (alt. 650 m), started in varved silts laid down in Tide Lake, which had been ponded for several centuries by Frankmackie Glacier (6 km to north) and survived early 1900's. Beneath ca. 6 m of silt, the well penetrated sand and gravel of fan and fluviatile origins, and then wood-bearing silty zone which evidently records an earlier lacustrine stage. Beneath this zone are more fluviatile gravels and at well bottom, 70 m down, is a third silt-rich zone, underlain in adjacent well by till. Coll. 1968 by well drillers; subm. by W.H. Mathews.

Comment (W.H.M.): date is interpreted as indicating one of three periods since deposition of lowest till when Frankmackie Glacier was sufficiently advanced to pond water in Tide Lake area. Lowest till may be either of Neoglacial age (but >2730 yrs. old) or of late Wisconsin age. Sample mixed with dead gas for counting.

Dawson Creek series

Freshwater mollusks from vicinity of Dawson Creek, British Columbia. GSC-1548 and GSC-1654 coll. 1970 and 1971 respectively, by T.H.F. Reimchen, then at the Univ. of Western Ontario, London; now with Bayrock Surficial Geology, Ltd., N. Vancouver.

GSC-1548. Dawson Creek (I) — 9960±170 / 8010 B.C.

Mollusk shells (mainly Lymnaea elodes, also L. stagnalis appressa, Gyraulus deflectus, and Sphaleriids; id. by M.F.I. Smith, Natl. Mus. Nat. Sci., Ottawa) from road-cut, 24 km north of Dawson Creek, British Columbia (55°58'50"N, 120°14'37"W), at alt. ca. 670 m. Sample collected at contact between silty clay and overlying massive silt, nearly 2 m below the ground surface and 15 to 30 cm behind natural face of 5 yr-old exposure.

GSC-1654. Dawson Creek (II) — 10,400±170 / 8450 B.C.

Shells of Lymnaea elodes (id. by M.F.I. Smith) from road-cut, ca. 30 km north of Dawson Creek, British Columbia (55°59'00"N, 120°15'40"W), at alt. ca. 655 m. Sample collected in sandy silt unit 2.7 m below ground surface, above silt unit, and 30 cm behind natural face of 5 yr-old exposure.

General Comment (W.B. Jr.): due to a mistake in the data supplied to the computer, the age for GSC-1548 was first calculated as 16,300±180 yrs., and this date was published by Reimchen and Rutter (1972); cf. also Reeves (1973). The recalculated age agrees closely with the age of GSC-1654, and it fits the regional picture of deglaciation chronology. Both dated samples refer to Reimchen and Rutter's lacustrine phase II, proglacial lakes (one of whose shorelines is at ca. 690 m) formed during the final withdrawal of Laurentide ice. Both samples mixed with dead gas for counting. GSC-1548 based on one 3-day count.

Northern Canada, Mainland

Yukon Territory

GSC-1937. Alaska Highway, Mile 1053.1 — 10,100±430 / 8150 B.C.

Freshwater shells (Lymnaea arctica and L. modicella; id. by M.F.I. Smith, Natl. Mus. Nat. Sci., Ottawa) from silt within Kluane loess at borrow pit, Mile 1053.1 (km 1685) on Alaska Hwy., Yukon (61°02'N, 138°22.5'W), at alt. ca. 825 m. Site is ca. 5 km east of turn-off to Silver City at S.E. end of Kluane Lake, and it is described in Hughes et al. (1972; Stop 3). Silty pond deposit, containing these two species plus Sphaeriids, overlies Kluane outwash and is in turn overlain by Kluane loess and Slims soil complex. Coll. 1972 by W. Blake, Jr.

Comment (W.B., Jr.): date is similar to one of 9780±80 yrs. (Y-1483; grass in place at base of Kluane loess near the Kaskawulsh Glacier)

but is ca. 2000 yrs. less than one of 12,500±200 yrs. (Y-1386; organic matter from bottom of kettle in Kluane ice-contact stratified drift in the Shakwak Valley, close to site of present sample) reported by Denton and Stuiver (1966, 1967). HCl-leach omitted due to small sample size (2.8 g). Sample mixed with dead gas for counting. Date based on one 3-day count.

GSC-1569. Kluane Lake (II) — 120±130; A.D. 1830; $\delta C^{13} = -21.6‰$

Driftwood (Populus sp., id. by R.J. Mott) from abandoned beach on point near south end of Kluane Lake, Yukon (61°02'N, 138°29'W), alt. ca. 760 m, ca. 15 m above present lake level. Coll. 1971 by V.N. Rampton.

Comment (V.N.R.): consideration of counting errors, corrections for half life, and fluctuations in atmospheric C^{14} concentration indicate an age range of modern to 320 B.P. (Hughes et al., 1972). However, living trees below abandoned beach of 250 yrs. (Ragle et al., 1971) indicate that Kluane Lake was at 15 m level between 250 and 320 B.P. (cf. GSC-867, 340±130 yrs., wood from in situ spruce stump below present lake level in Christmas Bay; GSC IX, 1970, p. 75).

GSC-1449. Swede Johnson Creek — >43,000

Wood (Picea or Larix, id. by R.J. Mott) located 2 m below top of 5 m gravel underlying 3 m till in borrow pit south of Alaska Hwy., 2.5 km west of highway crossing over Swede Johnson Creek, Yukon (61°35'N, 139°28'W). Coll. 1970 by O.L. Hughes and V.N. Rampton.

Comment (V.N.R.): absence of datable interstadial materials of finite age in Yukon is common phenomena (cf. Rampton, 1971; Hughes et al., 1972). Date based on one 5-day count.

Donjek River Bridge series

Wood underlying tephra in exposure on north side of Alaska Hwy. at west end of Donjek River Bridge, Yukon (61°41'N, 139°45'W). Stratigraphy in ascending order: 110+ cm of fine silty sand with woody layers, and 2.5 cm of volcanic ash 75 cm from base; 35 cm of volcanic lapilli; covered interval. Coll. 1971 by V.N. Rampton.

GSC-1568. Donjek River Bridge, upper wood — 1280±130; A.D. 670; $\delta C^{13} = -22.6‰$

Wood (Picea sp., id. by R.J. Mott) from below lapilli.

GSC-1564. Donjek River Bridge, lower wood — 1750±130; A.D. 200; $\delta C^{13} = -22.9‰$

Wood (Picea sp., id. by R.J. Mott) from below ash.

General comment (V.N.R.): GSC-1568 is similar to other dates relating to eastern lobe of White River ash, whereas GSC-1564 is similar to

numerous dates relating to northern lobe of White River ash (cf. Hughes et al., 1972; GSC IX, 1970, p. 80; GSC VII, 1968, p. 229-230).

GSC-1454. O'Brian Creek (II) 9040±140 7090 B.C.

Wood (Populus sp., id. by R.J. Mott) from 10 m above base of 18+ m-thick deposit of organic silt overlying 10 m of gravel on east bank White River, opposite O'Brian Creek, Yukon (62°38'N, 140°0.5'W), at alt. ca. 520 m. Coll. 1970 by D. Tempelmann-Kluit; subm. by V.N. Rampton.

Comment (V.N.R.): date is much younger than GSC-960 (>38,000 yrs.; GSC IX, 1970, p. 77) on peat at base of organic silt; a major hiatus may exist within the silt, and much of the valley fill in the region may have occurred relatively recently (cf. GSC-1407, 12,000±160 yrs.; GSC XI, 1971, p. 303). Date based on one 3-day count.

White River series (II)

Wood and organic silt downstream from Alaska Hwy. bridge across White River, Yukon (62°00'N, 140°34'W). Coll. 1971 by V.N. Rampton.

GSC-1615. White River, Yukon (VI) >48,000

Wood (Picea sp., id. by R.J. Mott) from mudflow debris, west bank of White River, 1.9 km downstream from bridge. Mudflow is underlain by 1.3 m partly oxidized till and 0.6+ m alluvium, and is overlain by slump composed of gray drift. Pretreatment of 41.0 g sample included 1 hour in hot 2% NaOH, 1 hour in hot 4N HCl, and distilled water rinses. Date based on one 1-day count and 4-day count in 5-L counter at 4 atm.

GSC-1579. White River, Yukon (VII) >40,000

Organic silt, ca. 7 m above river level, from top of 1 m organic silt and weathered till overlying gravel and underlying 10 m unweathered till and gravel. NaOH-leach omitted from sample pretreatment. Date based on one 4-day count.

General comment (V.N.R.): GSC-1615 indicates that a date of 48,000±1300 yrs. (GSC-732; GSC IX, 1970, p. 79) on wood in mudflow is probably due to contamination, as previously suspected. GSC-1579 confirms that weathering zones at site do not correlate with Boutellier nonglacial interval (37,000 to 30,000 B.P.) defined by Denton and Stuiver (1967; cf. Rampton, 1971; Hughes et al., 1972).

GSC-1229. Phillips Bay >43,000

Fragments of water-worn wood (Picea sp., id. by R.J. Mott) from near base of 3 m sand and gravel overlying pebbly clay in shore bluff at south edge of Phillips Bay, Yukon (69°15'N, 138°30'W). Coll. 1965 by J.G. Fyles; subm. by V.N. Rampton.

Comment (V.N.R.): if wood is not reworked interstadial or interglacial material, date indicates site has not been glaciated for at least 43,000 yrs. (cf. Mackay et al., 1972). Date based on one 4-day count.

Northwest Territories – District of Mackenzie

GSC-1286. Tununuk — 11,000±160 (9050 B.C.)

Peat at base of 3 m peat and sand sequence overlying 3+ m gravel in road-cut near Tununuk, southern tip of Richards Island, District of Mackenzie, N.W.T. (69°00'N, 134°40'W), at alt. 14 m. Coll. 1969 by V.N. Rampton.

Comment (V.N.R.): date relates to initiation of thermokarst and peat accumulation at site rather than to deglaciation of area (cf. Mackay et al., 1972; Fyles et al., 1972). NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

GSC-1373. 'Yaya' Lake — >31,000

Twigs (24) from sands at base of 1 m of peat, silt and sand exposed in miniature pingo 1 km east of point on N.E. side of 'Yaya' Lake, District of Mackenzie, N.W.T. (69°13'N, 134°35'W). Coll. 1969 by V.N. Rampton.

Comment (V.N.R.): sands have been interpreted as lacustrine in origin. Date suggests site has not been glaciated for at least 31,000 yrs. (cf. Mackay et al., 1972). Sample mixed with dead gas for counting. Date based on one 3-day count.

GSC-709. East Channel, Mackenzie River — >40,000

Water-worn wood (Picea or Larix sp., id. by R.J. Mott), associated with spruce cone from near base of 8 m sandy gravel overlying eroded surface of fine sand in terrace along N.W. bank of East Channel, Mackenzie River, District of Mackenzie, N.W.T. (69°14.5'N, 134°12.5'W), at alt. ca. 10 m. Coll. 1966 by J.G. Fyles.

Comment (J.G.F.): date suggests high terrace along East Channel, Mackenzie River, was formed >40,000 yrs. ago. (cf. Mackay, 1963; Mackay et al., 1972). Date based on one 3-day count.

Twin Lakes, Inuvik series

Moss peat from postglacial peat sequence on west side of Twin Lakes between Inuvik and East Channel, Mackenzie River, District of Mackenzie, N.W.T. (68°22'N, 133°44.5'W), at alt. 15 m. Coll. 1969 by M. Kuc.

GSC-1574. Twin Lakes, Paludella peat — 7700±140 (5750 B.C.)

Paludella squarrosa peat layer ca. 20 to 25 cm thick, 200 cm below surface, separating terrestrial part of profile from underlying lake deposits.

GSC-1514. Twin Lakes, Drepanocladus peat — 11,500±160 (9550 B.C.)

Basal layer ca. 330 cm below surface, above glaciofluvial gravels or till. Drepanocladus exannulatus is dominant, other mosses are Sphagnum sp. and Tomenthypnum nitens. Associated remains include Betula sp., Picea glauca, Populus sp., Myrica gale, and Salix sp.

General comment (M.K.): dated peat layers, together with GSC-25, 8200±300 yrs. (GSC I, 1962, p. 20-21; Mackay and Terasmae, 1963) and three younger dates on samples coll. by J.C. Ritchie (Wisconsin VII, 1970, p. 344), show development over >6000 yrs. to present shrub vegetation (Kuc, 1972). NaOH-leach omitted from pretreatment of both samples. GSC-1514 mixed with dead gas for counting. Each date based on one 3-day count.

GSC-1160. Parsons Lake — 11,400±160 / 9450 B.C.

Twigs and peat from near base of 5.5 m exposure of peat and lacustrine sediments at south end of Parsons Lake, District of Mackenzie, N.W.T. (68°56'N, 133°38'W). Coll. 1966 by J.G. Fyles.

Comment (V.N.R.): date relates to lacustrine sediments deposited in thermokarst basin rather than to deglaciation of area (cf. GSC-1321, 12,900±170 yrs.; Ritchie and Hare, 1971; this list). NaOH-leach omitted from sample pretreatment.

Tuktoyaktuk Peninsula, Lake 5 series

A series of lake sediment samples from 306 cm-long core raised from unnamed kettle lake (water depth, 9 m) on morainic ridge, Tuktoyaktuk Peninsula, District of Mackenzie, N.W.T. (69°03'N, 133°27'W). Coll. 1968 from ice with square-rod piston sampler by J.C. Ritchie, then Dalhousie Univ., Halifax; now Scarborough College, Univ. of Toronto, West Hill; and D.W. Schindler.

GSC-1338. Lake 5, 62 to 78 cm depth — 3630±140 / 1680 B.C. / δC^{13} = -27.5‰

Near base of Zone V, birch-alder assemblage.

GSC-1269. Lake 5, 125 to 132 cm depth — 5440±140 / 3490 B.C. / δC^{13} = -29.4‰

Top of Zone III; top of Picea dominated stratigraphic interval.

GSC-1354. Lake 5, 175 to 185 cm depth — 8690±180 / 6740 B.C.

Top of Zone II; bottom of Picea-dominated stratigraphic interval.

GSC-1237. Lake 5, 195 to 202 cm depth — 11,500±220 / 9550 B.C. / δC^{13} = -29.1‰

Zone I/II boundary; start of Picea rise.

GSC-1321. Lake 5, 240 to 260 cm depth — 12,900±170 / 10,950 B.C.

Lowermost layer with pollen spectra.

General comment (J.C.R.): relative and absolute pollen frequencies of 5 cm-interval samples from this core yielded a pollen stratigraphic record (Ritchie and Hare, 1971; Ritchie, 1972) suggesting the following late-Pleistocene vegetational sequence: 12,900 to 11,600 yrs. B.P., dwarf birch

tundra; 11,600 to 8500 yrs. B.P., forest tundra; 8500 to 5500 yrs. B.P., closed-crown spruce-birch forest; 5500 to 4000 yrs. B.P., tall shrub tundra; 4000 yrs. to present, dwarf birch heath tundra. Ritchie and Hare (1971) interpret these results in terms of a displacement northward of the Arctic Front (July position) in this area of at least 350 km during Hypsithermal Interval (8500 to 5000 yrs. B.P.). NaOH-leach omitted from pretreatment of all samples. GSC-1237 and -1338 mixed with dead gas for counting. GSC-1321 based on one 3-day count.

GSC-1265. Tuktoyaktuk Peninsula, wood

4940±140
2990 B.C.
$\delta C^{13} = -21.6‰$

Wood (Picea glauca, id. by J.C. Ritchie) from stump exposed in situ on gravel bank of small lake in tundra, ca. 35 km S.S.W. of Tuktoyaktuk, District of Mackenzie, N.W.T. (69°07'N, 133°16'W). Coll. 1969 by J.C. Ritchie.

Comment (J.C.R.): date correlates with end of a spruce pollen zone from lake sediments in nearby site (see GSC-1269, 5540±140 yrs.; Ritchie and Hare, 1971; this list). Radial measurements of wood suggest that growth was comparable to modern values from central Boreal forest, corroborating a Hypsithermal spruce transgression.

GSC-1169. Tuktoyaktuk Peninsula, twigs and peat

9560±150
7610 B.C.
$\delta C^{13} = -26.1‰$

Willow(?) twigs and peat from 313 m-thick clayey colluvium mudflow debris in exposure near small lake on Tuktoyaktuk Peninsula, District of Mackenzie, N.W.T. (69°10'N, 133°12'W). Colluvium overlies interlayered silt and pebbly clayey silt. Coll. 1966 by J.G. Fyles.

Comment (V.N.R.): date relates to local melting of permafrost and deposition of mudflow debris rather than to deglaciation of site (cf. GSC-1321, 12, 900±170 yrs.; Ritchie and Hare, 1971; this list). Date based on one 3-day count.

GSC-1582. Peninsula Point East

3430±140
1480 B.C.

Organic detritus (incl. vascular plant remains, id. by M. Kuc) from fossil soil layer in outer, older part of ice wedge exposed in shore bluff, 1 km east of Peninsula Point, District of Mackenzie, N.W.T. (69°24.5'N, 133°08'W), at alt. 15 m. Coll. 1971 by V.N. Rampton.

Comment (V.N.R.): date indicates time at which ice wedge growth was interrupted at site. NaOH-leach omitted from sample pretreatment.

Ibyuk Pingo series

Organic silt, peat, and wood from tilted strata on S.E. side of Ibyuk Pingo, District of Mackenzie, N.W.T. (69°24'N, 133°04'W). Stratigraphy in ascending order: 8.7 m sand containing lenses of gravel and wood,

3 cm organic material, 1.8 m pebbly clayey silt with rare pieces of wood and pods of peat and organic silt, 3 m silt and clay, and 0.6 m peat. Coll. 1965 by J.G. Fyles.

GSC-512. Ibyuk Pingo (I) — 14,130±440 / 12,180 B.C.

Organic silt from 5 cm above base of pebbly clayey silt.

GSC-481. Ibyuk Pingo (II) — 17,860±260 / 15,910 B.C.

Peat from 30 cm above base of pebbly clayey silt.

GSC-486. Ibyuk Pingo (III) — >37,500

Wood from 2 m below top of lower sand.

GSC-485. Ibyuk Pingo (IV) — >42,900

Wood from 0.6 m below top of lower sand.

General comment (J.G.F.): as pebbly, clayey silt is probably till that has slumped into a lake (cf. Müller, 1962; Fyles, 1967; Fyles et al., 1972), GSC-481 gives minimum age for last glaciation of area. GSC-486 and GSC-485 are consistent with dates of >33,000 (L-300A; Müller, 1962) and >26,000 (Be-49). This University of Bern date was originally reported by Müller in 1962 as 28,000±2000 yrs., but it has since been revised because contamination is known to have occurred in the Bern laboratory during the early phase of its operation (pers. comm. from H. Oeschger to W. Blake, Jr., Aug. 19, 1971; cf. Fyles et al., 1972). A date of 12,000±300 yrs. (S-69; Müller, 1962) was obtained 2 m from top of sequence. NaOH-leach omitted from pretreatment of GSC-481 and -512; both mixed with dead gas for counting. GSC-481, -485, and -512 each based on one 3-day count.

GSC-1458. Tuktoyaktuk, pingo tunnel — 9460±140 / 7510 B.C.

Woody peat from icy lacustrine silts overlying gravel and pingo ice. Sample taken 15 cm above floor and 9 m from entrance on west wall of tunnel in pingo, hamlet of Tuktoyaktuk, District of Mackenzie, N.W.T. (69°27'N, 133°01'W), at alt. ca. 3.7 m. Coll. 1970 by V.N. Rampton.

Comment (V.N.R.): date gives maximum for time of pingo formation; i.e., lake existed at site ca. 9500 yrs. ago (Fyles et al., 1972). NaOH-leach omitted from sample pretreatment. Date based on one 4-day count.

GSC-1327. Liverpool Bay — 9180±150 / 7230 B.C.

Black peat (mainly Ditrichum flexicaule, id. by M. Kuc) from 4 m-thick pebbly silt containing pods of peat, twigs, etc., in shore bluff on south side of Liverpool Bay, west of Nicholson Point, District of Mackenzie,

N.W.T. (69°48.5'N, 129°32'W), at alt. 5 m. Pebbly silt underlies 4.5 m organic clay and peat and overlies 3+ m sand (?). Coll. 1969 by V.N. Rampton.

Comment (V.N.R.): pebbly silt is interpreted as mudflow debris, which probably resulted from melting of ground ice. NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

GSC-1282. Castle Bluff, peat — 8640±150 / 6690 B.C. / δC^{13} = -26.2‰

Peat, 1 m above base of 3 m-thick peat and clay unit overlying 1 m sand, 12 m pebbly clay and 6.5 m bedrock in gully near sea at Castle Bluff, District of Mackenzie, N.W.T. (69°47'N, 128°47'W). Coll. 1969 by V.N. Rampton.

Comment (V.N.R.): date indicates age of pond materials deposited in basin of probable thermokarst origin. NaOH-leach omitted from sample pretreatment.

GSC-1190. Thunder River — >52,000

Wood 1 m above base of 7 m-thick unit of compact till, from gully on the north side of the Mackenzie River, 5 km west of the mouth of Thunder River, District of Mackenzie, N.W.T. (67°29'N, 131°00'W), at alt. ca. 32 m and 22 m above river level. Below till are 9 m of pink sand and gravel and a 12 m covered interval. Above till (containing the sample) are 40 m of till and slumped silt, a 12 m covered interval, and 10 m of silt.

Comment (R.J.F.): this date could be a minimum for the last ice advance in this area, or, if either the overlying slumped silt or covered interval contain a till, the sample relates to an earlier event. Mackay and Mathews (1973) suggest that, because the surface silt in this region has been fluted during the last glaciation, tills within the section, such as that enclosing GSC-1190, must be assigned to an earlier glaciation. Pretreatment of 55.5 g sample included 1 hour in hot 2% NaOH, 1 hour in hot 4N HCl, and distilled water rinses. Date based on one 1-day count and one 4-day count in 5-L counter at 4 atm.

GSC-1285. Hare Indian River — >38,000

Wood (Picea sp., id. by R.J. Mott) from lower part of 7 m-thick sand unit underlying 0.5 m boulders and gravel, 3 m gravel, and 25 m of silt and fine-grained sand in a cut on Hare Indian River, about 13 km upstream from the Mackenzie River and 6 km north of Ontadek Lake, District of Mackenzie, N.W.T. (66°21'30"N, 128°24'W), at alt. ca. 40 m, and ca. 15+ m above river level. Coll. 1968 by R.J. Fulton.

Comment (R.J.F.): the surface silt and sand was probably deposited in a glacial lake, hence the sand containing the wood predates the last glaciation of this area. At a nearby site on the Hare Indian River wood from the surface fine sand, about 5 m above a thin till bed which overlies, in turn, pea gravel and sand (the unit from which GSC-1285 was recovered), is also >38,000 years old (I-3736; Mackay and Mathews, 1973). Date based on one 3-day count.

2370±130
GSC-1647. Shiltee Island 420 B.C.

Organic debris containing seeds of Betula sp., leaves of Ledum sp. and Empetrum sp.; peat forming mosses: Tomenthypnum nitens, Mnium affine sensu latissimo, Dicranum elongatum, Drepanocladus exannulatus, and Bryum pseudotriquetrum; and humus-forming mosses: Hylocomium splendens, Drepanocladus uncinatus, and Eurhynchium pulchellum (all id. by M. Kuc), from bank of Peel River at Shiltee Island, District of Mackenzie, N.W.T. (67°18'N, 134°51'W), at alt. less than 30 m. Sample site, 16 km upstream (south) from Fort McPherson, was 7.75 m below ground surface and at river level at time of collection (3 August 1971). Coll. by R.M. Strang, then with Canadian Forestry Service, now with Dept. Indian Affairs and Northern Development, Ottawa.

Comment (W.B., Jr.): the average annual rate of silt accumulation has been calculated by Strang to be 0.3 cm on the basis of the C^{14} date, whereas values between 0.5 and 1.3 cm were obtained from studying ages and depths of root whorls on two nearby white spruce (Picea glauca) trees, both of which were close to 300 years old (Strang, 1973). NaOH-leach omitted from sample pretreatment.

Grotte Valerie series, South Nahanni River

Wood samples from floor of cave (Grotte Valerie) in limestone on north side of South Nahanni River at lower end of First Canyon, District of Mackenzie, N.W.T. (61°17'30"N, 124°05'30"W), at alt. ca. 670 m, ca. 365 to 425 m above river, and ca. 135 to 180 m in from cave entrance. Cave temperature relatively constant, with seasonal variations a few degrees above or below freezing; cave also contains numerous skeletons of Dall's sheep (Ovis dalli). Coll. 1971 by G.O. Lee, Natl. and Historic Parks Br., Dept. Indian Affairs and Northern Development, Ottawa.

7920±140
GSC-1634. Grotte Valerie, wood (I) 5970 B.C.

Exposed portion of worn piece of spruce wood (Picea sp., id. by R.J. Mott) frozen into ice floor of cave.

880±130
GSC-1727. Grotte Valerie, wood (II) A.D. 1070

Piece of wood (Picea sp., id. by R.J. Mott) 40 cm long lying on surface of ice floor of cave. Wood was yellowing in colour, had fine coating of clay-silt, and was worm eaten on surface; inner dry wood was dense and tough.

General comment (G.L.): GSC-1727 is considerably younger than GSC-1634, which was taken from the same general vicinity in the cave. These dates, in conjunction with other C^{14} dates on the skull of a Dall's sheep and uranium series dates on stalactites, will help to trace the historic development of the caves as well as to reconstruct the development of plant communities in this unglaciated terrain. GSC-1727 based on one 3-day count.

2500±140
GSC-1517. Coppermine 550 B.C.

Basal moss sedge peat at 83 to 87 cm depth above coarse marine beach sand and gravel in pit excavated with chain saw into frozen peat of level peat bog, on south side of road to airstrip ca. 3.2 km west of Coppermine, District of Mackenzie, N.W.T. (67°50'N, 115°16'W), at alt. 18.9 m. Coll. 1969 by H. Nichols, Univ. of Colorado, Boulder, Colorado.

Comment (H.N.): provides minimum date for age of underlying raised marine beach which Andrews et al. (1971) suggest emerged ca. 4000 yrs. B.P. Sample contained Carex sp., probably Eriophorum and aquatic mosses (Calliergon richardsonii, C. sarmentosum, C. trifarium, Drepanocladus revolvens, Scorpidium scorpioides; id. by M. Kuc, who describes deposit as mossy sapropel or limnic peat), so probably depositional hiatus occurred between beach emergence and moss accumulation. Frozen stratigraphy prevented examination of peat/sand interface for signs of subaerial weathering, soil formation, stream flow, etc. Aquatic moss accumulation over sand after estimated 1500-yrs.' exposure of site suggests possible environmental/climatic change, perhaps higher precipitation and/or higher permafrost level, synchronous with peat genesis and climatic change elsewhere in Canada and abroad (Nichols, 1967, 1969, 1970). NaOH-leach omitted from sample pretreatment.

Northern Canada, Arctic Archipelago

GSC Arctic

Baffin Island

9010±380
GSC-1903. Jackman Sound 7060 B.C.

Single right valve of marine pelecypod, Hiatella arctica, from ground surface on east side of unnamed lake in valley between York and Jackman Sounds, Frobisher Bay, Baffin Island, N.W.T. (62°21.5'N, 66°29'W), at alt. <60 m (from 1:250,000 topographic map). Coll. 1952 by W. Blake, Jr.

Comment (W.B., Jr.): date is similar to GSC-463 (8840±160 yrs.) and GSC-463-2 (8710±180 yrs.) on marine pelecypods at alt. ca. 20 m in delta (surface alt. ca. 38 m) at head of York Sound, 6.5 km to north (Blake, 1966; GSC VI, 1967, p. 182). The dates indicate that the outer part of Frobisher Bay was deglaciated by 8500 years ago, and perhaps as early as 9400 years B.P. HCl-leach omitted due to small sample size (2.75 g). Sample mixed with dead gas for counting. Date based on one 3-day count. WB Jr

3570±140
GSC-1507. Narpaing Fiord 1620 B.C.

Moss peat (Calliergon sarmentosum, id. by M. Kuc) from in situ compressed layer in bank of small creek ca. 1.5 km from head of Narpaing Fiord, Baffin Island, N.W.T. (67°34.5'N, 65°22.5'W), at alt. 6 to 7 m ± 0.5 m. Layer is 1 m above present river level and is overlain by 45 cm of medium sand and gravel. Coll. 1970 by J.T. Andrews, Univ. of Colorado, Boulder, Colorado.

Andrews

Comment (J.T.A.): date very slightly older than expected. Moss overlies a pebbly/silt matrix representing shallow water fiord-head deposition. Date gives minimum age for emergence of sites at alt. 6 to 7 m by postglacial isostatic recovery. Marine limit in vicinity is ca. 17 m (Andrews and Miller, 1972). Because moss is overlain by fluvial material, a change in base level or in sediment supply is suggested; both are possible. Submergence is now occurring along this part of coast, possibly related to load of Penny Ice Cap. Date of ca. 3600 yrs. B.P. accords with age of early Neoglacial moraines that front Akudlermuit Glacier, ca. 3 km east. Based on GSC-1507, head of Narpaing Fiord was deglaciated 6000 to 7000 yrs. B.P.

GSC-1845. Quajon Fiord — 1130±80 A.D. 820

Miller + Andrews

Organic-rich lens (mostly fragments of vascular plants, but marine algae probable also; id. by M. Kuc) 50 cm below surface of pit dug into beach at head of Quajon Fiord, Baffin Island, N.W.T. (67°38'N, 65°12'W), alt. 10-20 cm below present high tide. Coll. 1971 by G.H. Miller, subm. by J.T. Andrews, both of Univ. of Colorado, Boulder.

Comments (G.H.M. and J.T.A.): evidence for recent coastal submergence is widespread throughout the fiords and outer coast of northern Cumberland Peninsula and includes the destruction of paleo-Eskimo Thule and Dorset sites, advance of shingle ridges over terrestrial deposits, and cliffing of alluvial fans. Radiocarbon dates (4) related to this submergence all date between 700 and 1150 C^{14} years ago; e.g., see GaK-3096 (930±100 yrs.) and GaK-3639 (750±140 yrs.) from beneath beach material in Canso Channel and at the head of Narpaing Fiord, respectively (Andrews and Miller, 1972). NaOH leach omitted from sample pretreatment because of fine nature of material (19.3 g). Sample mixed with dead gas for counting.

GSC-1638. Okoa Bay — 8410±340 6460 B.C.

Miller

Single valve of Mya truncata from silty horizon in stream-cut bank of raised marine delta, small inlet on west side of mouth of Okoa Bay, Cumberland Peninsula, Baffin Island, N.W.T. (67°56'N, 66°03'W), at alt. 34.2 m and relating to delta surface at 37.1 m. Local marine limit is 42.8 m. Coll. 1971 by G.H. Miller; subm. by J.T. Andrews.

Comment (G.H.M.): locality was not glacierized during late-Wisconsin time; feature is due to depression beyond ice margin (main ice margin was >40 km S.W.). Relatively young date indicates possibility of a major marine transgression then. HCl-leach omitted due to small sample size (5.8 g). Sample mixed with dead gas for counting.

Devon Island

GSC-1606. Boat Point, wood, 24.0 m — 4500±130 2550 B.C. $\delta C^{13} = -23.3‰$

Driftwood log (Picea sp., id. by R.J. Mott) partly imbedded in shingle beach ca. 4.0 km S.S.W. of Boat Point, Devon Island, N.W.T. (75°58.5'N, 89°58'W), at alt. 24.0 m. Coll. 1970 by W. Blake, Jr.

Comment (W.B., Jr.): wood is ca. 2 m below 'pumice horizon' at this site, and together with GSC-1072 (5250±130 years) at 26.5 m it brackets position of pumice and provides further evidence that age of pumice is ca. 5000 years (Blake, 1973). Blake

GSC-1704. Cape Vera, wood, 25.0 m — 5020±140 (3070 B.C.) $\delta C^{13} = -23.1‰$

Driftwood log (Picea sp., id. by R.J. Mott) imbedded horizontally under 2 to 3 cm gravel in shingle beach 3.75 km S.W. of Cape Vera, Colin Archer Peninsula, Devon Island, N.W.T. (76°13.5'N, 89°19'W), at alt. 25.0 m. Coll. 1970 by W. Blake, Jr.

Comment (W.B., Jr.): age of wood, less than 0.5 m below single cobble of pumice at this site, lends further support to hypothesis that the 'pumice horizon' around Jones Sound is ca. 5000 years old (Blake, 1973; and dates from Boat Point and Cape Storm, this list). Blake.

GSC-1699. Porden Point, wood, ca. 36.5 m — 4410±150 (2460 B.C.)

Driftwood (Larix sp., id. by L.D. Wilson) loose on surface of shingle beach near Porden Point, Grinnell Peninsula, Devon Island, N.W.T. (76°15.5'N, 93°38'W), at alt. ca. 36.5 m. Coll. 1970 by J. Irish for J.W. Kerr; subm. by W. Blake, Jr.

Comment (W.B., Jr.): wood is younger than expected for the altitude at which it occurs, although Grinnell Peninsula has undergone greater postglacial uplift than region to east around Jones Sound. Since wood was a surface sample, possibility that it has been moved cannot be excluded. Blake

GSC-1764. Cape Majendie — >25,000

Single largest shell fragment, probably of Mya truncata, in collection from 7 km north of Cape Majendie, Sheills Peninsula, Devon Island, N.W.T. (76°17'N, 95°01'W), at alt. ca. 150 m. Coll. 1972 by M.G. Grosswald, Acad. of Sciences of the U.S.S.R., Moscow. Blake

Comment (W.B., Jr.): single valve dated to determine whether shells, which were thick, characterized by rounded corners (implying transport) and which occurred above highest visible raised beaches, were of postglacial or older age (cf. Grosswald, 1973). Because of the impossibility of cleaning other samples in the laboratory, due to the fortuitous burning-out of our Vecu Combustion Furnace, the sample was counted for a total of 10 days, and ages were computed for 3, 6, and 10 days (cf. Table 4, this list). The data summarized in this Table show that the 3-day count, which resulted in an age of >24,000 years for this sample, was not improved upon materially by the additional 3 or 7 days of counting. HCl-leach omitted due to small sample size (3.0 g). Sample mixed with dead gas for counting.

Ellesmere Island

Cape Storm series (II)

Driftwood logs, id. by R. J. Mott except for GSC-1512, from emerged beaches ca. 5 to 8 km N.N.E. of Cape Storm, Ellesmere Island, N.W.T. Coll. 1967 and 1970 by W. Blake, Jr.

GSC-1709. Cape Storm, wood, 45.5 m — 7240±160; 5290 B.C.; $\delta C^{13} = -22.9‰$

Picea sp. (76°24.5'N, 98°30'W)

GSC-1545. Cape Storm, wood, 38.0 m — 6540±280; 4590 B.C.; $\delta C^{13} = -23.2‰$

Picea or Larix (76°24.5'N, 87°30'W)

GSC-1591. Cape Storm, wood, 33.5 m — 6460±140; 4510 B.C.; $\delta C^{13} = -22.0‰$

Populus sp. (76°22.5'N, 87°34'W)

GSC-1713. Cape Storm, wood, 30.5 m — 6020±140; 4070 B.C.; $\delta C^{13} = -22.4‰$

Larix sp. (76°22.5'N, 87°32'W)

GSC-1463. Cape Storm, wood, 29.0 m — 5740±140; 3790 B.C.; $\delta C^{13} = -22.7‰$

Picea or Larix (76°22.5'N, 87°32'W)

GSC-1547. Cape Storm, wood, 25.5 m — 5340±130; 3390 B.C.; $\delta C^{13} = -25.4‰$

Picea sp. (76°23'N, 87°31'W)

GSC-1714. Cape Storm, wood, 23.0 m — 5180±140; 3230 B.C.; $\delta C^{13} = -22.2‰$

Picea or Larix (76°23'N, 87°31'W)

GSC-1410. Cape Storm, wood, 22.0 m — 5040±130; 3090 B.C.; δC^{13} = -23.1‰

Picea or Larix (76°23'N, 87°31'W)

GSC-1512. Cape Storm, wood, 21.5 m — 4770±130; 2820 B.C.; δC^{13} = -24.1‰

Picea or Larix (76°22.5'N, 87°32'W); id. by Mrs. L. Wilson.

GSC-1537. Cape Storm, wood, 19.0 m — 4540±140; 2590 B.C.; δC^{13} = -27.2‰

Picea sp. (76°24'N, 87°30'W)

GSC-1352. Cape Storm, wood, <3 m — 160±140; A.D. 1790; δC^{13} = -23.4‰

Picea sp. (76°24'N, 87°30'W)

GSC-1550. Cape Storm, wood, <2 m — 180±130; A.D. 1770; δC^{13} = -23.6‰

Pinus, probably Pinus sylvestris (76°23.5'N, 87°27'W)

GSC-1378. Cape Storm, wood, <2 m — 30±130 modern; A.D. 1920; δC^{13} = -23.7‰

Larix sp. (76°24'N, 87°30'W)

General comment (W.B., Jr.): dates on logs embedded in beaches (except for GSC-1545, small pieces that may have moved slightly), together with previous series (GSC XI, 1971, p. 313-314), show rate of uplift decreasing with time and concentration of wood between 4500 and 6500 yrs. old (Blake, 1972; Walcott, 1972). GSC-1410, at level with abundant pumice, supports earlier conclusion that pumice is ca. 5000 yrs. old (Blake, 1970, 1973). Wood on present-day storm beach is modern (GSC-1352, -1378, -1550). GSC-1545 mixed with dead gas for counting; date based on three 1-day counts. GSC-1352 and -1550 each based on one 1-day count; GSC-1410, -1512, and -1547 each based on one 3-day count; GSC-1378 based on one 4-day count.

8220±150

GSC-1443. South Cape Fiord, wood, 62 m 6270 B.C.
$\delta C^{13} = -23.6‰$

Blake

Driftwood log (Picea or Larix, id. by R.J. Mott) embedded in beach shingle 1.2 km west of South Cape Fiord, Ellesmere Island, N.W.T. (76°26'N, 85°02'W), at alt. ca. 62 m. Coll. 1970 by W. Blake, Jr.

Comment (W.B., Jr.): age is similar to that of highest log at Cape Storm to west (Blake, 1972); with previous series at same site it indicates decreasing rate of uplift with time (Blake, 1970; GSC XI, 1971, p. 314-315).

GSC-1558. Jakeman Glacier >26,000
$\delta C^{13} = -27.9‰$

Piece of wood (Salix sp., id. by R.J. Mott), 4.5 cm long, ca. 1 cm diam., with some embedded sand grains, in marine silt 4 km N.E. of coast along N.W. margin of Jakeman Glacier, Ellesmere Island, N.W.T. (76°30.5'N, 80°55'W), at alt. ca. 23 m. Coll. 1970 by W. Blake, Jr.

Blake

Comment (W.B., Jr.): wood is only "old" piece of locally-grown wood found in S.E. Ellesmere Island (Blake, 1972); it occurred in silt of post-glacial age as determined by other unpublished dates on marine shells. In spite of small size of sample (1.2 g), it received standard treatment with NaOH and HCl. Sample mixed with dead gas for counting. Date based on one 5-day count in 1-L counter.

9770±330

GSC-1572. Clarence Head 7820 B.C.

RLC

Single valve of marine pelecypod, Mya truncata, from well-washed sand and gravel bench ca. 1.5 km S.W. of Clarence Head, Ellesmere Island, N.W.T. (76°48'N, 77°48'W), at alt. ca. 27 to 30 m. Coll. 1960 by R.L. Christie; subm. by W. Blake, Jr.

Blake.

Comment (W.B., Jr.): single valve used, as large and thick shells appeared "old". Postglacial age is similar to that of 9880±500 yrs. (M-723; Michigan IV, 1959, p. 175) on marine algae from Wolstenholme Fiord on opposite side of Smith Sound (Blake, 1972). Due to small sample (6.0 g), only outer 5% removed by leaching.

6220±140

GSC-1348. Twin Glacier Valley 4270 B.C.

Marine shells, intact pairs and single valves of Mya truncata, from north-dipping bedded sand exposed along 'East River' of Twin Glacier Valley, near Alexandra Fiord Police Post, Ellesmere Island, N.W.T. (78°53'N, 75°43'W), at est. alt. ca. 30 m. Coll. 1968 by R.L. Christie, subm. by W. Blake, Jr.

RLC

Blake

Comment (W.B., Jr.): date is only one available for west side of Kane Basin and is a minimum for deglaciation. Dates from east side are as old as 7800±200 years. (L-1091E; R.L. Nichols, 1969). Date based on two 1-day counts in 1-L counter.

GSC-1571. Lincoln Bay — 6250±210 / 4300 B.C.

Single valve of marine pelecypod (Astarte borealis, id. by A.H. Clarke, Jr., Natl. Mus. Nat. Sci) in varved deposits 4 km W.N.W. of Lincoln Bay, Ellesmere Island, N.W.T. (82°08'N, 62°18'W), at alt. ca. 21 m and 16 m above river level. Coll. 1971 by G. Hattersley-Smith, Defence Research Board, Ottawa.

Comment (W.B., Jr.): date is minimum for deglaciation and is similar to age of shells at ca. 82 m on Polaris Promontory, on opposite side of Nares Strait in Greenland (6100±300 yrs., W-816; USGS V, 1960, p. 177; Davies, 1961; Blake, 1972). Due to small sample size (12.3 g) only outer 5% removed by leaching. Date based on one 3-day count in 1-L counter. Blake

Yelverton Inlet series

Driftwood logs, id. by R.J. Mott, from emerged beaches at south end of eastern arm of unnamed inlet west of Yelverton Inlet, south of Yelverton Bay, Ellesmere Island, N.W.T. (82°02'N, 81°57'W). Coll. 1962 by P.C. Atkinson, M. Emond, and J.J.J. Therrien, Surveys and Mapping Branch, E.M.R., Ottawa; subm. by W. Blake, Jr.

GSC-1534. Yelverton Inlet, 76 m — 8150±140 / 6200 B.C. / $\delta C^{13} = -25.7‰$

Larix or Picea

GSC-1603. Yelverton Inlet, ca. 53 m — 6410±250 / 4460 B.C.

Larix sp.

General comment (W.B., Jr.): GSC-1534 is oldest postglacial date so far obtained on north coast of Ellesmere Island, and is minimum for deglaciation. GSC-1603 is one of 11 logs (out of total of 16 of postglacial age) from northern N. Ellesmere Island and Axel Heiberg Island in range between ca. 5000 and 6500 yrs. (Blake, 1972). GSC-1534 based on one 3-day count. Blake

Axel Heiberg Island

Colour Lake series

Unconsolidated lake sediments (rhythmites) from deepest part of Colour Lake, Axel Heiberg Island, N.W.T. (79°25'N, 90°45'W), at alt. 176 m, water depth 24 m. Coll. 1969 with Kullenberg sampler by T. Caflish, subm. by F. Müller and T. Caflish, both then at McGill Univ., Montreal; now E.T.H., Zürich.

GSC-1538. Colour Lake, 0 to 10 cm depth — 16,000±820; 14,050 B.C.; δC^{13} = -26.7‰

Surface sample, 0 to 10 cm depth, from core M-20.

GSC-1377. Colour Lake, 145 cm depth — 14,000±1710; 12,050 B.C.

Small vertical increment from 2 replicate cores, A20 and M20, located 100 m apart in lake but correlated stratigraphically.

General comments (T.C.): dating of undisturbed cores carried out in attempt to assess time scale for rhythmites, but dates do not agree; (W.B., Jr.): material dated in both samples is probably a mixture of "dead" carbon carried into the lake together with modern and/or postglacial organic matter derived from plants of the surrounding tundra. Lake is receiving sediment at present, but bedrock formations in vicinity contain shale, and perhaps coal (Fricker, 1963), thus a ready source of carbon is available. Oldest postglacial shells nearby, at alt. 80 m, are only 9000±200 yrs. old (L-647F; Müller, 1963). NaOH-leach omitted from pretreatment of both samples; both mixed with dead gas for counting. GSC-1538 and -1377 based on one 1-day count and 3-day count, respectively.

Melville Island

GSC-1624. Sherard Bay — 7890±140; 5940 B.C.; δC^{13} = -22.1‰

Part of driftwood log (Picea sp., id. by R.J. Mott) partially buried in coarse sandy alluvial surface at ca. 24 m on south side of Sherard River, ca. 10 km from its mouth, Sabine Peninsula, Melville Island, N.W.T. (76°04'N, 108°38'W). Coll. 1971 by D.L. Forbes.

Comment (D.M. Barnett): this is highest driftwood log located on Melville Island thus far. It is possible that the log was refloated from a higher elevation which, if so, must have occurred soon after initial deposition. Therefore the sample represents a minimum date at which relative sea level was 24 m higher than now.

Sherard River valley series

Shells of Hiatella arctica from an abundant surface accumulation of shells in Sherard River valley, Sabine Peninsula, Melville Island, N.W.T. (76°05'N, 108°52'W), at alt. ca. 50 m. Coll. 1971 by D.M. Barnett.

GSC-1636. Sherard River valley (I) — 9750±690; 7800 B.C.

Single left valve of Hiatella arctica.

Comment (D.M.B.): date establishes postglacial age of shells. A larger sample (GSC-1752, below) offers a more refined date for relative sea level. HCl-leach omitted due to small sample size (3.1 g). Sample mixed with dead gas for counting. Date based on one 1-day count plus one 3-day count.

GSC-1752. Sherard River valley (II) — 10,200±150 / 8250 B.C.

Collection of whole Hiatella arctica shells, all between 3.5 and 5.0 cm in length. Blake

Comment (W.B., Jr.): this 26.0 g sample received the standard treatment; i.e., a 20% leach with HCl before being dissolved in H_3PO_4. Date overlaps GSC-1636 but provides a more accurate value for the time of deglaciation, when relative sea level was at 50 m or higher and when Sabine Peninsula was separated from the rest of Melville Island by an arm of the sea (Barnett, 1973). Date based on one 3-day count.

GSC-1609. Drake Point — >41,000

Largest wood fragment (14.5 cm long, 3.5 cm diam.; Larix sp. id. by R.J. Mott) of several partially embedded pieces at alt. 69 m adjacent to temporary air strip at Drake Point, Sabine Peninsula, Melville Island, N.W.T. (76°27'N, 108°56'W). Wood associated with 'old'-looking shell fragments. Coll. 1971 by D.M. Barnett. Barnett

Comments (D.M.B.): site probably above (but only slightly above) postglacial marine limit. Some chemical replacement of wood has occurred, as it produced less than normal CO_2 for its weight, but it was still buoyant; therefore, possibly, it has been redeposited by postglacial marine episode from an unknown source; (W.B., Jr.): date is one of many 'greater than' dates on wood in western Arctic Islands (Barnett, 1971, 1973; summary in Blake, 1972). Sample mixed with dead gas for counting. Date based on one 3-day count.

Banks Island

GSC-1437. Parker Point — 10,600±270 / 8650 B.C.

Fragments of Hiatella arctica shells from surface of silty sand 16 km N.N.W. of Parker Point, Banks Island, N.W.T. (73°46'N, 116°02'W), at alt. ca. 85 to 88 m, close to marine limit. Coll. 1970 by D.M. Barnett.

Comment (D.M.B.): date gives approximate age of marine limit in area. Barnett Date based on one 3-day count.

GSC-1478. Worth Point, marine shells — >19,000

Fragments of marine pelecypod shells (Astarte sp., probably including A. borealis and another Astarte; id. by W. Blake, Jr.), mainly from fresh exposure in yellowish-red crossbedded sandy layer; also from surface of 3 to 4 m-high spit and from slumped material at north end of spit, south side of unnamed bay 10 km south of Worth Point, west coast of Banks Island, N.W.T. (72°10'45"N, 125°38'W). Coll. 1970 by D.M. Barnett; subm. by J.G. Fyles. Two determinations were made on sample, whose small size (2.5 g) precluded leaching of outer material.

Sample mixed with dead gas for counting. — >19,000

Two 1-day counts in 1-L counter.

why must be ... rather, may be.

Same gas, remixed in 2-L counter. Two 2-day counts. >19,000

Fyles

Comments (J.G.F.): on the basis of geological evidence, it has been inferred that western Banks Island was not glaciated in Wisconsin time (Fyles, 1962); thus raised marine features must be pre-Wisconsin in age. Present date, although on an inadequate sample, supports inference of pre-Wisconsin age; (W.B., Jr.): as possibility exists that shell material present may be of more than one age, all valves used for dating had either periostracum or ligament still intact; other species in collection included Portlandia arctica (whole) and Serripes groenlandicus (fragment).

Beaufort Sea

GSC-1509. Beaufort Sea (I) 700±180 A.D. 1250

One valve of marine pelecypod, Astarte borealis (id. by F.J.E. Wagner), from piston core 845 (total length 440 cm) taken at Stn. 427 in the Beaufort Sea (70°56.5'N, 131°24.7'W), 55 nautical mi. (101.75 km) W.N.W. of Cape Dalhousie, District of Mackenzie, N.W.T., water depth 54 m. Sample, from 20 cm depth, is one of several shells taken from 10 to 30 cm increment in core near base of upper silty unit. Other species present are Arctinula groenlandica, Bathyarca glacialis, Mya sp., and Solariella sp. (Wagner, 1972). Coll. on Hudson-70 cruise, 1970, by F.J.E. Wagner.

Shearer

Comments (J.M. Shearer): silty unit containing shells overlies a coarse sandy unit interpreted as being a submerged beach. Date is thought to be much younger than time of transgression of the sea at this point; (W.B., Jr.): single valve was well preserved with periostracum intact, and interior still had lustre. HCl-leach omitted due to small sample size (5.9 g). Sample mixed with dead gas for counting. Date based on one 3-day count in 1-L counter.

GSC-1511. Beaufort Sea (II) 3530±240 1580 B.C.

One shell of ? Buccinum sp. (id. by F.J.E. Wagner) from piston core 820 (total length 1046 cm) taken at Stn. 377 in the Beaufort Sea (70°21.5'N, 137°33.0'W) from a depth of 322 m. Shell was taken from the 400 to 406 cm level, where Arctinula groenlandica, Portlandia lenticula, P. intermedia, Nucula tenuis, Tachyrhynchus erosum, Boretrophon clathratus, and ? Molleria sp. also occur (Wagner, 1972). Coll. on Hudson-70 cruise, 1970, by F.J.E. Wagner.

Shearer

Comments (J.M. Shearer): core generally consists of clay interspersed with shell fragments and coaly detritus. Dated shell, if in place, gives general rate of sedimentation for this area of Mackenzie Bay and Beaufort Sea. Depth habitat of species is not well enough known to interpolate corresponding sea level; (W.B., Jr.): in regard to this sample Wagner (1972) has stated that "when the dated molluscs were alive, the water depth is estimated to have been about 50 m. Therefore, some 3500 years ago the water at this site was approximately 270 m shallower than it is now". There is no evidence that sea level has varied more than 5 m from its present position in the last 3500 years, and many authors suggest that it was 2 m or less below its present position during this interval of time (Curray and

Shepard, 1972). Thus it would appear either that the dated gastropod lived in water far deeper than 50 m, or that it has been redeposited. The date does permit a computation of the rate of sedimentation, approximately 1m/1000 years according to Pelletier and Shearer (1972), although this must be regarded as a minimum value, as the time at which the gastropod reached its present position is unknown. HCl-leach omitted due to small sample size (4.0 g). Sample mixed with dead gas for counting. Date based on one 2-day count in 1-L counter.

Alaska

GSC-1576. White River >37,000

Fragments of flattened vascular plants (id. by M. Kuc) from silt in section on north bank of White River near Pingpong Mountain, along northern flank of St. Elias Mountains, in Alaska, ca. 13 km upstream from Yukon-Alaska border (61°43'N, 141°18'W), at alt. ca. 1216 m. Sample is from organic-rich layer in thin silt beds resting directly on a till body 7.9 m thick which, in turn, overlies fluvial deposits 3.4 m thick. Silt beds are overlain, successively, by 6.4 m of fluvial deposits, 13.1 m of till, 1.5 m of fluvial deposits and 3.0 m of muskeg and volcanic ash. Coll. 1970 by G.H. Denton, Univ. of Maine, Orono, Maine.

Comment (G.H.D.): date gives age of >37,000 B.P. for lower till. Upper till corresponds to Macauley Till mapped by Rampton (1971) in adjacent Yukon Territory. Originally it was suspected that this sample might afford a finite Middle Wisconsin age. However, no such finite ages are yet available in northern St. Elias region west of Kluane Lake. NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

England

GSC-1921. West Runton, Norfolk >52,000
$\delta C^{13} = -26.8‰$

Wood (Alnus glutinosa Gaertn., id. by D.F. Cutler, Royal Botanic Gardens, Kew) of a single tree bole from a coastal exposure of the Cromer Forest Bed, West Runton, Norfolk, England (52°56'N, 1°16'E; grid ref. TG 190431), at alt. ca. 1 m. Sample is from ca. 1 m below the top of Reid's estuarine Forest Bed in a section east of the West Runton Gap (Page, 1972). Coll. November 1971 and subm. September 1972 by N.R. Page, Middlesex Polytechnic at Hendon, London, England.

Comment (N.R.P.): interlaboratory check determination, West Runton 5. Samples from the same bole previously dated at $41,000^{+1600}_{-1300}$ yrs. (T-1119; Page, 1972), $44,500^{+1900}_{-1600}$ yrs. (T-1119/2), and >54,200 yrs. (GrN-6819). GSC-1921 is consistent with the Groningen dating.

Comment (W.B., Jr.): this well preserved wood sample (13 cm in diameter) was received damp, but was dried in an electric oven at G.S.C., Ottawa, on April 29-30, 1973. All outside wood and wood along cracks was removed with a knife. Pretreatment of the 45.0 g sample included 1 hour in hot 2% NaOH, 1 hour in hot 4N HCl, and 3 distilled water rinses. Date based

on one 3-day count and two 1-day counts in 5-L counter at 4 atm, and the age was computed for each of the 5 days; 1 count gave >48,000 years, the other four counts each gave >50,000 years, but statistics permit a value of >52,000 to be calculated for the whole 5-day period. The wood was submitted at my request so that the G.S.C. laboratory could date a sample on which a finite determination in the 40,000-yr. range had been obtained by another laboratory, in this case Trondheim. The result, together with the similar value obtained by Groningen, indicates that the age of the wood is beyond the range of radiocarbon dating. For additional information relating to the age of the Cromerian and Hoxnian Interglacials the reader is referred to Shotton (1973, including a rejoinder by Page), and it should be noted that a recent interlaboratory check on an Alnus trunk from Hoxnian deposits in Oakley Park pit, Hoxne, Suffolk gave values of >47,600 years (Birm-365; Shotton, 1973; Birmingham VII, 1973, p. 460; Singer et al., 1973) and >43,000 years (Q-1100; Cambridge XII, 1973, p. 540-541; Shotton, 1973).

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INDEX

Lab. no.	page	Lab. no.	page	Lab. no.	page
GSC- 481	34	GSC-1410	41	GSC-1550	41
- 485	34	-1417	13	-1553	19
- 486	34	-1423	15	-1558	42
- 512	34	-1424	22	-1564	29
- 709	31	-1428	22	-1565	12
- 857	24	-1431	23	-1568	29
-1001	24	-1432	19	-1569	29
-1096	21	-1433	25	-1571	43
-1151	21	-1437	45	-1572	42
-1160	32	-1443	42	-1574	31
-1169	33	-1449	29	-1575	7
-1190	35	-1453*	8	-1576	47
-1229	30	-1454	30	-1579	30
-1237	32	-1455	23	-1582	33
-1265	33	-1458	34	-1585	18
-1269	32	-1462	8	-1586	18
-1279	22	-1463	40	-1587	20
-1282	35	-1477	26	-1587-2	20
-1284	8	-1478*	45	-1591	40
-1285	35	-1480	13	-1592	9
-1286	31	-1481	18	-1594	26
-1307	6	-1482	11	-1598	10
-1312	6	-1486	10	-1603	43
-1318	7	-1487	24	-1606	38
-1321	32	-1487-2	25	-1609	45
-1327	34	-1491	18	-1615	30
-1331	7	-1494	9	-1620	21
-1334	6	-1500	12	-1624	44
-1335	23	-1507	37	-1630	8
-1338	32	-1509	46	-1631	19
-1342	23	-1511	46	-1634	36
-1343	6	-1512	41	-1635	27
-1344	15	-1514	31	-1636	44
-1348	42	-1517	37	-1638	38
-1352	41	-1522	11	-1642	10
-1354	32	-1524	25	-1646	16
-1355	14	-1524-2	25	-1647	36
-1357	15	-1533	13	-1648	20
-1372	27	-1534	43	-1651	27
-1373	31	-1537	41	-1654	28
-1377	44	-1538	44	-1672	19
-1378	41	-1545	40	-1675	26
-1400	14	-1547	40	-1684	12
-1403	6	-1548	28	-1699	39
-1405	16	-1549	22	-1704	39

*Two determinations on same sample.

Lab. no.	page	Lab. no.	page	Lab. no.	page
GSC-1709	40	GSC-1752	45	GSC-1921	47
-1713	40	-1764	39	-1922	16
-1714	40	-1772	17	-1927	14
-1727	36	-1845	38	-1928	17
-1741	16	-1903	37	-1937	28