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GEOLOGICAL SURVEY OF CANADA RADIOCARBON DATES VIII

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INTRODUCTION†

The Radiocarbon Dating Laboratory of the Geological Survey of Canada routinely operates two proportional counters; one 2 L and one 5 L. The 2 L counter is operated entirely at 2 atm. and the 5 L counter mainly at 1 atm. On occasion the 5 L counter is operated at 4 atm. Detailed descriptions of these two counters have recently been published (Dyck, 1967a). A 1 L counter has been fabricated and is now undergoing preliminary testing.

Some changes in sample pretreatment (especially with bone material) and in the preparation and purification lines have taken place during the past year. All organic samples, unless otherwise noted, are pretreated with hot 2% NaOH, hot 1 N HCl, and washed with hot, distilled, water. The water wash treatment is now continued until the resulting solution is neutral to an acid indicator. Samples are burned in a stream of oxygen and the released CO_2 is purified by passage through the following chemicals and traps; hot CuO (470°C), dil. H_2SO_4, O.1 N $AgNO_3$, $H_2SO_4 \cdot CrO_3$ solution, drierite, an acetone dry-ice trap, hot Pt. asbestos (400°C), and hot Ag wool (400°C). These traps successfully remove: water of combustion, SO_3, halides, and sulphur oxides, which make up the bulk of contaminants present. Prior to entering the combustion furnace, the oxygen stream is passed through 4% NaOH to remove traces of CO_2 which might be present in commercial tank oxygen, and $CaCl_2$ to remove traces of water. Because of problems encountered in the purification of bone samples and samples for high pressure work (4 atm.), an additional $AgNO_3$ trap has been inserted into the purification train. The final purification step consists of passing the gases through hot copper wire and Ag wool (500°C). Radon is removed from the CO_2 by fractional distillation (de Vries, 1957). With small samples, which have to be mixed with dead gas prior to counting, radon removal is carried out after mixing.

Gaseous samples are now stored mainly in Hoke metal cylinders. Experience has shown that CO_2 can be kept in these cylinders for periods of up to 6 months without becoming "dirty." The use of metal cylinders for storage has the distinct advantage of almost entirely eliminating the possibility of accidents in the laboratory, which are not uncommon with glass storage systems. This laboratory is now in the process of changing from a glass system to a completely metal system for all counters, with respect to gas storage and counter filling procedures. The preparation and purification lines will, of necessity, remain glass.

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† Prepared by the first author, who operates the laboratory. The date list has been compiled by the second and third authors from descriptions of samples and interpretations of dates by the collectors.

Shell samples are cleaned with a stiff brush and water before removal of outer layers with conc. HCl. The amount of outer layer removed by pretreatment depends on the size of the sample. With large samples (approx. 100 g) as much as 50% of the outer surface is removed, or 2 fractions, outer (21 to 60%) and inner (61 to 100%) are dated. With "normal-sized" samples (20 to 30 g) 20% is removed. With samples as small as 5 g the acid leach is omitted or only 5% is removed. The CO_2 is liberated from shell samples with H_3PO_4.

In the past year the pretreatment of bone samples has caused some problems. Originally both carbonate and organic (collagen) fractions of bones were dated. However, as was the case with other laboratories, it was soon discovered that the age obtained from the carbonate fraction was unreliable (Dyck *et al.*, 1966; Lowdon *et al.*, 1967; Lowdon and Blake, 1968). Last year this laboratory adopted the pretreatment method recommended by Berger (Berger and Libby, 1966) and discovered that virtually all of the collagen in the sample was lost. Samples collected from arid desert regions have a very hard fibrous collagen structure which is not attacked significantly by prolonged treatment with 0.1 N NaOH. However, samples which have been subjected to wet conditions have a soft collagen structure, (due to the action of amino acids) which allows them to dissolve in NaOH more readily. Thus is appears now that probably environmental conditions were responsible for the loss of organic material when the sample was subjected to a long base leach treatment. The procedure now adopted in this laboratory is to treat crushed bone material with 6 N HCl for approx. 2 hrs, then with 2 N HCl until all the carbonate fraction has been removed; wash thoroughly with distilled water; treat with O.1 N NaOH for 30 to 60 min; and wash again with distilled water.

During the past year the decision was made to submit all samples with an age of less than 5000 yrs for C^{13}/C^{12} determinations in order to evaluate, and correct for, the possible effects of carbon isotope fractionation. However, none of the dates reported in this list have been corrected for isotopic fractionation. The 5000 yr cut-off point is purely arbitrary, and could be increased in the future. Many radiocarbon dating laboratories now measure C^{13}/C^{12} ratios as an integral part of their work, and a knowledge of these ratios is now regarded as essential.

All age calculations in this laboratory are carried out monthly by a C.D.C. 3100 computer and are based on a C^{14} half-life of 5568 $\pm$ 30 yr and 0.95 of the activity of the N.B.S. oxalic-acid standard. Ages are quoted in yrs before 1950. Age errors include: counting errors of sample, background, and standard; 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 biosphere during the past 1100 yr. The error assigned to an age is always a minimum of $\pm$ 100 yr. Finite dates are based on the 2σ criterion (95.5% probability) and "infinite" dates on the 4σ criterion (99.9% probability). Details of counting characteristics of background and standard appear in previous GSC lists.

Recently a manual has been published by the Australian Inst. of Aboriginal Studies (Polach and Golson, 1966) dealing with most of the basic facets of radiocarbon dating, including: basis and validity of the method, sources of error, contamination of samples (sources and effects), isotope fractionation, interpretation of results, how samples should be submitted to the laboratory, and publication of results. The reading of this manual by all collectors and submitters of samples for dating, especially those working with archaeologic samples, is highly recommended.

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SAMPLE DESCRIPTIONS

ARCHAEOLOGIC SAMPLES

A. Eastern Canada

Curtis site series, Newfoundland

Charcoal with possibly small amounts of charred bone from Curtis site (DjAq-1), Twillingate, Newfoundland (49° 39′ 30″ N Lat, 54° 47′ 10″ W Long). Site is Archaic red ochre burial ground with rich deposit of stone artifacts, including unusually high proportion of ground slate. Burials were deep and seem to have been cremations. Samples are all from graves, assoc. with or mixed with red ochre deposits. Artifacts should date ca. 3000 yr B.P. However, if historic Boethuk were late surviving Archaic group, site might be considerably more recent. Coll. 1966 by D. MacLeod and D. Webber.*

GSC-758. Curtis site, Trench A-3 (depth 37 in.) **3560 ± 140 / 1610 B.C.**

Charcoal (NMC-123) from Trench A-3, SW face of Trench A. Depth 37 in., below rocks on top of ochre.

GSC-834. Curtis site, Trench A-3 (depth 37 to 40 in.) **3720 ± 130 / 1770 B.C.**

Charcoal (NMC-124) from Trench A-3, Stratum 4-A, on top of ochre bed, depth 37 to 40 in.

General Comment (D.M.): dates agree with expectations based on cultural typologies and also with date on NMC-121 (GaK-1254, 3200 ± 90 B.P.; Wilmeth, 1968). Site apparently is "Moorehead" cemetery of considerable size and importance; 1st C^{14} dates for such a site to my knowledge. After further excavation, cremation does not seem necessarily to have been practiced; small ceremonial fires in graves seem more likely, excluding probability of charred bone or other animal material from samples. NaOH-leach omitted from pretreatment of GSC-884.

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

470 ± 160

GSC-687. Dawson site, Quebec **A.D. 1480**

Encrusted carbon (NMC-95) from interior of potsherds from Dawson site (BjFj-1) Montreal, Quebec (45° 30′ N Lat, 73° 35′ W Long). Site is prehistoric Iroquoian component which, being only Iroquoian site in city of Montreal is, at present, most likely candidate for site of Hochelaga, visited by Jacques Cartier in A.D. 1534. Coll. 1965 by J. F. Pendergast, Ottawa; subm. by W. N. Irving. *Comment* (J.F.P.): supports proposal that Dawson site is of Cartier's Hochelaga, but following conclusions reached from study of total artifact assemblage remain valid and caution against making Dawson site and Hochelaga synonymous. Dawson site may be: 1) Cartier's Hochelaga; 2) site which predates Hochelaga, small sample of European material representing trickle of trade goods into area from Tadoussac before Cartier arrived; 3) site which postdates Cartier's visit, being relocated village of Hochelagans; 4) site which postdates Cartier's visit, being of group unknown to Cartier; or 5) site coeval with Hochelaga but unreported to Cartier. Latest known Iroquoian site in St. Lawrence R. Valley and hence probably represents very closely material culture of Cartier's Hochelagans. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

Berry site series, Quebec

Charcoal from Berry site (BgFo-3) Huntingdon Co., Quebec (45° 5′ N Lat, 74° 37′ W Long). On basis of ceramic seriation this is earliest recognized component in Onondaga sequence in area; samples should provide base date. Coll. 1964 by J. F. Pendergast and L. H. Wylie, Ottawa; subm. by W. N. Irving.

450 ± 130

GSC-453. Berry site, Pit 1 **A.D. 1500**

Charcoal (NMC-61) from Pit 1, 18 to 24 in. depth.

500 ± 130

GSC-451. Berry site, Pit 2 **A.D. 1450**

Charcoal (NMC-62) from Pit 2, 18 to 24 in. depth.

General Comment (J.F.P.): if Berry site is early component in local Iroquois sequence, earlier date of A.D. 1450 (GSC-451) leaves less than 100 yr for whole of sequence to evolve before Cartier's visit to Hochelaga in 1534. Appears unlikely in view of numerous kindred sites in area which involve significant artifact variation unlikely to occur in less than 100 yr. If dates are correct, they support theory of coeval non-Iroquois people who were making crude reproductions of Iroquois pottery using linear-stamping technique instead of incising. Bearing in mind discrepancies in other dates for this area, e.g., Summerstown Sta. site (M-1539, 100 ± 100), Salem site (M-1541, 60 ± 100), and Roebuck site (M-1538, 560 ± 100; all in Radiocarbon, 1963, v. 7, p. 139, 140), as well as GSC-446 (410 ± 130) and GSC-458 (390 ± 130)), both on Salem site (this list), it is suggested, on basis of ceramic seriation, that

Berry be considered earlier site than Salem and earliest village site located to date in area (Pendergast, 1967). Each date based on one 3-day count.

Salem site series, Ontario

Charcoal from Salem site (BgFp-4), Glengarry Co., Ontario (45° 04′ N Lat, 74° 35′ W Long). This is large prehistoric Iroquois site closely related to, but apparently older than, Roebuck site on basis of ceramic seriation. Evidence suggests Onondaga ceramics and pipes obtained high level of sophistication significantly earlier than Ontario Iroquois tradition to W. Dates will be extremely valuable in evaluating interplay between these 2 Iroquois traditions (Pendergast, 1966). Coll. 1964 by G. Gogo for J. F. Pendergast, Ottawa; subm. by W. N. Irving.

410 ± 130

GSC-446. Salem site, 5 to 6 in. depth A.D. 1540

Charcoal (NMC-59) from pit at 5 to 6 in. depth.

390 ± 130

GSC-458. Salem site, 14 to 22 in. depth A.D. 1560

Charcoal (NMC-60) from pit 10 ft W of pit yielding GSC-446. Coll. from white ash at 14 to 22 in. depth.

General Comment (J.F.P.): both these dates for Salem site are later than those for Roebuck site (560 ± 100, A.D. 1390, M-1538, *op. cit.*, above) and Hochelaga, visited by Cartier in A.D. 1534, yet on basis of ceramic seriation Salem should precede both these sites. Like dates for earlier Berry site (GSC-451, 500 ± 130; and GSC-453, 450 ± 130; this list), dating for Salem appears to be ca. 100 yr too late. Another date from Salem site (M-1541, 60 ± 100, *op. cit.*, above) is grossly too late. As yet there appears to be no stability of C^{14} dates for Salem site. Until more credible dates are available, ceramic seriation suggests Salem be considered earlier site than Roebuck and later site than Berry (Pendergast, 1966). Date for GSC-446 based on one 4-day count.

McIvor site series, Ontario

Charcoal, corn kernels, and charred cob fragment from McIvor site (BfFv-1), Grenville Co., Ontario (44° 56′ N Lat, 75° 32′ W Long), prehistoric Onondaga village site closely related to Roebuck site. Will act as check on Roebuck site date, A.D. 1390 ± 100 (M-1538, *op. cit.*, above), run on carbonized corn kernels and apparently too early. Will also help evaluate relative accuracy of carbonized wood and carbonized foodstuffs from Iroquois sites in view of some very erratic readings obtained on latter (cf. Hall, 1967). Coll. 1964 and subm. by J. V. Wright.

320 ± 130

GSC-441. McIvor site, Square A, charcoal A.D. 1630

Charcoal (NMC-53) from Square A, in midden deposit.

140 ± 130

GSC-457. McIvor site, Square A, corn A.D. 1810

Corn kernels and charred cob fragment (NMC-54) from Square A, in midden deposit.

GSC-460. McIvor site, Square B, corn **90 ± 130**
A.D. 1860

Corn kernels (NMC-55) from Square B, in midden deposit.

GSC-442. McIvor site, Square B, charcoal **280 ± 130**
A.D. 1670

Charcoal (NMC-56) from Square B, in midden deposit.

General Comments (J.V.W.): wood charcoal dates from McIvor site are ca. 100 yr younger than expected. Carbonized corn material consistently dated later than assoc. wood charcoal samples, suggesting there is unknown factor relegating dates of corn to very hazardous position. (W. Blake, Jr.): see Hall (1967) for information on isotopic fractionation in corn. GSC-442 mixed with dead gas for counting. Date for GSC-442 based on one 4-day count and for GSC-457 on one 3-day count.

Note (W. Blake, Jr. and J. A. Lowdon): in regard to the 9 dates from Dawson and Berry sites in Quebec and Salem and McIvor sites in Ontario, all former Iroquois settlements, a few special comments are in order and apply to numerous other dates reported in this list. For each of these sites, the collector comments that dates are 100 yrs (or less) younger than expected from archaeologic evidence, such as ceramic seriation, and various explanations are advanced to account for discrepancies. First, the submitters invariably use the A.D. or B.C. date as an absolute value, a procedure which is not valid because each date is accompanied by an error term of at least ± 130 yr.

Furthermore, investigators at several labs have shown recently that C^{14} content of the atmosphere has fluctuated considerably during the last few thousand yrs. For example, Damon *et al.* (1966) determined, using dendrochronologically dated tree rings, that the initial C^{14} content was within ± 15‰ of the 1850 A.D. value during the Christian era, except for the period between 1500 and 1700 A.D., when it fluctuated between 0 and + 30‰. Likewise Dyck (1966) found considerable positive variations (up to 22‰) in the C^{14} content of tree rings from the period between 1400 and 1800 A.D. Dyck (1967b), in referring to the graph published by Stuiver and Suess (1966) pointed out that "samples" with calendar dates of 320, 380, and 440 yrs all have the same C^{14} age of ca. 300 yrs." Most dates listed for Iroquois sites fall within period when ages expressed in radiocarbon yrs will be less than the true ages expressed in calendar yrs.

Further information concerning interpretation of radiocarbon dates on archaeologic materials can be found in articles by Davis (1965) and Stuckenrath (1965).

Heron Bay site series, Ontario

Charcoal and charred bone from Heron Bay site (DdIn-1), Pic R., Thunder Bay Dist., Ontario (48° 37′ N Lat, 86° 17′ W Long). Seriation of Laurel tradition material in N Ontario indicates Heron Bay site is one of earliest components, Early Middle Woodland (Wright, 1967), of

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tradition. It is also component from which largest sample and greatest amount of data was recovered. Dates for these samples will help consolidate temporal span of tradition, which played major role in forming character of Middle Woodland assemblages of NE. Date, 530 B.C. (S-119, Radiocarbon, 1962, v. 4, p. 77; Wright and Anderson, 1963) was obtained from Saugeen focus site in S Ontario in which Laurel tradition specimens were found directly assoc., and date, 320 A.D. (M-1507, Radiocarbon, 1965, v. 7, p. 130) was obtained from late Laurel component on N shore of Lake Superior. These dates suggest temporal span of at least 1000 yr for Laurel tradition in Ontario. Estimated age of site is 500 to 200 B.C. Coll. 1960-1964 and 1966; subm. by J. V. Wright.

1340 ± 170

GSC-208. Heron Bay site, 8 in. depth **A.D. 610**

Charcoal (NMC-4) from NE quadrant of Square Sigma at 8 in. depth. Occurred as scattered small particles.

1540 ± 160

GSC-445. Heron Bay site, 10 to 12 in. depth **A.D. 410**

Charcoal (NMC-57) from soot-stained lens in excavation unit T, SW sector, 10 to 12 in. depth.

1160 ± 130

GSC-449. Heron Bay site, major stratum **A.D. 790**

Charred bone (NMC-58) from major cultural stratum capped with sterile sand lens. Two determinations were made:

collagen fraction	1160 ± 130
carbonate fraction	390 ± 130

1810 ± 150

GSC-686. Heron Bay site (DdIn-1-1) **A.D. 140**

Encrusted carbon (NMC-93) from potsherds from Heron Bay site (DdIn-1-1).

General Comment (J.V.W.): archaeologic data as interpreted by submitter cannot accommodate young dates obtained for GSC-208, GSC-445, and GSC-449, nor for S-171 (unpubl.) which fall between 4th and 8th centuries A.D. (Wright, 1967). Date of GSC-686 is also too late, although closer to estimated age between 500 and 200 B.C. than any of previous 4 dates. Estimated age based on seriation and radiocarbon data. Amount of contamination resulting from GSC-686 having lain in open wooden trays for up to 7 yr is difficult to assess. NaOH-leach omitted from pretreatment of GSC-686. All 4 samples mixed with dead gas for counting.

B. Western Canada

4200 ± 140

GSC-660. Caribou Island site, Alberta **2250 B.C.**

Charcoal (NMC-97) from Caribou Is. site (GbOs-100) near Moose Lake, E central Alberta (54° 15′ N Lat, 110° W Long). From possible hearth in Stratum IV, Square JJ50, at depth 40 to 50 cm. Site yielded long

paleoclimatologic and archaeologic sequence for postglacial times, commencing with raised beach deposits yielding only unifacially flaked cobble tools. Early surface scoured by SE prevailing wind; later, prevailing wind shifted to NE and parabolic dunes formed on island. New types of artifacts were found in dune deposits. Increasing moisture stabilized dunes and formed soil, which yielded earliest projectile points. Dunes were later reactivated and finally reconsolidated. Sample should date initiation of dune reactivation. It is possible that buried soil was truncated at time of dune reactivation and that charcoal was originally in soil, but it is more likely that fire was built on or above paleosol after dune reactivation. Est. age, 3500 yr B.P., because of Duncan points in yellow sand. Coll. 1965 by W. Moore for A. L. Bryan, Univ. of Alberta, Edmonton; subm. by W. N. Irving. *Comment*: date correlates quite well with previous estimate, as Duncan points occur above dated sample. NaOH-leach omitted from sample pretreatment.

GSC-696. Muhlbach site, Alberta **1270 ± 150**
A.D. 680

Charred bone (NMC-99) from Muhlbach site (FbPf-100) near Stettler, Alberta (52° 15′ N Lat, 112° 50′ W Long), from Square B14, bone bed matrix (Zone C), ca. 50 cm below surface. Site is bison trap of Besant culture (Gruhn, 1965). Estimated age ca. A.D. 350. Coll. 1965 by J. Bellamy for R. Gruhn, Univ. of Alberta, Edmonton; subm. by W. N. Irving. *Comment* (R.G.): zone was saturated by solution from overlying bed of manure, so that sample could have been contaminated. Date is inconsistent with radiocarbon dates between 300 and 400 A.D. from other Besant sites in Alberta and Saskatchewan. No sample pretreatment. Sample mixed with dead gas for counting.

GSC-641. Fullerton site, Alberta **1230 ± 130**
A.D. 720

Charcoal (NMC-98) from Fullerton site (FfPi-100) near Wetaskiwin, central Alberta (52° 58′ N Lat, 113° 28′ W Long). From intrusive pit dug from level containing Oxbow projectile points, in Square B, depth 55 to 70 mm below surface. Site contains evidence for intermittent occupation by small hunting and/or family groups from ca. 7000 yr B.P. to historic times. Location is on top of large stabilized parabolic dune in old lake bed which still contains many sloughs. Because of absence of physical stratigraphy, identification of "level" from which pit was excavated is subject to error, but pit is definitely no earlier than Oxbow times. Estimated age 3500 to 5000 yr. Coll. 1965 by F. Taylor for A. L. Bryan; subm. by W. N. Irving. *Comment* (A.L.B.): surprisingly recent date clarifies certain anomalies, but shows that tracing any one assemblage through site will be even more difficult than suspected. Intrusion of pit probably began at higher "level" than previously thought. Unfortunately there are no other suitable samples to use as check. NaOH-leach omitted from sample pretreatment. Date based on one 4-day count.

7190 ± 150
5240 B.C.

GSC-459. Milliken site, British Columbia

Charcoal (NMC-69) from Milliken site (DjRi-3), Fraser Canyon, British Columbia (49° 33′ N Lat, 121° 24′ W Long). From Zone D, at N 7 ft, E 11.5 ft, depth ca. 9.5 ft below surface. Zone D of this deeply stratified site consists largely of sterile gravels probably laid down during last major eruptions of Mt. Mazama, which have an average date of ca. 4500 B.C. (cf. Powers and Wilcox, 1964). Seam of volcanic ash attributed to Mt. Mazama traverses Zone D at some parts of site. Sample will help date assemblage found on surface of Zone D which strongly resembles materials from preceding Milliken phase at DjRi-3 and in some respects materials of later Eayem phase at nearby Esilao (DjRi-5) site (cf. GSC-456, 1840 B.C., this list). The name Mt. Mazama has been provisionally assigned to this apparently transitional phase (Borden, 1965). Coll. 1960 by C. E. Borden and P. D. Harrison, Univ. of British Columbia, Vancouver; subm. by W. N. Irving. *Comment* (C.E.B.): date is earlier than anticipated, suggesting that fan gravels (Zone D) overlying cultural stratum (Zone E) dated 5400 B.C. built up more rapidly than assumed. In consequence cultural materials imbedded in surface of Zone D are probably also earlier than estimated. Sample mixed with dead gas for counting. Date based on one 3-day count.

Esilao site series, British Columbia

Charcoal from Esilao site (DjRi-5), Fraser Canyon, British Columbia (49° 33′ N Lat, 121° 24′ W Long). Site is deeply stratified; deepest excavated level has been dated 3530 B.C. (M-1547, Radiocarbon, 1965, v. 7, p. 138). Coll. 1963 by M. Suttles and D. M. Mitchell for C. E. Borden; subm. by W. N. Irving.

2180 ± 130
230 B.C.

GSC-455. Esilao site, 42 in. depth

Charcoal (NMC-65) from S 26 ft, 7 in., E 1 ft 9 in., 42 in. below surface. Will date component midway in time between 50 B.C. (M-1543, Radiocarbon, 1965, v. 7, p. 137) and 18th century A.D. Estimated age probably 2nd half of 1st millennium A.D.

2080 ± 130
130 B.C.

GSC-444. Esilao site, 99 to 102 in. depth

Charcoal (NMC-66) from S 27 ft 3 in. to 28 ft 3 in., E 11 ft 5 in. to 13 ft 8 in., 99 to 102 in. below surface. From stratum 3.5 ft below GSC-455, and above level of M-1543 (50 B.C., *op. cit.*, above).

3790 ± 130
1840 B.C.

GSC-456. Esilao site, 69 in. depth

Charcoal (NMC-67) from S 33 ft, W 12 ft 7 in., 69 in. below surface and ca. 15 ft above M-1544 (2470 B.C., Radiocarbon, 1965, v. 7, p. 137).

2640 ± 140
690 B.C.

GSC-448. Esilao site, 35 in. depth

Charcoal (NMC-68) from S 34 ft to 34 ft 3 in., W 17 ft to 17 ft

6 in., 35 in. below surface. Underlies massive gravel slide, ca. 45 ft above M-1544 (2470 B.C., Radiocarbon, 1965, v. 7, p. 137) and 3 ft above level of GSC-456. Should date hearth in level containing well-made adze blades and sawn steatite, located above deposits of Eayem phase. *General Comment* (C.E.B.): date 230 B.C. on GSC-455 requires explanation because sample appears considerably older than anticipated. Sample was taken from layer directly overlying Skamel phase deposits and might be expected to postdate latter. However, charred timbers from burned pit house in Skamel phase deposit have been dated 50 B.C. (M-1543, *op. cit.*, above) and 130 B.C. (GSC-444), respectively. The following explanation may account for inversion: following fire that destroyed 1st house, excavations for pit of new dwelling were made nearby into occupational deposits antedating construction of 1st house. These excavated older materials were dumped into location of burnt house, resulting in superimposition of older material over remains of more recent age. Date 130 B.C. on GSC-444 closely agrees with 50 B.C. (M-1543, *op cit.*, above) obtained on another charred timber from same burnt Skamel phase house. Date 1840 B.C. on GSC-456 is close to 2000 B.C., age estimated for this sample. Previous dates 3530 B.C. (M-1547) and 2470 B.C. (M-1544, both in *op. cit.*, above) on samples obtained at greater depths from same deposit, as well as thickness of deposit overlying level from which GSC-456 originated, suggest that Eayem phase of Fraser Canyon sequence lasted from ca. 3550 to perhaps 1100 B.C. Earliest ground slate implements yet documented in W N America appear in this phase ca. 2500 B.C. Date 690 B.C. on GSC-448 places this sample and assoc. cultural materials early in Baldwin phase of Fraser Canyon sequence. Other evidence and 3 previous C^{14} dates from Zone C at Milliken site (DjRi-3) indicate this phase lasted from ca. 1000 to 400 B.C. (cf. Radiocarbon, 1965, v. 7, p. 136-139; Borden, 1965). NaOH-leach omitted from pretreatment of GSC-448. GSC-456 and GSC-448 mixed with dead gas for counting. GSC-444 based on one 3-day count; GSC-456 based on one 4-day count.

GSC-530. Drynoch Slide site, British Columbia **7530 ± 270 5580 B.C.**

Charcoal (NMC-84) from Drynoch Slide site (EcRi:1), British Columbia (50° 20′ N Lat, 121° 24′ W Long). Sample is composite of small pieces of charcoal scattered throughout midden of fish remains and artifacts. Cultural material is in wind-blown sands resting directly on coarse gravels, presumably dating from an aggradation of Thompson R., and is overlain by ash, possibly Mazama Ash dated 6600 B.P. (Powers and Wilcox, 1964). Ash is overlain by extensive mud slide, dated 3175 ± 150 B.P. (I-462; Radiocarbon, 1963, v. 5, p. 66). Diagnostic feature is microblade, probably oldest found in S British Columbia to date. Date will be maximum for age of ash as well as another early date for presence of microblades in British Columbia. If ash is id. as Mazama, at least 1000 yr could be added to chronology currently being developed 30 mi away at Lochnore-Nesikep Creek on Fraser R. Coll. 1964 by D. Sanger,

Univ. of Washington, Seattle, Washington (now Natl. Mus. of Canada); subm. by W. N. Irving. *Comment* (D.S.): date agrees with geologic context and dates presence of microblades in S British Columbia.

2670 ± 130
720 B.C.

GSC-407. Lochnore Creek site, British Columbia

Charred log (NMC-50) from Lochnore Creek site (EdRk-7), British Columbia (50° 32′ N Lat, 121° 46′ W Long). From bottom of Housepit 2, depth 1.85 to 2.00m in most recent of 3 components. Assoc. assemblage predates introduction of small side-notched projectile points, but contains other traits known to occur in historic sites. Microblades, absent in historic assemblages, are present in small percentages but appear to be losing popularity. Housepits are probably as old as any known from interior of British Columbia. Coll. 1964 by D. Wyatt for D. Sanger; subm. by W. N. Irving. *Comment* (D.S.): although older determinations have been obtained on portions of same sample (see Table 1) this date is presently accepted as the most reasonable (Sanger, 1967). Two determinations were made:

GSC-407, standard pretreatment, date based on one 3-day count 2670 ± 130

GSC-407-2, no pretreatment, date based on one 1-day count 2600 ± 140

Another determination was made on same sample (although field number differed) after it had been dated by Geochron Labs., Inc.

GSC-520, acid pretreatment by Geochron, no further pretreatment by GSC; date based on one 3-day count 2680 ± 130

310 ± 130
A.D. 1640

GSC-405. Cow Springs site, British Columbia

Charred log (NMC-51) from Cow Springs site (EdRk-5), British Columbia (50° 32′ N Lat, 121° 46′ W Long). From test pit in E lip of 2-component, single house pit 92 cm below surface, in Zone II. Two distinct components are separated by sterile gravels and sands. Cow Springs is probably one of more recent sites in Lochnore-Nesikep Creek sequence, although it lacks some items assoc. with historic-age sites. Sealed-in Zone II deposits exhibited remarkable preservation, including 1-piece birch bark basket virtually identical in design with those of ethnographic Thompson Indians. Absolute date on this assemblage would estimate date of manufacture of baskets as well as age of many artifacts removed from burial ground EdRk-3, also in Lochnore-Nesikep Creek sequence. Coll. 1964 by M. Suttles for D. Sanger; subm. by W. N. Irving. *Comment* (D.S.): date is more recent than estimated. A portion of same sample has given dates A.D. 1175 ± 95 and 1125 ± 85 (both GX-0406) (Sanger, 1967) which are much closer to estimated age of A.D. 1200. Another determination was made on sample (although field number differed) after dating by Geochron Labs., Inc. (see Table 1):

Note (J. A. Lowdon and W. Blake, Jr.): the following table indicates certain apparent age discrepancies. The reader is referred also to descriptions of GSC-407 and GSC-405, this date list. Isotopes Inc. and GSC obtained identical results on different parts of sample EdRk-7-1962-7, and GSC obtained the same result on part of the sample (in this case numbered EdRk-7-7b-1962) after preliminary treatment by Geochron Labs. Inc. The GSC and Isotopes dates do not agree with the Geochron dates. Likewise GSC dates on EdRk-5-153-1 and EdRk-5-16 Zone 11 agree within the limits of error, but do not agree with the Geochron dates. As a result of these discrepancies a piece of Douglas fir of known age was dated by both GSC and Geochron; identical results were obtained. We can offer no satisfactory explanation, although possibly inhomogeneity in the samples received by GSC from Geochron is a factor.

Table 1

Comparison of C^{14} Ages of Charcoal

Sample No.	Laboratory	Lab. No.	Pretreatment	Age (Yrs. B.P.)
EdRk-7-1962-7*	Geological Survey of Canada	GSC-407	Standard alkali and acid leach**	2670 ± 130
	Geological Survey of Canada	GSC-407-2	Untreated	2600 ± 140
	Isotopes Inc.	I-1866	Untreated	2680 ± 100
EdRk-7-7b-1962*	Geochron Laboratories Inc.	GX-0407	Acid leach only	3280 ± 125
	Geochron Laboratories Inc.	GX-0407	Acid leach only	3220 ± 90
	Geological Survey of Canada	GSC-520†	Acid leach only	2680 ± 130
EdRk-5-153-1*	Geological Survey of Canada	GSC-405	Standard alkali and acid leach**	310 ± 130
EdRk-5-16 Zone 11*	Geochron Laboratories Inc.	GX-0406	Acid leach only	825 ± 85
	Geochron Laboratories Inc.	GX-0406	Acid leach only	775 ± 95
	Geological Survey of Canada	GSC-521†	Acid leach only	190 ± 200‡

* Separate fractions supplied by D. Sanger from the *same* field samples although sample nos. differ.

** See Radiocarbon, v. 5, 1963, p. 39-40.

† Material supplied by H. Krueger, Geochron Laboratories Inc., from residual of Geochron samples GX-0407 and GX-0406, respectively. Samples given acid treatment by Geochron Labs. and no further treatment by the Geological Survey of Canada.

‡ The greater uncertainty assigned is the result of the small sample size and large mixing ratio.

GSC-521, acid pretreatment by Geochron, no further pretreatment by GSC; date based on one 3-day count. 190 ± 200
Reason for discrepancy in dates is not known.

2180 ± 150
GSC-404. Lehman site, British Columbia **230 B.C.**

Charcoal (NMC-52, combined sample) from Lehman site (EdRk-8), British Columbia (50° 32′ N Lat, 121° 46′ W Long). From upper few cm of lowest of 2 distinct strata. Site was apparently a housepit, assumed to contain 2 components. Coll. 1964 by D. Sanger; subm. by W. N. Irving. *Comment* (D.S.): sample dates Zone I, or upper component, which does not contain microblades. Assoc. artifacts are similar to those at Lochnore Creek site at 720 B.C. (cf. GSC-407, this list; Sanger, 1967). Sample mixed with dead gas for counting.

1730 ± 130
GSC-440. Beach Grove site, British Columbia **A.D. 220**

Charcoal (NMC-47) from Beach Grove site (DgRs-1), Delta Municipality, British Columbia (49° 01′ 50″ N Lat, 123° 03′ 50″ W Long). From below Burial 17 within shallow grave pit, N 26 ft, E 3 ft, at 8 ft 7 in. depth below datum (6 ft 10 in. below surface). Site is shell midden 0.5 mi long, occupied as winter village component of Marpole phase. Recent dates for Marpole phase (UW-43, A.D. 410; UW-44, A.D. 350; Radiocarbon, 1966, v. 8, p. 503) have been much younger than 1st millennium B.C. range expected. If present sample confirms these late dates, it will indicate that Marpole phase persisted later than previously thought. Coll. 1961 by D. N. Abbott for W. Duff, Prov. Mus. of British Columbia (now at Univ. of British Columbia, Vancouver); subm. by W. N. Irving. *Comment* (W.D.): date confirms Beach Grove component is more recent than formerly believed, therefore, Marpole phase persisted later than was thought. Date questions previous estimates for Marpole component; it now seems unlikely that maximum age of Marpole phase is greater than perhaps 2400 yr. Sample mixed with dead gas for counting.

Montague Harbour site series, British Columbia

Charcoal and wood from Montague Harbour site (DfRu-13), Galiano Is., British Columbia (48° 53′ 25″ N Lat, 123° 24′ W Long). Site is stratified shell midden with 3 cultural horizons, Montague Harbour I-III, numbered from bottom to top and representing, respectively, Locarno Beach phase, Marpole phase, and Coast Salish. Coll. 1964 by D. H. Mitchell, J. Sendey, and T. Moore for W. Duff; subm. by W. N. Irving.

2890 ± 140
GSC-406. Montague Harbour I, Test Cut 1 **940 B.C.**

Charred wood (NMC-43) from Montague Harbour I level, Test Cut 1, S 3 ft, E 2 ft, below water table and 80 in. below surface. Layer of compact black soil containing little shell, but considerable bone.

GSC-423. Montague Harbour III, Test Cut 3 **790 ± 130 A.D. 1160**

Charcoal (NMC-45) from Montague Harbour III level, Test Cut 3, S 1 ft, E 4 ft, in black humus, yellow sand, and scattered shell fragments 104 in. below surface.

GSC-436. Montague Harbour III, Test Cut 1 **730 ± 130 A.D. 1220**

Charcoal (NMC-42) from Montague Harbour III level, Test Cut 1, S 13 ft 4 in., E 2 ft, in dark soil with scattered shell and charcoal, 60 in. below surface.

GSC-437. Montague Harbour I, Test Cut 2 **3160 ± 130 1210 B.C.**

Charcoal (NMC-44) from Montague Harbour I level, Test Cut 2, S 0-5 ft, E 3-5 ft, in stratum of black humus with charcoal and gravel, 94 in. below surface.

General Comment (D.H.M.): as Montague Harbour I materials seemed to align culture closely with another Locarno Beach phase site, Pender Is. Canal (DeRt-2) dated 2200 ± 120 B.P. (M-1515, Radiocarbon, 1965, v. 7, p. 137), it was originally thought that samples from DfRu-13 would be 2000 to 2500 yr old. Present dates must alter our opinion of Locarno Beach phase sites, but they do not mean a substantial realignment in thinking. NaOH-leach omitted from pretreatment of GSC-423; date based on one 3-day count.

GSC-746. Hagwilget site, British Columbia **3430 ± 200 1480 B.C.**

Charcoal (NMC-158) from Hagwilget site (GhSv-2), junction of Bulkley and Skeena Rivers, British Columbia (55° 15′ 20″ N Lat, 127° 36′ 05″ W Long). From Trench 1, Feature 1, 2.0 ft E, 0.6 ft N, 5.5 ft depth. Site is stratified fishing sta. in Bulkley Canyon and has been inhabited in historic past by both Gitksan and Carrier bands. Sample from hearth feature containing lithic artifacts and other cultural material. Hearth lies on well-marked stratum. Estimated age ca. 800 yr. Coll. 1966 by C. J. Turnbull for G. F. MacDonald. *Comment* (G.M.): date acceptable, but further research is necessary. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on three 1-day counts.

GSC-744. Garden Island site, British Columbia **1970 ± 130 20 B.C.**

Charcoal (NMC-156) from Garden Is. site (GbTo-23), Venn Passage, Prince Rupert, British Columbia (54° 19′ 05″ N Lat, 130° 23′ 15″ W Long). From Trench 2, 0.2 ft S, 4.2 ft W, 9.0 ft depth, lowest cultural level, overlying peat deposit and blue marine clay. Site is shell midden covering small island (100 by 400 ft) in Coast Tsimpsian area. Material is prehistoric. Estimated age 1500 to 2000 yr. Coll. 1966 by G. F. Mac-

Donald. *Comment* (G.M.): date is considered good for lowest component. A large sample of well-preserved human remains and artifacts is being analyzed.

C. Northern Canada, Mainland

Klo-kut site series, Yukon Territory

Wood charcoal and charred bone from Klo-kut site (MjVl-1), right bank of Porcupine R. ca. 6 mi above Old Crow, Yukon Terr. (67° 54′ N Lat, 139° 41′ W Long). Large, seasonally occupied Athabaskan site, with 3 to 4 ft of prehistoric deposits beneath late 19th to early 20th century level with metal and glass. Matrix consists of flood-deposited sands, silts and clays, on bank 30 ft above summer low water. Area IA is ca. 700 ft NE of W Block; their stratigraphic units are numbered differently. Some samples also dated at Gakushuin Univ., Toyko, Japan; these will appear in future Gakushuin list (cf. also Wilmeth, in press). All samples except those from Area IA are located on a uniform grid measured in ft. Coll. 1966 by W. N. Irving and D. MacLeod.

650 ± 130

GSC-747. Klo-kut site, Area IA, Layer 6 A.D. 1300

Wood charcoal (NMC-184) from Area IA, Feature 4, hearth, in S end of Square 23, Layer 6, 16 to 19 in. depth, directly above sterile silt. Will date prehistoric occupation similar to upper strata but with minor trait differences. Will also give some indication of rate of deposition of sediment and rate of culture change relative to upper and immediately inferior strata. Estimated age 500 yr.

870 ± 130

GSC-759. Klo-kut site, Area IA A.D. 1080

Wood charcoal (NMC-189) from Area IA, Square 16-25, Layer 10. Deep organic stratum, probably old burnt-off forest surface, 43 in. below surface. Probably dates forest fire which effected initial clearing of site and which rendered area readily habitable for 1st time. Deepest indications of occupation were found just above this level. Estimated age 600 to 800 yr.

600 ± 140

GSC-779. Klo-kut site, W Block, Layer IA A.D. 1350

Wood charcoal (NMC-180) from Squares 0/W100—N5-100, Layer IA. From bottom of hearth basin, directly above sterile silt. Will date late prehistoric occupation immediately above last major deposition of flood silt. Estimated age 100 to 300 yr.

460 ± 140

GSC-789. Klo-kut site, W Block, Layer IA A.D. 1490

Charred bone (NMC-180) from Squares 0/W100—N5/100, Layer IA. From bottom of hearth basin, directly above sterile silt. Will date late prehistoric occupation immediately above last major deposition of flood silt. Estimated age 100 to 300 yr.

General Comment (W.N.I.): combined series of GaK and GSC dates is rendered plausible if we discard GSC-759 and GaK-1253 (<240), which are inconsistent both with other dates from Area IA and with dates from other parts of site. According to stratigraphic position of GSC-759 below oldest level of occupation debris, it should be older than 1040 ± 100 yr (GaK-1252) and perhaps as old as 1790 ± 180 yr (GaK-1265). GSC-747 conforms to most others in series. GSC-779 (wood charcoal) and GSC-789 (charred bone), separated from same sample, are suspiciously old for bottom of uppermost prehistoric layer in W Block, especially when compared with GSC-747 from Layer 6 in Area IA. However, series of 4 dates from W Block is internally consistent, and there is no stratigraphic basis at W end of site, from which these samples as well as GaK-1264 (910 ± 70) and GaK-1265 (1790 ± 180) came, for discounting GSC-779 or GSC-789. Indication that site was 1st occupied intensively ca. 1000 yr ago is acceptable even though it exceeds previous estimates. No comparable archaeologic material from other sites has been dated. Earliest date, GaK-1265 (A.D. 160) may not represent human occupation. Most of the samples came from highly organic layers which thawed and became saturated every summer; possibility of contamination cannot be eliminated completely. NaOH-leach omitted from pretreatment of GSC-747, GSC-779, and GSC-789; these samples each mixed with dead gas for counting. GSC-747 and GSC-779 each based on one 3-day count.

D. Northern Canada, Arctic Archipelago

Tyara site series, Northwest Territories

Walrus and seal bone from Tyara site (KkFb-7), Sugluk Is., Northwest Territories, at entrance to Sugluk Inlet on S side of Hudson Strait (62° 15′ 30″ N Lat, 75° 33′ 40″ W Long). Early Dorset culture site with 3 stratified midden layers. Coll. 1958 by W. E. Taylor.

GSC-701. Tyara site, Trench 2 **2670 ± 130 / 720 B.C.**

Raw seal and bearded seal bone (NMC-117) from Trench 2, Square A, Level III. Est. age ca. 700 B.C. Alt of Level III ca. 49.5 ft.

GSC-702. Tyara site, Trench 1 **2200 ± 130 / 250 B.C.**

Raw walrus and bearded seal bone (NMC-114) from Trench 1, Level I. Est. age slightly older than 235 B.C.

GSC-703. Tyara site, Trench 3 **2630 ± 130 / 680 B.C.**

Raw walrus bone (NMC-116) from Trench 3, Square 1, Level II. Est. age ca. 610 B.C.

General Comments (W.E.T.): all 3 dates are entirely acceptable; (W. Blake, Jr.): dates form interesting comparison with those of Matthews (1966, 1967; see also Radiocarbon, 1967, v. 9, p. 156, 301; 1968, v. 10, p. 207; 1965, v. 7, p. 156; 1966, v. 8, p. 161) relating to emergence of land from sea since deglaciation.

2040 ± 130
80 B.C.

GSC-794. Kemp site, Baffin Island

Wood (predominantly driftwood) (NMC-135) from Kemp site (KdDq-8-2), Cape Tanfield, Baffin Is., Northwest Territories (62° 39′ N Lat, 69° 37′ W Long). From Sq. 5L15, depth 1.2 ft in permafrost. Rich undisturbed midden, 14 to 16 in. deep in Tanfield Valley at alt 31 ft above present high tide. Site covers est. 400 sq. ft. Typologically, artifacts fall into intermediary position between pre-Dorset and Dorset. Since sample is driftwood, date should be slightly older than midden. Should date earlier of 2 apparent components. More recent component dated 2200 ± 120 yr B.P. (M-1534, Radiocarbon, 1966, v. 8, p. 278). Typologically more recent than Tanfield site (P-698, 2608 ± 50 yr B.P., Radiocarbon, 1966, v. 8, p. 363). Est. age 2500 yr. Coll. 1966 by M. S. Maxwell, Michigan State Univ., Lansing, Michigan. Subm. by R. Wilmeth. *Comment* (M.S.M.): date does not fit available evidence. Comparatively clear typological seriation would place earlier occupation of this 2-component site as occurring slightly after Tanfield site, or ca. 550 B.C. Date based on one 3-day count.

2350 ± 140
400 B.C.

GSC-820. Tanfield site, Baffin Island

Charred (seal?) fat (NMC-136) from Tanfield site (KdDq-7-1A) Cape Tanfield, Baffin Is., Northwest Territories (62° 39′ N Lat, 69° 37′ W Long). From Sq. 5R5, depth 0.5 ft. Thin midden lying closer to sea coast than major part of Tanfield midden, which falls early in Dorset sequence. Sample may be either earlier or later than major part of midden, dated 2608 ± 50 (P-698, *op. cit.*, above). Age of midden is critical factor in filling out seriation of 20 sites in Cape Tanfield vicinity. Estimated age 1850 yr. Coll. 1966 by M. S. Maxwell. Subm. by R. Wilmeth. *Comment* (M.S.M.): interpretation of site has presented many problems. After submission of sample, and before receiving result, it was concluded that site was coeval with one of occupations at Nanook site (cf. M-1535, 2410 ± 120, Radiocarbon, 1966, v. 8, p. 278; P-704, 1916 ± 61 and P-706, 1827 ± 61, both in Radiocarbon, 1966, v. 8, p. 363) and probably represented a summer site, whereas latter was used in late autumn and winter. Date would fit well with an interpretation which made site coeval with end of Component II at Nanook site. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.

Ballantine site series, Victoria Island

Charcoal and bone or antler from Ballantine site (NiNg-3), overlooking SW extremity of Ferguson Lake, SE Victoria Is., Northwest Territories (69° 24′ N Lat, 106° 14′ W Long). Small single component midden site of early Dorset period, rich in artifacts. Samples will date early Dorset culture in area. Coll. 1965 by W. E. Taylor, Jr.

GSC-640. Ballantine site, Trench 1, Square 5 **2220 ± 140**
270 B.C.

Charcoal and bits of bone or antler (NMC-105) from Trench 1, Sq. 5, in midden stratum underlying modern humus layer and overlying sterile gravels. Est. age ca. 500 B.C. NaOH-leach omitted from sample pretreatment. Date based on one 3-day count. Sample mixed with dead gas for counting.

GSC-658. Ballantine site, Trench 1, Square 13 **2450 ± 220**
500 B.C.

Bits of charcoal (NMC-106) from Trench 1, Sq. 13, in midden stratum; in lower part of stratum at 7 to 15 in. depth. Est. age ca. 500 B.C. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.
General Comment (W.E.T.): both dates quite satisfactory.

GSC-713. Menez site, Victoria Island **2980 ± 150**
1030 B.C.

Charred wood and charred bone (NMC-107) from Menez site (NiNg-10), overlooking S side of Ekalluk R. near Wellington Bay, SE Victoria Island, Northwest Territories (69° 23′ N Lat, 106° 15′ W Long). From Test Cut 4, NW ¼, depth 2 to 4 in. in simple midden deposit which ranged from surface to 8 in. depth. Small single-component midden site of pre-Dorset culture. Coll. 1965 by W. E. Taylor, Jr. *Comment* (W.E.T.): date seems acceptable and consistent with sample I-2058 (2880 ± 105; Wilmeth, in press) from same site. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

GSC-656. Buchanan site, Victoria Island **2600 ± 130**
650 B.C.

Charcoal and bits of bone or antler (NMC-108) from Buchanan site (NiNg-1) overlooking S bank of Ekalluk R. near Wellington Bay, SE Victoria Is., Northwest Territories (69° 24′ N Lat, 106° 15′ W Long). From Trench 4, Sq. 1, in hearth at E edge of square, 5 to 7 in. depth. Although other, horizontally distinct, parts of site are Dorset culture components, this sample came from pre-Dorset component, buried midden layer overlooking other components which stood along river bank. Est. age ca. 2500 B.C. Coll. 1965 by W. E. Taylor, Jr. *Comment* (W.E.T.): date is far younger than initial guess and very possibly too young for pre-Dorset culture in this region. Other tests (I-2054 and I-2053) suggest occupation ca. 1000 B.C., which seems much more reasonable. NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

GSC-650. Lady Franklin Point site, Victoria Island **1330 ± 130**
A.D. 620

Burned bone and seal fat (NMC-111) from Lady Franklin Point site (NdPd-2), S coast, W end of Lady Franklin Point, Victoria Is., Northwest Territories. No precise location data available due to cataloguer's

error, but site is at ca. 68° 28′ 30″ N Lat and 113° 13′ W Long. Middens and house mounds of Thule culture winter village. Est. age ca. A.D. 1100. Coll. 1963 by W. E. Taylor, Jr. *Comment* (W.E.T.): artifacts suggest occupation roughly 400 yr younger than age suggested by date. General views on Thule culture chronology imply that sample date is too old. NaOH-leach omitted from sample pretreatment.

Umingmak site series, Banks Island

Charred twigs and bone from Umingmak site (PjRa-2), overlooking mouth of creek at S extremity of Shoran Lake, N interior of Banks Is., Northwest Territories (73° 30′ N Lat, 119° 20′ W Long). Multi-component pre-Dorset culture site of buried middens and frequent scattered surface finds of cultural debris. Refuse indicates seasonal occupation for musk-ox hunting. Est. age, middle of pre-Dorset culture period. Coll. 1965 by W. E. Taylor, Jr.

3420 ± 150

GSC-651. Umingmak site, 4 to 7 in. depth **1470 B.C.**

Burned bits of bone and burned willow (?) twigs (NMC-110) from Area A, Test cut 9, in midden stratum at 4 to 7 in. depth. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

3440 ± 150

GSC-669. Umingmak site, 3 to 6 in. depth **1490 B.C.**

Charred twigs and charred bone (NMC-109) from Area A, Test cut 9, in midden stratum at 3 to 6 in. depth. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.
General Comment (W.E.T.): dates slightly younger than est. age, but consistent with each other and quite acceptable.

E. Alaska

Punyik Point site series, Alaska

Wood charcoal from Punyik Point site (68° 08′ N Lat, 156° 08′ W Long), N side of Itivlik Lake, Brooks Range, Alaska. Stratified midden with Punyik variant of Denbigh Flint complex below Ipiutak-Norton culture level. Coll. and subm. by W. N. Irving.

3660 ± 150

GSC-712. Punyik Point site, Square H-16 **1710 B.C.**

Wood charcoal (NMC-102) from lower part of rich midden which filled house depression and produced pure sample of Punyik variant of Denbigh Flint complex, Sq. H-16, SE ¼. Est. of age of Denbigh Flint complex range from <4000 to >5000 yr, based on radiocarbon dates and geomorphic evidence from other sites. Date from this midden, when compared with others from Onion Portage, will help indicate whether it differs from latter site, which is geographically and environmentally

different. Date 2520 B.C. (W-1154, Radiocarbon, 1964, v. 6, p. 62) on twigs from alluvium under site, if correct, provides maximum age to be expected from sample.

GSC-884. Punyik Point site, Square R-15 **1360 ± 200 A.D. 590**

Wood charcoal fragments (NMC-104) from distinct occupation layer below an Ipiutak-Norton culture house, H 61-H, Sq. R-15, N ½, Layer 3. Layer was continuous with floor of early Denbigh house, and produced only Denbigh artifacts, which appear typologically older than those in midden from which sample GSC-712 was taken. Est. age 400 yr or more. *General Comment* (W.N.I.): GSC-712, which dates variant of Denbigh Flint complex at 1710 B.C., conforms well with dates on this complex at Onion Portage reported to me by Douglas Anderson. It tends to support inference from typology that this midden is from late phase of Denbigh Flint complex. GSC-884, which dates apparently older variant of Denbigh Flint complex to A.D. 590, cannot be correct. Charcoal came from near surface, so contamination by recent humic acids, or mixture with charcoal of Norton or later age may be suspected. Date is a little late to represent Norton-Ipiutak culture. NaOH-leach omitted from pretreatment of both samples, and both mixed with dead gas for counting. GSC-712 based on one 3-day count; GSC-884 based on two 1-day counts.

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Michigan XI	Crane and Griffin, 1966
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