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RADIOCARBON

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Editors

EDWARD S. DEEVEY — RICHARD FOSTER FLINT

J. GORDON OGDEN, III — IRVING ROUSE

Managing Editor

RENEE S. KRA

YALE UNIVERSITY

NEW HAVEN, CONNECTICUT

RADIOCARBON MEASUREMENTS: COMPREHENSIVE INDEX, 1950-1965

The editors of RADIOCARBON, with the support of the National Science Foundation, have published a Comprehensive Index to previously published radiocarbon measurements. Entries through Volume 7 of RADIOCARBON have been scrutinized, and revised where necessary, by all laboratories and authors of date lists. The Index lists all dates or other measurements in order of laboratory number, which have been kept current through the application of a series of corrections.

The price is ten dollars U.S. per copy. The Index will be sent to all subscribers to RADIOCARBON upon request.

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INSTRUCTIONS TO CONTRIBUTORS

Manuscripts of radiocarbon papers should follow the recommendations in *Suggestions to Authors*, 5th ed.* All copy must be typewritten in *double space* (including the bibliography): manuscripts for no. 1, vol. 11, must be submitted in *duplicate* by September 1, 1968, and for no. 2, by January 1, 1969.

Description of samples, in date lists, should follow as closely as possible the style shown in this volume. Each separate entry (date or series) in a date list should be considered an *abstract*, prepared in such a way that descriptive material is distinguished from geologic or archaeologic interpretation, but description and interpretation must be both brief and informative. Date lists should therefore not be preceded by abstracts, but abstracts of the more usual form should accompany all papers (e.g. geochemical contributions) that are directed to specific problems.

Each description should include the following data, if possible in the order given:

1. Laboratory number, descriptive name (ordinarily that of the locality of collection), and the date expressed in years B.P. (before present, i.e. before A.D. 1950) and, for finite dates, in years A.D. or B.C. The standard error following the date should express, within limits of $\pm$ 1σ, the laboratory's estimate of the accuracy of the radiocarbon measurement, *as judged on physicochemical (not geologic or archaeologic) grounds.*

2. Substance of which the sample is composed; if a plant or animal fossil, the scientific name if possible; otherwise the popular name; but not both. Also, where pertinent, the name of the person identifying the specimen.

3. Precise geographic location, *including latitude-longitude coordinates.*

4. Occurrence and stratigraphic position in precise terms.

5. Reference to relevant publications. Citations within a description should be to author and year, with specific pages wherever appropriate. References to published date lists should cite the journal, year, vol., and specific page (e.g., Radiocarbon, 1968, v. 10, p. 97). Full bibliographic references are listed alphabetically at the end of the manuscript, in the form recommended in *Suggestions to Authors.*

6. Date of collection and name of collector.

7. Name of person submitting the sample to the laboratory, and name and address of institution or organization with which submitter is affiliated.

8. Comment, usually comparing the date with other relevant dates, for each of which sample numbers and references must be quoted, as prescribed above. Interpretive material, summarizing the significance and implicitly showing that the radiocarbon measurement was worth making, belongs here, as do technical matters, e.g. chemical pretreatment, special laboratory difficulties, etc.

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* Suggestions to authors of the reports of the United States Geological Survey, 5th ed., Washington, D. C., 1958 (Government Printing Office, $1.75).

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EDITORIAL STATEMENT

Half life of C^{14}. In accordance with the decision of the Fifth Radiocarbon Dating Conference, Cambridge, 1962, **all dates published in this volume (as in previous volumes) are based on the Libby value, 5570 $\pm$ 30 yr,** for the half life. This decision was reaffirmed at the H^3 and C^{14} Conference, Pullman, Washington, 1965. Because of various uncertainties, when C^{14} measurements are expressed as dates in years B.P. the dates are arbitrary, and refinements that take some but not all uncertainties into account may be misleading. As stated in Professor Harry Godwin's letter to **Nature** (v. 195, no. 4845, p. 984, September 8, 1962), the mean of three new determinations of the half life, 5730 $\pm$ 40 yr, is regarded as the best value now obtainable. Published dates can be converted to this basis by multiplying them by 1.03.

A.D./B.C. dates. As agreed at the Cambridge Conference in 1962, A.D. 1950 is accepted as the standard year of reference for all dates, whether B.P. or in the A.D./B.C. system.

Meaning of δC^{14}. In Volume 3, 1961, we indorsed the notation Δ (Lamont VIII, 1961) for geochemically interesting measurements of C^{14} activity, corrected for isotopic fractionation in samples and in the NBS oxalic-acid standard. The value of δC^{14} that entered the calculation of Δ was defined by reference to Lamont VI, 1959, and **was corrected for age.** This fact has been lost sight of, by the editors as well as by authors, and recent papers have used δC^{14} as the **observed** deviation from the standard. This is of course the more logical and self-explanatory meaning, and cannot be abandoned now without confusion; moreover, except in tree-ring-dated material, it is rarely possible to make an age correction that is independent of the C^{14} age. In the rare instances where Δ or δC^{14} are used for samples whose age is both appreciable and known, we assume that authors will take special care to make their meaning clear; reference to "Δ as defined by Broecker and Olson (Lamont VIII)" is not sufficient to do this.

Radiocarbon Measurements: Comprehensive Index, 1950-1965. This index, covering all published C^{14} measurements through Volume 7 of RADIOCARBON, and incorporating revisions made by all laboratories, has been published. It is available at ten dollars U.S. per copy. The Index will be sent upon request to all subscribers to RADIOCARBON.

Expanded publication. Volume 10 and subsequent volumes are published in two semi-annual issues, in Winter and in Summer, with deadlines for manuscripts on 1 September and 1 January.

New member. Professor J. Gordon Ogden, III, Ohio Wesleyan University, has officially joined the editorial staff.

[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 179-199]

Radiocarbon

1968

ANU RADIOCARBON DATE LIST II

H. A. POLACH,*,** J. GOLSON,**
J. F. LOVERING,* and J. J. STIPP*
Australian National University, Canberra, Australia

The C^{14} measurements reported here were carried out by the Radiocarbon Laboratory, Dept. of Geophysics and Geochemistry, A.N.U., between Jan. and Aug. 1967. Laboratory equipment consists of a *Beckman* methane gas-proportional unit (ANU I) supplemented in Dec. 1966 by an automatic 3-channel *Beckman* model LS-200 liquid scintillation spectrometer. Synthesis of methane and benzene is the same as used in ANU I and described by Polach and Stipp (1967). Treatment of samples remains a 2N hot acid (HCl) wash unless otherwise specified. Where applicable, fractional separation follows procedures reported by Olson (1963), Berger *et al.* (1964), Tamers and Pearson (1965), and Krueger (1966). In the treatment of bone samples, physical or mechanical cleaning could not completely remove sedimentary material often filling the structural pores. This material, if present, was retained with the fraction referred to as "collagen". Since we are not dealing with pure collagen, we prefer to call it "acid-insoluble" bone fraction, a name describing the treatment. These dates are reported as equal to or greater than given age. Table 1 summarizes all dated fractions.

TABLE 1
Dated fractions of samples (ANU II)

ANU Number	ANU Date	Fraction dated
ANU-37a	910 ± 110	bone carbonate
37b	≥2420 ± 110	acid-insol. bone frac.
ANU-38a	3470 ± 60	bone carbonate
38b	≥8230 ± 190	acid-insol. bone frac.
ANU-41a	6750 ± 100	bone carbonate
41b	≥10,730 ± 370	acid-insol. bone frac.
ANU-46a	$\delta^{14}C+47 \pm 5\%$ w.r.t .95 NBS oxalic standard	NaOH-sol. ("humic")
46b	495 ± 100	NaOH-insol. charcoal
ANU-65a	Too small to date	NaOH-sol. ("humic")
65b	$31,600 \begin{smallmatrix} +1100 \\ -1300 \end{smallmatrix}$	NaOH-insol. charcoal
ANU-77a	24,800 ± 1600	NaOH-sol. ("humic")
77b	22,900 ± 1000	NaOH-insol. charcoal
ANU-81a	Too small to date	NaOH-sol. ("humic")
81b	$24,000 \begin{smallmatrix} +3300 \\ -5700 \end{smallmatrix}$	NaOH-insol. charcoal

* Department of Geophysics and Geochemistry
** Department of Anthropology and Sociology

The system of interlaboratory cross checks and independent duplicate measurements referred to in ANU I has been continued and results are summarized in Table 2.

TABLE 2

Interlaboratory cross checks and duplicate determinations

ANU Number	ANU Date	Other Number	Other Date	References
ANU-23	330±100			ANU I
ANU-23/2	340± 63			ANU II
ANU-30/1	250± 75	N-294	225±110	ANU II
ANU-30/2	274± 70			Bowler, pers. commun.
ANU-69	>37,000			ANU II
ANU-69/2	>30,000			
*ANU-70	15,850±320	GaK-510	13,700±270	ANU II Wright, pers. commun.
ANU-92/1	3015±140			ANU II
ANU-92/2	3100± 85			
ANU-133	30,030±810	W-901	30,800±1000	ANU II USGS VI
*ANU-180	21,200±700	V-92	19,900±2000	ANU II Wright, pers. commun.

* A recollection of samples previously submitted for dating. All others are independent determinations on identical samples.

Ages are relative to A.D. 1950, calculated on the basis of Libby half-life of 5568 yr. We have changed our practice of reporting the error. Since this is based, at 1 standard deviation, solely on statistical counting errors of the Background, Sample and Oxalic modern reference, we now propose to report it as such, instead of enlarging to ± 100 yr minimum as previously. To allow for other sources of error in the dating process (Anderson and Levi, 1952; Tauber, 1958; Libby, 1963; Polach and Golson, 1966), particularly those reported at 2% or less and/or referring to the last few millennia (Stuiver and Suess, 1966; Stuiver, 1967; Suess, 1967) we recommend that readers double the errors quoted in this list. Ages less than 200 yr should be considered modern. All ages in the following list were produced by liquid scintillation counting of benzene samples. One day is equivalent to 1300 min counting time. Benzene dilution means the sample did not produce enough benzene to fill the counting vial and "dead" benzene was introduced to make up the volume.

ACKNOWLEDGMENTS

Part of the work is supported by a grant from the Australian Inst. of Aboriginal Studies (A.I.A.S.); in this connection we acknowledge the help of D. J. Mulvaney, Dept. of Anthropol., A.N.U. M. Trotman, of the Electronics section of the Research School of Physical Sciences, A.N.U., has continued to give technical assistance.

ABBREVIATIONS

A.I.A.S.	:	Australian Institute of Aboriginal Studies, Canberra.
Anthropology	:	Department of Anthropology and Sociology, Research School of Pacific Studies, A.N.U.
A.N.U.	:	Australian National University, Canberra
C.S.I.R.O.	:	Commonwealth Scientific and Industrial Research Organization, Canberra
Geography	:	Department of Geography, Research School of Pacific Studies, A.N.U.
Geophysics	:	Department of Geophysics and Geochemistry, Research School of Physical Sciences, A.N.U.

SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

Australia

Echuca series, Victoria

Samples coll. during project on late Quaternary to Recent alluvial deposition on Riverine plain near Echuca, relating to sequence previously determined by Bowler and Harford (1966) in which late Quaternary neotectonic movement diverted major rivers in area and initiated complex sequence of lake, lunette, and fluviatile development.

13,500 ± 700
ANU-29. Goulburn river 11,550 B.C.

Charcoal from remains of fire in alluvial silts later buried by overbank deposition to depth 116 in. below present ground surface. Section exposed in left bank of Goulburn R. 9.5 mi ENE of Echuca, (36° 5′ S Lat, 144° 54′ E Long). Channel geometry of streams which deposited silts (Coonamoidgal II, Pels, 1966) indicates higher discharges than in present hydrological regime. Coll. 1966 by J. M. Bowler and F. Chamalaun, A.N.U.; subm. by Geography. Benzene dilution, 1-day count. *Comment* (J.M.B.): with N-296, 13,400 ± 340 (11,450 B.C.) (Hamada, pers. commun.) indicates streams older than previously estimated and correlative with late glacial phase.

260 ± 51
ANU-30. Campaspe prior stream A.D. 1690

Charcoal from narrow vertical concentration (1 in. x 8 in.) in stream bed gravels beneath 78 in. of younger sediments exposed in gravel pit 6.5 mi NE of Rochester, (36° 17′ S Lat, 144° 47′ E Long). Sample, apparently truncated by cross-bedded gravels, first assumed from tree growing *in situ* while stream activity deposited bedload. Stream now inactive with mature red-brown earth soil profile developed on alluvium over gravels. Coll. 1966 by J. M. Bowler; subm. by Geography. Result is average of 2 independent determinations, both benzene, 1-day counts: ANU-30/1, 250 ± 75 and ANU-30/2, 274 ± 70. *Comment* (J.M.B.): date confirmed by N-294, 225 ± 110 (A.D. 1725) (Hamada, pers. commun.). Too young to permit soil profile development; sample must be regarded as intrusive.

ANU-69. Khancoban, New South Wales **>37,000**

Lignitized wood coll. 22 ft below surface in fresh water alluvium of old creek meander beneath torrential gravel deposits derived from Khancoban Creek, alt 962 ft (36° 13′ S Lat, 148° 7′ E Long). Coll. 1963 by K. R. Sharp, Snowy Mts. Hydro-electric Authority; subm. by Geophysics. Benzene, 3-day count. Result at 95% level of confidence. Another independent determination, ANU-69/2, benzene dilution, 1-day count, gave >30,000 B.P. *Comment* (K.R.S.): alluvium in area almost 250 ft thick, highly weathered in lower parts. Upper 30 ft contains evidence of geologically recent flood(s) bringing enormous amounts of debris and causing major stream derangement. Dates this as >37,000 B.P., though there may have been later events.

ANU-76. Toolong Range, Upper Tumut Valley **$35,200 \pm {}^{1600}_{2150}$** **33,250 B.C.**

Partly carbonized wood augered from depth 190 cm from quartz gravels beneath basalt blockstream, alt 5300 ft (36° 9′ S Lat, 148° 22′ E Long). Blockstreams are regarded as periglacial phenomena, implying more rigorous climate than present. Sample provides *terminus post quem* for such climatic phase. Coll. 1967 by J. N. Jennings, A.N.U.; subm. by Geography. Benzene, 1-day count. *Comment* (J.N.J.): accords well with date of Costin's Munyang soil humus beneath solifluctional valley fill, NZ-596, 31,300 ± 2300 (29,350 B.C.) (Costin, pers. commun.); valuable addition to meager chronology of Pleistocene and Recent climatic events in this part of Australia.

Grove Creek series, Geary's Gap, New South Wales

Charcoal and decomposed plant remains (some highly mineralized) from base of 3 terrace deposits of Grove Creek (35° 06′ S Lat, 149° 22′ E Long), 23 mi NE of Canberra. Coll. 1967 by R. J. Coventry, A.N.U.; subm. by C.S.I.R.O.

ANU-91. K_3 terrace **6770 ± 75** **4820 B.C.**

Decomposed twigs and/or charcoal, highly mineralized, from K_3 terrace (well-differentiated yellow podzolic soil), overlain by K_2 terrace (gray minimal prairie soil). Coll. from ca. 3 sq ft, 6 in. back from exposed face. Benzene, 2-day count. *Comment* (R.J.C.): younger than expected. Walker (1962) reports 29,000 ± 800 (27,050 B.C.), NZ intralaboratory reference CR563, for similar terrace at Nowra, New South Wales. ANU-91 agrees with 2 other dates from K_3 terraces in NSW, V-13, 6425 ± 130 B.P. (4475 B.C.) (Walker, pers. commun.) at Kempsey, and GrN-3119, 6250 ± 90 (4300 B.C.) (Costin, pers. commun.) at Berridale. Without further dates from different regions, only tentative age-correlations may be implied.

3065 ± 80
ANU-92. K_2 terrace **1115 B.C.**

Decomposed twigs and/or charcoal of high ash content from base of K_2 terrace (gray minimal prairie soil) above and 10 ft N of ANU-91. Result is weighted mean of 2 independent determinations. ANU-92/1, 3015 ± 140 (dilution) and ANU-92/2, 3100 ± 85, both benzene, 1-day counts.

2460 ± 75
ANU-93. K_2 terrace **510 B.C.**

Charcoal fragments from base of exposed face of K_2 terrace, 7 ft below surface and 500 m NE of ANU-91 and 92. Benzene, 1-day count.

1775 ± 85
ANU-94. K_2 terrace **A.D. 175**

Charcoal fragments of high ash content from base of exposed face of K_2 terrace, 6 ft below surface and 1000 m NE of ANU-93. Benzene, 1-day count.
General Comment (R.J.C.): ANU-92 and 93 agree with ages for base of K_2 terrace at Nowra, New South Wales, 3740 ± 100 (1790 B.C.), New Zealand intralaboratory reference CR564, (Walker, pers. commun.) and Kempsey, New South Wales, V-12A, 3225 ± 140 (1275 B.C.), and V-12B, 3300 ± 100 (1350 B.C.), (Walker, pers. commun.). Also with solifluction deposits at Mt. Kosciusko, New South Wales, ranging from Y-1096, 1540 ± 160 (A.D. 410) to Y-1092, 2910 ± 130 (960 B.C.), (Yale VIII), attributed to colder conditions.

255 ± 64
ANU-95. K_1 terrace **A.D. 1695**

Charcoal fragments from base of K_1 (regosol) with little or no pedological differentiation, ca. 5 ft above ANU-94 and 1 ft below surface. Coll. over wide area way from exposed face. Benzene, 1-day count.
Comment (R.J.C.): ANU-95 may correlate with youngest solifluction deposits at Mt. Kosciusko dated at 170 ± 100 (Y-1090, Yale VIII) as well as with 390 ± 60 (A.D. 1560), New Zealand intralaboratory reference CR566, (Walker, pers. commun.) for K_1 terrace at Nowra. Lack of pedological differentiation implies last phase of landscape instability of region was initiated prior to arrival of Europeans.
General Comment (R.J.C.): above samples represent 1st series for K-cycle (Butler, 1959) deposits on S. Tablelands; results consistent with terrace stratigraphy.

II. VEGETATION HISTORY

New Guinea

Lake Birip series, Wabag Subdistrict, Western Highlands District

Swamp at edge of crater lake, alt 6200 ft (50° 34′ S Lat, 143° 50′ E

Long) worked by J. R. Flenley, A.N.U., during vegetation history project. All samples coll. with peat borer 1964 by J. R. Flenley; subm. by Geography.

ANU-63. A14, 67 to 72 cm deep **2930 ± 140**
980 B.C.

Soft brown coarse detritus mud with gray silt believed to be volcanic ash. Benzene dilution, 1-day count.

ANU-64. A14, 72 to 77 cm deep **275 ± 70**
A.D. 1675

Same as ANU-63.

ANU-79. A14, 62 to 67 cm deep **305 ± 90**
A.D. 1645

Soft brown coarse detritus mud. Benzene dilution, 2-day count.

ANU-80. A14, 77 to 82 cm deep **140 ± 70**
Modern

Same as ANU-79.

General Comment (J.R.F.): ANU-63 and 64 subm. to date sharp decline in forest pollen and complementary rise in pollen of *Casuarina*. ANU-79 and 80 subm. when ANU-63 gave discordant result. ANU-63, 64, and 80 might indicate stratigraphic inversion. However, ANU-64 and 80 do not differ significantly. ANU-63 is older than samples taken over depths from 215 to 285 cm in same sequence and dated between 1520 ± 100 (A.D. 430) and 2440 ± 90 (490 B.C.), (GaK-825 to 828 and GaK-665 to 667, Gakushuin VI). Perhaps ANU-63 contains material dug out during construction of pools for cultivation of *Eleocharis elegans* Willd., such construction stratigraphically postdating ANU-80. *Casuarina* sp. planted on dry ground around lake but also occurs naturally along watercourses. Rise in *Casuarina* pollen, dated by samples, may be important in interpreting effects of human disturbance of vegetation around lake.

III. ARCHAEOLOGIC SAMPLES

A. Australia

Graman Area B series, New England, New South Wales

Samples from 2 rock shelter sites, Site 1 (29° 24′ S Lat, 150° 44′ E Long) and Site 4 (29° 25′ S Lat, 150° 46′ E Long), on Girrawheen Sta., 8 mi NW of Graman, excavated by Isabel McBryde, Univ. of New England, as part of long-term project on archaeology of N New South Wales (McBryde, 1962). Coll. 1966 by I. McBryde; subm. by A.I.A.S.

ANU-54. Site 1, Trench 2, Zone (d), Level II, Spit 1 **2760 ± 65**
810 B.C.

Scattered charcoal from N end of trench, 16 to 19 in. below surface of deposit, upper part of Level II. Associated with industry of backed blades. Charcoal from Spit 2, Level II in same area of trench (Zone (d)), 19 to 28 in. below surface, is dated by GaK-1188, 3950 ± 50 (2000 B.C.) (McBryde, pers. commun.). Level I, Zone (d), at depth 10 to 13 in. below surface dated by GaK-1187, 2040 ± 70 (90 B.C.) (McBryde, pers. commun.). Dates for levels in Trench 1, on parallel alignment 72 in. away, are Level I, 4 to 5 in. below surface, GaK-805, 4640 ± 100 (2690 B.C.) and for Level II, 18 in. below surface, GaK-806, 5450 ± 100 (3500 B.C.), (Gakushuin VI). Benzene, 1-day count. *Comment* (I. McB.): dates from A.N.U. and Gakushuin for samples from Zone (d), Trench 2 are consistent but more recent than 2 dates from stratigraphic levels of Trench I (GaK-805 to 806).

ANU-55. Site 4, Trench 1, Zone (a), Level I **2050 ± 55**
100 B.C.

Sample from concentration of charcoal 6.5 in. below surface of deposit at base of Level I, associated with industry of backed blades, also bone artifacts. Another date for Level I, Zone (c) Trench 1, ca. 72 in. away and 13 in. below surface, is GaK-1189, 1750 ± 80 (A.D. 200), (McBryde, pers. commun.). Benzene, 1-day count. *Comment* (I. McB.): ANU-55 agrees with GaK-1189. Though closer to surface, ANU-55 was at base of Level I, whereas GaK-1189 was higher in that level.

ANU-56. Site 4, Trench 1, Zone (b), Level II **2290 ± 62**
340 B.C.

Concentration of charcoal 18.5 in. below surface of deposit in lower part of Level II, associated with rich collection of bone and stone implements (including backed blades). Another date for Level II, 60 in. away in Zone (d), 13 in. below surface, is GaK-1190, 2480 ± 80 (530 B.C.), (McBryde, pers. commun.). Benzene, 1-day count. *Comment* (I.McB.): ANU-56 and GaK-1190 agree.
General Comment (I. McB.): samples provide additional data on chronology of backed blade industries in E New South Wales, early dates for these industries at Site 1 being of particular interest. For details of backed blade chronology see introduction to Lapstone Creek series in A.N.U. I.

Oenpelli series, Northern Territory

Samples coll. during 2nd season of archaeological project during which 5 rock shelters in vicinity of Oenpelli mission were excavated, 2 (Tyimede 1 and 2) in Arnhem Land escarpment, 3 (Malangangerr, Nawamoyn, and Padypadiy) in sandstone residuals on alluvial plains of East Alligator R. Besides differences of ecological adaptation in plain and plateau sites, excavation documented technological change in region as a whole. Later industry occurs at all sites, characterized by stone points and edge-ground axes. Early industry occurs at Malangangerr, Nawamoyn, and Tyimede 2, characterized by chunky scrapers and edge-ground axes (C. White, 1967) (cf. Ingaladdi series, ANU-57, 58, and 60).

Dates previously available are

Later industry			
Malangangerr, upper level (Gakushuin V)	GaK-626	370 ± 80	(A.D. 1580)
Malangangerr, lower level (Gakushuin V)	GaK-627	5980 ± 140	(4030 B.C.)
Padypadiy, lower level (ANU I)	ANU-17	3120 ± 100	(1170 B.C.)
Tyimede 1, upper level (Gakushuin V)	GaK-630	<230	(Modern)
Tyimede 1, middle level (Gakushuin V)	GaK-631	1900 ± 90	(A.D. 50)
Tyimede 1, lower level (Gakushuin V)	GaK-632	10,790 ± 200	(8840 B.C.)
Earlier industry			
Malangangerr (Gakushuin V)	GaK-628	19,600 ± 550	(17,650 B.C.)
Malangangerr (Gakushuin V)	GaK-629	22,700 ± 700	(20,750 B.C.)
Malangangerr (ANU I)	ANU-19	18,000 ± 400	(16,050 B.C.)
Tyimede 2, presumably later stage (ANU-1)	ANU-18	6650 ± 500	(4700 B.C.)

Two problems were presented by these dates: (1) age of GaK-632 from Tyimede 1 compared with other dates for later industry and final stage of earlier industry. ANU-52 from Tyimede 1 and ANU-50 from neighboring site of Tyimede 2 subm. to investigates this problem. ANU-53 also relevant here; (2) unexpectedly but consistently old dates (GaK-628 to 629, ANU-19) for edge-ground axes. ANU-51 contributes to this question at another site. ANU-77a and 77b are lab's investigation of possibility of sample contamination at original site.

All samples coll. 1965 by Carmel White, A.N.U.; subm. by A.I.A.S.

4770 ± 150
ANU-50. Tyimede 2 **2820 B.C.**

Charcoal from hearths? in sand at 29 to 34 cm depth dating earliest phase of later stone point industry at site (12° 26′ S Lat, 133° 15′ E Long). Benzene, 1-day count.

21,450 ± 380
ANU-51. Nawamoyn, Cannon Hill station **19,500 B.C.**

Charcoal ca. 80 cm deep, in upper levels of sand below shell midden containing ANU-53. Dates earlier scraper and edge-ground axe industry at site (12° 23′ S Lat, 132° 56′ E Long). Benzene, 1-day count. *Comment* (H.A.P.): originally reported 21,450 ± 600 (C. White, 1967).

ANU-52. Tyimede 1 **3820 ± 100**
1870 B.C.

Charcoal 50 to 55 cm deep at same general level as GaK-632 in adjacent square. Dates earliest phase of stone point industry at site (12° 24′ S Lat, 133° 15′ E Long). Benzene, 1-day count.

ANU-53. Nawamoyn, Cannon Hill station **7110 ± 130**
5160 B.C.

Charcoal 42 to 48 cm deep, in base of shell midden above sand containing ANU-51. Dates early phase of stone point industry at site (12° 23′ S Lat, 132° 56′ E Long). Benzene dilution, 1-day count. *Comment* (H.A.P.): originally reported 7110 ± 160 (C. White, 1967).

ANU-77b. Malangangerr **22,900 ± 1000**
20,950 B.C.

Charcoal in sand at 134 to 144 cm depth, 30 cm directly below ANU-19, dating early scraper and edge-ground axe industry at site (12° 27′ S Lat, 132° 57′ E Long). Age based on NaOH-insoluble fraction, benzene dilution, 2-day count. ANU-77a, NaOH-soluble fraction, benzene dilution, 1-day count, dated 24,800 ± 1600 (22,850 B.C.) *Comment* (H.A.P.): lack of significant difference between the 2 determinations indicates no intrusive carbon, young or old, in site.

General Comment (C.W.): ANU-51 and 77b confirm high antiquity of ground stone tools in Australia, suggested by GaK-628 to 629 and ANU-19. Dates now available for early phase of stone point industry, ANU-53 and GaK-627 on plains, and ANU-50 and 52 on plateau, suggest early date GaK-632 refers not to stone points but to pre-point phase which cannot be recognized through artifacts. ANU-18 would then fall into place as dating late stage of earlier industry on plateau (cf. C. White, 1967.)

Ingaladdi rockshelter series, Willeroo station, Northern Territory

Excavations at sandstone rockshelter (15° 11′ S Lat, 131° 24′ E Long) begun in 1963 by D. J. Mulvaney, then of Univ. of Melbourne. Occupation extends over depth 2 m and comprises upper industry of stone points, adze flakes, and edge-ground axes in sandy deposit in top 90 cm, overlying core and flake tool industry in stony deposit in bottom 110 cm. GX-103 dates later industry 37 to 48 cm below surface at 1545 ± 75 (A.D. 405); GX-104 dates earlier industry 85 to 98 cm below surface at 6255 ± 135 (4305 B.C.), (Geochron I). Renewed work in trench at 90° to 1963 trench produced samples that follow, coll. 1966 by D. J. Mulvaney, A.N.U.; subm. by A.I.A.S.

ANU-57. 84 to 90 cm below surface **2890 ± 73**
940 B.C.

Charcoal from base of sandy layer and beginning of later industry at site. Benzene, 1-day count. *Comment* (D.J.M.): GX-103 is relatively higher than ANU-57, which dates appearance of points and adze flakes at site.

4920 ± 100
ANU-58. 109 to 116 cm below surface 2970 B.C.

Charcoal ca. 23 cm below ANU-57 towards top of stony accumulation and its contained core and flake tool industry. Benzene, 1-day count. *Comment* (D.J.M.): GX-104 stratigraphically lower in 1963 trench than ANU-58 in 1966 trench. Between ANU-58 and 57 important changes, both depositional (stony to sandy) and technological (core and flake tools to points and adze flakes), took place at site.

6800 ± 270
ANU-60. 168 to 175 cm below surface 4850 B.C.

Charcoal towards base of stony accumulation. Benzene dilution, 1-day count. *Comment* (D.J.M.): relatively lower in deposit than GX-104, it represents early stage of core and flake tool industry at site.
General Comment (D.J.M.): highly satisfactory agreement between all radiocarbon dates. 1966 excavations produced engraved art on rocks in rubbly layer, associated with core and flake tool industry.

125 ± 57
ANU-61. Anuru Bay, Arnhem Land, Northern Territory Modern

Ash and charcoal ca. 25 cm below surface in stone fireplace on coastal beach (11° 45′ S Lat, 133° 21′ E Long). Lines of stone fireplaces, remains of smokehouses, and abundant pottery mark preparation campsites of Macassan trepangers. Activities historically dated from mid-18th to early 20th century and confirmed by Aboriginal tradition. Coll. 1966 by C. C. Macknight, A.N.U.; subm. by Anthropology. Benzene, 1-day count. *Comment* (C.C.M.): accords with historical dating of Macassan activity.

550 ± 57
ANU-62. Port Essington, Coburg Peninsula, A.D. 1400
Northern Territory

Charcoal from 45 to 50 cm deep in Aboriginal shell midden 55 cm depth, adjacent to English military settlement (11° 22′ S Lat, 132° 9′ E Long) established 1838 and abandoned 1849 (Allen, 1967). European material occurs top 10 to 15 cm of midden. Coll. 1966 by F. J. Allen, A.N.U.; subm. by A.I.A.S. Benzene, 1-day count. *Comment* (F.J.A.): confirms conclusion reached on archaeological grounds that site occupied before settlement of Europeans and substantiates hypothesis that its function altered with that settlement.

Keilor series, near Melbourne, Victoria

Keilor terrace of Maribyrnong R. in vicinity of Keilor township has produced important information, especially skeletal, on late Pleistocene and early post-Pleistocene Aboriginal occupation of Australia (Gill, 1966; Bowler *et al.*, 1967). Gill reports 18,000 ± 500 (16,050 B.C.), (NZ-207, New Zealand I-V), for lower part of terrace, on charcoal from what he has interpreted as small Aboriginal midden (bones of food animals, no stone work).

Recent excavations in area (37° 52′ S Lat, 144° 50′ E Long) into alluvial clays beneath Keilor terrace by A. Gallus and Victorian Archaeol. Soc., with discovery of strata (1a, 1, 2, 3) of broken bones (including extinct marsupials) and some stone, assumed result of Aboriginal occupation. Samples coll. 1965 (ANU-81) and 1966 (ANU-65) by A. Gallus; subm. by A.I.A.S.

31,600 $^{+1100}_{-1300}$

ANU-65. Trench 2, Stratum 2 29,650 B.C.

Charcoal from 3rd of 4 strata ca. 40 in. beneath base of Keilor terrace. Age based on NaOH-insoluble fraction, benzene dilution, 2-day count. NaOH-soluble fraction too small for dating.

24,000 $^{+3300}_{-5700}$

ANU-81. Trench 2, beneath Stratum 2 22,050 B.C.

Charcoal ca. 40 in. from ANU-65, where, due to recent river erosion, present surface is only ca. 4 in. above sample. Two isolated occurrences combined to make 1 sample: i) 2 in. below deepest level of Stratum 2; ii) at same level as and ca. 36 in. from Stratum 3, 6 to 7 in. lower than Stratum 2. Age based on NaOH-insoluble fraction, benzene dilution, 2-day count. Sample yielded only 1/10th of full requirement, hence large errors. NaOH-soluble fraction too small for dating.

General Comment (A.G.): ANU-65, if interpretation is upheld, significantly extends chronology of Aboriginal occupation of Australia, since it would be earliest date yet recorded. Also important for history of pre-Keilor Arundel terrace formations. Overlapping occurs at 2 standard deviations between ANU-65 and ANU-81, considered, on stratigraphic grounds, to be earlier. Alternatively ANU-81 may in part be younger carbon that has moved down through clays which are notoriously liquid when wet. High antiquity of formation confirmed.

Koonalda cave series, Nullarbor Plain, South Australia

Koonalda cave (31° 25′ S Lat, 129° 53′ E Long) is extensive system in limestone, ca. 225 ft underground, entered by collapsed doline. Bands of chert in walls provided raw material for stone tool manufacture. Two trenches excavated by A. Gallus in 1956 and 1963: Trench III 450 ft from entrance in dim light, Trench I 42 ft further on in darkness. Trench III revealed undisturbed sequence of hearths in limestone rubble, one of which at depth ca. 24 in. was dated GaK-510, 13,700 ± 270 (11,750 B.C.) (Gallus, pers. commun.). In Trench I loose charcoal in limestone rubble at depth ca. 80 in. dated GaK-511 at 18,200 ± 550 (16,250 B.C.), (Gallus, pers. commun.). Renewed excavation by Gallus in 1966 provided ANU-66 from Trench I and in 1967 ANU-180 from "Squeeze" area 460 ft further into cave system.

Further work was organized for early 1967 by Koonalda Project Committee of Australian Inst. of Aboriginal Studies under direction of R. V. S. Wright, Univ. of Sydney, for whom ANU-70 and 71 were dated while in field, because of problem posed by ANU-66. ANU-148 and 149 are samples from Wright's excavation beneath limestone rubble from which all other dates derive, into water-lain, laminated red gravels, silts, and clays, 10 to 14 ft thick at point of excavation and underlain by white limestone rubble. Red deposits, which were washed into cave, contain some artifacts and rich Pleistocene fauna. Ca. 4 ft below their surface there is stratigraphic disconformity, ANU-148 being below, ANU-149 above this.

ANU-66. Trench I, ca. 170 to 185 in. deep **9400 ± 1500** **7450 B.C.**

Charred twigs in limestone rubble 91 to 103 in. below level of GaK-511. Coll. 1966 by A. Gallus; subm. by A.I.A.S. Benzene dilution, 1-day count. *Comment* (A.G.): stratigraphic inversion of ANU-66 and GaK-511 might be explained by intrusion of younger charcoal down cracks between rubble before they were filled with limestone dust (ANU-66) or by similar intrusion of older charcoal from rock fall in cave (GaK-511).

ANU-70. Trench III, Area C, ca. 24 in. deep **15,850 ± 320** **13,900 B.C.**

Charred twigs from same zone of charcoal hearth(s)? as GaK-510. Coll. 1967 by R. V. S. Wright; subm. by A.I.A.S. Benzene, 1-day count. *Comment* (R.V.S.W.): significantly older than GaK-510 from same hearth, 13,700 ± 270 (11,750 B.C.), but general antiquity of level substantiated.

ANU-71. Trench III, Area C, ca. 60 in. deep **19,300 ± 350** **17,350 B.C.**

Charcoal from hearth 36 in. below ANU-70. Coll. 1967 by R. V. S. Wright; subm. by A.I.A.S. Benzene, 1-day count.

ANU-149. Trench III, Area C, ca. 108 in. deep **>10,000**

Charcoal of high ash content apparently from single burnt stick washed into place and found in silt-clay band in red deposits, without evidence of hearth or surrounding charcoal. Since silt-clay band is part of graded sequence of 75 to 100 sequential bands and charcoal is scarce, any charcoal incorporated within them could date their deposition fairly closely. Sample 30 in. below top of red deposits and 15 in. above disconformity within them. Coll. 1967 by R. V. S. Wright; subm. by A.I.A.S. Benzene dilution, 4-day count. *Comment* (H.A.P.): count rate 1.8 sigmas above background. Result calculated by Callow's formula (NPL III) for minimum age. Count rate based on 0.13 g benzene which is 1/27th of full requirement.

ANU-148. Trench III, Area B, ca. 220 to 225 in. deep **19,400 ± 450** **17,450 B.C.**

Charcoal from notable concentration in single band of silt in deep red deposits with rare charcoal. Though sample was doubtless washed into cave, circumstances described for ANU-149 suggest relation to event

shortly before deposition. Sample is ca. 160 in. below level of ANU-71 and 10 ft S of it and ca. 3 ft from unexposed wall of cave at this level. It also lies ca. 95 in. below disconformity in red deposits, 1 to 2 ft above underlying limestone rubble and 2 ft below lowest pieces of flint acceptable as artifacts. Coll. 1967 by R. V. S. Wright; subm. by A.I.A.S. Benzene dilution, 1.5-days count.
General Comment (R.V.S.W.): GaK and ANU sequence of dates forms consistent depositional series where, because of random roof falls, depth is no measure of depositional rates. ANU-148 for bottom of excavation under graded red gravels and silts, although younger than expected, is acceptable as graded beds possibly accumulated in relatively short period, perhaps 300 yr (Jennings and Frank, A.N.U., pers. commun.).

21,200 ± 700
ANU-180. Area 5, ca. 8 in. deep 19,250 B.C.

Two combined samples of fragmented charcoal of high ash content from excavation at chert mining site in "Squeeze" area located in total darkness 850 ft from cave entrance. Scattered roof fall rests on ca. 3 in. surface layer of dust covering rock and dust infilling of unknown depth, in which sample lay at ca. 5 to 8 in. below top of surface dust. Coll. 1967 by A. Gallus; subm. by A.I.A.S. Benzene dilution, 2-day count. *Comment* (A.G.): Wright (pers. commun.) reports V-92, 19,900 ± 2000 (17,950 B.C.), for sample coll. 1966 in same area. Both samples confirm antiquity of human activity within Koonalda cave system and near surface of its deposits.

B. New Guinea

Batari cave series, Tairora Census Division, Eastern Highlands District

Site in calcarenite in Lamari R. valley 5 mi S of Obura Patrol Post, alt 4200 ft (6° 36′ S Lat, 145° 56′ E Long). Excavations 1.6 m deep produced evidence similar to that of Aibura cave 13 mi N in same valley. Aibura is dated GaK-623, 3800 ± 110 (1850 B.C.) to later than GaK-622, 770 ± 100 (A.D. 1180) (Gakushuin V). At Batari flaked stone tool industry essentially homogeneous and hunting environment apparently stable throughout occupation (White, 1965 and 1967). Circumstances questioned validity of ANU-40 dating lowest cultural material; therefore ANU-38 from same horizon was dated. Samples coll. 1965 by J. P. White, A.N.U.; subm. by Anthropology.

$\geqslant$8230 ± 190
ANU-38b. Horizon IV 6280 B.C.

Unidentifiable bones of food animals from lowest horizon in deposit at 70 to 100 cm depth. Age based on acid-insoluble bone fraction, benzene dilution, 2-day count. ANU-38a, bone carbonate, benzene, 2-day count, dated 3470 ± 60 (1520 B.C.). *Comment* (J.P.W.): ANU-38b probably dates earliest occupation at Batari (see ANU-40).

ANU-39. Horizon I **850 ± 53**
A.D. 1100

Charcoal from lower part of large hearth forming topmost undisturbed level of occupation. Provides last date for all archaeological material at site and correlates with only domesticated animal bones found. Benzene, 1-day count. *Comment* (J.P.W.): upper horizon of flaked tools just below this date shows no evidence of technological change found at Aibura from 800 B.P.

ANU-40. Horizon IV **16,850 ± 700**
14,900 B.C.

Scattered charcoal found in soil with artifacts below ANU-38; only carbon beneath ANU-39. Benzene dilution, 1-day count. *Comment* (J.P.W.): since sample only 20 cm laterally from culturally sterile riverine deposit containing spicules of carbon, date may not refer to human occupation. If carbon comes from natural sources, date documents 25 m of riverine downcutting since this time.

Kafiavana rockshelter series, S Asaro valley, Eastern Highlands District

Site (6° 14′ S Lat, 145° 25′ E Long) described in ANU I. Striking feature is ground stone tools by 9500 B.P. (ANU-20, ANU I). Samples coll. 1965 by J. P. White; subm. by Anthropology.

ANU-41b. 260 to 310 cm below surface **⩾10,730 ± 370**
8780 B.C.

Unidentifiable bones of food animals associated with ground stone tool fragments and marine shells. Sample, from area of $6m^2$ over depth 50 cm, subm. to confirm ANU-20, immediately above. Age based on acid-insoluble bone fraction, benzene dilution, 2-day count. ANU-41a, bone carbonate, benzene, 1-day count, dated 6750 ± 100 (4800 B.C.). *Comment* (J.P.W.): ANU-41b in stratigraphically consistent series of 3 with ANU-20, not less than 9500 B.P. (ANU I), and New Zealand intralaboratory reference R1894B, 9290 ± 140 (7340 B.C.), (Rafter, pers. commun.). All confirm antiquity of ground stone axe/adzes (White, 1967).

ANU-42. Base of Horizon II, 50 cm below surface **4690 ± 170**
2740 B.C.

Charcoal from creamy white matrix of hearth?, just above upper of 2 main concentrations of artifacts. Benzene dilution, 2-day count. *Comment* (J.P.W.): sample comes from phase of high humus content, when site probably largely abandoned. Above it utilized flakes become common. Pig first appears below (cf. Bulmer, 1966). Date provides *terminus ante quem* for main occupation of Kafiavana.

Manton plantation series, Mt. Hagen, Western Highlands District

Site is superimposed series of former agricultural systems marked by digging of water-control ditches on alluvial flats of Wahgi R., 6 mi E of Mt. Hagen township, alt ca. 5200 ft (5° 51′ S Lat, 144° 19′ E Long).

Rescue excavations conducted 1966 by R. J. Lampert, W. R. Ambrose, and J. Golson, and palynological investigations carried out by Jocelyn M. Wheeler, all A.N.U. Coll. 1966 by R. J. Lampert and W. R. Ambrose; subm. by Anthropology.

ANU-43. Trench M, Zone II **2300 ± 120** **350 B.C.**

Waterlogged wood from long pointed digging stick found in earliest of 3 superimposed drainage channels in zone of disturbed peat of prehistoric horticultural activity. Benzene dilution, 1-day count.

ANU-44. Trench N, Zone III **4560 ± 72** **2610 B.C.**

Waterlogged wood from branch in thin zone of undisturbed peat immediately above basal clay and below zone of disturbed peat with drainage channels. Benzene, 1-day count.

General Comment (R.J.L.): pattern of ditches, agricultural implements, and stone tools dated by ANU-43 identical with those associated with dry-land sweet potato agriculture in modern times (Lampert, 1967). Date is well before introduction of sweet potato to New Guinea; 1st direct dating of horticulture there (Golson *et al.*, 1967).

Watom Island series, New Britain, Bismarck Archipelago

Pottery from Rakival village on island's NE coast (4° 5′ S Lat, 152° 5′ E Long), reported 1909 (Meyer) and 1936 (Casey), now attributed to early and widespread tradition in SW Pacific, called Lapita (Golson, 1961; Poulsen, 1964; Solheim, 1964). Samples coll. 1966 by J. R. Specht, A.N.U.; subm. by Anthropology.

Complex situation involves possibly interconnected factors: burial of site by volcanic ash rapidly redistributed after ashfall, derangement of local drainage, coastal progradation, and transformation of coast locally from muddy embayment to open beach. Different aspects of situation registered in stratigraphy of 11 excavated trenches (9 at Site 6 near present church, 2 at Site 8, 50 m away near present cemetery).

ANU-37b. Site 8, Trench 1, 150 to 180 cm below surface **$\geqslant$2420 ± 110** **470 B.C.**

Bone from at least 3 burials in discolored sand above white sterile coral beach sand. Sand, 20 to 25 cm thick, containing shells and Lapita sherds, overlain by 20 to 35 cm thick black-to-brown clayey loam, containing sherds, representing period of stabilization and overlain by 70 to 80 cm volcanic ash. Age based on acid-insoluble bone fraction, benzene dilution, 1-day count. ANU-37a, bone carbonate, benzene dilution, 1-day count, dated 910 ± 110 (A.D. 1040). *Comment* (J.R.S.): on grounds of ceramic style Lapita occupation of Watom expected to predate settlement of S Melanesia, where, however, Fiji produces earlier and Tonga equally early dates (cf. ANU-24, ANU I). Sample may not date earliest occupation of site.

720 ± 57
ANU-72. Site 6, Trench VII, ca. 180 cm below surface **A.D. 1230**

Charcoal from hearth or oven dug into top of redistributed volcanic ash and sealed by narrow zone of silts overlain by thick light brown material (possibly also ash). No associated pottery. Benzene, 1-day count. *Comment* (J.R.S.): since ash redistribution apparently rapid, should provide close *terminus ante quem* for ash fall, as well as date post-ash occupation apparently unaccompanied by pottery.

1595 ± 60
ANU-73. Site 6, Trench VII, 310 cm below surface **A.D. 345**

Waterlogged root or stem wood, probably *Alstonia spathulata,* growing *in situ* in clay ca. 70 cm thick at base of trench. Sample from bottom, ca. 50 cm below ground water level. Clay contains shells, Lapita-style potsherds, stone artifacts, and bone. Separated from overlying ash of ANU-72 by banded gritty ash containing sherds. Benzene, 1-day count. *Comment* (J.R.S.): lack of knowledge about clay formation and associated material prevents archaeological discussion of sample, which dates vegetational phase and approx. age of formation from which it was collected.

780 ± 100
ANU-74. Site 6, Trench V, ca. 250 cm below surface **A.D. 1170**

Soil and charcoal at ground water level towards top of clayey soil containing shell and Lapita pottery with pumice pellets in upper part. Clayey soil at base of trench and considered equivalent to clay of ANU-73. Trenches are 10 m apart and stratigraphically different. Trench V, seaward of VII, has no layer of redistributed ash or underlying banded gritty ash *in situ* and much crab disturbance. Sample from beneath level of redistributed ash of Trench VII. Benzene dilution, 1-day count. *Comment* (J.R.S.): absence of clearly defined ash and sand layers, though pumice present, may reflect crab disturbance and explain closeness of result to ANU-72. Alternatively date may indicate, with ANU-73, period of basal clay formation, whatever relationship of included archaeological material may prove to be.

315 ± 53
ANU-75. Site 6, Trench III, ca. 250 cm below surface **A.D. 1635**

Shells of *Canarium* (food) nuts from silty clay at base of trench, containing Lapita pottery and shells, just below pumice layer. No *in situ* layer of redistributed ash; evidence of old stream courses subsequently infilled. Benzene, 1-day count. *Comment* (J.R.S.): pumice layer slopes steeply; sample may have been deposited on surface but later sunk through it. Tentatively dates start of last phase of aggradation in old

stream course or embayment. Associated archaeological material is almost certainly not in primary position.
General Comment (J.R.S.): formation of deposits at Site 6 are being investigated; interpretations for individual dates are provisional. ANU-37b provides only direct date for Lapita pottery on Watom.

C. Pacific Islands

340 ± 63
ANU-23/2. Site Tonga 5, near Veitongo village, Tongatapu, Tonga **A.D. 1610**

Charcoal from Fire Hollow D on site (21° 11′ S Lat, 175° 13′ E Long). Repeat of ANU-23 at collector's request, since date critical for interpretation of Tongan ceramic sequence. ANU-23 reported as 330 ± 100, physical measurement ± 80 (ANU I). Coll. 1964 by J. I. Poulsen, A.N.U.; subm. by Anthropology. Benzene, 3-day count. *Comment* (J.I.P.): confirmation of late date expected on archaeological evidence.

Naïa Bay series, New Caledonia

Two major excavated sites, 400 m apart, on W coast ca. 25 km NW of Noumea (22° 10′ S Lat, 166° 15′ E Long) provide pottery sequence in which major elements established by Gifford and Shutler (1956) are represented. Samples coll. 1966 by C. D. Smart, A.N.U.; subm. by Anthropology.

3165 ± 120
ANU-96. TON-7, oven ca. 90 cm deep **1215 B.C.**

Solid charcoal mass from thick deposit across base of large oven, Layer III, overlying white coral sand. Fill of oven contains few sherds, some with applied, some with stamp-impressed (Lapita-style) decoration. Benzene, 1-day count.

2065 ± 110
ANU-97. TON-7, oven ca. 50 cm deep **115 B.C.**

Charcoal from one of small ovens associated with lines of postholes within and under Layer IV, which contains paddle-impressed pottery. Benzene, 1-day count.

1745 ± 115
ANU-98. TON-6, ca. 90 cm deep **A.D. 205**

Charcoal from localized area in Layer II, deepest in sequence of 11 horizons, containing pottery with handles. Benzene dilution, 2-day count.

1635 ± 110
ANU-99. TON-6, 25 to 30 cm deep **A.D. 315**

Charcoal from oven sealed by Layer VII, associated with pottery with handles and incised decoration. Benzene, 1-day count.
General Comment (C.D.S.): results agree with those of Gifford and Shutler (1956, p. 89) who reported M-341, 2800 ± 350 (before 1954, 846 B.C.) and M-336, 2435 ± 400 (before 1954, 481 B.C.) for Lapita ware

(cf. ANU-96) and M-333, 1700 ± 300 (before 1954, A.D. 254) for paddle-decorated ware (cf. ANU-97), and series of later dates for poorly understood handled and incised wares (see Michigan I for 1st publication of these dates). Problem of almost identical dates ANU-98 and 99 is under investigation.

D. New Zealand

ANU-46b. Kauri Point, western Bay of Plenty, North Island — **395 ± 53** — **A.D. 1555**

Charcoal from 2nd of series of shell lenses laid down following construction of 1st defenses at fortified settlement (37° 30′ S Lat, 175° 58′ E Long) described in ANU I. Coll. 1962 by W. R. Ambrose, A.N.U.; subm. by Anthropology. Age based on NaOH-insoluble fraction, benzene, 2-day count. ANU-46a, NaOH-soluble fraction, commonly called "humic" and generally thought contaminant, gave $\delta^{14}C = +47 \pm 5\%$, benzene dilution, 1-day count, showing it to be more active than ^{14}C Modern reference standard. *Comment* (W.R.A.): with ANU-25, 495 ± 100 (A.D. 1455), (ANU I), date brackets construction of first defenses at site. *Comment* (H.A.P.): $\delta^{14}C$ is *observed* deviation from standard (Editorial Statement, Radiocarbon, 1966, v. 8).

Waitaki Gorge series, South Canterbury, South Island

During 1958 to 1960 and 1962, supported by grant from New Zealand Nat. Historic Places Trust, W. R. Ambrose, A.N.U., then of Univ. of Auckland, with Janet Ambrose and F. W. Davis, made records of rock paintings subsequently submerged by Benmore Hydroelectricity Scheme dam (Ambrose *et al.*, 1958-1960). Sites are 60 mi from sea, where Waitaki and tributary gorges afford most direct routes to interior. Excavations made at 3 decorated shelters and samples coll. in hope that, despite lack of direct association of rock art and very thin archaeological occupation, possible order of magnitude for age of art might be given. Only other evidence for this age is conflicting dates from Te Anau, W Otago (Duff, 1956, p. XII), NZ-51, 230 ± 60 (A.D. 1720) and NZ-52, 830 ± 50 (A.D. 1120), corrected dates, (New Zealand I-V).

ANU-47. Ahuriri rockshelter, Ahuriri Gorge — **625 ± 65** — **A.D. 1325**

Charcoal from undisturbed fireplace 6 in. below surface, (44° 32′ S Lat, 170° 12′ E Long). Coll. 1958 by W. R. Ambrose; subm. by Anthropology. Benzene dilution, 2-day count.

ANU-48. Gooseneck Bend rockshelter, Waitaki Gorge — **850 ± 150** — **A.D. 1100**

Charcoal and charred twigs from lowest cultural deposit, 6 in. below surface, associated with flake tools, (44° 29′ S Lat, 170° 12′ E Long). By evidence of superimposition drawings made here over period of time.

Coll. 1959 by W. R. Ambrose; subm. by Anthropology. Benzene dilution, 1.5-day count.

ANU-49. Junction Point rockshelter, Ahuriri River **695 ± 135 A.D. 1255**

Charcoal 6 in. from surface in lowest deposit, (44° 33′ S Lat, 170° 14′ E Long), associated with flake tools and necklace section of fossil *Dentalium*, considered early type in New Zealand. Coll. 1962 by W. R. Ambrose; subm. by Anthropology. Benzene dilution, 2-day count.

General Comment (W.R.A.): dates early penetration to inland areas of South Island; may be compared with those of inland moa-hunting site of Hawksburn, Central Otago (Lockerbie, 1959, p. 85-87), dated 14th to 16th century, (NZ-59 to 62, New Zealand I-V). Thin occupation at shelters suggests equally early art.

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BIRMINGHAM UNIVERSITY RADIOCARBON DATES II

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Measurements have continued with the 6 L counter which has proved reliable at pressures as high as 2.6 atm and as low as 0.3 atm. It has now been enclosed in a double ring of 27 geiger tubes which has reduced the background count to 10 cpm at 2 atm. So far, we have had no success with the 1.5 L Oeschger-type proportional counter. Failure to obtain steady readings is probably due to continued outgassing from the teflon insulation. All insulating parts have now been remanufactured from the same source of teflon as was used in the 6 L counter, and the Oeschger counter is being reassembled.

Results are still given without correction for δC^{13}. Errors quoted refer only to the standard deviation calculated from a statistical analysis of count rates and the Libby half-life of 5570 $\pm$ 30 yr.

SAMPLE DESCRIPTIONS

I. BRITISH FULL-GLACIAL

Birm-10. Brandon, Warwickshire **32,270 + 1029 — 971**
30,320 B.C.

Twigs in peat from channel at base of gravels of Avon No. 2 Terrace, 1 mi SW of Brandon (52° 22′ 28″ N Lat, 1° 25′ 35″ W Long, grid ref. SP 391753). Dateable stratigraphically and by fauna to Upton Warren Interstadial (Mid-Weichselian). Previous date of 28,200 $\pm$ 500 (NPL-87) refers to same locality (NPL IV, 1966). Subm. by F. W. Shotton.

Birm-27. Brandon, Warwickshire **30,766 + 551 — 520**
28,816 B.C.

Independent preparation from same sample of twigs as Birm-10.

Birm-24. Four Ashes, Staffordshire **36,340 + 770 — 700**
34,390 B.C.

Plant material (hand sorted) from peat interbedded as lens in gravels underlying red til with Irish Sea erratics 6 mi N of Wolverhampton (52° 40′ 13″ N Lat, 2° 07′ 24″ W Long, grid ref. SJ 916082). Subm. by F. W. Shotton.

Birm-25. Four Ashes, Staffordshire **30,655 + 765 — 700**
28,705 B.C.

Similar sample to Birm-24, from same gravel pit, but from another lens of peaty silt in gravels. Subm. by F. W. Shotton.

Birm-56. Four Ashes, Staffordshire **42,530 + 1345 − 1115**
40,580 B.C.

Similar sample to Birm-24 and 25, but from another separated lens of organic sediment in same gravel pit. Subm. by A. V. Morgan.
General Comment: these 3 results indicate Four Ashes gravels may cover large time span in Upton Warren Interstadial (Shotton, 1967).

Birm-46. Fall Bay, Glamorganshire **(b) 21,815 ± 629**
19,865 B.C.
(c) 22,796 ± 827
20,846 B.C.

Patella shells from Patella Beach (51° 33′ 54″ N Lat, 4° 17′ 19″ W Long, grid ref. SS 414873) regarded as Interglacial (George, 1932). Date given by radiocarbon falls in glacial period when beach could not have been formed. Determination likely to be in error due to contamination and deposit older than this. (b) is middle CO_2 fraction on acid treatment, (c) inner fraction. Subm. by R. E. G. Williams.

II. BRITISH LATE-GLACIAL AND POST-GLACIAL SITES

Birm-8. Church Stretton, Shropshire **8101 ± 138**
6151 B.C.

Carex peat, bottom 7 cm of peat layer between 52 and 231 cm depth below silty clay, in sewer trench between Manholes 20 and 21, 1/4 mi NE of Little Stretton (52° 30′ 50″ N Lat, 2° 49′ 20″ W Long, grid ref. SO 445924). Overlies strong solifluction gravel; pollen dated VIb. Subm. by P. H. Rowlands.

Birm-9. Church Stretton, Shropshire **11,048 ± 376**
9098 B.C.

Plant material washed from sample between 40 and 41 ft in gray clay containing bands of black organic clay between 32.5 ft and 44 ft in Royal Society Borehole 2, 1/3 mi NE of Church Stretton (52° 32′ 23″ N Lat, 2° 48′ W Long, grid ref. SO 459939). Underlies strong solifluction gravel; pollen dated II. Subm. by P. H. Rowlands.

Birm-11. Roberthill, Dumfriesshire **3911 ± 59**
1961 B.C.

Heartwood of tree trunk imbedded in peaty silt on gravel, in bank of River Annan at Roberthill Farm, near Lockerbie (55° 06′ N Lat, 3° 24′ W Long, grid ref. NY 110797). Measurement on independent sample of material used for Birm-5 (3847 ± 60). Subm. by G. R. Coope.

Birm-12. Isleham, Cambridgeshire **4201 ± 60**
2251 B.C.

Bog oak with borings of *Cerambyx cerdo*, part of 60-ft tree. In peat ca. 1 mi N of Isleham Parish Church (52° 21′ 30″ N Lat, 0° 25′ E Long, grid ref. TL 644760). Repeat of Birm-1 (4001 ± 66) on new material. Subm. by E. A. J. Duffy.

Birm-13. Linwood Moss, Renfrewshire **3513 ± 56**
1563 B.C.

Peat from basal layer of peat moss at height 26.9 ft O.D., overlying gray silt at Linwood Moss, 3 mi NW of Paisley (55° 52′ N Lat, 4° 29′ W Long, grid ref. NS 439664). Agrees closely with Birm-2 (3572 ± 64) on separated wood fragments from same peat (Birmingham I, 1967). Subm. by W. W. Bishop.

Birm-19. Heywood, Lancashire **9065 ± 247**
7115 B.C.

Sample at base of peat, depth 3.18 to 3.28 m. Garden of 115 Queens Park Rd., Heywood (53° 36′ N Lat, 2° 13′ W Long, grid ref. SD 857112). Subm. by D. Lord.

Birm-40. Redkirk Point, Dumfriesshire **10,898 ± 127**
8948 B.C.

Top 1 in. of peat bed (Peat I), lower of 2 separate beds in silts on foreshore E of Redkirk Point (54° 58′ 32″ N Lat, 3° 05′ 30″ W Long, grid ref. NY 303652). Sample dates abundant insect fauna. Subm. by G. R. Coope.

Birm-41. Redkirk Point, Dumfriesshire **11,205 ± 177**
9255 B.C.

Bottom 2 in. of same peat bed as Birm-40. Subm. by G. R. Coope.

III. BRITISH ANTARCTIC SURVEY

Samples of wood, seaweed, shell, and whalebone coll. by B. S. John and D. E. Sugden from South Shetland Islands. Whalebone samples have not yet been measured. Samples of recent seaweed and shells show hard water effect by having appreciable apparent ages (Broeker, 1963). This makes determinations of seaweed and shells incorporated in raised beach gravels very difficult to interpret. Dates are therefore given without further comment.

Birm-14. Nelson Island **802 ± 43**
A.D. 1148

Piece of log part-buried in gravels 23 ft above MSL, S end of E-facing bay to S of Rip Point (62° 15′ S Lat, 58° 59′ W Long). Expected to date 1 of higher beaches, but low figures cast doubt about validity of specimen as true nonanthropogenic constituent of beach. Wood id. by Forest Products Research Lab. at Princes Risborough as heartwood of *Austrocedrus chilensis* (Chilean Pine), now growing in narrow zone between Patagonian and Chilean Andes. Modern *Austrocedus* trees commonly reach 100 yr but rarely as much as 250. Tree probably not recent, but possibly piece of ship's furniture. Subm. by B. S. John.

Birm-15. King George Island **2513 ± 50**
563 B.C.

Modern seaweed coll. from shoreline as check against similar material in raised beaches, E of South Spit on S shore of Marian Cove (62° 14′ S Lat, 58° 48′ W Long). Subm. by B. S. John.

Birm-16. King George Island **1223 ± 81**
A.D. 727

Seaweed from ca. 1 ft depth in raised beach gravel truncating inclined gravel sheets of beach, 16 to 17 ft above MSL; low cliff cut into gravels E of South Spit S shore Marian Cove (62° 14′ S Lat, 58° 48′ W Long). Apparently younger than modern seaweed Birm-15. Subm. by B. S. John.

Birm-23. King George Island **7683 ± 86**
5733 B.C.

Seaweed from weathered layer ca. 14 ft above MSL in horizontally bedded gravels, overlain by 4 to 5 ft till rising to 19 ft above MSL, S shore of Potter Cove (62° 14′ S Lat, 58° 41′ W. Long). Subm. by B. S. John.

(a) 850 ± 145
A.D. 1100

Birm-47. King George Island **(b) 586 ± 113**
A.D. 1364

Modern bivalve shells (mostly *Mya*) from beach on S shore of Potter Cove (62° 14′ S Lat, 58° 41′ W Long), just above high water mark. Samples from acid treatment of inner (a) and outer (b) shell layers. Subm. by B. S. John.

IV. SPITSBERGEN

Birm-18. N. Moraine, Balhallfonna, Ny Friesland **9125 ± 161**
7175 B.C.

Probable marine algae in bedded sands and gravels overridden by thrust tills of terminal moraine, 1.5 km from beach (79° 50′ N Lat, 17° 50′ E Long). Age possibly overestimated due to hard water effect (Broecker, 1963). Subm. by G. S. Boulton.

Birm-21. S end of Werenskiold Glacier, S.W. Spitsbergen $\delta C^{14}‰ = +$ **21.7 ± 11.0**

Specimen of moss amongst boulders (77° 04′ 41″ N Lat, 15° 13′ 23″ E Long) 30 m above sea level. N of 1957 glacier termination, S of 1958 ice surface, and believed to be vegetation uncovered by retreat and representing plants growing before earlier advance of glacier. Determination shows, however, that plants are modern with activity slightly above oxalic acid standard. Subm. by S. Baranowski.

Birm-37. Head of Sorgfjord, Vestspitsbergen **6526 ± 80**
4576 B.C.

Pine wood, piece of drift wood imbedded in top surface of 60 ft raised beach, at head of Sorgfjord, 400 yd from terminus of Dunerbreen. Sample dates part of history of post-glacial sea-level changes in Spitsbergen. Subm. by G. S. Boulton.

V. VOLCANIC DEPOSITS

Birm-35. San Miguel, Azores **4672 ± 100**
2722 B.C.

Carbonized wood enclosed in lahar (pyroclastic flow deposit) assoc. with last very large explosive eruption of Fogo Volcano, 5 km N of Villa Franco (37° 45′ N Lat, 25° 25′ W Long). Subm. by G. P. L. Walker.

Birm-51. Mansion Village, S. Kitts, W. Indies **3658 ± 94**
1708 B.C.

Carbonized wood in ash layer beneath pumice layer, ca. 4 ft below surface in road cutting S of Mansion Village. Pumice layer is from last major eruption of Mt. Misery Volcano (17° 22′ 50″ N Lat, 62° 45′ 28″ W Long). Subm. by P. E. Baker (Robson and Tomblin, 1966).

Birm-52. Soufriere Hills, Montserrat, W. Indies **23,566 ± 886**
21,616 B.C.

Charcoal at base of 20-ft-thick pyroclast flow representing last major activity of Soufriere Hills Volcano, 270 ft above MSL, Peat Gut, N side Bethel Village, Montserrat (16° 45′ N Lat, 62° 10′ W Long). Subm. by P. E. Baker (McGregor, 1938).

VI. ARCHAEOLOGIC SAMPLES

A. British

Birm-26. Ryton on Dunsmore, Warwickshire **2701 ± 41**
751 B.C.

Charcoal from pit containing urn of Bronze age 27 in. below modern ground surface ca. 1.5 mi SW Ryton on Dunsmore (52° 20′ 40″ N Lat, 1° 27′ 15″ W Long, grid ref. SP. 372725). Dates urn at Late Bronze age and helps determine chronology of Bronze age in English Midlands. Subm. by J. Bateman and V. S. White.

Birm-36. Fladbury, Worcestershire **1099 ± 81**
A.D. 851

Charred wood from floor of oven covered by layer of large pieces of burnt daub and then by black earth with pottery pre-1200 A.D. In Fladbury village (52° 06′ 55″ N Lat, 2° 00′ 28″ W Long, grid ref SO 995464). Late Saxon date of structure is significant. Subm. by D. P. S. Peacock.

B. Non-British

Birm-22. Huenque Valley, Peno, Peru **580 ± 76**
A.D. 1370

Carbonized material from hearth in cave ca. 4000 m above sea level close to road Ilave to Tacna, ca. 40 km from Ilave (16° 40′ S Lat, 69° 40′ E Long). Date of occupation later than anticipated. Subm. by P. S. Gelling.

Birm-28. Kintampo, Ghana, Cave KT 1 **2007 ± 68**
57 B.C.

Four aggregated samples of charcoal from Layers 2 to 5 of Cave KT 1 in Inselberg N of Kintampo-Tamale Rd. at Milestone 136 (8° 04′ N Lat, 1° 44′ W Long). Figure dates upper levels of cave earth which contain debris of quern factory. Subm. by P. A. Rahtz.

Birm-30. Kintampo, Ghana, Cave KT 1 **3339 ± 35**
1389 B.C.

Three aggregated samples of charcoal from Layers 8 and 8b of Cave KT 1 (see Birm-28). Dates lower occupation levels of cave. Subm. by P. A. Rahtz.

Birm-29. Kintampo, Ghana, Cave K 6 **3570 ± 84**
1620 B.C.

Broken husks of fruit (*Celtis adolphifriderici*), 76 to 77 in. depth in cave floor in ashy layer of test pit. Assoc. with pottery and stone axes (8° 01′ N Lat, 1° 45′ W Long). Husks are almost entirely $CaCO_3$; age was measured on CH_4 from acid-generated CO_2. There is possibility of "hard-water" error. Subm. by P. A. Rahtz.

Birm-31. Kintampo, Ghana, Cave K 8 **3401 ± 74**
1451 B.C.

Broken husks of fruits (*Celtis adolphifriderici*) from cave earth of Cave K 8, Buobini 0.5 mi W of Kintampo (8° 04′ N Lat, 1° 44′ 33″ W Long). Dates newly defined Buobini culture (but cf. Birm-29, possibility of overestimate of age due to mineral carbonate). Subm. by P. A. Rahtz.

3659 ± 66
1709 B.C.
Birm-34. Ledro, Trento, Italy **3642 ± 36**
1692 B.C.

Wooden beam found in waterlogged layer of Bronze age settlement at Molina di Ledro, Trento Province, (Battaglia, 1943). Two figures are independent determinations on gas from same specimen. Date is important in settling disputed age of Early Bronze age Polada culture. Subm. by L. H. Barfield.

VII. MISCELLANEOUS SAMPLES

(a) 4224 ± 97
2274 B.C.

Birm-20. Tarkhan II Linen

(b) 4206 ± 68
2256 B.C.

Sample provided by British Mus. is same material dated 4265 ± 80 (UCLA-739) 4200 ± 90 (A-569), 4310 ± 90 (NPL-5), and 4150 ± 110 (Burleigh, pers. commun., by British Mus.) (a) represents 1000 mins of counting at 1 atm and (b) 1000 mins at 2 atm. Determination to check calibration of Birmingham Lab.

Birm-42. Piazzo del Cuoma, Pisa, Italy

3877 ± 116
1927 B.C.

Wood in "Upper Sand," Sample 8 of Borehole 110, testing stratigraphical sequence around Leaning Tower, 9.4 m below ground level and 6.4 m below sea level. Subm. by A. W. Skempton.

Birm-54. Lake Katwe, Uganda

1208 ± 24
A.D. 742

Wood from mud layer 7 ft deep in pit 3600 ft from SW edge of Lake Katwe (Sample 4), (0° 08′ S Lat, 29° 53′ E Long, U.T.M. grid ref. RK 1885). One of series to test sedimentation rate. Subm. by W. H. Morton, Geol. Survey, Uganda.

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GEOLOGICAL SURVEY OF CANADA RADIOCARBON DATES VII

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INTRODUCTION

The 2-L counter (GSC I) and the 5-L counter (GSC IV) were operated routinely during the past year. The 5-L counter was operated at 1 atm, except for February-March 1967, when it was operated at 4 atm. Approximately half the determinations reported were obtained from each counter.

Age calculations are based on a C^{14} half-life of 5568 $\pm$ 30 yr and 0.95 of the activity of the NBS oxalic-acid standard. Ages are quoted in yr 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 $\pm$ 1.5% in the C^{14} concentration of the biosphere during the past 1100 yr. No ages are quoted with a standard deviation of less than $\pm$ 100 yr. Finite ages are based on the 2σ criterion and "Infinite" ages on the 4σ criterion (GSC II). All age calculations have been carried out by a C.D.C. 3100 computer, instead of the I.B.M. 1620 reported in RADIOCARBON, vol. 9.

Slight changes have been made in preparation and purification techniques described in GSC IV. An additional 0.1 N $AgNO_3$ trap has been inserted in the purification line; this has saved time in purification of samples. The laboratory now dates only the collagen fraction of bone samples.

Average background and standard counting rates over the past 12 months are listed in Tables 1 and 2. The monthly average background count is made up of 4 individual daily counts (except for March-April, 1967, in the 2-L counter, where the average is that of 8 counts, and February-March, 1967, in the 5-L counter, where the average is made up of 9 individual counts). During the 12-month period 10 different background preparations were counted in the 2-L counter, and 11 in the 5-L counter. Not one of the counts was rejected, for statistical or other reasons.

* The introductory part of this paper has been prepared by the first author, who operates the laboratory. The date list has been compiled by the second author from descriptions of samples and interpretations of dates by the collectors.

TABLE 1

Monthly Background (c/m) for Period
October 1, 1966 to September 30, 1967

Month	2-L counter (2 atm)	5-L counter (1 atm)
October 1966	1.317 ± .025	2.266 ± .038
November	1.311 ± .024	2.207 ± .042
December	1.225 ± .045	2.160 ± .024
January 1967	1.239 ± .020	2.123 ± .024
February	1.263 ± .021	*2.905 ± .033 (February–March)
March	1.249 ± .016 (March–April)	
April		2.135 ± .030
May	1.181 ± .019	2.200 ± .026
June	1.211 ± .019	2.194 ± .025
July	1.179 ± .026	2.125 ± .030
August	1.170 ± .019	2.106 ± .025
September	1.170 ± .023	2.129 ± .024

* 5-L counter operating at 4 atm.

The standard counting rates (see Table 2) are the monthly averages of 3 individual daily counts (except for March-April in the 2-L counter, and February-March in the 5-L counter, where the average of 2 months is used.) Seven different oxalic-acid preparations were counted in the 2-L counter and 6 in the 5-L counter. One of the standards for the 5-L counter was rejected (April) because the result fell outside the maximum statistical error.

TABLE 2

Monthly Standard, N_o*, (c/m) for Period
October 1, 1966 to September 30, 1967

Month	2-L counter (2 atm)	5-L counter (1 atm)
October 1966	19.888 ± .145	28.776 ± .122
November	20.021 ± .174	28.944 ± .119
December	20.159 ± .103	29.079 ± .117
January 1967	20.208 ± .100	29.011 ± .101
February	20.161 ± .099	**112.085 ± .244 (February–March)
March	20.139 ± .082 (March–April)	
April		28.951 ± .123
May	20.058 ± .099	28.862 ± .120
June	20.280 ± .097	28.990 ± .118
July	20.210 ± .231	29.034 ± .126
August	20.057 ± .156	29.250 ± .118
September	20.030 ± .090	29.103 ± .119

* $N_o = 0.95 \times$ net counting rate of the NBS oxalic-acid standard.
** 5-L counter operating at 4 atm.

Tests for C^{14} contamination in shell samples were continued as shown in parts A and B of Table 3.

TABLE 3

Tests for C^{14} Contamination*

Sample No.	Fraction	Age (yr B.P.)
A. Marine Shells		
GSC-110	21-100%**	8160 ± 140
GSC-110-2	51-100	8090 ± 160
GSC-667	21-60	26,700 ± 450
	61-100	27,790 ± 480
GSC-695	21-60	>30,000
	61-100	>38,000
GSC-787	21-60	33,800 ± 900
	61-100	42,400 ± 1900
B. Fresh Water Shells		
GSC-689	21-60	10,700 ± 160
	61-100	10,900 ± 150
C. Marl and Organic Detritus		
GSC-384	Inorganic (Marl)	12,190 ± 160
	Organic	9580 ± 220
	Inorganic (Marl)†	4820 ± 140
GSC-657	Inorganic (Marl)	13,200 ± 170
	Organic	13,800 ± 170
GSC-675	Inorganic (Marl)	12,100 ± 170
	Organic	11,500 ± 180

* Detailed descriptions of all samples appear in this date list except for GSC-657, 675, and 689.

** Two separate preparations were made on shells from the same sample.

† In this second preparation, from another bag of submitted sample, carbonate sand grains were removed by sieving.

Part C, of Table 3, illustrates the results obtained from different fractions of the same sample.

After many futile attempts to construct a 1-L counter with a lower background count than the present 2-L counter, the GSC Instrument Shop has fabricated one which, on preliminary testing, gives a background of ca. 1.10 c/m and a net modern count of ca. 6.00 c/m. Further information will be published in a future edition of RADIOCARBON.

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

A. Eastern Canada

GSC-598. St. George's Bay, Newfoundland **13,420 ± 190**
11,470 B.C.

Marine pelecypod shell fragments (*Macoma* sp. ?) from sea cliff 0.7 mi SW of mouth of Highlands R., St. George's Bay, Newfoundland (48° 11′ N Lat, 58° 54.5′ W Long), at alt ca. 18 ft. Shells coll. 2 ft above base of blue-black massive silty clay overlying red-brown compact till with sharp contact, and overlain by red-brown silt and clay rhythmites believed to be bottomset beds of marine delta. Alt of delta surface ca. 50 ft, but marine limit higher as delta surface is terraced. Coll. 1964 by I. A. Brookes, York Univ., Toronto. *Comment* (I.A.B.): date gives age of early part of marine submergence following deposition of underlying till.

GSC-461. Sable Island, Nova Scotia **210 ± 130**
A.D. 1740

Plant detritus from soil horizon, exposed in dune blow-out at low tide level on NW beach of Sable Island, Nova Scotia (43° 56′ N Lat, 60° 02′ W Long). Coll. 1965 from fresh exposure by N. James and D. J. Stanley, Dalhousie Univ., Halifax; subm. by J. Terasmae.* *Comment* (J.T.): date indicates recent, relatively stable episode with soil formation, followed by erosion and dune-sand accumulation. Pollen assemblages from this soil horizon indicate vegetation similar to modern plant communities on Sable Island. NaOH-leach omitted from sample pretreatment.

GSC-791. 'Salmon River Lake,' Nova Scotia **5540 ± 140**
3590 B.C.

Lake mud from 2.60 to 2.80 m depth in core coll. with piston sampler under 2 m of water in deepest part of 'Salmon River Lake,' Richmond County, Cape Breton Island, Nova Scotia (45° 38′ 40″ N Lat, 60° 46′ 30″ W Long), at alt ca. 140 ft. Coll. 1955 by D. A. and B. G. R. Livingstone, Duke Univ., Durham, North Carolina. *Comment* (D.A.L.): date is first from hemlock maximum on Cape Breton Island. NaOH-leach omitted from sample pretreatment.

'Silver Lake' series, Nova Scotia

Samples coll. with piston corer in sediments under 2.75 m of water in deepest part of Silver Lake, Halifax County, Nova Scotia (43° 33′ 48″ N Lat, 63° 38′ 34″ W Long). Coll. 1955 by D. A. Livingstone.

GSC-792. 'Silver Lake', 2.35 to 2.60 m **4540 ± 140**
2590 B.C.

Lake mud from 2.35 to 2.60 m depth in core.

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

GSC-772. 'Silver Lake', 3.50 to 3.67 m **7140 ± 140**
5190 B.C.

Lake mud from 3.50 to 3.67 m depth in core.
General Comment (D.A.L.): GSC-772 and GSC-792 date lower and upper boundaries, respectively, of hemlock zone (Livingstone and Estes, 1967; Livingstone, in press); together with GSC-791 (5540 ± 140, this list) they suggest this zone was contemporaneous with C-1 hemlock in Maine and S New England. Maximum abundance of hemlock pollen appears to have been deposited during latter part of C-1 time in a S New England sense. NaOH-leach omitted from pretreatment of both samples.

GSC-695. Cape St. Mary, Nova Scotia **>38,000**

Marine shells from stony clay in sea cliff 1 mi SE of Cape St. Mary, Digby County, Nova Scotia (44° 05′ N Lat, 66° 11′ W Long), at alt 15 to 35 ft. Clay overlies gravel and underlies cemented, N-dipping, glaciofluvial gravel, surface of which has been reworked by postglacial marine action up to 40 to 45 ft. Shell species (id. by F. J. E. Wagner) are comparable to those of area today and unlike postglacial cold-water forms of opposing New Brunswick shore and of Gulf of St. Lawrence. Coll. 1966 by D. R. Grant. Two fractions were dated:

outer fraction (21-60% leach), two 1-day counts	>30,000
inner fraction (61-100% leach), one 3-day count	>38,000

Comment (D.R.G.): shell-bearing stony clay is interpreted as till deposited by glacier lobe that flowed from W or NW (from St. Mary's Bay) toward S end of Nova Scotia; shells were picked up from sea bottom.

GSC-775. East Baltic Bog, Prince Edward Island **8430 ± 150**
6480 B.C.

Gyttja from depth 574 to 578 cm at base of peat-sediment sequence overlying sand in E Baltic Bog, alt 140 ft, 8 mi E of Souris, Prince Edward Island (46° 24′ 30″ N Lat, 62° 09′ W Long). Sample obtained with a GSC piston corer (Mott, 1966). Coll. 1966 by T. W. Anderson. *Comment* (T.W.A.): sample (in Pollen Zone Al; Deevey, 1958) dates beginning of organic accumulation in bog. NaOH-leach omitted from sample pretreatment.

GSC-793. Mermaid Lake Bog, Prince Edward Island **8630 ± 180**
6680 B.C.

Gyttja coll. with a GSC piston corer from depth 276 to 280 cm at base of peat-sediment sequence in Mermaid Lake Bog, alt <50 ft, 6 mi NE of Charlottetown, Prince Edward Island (46° 15′ N Lat, 63° 01′ 30″ W Long). Gyttja is underlain by sand. Coll. 1966 by T. W. Anderson. *Comment* (T.W.A.): sample (in pollen zone Al) dates beginning of organic accumulation in bog. NaOH-leach omitted from sample pretreatment.

GSC-773. Portage Bog, Prince Edward Island **9880 ± 150**
7930 B.C.

Gyttja coll. with a GSC piston corer from depth 623 to 628 cm at base of peat-sediment sequence in Portage Bog, alt <25 ft, 1 mi NNW of Portage, Prince Edward Island (46° 40′ 25″ N Lat, 64° 04′ 30″ W Long). Gyttja is underlain by pebbly sand. Coll. 1966 by T. W. Anderson. *Comment* (T.W.A.): sample (in pollen zone L3) dates beginning of organic accumulation in bog. NaOH-leach omitted from sample pretreatment.

12,300 ± 160
GSC-795. Sand Point, New Brunswick **10,350 B.C.**

Marine shells in silt bed ca. 50 ft above high tide level, overlying coarse gravel of kame-terrace sequence and overlain by cross-bedded fluvial or deltaic gravel, E side of St. Croix R., 5 mi N of river mouth on Passamaquoddy Bay in St. Andrew's, New Brunswick (45° 08′ 30″ N Lat, 67° 07′ 45″ W Long). Locality is 20 mi NNW of Lubec, Maine, at E end of Cherryfield-Eastport moraine system and is NW of its projection to St. John (Borns, 1967). Site discovered by J. Welsted, Brandon Univ., Brandon, Manitoba, 1966. Coll. by N. R. Gadd, 1967. *Comment* (N.R.G.): marine clay is intercalated between ice-contact strata and younger fluvial or deltaic beds probably related to offlap conditions; apparently clay was deposited during maximum post-last-glaciation marine submergence; date should closely approximate age of that event. Date based on one 3-day count.

GSC-655. Sutton, Quebec **>28,000**

Wood fragment from sand folded and faulted by ice thrusting in proximal part of glacial delta extending across valley of Sutton R., 2.2 mi SW of RR sta. at Sutton, Quebec (45° 05′ 20″ N Lat, 72° 39′ 10″ W Long), at alt ca. 625 ft. Delta deposited in Fort Ann phase of Glacial Lake Vermont, which sample was expected to date. Coll. 1966 by R. Doak; subm. by J. A. Elson, McGill Univ., Montreal. *Comment* (J.A.E.): wood is older fossil material probably glacially transported; it may represent St. Pierre nonglacial interval although it was not compressed as is most plant matter from St. Pierre beds. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

12,570 ± 220
GSC-419. St. Hilaire, Quebec **10,620 B.C.**

Plant detritus in silt from 29 ft below surface of bog (alt 850 ft) on St. Hilaire Mt., 3 mi E of St. Hilaire Sta., Quebec (45° 33′ 30″ N Lat, 73° 08′ 30″ W Long). Coll. 1965 with 2-in GSC piston corer by P. Lasalle, Dept. of Natural Resources, Quebec, and J. Terasmae. *Comment* (J.T.): date is minimum for deglaciation of SW part of St. Lawrence Lowland (cf. Lasalle, 1966). NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

10,880 ± 260
GSC-482. Lac Hertel, Quebec **8930 B.C.**

Silty gyttja from 776 to 790 cm depth beneath water/sediment interface in Lac Hertel on St. Hilaire Mt., 0.5 mi N of St. Hilaire village, Quebec (45° 32′ 45″ N Lat, 73° 09′ W Long). Coll. 1965 with Livingstone piston corer by J. Terasmae and P. Lasalle. *Comment* (J.T.): date is minimum for isolation of lake basin (present lake alt 566 ft) from Champlain Sea in St. Lawrence Lowland; also supports validity of date on marine shells at alt 298 ft on St. Hilaire Mt. (Y-1558, 10,560 ± 160; Lasalle, 1966; Terasmae and Lasalle, 1968). NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

GSC-680. Kazabazua, Quebec **9910 ± 200**
7960 B.C.

Gyttja from 8.95 to 9.05 m depth below bog surface in kettle in sand plain (alt ca. 600 ft), 2.2 mi W of Kazabazua, Quebec (45° 57′ N Lat, 76° 04′ W Long). Coll. 1966 with 2-inch GSC piston corer by J. Terasmae. *Comment* (J.T.): date is minimum for sand plain in Gatineau R. valley, N of Ottawa, and gives age for early-postglacial *Picea* maximum in pollen diagram from this locality. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

GSC-681. Mer Bleue Bog, Ottawa, Ontario (II) **7650 ± 210**
5700 B.C.

Gyttja from 515 to 525 cm depth below surface of bog (alt 225 ft), 8 mi E of Ottawa, Ontario (45° 34′ N Lat, 75° 30′ 20″ W Long). Coll. 1966 with 2-inch GSC piston corer by J. Terasmae. *Comment* (J.T.): date is minimum for abandonment of an ancient Ottawa R. channel (cf. GSC-548, 6750 ± 150, GSC VI). NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

Atkins Lake series, Ontario

Samples of bottom sediments in Atkins Lake (alt 381 ft, water depth 65 cm), 11 mi S of Merrickville, Ontario (44° 45′ N Lat, 75° 51′ W Long). Coll. 1966 with Livingstone piston corer by T. W. Anderson and M. Ouelett; subm. by J. Terasmae.

GSC-807. Atkins Lake, 134 to 147 cm **1020 ± 160**
A.D. 930

Gyttja from 134 to 147 cm depth below lake level.

GSC-762. Atkins Lake, 441 to 453 cm **11,100 ± 270**
9150 B.C.

Gyttja from 441 to 453 cm depth below lake level.

General Comment (J.T.): GSC-762 is minimum age of westernmost limit reached by Champlain Sea NW of Brockville. GSC-807 dates change from dark-brown to black gyttja, and nearly coincides with upper peak zone of *Tsuga* and rise of *Picea* graph in pollen record. NaOH-leach omitted from pretreatment of both samples. Both samples mixed with dead gas for counting. Date GSC-762 based on one 3-day count.

10,500 ± 180
GSC-765. Grady Lake, Ontario **8550 B.C.**

Gyttja from 13.46 to 13.57 m depth below lake level (alt 563 ft; water depth 325 cm) in Grady Lake, 3 mi NNE of Westport, Ontario (44° 43′ N Lat, 76° 22′ 30″ W Long). Coll. 1966 with Livingstone piston corer by R. J. Mott and M. Ouellet; subm. by J. Terasmae. *Comment* (J.T.): date is minimum for deglaciation of this area N of Dummer Moraine (cf. GSC-649, 11,180 ± 180, this list) and gives age of *Picea* peak in pollen record. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

8790 ± 170
GSC-742. Northeastern Lake Ontario **6840 B.C.**

Gyttja beneath clay at alt 50 m (165 ft) from local basin in NE Lake Ontario, alt 74.5 m (245 ft), between Galloo and Little Galloo Islands, New York (43° 53.1′ N Lat, 76° 24.8′ W Long). Basin closure is ca. 6 m (20 ft). Sample is segment of gyttja underlying 49 cm non-calcareous clay and overlying firm calcareous clay. Coll. 1966 with gravity corer (3.5 cm I.D.) by C. F. M. Lewis. *Comment* (C.F.M.L.): gyttja considered a pond deposit, indicating Lake Ontario was then at least 17 m (55 ft) lower; Galloo Island area was more widely exposed subaerially than at present. Date approximates low-level Admiralty phase of Lake Ontario and is maximal for subsequent flooding of site (Lewis and McNeely, 1967) by differential uplift of lake outlet at head of St. Lawrence R. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

11,180 ± 180
GSC-649. Little Round Lake, Ontario **9230 B.C.**

Silty gyttja from 19.01 to 19.06 m depth below lake level (alt 675 ft; water depth at coring site, 15.8 m) in Little Round Lake, 2 mi N of Sharbot Lake, Ontario (44° 47′ 20″ N Lat, 76° 41′ 30″ W Long). Coll. 1966 by R. J. Mott and R. N. McNeely with Livingstone piston corer. *Comment* (J. Terasmae): date is minimum for ice retreat from Dummer Moraine, a major glacial feature WNW of Kingston, Ontario (cf. GSC-765, 10,500 ± 180, this list). NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.

11,350 ± 260
GSC-625. Ross Lake, Ontario **9400 B.C.**

Silty gyttja from 32.8 to 33.1 ft depth below lake level (alt 463 ft; water depth 18 ft) in Ross Lake, 5 mi N of Foxboro, Ontario (44° 19′ N Lat, 77° 27′ 30″ W Long). Coll. 1966 with Livingstone piston corer by J. Terasmae. *Comment* (J.T.): date is minimum for end of Lake Iroquois stage in Lake Ontario basin (cf. GSC-679, 11,020 ± 170, and GSC-626, 11,760 ± 310, this list.) NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

11,020 ± 170
GSC-679. Oak Lake, Ontario **9070 B.C.**

Sandy gyttja from 55.8 to 56.1 ft depth below lake level (alt 668 ft; water depth at coring site 37 ft) in Oak Lake, 2.5 mi SE of Stirling, Ontario (44° 16′ N Lat, 77° 31′ 30″ W Long). Coll. 1966 in 2-inch Shelby tube by J. Terasmae. *Comment* (J.T.): date is minimum for end of Lake Iroquois stage here (cf. GSC-625, 11,350 ± 260 and GSC-626, 11,760 ± 310, this list). NaOH-leach omitted from sample pretreatment. Date based on one 3-day count.

11,760 ± 310
GSC-626. Biddy Lake, Ontario **9810 B.C.**

Gyttja from 46.2 to 46.5 ft depth below lake level (alt 566 ft; water depth 29 ft) in Biddy Lake, 4 mi NE of Colborne, Ontario (44° 03′ N Lat, 77° 49′ 30″ W Long). Coll. 1966 with Livingstone piston corer by J. Terasmae. *Comment* (J.T.): date is minimum for end of Lake Iroquois stage here (cf. GSC-625, 11,350 ± 260 and GSC-679, 11,020 ± 170, this list). Biddy Lake was isolated from glacial lake by a bay-mouth bar. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

9820 ± 200
GSC-638. North Bay, Ontario **7870 B.C.**

Gyttja from 4.6 to 4.7 m depth below lake level (alt 1025 ft; water depth 1.25 m) in small unnamed pond 2 mi N of North Bay, Ontario (46° 21′ N Lat, 79° 28′ W Long). Coll. 1965 with Hiller peat borer by J. Terasmae. *Comment* (J.T.): date is minimum for ice retreat from North Bay and opening of this outlet E from Great Lakes (cf. Terasmae and Hughes, 1960), and agrees with bog bottom date from same area (S-100, 9570 ± 150, Saskatchewan III). NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

7560 ± 180
GSC-670. Iroquois Falls, Ontario **5610 B.C.**

Silty gyttja from 500 to 510 cm depth below sediment/water interface in '19 Mile Lake' (alt ca. 850 ft), 19 mi N of Iroquois Falls, Ontario (49° 01′ N Lat, 80° 36′ W Long). Coll. 1965 by T. W. Anderson with Livingstone piston corer; subm. by J. Terasmae. *Comment* (J.T.): date is minimum for final drainage of Glacial Lake Barlow-Ojibway in N Ontario and postdates Cochrane ice readvance (cf. GSC-487, 7660 ± 140, and GSC-309, 7150 ± 140, both in GSC V; GSC-624, 7380 ± 140, GSC VI). NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

12,190 ± 230
GSC-620. Walker Pond, Ontario **10,240 B.C.**

Gyttja from 16.0 to 16.13 m depth below lake level (alt 900 ft; water depth 10 m) in Walker Pond, 2 mi SE of London, Ontario (42° 57′ N

Lat, 81° 13′ W Long). Coll. 1965 with Livingstone piston corer by J. Terasmae. *Comment* (J.T.): date is minimum for ice retreat from Ingersoll Moraine and Lake Maumee stage. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.

11,380 ± 170
GSC-611. Thamesville, Ontario **9430 B.C.**

Mastodon bones from E side gravel pit in Kent Co., Camden Twp., 1.5 mi NE of Thamesville, Ontario (42° 34′ N Lat, 81° 57.4′ W Long), at alt ca. 620 ft. Sample excavated by drag line from fresh exposure, at 6 ft depth. Scattered bones occur near base of 3-ft section of gravel and in underlying fine sediments; gravel is overlain by alluvium with shells and wood. Coll. 1965 by B. Tinline for A. Dreimanis, Univ. of Western Ontario, London. *Comment* (A.D.): gravel is probably alluvial deposit of early Thames R. rather than deltaic deposit of river in Lake Lundy or Lake Grassmere, as date appears too young for these lakes. Collagen fraction used for dating.

8910 ± 150
GSC-614. Ferguson Farm, Tupperville, Ontario **6960 B.C.**

Mastodon bones from J. Ferguson farm, Chatham Tp., con. 14, lt. 10, 2 mi SSW of Tupperville, Ontario (42° 33.9′ N Lat, 82° 17.3′ W Long), at alt ca. 585 ft. Bones exposed by excavation along N side of drainage ditch in slight depression in lacustrine sediments. Bones are at base of gyttja and peat, underlain successively by marl and lacustrine clay, both with molluscs. Coll. 1954 by A. Dreimanis. *Comment* (A.D.): date, which agrees with pollen diagram from site, suggests non-sedimentation and exposure of bones for ca. 2500 yrs, because gyttja from cavities within mastodon skull is 6230 ± 240 yr old (S-16, Saskatchewan II; Dreimanis, 1961; 1967). Collagen fraction used for dating. Date based on one 3-day count.

9580 ± 220
GSC-384. Roddick Township, Ontario **7630 B.C.**

Carbonaceous material in marl exposed in gully ca. 1 ft deep at bottom of beach-ridge gravel pit, NE corner sec. 27, Roddick Tp., Rainy R. District, ca. 5 mi SW of Fort Frances, Ontario (48° 33′ N Lat, 93° 29′ W Long), at alt ca. 1140 ft. Originally sand and gravel overlay sandy marl rich in aquatic snail shells, marl containing carbonized plant fragments, and sandy till. Johnston (1915) interpreted gravel beach as Campbell strandline of Lake Aggasiz; marl probably formed in lagoon across which beach advanced. Coll. 1964 by J. A. Elson, McGill Univ., Montreal. Three determinations were made:

inorganic portion (bulk sample, untreated)	12,190 ± 160
organic portion (centrifuged residue after inorganic portion dissolved in phosphoric acid)	9580 ± 220
inorganic portion (fine fraction only, after sieving marl in second bag of submitted sample)	4820 ± 140

Comment (J.A.E.): sample was intended to check validity of marl dates in this part of Lake Agassiz Basin; cf. GSC-383 (10,600 ± 150, GSC VI), a marl date in agreement with dates on wood on W side of basin. It was thought marl as a whole, which contained sand, might have ancient carbonate grains derived from Paleozoic rocks, but that fine fraction would be uncontaminated. Bulk sample of marl appears to contain grains of ancient carbonates as anticipated. Probably fine fraction has received younger carbonate from ground water which percolated freely through overlying beach sand and gravel. Carbonaceous matter gives date for Lake Agassiz compatible with many others (*e.g.*, W-1057, 9200 ± 600, USGS VII: Elson, 1967). NaOH-leach omitted from pretreatment of organic fraction; sample mixed with dead gas for counting.

B. Western Canada

Zelena Series, Manitoba

Samples from lacustrine silt and marl separating surface till from underlying till, in road cut on E side of Shell R. valley, ca. 1 mi N and 3 mi E of Zelena, Manitoba, NW 1/4 sec. 17, tp. 28, rge. 27, W prin. mer. (51° 24′ N Lat, 101° 14′ W Long). Coll. 1966 by R. W. Klassen.

GSC-653. Zelena, Manitoba, charcoal — **37,700 ± 1500; 35,750 B.C.**

Charcoal from silt above marl zone.

GSC-711. Zelena, Manitoba, marl — **28,220 ± 380; 26,270 B.C.**

Marl, composed almost entirely of calcium carbonate, below silt.

General Comment (R.W.K.): apparent age difference of charcoal and marl probably due to contamination of marl by modern carbon. More reliable charcoal date suggests maximum age for silt; inter-till beds can probably be correlated with deposits of redefined Port Talbot Interstade in Lake Erie region (Klassen, 1967; Dreimanis *et al*; 1966). No sample pretreatment for GSC-711; date based on one 3-day count. NaOH-leach omitted from sample pretreatment for GSC-653.

Shellmouth, Manitoba series

Wood samples exposed by damsite excavation at base of E wall of Assiniboine R. valley, 3.75 mi NE of Shellmouth, Manitoba, NE 1/4 sec 1, tp. 23, rge. 29, W prin. mer. (50° 58′ N Lat, 101° 24′ W Long). Coll. 1966 by R. W. Klassen.

GSC-677. Shellmouth, Manitoba (I) — **10,690 ± 190; 8740 B.C.**

Wood from top of alluvial silt beneath till slump block and ca. 10 ft above flood plain.

GSC-678. Shellmouth, Manitoba (II) — **>41,000**

Wood from alluvial sand beneath 200 to 250 ft of drift including at least 3 tills, and overlying bedrock.

General Comment (R.W.K.): date GSC-677 is minimum for development of Assiniboine R. valley. Sand containing wood on which date GSC-678 was obtained is interpreted as interglacial deposit within preglacial valley, here crossed by Assiniboine R. valley. Due to a computer error, date was reported as >42,600 (Klassen, 1967). Date GSC-678 based on one 4-day count.

GSC-756. Roblin, Manitoba **2760 ± 130** **810 B.C.**

Wood from borehole in Assiniboine R. flats ca. 8 mi SW of Roblin, Manitoba, SW 1/4 sec. 35, tp. 24, rge. 29, W prin. mer. (51° 07′ N Lat, 101° 26′ W Long). Coll. 1966 by R. W. Klassen. *Comment* (R.W.K.): sample believed from 40 to 50 ft level in river alluvium but young date indicates near-surface source. Sample mixed with dead gas for counting. Date based on one 3-day count.

GSC-750. Dropmore, Manitoba **>42,000**

Wood from 280 to 310 ft in borehole ca. 0.75 mi S of Dropmore, Manitoba, SE 1/4 sec. 27, tp. 23, rge. 29, W prin. mer. (51° 01′ N Lat, 101° 27′ W Long). Sand and gravel unit in which wood occurs is at 243 to 328 ft depth and underlies at least 3 tills. Coll. 1966 by R. W. Klassen. *Comment* (R.W.K.): sand and gravel may be subsurface equivalent of exposed unit from which GSC-678 (>41,000, this list) was taken.

GSC-676. Makaroff, Manitoba **>34,000**

Wood fragments and organic debris from upper surface of varved clay and basal zone of overlying till ca. 1 mi E and 2 mi N of Makaroff, Manitoba, NE 1/4 sec. 27, tp. 27, rge. 29, W prin. mer (51° 23′ N Lat, 101° 29′ W Long). Varved clay up to 4 ft thick is underlain by stony silt and overlain by 2 tills. Units are exposed in road cut in terrace along E side of Big Boggy Creek. Coll. 1966 by R. W. Klassen. *Comment* (R.W.K.): date records nonglacial interval preceding at least last 2 glaciations in this region. Due to a computer error, date was reported as >42,600 (Klassen, 1967).

GSC-790. Spring Valley, Saskatchewan **>38,000**

Peaty muck from SE-dipping layers or lenses within silty-clayey beds overlain by brownish till, exposed in roadside cut 3 mi SE of Spring Valley, Saskatchewan (49° 49′ N Lat, 105° 22′ W Long), at alt ca. 2600 ft. Sample is from uppermost of 3 organic layers, in hummocky terrain, within The Dirt Hills ice-thrust moraine. Coll. 1965 by V. K. Prest. *Comment* (V.K.P.): uncompressed peat believed related to other occurrences of buried organic materials in this region (cf. Parizek, 1964; also GSC-618, 10,710 ± 250, GSC VI); these occur within and beneath glacial drift that slumped as dead ice melted, in postglacial time, to produce markedly hummocked and kettled surface. "Old" age of GSC-790 indicates presence of older sediments within ice-thrust moraine; pollen studies suggest sediments are Pleistocene. NaOH-leach omitted from sample pretreatment.

GSC-761. Bridgeford, Saskatchewan **1460 ± 140**
A.D. 490

Plant detritus beneath 10 ft sand in Qu'Appelle Valley, ca. 4 mi N of Bridgeford, Saskatchewan, NE 1/4 sec. 24, tp. 23, rge 4, W 3rd mer. (50° 58′ N Lat, 106° 26′ W Long). Coll. 1966 by R. W. Klassen. *Comment* (R.W.K.): material coll. to determine rate of sediment accumulation in divide area of abandoned valley. Young date suggests probable eolian origin for sand. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.

Medicine Hat series, Alberta (II)

GSC-780. 'Mitchell Bluff' **>30,000**

Wood fragment coll. during excavation for bones on knoll at NW end 'Mitchell Bluff,' S bank of South Saskatchewan R., 6 mi N of Medicine Hat, Alberta; NE 1/4 sec. 32, tp. 13, rge. 5, W 4th mer. (50° 07′ 45″ N Lat, 110° 38′ 40″ W Long) at alt ca. 2200 ft. Wood was 3 ft below surface in gravel and sand with extensive mammal fauna and chert fragments possibly worked by man. Coll. 1966 by C. S. Churcher, Royal Ontario Mus., Toronto, and L. M. Kisko. *Comment* (A.M. Stalker): date is minimum for mammal fauna and chert fragments. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.

GSC-704. 'Island Bluff' **0 ± 140**
A.D. 1950

Bison bones from W side of gully tributary to NE bank North Saskatchewan R., at 'Island Bluff' section ca. 7 mi N of Medicine Hat, Alberta, SW 1/4 sec. 4, tp. 14, rge. 5, W 4th mer. (50° 08′ 30″ N Lat, 110° 38′ 30″ W Long). Bones, at alt ca. 2250 ft, were ca. 120 ft above river and 150 ft below prairie level. Bones from site previously id. as *Bison occidentalis* (?) and considered older than topographically higher classical Wisconsin till sheets (Westgate, 1965). Material dated because bones appeared too fresh for age suggested and inclosing deposits were unlike others at same level. Coll. 1966 by C. S. Churcher. *Comment* (A. M. Stalker): date confirms that inclosing material is slumped, and throws doubt on reported presence of *Bison occidentalis* (?). Sample mixed with dead gas for counting. Date based on one 1-day count.

GSC-802. 'Mitchell Bluff' and 'Island Bluff' **5540 ± 250**
3590 B.C.

Combined sample from 'Mitchell Bluff' (NE 1/4 sec. 32, tp. 13, rge. 5, W 4th mer.; 50° 07′ 45″ N Lat, 110° 38′ 40″ W Long) and 'Island Bluff' (SW 1/4 sec. 4, tp. 14, rge. 5, W 4th mer.; 50° 08′ 20″ N Lat, 110° 38′ 30″ W Long), at alt ca. 2200 ft. Sample consisted of bone coll. from same bed of sand and gravel on both banks of South Saskatchewan R., ca. 100 ft above river and beneath 60 to 180 ft drift, mostly till. Source bed contained mammals and worked (?) chert fragments. Coll. 1966 by

C. S. Churcher and L. M. Kisko. *Comment* (A. M. Stalker): sample expected to be beyond range of dating; reason for young age is not known. However, during preparation for identification, bones were washed in Gelva (Code #V15, Shawinigan Chemicals of Canada), an organic compound; this is probable source of contamination. GSC-780 (>30,000, this list) came from same bed at 'Mitchell Bluff' and is thought a better indication of age of sand and gravel. Sample mixed with dead gas for counting. Date based on one 3-day count.

11,200 ± 200
GSC-805. 'Lindoe Bluff' 9250 B.C.

Bone, chiefly bison and horse, from 'Lindoe Bluff' on W bank of South Saskatchewan R. 2 mi N of Medicine Hat, Alberta, W ½ sec. 17, tp. 13, rge. 5, W 4th mer. (50° 04′ 50″ N Lat, 110° 39′ 20″ W Long), at alt ca. 2175 ft. Bones were in gravel laid down when river bed was 25 to 50 feet above present level. Coll. 1966 by C. S. Churcher. *Comment* (A. M. Stalker): date gives age of abundant mammal fauna at site and indicates South Saskatchewan R. incised rapidly immediately following last glaciation, but downcutting soon slowed. Sample mixed with dead gas for counting.

35,980 ± 1060
GSC-728. Taber, Alberta 34,030 B.C.

Small pieces of oxidized wood from alluvial sand at 'Rattlesnake Bluff,' E bank Oldman R., 8 mi NNE of Taber, Alberta, SE ¼ sec. 24, tp. 11, rge. 16, W 4th mer. (49° 55′ 30″ N Lat, 112° 04′ W Long), at alt ca. 2450 ft. Wood found scattered, where it had been washed into place, ca. 10 ft above base of sand bed, overlying till and preglacial(?) gravel and overlain by 4 tills. Coll. 1961 by A. M. Stalker. *Comment* (A.M.S.): the 4 tills appear to be Classical Wisconsin. Sample mixed with dead gas for counting.

5410 ± 300
GSC-803. Fort Macleod, Alberta 3460 B.C.

Bison bone from Head's-Smashed-In Buffalo Jump ca. 10 mi W of Fort Macleod, Alberta, NE ¼ sec. 6, tp. 9, rge. 27, W 4th mer. (49° 42′ 40″ N Lat, 113° 38′ 45″ W Long), at alt ca. 3475 ft. Source of sample was Layer 38 in archeological Test Pit z, 27.6 ft below original surface and above large bedrock block that had slid E 100 ft from nearby cliff. Coll. 1966 by B. Reeves, Univ. of Calgary, Calgary; subm. by A. M. Stalker. *Comments* (B.R.): date is earliest yet obtained for any buffalo jump in Northern Plain; (A.M.S.): date is minimum for occurrence of bedrock slide and dates time of occupation of Layer 38. Sample mixed with dead gas for counting. Date based on one 3-day count.

Castle River series, Alberta (II)

Samples from 'Mountain Mill Bluff' on S Bank Castle R., ca. 6 mi W of town of Pincher Creek, Alberta in SE ¼ sec. 21, tp. 6, rge. 1, W

5th mer. (49° 29′ N Lat, 114° 03′ 30″ W Long). Coll. 1966 by A. M. Stalker. Section shows Cordilleran outwash overlain by stream and wind deposits, including 3 buried soils of which lowest is thickest and best developed. Previous samples in this series (cf. GSC VI) include GSC-447 (6150 ± 140, bison jaw) and GSC-490 (6100 ± 180, bison teeth).

6340 ± 140
GSC-705. Castle River, bison bone **4390 B.C.**

Bison bone from gravel and coarse sand outwash, ca. 30 ft above river, alt ca. 3800 ft.

3380 ± 170
GSC-741. Castle River, shells **1430 B.C.**

Terrestrial-gastropod shells from alluvial or eolian sand ca. 75 ft above river and ca. 45 ft above outwash that yielded bison bones for GSC-447, GSC-490, and GSC-705, alt ca. 3850 ft. Shells came from in and just below middle buried soil ca. 5 ft above lowest (main) buried soil.

2680 ± 140
GSC-743. Castle River, charcoal **730 B.C.**

Charcoal from approx. same site as shells of GSC-741.

General Comment (A.M.S.): GSC-705 came from approx. same spot as GSC-447 and GSC-490 (6150 ± 140 and 6100 ± 180, respectively; GSC VI). It was dated to check these 2 dates, which were younger than expected. It appears to substantiate them. GSC-741 and GSC-743 were run partly to check earlier dates. Ca. 3000 yr interval between dates from outwash and those from near middle buried soil allows abundant time for deposition of intervening beds and formation of thick, lowest, buried soil. In addition, GSC-741 and GSC-743 give minimum time for development of lowest buried soil and maximum for development of middle soil horizon. The 700-yr difference between GSC-741 and GSC-743 is disconcerting, particularly as latter was, if anything, stratigraphically lower. Reason for difference is not known. GSC-741 mixed with dead gas for counting. Date for GSC-705 based on one 3-day count.

8320 ± 140
GSC-767. Duffield, Alberta **6370 B.C.**

Wood from top of river gravel in abandoned meander of North Saskatchewan R., N of Duffield, Alberta (52° 25′ 33″ N Lat, 114° 16′ 38″ W Long), <10 ft above river. Gravel overlies bedrock and is overlain by clay, and marl with woody peat. Coll. 1966 by L. V. Hills, Univ. of Calgary, Calgary. *Comment* (L.V.H.): date confirms earlier date of 8150 ± 100 yr (S-106, Saskatchewan III) on wood at base of marl, and indicates that during last 8300 yr downcutting by North Saskatchewan R. has been slow. Date based on one 4-day count.

4850 ± 130
GSC-752. Goose Creek Basin, Alberta **2900 B.C.**

Peat 180 cm below surface inside "Prairie mound"-type feature N of Goose Lake, Alberta (54° 22′ 30″ N Lat, 115° 06′ W Long), at alt ca. 2475 ft. Coll. 1966 with Hiller sampler by D. A. St-Onge. *Comment* (D.S.): date indicates that considerable time elapsed between drainage of glacial lake (phase of Glacial Lake Edmonton?) from area and start of organic accumulation in depression. Date based on one 3-day count.

4150 ± 140
GSC-674. Iosegun River Basin, Alberta **2200 B.C.**

Basal peat 320 cm below surface between Iosegun R. and Atikamek Creek, Alberta (54° 34′ N Lat, 116° 48′ W Long), at alt. ca. 2450 ft. Coll. 1965 with Hiller sampler by D. A. St-Onge. *Comment* (D.S.): dates start of accumulation of organic debris in this part of basin of Glacial Lake Rycroft (cf. GSC-551, 6590 ± 150, GSC VI). NaOH-leach omitted from sample pretreatment.

8530 ± 170
GSC-673. Marsh Head Creek, Alberta **6580 B.C.**

Basal peat 270 cm below surface, overlying sand, in valley of Marsh Head Creek, Alberta (54° 13′ N Lat, 116° 55′ W Long), at alt ca. 2940 ft. Coll. 1965 with Hiller sampler by D. A. St-Onge. *Comment* (D.S.): valley was occupied by Little Smoky R. draining E into Athabasca R. when northward drainage was blocked by ice. Date is minimum for abandonment of valley segment by Little Smoky R.; however, dates from deltaic deposits in Glacial Lake Rycroft (GSC-508, 12,190 ± 350, GSC VI; GSC-694, 13,510 ± 230 and GSC-698, 13,580 ± 260; this list) indicate that considerable time elapsed before organic debris started to accumulate. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting. Date based on one 3-day count.

Little Smoky River series, Alberta

Fresh-water gastropod shells in sand in road cut, South Kaybobs Oilfield, Alberta (54° 21′ N Lat, 117° 01′ W Long), at alt ca. 2700 ft. Coll. 1966 by D. A. St-Onge.

13,510 ± 230
GSC-694. Little Smoky River, large shells **11,560 B.C.**

Large clean shells hand-picked out of sample.

13,580 ± 260
GSC-698. Little Smoky River, small shells **11,630 B.C.**

Small shells partly filled with calcareous silt from same sample as GSC-694.

General Comment (D.S.): identical dates indicate that small amount of calcareous silt had no influence on sample age in this locality. Sample is from same locality, but 3 to 5 ft lower in section than GSC-508 (12,190 ± 350, GSC VI); dates sedimentation in Glacial Lake Rycroft (cf. St-Onge, 1967). Sample GSC-694 mixed with dead gas for counting. Each date based on one 3-day count.

GSC-768. Marlboro, Alberta **8830 ± 150**
6880 B.C.

Marl from 4 ft below surface on N side of lake, ca. 3 mi E of Marlboro, Alberta, in LSD 14, sec. 6, tp. 53, rge. 19, W 5th mer. (53° 33′ 30″ N Lat, 116° 43′ 30″ W Long), at alt 3000+ ft. Marl was completely saturated. Sample from hole dug to depth 4 ft; roots of surface vegetation penetrate to this depth. In places marl is overlain by organic material; it is underlain by outwash derived from last Cordilleran glacier. Coll. 1966 by M. A. Roed, Edmonton, Alberta. *Comment* (M.A.R.): date is minimum for deglaciation (cf. dates on Glacial Lake Rycroft from Little Smoky River valley, ca. 55 mi N of Marlboro: GSC-508, 12,190 ± 350, GSC VI; GSC-694, 13,510 ± 230 and GSC-694, 13,580 ± 260, this list).

Banff National Park series, Alberta

Charcoal from loess deposits on kame complex exposed along North Saskatchewan R. SW of highway bridge across river in Banff National Park, Alberta (51° 58′ N Lat, 116° 43′ W Long). Coll. 1965 by A. Dreimanis.

GSC-577. Banff National Park, charcoal (upper) **2120 ± 150**
170 B.C.

Charcoal from 2 charcoal-rich lenses in loess, ca. 3 ft below surface and 0 to 4 in. above "upper continuous volcanic ash layer." Ash is underlain successively by loess, "lower continuous volcanic ash layer," loess, and glaciofluvial gravel. Site is 450 ft SW of highway bridge.

GSC-531. Banff National Park, charcoal (lower) **2670 ± 140**
720 B.C.

Charcoal (single charred piece of wood) from loess, ca. 3 ft below surface and 1 to 2 in. below "upper continuous volcanic ash layer." Loess bed is underlain successively by "lower continuous volcanic ash layer," loess with at least 1 buried soil underlain by charcoal (9330 ± 170 yr old, GSC-332, GSC V), loess and fine sand with rock fragments, and glaciofluvial gravel. Site is 300 ft SW of highway bridge.
General Comment (A.D.): mineralogical, chemical, and textural investigations id. "upper continuous volcanic ash layer" as Bridge R. ash (Westgate and Dreimanis, 1967). Dates bracketing time of deposition agree with GSC-529, 2440 ± 140 (this list; also see Nasmith *et al.*, 1967), a date on peat immediately below Bridge R. ash in Jesmond Bog, British Columbia. NaOH-leach omitted from sample pretreatment of GSC-531. Date GSC-577 based on one 3-day count.

GSC-719. Leviathan Lake, British Columbia **10,270 ± 190**
8320 B.C.

Peat from base of 190-cm-thick bog at W edge of Leviathan Lake, 1 mi E of mouth of Campbell Creek, E side of Kootenay Lake, 3.5 mi NE of Kaslo, British Columbia (49° 57′ 00″ N Lat, 116° 51′ 15″ W

Long). Coll. 1966 with Hiller peat borer by R. J. Fulton. *Comment* (R.J.F.): date is minimum for establishment of vegetation following deglaciation (Fulton, in press). Sample mixed with dead gas for counting.

Meadow Creek series, British Columbia

Wood and peat from borrow pit on E side of Meadow Creek, 1.5 mi W of Duncan Lake dam and 6 mi N of Kootenay Lake, British Columbia (50° 15′ N Lat, 116° 59′ W Long). Pit exposes till overlying nonglacial sediments which overlie a paleosol developed on a 2nd till. Nonglacial sediments are overbank and channel deposits separated into 3 units, in ascending order: 1) silt and gravel, 2) topset gravel and sand, and 3) intermixed sand, gravel, and silt. Paleosol is exposed below upper 2 units but slopes underneath exposure of interstratified silt and gravel (Fulton, in press). Coll. 1965 and 1966 by R. J. Fulton.

43,800 ± 800
GSC-740. Meadow Creek (I) **41,850 B.C.**

Root in growth position 265 cm below top of interstratified silt and gravel. Sample is lowermost dated. Date based on one 1-day and one 3-day count in 5-L counter at 4 atm.

42,300 ± 700
GSC-720. Meadow Creek (II) **40,350 B.C.**

Peat 60 cm below top of interstratified silt and gravel. Date based on two 1-day counts and one 3-day count in 5-L counter at 4 atm.

41,900 ± 600
GSC-733. Meadow Creek (III) **39,950 B.C.**

Roots from upper 10 cm of paleosol. Date based on one 5-day count in 5-L counter at 4 atm.

41,800 ± 600
GSC-716. Meadow Creek (IV) **39,850 B.C.**

Stump rooted in paleosol and buried by topset gravel and sand. Two determinations were made:

in 2-L counter (one 1-day count)	>36,000
in 5-L counter at 4 atm (one 3-day count and one 1-day count)	41,800 ± 600

33,700 ± 300
GSC-542. Meadow Creek (V) **31,750 B.C.**

Wood from silt band within intermixed sand, gravel, and silt unit, 75 cm above paleosol and 30 cm above bed of volcanic ash. Two determinations were made:

in 2-L counter (one 1-day count)	35,700 ± 1500
in 5-L counter at 4 atm (three 1-day counts)	33,700 ± 300

32,710 ± 800
GSC-493. Meadow Creek (VI) **30,760 B.C.**

Wood from a silt bed within intermixed sand, gravel, and silt unit, 195 cm above paleosol.

GSC-715. Meadow Creek (VII) **25,840 ± 320**
23,890 B.C.

Wood from gravel at top of intermixed sand, gravel, and silt unit, 1 m below upper till. Date based on one 3-day count.

General Comment (R.J.F.): sequence of dates from apparently conformable series of sediments indicates that this part of British Columbia was not occupied by ice from at least ca. 44,000 yr B.P. until after ca. 26,000 yr B.P.; previously, peat from 40 ft depth in borehole at Duncan Lake damsite was dated at >39,700 (GSC-219, GSC IV). This nonglacial interval corresponds to Olympia Interglaciation of Armstrong *et al.* (1965).

Nakimu Caves series, British Columbia

Wood samples from Nakimu Caves, Glacier National Park, Selkirk Range, British Columbia (51° 16′ N Lat, 117° 35′ W Long). Coll. 1965 by D. C. Ford, McMaster Univ., Hamilton.

GSC-538. Nakimu Caves (I) **270 ± 140**
A.D. 1680

Wood, at alt ca. 5250 ft, exposed in eroding colluvium outside of and below an important abandoned passage in cave system. Colluvium consists of limestone scree from local cliffs mixed with silt washed from higher, till-mantled plateau.

GSC-574. Nakimu Caves (II) **4350 ± 350**
2400 B.C.

Wood from crack in ceiling of 'Micaschist Passage,' at alt ca. 5020 ft, 270 ft below ground surface, 'Micaschist Passage' is 3rd of sequence of 6 underground channels developed by trunk stream to bypass older, larger channel filled with clastic deposits.

General Comment (D.C.F.): date GSC-538 indicates that since tree lived a phase of periglacial accumulation of colluvium has occurred just below treeline. Wood from GSC-574 must have been emplaced close to time that active enlargement of 'Micaschist Passage' ceased. Date corresponds closely to estimate obtained by extrapolating modern mean rate of limestone solution in trunk stream. Sample GSC-574 mixed with dead gas for counting.

Columbia River Flood Plain series, British Columbia

Samples from test holes drilled in floodplain and delta of Columbia R. S of Revelstoke, British Columbia. Coll. 1966 by R. J. Fulton.

GSC-778. Greenslide, British Columbia (I) **6970 ± 150**
5020 B.C.

Wood fragments from 105-ft depth at ferry 2.5 mi S of Greenslide, E side of Columbia R., 12 mi S of Revelstoke, British Columbia (50° 51′ 20″ N Lat, 118° 06′ 15″ W Long). Coll. with split-tube sampler from rotary drill hole (collar alt 1425 ft) which penetrated 35 ft of gravel overlying 325 ft of medium to fine-grained sand containing pockets of organic detritus.

GSC-798. Greenslide, British Columbia (II) **6700 ± 140**
4750 B.C.

Wood from between 190 and 200 ft depth in same rotary drill hole as GSC-778. Sample coll. from cuttings.

GSC-809. Sidmouth, British Columbia (I) **3480 ± 130**
1530 B.C.

Wood and plant detritus from 165 ft depth at Sidmouth, W side of Columbia R., 24 mi S of Revelstoke, British Columbia (50° 43′ 25″ N Lat, 117° 58′ 10″ W Long). Coll. with split-tube sampler from rotary drill hole (collar alt 1420 ft) which penerated 40 ft of pebbly sand overlying 650 ft of medium to fine-grained sand containing scattered pockets of organic detritus.

GSC-819. Sidmouth, British Columbia (II) **3780 ± 140**
1830 B.C.

Wood fragments from 225 ft depth in same drill hole as GSC-809. Coll. with split-tube sampler.

General Comment (R.J.F.): medium and fine-grained sands are deltaic sediments deposited in Upper Arrow Lake; gravel and pebbly sands are topset and channel materials deposited above finer grained deltaic deposits. Dates indicate Columbia R. delta was extended 12 mi in ca. 3000 to 3500 yr. GSC-778 and GSC-798, similar dates 100 ft apart in Greenslide hole, suggest rapid sedimentation of fine-grained deltaic material. Dates GSC-809 and GSC-819 also are inconclusive. Depending on which way errors are applied, rapid sedimentation or sedimentation as slow as 60 ft in over 700 yr may be indicated. NaOH-leach omitted from pretreatment of GSC-798. GSC-819 mixed with dead gas for counting.

GSC-760. Mt. Breakenridge, British Columbia **5950 ± 140**
4000 B.C.

Fragments of roots (*Abies* sp., id by R. J. Mott) from alt 7000 ft (900 ft above tree line) on W side of Mt. Breakenridge, ca. 60 mi NE of Vancouver, British Columbia (49° 44′ N Lat, 121° 57′ W Long). Sample from relatively sheltered site on SE side of nunatak. Coll. 1966 by E. D. Dodson, Falconbridge Nickel Mines, Vanvouver; subm. by J. O. Wheeler. *Comment* (E.D.D. and J.O.W.): wood exposed by glacier retreat indicates that prior to Neoglacial maximum trees grew at least 900 feet above present tree line. Other dated occurrences of high-level wood exposed by glacial retreat in British Columbia are GSC-169 (3760 ± 140, GSC III) from Downie Creek, GSC-197 (5470 ± 140, GSC V) from Ruddock Creek, both ca. 200 mi NE, and Y-140 bis (5260 ± 200, Yale V; cf. Y-140, 5850 ± 180, Yale II) from Mt. Garibaldi 60 mi NW of Mt. Breakenridge (cf. also GSC-718, 5250 ± 130, wood from Yukon, this list). Date based on one 3-day count.

Jesmond Bog series, British Columbia

Peat from 2 levels in Borehole #2, 500 ft from N edge of Jesmond

Bog, Jesmond, British Columbia (51° 05′ N Lat, 121° 59′ W Long), at alt ca. 3700 ft. Coll. 1965 with Hiller sampler by W. H. Mathews, H. W. Nasmith, G. E. Rouse, and C. Towers; subm. by W. H. Mathews, Univ. of British Columbia, Vancouver.

GSC-511. Jesmond Bog, basal peat **9210 ± 150**
7260 B.C.

Peat from 630 to 640 cm depth, below Mazama(?) ash layer at 433 cm; gravel at 670 cm.

GSC-529. Jesmond Bog, upper peat **2440 ± 140**
490 B.C.

Peat from 160 to 170 cm depth, immediately below Bridge R. ash (142 to 160 cm).

General Comment (W.H.M.): GSC-511 gives reasonable minimum age for start of postglacial bog growth at a site close to latest Wisconsin axis of Cordilleran ice sheet in Interior Plateau of British Columbia (Glacial Map of Canada, 1958). GSC-529 gives maximum age for Bridge R. ash (Nasmith *et al.*, 1967) and agrees with limiting dates obtained by Westgate and Dreimanis (1967) of 2120 ± 150 yr (GSC-577) and 2760 ± 140 yr (GSC-531, both in this list). NaOH-leach omitted from pretreatment of both samples.

Quesnel series, British Columbia

Wood from 3 sites near Quesnel, British Columbia. Coll. 1966 and 1967 by J. E. Armstrong.

GSC-825. Quesnel, British Columbia (I) **5790 ± 140**
3840 B.C.

Wood from sand bed exposed in 'Big Slide' on E bank Fraser R. ca. 10 mi N of Quesnel (53° 05′ N Lat, 122° 31′ W Long). Sand bed overlies slide deposit resting on late Tertiary sediments and underlies fine sand and silt, and a till-like deposit. All form part of Fraser R. terrace at ca. 200 ft above river; post-Tertiary deposits are ca. 100 ft thick. *Comment* (J.E.A.): date indicates that all deposits above late Tertiary sediments were laid down in postglacial time and till-like material overlying sand bed is redeposited. Fraser R. has incised more than 200 ft since deposition of wood-bearing sand. Date based on one 3-day count.

GSC-853. Quesnel, British Columbia (II) **6640 ± 140**
4690 B.C.

Wood from bed of sand exposed along S bank Cottonwood R. ca. 18 mi E of Quesnel (53° 05′ N Lat, 122° 15′ 30″ W Long). Wood is ca. 5 ft above base of alluvial terrace, ca. 30 ft high. Downstream, similar deposits overlie till. *Comment* (J.E.A.): date indicates sediments are postglacial; and, with GSC-825 (5790 ± 140, this series) shows period of aggradation along rivers lasted at least ca. 850 yr. Both rivers are now degrading. Date based on one 3-day count.

GSC-851. Quesnel, British Columbia (III) **>40,000**

Wood from till overlying late Tertiary sediments, containing organic material, on E bank Fraser R. ca 1 mi N of Quesnel (53° 00′ N Lat, 122° 31′ W Long). Wood is spruce or larch; associated pollen appear to be mainly late Tertiary species. *Comment* (J.E.A.): date suggests wood possibly derived from underlying late Tertiary sediments, although similar pieces of wood were not found in Tertiary deposits near site. Nature of pollen suggests similar source. Date based on one 1-day count.

960 ± 130
GSC-852. North Vancouver, British Columbia **A.D. 990**

Shells, mainly large pectens (*Solen sicarius*), coll. from marine clay during excavation for new dock on N side Burrard Inlet in North Vancouver, British Columbia (49° 18′ N Lat, 123° 05′ W Long), at alt −30 ft. Recent distribution of this species is from Vancouver Island to Baja California on sandy mud flats and at max. depth 150 ft. Coll. 1966 by W. Barker and S. Wooster; subm. by J. E. Armstrong. *Comment* (J.E.A.): date confirms assumption, based on presence of large pectens, that shell-bearing marine clay is of recent origin. Pretreatment involved leaching of outermost 50% of shell. Date based on one 3-day count.

C. Northern Canada, Mainland

5250 ± 130
GSC-718. Kletsan Creek, Yukon **3300 B.C.**

Wood from fresh exposure on SE bank, W tributary of Kletsan Creek, Yukon Territory (61° 31′ N Lat, 140° 58′ W Long), from 2 ft below top of unoxidized gravel overlying oxidized(?) till and underlying pebbly silt, volcanic ash, and turf. Coll. 1966 by V. Rampton. *Comment* (V.R.): relationship of gravel to climatic and glacial history of region is presently unclear; however, site is ca. 200 ft above tree line, suggesting conditions formerly more favorable to tree growth (cf. GSC-760, 5950 ± 140, this list, for comments on trees above tree line in S British Columbia). Date based on one 3-day count.

GSC-524. Stewart River, Yukon (II) **>42,900**

Wood from volcanic ash, S side Stewart R., Yukon Territory (63° 30.2′ N Lat, 137° 16′ W Long). Sample from gully 1300 ft downstream of discontinuous exposure. Ash layer 1 to 5 in. thick lies in surface layer of organic silt and peat, overlying gravel, till, and gravel. Coll. 1965 by O. L. Hughes. *Comment* (O.L.H.): upper gravel and till are products of Reid advance (Bostock, 1966); hence date is minimum for that event. Wood from similar ash exposed 43 mi downstream is >38,940 yr old (GSC-342, GSC V). Date based on one 3-day count.

1590 ± 150
GSC-565. McQuesten River, Yukon **A.D. 360**

Charcoal from top of buried soil in N bank McQuesten R., 0.5 mi W of Vancouver Creek, Yukon Territory, (63° 38′ N Lat, 137° 06′ W Long).

Soil is developed in fine sand overlying gravel, sand, and silt, and is overlain by loess with 2 weak soils. Coll. 1965 by O. L. Hughes. *Comment* (O.L.H.): charcoal probably resulted from forest fire; similar loess is presently being deposited at top of bank. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

GSC-472. Gravel Lake, Yukon **10,930 ± 190**
8980 B.C.

Gyttja from base of 3 m-thick organic layer, SE end Gravel Lake, Yukon Territory (63° 48.5′ N Lat, 137° 53.5′ W Long). Water depth 1.5 m. Coll. 1965 with Hiller peat sampler by O. L. Hughes. *Comment* (O.L.H.): Gravel Lake lies in Tintina Trench on thick drift fill presumed older than deposits of Reid advance and hence >42,900 yr old (GSC-524, this list). Lake is impounded on NE side by large fan and at its NW (outlet) end by extensive bog; hence lake may be much younger than underlying drift. NaOH-leach omitted from sample pretreatment. Sample mixed with dead gas for counting.

GSC-527. Hunker Creek, Yukon **>53,900**

Spruce wood from Fant and Norbeck placer pit, at limit of Hunker Creek between Too Much Gold and Gold Bottom Creeks, Klondike District, Yukon Territory (63° 58′ N Lat, 138° 57′ W Long). Taken from organic silt overlying auriferous gravel and overlain, successively, by silty gravel with mammoth, horse, and bison remains, organic silt, and peat. Area has not been glaciated. Coll. 1960 by O. L. Hughes. *Comment* (O.L.H.): date is based on one 4-day count in 5-L counter at 4 atm and supercedes earlier date of >35,000 (I(GSC)-181, Isotopes II) on same sample.

White River ash series, Yukon

Ash derived from source near Yukon-Alaska Boundary, 10 mi S of White R., distributed in E Alaska and south-central Yukon Territory as 2 lobes, 1 extending northward, 1 eastward (Bostock, 1952). Fernald (1962) reported ages of 1520 ± 100 (I-176, peat above ash) and 1750 ± 110 (I-275, peat below ash) from samples from upper Tanana Valley, Alaska, from which Stuiver *et al.* (1964) calculated an age of 1635 ± 80 yr for ash of N lobe. They reported ages of 1460 ± 70 yr (Y-1363, peat above ash) and 1390 ± 70 (Y-1390, peat below ash) from near Kaskawulsh Glacier, Yukon Territory; they calculated age of 1425 ± 50 yr for ash of E lobe, and suggested 2 lobes possibly represent separate eruptions of ash 200 yr apart.

GSC-400. Yukon River, Yukon **1990 ± 130**
40 B.C.

Wood from silt immediately beneath 2-in-thick ash, E bank Yukon R., 1.3 mi above mouth of Coal Creek (64° 28′ N Lat, 140° 27.5′ W Long). Ash is 2.5 ft below flood plain surface 4 ft above high water level of Yukon R. Coll. 1961 by O. L. Hughes.

1200 ± 140
GSC-408. Finlayson Lake map-area, Yukon **A.D. 750**

Peat from immediately beneath 2-in-thick ash layer, 14 in. below surface of string bog between Black and North R., (61° 06′ N Lat, 130° 25′ W Long). Coll. 1959 by L. H. Green.

1240 ± 130
GSC-343. 'Glacier Creek,' Yukon **A.D. 710**

Peat from 1 cm below to 1 cm above ash layer 1 to 2 mm thick at depth 0.7 m in bog on W side North Klondike R. (64° 08.6′ N Lat, 138° 32.5′ W Long). Bog lies between river and Dempster Highway 1.5 mi S of crossing of 'Glacier Creek.' Coll. 1964 by O. L. Hughes.
General Comment (O.L.H.): age of GSC-400 is compatible with its position beneath ash of N lobe. GSC-408 lies beneath ash of E lobe, and GSC-343 lies between 2 lobes as delineated by Bostock (1952), yet dates are some 200 yr younger than age of E lobe as reported by Stuiver *et al.* (1964). Ash blanket within E lobe is remarkably continuous single layer; it is unlikely that these localities represent a separate, hitherto unsuspected ash fall. No explanation for discrepancy is available. Each of 3 dates based on one 3-day count.

North Fork Pass series, Ogilvie Mountains, Yukon

During last advance of valley glaciers in Ogilvie Mts., Yukon Territory, ice advanced out of headwaters of East Blackstone R. into N continuation of North Fork Pass, where it diverged N and S to form a "hammer-head"-shaped moraine, S loop of which now forms divide in North Fork Pass (Vernon and Hughes, 1966, p. 12). Samples coll. 1965 within limits of moraine system by O. L. Hughes. Borings were made with SIPRE-type ice-corer (cf. Hughes and Terasmae, 1963).

5070 ± 130
GSC-411. East Blackstone River, Yukon **3120 B.C.**

Organic silt from E bank East Blackstone R., ca. 0.5 mi upstream from crossing of Dempster Hwy and river (64° 35.7′ N Lat, 138° 20′ W Long). Sample coll. at downstream end of exposure near base of 10 ft sec. of fluvial sediments, mainly gravel, with peat and organic silt, disconformably overlying glaciolacustrine(?) silt.

3100 ± 130
GSC-416. Dempster Highway, Yukon (I) **1150 B.C.**

Basal peat from 4.6 to 4.75 ft depth in boring at margin of small pond, at N fringe of moraine, W side Dempster Hwy at Mile 55.8 (64° 36′ N Lat, 138° 22.5′ W Long). Peat underlain by till(?).

3180 ± 130
GSC-469. Dempster Highway, Yukon (II) **1230 B.C.**

Basal peat from 4.15 to 4.3 ft depth in boring, 16 ft E of GSC-416, small pond, W side Dempster Hwy at Mile 55.8 (64° 36′ N Lat, 138° 22.5′ W Long). Peat underlain by till(?) or coarse outwash(?).

11,250 ± 160
GSC-470. North Fork Pass, Yukon (I) **9300 B.C.**

Organic silt with twigs (dwarf birch?) from 16 ft depth in boring in peat hummock, NE side of large pond in flat N of moraine loop forming divide in North Fork Pass (64° 35′ N Lat, 138° 17.5′ W Long); 6 ft fibrous peat overlies 10+ ft silty sand, grit, and pebbles with sparse organic material.

7050 ± 140
GSC-471. North Fork Pass, Yukon (II) **5100 B.C.**

Organic silt with twigs (dwarf birch?) from 6.6 to 6.8 ft depth in boring in peat hummock 200 ft NW of GSC-470 (64° 35′ N Lat, 138° 17.5′ W Long); 4 ft fibrous peat overlies 2.8+ ft of silt with grit. *General Comment* (O.L.H.): minimum age of moraine in North Fork Pass, previously 7510 ± 100 yr (GSC-50, GSC I), extended by GSC-470 to 11,250 ± 160. Date may be older than beginning of loess deposition 10,900 ± 150 yr ago (GSC-311, GSC V) in bog sequence near Chapman Lake, 16 mi N of moraine system, assumed to correlate with last glacial advance. If age difference is real (*i.e.*, not within limits of error of dating method) and if silt deposition was related to glacial advance, difference may be due to one or both of 2 factors: 1) change of East Blackstone R. from normal to braided stream that was source of loess, may have taken place during retreat following advance; 2) time lag may have occurred between change in stream regimen near ice margin and response of stream to change downstream. Pretreatment of GSC-411 included *cold* NaOH-leach. Dates for GSC-411 and GSC-470 each based on one 3-day count.

East Blackstone River series, Yukon

Peat and organic silt from boreholes in permanently frozen bog bordering small pond, in moraine where unnamed valley opens from W into valley of East Blackstone R., Yukon Territory (64° 38′ N Lat, 138° 24′ W Long). Coll. 1965 with SIPRE-type ice-corer by O.L. Hughes.

6840 ± 150
GSC-415. East Blackstone River, peat **4890 B.C.**

Peat from 5.3 to 5.5 ft depth in boring on W side of pond.

13,740 ± 190
GSC-515. East Blackstone River, organic silt **11,790 B.C.**

Organic silt from 12.5 to 13 ft depth in boring on E side of pond. *General Comment* (O.L.H.): date GSC-515 is minimum for establishment of vegetation on moraine, mapped as correlative with moraine system in North Fork Pass (Vernon and Hughes, 1966) that is more than 11,250 ± 160 yr old (GSC-470, this list); moraine may correlate more closely with older moraine system near Chapman Lake, ca. 16 mi N, older than 13,870 ± 180 yr (GSC-296, GSC V). NaOH-leach omitted from pretreatment of GSC-515. Date GSC-415 based on one 4-day count.

5290 ± 140
3340 B.C.

GSC-409. Blackstone River, Yukon (II)

Organic silt from 8.7 ft depth in boring made with SIPRE-type ice-corer on SW edge of small pond, W of Blackstone R. and 5.2 mi N of Chapman Lake, Yukon Territory (64° 56′ N Lat, 138° 20′ W Long). Pond is in subdued moraine beyond limit of and higher than moraine of "intermediate" age (older than 13,870 ± 180, GSC-296, GSC V) in vicinity of Chapman Lake. Coll. 1964 by O. L. Hughes. *Comment* (O.L.H.): sample from depth 11.4 ft in same boring (GSC-295, 6650 ± 140, GSC V) was younger than expected; this sample, dated as check, is consistent with GSC-295. Organic accumulation at locality began long after construction of moraine. NaOH-leach omitted from sample pretreatment.

9750 ± 150
7800 B.C.

GSC-586. Snake River, Yukon (II)

Silty peat from base of 10-ft sec. of alluvial silt, overlying successively gravel, organic silt with wood, boulder gravel, and bedrock of a terrace on W side of Snake R., Yukon Territory (65° 41′ N Lat, 133° 26′ W Long). Coll. 1962 by O. L. Hughes. *Comment* (O.L.H..): wood from beneath gravel is >31,000 yr old (GSC-181, GSC IV). Gravel interpreted as outwash of late-Wisconsin valley glaciation in upper Snake R. Outwash deposition ceased prior to 9750 B.P.; river was incised ca. 225 ft after that date. NaOH-leach omitted from sample pretreatment.

2280 ± 150
A.D. 330

GSC-785. Gordon Bay, Northwest Territories

Fragments of whole shells of marine pelecypods, mainly *Portlandia arctica* and *Macoma calcarea* (id. by F. J. E. Wagner), from exposure at head of Gordon Bay, Bathurst Inlet, Northwest Territories (66° 49.5′ N Lat, 107° 05′ W Long), at alt 4 to 5 ft, within basal silt-clay unit with scattered plant detritus. Coll. 1962 by W. Blake, Jr. *Comment* (W.B., Jr.,): date is surprisingly young, in view of dates 2170 ± 140 (GSC-138) and 1850 ± 140 (GSC-137, both in GSC III) on plant detritus at alt 19 ft and shells at alt 24 ft in sec. Possibly thin shells were contaminated, and small sample (5.5 g) allowed no sample pretreatment to remove outer shell layers. Sample mixed with dead gas for counting. Date based on one 4-day count.

8720 ± 150
6770 B.C.

GSC-737. Hope Bay, Northwest Territories

Whole shells and fragments of marine pelecypods *Hiatella arctica* and *Mya truncata* from surface of sand-silt deposit 3.5 mi W of Hope Bay, S side Melville Sound, Northwest Territories (68° 06.5′ N Lat, 106° 54′ W Long), at alt ca. 470 ft. Coll. 1962 by H. H. Bostock for W. Blake, Jr. *Comment* (W.B., Jr.): shells are older than other shells at similar alt near Bathurst Inlet (cf. GSC-344, 8360 ± 150, alt 480 ft; GSC-594, 8220 ± 160, alt 480 ft; GSC-604, 8070 ± 160, alt 500 ft; GSC-636, 8230 ±

140, alt 490 ft; all listed in GSC VI), indicating relative sea level 8700 yr ago was above alt of coll. site. Date based on one 3-day count.

GSC-110-2. MacAlpine Lake, Northwest Territories **8090 ± 160** **6140 B.C.**

Whole shells and fragments of marine pelecypod *Hiatella arctica* from ground surface down to 1-ft depth in silt, alt ca. 600 ft. 18 mi NW of MacAlpine Lake, Northwest Territories (66° 49′ N Lat, 103° 28′ W Long). Coll. 1962 by W. Blake, Jr. *Comment* (W.B., Jr.): re-dating done as sample is critical for age of MacAlpine Lake Moraine. Date agrees closely with original date 8160 ± 140 (GSC-110, GSC III; Blake 1963, 1966), on which pretreatment included leaching of outer 10% of shell. For GSC-110-2 pretreatment involved leaching of outer 50% of shell. Date based on one 3-day count.

GSC-693. Back River, Northwest Territories **6140 ± 150** **4190 B.C.**

Marine pelecypod shell fragments (*Mytilus edulis*) from fine sand in river bank, cut into probable deltaic terrace, alt 160 ft, S side Back R., 8 mi SW of mouth of Hermann R., Northwest Territories (66° 08′ N Lat, 96° 18′ W Long). Coll. 1966 by B. G. Craig. *Comment* (B.G.C.): date, on sample ca. 340 ft below marine limit (Craig, 1961) may give age of relative stand of sea at 160 ft. Date is minimum for withdrawal of ice to SE from MacAlpine Lake end moraine (Blake, 1963; Craig, 1965) and agrees closely with date on marine shells (I-1224, 6015 ± 150, GSC V; Blake, 1966) from Beverly Lake, Thelon R. Valley.

GSC-725. Baker Lake (21 ft) shells **5220 ± 140** **3270 B.C.**

Marine pelecypod shells (*Hiatella arctica*) from ground surface and up to 18 in. depth in sandy gravel, alt 21 ft, Baker Lake settlement, Northwest Territories (64° 19′ N Lat, 96° 03′ W Long). Coll. 1966 by J. G. Fyles and B. G. Craig. *Comment* (B.G.C. and J.G.F.): shells form part of Thelon Shell series (GSC V) and were assumed to have been deposited near sea level. Other samples of similar age in series are considerably higher (*e.g.*, GSC-299, 5480 ± 150, alt 295 ft, GSC V); age of tundra-plant debris from similar alt assumed to date stand of sea at 25 to 30 ft (GSC-23, 1800 ± 60, GSC I) is considerably younger, indicating this sample was either deposited in deep water or was reworked from higher alt. Date based on one 3-day count.

GSC-691. Hall Beach, Northwest Territories **1020 ± 130** **A.D. 930**

Articulated marine pelecypod shells (*Mya truncata*) at 3-ft depth in stony silt in sec., ca. 0.25 mi E of airstrip at Hall Beach, Melville Peninsula, Northwest Territories (68° 47′ N Lat, 81° 14′ W Long), at alt ca. 23 ft. Coll. 1966 by J. T. Andrews, Geog. Branch, Ottawa, for B. G. Craig. *Comment* (J.T.A. and B.G.C.): date indicates average rate of uplift for last 1000 yr in this area is ca. 2 ft/100 yr (cf. Andrews, 1966).

Gilmour Island series, Ottawa Islands, Northwest Territories

Marine shells from Gilmour Island, Ottawa Islands, Northwest Territories (59° 50′ N Lat, 80° 00′ W Long), ca. 68 mi W of E coast of Hudson Bay. Coll. 1966 by J. T. Andrews and G. Falconer, Geog. Branch, Ottawa.

GSC-688. Gilmour Island, 485 ft — **6940 ± 140** / **4990 B.C.**

Whole shells and fragments, some weathered, of *Mya truncata, Hiatella arctica,* and *Balanus* sp. on and in beach gravel at alt 485 ft, ca. 16 to 23 ft below local marine limit.

GSC-706. Gilmour Island, 455 ft — **7430 ± 180** / **5480 B.C.**

Marine pelecypod shells (*Hiatella arctica, Mya truncata,* and *Macoma* sp.) from surface of delta at alt 455 ft, less than 2 mi W of GSC-688. Local marine limit at ca. 510 ft. Shells polished, presumably from sand blast.
General Comment (J.T.A. and G.F.): date GSC-688 was unexpectedly young compared with dates from Churchill, Manitoba (GSC-92, 7270 ± 120, GSC III) and from S of James Bay (I (GSC)-14, 7875 ± 200, Isotopes I; Gro-1698, 7280 ± 80, Terasmae and Hughes, 1960; I-1256, 7523 ± 200, Blake, 1966); younger date for higher sample might be due to contamination, as this sample was larger but much more fragmented than GSC-706. Partly from rebound curve calculated from lower sites, GSC-706 is assumed a closer approximation to time of deglaciation, although still younger than expected. Dates suggest late deglaciation of Ottawa Islands. Sample GSC-706 mixed with dead gas for counting; date based on one 3-day count.

Sugluk Inlet series, Quebec

Shells and organic debris from marine sediments near Sugluk Inlet, Quebec. Coll. 1962 and 1965 by B. Matthews, McGill Univ., Montreal; subm. by W. Blake, Jr.

GSC-672. Sugluk Inlet, shells — **7970 ± 250** / **6020 B.C.**

Shell fragments of *Hiatella arctica* in silty-clay at alt 324 ft in 'Rivière Sugluk' valley near Sugluk village (62° 12′ N Lat, 75° 38′ W Long). Sample coll. from mud boils (near distal side of breached end moraine) from highest fossiliferous marine deposits on SE side of Sugluk Inlet, near local marine limit (alt ca. 340 ft). *Comment* (B.M.): result compares favorably with I-729 (7650 ± 250, Matthews, 1966) from near marine limit on NW side of Sugluk Inlet. Date gives minimum age for nearby end moraine and general deglaciation of S shore of Hudson Strait. Few species present (only *Mya truncata* and *Balanus* sp. besides *H. arctica*) compared with low-level deposits (>50 spp.; cf. Matthews, 1967) suggest rigorous marine conditions ca. 8000 yr ago. Sample mixed with dead gas for counting. Date based on one 4-day count.

GSC-812. Sugluk Inlet, organic debris (I) **4770 ± 140**
2820 B.C.

Fragments of mosses, ericaceous remains, *Salix* twigs and leaves from 1.5 in.-thick peat in marine shelly sand with thin organic (salt marsh) layers. Sample from alt 78 ft (14 ft below surface of marine terrace) from river-bank exposure near Sugluk village (62° 13′ N Lat, 75° 38′ W Long). *Comment* (B.M.): date gives minimum age of "Upper Tunit Beach" (100 ft alt). Shells from raised beach at similar alt at Kugluk Cove are 6070 ± 140 (N-285, RIKEN III; Matthews, 1967), giving maximum age of "Upper Tunit Beach." GSC-812 probably more closely approximates time of beach formation than does N-285. Thin peaty layers (containing fossil mosses, with rhizoids, in living position) interbedded with fossiliferous marine material in both "Upper Tunit Beach" and "Hemithyris Beach" (see GSC-818, this series) suggest beaches were formed during marine transgression(s). Sample mixed with dead gas for counting. Date based on one 3-day count.

GSC-818. Sugluk Inlet, organic debris (II) **2840 ± 160**
890 B.C.

Organic deposit (mainly mosses in living position and some *Salix* twigs) from 0.5 in.-thick peat at alt 13 ft in interbedded fossiliferous marine silty sand and thin peaty layers, near Sugluk village (62° 13′ N Lat, 75° 39′ W Long). Sample coll. from cut-bank exposure in lowest well-formed marine terrace (alt 15-20 ft) in N Ungava. *Comment* (B.M.): date gives age of "*Hemithyris* Beach" (alt 20 ft) and suggests uplift in Sugluk Inlet in last 3000 yr may have been less than 6 in./100 yr. Date presumed closer to correct age of beach than N-282 (5220 ± 130, RIKEN III), date on shells at 20 ft, Sugluk Inlet; also see GSC-537 (1600 ± 140, GSC VI), date on detrital peat at alt 28 ft, Sugluk Inlet, Pollen studies by D. D. Bartley (Botany Dept., Leeds Univ.) indicate high values of long distance types in sample; i.e., conifer pollen forms 45.5% of total pollen excluding spores. Either climate was warmer 2800 yr ago, resulting in northward shift of forest-tundra boundary, or *Pinus* and *Picea* are over-represented because of decrease in pollen rain from local species of plants. Presence of mollusc *Periploma papyratium* in marine silt below dated peat may indicate slightly higher sea temperature 2800 yr ago than at present. Sample mixed with dead gas for counting.

GSC-801. Deception Bay, Quebec **6080 ± 160**
4130 B.C.

Shells of *Mya truncata* from 1-ft-thick layer of shelly gravel with organic debris, alt 180 ft, in gravel pit in marine terrace remnant, SW side Deception Bay, Quebec (62° 08′ N Lat, 74° 41′ W Long). Gravel overlies fossiliferous silt and is overlain by solifluction material and beach shingle. Coll. 1965 by B. Matthews; subm. by W. Blake, Jr. *Comment* (B.M.): date gives approx. age of "*Axinopsida* Beach" (180 ft alt), traceable along coast of N Ungava. Abundant plant remains and intertidal and shallow water molluscs (i.e., *Littorina saxatilis, Acmaea testudinalis, Axinopsida orbiculata,* and *Mytilus edulis*) in beach deposit suggest slightly better climate and sea-ice conditions when beach formed than at present. Date based on one 3-day count.

GSC-697. Tasisuak Lake, Labrador **4060 ± 130**
2110 B.C.

Marine pelecypod shells (*Mya truncata, Mya arenaria, Clinocardium ciliatum, Hiatella arctica, Serripes groenlandicum, Chlamys islandicus;* id. by K. V. W. Palmer, Paleontological Res. Inst., Ithaca, New York) from S shore of Tasisuak Lake, Labrador (56° 37′ 49″ N Lat, 62° 33′ 55″ W Long), at alt ca. 10 ft. Coll. 1962 by E. P. Wheeler II, Cornell Univ., Ithaca, New York; subm. by J. T. Andrews. *Comment* (E.P.W.): shell fragments occurred in silt but most shells were concentrated by wave-action on beach, which implies relative sealevel was considerably above present to allow suitable conditions of salinity in narrow fiord valley where silt was being deposited. Coarse deltaic deposits rise ca. 20 ft above lake; date is minimum for relative sealevel at alt 30 ft. Date based on one 4-day count.

D. Northern Canada, Arctic Archipelago

GSC-708. Barrier Inlet, Baffin Island (solifluction) **1790 ± 130**
A.D. 160

Black organic debris overlying sand and underlying solifluction debris, ca. 5 mi N of head of Barrier Inlet, Baffin Island Northwest Territories (62° 34′ N Lat, 68° 52′ W Long), at estimated alt ca. 125 ft. Coll. 1965 by W. Blake, Jr. *Comment* (W.B., Jr.): solifluction debris over-rode vegetation earlier at this site than at site near Lake Harbour (GSC-591, 680 ± 180, GSC VI). Date is minimum for emergence. NaOH-leach omitted from sample pretreatment.

GSC-827. 'Iqaluaaluit' Fiord, Baffin Island **6650 ± 180**
4700 B.C.

Marine pelecypod shells (*Mya truncata, Portlandia arctica*) sparsely distributed on surface of silty clay at outlet of unnamed lake, 1 mi S of middle part of 'Iqaluaaluit' Fiord, Baffin Island, Northwest Territories (68° 32′ N Lat, 68° 26.5′ W Long), at alt ca. 130 ft. Coll. 1966 by P. Lewis for J. T. Andrews. *Comment* (J.T.A.): date may refer either to maximum marine submergence at alt ca. 185 ft or to readvance during which ice-contact deltaic sands at alt ca. 160 ft were deposited. Both events may have occurred within limits of error of date, *i.e.*, between 6830 and 6470 yr B.P. Because of small sample (6.0 g), only outer 10% removed before dating. Sample mixed with dead gas for counting. Date based on one 4-day count.

Ekalugad Fiord series, Baffin Island

Marine pelecypod shells from 2 localities along S side of Ekalugad Fiord, Baffin Island, Northwest Territories.

GSC-707. 'Qammattalik' **9180 ± 1140**
7230 B.C.

Shells, mainly *Portlandia arctica* but also *Mya truncata* and *Clinocardium ciliatum*, from within and surface of massive clay deposits 0.5 mi SE of 'Qammattalik' ("Fox-Charlie Bay"), Baffin Island (68° 42.8′ N Lat, 68° 39′ W Long), at alt ca. 180 ft. Local marine limit at alt ca. 235 ft. Coll. 1966 by J. T. Andrews and J. T. Buckley, Geog. Branch, Ottawa.

GSC-739. 'Kanguursit' **6930 ± 150**
4980 B.C.

Shells, mainly *Mya truncata* and *Portlandia arctica,* but also *Serripes groenlandicus* and *Clinocardium ciliatum* scattered sparsely within blue-black clay 0.3 mi SE of 'Kanguursit' and ca. 1.5 mi E of mouth of 'South Ekalugad R.,' Baffin Island (68° 44′ N Lat, 68° 56′ W Long), at alt. ca. 110 ft. Local marine limit at alt ca. 130 ft. Clay overlain by deltaic shallow-water deposits. Coll. 1966 by J. T. Buckley.
General Comment (J.T.A. and J.T.B.): moraines E of 'Qammattalik' deposited during readvance phase following deposition of clay from which shells for GSC-707 were coll. Moraines relating to readvance are traceable for >100 mi in Ekalugad Fiord-Kangok Fiord area. Best age estimate of this phase, bracketed by other radiocarbon dates (Andrews, 1967) is ca. 7900 yr B.P., *i.e.*, close to lower confidence limit on GSC-707, 8040 yr B.P. GSC-739 postdates readvance. Both samples were small with thin shells. Date for GSC-707 (7.1 g sample) based on one 4-day count. For GSC-739 (10.6 g) only outer 5% of shell removed before dating; date based on one 5-day count. Both samples mixed with dead gas for counting.

GSC-813. Pitchford Fiord, Baffin Island **8630 ± 190**
6680 B.C.

Whole shells and fragments of marine pelecypod, *Hiatella arctica,* from bedded fine sand and silt 0.75 mi S of head of Pitchforth Fiord, Baffin Island, Northwest Territories (68° 57.5′ N Lat, 68° 34′ W Long). Beds containing shells traced to surface at alt 180 ft; local marine limit at alt ca. 225 ft. Coll. 1966 by J. T. Andrews. *Comment* (J.T.A.): date is minimum deglaciation of innermost part of Pitchforth Fiord. No sample pretreatment as only 5.6 g subm. Sample mixed with dead gas for counting. Date based on one 4-day count.

GSC-814. Dewar Lakes, Baffin Island **610 ± 160**
A.D. 1340

Organic material at 2 ft depth in frozen ground (July 23rd) ca. 12 mi NW of Dewar Lakes DEW-Line Site, Baffin Island, Northwest Territories (68° 47′ N Lat, 71° 31′ W Long), at alt ca. 1850 ft. Sample probably not lowest organic material in sec. Coll. 1966 by D. M. Barnett, Geog. Branch, Ottawa. *Comment* (D.M.B.): date is minimum for deglaciation but is younger than I-2414 (1360 ± 105; Andrews, 1967), basal organic debris from section 8 mi E. A moraine occurs between the 2 sites. Sample mixed with dead gas for counting.

Clyde Inlet series, Baffin Island

Samples from distinct delta levels at head of Clyde Inlet, Baffin Island, Northwest Territories (69° 51′ N Lat, 70° 29′ W Long). Coll. 1965 by D. M. Barnett.

GSC-583. Clyde Inlet, 16 ft shells **2770 ± 140**
820 B.C.

Whole marine pelecypod shells (*Hiatella arctica* and *Mya truncata*) at alt 16 ft in foreset beds of prominent low-level delta (alt ca. 20 ft).

GSC-584. Clyde Inlet, 16 ft plant debris **3450 ± 170**
1500 B.C.

Plant debris at alt 16 ft in foreset beds of prominent low-level delta (alt ca. 20 ft). Debris is stratigraphically below shells (GSC-583) though from adjacent stratum.

GSC-631. Clyde Inlet, 95 ft shells **6220 ± 140**
4270 B.C.

Whole valves of marine pelecypods (*Hiatella arctica*) in coarse sand with some cobbles, associated with delta level at alt 95 ft.

General Comment (D.M.B.): the 3 dates, with date on shells at alt 165 ft (I-1932, 7940 ± 130, Andrews, 1967; cf. *Comment* under GSC-556, 7740 ± 140, GSC VI, date on shells from outer Clyde Inlet), illustrate decreasing rate of land emergence with time at head of Clyde Inlet. For GSC-584 NaOH-leach omitted from sample pretreatment; sample mixed with dead gas for counting. Dates GSC-583 and GSC-631 each based on one 3-day count.

Sam Ford Fiord series, Baffin Island

Marine molluscs from 2 sites in inner Sam Ford Fiord, Baffin Island, Northwest Territories. Coll. 1965 by J. E. Smith, Geog. Branch, Ottawa.

GSC-630. Sam Ford Fiord, 175 ft **8000 ± 150**
6050 B.C.

Whole valves and fragments of marine pelecypods in horizontal position in silt and clay, ca. 3 mi NNE of head of Sam Ford Fiord, Baffin Island (70° 03′ N Lat, 71° 29′ W Long), at alt ca. 175 ft. Shells coll. at 1 ft depth.

GSC-633. Sam Ford Fiord, 165 ft **6270 ± 150**
4320 B.C.

Marine molluscs, not *in situ*, from 10 in. below surface in gully in clay ca. 14.5 mi NNE of head of Sam Ford Fiord, Baffin Island (70° 12′ N Lat, 71° 20′ W Long), at alt ca. 165 ft.

General Comment (J.E.S.): both samples are contained in materials supposedly pushed by ice during readvance. However, comparison with other dates obtained from Sam Ford Fiord suggests samples GSC-630 and GSC-633 probably were interchanged in field; *i.e.*, GSC-633 is not compatible with I-1553 (7500 ± 200, Isotopes V), shells from alt ca. 205 ft 14.5 mi NNE from fiord head (3 ft below outwash delta on distal side of lateral moraine), as shells are interpreted as either contemporaneous with culmination of advance (to Terminal Stage 1 of Smith, 1966) and building of moraine, or as plowed up during readvance to present position of moraine (Falconer *et al.*, 1965). Likewise, GSC-630 is not compatible with I-1556 (6240 ± 140, Isotopes V) at alt ca. 150 ft 1.0 mi S of fiord head. Both samples mixed with dead gas for counting. Date for GSC-630 based on one 3-day count.

GSC-452. Holder Hills, Ellesmere Island **1380 ± 130**
A.D. 570

Bone from whale skull on beach near Holder Hills, Ellesmere Island (78° 54′ N Lat, 85° 10′ W Long) at alt ca. 8 ft. Coll. 1962 by W. O. Kupsch, J. C. Sproule Assocs. *Comment* (W.O.K.): assuming dead whale stranded on shore, date records late phase of marine inundation and average uplift during last 1400 yr of ca. 0.6 ft/100 yr. Two fractions were dated:

collagen fraction	1380 ± 130
inorganic fraction	450 ± 130

GSC-745. Macdonald River, Ellesmere Island (shells) **5700 ± 140**
3750 B.C.

Marine pelecypod shells (*Hiatella arctica* and *Mya truncata*) from surface of silt exposed 1 mi S of Macdonald R. delta, at head of Tanquary Fiord, Ellesmere Island, Northwest Territories (81° 24′ N Lat, 76° 55′ W Long), at alt 42 ± 2 ft. Coll. 1964 by G. Hattersley-Smith, Defence Res. Board, Ottawa. *Comment* (G. H-S.): dates gives point on uplift curve for area, which suggests that from 6500 to 5000 yr ago isostatic uplift was ca. 11.5 ft/100 yr, and subsequently averaged ca. 1 ft/100 yr (Hattersley-Smith and Long, 1967). Date based on one 3-day count.

GSC-722. Truro Island, McDougall Sound **9160 ± 160**
7210 B.C.

Shell fragments of *Hiatella arctica* and *Mya truncata* from ground surface on E side Truro Island, McDougall Sound, Northwest Territories (75° 19′ N Lat, 97° 10′ W Long), at alt ca. 350 ft. Coll. 1964 by J. G. Fyles for W. Blake, Jr. *Comment* (W.B., Jr.): date, on shells close to limit of marine submergence, is minimum for time of deglaciation of N McDougall Sound, between Cornwallis and Bathurst Islands.

GSC-724. Cockscomb Peak, Bathurst Island **9230 ± 280**
7280 B.C.

Shell fragments, mainly *Hiatella arctica*, from ground surface on ridge of Cockscomb Peak, E Bathurst Island, Northwest Territories (76° 11′ N Lat, 97° 35′ W Long), at alt ca. 350-365 ft. Coll. 1964 by W. Blake, Jr. *Comment* (W.B., Jr.): as shells are assumed to be close to marine limit, date is minimum for deglaciation. Sample mixed with dead gas for counting; date based on three 1-day counts.

8090 ± 150
GSC-726. Walker River, Bathurst Island **6140 B.C.**

Fragments of shells, mainly *Hiatella arctica* and *Mya truncata,* from surface of stony silt on S side of Walker R., ca. 3 mi W of Driftwood Bay, Bathurst Island, Northwest Territories (75° 57′ N Lat, 97° 52′ W Long), at alt ca. 260 ft. Coll. 1963 by W. Blake, Jr. *Comment* (W.B., Jr.): shells are in thin silt overlying peat, surface sample of which is 7100 ± 140 yr old (GSC-201, GSC IV); at ca. 300 ft alt, close to marine limit, shells are 9600 ± 210 yr old (GSC-174, GSC IV). Shells and enclosing stony silt apparently represent colluvium deposited over peat. Date must be reconciled with GSC-174 which possibly was contaminated by "old" shells redeposited from higher alt (cf. Blake, 1964); or possibly GSC-726 was contaminated in unknown way by younger material.

9570 ± 140
GSC-692. Young Inlet, Bathurst Island **7620 B.C.**

Shell fragments of *Mya truncata* from surface of silt 3 mi SE of head of Young Inlet, Bathurst Island, Northwest Territories (76° 24.5′ N Lat, 98° 44′ W Long), at alt ca. 360 to 370 ft. Coll. 1963 by W. Blake Jr. *Comment* (W.B., Jr.): date on shells within 100 ft of marine limit confirms GSC-251 (9690 ± 140, GSC VI); coll. 12.5 mi to NE; together dates indicate NE corner of Bathurst Inlet was deglaciated by ca. 9600 yr B.P. Date based on one 3-day count.

7660 ± 140
GSC-738. Morshead Point, Bathurst Island **5710 B.C.**

Shell fragments of *Mya truncata* from surface of sand deposit, E side of outlet gorge from unnamed lake, 1 mi SW of Morshead Point, Bathurst Island, Northwest Territories (76° 37.5′ N Lat, 100° 06′ W Long), at alt ca. 115 ft. Coll. 1963 by W. Blake, Jr. *Comment* (W.B., Jr.): area was deglaciated ca. 9200 yr ago (GSC-182, 9240 ± 160, GSC IV; Blake, 1964). Date, on shells slightly above present lake, indicates lake was arm of sea for at least 1500 yr. Date based on one 3-day count.

9750 ± 160
GSC-721. Massey Island **7800 B.C.**

Shell fragments, mainly marine pelecypod *Hiatella arctica,* from ground surface on flat ridgetop, NE part of Massey Island, Northwest Territories (76° 05′ N Lat, 102° 33′ W Long), at alt ca. 350 ft. Coll. 1964 by W. Blake, Jr. *Comment* (W.B., Jr.): shells coll. close to marine limit. Date is minimum for deglaciation and is similar to GSC-249 (9780 ± 190, GSC VI), on shells at same alt from Schomberg Point, westernmost Bathurst Island. Sample mixed with dead gas for counting.

Winter Harbour Moraine series II, Melville Island

Winter Harbour moraine on S coast of Melville Island, Northwest

Territories, marks stand of NW margin of Laurentide Ice Sheet, probably at local maximum during classical Wisconsin (Fyles, 1967). Shell-bearing marine deposits occur up to ca. 200 ft alt on the inland (distal) side of moraine and below 100 ft on seaward (proximal) side. Dates on marine shells coll. 1966 by J. G. Fyles supplement those in GSC VI.

GSC-727. "Pale" till **>33,000**

Fragments of shells (*Hiatella arctica*) from degraded surface of "pale" till, alt 260 ft, 0.5 mi NW of distal margin of Winter Harbour moraine at 74° 47′ N Lat, 110° 52′ W Long. "Pale" till is older than moraine and possibly pre-Wisconsin. *Comment* (J.G.F.): shells represent either marine submergence younger than till or glacially transported material incorporated in till. Sample mixed with dead gas for counting.

42,400 ± 1900
GSC-787. "Old" till **40,450 B.C.**

Fragments of *Hiatella arctica* from shallow slide scar at 74° 38.5′ N Lat, 110° 51′ W Long, alt 280 ft, in till adjacent to distal margin of Winter Harbour moraine and apparently older than moraine. *Comment* (J.G.F.): enclosing till is probably equivalent to "pale" till on which GSC-727 (>33,000, this series) was coll. Two fractions were dated separately after removal of outer 20% of shells; both dates probably are minimal:

outer fraction (21 to 60% leach), two 1-day counts	33,800 ± 900
inner fraction (61 to 100% leach), one 3-day count	42,400 ± 1900

27,790 ± 480
GSC-667. Moraine crest **24,840 B.C.**

Fragments of *Hiatella arctica* from bouldery surface on top of Winter Harbour moraine, alt >200 ft, but <300 ft (from contour map), at 74° 56′ N Lat, 110° 46′ W Long. Shells probably transported onto moraine by Laurentide ice from source to SW beneath Viscount Melville Sound. *Comment* (J.G.F.): Two fractions were dated separately after removal of outer 20% of shells:

outer fraction (21 to 60% leach), two 1-day counts	26,700 ± 450
inner fraction (61 to 100% leach), one 3-day count	27,790 ± 480

Similarity of dates on inner and outer fractions suggests no major contamination and possible representation of approx. absolute age rather than minimum ages.

11,310 ± 150
GSC-664. Cape Providence **9360 B.C.**

Hiatella arctica from highest shell-bearing beds in horizontally stratified silt and clay to bedrock hillside ca. 4 mi NE of Cape Providence (74° 26′ N Lat, 112° 11′ W Long). Site is beyond SW end of NE-SW trending Winter Harbour moraine but apparently bears distal relation to it. *Comment* (J.G.F.): date probably relates to narrow marine embayment developed between bedrock hillside and Laurentide ice front at

Winter Harbour moraine; sample occurrence is comparable to GSC-278 (10,340 ± 140, GSC VI), ca. 25 mi to NE along distal side of moraine. Cf. also GSC-363, 10,900 ± 160 (GSC VI) and GSC-786, 10,900 ± 150 (this series) from distal part of moraine near GSC-278. Date based on one 3-day count.

10,900 ± 150
GSC-786. Distal Ridge **8950 B.C.**

Fragments of *Hiatella arctica* from stony sandy crest (alt 260 ft) of narrow ridge forming distal margin of Winter Harbour moraine at 74° 43.5′ N Lat, 110° 53′ W Long. *Comment* (J.G.F.): shells incorporated into till of moraine ridge by minor ice-marginal fluctuations which picked up penecontemporaneous marine material equivalent to GSC-664 (11,310 ± 150, this series) and GSC-278 (10,340 ± 150, GSC VI). Occurrence is comparable to GSC-363 (10,900 ± 160, GSC VI). Outer 50% of shells removed before dating. Date based on one 3-day count.

9620 ± 150
GSC-665. Delta **7670 B.C.**

Shells and fragments of *Hiatella arctica* from eroded surface of silty sand 10 to 15 ft below surface of delta (alt 80 ft) at Winter Harbour (74° 47.5′ N Lat, 110° 41′ W Long). *Comment* (J.G.F.): site is within ca. 30 ft of local marine limit on proximal side of Winter Harbour moraine; date is minimum for retreat of Laurentide ice from moraine. Occurrence is comparable to GSC-339 (9550 ± 160, GSC VI), shells from proximal side of moraine W of Hearne Point.

7090 ± 150
GSC-854. Satellite Bay, Prince Patrick Island **5140 B.C.**

Organic debris from 6 ft depth in layer parallel with surface on N side of elongate pingo, 11.5 mi SW of Cape Krabbe and 0.9 mi from coast on N bank of river flowing into head of Satellite Bay, Prince Patrick Island, Northwest Territories (77° 22′ N Lat, 116° 35′ W Long), at alt ca. 12 ft. Sample buried through melting of upper part of underlying ice wedge, and subsequent downslope movement of material into resulting depression; excavation in frozen ground accomplished by pumping water. Coll. 1966 by A. Pissart, Univ. of Liège, Liège, Belgium. *Comment* (A.P.): melting ice wedge and accumulation of organic debris postdates development of pingo; *i.e.*, sea withdraw from site and pingo developed more than 7100 yr ago. NaOH-leach omitted from sample pretreatment.

9740 ± 150
GSC-764. Intrepid Inlet, Prince Patrick Island **7790 B.C.**

Organic debris from continuous, nearly horizontal layer at 5 to 9 ft depth (surface slope 22°), 14.5 mi NNW of Salmon Point and 3.3 mi W of Intrepid Inlet, Prince Patrick Island, Northwest Territories (76° 42′ N Lat, 118° 39′ W Long), at alt 100 ft. Organic layer is thin soil with vegetation in growth position, overlain by slope deposits of sand in which ice-wedges have developed. Sequence is contained in N-facing nivation hollow; excavation in frozen material was accomplished by pumping water. Coll. 1966 by A. Pissart. *Comment* (A.P.): date indicates slow slope evolution, that nivation hollow is more than 9700 yr old, and that ice-wedges in overlying sand have formed since. Date also is minimum for deglaciation; comparison with GSC-260 (11,160 ± 150, GSC VI), date on marine shells in silt and sand beneath delta terrace at alt 100 ft, on E side of Intrepid Inlet, indicates both nivation hollow and soil developed soon after deglaciation and/or emergence. NaOH-leach omitted from sample pretreatment.

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GSC II	Dyck and Fyles, 1963
GSC III	Dyck and Fyles, 1964
GSC IV	Dyck, Fyles, and Blake, 1965
GSC V	Dyck, Lowdon, Fyles, and Blake, 1966
GSC VI	Lowdon, Fyles, and Blake, 1967
Isotopes I	Walton, Trautman, and Friend, 1961
Isotopes II	Trautman and Walton, 1962
Isotopes V	Trautman and Willis, 1966
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ISOTOPES' RADIOCARBON MEASUREMENTS VI

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INTRODUCTION

This list presents dates on a portion of the samples measured at ISOTOPES since publication of Isotopes V, and for previously analyzed samples for which complete sample data are now available.

Samples were analyzed by gas proportional counting of carbon dioxide at 3 atm pressure in counters of 1 l. volume. Each sample was assayed twice, in different counters and on different days.

Procedures employed in sample preparation and age calculations have been described previously (Isotopes V).

ACKNOWLEDGMENTS

It is recognized that data obtained at this laboratory remain the sole property of our clients. We wish to thank those who have consented to have their data published here, and for their efforts in supplying informative comments.

We are greatly indebted to Mr. C. Tucek who, until April 1967, supervised the laboratory operations. We also wish to thank Miss B. Wallin, Mr. J. Bonicos, and Miss P. Kondratick for their painstaking assistance in the laboratory. Mrs. J. Barker supplied invaluable help in assembling the diverse mass of data associated with this listing.

I. GEOLOGIC SAMPLES

A. Western United States

Fox series, Alaska

Wood from Fox, 10 mi N of Fairbanks on Steese Highway (64° 57′ N Lat, 147° 37′ W Long), Alaska. Under ca. 45 ft frozen silt in U.S. Army Cold Regions Research and Engineering Laboratory's Alaska Permafrost Tunnel. Coll. and subm. 1965 by G. K. Swinzow, USA CRREL, Hanover, New Hampshire.

11,000 ± 280
I-1370. Fox, Alaska, 100 ft **9050 B.C.**

Light wood, 100 ft depth, conifer root section.

11,400 ± 450
I-1369. Fox, Alaska, 59 ft **9450 B.C.**

Dark wood, 59 ft depth, (apparently willow).

General Comment (G.K.S.): perennially frozen Fairbanks silt has year round temperature of ca. —2°C. Formation contains partially decomposed floral and faunal remains; strong H_2S odor and traces of CH_4 may indicate continuing decomposition in frozen state. Underlying this silt are productive auriferous gravels.

Barrow Drained Lake series, Alaska

Peat from drained lake basin, Barrow (71° 19′ 00″ N Lat, 156° 34′ 45″ W Long), Alaska. Coll. 1963 by J. Brown and P. V. Sellmann, U.S. Army Cold Regions Research and Engineering Lab., Hanover, New Hampshire; subm. 1964 by J. Brown.

3200 ± 230
I-1544. Barrow Lake, upper **1250 B.C.**

Buried lacustrine peat at 0.4 m depth consisting of frozen, well-preserved, fibrous peat. Surface elev. 2.7 m.

5010 ± 320
I-1545. Barrow Lake, lower **3060 B.C.**

Buried peat overlying inactive ice wedge at 1.2 m depth in same section as I-1544.
General Comment (J.B.): dates provide maximum ages for deposition of 2 peat layers in this 1 section, and which in turn provides maximum age bracket for formation and drainage of shallow arctic lake (Brown, 1965).

+3600
31,400
−2400
I-1604. Barrow Ridge, Alaska **29,450 B.C.**

Finely divided organic matter from shaft of U.S. Coast and Geodetic Survey Seismic and Magnetic Installation located on vegetated inland beach ridge, Barrow (71° 17′ 30″ N Lat, 156° 35′ W Long), Alaska. Sample from 5.6 m depth in sandy upper unit of Gubik formation. Coll. 1964 by J. Brown and P. V. Sellmann; subm. 1964 by J. Brown. *Comment* (J.B.): this sample, along with samples I-1384 and I-1394, provide dates for late Pleistocene events in N Alaska. Youngest date (I-1384, 25,300 ± 2300, Isotopes V) may represent marine transgression that took place prior to Wisconsin maximum. Date from the upper unit of Gubik (I-1604, this sample) is 1st finite age for this deposit in N Alaska and is consistent with previous correlation of Wisconsin age. Date from lower unit (I-1394, >36,300 Isotopes V) indicates pre-Wisconsin age for lower Barrow unit (Black, 1964; Brown, 1965; Sellmann *et al.*, 1965).

Barrow Spit series, Alaska

Mosses from 1.5 m frozen peat core at sea level on gravel spit, Barrow (71° 21′ N Lat, 156° 33′ W Long), Alaska. Coll. 1965 by Jerry Brown, P. V. Sellmann, and Otto Engelberth; subm. 1965 by Jerry Brown.

2650 ± 160
I-1868. Upper 25 cm **690 B.C.**

2860 ± 140
I-1949. Mid 25 cm **910 B.C.**

4570 ± 130
I-1869. Lower 25 cm **2620 B.C.**

General Comment (J.B.): sequence provides evidence for filling and later burial of small coastal lake by transgressing sea, indicating sea level within several m of present level since 700 B.C. (Brown and Sellmann, 1966).

Permafrost Tunnel series, Fairbanks, Alaska

Samples from Permafrost Tunnel (64° 57′ N Lat, 147° 37′ W Long), Fairbanks, Alaska. Coll. and subm. 1965 and 1966 by P. V. Sellmann.

I-1841. Tunnel, 1 T — 350 + 6 **$33{,}700^{+2500}_{-1900}$ 31,750 B.C.**

Twig from 40 ft depth from exposure in wall of tunnel in Pleistocene valley silt section.

I-1842. Tunnel, 3 T — 205 top **$31{,}400^{+2900}_{-2100}$ 29,450 B.C.**

Organic residue (soluble and fibrous) extracted from ice-wedge. *Comment* (P.V.S.): sample dates oldest sequence of sediments exposed in valley section.

I-1843. Tunnel, 2 T — 3 + 56 **$32{,}300^{+2000}_{-1600}$ 30,350 B.C.**

Organic residue (soluble and fibrous) extracted from ice-wedge.

I-2118. Tunnel-Vent, Shaft 1966 — TS (6) **6970 ± 135 5020 B.C.**

Fine fibrous plant material from 6 ft depth in Pleistocene valley silt section.

I-2119. Tunnel-Vent, Shaft 1966 — TS (12) **8460 ± 250 6510 B.C.**

Fine fibrous plant material from 12 ft depth in Pleistocene valley silt section.

I-2120. Tunnel-Vent, Shaft 1966 — TS (26) **2510 ± 570 560 B.C.**

Fine fibrous plant material from 26 ft depth in Pleistocene valley silt section.

I-2121. Tunnel-Vent, Shaft 1966 — TS (34) **$30{,}700^{+2100}_{-1600}$ 28,750 B.C.**

Fine fibrous plant material from 34 ft depth in Pleistocene valley silt section.

General Comment (P.V.S.): series helps confirm Wisconsin age of sediments and dates period of large sized ice-wedge development (Sellmann, 1967).

I-2593. Panamint Valley, California **<230**

Scirpus seeds from Core II, 40 to 46 cm depth and Core III, 34 to 40 cm depth, Warm Sulphur Springs, Panamint Valley (36° 7′ N Lat, 117° 13′ W Long), California. Seeds were hand-picked from organic silt also containing molluscs and fossil pollen. Sorted sand lies below this horizon tentatively interpreted as shallow lake deposit. Coll. 1966 and subm. 1967 by P. J. Mehringer, Jr. *Comment* (P.J.M.): sample most probably predates 1870 because mesquite trees (*Prosopis* spp.), that are abundant in vicinity of spring, are mentioned in historic records and seeds subm. for dating are stratigraphically below occurrence of mesquite pollen.

Niwot Ridge series, Boulder County, Colorado

Soil samples from Niwot Ridge (40° 03′ 23″ N Lat, 105° 35′ 28″ W Long), 11,650 ft elev., Boulder County, Colorado. Coll. and subm. 1963 to 1965 by J. B. Benedict, Inst. Arctic and Alpine Research, Nederland, Colorado. Dating financed with grant from Soc. of Sigma Xi and RESA Research Fund.

2470 ± 110
I-1792. 65-SBT-27.4 ft **520 B.C.**

Buried soil A horizon, 27.4 ft in back of and ca. 4 ft below surface of stone-banded solifluction terrace. Sample coll. at extreme upslope end of buried A horizon.

2020 ± 110
I-1371. 63-SBT-20.7 ft **70 B.C.**

Buried soil A horizon, 20.7 ft in back of and ca. 4 ft below surface of stone-banked solifluction terrace.

1340 ± 110
I-1698. 63-SBT-13 ft **A.D. 610**

Buried soil A horizon, 13.0 ft in back of and ca. 4 ft below surface of stone-banked solifluction terrace.

1250 ± 120
I-1697. 63-SBT-5 ft **A.D. 700**

Buried soil A horizon, 5.0 ft behind front, ca. 4 ft below surface of stone-banked solifluction terrace.

355 ± 115
I-1510. 64-SBT-0 ft **A.D. 1595**

Modern soil A horizon, immediately in front of stone-banked solifluction terrace.

General Comment (J.B.B.): dates indicate that terrace began to form during Temple Lake time. Sample I-1510 was dated to make approx. correction for age of A horizon at time of burial. Average rates of downslope movement during past 2500 yrs have been less than 4 mm per yr on this slope, except for brief period (1000 to 1200 B.P.) when they averaged ca. 23 mm per yr. Period of rapid movement is interpreted as an interval of increased soil moisture.

26,900 +1200 −1100
24,950 B.C.

I-2214. Silver Peak Site, Nevada

Clay core sample taken from 122 ft depth in exploratory drill hole FX-6 (NE 1/4, sec. 17, T2 S, R39 E), Silver Peak Site, Nevada. Coll. and subm. 1966 by Foote Mineral Co., Exton, Pennsylvania.

6150 ± 210
4200 B.C.

I-1505. Deschutes County, Oregon

Charcoal from Lava Cast Forest lava flow on Newberry Volcano (43° 48′ N Lat, 121° 17′ W Long), Deschutes County, Oregon. Charcoal found in void enclosed by lava. Coll. 1964 by N. V. Peterson and E. A. Groh; subm. 1964 by R. G. Bowen, Dept. of Geol. and Mineral Industries, Portland, Oregon.

29,000 +2000 −1600
27,050 B.C.

I-1641. Bird Site, Oregon

Snail shells from "Bird Site," 800 ft E of Fossil Lake (43° 19′ N Lat, 120° 29′ W Long), Lake County, Oregon. From 12-in. bed of sand and flat-pebble gravel immediately below 1- to 5-in. layer of white volcanic ash. Coll. 1964 and subm. 1965 by I. S. Allison, Dept. of Geol., Oregon State Univ., Corvallis, Oregon. *Comment* (I.S.A.): sample dates ash bed and assoc. vertebrate fossils.

30,700 +2500 −1900
28,750 B.C.

I-1640. Lake County, Oregon

Ostracods and oolites from seam 5 in. below biotite-bearing volcanic ash layer in Ana R. exposure, Summer Lake basin (42° 59′ N Lat, 120° 44′ W Long), Lake County, Oregon. Coll. 1953 and subm. 1965 by I. S. Allison. *Comment* (I.S.A.): sample dates ash layer.

1845 ± 180
A.D. 105

I-959. Continental Shelf, Oregon

Organic carbon from gravity core coll. during R.V. *Brown Bear* Cruise 311, Sta. 5, 78 fms (46° 01.8′ N Lat, 124° 29.0′ W Long), from continental shelf off coast of Oregon. Interval of green clayey silt 5 to 13 cm from top of 20 cm core. Coll. 1962 and subm. 1963 by D. A. McManus, Dept. of Oceanog., Univ. of Washington.

4800 ± 300
I-798. Cascadia Basin, Northeast Pacific Ocean **2850 B.C.**

Organic carbon in gravity core coll. during R.V. *Brown Bear* Cruise 312, Sta. 56 (46° 145′ N Lat, 127° 00.0′ W Long), Cascadia Basin, NE Pacific Ocean. From layer of grayish olive-green clayey silt 90 to 97 cm below top of 103 cm core. Coll. by Fritz Osell, Dept. of Oceanog., Univ. of Washington; subm. 1963 by D.A. McManus.

7990 ± 600
I-800. Juan de Fuca Canyon, Washington **6040 B.C.**

Organic carbon in piston core coll. during R. V. *Brown Bear* Cruise 291, Sta. 8 (47° 39.0′ N Lat, 125° 38.0′ W Long), Juan de Fuca Canyon off coast of Washington. Interval between 269.5 and 276 cm in layer of olive-gray silty clay. Coll. and subm. 1963 by D. A. McManus.

Continental Slope series, Washington

Organic carbon coll. during R. V. *Brown Bear* Cruise 291, from continental slope off coast of Washington. Coll. and subm. 1963 by D. A. McManus.

8550 ± 1550
I-960. Continental Slope, No. 1 **6600 B.C.**

Organic carbon in piston core from continental slope, Sta. 18 (46° 41.0′ N Lat, 125° 12.0′ W Long), off coast of Washington. Lowermost 8.5 cm in 514.5 cm gravity core.

11,300 ± 2000
I-961. Continental Slope, No. 2 **9350 B.C.**

Organic carbon in piston core from continental slope, Sta. 18 (46° 41.0′ N Lat, 125° 12.0′ W Long), off coast of Washington. Interval from 366 to 373 cm below top of 514.5 cm gravity core in layer of predominantly greenish-black clay characteristic of upper 390 cm of core.

7360 ± 1000
I-962. Continental Slope, No. 3 **5410 B.C.**

Organic carbon in piston core from continental slope, Sta. 18 (46° 41.0′ N Lat, 125° 12.0′ W Long), off coast of Washington. Transition layer 298 to 300 cm below top, between olive-gray silty clay (above) and dark greenish-gray clay (below) in 514.5 cm core of predominantly clay with some sand layers.

480 ± 130
I-963. Continental Slope, No. 4 **A.D. 1470**

Organic carbon in gravity core from continental slope, Sta. 19, 61 fms (46° 49.3′ N Lat, 124° 36.3′ W Long), off coast of Washington. Interval between 9 and 16.5 cm from top in 16.5 cm length core. Composed of olive-gray sandy silt.

1120 ± 220
A.D. 830

I-964. Continental Slope, No. 5

Organic carbon in gravity core from continental slope, Sta. 62 (46° 21.8′ N Lat, 124° 17.8′ W Long), off coast of Washington. Interval between 20 and 28 cm from top of core in layer of olive-gray silt (depth 10 to 29 cm). Core stopped in shell rich layer of sandy silt, total core length 48.5 cm.

2475 ± 175
525 B.C.

I-965. Continental Slope, No. 6

Organic carbon in gravity core from continental slope, Sta. 62 (46° 21.8′ N Lat, 124° 17.8′ W Long), off coast of Washington. Interval between 39 and 45 cm from top in layer of olive-gray sandy silt.

6710 ± 330
4760 B.C.

I-1430. Cobb Seamount D-19, Washington

Mytilus shells coll. in pipe dredge recovery during R. V. *Brown Bear* Cruise 139, from 55 fms on "45 fms" terrace, SW side Cobb Seamount (46° 46.2′ N Lat, 130° 49.0′ W Long), N Pacific Ocean, Washington. Sample also included subrounded basalt cobbles and pebbles, and *Pecten* fragments (Budinger and Enbysk, 1960). Coll. 1956 by T. F. Budinger, Dept. of Oceanog., Univ. of Washington, Seattle, Washington; subm. 1964 by B. J. Enbysk. *Comment* (B.J.E.): date may be too young as overgrowth of probably much more recent encrusting organisms might not have been adequately removed. Other materials will be submitted from this terrace.

Deep Sea Core series, Washington

Marine mud from deep sea core 326-36, (46° 29.0′ N Lat, 124° 42′ 24″ W Long), off coast of Washington. Coll. and subm. 1963 by C. F. Royse, Dept. of Geol., Univ. of North Dakota, Grand Forks, North Dakota.

1680 ± 120
A.D. 270

I-1258. Upper Core, 326 1

Depth 360 fms, 0 to 19 cm in core.

4860 ± 200
2910 B.C.

I-1259. Middle Core, 326-2

Depth 360 fms. 132 to 150 cm in core.

7755 ± 300
5805 B.C.

I-1260. Lower Core, 326-3

Depth 360 fms, 250 to 265 cm in core.

General Comment (C.F.R.): dating organic portion of 3 intervals of single core indicates average depositional rate to be ca. 41 cm per 1000 yr off Washington coast. Average depositional rate is considered representative of pelagic sedimentation on upper continental slope off Washington state. Rates for upper and lower portions of core indicate sedimentation has been nearly constant during last 6000 yr. A 4-cm-thick ash layer at 240-cm level would date ca. 5700 yr B.P. by applying average sedimentation rate of 50 mg $cm^{-2}yr^{-1}$. Source of ash may be from eruption of Mt. Mazama (Royse, 1964).

12,600 ± 190
I-1881. Orcas Island, Washington **10,650 B.C.**

Shells from Orcas Island (48° 37′ N Lat, 123° 01′ W Long), Washington. In pebbly clay more than 100 ft above sea level. Coll. and subm. 1964 by D. J. Easterbrook, W. Washington State College, Bellingham, Washington. *Comment* (D.J.E.): dates late Pleistocene glaciomarine drift on Orcas Island.

+3000
34,900
—2200
I-1880. Whidbey Island, Washington **32,950 B.C.**

Peat from Whidbey Island (48° 18′ N Lat, 122° 30′ W Long), Washington. Interbedded with gravel, 5 ft above sea level. Coll. and subm. 1965 by D. J. Easterbrook. *Comment* (D.J.E.): peat and gravel sequence overlain by Vashon till. Age of 26,850 ± 1,700 was obtained higher in sequence at this locality.

I-2159. Astoria Canyon, 6508-C-14, Washington **>30,700**

Calcite and dolomite in piston core coll. by R. V. *Yaquina* in 358 m of water, 30 nautical mi W of mouth of Columbia R. near S edge of Astoria Canyon (46° 03.2′ N Lat, 124° 45.7′ W Long), Washington. From depth 156 to 166 cm in 230 cm core. Coll. 1965 and subm. 1966 by K. L. Russell, Dept. of Oceanog., Oregon State Univ., Corvallis, Oregon.

5620 ± 145
I-2307. Astoria Canyon, 6502-3-7, Washington **3670 B.C.**

Marine sediment containing magnesium-rich calcite coll. in 815 fms of water by R. V. *Yaquina* from bottom of Astoria Canyon (46° 05.2′ N Lat, 125° 00.7′ W Long), Washington. In uniform sequence of green pelagic clays at depth 2.04 m in core, carbonate layer only 2 cm thick (Ph.D. Thesis by Paul Carlson, Dept. of Oceanog., Oregon State Univ.). Coll. 1965 and subm. 1966 by K. L. Russell.

B. Central United States

16,000 ± 340
I-1719. Warren County, Illinois **14,050 B.C.**

Snail shells from grayish layer within "Iowan age" loess in 13 ft section of Peorian loess (Ruhe *et al.*, 1957; Leighton and Willman, 1950) at depth 7 to 8 ft, Warren County (40° 54′ N Lat, 90° 45′ W Long), Illinois. Coll. 1965 by J. D. Alexander and H. L. Wascher; subm. 1965 by H. L. Wascher, Univ. of Illinois, Dept. of Agronomy, Urbana, Illinois.

13,700 ± 260
I-1720. Henderson County, Illinois **11,750 B.C.**

Snail shells from 4 to 5 ft depth in loess section more than 25 ft thick (Ruhe *et al.*, 1957; Leighton and Willman, 1950) in Henderson County (41° 1′ N Lat, 90° 52′ W Long), Illinois. Coll. 1965 by J. D. Alexander and H. L. Wascher; subm. 1965 by H. L. Wascher.

24,100 ± 600
I-1963. Peoria County, Illinois, No. 1 **22,150 B.C.**

Organic material from upper 20 in. of peat bed at depth 135 to 155 in., Peoria County (40° 35′ N Lat, 89° 48′ W Long), Illinois. Sample composed of fragments of leaves and stems of herbs, shrubs, and grasses or sedges stratified with gray silt thought to be earliest part of Peorian loess or latest part of Farmdale loess deposition time. Coll. 1965 by J. D. Alexander and H. L. Wascher, subm. 1965 by H. L. Wascher. *Comment* (H.L.W.): age yields reasonable date for ending of Farmdale and beginning of Peorian loess deposition (Ruhe *et al.*, 1957; Leighton and Willman, 1950).

26,100 ± 900
I-1964. Peoria County, Illinois, No. 2 **24,150 B.C.**

Organic material from 30-in. peat bed in Peoria County (40° 35′ N Lat, 89° 48′ W Long), Illinois. Sample from depth 155 to 185 in., immediately beneath I-1963. Coll. 1965 by J. D. Alexander and H. L. Wascher; subm. 1965 by H. L. Wascher. *Comment* (H.L.W.): age agrees with other datings of Farmdale time.

I-1962. Stephenson County, Illinois **>39,900**

Decomposed organic material with charcoal and woody fragments from middle of 9-in. horizon of paleo-humic gley at depth 223 to 232 in., 6 mi W of Freeport, Stephenson County, E of center sec. 1, T26 N, R6 E (42° 17′ N Lat, 89° 45′ W Long), Illinois. Horizon developed on accretion-gley buried by Peorian loess 0 to 209 in., and stratified silts and organic bands from 202 to 223 in., underlain by gleyed clay loam. Coll. and subm. 1965 by L. R. Follmer, Univ. of Illinois, Dept. of Agronomy, Urbana, Illinois. *Comment* (L.R.F.): attempts to date paleosol which developed on drift beyond limits of Shelbyville drift in NW Illinois (Kempton, 1963; Ruhe *et al.*, 1957).

Colo Bog series, Iowa

Peaty muck from SW 1/4 NW 1/4 sec. 11, T83 N, R21 W, Colo Bog (42° 1′ N Lat, 93° 15′ W Long), Story County, Iowa. Coll. 1962 by P. H. Walker and W. L. Jackson; subm. 1963 by R. V. Ruhe, Iowa State Univ., Ames Iowa.

I-1013. Colo Bog, No. 1 **3100 ± 130**
1150 B.C.

From grass pollen zone, 34 to 36 in. depth in core.

I-1014. Colo Bog, No. 2 **8320 ± 275**
6370 B.C.

From hardwood forest pollen zone, 11 to 11.25 ft depth in core.

I-1015. Colo Bog, No. 3 **13,775 ± 300**
11,825 B.C.

From conifer pollen zone, 15.5 to 15.75 ft depth in core.

Jewell Bog series, Iowa

Peaty muck from NW 1/4 sec. 19, T86 N, R24 W, Jewell Bog (42° 14′ N Lat, 93° 41′ W Long), Hamilton County, Iowa. Coll. 1962 by P. H. Walker and W. L. Jackson; subm. 1963 by R. V. Ruhe.

I-1016. Jewell Bog, No. 1 **2365 ± 500**
415 B.C.

From grass pollen zone, 24 to 26 in. depth in core.

I-1017. Jewell Bog, No. 2 **10,230 ± 400**
8280 B.C.

From hardwood-conifer pollen zone, 17.5 to 17.75 ft depth in core.

I-1018. Jewell Bog, No. 3 **10,670 ± 400**
8720 B.C.

From conifer-hardwood pollen zone, 23.3 to 23.5 ft depth in core.

I-1019. Jewell Bog, No. 4 **11,640 ± 400**
9690 B.C.

From conifer pollen zone, 28 to 28.5 ft depth in core.

Jewell Bog, Core 2 series, Iowa

Peaty muck from NW 1/4 sec. 19, T86 N, R24 W, Jewell Bog (42° 14′ N Lat, 93° 41′ W Long), Hamilton County, Iowa. Coll. 1964 by P. H. Walker and W. L. Jackson; subm. 1965 by R. V. Ruhe.

I-1417. Jewell Bog, A **9570 ± 180**
7620 B.C.

From middle part of lower peaty muck, conifer-hardwood pollen zone, 14.7 to 15 ft depth in core.

I-1418. Jewell Bog, B **10,640 ± 270**
8690 B.C.

From base of lower peaty muck, conifer pollen zone, 19.67 to 20 ft depth in core.

I-1023. Bentley, Iowa **21,360 ± 850**
19,410 B.C.

Spruce wood from organic zone at base of Wisconsin loess in cut along Rock Island R.R., NW 1/4 sec. 21, T76 N, R41 W, Bentley (41°

22′ N Lat, 95° 35′ W Long), Pottawattamie County, Iowa. Depth 43 to 44 ft. Coll. 1961 and subm. 1963 by R. V. Ruhe.

Madrid series, Polk County, Iowa

Spruce wood from loess interbedded between tills in E road cut of State Highway 60 on S valley slope of Des Moines R., NW 1/4 sec. 30, T81 N, R25 W, Madrid (41° 47′ N Lat, 93° 49′ W Long), Polk County, Iowa. Coll. 1961 by R. V. Ruhe and W. H. Scholtes; subm. 1963 by R. V. Ruhe.

16,100 ± 500
I-1024. Madrid, No. 1 **14,150 B.C.**

From 30 to 31 ft depth.

I-1025. Madrid, No. 2 **>40,000**

From 52 ft depth.

Palermo area, Grundy County series, Iowa

Organic carbon from silts between tills, NW 1/4 sec. 29, T87 N, R17 W, Palermo area (42° 20′ N Lat, 92° 51′ W Long), Grundy County, Iowa. Coll. 1964 by T. E. Fenton and R. C. Shuman; subm. 1964 by R. V. Ruhe.

I-1265. Palermo, No. 1 **>30,000**

From 42 to 42.5 ft depth in core.

I-1266. Palermo, No. 2 **>40,000**

From A horizon of paleosol on lower till, 44 to 45 ft depth in core.

25,000 ± 2500
I-1267. Hayward Paha, Tama County, Iowa **23,050 B.C.**

Organic carbon from base of Wisconsin loess above Yarmouth-Sangamon paleosol in center, sec. 36, T86 N, R13 W, Hayward Paha (42° 13′ N Lat, 92° 18′ W Long), Tama County, Iowa. From 35 to 35.5 ft depth in core. Coll. 1963 by T. E. Fenton and R. C. Shuman; subm. 1964 by R. V. Ruhe.

13,900 ± 400
I-1268. Stratford, Hamilton County, Iowa **11,950 B.C.**

Spruce wood from base of Cary till, NW 1/4 sec. 6, T86 N, R26 W, Stratford (42° 17′ N Lat, 93° 56′ W Long), Hamilton County, Iowa. From 64 to 65 ft depth. Coll. 1963 by P. H. Walker, W. L. Jackson, and R. V. Ruhe; subm. 1964 by R. V. Ruhe.

29,000 ± 3500
I-1269. Salt Creek, Tama County, Iowa **27,950 B.C.**

Organic carbon from base of Wisconsin loess above Yarmouth-Sangamon paleosol, NE 1/4 NW 1/4 sec. 7, T84 N, R14 W, Salt Creek (42° 6′ N Lat, 92° 34′ W Long), Tama County, Iowa. From 43 to 44 ft depth. Coll. 1963 by G. F. Hall and T. E. Fenton; subm. 1964 by R. V. Ruhe.

16,100 ± 1000
I-1270. Boone, Boone County, Iowa **14,150 B.C.**

Spruce wood from loess interbedded between tills in N cut along new U.S. Highway 30 on W valley slope of Des Moines R. in center, sec. 2, T83 N, R27 W, Boone (42° 2′ N Lat, 93° 57′ W Long), Boone County, Iowa. From 25 to 25.5 ft depth. Coll. and subm. 1964 by R. V. Ruhe.

14,200 ± 500
I-1402. Nevada, Story County, Iowa **12,250 B.C.**

Spruce wood from loess interbedded between tills in S cut at Nevada interchange along new U.S. Highway 30 at NC sec. 18, T83 N, R22 W, Nevada (41° 59′ N Lat, 93° 27′ W Long), Story County, Iowa. From 14 ft depth. Coll. and subm. 1964 by R. V. Ruhe.

23,900 ± 1100
I-1403. Grinnell, Poweshiek County, Iowa **21,950 B.C.**

Peat from base of Wisconsin loess, foundation excavation beneath Roberts Theater on Grinnell College campus, sec. 9, T80 N, R16 W, Grinnell (41° 44′ N Lat, 92° 43′ W Long), Poweshiek County, Iowa. From 12 to 12.5 ft depth. Coll. 1960 by B. F. Graham; subm. 1964 by R. V. Ruhe.

Palermo, Core 2 series, Iowa

Organic carbon from sec. 29, T87 N, R17 W, Palermo area (42° 19′ N Lat, 92° 52′ W Long), Grundy County, Iowa. Coll. 1964 by R. V. Ruhe and G. F. Hall; subm. 1965 by R. V. Ruhe.

22,600 ± 600
I-1404. Palermo area, A **20,650 B.C.**

From base of Wisconsin loess at SW corner, 17.5 to 18 ft depth in core.

I-1405. Palermo area, B **>36,000**

From silts interbedded between tills at SW corner, 30 to 31 ft depth in core.

24,600 ± 1100
I-1406. Kinross, Keokuk County, Iowa **22,650 B.C.**

Organic carbon from base of Wisconsin loess, SE 1/4 SW 1/4 sec. 27, T77 N, R10 W, Kinross (41° 26′ N Lat, 91° 58′ W Long), Keokuk County, Iowa. From 10.5 to 11 ft. depth in core. Coll. 1964 by R. I. Dideriksen and J. A. Kovar; subm. 1965 by R. V. Ruhe.

19,200 ± 900
I-1408. Harvard, Wayne County, Iowa **17,250 B.C.**

Organic carbon from base of Wisconsin loess, NW 1/4 sec. 15, T68 N, R21 W, Harvard (40°42′ N Lat, 93° 16′ W Long), Wayne County, Iowa. From 7.6 to 8.3 ft depth in core. Coll. 1964 by W. P. Dietz and J. D. Highland; subm. 1965 by R. V. Ruhe.

20,300 ± 400
I-1409. Hayward Paha, Iowa **18,350 B.C.**

Organic carbon from base of Wisconsin loess above lower part of Yarmouth-Sangamon paleosol beveled by Iowan erosion surface in center, sec. 36, T86 N, R13 W, Hayward Paha (42° 13′ N Lat, 92° 18′ W Long), Tama County, Iowa. From 11 to 11.5 ft depth in core. Coll. 1964 by T. E. Fenton and W. P. Dietz; subm. 1965 by R. V. Ruhe.

18,700 ± 700
I-1411. Greenfield, Adair County, Iowa **16,750 B.C.**

Organic carbon from base of Wisconsin loess, WC sec. 17, T76 N, R31 W, Greenfield (41° 22′ N Lat, 94° 27′ W Long), Adair County, Iowa. From 14.3 to 15 ft depth in core. Coll. 1964 by R. V. Ruhe and W. P. Dietz; subm. 1965 by R. V. Ruhe.

McCulloch Bog series, Hancock County, Iowa

Peaty muck from SE 1/4 sec. 32, T94 N, R24 W, McCulloch Bog (42° 55′ N Lat, 93° 43′ W Long), Hancock County, Iowa. Coll. 1964 by P. H. Walker and W. L. Jackson; subm. 1965 by R. V. Ruhe.

3170 ± 190
I-1412. McCulloch Bog, No. 1 **1220 B.C.**

From grass pollen zone, base of upper peat, 36 to 38 in. depth in core.

8210 ± 260
I-1413. McCulloch Bog, No. 2 **6260 B.C.**

From hardwood forest pollen zone, upper part of lower peaty muck, 11.25 to 11.5 ft depth in core.

14,500 ± 340
I-1414. McCulloch Bog, No. 3 **12,550 B.C.**

From conifer pollen zone, base of lower peaty muck, 19.3 to 19.5 ft depth in core.

Woden Bog series, Hancock County, Iowa

Peaty muck and organic carbon at NE corner, sec. 13, T97 N, R26 W, Woden Bog (43° 13′ N Lat, 94° 53′ W Long), Hancock County, Iowa. Coll. 1964 and 1965 by P. H. Walker, L. H. Durkee, and W. L. Jackson; subm. 1965 by R. V. Ruhe.

7050 ± 210
I-1415. Woden Bog, No. 1 **5100 B.C.**

Upper part of lower peaty muck, hardwood forest pollen zone, 21.25 to 21.5 ft depth in core.

11,570 ± 330
I-1416. Woden Bog, No. 2 **9620 B.C.**

Organic carbon from lower silts, conifer pollen zone, 31.5 to 32.5 ft depth in core.

2830 ± 115
I-1852. Woden Bog, No. 3 **880 B.C.**

Organic carbon below base of upper peat, grass pollen zone, 25 to 28 in. depth in core.

5390 ± 125
I-1853. Woden Bog, No. 4 **3440 B.C.**

Organic carbon from upper silts, grass pollen zone, 8 to 8.5 ft depth in core.

7770 ± 140
I-1854. Woden Bog, No. 5 **5820 B.C.**

Upper part of lower peaty muck, hardwood forest pollen zone, 24.25 to 24.5 ft depth in core.

9300 ± 130
I-1855. Woden Bog, No. 6 **7350 B.C.**

Organic carbon from lower silts, hardwood forest pollen zone, 27.5 to 27.75 ft depth in core.

16,500 ± 500
I-1419A. Humeston, Wayne County, Iowa **14,550 B.C.**

Organic carbon from base of Wisconsin loess, SE 1/4 sec. 21, T69 N, R23 W, Humeston (40° 45′ N Lat, 93° 31′ W Long), Wayne County, Iowa. From Yarmouth-Sangamon paleosol, 8.5 to 9.25 ft depth in core. Coll. 1964 by W. P. Dietz, J. D. Highland, T. E. Fenton, and R. V. Ruhe; subm. 1965 by R. V. Ruhe. *Comment* (R.V.R.): humic acid fraction removed with 2 Na OH treatments.

$$\mathbf{19{,}000}^{+6000}_{-3000}$$
I-1419B. Humeston, Wayne County, Iowa **17,050 B.C.**

Organic carbon from base of Wisconsin loess, SE 1/4 sec. 21, T69 N, R23 W, Humeston (40° 45′ N Lat, 93° 31′ W Long), Wayne County, Iowa. From Yarmouth-Sangamon paleosol, 8.5 to 9.25 ft depth in core. Coll. 1964 by W. P. Dietz, J. D. Highland, T. E. Fenton, and R. V. Ruhe; subm. 1965 by R. V. Ruhe. *Comment* (R.V.R.): humic-acid fraction date.

23,900 ± 1100
I-1420. Bentley, Pottawattamie County, Iowa **21,950 B.C.**

Organic carbon from buried soil A horizon, NW 1/4 sec. 21, T76 N, R 41 W, Bentley (41° 22′ N Lat, 95° 35′ W Long), Pottawattamie County, Iowa. From base of Wisconsin loess that contained spruce wood (I-1023, this date list), depth 43 to 44 ft. Coll. 1964 and subm. 1965 by

R. V. Ruhe. *Comment* (R.V.R.): reasonable agreement between soil organic carbon and wood date indicates validity of buried soil organic carbon as dating medium.

2080 ± 115
I-1421. Wolf Creek, Tama County, Iowa **130 B.C.**

American elm log from 9 ft depth on N stream bank, NE 1/4 sec. 24, T86 N, R13 W, Wolf Creek (42° 14′ N Lat, 92° 18′ W Long), Tama County, Iowa. Overlying alluvium noncalcareous. Coll. 1964 by R. V. Ruhe, W. P. Dietz, and G. F. Hall; subm. 1965 by R. V. Ruhe.

7280 ± 160
I-1978. Barney Lake, Michigan **5330 B.C.**

Sedge and *Sphagnum* peat from sediment core under 4 ft of water at SE end of Barney Lake, Beaver Island, Charlevoix County (45° 43′ N Lat, 85° 34′ W Long), Michigan. From ca. 30 cm above basal sand of core and beneath marly gyttja and sand. Coll. and subm. 1965 by S. B. Bushouse and R. O. Kapp, Alma College, Biology Dept., Alma, Michigan. *Comment* (S.B.B.): date indicates peat was formed during Chippewa low water stage in Lake Michigan basin (Bushouse and Kapp, as mss.).

205 ± 115
I-1718. Winona County, Minnesota **A.D. 1745**

Wood from stump rooted in recent alluvial silt, now exposed in bed of Whitewater R., NE 1/4, NW 1/4, sec. 11, Twp. 108 N, Range 10 W, Winona County (44° 12′ N Lat, 91° 59′ W Long), Minnesota. Coll. 1964 and subm. 1965 by S. C. Happ, U.S. Dept. of Agriculture, Oxford, Mississippi. *Comment* (S.C.H.): date indicates somewhat more aggradation of stream bed during past 100 to 300 yr than had been previously recognized.

+ 2000
32,300
— 1600
I-1851. Gilman Canyon, Nebraska **30,350 B.C.**

Soil-like material from road cut to Gilman Canyon floor, 90 ft below upland surface, lower 1 ft 10 in. of Gilman Canyon Formation (5 ft 9 in. thick) SW, SW, SE, sec. 7, TION, R26 W(40° 51′ N Lat 100° 19′ W Long), Lincoln County, Nebraska. Coll. 1965 by J. A. Elder, V. H. Dreeszen, and E. C. Reed, Nebraska Geol. Surv.; subm. 1965 by E. C. Reed. *Comment* (E.C.R.): date confirms Reed and Dreeszen's (1965) classification of Gilman Canyon Formation as Early Wisconsinan. Previously regarded as A-horizon of Sangamon Soil.

C. Eastern United States

Quaise Marsh series, Massachusetts

Peat immediately above hard substratum at S end of Quaise Marsh (41° 72′ 22″ N Lat, 70° 02′ 30″ W Long), Massachusetts. Salt marsh vegetated with dwarf form of *Spartina alterniflora*. Coll. and subm. 1964 by J. M. Zeigler and A. C. Redfield, Woods Hole Oceanog. Institution, Woods Hole, Massachusetts.

1305 ± 120
I-1441. Quaise March, 4.3 to 4.8 ft depth A.D. 645

1695 ± 110
I-1442. Quaise Marsh, 6. 3 to 6.8 ft depth A.D. 255

General Comment (A.C.R.): dates help determine recent rate of rise in relative sea level and agree with similar measurements at Barnstable, Massachusetts (Redfield and Rubin, 1962).

Nauset Marsh series, Massachusetts

Peat immediately above hard substratum in small salt marsh adjoining Nauset Marsh and W of Cape Cod Natl. Seashore headquarters (41° 50′ 42″ N Lat, 69° 57′ 0″ W Long), Eastham, Massachusetts. Surface of marsh covered with *Spartina potens*. Coll. and subm. 1965 by G. Bartlett and A. C. Redfield.

2300 ± 105
I-1967. Nauset Marsh, 10.2 to 10.7 ft depth 350 B.C.

3460 ± 100
I-1968. Nauset Marsh, 17.2 to 17.7 ft depth 1510 B.C.

General Comment (A.C.R.): dates help determine recent rate of rise in relative sea level and are consistent with similar measurements at Barnstable, Massachusetts (Redfield and Rubin, 1962).

Milton Salt Marsh series, Massachusetts

Peat from salt marsh on SE side of Neponset R., N of Milton Hill (42° 16′ N Lat, 70° 03.5′ W Long), Massachusetts. Coll. 1966 by A. C. Redfield and A. E. Waller; subm. 1966 by A. C. Redfield.

1310 ± 95
I-2215. Milton Salt Marsh, 1.1 to 1.5 ft depth A.D. 640

1360 ± 105
I-2216. Milton Salt Marsh, 2.1 to 2.5 ft depth A.D. 590

1860 ± 100
I-2217. Milton Salt Marsh, 3.1 to 3.5 ft depth A.D. 90

General Comment (A.C.R.): samples from this location at greater depth have been dated but have not been published.

Riverhead Salt Marsh series, New York

Peat from salt marsh on W side Reeves Bay, Riverhead (40° 54.8′ N Lat, 72° 37.4′ W Long), New York. Below 8.5 ft depth, peat is of fresh water origin (Johnson, 1925). Coll. 1963 by A. C. Redfield, R. Fairbridge, and W. Newman; subm. 1966 by A. C. Redfield.

I-2076. *Spartina* peat, depth 7.4 to 7.7 ft **3900 ± 105**
1950 B.C.

I-2077. Fresh water peat, depth 11.2 to 11.7 ft **8070 ± 130**
6120 B.C.

General Comment (A.C.R.): samples from this location analyzed by Lamont have yielded results as follows: L-863A, depth 3.5 to 4.0 ft, 930 ± 150; L-863D, depth 14.7 to 15.2 ft, 10,950 ± 300 (unpubl.).

I-838. Malloy Farm site, New York **12,100 ± 400**
10,150 B.C.

Wood (spruce) from Malloy Farm site, Ewings Road, N of Lockport (43° 14′ 20″ N Lat, 78° 42′ 30″ W Long), New York. From layer of organic material containing fresh water mosses and shells ca. 6 in. thick beneath 10 to 12 ft coarse sand and gravel, elev. 360 ft. Recent find is 7½ lb. 11¾ in. mammoth tooth. Coll. and subm. 1963 by R. L. McCarthy, Board of Education, Lockport, New York. *Comment* (R.L.C.): dates N edge of old Lake Iroquois.

Walden Creek Marsh series, Southport, N. Carolina

Peat (attributed to *Juncus roemerianus*) immediately above clay substratum, from Walden Creek Marsh (33° 58′ 25″ N Lat, 77° 58′ 45″ W Long), Southport, N. Carolina. Sample length 0.5 ft, depth measured from surface of (*Disticlis spicata* vegetated) marsh. Coll. and subm. 1964 by A. C. Redfield and A. W. Cooper.

I-1576. Depth 4.4 to 4.9 ft **2310 ± 130**
360 B.C.

I-1577. Depth 6.4 to 6.9 ft **3100 ± 120**
1150 B.C.

I-1578. Depth 9.25 to 9.75 ft **3920 ± 130**
1970 B.C.

I-1579. Depth 10.4 to 10.9 ft **3720 ± 140**
1770 B.C.

General Comment (A.C.R.): purpose of series was to determine recent rate of rise in relative sea level. Data accords with similar measurements at Newburyport, Massachusetts (McIntire and Morgan, 1963).

Singletary Lake series, N. Carolina

Silt and mud using a large diameter piston corer, from Singletary Lake (34° 36′ N Lat, 78° 27′ W Long), Bladen County, N. Carolina. Coll. 1962 by D. R. Whitehead and D. H. Hamilton, III, Williams College, Williamstown, Massachusetts; subm. 1965 by D. R. Whitehead.

5750 ± 135
I-1752. Singletary Lake, 1.04 m **3800 B.C.**

Gel-mud, 1.04 to 1.08 m depth in core, from lower portion of upper organic horizon. *Comment* (D.R.W.): date supports pollen data indicating post-glacial correlation.

11,000 ± 200
I-1751. Singletary Lake, 1.41 m **9050 B.C.**

Gray lake silt, 1.41 to 1.49 m depth in core, from top of upper silt in profile. *Comment* (D.R.W.): date supports pollen data indicating late-glacial correlation.

16,200 ± 290
I-1750. Singletary Lake, 1.685 m **14,250 B.C.**

Gray lake silt, 1.685 to 1.735 m depth in core, from middle of upper silt horizon. *Comment* (D.R.W.): date supports pollen data indicating full-glacial correlation.

+ 3200
35,800
— 2600
I-1748. Singletary Lake, 2.02 m **33,850 B.C.**

Gray lake silt, 2.02 to 2.07 m depth in core, from base of upper silt zone. *Comment* (D.R.W.): date and pollen data indicate correlation with Port Talbot interstadial.

I-1749. Singletary Lake, 2.30 m **>40,000**

Fibrous gel-mud, 2.30 to 2.34 m depth in core, from middle organic horizon. *Comment* (D.R.W.): date and pollen data suggest correlation with Port Talbot interstadial. Pollen spectra show time of climatic amelioration and low-water phase of lake (Frey, 1951; Whitehead, 1963; 1964).

D. Canada

7670 ± 170
I-2244. Peace River tusk, British Columbia **5720 B.C.**

N. American elephant tusk from 50 ft depth in terminal moraine at E edge of Rocky Mt. Foothills on Great Plains, Portage Pass, Peace R. District (56° N Lat, 122° 10′ W Long), British Columbia, Canada. Coll. 1966 by L. T. Jory; subm. 1966 by D. D. Campbell, Dolmage, Campbell and Assoc., Vancouver, British Columbia, Canada. *Comment* (D.D.C.): date indicates some elephants survived longer than previously believed in ice fringes of Canadian Rocky Mts. Most recent dated elephant remains in U.S.A. are ca. 2000 yr older than this specimen.

355 ± 90
I-2245. Duncan River, British Columbia **A.D. 1595**

Driftwood from evergreen tree at 15 ft depth in river-deposited sand and gravel away from present river bed, Duncan R. Valley, N end of

Kootenay Lake (50° 20′ N Lat, 116° 55′ W Long), British Columbia, Canada. Coll. 1966 by P. Ottesen; subm. 1966 by D. D. Campbell. *Comment* (D.D.C.): date indicates in 355 yr Duncan R. deposited 15-ft sand and gravel.

I-2259. Peace River, British Columbia **>40,000**

Charcoal (crumbly) remnant of burnt tree from S terrace of Peace R. where it issues onto Great Plains from Rocky Mts., Hudson Hope (56° N Lat, 122° W Long), British Columbia, Canada. From 6-in. discontinuous layer of charcoal 15 ft below upper surface of 100-ft thick buried sequence of sand and gravel. Coll. and subm. 1966 by D. D. Campbell. *Comment* (D.D.C.): date represents interval when proglacial lake on Canadian Plains had either completely or very appreciably receded, allowing rejuvenated Peace R. to flow eastward across lake beds.

I-1911. Port Hope, Ph 1, Ontario **345 ± 175**
A.D. 1605

Wood with organic soil from 25 to 35 cm thick horizon at 2 m depth in stoney glacial till from Port Hope (43° 57′ N Lat, 78° 20′ W Long), Ontario, Canada. Coll. and subm. 1965 by J. C. Ritchie, Trent Univ., Peterborough, Ontario, Canada. *Comment* (J.C.R.): plant macrofossil and pollen analyses are being conducted on this material (Coleman, 1936; Gravenor, 1957).

I-2106. Russell Pond, Ru-1, Manitoba **10,250 ± 140**
8300 B.C.

Gyttja (limnic sediment) from Russell (50° 48′ N Lat, 100° 78′ W Long), Manitoba, Canada. At 386 to 391 cm level of lake sediments, immediately below transition to heavy clay sediment. Coll. and subm. 1966 by J. C. Ritchie. *Comment* (J.C.R.): sample from late-glacial (*Picea-Shepherdia canadensis-Artemisia* forest community) to hypsithermal (grassland spectra) when lake was intermittently dry.

Manitoba series, Canada

Limnic sediment from nameless lake near Belmont, Manitoba (49° 26′ N Lat, 99° 26′ W Long), Canada. Coll. and subm. 1967 by J. C. Ritchie.

I-3156. Belmont—BT 22 **3570 ± 130**
1620 B.C.

From 195 cm depth in lake sediments, at transition from grass-herb dominated assemblages (pollen) to oak-birch assemblage.

I-3157. Belmont—BT 115 **9430 ± 160**
7480 B.C.

From 610 cm depth in lake sediments, at transition from spruce dominated pollen zone to grassland zone, probably marking beginning of hypsithermal.

General Comment (J.C.R.): lake is ca. 20 km from Glenboro site, for which Isotopes C-14 determinations have provided a chronology. Pollen diagrams from these lakes are consistent.

E. Europe

5700 ± 170
I-1543. Benbecula, Scotland **3750 B.C.**

Coniferous wood from Barve Beach, SW coast of Island of Benbecula (57° 26′ N Lat, 7° 21′ W Long), Scotland. Sample found in sequence of organic material interstratified with sand, 1 ft 10 in. below ordnance datum. Coll. and subm. 1964 by W. Ritchie. *Comment* (W.R.): pollen techniques show most of organic material to be derived from fresh water marsh vegetation. Date and sample stratigraphic position give index of amount and rate of sealevel change.

$28{,}000\,^{+1800}_{-1500}$
I-1667. Northwich, Cheshire **26,050 B.C.**

Mollusc, (*Nucella lapillus,* Linné) from gravel pit near Northwich, Cheshire (53° 13′ 30″ N Lat, 2° 35′ 20″ W Long), England. Shells were taken from base of till and sand complex, Upper Boulder Clay of Cheshire. Coll. 1965 by P. Worsley; subm. 1965 by C. S. Boulton, Keele Univ., Staffordshire, England. *Comment* (C.S.B.): till-sand complex is part of drift sheet which represents last advance of ice into Cheshire-Shropshire basin and is related to Late Weichselian Max. of N Europe (Boulton and Worsley, 1965).

I-1687. Druidston Irish Sea Till **>36,000**

Mollusca fragments from St. Bridges Bay, Pembrokeshire (51° 48′ 20″ N Lat, 5° 5′ 40″ W Long), S Wales. Sample coll. from coastal exposure of Irish Sea Till capped by outwash deposits. Coll. and subm. 1965 by B. S. John, Univ. of Oxford, Oxford, England. *Comment* (B.S.J.): stratigraphic evidence indicates Druidston Irish Sea Till is same age as outwash deposits. Outwash from Pembrokeshire was dated at younger than 38,000 yr B.P. (John, 1965). Mollusc species of both till and outwash datings were the same, and considered to represent Main Würm Age (Synge, 1964).

N Norwegian Sea series, Norway

Organic carbon core samples taken while aboard USS *Edisto* from N Norwegian Sea (70° 00′ N Lat, 0° 00′ W Long), Norway. Coll. 1963 and subm. 1965 by J. S. Creager, Dept. of Oceanog., Univ. of Washington.

19,200 ± 3100
I-1694. No. 1 **17,250 B.C.**

Yellowish-brown sediment between 4 to 22 cm from top of 118.5 cm piston core. *Comment* (J.S.C.): stratigraphy indicates environment of sedimentation in this particular area is similar to those existing in entire Norwegian Sea immediately following close of Pleistocene Epoch.

17,900 ± 900
I-1695. No. 2 **15,950 B.C.**

Medium dark-gray sediment between 27 to 55 cm from top of 118.5 cm piston core. *Comment* (J.S.C.): date indicates sediment may have been deposited by drifting glacial ice during late Pleistocene time.

22,200 ± 1800
I-1696. No. 3 **20,250 B.C.**

Medium dark-gray sediment between 93 to 121 cm from top of 118.5 cm piston core. *Comment* (J.S.C.): date indicates sediment may have been deposited by drifting glacial ice during late Pleistocene time.

Maanselänsuo series, Finland

Biogenic material from wall of ditch in Maanselänsuo fen (65° 37′ N Lat, 29° 38′ E Long), Kuusamo, Finland. Coll. Oct. 1964 and subm. Apr. 1965 by Yrjö Vasari, Univ. of Oulu, Oulu, Finland.

9100 ± 220
I-1699. Maanselänsuo, No. 1 **7150 B.C.**

Alternating layers of fine sand and mosses (*Drepanocladus exannulatus s. str.*), from depth 175 to 185 cm in transition zone from overlying peat to fine sand (Vasari, 1965a). *Comment* (Y.V.): sample represents "Upper Paleoholocene" phase in vegetational history of Kuusamo district (supposedly synchronous with Younger Dryas) and taken to date that phase.

9150 ± 220
I-1700. Maanselänsuo, No. 2 **7200 B.C.**

Lowermost layer of *Bryales-Carex* peat, at depth 165 to 170 cm (Vasari, 1965a). *Comment* (Y.V.): sample represents beginning of "Lower Eoholocene" phase in local vegetational history. This, together with results of other samples (I-1699, this series; I-775 and I-777, Isotopes V), indicate change from park-tundra phase ("Upper Paleoholocene") into birch forest phase ("Lower Eoholocene"), occurred at different times in different places. This change occurred mainly during pre-Boreal, but at times as late as Boreal period.

6500 ± 180
I-1701. Maanselänsuo, No. 3 **4550 B.C.**

Carex peat from depth 110 to 115 cm (Vasari, 1965a). *Comment* (Y.V.): sample dates beginning of "Upper Mesoholocene" phase in local vegetational history. Age confirms concept that "Upper Mesoholocene" corresponds to Zone VII in zoning system of Jessen.

I-1702. Maanselänsuo, No. 4 **1900 ± 130**
A.D. 50

Sphagnum-Carex peat with wood from depth 55 to 60 cm (Vasari, 1965a). *Comment* (Y.V.): sample was expected to date boundary between "Lower Neoholocene" and "Upper Neoholocene," supposedly corresponding to Sub-Boreal and Sub-Atlantic transition). Age obtained is too recent. No correlatives for these periods can be distinguished in pollen diagrams from Kuusamo district (Vasari, 1965b; I-1703, this date list).

I-1703. Mäkelä, Finland **3550 ± 150**
1600 B.C.

Highly humified peat from Mäkelä (66° 01′ N Lat, 29° 15′ E Long), Kuusamo, Finland. From bottommost layer of peat (ca. 20 cm thick) covering steep hill slope. Coll. 1964 and subm. 1965 by Yrjö Vasari. *Comment* (Y.V.): sample taken in connection with studies on age of peat formation on hill-slopes. On basis of pollen analysis, sample was expected to represent "Upper Neoholocene" phase; age however, indicates peat originated from sub-Boreal period (Vasari, 1965b; I-1702, this date list).

I-1758. Maanselkä, Finland **1095 ± 115**
A.D. 855

"Humic acid" extracted from B horizon of iron podzol profile in spruce forest at Maanselkä (65° 54′ N Lat, 29° 01′ E Long), Kuusamo, Finland. Coll. 1964 and subm. 1965 by Yrjö Vasari.

I-1759. Kurvinen, Finland **530 ± 130**
A.D. 1420

"Humic acid" extracted from B horizon of iron podzol profile in spruce forest at Kurvinen (65° 36′ N Lat, 29° 38′ E Long), Kuusamo, Finland. Coll. 1964 and subm. 1965 by Yrjö Vasari.

I-1760. Kuusamo, Finland **<200**

"Humic acid" extracted from B horizon of iron podzol profile in dry *Pinus silvestris*-lichen forest on sandy ground at center of Kuusamo commune (66° 01′ N Lat, 29° 21′ E Long), Finland. Coll. 1964 and subm. 1965 by Yrjö Vasari. *Comment* (Y.V.): ages obtained from "humic acid" (samples I-1758, I-1759, and I-1760, this date list) indicate renewal of humus material in podzols is relatively rapid.

Southwest Finland series

Peat samples taken with piston core from raised bogs in Finland. Coll. and subm. 1965 by Toive Aartolahti, Dept. of Geog., Univ. of Helsinki, Finland (Aartolahti, 1966).

I-1804. Vähäsuo Bog, Finland **4770 ± 115**
2820 B.C.

Peat *(Eriophorum-Sphagnum)* from raised bog, 2.20 to 2.25 m depth, Vähäsuo bog (60° 45′ 38″ N Lat, 23° 49′ 5″ E Long), Tammela, Finland.

3780 ± 115
I-1805. Vähäsuo Bog, Finland **1830 B.C.**

Peat *(Sphagnum)* from raised bog, 2.15 to 2.20 m depth, Vähäsuo bog (60° 45′ 38″ N Lat, 23° 49′ 5″ E Long), Tammela, Finland. *Comment* (T.A.): vigorous spread of *Picea* began in area at this level.

3470 ± 110
I-1806. Linturahka Bog, Finland **1520 B.C.**

Peat *(Sphagnum-Carex)* from raised bog, 2.95 to 3.00 m depth, Linturahka bog (60° 42′ 39″ N Lat, 22° 59′ 41″ E Long), Mellilä, Finland.

3400 ± 110
I-1807. Linturahka Bog, Finland **1450 B.C.**

Peat *(Sphagnum-Carex)* from raised bog, 2.90 to 2.95 m depth, Linturahka bog (60° 42′ 39″ N Lat, 22° 59′ 41″ E Long), Mellilä, Finland. *Comment* (T.A.): vigorous spread of *Picea* began in area at this level.

3390 ± 110
I-1808. Isosuo Bog, Finland **1440 B.C.**

Woody peat (*Carex*) from raised bog, 2.48 to 2.53 m depth, Isosuo bog (60° 30′ 32″ N at, 22° 15′ 19″ E Long), Turku, Finland. *Comment* (T.A.): vigorous spread of *Picea* began just above this level.

3700 ± 115
I-1810. Haukjärvenneva Bog, Finland **1750 B.C.**

Peat *(Carex)* from raised bog, 2.68 to 2.73 m depth, Haukjärvenneva bog (61° 51′ N Lat, 21° 33′ E Long), Siikainen, Finland.

3300 ± 120
I-1811. Haukjärvenneva Bog, Finland **1350 B.C.**

Woody peat *(Carex)* from raised bog, 2.63 to 2.68 m depth, Haukjärvenneva bog (61° 51′ N Lat, 21° 33′ E Long), Siikainen, Finland. *Comment* (T.A.): vigorous spread of *Picea* in area at this level.

4060 ± 120
I-1874. Mustaneva Bog, Finland **2110 B.C.**

Peat *(Carex-Sphagnum)* from raised bog, 3.90 to 3.95 m depth, Mustaneva bog (60° 41′ 33″ N Lat, 24° 59′ 27″ E Long), Hausjärvi, Finland. *Comment* (T.A.): vigorous spread of *Picea* began in area at this level.

4090 ± 120
I-1875. Mustaneva Bog, Finland **2140 B.C.**

Peat *(Carex-Sphagnum)* from raised bog, 3.95 to 4.00 m depth, Mustaneva bog (60° 41′ 33″ N Lat, 24° 59′ 27″ E Long), Hausjärvi, Finland.

Haapasuo Bog series, Finland

Peat and gyttja taken with piston drill from Haapasuo bog, Askola (60° 34′ N Lat, 25° 36′ E Long), Finland. Coll. and subm. 1965 by R. Tynni, Geol. Survey, Otaniemi, Finland.

9230 ± 150
I-1884. Haapasuo 1 **7280 B.C.**

Peat *(Bryales-Equisetum)*. *Comment* (R.T.): according to pollen analysis, peat is of pre-Boreal age.

8600 ± 140
I-1887. Haapasuo 2 **6650 B.C.**

(Equisetum) gyttja and peat. *Comment* (R.T.): date in accord with pollen analysis of Boreal age.

7120 ± 140
I-1886. Haapasuo 3 **5170 B.C.**

(Sphagnum) peat. *Comment* (R.T.): date corresponds with rise of *Alnus*-pollen curve at transition Boreal to early Atlantic.

3300 ± 110
I-1885. Martinsuo Bog, Finland **1350 B.C.**

Peat *(Deciduos)* taken with piston drill from Martinsuo bog (60° 34′ N Lat, 25° 39′ E Long), Askola, Finland. Coll. and subm. 1962 by R. Tynni. *Comment* (R.T.): dated horizon corresponds to rise of *Picea*-pollen curve at transition sub-Boreal to sub-Atlantic.

Råbacka series, Finland

Peat and detritus gyttja from 36 km N of Helsinki (60° 29″ 47″ N Lat, 24° 57′ 27″ E Long), Finland (Mölder, Valovirta, and Virkkala, Bull. 178). Coll. and subm. 1965 by K. Virkkala, Geol. Survey, Otaniemi, Finland.

3510 ± 110
I-1923. Råbacka 1 **1560 B.C.**

(Carex-Sphagnum) peat from depth 0.30 to 0.35 m in bog. *Comment* (K.V.): Subboreal time (Zone VIII), beginning of common occurrence of spruce.

7960 ± 150
I-1924. Råbacka 2 **6010 B.C.**

(Sphagnum-Carex) peat from depth 1.15 to 1.25 m in bog. *Comment* (K.V.): zone boundary V/VI, beginning of common occurrence of alder.

8550 ± 160
I-1925. Råbacka 3 **6600 B.C.**

(*Carex*) peat from depth 1.7 to 1.8 m in bog. *Comment* (K.V.): Zone V, Boreal *Pinus* maximum.

8880 ± 140
I-1926. Råbacka 4 **6930 B.C.**

(Carex) peat from depth 1.85 to 1.95 m in bog. *Comment* (K.V.): Zone Boundary IV/V.

9430 ± 200
I-1927. Råbacka 5 **7480 B.C.**

Detritus gyttja from 2.1 to 2.2 m depth in bog. *Comment* (K.V.): Zone IV, Preboreal *Betula*-maximum.

F. Africa

12,720 ± 350
I-929. Wadi Halfa area, Sudan **10,770 B.C.**

Pelecypod shell *(Corbicula artini)* from 200 m E of Nile on Khor Kidingkong in Akasha district 100 km SW of Wadi Halfa (20° 15′ N Lat, 31° 14′ E Long), Sudan. Site is 15 m above Nile flood level, and 195 m above MSL in upper soft pale-gray Sebilian silt, 20 m below top. No associated fossils. Coll. 1961 and subm. 1962 by C. W. Sutton, Millburn Mus. *Comment* (C.W.S.): bivalves mostly with valves together, minimizing possibility of reworking or transportation by currents. Shells occupy rich horizon in former backwater of river in thick sequence of silts otherwise barren. Since overlying 20 m of silt is uninterrupted, date reflects youngest high oscillation of Nile when siltation built valley to 35 m above present flood level. Time may correspond to warm (Alleröd) interstadial of Europe and N. America.

G. Australia

2150 ± 180
I-1135. Curracurrang Cove, Australia **200 B.C.**

Wood charcoal from Curracurrang Cove, Royal Natl. Park (34° 8′ 50″ S Lat, 151° 6′ 25″ E Long), New South Wales, Australia. Sample found in compact occupation layer, rich in humic material, in coastal rock shelter. Coll. 1962 and subm. 1963 by J. V. S. Megaw, Univ. of Sydney, New South Wales, Australia. *Comment* (J.V.S.M.): Curracurrang represents a cultural development as postulated by McCarthy (1961). Sample associated with bandi points and geometric microliths. Date agrees with others obtained in E Australia with geometric microliths (McBryde, 1961; Mulvaney, 1962) but is 1st to be associated with bandi points.

H. Mexico

West Coast of Mexico series

Clayey silt from Middle American Trench coll. with 2.5 in I.D. gravity core. Coll. 1963 by D. A. Ross; subm. 1964 by R. D. McIver, Jersey Production Research Co., Tulsa, Okahoma.

6030 ± 320
I-1529. 338 B **4080 B.C.**

From continental flank of M.A.T. (19° 00′ 48″ N at, 105° 21′ W Long), 0 to 12 cm in core; water depth 3,861 m.

I-1530. 338 B **9890 ± 380**
7940 B.C.

From continental flank of M.A.T. (19° 00′ 48″ N Lat, 105° 21′ W Long), 27 to 41 cm in core; water depth 3,861 m.

I-1531. 338 B **11,500 ± 350**
9550 B.C.

From continental flank of M.A.T. (19° 00′ 48″ N Lat, 105° 21′ W Long), 54 to 65 cm in core; water depth 3,861 m.

I-1532. 340, 0-12 cm **1270 ± 200**
A.D. 680

From bottom of M.A.T. (18° 55′ 30″ N Lat, 105° 23′ 48″ W Long), 0 to 12 cm in core; water depth 4,787 to 4,795 m.

I-1533. 340, 51-61 cm **2170 ± 190**
220 B.C.

From bottom of M.A.T. (18° 55′ 30″ N Lat, 105° 23′ 48″ W Long), 51 to 61 cm in core; water depth 4,787 to 4,795 m.

I-1534. 340, 95-105 cm **2440 ± 210**
490 B.C.

From bottom of M.A.T. (18° 55′ 30″ N Lat, 105° 23′ 48″ W Long), 95 to 105 cm in core; water depth 4,787 to 4,795 m.

I-1535. 368, 0-11 cm **2080 ± 125**
130 B.C.

From seaward flank of M.A.T. (19° 22′ 54″ N Lat, 106° 05′ 06″ W Long), 0 to 11 cm in core; water depth 4,202 m.

I-1536. 368, 27-39 cm **4530 ± 200**
2580 B.C.

From seaward flank of M.A.T. (19° 22′ 54″ N Lat, 106° 05′ 06″ W Long), 27 to 39 cm in core; water depth 4,202 m.

I-1537. 368, 76-90 cm **9490 ± 380**
7540 B.C.

From seaward flank of M.A.T. (19° 22′ 54″ N Lat, 106° 05′ 06″ W Long), 76 to 90 cm in core; water depth 4,202 m.

I-1538. PG 414, 0-11 cm **1510 ± 120**
A.D. 440

From bottom of M.A.T. (21° 06′ 48″ N Lat, 106° 26′ 06″ W Long), 0 to 11 cm in core; water depth 4,154 m.

I-1539. PG 414, 23-35 cm **2100 ± 215**
150 B.C.

From bottom of M.A.T. (21° 06′ 48″ N Lat, 106° 26′ 06″ W Long), 23 to 35 cm in core; water depth 4,154 m.

2600 ± 210
650 B.C.

I-1540. PG 414, 76-88 cm

From bottom of M.A.T. (21° 06′ 48″ N Lat, 106° 26′ 06″ W Long), 76 to 88 cm in core; water depth 4,154 m.

General Comment: samples were submitted as strontium carbonate.

I. Bermuda

Bermuda Marsh series, Bermuda

Peat, organic silt, and clay from Shelly Bay and Long Bay, Bermuda. Purpose of series was to determine rate of rise of relative sea level. Coll. and subm. 1965 by A. C. Redfield, Woods Hole Oceanog. Inst., Massachusetts.

1850 ± 110
A.D. 100

I-1683. Shelly Bay, 5.2 ft

Peat from Shelly Bay (32° 19′ 54″ N Lat, 64° 44′ 15″ W Long), swamp separated from sea by shelly sand beach. Depth estimated re MSL at Ferry Reach, Bermuda. From depth −5.4 to −5.7 ft from 0.2 ft above rock bottom. Ground water estimated 0.2 ft below MSL.

1820 ± 120
A.D. 130

I-1684. Shelly Bay, 7.25 ft

Peat from Shelly Bay (32° 19′ 54″ N Lat, 64° 44′ 15″ W Long), from depth −7.4 to 7.79 ft from 1.0 ft above rock bottom.

880 ± 120
A.D. 1070

I-1685. Long Bay, 2.45 ft

Peat from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), swamp separated from sea by shelly sandbeach. From depth −1.2 to −1.8 ft from 6.4 ft above rock bottom. Ground water estimated 0.86 ft above MSL.

3900 ± 120
1950 B.C.

I-1686. Long Bay, 8.45 ft

Organic silt from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth −7.2 to −7.8 ft from 0.4 ft above rock bottom.

3600 ± 120
1650 B.C.

I-1762. Long Bay, A-11.4 ft

Silty peat from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth −9.8 to 10.4 ft from 2 ft above rock bottom.

3930 ± 120
1980 B.C.

I-1763. Long Bay, B-11.45 ft

Organic silt from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth −10.2 to —10.7 ft from immediately below I-1762.

1510 ± 110
I-1764. Long Bay, C-4.05 ft **A.D. 440**

Peat from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth −2.8 to −3.3 ft.

1440 ± 110
I-1765. Long Bay, D-4.35 ft **A.D. 510**

Organic silt from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth −3.2 to −3.5 ft from immediately below I-1764.

1210 ± 95
I-1969. Long Bay, E **A.D. 740**

Peat from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth 1.75 to 2.25 ft below MSL from 1.1 ft above rock bottom.

2050 ± 105
I-1970. Long Bay, F **100 B.C.**

Calcareous sand from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth 2.15 to 2.55 ft below MSL from 0.5 ft above rock bottom.

2440 ± 110
I-1971. Long Bay, G **490 B.C.**

Peat from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth 3.95 to 4.35 ft below MSL from 1.4 ft above rock bottom.

2760 ± 100
I-1972. Long Bay, H **810 B.C.**

Calcareous sand from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth 4.35 to 4.75 ft below MSL from 1.0 ft above rock bottom.

2530 ± 100
I-1973. Long Bay, I **580 B.C.**

Peat from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth 5.15 to 5.65 ft below MSL from 0.6 ft above rock bottom.

2590 ± 100
I-1974. Long Bay, J **640 B.C.**

Calcareous silt from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth 5.75 to 6.15 ft below MSL from 0 ft above rock bottom.

2690 ± 90
I-1975. Long Bay, K **740 B.C.**

Peat from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth 6.15 to 6.55 ft below MSL from 1.5 ft above rock bottom.

I-1976. Long Bay, L **3170 ± 120**
1220 B.C.

Calcareous silt from Long Bay (32° 18′ 06″ N Lat, 64° 52′ 24″ W Long), from depth 6.65 to 7.05 ft below MSL from 1.0 ft above rock bottom.

II. PHYSICAL GEOGRAPHY SAMPLES

A. Canadian North West Territories

East Baffin Island series

Samples from various locations on Baffin Island, NW Territories. Coll. and subm. during 1965 and 1966 by members of eog. Branch, Dept. of Energy, Mines, and Resources (formerly Mines and Tech. Surveys), Ottawa, Canada.

I-1812. Cape Christian Cliffs, No. 1 **>39,000**

Marine shells (*Astarte, Mya*), fragments, and (*Hiatella arctica*, Linné) from 21 km NW of Clyde settlement (70° 38.6′ N Lat, 68° 42.4′ W Long). From exposure in sea cliffs at 5.6 m above sea level. Coll. and subm. 1965 by O. H. Løken (Løken, 1966; Andrews, 1966b).

I-1813. Cape Christian Cliffs, No. 2 **>39,000**

Marine shells (*Serripes groenlandicum*, Bruguière), (*Mya truncata*, Linné), and (*Hiatella arctica*, Linné) from ca. 17.5 km NNE of Clyde settlement (70° 36.2′ N Lat, 68° 28.1′ W Long). From exposure in sea cliffs at 13.4 m above sea level. Coll. and subm. 1965 by O. H. Løken. *Comment* (O.H.L.): sample redated by Yale (Y-1702, >50,000) (Løken, 1966; Andrews, 1966b).

I-1814. Cape Aston **>39,000**

Marine shells from clay stratum in delta, considered *in situ* (69° 54.6′ N Lat, 67° 34.2′ W Long). Elev. of site 65 m above sea level, delta surface lies 84 m above sea level. Coll. and subm. 1965 by O. H. Løken (Løken, 1966; Andrews, 1966b).

I-1829. McBeth Fiord **>41,100**

Marine shell fragments from moraine ridge well above local marine limit, 24.5 m above sea level, N side of McBeth Fiord (69° 44.2′ N Lat, 67° 2′ W Long). Coll. and subm. 1965 by O. H. Løken. *Comment* (O.H.L.): shells assumed to have been carried up from sea bed during glacial readvance (Løken, 1966; Andrews, 1966b).

I-1832. Clyde Fiord **34,900 +2100 −1700**
32,950 B.C.

Marine shells from lateral moraine of readvance at 51 m above sea level, N side of outer Clyde Fiord (70° 17′ N Lat, 69° 00′ W Long). Coll.

and subm. 1965 by J. E. Smith. *Comment* (J.E.S.): dates from other samples in area indicate date is probably minimum (Løken, 1966; Andrews, 1966b).

I-1816. Cape Christian Cliffs, No. 3 **>39,000**

Marine shells (*Hiatella arctica,* Linné) from coastal cliff exposure 2 m above sea level, 17.5 km NNE of Clyde settlement (70° 36.2′ N Lat, 62° 28.1′ W Long). Coll. and subm. 1965 by O. H. Løken.
General Comment (O.H.L.): 2 samples redated by Yale indicate all samples in this series are probably of great age and are beyond range of finite dating. They show that ice-free areas existed along outer NE coast of Baffin Island for at least 54,000 yrs although outlet glaciers have pushed beyond fiord mouths more recently than this (Løken, 1966; Andrews, 1966b).

Baffin Island Lake series

785 ± 105
I-1834. Flint Lake **A.D. 1165**

Peat from continuous peat layer overlain by 1 m marine clay, Flint Lake (69° 16′ N Lat, 74° 22′ 30″ W Long), Baffin Island, N.W.T. Coll. and subm. 1965 by J. T. Andrews. *Comment* (J.T.A.): vegetation appeared *in situ* and indicated transgression at ca. 41 m above sea level. Date indicates layer was overrun by mass movement despite lack of structures in overlying clay (Andrews, 1966b).

5270 ± 140
I-1833. Gillian Lake **3320 B.C.**

Marine shells from 5 cm sand layer overlain by deltaic deposits, Gillian Lake (69° 28′ N Lat, 75° 31′ W Long), Baffin Island, N.W.T. Coll. and subm. 1965 by C. A. M. King and J. T. Philpot. *Comment* (J.T.P.): delta surface lies at 67 m above sea level. Date indicates sea invaded Gillian Lake basin; date also compares well with I-1244 (Isotopes V) from similar elev. along this portion of Baffin coast (Andrews, 1966b).

5570 ± 130
I-1831. Piling Lake, No. 1 **3620 B.C.**

Marine shells (*Mya truncata,* Linné) and (*Hiatella arctica,* Linné) from pit in estuarine silts at 64 m above sea level, Piling Lake (69° 07′ N Lat, 75° 02′ W Long), Baffin Island, N.W.T. Coll. and subm. 1965 by J. T. Andrews. *Comment* (J.T.A.): marine limit in area clearly marked at 83 m above sea level. Date indicates this feature probably dates from ca. 6,000 B.P., on distal side of *Isortoq* phase moraines dated ca. 6.700 B.P. (Andrews, 1966a; 1966b).

1950 ± 100
I-1830. Piling Lake, No. 2 **A.D. 0 B.C.**

Marine shells (*Mya Truncata,* Linné), (*Portlandua arctica,* Gray), (*Astarte borealis,* Schumacher), (*Astarte montagui,* Dillwyn) forma *typica,* from beach foreset beds exposed in stream cut at 2.5 m above sea level, Piling Lake (69° 06′ N Lat, 74° 47′ W Long), Baffin Island, N.W.T. Coll. and subm. 1965 by J. T. Andrews. *Comment* (J.T.A.): sample dates relative sea level at ca. 5 to 7 m above present sea level and indicates isostatic readjustment of W Baffin Island might still be occurring at rate of 0.4 m/century (Andrews, 1966b).

Baffin Island Fiord series

1860 ± 110
I-1835. Clyde Fiord **A.D. 90**

Peat from stream cut along distal side of glacio-marine delta showing 5-m-thick peat sequence in inner Clyde Fiord (69° 51′ N Lat, 70° 28′ W Long), Baffin Island, N.W.T. Coll. and subm. 1965 by D. M. Barnett. *Comment* (D.M.B.): sample from bottom of longest unbroken sequence and not from base of deposit from which it may be separated by erosional hiatus (Andrews, 1966b).

8180 ± 130
I-1983. Dexterity Fiord **6230 B.C.**

Marine shells (*Mya Truncata,* Linné) and (*Hiatella arctica,* Linné) *in situ* from stratified deltaic beds 39 m above sea level, Duart Bay Dexterity Fiord (71° 20′ 50″ N Lat, 72° 52′ 50″ W Long), Baffin Island, N.W.T. Coll. 1963 by D. A. Harrison; subm. 1966 by J. T. Andrews. *Comment* (J.T.A.): date indicates outer part of Dexterity Fiord may have been ice-free by ca. 9,000 B.P. (Harrison, 1964).

4920 ± 180
I-1931. Sam Ford Fiord, No. 2 **2970 B.C.**

Marine shells from sand/silt beds in beach deposit 15.7 m above sea level at Sam Ford Fiord (70° 01.3′ N Lat, 71° 32.8′ W Long), Baffin Island, N.W.T. Coll. 1964 and subm. 1966 by O. H. Løken. *Comment* (O.H.L.): same sample site as I-1670 (4770 ± 140, Isotopes V) which did not fit into expected pattern of elev. and time. Samples agree within 2 standard errors. Best estimate for site is now 4845 ± 228 B.P. (Andrews, 1966b).

8210 ± 130
I-1933. Sam Ford Fiord, No. 1 **6260 B.C.**

Marine shells from boulder-rich marine clays that were involved in ice advance, 19 m above sea level at Sam Ford Fiord (70° 20′ N Lat, 71° 08′ W Long), Baffin Island, N.W.T. Coll. 1965 and subm. 1966 by J. E. Smith. *Comment* (J.E.S.): studies on lateral deposits along Sam Ford Fiord indicate sample dates major moraine phase traceable to head of Clyde Fiord. Date indicated temporal association of this moraine with Cockburn moraines of Baffin Island and McAlpine-Arctic mainland moraines all dated ca. 8,300 B.P. (Andrews, 1966b).

I-1934. Inugsuin Fiord **6560 ± 125**
4610 B.C.

Marine shells (*Mytilus edulis,* Linné), (*Mya Truncata,* Linné), and (*Hiatella arctica,* Linné), from stratified sand/silt layer, 8.5 to 11.0 m above sea level at Inugsuin Fiord (69° 56′ N Lat, 68° 40′ W Long), Baffin Island, N.W.T. Coll. 1965 by D. A. Harrison; subm. 1966 by O. H. Løken. *Comment* (O.H.L.): sample dates relative sea level at 11.0 m above present sea level. Marine limit in vicinity is ca. 25 m above sea level.

B. Great Britain

I-1909. Bride moraine, Great Britain **>30,300**

Marine shells *(Turitella* and *Macoma)* from sea cliff exposure in Bride moraine, Isle of Man (54° 20′ N Lat, 04° 20′ W Long), Great Britain. Coll. 1964 by C. A. M. King; subm. 1966 by J. T. Andrews. *Comment* (J.T.A.): sample weighed 6 gms, mixed with coal gas for counting. Date older than expected, may indicate that Bride moraine represents 2 phases. Upper section of moraine is frequently linked with Scottish readvance.

III. ARCHAEOLOGIC SAMPLES

A. Western United States

Port Moller series, Alaska

Charcoal from Hot Springs shell midden (55° 53′ N Lat, 160° 30′ W Long), W side of Port Moller (bay), Alaska. Coll. 1960 by S. Sugihara, Meiji Univ., subm. 1964 by C. S. Chard, Univ. of Wisconsin, Madison, Wisconsin.

I-1507. Trench I, bottom level **2680 ± 250**
730 B.C.

I-1508. Trench II, Section 2 **2960 ± 320**
1010 B.C.

From bottom of cultural deposit.

General Comment (C.S.C.): dates agree with time depth now known for human occupation elsewhere on Alaska Peninsula and in Aleutians (De Laguna, 1934; Workman, 1965).

I-1918. Sanders, Arizona **740 ± 95**
A.D. 1210

Charcoal flecks mixed with fluvial sand and roots off floor of Pithouse 3, from Sanders (35° 14′ N Lat, 109° 22′ W Long), Arizona. Coll. and subm. 1965 by G. J. Gumerman, Mus. of N Arizona, Flagstaff, Arizona. *Comment* (G.J.G.): date appears too late for preceramic site assigned to Basketmaker II tradition (A.D. 1 to 500) because of artifact type and architecture.

7600 ± 200
I-1928. Kern County, California 5650 B.C.

Fresh water clam shell (*Anadonta nuttalliana,* Lea) at foot of Buena Vista Hills, elev. 295 to 304 ft above sea level, on shore line of old Buena Vista Lake (35° 10′ 55″ N Lat, 119° 21′ 20″ W Long), Kern County, California. From cultural deposit 280 to 340 cm below ground surface (Gifford and Schenck, 1926; Wedel, 1941). Coll. 1965 by J. W. Grossman and John Waller; subm. 1965 by R. L. Burtner, Chevron Research Co. *Comment* (J.W.G.): date suggests possible affiliations with San Dieguito and Mohave complexes.

2130 ± 105
I-2007. Bare Ranch, California 180 B.C.

Charcoal from 1.80 m depth, elev. 4550 ft, Bare Ranch (41° 12′ N Lat 120° 1′ W Long), Lassen County, California. From 1 of series of circular house floors exposed during construction. Site is known locally as Chief Winnemucca's camp. Coll. 1965 by W. A. Davis and Don Tuohy; subm. 1966 by W. A. Davis, Univ. of Nevada, Reno, Nevada. *Comment* (W.A.D.): site was tested by J. F. O'Connell, Univ. of California, summer of 1966, who reported (oral commun.) that dated level yielded cultural material corresponding to Early Lovelock phase.

890 ± 150
I-1112. Mesa Verde, Colorado A.D. 1060

Charcoal from cist in 1 of deepest caves in Mesa Verde Natl. Park, W side of Long Canyon (37° 11′ 15″ N Lat, 108° 31′ 30″ W Long), Wetherill Mesa, Colorado. From site 1291, ca. 1.5 ft depth, Mesa Verde Mus. Cat. No. 41285/718, Field Specimen Cat. No. 103. Coll. 1963 by J. D. Swannack, Jr.; subm. 1963 by D. Osborne, U.S. Dept. of Interior, Natl. Park Service. *Comment* (D.O.): site 1291 has longest history of occupation in park from Basketmaker III through Pueblo III period. Best estimate is that cist was constructed during Basketmaker III period, dated in this park from ca. A.D. 600 to 700. Charcoal was probably washed in from Pueblo II occupation.

Spooner Lake series, Nevada

Charcoal from bedrock mortar and bedrock metate site at Spooner Lake (39° 6′ N Lat, 119° 54′ W Long), Douglas County, Nevada. Site is strategically located at pass on mule deer migration route, elev. 7000 ft. Culture-bearing deposit is homogeneous granitic sands and clays resting on granite rock which is rapidly decomposing along contact zone. Coll. 1965 and subm. 1966 by W. A. Davis.

565 ± 120
I-1995. No. 1, Cat. No. 14 A.D. 1385

From Pit No. 2, 0 to 15 cm depth. Spooner IV component, Kings Beach complex. *Comment* (W.A.D.): dates occurrence of Desert Side-

Notched projectile points (Sierra sub-type) and bedrock mortar pestle (Baumhoff and Byrne, 1959).

1800 ± 100
I-1996. No. 2, Cat. No. 199 **A.D. 150**

From Pit No. 11, 22 to 42 cm depth, composite. Spooner III component, late phase of Martis complex.

1890 ± 100
I-1997. No. 3, Cat. No. 228 **A.D. 60**

From Pit No. 12, 25 cm depth. From possible post associated with slab metate and biface mano. Spooner III component; late phase of Martis complex. *Comment* (W.A.D.): may date earliest appearance of Martis Corner-Notched projectile points.

3050 ± 105
I-1998. No. 4, Cat. No. 213 **1100 B.C.**

From Pit No. 11, 62 to 82 cm depth, composite. Spooner II component, early phase of Martis complex.

2960 ± 195
I-1999. No. 5, Cat. No. 217 **1010 B.C.**

From Pit No. 11, 82 to 102 cm depth, composite. Spooner II component, early phase of Martis complex. *Comment* (W.A.D.): younger date than I-1998 probably due to occupation mixture. I-1998 and I-1999 may date introduction of Rose Spring Corner-Notched projectile points.

4920 ± 120
I-2000. No. 6, Cat. No. 535 **2970 B.C.**

From Pit No. 26, charcoal lens 45 cm depth. *Comment* (W.A.D.): "wide-stem" Pinto point was recovered ca. 1 m distant and 5 cm above lens (Harrington, 1957).

7100 ± 140
I-2001. No. 7, Cat. No. 539 **5150 B.C.**

From Pit No. 26, 55 to 75 cm depth, composite. *Comment* (W.A.D.): data indicates possible existence of buried site E of bedrock mortar boulders.

410 ± 95
I-2002. No. 8, Cat. No. 526 **A.D. 1540**

From Pit No. 25, 28 to 48 cm depth, composite. From square in S-center of bedrock mortar area. Spooner IV component, Kings Beach complex.

1720 ± 100
I-2003. No. 9, Cat. No. 273 **A.D. 230**

From Pit No. 13, 10 to 30 cm depth, composite. On NE edge of bedrock mortar area. Spooner III component, late phase of Martis complex. *Comment* (W.A.D.): dates occurrence of thin portable metates.

I-2004. No. 10, Cat. No. 273 **<380**

From Pit No. 14, 28 to 48 cm depth, inverted deposit. Composite from S edge of bedrock mortar area. Spooner V component, Washo occupation phase. *Comment* (W.A.D.): submitted as check on extent of post-contact disturbances.

General Comment (W.A.D.): premature summary based on field data (Davis, 1966) tentatively reported that artifact inventory represented "relatively pure component" protohistoric in age. Detailed laboratory analysis did not support assumption. Index artifact type distribution anomalies plus post-contact disturbances made thorough checking by radiocarbon dating mandatory. Dates are internally consistent when correlated with excavation and laboratory data; they provide provisional culture chronology for Lake Tahoe region of Sierra Nevada Mts.

I-2006. Jacks Valley, Nevada **<460**

Charcoal from rock-oven hearth, Jacks Valley (39° 5′ N Lat, 119° 47′ W Long), Douglas County, Nevada. Elev. 4880 ft, cultural feature #2, Cat. No. 262, 15 cm depth. Jacks Valley II component, late phase of Kings Beach complex. Coll. 1965 and subm. 1966 by W. A. Davis.

1000 ± 115
I-1713. Rio Puerco, New Mexico **A.D. 950**

Charred corn from 20 in. depth, E bank of Rio Puerco, ca. 1 mi N of Highway 66, 18 mi W of Albuquerque (35° N Lat, 102° 15″ W Long), New Mexico. Many joined ears of corn were found encased by flat stones, all charred but not consumed, overlain by ca. 1 ft or black volcanic sand. Coll. 1961 by H. C. Neugebauer; subm. 1965 by C. H. Hapgood, Keene State College, New Hampshire. *Comment* (C.H.H.): date indicates volcanic eruptions in area were more recent than supposed.

Brewster series, Okanogan County, Washington

Charcoal from right bank of Columbia R., downstream from town of Brewster, Okanogan County, Washington.

3020 ± 150
I-2032. Neff Site, 45OK58, No. 279 **1070 B.C.**

Charcoal from small scattered hearth 1.6 m below surface (48° 4′ 40″ N Lat, 119° 50′ W Long), ca. 3 mi downstream from Brewster. Stratum also contained lanceloate and large basal-notched projectile points (Collier, Hudson, and Ford, 1942; Osborne, Crabtree, and Bryan, 1952; Swanson, 1959). Coll. 1966 by D. Browman; subm. 1966 by G. F. Grabert, Univ. of Washington, Dept. of Anthropol., Seattle, Washington.

2730 ± 160
I-2033. Hymer Site, 45OK78, No. 459 **780 B.C.**

Charcoal from housepit hearth 2.40 m below surface (48° 5′ 20″ N Lat, 119° 48′ 45″ W Long), ca. 1 mi downstream from Brewster on 1st terrace above active flood plain. Sample associated with fire-broken rocks, post molds, fish-bone, and fresh-water mussel (*Margaritifera*) shell. Coll. 1966 by D. Cole subm. 1966 by G. F. Grabert.

General Comment (G.F.B.): dates seem internally consistent with types of artifactual material, and in their external relationships to similar sites. Artifacts from both sites (I-2032 and I-2033) show similarities to those of comparable dates from Middle Columbia Region.

B. Central and Eastern United States

I-2308. R-16, Monks Mound, Illinois **1020 ± 100**
A.D. 930

Wood from 3rd terrace, E 180 – N 139, Hole No. 7, Monks Mound Ms-38 (38° 37′ N Lat, 90° 04′ W Long), Cahokia site, Madison County, Illinois. Taken by Shelby Tube Coring at depth 68 ft, apparent living surface 29 ft above base of mound. Coll. and subm. 1966 by J. W. Porter and N. A. Reed, Washington Univ., St. Louis. *Comment* (J.W.P.): sample establishes date for 1 of early construction stages of mound, to be compared with A.D. 1120 ± 100 for last known living stage at 96 ft above base, 4 ft below present surface.

Effigy Mounds series, Iowa

Hickory charcoal from cremation zone, 38 to 40 in. depth in conical mound 12, sec. 27, T96 N, R3 W, Effigy Mounds Natl. Monument (43° 5′ N Lat, 91° 11′ W Long), Allamakee County, Iowa. Soil profile above zone is weakly developed, cremation zone is in buried B horizon 32+ in. Coll. 1960 by R. B. Parsons and W. H. Scholtes; subm. 1961 by R. V. Ruhe.

I-295. Effigy Mounds, No. 1 **1740 ± 110**
A.D. 210

I-296. Effigy Mounds, No. 2 **1960 ± 90**
10 B.C.

Knox County series, Nebraska

Charcoal, carbon, and ash from Knox County, Nebraska. Coll. 1963 and subm. 1964 by R. D. Gant, South Dakota Mus., State Univ. of South Dakota, Vermillion, South Dakota.

I-1308. Knox County, No. 1 **2660 ± 110**
710 B.C.

Charcoal from depth 4.5 to 5.0 ft, SE 1/4, sec. 14, T33 N, R2 W, Knox County (42° 30′ N Lat, 97° 45′ W Long), Nebraska. From layer of refuse sandwiched between thick strata of dark brown humus. Associated with flakes, cores, a single point fragment, bison bones, and a rim sherd (Howard and Gant, 1966). *Comment* (R.D.G.): date should establish early horizon for Plains Woodland on central Plains.

2750 ± 210
I-1309. Knox County, No. 2 **800 B.C.**

Carbon from depth 5.5 ft, SE 1/4, sec. 14, T33 N, R2 W, Knox County (42° 30′ N Lat, 97° 40′ W Long), Nebraska. Associated with unworked flakes, mid-section of projectile point, blade fragments, and polished antler tine (Howard and Gant, 1966). *Comment* (R.D.G.): date is close to that of Sample No. 1 (I-1308, this list) and may indicate separation of Plains Archaic from Plains Woodland horizon.

2960 ± 125
I-1310. Knox County, No. 3 **1010 B.C.**

Organic material (ash and carbon) from fire hearth at depth 16.5 ft, SE 1/4, sec. 14, T33 N, R2 W, Knox County (42° 30′ N Lat, 97° 40′ W Long), Nebraska. Artifacts and cultural detritus found at this depth are similar to material culture recovery from Occupation Level I at Signal Butte in NE Nebraska (Strong, 1935; Howard and Gant, 1966). *Comment* (R.D.G.): date should be assigned to Plains Archiac Tradition dating corner-notched "fish-tailed" style projectile points.

3640 ± 110
I-1345. Ocala National Forest, Florida **2690 B.C.**

Shells (*Viviparus georgianus* Lea) from "Midden No. 1" at 12 in. depth, Ocala Natl. Forest (29° 5′ 30″ N Lat, 81° 31′ W Long), NE Lake City, Florida. Coll. and subm. 1964 by R. P. Bullen, Univ. of Florida, Florida State Mus., Gainesville, Florida. *Comment* (R.P.B.): sample taken to compare date with those of neighboring midden. Date as anticipated was younger but may not be reliable due to $CaCO_3$ in water where shells grew (Bullen and Bryant, 1965).

Crystal River series, Florida

Charcoal from Crystal R. (28° 54′ 15″ N Lat, 82° 37′ 45″ W Long), Citrus City, Florida. Sample I-1365 coll. 1960, other samples coll. 1964; all subm. 1964 by R. P. Bullen.

1310 ± 100
I-1365. CR 1-1 **A.D. 640**

From charcoal "hearth" or "fireplace" 19 ft below top of large temple mound. *Comment* (R.P.B.): date is reasonable for construction of lower part of this early temple mound.

1870 ± 130
I-1366. CR 2-3 **A.D. 80**

From midden, 18 to 24 in. depth, associated with fabric or textile in pressed and plain sherds. *Comment* (R.P.B.): date seems early but is about right for close of Deptford period.

1750 ± 130
I-1367. CR 3-6 **A.D. 200**

From midden, 54 to 60 in. depth, associated with Deptford Linear check and simple stamped plus Pasco Plain sherds. *Comment* (R.P.B.): date is about right for close of late Deptford in this area.

330 ± 100
I-1368. CR 4-7 **A.D. 1620**

From base of main burial mound at Crystal R. site. *Comment* (R.P.B.): sample believed contaminated by charcoal from fires during earlier excavation.

1420 ± 125
I-1464. Ci-1 **A.D. 530**

From path of food remains, 15 to 18 in. depth, leading from bottom of recently discovered stele to bottom of nearby rock. *Comment* (R.P.B.): date indicates erection of stele. Ramp of early temple mound (I-1365, this series) points almost directly toward this stele.

1980 ± 100
I-1916. Crystal River No. 6, Florida **30 B.C.**

Charcoal from N side Crystal R. (28° 54′ 30″ N Lat, 82° 37′ 35″ W Long), peninsula Florida. From pit in basal black zone under main burial mound. Coll. and subm. 1965 by R. P. Bullen. *Comment* (R.P.B.): zone is presumably 1st part of construction of main burial mound at Crystal R. Date implies large burial mound was built first and high conical part was constructed later upon platform.

3040 ± 115
I-1661. Polk City, No. 1, Florida **1090 B.C.**

Wood (American Cyanamid) from derelict Indian canoe below 5 ft of peat and muck, NE of Lakeland, Polk City (28° 7′ N Lat, 81° 55′ 30″ W Long), Florida. Coll. and subm. 1965 by R. P. Bullen. *Comment* (R.P.B.): date indicates dugout canoes were in use 3000 yr ago.

Mosquito Lagoon series, Florida

Charcoal from Mosquito Lagoon (28° 49″ N Lat, 80° 49′ W Long), SE of Oak Hill, Volusia City, Florida. Coll. 1963 by R. P. Bullen and W. J. Bryant; subm. 1965 by R. P. Bullen.

955 ± 110
I-1663. Test 1 **A.D. 995**

From 36 to 42 in. depth, Midden Test 1.

1680 ± 220
I-1664. Test 2 **A.D. 270**

From 5 ft depth, Midden Test 2, associated with St. Johns Plain pottery.

General Comment (J.P.B.): dates confirm previous estimates of time of St. Johns I A late period.

Burtine Island series, Florida

Shells and charcoal from Burtine Island (28° 59′ 30″ N Lat, 82° 44′ 45″ W Long), W coast of Florida. Coll. and subm. 1965 and 1966 by R. P. Bullen.

2630 ± 100
I-1913. Burtine Island, Site A **680 B.C.**

Melongena shell from 18 to 24 in. depth. *Comment* (R.P.B.): date pertains to undecorated ceramic period of Florida Gulf Coast. Apparently it is before instead of after Weeden Island period.

1505 ± 95
I-1914. Burtine Island, Site C **A.D. 445**

Venus clam shell from 18 to 24 in depth. *Comment* (R.P.B.): sample associated with ceramics of Perico period and Deptford simple stamped sherds. Deptford period may have lasted later in this area.

235 ± 100
I-1915. Burtine Island, Site D **A.D. 1715**

Charcoal from 24 to 27 in. depth. *Comment* (R.P.B.): charcoal must have been from stump which burnt in ground.

1965 ± 95
I-1961. Burtine D, Sample 4 **15 B.C.**

Busycon shell from 36 to 43 in. depth in shell midden. *Comment* (R.P.B.): date indicates shell from Deptford period.

325 ± 90
I-2010. Burtine C, 12-18 in. **A.D. 1625**

Charcoal from 12 to 18 in. depth in shell midden. *Comment* (R.P.B.): date is incongruent with archaeology. Must indicate disturbance of undetected post hole or pit.

3390 ± 110
I-1988. Burtine C, Test 2 **1440 B.C.**

Melongena corona shell from 6 to 12 in. depth in shell midden. *Comment* (R.P.B.): date incompatible with archaeology, probably because of antique carbon from limestone in solution in shells environment.

625 ± 95
I-1965. Barnstable, Massachusetts **A.D. 1325**

Carbonized wood from shell heap at Sandy Neck, Barnstable (41° 44′ 06″ N Lat, 70° 22′ 20″ W Long), Massachusetts. From surface exposure of presumed Indian camp site. Assoc. with pottery fragments and broken clam shells. Coll. and subm. 1965 by A. C. Redfield.

640 ± 95
I-2399. Nahrwold site, Middleburgh, New York A.D. 1310

Charcoal from Nahrwold site (42° 34′ 30″ N Lat, 74° 20′ 37″ W Long), town of Middleburgh, Schoharie County, New York. Charcoal taken from storage pit, assoc. with much bone and flint refuse, a sinew-stone, flint knife, and potsherds of Castle Creek Beaded type (Ritchie, 1965). Coll. and subm. 1966 by W. A. Ritchie, New York State Mus. and Sci. Serv., New York. *Comment* (W.A.R.): date agrees with very late Owasco period just preceding transition into early lroquois Oak Hill horizon.

2540 ± 100
I-2400. Weinman site, Warren County, New York 590 B.C.

Charcoal from Weinman site (43° 27′ 30″ N Lat, 73° 34′ 18″ W Long), Assembly Point, Lake George, Warren County, New York. Sample from base of Feature 16, large oval pit originating at or near top of Stratum 2, Archaic zone at site (Funk *et al.*, 1965; Funk, 1966a). Coll. 1965 by R. E. Funk and T. P. Weinman; subm. 1966 by R. E. Funk. New York State Mus. and Sci. Serv., New York. *Comment* (R.E.F.): date is much later than expected. Sample was believed assoc. with late Archaic manifestations which occurred at top of Stratum 2. However, it appears that Feature 16 actually originated at contact plane of Strata 1a and 2, so that sample dates small Early Woodland component at site.

3710 ± 100
I-2401. Pickle Hill site, Warren County, New York 1760 B.C.

Charcoal from Pickle Hill site (43° 24″ N Lat, 73° 33′ W Long), Queensbury Township, Warren County, New York. Combined charcoal samples from 2 large oval cooking features which extended into subsoil below plow zone on this single-component site of late Archaic River phase (Ritchie, 1965). Coll. 1966 by Thomas and Paul Weinman; subm. 1966 by R. E. Funk. *Comment* (R.E.F.): date is congruent with previous estimates for River phase.

C. Canada

Deep River series, Ontario

Wood charcoal from refuse pit, near Deep R. (46° 06′ N Lat, 77° 27′ W Long), Ontario, Canada. Coll. 1962 by B. M. Mitchell; subm. 1966 by W. N. Irving, Natl. Mus. of Canada.

1820 ± 100
I-2083. Deep River, No. 1 A.D. 130

From 12 to 16 in. depth in 40 in. deep refuse pit, Site CaGi-1, Sq. D-19W. Assoc. with Vinette-1 potsherds, firestone, flint chips, ash, and wood-carbon.

2030 ± 100
I-2084. Deep River, No. 2 **80 B.C.**

From 24 in. depth in 40 in. deep refuse pit, Site CaGi-1, Sq. D-19W. *General Comment* (B.M.M.): dates agree well with age estimate and supports chronological priority of Early Point Peninsula, Vinette-1 ware in Canada (Mitchell, 1966).

Southern Indian Lake series, Canada

Samples from 16 mi NE of South Indian Lake (56° 57′ N Lat, 98° 44′ W Long), Manitoba, Canada. Coll. 1965 by J. V. Wright; subm. 1966 by W. N. Irving.

435 ± 110
I-2078. HfLq-1, Samples I and II **A.D. 1515**

Charcoal from Trench 2, Stratum I. *Comment* (W.N.I.): date substantiates late position of Stratum I at HfLq-1 site and indirectly supports premise that Selkirk pottery was still in use during historic period in area as suggested by surface assoc. of pottery and European trade items at other nearby sites. Apparent survival of Selkirk pottery into historic period suggests some bands of Chipewyan and Cree shared common tradition.

I-2080. HfLq-1, Sample III **<1210**

Charcoal from Trench 2, Stratum II.

730 ± 150
I-2081. HfLq-1, Sample IV **A.D. 1220**

Charcoal from Trench 1, Stratum II, NE quadrant. *Comment* (W.N.I.): agreement between Samples III and IV indicates early 12th century occupation period for Stratum II at HfLq-1 site. Selkirk ceramics were used in region a long time and not introduced at a late date.

705 ± 320
I-2082. HfLq-1, Sample V **A.D. 1245**

Charcoal from Trench 1, thin lens diverging from bottom of Stratum II. *Comment* (W.N.I.): agreement of date with Samples III and IV suggests thin lens below Stratum II is not significantly older than Stratum II.

1630 ± 135
I-2086. Keewatin District, N.W.T. **A.D. 320**

Wood charcoal from exposed hearth, Site JjLk-4, S shore of passage between Oftedal and North Henik Lakes, Keewatin District (61° 37′ N Lat, 97° 45′ W Long), N.W.T., Canada. Coll. 1964 and subm. 1966 by W.N. Irving. *Comment* (W.N.I.): along with I-2087 and I-2089 (this date list) is 1st archaeological date from Barren Grounds. Assoc. artifacts represent form of Archaic culture (Irving, mss. in preparation).

Lamb Pegeelak series, N.W.T.

Charred wood and charcoal from Lamb Pegeelak site, Oftedal Lake, 150 yds S of outlet (61° 37′ 55″ N Lat, 97° 53′ 50″ W Long), Keewatin District, N.W.T. Coll. 1964 by C. F. Merbs (I-2089) and W. N. Irving; subm. 1966 by W. N. Irving.

1110 ± 90
I-2087. Lamb Pegeelak site, No. 1 **A.D. 840**

Charred log of 6 in. depth in layer of humus and charcoal, between 2 A2 (podzol) soil horizons. *Comment* (W.N.I.): sample dates forest fire. It is nearly contemporary with other dates on forest fires from Ennadai Lake and the Kazan R. (Bryson *et al.,* 1965; Irving, mss. in preparation).

2040 ± 295
I-2089. Lamb Pegeelak site, No. 2 **90 B.C.**

Charcoal (mostly wood) from uppermost Zone A, assoc. with flint chips and burned bone. *Comment* (W.N.I.): sample dates Zone A, believed younger than Zone B (Bryson *et al.,* 1965).

National Museum of Canada series, N.W.T.

Samples from various sites in N.W.T., Canada. Coll. and subm. 1963 to 1965 by W. E. Taylor, Jr., Natl. Mus. of Canada, Ottawa.

600 ± 105
I-2052. Jackson site, No. 1 **A.D. 1350**

Willow twigs from cultural debris on floor of house, Jackson site, Police Point, near Cape Parry (70° 12′ N Lat, 124° 34′ W Long), N.W.T., Canada. Debris, 3 to 6 in. thick, was exposed by bulldozer.

935 ± 90
I-2088. Jackson site, No. 2 **A.D. 1015**

Wood fragments with adhering organic matter from cultural debris on floor of house, Jackson site, Police Point, near Cape Parry (70° 12′ N Lat, 124° 34′ W Long), N.W.T., Canada. *Comment* (W.E.T.): artifacts from Jackson site represent developed stage of Thule culture (Taylor, 1964; 1965).

2910 ± 105
I-2053. Buchanan site, No. 1 **960 B.C.**

Charcoal (granular) mixed with soil from midden 8 to 12 in. depth, Trench 2, Sq. 4, SE 1/4, Buchanan site, S bank of Ekalluk R., SE Victoria Island (69° 24′ N Lat, 106° 15′ W Long), N.W.T., Canada. *Comment* (W.E.T.): date indicates late Pre-Dorset occupation at Buchanan site (Taylor, 1967).

2990 ± 125
I-2054. Buchanan site, No. 2 **1040 B.C.**

Charcoal (granular) mixed with soil from hearth remnant 4 to 5 in. depth, Trench 5, Sq. B, Buchanan site, S bank of Ekalluk R., SE Victoria Island (69° 24′ N Lat, 106° 15′ W Long), N.W.T., Canada.

1260 ± 95
I-2055. Ballantine site **A.D. 690**

Peat from midden matrix, 5 to 8 in. depth, Trench 1, Sq. 8, Ballantine site, SW extremity of Ferguson Lake, SE Victoria Island (69° 24′ N Lat, 106° 14′ W Long), N.W.T., Canada. *Comment* (W.E.T.): date seems too young, artifacts reflect early Dorset occupation (Taylor, 1964; 1967).

1055 ± 100
I-2056. Ferguson Lake site **A.D. 895**

Peat from midden matrix, 6 to 7 in. depth, Trench 4, Sq. 4, Ferguson Lake site, SW extremity of Ferguson Lake, SE Victoria Island (69° 24′ N Lat, 106° 13′ W Long), N.W.T., Canada.

3180 ± 120
I-2057. Wellington Bay site **1230 B.C.**

Charcoal (powdered) mixed with soil, 7 to 8 in. depth, from Wellington Bay site, ca. 1 mi SE of mouth of Ekalluk R., SE Victoria Island (69° 23′ N Lat, 106° 17′ W Long), N.W.T., Canada. From Sec. 3 of Test Cut 1, in N side of site which caps small hill. *Comment* (W.E.T.): date indicates site is of Pre-Dorset culture.

2880 ± 105
I-2058. Menez site **930 B.C.**

Charcoal (powdered) mixed with soil, 4 to 7 in. depth in W part of Test Cut 4, from Menez site, S side of Ekalluk R., SE Victoria Island (69° 24′ N Lat, 106° 15′ W Long), N.W.T., Canada. *Comment* (W.E.T.): date indicates Menez was occupied very late in Pre-Dorset period (Taylor, 1967).

705 ± 120
I-2059. Pembroke site **A.D. 1245**

Charred bone in House 5, 10 to 12 in. depth, by small hearth, Pembroke site, SE bank of Freshwater Creek, ca. 1 mi upstream from Cambridge Bay, SE Victoria Island (69° 7′ N Lat, 105° W Long), N.W.T., Canada. *Comment* (W.E.T.): date and artifacts suggest rather early Thule occupation.

D. Europe

4130 ± 105
I-2328. Stonehenge I, England **2180 B.C.**

Antler of Red Deer *(Cervus elaphus)* from 6 ft depth in bottom of ditch at Stonehenge 8 mi N of Salisbury (51° 10′ 42″ N Lat, 1° 49′ 29″ W

Long), Wiltshire, England. Coll. 1964 and subm. 1966 by R. J. C. Atkinson, Univ. College, Cardiff, Great Britain. *Comment* (R.J.C.A.): sample dates construction of bank and ditch, and by inference Aubrey Holes which are concentric with them (Atkinson, 1956).

I-2290. Kobeaga Cave, Spain **2690 ± 100**
740 B.C.

Human bone from Kobeaga Cave near village of Ispaster (43° 21′ 14″ N Lat, 1° 07′ 11″ E Long), Vizcaya Province, Spain. Coll. and subm. 1966 by E. Nolte y Aramburu, Las Arenas, Vizcaya, Spain. *Comment* (E.N.yA.): date indicates delay in Bronze age. Small mountain range in area may have been barrier against foreign cultures.

E. Africa

Igbo-Ukwu series, Nigeria

Charred bone in House 5, 10 to 12 in. depth, by small hearth, Pem-Lat, 7° 1′ E Long), E. Nigeria. Coll. 1960 (I-2008) and 1964 and subm. 1966 by Thurstan Shaw, Inst. of African Studies, Univ. of Ibadan, Nigeria, Africa.

I-1783. Igbo Jonah, Cutting II C **13,500 ± 250**
11,550 B.C.

Charcoal from depth 1.3 to 1.75 m in sandy deposit (Shaw, 1965b). *Comment* (T.S.): layer of charcoal was probably result of bush-burning, either by human activity or natural bush-fires.

I-1784. Igbo Jonah, Pit IV **1110 ± 145**
A.D. 840

Charcoal from composite, 1.6 to 2.9 m depth, in pit which contained copper, bronze, and iron work (Shaw, 1965b). *Comment* (T.S.): 1 of 1st dates obtained for any archaeological site at Igbo-Ukwu; earlier than anticipated.

I-2008. Igbo Richard **1110 ± 120**
A.D. 840

Wood surrounding copper bosses, believed part of stool, from depth 3.3 m in burial chamber (Shaw, 1965b). *Comment* (T.S.): 1 of 1st dates obtained for any archaeological site at Igbo-Ukwu; earlier than anticipated.

Iwo Eleru series, Nigeria

Wood charcoal ca. 15 mi N of Akure (7° 24′ N Lat, 5° 10′ E Long), W Nigeria. Coll. and subm. 1965 by T. Shaw.

I-1753. UI/651 **11,200 ± 200**
9250 B.C.

From 0.70 to 1.00 m depth, cutting XXIII D. Associated with skeletal material. *Comment* (T.S.): date earlier than anticipated, but not inconsistent with assoc. type of stone industry (Shaw, 1965a).

I-1754. UI/652 **9150 ± 150**
7200 B.C.

From 1.00 to 1.15 m depth, cutting XVIII D, Level 7. *Comment* (T.S.): this date from different part of occupation layer, believed to have had long existence, has some confirmation for antiquity of I-1753 (Shaw, 1965a).

I-1844. Grahamstown, South Africa **18,740 ± 320**
16,790 B.C.

Charcoal from rock shelter, Square C3, Layer 4 (cultural horizon), at depth ca. 1 ft 3 in., Howieson's Poort (32° 22′ S Lat, 26° 28′ E Long), near Grahamstown, Cape Province, South Africa. Coll. and subm. 1965 by J. Deacon and H. J. Deacon, Albany Mus., Grahamstown, South Africa. *Comment* (H.J.D.): date, slightly older than expected, indicates crescents and backed blades characteristic of Wilton Later Stone Age culture were being made as early as 18,000 yr ago in this region of South Africa (Stapleton and Hewitt, 1927; 1928).

F. Iran

Deh Luran series, Iran

Samples from 2 sites, Ali Kosh and Tepe Sabz, in Deh Luran region (32° 15′ to 32° 30′ N Lat, 47° 8′ to 47° 24′ E Long), SW Iran. Coll. 1963 by Frank Hole and James Neely; subm. 1964 by Frank Hole, Rice Univ., Houston, Texas.

I-1489. AK — 94 — 691 **7670 ± 170**
5720 B.C.

Carbonized seeds and ash from Ali Kosh (Bus Mordeh phase), Square 94, 690 cm depth. Directly above sterile sand. *Comment* (F.H.): estimated age between 7000 to 8000 B.C.

I-1491. AK — 69 — 260 **8100 ± 170**
6150 B.C.

Charcoal and ash from Ali Kosh (Ali Kosh phase), Square 69, 260 cm depth.

I-1493. TS — 25 — 501 **6470 ± 160**
4520 B.C.

Charcoal from Tepe Sabz (Mehmeh phase), Square 25, 500 cm depth.

I-1494. AK — 59 — 150 **7820 ± 190**
5870 B.C.

Charcoal and ash from Ali Kosh (Mohammad Jaffar phase), Square 59, 150 cm depth.

I-1496. AK — 91 — 525 **7380 ± 130**
5430 B.C.

Charred seeds and ash from Ali Kosh (Bus Mordeh phase), Square 91, 525 cm depth. *Comment* (F.H.): estimated age 7000 to 8000 B.C.

I-1497. TS — 20 — 968 **6740 ± 190**
4790 B.C.

Carbonized wood from Tepe Sabz (Sabz phase), Square 20, 960 to 980 cm depth. *Comment* (F.H.): estimated age 5000 to 6000 B.C.

I-1500. TS — 7 — 380 and TS — 9 — 400 **5410 ± 160**
4360 B.C.

Carbonized wood from Tepe Sabz (Mehmeh phase), 2 samples combined, Square 7, 380 cm depth and Square 9, 400 cm depth. *Comment* (F.H.): estimated age 4000 B.C.

I-1501. TS — 21 — 680 **7460 ± 160**
5510 B.C.

Charcoal from Tepe Sabz (Khazineh phase), Square 21, 680 cm depth.

I-1502. TS — 15 — 312 **6060 ± 140**
4110 B.C.

Charred wood, seeds, and dung from Tepe Sabz (Bayat phase), Square 15, 310 cm depth.
General Comment (F.H.): this series of dates are 1st obtained from SW Iran for prehistoric period. Although dates show some marked departures from the expected, we have a fairly good idea, from stratigraphic succession and from dates obtained at other sites, what chronological limits of Deh Luran sequence are. We cannot estimate as well, duration of any phase within sequence (Hole, 1962; Hole and Flannery, 1962; Hole *et al.*, 1965; UCLA IV).

G. Peru

Chilca Canyon series, Peru

Samples from Cave I in upper Chilca Canyon, central coast of Peru. Coll. 1967 by Bernardino Ojeda and Frederic Engel subm. 1967 by Frederic Engel, Inst. of Anthropol., Natl. Agrarian Univ., Lima, Peru.

I-3160. Cave I, V-2623, Peru **9940 ± 200**
7990 B.C.

Ashes, peat, and carbonized plants mixed with fine gravel from deepest level in Cave I, Site 12B-VI-470, Level 900, elev. 3,600 m, upper Chilca Canyon (12° 14′ to 15′ S Lat, 76° 21′ to 22′ W Long), central coast of Peru.

I-3161. Cave I, V-2643, Peru **4810 ± 125**
2860 B.C.

Charcoal and mat material from Level 2 in cave "Tres Ventanas," elev. 3,900 m, upper Chilca Canyon (12° 13′ 14″ S Lat, 76° 22′ 23″ W Long), central coast of Peru. Assoc. with unknown type of pottery.

I-3162. Casma Valley, Peru **1500 ± 100**
A.D. 450

Charcoal from inside house on terrace of Bombon Grande, Site 8 C-X-4, Level 1, elev. 650 m, Casma valley (9° 31′ 32″ S Lat, 77° 56′ 57″ W Long), N coast Peru. Coll. 1966 by Frederic Engel and Bernardino Ojeda; subm. 1967 by Frederic Engel. *Comment* (F.E.): sample helps date early canal irrigated complex with temple, dwellings, and planting terraces belonging to unidentified culture.

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COPENHAGEN RADIOCARBON DATES IX

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Carbon-14 Dating Laboratory

Department of Natural Sciences, National Museum, Copenhagen

The following list comprises a selected number of measurements made up to October, 1967. Age calculations are based on 95% of the activity of the NBS oxalic-acid standard, and on a half-life for C^{14} of 5570 yr. Results are reported in yr before 1950, and in the A.D./B.C. scale.

Errors quoted include standard deviations of the count rates for the unknown sample, contemporary value, and background. Because possible errors arising from isotopic fractionation in the plants, or from the de Vries effect, have not been included, calculated errors smaller than 100 yr have been increased by rounding to that figure as a minimum.

Sample descriptions have been prepared in collaboration with collectors and submitters.

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SAMPLE DESCRIPTIONS

I. GEOLOGIC AND POLLEN-DATED SAMPLES

A. Denmark

Limfjordstunnel, Allerød section

Samples from 2 thin organic layers found in profile through calcareous sediments at Rørdal (57° 4′ N Lat, 9° 59′ E Long), Jutland, during construction of tunnel underneath Limfjord. Organic stripes found ca. 7 m below present surface assumed representative of warm intervals during Late Glacial time, either Allerød or Bølling. Coll. 1966 and subm. by Th. Sorgenfrei, Inst. Tech. Geol., Tech. Univ., Copenhagen. *Comment*: dates suggest Allerød age for both samples. Sediments were calcareous; dates may be older than true ages.

K-1212. Limfjordstunnel, II **11,800 ± 140**
9850 B.C.

Peat from upper layer, 1 m NE of P 6. Date is average of 2 measurements: 11,720 ± 180 and 11,880 ± 180.

K-1211. Limfjordstunnel, I **11,650 ± 160**
9700 B.C.

Humic material from lowest of 2 organic layers. Date is average of 2 measurements: 11,510 ± 180 and 11,860 ± 220.

K-1145. Draved Mose, H 1312, D.G.U. 304 **7880 ± 120**
5930 B.C.

Peat from Profile H 1312 in drainage ditch in bog Draved Mose (55° 1′ N Lat, 8° 57′ E Long), S Jutland; near shore of prehistoric "Draved Lake." Peat 63 to 64 cm above sand. Dates immigration of alder. Coll. 1963 and subm. by A. Andersen and Johs. Iverson, Geol. Survey of Denmark. *Comment*: many overlying and underlying samples from peat monolith cut out of this profile were previously dated (Copenhagen VII); dates agree. Date is average of 2 measurements: 7750 ± 150 and 8000 ± 150.

Draved Mose, charred pine stumps

Samples from charred pine stumps and charred plant material from Profile H 1312 in bog Draved Mose (55° 1′ N Lat, 8° 57′ E Long), S Jutland. Found at transition from forest peat to sphagnum peat, close to pollen zone border VI/VII (ex Knud Jessen) where several charred stumps were discovered, suggesting destruction of large parts of forest by fire. Coll. 1965 and subm. by A. Andersen, Geol. Survey of Denmark. *Comment*: series of charred pine stumps from same level and profile were previously dated (Copenhagen VII); dates agree. Compare also Elsborg series (this date list).

K-1144. Draved Mose, D.G.U. 300 **7890 ± 150**
5940 B.C.

Wood (*Pinus* sp.) from outer year-rings of root belonging to charred stump sticking out of Profile H 1312.

K-1143. Draved Mose, D.G.U. 299 **7920 ± 150**
5970 B.C.

Charcoal (*Pinus* sp. and *Betula* sp.) from thin layer of charcoal, 73 to 75 cm above sand, found with sample K-1144.

K-1142. Draved Mose, D.G.U. 297 **7870 ± 150**
5920 B.C.

Charred plant material from charred stripe, 82 to 83 cm above sand, few cm above charcoal of K-1143. Probably originates from fire in heather vegetation that succeeded pine forest.

K-1141. Draved Mose, P 1959, D.G.U. 276 **6610 ± 140**
4660 B.C.

Alder fen peat from open profile, P 1959, 30 m long, in central part of bog Draved Mose (55° 1′ N Lat, 8° 57′ E Long), S Jutland. Profile exposes peat from early Atlantic time to present and overlies sand. Sample taken from 0 to 1 cm above sand. Dates beginning of peat formation at site. Coll. 1960 and subm. by A. Andersen and Johs. Iverson. *Comment*: many overlying samples from peat monolith cut out of this profile were previously dated (Copenhagen VI and VII).

Elsborg Mose, charred pine stumps

Charred stumps and layers of charcoal from bog Elsborg Mose in forest Løvenholm Skov (56° 26′ N Lat, 10° 27′ E Long), Jutland. Many charred pine stumps with layers of charcoal found in all parts of bog suggesting one or more extensive forest fires. Samples were measured to date this fire and compare age with that of charred stumps in Draved Mose. Coll. 1965 by H. Bahnson and A. Andersen; subm. by A. Andersen. *Comment*: stumps are younger than those of Draved Mose (Copenhagen VII, and this date list).

K-1021. Elsborg Mose, D.G.U. 283a **7190 ± 150**
5240 B.C.

Wood (*Pinus* sp.) from charred stump from profile in W part of bog. Tree had been standing at shore of small lake. Stump was in tilted position toward shore; a charred layer sloped down to lake.

K-1022. Elsborg Mose, D.G.U. 284c **7140 ± 150**
5190 B.C.

Charcoal (*Pinus* sp.) from sloping charred layer found with sample K-1021.

K-1023. Elsborg Mose, D.G.U. 285a **7320 ± 120**
5370 B.C.

Wood (*Pinus* sp.) from charred stump from N part of bog. Date is average of 2 measurements: 7400 ± 150 and 7240 ± 150.

K-1024. Elsborg Mose, D.G.U. 286a **6850 ± 120**
4900 B.C.

Charcoal (*Pinus* sp.) from layer of charcoal beside sample K-1023. Layer turned in over and covered stump. Date is average of 2 measurements: 6760 ± 140 and 6940 ± 140.

K-1222. Stensballe Sund, oyster bank **6340 ± 130**
4390 B.C.

Shells (*Ostrea edulis*) from large natural shell bank in Stensballe Sund, loc. I A (55° 52′ N Lat, 9° 54′ E Long), Jutland. Shells from lowest layer of bank, where shells were *in situ* in bottom sediments. Date 1st immigration of oyster into narrow sound, where even slight tide could produce strong circulation. Presumably contemporary with one of the Littorina transgressions. Coll. 1966 and subm. by U. Møhl, Zool. Mus., Univ. of Copenhagen. *Comment*: 10 to 20% of surface material was dissolved before dating. Age calculated on basis of contemporary value for terrestrial material.

K-1190. Roskilde Fjord, oyster bank **5660 ± 130**
3710 B.C.

Shell (*Ostrea edulis*) from large natural shell bank in Roskilde Fjord, Loc. II (55° 44′ N Lat, 12° 3′ E Long), Zealand. Shell from lowest layer of bank, where shells *in situ* were sitting in or lying on bottom sediments. Dates first immigation of oyster into Roskilde Fjord, which today is too fresh for oyster. Presumably contemporary with one of Littorina transgressions. Coll. 1966 and subm. by U. Møhl.

B. Greenland

K-1250. Patorfik, Cleft II, G.G.U. 20 **>35,000**

Shells (*Astarte et al.*) from Quaternary layer of consolidated marine clay in Cleft II at Patorfik (70° 24′ N Lat, 52° 32′ W Long), Umanak District, W Greenland. Shells were sticking in consolidated layer of coastal cliff, 3.3 m above sea level. Locality described by Laursen (1944). Coll. 1964 and subm. by A. Rosenkrantz, Mineralog. Mus., Univ. of Copenhagen. *Comment*: date indicates interglacial age of shells.

K-1249. Qaersuarssuk Kitdleg, G.G.U. 19 **8610 ± 160**
6660 B.C.

Shells (*Saxicava arctica* and *Mya truncata*) from layer of marine sand at Qaersuarssuk Kitdleg (70° 44′ N Lat, 52° 40′ W Long), Umanak District, W Greenland. Shells from layer of post-glacial, raised, deltaic sediments in coastal cliff, Locality 4a, 5 m above sea level. Fauna indicates arctic, but not high-arctic climate. Locality described by Laursen (1944). Coll. 1964 and subm. by A. Rosenkrantz.

K-988. Nerutussoq nigerdleq, G.G.U. 2b **9580 ± 210**
7630 B.C.

Laminated, clayey gyttja from lake 90 m above sea level at Nerutussoq nigerdleq (62° 4′ N Lat, 49° 20′ W Long), Frederikshåb, W Greenland. Sample from unit of lake deposits (6.5 cm thick) overlying basal unit (4.5 cm thick) which contained too little organic material for C^{14} measurement. Lake deposits lay on fluvioglacial sands from moraine system tentatively dated to ca. 9000 B.P. Coll. 1964 and subm. by M. Kelly, Geol. Survey of Greenland, Copenhagen.

Qaqarssuaq series

Gyttja from borings through deposits in 3 lakes on different levels at Qaqarssuaq (62° 7′ N Lat, 49° 37′ W Long), Frederikshåb, W Greenland. Date post-glacial marine transgression and regressions at locality. Coll. 1965 and subm. by M. Kelly.

K-1149. Qaqarssuaq, G.G.U. 13 **9840 ± 170**
7890 B.C.

Detritus gyttja, rich in mosses and cladocera, from basal unit (1.7 cm thick) of fresh water organic sediments resting on inorganic laminated clays, silts, and sands of glacial and glaciomarine provenance. Core taken in existing lake at 42 m above sea level. Dates approx. maximum of post-glacial marine transgression in area. Sample aggregated from 3 adjacent boreholes.

K-1150. Qaqarssuaq, G.G.U. 14b **8510 ± 160**
6560 B.C.

Non-calcareous gyttja from 2 to 4.5 cm above bottom in basal fresh water deposits overlying marine gyttja. From existing lake at 33 m above sea level. Dates regression from sea-level at height of lake. Zone (a) of local pollen succession. Supposed age: Boreal. Sample aggregated from 3 adjacent boreholes.

K-1151. Qaqarssuaq, G.G.U. 15a, b. **8680 ± 160**
6730 B.C.

Non-calcareous gyttja from lowest 4.5 cm of basal fresh-water deposits overlying marine silts and sands in existing lake at 21 m above sea level. Dates regression from sea level at height of lake. Zone (a) of local pollen succession. Supposed age: Late Boreal or Early Atlantic. *Comment*: date considered too old.

K-1154. Mellembygd, G.G.U. 18 **8210 ± 160**
6260 B.C.

Marine shells (*Mytilus edulis*) from layer, 50 cm thick, of sands rich in comminuted shell fragments ca. 9 m above sea level at Mellembygd (62° 4′ N Lat, 49° 20′ W Long), Frederikshåb, W Greenland. Shell sand interpreted as littoral deposit, overlain by 2 m of unfossilferous sand and underlain by glaciomarine silt with boulder. Dates maximum age for sea level within a few m of present height of site. Supposed age: Late Atlantic. Coll. 1965 and subm. by M. Kelly. *Comment*: date considered too old for height. Shells probably sedimented at some depth (ca. 15 m) below contemporaneous sea level.

K-1153. Qivdlagissat, G.G.U. 17b **7750 ± 150**
5800 B.C.

Non-calcareous clayey gyttja from 2 to 7 cm above bottom of layer of freshwater gyttja in existing lake 22 m above sea level at Qivdlagissat (62° 7′ N Lat, 49° 31′ W Long), Frederikshåb, W Greenland. Gyttja overlies marine silts and sands. Zone (a) of local pollen succession. Supposed age: Early Atlantic. Sample aggregated from 3 adjacent boreholes. Coll. 1965 and subm. by M. Kelly.

K-1152. Sarfa, G.G.U. 16b **4780 ± 120**
2830 B.C.

Non-calcareous detritus gyttja from 2 to 5 cm above bottom of layer of freshwater organic sediments in existing lake 4 m above sea level at Sarfa (62° 1′ N Lat, 49° 35′ W Long), Frederikshåb, W Greenland. Organic sediments overly marine sands. Zone (c) of local pollen succession. Supposed age: Sub-boreal. Sample aggregated from 2 adjacent boreholes. Coll. 1965 and subm. by M. Kelly.

K-956. Godthåb, G.G.U. 1 **7920 ± 140**
5970 B.C.

Marine algae in sands from core (no. 138) through post-glacial marine and freshwater deposits at Godthåb (64° 11′ N Lat, 51° 45′ W Long), W Greenland. Sample represents lower 7.3 cm of core from ca. 20.15 m above sea-level in marine layer extending from 19.8 m to 20.2 m above sea level underlain by marine silts and overlain by freshwater sands. Sample from sediment supposedly deposited shortly before regression of sea level from ca. 21 m above present. Supposed age: Early Atlantic. Coll. 1964 and subm. by M Kelly.

K-987. Tasiussaq, G.G.U. 3 **7850 ± 190**
5900 B.C.

Laminated, non-calcareous, clayey gyttja from lake ca. 48 m above sea level at Tasiussaq (69° 2′ N Lat, 51° 3′ W Long), Claushavn, W Greenland. Sample is basal unit (1.5 cm thick) of lake deposits resting on fluvioglacial sands. Dates minimum age for major moraine system on outwash of which lake is situated, and minimum age for time when sea level was ca. 40 m above present. Moraine system tentatively dated by sea level changes to ca. 8000 B.P. Sample aggregated from 4 adjacent boreholes. Coll. 1963 and subm. by M. Kelly.

C. England

K-1057. Barfield Tarn, elm fall **5340 ± 120**
3390 B.C.

Gyttja from boring in post-glacial lake sediments in Barfield Tarn (54° 16′ N Lat, 3° 22′ W Long), Cumberland, England. Sample from 311 to 316 cm below surface in core. Pollen analytically dated to elm fall at Atlantic/Sub-boreal transition. Horizon coincides with change in sediment from gyttja to clay mud, and with occurrence of pollen grains of weeds and cereals. Coll. 1965 and subm. by W. Pennington (Mrs. T. G. Tutin), Univ. of Leicester, England. *Comment*: date slightly older than most dates for elm fall (Godwin, 1960; Nilsson, 1964; Copenhagen VI). This may have been caused by compactness of sediment; 5 cm in core may represent some hundred yr.

K-1058. Angle Tarn, elm fall **5210 ± 120**
3260 B.C.

Gyttja from boring in post-glacial like sediments in Angle Tarn (54° 27′ N Lat, 3° 10′ W Long), Cumberland, England. Sample from 192 to 200 cm below surface in core, at horizon of elm fall, marked by soil erosion which may indicate disturbance of forest. Sample overlies 50 cm of gyttja which represents time from Pre-boreal to Sub-boreal. Coll. 1965 and subm. by W. Pennington (Mrs. T. G. Tutin).

D. Iceland

K-1166. Grimsnes, volcanic layer **6220 ± 140**
4270 B.C.

Charred plant material (probably mosses and heather) below lava layer at Grimsnes (64° 27′ N Lat, 20° 49′ W Long), SW-Iceland. Plant material was charred when lava from Seydisholar volcano flowed over locality. Sample from 0 to 0.5 cm below lava. Stratigraphy indicates lava layer is considerably older than H 3 and younger than Layer H 5 from Hekla volcano (Jakobsson, 1966). Coll. 1965 and subm. by S. Jakobsson, Mineralogical Mus., Univ. of Copenhagen.

E. Poland

K-798. Vistula, oak trunk **1820 ± 100**
A.D. 130

Wood (*Quercus* sp.), outer year rings of big tree trunk on terrace of Vistula R. at Przegorzaly (50° 3′ N Lat, 19° 53′ E Long), Krakow, Poland. Trunk was lying at depth 5 to 6 m below recent surface, in sandy and gravely sediments. Now on exhibition in Bot. Inst., Krakow. Subm. by W. Szafer, Bot. Inst., Krakow.

F. Colombia

K-577 bis. Paramo de Palacio **7920 ± 140**
5970 B.C.

Detritus gyttja, sec. "Laguna de la America," Paramo de Palacio (ca. 4° 46′ N Lat, 73° 51′ W Long), E Cordillera, Colombia. Section taken with Dachnowsky borer; represents Holocene and Late Glacial. Sample from layer 360 to 380 cm below surface, underlying thin layer of volcanic ash. From pollen analysis Allerød age suggested by van der Hammen and Gonzalez (1960). Coll. 1956 and subm. by T. van der Hammen, Geol. Mus., Leiden, Netherlands. *Comment*: date agrees well with previous date: K-577, 8130 ± 120 (Copenhagen IV). Van der Hammen and Gonzalez (1960) suggested discrepancy between C^{14} age and pollen analytical interpretation might be due to possible infiltration of younger material from above. Infiltration of magnitude necessary to change date from Allerød age to 8000 B.P., however, would also make pollen analysis unreliable.

G. Subantarctic Islands

Marion Island series

Samples from 2 borings in swamps on Marion Is. (46° 50′ S Lat, 37° 40′ E Long). Swamps overlie lava. Samples date stages in Late and Post-glacial vegetational development studied by pollen analysis (Schalke and van Zinderen Bakker, 1967). Coll. 1965 and subm. by E. M. van Zinderen Bakker, Sr., Dept. of Bot., Univ. of O.F.S., Bloemfontein, South Africa.

K-1064. Macaroni Bay, no. 2696 **9500 ± 140**
7550 B.C.

Non-calcareous peat from swamp near Macaroni Bay. Sample 175 to 185 cm below surface in core from middle of swamp, 300 cm deep. Date is average of 3 measurements: 9940 ± 210, 9170 ± 210, and 9400 ± 210. *Comment*: (E.M.v.Z.B.) date suggests some oases with a few flowering plants existed on more sheltered E side of island during Pleniglacial II when island was mainly covered by ice.

K-1063. Junior's Kop, no. 2576 **3180 ± 120**
1230 B.C.

Non-calcareous gyttja from swamp near Junior's Kop. Sample from lowest part of core, 340 to 350 cm below surface, in central part of swamp, overlying black lava. Dates minimum age for lava of Late or Post-glacial age.

II. ARCHAEOLOGIC SAMPLES

A. Denmark

Draved Mose, Mesolithic dwelling places

Samples from 2 Mesolithic dwelling places found at shore of the prehistoric "Draved Lake" in Draved Mose (55° 1′ N Lat, 8° 57′ E Long), S Jutland. Dwelling places found on former sand dunes, now covered by peat. Flint implements from early Mesolithic culture (Kapel, 1964). Coll. 1961 and subm. by H. Kapel and A. Andersen, Geol. Survey of Denmark. *Comment*: samples from Mesolithic dwelling places in Draved Mose were previously dated (Copenhagen V, VII). Dates agree well with oldest group of dates.

K-1139. Draved Mose, D.G.U. 147 **9250 ± 180**
7300 B.C.

Charcoal (*Pinus* sp. *and Calluna*) from cultural layer, Square G 6, on dwelling place No. 611. Core axes, trimmed blades, and microliths from early Mesolithic culture were in cultural layer.

K-1140. Draved Mose, D.G.U. 254 **9210 ± 180**
7260 B.C.

Charcoal (*Pinus* sp.) from cultural layer, Square H 1 and C 7 on dwelling place No. 332. Found together with flint implements, e.g., core axes, scrapers, and microliths, and with large worked stones. Implements seem to represent 2 phases within early Mesolithic culture.

K-1098. Højelse, Mesolithic antler axe **6080 ± 130**
4130 B.C.

Wood (*Quercus* sp.) from 11-yr-old cut branch at Kemisk Værk Køge, Højelse (55° 28′ N Lat, 12° 12′ E Long), Zealand. From cultural layer of gyttja, resting on swamp peat. Layer also contained ornamented antler axe and horizon with scattered flint waste (Liversage, 1967). Coll. 1965 and subm. by D. Liversage, Natl. Mus., Copenhagen.

Norslund, Coastal culture

Charcoal and shells from dwelling place at Norslund (56° 1′ N Lat, 10° 14′ E Long), Jutland. Assemblage of implements in dated cultural layers constitutes separate group. Norslund group, within early Coastal cultures (Andersen and Malmros, 1966). Cultural layers probably older than or contemporaneous with beginning of High Atlantic transgression. Coll. 1964 and subm. by Søren H. Andersen and C. Malmros, Prehist. Mus., Aarhus, Denmark.

K-990. Norslund, Layer 3 (A) **5730 ± 120**
3780 B.C.

Charcoal (*Corylus avellana*) from layer of gyttja (No. 3) with implements from Norslund Group.

K-991. Norslund, Layer 3 (B) **5680 ± 120**
3730 B.C.

Charcoal (*Corylus avellana*) from same layer as K-990.

K-973. Norslund, Layer 4 **6420 ± 130**
4470 B.C.

Shells (*Ostrea edulis*) from shell layer (No. 4) below layer dated in K-990 and K-991. *Comment*: date is older than expected. Shells may be natural deposit with no connection to cultural layers.

Salpetermosen, Ertebølle culture

Charcoal from Ertebølle dwelling place found in Salpetermose bog, Amtmandsvang (55° 55″ N Lat, 12° 18′ E Long), Zealand. On uppermost part of dwelling place 2 cultural layers were found, a lower from Mesolithic Old Coastal culture, and an upper from Ertebølle culture, separated by thin calcareous layer. Samples from stone-lined fire places in Ertebølle layer, which contained flake axes, transverse arrow heads, a few thick-walled potsherds, and large accumulations of bones, mainly of red deer. No bones of domesticated animals (except dog) were found. Coll. 1959 and subm. by U. Møhl, Zool. Mus., Univ. of Copenhagen. *Comment*: dates are older than expected. Contamination with material from older cultural layer cannot be excluded.

K-1232. Salpetermose, Hg 2466 **5550 ± 120**
3600 B.C.

Charcoal (*Alnus* sp.) from fire place in Square II 7.

K-1235. Salpetermosen, Pd 187 **5410 ± 120**
3460 B.C.

Charcoal (*Ulmus* sp.) from fire place in Square III 7.

K-1234. Salpetermosen, Hg 2469 **5780 ± 120**
3830 B.C.

Charcoal (*Corylus avellana*) from fire place in Square III 7.

K-1233. Salpetermose, Hg 2468 **6020 ± 100**
4070 B.C.

Charcoal (*Alnus* sp.) from fire place in Square III 7. Date is average of 2 measurements 6070 ± 120 and 5980 ± 120.

Ølby Lyng, Ertebølle culture

Wood from outcast layer in marine sediments at dwelling place at Ølby Lyng (55° 30′ N Lat, 12° 13′ E Long), Zealand. Layer contained implements of late Ertebølle culture, e.g., flat-trimmed flake axes and thick-walled potsherds (Liversage, 1967). Wickerwork screen in marine sand layers was found 10 m from previous shore line. Sample from post supporting screen dated to determine if it was contemporaneous with Ertebølle dwelling place. Coll. 1963 and subm. by D. Liversage. *Comment*: screen was younger than Ertebølle dwelling place.

K-1231. Ølby Lyng, 371 **5320 ± 130**
3370 B.C.

Wood (*Tilia* sp.) lying horizontally in outcast layer.

K-1230. Ølby Lyng, 295 **5210 ± 130**
3260 B.C.

Wood (*Tilia* sp.) lying horizontally in same layer as K-1231.

K-1010. Ølby Lyng, 362 **4030 ± 120**
2080 B.C.

Wood (*Fraxinus excel.*) from post supporting wickerwork screen found 10 m from previous shore line.

Konens Høj, Early Neolithic

Charcoal from habitation layer and grave in natural sand bank, Konens Høj, at Nybro (55° 59′ N Lat, 10° 40′ E Long), Jutland. Habitation layer contained potsherds and flint implements of early Neolithic type. Stone-lined grave was inserted into habitation layer and contained bones, a type-C funnel beaker, an amber ornament, and 2 copper ornaments (Stürup, 1966). Coll. 1963 and subm. by B. G. Stürup, Prehist. Museum, Randers, Denmark.

K-923. Konens Høj, cx **5260 ± 100**
3310 B.C.

Charcoal (*Quercus* sp.) from accumulation of charcoal in habitation layer. Probably originates from minor branches because of irregularly formed year-rings. Date is average of 2 measurements: 5210 ± 120 and 5320 ± 120.

K-919. Konens Høj, av **4850 ± 100**
2900 B.C.

Charcoal (*Quercus* sp.) from S end of grave in sand overlying bottom. Stratigraphy indicates charcoal is contemporaneous with antiquities in grave. Date is average of 2 measurements: 4820 ± 120 and 4880 ± 120.

K-955. Aptrup, Neolithic ard furrows **4690 ± 100**
2740 B.C.

Sample of charcoal powder from pit found below tumulus from Single Grave culture at Aptrup (56° 17′ N Lat, 9° 49′ E Long), Jutland. Network of ard furrows was under tumulus. Furrows crossed top of pit containing charcoal. Sample is therefore older than ard furrows and tumulus (Seeberg and Kristensen, 1965). Coll. 1964 and subm. by P. Seeberg, Viborg Stiftsmus., Viborg.

Aamosen, Neolithic paddles and dug-out boat

Wood from Neolithic dug-out and 2 paddles from Aamosen bog, Øgaarde-K and Husede I (55° 36′ N Lat, 11° 34′ E Long), Zealand. Dug-out, 7 m long, was square-stern type with grooves for insertion of transom. Remains of fire were lying on bottom of dugout, found in 1943 (Troels-Smith, 1946). Paddles found 21 yr later only few tenths m. from dugout. Coll. 1943 and 1964 and subm. by J. Troels-Smith and Sv. Jørgensen, Natl. Mus., Copenhagen. *Comment*: dates suggest that dug-out and paddles belong together. Dugout had been treated with preservatives prior to dating. Preservatives extracted as described in K-599 (Copenhagen V). Only lignin fraction was large enough for dating.

K-1165. Øgaarde-K, dug-out **4590 ± 120**
2640 B.C.

Wood (*Alnus* sp.) from dug-out (Boat No. 3) from Øgaarde-K. Sample from outer year-rings only. Pollen analytically dated to Sub-boreal, after land occupation phase (Iversen, 1941).

K-985. Paddle, Husede I, 3412 D **4560 ± 110**
2610 B.C.

Wood (*Quercus* sp.) from paddle at position Hu. I, 3412 D and C.

K-986. Paddle, Husede I, 3404 E **4500 ± 110**
2550 B.C.

Wood (*Quercus* sp.) from paddle at position Hu. I, 3404 E, F, and H.

K-1214. Bølling Sø, Neolithic dug-out **4510 ± 120**
2560 B.C.

Wood (*Alnus* sp.) from outer year-rings in dug-out boat in former lake Bølling Sø (56° 11′ N Lat, 9° 22′ E Long), Jutland. Boat was embedded in undisturbed gyttja layers in S part of lake. Pollen analytically dated to early Sub-boreal; younger than elm fall and presumably older than land occupation phase (*Plantago lanceolata* 0.2 to 0.3% of AP). Coll. 1959 and subm. by J. Troels-Smith.

K-1189. Momhøj Mose, disc wheel **4210 ± 120**
2260 B.C.

Wood (*Quercus* sp.) from disc wheel found in Momhøj Mose bog, Bjerregaard (ca. 56° 10′ N Lat, ca. 8° 55′ E Long), Jutland. From small peat deposit above pieces of wood which may originate from primitive trackway. Depth in bog unknown. Disc wheel is early one-piece type with fixed nave. Subm. from mus. collection by C. L. Christensen, Herning Mus., Herning, and H. Norling-Christensen, Natl. Mus., Copenhagen. *Comment*: similar type disc wheels from Netherlands dated to ca. 2100 B.C. (van del Waals, 1964). One-piece disc wheels from Denmark previously dated to ca. 1500 B.C. (Copenhagen VII), (cf. also K-1112, this date list). Sample superficially treated with preservatives. Prior to dating, preservatives were extracted and cellulose from sample separated and dated (cf. K-599, Copenhagen V.).

K-1188. Kideris Mose, disc wheel **4180 ± 100**
2230 B.C.

Wood (*Quercus* sp.) from disc wheel from Kideris Mose bog (56° 5′ N Lat, 8° 58′ E Long), Jutland. Two disc wheels found together, both with fixed naves. Disc of dated wheel consisted of 2 pieces joined together similarly to Iron Age tripartite disc wheels; considered transitional type. Subm. from mus. collection by C. L. Christensen and H. Norling-Christensen. *Comment*: K-1189 and K- 1188 are oldest dated wheels from Denmark. Sample was treated with preservatives. They were extracted, and sample material was separated in cellulose and lignin fractions (Copenhagen V), which were dated separately: K-1188 A (cellulose), 4190 ± 120; and K-1188 B (lignin), 4170 ± 120. Date is average of these 2 measurements.

K-1116. Søndersø, domesticated ox **4070 ± 120**
2120 B.C.

Hip bone (*Bos taurus domesticus*) from skeleton of ox found in Søndersø peat bog (55° 47′ N Lat, 12° 20′ E Long), Zealand. Presumably from Sub-boreal or Sub-atlantic time. Only organic fraction was used in dating. Coll. 1941 and subm. by M. Degerbøl, Zool. Mus., Univ. of Copenhagen. *Comment*: date confirms Sub-boreal age.

K-1284. Kobberup, Single Grave culture **3900 ± 120**
1950 B.C.

Charred wood (*Corylus avellanta)* from 1-to-2-yr-old twigs in Neolithic stone cist at Kobberup (56° 31′ N Lat, 9° 10′ E Long), Jutland. Sample was lying in layer of flint underlying wooden coffin in stone cist. Grave contained Glob's type I battle axe (Glob, 1945), which belongs to Younger Ground Grave period (Y. Bundgravstid) within Single Grave culture. Grave also contained very well-preserved wooden objects. Coll. 1966 and subm. by P. Kjærum, Prehist., Mus., Aarhus, Denmark.

K-1138. Gasse Høje, Single Grave culture **3890 ± 100**
1940 B.C.

Charcoal (*Quercus* sp.) from Neolithic stone chamber at Gasse Høje (55° 10′ N Lat, 8° 50′ E Long), S Jutland. Charcoal mixed with crushed, white burned flint which covered floor of rectangular chamber covered with single cap-stone. It contained parts of skeletons of 4 persons, 5 transverse arrow heads, and late-type battle axe. Coll. 1965 and subm. by O. Voss, Univ. Aarhus, Jutland. *Comment*: date is average of 2 measurements: 3860 ± 120 and 3920 ± 120.

Gaevhul Bakke, Late Neolithic

Charcoal from 2 cultural layers in deposits of blown sand at Gævhul Bakke (56° 50′ N Lat, 8° 15′ E Long), Jutland. Layers separated by sand. Both cultural layers contained flint implements and potsherds of late Neolithic type. Coll. 1966 and subm. by D. Liversage.

K-1204. Gaevhul Bakke, 35 **3560 ± 120**
1610 B.C.

Charcoal (*Alnus* sp.) from lower layer.

K-1203. Gaevhul Bakke, 16 **3440 ± 120**
1490 B.C.

Charcoal (*Alnus* sp.) from upper layer.

K-1020. Ulstrupgaard, Late Neolithic grave **3430 ± 110**
1480 B.C.

Charcoal (*Tilia* sp.) from primary grave under tumulus at Ulstrupgaard (56° 2′ N Lat, 9° 36′ E Long), Jutland. Sample originates from charcoal fragments lying at bottom of grave with grain parallel to grave's long axis, presumably remains of log coffin. Grave contained reflaked flint dagger. Coll. 1966 and subm. by D. Liversage.

K-1009. Klosterlund Mose, pole **3510 ± 110**
1560 B.C.

Wood (*Quercus* sp.) from 3.3-m-long worked pole, probably from wagon, found during peat cutting in Klosterlund Mose bog (56° 11′ N Lat, 9° 21′ E Long), Jutland. Coll. 1961 by H. Hansen; subm. by H. Norling-Christensen.

K-1112. Nonnebo Mose, disc wheel **3350 ± 120**
1400 B.C.

Wood (*Alnus* sp.) from disc wheel from Nonnebo Mose bog (55° 22′ N Lat, 10° 34′ S Long), Funen. Wheel was early one-piece type with fixed nave. Subm. from mus. collection by E. Albrectsen and H. Norling-Christensen. *Comment*: date agrees with age of similar disc wheel from Fårup (Copenhagen VII), but is much younger than those of Momhøj Mose and Kideris Mose (this date list). Sample treated with preservatives, which were extracted (see Copenhagen V) and the lignin fraction was separated and dated.

K-1115. Måløv, Early Bronze age **2860 ± 120**
910 B.C.

Charcoal (*Corylus avellana*) from layer, presumably old mould surface, under Bronze age tumulus at Måløv (55° 45′ N Lat, 12° 8′ E Long), Zealand. Probably remains of vegetation before tumulus was erected. Tumulus contained woman's grave from Bronze age, Period III. Coll. 1965 and subm. by H. Thrane, Natl. Mus., Copenhagen.

Kirkebakkegaard, Bronze age and Iron age

Charcoal from pits under plowing depth in field at Kirkebakkegaard (55° 50′ N Lat, 12° 15′ E Long), Zealand. Pits contained potsherds from Late Bronze age and Early Iron Age. Coll. 1966 and subm. by H. Thrane.

K-1218. Kirkebakkegaard, Pit No. 2 **2780 ± 100**
830 B.C.

Charcoal (*Fagus sylv.*) from lower layer in Pit No. 2. Layer contained indistinct potsherds from Late Bronze age, separated from upper layer by yellow, sterile clay layer. Sample dates earliest use of pit. Date is average of 2 measurements: 2790 ± 120 and 2770 ± 120.

K-1217. Kirkebakkegaard, Pit No. 4 **2170 ± 110**
220 B.C.

Charcoal (*Fagus sylv.*) from accumulation of charcoal in lower part of Pit No. 4, with indistinct-type potsherds presumably from Early Iron age.

Foerlev Nymølle, Iron-age offerings

Charcoal and wood from cult place in bog at Foerlev Nymølle (56° 3′ N Lat, 9° 54′ E Long), Jutland. Place contained separate offerings from Pre-Roman Iron age, some covered by stone packings. Offerings were of different types; a few were small heaps of charcoal with fragments of burned bones. Finds consist of potsherds, bones of animals, a single bone of man, and worked wooden objects. Potsherds suggest cult place had been in use for considerable duration. Coll. 1963 and 1966 and subm. by Harald Andersen, Prehist. Mus., Aarhus, Denmark.

K-1224. Foerlev Nymølle 1078 ZU **2350 ± 110**
400 B.C.

Twig (*Alnus* sp.) found under stone in stone packing and thus contemporary with cult place. Twig was cut at one end.

K-880. Goerlev Nymølle 1078 QL **2040 ± 100**
90 B.C.

Charcoal (*Quercus* sp.) from heap of charcoal on cult place. Pieces of burned bones were found in heap.

K-1252. Rybjerg Mose, "double paddle" **2280 ± 110**
330 B.C.

Wood (*Quercus* sp.) from wooden object, resembling small double paddle, ca. 90 cm long from Rybjerg Mose bog (56° 3′ N Lat, 8° 20′ E Long), Jutland. Function of object unknown. It appears that wood had been allowed to dry and shrink freely without application of preservatives. Subm. from collection in Ringkøbing Mus. by O. Crumlin-Pedersen, Natl. Mus., Copenhagen.

K-1251. Holmegård Mose, "double paddle" **2170 ± 110**
220 B.C.

Wood (*Quercus* sp.) from wooden object resembling double paddle, similar to K-1252, ca. 90 cm long, from Holmegårds Mose bog (56° 2′ N Lat, 8° 20′ E Long), Jutland. Coll. 1953 for Ringkøbing Mus.; subm. by O. Crumlin-Pedersen. *Comment*: sample treated with preservatives, which were extracted before dating.

K-1113. Rappendam, disc wheel **2020 ± 110**
70 B.C.

Wood (*Alnus* sp.) from disc wheel from Rappendam (55° 50′ N Lat, 12° 9′ E Long), Zealand. Wheel is tripartite type with separate inserted nave found with many remains from naves and wagons. Coll. 1941 and 1942 by G. Kunwald; subm. by H. Norling-Christensen. *Comment*: tripartite disc wheels previously dated to Pre-Roman Iron age (van der Waals, 1964; Copenhagen VII). Sample treated with preservatives which were extracted (Copenhagen V) and cellulose fraction was separated and dated.

Olmersdiget, Iron-age linear earthwork

Wood from palisades and construction parts from linear earthwork (defensive dike), Olmersdiget, S Jutland. Dike is several km long, interrupted by lakes and meadows. Samples taken at different parts of dike. *Comment*: dates suggest reconstruction or repair of defensive dike during several hundred yr.

K-1183. Olmersdiget, Tinglev No. 29 **1830 ± 100**
A.D. 120

Outer year-rings from post No. 29 (*Quercus* sp.) in palisade at S end of Olmersdiget, S of Tinglev (54° 54′ N Lat, 9° 17′ E Long). Coll. 1965 and subm. by H. Neumann, Haderslev Mus., Haderslev, Denmark.

K-1182. Olmersdiget, Tinglev No. 36 **1760 ± 100**
A.D. 190

Outer year-rings from post No. 36 (*Quercus* sp.) in palisade at S end of Olmersdiget, same location as K-1183. Coll. 1965 and subm. by H. Neumann.

K-847. Olmersdiget, Almstrup Mose **1850 ± 100**
A.D. 100

Wood (*Quercus* sp.) from post in palisade ring in bog at Almstrup (54° 57′ N Lat, 9° 18′ E Long), middle part of Olmersdiget. Date is average of 2 measurements: 1800 ± 110 and 1890 ± 100. Coll. 1962 and 1963 and subm. by V. LaCour, Natl. Mus., Copenhagen.

K-984. Olmersdiget, Almstrup **1540 ± 100**
A.D. 410

Wood (*Betula* sp.) from branch at bottom of ditch in front of dike at Almstrup, middle part of Olmersdiget. Coll. 1962 and 1963 and subm. by V. LaCour.

K-799. Olmersdiget, Ligaard **1350 ± 100**
A.D. 600

Wood (*Quercus* sp.) from pointed post in palisade ring at Uge Bæk brook, SE of Ligaard (54° 59′ N Lat, 9° 20′ E Long), N end of Olmersdiget. Coll. 1962 and 1963 and subm. by V. LaCour.

K-1242. Mammen, Iron-age ard **1830 ± 100**
A.D. 120

Wood (*Quercus* sp.) from beam of ard found during peat cutting in bog at Mammen (56° 24′ N Lat, 9° 65′ E Long), Jutland. Coll. 1953 by P. V. Glob and H. Andersen; subm. by A. Steensberg, Univ. of Copenhagen. *Comment*: cf. date of ard from Hendriks Mose (Copenhagen V). Sample treated with preservatives which were extracted (Copenhagen V) and lignin fraction was separated and dated.

K-1219. Haarlevvej, Iron-age road **1830 ± 100**
A.D. 120

Wood (*Fagus sylv.*) from axle on stone layer in prehistoric road Haarlevvejen in Haarlev Enge (55° 21′ N Lat, 12° 14′ E Long), Zealand. Sample from Ditch I over lower of 2 road constructions. Coll. 1966 and subm. by Torben Witt, Køge Mus., Denmark. *Comment*: cf. date for Broskov road (Copenhagen VI).

K-1285. Skovmarken, prehistoric iron furnace **1910 ± 100**
A.D. 40

Charcoal (*Quercus* sp.) from clay-lined pit with slag originating from some form of iron smelting or iron preparation at Skovmarken (57° 10′ N Lat, 9° 54′ E Long), Jutland. Charcoal mixed with slag; must belong to construction. Coll. 1966 and subm. by O. Voss, Univ. of Aarhus, Denmark.

Drengsted, prehistoric iron furnaces

Charred straw from prehistoric iron furnaces in field at Drengsted (55° 5′ N Lat, 8° 40′ E Long), S Jutland. Ca. 100 slag pits found in field with dwelling place from Roman Iron age. Only slag pits left of furnaces. Plug of straw was placed in each pit. During iron smelting slag fused into single large lump which reproduced shape of portion of pit and preserved part of straw (Voss, 1963). Coll. 1964 and 1965 and subm. by O. Voss. *Comment*: samples from prehistoric iron furnaces at Drengsted previously dated (Copenhagen VI). New dates agree and suggest short settlement. See also dates for prehistoric iron furnaces of same type at Torsted and Snorup (this date list).

K-1134. Drengsted, OV **1610 ± 100**
A.D. 340

Charred straw from Pit OV.

K-1135. Drengsted, PF **1560 ± 100**
A.D. 390

Charred straw from Pit PF.

K-1136. Drengsted, MF **1630 ± 100**
A.D. 320

Charred straw from Pit MF.

K-1137. Drengsted, MN **1540 ± 100**
A.D. 410

Charred straw from Pit MN.

K-1158. Drengsted, MØ **1590 ± 100**
A.D. 360

Charred straw from Pit MØ.

K-1159. Drengsted, MI **1530 ± 100**
A.D. 420

Charred straw from Pit MI.

K-1160. Drengsted, MO **1630 ± 100**
A.D. 320

Charred straw from Pit MO.

K-1254. Drengsted, VE **1510 ± 100**
A.D. 440

Charred straw from Pit VE.

K-1255. Drengsted, VF **1470 ± 100**
A.D. 480

Charred straw from Pit VF.

K-1253. Torsted, prehistoric iron furnace **1480 ± 100**
A.D. 470

Charred straw from slag pit at Torsted (56° 12′ N Lat, 8° 26′ E Long), Jutland. Slag pit belongs to prehistoric iron furnace similar to those of Drengsted series, above. Coll. 1965 and subm. by O. Voss.

Snorup, prehistoric iron furnaces

Samples of charred straw from slag pits at Snorup (55° 43′ N Lat, 8° 43′ E Long), S Jutland. Slag pits belong to prehistoric iron furnaces similar to those of Drengsted series, above. Coll. 1966 and subm. by O. Voss. *Comment*: dates of samples from slag pits at Drengsted, Torsted, and Snorup show remarkable consistency in age suggesting that technique was in use for short period only.

K-1256. Snorup, No. 6 **1450 ± 100**
A.D. 500

Charred straw from Pit No. 6.

K-1257. Snorup, No. 7 **1560 ± 100**
A.D. 390

Charred straw from Pit No. 7.

Eskholm, charcoal patches

Samples of charcoal from circular patches of charcoal, ca. 1 m in diameter, found by deep plowing in field on Eskholm (55° 53′ N Lat, 10° 39′ E Long), Stavns Fjord, Samsø. Two patches contained charcoal of yew. Coll. 1963 and subm. by J. Troels-Smith.

K-881. Eskholm, L **1640 ± 120**
A.D. 310

Charcoal (*Taxus baccata*) from Patch L found with larged burned stones.

K-1014. Eskholm, M **1620 ± 100**
A.D. 330

Charcoal (*Taxus baccata*) from Patch M.

K-1013. Eskholm, A **840 ± 100**
A.D. 1110

Charcoal (*Quercus* sp.) from Patch A.

Gerlev, channel blocking

Wood from supposedly artificial blocking in natural channel in Roskilde Fjord at Gerlev (55° 51′ N Lat, 12° 2′ E Long), Zealand. Blocking at ca. 1 m depth, consisting of branches, minor trunks, and stones packed together (Crumlin-Pedersen, 1966). Coll. 1965 and subm. by O. Crumlin-Pedersen.

K-1093. Gerlev, No. 6 **1610 ± 100**
A.D. 340

Branch (*Betula* sp.) from packing of branches in blocking.

K-1110. Gerlev, No. 4 **1810 ± 100**
A.D. 140

Outer year-rings from 20-yr-old branch (*Betula* sp.) from same packing as K-1093.

K-1111. Gerlev, No. 5 **1560 ± 100**
A.D. 390

Wood (*Salix* sp.) from blocking.

K-1094. Gredstedbro, shipwreck **1400 ± 100**
A.D. 550

Wood (*Quercus* sp.) from treenail in ship's frame from stream Kongeåen at Gredstedbro (55° 24′ N Lat, 8° 44′ E Long), Jutland. Found ca. 20 yr ago with other remains of wreck. Typologically parallel to Anglo-Saxon funeral ship from ca. A.D. 600, excavated at Sutton Hoo, England (Crumlin-Pedersen, 1967). Kept in Antiquarian Collections, Ribe; subm. by O. Crumlin-Pedersen.

K-1096. Øer Hage, wreck Hasnaes I **1360 ± 100**
A.D. 590

Wood (*Quercus* sp.) from plank in ship (Hasnæs I) with lashed frames at Øer Hage (56° 9′ N Lat, 10° 42′ E Long), Jutland, 160 to 170 m inland from present shore line. Coll. 1961 and subm. by O. Crumlin-Pedersen. *Comment*: sample treated with polyethylene glycol, which was extracted before dating.

K-848. Nørre Kongerslev, dug-out boat **1170 ± 100**
A.D. 780

Wood (*Quercus* sp.) from double-pointed dugout with rounded bottom-section at Nørre Kongerslav (56° 54′ N Lat, 10° 8′ E Long), Jutland. Dugout from bog ca. 50 m from medieval earthwork. In boat was coarse, worked flint implement. Coll. 1960 and subm. by O. Crumlin-Pedersen.

K-1156. V. Skarholmsrende, blocking **1020 ± 100**
A.D. 930

Wood (*Quercus* sp.) from pointed pile in blocking in natural channel at Vester Skarholmsrende (54° 42′ N Lat, 11° 47′ E Long), Lolland (Schultz, 1936). Coll. 1966 and subm. by O. Crumlin-Pedersen.

K-1097. Øer Hage, wreck Hasnaes II **960 ± 100**
A.D. 990

Two wooden treenails (*Salix* sp.) from oak plank in shipwreck Hasnæs II at Øer Hage (56° 9′ N Lat, 10° 42′ E Long), Jutland, ca. 50 m inland from present shore line. Ship is typologically parallel to Viking ships from Skuldelev, Nos. 3 and 5 (Crumlin-Pedersen, 1968; Copenhagen VII). Coll. 1961 and subm. by O. Crumlin-Pedersen.

K-1095. Helnaes, blocking **890 ± 100**
A.D. 1060

Wood (*Fagus sylv.*) from blocking in natural channel at Helnæs (55° 8′ N Lat, 10° 3′ E Long), Funen. Blocking may be part of SE Danish system of defensive blockings against Wends. Coll. 1965 and subm. by O. Crumlin-Pedersen.

K-846. Kalvebod, bast rope **880 ± 100**
A.D. 1070

Sample of bast (*Tilia* sp.) from rope at Kalvebod Strand (55° 38′ N Lat, 12° 32′ E Long), Zealand. Found at water depth 4 to 6 m, covered by 0.5 m of sand, with large anchor stones, possibly connected with fishing. Coll. 1963 and subm. by O. Crumlin-Pedersen.

K-1213. Aarslev Enge, dugout boat **820 ± 100**
A.D. 1130

Wood (*Quercus* sp.) from well-preserved dugout in bog at Aarslev Enge (56° 9′ N Lat, 10° 4′ E Long), Jutland. Dugout was lying on gyttja, covered by gyttja and peat. Coll. 1966 and subm. by H. J. Madsen, Prehist. Mus., Aarhus, Denmark. *Comment*: sample was treated with polyethyleneglycol, which was extracted before dating.

K-977. Øresund, shipwreck **700 ± 100**
A.D. 1250

Wooden treenail (*Juniperus communis*) from frame fished up in Sound, Øresund, at Kastrup (55° 38′ N Lat, 12° 40′ E Long). Frame presumably from small vessel constructed in reverse clinker method (Crumlin-Pedersen, 1965). Coll. 1965 and subm. by O. Crumlin-Pedersen.

Egholm, medieval castle

Wood from piles in bank around medieval castle Egholm (55° 44′ N Lat, 11° 54′ E Long), Zealand. Piles were driven into base of original bank to protect it against water in surrounding moat, which was later destroyed during construction of big building ca. A.D. 1350. Coll. 1961 and subm. by J. Hertz, Natl. Mus., Copenhagen.

K-792. Egholm, N 2A **750 ± 100**
A.D. 1200

Wood (*Fagus sylv.*) from pile in bank.

K-793. Egholm, N 2 **580 ± 100**
A.D. 1370

Wood (*Fagus sylv.*) from pile in bank.

K-854. Sjørring, earthwork **720 ± 100**
A.D. 1230

Wood (*Quercus* sp.) from construction timber in earthwork at Sjørring (56° 57′ N Lat, 8° 46′ E Long), Jutland. Probably originates from bridge connected with earthwork. Coll. 1963 and subm. by V. La Cour. *Comment*: sample treated with preservatives which were extracted. Sample material was separated in lignin and cellulose fraction (Copenhagen V) and dated separately: K-854 A (lignin) 700 ± 100, and K-854 B (cellulose) 740 ± 100. Date is average of these 2 measurements.

K-777. Allerup Bakker, earthwork **650 ± 100**
A.D. 1300

Charred wood and bark (*Fagus sylv.*) from moat around earthwork "Voldene" at Allerup Bakker (57° 14′ N Lat, 10° 13′ E Long), Jutland. Sample found in humic layer, No. 9, 25 cm below present surface and 70 cm above bottom. Earthwork probably was abandoned when layer No. 9 was deposited (La Cour and Stiesdal, 1963). Coll. 1960 by B. Fredskild; subm. by V. La Cour and H. Stiesdal, Natl. Mus., Copenhagen.

K-869. V. Bjerregrav, wheel-plow **730 ± 100**
A.D. 1220

Wood (*Quercus* sp.) from beam of wheel-plow found at Navndrup, V. Bjerregrav (56° 35′ N Lat, 9° 31′ E Long), Jutland. Plow discovered ca. 50 cm below surface during drainage in meadow along stream Mølleåen. Coll. 1963 and subm. by A. Steensberg.

K-728. Karstofteå, lever **640 ± 100**
A.D. 1310

Wood (*Quercus* sp.) from curved piece of wood, probably lever from water mill (horizontal mill), in stream Karstofteå (55° 55′ N Lat, 9° 3′ E Long), Jutland. Coll. 1960 and subm. by A. Steensberg.

K-886. Linå, plow **440 ± 100**
A.D. 1510

Wood (*Quercus* sp.) from plow-sheath in mold-board plow, presumably wheel-plow, found during drainage in meadow at Linå (56° 9′ N Lat, 9° 50′ E Long), Jutland. Plow is same type as Tømmerby and Andbjerg plows (Steensberg, 1962; Copenhagen V). Coll. 1962 and subm. by A. Steensberg. *Comment*: sample treated with linseed oil. It was extracted, and the lignin fraction was separated (Copenhagen V) and dated.

K-976. Voldstedlund, skeleton of cow **210 ± 100**
A.D. 1740

Bones from skeleton of cow found in W chamber in passage grave at Voldstedlund (56° 39′ N Lat, 9° 53′ E Long), Jutland. Skeleton (without head and hoofs) lay in seemingly untouched chamber in a passage grave where passage was filled with untouched layers of earth. Skeleton lay on heap of stones covered by earth, probably from damaged corner in chamber. *Comment*: date shows no connection between skeleton and time when passage grave was in use.

B. Faroe Islands

Kirkjubø, medieval church

Charcoal and wood from oldest foundations and grave in medieval church at Kirkjubø (61° 57′ N Lat, 6° 47′ W Long), Strømø, Faroe Islands. Coll. 1964 and subm. by Sverri Dahl and Leon Andreasen, Antiquarian Collections, Thorshavn, Faroe Islands. *Comment*: samples probably originate from imported timber.

K-1286. Kirkjubø, No. 1752 **740 ± 100**
A.D. 1210

Charcoal (*Pinus* sp.) from oldest foundations in church.

K-1287. Kirkjubø, No. 1753 **690 ± 100**
A.D. 1260

Charcoal (*Pinus* sp.) from oldest foundations in church.

K-1288. Kirkjubø, No. 1576 **1150 ± 100**
A.D. 800

Charred wood (*Thuja* sp.) from trunk or branch, which contained at least 50 year-rings. Found in oldest foundations in church. *Comment*: unexpectedly high age.

K-916. Kirkjubø, No. 1000 **690 ± 100**
A.D. 1260

Wood (*Pinus* sp.) from bottom of coffin under floor of choir.

C. Greenland

Jørgen Brønlund Fjord, Vendenaes

Charcoal from Paleo-Eskimo ruins on terrace at tent place Vendenæs (82° 9′ N Lat, 30° 5′ W Long), Jørgen Brønlund Fjord, Peary Land. Implements from Independence I culture found in ruins (Knuth, 1965, 1967). Coll. 1964 and subm. by E. Knuth, Natl. Mus., Copenhagen. *Comment*: dates agree with previous dates from Independence I culture from same area (Copenhagen VII). Cf. also Ellesmere Island series, Canada (this date list).

K-1061. Vendenaes, No. 31 **3760 ± 120**
1810 B.C.

Charcoal (*Salix* sp.) from hearth in Ruin No. 3 on terrace, 12.3 m above sea level.

K-1062. Vendenaes, No. 32 **3800 ± 120**
1850 B.C.

Charcoal (*Salix* sp.) from hearth in Ruin No. 4 on terrace, 11.8 m above sea level.

K-1196. J. Brønlund Fjord, Gammel Strand Vest **3620 ± 110**
1670 B.C.

Charcoal (*Salix* sp.) from Paleo-Eskimo ruin at site Gammel Strand Vest (82° 11′ N Lat, 29° 22′ W Long), Jørgen Brønlund Fjord, Peary Land. Sample found in mid-passage hearth of well-preserved ellipsoid ruin (No. 3), lying on terrace, 14.3 m above sea level and 1 km from present shore line. Implements of Independence I culture found in ruin (Knuth, 1965, 1967). Coll. 1964 and subm. by E. Knuth.

K-1059. Jørgen Brønlund Fjord, Hellebaek **2510 ± 110**
560 B.C.

Charcoal (*Salix* sp.) from Paleo-Eskimo ruin at Hellebæk (82° 11′ N Lat, 31° 21′ W Long), Jørgen Brønlund Fjord, Peary Land. Sample was found partly in hearth of house ruin, partly on fireplace 4 m in front of ruin. Implements of Independence II culture were in ruin (Knuth, 1965, 1967). Coll. 1963 and subm. by E. Knuth. *Comment*: first date of Independence II culture made on local plant material (arctic willow). Date is a few hundred yr younger than previous dates of Independence II culture made on drift wood (Copenhagen III, IV, and VII).

Itivnera series, Sarqaq culture

Peat and charcoal from Paleo-Eskimo dwelling place at Itivnera (64° 23′ N Lat, 50° 15′ W Long), Kapisigdlit, Godthåb Fjord, W Greenland. Samples date layer from Sarqaq culture and periods of peat formation before and after cultural layer. Peat overlies sand. Pollen analytically investigated by B. Fredskild. Coll. 1960 and subm. by B. Fredskild, Natl. Mus., Copenhagen. *Comment*: Sample from layer previously dated (K-588, Copenhagen V).

K-1192. Itivnera, 0 to 4 cm **3200 ± 120**
1250 B.C.

Peat with detritus from layer, 1 to 4 cm thick, underlying cultural layer from Sarqaq dwelling place. Peat overlies old inorganic beach sediments. Peat formation suggests change of climate.

K-1193. Itivnera, 4 to 14 cm **3140 ± 120**
1190 B.C.

Charcoal (*Salix* sp.) from cultural layer from Sarqaq dwelling place, immediately above K-1192. Sample from lowest part of layer, 4 to 14 cm above sand. Layer extends from 4 to 21 cm above sand.

K-1194. Itivnera, 24 to 26 cm **2290 ± 100**
340 B.C.

Humified peat from lower part of sterile peat layer overlying cultural layer, 24 to 26 cm above sand.

K-1195. Itivnera, 34 to 36 cm **630 ± 100**
A.D. 1320

Swamp peat from lowest part of layer of swamp peat overlying humified peat, 34 to 36 cm above sand. Formation of swamp peat suggests change of climate.

D. Alaska

Trail Creek, Cave 2

Bone and antler of caribou from various layers in Cave 2 at Trail Creek (65° 48′ N Lat, 163° 13′ W Long), Alaska, U.S.A. Limestone caves found 30 mi. inland from Deering which served as shelter for caribou hunters; implements of several Eskimo cultures found in caves (Larsen, 1955, 1962, and 1968). Samples date layers in Cave 2. Coll. 1949 and 1950, and subm. by Helge Larsen, Natl. Mus., Copenhagen. *Comment*: all dates made on organic fraction only, which is more reliable. Dates are close to expected values, except for K-1289.

K-982. Trail Creek, Cave 2, No. 1 **1100 ± 100**
A.D. 850

Marrow-cracked bones of caribou from 1st m from entrance in 25-to-40-cm-thick Layer I which consisted of black, loose earth with small stones.

K-979. Trail Creek, Cave 2, No. 2 **2810 ± 110**
860 B.C.

Marrow-cracked bones of caribou from 2nd m from entrance in 40-to-60-cm-thick Layer II, composed of brownish earth with rock fragments and big stones. Layer contained implements of Choris or closely related culture.

K-983. Trail Creek, Cave 2, No. 4 **2700 ± 110**
750 B.C.

Well-preserved antler of caribou from same sec. and layer as K-979.

K-980. Trail Creek, Cave 2, No. 3 **9070 ± 150**
7120 B.C.

Marrow-cracked bones of caribou from 20-to-50-cm-thick Layer III, which consisted of dark, loose materials with mica and many scattered rock fragments. Layer contained implements older than Denbigh Flint Complex.

K-1289. Trail Creek, Cave 2, No. 5 **2160 ± 110**
210 B.C.

Bones of caribou 10 to 11 m from entrance, in lowest layer, which contained implements presumably belonging to Denbigh Flint Complex. *Comment*: date considered too young. Solifluction and frost action may have caused mixing of layers.

Trail Creek, Cave 9

Bones of caribou found in Cave 9, Trail Creek (65° 48′ N Lat, 163° 13′ W Long), Alaska, U.S.A. Cave had 2 narrow passages, N-S and W-E. Samples from 2nd m in W room, where layer was thick and contained both dar kand light bones of caribou. Dark and light bones dated separately, only organic fraction was used. Layer contained implements from several stages of Paleo-Eskimo cultures (Larsen, 1955, 1962, and 1968). Coll. 1950 and subm. by Helge Larsen. *Comment*: dates show considerable mixing of bones in layer in this part of cave; dark bones are older than light ones. Samples from cave previously dated (Copenhagen III).

K-1290. Trail Creek, Cave 9, No. 2a **2770 ± 110**
820 B.C.

Dark bones of caribou from layer in W room.

K-1291. Trail Creek, Cave 9, No. 2b **510 ± 100**
A.D. 1440

Light bones of caribou from same layer as K-1290.

K-1210. Trail Creek, Cave 9, horse **15,750 ± 350**
13,800 B.C.

Organic fraction of scapula of horse outside S entrance to Cave 9, Trail Creek (65° 48′ N Lat, 163° 13′ W Long), Alaska, U.S.A. Found with heel bone of *Bison* sp., which apparently had been worked by man.

Coll. 1950 and subm. by Helge Larsen. *Comment*: if brought by man, which seems possible, it is earliest evidence of man in Alaska.

Cape Krusenstern, Eskimo cultures

Charcoal from house ruins on series of beach ridges at Cape Krusenstern (67° 5′ N Lat, 163° 50′ W Long), Kotzebue Sound, Alaska. More than 100 beach ridges were deposited consecutively at about same height above sea-level. Dwelling places and houses from time of Denbigh Flint complex and to present were found on ridges. Eskimos seem, in all periods to have settled on youngest beach ridge, closest to sea (Giddings, 1961 and 1966). Coll. 1959 and subm. by J. L. Giddings, Brown University. *Comment*: samples from house ruins at Cape Krusenstern previously dated (Pennsylvania IV and IX; Bern II).

K-837. Cape Krusenstern, house No. 50 **1180 ± 110**
A.D. 770

Charcoal (*Picea* sp.) from driftwood in tent ring 50 cm below floor in house No. 50 on partly covered beach ridge.

K-851. Cape Krusenstern, house No. 32 **1180 ± 110**
A.D. 770

Charcoal, probably of driftwood, from house No. 32. Probably represents Birnirk culture.

K-816. Cape Krusenstern, house No. 33 **1100 ± 100**
A.D. 850

Charcoal (*Picea* sp.) from driftwood from hearth in kitchen of house No. 33, lying 1 m below present surface of beach ridge. House represents either Birnirk or W Thule culture. Date is average of 2 measurements: 1080 ± 110 and 1120 ± 110.

K-817. Cape Krusenstern, house No. 6 **1070 ± 100**
A.D. 880

Charcoal (*Picea* sp.) from driftwood from hearth in house No. 6, excavated 0.5 to 1 m below surface of beach ridge. House represents W Thule culture. Date is average of 2 measurements: 1080 ± 110 and 1070 ± 110.

K-850. Cape Krusenstern, house No. 4 **1000 ± 110**
A.D. 950

Charcoal, probably from driftwood, from floor in kitchen of house No. 4, which belongs to W Thule culture.

Onion Portage site, Paleo-Eskimo cultures

Charcoal from cultural layers at Onion Portage (67° 10′ N Lat, 158° 52′ W Long). Kobuk R., Alaska. Site, a stratigraphic series of cultural layers, separated by sterile sand, lies 200 km inland from Chukchi Sea. Layers correspond partly to layers at Cape Krusenstern and seem to cover approx. same period of time (Giddings, 1962 and 1966). Coll. 1959 and subm. by J. L. Giddings.

K-835. Onion Portage, below "Old Hearth" **3170 ± 120**
1220 B.C.

Charcoal, probably from driftwood and local brush, in thin layer, ca. 30 cm below cultural layer "Old Hearth" (layer No. 3).

K-832. Onion Portage, above "Old Hearth" **2750 ± 140**
800 B.C.

Charcoal from local brush and driftwood in layer from natural fire above "Old Hearth." Sample older than Norton culture.

K-836. Onion Portage, "Middle Layer" **1570 ± 140**
A.D. 380

Charcoal from driftwood and local brush from "Middle Layer" (layer No. 2), lying 70 cm below surface. Layer is younger than K-832 and older than Thule culture. Artefacts from layer related to Norton and Ipiutak cultures.

E. Arctic Canada

Ellesmere Island, Kettle Lake

Charcoal from Paleo-Eskimo ruins on dwelling places at Kettle Lake (81° 24′ N Lat, 76° 47′ W Long), Tanquary Fiord, Ellesmere Island. Ruins N and S of Kettle Lake on terraces and moraine ridges 90 to 97 m above sea level contained implements of Independence I culture. Site supposedly represents station on migration route to Peary Land, 700 km E, used by Independence I people (Knuth, 1967). Coll. 1966 and subm. by E. Knuth. *Comment*: samples are same age as Independence I samples from Peary Land (Copenhagen VII; this date list).

K-1260. Kettle Lake South, E 6a **3930 ± 130**
1980 B.C.

Charcoal (*Salix* sp.) from fire place in ruin M. 3, 97 m above sea level on moraine ridge, a few m higher than Independence I ruins at South-group terrace.

K-1261. Kettle Lake South, E 9 **3810 ± 130**
1860 B.C.

Charcoal (*Salix* sp.) from hearth in mid-passage of South-group ruin No. 3, on terrace 95 m above sea level.

K-1262. Kettle Lake North, E 10 **3760 ± 130**
1810 B.C.

Charcoal (*Salix* sp.) from hearth in mid-passage of North-group ruin No. 4, on terrace 90 m above sea-level, *vis-à-vis* Kettle Lake South-group.

K-1259. Ellesmere Island, "Ella Lake" **570 ± 100**
A.D. 1380

Charcoal (*Salix* sp.) from fire place found in front of Neo-Eskimo tent at "Ella Lake," W of Ella Bay (81° 3′ N Lat, 70° 5′ W Long), Archer

Fiord, Ellesmere Island. Tent ring had platform of big plane stones raised 20 cm above floor. Coll. 1966 and subm. by E. Knuth.

F. Egypt

K-1003. Kalabcha, door-lock **1980 ± 100**
30 B.C.

Wood (*Sapotaceae* sp.) from door-lock in temple at Kalabcha (23° 7′ N Lat, 32° 10′ E Long), Egyptian Nubia. Temple was under construction during reign of emperor Augustus, but construction may have begun earlier. It is not known if lock originates from 1st temple from XVIII dynasty (1570 to 1314 B.C.), or if it is connected with construction of 2 other great temples in Nubia (Philae and Dakka), i.e., ca. 350 to 250 B.C. Coll. 1961 and subm. by Vetle Jørgensen, Natl. Mus., Copenhagen. *Comment*: dates lock to time of Augustus.

K-1282. Gebel el Tuna, water wheel **1900 ± 100**
A.D. 50

Wood or bark from palm stump in Roman garden at Gebel el Tuna (27° 30′ N Lat, 31° 0′ E Long), Egypt. Garden irrigated by ox-powered pot-garland machine of saquiya type. Desert location and water table being ca. 34 m below surface, plant life depended on water-raising machine. During excavation in 1935 garden and well, and some palm stumps, were discovered (Schiøler, 1962 and 1963). Sample originates from 1 of stumps; probably dates later part of period when irrigation system was in use. Coll. 1964 and subm. by Th. Schiøler.

G. Iceland

Hvitarholt, Viking farm

Charcoal from buildings of Viking farm at Hvitarholt (64° 9′ N Lat, 20° 20′ W Long), Iceland. Expected archaeological age: 9th century or early 10th century A.D. Coll. 1963 to 1966 and subm. by K. Eldjarn, Natl. Mus., Reykjavik.

K-1243. Hvitarholt I **970 ± 100**
A.D. 980

Charcoal (*Betula* sp.) from layer of charcoal below floor and walls in farm building ("skåle").

K-1244. Hvitarholt II **890 ± 100**
A.D. 1060

Charcoal (*Betula* sp.) from stove in semi-subterranean building, perhaps bathhouse, beside building of K-1243.

K-1245. Hvitarholt III **910 ± 100**
A.D. 1040

Charcoal (*Sorbus* sp.) from floor in great hall, beside open hearth in middle of hall.

H. Iran

Tepe Guran, Neolithic village

Charred plant material from early Neolithic layers in mound Tepe Guran (33° 43′ N Lat, 47° 6′ E Long), Luristan, Iran. Mound contained 21 habitation layers from Islamic time, Bronze age, and early Neolithic. Three soundings, G I, G II, and G III, were made through layers in different parts of mound (Meldgaard *et al.*, 1964; Mortensen, 1965). Coll. 1963 and subm. by J. Meldgaard and P. Mortensen, Natl. Mus., Copenhagen.

K-1006. Tepe Guran, G III, No. 1 **8410 ± 200**
6460 B.C.

Charcoal (*Pistacia* sp. and undetermined pieces) from aceramic Neolithic habitation layer in sounding G III, 12 to 15 cm above virgin soil. Layer seems to correspond to Level U in sounding G I. Dates approx. time of 1st habitation at Tepe Guran.

K-879. Tepe Guran, G I, No. 28 **7760 ± 150**
5810 B.C.

Charcoal from herbaceous stalks, perhaps remains of fallen roofing, from sounding G I, in front of oven on floor in level H, which represents early Neolithic phase; pottery is contemporary with ceramics from Serab.

K-856. Tepe Guran, Luristan bronze **3170 ± 120**
1220 B.C.

Charcoal (*Quercus* sp.) from grave in mound Tepe Guran (33° 43′ N Lat, 47° 6′ E Long), Luristan, Iran. Found in pot (No. 1) from grave No. 11 in Layer C, which represents Luristan Bronze period (Meldgaard *et al.*, 1964). Coll. 1963 and subm. by H. Thrane, Natl. Mus., Copenhagen.

I. Iraq

Tell Shimshara, Neolithic village, potsherds

Organic-tempered potsherds from Neolithic layers in mound Tell Shimshara (36° 15′ N Lat, 45° O′ E Long), Kurdistan, Iraq. Mound contained 16 Islamic, Hussian, and Neolithic habitation layers. Earliest layers (16 to 14) were aceramic; following layers (13 to 9) contained Hassuna/Samarra pottery contemporary with Hassuna IV to VI (Mortensen, 1968). Coll. 1957 by H. Ingholt, Yale University; subm. by P. Mortensen. *Comment*: measurements made on charred remains of organic tempering in potsherds. Tempering material was only partly oxidized at low temperature used during manufacture of vessels, and flakes of black carbon were present inside sherds. C^{14} measurements on organic-tempered potsherds were previously made by Kohl and Quitta (1963 and 1964), and by Stuckenrath (1963). Large errors may occur occasionally in dating such material, especially if carbon content of sherds is low (less than 1%). This may be attributed either to infiltration of younger material in porous sherds, or to small amount of old organic matter in clays used in manufacture. Before dating, sherds were treated with dilute acid to remove carbonates.

K-951. Tell Shimshara, Level 13 **7940 ± 150**
5990 B.C.

Coarse, organic-tempered potsherds (undecorated Coarse Ware) from Level 13, immediately above 3 aceramic layers. Carbon content: 0.16%. *Comment*: date close to expected value.

K-972. Tell Shimshara, Level 11 **7820 ± 150**
5870 B.C.

Coarse, organic-tempered potsherds (undecorated Coarse Ware) from Level 11, above K-951. Carbon content: 0.20%. *Comment*: date close to expected value.

K-981. Tell Shimshara, Level 10 **10,030 ± 160**
8080 B.C.

Coarse, organic-tempered potsherds (undecorated Coarse Ware) from Level 10, immediately above K-972. Carbon content: 0.32%. *Comment*: old date probably due to small amount of old organic matter in clay.

K-960. Tell Shimshara, Level 9 **7300 ± 150**
5350 B.C.

Coarse, organic-tempered potsherds (undecorated Coarse Ware) from Level 9, immediately above K-981, which represents latest Neolithic habitation at Tell Shimshara. Carbon content: 0.21%. *Comment*: date close to expected value.

J. Jordan

Beidha, preceramic Neolithic village

Charcoal and charred plant material from preceramic Neolithic village at Beidha (30° 22′ N Lat, 35° 26′ E Long), Petra Area, Jordan. Six main building levels were differentiated, comprising 4 types of architecture in stone; each main level had its own individual phases. Implements, bones, and plant remains were discovered in layers (Kirkbride, 1966a and 1966b). Coll. 1964 and subm. by D. Kirkbride, Univ. of Oxford. *Comment*: sample from burnt roof beam in same house in layer IV as K-1084 was previously dated to BM-111, 8780 ± 200 (Kirkbride, 1966a). Samples contained considerable amount of radon, part of which entered gas samples despite radiochemical purification. After 2 to 3 weeks radon decayed. Dates are from measurements made after decay period.

K-1086. Beidha, Level VI, L. 413 **8940 ± 160**
6990 B.C.

Charcoal (*Quercus* sp.), pieces of debris, probably roofing material, from fill of burnt, segmented, round house of Level VI, oldest level.

K-1082. Beidha, Level VI, E. 130 **8710 ± 130**
6760 B.C.

Carbonized nuts (*Pistacia atlantica*) from floor of segmented, round house of Level VI, destroyed by fire. Date is average of 2 measurements: 8770 ± 160 and 8650 ± 160.

K-1083. Beidha, Level V, L. 411 **8640 ± 160**
6690 B.C.

Carbonized tree trunk (*Pistacia* sp.) found *in situ* in large posthole set in floor of burnt house in Level V.

K-1084. Beidha, Level IV, E. 2P **8730 ± 160**
6780 B.C.

Charcoal (*Juniperus* sp.), roof debris from house in Level IV, destroyed by fire.

K-1085. Beidha, Level II, F. 4 **8550 ± 160**
6600 B.C.

Charcoal (*Juniperus* sp.) near top of stone-lined pit, inside main house of late Level II.

K. Switzerland

Sumpf, Late Bronze age

Wood and charcoal from large pile dwelling at Sumpf (47° 11′ N Lat, 8° 27′ E Long), Canton Zug, Switzerland. Two cultural layers separated at pile dwelling, both Late Bronze age (HA/HB-Reinecke). Remains of many houses, trackways, etc., and rich collection of implements and sherds was uncovered (Speck, 1953, 1955). Coll. 1954 by J. Troels-Smith and Sv. Jørgensen, subm. by J. Troels-Smith.

K-1122. Sumpf, Hg 8769 **2600 ± 110**
650 B.C.

Charcoal (*Alnus* sp.) from upper layer.

K-996. Sumpf, SHg 490 **2690 ± 100**
740 B.C.

Wood (*Alnus* sp.) upper layer in E wall at Square 60.

K-997. Sumpf, SHg 501 **2830 ± 100**
880 B.C.

Upper end of wooden post (*Quercus* sp.), ca. 1.5 to 2 m long, standing vertically through layers.

K-998. Sumpf, SHg **2880 ± 100**
930 B.C.

Lower end of same post as in K-997.

K-1121. Sumpf, Hg 8768 **2940 ± 110**
990 B.C.

Charcoal (*Albies alba*) from lower layer.

L. Syria

Hama series

Charcoal from layer in citadel mound of Hama (35° 5′ N Lat, 36° 35′ E Long), Syria. Mound (the old Hamath) was excavated by Hama Expedition of Carlsberg Foundation during 1931 to 1938. Samples are from Period E, Square P 17, Building I, Room F. They originate from building timber (wainscots), torn down from walls and placed in gateway (Room F) in citadel which was burnt by Assyrians in 720 B.C. (Fugmann, 1958). Samples must be older than 720 B.C. Coll. 1935; subm. by P. J. Riis, Univ. of Copenhagen.

K-968. Hama, Period E, P 17 (A) **2800 ± 110**
850 B.C.

Charcoal (*Juniperus* sp.) from building timber in Square P 17, Building I, Room F.

K-969. Hama, Period E, P 17 (B) **2870 ± 110**
920 B.C.

Charcoal (*Abies* sp.) from building timber in square P 17, Building I, Room F. *Comment*: treated with paraffin, which was removed before dating.

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[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 328-332]

UNIVERSITY OF KIEL RADIOCARBON MEASUREMENTS III

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Most of the measurements have been obtained with a 4.5-L CO_2 counter (Kiel I). Dates given are not corrected for C^{13}/C^{12} except Ulmus series. Error corresponds to 1σ of statistical variations of sample net counting rate including variance of reference and background, but does not include the uncertainty in C^{14} half-life and in secular C^{14} variations. Half-life is 5570 yr and A.D. 1950 is zero point of B.P. scale.

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I. BOMB PRODUCED RADIOCARBON

To get some more information about the distribution of bomb produced C^{14}, we measured the last 17 tree-rings of an *Ulmus* cut 1965 in Kiel (54° 19′ 55″ N Lat, 10° 7′ 30″ E Long). The C^{13}/C^{12} ratio was measured with an Atlas CH4 mass spectrometer against NBS standard oxalic acid which was prepared in the same manner as tree samples. For the oxalic acid we assumed $\delta C^{13} = -19.3‰$ (Craig, 1961). In this assumption, there can be a systematic error, which is too small to affect the Δ-values seriously. δC^{13} values in parenthesis were not measured. For calculation of Δ we used in these cases the mean value −25.5‰.

Sample	Year of tree-ring growth	δC^{14} ‰	δC^{13} ‰	Δ
KI-141/1	1964	908 ± 15	—24.4	906 ± 15
KI-141/2	1963	842 ± 10	(—25.5)	844 ± 10
KI-141/3	1962	405 ± 22	—25.6	407 ± 22
KI-141/4	1961	233 ± 7	—27.0	238 ± 8
KI-141/5	1960	253 ± 9	—26.0	256 ± 9
KI-141/6	1959	292 ± 7	(—25.5)	293 ± 7
KI-141/7	1958	171 ± 6	—25.2	171 ± 6
KI-141/8	1957	116 ± 9	(—25.5)	117 ± 9
KI-141/9	1956	26 ± 10	—25.3	27 ± 10
KI-141/10	1955	18 ± 6	—24.2	16 ± 6
KI-141/12	1953	— 6 ± 7	—25.1	— 6 ± 7
KI-141/13	1952	— 5 ± 9	—25.4	— 4 ± 9
KI-141/14	1951	—20 ± 6	—26.2	—18 ± 6
KI-141/15	1950	—21 ± 5	—25.5	—20 ± 5
KI-141/16	1949	—37 ± 5	—25.3	—36 ± 5
KI-141/17	1948	—41 ± 6	—26.6	—38 ± 6

II. GEOLOGIC SAMPLES

Dahldorf series

Peat samples from N part of "Teufelsmoor," 2 km SW of Gnarrenburg (53° 22.1′ N Lat, 8° 58.7′ E Long), Germany. Coll. 1963 and subm. 1965 by F. Overbeck, Botanisches Inst., Univ. Kiel, who also made pollen analysis. Series aids investigation of history of settlement in N Germany. Samples KI-135, KI-136, and KI-137 contained large amounts of rootlets, most of which were removed before chemical treatment. Some dates were listed earlier in Kiel I and Kiel II. The completed series is given now.

2160 ± 80
KI-23. Dahldorf II-1, 30 cm depth **210 B.C.**

Sphagnum peat from upper part of highly humified peat layer. From this level upward *Carpinus* exceeds 1%. Fagus is 5% and more (Kiel I).

2530 ± 50
KI-133. Dahldorf II-2, 50 cm depth **580 B.C.**

Plantago lanceolata, Rumex, Artemisia at minimum show lack of agriculture. No cereal-type pollen found. Fagus at minimum. *Corylus* is dropped to 10%.

2550 ± 50
KI-24. Dahldorf II-3, 70 cm depth **600 B.C.**

Maximum of humification. *Corylus* at 5 to 10%. No agriculture at this time (Kiel I).

2960 ± 40
KI-135. Dahldorf II-4, 98 cm depth **1010 B.C.**

Sample from just above contact between black and light peat.

3110 ± 70
KI-136. Dahldorf II-5, 100 cm depth **1160 B.C.**

0 to 1 cm below contact between dark and light peat, just below 1st indication of cereal-type pollen. *Comment*: date includes previous measurement (KI-25, Kiel II). KI-135 and KI-136 indicate no great interval of reduced growth rate during change from dark to light peat.

3050 ± 60
KI-137. Dahldorf II-6, 105 cm depth **1100 B.C.**

Above this level *Fagus* is less than 1%.

3510 ± 65
KI-138. Dahldorf II-7, 130 cm depth **1560 B.C.**

Maximum of *Corylus* (up to 38%). *Tilia* less than 1%. *Plantago lanceolata* beginning of strong increase (Kiel II).

4710 ± 45
KI-139. Dahldorf II-8, 187 cm depth **2760 B.C.**

KI-140. Dahldorf II-9, 195 cm depth **4600 ± 100** **2650 B.C.**

From this level upward *Plantago* curve is continuous and *Ulmus* is less than 5.2% (Kiel II).

Esterweger series

Peat samples from "Esterweger Dose," bog near Burlage (53° 3.2′ N Lat, 7° 34.5′ E Long, Messtischblatt Burlage Nr. 2911 r 3408680 h 5878340), Germany. Coll. 1963 and subm. 1965 by R. Wiermann, Botanisches Inst., Univ. Münster, Germany. *Comment*: this series aids investigation of development of vegetation in N Germany and helps date some significant horizons in history of propagation of *Fagus* (KI-177-179) and *Carpinus* (KI-175, 176). Other samples give dates of special events in history of agriculture (lack of agriculture) KI-169-170; KI-172; KI-174 and KI-177-179).

KI-169. ED-II, 1, 5.0 to 9.5 cm **210 ± 40** **A.D. 1740**

KI-170. ED-II, 2, 9.5 to 14.0 cm **410 ± 35** **A.D. 1540**

KI-172. ED-II, 4, 24.5 to 28.0 cm **680 ± 35** **A.D. 1270**

KI-173. ED-II, 5, 38.3 to 42.0 cm **800 ± 55** **A.D. 1150**

KI-174. ED-II, 6, 49.5 to 54.0 cm **1050 ± 40** **A.D. 900**

KI-175. ED-II, 7, 75 to 80 cm **1560 ± 50** **A.D. 390**

KI-176. ED-II, 8, 80 to 85 cm **1450 ± 60** **A.D. 500**

KI-177. ED-II, 9, 85 to 90 cm **1490 ± 55** **A.D. 460**

KI-178. ED-II, 10, 90 to 95 cm **1620 ± 50** **A.D. 330**

KI-179. ED-II, 11, 95 to 100 cm **1730 ± 50** **A.D. 220**

Kubitzberg

Peat from Kubitzberger Moor, bog (54° 24′ N Lat, 10° 7′ E Long), 1 km NW of Altenholz near Kiel, Germany. Coll. by Usinger; subm. 1967 by L. Aletsee and J. Gehl, Botanisches Inst., Univ. Kiel. Samples record development of forests in N Germany. Height difference between samples is 35 cm.

KI-94. Kub B II — a **8200 ± 160**
6250 B.C.

Maximum of *Corylus*; 1st *Fagus* pollen.

KI-219. Kub B II — b **8530 ± 70**
6580 B.C.

First increase of *Corylus*.

III. ARCHAEOLOGIC SAMPLES

Möllenknob series

Samples from excavations of "Möllenknob" settlement near Archsum on Sylt island, Schleswig-Holstein (54° 52.7′ N Lat, 8° 22.5′ E Long, Topographische Karte 1116 Morsum r 3460 760 h 6082 360), Germany.

Rural settlement in form of "Tell" at border of sandy moraine ("Geest") to marsh ("Marsch") with 7 phases of late Bronze age to 4th century A.D.

Excavations directed by G. Kossack, Inst. für Ur-und Frühgeschichte, Univ. Kiel. Coll. 1963, 1964 by R. Kenk; subm. 1965 by G. Kossack and F. R. Averdieck, Univ. Kiel. Excavations are being conducted now; a complete treatise on "Möllenknob" is to be published.

Archaeologic dating will not be exact until material is studied in detail.

KI-144. Möllenknob 25, 6 **1650 ± 35**
A.D. 300

Carbonized barleycorns from rubble of burned dwelling house; 100 cm below surface (3.90 m NN); preliminary archaeol. estimate 200-300 A.D.

KI-145. Möllenknob 13, 1 **1910 ± 45**
A.D. 40

Charcoal of *Fraxinus* root 30 to 40 cm below surface; archaeol. dated ca. 4th century A.D.

KI-146. Möllenknob 28, 3 **1920 ± 60**
A.D. 30

Charcoal (*Quercus*) of house post; 100 cm below surface; preliminary archaeol. estimate 200-400 A.D.

KI-147. Möllenknob 64, 5 **2030 ± 70**
80 B.C.

Wood (*Quercus*); 150 cm below surface; preliminary archaeol. estimate 0-200 A.D.

KI-148. Möllenknob 68, 3 **1940 ± 40**
A.D. 10

Wood (*Alnus*) from pile, 160 m below surface; preliminary archaeol. estimate 0-200 A.D.

KI-149. Möllenknob 98, 11 — **3060 ± 50** — **1110 B.C.**

Charcoal (*Quercus*); 120 cm below surface; supposedly belongs to late Bronze age grave.

KI-150. Möllenknob 101, 4 — **1920 ± 60** — **A.D. 30**

Charcoal (*Quercus*); 100 cm below surface; parts of burned house; preliminary archaeol. estimate 0-200 A.D.

KI-151. Möllenknob 123, 5 — **1980 ± 60** — **30 B.C.**

Charcoal (*Quercus*) from rubble of burned dwelling; preliminary archaeol. estimate 200-400 A.D.

KI-74. Möllenknob — **1830 ± 60** — **A.D. 120**

Wattle and daub in stratum of dung; preliminary archaeol. estimate ca. 2nd century A.D.

General Comment (F.R.A.): there seems to be a systematic difference between C^{14} dates and archaeologic dates, which cannot be explained by variations of C^{14} content of atmosphere. Possibly on this island without trees the same wood was used more than once, and therefore was cut long before it reached discovery site.

Cereals and wattle, expected to have grown a short time before their carbonization, give same age as expected archaeologically (KI-144, KI-74).

Dätgen, mummified human body

Sphagnum cuspidatum peat, Grosses Moor, Dätgen, (54° 10 N Lat, 9° 56′ E Long), Germany. Subm. 1966 by L. Aletsee, Botanisches Inst., Univ. Kiel, now at Technische Hochschule Aachen.

KI-86. Dätgen — upper layer — **2055 ± 50** — **105 B.C.**

Peat from hollow mummified body was lying in. According to stratigraphical position peat should give lower age limit. Date given in Kiel I (KI-17, 2065 ± 90) should be upper age limit.

KI-92. Dätgen — medium layer — **2030 ± 60** — **80 B.C.**

Third peat sample from another part of hollow. *Comment*: there is no significant difference among the 3 dates.

References

Date lists:

Kiel I — Willkomm and Erlenkeuser, 1966

Kiel II — Willkomm and Erlenkeuser, 1967

Craig, Harmon, 1961, Mass-spectrometer analyses of radiocarbon standards: Radiocarbon, v. 3, p. 1-3.

[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 333-345]

RIKEN NATURAL RADIOCARBON MEASUREMENTS IV

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The C^{14} dates given below are a continuation of the work presented in our previous list (RIKEN III), and have been obtained by counting CO_2 at ca. 2 atm pressure in a 2.7 L stainless steel counter. Results obtained mainly during 1967 are described.

Shell samples were treated with 1% HC1 to remove the outer 10%. Calcareous deposits on the surface, when observed, were removed by mechanical means.

Dates were calculated on the basis of the C^{14} half-life of 5568 yr and 95% NBS oxalic acid as modern standard. No correction was applied even for fresh water shell samples.

SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

A. Japan

Iide series

Wood found at ca. 40 m from entrance of lateral pit dug into ancient landslide material, near Shirakawa dam at Iide-machi, Nishi-okitama-gun, Yamagata pref. (38° 0′ N Lat, 139° 55′ E Long). Coll. by S. Akutagawa; subm. 1966 by K. Kojima, Public Works Research Inst.

N-314. Iide 1 — **14,990 ± 260**
13,040 B.C.

N-358. Iide 2 — **14,800 ± 330**
12,850 B.C.

Each sample is from different piece of wood. *Comment* (K.K.): dates are much older than expected age of landslide.

Shiragake series

Charred wood samples from Arasawa pumice flow at Shiragake, Nikko city, Tochigi pref. (36° 44′ N Lat, 139° 34′ E Long). Coll. 1966 and subm. by M. Oishi, Natl. Research Center for Disaster Prevention. *Comment* (M.O.): dates Arasawa pumice flow.

N-355-1. Shiragake 1 — **13,800 ± 250**
11,850 B.C.

N-355-2. Shiragake 2 — **13,500 ± 240**
11,550 B.C.

N-356. Matsushiro **14,000 ± 255**
12,050 B.C.

Carbonized grass from hot spring well, ca. 10 m deep, at Kagai, Matsushiro-machi, Nagano city, Nagano pref. (36° 24′ N Lat, 138° 13′ E Long). Material considered bog sediment at Matsushiro basin. Coll. 1966 and subm. by H. Takahashi, Natl. Research Center for Disaster Prevention. *Comment* (H.T.): dates latest period of lake formation at Matsushiro basin.

Sasakawa series

Wood and peat exposed from sea bed by Niigata Earthquake in 1964, off Sasakawa, Sanboku-mura, Iwafune-gun, Niigata pref. (38° 25′ N Lat, 139° 20′ E Long). Coll. 1964 by Niigata Prefectural Fisheries Experimental Station; subm. by H. Takahashi.

N-357-1. Wood **12,700 ± 225**
10,750 B.C.

N-357-2. Peat **27,400 ± 1050**
25,450 B.C.

N-308. Inzai-machi **30,700 ± 1500**
28,750 B.C.

Marine shell (*Mactra sulcataria*) from Omori, Inzai-machi, Inba-gun, Chiba pref. (35° 51′ N Lat, 140° 8′ E Long). Shell layer, 3.4 m thick, is 1.6 m below ground surface, underlain by sand and clay. Coll. and subm. 1965 by M. Nishimura, Waseda Univ. *Comment* (M.N.): date gives information on valley formation of Tone R., where many prehistoric remains are found.

N-309. Daisen **910 ± 105**
A.D. 1040

Charred wood from Hijira, Yasugi city, Shimane pref. (35° 25′ N Lat, 133° 11′ E Long), from basaltic sand and clay, 1 m thick, above pumice bed of volcanoes, Mt. Daisen and Mt. Sambeyama. Coll. and subm. by T. Kimachi, Yonago Kita High School.

Sarobetsu series

Material from peat bed at Sarobetsu plain, Toyotomi-machi, Teshio-gun, Hokkaido (45° 8′ N Lat, 141° 43′ E Long). Coll. 1966 by H. Ando; subm. by M. Kurokawa, Hokkaido Development Bureau.

N-276-1. Wood **1340 ± 110**
A.D. 610

N-276-2. Peat **1530 ± 110**
A.D. 420

Both samples are from base of peat bed, 2.2 m below surface. *Comment* (M.K.): dates are younger than previously expected: 3000 to 5000 yr considering normally accepted value of peat deposition rate of 1 cm/10 yr in Hokkaido and later shrinkage of peat bed.

N-324. Musashi Bank **1950 ± 110**
A.D. 0

Upper jaw bone of whale from sea bed at Musashi Bank, N Japan Sea (44° 50′ N Lat, 141° 18′ E Long), 120 m deep, where Tertiary sedimentary rocks are exposed. Dredged by Umitaka-maru, training ship of Tokyo Univ. of Fisheries; subm. by S. Kuroda.

N-360. Kozu Island **1950 ± 110**
A.D. 0

Carbonized wood from road to Tako Beach, Kozu Is., Izu Is., Tokyo city (34° 12′ N Lat, 139° 9′ E Long), from volcanic ash 100 m above sea level. Coll. and subm. by S. Kuroda. *Comment* (S.K.): dates latest eruption period of Kozu Is. believed 11th or 12th century A.D.

B. Australia

Echuca series

Charcoal fragments from Goulburn valley, Victoria, Australia, which determine age of Quaternary tectonics, fluviatile sediments, and associated soils in Echuca area (Bowler and Harford, 1966; Bowler, 1967). Coll. and subm. 1966 by J. M. Bowler, Australian Natl. Univ.

N-294. Echuca C3 **215 ± 105**
A.D. 1735

Plant root charcoal from gravel pit 10.5 km NE of Rochester (36° 17′ S Lat, 144° 47′ E Long), 1.8 m below surface. Carbonaceous remains appeared truncated by undisturbed cross-bedding in overlying sand. *Comment* (J.M.B.): in view of recent age and mature soil profile developed on sand, material must be regarded as intrusive.

N-295. Echuca C4 **720 ± 110**
A.D. 1230

Plant root charcoal from same site as N-294, 2.7 to 3.0 m below surface in gray calcareous plastic clay disconformably underlying channel sand of Campaspe prior stream on which well-organized red-brown earth soil has developed. *Comment* (J.M.B.): material is now regarded as intrusive from near present surface.

N-296. Echuca C5 **13,000 ± 330**
11,050 B.C.

Fragmental carbon from gravel pit 1 km N of McCoy's Bridge across Goulburn R. near Kotupna (36° 9′ S Lat, 145° 8′ E Long), 4.5 m below surface in coarse cross-bedded sand and gravel of ancestral river channel of Goulburn system incised into mottled clay.

N-297. Echuca C6 **5170 ± 130**
3220 B.C.

Framental carbon from same site as N-296, 1.8 to 2.7 m below surface in gray silt and sandy clay overlying ancestral river sand of N-296.

N-298. Shepparton C1 **29,700 ± 1250**
27,750 B.C.

Fragmental carbon from N bank of Goulburn R., 8 km S of Shepparton (36° 27′ S Lat, 145° 22′ E Long), 9 m below present ground surface in prior stream bed sand and gravel overlying leached and mottled clay and ferruginous sandstone.

N-299. Shepparton 2a **25,500 ± 770**
23,550 B.C.

Fragmental carbon from same section as N-298, 5.5 m below surface in a clay plug infilling final channel of prior stream dated by N-298.

N-300. Shepparton 2b **23,800 ± 610**
21,850 B.C.

Fragmental carbon from same site as N-299, 5.75 m below surface.

N-301. Shepparton 3 **16,150 ± 330**
14,200 B.C.

Fragmental carbon from section of N bank of Goulburn R., 8 km SSW of Shepparton (36° 27′ S Lat, 145° 21′ E Long), 2.7 m below surface of inset (Coonambidgal) terrace, in bedded river sand, disconformably overlying mottled clay and disconformably overlain by younger silt and sandy clay represented by N-303.

N-302. Shepparton 4 **4970 ± 125**
3020 B.C.

Fragmental carbon from same stratigraphic section as N-298, 299, and 300, 3.6 m below surface in fine clayey sand of inset (Coonambidgal) terrace incised into prior stream sediments represented by N-298, 299, and 300.

N-303. Shepparton 5 **8090 ± 155**
6140 B.C.

Charcoal of trees burnt *in situ* from same site as N-301, 3.0 m below surface in reddish brown silt with abundant oxidized earth, disconformably overlying channel sand of N-301 within inset (Coonambidgal) terrace of Goulburn R.

N-306. Barmah 1 **20,300 ± 450**
18,350 B.C.

Carbonaceous plant fragments from gravel pit 1.5 km SE of Barmah and 22 km NE from Echuca (36° 1′ S Lat, 144° 58′ E Long), 2.7 to 3.6 m below surface in stream bed sand of prior stream—ancestral river of Goulburn R. system. This stream continued across Cadell Block where it joined Green Gully—ancestral to Murray R.

N-307. Kanyapella 15 **275 ± 100**
A.D. 1675

Fragmental carbon from gravel fan on E side of Echuca Depression, 17 km ENE of Echuca (36° 6′ S Lat, 144° 58′ E Long), 1.5 m below surface on bar of channel sand associated with lagoon entering Echuca Depression. *Comment* (J.M.B.): recent age obtained indicates recurrent deposition by this system to present time.

Ryan's Creek series

Material from valley of Ryan's Creek, at junction of creek and tributary, New South Wales, Australia (35° 48′ S Lat, 149° 19′ E Long). Coll. and subm. 1966 by C. Crook, Australian Natl. Univ.

2300 ± 115
N-325. Ryan's Creek 1 (JC 14/1) 350 B.C.

Charcoal fragments from river sediments, Good Good Pedolith, forming terrace, dissected by present stream, ca. 2 m below surface.

3520 ± 120
N-326. Ryan's Creek 2 (JC 14/2) 1570 B.C.

Charcoal fragments from river sediments, Ryan's Creek Pedolith, underlying Good Good Pedolith represented by N-325.

C. Great Britain

1710 ± 110
N-293. Cawood, Yorkshire A.D. 240

Wood from Stockbridge Experimental Farm, Cawood, Yorkshire, England (53° 49′ N Lat, 1° 9′ W Long), from presumed fluvioglacial sand containing seeds, leaves, and twigs, 135 to 140 cm below surface, 3.2 km S of Escrick moraine and 2 km S of Wharfe R. near its junction with Ouse R. Coll. and subm. 1966 by B. Matthews, Soil Survey of England and Wales. Estimated age: 5000 yr or older.

II. PEDOLOGIC SAMPLES

Samples of humic soil in volcanic ash from various localities coll. by K. Kawai, Natl. Inst. Agricultural Sci., and dated to determine relationships among soil age, weathering of primary minerals in soil, and clay mineral composition of soil. *Comment*: dated on total organic carbon in soil.

815 ± 110
N-277. Kutchian A.D. 1135

Material from Kutchian-machi, Abuta-gun, Hokkaido (42° 55′ N Lat, 140° 46′ E Long), 0 to 22 cm below surface. Ash layer is 2 to 3 m thick, underlain by grayish clay 5 cm thick, silt, and fine sandy volcanic soil. Coll. 1965. *Comment* (K.K.): date unexpectedly young.

3380 ± 125
N-278. Miura 1430 B.C.

Material from Hasse-machi, Miura city, Kanagawa pref. (35° 10′ N Lat, 139° 38′ E Long), 18 to 30 cm below surface. Coll. 1963.

N-279. Nishigoshi **1220 ± 110**
A.D. 730

Material from Kuroishi, Nishigoshi-mura, Kikuchi-gun, Kumamoto pref. (32° 59′ N Lat, 130° 54′ E Long), 15 to 34 cm below surface. Coll. 1963.

III. PALYNOLOGIC SAMPLES

Samples of palynologic interest, peat, and other organic material in soil, coll. from various localities by J. Nakamura, Kochi Univ. (Nakamura and Tsukada, 1960; Nakamura, 1965). *Comment*: dated on total organic carbon in soil.

Kumanoyu series

Clayey peat deposited on ancient solfatara and containing volcanic ash, silt, pebbles, and wood fragments, more than 20 m thick, at Kumanoyu hot spring, Nanae-machi, Kameda-gun, Hokkaido (41° 56′ N Lat, 140° 39′ E Long). Coll. 1965.

N-340. Kumanoyu 1 **14,200 ± 260**
12,250 B.C.

70 cm below surface.

N-341. Kumanoyu 2 **14,800 ± 260**
12,850 B.C.

100 cm below surface.

N-342. Kumanoyu 3 **15,700 ± 290**
13,750 B.C.

240 cm below surface.

N-343. Chippubetsu **23,300 ± 910**
21,350 B.C.

Clayey peat from boggy plain between Ishikari R. and Uryu R., Chippubetsu-machi, Uryu-gun, Hokkaido (43° 45′ N Lat, 141° 55′ E Long), 8.2 to 8.3 m below surface. Coll. 1965.

N-344. Itachino **4490 ± 140**
2540 B.C.

Humic soil from sediments of lacustrine origin, 6.3 m thick, at Itachino, Nangoku city, Kochi pref. (33° 33′ N Lat, 133° 34′ E Long), 135 to 150 cm below surface. Coll. 1966.

IV. ARCHAEOLOGIC SAMPLES

A. Japan

N-286. Nishinojo **5460 ± 130**
3510 B.C.

Carbon in pottery matrix of potsherd from Nishinojo shell mound, Namiki, Kozaki-machi, Katori-gun, Chiba pref. (35° 53′ N Lat, 140° 23′ E Long), found in dark soil 30 to 50 cm thick containing shell. Pottery considered comparable with Early Jomon, Hanazumi-kaso type, or Earliest Jomon, Kayama type (Nishimura *et al.*, 1955; Nishimura, 1965). Coll. 1963 and subm. 1966 by M. Nishimura, Waseda Univ. *Comment*: shell and charcoal from same shell mound yielded 8150 ± 180 and 8240 ± 190 (N-168, 170, RIKEN II), respectively.

6030 ± 135
N-287. Shimogumi **4080 B.C.**

Carbon in pottery matrix of potsherd from Shimogumi shell mound, Shimodamachi, Kohoku-ku, Yokohama city, Kanagawa pref. (35° 34′ N Lat, 139° 37′ E Long), found in shell layer 80 to 100 cm thick overlain by surface soil 30 to 40 cm thick. Pottery is of Early Jomon, Hanazumi-kaso type (Nishimura and Nakazawa, 1950). Coll. 1949 and subm. 1966 by M. Nishimura.

4840 ± 140
N-288. Hataya-araku **2890 B.C.**

Carbon in pottery matrix of potsherd from Hataya-araku shell mound, Neto, Kashiwa city, Chiba pref. (35° 53′ N Lat, 140° 0′ E Long), found in shell layer 50 cm below ground surface. Pottery is of unnamed type considered to belong to Early Jomon. Coll. 1956 and subm. 1966 by M. Nishimura.

4960 ± 125
N-289. Ta **3010 B.C.**

Carbon in pottery matrix of potsherd from Ta shell mound, Towada-mura, Tsukuba-gun, Ibaraki pref. (36° 0′ N Lat, 140° 2′ E Long), found in shell layer 40 to 50 cm thick. Pottery is of Early Jomon, Sekiyama type. *Comment*: fresh water and marine shell samples from same shell mound yielded 5640 ± 150 and 5630 ± 140 (N-191-1 and N-191-2, RIKEN III). Coll. and subm. 1966 by M. Nishimura.

Mukoyama shell mound series

Material from Mukoyama shell mound, Toride-machi, Kita-soma-gun, Ibaraki pref. (35° 56′ N Lat, 140° 1′ E Long). Shell layer is between dark soil overlying loam, 80 to 90 cm thick, overlain by surface soil 30 cm thick, and assoc. with Early Jomon pottery of Ukishima III type. Coll. 1966 and subm. by M. Nishimura.

4920 ± 195
N-365. Charcoal **2970 B.C.**

Charcoal fragment found on floor of dwelling pit.

5090 ± 130
N-366-1. Marine shell (*Meretrix lusoria*) **3140 B.C.**

5090 ± 140
N-366-2. Fresh water shell (*Corbicula japonica*) **3140 B.C.**

Both shell samples are from E side of Trench C.

Shin shell mound series

Material from Shin shell mound, Takeda, Kozaki-machi, Katori-gun, Chiba pref. (35° 52′ N Lat, 140° 25′ E Long). Shell layer, 30 to 40 cm thick, is on dark soil and assoc. with Late Jomon pottery of Angyo I and II types. Coll. 1966 and subm. by M. Nishimura.

3170 ± 120
N-367-1. Marine shell (*Meretrix lusoria*) 1220 B.C.

3230 ± 120
N-367-2. Fresh water shell (*Corbicula japonica*) 1280 B.C.

Both samples are from N side of Trench E.

Dochi shell mound series

Material from Dochi shell mound, S bank of Kokai R., Moriya-cho, Tsukuba-gun, Ibaraki pref. (35° 57′ N Lat, 140° 1′ E Long). Two shell layers are distinguishable 20 to 30 cm below ground surface: upper one, 20 cm thick, containing fresh water shell (*Corbicula japonica*) and assoc. with fiber tempered pottery of Early Jomon period, and lower one, 30 to 40 cm thick, on dark soil containing marine shell (*Anadara* sp., *Meretrix* sp., and *Ostrea* sp.) and assoc. with pottery of Earliest Jomon, Kayama type. Coll. and subm. 1967 by M. Nishimura.

6740 ± 150
N-368. Marine shell 4790 B.C.
(*Anadara granosa bisenensis*)

5260 ± 130
N-369. Fresh water shell (*Corbicula japonica*) 3310 B.C.

To study geomorphological development of area, peat and shell samples are coll. from reconstruction site of Joso bridge across Kokai R. near Dochi shell mound (35° 58′ N Lat, 140° 1′ E Long) and dated.

2780 ± 120
N-370. Peat 830 B.C.

From alluvial deposit overlying marine sand.

N-371. Marine shell (*Anadara subcrenata*) >37,800

From marine sand, about 10 m below alluvial deposit.

Hazama shell mound series

Material from Hazama shell mound, Itako-machi, Namegata-gun, Ibaraki pref. (35° 57′ N Lat, 140° 33′ E Long). Shell layer, 30 cm thick, is on dark soil overlain by surface soil 20 to 30 cm thick. Associated pottery is of Earliest Jomon period, Ugashimadai type. Coll. and subm. 1967 by M. Nishimura.

7290 ± 145
N-372. Carbon in pottery matrix 5340 B.C.

N-373. Marine shell (*Meretrix lusoria*) **6910 ± 145**
4960 B.C.

N-374. Daishuku **3940 ± 125**
1990 B.C.

Fresh water shell (*Corbicula japonica*) from Daishuku shell mound, Toride-machi, Kita-soma-gun, Ibaraki pref. (35° 54′ N Lat, 140° 4′ E Long). Shell layer, 30 to 40 cm thick, is overlain by surface soil 20 to 30 cm thick, and assoc. with Middle Jomon pottery of Kasori E type. Coll. and subm. 1967 by M. Nishimura.

N-375. Minami-sakai **3960 ± 125**
2010 B.C.

Marine shell (*Meretrix lusoria*) from Minami-sakai shell mound, Kita-sakaikubo, Inai-machi, Ishinomaki city, Miyagi pref. (38° 27′ N Lat, 141° 22′ E Long). Shell layer, 30 to 40 cm thick, is ca. 30 cm below ground surface. Associated pottery considered comparable with Late Jomon, Horinouchi type in Kanto District. Coll. 1966 by H. Kaneko, Waseda Univ.; subm. by M. Nishimura.

N-280. Honancho **1410 ± 110**
A.D. 540

Charred timber from Dwelling Pit F of Yayoi period at Honan-cho, Suginamiku, Tokyo (35° 41′ N Lat, 139° 40′ E Long). Excavated 1955 by M. Sakakibara and A. Aoki. Pottery is Maenocho type. Coll. 1955 and subm. 1958 by N. Watanabe. *Comment* (N.W.): 1220 ± 130 (N-57, RIKEN I) associated with same type pottery.

Todoroki series

Charcoal and shell from Todoroki shell mound of Jomon period at Miyanosho, Udo city, Kumamoto pref. (32° 41′ N Lat, 130° 38′ E Long), excavated 1966 by T. Esaka, Keio Univ. Coll. and subm. 1966 by N. Watanabe.

N-317. Charcoal **3960 ± 175**
2010 B.C.

N-318. Shell (*Ostrea* sp.) **3960 ± 130**
2010 B.C.

Materials were from same shell layer of Loc. 23, associated with Ataka-type pottery of Middle Jomon period.

N-319. Charcoal **3370 ± 135**
1420 B.C.

N-320. Shell (*Meretrix* sp.) **3260 ± 120**
1310 B.C.

Materials were from same shell layer of Loc. ET2, associated with Kitakuneyama-type pottery of Late Jomon period.

Kitami series

Charcoal from dwelling pit of Middle Jomon period under refuse deposit at Kitami-cho, Setagaya-ku, Tokyo (35° 38′ N Lat, 139° 36′ E Long), excavated 1948 by N. Watanabe and H. Watanabe, Univ. of Tokyo. Pottery is Kasori E II type. Coll. 1948 and subm. 1966 by N. Watanabe.

N-321. Charcoal on floor of dwelling pit **4160 ± 130**
2210 B.C.

N-322. Charcoal from deposit in dwelling pit **4240 ± 125**
2290 B.C.

Comment (N.W.): comparable dates 4513 ± 300 and 4546 ± 220 (C-603 and 548, Chicago II).

B. Korea

Hwano-li series

Wooden part of saddle from ancient tomb No. 34 at Hwano-li, Kyungju city, Korea (35° 51′ N Lat, 129° 12′ E Long). Expected age: 5th or 6th century A.D. Coll. 1965 by Y. J. Yun; subm. by Y. H. Kang, Kyungpuk Univ.

N-351. Hwano-li 1 **1630 ± 110**
A.D. 320

N-352. Hwano-li 2 **1580 ± 115**
A.D. 370

Buyo series

Charred rice and soybean grains beneath ground surface at Buyo city, Jungchungpuk-do, Korea (36° 16′ N Lat, 126° 55′ E Long). According to legend, they are provisions of Pèkché, which were burned during war in A.D. 660 against Silla. Coll. and subm. 1967 by Y. H. Kang.

N-353. Charred rice grains **430 ± 105**
A.D. 1520

N-354. Charred soybean grains **520 ± 105**
A.D. 1430

C. Africa

N-290. Ngungani, Kenya (NG 66, Mound I) **435 ± 105**
A.D. 1515

Charcoal from fill of large pit beneath low mound, ca. 60 cm below original ground level, at Ngungani, Chyulu Hills, Kenya (2° 35′ S Lat, 37° 50′ E Long). Coll. 1966 by R. C. Soper; subm. by H. N. Chittick, Brit. Inst. Hist. and Archaeol. E. Africa.

Kwale series

Charcoal from remains of Early Iron age at Kwale, Kenya (4° 12′ S Lat, 39° 26′ E Long). Coll. 1966 by R. C. Soper; subm. by H. N. Chittick.

N-291. Kwale 1 (KW 66 J/3) **1680 ± 110** **A.D. 270**

Ca. 50 cm below present surface.

N-292. Kwale 2 (KW 66 A) **1690 ± 110** **A.D. 260**

Ca. 30 cm below present surface. *Comment* (H.N.C.): N-292 required as check for N-291, which could conceivably be more recent root intrusion carbonized *in situ.*

Manda series

Charcoal from site of Islamic settlement at Manda, Kenya (2° 13′ S Lat, 40° 58′ E Long). Coll. and subm. 1966 by H. N. Chittick.

N-338. Manda 1 (LP I(4)) **1130 ± 110** **A.D. 820**

From upper burnt level at top of strata of Period I.

N-339. Manda 2 (LP V(5)) **1430 ± 110** **A.D. 520**

From lower part of strata of Period I overlying old beach. *Comment* (H.N.C.): true dates of both samples, based on assoc. Chinese porcelain and Islamic wares, are in 9th and 10th centuries, probably between 850 and 950 A.D. N-338 is at end of period, perhaps early 10th century. N-339 is unlikely to date more than 50 yr before N-338 (Chittick, 1967).

N-347. Bombo, Tanzania **1730 ± 115** **A.D. 220**

Charcoal from Bombo, South Pare Hills, Tanzania (4° 16′ S Lat, 38° 0′ E Long), 2 m below surface, associated with Iron-age pottery. Coll. 1967 by R. C. Soper; subm. by H. N. Chittick. *Comment* (R.C.S.): pottery very similar to that of Kwale (N-291 and 292, this list).

N-348. Bombo Mission, Tanzania **1060 ± 110** **A.D. 890**

Charcoal from Bombo Mission, South Pare Hills, Tanzania (4° 16′ S Lat, 38° 0′ E Long), 70 to 80 cm below surface in hill-side rubbish-tip of Iron-age date. Coll. and subm. 1967 by R. C. Soper. *Comment* (R.C.S.): sample belongs to different Iron-age culture from that of N-347. According to stylistic sequence of pottery, date was expected to be significantly later than that of N-257 at Gonja Maore (1080 ± 110, RIKEN III).

N-349. Amboni Cave, Tanzania (AM 67 (6)) **1590 ± 120** **A.D. 360**

Charcoal from Iron-age occupation layer, 52 to 58 cm below surface, in mouth of Amboni Cave, near Tanga, Tanzania (5° 4′ S Lat, 39° 3′ E Long). Coll. and subm. 1967 by R. C. Soper. *Comment* (R.C.S.): date is much earlier than expected, as associated pottery seemed unlikely to be earlier than ca. 12th or 13th century A.D.

N-346. Univ. of Ife Campus, Nigeria **2300 ± 115**
350 B.C.

Charcoal from Univ. of Ife campus, Ile-Ife, W. Nigeria (7° 31′ N Lat, 4° 32′ E Long). Sample contained in stone line separating 2 Holocene slope deposits, 80 cm below surface, and associated with undefined pottery and microliths. Coll. 1966 and subm. by H. Fölster, Univ. of Ife.

D. Andes

N-310. Guillermo's House (TAM 1) **575 ± 105**
A.D. 1375

Charcoal and burnt palm kernels from top 4 levels of Trench A at Guillermo's House, Peru (8° 51′ S Lat, 74° 18′ W Long). All levels are in very rich midden of Caimito complex. Coll. 1964 by D. W. Lathrap, Univ. of Illinois; subm. 1966 by S. Izumi, Univ. of Tokyo. *Comment* (D.W.L.): dates Caimito occupation at Imaríacocha. Expected age between A.D. 1200 to 1600. Another measurement on Caimito complex: 630 ± 60 (Y-1544).

N-311. Ticuna Plaza (AMA 2) **1150 ± 110**
A.D. 800

Charcoal from large pit cut into sterile base, encountered in trench excavated in NW corner of Ticuna Plaza in Ticuna, Cashillococha, Peru (4° 0′ S Lat, 70° 40′ W Long). Pit was packed with ceramics of Nataq ceramic complex, sherd tempered, with red-on-cream rectilinear painting. Coll. 1964 by D. W. Lathrap; subm. 1966 by S. Izumi.

N-312. Nueva Esperanza (UCA 17) **1180 ± 105**
A.D. 770

Charcoal from lower levels of pure midden of Nueva Esperanza complex, Nueva Esperanza, Peru (8° 14′ S Lat, 74° 41′ W Long). Coll. 1964 by T. P. Myers, Univ. of Illinois; subm. by S. Izumi. *Comment* (D.W.L.): material is probably earlier than Cumancaya material (1140 ± 80, Y-1545) on seriational grounds.

N-313. José's Hill (UCA 34) **1860 ± 110**
A.D. 90

Burnt shell of *charapu* turtle from Yarinacocha complex midden, José's Hill, Peru (8° 15′ S Lat, 74° 39′ W Long). Coll. 1964 by T. P. Myers; subm. 1966 by S. Izumi. *Comment* (D.W.L.): midden here overlay midden of Shakimu complex materials (2600 ± 100, Y-1543), and should post-date them by considerable period of time.

E. Great Britain

Burghead Fort series

Charred oak (id. by J. S. Murray, Univ. of Aberdeen) from wall of Fort Burghead, Scotland (57° 42′ N Lat, 3° 30′ W Long). No artifacts found inside fortress. Coll. and subm. 1966 by A. Small, Univ. of Aberdeen.

N-327. Burghead Fort 1 (RS.1) **1560 ± 110**
A.D. 390

N-328. Burghead Fort 2 (RS.2) **1340 ± 105**
A.D. 610

N-329. Burghead Fort 3 (RS.3) **1560 ± 115**
A.D. 390

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[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 346-349]

OAK RIDGE ASSOCIATED UNIVERSITIES RADIOCARBON DATES II

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The Radiocarbon Dating Laboratories of the Oak Ridge Associated Universities (ORAU) has previously published radiocarbon dates under the Oak Ridge Institute of Nuclear Studies (ORINS) name. ORINS has recently changed its name to ORAU and its laboratories and programs have accordingly assumed this new name. The ORINS prefix, which previously designated the published radiocarbon dates of this laboratory, will be continued to minimize confusion in the literature.

The radiocarbon dating program carried out at this laboratory is primarily concerned with assisting the ORAU Special Training Program in its teaching and research activities. Radiocarbon dates which appear in this paper represent samples submitted from research groups associated with the 41 universities which make up ORAU and by other college and university personnel who do not have access to radiocarbon dating facilities.

Carbon samples are chemically synthesized to liquid benzene and their C^{14} activity determined by liquid scintillation spectroscopy. Samples are first converted to lithium carbide and then to acetylene gas as described by Barker (1953). The acetylene is catalytically trimerized to benzene by a method described by Noakes *et al.* (1965). Chemical yields for the synthesized benzene routinely approach 90% with no evidence of chemical impurities or carbon isotope fractionation occurring in the chemistry.

A Packard Tricarb Model 314 D.C. liquid scintillation spectrometer, which has been modified for low level counting, is used to count the benzene samples. Counting efficiency is 50% when operating at a voltage of 800 with discriminator setting of 100-800-1000. Background count rate is 1.7 c/m with a 5 cc benzene sample. Shielding consists of 4 in. of lead with coincidence and anticoincidence systems.

The modern reference standard is 0.95% activity of NBS oxalic acid standard which is 6.82 c/m/g carbon. Ages are calculated on a C^{14} half-life of 5570 yr as suggested by Godwin (1962). The statistics quoted are compiled as one standard deviation (1σ) of the uncertainty involved in counting background, standard, and sample.

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Dr. Brian Logan, Geol. Dept., Univ. of W. Australia, contributed many samples and helped in the evaluation. Dr. James Harding of Oceanonics, Inc. and William Bryant, Oceanog. Dept., Texas A & M Univ., submitted many marine samples and assisted in their evaluation. Mr. Darwin Chapman, a research assistant at the ORAU Special Training Division, assisted in sample preparation and counting.

* ORAU Research Participant, Graduate Student, UCLA at San Diego, California.

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

A. Campeche Bank, Yucatan

Series of cores were taken from Campeche Bank, Yucatan, for study of physical, chemical, and geochemical properties of carbonate sediments in the area. Cores were coll. on various cruises of Texas A & M research vessel, "R. V. Alaminos," during 1965 and 1966.

$CaCO_3$ material from middle and lower sections of core (21E-65-A4) from Campeche Bank (20°-20′ N Lat, 92° 17½′ W Long); water depth 90 fms. Coll. 1965 by William Bryant, Dept. of Geol. Oceanog., Texas A & M Univ.; subm. 1965. *Comment*: medium-grained dark-gray calcarenite with lithic fragments in 300 cm section graded to light-gray calcilutite with dark-gray calcarenite with blebs of dark clay at 1000 cm section.

Lab No.	Core Interval (cm)	C^{14} Date
ORINS-65	**610-620**	**8,936 ± 90** **6,986 B.C.**
ORINS-66	**670-680**	**9,180 ± 90** **7,230 B.C.**
ORINS-68	**780-790**	**9,323 ± 100** **7,373 B.C.**
ORINS-69	**920-930**	**10,267 ± 105** **8,317 B.C.**
ORINS-72	**950-960**	**11,078 ± 130** **9,128 B.C.**
ORINS-70	**960-970**	**12,585 ± 100** **10,635 B.C.**
ORINS-73	**1000-1010**	**14,750 ± 130** **12,800 B.C.**

ORINS-63. Campeche Bank, Sample 8E-65-A4 **15,000 ± 154**
13,050 B.C.

Whitish-gray fine-grained calcilutite from upper middle section (interval 380 to 390 cm) of core from Campeche Bank (21°-59′ N Lat, 92°-19′ W Long); water depth 70 fms. Coll. 1965 by William Bryant; subm. 1965. *Comment*: $CaCO_3$ content less than 80% with pellets and dark-gray lithic fragments.

ORINS-71. Campeche Bank, Sample 10E-65-A4 **>41,000**

Medium- to coarse-grained gray calcarenite from bottom (1210 to 1220 cm) of core from Campeche Bank (20° 59′ N Lat, 96° 26′ W Long); water depth 73 fms. Coll. 1965 by William Bryant; subm. 1965. *Comment*: $CaCO_3$ content less than 80% with admixture of brown silt and clay. C^{14} date chronology of this core from 100 to 1150 cm intervals, publ. by Noakes (1967).

B. Shark Bay, Western Australia

Shark Bay is lagoonal sea lying between (26° 45′ S Lat, 24° 30′ S Long) on W coast of Australia. Since 1964, a marine research group from the Dept. of Geol., Univ. of W. Australia, has been conducting research programs on carbonate sedimentation and diagenesis of carbonate sediments in Shark Bay. The following C^{14} dates are mainly on shell material obtained from emergent Quaternary sediments in the area.

ORINS-62. Shark Bay, B265133 **424 ± 86**
A.D. 1,526

Oöid sand from Sta. B265133, Hamelin Pool W. Australia (26° 08′ S Lat, 113° 57′ E Long). Oöids are quartz nucleated and found in 4 to 5 ft depth of Anchorage Bank. Coll. 1965; subm. by Brian W. Logan.

ORINS-80. Shark Bay, L 157001 **27,861 ± 630**
25,911 B.C.

Coral (*Lobophillia corymbosa*) (Forskal) from emergent coral reef, Tetradon Loop, Dirk Hartog I., Shark Bay, W. Australia, (25° 27′ S Lat, 113° 07′ E Long). Reef top is ca. 10 ft above present mean sea-level. Coll. 1957; subm. by Brian W. Logan.

ORINS-79. Shark Bay, L 157002 **>30,000**

Coral (*Galaxea fascicularis*) (Linne) from same location and emergent coral reef as L 157001. Coll. 1957; subm. by Brian W. Logan.

ORINS-61. Shark Bay, G 266001 **30,532 ± 1078**
28,582 B.C.

Marine pelecypods (*Hemicardium hemicardium, Circe sugillata, Chama* sp., *Fargum unedo, Circe plicatina, Pitarina citrine*) from subsurface intertidal zone, Gladstone embayment, Shark Bay, W. Australia (25° 59′ S Lat, 114° 15′ E Long). Sample from 2 cores, over 6-in. interval ca. 4 ft below mean high water level. Coll. 1966; subm. by G. R. Graves.

ORINS-78. Shark Bay, 6266002 **36,888 ± 2750**
34,938 B.C.

Valves of pelecypods (*Ostrea* sp. and *Chama* sp.) from base of tertiary anticline (old shoreline) on W margin of Lake Mc. Leod, W. Australia (23° 32′ S Lat, 113° 52′ E Long). Sample locality is ca. 15 to 20 ft above mean sea level. Coll. 1966; subm. by G. R. Davis.

II. ARCHAEOLOGIC SAMPLES

ORINS-75. Kum River, Korea — 5,596 ± 600, 3,646 B.C.

Organic silt from Kum R. prehistoric excavation site 36° 27′ N Lat, 127° 9′ E Long), Korea. Sample obtained 600 cm below present vegetation level. Coll. 1966; subm. by P. K. Sohn, Yonsei Univ., Seoul, Korea. *Comment*: sample treated with dil. alkali and acid and dry-combusted.

ORINS-83. Grassy Cove Cave, Tennessee — 3,404 ± 68, 1,454 B.C.

Fecal pellets containing visible grass and other undigested vegetation from karst cavernous formation (36° 30′ N Lat, 85° 30′ W Long), Crossville, Tennessee. Sample from attic formation of Grassy Cove Cave in dry uncovered condition. Coll. 1967; subm. by Fred Fischer, ORAU Research Participant, Oak Ridge, Tennessee. *Comment*: sample treated with dil. alkali and acid and dry-combusted.

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UNIVERSITY OF ROME CARBON-14 DATES VI

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The list includes age measurements carried out from December 1966 and November 1967. All samples both of archaeologic and geologic interest are drawn from Italian territory.

Chemical techniques have remained unchanged (Bella and Cortesi, 1960). Two counters have been used for dating: the 1st, of 1.5 L, already described (Bella and Cortesi, 1960; Alessio, Bella, and Cortesi, 1964), the 2nd, of 1 L, recently assembled, is identical to the previous 1 L counter (Alessio, Bella, and Cortesi, 1964), its anticoincidence system was realized by a plastic scintillator and photomultipliers. Background 6.15 ± 0.08 counts/min, counting rate for modern carbon 24.49 ± 0.15 counts/min. Higher efficiency of electronic recording was obtained by reducing pulse length and by a few other changes. All samples are usually measured by both counters.

The errors quoted, as in previous measurements, are 1σ statistical error. Age has been calculated using Libby's half-life of 5568 ± 30 yr, with 1950 as the standard year of reference. As in all previous measurements, the same modern wood, grown near Rome between 1949 and 1953, has been taken as modern standard: its activity has once again been carefully checked and judged satisfactory.

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SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

Italy

Riparo Arma di Nasino series

Charcoal from Riparo Arma di Nasino deposit, Val Pennavaira, province of Savona, Liguria (44° 06′ 35″ N Lat, 8° 02′ 59″ E Long, 250 m above sea level) Cave No. 407 in "Catalogo Speleologico Ligure." Coll. 1962, 1963, 1966 and subm. 1965 and 1966 by M. Leale Anfossi. Deposit in small Arma di Nasino shelter, halfway up calcareous slope, on left side of Pennavaira creek, was discovered in 1961 by Leale Anfossi who, in 1962-64 and 1967, conducted excavations for Ist. Int. di Studi Liguri, Bordighera, and Soprintendenza alle Antichità della Liguria, Genova. Throughout deposit pottery and flint industry belonging to various cultural horizons, not always showing typical features, were found together with bones of both domestic and wild fauna, food refuse, and several hearths. From surface 15 layers were distinguished, their average thickness and archaeological characteristics follow: I) 30 cm thick, modern pottery; II) 40 cm thick, upper level, pottery of Roman epoch (1st century A.D.), lower level, coarse pottery of Iron age, bones of prevailing domestic animals, food refuse, 2 hearths; III) 40 cm thick, atypical coarse pottery and some bronze objects (Bronze age?), bones of prevailing domestic animals, food refuse, 1 hearth and remains of a buried child; IV-V) 55 cm thick, atypical coarse corded pottery as in III, of difficult identification (Bronze age?), bones of both domestic and wild animals, food refuse, thick ash deposit and 2 hearths; VI) 45 cm thick, pottery attributed to Early Bronze age or Eneolithic, including bell-beakers of Iberia and Sardinia type, flint industry, very small implements and blades, bones of wild fauna (*Cervus, Bos, Sus*), food refuse, and various hearths; between Layers VI and VII, a sort of pavement formed by several large flat stones; VII) 20 cm thick, atypical printed pottery perhaps ascribable to Late Neolithic, bones of wild fauna, food refuse; VIII) 30 cm thick, atypical pottery and polished pottery of Lagozza type attributed to Late Neolithic, bones of wild fauna, food refuse and 1 hearth; IX) 25 cm thick, fine printed pottery, including square-mouthed pots, attributed to Middle-Early Neolithic, flint industry, bones of wild fauna and shells of marine molluscs (*Cardium*), food refuse, and burial of young man in crouching position, typically Neolithic; X) 30 cm thick, Early Neolithic pottery, printed and with cardial decoration, bones of cold fauna (*Ibex*), and some hearths; XI) 20 cm thick, flint industry of Romanellian type, bones of cold fauna, food refuse; XII) 15 cm thick, plentiful flint industry of Epigravettian type with factory debris prevailing over implements, bones of cold fauna, food refuse; XIII) 30 cm thick, flint industry of same Epigravettian type as XII, bones of cold fauna, food refuse; XIV) 70 cm thick, sterile gravels; XV) 30 cm thick, only bones, small bits, and scanty charcoal. Rock bottom of shelter has not been reached; presumably, it is at ca. 7.50 m depth (Leale Anfossi, 1962; and pers. commun.). Digging was difficult especially in the upper layers, as they were interlaced with tree-roots and partly disarranged by people and domestic animals who now frequent the shelter. Several samples dated from Layers II-X, were from different areas of deposit and are listed separately according to excavation campaigns. All charcoal was given standard pretreatment by 10% HCl; a few, α-labelled in list, were given additional leaching by 6% NH_4OH and 2 ages were measured.

Samples coll. during 1962 excavation in N end of deposit:

R-319. Arma di Nasino II-62 **1330 ± 50**
A.D. 620

1745 ± 50
R-319α. Arma di Nasino II-62 **A.D. 205**

Charcoal from upper level of Layer II, 70 to 75 cm below surface, Sec. D-C. *Comment*: R-319 sample appears contaminated; true age R-319α agrees with Roman epoch.

2325 ± 50
R-321. Arma di Nasino IIa-62 **375 B.C**

2195 ± 50
R-321α. Arma di Nasino IIa-62 **245 B.C.**

2295 ± 50
R-322. Arma di Nasino IIb-62 **345 B.C.**

Charcoal from lower level of Layer II, 0.95 to 1.20 m below surface, Sec. D-C. *Comment*: R-321 sample appears uncontaminated, R-321 and R-321α ages being consistent. All dates agree with Iron age of layer.

2295 ± 50
R-325. Arma di Nasino IV-62 **345 B.C.**

2540 ± 50
R-326. Arma di Nasino IVa-62 **590 B.C.**

Charcoal from Layer IV, 1.40 to 1.60 m below surface, various secs., and from 1 hearth. *Comment*: ages agree with Iron age; atypical pottery was found.

2925 ± 50
R-328. Arma di Nasino V-62 **975 B.C.**

Charcoal from Layer V, 1.60 to 1.80 m below surface, Sec. D-C. *Comment*: date belongs to Late Bronze age; atypical pottery was found.

3430 ± 50
R-329. Arma di Nasino VI-62 **1480 B.C.**

3600 ± 50
R-329α. Arma di Nasino VI-62 **1650 B.C.**

3490 ± 50
R-330. Arma di Nasino VIa-62 **1540 B.C.**

Charcoal from Layer VI, 1.90 to 2.00 m below surface, several secs. *Comment*: R-329 and R-329α ages are very close and R-329 and R-330 considered uncontaminated. They date "bell-beaker level."

3645 ± 70
R-331α. Arma di Nasino VII-62 **1695 B.C.**

Charcoal from Layer VII, 2.20 to 2.35 m below surface, various secs. *Comment*: date agrees with presumed age of layer: synchronous or slightly older than Layer VI.

R-332. Arma di Nasino VIII-62 **4705 ± 70**
2755 B.C.

Charcoal from Layer VIII, 2.50 m below surface, G-F and F-G secs., and from hearth. *Comment*: age agrees with presence of Lagozza-type pottery in layer along with atypical pottery.

R-333. Arma di Nasino X-62 **5980 ± 85**
4030 B.C.

Charcoal from Layer X, 3.50 to 3.70 m below surface, various secs. *Comment*: age agrees with presence in the layer of printed pottery attributed to Early Neolithic.

Samples coll. during 1963 excavation in central area of deposit:

R-253. Arma di Nasino II-63 **2025 ± 65**
75 B.C.

Charcoal from upper level of Layer II, 60 to 90 cm below surface, various secs. *Comment*: age agrees with Roman epoch or Late Iron age indicated by stratigraphy.

R-255. Arma di Nasino III-63 **1785 ± 65**
A.D. 165

Charcoal from Layer III, depth not recorded, Sec. L-O. *Comment*: age too young, probable contamination of sample with younger material.

R-256. Arma di Nasino IV-63 **3255 ± 70**
1305 B.C.

Charcoal from Layer IV, 1.60 to 1.75 m below surface, Zone B-C-L-O. *Comment*: date shows Late Bronze age; atypical pottery was found in layer.

R-257. Arma di Nasino V-63 **3525 ± 65**
1575 B.C.

R-258. Arma di Nasino Va-63 **3390 ± 90**
1440 B.C.

Charcoal from Layer V, 1.60 to 1.70 m below surface, various zones. *Comment*: dates show Bronze age; atypical pottery was found in layer.

R-259. Arma di Nasino VI-63 **3340 ± 90**
1390 B.C.

R-260. Arma di Nasino VIa-63 **3680 ± 95**
1730 B.C.

Charcoal from Layer VI, 1.70 to 1.90 m below surface, various zones. *Comment*: R-260 date agrees better with presence of pottery including bell-beakers (Cf. R-329 and R-330).

R-261. Arma di Nasino VII-63 **4680 ± 100**
2730 B.C.

Charcoal from Layer VII; 2.30 to 2.50 m below surface, various zones. *Comment*: in this area Layer VII appears to belong to Eneolithic horizon and is much older than at 1962 excavation area, (Cf. R-331α).

R-262. Arma di Nasino VIII-63 **4220 ± 90**
2270 B.C.

Charcoal from Layer VIII among stones of hearth, depth not recorded. *Comment*: age too young; probable disarrangement of deposit.

R-263. Arma di Nasino VIIIa-63 **6140 ± 110**
4190 B.C.

Charcoal from Layer VIII, 2.60 to 2.85 m below surface, Zones B-C-G and B-C. *Comment*: Layer VIII in this area, as well as in W area (Cf. R-313), appears to belong to Lower Neolithic age and to be much older than in N end excav. area (Cf. R-332).

R265. Arma di Nasino IXs-63 **6280 ± 120**
4330 B.C.

Charcoal from upper level of Layer IX, 2.80 to 3.00 m below surface, Zones B-C-L-O and B-C-G-M. *Comment*: date confirms Lower Neolithic age of layer (Cf. also R-315 and R-316 dates for this layer).

R-267. Arma di Nasino IXi-63 **6470 ± 120**
4520 B.C.

Charcoal from lower level of Layer IX, 3.00 to 3.30 m below surface, various zones. *Comment*: R-267 date agrees with R-265 and dates layer as Lower Neolithic.

Samples coll. during 1966 excavation in W and E sides of deposit:

R-306. Arma di Nasino IIIs-66 **3045 ± 50**
1095 B.C.

Charcoal from upper level of Layer III, Zone A-B-W. *Comment*: date shows Late Bronze age; atypical pottery was found in layer.

R-307. Arma di Nasino IV-66 **3390 ± 50**
1440 B.C.

Charcoal from Layer IV, Zone A-B-W, found in hearth. *Comment*: date shows Late Bronze age; atypical pottery present in layer.

R-308. Arma di Nasino V-66 **3550 ± 55**
1600 B.C.

R-308α. Arma di Nasino V-66 **3690 ± 60**
1740 B.C.

Charcoal from Layer V, Zone A-B-W. *Comment*: sample appears uncontaminated, dates being satisfactorily consistent; they show Bronze age; atypical pottery present in layer.

R-309. Arma di Nasino VI-66 **4220 ± 55**
2270 B.C.

R-309α. Arma di Nasino VI-66 **4110 ± 55**
2160 B.C.

Charcoal from Layer VI, Zone A-B-W, found in hearths. *Comment*: sample appears uncontaminated, ages being consistent; Layer VI, containing "bell-beaker level" shows somewhat older in this excavation area (Cf. R-329, R-330, and R-260).

R-311. Arma di Nasino VII-CI-66 **3765 ± 70** **1815 B.C.**

Charcoal from Layer VII, corridor-entrance E area. *Comment*: (Cf. R-314).

R-314. Arma di Nasino VIII-CI-66 **4275 ± 65** **2325 B.C.**

R-314α. Arma di Nasino VIII-CI-66 **4340 ± 60** **2390 B.C.**

Charcoal from Layer VIII, corridor-entrance E area. *Comment*: Sample R-314 appears uncontaminated. In this E area (corridor and entrance) Layers VII and VIII were not clearly defined; they appear younger than W underanged A-B-W zone (see R-313); ages probably not reliable.

R-313. Arma di Nasino VIII-66 **6420 ± 65** **4470 B.C.**

R-313α. Arma di Nasino VIII-66 **6400 ± 105** **4450 B.C.**

Charcoal from lower level of Layer VIII, Zone A-B-W, found in hearth. *Comment*: sample uncontaminated dates layer to Lower Neolithic, (see also R-263).

R-315. Arma di Nasino IXs-66 **6280 ± 70** **4330 B.C.**

Charcoal from upper level of Layer IX, Zone A-B-W, found in hearth (Cf. R-316).

R-316. Arma di Nasino IXm-66 **6015 ± 65** **4065 B.C.**

R-316α. Arma di Nasino IXm-66 **5955 ± 65** **4005 B.C.**

Charcoal from middle level of Layer IX, Zone A-B-W, found in hearth. *Comment*: R-316 appears uncontaminated. R-315 and R-316 date layer to Lower Neolithic, though age appears younger than overlying Layer VIII.

General Comment: C^{14} ages show the same well-defined chronological horizons in the 3 excavated areas, as well as a few stratigraphical and archaeologic discrepancies that can be summarized as follows, from present backwards: a) Dates ranging from 1800 to 2600 yr B.P., were obtained for the Roman epoch and Iron-age pottery present in deposit; in N end, 1962 excavation, this chronological horizon goes down to Layer IV. b) A number of dates are uniformly distributed between 3000 and 3700 yr B.P., within limit of Bronze age; typical artifacts of this age have not been identified, however (Layers III, IV, and V). Bell-beaker level, Layer VI, of 3500-3700 yr B.P. was found in N (1962) and central (1963) excavated areas. c) Some samples measured from 4100 to 4800 yr B.P. which should be Eneolithic and Upper Neolithic; atypical coarse Neolithic pottery associated with these samples except in W (1966) excavated area where bell-beaker level appears older corresponding to ca. 4100-4200 yr. d) C^{14} dates within 6th millennium B.P. are lacking from whole deposit. e) Lower levels of deposit have yielded outstanding group of C^{14} dates between 5900 and 6600 yr B.P.; these agree with Lower Neolithic age of pottery id. in Layers IX and X, appearing to belong to this chronological horizon in the whole deposit. On the contrary, Layers VII and VIII have yielded various C^{14} dates not always corresponding to their archaeol. ages.

The above and some other minor inconsistencies existing between C^{14} dates and stratigraphy still need to be discussed. The excavation, particularly of still undated lower layers, is still in progress.

Lagozza di Besnate series

Since 1877, diggings in Holocene peat-bog covering dried up old intermorainal lacustrine basin of Lagozza di Besnate, 16 km ca. SSW Varese, W Lombardy (45° 42′ 11″ N Lat, 8° 46′ 20″ E Long) have yielded numerous archaeologic remains including flint industry, pottery, and wooden objects, presumably belonging to prehistoric lacustrine settlement, probably of lake-dwellings. Similar archaeologic artifacts were discovered in basin during 1st stratigraphic digging carried out by I. Regazzoni (Castelfranco, 1880; Regazzoni, 1887). Ca. 1940 culture ascribed to Upper Neolithic and named Lagozza culture was id. in W Lombardy and in nearby regions (Laviosa Zahbotti, 1939; 1939a; 1940). In 1953-54 further archaeol. excavations in peaty clayey lacustrine deposit at Lagozza di Besnate were made by O. Cornaggia Castiglioni; piles of lake dwellings, flint industry, and pottery of Lagozza culture were found (Cornaggia Castiglioni, 1955) and pollen analysis was made of peaty sediments (Pasa Durante and Pasa, 1956). Recently (1966-67) G. Guerreschi has carried out further studies on Lagozza culture.

R-78. Lagozza di Besnate 1 (remeasured) **4735 ± 50**
2785 B.C.

R-78A. Lagozza di Besnate 1a **4580 ± 50**
2630 B.C.

R-338. Lagozza di Besnate 1b **4980 ± 50**
3030 B.C.

Well-preserved wood, 3 fragments of pile (*Conifera* log, 12 cm in diam.) driven in bottom sediment of old lacustrine basin. It belonged to lower structure of lake-dwelling. Coll. 1953 and subm. 1956 and 1966 by O. Cornaggia Castiglioni, Soprintendenza ai Monumenti, Milano. *Comment*: wood was devoid of humic matter; R-78 new measurement agrees closely with Pisa date on 4th fragment of same pile, Pi-34, 4794

± 90 (Pisa II) and with culture present in deposit; 1st date for R-78 was: 4200 ± 300 (Rome II). R-78A date is consistent with preceding ones while R-338 date is somewhat older.

4805 ± 50
R-337. Lagozza di Besnate 2 **2855 B.C.**

Wood (*Conifera*) from "boomerang" fragment found ca. 1877 in lacustrine sediments, and since then housed in Cornaggia Castiglioni collection, Milano. Subm. 1966 by O. Cornaggia Castiglioni. This type implement well-known in lake-dwellings and in "bonifica" settlements of Upper Neolithic and Bronze ages, Lagozza and Polada cultures, throughout Po Plain, is now supposed to have been used as throwing-weapon and called "boomerang" for its similar shape (Cornaggia Castiglioni, 1959; 1960). *Comment*: wood slightly darkened but without humic matter. Date agrees with range of Lagozza culture.

General Comment: dates obtained at Pisa and Rome Labs for Lagozza culture in Lagozza di Besnate go from ca. 4700 to 5000 B.P. Levels 12-13 of Grotta delle Arene Candide deposit, Liguria, showing elements of Lagozza culture, were dated: R-104, 5075 ± 45 (Rome IV).

4385 ± 50
R-336. Lagozzetta di Besnate **2435 B.C.**

Wood from large cylindrical vessel, carved in root portion of log, found in 1872 while digging in Holocene peat-bog covering small inter-morainal lacustrine basin of Lagozzetta di Besnate, 150 m SW Lagozza di Besnate, 16 km ca. SSW Varese, (45° 42′ 11″ N Lat, 8° 46′ 20″ E Long) (Caimi, 1877). Housed at Mus. Civico di Archaeol., Milano, labelled L236; subm. 1967 by O. Cornaggia Castiglioni. With vessel were found flint arrows, a handled wooden bowl, and several fir-tree trunks set in order, which presumably belonged to wooden stacked platform or "bonifica." According to Cornaggia, archaeologic specimens could belong typologically to 1st phase of Polada culture in W. Lombardy (Cornaggia Castiglioni, 1956). Typical Polada culture spreads into E Lombardy and Venetia. *Comment*: inner part of wood was well-preserved; impaired thin outer part was removed. According to Cornaggia Castiglioni, R-336 should date 1st appearance of Polada culture in W Lombardy (Cornaggia Castiglioni, 1956).

Typical Polada culture in Polada site and in several lake-dwellings scattered through E Lombardy has been dated many times in Rome and Pisa: dates ranging between 3200 and 3500 yr B.P. were obtained (see: Rome II p. 82; Rome III, p. 215; Rome V, p. 349, and Pisa II, p. 102).

950 ± 50
R-339. Lago di Ledro B **A.D. 1000**

Externally charred wood from large trunk belonging to wooden stacked packwork thought to be "bonifica," N shore of Lago di Ledro near road between Molina di Ledro and Pieve di Ledro, 7 km SE Riva del Garda, province of Trento (45° 51′ 37″ N Lat, 10° 45′ 56″ E Long, 655 m above sea level; U.T.M. coordinate system, 32-T-PR-37108214). "Bonifica," showing evidence of fire, was found in superficial peaty layer, 70 cm thick, of now filled lacustrine bay. It overlay white sandy-clayey, thick, lacustrine deposit, and was underlain by *Cornus mas* seeds, bone bits, and potsherds which resemble pottery of Polada culture found in large lake-dwelling settlement situated in emissary Ponale area (Battaglia, 1943) at distance of 300 m and dated by Rome and Pisa Labs at 3100-3300 yr B.P. (see Rome II, p. 82; Pisa II, p. 102) (Cornaggia Castiglioni, 1955a). *Comment*: inner, unburnt wood appeared well-preserved and devoid of humic matter. Visible rootlets were carefully hand picked. Because of potsherds "bonifica" was supposed to be prehistoric. C^{14} date shows it to be medieval. Potsherds most probably came from Ponale lake dwellings.

R-341. Riparo Blanc **8565 ± 80**
6615 B.C.

Charcoal from Mesolithic layer of Riparo Blanc deposit at foot of W slope of Mt. Circeo promontory, Cava d'Alabastro locality, Comune of S. Felice Circeo, province of Latina, Latium (41° 13′ 45″ N Lat, 13° 02′ 36″ E Long, ca. 20 m above sea level). Coll. 1962 and subm. 1967 by M. Taschini, Soprintendenza alle Antichità Roma V. Excavations of small rock-shelter deposit were carried out in 1960-63 by Ist. Italiano di Paleontologia Umana, and directed by L. Cardini (Cardini and Taschini, 1958-61). Calcareous concretions formed by water percolating down slope through the deposit have acted partly to cement as well as to preserve them. Trench 4 m in depth was dug; rock bottom of shelter was not reached. Two archaeologic layers were identified. In lower one, of Pleistocene age, ca. 3 m thick, sparse Epigravettian industry and large mammal fauna (*Bos, Equus, Cervus*, etc.) were found. Upper layer, max. thickness ca. 90 cm, contained a particular Mesolithic flake industry made on small pebbles, including mainly denticulates, notched pieces, and perforators; very few wild mammal and micromammal bones (*Capreolus, Sus, Vulpes, Arvicola*, etc.), fish and crustacea remains, and plentiful shells of marine and fresh water molluscs, resulting both as food refuse (*Trochus, Patella, Cardium, Helix*, etc.) and personal ornaments (*Columella*, etc.). Mesolithic horizon unvaried through layer: charcoal was found in lower part (Taschini, 1962-65; 1964). *Comment*: R-341 date agrees, for what we yet know, with chronology of late Mesolithic cultures in Italy.

So far the following Mesolithic sites in S Italy and Levanzo Island (near NW Sicily coast) have been dated at Pisa and Rome Labs: Levanzo, Pi-119, 9694 ± 110 (Pisa II); Grotta La Porta (Positano), Pi-10, 8619 ± 200 (Pisa I); Grotta di Ortucchio (Avezzano), Early Mesolithic, Pi-23, 12,619 ± 410 (Pisa I); Grotta della Madonna (Praia a Mare), Mesolithic layer, R-187, 8735 ± 80; R-187α, 8875 ± 85; R-188, 9070 ± 80 (Rome IV). Levanzo, La Porta, and Ortucchio do not show as much specialization in either industry or economy as the Riparo Blanc Mesolithic deposit. Riparo Blanc and Grotta della Madonna appear similar in industry, though in Grotta della Madonna geometric microliths are also present. Economy differs, as people of Grotta della Madonna were not only mollusc gatherers, like those of Riparo Blanc, but also were large mammal hunters, as testified by presence of plentiful bone remains. Analogies can also be established between Mesolithic occupation of Riparo Blanc and some mesolithic sites on coast of Provence (Montadien) and in Pyrenees (Arudien).

R-191. Picture frame **<300**

Wood from picture-frame, subm. 1964 by owner, A. Mazzi, Rome, whose family kept it at Massa Carrara since 1840. *Comment*: wood tissue was not impaired but worm-eaten: sample carefully chosen from well-preserved part. Dating was required as frame was recently ascribed by restorer to medieval time, (ca. 11th century A.D.).

II. GEOLOGIC SAMPLES

Italy

R-158. Villar Dora, Val di Susa **9910 ± 75**
7960 B.C.

R-158A. Villar Dora, Val di Susa **10,000 ± 75**
8050 B.C.

Well-preserved wood, large fragment from trunk of *Pinuxylon* Gothan, ex *Pinus silvestris* L. (id. by G. Charrier, pers. commun.) found in lacustrine deposit 750 m S Villar Dora, Comune of Almese, Val di Susa, prov. of Turin, Piedmont (45° 06′ 26″ N Lat, 7° 22′ 43″ E Long, 349 m above sea level; coordinate system U.T.M. 32-TLQ-72609649). Coll. 1962 by L. Peretti, Ist. di Giacimenti Minerari, Politecnico of Turin; subm. 1963 by G. Charrier, Ist. di Giacimenti Minerari, Politecnico of Turin. In this locality, on left of Dora Riparia R., clay quarry section shows the following profile; soil surface to −1 m, recent pebble deposit by Dora Riparia R.; −1 to −1.80 m, reddish silty sediments containing shells of fresh water Gasteropoda; −1.80 to quarry bottom, ca. −4 m, bluish-gray silty-clay lacustrine deposit containing remains of herbaceous plants, fauna including *Ostracoda*, shells of *Lamellibranchiata*, some bones and numerous teeth of *Bos primigenius* Bojanus. Sample from −3.50 m. Other plant remains and fauna id. by G. Charrier. Drillings in other places show lacustrine deposit spreads over wide area in Lower Valle di Susa, underlying recent alluvium and confirms existence of ancient lacustrine basin filled by turbidity flows in Early Holocene; bottom has not been reached. *Comment*: wood well-preserved and devoid of carbonate and humic matter; R-158 was given pretreatment by 10% HCl, R-158A given no pretreatment. C^{14} age dates lacustrine formation as Early Preboreal. R-158 is related to sample R-52, 7780 ± 100 (Rome II) from Boreal/Atlantic transition in lacustrine deposit a few km W of site. In Val di Susa and nearby valleys studies of Late Würm and Postglacial formations are being made by L. Peretti and G. Charrier.

Pontebba series

In 1965, partial sec. of postglacial formation was found at Pontebba, Fella Valley, E Alps, Udine prov., Friuli, (46° 30′ 20″ N Lat, 13° 19′ 48″ E Long, 568 m above sea level). From top downward: IV) alluvial gravels, thickness to 30 m, of Fella R. and of alluvial fan of its affluent Rio degli Uccelli; floated woods (boughs) imbedded in lower level; III) lacustrine clays, thickness 0 to 6 m, establishing existence of presumably small, lacustrine basin, as inferred by comparison with different sections, several trunks of *Larix* were found in growth position; II) lower fluvial gravels, thickness 0.20 to 1 m, with reddish paleosol on top; on these gravels forest of *Larix* had established; I) lower lacustrine clays, exposed for only a few cm, total thickness unknown. Floated woods from Layer IV and *Larix* trunk from Layer III coll. 1965 and subm. 1966 by M. Manzoni, Ist. di Geologia, Univ. of Bologna, on behalf of R. Selli, Director Ist. di Geologia, Univ. of Bologna.

R-280B. Pontebba IV — **9120 ± 175** — **7170 B.C.**

R-304. Pontebba IVa — **9130 ± 75** — **7180 B.C.**

R-304B. Pontebba IVb — **9160 ± 65** — **7210 B.C.**

Wood, floated boughs, 3 different fragments, from bottom of fluvial gravels IV in contact with underlying lacustrine clays III. *Comment*: wood had become soft and light; devoid of humic matter; all samples were given 10% HCl pretreatment.

R-303. Pontebba II-III — **9160 ± 75** — **7210 B.C.**

R-303A. Pontebba II-III. — **8975 ± 80** — **7025 B.C.**

Well-preserved wood from large trunk of *Larix* (id. by M. Manzoni, pers. commun.) from lacustrine clays III and belonging to forest grown on underlying fluvial gravels II. *Comment*: R-303 10% HCl pretreatment was given, R-303A no pretreatment was given.

General Comment: synchronous ages for both floated woods, R-280B, R-304, R-304A, and *Larix* trunk, R-303, R-303A, are suitable and indicate quick filling of small lacustrine basin and high rate of Fella R. alluvial transport. Dates accord with previously known ages assigned to stadial moraines of Fella glacier; transition to fluvial post-Würmian environment, closer to lacustrine event dated by C^{14}, correlates with transgression of Yoldia Sea in N Europe.

R-159. Cava Bentivoglio **5065 ± 50**
3115 B.C.

R-159A. Cava Bentivoglio **4930 ± 50**
2980 B.C.

R-159α. Cava Bentivoglio **5000 ± 60**
3050 B.C.

R-159β. Cava Bentivoglio **4820 ± 50**
2870 B.C.

Heavily darkened wood fragment from tree trunk at 11 m depth in Holocene formation at Casalone di S. Marino locality, ca. 6 km SSW Bentivoglio, prov. of Bologna, Emilia (44° 35′ 05″ N Lat, 11° 23′ 28″ E Long, 22 m above sea level). Coll. and subm. by M. Fornaseri, Ist. di Geochimica, Univ. of Rome. 18 m sec. in clay quarry of Industria Bolognese Laterizi shows following profile from surface downward: 0 to −7 m, clayey fine sand immediately under thin layer of agricultural soil; −7 to −9 m, clayey coarse sand with imbedded clayey lenses; −9 to −18 m bluish clay with imbedded sandy lenses, containing plant remains (twigs) and fresh water molluscs (*Unio*). In sandy layer at −11 m depth a few floated and darkened tree trunks, 35 to 40 cm in diam., have been recovered. Calcareous concretions, 2 to 10 cm in diam., (local name "calcinello") scattered through whole section, both in sand and clay layers. Lower limit of formation not reached: it is part of widespread alluvial Holocene deposit of Lower Po Plain. Presence of *Unio* indicates lacustrine-marsh environment. *Comment*: no $CaCO_3$ was present in evenly darkened wood. By boiling with dilute HCl CO_2 was evolved and large amount of Fe^{++} detected, probably ferrous carbonate and humate: by additional leaching with 6% NH_4OH a plentiful humic fraction was extracted. Because of deep impairment of wood and possible contamination, procedure of sample preparation was as follows: R-159A, no pretreatment; R-159, pretreatment by boiling dilute HCl until all CO_2 was evolved and Fe^{++} quantitatively dissolved; R-159β, humic fraction extracted by additional leaching with 6% NH_4OH and precipitated again by acidifying with dilute HCl; R-159α fraction insoluble in above 6% NH_4OH leaching. The 4 ages are not significantly different and show material was not contaminated. Lacustrine episode belongs to late Holocene time. Determination is 1st in this region for widespread deposits heretofore known only as Holocene.

Adriatic Sea series

In 1965 and 1966 2 cruises in Upper Adriatic Sea were made by Ist. di Geologia, Univ. of Bologna, under direction of R. Selli, for studying sedimentation environment of submarine part of Po R. delta and offshore area (Ciabatti, Colantoni, and Rabbi, 1965; 1966). Paleontological, mineralogical, chemical, and grain size distribution studies were made as well as physical and chemical analyses of both surface and bottom waters, and studies on distribution of bottom organisms (Ciabatti and Colantoni, 1966; D'Onofrio, 1967; Gallignani and Rabbi, 1966; Tomadin, 1967). Area of 640 km² was covered by net system of 122 stations between Porto Celere and 5 km S Porto Volano, along coast and 15 km out (44° 45′ to 45° 06′ N Lat, 12° 16′ to 12° 45′ E Long). Core was taken at each station, water and bottom samples were coll., and density, temperature, pH measurements, etc. were determined. In 1966 cruise, further bottom samples and cores were taken. Samples coll. 1965 by M. Ciabatti and P. Colantoni, Ist. di Geologia, Univ. of Bologna, and subm. by R. Selli.

R-334. Adriatic Sea G.5-5 **8475 ± 60**
6525 B.C.

Bits of darkened wood and sapropelitic matter from core G.5, 107 cm long, from Sta. 47, 12 km E of shore (44° 57′ 54″ N Lat, 12° 42′ 03″ E Long), water depth 30.20 m; 90 cm below top of core.

R-335. Adriatic Sea G.5-2 **8000 ± 60**
6050 B.C.

Bits of darkened wood and sapropelitic matter from 30 cm below surface of same G.5 core.

General Comment: sedimentation appears much slower in more recent time. Erosion of bottom sediments or reduced or missed sedimentation caused by bottom current can be postulated or transport of older terrigenous organic materials by Po R. Available dates are insufficient for explanation.

Sapropelitic muds from 103 and 109 cm below top of core from Adriatic Sea at approx. same lat. (44° 58′ N Lat) and not too far E off (12° 54′ E Long) from G.5 core, water depth 33 m, were dated at Stockholm Lab: St-426, 9240 ± 80 and St-427, 8960 ± 170 (Stockholm III). Ages are consistent with core G.5 dates. According to K. Fredriksson, Geol. Survey of Sweden, who subm. samples, top of sediments may have been eroded.

R-340α. Monte li Santi **>42,000**

Heavily humified wood (probably *Fagus*) from diatomite at Monte li Santi locality, near Mazzano Romano, prov. of Rome (42° 12′ 14″ N Lat, 12° 24′ 52″ E Long). Coll. 1965 and subm. 1966 by M. Follieri and I. Napoleone, Ist. di Botanica, Univ. of Rome. Partial section through lacustrine deposit for quarry works, 12 m in depth, shows mainly diatomaceous sediments with interbedded lenses and layers of different thicknesses of volcanic materials. Pollen analysis of diatomite section shows 5 vegetation phases from bottom to soil surface: Pollen Zone A, 12 to 11.65 m below soil surface, Steppe; Pollen Zone B, 11.65 to 11.32 m, *Quercetum mixtum*; Pollen Zone C, 11.32 to 10.75 m, *Fagetum*; Pollen Zone D, 10.75 to 10.42 m, *Fagus* decreases; Pollen Zone E, 10.42 to 6.60 m, Cold Steppe; 6.60 m to soil surface, layers poor in pollen (Napoleone and Follieri, 1968). Wood was found at 11.24 m depth, in *Fagus* culmination levels, *Fagetum* phase. *Comment*: sample was pretreated with 10% HCl: abundant Fe^{++} was detected, probably ferrous humate, since sample was devoid of CO_3^{--} and S^{--}. Additional leaching with 6% NH_4OH was given, though plentiful humic fraction of sample appears to be result of wood decomposition, rather than an external contamination, since diatomite is devoid of humus. Cold climate shown by basal pollen zone may indicate deposit to be Riss or Early Würm phase. Mindel glacial in Italy, with available knowledge, shows older vegetation features than this deposit, and on the other hand presence of *Zelkova* leads the authors to exclude Main and Late Würm or Postglacial phases. C^{14} date bears out given upper limit.

III. CROSS-CHECK SAMPLES

R-106. Usselo (remeasured) **11,740 ± 90**
9790 B.C.

Wood (*Betula*) found in peat from sec. near Usselo, Overijssel prov., Netherlands (52° 10′ N Lat, 6° 50′ E Long). Sample given to us by Hl. de Vries at Groningen in Nov. 1957. *Comment*: sample dated at Rome Lab. in 1962: R-106, 11,800 ± 280 (Rome II). Latter measurement, carried out for instrument control on CO_2 evolved from same $CaCO_3$ then prepared, agrees with preceding measurement. For sample significance and checking of ages obtained at different Labs, see Rome II, p. 79.

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UNIVERSITY OF SASKATCHEWAN RADIOCARBON DATES V

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This series reports some of the measurements made since publication of the previous list. Equipment and methods are described in Saskatchewan II.

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

Sharp Hills series

Peat from Sharp Hills, Alberta (51° 21′ N Lat, 114° W Long). A glaciofluvial deposit apparently laid down by an englacial stream emerging from retreating ice, consisting of stratified sand and gravel with till inclusions. Samples coll. ca. 20 ft apart in gravel 15 to 20 ft below ground level. Coll. 1963 and subm. by J. G. Nelson, Univ. of Calgary, Calgary, Alberta.

S-204. Sharp Hills, peat **>35,000**

S-205. Sharp Hills, peat **33,500 ± 2000**
31,550 B.C.

General Comment (J.G.N.): dates are 1st from Erratics Train area of Alberta, and are much greater than expected.

S-206. Carstairs, Alberta **26,700 ± 1400**
24,750 B.C.

Peat from outwash deposit S of Carstairs, Alberta (51° 20′ N Lat, 114° 10′ W Long) occurring in scattered particles and lens-like masses up to 3 ft long and over 1 ft wide. Coll. 1963 and subm. by J. G. Nelson. *Comment*: like S-204 and S-205, date is from Erratics Train area of Alberta. Although appreciably younger than S-204 and S-205, is still older than expected.

S-212. Edmonton, Alberta **170 ± 70**
A.D. 1780

Wood from toe of slip contained in slump block on S bank of N Saskatchewan R., Edmonton, Alberta (53° 36′ 5″ N Lat, 113° 18′ 40″ W Long). Coll. 1963 by W. T. Painter; subm. by S. R. Sinclair, Univ. of Alberta, Edmonton, Alberta. *Comment* (S.R.S.): age of sample relates it to others in immediate area where age can be determined by patterns of tree growth. Ultimate aim is piecing together history of slumping of valley's slope.

S-213. Red Deer River Valley, Alberta **>33,000**

Charcoal from kame moraine upstream from Ya Ha Tinda ranch in Red Deer valley (51° 38′ N Lat, 115° 50′ W Long). Recovered as fragments ca. 10 to 15 ft below surface, from mixture of stratified sand and gravel. Coll. 1962 by J. G. Nelson; subm. by C. P. Gravenor, Research Council of Alberta, Edmonton, Alberta. *Comment* (J.G.N.): 1st date from downstream part of alpine valley in E-central Alberta ca. 15 mi downstream from Drummond Glacier, located in headwaters of Red Deer R. Date is greater than expected.

S-215. Edmonton, Alberta **>33,000**

Wood from Saskatchewan Sands and Gravels of Edmonton area, Alberta (53° 29′ 30″ N Lat, 113° 35′ W Long). Sample found at depth 73 ft below surface. Sand layer is 45 ft thick overlain by 8 ft till and 30 ft Lake Edmonton deposits of silt and clay. Coll. 1962 by L. A. Bayrock; subm. by C. P. Gravenor. *Comment* (L.A.B.): Saskatchewan Sands and Gravels believed to be Pleistocene but older than 33,000 yr.

Marsden series, Saskatchewan

Carbonaceous silt (probably buried soil) 4 ft below surface, under till, near Marsden, Saskatchewan (52° 53′ N Lat, 109° 54′ W Long). S-228 and S-228B are organic fractions taken from different locations. S-228A is carbonate fraction from same sample as S-228B. Coll. 1963 by D. L. Delorme; subm. by E. A. Christiansen, Saskatchewan Research Council, Saskatoon.

S-228. Organic fraction **21,000 ± 800**
19,050 B.C.

S-228A. Carbonate fraction **18,000 ± 450**
16,050 B.C.

S-228B. Organic fraction **19,200 ± 400**
17,250 B.C.

Comment (E.A.C.): dates part of weathering interval prior to last glaciation which took place ca. 18,000 yr ago in Marsden area.

S-229. Allan, Saskatchewan **>34,000**

Wood in unoxidized till 24 ft below surface near Allan, Saskatchewan (51° 56′ N Lat, 106° 04′ W Long). Coll. 1964 by I. W. Tweddell; subm. by E. A. Christiansen.

Batoche Ferry series, Saskatchewan

Carbonaceous material in stratified drift over till and under aeolian sand near Batoche Ferry, Saskatchewan (52° 46′ N Lat, 106° 08′ W Long). Coll. 1964 and subm. by E. A. Christiansen.

S-233. Charcoal or coal **>32,000**

From Fluvial sand over till and under A-horizon (S-234).

S-234. A-horizon **8100 ± 120**
6150 B.C.

Overlain by 24 ft aeolian sand. *Comment* (E.A.C.): because sample S-233, which was derived from datable surficial, stratified drift, is beyond datable range, carbonaceous material is interpreted as reworked coal. Sample S-234 dates deposition of overlying aeolian sand.

Old Wives series, Saskatchewan

Samples from SE of Old Wives, Saskatchewan (50° 56′ N Lat, 105° 59′ W Long) underlain by minimum of 2 ft exposed unoxidized clay. S-235 is marl from S ditch of road in 1 ft interlaminated clay and marl, overlain by 3 ft unoxidized clay and 1 ft till. S-236 is organic material from N ditch of road in 1 to 2 in. sandy layer, overlain by 7 ft till. Exposures show structural deformations probably caused by collapse of lacustrine sediments on melting of stagnant ice. Marl contains following ostracode species: *Candona acutula, C. candida, C. compressa, C. renoensis, Cyclopris ampla, Cypridopsis vidua, Limnocythere trapeziformis, Potamocypris smaragdina, Notodromas monacha, Dolerocypris fasciata.* Coll. 1964 by D. L. Delorme; subm. by W. O. Kupsch, Univ. Saskatchewan, Saskatoon.

S-235. Old Wives, marl **12,000 ± 180**
10,050 B.C.

S-236. Old Wives, organic **9400 ± 160**
7450 B.C.

General Comment (W.O.K.): samples are considered from same stratigraphic unit but S-236 more reliable (Delorme, 1965, p. 66-68). Date is minimum for deglaciation.

S-239. Biggar, Saskatchewan **9200 ± 150**
7250 B.C.

Marl at 9 in. depth from 20 in. thick lacustrine calcareous silty clay exposed in hummocky moraine near Biggar (51° 27′ N Lat, 107° 59′ W Long). Unit contains following ostracode species: *Candona acutula, C. candida, C. compressa, C. rawsoni, Cyclocypris ovum, C. ampla, Cypridopsis vidua, Ilyocypris gibba, I. bradyi, Limnocythere trapeziformis, Potamocypris smaragdina.* Coll. 1963 by D. L. Delorme; subm. by W. O. Kupsch. *Comment* (W.O.K.): date is minimum for deglaciation (Delorme, 1965, p. 80-84).

S-241. Ormiston, Saskatchewan **15,200 ± 260**
13,250 B.C.

Silty marl near Ormiston, Saskatchewan (49° 54′ N Lat, 105° 27′ W Long). Sample 2 ft 4 in. from top of 3 ft 2 in. horizontal silt layer, overlain successively by 3 ft gravel, 4 ft dipping silt layer, and 4 ft till. Silt believed deposited in lake close to glacier ice, with final melting of buried ice causing high dips of strata and sliding or flow of upper till on top. Deposit above lower silt regarded as kame or kame-eskerine complex. Lower silt contains following ostracode species: *Ilyocypris gibba, I. bradyi, Candoma causdata, S. renoensis, C. acutula, C. candida, C. compressa, C. rawsoni, Cypridopsis vidua, Cyclocypris ovum, C. ampla, Limnocythere trapeziformis, L. ceriotuberosa, Cyprinotus glaucus, Cytherissa lacustris.* Abundant gastropods and charophytes. Coll. 1963 by D. L. Delorme; subm. by W. O. Kupsch. *Comment* (W.O.K.): date is minimum for deglaciation. Dead ice believed present when sampled unit was deposited (Delorme, 1965, p. 63-65).

S-242. Crestwynd, Saskatchewan **5500 ± 120**
3600 B.C.

Marl from 21 in. thick silty calcareous clay at surface of swell of moderately undulating terrain near Crestwynd (50° 10′ N Lat, 105° 20′ W Long), believed deposited near edge of superglacial lake on surface of wasting glacier. As stagnant ice melted original attitude of strata was disturbed. Unit contains following ostracode species: *Candona acutula, C. rawsoni, Cyclocypris ampla, Ilocypris gibba, Limnocythere trapeziformis.* Coll. 1963 by D. L. Delorme; subm. by W. O. Kupsch. *Comment* (W.O.K.): date should be minimum for deglaciation, but is believed too young considering other evidence (Delorme, 1965).

Sturgeon Lake series, Saskatchewan

Samples from terrace cut-bank along N side of Sturgeon R., Saskatchewan at E end of Sturgeon Lake (53° 25′ N Lat, 106° 00′ W Long). Two main stratigraphic units in section (1) Member B 2 ft 6 in. of interbedded calcareous sands and clays grading into marl of varying purity, overlying (2) Member A over 7 ft 8 in. predominantly of marl with interbedded calcareous sands and clays. Beds are horizontal, and a disconformity separates Member B from Member A, distinctly ocherous near top. Both members contain abundant gastropods, charophytes, diatoms, and following ostracodes: *Candona acutula, C. decora, C. distincta, C. compressa, C. ohioensis, C. rawsoni, Lymnocythere staplini, L. trapeziformia, Cyclocypris ampla, C. ovum, Cypridopsis vidua, Potamocrypris pallida, Cyprinotus salinus.* Coll. 1963 by D. L. Delorme; subm. by W. O. Kupsch.

S-244. Marl **5900 ± 100**
3950 B.C.

From Member B, 1 in. below soil.

S-243. Marl **9100 ± 150**
7150 B.C.

From Member B, 2 ft 6 in. below soil, above unconformity.

S-253A. Marl **8950 ± 150**
7000 B.C.

From mixed marl and charcoal from Member A, 5 ft 2 in. below soil; above base of exposed section.

S-253B. Charcoal **8550 ± 130**
6600 B.C.

From mixed marl and charcoal from Member A, 5 ft 2 in. below soil; 5 ft above base of exposed section.
General Comment (W.O.K.): S-253A (marl) and S-253B (charcoal) agree with date of lower marl. Age of S-243, which dates time local drying produced ocherous staining at unconformity, is probably too great. All dates are post-glacial for this area (Delorme, 1965, p. 102-106).

S-245. Houghton, Saskatchewan **>27,000**

Wood chips from sandy clay and gravel 480 to 520 ft below surface from rotary testhole, overlain by drift, mainly till (51° 13′ N Lat, 107° 55′ W Long). Coll. 1962 by R. E. Creelman; subm. by E. A. Christiansen.

S-246. Kyle, Saskatchewan **12,000 ± 200**
10,050 B.C.

Mammoth bone 0 to 4 ft below surface in oxidized clayey, fossiliferous sand near Kyle, Saskatchewan (50° 50′ N Lat, 108° 07′ W Long). Coll. 1964 by T. Kehoe; subm. by E. A. Christiansen. *Comment* (E.A.C.): scattered skeletal remains and contorted pond deposits in which mammoth was buried indicate that remains were disturbed during melting of stagnant ice after mammoth died 12,000 yr ago.

S-247. St. Brieux, Saskatchewan **>33,000**

Wood 27 ft below surface in well presumably below uppermost till (52° 34′ N Lat, 104° 50′ W Long). Coll. 1951 by A. Coquet; subm. by E. A. Christiansen.

S-248. Matador, Saskatchewan **11,620 ± 130**
9670 B.C.

Organic clay, probably A-horizon, 1 ft thick underlying 4 ft of massive clay and overlying 5 ft of contorted clay and till (50° 44′ N Lat, 108° 02′ W Long). Coll. 1964 and subm. by E. A. Christiansen. *Comment* (E.A.C.): dates inundation of soil by glacial lake in which overlying clay was deposited.

S-249. Floral, Saskatchewan **>33,000**

Carbonaceous silt overlain by 2 weathered zones 156 to 184 ft below surface (52° 05′ N Lat, 106° 27′ W Long). Coll. 1964 and subm. by E. A. Christiansen.

S-251. Wandsworth, Saskatchewan **34,000 ± 1800**
32,050 B.C.

Carbonaceous clay overlying 2nd weathering zone 232 to 252 ft below surface (52° 54′ N Lat, 106° 37′ W Long). Coll. 1964 and subm. by E. A. Christiansen. *Comment* (E.A.C.): dates 2nd last glaciation.

S-252. Alvena, Saskatchewan **33,500 ± 2000**
31,550 B.C.

Carbonaceous silt 183 to 189 ft below surface from sidehole core below single till (52° 36′ 30″ N Lat, 106° 03′ W Long). Coll. 1964 and subm. by E. A. Christiansen. *Comment* (E.A.C.). dates weathering interval prior to last glaciation.

Frenchman's Flat series, Saskatchewan

Samples from alluvial fine sand, silt, and clay of local S Saskatchewan R. flood plain S of Saskatoon, Saskatchewan. Coll. 1963 and 1964 and subm. by L. E. Hodgins, Univ. Calgary, Calgary, Alberta.

S-261. Frenchman's Flat, depth 3 ft **1450 ± 70**
A.D. 500

Charcoal and organic soil from S end of flood plain (51° 47′ N Lat, 106° 45′ W Long).

S-262. S Frenchman's Flat, depth 4 ft **1950 ± 85**
A.D. 0

Charcoal and organic soil from same section as S-261.

S-263. S Frenchman's Flat, depth 7 ft 2 in. **2980 ± 75**
1030 B.C.

Charcoal and organic soil from same section as S-261.

S-264. C Frenchman's Flat **540 ± 75**
A.D. 1410

Horizontal log under 8 ft of alluvium in central part of flood plain (51° 57′ N Lat, 106° 47′ W Long).

S-265. C Frenchman's Flat **450 ± 60**
A.D. 1500

Charcoal layer under 4 ft 6 in. of alluvium, about 100 yards S of S-264 site.

S-266. C Frenchman's Flat **1035 ± 60**
A.D. 915

Bison bones under 8 ft of alluvium (51° 54′ N Lat, 106° 45′ W Long). *General Comment* (L.E.H.): samples date parts of local but morphologically significant flood plain and give rates of sedimentation of overbank flood deposits. Range of dates indicate main river channel has been relatively stable for at least 3000 yr, and are minimum for earlier postglacial degradation and aggradation. S-266 is maximum for Pike Lake (large ox-bow) which probably also post-dates S-264 and S-265.

S-267. Marsden, Saskatchewan **33,000 ± 2000**
31,050 B.C.

Carbonaceous lens in noncalcareous, oxidized till 3 ft below surface beneath uppermost till (52° 49′ N Lat, 109° 49 W′ Long). Coll. 1965 and subm. by E. A. Christiansen. *Comment* (E.A.C.): dates weathering interval prior to last glaciation.

Slave River Delta series, North West Territories

Samples from S end of modern Slave R. Delta (61° 15′ N Lat, 113° 20′ W Long), from 10 ft high bank near beginning of 1st distributary channel (Jean R.). Coll. 1965 and subm. by N. J. McMillan, Tenneco Oil and Minerals Ltd., Calgary, Alberta.

S-268. Slave River Delta, peat **2725 ± 115**
775 B.C.

From 4 in. bed in vertical bank of Jean R. 8 ft below ground level.

S-269. Slave River Delta, wood **2215 ± 95**
265 B.C.

Enclosed in stratified silty clay 4 ft below ground level in bank of Slave R. 0.2 mi W (downstream) from S-268. *Comment*: dates help establish sedimentation rate and growth of Slave R. Delta.

S-273. Wolfe, Saskatchewan **>34,000**

Carbonaceous silt 79 ft below surface in 2nd weathering zone (52° 15′ N Lat, 108° 27′ W Long). Coll. 1965 and subm. by E. A. Christiansen.

S-274. Paynton, Saskatchewan **>35,000**

Coal or charcoal 85 ft below surface in sand from sidehole core below till (52° 56′ N Lat, 108° 54′ W Long). Coll. 1965 and subm. by E. A. Christiansen. *Comment* (E.A.C.): stratigraphic position suggests carbonaceous material is datable, but because date beyond datable range sample is presumed reworked coal.

Garry Island series, North West Territories

Wood samples from 3.3 m section of peat and from underlying lake silt above ice-thrust Pleistocene sediments at elev. 30 m above sea level on Garry Island, North West Territories (69° 31′ N Lat, 135° 47′ W Long). Face of peat was cleaned off to permafrost and wood obtained from frozen ground. Coll. 1964 and subm. by D. E. Kerfoot and J. R. Mackay, Univ. of British Columbia, Vancouver.

S-276. Wood 1.9 m depth from peat **9500 ± 150**
7550 B.C.

S-278. Wood 2.3 m depth from peat **11,300 ± 190**
9350 B.C.

S-277. Wood 3.7 m depth from silt **11,700 ± 250**
9750 B.C.

Comment (J.R.M.): as underlying icy beds are nearly vertical, permafrost has been present continuously for at least 11,700 yr. Peat overlain by 0.8 m of soil, moved downslope by solifluction.

Pike Lake series, Saskatchewan

Buried soil "A" horizons from 30 ft high sand dune NW of Pike Lake, Saskatchewan (51° 56′ N Lat, 106° 50′ W Long). Seven dark carbonaceous horizons, each 2 to 16 in. thick and clearly separated from other horizons by "clean" eolian fine sand, were exposed in road cut at depths ranging from 20 ft to 5 ft below crest of dune. (Minor horizons at 15 and 11 ft are not dated.) Coll. 1964 and subm. by L. E. Hodgins, Univ. Calgary, Calgary, Alberta.

S-281. Pike Lake dune, depth 20 ft **3510 ± 70**
1560 B.C.

S-282. Pike Lake dune, depth 16 ft **3470 ± 70**
1520 B.C.

S-284. Pike Lake dune, depth 10 ft **2400 ± 70**
450 B.C.

S-285. Pike Lake dune, depth 9 ft **2450 ± 70**
500 B.C.

S-286. Pike Lake dune, depth 5 ft **820 ± 60**
A.D. 1130

General Comment (L.E.H.): buried soils indicate periods of well-established vegetation and stabilized dunes, and relatively moist conditions. Intervening clean sand accumulations indicate periods of dune building and relatively dry conditions. Thickness of organic horizons dated by S-281 (6 to 9 in.) and S-286 (6 to 16 in.) and organic content of S-286 horizon are greater than those of other horizons and reflect longer periods of moist conditions and dune stability. Some accumulation of sand may have occurred during soil development.

S-287. Meridian Ferry, Saskatchewan **2270 ± 70**
320 B.C.

Wood 11 to 12 ft below surface from augerhole under 11 ft of flood plain silt adjacent to N Saskatchewan R. (53° 36′ N Lat, 109° 59′ 30″ W Long). Coll. 1965 and subm. by E. A. Christiansen. *Comment* (E.A.C.): dates postglacial flood plain deposition.

S-288. Banks Island, North West Territories **>34,000**

Canon bone of *Ovibus moschatus* from gravel bar on Bernard R., North West Territories (73° 23′ N Lat, 121° 54′ W Long). Coll. 1963 and subm. by W. J. Maher, Univ. Saskatchewan, Saskatoon. *Comment*: evidence for existence of Wisconsin refugium on unglaciated islands of W artic Archipelago is inconclusive. (Savile, 1961; Porsild, 1955). Date tends to substantiate existence of refugium.

Borgarfjördur series, W. Iceland

Marine shells from silts with angular stones (id. as silt-tills) from S shore of Borgarfjördur inlet (64° 32′ N Lat, 21° 46′ W Long). Coll. 1964 and subm. by I. Y. Ashwell, Univ. Calgary, Calgary, Alberta.

S-289. Efri-Hreppur **12,100 ± 250**
10,150 B.C.

Shells (*Tellian calcarea, Mya truncata, Saxicava arctica*) in silt-till matrix, 21 to 26 m above present sea level, capped by glacio-fluvial gravel.

S-290. Ardalur **12,100 ± 150**
10,150 B.C.

Shells (*Chlamys islandica, Nucula tenuis, Astarte montagui, Cardium fasciatum, Tellina calcarea, Mya truncata, Saxicava pholadis, Saxicava arctica Margarita groenlandica*) in silt-till matrix, 25 to 30 m above present sea level, capped by glacio-fluvial gravel. Some shells broken.

S-291. Grjoteyri **12,800 ± 220**
10,850 B.C.

Shells (*Tellina calcarea, Mya truncata, Saxicava arctica, Neptunea? antiqua, Trophon clathratus*) in silt-till matrix, showing signs of occasional layering, 15 to 21 m above present sea level, glacio-fluvial shingle above, with further silt-till containing shell fragments at 31 to 33 m. Shells in dated sample often broken. *Comment* (I.Y.A.): all 3 dates compare closely with 2 earlier samples I-1824a and I-1825, the former at 111 to 135 m, the latter at 16 to 24 m above present sea level. All found along 8 km line at foot of Skardsheidi-Hafnarfjall massif, in same types of matrix. Ashwell suggested (1967) that material was dropped from floating ice-shelf. Disturbance and breaking of shells may indicate that parts of deposit were moved, or that stones falling from shelf above were responsible for damage.

Quill Lake series, Saskatchewan

Gyttja from 12, 17, and 27 ft below water surface in Quill Lake, Saskatchewan (51° 48′ N Lat, 104° 19′ W Long). Coll. 1966 and subm. by E. A. Christiansen.

S-292. Gyttja 27 ft below water surface **11,000 ± 150**
9050 B.C.

S-293. Gyttja 17 ft below water surface **5970 ± 85**
4020 B.C.

S-294. Gyttja 12 ft below water surface **3500 ± 85**
1550 B.C.

Comment (E.A.C.): linear relationship between depth intervals and age suggest uniform sedimentation of rate of 1 ft in 500 yr. S-292 indicates that area was deglaciated more than 11,000 yr ago.

S-295. Howe Sound, British Columbia **5770 ± 150**
3820 B.C.

Shell material dredged from sea bottom in Howe Sound, British Columbia (40° 20′ N Lat, 123° 19′ W Long), enclosed in gravelly glacial till with 41% water content. Coll. 1965 and subm. by J. W. Murray, Univ. British Columbia, Vancouver. *Comment* (J. W. M.): material was dredged from submarine ridge (depth 25 m), dating from unknown stade of Pleistocene at mouth of Howe Sound, a fjord on coast of SW British Columbia. Date may be derived either from mixture of older Pleistocene and Recent shells or from unmixed assemblage. The latter is favored because no living benthic invertebrates have been dredged from locality. Geologic evidence indicates submarine ridge is much older than 5770 yr, but since formation, ridge has existed as relic topographic high on sea floor, essentially free from additions of terrigeneous sediments. Benthic shell fish apparently flourished on ridge top 5770 ± 150 yr ago and have remained unburied up to present.

S-296. Saskatoon, Saskatchewan **8160 ± 125**
6210 B.C.

Carbonaceous gray, clayey silt, or ablation till (A-horizon) 4 in. thick, overlain by 18 in. of massive, clean sand in excavation at Saskatoon, Saskatchewan (52° 08′ N Lat, 106° 40′ W Long). Coll. 1966 and subm. by E. A. Christiansen. *Comment* (E.A.C.): dates deposition of surficial sand.

S-297. Saltcoats, Saskatchewan **>33,000**

Wood from sand 90 to 236 ft in cuttings from testhole overlain by 40 ft of silt and 40 ft of till near Saltcoats, Saskatchewan (51° 03′ N Lat, 102° 05′ W Long). Coll. 1966 and subm. by E. A. Christiansen.

S-298. Maple Creek, Saskatchewan **2000 ± 70**
50 B.C.

Charcoal under 9 ft of clay and 11 ft above Gap Creek bed near Maple Creek, Saskatchewan (49° 51′ N Lat, 109° 36′ W Long). Coll. 1966 by G. C. Watson; subm. by E. A. Christiansen. *Comment* (G.C.W.): dates use of fire pit and predates deposition of overlying clay.

S-299. Foxdale, Saskatchewan **>33,000**

Wood from sand in testhole 115 to 120 ft below surface overlain by till near Foxdale, Saskatchewan (53° 25′ N Lat, 106° 20′ W Long). Coll. 1966 by G. Riddle; subm. by E. A. Christiansen.

Evesham series, Saskatchewan

Carbonaceous silt and clay over till near Evesham, Saskatchewan (52° 29′ N Lat, 109° 57′ W Long). Coll. 1965 and subm. by E. A. Christiansen.

S-300A. Carbonate fraction 6 ft below surface **14,670 ± 240**
12,720 B.C.

S-300B. Organic fraction 6 ft below surface **15,850 ± 225**
13,900 B.C.

S-401A. Carbonate fraction 3 ft below surface **12,725 ± 135**
10,775 B.C.

S-401B. Organic fraction 3 ft below surface **18,000 ± 275**
16,050 B.C.

S-402A. Organic fraction 1 ft below surface **4100 ± 100**
2150 B.C.

S-402B. Organic fraction 1 ft below surface **5230 ± 100**
3280 B.C.

Comment (E.A.C.): close agreement of S-300A and B suggests dates are acceptable. S-401A is also acceptable date because it is stratigraphically higher and therefore younger. S-401B, however, does not fit stratigraphic sequence and is therefore unacceptable. S-402A and B were run on separate portions of same sample. Difference in measurements suggests material is not homogeneous. Because glacial lake in which samples 402A and B were deposited must predate Quill Lake date (S-292, 11,000 yr B.P.) it is concluded that 402A and B were contaminated by recent carbon through soil-forming processes. S-300A and B show glacier retreated from area more than 15,000 yr ago.

S-404. St. Denis, Saskatchewan **>35,000**

Carbonaceous silt, probably gyttja, 86 to 88 ft below surface in side-hole core from testhole under 86 ft of till near St. Denis, Saskatchewan (52° 09′ N Lat, 106° 12′ W Long). Coll. 1966 and subm. by E. A. Christiansen. *Comment* (E.A.C.): carbonaceous silt was deposited more than 35,000 yr ago.

II. ARCHAEOLOGIC SAMPLES

Gull Lake series, Saskatchewan

Charred wood from prehistoric bison drive site, Gull Lake Site (EaOd-1), on escarpment of Missouri Coteau, 6 mi S of Gull Lake, Saskatchewan (50° 00′ 15″ N Lat, 108° 32′ 20″ W Long). Forty-eight stratigraphic layers, with sub-layers, many containing butchered bison bone, were distinguished in 18 ft of deposits. Top 8 layers contained Plains Side-notched points, pottery, and artifacts of period ca. A.D. 1600 to mid-19th century. Layers 15 to 24b contained Prairie Side-notched points, pottery, and artifacts of period A.D. 700 to A.D. 1300. Site excavated in 1953, 1960, and 1963 by Saskatchewan Mus. of Nat. History. Two C^{14} dates have been determined for Layers 21 and 24b (S-150, 1165 ± 80 and S-149, 1220 ± 80, Saskatchewan III). Coll. 1963 and subm. by T. F. Kehoe, Saskatchewan Mus. of Nat. History, Regina.

S-254. Layer 26 **1290 ± 60**
A.D. 660

S-255. Layer 31a **1740 ± 60**
A.D. 210

S-256. Layer 34 **1900 ± 65**
A.D. 50

Comment (T.F.K.): Layer 26 contained many butchered bison bone, Timber Ridge Sharp-eared variety of Avonlea points, and no pottery. Layer and date considered termination of Avonlea occupations. Layer 31a contained bone, no pottery, and Gull Lake ("classic") variety of Avonlea point; considered beginning of Avonlea at site and in region. Layer 34 contained lense of charcoal and single bell-shaped limestone pestle; considered to pre-date Avonlea occupations and bison drive complex.

Walter Felt series, Saskatchewan

Charcoal from layers of prehistoric bison drive and occupation site, Walter Felt site (EcNm-8) on escarpment of Missouri Coteau, 8 mi S of Mortlach, Saskatchewan (50° 20′ 34″ N Lat, 106° 05′ 40″ W Long). Twenty stratigraphic layers, with sub-units, were distinguishable in 5 ft of deposits. Top 4 layers contained Plains Side-notched points, check-stamped pottery, many butchered bison bones, and artifacts of proto-historic period (ca. A.D. 1700 to and including white contact). Coll. 1962 and 1965 and subm. by T. F. Kehoe.

S-280. Layer 4 **400 ± 40**
A.D 1550

S-203. Layer 6 **700 ± 80**
A.D. 1250

S-202. Layer 7 **1260 ± 70**
A.D. 690

S-201. Layer 10 **1535 ± 80**
A.D. 415

S-260. Layer 10 **1535 ± 90**
A.D. 415

S-200. Layer 13 **1610 ± 70**
A.D. 340

S-279. Layer 15b **2430 ± 90**
480 B.C.

General Comment (T.F.K.): layer 6 contains Prairie Side-notched points and probably indicates terminal period for these points, before Plains Side-notched points superseded them. Layer 7 contains earlier Prairie Side-notched points and correlates with beginning of Late Woodland period at Gull Lake site. Layer 10 contains Samantha points with no recognizable cognate forms or other dated localities in N Plains. Layer 13 yielded Middle Woodland pottery and Besant points similar to if not identical with Besant points at Mortlach site (Wettlaufer, 1955) (S-22, 1580 ± 150, McCallum, 1955). Layer 15b yielded Pelican Lake points, no pottery, and compares to Level 4 (2230 ± 100, S-49a, Saskatchewan III) at Long Creek site. S-280 dates triangular points and check-stamp pottery from bison bone pit near drive site.

Glen Ewen Burial Mound series, Saskatchewan

Charcoal samples from man-made burial mound 14 mi S of Glen Ewen, Saskatchewan (49° 01′ N Lat, 101° 58′ 20″ W Long). Conical mound is 50 ft in diameter, 1.5 ft high, with 4 linear mounds about 12 ft wide radiating from it for as much as 600 ft and terminating in conical mounds. Coll. 1959 and subm. by T. F. Kehoe.

S-258. Charred wood **1220 ± 70**
A.D. 730

From planking covering a burial chamber beneath central tumulus.

S-259. Charred wood **1110 ± 90**
A.D. 840

Assoc. with secondary single flexed arm burial on periphery of central mound.

General Comment (T.F.K.): S-258 dates construction of mound and compares favorably with similar Late Woodland burial mounds in Plains region, and with beginning of Late Woodland occupation at Gull Lake site, Saskatchewan (S-149, 1220 ± 80, Saskatchewan III). Secondary burial dated by S-259 is probably intrusive, post-dating mound construction.

Kenney series, Alberta

Charcoal from hearths at Kenney site, near Brocket, Alberta, 45 mi W of Lethbridge, Alberta on flood plain on E bank of Pincher Creek (49° 33′ N Lat, 113° 45′ W Long). Three stratified occupation layers asoc. with developed (Ah) soil profiles. Coll. 1964 by B. Reeves; subm. by R. G. Gorbis, Univ. of Calgary, Calgary, Alberta.

S-270. Layer 4, 12 in. depth **355 ± 60**
A.D. 1595

Contains potsherds and small notched projectile points.

S-272. Layer 8, 30 in. depth **1600 ± 115**
A.D. 350

Contains Besant points. *Comment* (R.G.F.): determinations for upper and lower layers (4 and 8) are consistent with previous age estimates. Most pottery in Alberta is no more than 500 yr old; Layer 4 seems typical. Besant components similar to Layer 8 have been dated for Old Women's Buffalo Jump, Alberta (1650 ± 60, S-90, Saskatchewan III), and for Mortlach and Walter Felt sites. Saskatchewan (1580 ± 159, S-22, McCallum, 1955, and 1610 ± 70, S-200, this list).

S-403. Moon Lake, Saskatchewan **5000 ± 90**
3050 B.C.

Burnt bone 5.5 ft below surface from seasonal campsite near Moon Lake, Saskatchewan (52° 02′ N Lat, 106° 47′ W Long). Assoc. with

7 small Oxbow-type projectile points. Coll. 1966 by I. D. Dyck; subm. by Z. S. Pohorecky, Univ. Saskatchewan, Saskatoon. *Comment* (Z. S. P.): controlled excavation of 196 sq ft at this unicomponent cultural site shows Oxbow settlement pattern for 1st time, not camp-circle around campfire but fan-shaped camp-triangle est. 600 sq ft. Flint-knapping, butchering, bone-smashing, hide-scraping, and food-preparation (mainly *Bison,* some goose, also carnivore) were activities of 5 to 9 persons, each with place in trianguloid area, fanning outward and SE from windbreak, evidenced by 4 post-holes 14 to 22 in. apart, arranged in arc against prevailing NW wind. Hearth 2 ft NE of post-hole pattern and N of camp-area, which was downwind and W of campfire's smoke. Springs were 3/8 m S and E of campsite. Tiny tools predominate, including 12 end-scrapers (10 tiny), 1 tiny side-scraper, 2 tiny blades, 2 bone scrapers, 1 chisel, 1 chopper.

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[RADIOCARBON, VOL. 10, No. 2, 1968, P. 379-383]

TARTU RADIOCARBON DATES III

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In dating the samples reported here as well as in calculating their ages, the same equipment and method of processing and counting were used which were previously described in Tartu I and II.

TA-103. Akali **6255 ± 100**
4305 B.C.

Arboreal coal from hearth of settlement Akali, 4 km S of village Praaga on right bank of Akali R., Tartu Dist., Estonian SSR. Putative age of sample: 3rd millennium B.C. or older. Coll. 1966 by K. Jaanits, subm. by L. Jaanits, Hist. Inst., Acad. Sci. of Estonian SSR.

TA-121. Byzovaya **18,320 ± 280**
16,370 B.C.

Bones of mammoth (*Mammonteus primigenius* Blumenbach) found near settlement Byzovaya, Pechorskij Dist., Komi ASSR. Sample depth, 1.5 to 20 m. Probable age: Late Pleistocene (Ilves *et al.*, 1968). Coll. 1964 by V. I. Kanivtsa, subm. by I. E. Kuzmina, Zool. Inst. Acad. Sci. of SSSR.

TA-134. Naroch **10,100 ± 95**
8150 B.C.

Wood remains from sec. on S bank of Lake Naroch, Myadel'skij Dist., Byelorussian SSR. In abrasion terrace outcrop: grayish-yellow sand (fill), 100 cm; sod-podzolic soil overlying sand with admixture of gravel, 70 cm, eolian and lacustrine sands, 400 cm, alluvial peat with interlayers of muddy sand, in places containing many wood fragments and intact tree trunks, 15 to 20 cm, lacustrine sand with sparse inclusions of gravel and shingle. Visible thickness 80 to 100 cm (Voznyachuk and Punning, 1967). Silicon implements attributed by V. B. Bud'ko and M. M. Chernyavskij to end of Late Paleolithic or Early Mesolithic were found near outcrop in sand. According to V. A. Kaleshishtch, sample contains pollen of pine up to 94%, birch 5%, spruce 0.5%, alder 0.5%, and willow 1%. Coll. 1966 and subm. by L. N. Voznyachuk, Byelorussian State Univ.

TA-135. Naroch **10,810 ± 100**
8860 B.C.

Fragments of big tree trunk (according to H. Paaves, *Pinus silvestris*) from outcrop where sample TA-134 was collected. Submerged alluvial peat formed in late Alleröd or on border of Alleröd and Dryas intervals, also corroborated by paleocarpological, palynological, and archaelogical data.

TA-136. Peedu **39,180 ± 1960**
37,230 B.C.

Large wood fragments from inter-morainic stratum near town Elva on NW Otepää elev. in SE Estonia. Pollen analysis by E. Liivrand shows that when lake and swamp deposits accumulated alder (~ 50%) and fir (1 to 10%) pollen, spruce and pine also played important role in ancient vegetation; pollen grains of white beech and elm were also detected (Punning *et al.*, 1967). Palynologically, profile has some features similar to deposits at Karuküla (Serebryanny *et al.*, 1968).

TA-137. Loobu **13,970 ± 115**
12,020 B.C.

Bryales peat containing calcareous aleurite and subfossils on left bank of Loobu R., Rakvere Dist., Estonian SSR. Stratigraphy of outcrop from surface: well-decomposed peat, 110 cm; lime sapropelite containing plant remains and shells, 45 cm; Bryales peat with bluish-gray lime aleurite and subfossils, 9 cm; Bryales peat slightly muddy with subfossils, 9 cm; bluish-gray clay with plant remains in upper part, 177 cm; gray stratified clay. Sample depth, 160 to 169 cm. Pollen-analysis by R. Pirrus. Sample attributed to Pollen Zone IX (V. Post-Nilsson system). Coll. 1966 and subm. by R. Pirrus, Geol. Inst., Acad. Sci. of Estonian SSR.

TA-138. Loobu **14,725 ± 260**
12,775 B.C.

Bryales peat with lime aleurite and subfossils coll. at depth 170 to 178 cm. Sample is referred to Pollen Zone X (see TA-137). *Comment*: greater sample age is probably due to incorporation of carbonates from ancient limestone dissolved in water.

Vaskrääma series

Submerged organogenous deposits 0.5 km W of Vaskrääma RR Sta., on beach of Pärnu Bay, SW Estonia. Stratigraphy of sec.: humified sand 0 to 25 cm; limonitic sand 25 to 55 cm, sand containing gravel 130 to 177 cm; clay. Upper part of organogenous layer submerged by Littorina deposits is composed of lagoon sapropels; lower part is made up of woody peat. In upper art of organogenous layer brackish water diatoms are found (*Campylodiscus clypeus* Ehr.). Pollen analysis by H. Kessel, Geol. Inst., Acad. Sci. of Estonian SSR. Coll. 1966 by J. M. Punning, subm. by H. Kajak, State Production Geol. Comm. of Estonian SSR, later referred to as Geol. Comm.

TA-139. Vaskrääma **6870 ± 110**
4920 B.C.

Depth of sample, 135 to 140 cm. Sample attributed to Pollen Zone VI (V. Post-Nilsson system).

6975 ± 110
TA-140. Vaskrääma **5025 B.C.**

Sample at depth 145 to 150 cm is referred to Pollen Zone VI (V. Post-Nilsson system). From this level downward brackish-water diatoms are found in sapropels.

7580 ± 170
TA-141. Vaskrääma **5630 B.C.**

Sample at depth 165 to 170 cm is attributed to Pollen Zone VII (V. Post-Nilsson system).

20,900 ± 390
TA-154. Kostenki XII **18,950 B.C.**

Bones of horse (*Equus caballus* L.) from Paleolithic settlement in Kostenki Dist. on right bank of Don R., S of town Voronezh. Sample depth, 2.0 to 2.5 m. Probable age: Late Paleolithic (Ilves *et al.*, 1968). Coll. 1964 by A. N. Rogalyeva, subm. by I. V. Kuzmina.

1060 ± 60
TA-156. Arashu **A.D. 890**

Wood remains from settlement on Lake Arashu, Cesis Dist., Latvian SSR, 7 km S of town Cesis. Depth, 75 cm. Coll. 1966 and subm. by J. F. Apals, Hist. Inst. Acad. Sci. of Latvian SSR.

7375 ± 170
TA-157. Vigala **5425 B.C.**

Brown reed peat from deposits of Littorina transgression near Vigala RR Sta., Rapla Dist., Estonian SSR. Thickness of organogenous layer, 35 cm. Underlying layer: clayey aleurite with plant remains: overlying layer: fine-grained-to-aleurite sand with plant remains. Sample depth, 165 to 175 cm. Coll. 1966 and subm. by H. Stumbur, Geol. Comm.

910 ± 200
TA-159. Rannapungerja **A.D. 1040**

Wood remains (oak) from bank of Rannapungerja R., Mustvee Dist., Estonian SSR. Depth, 300 cm. Sample underlies alluvial sands. Pollen analysis by R. Pirrus indicates Pollen Zone I b (V. Post-Nilsson system). Coll. 1966 and subm. by E. Rähni, Geol. Inst.

670 ± 50
TA-160. Smorgoni **A.D. 1280**

Well-preserved fragment of oak from quarry near Smorgoni Hydromechanized Gravel Plant, 130 km NW of Minsk, Byelorussian SSR, floodland of Viliya R. Many bones of mammals, (musk ox, bison, deer, etc.) were found in these quarries. Depth of oak trunks, 400 to 600 cm. Coll. 1966 and subm. by L. N. Voznyachuk.

1045 ± 60
TA-161. Smorgoni **A.D. 905**

Fumed oak from quarry near Smorgoni Hydromechanized Gravel Plant (see TA-160).

TA-162. Abava **9870 ± 200**
7920 B.C.

Wood remains from 1st riparian terrace of Abava R. near Sabile, Jelgava Dist., Latvian SSR. Stratigraphy of deposits from surface fine-grained, light-gray sand, 130 cm. Well-decomposed sedge and Bryales peat with wood remains 130 to 100 cm; fine-grained gray sand 160 to 180 cm; slightly decomposed Carex-Bryales peat with wood remains 180 to 275 cm; bluish-gray sandy loam with interlayers of moss 275 to 315 cm. Sample taken from upper peat layer and pollen-analyzed by V. Stelle. Putative age: Pre-Boreal or Boreal. Coll. 1966 and subm. by V. Stelle, Geol. Inst. of Latvian SSR.

TA-163. Abava **10,410 ± 90**
8460 B.C.

Wood remains from lower peat layer of riparian terrace of Abava R. (see TA-162). Probable age: Late Dryas. Coll. 1966 and subm. by V. Stelle.

TA-175. Sindi **9300 ± 75**
7350 B.C.

Humified peat from quarry wall near RR bridge at Sindi on right bank of Pärnu R., Pärnu Dist., Estonian SSR. Depth, 230 to 233 cm. Pollen analysis by H. Kessel, Geol. Inst., attributes sample to Pollen Zone IX (V. Post-Nilsson system). Coll. 1967 and subm. by H. Kajak.

TA-176. Sindi **9575 ± 115**
7625 B.C.

Wood remains from layer of humified clayey sand taken from quarry wall near RR bridge at Sindi (see TA-175). Depth, 315 to 325 cm. Layer contains deer bones and remains of fish skeletons. Sample is referred to Pollen Zone IX (V. Post-Nilsson system). Coll. 1967 and subm. by H. Kajak.

TA-177. Raunis **13,250 ± 160**
11,300 B.C.

Remains of Sphagnum and green mosses from exposure near Cesis-Veselava Rd., 100 m below road bridge on right bank of Raunis R., Latvian SSR. Stratigraphy of exposure: soil 0 to 30 cm; sandy stratum with lenses of loam, 30 to 200 cm; dark brown moraine with prevailing loamy substance; rubbly fraction with carbonaceous rocks predominating, 200 to 230 cm; stratified organic remains, 230 to 285 cm; moraine. Strata where sample was taken at depth 260 to 275 cm is composed of aleurite with well-preserved remains of Sphagnum and green mosses. Dating of these plant remains at Vernadski Inst. of Geochem. and Analytic Chem. yielded age 13,390 ± 500 yr. (Mo-296, Vinogradov, *et al.*, 1963.) Coll. 1967 and subm. by J. M. Punning, Geol. Comm.

865 ± 50
TA-180A. Sinialliku **A.D. 1085**

Charcoal from ancient stronghold at Sinialliku 0.5 km SE of Sinialliku RR Sta., Viljandi Dist., Estonian SSR. Sample at depth 130 cm from soil containing charcoal. Probable age: end of 12th or beginning of 13th century. Coll. 1967 and subm. by J. Selirand, Hist. Inst., Acad. Sci. of Estonian SSR.

860 ± 50
TA-180B. Sinialliku **A.D. 1090**

Same sample as TA-180A, but counting material was synthesized by using vanadium-oxide as catalyst.

7085 ± 80
TA--181. Kärla **5135 B.C.**

Reed peat underlying Littorina deposits at locality Kärla, Is. Saaremaa, Estonian SSR. Thickness of organogenous layer, 36 cm. Depth (with reference to organogenous layer), 0 to 3 cm. Pollen analysis by H. Kessel attributes sample to Pollen Zone VII (V. Post-Nilsson system). Coll. 1967 by J. M. Punning, subm. by G. Elterman, Geol. Comm.

7820 ± 80
TA-182. Kärla **5870 B.C.**

Wood peat at locality Kärla (See TA-181). Depth, with reference to organogenous layer, 30 to 33 cm. Pollen analysis indicates Pollen Zone VII (V. Post-Nilsson system). Coll. 1967 by J. M. Punning, subm. by G. Elterman.

5950 ± 60
TA-183. Seliste **4000 B.C.**

Well-decomposed muddy peat underlying Littorina deposits, Pärnu Dist., Estonian SSR. Depth of organogenous deposits, 265 to 317 cm. Sample at depth 3 to 8 cm (with reference to organogenous layer). Coll. 1967 and subm. by H. Kajak.

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UNIVERSITY OF TEXAS AT AUSTIN RADIOCARBON DATES VI

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This laboratory is now a part of the Bureau of Economic Geology, The University of Texas at Austin. The present list reports C^{14} measurements made in dating projects completed in the year ending November, 1967, and some measurements for projects still in progress. Age calculations are based on C^{14} half-life of 5568 yr and a modern standard of 95% of NBS oxalic acid. The deviations reported are based on the counting statistics of the sample, background, and modern, and are $\pm 1\sigma$ except that when the sample count approaches either the modern or the background, 2σ limits are reported. The laboratory continues to use liquid scintillation counting of benzene, using Li_2C_2 and vanadium activated catalyst in preparation, as described in Texas IV and earlier lists. Chemical yields now average 85%.

Rightmire's caliche dating (done for an M.A. thesis in the Dept. of Geol.) is the principal project reported in this list; in addition to the research he prepared the samples in our laboratory and wrote the statements which accompany the list. Valastro is in charge of all technical operations in the laboratory, and he and Davis share the administrative responsibilities. Davis, who handles sample screening (with the aid of an Advisory Committee) and archaeological appraisal, compiled the list.

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I. GEOLOGIC SAMPLES

A. Caliche deposits, West Texas

The accompanying list results from development of a method of age determination for freshwater inorganic carbonate deposits based on C^{14} and C^{13}/C^{12} composition. This statement abstracts full report of method in preparation by C. T. Rightmire and Earl Ingerson. Most caliche contains C^{12} and C^{13} derived from limestone and soil air CO_2. C^{14} is incorporated in a given proportion to the C^{13} and C^{12} of the soil air CO_2, permitting age correction. After carbonate sources are analyzed for C^{13}/C^{12} ratio, δC^{13} values of caliche sample (δC^{13}_{sm}), limestone source (δC^{13}_{1s}) and soil air CO_2 (δC^{13}_{s}) can be inserted into the equation:

$$P = \frac{\delta C^{13}_{sm} - \delta C^{13}_{s}}{\delta C^{13}_{s} - \delta C^{13}_{1s}}$$

to give P, the desired correction factor in terms of C^{13} (Ingerson and Pearson, 1964). This factor can be applied to measured activity (A_m) to give corrected activity (A_c):

$$A_c = \frac{A_m}{P}$$

which can be used directly in the age equation:

$$t = 8033 \ln \frac{A_o}{A_m}$$

in which t = age in yrs, 8033 = mean life of C^{14} atom, A_m = background-corrected C^{14} activity of sample, and A_o = background-corrected activity of a standard assumed to be identical activity of the sample. The true age can then be calculated:

$$t = 8033 \ln \frac{A_o}{A_c}$$

Listed below are results for 48 samples from 16 caliche profiles in the Finlay area, Hudspeth County, far W Texas (31° 10′ to 31° 17′ N Lat, 105° 38′ to 105° 45′ W Long). C^{13}/C^{12} ratio and C^{14} activity were determined for each sample, and C^{13}/C^{12} ratios were determined for 5 soil air samples. Samples which might be contaminated by recent organic material or limestone were omitted. Samples used for C^{13}/C^{12} analyses were split from those prepared for C^{14} work. It is assumed that soil air CO_2 is in exchange equilibrium with the atmospheric carbon reservoir, and that concentration of CO_2 in soil air of an arid or semi-arid sandy soil is 5 times that of atmospheric CO_2. If these assumptions are valid, corrected ages are valid. In any case, corrected ages more closely approximate true age of "young" inorganic carbonate than any ages of same material determined by the C^{14} method thus far.

In the list, each profile is signified by letters and a number (e.g., CGA-4). Coll. and subm. 1966 by C. T. Rightmire, Dept. of Geol., Univ. of Texas at Austin.

Sample No.	Field No.	Depth (In.)	δC^{13}	Uncorrected Age	Corrected Age
Tx-387	CGA-4-A	6-8	−3.66	20,800 ± 500	6,470 ± 500
Tx-386	CGA-4-B	20-25	−4.37	28,070 ± 1160	15,700 ± 1160
Tx-406	CGA-4-C	33-36	−5.14	34,280 ± 2450	23,580 ± 2450
Tx-372	CGA-5-A	10-15	−4.79	25,130 ± 1270	13,740 ± 1260
Tx-373	CGA-5-B	28-31	−4.94	26,350 ± 960	15,250 ± 960
Tx-378	CGA-5-C	45-50	−5.28	31,820 ± 1850	21,400 ± 1860

Sample No.	Field No.	Depth (In.)	δC^{13}	Uncorrected Age	Corrected Age
Tx-374	CGA-6-A	4-8	−3.88	22,810 ± 620	9,200 ± 620
Tx-375	CTA-6-B	18-22	−4.85	23,450 ± 660	12,190 ± 660
Tx-379	CGA-6-C	45-50	−4.93	29,750 ± 1390	18,650 ± 1390
Tx-376	CGA-7-A	10-14	−5.66	18,330 ± 380	8,580 ± 380
Tx-377	CGA-7-B	32-36	−4.01	22,950 ± 630	9,710 ± 630
Tx-381	CGA-7-C	51-56	−3.98	23,710 ± 860	10,370 ± 860
Tx-380	CGA-8-A	0-1	−3.75	21,040 ± 510	7,040 ± 510
Tx-403	CGA-8-B	9-12	−4.05	21,750 ± 750	8,610 ± 760
Tx-404	CGA-8-C	33-40	−4.33	24,050 ± 710	11,590 ± 710
Tx-405	BA-3-A	5-9	−4.45	24,430 ± 760	12,280 ± 1210
Tx-431	BA-3-B	14-18	−4.72	27,180 ± 1040	15,610 ± 1040
Tx-407	BA-3-C	34-40	−4.72	34,210 ± 2490	22,650 ± 2500
Tx-408	BA-7-A	5-9	−4.81	16,650 ± 290	5,290 ± 290
Tx-409	BA-7-B	17-23	−4.22	25,480 ± 840	12,750 ± 840
Tx-410	BA-7-C	36-42	−4.14	32,060 ± 3900	19,130 ± 1900
Tx-430	AC-2-B	20-23	−3.84	31,780 ± 1840	18,050 ± 1840
Tx-432	AC-2-C	27-31	−3.96	36,030 ± 3210	22,050 ± 1240
Tx-433	AC-2-D	50-54	−4.10	>37,000	>37,000
Tx-434	AC-5-A	4-6	−3.84	23,220 ± 680	9,480 ± 680
Tx-435	AC-5-C	21-25	−3.72	25,450 ± 770	10,560 ± 770
Tx-436	AC-5-D	43-47	−4.40	26,570 ± 980	14,310 ± 990
Tx-411	R80S-8-A-2	26-30	−3.73	22,250 ± 900	8,210 ± 900
Tx-412	R80S-8-B	44-48	−3.66	26,080 ± 910	11,840 ± 910
Tx-413	R80S-8-D	70-74	−3.48	29,950 ± 1470	15,100 ± 1470
Tx-414	R80S-9-A	7-11	−4.38	22,560 ± 1220	10,230 ± 1220
Tx-415	R80S-9-B	20-24	−4.08	27,670 ± 1100	14,580 ± 1100
Tx-417	R80S-9-C	32-36	−4.29	35,300 ± 2890	22,760 ± 2810
Tx-421	TT-5-A-1	0-1	−3.11	20,730 ± 500	4,650 ± 490
Tx-422	TT-5-B	10-13	−4.96	24,100 ± 890	13,070 ± 850
Tx-423	TT-5-C	23-27	−3.65	29,940 ± 1470	15,670 ± 1460
Tx-424	TT-6-A-2	14-17	−3.43	27,170 ± 1080	12,180 ± 1120
Tx-425	TT-6-B	24-27	−3.68	28,820 ± 1270	14,620 ± 1270
Tx-426	TT-6-C	34-38	−4.02	30,790 ± 1580	17,550 ± 1580
Tx-427	TT-7-A-1	8-12	−3.21	17,390 ± 340	1,700 ± 330
Tx-428	TT-7-C	39-41	−3.94	30,630 ± 1550	17,240 ± 1550
Tx-429	TT-7-D	51-55	−4.49	32,710 ± 2420	20,650 ± 2420
Tx-418	CP3-II-B	13-16	−3.98	20,770 ± 490	7,420 ± 490
Tx-419	CP3-II-C	21-24	−3.84	27,180 ± 860	13,460 ± 860
Tx-420	CP3-II-E	38-41	−4.43	34,820 ± 2670	22,700 ± 2610
Tx-437	CP3-III-A-2	18-22	−3.64	27,640 ± 1100	13,320 ± 1100
Tx-438	CP3-III-B	33-37	−3.93	31,300 ± 1770	17,820 ± 1770
Tx-439	CP3-III-C	57-61	−4.21	32,270 ± 3600	19,540 ± 2780

General Comment (C.T.R.): Caliche was formed as pedologic process from CO_2 in rainwater and soil air. Carbon isotope composition of deposits varies with type of vegetation which, in turn, varies with climate; therefore, this type of analysis may eventually lead to determination of climate at time of secondary carbonate deposition.

Corrected C^{14} ages show that major carbonate accumulation occurred 10,000 to 15,000 yr ago, but sample at base of AC-2 profile is "dead," indicating that caliche has been forming on these surfaces for >37,000 yr. Thickening and deepening of sections toward present course of Rio Grande (ca. 7 mi distant) indicates that drainage over at least total time studied was toward that river, except in minor topographic depressions.

Decrease of δC^{13} with depth through 9 of the 16 profiles may indicate lessening of influence of plants on carbon composition with time. Studies of this type may enable correlation of terrace surfaces between closed basins. Additional C^{13}/C^{12} studies on soil air and rainwater are needed, as well as studies of CO_2 concentration in soil air in different climates.

B. Carbonate Samples, W Texas and N Mexico

Samples coll. 1965-67 and subm. by C. C. Reeves, Jr., Dept. Geosci., Texas Tech. College, Lubbock, Texas. Comments by C. C. R., Jr.

34,460 ± 2540
Tx-463. Oscar Roberts Spring, Mound Lake 32,510 B.C.

Carbonate from N edge of playa, Mound Lake, Lynn and Terry Counties, Texas (33° 13′ N Lat, 102° 05′ W Long). Believed nearly contemporary; dated to see whether carbonate is currently being deposited. *Comment*: coring in summer 1967 shows Oscar Roberts dolomite wedge definitely predates Tahoka Clay; thus date not too surprising, but probably a few thousand yr too old. Surface configuration of dolomite illustrates either solution and redeposition or erosion.

Mound Depression series, II

Organic mud from core in playa of Mound Lake (see above, Tx-463). Core taken off drilling pad on road leading to large central island. Dates on earlier series from this core are Tx-270 through Tx-273 (Texas IV).

31,720 ± 2930
Tx-327. ML 14 29,770 B.C.

Depth 14 ft.

Tx-328. ML 18-18 1/2 >36,000

Combined samples, 18 and 18½ ft deep. *Comment*: dates indicate that lacustrine sec. beneath modern fill predates Tahoka Clay sec.

Guthrie Depression series

Limestone samples from 3 carbonate zones in pit dug in volcanic ash in Guthrie Depression, 7 mi N of Tahoka and 300 yd W of U.S. Hwy 87, Lynn County, Texas (33° 04′ N Lat, 101° 48′ W Long). Ash id. as Pearlette, but previous dates on these samples by Humble (see below) indicate much younger age than Pearlette; present dates serve as additional checks.

Tx-346. GLL-2 **24,740 ± 1000**
22,790 B.C.

From deepest carbonate zone. Humble date on this sample (O-2261, Reeves, pers. commun.) is 31,750 ± 2500 B.P.

Tx-347. GLM-2 **>37,000**

From middle carbonate zone, 5.5 ft below present surface. Humble date on this sample (O-2052, Reeves, pers. commun.) is 34,400 ± 3450.

Tx-348. GLU-2 **34,160 ± 2470**
32,210 B.C.

From uppermost carbonate zone. Humble date (O-2260, Reeves, pers. commun.) is 30,625 ± 220 B.P.
General Comment: discrepancies between dates from Austin and Humble labs indicate contamination, undoubtedly by dead carbon. Even so, dates collectively show that ash is not Pearlette and thus not of Kansan age.

Brownfield Lake series

Inorganic carbonate samples from Ozark-Mahoney Lake #1, W side of road, Brownfield Lake basin, 15 mi SE of Brownfield, Terry County, Texas (33° 07′ N Lat, 102° 07′ W Long).

Tx-382. Brownfield Lake B-1 **29,370 ± 1400**
27,420 B.C.

At N end of Lake, beneath Tahoka Clay sec.

Tx-383. Brownfield Lake B-2 **15,900 ± 280**
13,950 B.C.

At N end of Lake; probably represents Vigo Park Interval.

Tx-384. Brownfield Lake B-3 **21,290 ± 500**
19,340 B.C.

From E side of Lake, beneath Tahoka Clay sec.

Tx-385. Brownfield Lake, F-1 **12,360 ± 380**
10,410 B.C.

At N end of Lake, from lower part of Zone 2, 6 ft below present surface, in Tahoka Clay sec.
General Comment: Tx-382 correlates with other dates on dolomites deposited during Rich Lake interpluvial. Tx-383 represents Vigo Park dolomite; somewhat young age results from greater size of Brownfield Lake. Tx-385 is from base of lacustrine sand, probably deposited during Blackwater Subpluvial.

Shafter Lake series

Inorganic carbonate from N side of Shafter Lake basin, just S of Highway, 8 mi NW of Andrews, Andrews County, Texas (32° 22′ N Lat, 102° 43′ W Long). Dated to determine relation of Shafter Lake dolomites to those found in more northern pluvial lake basins.

Tx-349. Shafter Lake SLU **13,890 ± 230**
11,940 B.C.

Tx-350. Shafter Lake SLL **15,240 ± 340**
13,290 B.C.

General Comment: stratigraphic position and couplet of carbonates suggest Vigo Park age, but both dates are somewhat too young. Contamination is suspected.

Tx-355. Silver Lake S 3-4 **12,170 ± 190**
10,220 B.C.

Inorganic carbonate from depth 3 to 4 ft, N edge of Silver Lake playa, 16 mi NE of Morton, Cochran, and Hockley Counties, Texas (33° 46′ N Lat, 102° 39′ W Long). Dated to determine possible age of carbonate wedge in Silver Lake. *Comment*: date indicates playa formed on ancient rather than Recent lacustrine debris. High water table has minimized deflation compared to other basins.

Tx-464. Lake Palomas, Chihuahua **27,150 ± 1060**
25,200 B.C.

Carbonate from base of La Mota abandoned shoreline, Lake Palomas basin, NW Chihuahua, Mexico, ca. 120 km SW of Juarez (31° 35′ N Lat, 107° 15′ W Long). Dated to determine age of shoreline and lacustrine sediments. *Comment*: surprisingly young date for high-level La Mota shoreline (elev. ca. 4000 ft). Probably correlates with early Bonneville-Sehoo shoreline formations of Nevada and Utah.

C. Oregon

Tx-487. Muir Creek, Oregon **6940 ± 120**
4990 B.C.

Charcoal found enclosed in pumice lapillistone believed to derive from major eruption of Mt. Mazama (Williams, 1942). From road cut on NW side Oregon Hwy 230, 200 m SW of Muir Creek bridge (43° 02′ N Lat, 122° 22′ W Long). Found at least 5 m below existing soil profile. Exposed thickness of lapillistone is ca. 8.5 m; overlain by 1 to 6 m of stratified and sorted pumiceous volcanic sandstone, on which is ca. 1 m of soil. This is same locality as sample C-247 (6453 ± 250; Libby, 1955, p. 118) which was also run as M-21 (6500 ± 500; Michigan I). Date from another locality relating to Mazama eruption is W-858 (6640 ± 250, USGS V). Present sample also dated by Gakushuin (GaK-1124, 7010 ± 120; L. Johnson, pers. commun.). Coll. 1965 by L. S. Cressman and L. R. Kittleman; subm. by Kittleman and L. Johnson, Jr., Univ. of Oregon, Eugene. *Comment* (L.J., Jr.): date is almost identical to GaK-1124 for same charcoal sample and agrees within 1σ with M-21. Tx-487 and GaK-1124 provide most reliable dates, so far, for major eruption of Mt. Mazama.

II. ARCHAEOLOGIC SAMPLES: CADDOAN AREA

The following samples are 1st of large series being run from Caddoan archaeologic area in adjacent parts of Texas, Oklahoma, Arkansas, and Louisiana. Caddoan assemblages represent horticultural, village-dwelling peoples and are classed either as Gibson aspect, usually earlier, or Fulton aspect which extends into historic (post—A.D. 1600) period.

A. Oklahoma

Except as noted, samples coll. by D. G. Wyckoff, Oklahoma R. Basin Survey, and subm. by R. E. Bell, Dept. Anthropol., Univ. of Okla., Norman. Comments by Wyckoff.

Fine site series

Charcoal samples from Fine site (Sq-13), 4 mi S and 1.5 mi E of Vian, Sequoyah County, Oklahoma (35° 26′ N Lat, 94° 57′ W Long). Site has both late Gibson aspect and early Fulton aspect components. Coll. 1967.

500 ± 70
Tx-519. Fine site, House 1 A.D. 1450

From charred post in Trench I, House pattern 1, Sq. 0-N1, at depth 15 inches. Small rectangular structure, early Fulton aspect. *Comment*: date compatible with early Fulton aspect assignment.

840 ± 60
Tx-485. Fine site, Trench C A.D. 1110

Charred posts of incomplete structure in Trench C, S ½ of Sq. 0-W1. Late Gibson aspect. *Comment*: date seems early for late Gibson.

560 ± 90
Tx-479. Beaver site, House 3 A.D. 1390

Charcoal from Post 39, House 3, Beaver site (Mc-1), directly N of old Hochatown Bridge over Mountain Fork R., McCurtain County, SE Oklahoma (34° 12′ N Lat, 94° 41′ W. Long). Oval house pattern, believed assoc. with early Fulton aspect component. Coll. 1965. *Comment*: date compatible with early Fulton assignment. Agrees with Tx-488 from Bill Hughes site (below) which is similar archaeologically.

540 ± 60
Tx-488. Bill Hughes site, Feature 2 A.D. 1410

Charcoal from burned area (Feature 2) containing charred Fulton aspect pottery, Bill Hughes site (Mc-21), on ridge N of where Bee Creek enters flood plain of Mountain Fork R., McCurtain County, Oklahoma (34° 13′ 50″ N Lat, 94° 40′ 50″ W Long). From same feature, another sample was dated at 294 ± 170 (SM-887; R. E. Bell, pers. commun.) which is thought to be too recent. Coll. 1964. *Comment*: date agrees with early Fulton assignment better than SM-887. Agrees with Tx-479 from Beaver site (above), which is similar archaeologically.

390 ± 60
Tx-486. Harvey site, Feature 5 **A.D. 1560**

Charcoal from Feature 5 at Harvey site (Sq-18), 4 mi W and 5 mi S of Sallisaw, Oklahoma (35° 22′ 45″ N Lat, 94° 52′ 10″ W Long). Feature 5 is bell-shaped pit with artifacts of Ft. Coffee focus, late Fulton aspect. Coll. 1967. *Comment*: date agrees well with late Fulton assignment. Although it agrees within 1σ with Tx-519 from Fine site (this date list), it suggests, as does archaeologic evidence, that Harvey is more recent than Fine.

790 ± 200
Tx-489. Sheffield, Feature 4 **A.D. 1160**

Charcoal, separated by flotation from fill dirt inside Feature 4, Sheffield site (Sq-22), 3 mi S and 2 mi W of Vian, Sequoyah County, Oklahoma (35° 27′ N Lat, 95° 00′ W Long). Feature 4 was circular house, early Ft. Coffee focus, early Fulton aspect. Should be earlier than Tx-486 (above). Large error quoted is due to small size of sample. Coll. 1966 *Comment*: even with large error, date seems too early. Archaeologic evidence suggests only slightly earlier time than Harvey site (Tx-486, above).

610 ± 70
Tx-490. Baldwin site, Feature 1 **A.D. 1340**

Charcoal from Feature 1, Baldwin site (Mc-84), S side Long Creek ¾ m SE of Ringgold, McCurtain County, Oklahoma, in Pine Creek Reservoir area (34° 12′ 45″ N Lat, 95° 06′ 00″ W Long). Feature 1 is trash pit with primarily shell-tempered pottery, believed part of Fulton aspect component. Coll. 1965 by Stephen Israel. *Comment*: date compatible with Fulton assignment.

770 ± 70
Tx-493. Cat Smith, House 2 **A.D. 1180**

Charred pole from W wall, House 2, Cat Smith site (Ms-52), 3 mi NW of Gore, Muskogee County, Oklahoma (35° 34′ N Lat, 95° 10′ W Long). House is affiliated with early Fulton aspect of Arkansas R. valley. Coll. 1966 by T. P. Barr. *Comment*: date seems early, but both Gibson and Fulton ceramics were found in what is believed to be single component. Perhaps date refers to growth period of wood rather than to occupation of site.

B. Louisiana

Belcher site series

Charcoal samples from remains of burned structures at Belcher site, ½ m E of Belcher, Caddo Parish, NW Louisiana (32° 44′ N Lat, 93° 48′ W Long). Site, described in detail by Webb (1959), covers 4 periods: Belcher I (earliest), late Gibson aspect, Alto-Haley materials; Belcher II, related to Bossier focus; Belcher III, fully-developed Belcher focus; Belcher IV, late Belcher focus. Present samples dated to check earlier dating, as shown; further dating is planned. Coll. 1936-37 (except as noted) and subm. by C. H. Webb, 1560 Line Ave., Shreveport, La. 71101. Comments by C. H. W.

320 ± 70
Tx-476. Belcher, House 1 **A.D. 1630**

From House 1, Belcher IV component, latest prehistoric; no evidence of European contact. *Comment*: date quite feasible, since this is final occupation and some sherds approach Natchitoches (historic) materials in types and appearance.

320 ± 70
Tx-477. Belcher, House 2 **A.D. 1630**

From House 2, Belcher II component. See also Tx-473, below. *Comment*: House 2 underlies House 1 (Tx-476, above) and there are distinct pottery differences, hence date should be earlier. Cult material, Spiro-like, in burials originating from this level should be in 15th or 16th centuries.

280 ± 70
Tx-473. Belcher, House 7 **A.D. 1670**

From House 7, on primary mound level overlying House 8 (Tx-474, below). Early Belcher III; should be close to same age as House 2 (Tx-477, above). From same house came samples Tx-142, 555 ± 80 (Texas III), and O-322, 200 ± 100 (Webb, 1959, p. 207) which is too recent. Coll. 1953-4. *Comment*: date tending later than Tx-476 (above) for House 1, is inconsistent with stratigraphy. Culturally should be, like House 2, in 15th or 16th century.

640 ± 50
Tx-472. Belcher, House 4 **A.D. 1310**

From House 4, sub-mound, Belcher I period; earliest house stratigraphically and stylistically. From same house came sample O-320, 1100 ± 100 (Webb, 1959, p. 207) which was thought to be 200-300 yr too early. Present sample should be same age as Tx-474 (below). *Comment*: consistent with other dates reported here in that it should be earliest. May represent true age but 100-200 yr earlier would seem more consistent with archaeologic evidence.

360 ± 70
Tx-474. Belcher, House 8 **A.D. 1590**

From House 8, pre-mound, late Belcher I period; should be approx. same age as, or slightly later than, Tx-472 (above). Coll. 1953-4. *Comment*: consistent in that house should date later than House 4 (Tx-472) and earlier than House 7 (Tx-473), which it underlies. Should be nearer House 4 date.

2190 ± 120
Tx-480. McKinney mound, A **240 B.C.**

From Ralph McKinney mound, 2 mi NW of Hosston, Caddo Parish, Louisiana, on Black Bayou Lake (32° 53′ N Lat, 93° 54′ W Long).

Sample is charcoal scattered in fill of deeper levels of single-unit, unstratified mound, 2 to 5 ft below plowed surface. Nearby in mound and believed to be contemporaneous were cremations assignable to Bellevue focus (Fulton and Webb, 1953); should equate in time with Marksville. Part of present sample was dated by Humble at 800 ± 105 (0-1134, Webb, pers. commun.); archaeologic evidence indicates Humble date is too recent. Coll. 1958-9 by R. McKinney; subm. by C. H .Webb. *Comment*: date may approximate actual age, but is earlier than anticipated. Bellevue focus seems to be on Marksville time level, but since McKinney mound had copper and stone beads, not found at other Bellevue sites, it may be somewhat earlier than other Bellevue.

C. Texas

Resch site series

Fragments of charred nuts from fill of Resch site (41 HS 16), on Potter's Creek 12 mi S of Marshall, Harrison County, Texas (32° 24′ N Lat, 94° 15′ W Long). Unstratified site excavated in 5 ft squares and 0.5 ft levels; thus, Level 4 is 1.5 to 2 ft below surface. Levels 1 and 2, almost sterile; Levels 3 and 4, some arrow points, Gibson aspect and Coles Creek sherds, mostly dart points and heavy bone and clay-tempered sherds; Level 5, bone-, clay-, and sand-tempered sherds, a few Caddoan and several Marksville sherds, mostly dart points, hence seems mixed; Level 6, like Level 5 but rare Caddoan and Coles Creek, more frequent Marksville and Techefuncte, many fire stones, heaviest occupation; Levels 7 and 8, mostly sand-tempered sherds, grooved axes, dart points, rare Tchefuncte or Marksville sherds. Each sample made up of materials from several squares, in most cases adjacent squares close to origin of grid. Coll. 1965-6 by Forrest Murphey; subm. by C. H. Webb. Comments by Webb.

2250 ± 140
Tx-482. Resch, Levels 3 and 4 **300 B.C.**

Comment: date earlier than expected.

2360 ± 130
Tx-484. Resch, Level 5 **407 B.C.**

Comment: earlier than anticipated from this level, which should not date before Marksville times.

2150 ± 100
Tx-481. Resch, Level 6 **200 B.C.**

Comment: date consistent with occurrence of Tchefuncte sherds on this level, but by stratigraphy should be earlier than Tx-482 and Tx-484.

1850 ± 90
Tx-483. Resch, Levels 7 and 8 **A.D. 100**

Comment: too recent in view of dates from higher levels and indications of pre-Tchefuncte or Tchefuncte time range.

General Comment: dates are generally satisfactory in that major occupation is on Tchefuncte and Marksville time level, judging from trade sherds. Vagaries in distribution of sherds and of charred nut hulls from which dates were obtained are explainable by aboriginal churning of light sand midden and subsequent heavy gopher disturbance.

Coral Snake series

Charcoal from in and beneath primary fill of Coral Snake mound (16 SA 48), 2 mi E of Pendleton Crossing of Sabine R., Sabine Parish, Louisiana, in Toledo Bend Reservoir basin (31° 38′ N Lat, 93° 42′ W Long). Artifacts in primary fill included Marksville, Marksville-like, and Tchefuncte materials; later secondary fill had Caddoan sherds. Previous date, presumed to be from primary fill, is Tx-265, 1650 ± 90 (Texas IV). Coll. and subm. by H. P. Jensen, Jr., S Methodist Univ., Dallas, Texas.

1970 ± 100
Tx-442. Coral Snake 28 **20 B.C.**

At base of primary mound, assoc. with Marksville Stamped sherd and trapezoidal copper pendant; N496.7/E500.5, elev. 95.75 ft.

1770 ± 80
Tx-443. Coral Snake 36 **A.D. 180**

Within primary mound fill; no direct assoc. N494/E505, elev. 98 ft.

3210 ± 210
Tx-444. Coral Snake 112 **1260 B.C.**

From Feature 45, fire basin; N498/E487, elev. 94.3 to 93.5 ft, 2 ft W of westernmost extension of sub-floor pit at mound base, ca. 1 ft below original ground surface. Believed to be placed in prepared area before construction started.

General Comment (H.P.J., Jr.): Tx-442 agrees well with accepted dates for Marksville. However, Tx-443 is midway between Tx-442 and Tx-265 and agrees with both within 1σ. We thus remain uncertain as to date of primary mound construction. Since Tx-265, -442, -443 are in proper sequence with respect to relative elevation, perhaps mound was built over several centuries. Tx-444 is far too early for assoc. with mound construction; probably dates previous Archaic occupation.

III. OTHER ARCHAEOLOGIC SAMPLES

A. Texas

Ingleside Cove series, Gulf Coast

Charcoal and scallop shells (*Aequipecten irradians*) from Ingleside Cove site (41 SP 43), shell midden on NE shore of Ingleside Cove, Corpus Christi Bay 2.3 mi SSW of Ingleside, Texas (27° 50′ N Lat, 97° 13′ W Long). Midden buried in upper 2.0 to 2.5 ft of bluff; lower zone (Zone 2b) has preceramic, Late Archaic remains; upper zones (2c, 2d) have Rockport focus materials. Samples dated are from Late Archaic occupation. Each sample was split into 2 parts which were prepared and counted separately; dates are averages. Coll. 1967 and subm. by Dee Ann Story, Dept. of Anthropol., Univ. of Texas at Austin.

780 ± 40
Tx-520. Ingleside Cove 118 **A.D. 1170**

Charcoal from Feature 4, small hearth, Sq. N100/W120, 2.0 to 2.5 ft below surface; lower Zone 2b.

820 ± 50
Tx-521. Ingleside Cove 162 **A.D. 1130**

Shell from near Feature 4 (Tx-520, above); should be approx. same age. Sq. N100/W120, 2.0 to 2.5 ft deep; lower Zone 2b.

710 ± 40
Tx-522. Ingleside Cove 171 **A.D. 1240**

Shell, upper Zone 2b; N122.5/W123, 1.6 to 1.9 ft below surface. Should be approx. same age as Tx-523 (below).

820 ± 50
Tx-523. Ingleside Cove 178 **A.D. 1130**

Shells from edge of Feature 7, hearth at contact between Zones 2b and 2c. N98.5/128, 0.9 ft below surface. Should be approx. same age as Tx-522 (above).

General Comments (D.A.S.): no previous C^{14} ages from central Texas coast are available for comparison, but present dates are internally consistent and may well accurately reflect lateness of Archaic occupation in this area as well as rapid rate of midden accumulation. (S.V., Jr.): shell agrees with charcoal, but since only 1 charcoal sample is involved, more work is needed before validity of shell dates in this environment is certain.

Greenhaw series, Edwards Plateau

Samples of carbon-stained earth from Midden F at Greenhaw site (41 HY 29), at junction of Cottonwood and Little Bear Creeks 7.5 mi W of Buda, Hayes County, Texas (30° 07′ N Lat, 97° 57′ W Long). This is burned rock midden site. Midden F contained dart points of types Pedernales, Bulverde, and some others; typologically Middle Archaic. Samples coll. to study techniques of obtaining dates from carbon-bearing earth. Coll. 1965, 1967 and subm. by Frank A. Weir, Dept. Anthropol., Univ. of Texas at Austin.

800 ± 110
Tx-360. Greenhaw c-1 **A.D. 1150**

From Sq. S160/W400, 0.5 to 1.0 ft level; directly assoc. with stem of Pedernales point. Sample prepared for submission to lab by bathing in 20% HC1, washing and centrifuging in distilled water; whole procedure carried out 3 times, then repeated with bath of HF.

Tx-451. Greenhaw 274 **2850 ± 90**
900 B.C.

From Sq. S151/W425, 3.0 to 3.5 ft level. Near Pedernales point and corner-notched point. Sample treated in lab as follows: minute charcoal particles recovered by repeated flotation in distilled H_2O and passage through 100 mesh U. S. Std. screen. Intrusive carbonates removed by HCl bath. HCl removed by repeated bathing in distilled H_2O, settling, decanting supernatant. Sample then dried and burned.

Tx-453. Greenhaw 272 **2650 ± 80**
700 B.C.

From Sq. S151/W420, 1.5 to 2.0 ft level. Pretreated as Tx-451. Should be younger than Tx-451, older than Tx-360.

Tx-465. Greenhaw 264 **2900 ± 100**
950 B.C.

From Sq. S160/W400, 1.25 to 1.50 ft level. Pretreated as Tx-451. Pedernales and Bulverde points were in this level.

General Comments (F.A.W.): by all current estimates of age of central Texas Middle Archaic, Tx-360 is at least 1500 yr too young. Probable explanation is downward movement of modern charcoal (from burning brush and stumps on midden), especially via soil cracks as much as 1 ft deep which form in dry seasons. Other 3 dates, from deeper in midden, are younger than expected for Middle Archaic and are possibly affected by humic acid saturation; however, expectations were based only on guesses. (S.V., Jr.): wide discrepancy between Tx-360 and other dates would not be due to different pretreatment or variable degree of humic acid contamination; therefore, contamination by modern charcoal is most likely explanation.

Dunlap Midden 1 series, Edwards Plateau

Charcoal samples from fill of Midden 1 at Dunlap site complex (41 CX 5), approx. 8 mi E of Pecos R. and 2.5 mi N of U. S. Hwy. 290, on Old Spanish Trail (30° 43′ N Lat, 101° 36′ W Long). Midden 1 was burned-rock midden containing slab-lined basins presumed to be pits for roasting sotol. Ensor dart points and arrow points were found in midden but not in direct assoc. with basins. Samples occurred as small fragments of charcoal in fill between and under slabs of basins. Coll. 1966 by C. A. Calhoun, E. M. Davis *et al.*, Texas Archeol. Soc.; subm. by Davis.

Tx-351. Dunlap A **670 ± 80**
A.D. 1280

From fill between 2 superimposed slab-lined basins, Feature 2.

Tx-310. Dunlap B **940 ± 120**
A.D. 1010

From among rocks in NW ¼ of Feature 1, large slab-lined basin.

Tx-357. Dunlap C **630 ± 90**
A.D. 1320

From among stones in another part of Feature 1 (see Tx-310, above); should be same age.

Tx-359. Dunlap D **570 ± 100**
A.D. 1380

From between lining slabs of 2 superimposed basins of Feature 2 (see Tx-351, above); should be same age.

Tx-358. Dunlap E **540 ± 80**
A.D. 1410

From dark stratum just above NE rim of Feature 1 (see Tx-310, -357, above).

General Comment (E.M.D.): no significant differences among dates except for Tx-310 which is early (although consistent within 2σ). Midden 1 apparently dates from ca. 14th century.

Devil's Mouth series, Amistad Reservoir

Charcoal samples from Devil's Mouth site (41 VV 188), stratified river terrace site at confluence of Devil's R. and Rio Grande, ca. 1 mi above Amistad Dam, Val Verde County, Texas (29° 27′ N Lat, 100° 03′ W Long). Initial excavation of site reported by Johnson (1964); present samples from more recent work. Coll. 1967 by W. M. Sorrow; subm. by J. R. Ambler, Texas Archeol. Salvage Project, Univ. of Texas at Austin.

Tx-525. Devil's Mouth 708, Zone O **4900 ± 100**
2950 B.C.

From Pit 10, Bench 1, Level 4, Zone O, Feature 3. In Zone O were several points called "Early Barbed" by Johnson (1964, p. 33); therefore, should be similar in age to Tx-314 (7430 ± 240, Texas V) for "Early Barbed" points at nearby Devil's Rock-shelter. *Comments* (W.M.S. and S.V., Jr.): much later than Tx-314. Sample, charcoal flecks in silt, so small that after picking over and pretreatment, whole sample (charcoal and silt) was burned. No evidence of redeposition or intrusion in field, and everything satisfactory in laboratory; thus, no field or lab explanation for lateness of date. Archaeologically, "Early Barbed" point category includes such wide range of forms that long time span could be represented; note Tx-313 (5360 ± 170, Texas V) for "Early Barbed" date closer to present date. Obviously, more dates needed.

Tx-526. Devil's Mouth 707-822, Zone P **8780 ± 310**
6830 B.C.

Combined sample from Zone P: #707 from backhoe profile, W side Unit 15; #822 from Unit 13, upper ½ ft of zone. Zone P is stratum of limestone gravels (above Johnson's "Upper Gravels") containing expanding-stem points like those called "Paleo-Indian" by Johnson (1964, Figs. 17, L, and 18, A). Possibly earliest occupation zone at site. *Comment* (W.M.S.): date compatible with possibility of late Paleo-Indian time.

B. Midden Sites, W Texas and New Mexico

The following are charcoal samples from midden circles and similar sites in W Texas and S New Mexico, coll. as part of continuing study of this type of site. Coll. 1965 and subm. by J. W. Greer, Dept. of Anthropol., Univ. of Texas at Austin, via E. M. Davis. Comments by J. W. G.

Tx-361. Cammack Sotol Pit, B **610 ± 80**
A.D. 1340

Charcoal from Cammack Sotol Pit (41 VV 260; Greer's site Tx-14), W bank of tributary of Cow Creek, 2 mi SE of Comstock, Val Verde County, Texas (29° 39′ N Lat, 101° 10′ W Long). Combined sample from all units of Trench III, 1 to 2 ft below surface. Should date early Neo-Indian occupation with predominantly expanding-stem and contracting-stem arrow points (Livermore and Perdiz types). Probably equivalent to Livermore focus. Another sample from this site previously dated at 625 ± 185 (Tx-227, Texas IV). *Comment*: agrees with previous date from site and is nearly identical with original estimate.

Tx-362. Hodge site **710 ± 80**
A.D. 1240

Charcoal from Hodge site (41 VV 247; Greer's site Tx-21), SE bank of small tributary of Big Fielder canyon, 12 mi W of Pecos R., ca. 16 mi WSW of Pandale, Val Verde County, Texas (30° 08′ N Lat, 101° 42′ W Long). From lower half of deposit in ashy soil of central depression; 1.5 to 2.5 ft below surface in Units 5, 6, 7. Assoc. artifacts indicate middle Late Archaic, late Montell-Marshall, or early Ensor-Frio. *Comments*: more recent than expected; much later than Tx-291 (2560 ± 100, Texas V) from Felton Cave, 50 mi NE of here, which probably represents approx. same cultural period. (E.M.D.): dates from Arenosa Shelter 30 mi SSE of here (Tx-284-286, 311, Texas V) indicate ca. 1850–2600 B.P. for Montell-to-Ensor time, so that Felton Cave date seems more nearly correct than Hodge site date.

Pow Wow site series

Samples from Pow Wow site (Greer's site Tx-2), just N of Pow Wow Arroyo, 27 mi E of El Paso, Texas (31° 51′ N Lat, 106° 02′ W Long); center of Midden 1 (Unit 4), from 0.3 ft below surface to underlying sterile caliche. Pottery seems to indicate early Jornada branch, Mogollon.

Tx-363. Pow Wow, A **960 ± 80**
A.D. 990

Tx-364. Pow Wow, B **1110 ± 60**
A.D. 840

General Comment: dates should be identical; average agrees with Lehmer's estimate of ca. A.D. 900 for beginning of Jornada branch (Lehmer, 1948).

Tx-365. Carlsbad A-07 **780 ± 90**
A.D. 1170

Charcoal from Site A-07 (Greer's NM-1) in Carlsbad Caverns Nat. Park, New Mexico; at head of Oak Springs Canyon and Bat Cave Draw (32° 11′ N Lat, 104° 27′ W Long). From Midden 2, central depression, Unit 4; combined sample from entire unit, from surface to bedrock. Pottery suggests possibly early Jornada branch, possibly late "Guadalupe Basket Maker." *Comment*: agrees with previous age estimates for pottery types found here (Lehmer, 1948).

Tx-366. Carlsbad A-23 **620 ± 80**
A.D. 1330

Charcoal from Site A-23 (Greer's NM-2) in Carlsbad Caverns Nat. Park, New Mexico, on ridge-top S of tributaries to Walnut Canyon and W of Bat Cave Draw (32° 10′ N Lat, 104° 28′ W Long). From central depression, Midden 2, Units 4 and 35, combined sample from surface to bedrock. Chupadero Black-on-White sherds were found in excavation; on surface of neighboring midden (site A-22) were sherds of Chupadero Black-on-White, El Paso Brown, and Lincoln Polychrome. Probably late Jornada branch, phase unknown. *Comment*: agrees with previous estimates for pottery types represented here (Lehmer, 1948).

Carlsbad A-59 series

Charcoal samples from middens at Site A-59 (Greer's NM-82) in Carlsbad Caverns Nat. Park, N side of mouth of Slaughter Canyon (32° 06′ N Lat, 104° 34′ W Long). Pottery indicates site probably relates to El Paso phase of Jornada branch, but might relate to Mesilla and Dona Ana phases.

Tx-367. Carlsbad A-59, A **790 ± 80**
A.D. 1160

From central depression of Midden 3; Excavation Unit 1, 1.9 to 2.9 ft below surface.

Tx-368. Carlsbad A-59, B **850 ± 100**
A.D. 1100

Same provenience as Tx-367 (above), 2.9 ft below surface to bedrock.

Tx-369. Carlsbad A-59, C **510 ± 80**
A.D. 1440

From central depression of Midden 5, Excavation Unit 2, 0.3 ft below surface to bedrock.

Tx-370. Carlsbad A-59, D **460 ± 90**
A.D. 1490

From central depression of Midden 5, Excavation Unit 1, 0.3′ below surface to bedrock.

General Comment: dates from Midden 3 are slightly earlier than expected, since it was assumed close in time to Midden 5. All dates agree with previous estimates of age of pottery types represented here (Lehmer, 1948).

C. Mexico

Tx-441. Huipilli precolombino **660 ± 80**
A.D. 1290

Fragment of woven cotton garment from Mexico, believed precolumbian. Purchased from native collector; original provenience unknown; possibly Chilapa, Guerrero (Johnson and Franco, 1967). Dated in hope of validating precolumbian age. Subm. by Donald Cordry, Austin, Texas. *Comment* (D.C.): date validates precolumbian age.

D. Sudan

Atbara River series

Charcoal from 2 late Neolithic sites near Atbara R., Sudan. Coll. 1967 and subm. by J. L. Shiner, S. Methodist Univ., Dallas, Texas.

Tx-445. Small Butana, A **4410 ± 90**
2460 B.C.

From Small Butana site (N-125), 65 m E of Atbara R. channel, 2.2 km N of Butana bridge, near Khashm el Girba (15° 06′ N Lat, 35° 58′ E Long). Top center of mound, 30 cm below surface. Previously unknown archaeological complex: chipped and flaked stone, animal bones, ceramics with incised designs, seemingly later than those of Tx-446; may be ancestral to Iron age Jebel Moya.

Tx-446. Sudan N-120, A **3050 ± 90**
1100 B.C.

From Site N-120, 10 mi E of Atbara R., 2500 ft S of RR from Khashm el Girba to Kassala (15° 04′ N Lat, 36° 01′ E Long). SE quarter of site, 1 to 1.3 m below surface. Hitherto unknown industry now named Hagiz; incised ceramics and microliths; thought to be late Neolithic. Should be earlier than Tx-445.

General Comment (J.L.S.): expected sequence reversed by unexpectedly early date for Tx-445. If this date approx. true age, it suggests even earlier Neolithic in this area, which would not be derived from Egypt.

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[RADIOCARBON, VOL. 10, No. 2, 1968, P. 402-416]

UCLA RADIOCARBON DATES VIII*

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The measurements reported were made during the 2nd half of 1967 in the Isotope Lab. of the Inst. of Geophysics and Planetary Physics as a continuation of the UCLA date lists I through VII. Samples were analyzed as CO_2-gas at close to one atm in a 7.5 L proportional counter with 3 energy channels described earlier. Radiocarbon ages were calculated for uniformity on the basis of a 5568 yr half-life as was recommended by the Sixth International C^{14} and H^3 Dating Conference, June 1965, in Pullman, Washington. The standard for the contemporary biosphere remains as 95% of the count rate of NBS oxalic acid for radiocarbon labs. Background determinations have been based on CO_2 obtained from marble. The error listed is always at least a 1σ statistical counting error. In critical cases C^{13}/C^{12} isotope ratio measurements were made to correct the dates for fractionation. All samples were subjected to accepted NaOH and/or HCl pretreatments depending on the individual case as a minimum to exclude contamination.

A recent summary on the development of radiocarbon dating is that by Libby, 1965.

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SAMPLE DESCRIPTIONS

A. United States

La Brea Tar Pit series

Bones from La Brea tar pits, Los Angeles, California (see UCLA V for details on locality and history). Part of extensive analysis of late Pleistocene fossil community now using bone of extinct species. Data with each bone represent pit, depth, and grid data on 3 foot square grid system (Howard, 1962).

Dense mid-shaft bone of femur of *Smilodon californicus* (sabre-tooth tiger) was used, except for UCLA-1292L which is tibia of same species.

Free amino acids were dated after liquid chromatography of collagen hydrolysate prepared according to procedures modified from Ho (1965)

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by T. Y. Ho. This procedure permits complete removal of petroleum contamination. NaOH treatment for possible humic acid contamination was included in a few samples as indicated. Complete procedure will be published elsewhere (Ho, Marcus, and Berger, 1968). Subm. 1967 by L. F. Marcus.

21,400 ± 560
UCLA-1292A. La Brea Tar Pits 19,450 B.C.

LACMVP RLB A-675, A-511. Pit 3, coordinates E-5, 22 ft. Left femur. (UCLA-1292J is another sample from same bone treated with NaOH.)

12,650 ± 160
UCLA-1292B. La Brea Tar Pits 10,700 B.C.

LACMVP RLB A-642. Pit 3, coordinates C-4, 7 ft. Left femur.

14,500 ± 190
UCLA-1292C. La Brea Tar Pits 12,550 B.C.

LACMVP RLB A-398, A-719. Pit 3, coordinates E-2, 12 ft. Left femur. At same level as tree data (LJ-55, LJ-89, LJ-21; La Jolla I) (Y-354, Y-355; Yale IV), note UCLA-1292A is below this level, UCLA-1292B above, UCLA-1292E at approx. same level.

28,000 ± 1400
UCLA-1292D. La Brea Tar Pits 26,050 B.C.

LACMVP RLB A-411. Pit 4, coordinates D-2, 15.5 ft. Left femur.

14,400 ± 2100
UCLA-1292E. La Brea Tar Pits 12,450 B.C.

LACMVP RLB A-835. Pit 3, coordinates C-4, 11.5 ft. Right femur.

14,950 ± 430
UCLA-1292F. La Brea Tar Pits 13,000 B.C.

LACMVP RLB A-797. Pit 13, coordinates E-11, 11 ft. Left femur.

26,700 ± 900
UCLA-1292G. La Brea Tar Pits 29,750 B.C.

LACMVP RLB A-846. Pit 4, coordinates D-2 and 4, 8 ft. Right femur.

23,700 ± 600
UCLA-1292H. La Brea Tar Pits 21,750 B.C.

LACMVP RLB A-4435. Pit. 60, coordinates C-10, 9 to 12 ft. Right femur.

15,300 ± 200
UCLA-1292I. La Brea Tar Pits 13,350 B.C.

LACMVP RLB A-4436. Pit 13, coordinates F-10, 14.5 ft. Right femur.

UCLA-1292J. La Brea Tar Pits **20,500 ± 900**
18,550 B.C.

LACMVP RLB A-675, A-511. Additional sample from same specimen as UCLA-1292A, treated with 1/10 N NaOH (Berger, Horney, and Libby, 1964).

UCLA-1292K. La Brea Tar Pits **19,300 ± 395**
17,350 B.C.

LACMVP RLB K-3407. Pit 3, coordinates E-4, 26 ft. Right femur. Treated with 1% NaOH.

UCLA-1292L. La Brea Tar Pits **15,200 ± 800**
13,250 B.C.

LACMVP RLB T-6101. Pit 4, coordinates C-2, 11.5 ft. This is suspected artifact; bone was carefully scraped from inside (included some cancellous bone). Sample treated with 1% NaOH.

General Comments (L.M.): the 5 specimen from Pit 3 indicate stratification in that deposit into 2 time periods. There is also preliminary indication that Pit 13 may be of same age as younger part of Pit 3. (R.B.): it had been thought that action of natural gas moving through levels of tar pits might exercize stirring action, greatly increasing difficulties of archaeologist and palaeontologist. Apparently, phenomenon was overestimated.

UCLA-1296. Abalone shell, Malibu, California **260 ± 80**
A.D. 1690

Haliotis cracheroidi from cemetery of village site near junction of Virgines and Malibu Canyons, Malibu, California (34° 5′ 45″ N Lat, 118° 45′ W Long). Pit S-10, W-22, 30-39′ below datum. Date corrected by −160 yr according to Berger, Taylor, and Libby (1966). Coll. and subm. by C. King, UCLA Archaeol. Survey.

B. Mexico

La Venta series

Continuation of series in UCLA VII concerning age of La Venta, Tabasco, site (18° 10′ N Lat, 94° 5′ W Long). Samples coll. July 1967 by R. F. Heizer, Univ. of California, Berkeley and P. Drucker, San Andreas Tuxtla, Mexico; subm. and commented on by R. F. Heizer and R. Berger.

UCLA-1330. La Venta **2300 ± 60**
350 B.C.

Charcoal from NW perimeter of Mound A-2. Stratigraphy not clear to which building phase of La Venta this belongs, but date indicates Phase IV.

UCLA-1331. La Venta **2660 ± 140**
710 B.C.

Charcoal stratigraphically below sample UCLA-1330 in same trench. Because no direct tie-in with phase-dated levels of 1955 excavation could be made, C^{14} age can be interpreted as belonging to Phase II or III.

UCLA-1332. La Venta **2550 ± 80**
600 B.C.

Charcoal from thin clay fill layer overlying Phase III old-rose floors inside and at W edge of Ceremonial Court area. Date agrees with recent revision of age of La Venta site (Berger, Graham, and Heizer, 1967).

UCLA-1288. Mexican idol **410 ± 80**
A.D. 1540
$\delta C^{13} = -24.29‰$

15-cm long carved wooden idol from Guerrero. No date known for respective style. Coll. and subm. 1967 by P. T. Fürst, Univ. of California, Los Angeles.

UCLA-1298. Tecualillo, Nayarit **700 ± 80**
A.D. 1250

Charcoal from site in Teacapan estuary (22° 27′ N Lat, 105° 39′ W Long). Test square A, 6 ft deep. Ceramic styles indicate late site for which confirmation was sought. Coll. by S. Scott, State Univ. of New York, Buffalo and subm. through C. W. Meighan, Univ. of California, Los Angeles.

C. South America

Northern Chile series

Undertaken under the Univ. of California/Univ. of Chile Cooperative Program to explore general archaeol. of N Chile which up till now is rather uncertain. Conclusions can only be drawn after more extensive investigation and dating. Samples coll. and subm. if not noted otherwise by D. L. True, Univ. of California, Davis, and C. W. Meighan.

UCLA-1293. **4690 ± 80**
2740 B.C.

Charcoal from small camp near Quebrada Tarapaca, Tarapaca (ca. 20° S Lat, 69° 30′ W Long). Assoc. with preceramic complex in Tr-12-1. Coll. Jan. 1967.

UCLA-1294A. **680 ± 80**
A.D. 1270

Matting from Site A-Z-8, Burial N 2/5, San Miguel de Azapa, (18° 34′ S Lat, 70° 12′ W Long). Dates San Miguel culture. Coll. 1965 by O. Espoueys.

UCLA-1294B. **280 ± 80**
A.D. 1670

Textile from same site as UCLA-1294A. Dates Burial M-10, San Miguel Tardio phase. Coll. Nov. 1965 by J. C. Montane.

UCLA-1294C. **580 ± 80**
A.D. 1370

Matting from same site as UCLA-1294A. Dates Burial M27 of San Miguel Tardio phase. Coll. Nov. 1967, J. Montane.

810 ± 80
UCLA-1294D. **A.D. 1040**

Textile from same site as UCLA-1294A. Dates Burial M4/2, San Miguel culture. Coll. by O. Espoueys.

610 ± 60
UCLA-1294E. **A.D. 1340**

Matting. Another date for same feature as UCLA-1294C.

D. Pacific

New Hebrides series

Continuation of archaeol. exploration of New Hebrides, UCLA IV. Samples coll. and subm. by R. Shutler, Jr., San Diego State College, San Diego, California.

645 ± 80
UCLA-1295A. Tanna **A.D. 1305**

Charcoal from heavy occupation level in cave, TaRs 1, Pit 16, depth 36 to 42 in. (19° 32′ 30″ S Lat, 169° 15′ 30″ E Long). Assoc. with stone and shell artifacts, and shell and bone debris from human habitation. Sample dates Conus cup bead type (*Conus miles*). This type of bead also found on Futuan and Efate Islands. Coll. 30 Mar. 1964.

1095 ± 80
UCLA-1295B. Tanna **A.D. 855**

Charcoal from same location as preceding sample but from Pit 14, depth 24 to 30 in., just above heavy occupation level. Sample dates stone disc bead type. Coll. 30 Mar. 1964.

455 ± 80
UCLA-1295C. Efate **A.D. 1495**

Charcoal from lowest level of rock shelter, EfRs 7, Tr. C, depth 26 to 32 in., on Efate (17° 45′ 0″ S Lat, 168° 17′ 30″ E Long). Assoc. with gorge fish hook and other debris.This hook type occurs also on Tanna, Futuan, and in Polynesia.

170 ± 80
UCLA-1295F. Futuna **A.D. 1780**

Charcoal from feature FuRs 12, Tr. 7, depth 18 to 24 in. (Level 5) on Futuna (19° 30′ 50″ S Lat, 170° 13′ 30″ E Long). Assoc. with shell and bone from human habitation. Might indicate introduction of taro into S New Hebrides as id. by pollen analysis.

790 ± 80
UCLA-1295G. Futuna **A.D. 1160**

Charcoal from Feature FuRs 12, Tr. 3, depth 18 to 24 in. near bottom of trench on Futuna (19° 30′ 30″ S Lat, 170° 13′ 30″ E Long). Assoc. with human burials, shell artifacts, and shell and bone debris from human occupation. Sample dates Conus cup bead type found also on Tanna (UCLA-1295A, above) and Efate.

Guam sherd series

Part of study to determine suitability of carbon-bearing potsherds for C^{14} dating by comparing sherds with assoc. charcoal samples (Taylor and Berger, 1968). Samples coll. by F. Reinman, Chicago Nat. Hist. Mus., 1965, to evaluate ceramic sequence on Guam (13° 30′ N Lat, 144° 40′ E Long). Samples obtained through courtesy of C. W. Meighan and subm. by R. E. Taylor and R. Berger.

UCLA-1232A. Guam **420 ± 100**
A.D. 1530

Charcoal from Pit 3, 6 to 12 in. depth.

UCLA-1232B. Guam **495 ± 80**
A.D. 1455

Sherds from same stratigraphic position as UCLA-1232A.

UCLA-1232C. Guam **965 ± 80**
A.D. 985

Charcoal from Pit 3, 24 to 30 in. depth.

UCLA-1232D. Guam **895 ± 120**
A.D. 1055

Sherds from same location as UCLA-1232C.

UCLA-1232G. Guam **320 ± 80**
A.D. 1630

Charcoal from Pit 4, 6 to 12 in. depth.

UCLA-1232H. Guam **275 ± 80**
A.D. 1675

Sherds from same stratigraphic unit as UCLA-1232G.

UCLA-1232I. Guam **805 ± 80**
A.D. 1145

Charcoal from Pit 4, 18 to 24 in. depth.

UCLA-1232J. Guam **670 ± 100**
A.D. 1280

Sherds from same location as UCLA-1232I.

General Comment (R.B.): Reasonable agreement between sample pairs is indicated suggesting that C^{14} dating of suitable ceramics is feasible. C. W. Meighan thinks dates based on ceramics may be preferable to charcoal twin as chances of stratigraphically disturbing many sherds are less than for compact charcoal sample. Additional Guam samples are GaK-1356-1371 (ms. in preparation).

E. Europe

European medieval architecture series

Continuation of investigation in UCLA III-VII into potential and limitations of radiocarbon dating in Middle Ages. For maximum precision δC^{13} measurements are included, also sample location in timber as well as comparison with secular variations of C^{14} concentration in dendrochronologically dated wood (Suess, 1965). Samples coll. 1967, subm. and commented on by W. Horn, Univ. of California, Berkeley and R. Berger unless noted otherwise.

580 ± 80

UCLA-1301. Canteloup $\delta C^{13} = -26.88‰$

Oak sapwood from waney edge of Post V (carpenter's mark) S side of barn at Canteloup presently being dismantled and re-erected as church on grounds of Abbaye de Fontenelle, Saint Wandrille, Seine-Maritime, Ignace Dalle, Abbot. The building type of aisled and bay-divided medieval timber hall was and still is equally suitable as house, barn, festal hall or church as discussed in Horn and Born (1965). Coll. 19 July 1967.

650 ± 60

UCLA-1302. Canteloup $\delta C^{13} = -24.16‰$

Oak heartwood sample from same post used in UCLA-1301. Wood located ca. 30 yr from center of tree which was felled at age of ca. 100 yr. *Comment* (R.B.): when all correction factors are taken into account, Canteloup was erected most probably at very end of 13th or beginning of 14th century and will provide genuine medieval church at its new location (49° 32′ N Lat, 0° 45′ E Long).

380 ± 80

UCLA-1303. Richelieu $\delta C^{13} = -24.54‰$

Oak bark from lowest longitudinal rail marked VII between Posts VI and VII on S side of central aisle of market hall in Richelieu built by cardinal as model village *in toto* between A.D. 1631 and ca. 1640 near Tours (47° 1′ N Lat, 0° 20′ E Long). Growth-increment of bark correction 30 yr. Coll. 30 July 1967. *Comment* (R.B.): calculated most probable historical age of erection: ca. A.D. 1630.

930 ± 60

UCLA-1306. Sully $\delta C^{13} = -23.04‰$

Chestnut wood (*Castania vesca*) from curved long ashlar piece rising from floor to rafters in upper hall of castle of Sully-s-Loire (47° 46′ N Lat, 2° 22′ E Long). Castle built in A.D. 1363 according to L. Martin (1962). *Comment*: corrected date permits probable historical age from A.D. 1050 to 1220. Exact original position of timber in tree uncertain due to construction placement.

515 ± 60

UCLA-1307. Arpajon $\delta C^{13} = -23.83‰$

Oak heartwood from market hall in Arpajon (48° 35′ N Lat, 2° 15′ E Long) built according to local tradition in A.D. 1450-1470 by Louis Mallet de Graville. Tree-ring correction 40 yr. Coll. 10 July 1967. *Comment*: probable historical date ca. A.D. 1450.

400 ± 60

UCLA-1308. Troussures $\delta C^{13} = -24.42‰$

Chestnut sapwood from post replacing the original stone arcade pillar in 13th-century abbey barn of Troussures. Post bears date A.D. 1609 by carpenter. Coll. 17 July 1967. *Comment*: probable historical date ca. A.D. 1600 or 1450.

860 ± 80

UCLA-1309. Maubuisson $\delta C^{13} = -22.58‰$

Waney edge of Truss 9, S brace with carpenter mark 9 of barn of Abbey of Maubuisson founded A.D. 1236. *Comment*: probable historical age ca. A.D. 1050-1220 due to plateau in curve of secular variations in C^{14} content of wood.

330 ± 60

UCLA-1310. Questembert $\delta C^{13} = -26.02‰$

Bark from post of Truss IV (center aisle post), S side of building of market hall at Questembert (47° 40′ N Lat, 2° 36′ W Long). Barn built A.D. 1675 as marked on tie-beam. Bark growth increment correction −40 yr. *Comment*: probable historical age ca. A.D. 1660.

420 ± 60

UCLA-1312. Milly $\delta C^{13} = -22.80‰$

Oak wood peg from original post of market hall sawed and trimmed into bench at St. Blais des Simples, burial chapel of Jean Cocteau (48° 24′ N Lat, 2° 28′ E Long). Market hall built A.D. 1479 by Louis Mallet de Graville. *Comment*: probable historical age ca. A.D. 1450.

555 ± 60

UCLA-1313. Parcey-Meslay $\delta C^{13} = -24.23‰$

Oakwood from waney edge of Post 4 counted from W, S side of barn of Parcey-Meslay, near Tours (47° 28′ N Lat, O° 21′ W Long). Barn built in time of Abbot Hugue de Rochecourbon (A.D. 1211-1227). Coll. 31 July 1967. *Comment*: previous measurement UCLA-570 (UCLA IV) at A.D. 1215 is corroborated by this date which after modification yields time span of ca. A.D. 1400-1250.

670 ± 60

UCLA-1314. Lenham $\delta C^{13} = -24.30‰$

Charred oak sapwood from arcade plate in W part of minor barn at Lenham, Kent (51° 13′ N Lat, O° 38′ W Long). A 13th-century document mentions destruction of church and subsidiary buildings by fire in A.D. 1298. Tree-ring correction −15 yr. Coll. 19 August 1967. *Comment*: probable historical date based on C^{14} measurement after correction yields A.D. 1250.

560 ± 60

UCLA-1315. Ter Doest $\delta C^{13} = -24.19‰$

Oakwood from waney edge from transverse brace reaching from suspended wall-piece to aisle-tie northernmost freestanding truss. Barn of Abbey of Ter Doest near Bruges (51° 16′ N Lat, 3° 12′ E Long).

Coll. 19 Aug. 1967. *Comment*: adjusted radiocarbon date yields probable historical span of erection from A.D. 1270-1400. Re-examination of previous dates UCLA-568A and B (UCLA IV) and UCLA-1036 and 1038 (UCLA VI) together with present date allow for time span of construction from late 13th through 14th centuries. Stylistically, barn is late 13th century when compared with elements of historically dated church a few mi. away.

630 ± 60

UCLA-1316. Church Enstone $\delta C^{13} = -24.61‰$

Bark of oak from foot of N cruckblade of Truss 5, upper face, E edge, 12 in. above pad. Church dated by inscription A.D. 1382. Coll. 23 Aug. 1967. Growth increment correction 40 yr. *Comment*: probable historical date range: 14th century.

120 ± 80

UCLA-1317. Beaumont-in-Gatinais $\delta C^{13} = -23.85‰$

Oak bark from Post h' SW edge, directly under tie-beam of Beaumont Hall (48° 8′ N Lat, 2° 29′ E Long). *Comment*: probable historical age of post as old as mid-17th century.

490 ± 60

UCLA-1318. Egreville $\delta C^{13} = -22.52‰$

Oak wood from central shake in Post c′ under bracing strut, W face of market hall in Egreville (48° 10′ N Lat, 2° 52′ E Long). Coll. July 1967. Tree-ring allowance 30 to 50 yr. *Comment*: probable historical date first half of 15th century.

890 ± 60

UCLA-1338. St. Pierre-sur-Dives $\delta C^{13} = -23.03‰$

Oak heartwood from central shake under aisle tie-beam of Post 1, NE corner of market hall (49° 1′ N Lat, 2′ W Long). One of apparently 4 old posts, rest all post-1945 replacements. Coll. 24 July 1967. *Comment*: probable historical age: 12th to mid-13th centuries.

550 ± 60

UCLA-1340. Frindsbury

Oak sapwood from 2. post of W row counting from N, NW edge of barn at Frindsbury near Rochester (51° 24′ N Lat, 30′ E Long). Coll. 21 Aug. 1967. *Comment*: probable historical age: end of 13th through all of 14th centuries.

450 ± 60

UCLA-1341. Brook $\delta C^{13} = -24.34‰$

Oakwood from waney edge from shoring beam, N aisle, easternmost truss, upper side, W edge of Court Lodge Barn at Brook near Wye (51° 11′ N Lat, 56′ E Long). Coll. 20 Aug. 1967. *Comment*: probable historical age: ca. A.D. 1450.

570 ± 60

UCLA-1342. Leigh Court $\delta C^{13} = -25.25‰$

Oak sapwood from upper fare of N blade of Truss 2, 3′6″ above springing of blade of Leigh Court Barn near Worcester (52° 11′ N Lat, 2° 13′ W Long). *Comment*: probable historical age: end of 13th through 14th centuries. Leigh Court appears to be most beautiful extant cruck barn discovered by F. W. D. Charles and is of great importance in history of cruck construction.

390 ± 60

UCLA-1257. Harwell Church $\delta C^{13} = -26.37‰$

Oakwood from N transept tie-beam of Harwell Church (51° 37′ N Lat, 1° 18′ W Long). Some 60 tree-rings removed and older than UCLA-1250 (UCLA VII). Implications of this measurement and earlier ones with respect to secular variations in C^{14} content of wood are discussed in Fletcher, 1968. Coll. 1962 and subm. by J. M. Fletcher, Harwell, England.

Ukrainian Bronze age series

First radiocarbon dates on aspects of Ukrainian Bronze age in greater framework of Indo-European migrations. Samples obtained 1966 through Inst. of Archaeol., Soviet Acad. of Sci., Moscow by M. Gimbutas, Univ. of California, Los Angeles.

4210 ± 80

UCLA-1270. Tsatsa **2260 B.C.**

Wood from Barrow 6, Grave 3 at Tsatsa (48° 13′ N Lat, 44° 40′ E Long). Early Yamna culture. Coll. 1962 by V. P. Shilov.

4150 ± 80

UCLA-1271. Ust'man **2200 B.C.**

Wood from Barrow 1, Grave 13 at Ust'man. Early Yamna culture. Coll. 1962 by V. P. Shilov.

3390 ± 80

UCLA-1272. Argadinskaja **1440 B.C.**

Wood from Barrow 9, Grave 4 at Argadinskaja. Timber Grave culture. Coll. 1959 by V. P. Shilov.

3860 ± 80

UCLA-1273. Kudinov **1910 B.C.**

Wood from Barrow 2, Grave 6 at Kudinov. Catacomb Grave culture. Coll. 1961 by A. P. Mantsevich.

3525 ± 80

UCLA-1274. Kudinov **1575 B.C.**

Wood from Barrow 1, Grave 7 at Kudinov. Timber Grave culture. Coll. 1961 by A. N. Melent'ev. *Comments* (M.G.): dates fall in expected time ranges and confirm expectations. (R.B.): when tree-ring calibrated C^{14} dating is applied, age increases by 3 to 600 yr for some samples.

F. Africa

UCLA-1247E. Lothagam, Turkana, Kenya **7560 ± 1000**
5610 B.C.

Shells from basal level of fishing camp on 210 ft beach of Lake Rudolph (4° N Lat, 36° E Long) assoc. with burials showing robust physical type and mesolithic industry with bone harpoons and leister points plus micro- and macrolithic stone technology. Coll. 1966 by L. Robbins and subm. by J. D. Clark, Univ. of California, Berkeley. *Comment* (RB): date is uncorrected and may not represent best obtainable age until more data are forthcoming on radiocarbon content of Lake Rudolph. Margin of error has been increased to reflect uncertainty.

Fingira Rockshelter series

Located SW end of Nyika Plateau, Malawi (10° S Lat, 33° E Long) between 7 to 8000 ft. Occupied in Later Stone age times by short, robust group, of which 2 burials and other scattered human bones have been found. Material culture includes microlithic tools in quartz, interesting bone industry, shell beads, pendants, much ocher. Found also was much food waste. Schematic paintings occur on rock-shelter wall. Deposit was shallow, 33 in. where tested. Practically no evidence of Iron age occupation. Coll. Aug. 1966 by Beatrice Sandelowsky and K. R. Robinson; subm. by J. D. Clark.

UCLA-1258. Fingira **3260 ± 80**
1310 B.C.

Charcoal from Trench E, 15 to 18 in. deep.

UCLA-1259. Fingira **3430 ± 80**
1480 B.C.

Charcoal from Test Pit E, 27 to 33 in. deep. *Comment* (J.D.C.). data indicates the Nyika was settled by hunters and gatherers earlier than expected. Archaeological assemblage very different from contemporary assemblage found in Malawi Rift.

UCLA-1289. Mwavarambo **885 ± 80**
A.D. 1065

Charcoal from Test Pit B 2, 16 to 18 in. deep, Mwavarambo site already dated as UCLA-1242 (UCLA VII) at 655 ± 80. Date confirms contemporaneity of Mwavarambo Ware at this site with two other early Iron age wares in Karonga district. Coll. July 1966 by K. R. Robinson; subm. by J. D. Clark.

UCLA-1299. Vintukutu **1100 ± 80**
A.D. 850

Charcoal with sherds at Vintukutu Iron age Site 54 8 to 10 in. below surface. This is earlier Iron age site 40 mi. S of those excavated in Karonga district (9° 54′ S Lat, 33° 55′ E Long) (UCLA VII) showing affinites with Mwamasapa pottery and derivative wares. Coll. 1966 by K. R. Robinson; subm. by J. D. Clark.

General Comment (R.B.): preceding African dates and those in UCLA VII are discussed in detail in individual papers in Proceedings of VI. Congrès Panafricain de Prehistoire et de L'Etude du Quaternaire, Dakar, Senegal, December 1968.

G. C^{14} in Atmospheric Carbon Dioxide

Atmospheric Radiocarbon Activity series, California

This series is continuation of data published in UCLA IV-VI. C^{14} content in ground level atmospheric CO_2 is monitored monthly at China Lake, California (35° 37′ N Lat, 117° 41′ W Long). Samples are coll. with cooperation of Gilbert Plain, Assoc. Head, Research Dept., Naval Ordnance Test Station, China Lake, California.

The following list contains exposure times of NaOH solutions to air and percent increase of C^{14} above reference level of 1890 or 0.95 NBS oxalic acid. Data are graphed in Fig 1. The statistical error is less than one-half percent.

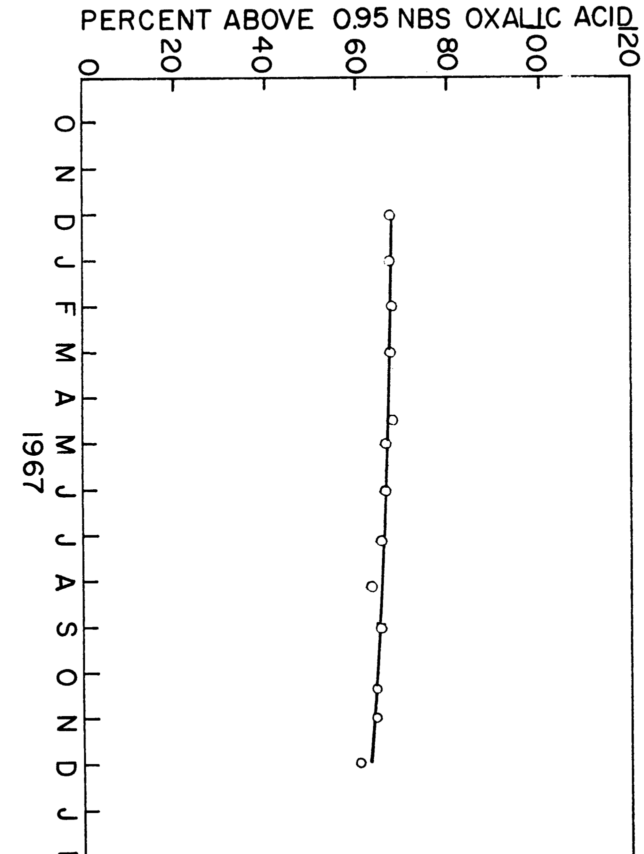

Fig. 1.

Sample no.	Exposure time	C^{14}, %
UCLA-1154	26 Nov.—3 Dec. 1966	+66.9
UCLA-1155	28 Dec.—4 Jan. 1967	+66.8
UCLA-1132	28 Jan.—5 Feb. 1967	+67.5
UCLA-1168	25 Feb.—4 Mar. 1967	+67.3
UCLA-1174	10 Apr.—17 Apr. 1967	+66.9
UCLA-1175	29 Apr.—5 May 1967	+65.9
UCLA-1179	27 May—3 June 1967	+65.8
UCLA-1182	2 July—9 July 1967	+65.1
UCLA-1183	7 Aug.—13 Aug. 1967	+62.8
UCLA-1184	1 Sept.—8 Sept. 1967	+64.9
UCLA-1185	10 Oct.—17 Oct. 1967	+64.1
UCLA-1187	28 Oct.—4 Nov. 1967	+64.0
UCLA-1188	26 Nov.—3 Dec. 1967	+60.5

Atmospheric Radiocarbon Activity series, Brazil

C^{14} content in ground level atmospheric CO_2 was also monitored for several months at Escola de Engenharia, Sao Carlos, Brazil (22° S Lat, 47° 52′ W Long). Samples were coll. with cooperation of M. Tolentino, Dept. of Chem. and Geol. through J. H. Reynolds, Univ. of California, Berkeley and U. G. Cordani, Univ. of Sao Paulo.

Sample no.	Exposure time	Brazil C^{14}, %	Calif. C^{14}, %
UCLA-1156	27 July—1 Aug. 1966	+64.8	+66.6
UCLA-1157	24 Aug.—31 Aug. 1966	+64.1	+72.3
UCLA-1158	24 Sept.—1 Oct. 1966	+65.4	+70.4
UCLA-1159	24 Oct.—31 Oct. 1966	+79.0	+67.2
UCLA-1180	23 Nov.—30 Nov. 1966	+62.5	+66.9
UCLA-1181	27 Dec.—30 Dec. 1966	+63.2	+66.8

For convenience, California data from UCLA VI for similar time periods have been added. Comparison shows almost complete gross equilibration of atmospheres of both hemispheres.

H. Geochemical Determination

UCLA-1186. Methane **>40,000**

Gas sample from location near 4843 Longridge, Van Nuys, California. Question if natural gas or sewage gas leak which kills deep-rooting trees in area. Subm. by F. J. Folmer and J. R. Mazelli, S California Gas Co., 1967. *Comment* (R.B.): natural gas origin is indicated, but it is still undecided if imported natural gas or seepage from geologic oil or gas bearing formations below Van Nuys.

UCLA-1228. Mt. Vesuvius, Italy **30,700 ± 1100** **28,750 B.C.**

Presumably dates eruptive phase of Vesuvius. Carbonized wood enclosed in tuff considered from geomorphological evidence to be of Würm age. Subm. 1967 by E. Franco, Inst. di Mineralogia, Univ. of Naples.

I. Vegetation and Climate

Neotoma Midden series

Part of dating program begun with UCLA III-VI to use macrofossil plan rests of packrat middens to infer environmental conditions at time of deposition. Coll. 1966 and subm. by P. W. Wells, Univ. of Kansas, Lawrence and R. Berger.

1860 ± 80
UCLA-1098A. Laramie Basin, Wyoming A.D. 90

Midden from 7500 ft, Site 1, No. 25. Contains *Pinus ponderosa* and *Juniperus scopulorum* in abundance in the midden whereas no living *Pinus* at site today and only 2 *Juniperus* barely surviving. Indicates time of more favorable growth conditions for woodland as well as higher rainfall for area.

4060 ± 80
UCLA-1098B. Laramie Basin, Wyoming 2110 B.C.

Midden from Site 2, No. 26. Contains *Pinus ponderosa* and *Juniperus scopulorum.*

2320 ± 80
UCLA-1098D. Laramie Basin, Wyoming 370 B.C.

Midden from 7500 ft, Site 4, No. 28. Contains *Juniperus scopulorum.*

1735 ± 80
UCLA-1098E. Laramie Basin, Wyoming A.D. 215

Wood from beneath sand dune (*Juniperus scopulorum*). No. 29. Corroborates midden dates.

16,400 ± 250
UCLA-1099. Pintwater Cave, Nevada 14,450 B.C.

Midden from Pintwater Cave, S Nevada, elev. 1280 m. containing xerophytic semidesert assemblage. Pintwater dates are discussed in Wells and Berger (1967) and provide evidence for pluvial expansion of the pinyon-juniper zone at the close of the Wisconsin glacial to 600 m below present lower limit of woodland. Coll. 18 Dec. 1966.

17,750 ± 200
UCLA-1218. North Muddy Mountains, Nevada 15,800 B.C.

Midden from 530 m. in N Muddy Mts., 50 km NE of Gipsum Cave. Discussed in same publ. Coll. 17 Dec. 1966.

12,900 ± 180
UCLA-1219. North Muddy Mountains, Nevada 10,950 B.C.

Midden from 550 m. in same general location as UCLA-1218. Coll. Dec. 1966 and discussed as above.

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UCLA VI	Berger and Libby, 1967
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[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 417-467]

RADIOCARBON DATES FROM SOVIET LABORATORIES, 1 January 1962—1 January 1966

Commission for the Study of the Quaternary Period,
Academy of Sciences, USSR

(Translated by Edith M. Shimkin, University of Illinois)*

General Comments: D. B. Shimkin and E. M. Shimkin, University of Illinois.

In 1966, the Commission for the Study of the Quaternary Period published an analysis of current findings and problems in Pleistocene geology (Grichuk *et al.*, 1966), to which was appended an official list (p. 240-282) of all 323 Soviet radiocarbon dates determined between 1962-65. The determinations are presented by laboratory, namely, the Laboratory of the Geological Institute, Academy of Sciences, USSR (GIN), the Radiocarbon Laboratory of the V. G. Khlopin Radiological Institute, Leningrad (Le)**, the Laboratory for Quaternary Geochronology of the All-Union Institute for Geological Research, Leningrad (LG), the Radiocarbon Laboratory of the V. I. Vernadsky Institute of Geochemistry and Analytical Chemistry (Mo), the Geo-Biochemical Laboratory of the Institute of Zoology and Botany, Estonian SSR, Tartu (TA), and the Laboratory of Tbilisi State University (TB). In the report on the Vernadsky Institute (Mo), 57 dates previously reported in Radiocarbon, 1966, v. 8, p. 292-323, have been omitted, but revisions in 3 other dates of this laboratory are given. Similarly, 37 dates from the Estonian Institute of Zoology and Botany (TA) published in Radiocarbon, 1966, v. 8, p. 430-441, have been excluded, although revisions of 7 other dates from that institution are presented.

All Soviet reports to date use a half-life for C^{14}, of 5568 yr. The methods used by the Vernadsky Institute (Mo) and the Estonian Institute of Zoology and Botany (TA) have previously been published (Radiocarbon, *op. cit.*); in the current reports are partial statements on procedures used by the Geological Institute (GIN) (Cherdyntsev *et al.*, 1964), and the Laboratory of Quaternary Geochronology (LG) (Arslanov *et al.*, 1966). Data on procedures of the Khlopin Radiological Institute (Le) and the Tbilisi State University (TB) are not available.

The original copy has been edited for conciseness and clarity. The original haphazard order of the date lists has been changed to a geographical sequence running essentially west to east.

Sample locations were not provided in the original Russian text. With a few exceptions, the necessary information was found in the Atlas

* Partly aided by and in association with the Center for Russian Language and Area Studies, University of Illinois. Dr. and Mrs. Shimkin wish to express their appreciation to Dr. Henry Field for his aid in initiating this work. Russian text received from Inst. of Archaeol., Leningrad, following my request in 1964 to Mtislav Keldysh, Pres., Acad. of Sci., USSR (H.F.).

** Not to be confused with LE (ex-RUL), the Radiocarbon Laboratory of the Inst. of Archaeol., Acad. of Sci., USSR (Neustadt, 1965, p. 65). Some RUL-dates have been published in Radiocarbon, 1965, v. 7, p. 223-228.

SSSR, 1955, and maps of the Main Administration of Geodesy and Cartography of the Ministry of Geology, the Main Administration of Geodesy and Cartography, MVD, USSR, and the USSR maps of the U.S. Army Map Service. A map and key to the Kostenki Sites (GIN-86, 93, 89, 79, 78, 85, 77, 107, 88) appear in Tret'yakov and Mongayt (eds.), *Notes on the History of the USSR*, p. 23. Detailed citations to the above sources appear in the list of references below. In addition, coordinates were checked with those appearing in Radiocarbon, 1966, v. 8.

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[RADIOCARBON, VOL. 10, No. 2, 1968, P. 419-425]

GEOLOGICAL INSTITUTE RADIOCARBON DATES I*

V. V. CHERDYNTSEV, V. A. ALEKSEYEV, N. V. KIND,
V. S. FOROVA, and L. D. SULERZHITSKIY

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INTRODUCTION

We used the scintillation variant of the radiocarbon method. The scintillator is prepared on the basis of ethylbenzol [benzene],** synthesized from acetylene according to the method of Kuchkarev and Kondratenko (1955). For radiocarbon dating we used materials both rich in carbon: wood and charcoal, and [those] poorer: also peat, buried soils, and fossil bones. In the first instance, the initial material for synthesis was [char]coal, which was treated as follows:

$$C \rightarrow CaC_2 \rightarrow C_2H_2.$$

In the second instance, the samples, after removal of foreign carbonaceous materials, were burned in a stream of O_2, and the carbon was then transformed into carbon dioxide; later into acetylene:

$$CO_2 \rightarrow (NH_4)_2CO_3 \rightarrow SrCO_3 \rightarrow C_2H_2.$$

In both cases acetylene served for the synthesis of $C_6H_5C_2H_5$.

The material was first treated with hydrochloric acid to remove carbonate, which reached up to 60 percent in fossil bone. Carbonate carbon we do not investigate for radiocarbon, since earlier studies (Kind and Alekseyev, 1964, p. 70) established that it commonly represents "dead" carbon, ultimately deriving from the carbonates of old bedrock. All samples other than soils and peat were also treated with alkali to remove humic substances introduced into the sample by secondary processes. In addition, samples (especially peat and soils) were mechanically cleaned of foreign inclusions: contemporary roots, etc. Treatment with acid and alkali can reduce the carbon content of a sample by as much as 85%. The yield of carbon in the synthesis of ethylbenzol [benzene] was not too high (about 20%), and the synthesis was laborious. Thus ethylbenzol should not be regarded as the best basis for scintillators in radiocarbon measurements. However, in starting the laboratory, we fixed upon it in view of the relative simplicity of the method.

The purity of the ethylbenzol was controlled by measurements of specific gravity and indices of refraction, as well as by the scintillation effectiveness of the reagent prepared. To the extracted ethylbenzol we added n-terphenyl (4g/l.) and POPOP (0.1g/l.). The resulting solution served as the scintillator.

Measurements were conducted on an apparatus with two scintillation counters (with photomultiplier FEU – IS), working in coincidence.

* Submitted as part of Radiocarbon Dates from Soviet laboratories, 1 January 1962–1 January 1966. See p. 417, this issue. Published as: Radiocarbon dates of the Laboratory of the Geological Institute, Academy of Sciences, USSR: Geokhimiya (Geochemistry), 1964, no. 4, p. 315-317.

** Information in brackets interpolated by translator (E.M.S.) and commentator (D.B.S.).

The scintillator was poured into a fluorine-plastic chamber with a standard volume of 15 cm^3, geometrically enclosing the cathode of the photomultiplier. The apparatus uses standard units.

The counting system is surrounded by shielding of lead (20 cm), steel (3 cm), and mercury (2 cm). . . . The standard of accuracy of the apparatus ($n/\sqrt{n_0}$) varies from 5 to 6. Using a 3 σ criterion on 48-hour determination of sample and background, we find that our apparatus can measure ages up to 35,000 yr.

Odessa Oblast series, Ukrainian SSR

10,430 ± 170
GIN-4. Gradenitsa, Ukrainian SSR **[8480 B.C.]**

Buried soil from Gradenitsa village, Belayevka Raion, Odessa Oblast, Ukrainian SSR [46° 30′ N Lat, 30° 10′ E Long]. Exposure 37; Stratum 2. Upper buried soil. Subm. 1960 by A. I. Moskvitin, Geol. Inst., Acad. of Sci., USSR; according to him, soil belongs to Mologo-Sheksnya Interglacial [Paudorf Interstadial], corresponding in age to ca. 40,000 yr. *Comment* (D.B.S.): Cf. Grichuk *et al.*, 1966, p. 102; dates given are 25,000-35,000 yr.

9540 ± 740
GIN-5. Odessa Oblast, Ukrainian SSR **[7590 B.C.]**

Buried soil from Odessa Oblast. Cape "E". See GIN-4. Subm. 1960 by A. I. Moskvitin.

Molodova V site series, Ukrainian SSR

This multi-stratum Paleolithic campsite, on Dnestr R. [approx. 48° 25′ N Lat, 26° 30′ E Long] was excavated 1951-1963 by A. P. Chernysh (1959). Regional geologic conditions were studied by I. K. Ivanova (1959). Samples GIN-6-10 coll. 1961 by N. V. Kind. (Cf. also GIN-54, 56, 147, 52, 105, 106, Geol. Inst. II) (D.B.S.). Alternate spelling: Molodovo (E.M.S.). [Ref.: Alekseyev *et al.*, 1964.]

250 ± 160
GIN-6. Molodova V site **[A.D. 1700]**

Contemporary chernozem-type soil.

10,590 ± 230
GIN-7. Molodova V site **[8640 B.C.]**

Fossil bones from cultural Stratum la, depth 1.0 to 1.1 m. Grayish-yellow limy loam. Archaeologic date: early Mesolithic; geologic date: approx. Allerød to Upper [Younger] Dryas. Date corresponds to age of Mesolithic sites in W Europe. According to A. P. Vinogradov *et al.* (1963), age of Upper Dryas in Upper Volga region is 10,535 ± 330 yr.

11,900 ± 230
GIN-8. Molodova V site **[9950 B.C.]**

Fossil bones from cultural Stratum 2, depth 1.2 to 1.4 m. Light yellow loess-like loam. Archaeologic date: late Magdalenian, believed to be 11 to 13,000 yr old.

13,370 ± 540
GIN-9. Molodova V site **[9420 B.C.]**

Charcoal from campfire in cultural Stratum 3, depth 1.6 to 1.8 m. Grayish-yellow loam, presumably Lower [Earlier] Dryas. Archaeologic date: late Magdalenian. Absolute age of Lower Dryas in W Europe is 14 to 16,000 yr.

23,700 ± 320
GIN-10. Molodova V site **[21,750 B.C.]**

Buried soil from cultural Stratum 7, depth 3.1 to 3.25 m. Humus-enriched loam from campfire area with charcoal inclusions. Archaeologic age: late Solutrean. For charcoal from identical stratum, A. A. Vinogradov *et al.* (1962) obtained date 23,000 ± 800 yr (Mo-11, Vernadsky Inst. I-IV).

290 ± 80
GIN-3. Moscow area, Moscow Oblast **[A.D. 1660]**

Wood from beginning of our century from Moscow area [55° 45′ N Lat, 37° 37′ E Long]. Sample studied for clarifying Suess effect, . . . from 1860-1950, because of augmentation of "dead" [*i.e.*, fossil] carbon dioxide through burning of mineral fuel in industrial installations. [Spurious] age . . . is of right order of magnitude [for effect].

Nerl' River series, Vladimir Oblast

9750 ± 200
GIN-11. Nerl' River **[7800 B.C.]**

Top of peat, 1.2 m thick, with plant remains, in Kamennyy Ovrag [ravine], Yakimanka village, on Nerl' R., Vladimir Oblast [56° 22′ N Lat, 40° 22′ E Long]. Deposit occurs on left bank near thalweg, 1 km from mouth, at depth 6 to 8 m. Base of peat disturbed by frost. Peat presumably overlies till of Dnepr [Mindel] Glaciation. Results of paleobotanical study of fruits, seeds, and pollen and especially presence of *Brasenia Schreberi* and *Tilia platyphyllus*, assign peat to Mikulino Interglacial (Riss-Würm)(Metel'tseva and Sukachev, 1961). Coll. 1963 by S. M. Tseytlin, Geol. Inst., Acad. of Sci., USSR. (Cf. GIN-84, this list and Mo-362, Vernadsky Inst. IV, 1968).

>22,000
27,000 ± 2700
GIN-12. Nerl' River **[25,050 B.C.]**

Compact peat from middle of same layer. Coll. 1962 by N. V. Kind.

Sungir' series, Vladimir Oblast

13,300 ± 300
GIN-13. Sungir' Brook, Vladimir Oblast **[11,350 B.C.]**

Buried soil from high terrace, old hollow of channel on left bank, Sungir' brook, Moscow–Gor'kiy road on E outskirts of Vladimir [56° 10′ N Lat, 40° 35′ E Long]. Podsol type soil at depth 2.2 to 3.4 m, is strongly deformed by frost cracking (Bader and Gromov, 1963). Coll. 1963 by S. M. Tseytlin.

GIN-14. Sungir' site **14,600 ± 600 [12,650 B.C.]**

Bones from Paleolithic campsite of Sungir' near Vladimir. Coll. 1963 by S. M. Tseytlin. Campsite excavated by O. N. Bader (1959; Bader and Gromov, 1963), according to whom date is latest Aurignacian.

GIN-15. Sungir' site **16,200 ± 400 [14,250 B.C.]**

Buried steppe soil from upper part of right-side slope of valley of Sungir' brook. Coll. 1963 by S. M. Tseytlin. At campsite, soil is at depth 4.75 to 5.4 m (Bader and Gromov, 1963), and disturbed by solifluction. Above sampled horizon are bone remains and flint inventory of superimposed cultural stratum of campsite.

GIN-16. Ulovka River, Vladimir Oblast **>35,000**

Buried soil from depth 7 m in upper terrace of ancient channel. [Taken] 3 km from mouth of Ulovka R., branch of Nerl' R., at Ulovo village [approx. 56° 20′ N Lat, 40° 50′ E Long], Vladimir Oblast. Coll. 1963 by S. M. Tseytlin. Lower buried soil in cross section of left bank of stream is at depth 7 m from surface. Moraine, presumably of Dnepr [Mindel] Glaciation, lies 5 m below this soil (Bader and Gromov, 1963). Soil is oldest encountered in Quaternary deposits in Sungir' campsite region (GIN-11-15).

GIN-17. Sungir' flood plain **1580 ± 140 [A.D. 370]**

Wood from alluvium, lower horizon of cross section of high flood plain of Sungir' brook (height, 4 to 5 m), at Suromna village [approx. 56° 10′ N Lat, 40° 35′ E Long]. Coll. 1963 by S. M. Tseytlin.

GIN-18. Klyaz'ma River flood plain, Vladimir Oblast **4500 ± 210 [2550 B.C.]**

Wood from lower horizon of high flood plain of Klyaz'ma R. at Bogolyubova village below mouth of Sungir' brook [approx. 56° 10′ N Lat, 41° 00′ E Long], Vladimir Oblast. [Coll. name and date not given. (E.M.S.)]

Vyatka River series, Kirov Oblast

GIN-19. Vas'kino village **7400 ± 230 [5450 B.C.]**

Wood from Vas'kino village [probably near Karino village, see GIN-20. (D.B.S.)], Kirov Oblast. Peat in high terrace of Vyatka R. Sample taken from lower horizon of upper layer, separated from lower layer by sandy horizon. Geologic age is Holocene. Coll. 1962 by V. V. Cherdyntsev.

GIN-20. Karino village **8080 ± 250**
[6130 B.C.]

Spruce from Karino village, [probably Karintorf: 58° 35′ N Lat, 50° 15′ E Long (D.B.S.)], Kirov Oblast, from peat deposit of high terrace of Vyatka R. Conditions of deposition are same as for GIN-19. Coll. 1962 by V. V. Cherdyntsev. In other specimen from this stratum were detected following ratios of radioactive isotopes: $U^{234}/U^{238} = 1.55 \pm 0.03$; $Io/U = 0.10 + 0.01$ (units of activity), which by ionium accumulation method, dates wood at 8000 ± 1000 yr. For 6 samples of peat from same deposit, ionium method gives values of 5 to 16 millennia with a mean of 8900 ± 1700 yr.

GIN-1. Teysheb-baini, Armenian SSR **2600 ± 135**
[650 B.C.]

Charred wood. Karmir-blur hamlet near Erevan. Excavations of ancient Urartu city of Teysheb-baini [40° 11′ N Lat, 44° 35′ E Long], burned during assault by nomads at beginning of 6th century B.C. (Piotrovskiy, 1959). Coll. 1961 by V. V. Cherdyntsev. (Cf. GIN-32, this list and Mo-241, Vernadsky Inst. V, 1968. [D.B.S.]).

GIN-2. Lchashen, Armenian SSR **3150 ± 100**
[1200 B.C.]

Wood remains of ritual chariot from burial, presumably 13th century B.C., from Lchashen [approx. 40° 20′ N Lat, 45° 10′ E Long], Lake Sevan, Armenian SSR. Sample received 1961 by T. S. Khachaturyan, State Hist. Mus. of Armenian SSR [Erevan]).

Ust' Port series, Krasnoyarsk Krai, Siberia

GIN-21. Yenisey River flood plain **220 ± 140**
[A.D. 1730]

Large trunk from flood plain of Yenisey R. terrace, 7 m high, region of Ust'-Yenisey Port [correctly, Ust' Port: 69° 45′ N Lat, 84° 34′ E Long]. Flood plain composed of interlayered clays, loam, and alluvia with streaks of peat, with large tree boles along entire cross section. Samples GIN-21-24 coll. by N. V. Kind and S. L. Troitskiy, Inst. of Geol. and Geophysics, Siberian Branch, Acad. of Sci., USSR [Novosibirsk].

GIN-22. Yenisey River flood plain **765 ± 85**
[A.D. 1185]

Wood from same cross section as GIN-21; depth 1.3 m.

GIN-23. Yenisey River flood plain **3700 ± 100**
[1750 B.C.]

Bits of slightly decomposed wood from same cross section as GIN-21 and 22, depth 3.5 m.

GIN-24. Yenisey River flood plain **4330 ± 160**
[2380 B.C.]

Large trunk from same cross section as GIN-21-23. Depth 6.8 m.

Malaya Kheta River series, Krasnoyarsk Krai, Siberia

GIN-25. Malaya Kheta River **6800 ± 200 [4850 B.C.]**

Wood from peat overlying 20-m "Karginskoye" terrace of Yenisey R. on Malaya Kheta R., 7 km above its mouth [69° 35′ N Lat, 84° 30′ E Long]. Depth, 1.3 m. Pine cones and bark of white-boled birch [*B. platyphylla*] indicate warmer climate (Holocene Climatic Optimum) than today. Samples GIN-25-27 coll. 1962 by N. V. Kind and S. L. Troitskiy. *Comment* (D.B.S.): Karginskoye period in Siberia has been tentatively equated with Paudorf Interstadial by Cherdyntsev *et al.* (1964, p. 322-323).

GIN-26. Malaya Kheta River **8500 ± 250 [6550 B.C.]**

Wood from same peat deposit at Malaya Kheta settlement [69° 35′ N Lat, 84° 30′ E Long] in same stratigraphic position as GIN-25, at depth ca. 3 m.

GIN-27. 17 km above mouth of Malaya Kheta R. **26,800 ± 1400 [24,850 B.C.]**

Wood from lower horizon of same cross section of "Karginskoye" terrace, 17 km above mouth of river [69° 28′ N Lat, 84° 30′ E Long]. Sample at depth 19 m from surface, elev. 3.5 m above water level of Malaya Kheta R., from peat in loam, alluvium, and sand. *Comment* (N.V.K. and S.L.T.): these are flood-plain deposits of Karginskoye age.

GIN-28. Igarka Permafrost Station **21,350 ± 650 [19,400 B.C.]**

Large tree trunk from depth 6 m in alluvium in shaft at Igarka Permafrost Station, Krasnoyarsk Krai [Igarka city: 67° 30′ N Lat, 86° 30′ E Long]. Alluvium is from "Karginskoye" terrace of Yenisey R. Mouth of shaft 22 to 23 m [elev.] above water level. Sample taken from accumulation of tree boles in alluvial deposits frozen for many yr. Alluvium unconformably overlies varved clay of last stage of Zyryanka [Early Würm (?) (Cherdyntsev, *et al.*, 1964)] Glaciation, (Saks, 1951, Sheveleva, 1963). Vinogradov *et al.* (1959) dated another wood sample from same locality at >24,500 yr (Mo-4).

GIN-30. Bol'shaya Ercha River flood plain **3150 ± 100 [1200 B.C.]**

Birch wood from lower part of high flood plain of Bol'shaya Ercha R., tributary to Indigirka R., Yakut ASSR [69° 40′ N Lat, 148° 00′ E Long]. Inferred age: Atlantic. Wood from same stratum was dated 4770 ± 280 yr (Vinogradov *et al.*, 1962, Mo-229, Vernadsky Inst. I-IV, 1966). Subm. 1960 by Yu. A. Lavrushin.

GIN-29. Amguyema River, Magadan Oblast **9350 ± 230** **[7400 B.C.]**

Wood from II terrace of Amguyema R. [approx. 68° 00′ N Lat, 177° 30′ W Long], Chukchi Peninsula. Sample from sand with layers of peat at depth 8.5 to 9 m. Subm. 1962 by O. M. Petrov.

REFERENCES appear on p. 443.

[RADIOCARBON, VOL. 10, No. 2, 1968, P. 426-436]

GEOLOGICAL INSTITUTE RADIOCARBON DATES II*

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GIN-104. Pavlov campsite, Czechoslovakia **26,000 ± 350 [24,050 B.C.]****

Charcoal. Pavlov campsite [48° 50′ N Lat, 16° 25′ E Long], Czechoslovakia. Archaeologic [*sic*] age is beginning of Würm III. Other determinations of charcoal from same campsite are: 24,800 ± 150 yr (GRO-1325, de Vries, 1958) and 26,400 ± 230 yr (GRO-1242, *ibid.*), which agree with our date. Subm. by A. N. Rogachev; [no date given (E.M.S.)].

Molodova V site series

This Paleolithic campsite in Dnestr region, Ukrainian SSR [approx. 48° 25′ N Lat, 26° 30′ E Long] was excavated 1951-1963 by A. P. Chernysh (1959). Samples GIN-52, 54, 56, 105, and 106 coll. 1962 by N. V. Kind. References: Ivanova (1959); Chernysh (1959); Alekseyev *et al.* (1964). Cf. also Ivanova (1966); fig. 20 presents consolidated stratigraphic table, to depth 12 m, of excavations, including soil horizons, culture (Mousterian, Upper Paleolithic, and Mesolithic), mammalian and molluscan fauna, assoc. woody species, inferred climates, radiocarbon dates, and tentative geologic correlations; also, GIN-6-10, Geol. Inst. I (D.B.S.).

GIN-54. Molodova V site **10,940 ± 150 [8990 B.C.]**

Loam with campfire charcoal. Early Mesolithic Stratum 1, depth 0.5 to 0.8 m. Estimated stratigraphic position: Allerød to [Upper] Earlier Dryas.

GIN-56. Molodova V site **12,300 ± 140 [10,350 B.C.]**

Loam with campfire charcoal from Stratum [2], (late Magdalenian), depth 1.2 to 1.4 m. C^{14} age of fossil bones from same stratum, according to ethyl-benzol variant, is 11,900 ± 230 yr (GIN-8).

GIN-147. Molodova V site **17,100 ± 1400 [15,150 B.C.]**

Charcoal from campfire, Stratum 4, (late Magdalenian) depth 1.9 to 2.05 m.

* Submitted as part of Radiocarbon Dates from Soviet laboratories, 1 January 1962—1 January 1966. See p. 417, this issue. Published as: Radiocarbon dates of the Laboratory of the Geological Institute, Academy of Sciences, USSR: Geokhimiya, 1965, no. 12, pp. 1410-1421.

** Information in brackets interpolated by translator (E.M.S.) and commentator (D.B.S.).

17,100 ± 180
GIN-52. Molodova V site **[15,150 B.C.]**

Loam with campfire charcoal, Stratum 5 (middle Magdalenian), depth 2.2 to 2.4 m.

16,750 ± 250
GIN-105. Molodova V site **[14,800 B.C.]**

Loam with campfire charcoal, Stratum 6 (early Magdalenian), depth 2.6 to 2.8 m.

23,100 ± 400
GIN-106. Molodova V site **[21,150 B.C.]**

Soil, Stratum 10 (mature Solutrean), depth 4.4 to 4.9 m.

22,850 ± 120
GIN-72. Molodova I site, Ukrainian SSR **[20,900 B.C.]**

Shells of land molluscs. Molodova [48° 35′ N Lat, 26° 45′ E Long], Baylova Ripa ravine, on left bank of Dnestr, above Molodova I campsite. Layer of loessal alluvia underlies zone of soil formation and corresponds to 2 soils in cross section of Molodova V (Ivanova, 1960); upper one is synchronous with cultural Strata 9 and 10 (Ivanova, 1959; Chernysh, 1959). Depth of stratum is 6.5 to 7 m. Sample coll. 1962 by N. V. Kind.

Vyg River sites series, Karelian ASSR

4010 ± 70
GIN-130. Zalavruga I site **[2060 B.C.]**

Charcoal from bonfire from Zalavruga I campsite, Vyg River, Malinin Island [1.5 km SE of Besovy Sledki, 64° 30′ N Lat, 34° 40′ E Long] (Gurina, 1961, p. 516), Karelian ASSR. Depth 0.70 m (Cross Section 15, Quadrants 2 and 2a). Intrusive particles of sand mixed with ocher. Inferred archaeologic date: 2nd millennium B.C.

5430 ± 50
GIN-129. Besovy Sledki site **[3480 B.C.]**

Wood from Besovy Sledki campsite [64° 30′ N Lat, 34° 40′ E Long], Vyg R. [actually located on old channel of Vyg R. (D.B.S.)], Karelian ASSR, in layer of silty sand at depth 1.1 m under cliff on which campsite was located. Layer contains many pottery fragments. Thought to date from 2nd half of 3rd millennium B.C.

230 ± 100
GIN-57. Moscow, Moscow Oblast **[A.D. 1720]**

Wood from house in Moscow, built ca. A.D. 1900. Discrepancy probably due to Suess effect. Date of approx. contemporaneous sample, GIN-3: 290 ± 80 yr (Geol. Inst. I).

5730 ± 120
GIN-112. Berendeyevo swamp, Yaroslavl' Oblast **[3780 B.C.]**

Wood from Berendeyevo swamp [56° 35′ N Lat, 39° 00′ E Long] in Pereslavl' Raion, Yaroslavl' Oblast. Pile-dwelling settlement in peat mass 70 cm above base of underlying sapropels. Archaeologic date: 2nd phase of comb-and-pit-marked Neolithic, approx. 1st half of 3rd millennium B.C. Subm. by A. L. Nikitin, Inst. of Archaeol., Acad. of Sci., USSR. (Cf. Vernadsky Inst. I-IV, 1966, Mo-206-214; also Neustadt, 1965, p. 87-91 [D.B.S.]).

GIN-111. Lake Pleshcheyevo, Yaroslavl' Oblast **8550 ± 35** **[6600 B.C.]**

Wood from shore of Lake Pleshcheyevo, Perslavl'-Zalesskiy [56° 42′ N Lat, 38° 50′ E Long]. Sample from peat at depth 1.9 m, overlying fluvial-glacial sediments. Geologic age: basal Holocene. Coll. 1964 by V. V. Cherdyntsev.

Pleshcheyevo campsites series, Yaroslavl' Oblast

GIN-114. Pleshcheyevo I site **1530 ± 30** **[A.D. 420]**

Charcoal from hearth pit in dune sand, 25 to 30 cm thick, 1 km from present shoreline of Lake Pleshcheyevo, Pleshcheyevo I campsite, Pereslavl' Raion, Yaroslavl' Oblast [56° 57′ N Lat, 38° 43′ E Long]. Cultural stratum overlain by contemporary soil and underlain by lake sands. Inferred date: medieval. Subm. [n.d.] by A. L. Nikitin.

GIN-116. Pleshcheyevo II site **3870 ± 30** **[1920 B.C.]**

Charcoal from Pleshcheyevo II campsite, same locality as GIN-114, in sand dune at former shoreline of L. Pleshcheyevo, 0.5 km from present shoreline on SW side. Cultural stratum, ca. 40 cm thick, overlies soil, and is overlain by horizon of contemporary podsolic soil, up to 25 cm thick. Archaeologic date: 2nd phase of comb-and-pit-marked Neolithic. Settlement date same as pile dwelling, GIN-112. Age of sample appears markedly less than estimated. Subm. by A. L. Nikitin.

GIN-113. Pleshcheyevo III site **2480 ± 50** **[530 B.C.]**

Charcoal from remains of dwelling destroyed by fire at Pleshcheyevo III campsite, near Samples GIN-114 and 116. Campsite on low dune, 400 m from present shoreline. Cultural stratum, at depth 35 to 40 cm, in contemporary forest soil, underlain by lake sand. Stratum has strictly local character, and penetrates to depth 50 to 70 cm. Archaeologic date: Early Iron age before introduction of *gorodishche* [fortified settlement], tentatively, middle 1st millennium B.C. Subm. by A. L. Nikitin.

GIN-115. Pleshcheyevo IV site **4720 ± 50** **[2770 B.C.]**

Charcoal from Pleshcheyevo IV campsite, near GIN-114. Geographic and stratigraphic position analogous to Pleshcheyevo I. Samples taken along whole cultural stratum. Archaeologic date: Volosovo culture, late Eneolithic, ca. middle of 2nd millennium B.C. [Cf. Tret'yakov and Mongayt, 1956, p. 101. (D.B.S.)] Subm. by A. L. Nikitin.

2200 ± 30
GIN-128. Dikarikha site **[250 B.C.]**

Charcoal from hearth depth 0.45 to 0.50 m, at Dikarikha campsite from low dune on N shore of L. Pleshcheyevo [56° 57′ N Lat, 38° 46′ E. Long]. Cultural stratum (settlement and cemetery) lies in sandy loamy deposits. Archaeologic date: late Bronze. Subm. by A. L. Nikitin.

9080 ± 85
GIN-67. Sungir' Stream, Vladimir Oblast **[7130 B.C.]**

Peat from Sungir' Stream, above Suromna village [approx. 56° 10′ N Lat, 40° 35′ E Long], Vladimir Oblast. Peat, ca. 10 cm thick, from depth 1.5 m in lacustrine and paludal loam in I terrace. Estimated geologic age: late Glacial to early Holocene. Sample coll. 1963 by S. M. Tseytlin and L. D. Sulerzhitskiy.

Ulovo series, Vladimir Oblast

18,600 ± 200
GIN-82. Ulovo **[16,650 B.C.]**

Buried soil of II terrace, depth 3.7 m, from left bank of Ulovka R. valley, 3 km above confluence with Nerl' R., Ulovo village, Vladimir Oblast [approx. 56° 20′ N Lat, 40° 50′ E Long]. Upper stratum of buried soil of Terrace 2 above flood plain. Strongly humified loam lies 3.7 m beneath topsoil loams; former overlie moraine, disturbed by solifluction, overlying periglacial sand. Inferred age: late Glacial. Coll. 1963 by S. M. Tseytlin and L. O. Sulerzhitskiy. (Cf. GIN-16, Geol. Inst. I [D.B.S.]).

35,000 ± 1000
GIN-81. Ulovo **[33,050 B.C.]**

Buried soil from same exposure as GIN-82, lower soil stratum, 0.15 m thick at depth 6.2 m. Soil is inclusion within deposits of periglacial alluvia disturbed by deposition of ice-wedge casts. Overlies till of Dnepr (?) [Mindel] Glaciation. Inferred age: a Würm interstadial. Coll. 1963 by S. M. Tseytlin and L. D. Sulerzhitskiy. Previous date of >35,000 yr for this sample (GIN-16, Geol. Inst. I).

20,540 ± 120
GIN-83. Vladimir, Vladimir Oblast **[18,590 B.C.]**

Buried soil (loam disarrayed by solifluction) in Dobrosel'skiy clay pit, Vladimir city [56° 08′ N Lat, 40° 24′ E Long]. Depth ca. 4.5 m. Rests on alluvium, overlying till. Age probably Paudorf. Overlain by gray (podsolized) loams identical at 3.5 m depth with soil underlying cultural stratum of Sungir' campsite (GIN-15, Geol. Inst. I). Coll. 1963 by S. M. Tseytlin and L. D. Sulerzhitskiy.

Yakimanka series, Vladimir Oblast

GIN-84. Yakimanka **20,300 ± 150 [18,350 B.C.]**

Buried soil from Kamennyy Ovrag ["Stony Ravine"] in Yakimanka village, Suzdal' Raion, Vladimir Oblast [56° 22′ N Lat, 40° 22′ E Long]. Sample from upper part of left slope, 1 km from confluence with Nerl' R., depth 2.5 m; underlies topsoil loams, and overlies till. Soil disturbed by solifluction. Age approx. that of GIN-82. Coll. 1963 by S. M. Tseytlin and L. D. Sulerzhitskiy.

GIN-102a. Yakimanka **>45,000**

Humus extracted from peat with alkaline treatment, from Kamennyy Ovrag, Yakimanka village. Peat at depth 5 m, base of left bank of ravine, 1 km from confluence with Nerl' R. Overlain with loams and underlain by sand. Thickness of peat ca. 1.5 m. Paleobotanical data correlate with Mikulino [Eem] Interglacial (Metel'tseva and Sukachev, 1961). Dates of earlier samples: 9750 ± 200 yr (GIN-11, Geol. Inst. I), and >22,000 (GIN-12, Geol. Inst. I). Reasons for discrepancy are unclear. Present measurement corroborates ancient age of peat deposit, which lies beyond limits of our variant of C^{14} method. Coll. 1964 by N. V. Kind.

GIN-80. Yeliseyevichi site, Bryansk Oblast **33,000 ± 400 [31,050 B.C.]**

Wood from Yeliseyevichi campsite, Bryansk Oblast [53° 35′ N Lat, 33° 35′ E Long]. [Erroneously given in text as Belorussian SSR. (D.B.S.)]. Found in base of hearth at depth 2.3 m, in floor of dwelling made of mammoth bones, in stratum of loessal loams. Archaeologic estimate, according to V. D. Bud'ko, who subm. sample, is Late Gravettian, analogous to Pavlov campsite (GIN-104, this list). (Cf. also Butzer, 1964, p. 389-393. [D.B.S.])

GIN-94. Kursk I site, Kursk Oblast **11,600 ± 200 [9650 B.C.]**

Fossil bone from Kursk I campsite [51° 40′ N Lat, 36° 10′ E Long], Kursk. I terrace above flood plain, right bank of Seym R. Cultural stratum of campsite lies in reddish-brown clay at depth 1.2 m from surface. Estimated archaeologic age: early or middle Magdalenian. Sample coll. 1963 by P. I. Boriskovskiy, Inst. of Archaeol., Acad of Sci., USSR.

Kostenki Group sites series, Voronezh Oblast

GIN-86. Kostenki I site **14,020 ± 60 [12,070 B.C.]**

Charred bone from upper stratum of Kostenki I campsite [51° 25′ N Lat, 39° 01′ E Long]. "Second dwelling." Depth, 1.5 m. Coll. 1963 by A. A. Velichko, Inst. of Geog., Acad. of Sci., USSR and A. N. Rogachev, Inst. of Archaeol., Acad. of Sci., USSR. (Cf. Yefimenko, 1953, p. 420-436 for description; Tret'yakov and Mongayt, 1956, p. 23, for map and key to sites. [D.B.S.])

11,000 ± 200
GIN-93. Kostenki II site **[9050 B.C.]**

Fossil bones. Kostenki II campsite [51° 24′ N Lat, 39° 01′ E Long]. Scapula of mammoth from stratum enclosing burial of body of Crô-Magnon type. Subm. by P. I. Boriskovskiy [n.d. (E.M.S.)]

23,600 ± 300
GIN-89. Kostenki XII site **[21,650 B.C.]**

Loam of upper humified layer at Kostenki XII campsite [51° 25′ N Lat, 39° 01′ E Long], with aggregate thickness of 0.55 m, at depth 1.7 m. Enriched with humus in lower part of layer. On underlying brownish-gray loam are separate lenses of volcanic ash. Cultural Stratum II of campsite assoc. with [humified] layer. Coll. 1963 by A. A. Velichko and A. N. Rogachev.

14,300 ± 460
GIN-79. Markina Gora site **[12,350 B.C.]**

Fossil bones from Markina Gora campsite (Kostenki XIV) [51° 24′ N Lat, 39° 00′ E Long]. Slivers of tubular [*sic*] bones of horse from cultural Stratum III, Markina Gora campsite, synchronous with burial of Negroid-type man. Coll. 1963 by A. A. Velichko and A. N. Rogachev.

20,100 ± 200
GIN-78. Kostenki XVII site **[18,150 B.C.]**

Loam from lower humified layer at campsite Kostenki XVII [51° 24′ N Lat, 39° 01′ E Long]. Stratum 6 at depth 6.35 to 6.45 m. Ca. 1.5 m higher occur lenses of volcanic ash. Basic cultural stratum of campsite assoc. with lower [humified] layer. Inventory of both cultural strata [GIN-77] is same type and close in time (Boriskovskiy, 1953). Coll. 1963 by A. A. Velichko and A. N. Rogachev.

9610 ± 190
GIN-85. Kostenki XVIII site **[7660 B.C.]**

Fossil bone splinters from upper cultural stratum of Kostenki XVIII campsite [51° 25′ N Lat, 39° 01′ E Long], Anosovskiy Log [ravine]. Coll. 1963 by A. A. Velichko and A. N. Rogachev.

20,000 ± 350
GIN-77. Kostenki XVIII site **[18,050 B.C.]**

Humified loam from Kostenki XVIII campsite, same location as GIN-85. Stratum 4a at depth 3.6 to 3.7 m; upper surface shows maximum enrichment with humus and charcoal. At depth 1.1 m from zone of contact [with topsoil chernozem] lenses of volcanic ash occur. Finds of Upper Paleolithic inventory assoc. with Stratum 4a. Coll. 1963 by A. A. Velichko and A. N. Rogachev.

GIN-107. Kostenki XIX site **11,800 ± 500** **[9850 B.C.]**

Charred bone from Kostenki XIX campsite [51° 25′ N Lat, 39° 00′ E Long], Kostenki village. Located on I terrace above flood plain of Don R. Cultural stratum lies in loam at depth 1 to 2.5 m, becoming deeper downslope. Coll. [n.d.] by P. I. Boriskovskiy. Estimated archaeologic age: Late Paleolithic or transitional to Mesolithic (Boriskovskiy, 1963).

GIN-88. Borshevo II site (Kostenki Group) **12,300 ± 100** **[10,350 B.C.]**

Humified alluvium from I Terrace above flood level of Don R., Borshevo village. Underlies lower cultural stratum of Borshevo II campsite [51° 20′ N Lat, 39° 06′ E Long]. Sampled layer, 0.15 m thick, at depth 3.35 m, contains plant remains and mollusc shells. Archaeologic age: transitional from Magdalenian to Azilian, *i.e.*, transitional between Upper Paleolithic and Epipaleolithic (D.B.S.). Coll. 1963 by A. A. Velichko and A. N. Rogachev.

GIN-66. Chyornyy Yar, Astrakhan Oblast **12,500 ± 140** **[10,550 B.C.]**

Humified loam with plant remains. Chyornyy Yar village [48° 03′ N Lat, 46° 07′ E Long], Astrakhan Oblast. Peaty lens on base of [Lower] Khvalinsk [Würm III(?)] marine clay, lies at depth 4 m. Underlying lenses are Atelian [Würm I(?)] loams and [Lower] Khazar [Riss] estuarine clays. (Cf. Grichuk *et al.*, 1966, p. 170-174; Gerasimov, 1953, p. 107-110 [D.B.S.]). Inferred geologic age: beginning of [Lower] Khvalinsk [Würm III(?)] Transgression, Mologo-Sheksnya Interglacial [Eem Interstadial]. Sample coll. 1963 by Yu. M. Vasil'yev, Geol. Inst., Acad. of Sci., USSR. C^{14} date is significantly younger than inferred geologic age.

GIN-926. Akhshtyr cave, N. Caucasus **19,500 ± 500** **[17,550 B.C.]**

Charcoal from Akhshtyr cave, Mzymta R., Adler Raion, Krasnodar Krai [43° 32′ N Lat, 39° 59′ E Long]. Hearth in cultural stratum at depth ca. 7.00 m. Archaeologic age: base of Upper Paleolithic strata. Coll. 1963 by Ye. A. Vekilova, Inst. of Archaeol., Acad. of Sci., USSR.

Nabati series, Poti, Georgian SSR

GIN-108. Poti, Georgian SSR **4140 ± 50** **[2190 B.C.]**

Peat from Nabati deposit near city of Poti [42° 10′ N Lat, 41° 40′ E Long], Kolkhidian [Colchis] depression, Georgian SSR. [*Carex*]—reedy peat at depth 3.5 m. Samples GIN-108 and 127 subm. [n.d.] by P. P. Timofeyev, Geol. Inst., Acad. of Sci., USSR.

GIN-127. Poti, Georgian SSR **6660 ± 60** **[4710 B.C.]**

Sedge [*Carex*] peat from same deposit as GIN-108. Depth, 6 m.

GIN-32. Karmir-blur, Armenian SSR **2500 ± 40** **[550 B.C.]**

Charred wood from Karmir-blur hamlet on outskirts of Erevan [40° 11′ N Lat, 44° 35′ E Long]. Ruins of Urartu city of Teysheb-baini, burned by nomads at beginning of 6th century B.C. (Cf. also Mo-241, Vernadsky Inst. IV-V. [D.B.S.]) Another date (GIN-1): 2600 ± 135 yr, Geol. Inst. I. Dates agree well with archaeologic estimate (Cherdyntsev *et al.*, 1964).

GIN-126. Irtysh River, Omsk Oblast **30,700 ± 300** **[28,750 B.C.]**

Wood from stump in alluvium of II terrace above flood plain of Irtysh R. at Lipovskaya village [unlocated, near 55° N Lat, 73° E Long]. Inferred age: Karginskoye [Paudorf Interstadial (?)]. Sample subm. [n.d.] by I. A. Volkov, Inst., of Geol. and Geophysics, Siberian Division, Acad. of Sci., USSR [Novosibirsk].

Lower Yenisey River series

Samples GIN-101 through GIN-61 which follow, seek to correlate sediments in lower Yenisey R. with terrace stratigraphy of middle Yenisey at Podkamennaya Tunguska (61° 50′ N Lat, 90° 31′ E Long) and upper Yenisey at Krasnoyarsk city (56° 00′ N Lat, 92° 50′ E Long). (Cf. Gorshkov, 1966. [D.B.S.])

GIN-101. Yar'yakhamal River, Krasnoyarsk Krai **>45,000**

Wood from Ust'-Yenisey Port [Ust'-Port: 69° 45′ N Lat, 84° 30′ E Long], Yar'yakhamal R., at depth ca. 2 m, from alluvium (?), transitional downward to marine Kazantseva [Riss-Würm Interglacial (?)] sands. In upper part of facies, immediately beneath sample, is horizon with cryogenic disturbances. Inferred geologic age: late Kazantseva or early Zyryanka [Würm I and II (?)].

GIN-55. Malaya Kheta R., Krasnoyarsk Krai **21,700 ± 1700** **[19,750 B.C.]**

Peat from Yenisey R. [basin], 20-m "Karginskoye" terrace, at Malaya Kheta R. [69° 20′ N Lat, 84° 30′ E Long], 17 km above its mouth. Layer of alluvial peat lies at depth 7 m in upper part of Karginskoye [Paudorf (?)] alluvium, 1.0 to 1.5 m below Sartanskoye [Würm III (?)] deposits. Pollen diagrams indicate onset of cooling. Coll. 1962 by N. V. Kind and S. L. Troitskiy. Large standard deviation measurement caused by small quantity of sample.

GIN-140. Igarka Permafrost Station, Krasnoyarsk Krai **35,400 ± 300** **[33,450 B.C.]**

Wood from Igarka Permafrost Station, Acad. of Sci., USSR [Igarka city: 67° 30′ N Lat, 86° 30′ E Long]. Karginskoye [Paudorf Interstadial (?)] deposits. Earlier C^{14} dates reported by A. P. Vinogradov *et al.*, (1959) were not less than 24,500 yr (Mo-4); and by us, 21,350 ± 650 yr (GIN-28, Geol. Inst. I). Discrepancy in dates made repetition of determination necessary. Sample coll. 1962 by N. V. Kind and S. L. Troitskiy.

GIN-76. Igarskiy Yar, Krasnoyarsk Krai **35,800 ± 600** **[33,850 B.C.]**

Buried wood from II, 20 to 25-m terrace of Yenisey R. at Igarka [67° 30′ N Lat, 86° 20′ E Long]. Exposure "Igarskiy yar" [*yar* = steep bank]. Sample at depth 3.5 m below base of fluvial-glacial sediments overlying till of Zyryanka age. Wood belongs to period of glacial retreat [after] maximal stage of Zyryanka Glaciation. Coll. 1962 by N. V. Kind and S. L. Troitskiy. *Comment* (D.B.S.): Zyryanka = Würm I and II(?) (Cherdyntsev *et al.*, 1964).

GIN-98. Denezhkino, Krasnoyarsk Krai **36,900 ± 400** **[34,950 B.C.]**

Buried wood from II, 30 m terrace of Yenisey R. at Benezhkino settlement [66° 40′ N Lat, 86° 50′ E Long], in obliquely stratified fluvial-glacial sediment, at elev. 13 m above water level. Stratigraphic position approx. same as sample GIN-76. Coll. 1962 by N. V. Kind and S. L. Troitskiy.

GIN-99. Koneshchel'ye settlement, Krasnoyarsk Krai **32,500 ± 700** **[30,550 B.C.]**

Plant remains with wood fragments from Yenisey R. at Koneshchel'ye settlement [unlocated: on Yenisey R. between 65° and 69° N Lat (D.B.S.)]. II terrace, 30 m above river. Sandy layer, with plant remains, at depth 4.5 m, assoc. with top of 8 to 10-m alluvial facies of Karginskoye (?) period; this facies was deposited on Zyryanka glacial and fluvial-glacial deposits. Layer disturbed by frost, believed related to beginning of Sartanskoye cooling. Coll. 1962 by N. V. Kind and S. L. Troitskiy.

Bol'shoy Shar sub-series, Yenisey River, Krasnoyarsk Krai

GIN-100. Bol'shoy Shar **30,200 ± 600** **[28,250 B.C.]**

Plant remains from II, 30-m terrace of Yenisey R. opposite mouth of Bol'shoy Shar channel [unlocated: between 65° and 69° N Lat (D.B.S.)]. From alluvium with plant remains, at depth 17 m, overlain and underlain by varved clays from peri-glacial lake at edge of Zyryanka glacier, at time of maximum S advance. Samples GIN-100, 100a, and 110 coll. 1962 by N. V. Kind and S. L. Troitskiy.

GIN-100a. Bol'shoy Shar **34,800 ± 1600** **[32,850 B.C.]**

Humus extracted from sample GIN-100. Closeness of dates of samples GIN-100a and 110, and discrepancy with GIN-100, point to contamination of GIN-100 with younger carbon.

GIN-110. Bol'shoy Shar **35,200 ± 700 [33,250 B.C.]**

Plant remains from same locality as GIN-100; depth, 18 m.

GIN-61. Nizhnaya Tunguska R., Krasnoyarsk Krai **37,000 ± 1900 [35,050 B.C.]**

Buried wood from III terrace of Nizhnaya Tunguska R. at Uchami Faktoriya [trading post; 63° 45′ N Lat, 96° 25′ E Long]. Sample from middle of sandy alluvium (Karginskoye (?)), deposited on lacustrine and fluvial sediments of Zyryanka age. Coll. 1963 by S. M. Tseytlin.

Upper Yenisey Paleo-Mesolithic series

GIN-117. Afontova Gora II site, Krasnoyarsk Krai **20,900 ± 300 [18,950 B.C.]**

Charcoal from early Siberian Paleolithic campsite, Afontova Gora [56° 00′ N Lat, 92° 50′ E Long]. Lower humic layer probably corresponds to lower cultural stratum of campsite. Inferred geologic age: Late Karginskoye [Paudorf Interstadial (?), cf. Cherdyntsev *et al.*, 1964]. Coll. 1962 by S. M. Tseytlin. (Cf. also Mo-343, Vernadsky Inst. I-IV, 1966. [D.B.S.])

Upper Yenisey Paleo-Mesolithic series (cont'd.)

GIN-91. Kokorevo I site **13,300 ± 50 [11,350 B.C.]**

Charcoal from Kokorevo I (Zabochka) campsite at Kokorevo village, Novoselovo Raion, Krasnoyarsk Krai [55° 10′ N Lat, 90° 45′ E Long]. Alluvium of II terrace above Yenisey R. flood plain at depth 2.85 m, presumably Sartanskoye age. Cultural stratum is at depth 3.8 m. Archaeologic age: Siberian Upper Paleolithic. Coll. 1962-1963 by Z. A. Abramova, Inst. of Archaeol., Acad. of Sci., USSR. *Comment* (D.B.S.): Sartanskoye is probably equivalent to Würm III; (cf. Cherdyntsev *et al.* 1964).

GIN-90. Kokorevo II site **13,330 ± 100 [11,380 B.C.]**

Charcoal from Kokorevo II (Telezhnyy Log) campsite on right bank of Borozda R., left tributary to Yenisey, at Kokorevo village (see GIN-91). Cultural stratum occurs in alluvial deposits of Sartanskoye age (?) under 2 layers of buried soil. Archaeologic age: Siberian Upper Paleolithic. Coll. 1962-1963 by Z. A. Abramova.

Angara River Paleo-Mesolithic series

GIN-96. Ust'-Belaya site, Irkutsk Oblast **8960 ± 60 [7010 B.C.]**

Fossil bone from multi-stratum campsite, Ust'-Belaya [52° 55′ N Lat, 103° 35′ E Long], III-IV cultural horizons; I terrace above flood plain of Belaya R., 800 m above confluence with Angara R. Alluvial deposits of flood-plain facies. Concluding phase of flood-plain alluvia accumulation. Inferred archaeologic age: Mesolithic. Coll. 1962-1963 by Z. A. Abramova.

GIN-97. Mal'ta site, Irkutsk Oblast **14,750 ± 120 [12,800 B.C.]**

Fossil bones from campsite at Mal'ta village [52° 52′ N Lat, 103° 25′ E Long], Irkutsk Oblast. III terrace above flood plain of Belaya R. Sample taken at depth 1.05 m from lower cultural stratum which lies in loess-like loam, overlapping surface of alluvium. Inferred geologic age: last Interstadial of Zyryanka Glaciation. Archaeologic age: early Siberian Paleolithic. Coll. 1963 by E. L. Ravskiy, Geol. Inst., Acad. of Sci., USSR.

GIN-103. Malaya Anyuy River, Yakut ASSR **>45,000**

Wood from Malaya Anyuy R., 22 km above Anyuysk village [68° 20′ N Lat, 161° 30′ E Long], E part of Kolyma lowland. Fragment of log of *Larix dahurica* from lacustrine-alluvial layer containing also *Pinus pumila*. Inferred geologic age: Karginskoye [Paudorf Interstadial (?)]. Coll. 1963 by A. V. Sher.

Avacha Volcano series

GIN-122. Avacha Volcano, Kamchatka **5480 ± 70 [3520 B.C.]**

Charred wood from dike of agglomerate, Avacha Volcano, Kamchatka [53° 20′ N Lat, 158° 40′ E Long].

GIN-118. Zhirovaya, Kamchatka **106 ± 2% contemporary carbon std**

CO_2. Zhirovaya, Lower Zhirovaya springs, Kamchatka [unlocated; near Avacha Volcano]. Presence of contemporary "living" carbon was shown: value of C^{14} shown is in relation to 0.95 × NBS oxalic acid. *Comment*: nuclear fallout appears to be contaminant. (Ed.)

Kunashiri Island series, Kurile Islands, Sakhalin Oblast

GIN-124a. Kunashiri Island **39,300 ± 600 [37,340 B.C.]**

Wood from base of pyroclastic layer from Kunashiri Is. [ca. 44° 00′ N Lat, 145° 40′ E Long], Kurile Islands. Sample not pretreated with alkali and acid.

GIN-124b. Kunashiri Island **40,200 ± 750 [38,240 B.C.]**

Control sample of wood at same locality as GIN-124a. Subjected to usual chemical treatment. Difference between 2 dates is within statistical tolerances.

REFERENCES appear on p. 443.

[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 437-445]

GEOLOGICAL INSTITUTE RADIOCARBON DATES III*

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GIN-152. Kut site, Ukrainian SSR **4090 ± 80 [2140 B.C.]****

Charcoal from campsite hearth from Zozov village, Rovno Oblast [Rovno city: 50° 30′ N Lat, 26° 12′ E Long], Ukrainian SSR. Kut hamlet, semi-subterranean Dwellings VII and VIII. Corded pottery culture; (cf. Gimbutas, 1956 [D.B.S.]). Subm. by I. K. Sveshnikov, Inst. of Social Studies, L'vov.

Krasnoye Selo series, Volkovysk Raion, Belorussian SSR

GIN-148. Krasnoye Selo **4310 ± 45 [2360 B.C.]**

Charcoal from Krasnoye Selo settlement, Volkovysk Raion [53° 09′ N Lat, 24° 28′ E Long], in Neolithic shafts for mining flint. Sample from torches found in Shaft 13. Excavated and coll. by N. N. Gurina, Inst. of Archaeol., Acad. of Sci., USSR.

GIN-164. Krasnoye Selo **5050 ± 25 [3100 B.C.]**

Charcoal from same location from torches found in Shafts 3, 11, and 18. Greater quantity of material ensured smaller standard error for this trial than for sample GIN-148.

GIN-163. Narva II site, Estonian SSR **13,400 ± 330 [11,450 B.C.]**

Wood from Narva R., Narva II campsite [59° 25′ N Lat, 28° 10′ E Long]. Excavated and coll. 1952 by N. N. Gurina. Sample, according to C^{14} analysis, reveals late Paleolithic age. *Comment* (D.B.S.): see also Tartu I, 1966 (Radiocarbon, v. 8, p. 431-432), esp. TA-17, 40, 52, 41, 25, and 53; note that dates derived from TA series are substantially younger than indicated in GIN-163 above. GIN-163 is highly implausible because Narva-Kunda area was freed of glaciation only in Allerød Period—11,000-10,800 yr B.P. (See Grichuk *et al.*, 1966, p. 19).

GIN-173. Cheremoshnik, Yaroslavl' Oblast **33,300 ± 500 [31,350 B.C.]**

Wood from Cheremoshnik village, outskirts of Rybinsk [58° 05′ N Lat, 38° 55′ E Long], in peat from ravine, at depth 4.5 to 5 m. Coll.

* Submitted as part of Radiocarbon Dates from Soviet laboratories, 1 January 1962—1 January 1966. See p. 417, this issue. Published as: Radiocarbon dates of the Laboratory of the Geological Institute, Academy of Sciences, USSR: Geokhimiya, 1966 (in press).

** Information in brackets interpolated by translator (E.M.S.) and commentator (D.B.S.).

1965 by N. V. Kind. Attributed by A. I. Moskvitin (1966), from pollen data, to 1st half of Mikulino [Eem] Interglacial. For technical reasons, sample was removed from near surface without deep cleaning; date, therefore, is probably too young. Previous date of analogous sample is 31,600 yr (Le-17). Another date, 19,500 ± 300 yr LE[RUL]-199, Inst. of Archaeol. I, 1965), is evidently also in error.

GIN-174. Moscow Canal Diversion, Yaroslavl' Oblast >45,000

Wood from Moscow Canal Diversion, 5 km from connection with Volga R., Sta. 50 [56° 40′ N Lat, 37° 10′ E Long]. From peat in lentil of lacustrine deposits overlying Dnepr (?) [Mindel] till. Inferred geologic age: either Mikulino [Eem] or Mologo-Sheksnya [Paudorf] Interglacial.

GIN-175. Volga River, Yaroslavl' Oblast >50,000

Wood from right bank of Volga R. on outskirts of Tutayev [57° 50′ N Lat, 39° 35′ E Long], 600 to 700 m above mouth of Dolgopolka R. [Cf. also LG-1, All-Union Geol. Inst. I (D.B.S.)]. From peat within lake-bog clay between 2 tills. Inferred geologic age: Mikulino [Eem] Interglacial. Previous date for this sample, 15,700 ± 300 yr (LE[RUL]-197, Inst. of Archaeol. I, 1965) is evidently erroneous.

Cheremukha River series, Yaroslavl' Oblast

30,700 ± 300
GIN-176. Cheremukha River [28,750 B.C.]

Wood from Cheremukha R., suburbs of Rybinsk [58° 05′ N Lat, 38° 55′ E Long]. At depth 9.5 m in lacustrine sediments forming lower part of cross section of 10 to 12 m terrace, and 1.5 m below lacustrine deposits underlying alluvium. According to A. I. Moskvitin (1966) and V. A. Novskiy (1958) deposits belong to Mologo-Sheksnya [Paudorf] Interstadial. Sample Le-25, ca. 20 to 50 cm = 39,000 ± 2000 yr (Neustadt, 1965, p. 65), and Mo-26 (same depth) = 42,700 ± 2000 yr (*ibid.*). Dates are consistent, since differences do not go beyond respective counting errors (4δ). Coll. 1965 by N. V. Kind.

GIN-177. >49,000

Wood from same location, from depth 1.5 to 1.8 m below GIN-176 from base of dense bluish-gray loam at water level. Inferred age same as GIN-176. (Cf. also MO-304 and LG-6A from slightly different locality. [D.B.S.])

GIN-178. Chermenino, Yaroslavl' Oblast >52,000

Wood from Chermenino village [58° 04′ N Lat, 38° 52′ E Long], 8 to 9 km below Rybinsk. At base of 13-m terrace of Volga R. containing sandy alluvium with Unionidae. Sample taken at water level. Age according to A. I. Moskvitin (1966) is Mologo-Sheksnya [Paudorf]; according to V. P. Grichuk (1966), Mikulino [Eem]. Coll. 1965 by N. V. Kind. Samples located higher in same exposure: Le-21 (depth 2 m) 25,900 ± 900 yr; Le-22 (depth ca. 2.5 m) 28,800 ± 2000 yr; Le-23 (1 m above water level) 31,900 ± 800 yr (Starik and Arslanov, 1961). Sample Mo-307 (Vernadsky Inst. IV), analogue of Le-21, depth 2 m, was >28,000 yr when measurement was repeated in another lab. (Cf. also LG-4A and 4B, LG-5, All-Union Geol. Inst. I [D.B.S.]).

7730 ± 40
GIN-197. Berendeyevo I site, Yaroslavl' Oblast [5780 B.C.]

Birchbark from Berendeyevo I campsite, Berendeyevo swamp [56° 35′ N Lat, 39° 00′ E Long] in Pereslavl' Raion, Yaroslavl' Oblast. Pile dwelling of pit-and-comb-marked pottery period (early Neolithic) (Gimbutas, 1956). Burial 20 cm below cultural stratum of campsite, wrapped in birchbark. Wood (piling) from campsite gave date 5730 ± 120 yr (GIN-112, Geol. Inst. II), which fully agrees with dates 5415 ± 195 yr (Mo-209, Vernadsky Inst. I-IV, 1966) and 6090 = 210 yr (Mo-211, *op cit.*) received for strata of peat deposit, between which cultural stratum of campsite is located.

28,520 ± 170
GIN-190. Ples, Ivanovo Oblast [26,570 B.C.]

Peat from Ples [57° 25′ N Lat, 41° 30′ E Long], left bank of Gremyachka ravine, from lacustrine-alluvial lentil overlying Dnepr (?) till. Inferred geologic age: Mikulino [Eem]. Coll. 1965 by N. V. Kind. *Comment*: date probably too young, as is Le-19, 36,600 ± 1500 yr (Neustadt, 1965, p. 65) for wood from same exposure; in latter case smallness of sample affected preparation.

7350 ± 100
GIN-151. Kaindy-Su, Kirgiz SSR [5400 B.C.]

Charcoal from Kaindy-Su [river], Naryn R. Basin [unlocated; within 42° 20′-40′ N Lat, 74° E Long], W Tyan Shan, Kirgiz SSR. From II terrace of river, sandy-clayey layer of lacustrine-alluvial deposits; depth, 12.1 m. Clayey streak contains charcoal. Inferred geologic age: early Holocene. Coll. 1964 by E. A. Fin'ko, Inst. of Geog., Acad. of Sci., USSR.

3155 ± 65
GIN-161. Chile River, Kirgiz SSR [1205 B.C.]

Charcoal from Chile R., Dzheyranbel' Pass [39° 55′ N Lat, 73° 00′ E Long], N slopes of Alay Range, Kirgiz SSR. Remains of primitive smelting furnace and fragments of slag with streaks of charcoal and bits of smelted ore (lazurite and malachite), lie in diluvial deposits, 1.7 to 2.0 m thick, perpendicular to slope of streamlet. Inferred [archaeologic] age: not earlier than Late Bronze. Coll. 1964 by G. P. Pshenin, Inst. of Geog., Acad of Sci., USSR.

Igarka series

9200 ± 40
GIN-179. Igarka, Krasnoyarsk Krai [7250 B.C.]

Wood from base of water-divide peat bog, 2 km N of city, on road to Graviyku settlement, Igarka, Karsnoyarsk Krai [67° 30′ N Lat, 86°

30′ E Long]. Contact of peat with underlying lacustrine alluvium is at depth 1.35 m. Inferred age: Holocene. Samples GIN-179 to 181 subm. by G. M. Levkovskaya, Leningrad State Univ.

9480 ± 120
GIN-180. Igarka **[7530 B.C.]**

Peat from depth 1.15 m. Holocene.

6030 ± 100
GIN-181. Igarka **[4080 B.C.]**

Peat from depth 40 to 45 cm. Holocene.

24,800 ± 120
GIN-162. Chadobets River, Krasnoyarsk Krai **[22,850 B.C.]**

Wood from Chadobets R. [mouth: 58° 40′ N Lat, 98° 45′ E Long], lower course N Angara region. I terrace above flood plain, . . . "*in situ,* 1 m above mean water level, in alluvium with Upper Pleistocene fauna: mammoth, *Coelodonta antiquitatis, Equus caballus, Bison priscus, Bison* sp., *Bos* (*Bison*) sp., *Rangifer tarandus, Megaloceros* sp., *Cervus elaphus*" (Grichuk *et al.*, 1966, p. 220; summary description ambiguous. [D.B.S.])

Overlain by flood-plain deposits and periglacial alluvia with large icewedge casts pertaining to Sartanskoye [Würm III] Glaciation. Inferred age: beginning of Sartanskoye Glaciation. Subm. by S. A. Laukhin, Moscow State Univ.

4480 ± 25
GIN-141. Irkut River, Buryat-Mongol ASSR **[2530 B.C.]**

Wood from high flood plain (3.5 m), deposited from loam, in upper course of Irkut R., W part of Tunka lowland [51° 45′ N Lat, 102° 35′ E Long]. Sample taken 0.5 m above water level. From pollen diagram, lower part of section corresponds to Holocene climatic optimum. Coll. 1961 by E. I. Ravskiy, Geol. Inst., Acad. of Sci., USSR.

10,170 ± 140
GIN-142. Ulu-Gorkhon River, Buryat-Mongol ASSR **[8220 B.C.]**

Wood from Ulu-Gorkhon R. [near 51° 45′ N Lat, 103° 00′ E Long], branch of Irkut, Tory lowland. From clay at base of 6-m terrace. Inferred age (from pollen data): Karginskoye [Paudorf (?)]. Coll. 1961 by E. I. Ravskiy.

10,325 ± 35
GIN-153. Samaldynkan River, Yakut ASSR **[8402 B.C.]**

Wood from left bank of Lena R., I terrace above flood plain of Samaldynkan R. [66° 50′ N Lat, 122° 35′ E Long], Zhigansk Raion, Yakut ASSR. [Given in map data as Samal'dzhikan R., branch of Khoroungka R., which is a W branch of Lena R. Coordinates given are for mouth of Samal'dzhikan (D.B.S.).] Sample from bottom of exposed alluvium. Pollen diagram shows forest. Inferred age: Karginskoye [Paudorf (?)]. Coll. 1964 by S. A. Garkusha, Moscow State Univ. and V. V. Kolpakov (VAGT). [Abbreviation unknown (E.M.S.).]

GIN-154. Lena River, Yakut ASSR **>45,000**

Wood from right bank of Lena R., below Zhigansk village [66° 45′ N Lat, 123° 20′ E Long]. In outwash of deposits from glacial river valley which skirted edge of glacial during 1st Zyryanka [Würm I and II (?)] Glaciation. Inferred age: beginning of Zyryanka Glaciation. Subm. 1965 by S. A. Garkusha.

Niimingde River series, Yakut ASSR

33,700 ± 800
GIN-155. Niimingde River **[31,750 B.C.]**

Wood from upper part of lacustrine-alluvial sand with peat from Niimingde [Nimingde] R., branch of Sobolookh-Mayan R., E tributary to Lena R., Yakut ASSR [67° 25′ N Lat, 125° 20′ E Long]. Inferred age: either interstadial between 1st and 2nd phases of Zyryanka [Würm I and II (?)] Glaciation or Karginskoye Interglacial [Paudorf Interstadial (?)]. Subm. 1965 by S. A. Garkusha.

40,760 ± 580
GIN-149. Niimingde River **[38,810 B.C.]**

Wood from 2-m peat layer in alluvium, overlain by 10-m lacustrine-alluvial and fluvial-glacial sediments, from locality of GIN-155, 35 to 40 km from piedmont of Verkhoyansk Mts. Sediments related to Sartanskoye [Würm III (?)] terminal moraine, and "cold" pollen spectrum. Inferred age: Karginskoye [Paudorf (?)]. Coll. 1964 by S. A. Garkusha.

25,900 ± 150
GIN-188. Kuraanakh-Salaa River, Yakut ASSR **[23,950 B.C.]**

Wood from Kuraanakh-Salaa R. [mouth: 69° 55′ N Lat, 132° 30′ E Long], in W part of coastal plain. Wood is from depth 19 m in lacustrine sediments containing vertebrates of "Upper Paleolithic Complex." Inferred age: Upper Pleistocene. Subm. by I. E. Timashev, Second Hydro-geol. Adm.

1010 ± 25
GIN-150. Tirekhtyakh River, Yakut ASSR **[A.D. 940]**

Wood from depth 1.5 m in alluvium in terrace of Tirekhtyakh R. [66° 05′ N Lat, 143° 45′ E Long], branch of Moma R., Indigirka basin. Analogous terrace of branch of Tirekhtyakh R. is overlain by deposits of youngest mt. glaciation. Inferred age: Middle (?) Holocene. Subm. by B. A. Onishchenko, Siberian Div., Acad. of Sci., USSR [Novosibirsk].

42,800 ± 400
GIN-143. Malyy Anyuy River, Yakut ASSR **[40,850 B.C.]**

Wood from Malyy Anyuy R. [general location 68° N Lat, 162-168° E Long], 8 km above mouth of Vesyolaya R. Peat in lacustrine-alluvial deposits of Kolyma R.; depth 10 m. Overlain by peat, presumably of Karginskoye [Paudorf (?)] proper; underlain by lacustrine silt presumably of Zyryanka [Würm I and II (?)] Age. Inferred age: Karginskoye. Coll. 1964 by M. N. Alekseyev, Inst. of Geol., Acad. of Sci., USSR.

6665 ± 110
GIN-182. Amguyema site, Magadan Oblast, Siberia [4715 B.C.]

Charcoal from Amguyema R. middle course [67° 20′ N Lat, 178° 00′ W Long], Chukchi Natl. Okrug. Amguyema IV campsite is on rocky headland (elev. 6 m) at base of loam layer, Amguyema R. terrace. Culture is early Neolithic. Subm. by N. N. Dikov, Siberian Div., Acad. of Sci., USSR, Magadan.

3900 ± 100
GIN-183. Yelizovo site, Kamchatka [1950 B.C.]

Charcoal from Avacha R., Kamchatka at 8-m terrace on left bank of river at Yelizovo village [53° 05′ N Lat, 158° 20′ E Long]. Cultural stratum of Yelizovo campsite at depth 1 m in brown silt. Culture is early Neolithic. Subm. by N. N. Dikov.

Ushki I site series, Kamchatka

7600 ± 300
GIN-184. Ushki I site [5650 B.C.]

Charcoal from Ushkovskoye Lake, connecting with Kamchatka R., near Klyuchi village, Kamchatka [56° 13′ N Lat, 160° 10′ E Long]. Ushki I campsite in SW part of excavation. Hearth under IVa stratum of volcanic ash from eruption of Shiveluch Volcano. Depth, 0.7 m. GIN-184 and 186 subm. by N. N. Dikov. (Cf. also Mo-354 and 345, Vernadsky Inst. I-IV, 1966. [D.B.S.])

21,000 ± 900
GIN-186. Ushki I site [19,150 B.C.]

Charcoal from Ushki I campsite (see GIN-184). Mesolithic or Paleolithic hearth in Quadrant 2-NK at depth 10 m.

Avacha Volcano series

5555 ± 45
GIN-119. Avacha Volcano [3605 B.C.]

Charcoal from vicinity of Avacha Volcano, left bank of Sukhaya Yelizovka R., Kamchatka [53° 20′ N Lat, 158° 40′ E Long], in lower part of 15-m cliff. Deposits are from dike of agglomerate presumably synchronous with formation of caldera. Sample is approx. same age as charcoal from left bank of Sukhaya Khalakhtyrka R., dated at 5480 ± 70 yr (GIN-122, Geol. Inst. II, 1968). Samples GIN-119 to 121 subm. [n.d.] by I. V. Melekestsev and A. M. Chirkov, Inst. of Vulcanol., Siberian Branch, Acad. of Sci., USSR.

3300 ± 35
GIN-120. Avacha Volcano [1350 B.C.]

Charcoal from foot of Avacha Volcano, 2.5 km SE of Monakh Mts., Kamchatka, in upper part of 50- to 60-m cliff, formed by cones of 2 agglomerate dikes. Lower dike flowed at time caldera was formed.

GIN-121. Avacha Volcano **3110 ± 25 [1160 B.C.]**

Charcoal from same location as GIN-120, 1.7 km W of Monakh Mts., right bank of Kambal'nyy stream at base of 50-m cliff, formed by dike of agglomerate, younger than dike which flowed at time of caldera formation. Inferred age: near date for sample GIN-120.

GIN-170. Kondon site, Khabarovsk Krai **4520 ± 25 [2570 B.C.]**

Charcoal from Guni R. in region of Lake Evoron in Komsomol'sk Raion, Khabarovsk Krai. Neolithic settlement Kondon [51° 15′ N Lat, 136° 30′ E Long] is on II terrace above flood plain. Foundation of ancient dwelling; depth, 1.2 m. Culture is characterized by pottery ornamented with spirals and "Amur plaited impressions." (Cf. Tret'yakov and Mongayt, 1956, p. 120-123 [D.B.S.]). Inferred age: 2nd to 3rd millennium B.C., or older. Coll. 1963 by A. P. Okladnikov, Siberian Div., Acad. of Sci., USSR.

GIN-160. Mendeleyev Volcano, Kunashiri Island, Sakhalin Oblast, Kurile Islands **4220 ± 50 [2270 B.C.]**

Charred wood from Mendeleyev [Tyatya] Volcano [44° 20′ N Lat, 146° 15′ E Long], Kunashiri Is., 1 km N of cone of volcano, product of latest explosive eruption. Layer of crumbly lappilloid tufic dacite, depth 0.4 to 1.3 m, includes charred tree trunks and bushes. Subm. by N. A. Shpetalenko, Sakhalin Geol. Adm.

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[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 446-447]

KHLOPIN INSTITUTE RADIOCARBON DATES I*

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Radiological Laboratory, V. G. Khlopin Institute, Leningrad

Khar'khov series, Ukrainian SSR

Le-67. Khar'khov, Ukrainian SSR **610 ± 170** **[A.D. 1340]****

Lime (grouting) from old structures near city of Khar'khov [50° 00′ N Lat, 36° 10′ E Long]. Subm. [n.d.] by L. P. Papkova.

Le-68. Khar'khov, Ukrainian SSR **1220 ± 150** **[A.D. 730]**

Lime (grouting) from old structures near city of Khar'khov. Subm. [n.d.] by L. P. Papkova.

Mga River series

Le-56. Mga River, Leningrad Oblast **36,500 ± 100** **[34,550 B.C.]**

Humus from upper layer of marine-interglacial stratum at Mga R., near Gory Sta., Leningrad Oblast [59° 40′ N Lat, 31° 15′ E Long]. Sample from greenish-black layered aleurite clay at 1 to 1.5 m above river surface. Coll. 1962 by Kh. A. Arslanov, All-Union Geol. Inst., Leningrad and D. B. Malakhovskiy (Cf. Starik *et al.*, 1964).

Le-57. Mga River, Leningrad Oblast **47,400 ± 1400** **[45,450 B.C.]**

Shells from same stratum as Sample Le-56.

Yaroslavl' Oblast

Le-64. Chermenino, Yaroslavl' Oblast **>56,200**

Wood from lower strata of interglacial sediments on right bank of Volga R. at Chermenino village [58° 04′ N Lat, 38° 52′ E Long], 9 km from Rybinsk. Subm. 1962 by N. S. Chebotareva, Geog. Inst., Acad. of Sci., USSR. (Cf. Mo-307, Vernadsky Inst. IV-V, 1968, LG-5, All-Union Geol. Inst. I, 1968, and Arslanov *et al.*, 1966).

Le-65. Mazikha River, Yaroslavl' Oblast **>54,500**

Wood from lake deposits, 4 m thick, left bank of Mazikha R. near Shurskol village, Rostov Raion [57° 15′ N Lat, 39° 25′ E Long], Yaroslavl' Oblast. Sample taken at elev. 3 m above river surface. Subm. 1962 by V. A. Novskiy.

* Submitted as part of Radiocarbon Dates from Soviet laboratories, 1 January 1962—1 January 1966. See p. 417, this issue.

** Information in brackets interpolated by translator (E.M.S.) and commentator (D.B.S.).

Le-71. Pechegda River, Yaroslavl' Oblast **3330 ± 100** **[1380 B.C.]**

Wood from left bank of Pechegda R. midway between its mouth and intersection of Rybinsk-Yaroslavl' rd. [58° 05′ N Lat, 39° 40′ E Long]. Sample from base of silt 2 m thick. Subm. 1962 by V. A. Novskiy.

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[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 448-450]

ALL-UNION GEOLOGICAL INSTITUTE RADIOCARBON DATES I*

Kh. A. ARSLANOV, L. I. GROMOVA, and Yu. A. RUDNEYEV

Laboratory for Quaternary Geochronology of the
All-Union Geological Research Institute, Leningrad

For determining age scintillation variant was used. Measurement of a large quantity of benzol [benzene]** permitted reaching a limit of 62,000 yr without isotope enrichment. Precautions against contamination of the samples with contemporary carbon and tritium were taken in laboratory handling. Dating began only after it had been established that contamination had not taken place during chemical treatment. Benzol which displayed no radioactivity was synthesized from anthracite. Special measures were taken to remove humic acids from the sample by boiling the powdered sample for three days with three fresh lots of 2% solution of NaOH (Arslanov *et al.*, 1966a, p. 134).

Yaroslavl' Oblast

LG-1. Dolgopolka River, Yaroslavl' Oblast **>50,000**

Wood from interglacial sediments in terrace at mouth of Dolgopolka R., tributary of Volga R., at Otmishchevo village [57° 55′ N Lat, 39° 25′ E Long], 4 km above Tutayev, Yaroslavl' Oblast, from layer of humified alluvium ca. 1.5 m above water surface. Coll. 1965 by Kh. A. Arslanov, All-Union Geol. Inst., Leningrad, Ye. P. Zarrina, I. I. Krasnov, and V. A. Novskiy.

Cheremukha River series

This series of measurements was undertaken to fix geological age of deep lacustrine deposits in test section of Cheremukha R. The critical stratum is overlain by 7.5 m of sand. It constitutes a brown-black peaty alluvium, 1.25 m thick with abundant plant remains. Immediately above water level is base stratum 0.3 m thick, of silty gray sand with tree trunks.

Pollen analysis of peaty stratum indicated interstadial climatic conditions which were dated as Mologo-Sheksnya (Paudorf) on basis of 2 determinations: LE-70A = 35,360 ± 400 yr (Arslanov *et al.*, 1966a, p. 135) near top of peaty layer, and LE-66A = 46,270 ± 1240 yr (*ibid.*) at base of gray silty sand. In the present series 1961 determinations (Sukachev *et al.*, 1961) have been reworked on basis of 1965 samples (LG-6A and LG-3A) and show that deposits are older than Mologo-Sheksnya (Arslanov *et al.*, 1966a). [*D.B.S.*]

LG-6A. Cheremukha River **>48,200**

Wood from interglacial lacustrine sediments in flood-plain terrace of Cheremukha R., 8 km S of Rybinsk [58° 00′ N Lat, 39° 00′ E Long].

* Submitted as part of Radiocarbon Dates from Soviet laboratories, 1 January 1962—1 January 1966. See p. 417, this issue.

** Information in brackets interpolated by translator (E.M.S.) and commentator (D.B.S.).

Sample from layer of peaty alluvium with many plant remains, at depth 7.5 to 7.8 m below terrace surface. Coll. 1965 by Kh. A. Arslanov, Ye. P. Zarrina, I. I. Krasnov, and V. A. Novskiy. *Comment* (D.B.S.): given stated limit of measurements at this laboratory, the indeterminate date presumably represents effects of inadequate sample size; (Cf. also Mo-304, Vernadsky Inst. IV-V, 1968).

LG-6B. Cheremukha River **>38,600**

Humic acids extracted from Sample LG-6A. *Comment* (D.B.S.): relatively low age indicates secondary origin for acids; (Cf. Arslanov *et al.*, 1966a, p. 134).

LG-3A. Cheremukha River **>61,800**

Wood from lower stratum, gyttja, at level of Volga R.

LG-3B. Cheremukha River **>48,500**

Humic acids extracted from Sample LG-3A.

Chermenino series

LG-5. Chermenino, Yaroslavl' Oblast **>45,900**

Wood from upper strata of interglacial lacustrine sediments, in terrace of Volga R. at Chermenino village, 9 km below Rybinsk [58° 04′ N Lat, 38° 52′ E Long]. From gyttja at depth 2.2 to 2.5 m below terrace surface and beneath veneer of alluvium. Coll. 1965 by Kh. A. Arslanov, Ye. P. Zarrina, I. I. Krasnov, and V. A. Novskiy. (Cf. MO-307, Vernadsky Inst. IV-V, 1968 and Le-64, Khlopin Inst. I, 1968).

LG-4A. Chermenino, Yaroslavl' Oblast **>58,900**

Wood from same exposure, at depth 4.8 m, in middle part of stratum of interglacial sediments (sand with shells and plant remains).

37,850 ± 760
LG-4B. Chermenino, Yaroslavl' Oblast **[35,900 B.C.]**

Humic acids extracted from specimen LG-4A. *Comment*: sample apparently contaminated by humic acids from overlying younger sediments.

LG-8. Yakovka River, Yaroslavl' Oblast **>50,500**

Wood from upper strata of interglacial deposits at mouth of Yakovka R., 2 km downstream from Chermenino village [58° 04′ N Lat, 38° 50′ E Long], Rybinsk Raion, Yaroslavl' Oblast. From gyttja with plant remains, at depth 6.8 to 7 m below surface. Coll. 1965 by Kh. A. Arslanov, Ye. P. Zarrina, I. I. Krasnov, and V. A. Novskiy.

LG-9. Edoma River, Yaroslavl' Oblast **>51,000**

Wood from lower layers of alluvium in floodplain terrace of Edoma R. flowing into Volga R. at Bol'shoye Titovskoye village [ca. 57° 55′ N Lat, 39° 20′ E Long] between Rybinsk and Tutayev, at base of gravel overlying till, at depth 13.7 m. Coll. 1965 by Kh. A. Arslanov, Ye. P. Zarrina, I. I. Krasnov, and V. A. Novskiy.

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[RADIOCARBON, VOL. 10, No. 2, 1968, P. 451-453]

RADIOCARBON DATING IN THE VERNADSKY INSTITUTE IV*

A. P. VINOGRADOV, A. L. DEVIRTS, E. I. DOBKINA, and N. G. MARKOVA

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1720 ± 170
Mo-297. Timoshkovichi, Belorussian SSR [A.D. 230]**

Peat, at depth 3.5 m, from upper of 2 layers, at village of Timoshkovichi [53° 35′ N Lat, 26° 05′ E Long], Korelichi Raion, Grodno Oblast, Belorussian SSR. Timoshkovichi is located on Novogrudok upland, beyond limits of region of Valday [Würm] Glaciation. Cross section synchronous with ancient ravine of Neman R. basin where 2 horizons of peat can be detected: the lower, according to pollen data, accumulated at time of Mikulino [Eem] Interglacial; the upper believed accumulated at time of 2nd climatic optimum of Mikulino Interglacial, or at time of early Interstadial of Valday [Würm] Glaciation (Tsapenko and Makhnach, 1959). Coll. 1962 by N. S. Chebotareva, Geog. Inst., Acad. of Sci., USSR.

Ligovka River series

3100 ± 180
Mo-315. Ligovka River, Leningrad Oblast [1150 B.C.]

Wood from left bank of Ligovka R. [59° 50′ N Lat, 30° 00′ E Long] at Gorelovo sta. near Leningrad. From sediments postdating Baltic Ice Lake. Coll. 1962 by O. M. Znamenskaya, Leningrad State Univ., V. P. Grichuk, Geog. Inst., Acad. of Sci., USSR, and N. S. Chebotareva, (Cf. Mo-201, Vernadsky Inst. I-IV, 1966; Vinogradov *et al.*, 1962; Serebryannyy *et al.*, 1962).

9600 ± 300
Mo-316. Ligovka River, Leningrad Oblast [7650 B.C.]

Wood from same area as Mo-315, but from sediments of II Baltic Ice Lake.

Mo-256. Mikulino village, Smolensk Oblast >34,000

Peat, with plant remains from Mikulino village [55° 00′ N Lat, 31° 05′ E Long], Rudnya Raion, Smolensk Oblast. From shallow ravine, which cuts across moraine plateau on which Mikulino is located. Overlain by lacustrine silt and till; underlain by gyttja, sand, and till. Inferred age from pollen data: ca. 64,000 yr. Coll. 1958 by N. S. Chebotareva.

* Published as, "The determination of absolute age according to C^{14}. Report No. 4," Geokhimiya, 1963, no. 9, p. 795-811. Submitted as part of Radiocarbon Dates from Soviet Laboratories, 1 January 1962-1 January 1966. See p. 417, this issue.

** Information in brackets interpolated by translator (E.M.S.) and commentator (D.B.S.).

Mo-304. Cheremukha River, Yaroslavl' Oblast **>29,000**

Wood from lacustrine sediments in terrace on Cheremukha R. [58° 00′ N Lat, 37° 50′ E Long], right tributary of Volga R., S of Rybinsk. Coll. 1962 by N. S. Chebotareva. [Sediments comprise SE rim of Mologo-Sheksnya Basin. Sample apparently from silty gray loam 0.3 to 2.3 m above water level (Arslanov *et al.*, 1966).] This stratum previously determined at 42,000 to 43,000 yr (Starik and Arslanov, 1961), is significantly younger than generally accepted age of Mikulino Interglacial. [42,000 to 43,000 yr age might be interpolation between LE-66A and LE-70A (Arslanov *et al.*, 1966) for position of sample rather than true date. Pollen data had indicated either Mikulino or Mologo-Sheksnya (Paudorf) age for these deposits; (Cf. LG-6A, All-Union Geol. Inst., 1968). [*D.B.S.*]

Mo-307. Chermenino, Yaroslavl' Oblast **>28,000**

Wood from depth 2 m in 14 m terrace of Volga R. at Chermenino [58° 00′ N Lat, 37° 50′ E Long] S of Rybinsk. Coll. 1962 by N. S. Chebotareva. Cross section reveals sediments [gray silty loams, 8 m thick, with plant remains and freshwater molluscs] of [supposed] Mologo-Sheksnya [Paudorf Interstadial] lake overlain by [4 m thick] sands [late Würm (?)] with pebbles, animal remains, and wood. Sample from plant remains in these sands. Age of sands determined earlier as 25,900 ± 900 yr (Le-21) and 28,800 ± 2000 yr (Le-22) (Neustadt, 1965, p. 65; Starik and Arslanov, 1961). *Comment* (D.B.S.): earlier determinations of wood samples had to be repeated from new sample because of possible contamination; (Cf. also Le-64, Khlopin Inst. I, 1968 and LG-5, 4A and 4B, All-Union Geol. Inst I, 1968). Information in brackets from Arslanov *et al.*, 1966, p. 136.

Desna River series

3880 ± 180
Mo-289. Desna River, Bryansk Oblast **[1930 B.C.]**

Buried soil, deposited on loess ["post-loessal"], from right bank of Desna R. [53° 10′ N Lat, 34° 20′ E Long], from plateau in Bryansk Oblast. Coll. 1962 by T. D. Morozova and A. A. Velichko, Geog. Inst., Acad. of Sci., USSR. Depth 0.4 m. Inferred geologic age: Late Pleistocene; inferred archaeologic age: end of Upper Paleolithic (Velichko *et al.*, 1964).

All humic substances were fully extracted from sample.

3150 ± 180
Mo-336. Desna River, Bryansk Oblast **[1200 B.C.]**

Soil from same location but with extraction of . . . organic substances prior to extraction of tightly bound forms of humic acids and humins [*guminov*], (Cf. Mo-337 and 342, Vernadsky Inst. I-IV, 1966.) [*D.B.S.*]

Mo-249. Imnati Peat Deposit, Georgian SSR (revised) <100

Peat from Poti bog ca. 8 km SE of Poti [42° 10′ N Lat, 42° 25′ E Long] Georgian SSR, from depth 1.75 to 2.0 m. Pollen data indicate age of 1000 to 1500 yr. Coll. 1961 by N. A. Khotinskiy, Geog. Inst., Acad. of Sci., USSR. [See Neustadt, 1965, p. 106 for detailed description of cross section. *D.B.S.*].

Mo-290. Lake Baikal, Buryat-Mongol ASSR >28,000

Wood from sand, at depth 16.45 to 17.45 m below water surface, S Lake Baikal, near Solzan settlement [ca. 52° 00′ N Lat, 106° 00′ E Long]. Hard bottom at 20 m below surface. Coll [n.d.] by L. V. Tauson, Inst. of Geochem., Siberian Div., Acad. of Sci., USSR.

1040 ± 120
Mo-258. Victoria Islands, Soviet Arctic (revised) [A.D. 910]

Driftwood from Victoria Islands [ca. 80° 15′ N Lat, 37° 30′ E Long] in W sector of Soviet Arctic, from surface of marine terrace at Cape Knipovich, alt. 5.5 m. Driftwood had melted out from under ice dome in 1961. Inferred age: boundary between Upper and Middle Holocene (Grosval'd *et al.*, 1961, 1963, 1964). Subm. by M. G. Grosval'd, Geog. Inst., Acad. of Sci., USSR.

REFERENCES appear on p. 463.

[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 454-464]

RADIOCARBON DATING IN THE VERNADSKY INSTITUTE V*

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28,900 ± 600
Mo-422. Mende village, Hungary **[26,950 B.C.]** **

Charcoal from layer of buried soil from old brick works in Mende, Hungary (47° 30′ N Lat, 19° 30′ E Long) [unconfirmed, *D.B.S.*]. Deposits are humic loess loams, containing bits of charcoal. Sample at depth ca. 6.5 m. This cross section is one of classical loess excavations in Hungary. Sample coll. 1964, by M. Pechi [Pecs] and D. Khan [Hahn].

Mo-105. Bayya-de-F'yer, Romania **>29,000**

Bone of bear from campsite Bayya-de-F'yer [(?) Baia de Fier: ca. 45° N Lat, 23° E Long] in region of Kraynova [(?) Craiova] in W Romania. Campsite, discovered 1951 by K. S. Nikolescu-Plopshor, contains bones of primitive man and animals with quartzite implements. Sample subm. by N. Khaas [Haas]. *Comment*: age determined from organic fraction of bone.

Mo-423. Starun' village, L'vov Oblast, Ukrainian SSR **>33,000**

Remains of carcass of woolly rhinoceros (*Rhinoceros antiquus*) from region of Starun' village [unlocated], L'vov Oblast [46° 50′ N Lat, 24° 00′ E Long], Ukrainian SSR. Inferred age: last glacial epoch. Subm. [n.d.] by K. K. Markov.

5810 ± 150
Mo-417. Vulkaneshty II site, Moldavian SSR **[3860 B.C.]**

Fragment of charred wooden block from shore of Kagul R., Vulkaneshty village [45° 40′ N Lat, 28° 25′ E Long], a raion center in Moldavian SSR. Sample from foundation of dwelling at campsite Vulkaneshty II, belonging to Gumel'nitsa culture distributed along lower Danube in 4th to 3rd millennia B.C. (Gimbutas, 1956). Excavations conducted 1964 by archaeological expedition of Inst. of Archaeol., Acad. of Sci., USSR and Inst. of History, Acad. of Sci., Moldavian SSR. Subm. by T. S. Passek. *Comment* (D.B.S.): Gumel'nitsa settlements were recently discovered in USSR. The type site is in Romania.

Mo-202. Purmalyay I, Lithuanian SSR (revised) **>35,000**

Peat from Purmalyay I settlement, Klaipeda region [55° 40′ N Lat, 21° 10′ E Long], Lithuanian SSR, at depth 20 m, overlain by sand with

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** Information in brackets interpolated by translator (E.M.S.) and commentator (D.B.S.).

admixture of organic substances (thickness, ca. 4 m) covered by 6 m stratum of loam containing boulders. Sand with admixture of organic substances also underlies peat. Coll. 1960, and subm. by V. K. Gudelis, Geol. and Geog. Inst., Acad. of Sci., Lithuanian SSR. Inferred age: interstadial, evidently pertaining to last Glaciation.

Venta River series

Mo-224. Venta River, Latvian SSR **7110 ± 170 [5160 B.C.]**

Peat from left bank of Venta R. [57° 15′ N Lat, 21° 35′ E Long] at Varve, 10 km S of Ventspils, Latvian SSR. Venta R. in this area cuts through Littorina lagoons and older deposits. Samples Mo-224 and 225 coll. 1960 by E. F. Grinbergs. From stratum of bottom [*nizhniy*] woody peat, 0.27 m thick and from lower part of superimposed stratum of sapropel-type sediments 0.4 m thick containing streaks of sand and fresh-water mollusc shells. Upper part of cross section holds sandy-pebbly shoreline deposits. Absolute height of crown of exposure is 7.5 m; that of foot of peat stratum is 4.4 m. Peat is overlain by thinly-grained sands, extending under water level of Venta R. Inferred age: beginning of Atlantic phase of Holocene.

Mo-225. Venta River, Latvian SSR **8970 ± 180 [7020 B.C.]**

Sandy sapropel from left bank of Venta R. at city limits of Ventspils [57° 20′ N Lat, 21° 32′ E Long] where Venta R. cuts through estuary portion of lagoon of Littorina Sea. Absolute height of crown of exposure is 4 m. Fine-grained sand 2.5 m thick, and sandy sapropel with shells of fresh-water molluscs 0.3 m thick overlie dusty, blue-gray clays 0.6 m thick. According to pollen and diatom data, clays were accumulated during transgression of Ancylus Lake; sapropels during regression of lake; and sands during transgression of Littorina Sea. Inferred age: end of Boreal or beginning of Atlantic phase of Holocene.

Mo-375. Karukyula, Estonian SSR **>33,000**

Peat from bog in stratigraphic section at Karukyula [58° 04′ N Lat, 25° 00′ E Long], on plain formed by basic moraine, 7 km S of Kilingi-Nymme, Pyarnu [Pärnu] Raion, Estonian SSR. Cross section reveals: soil horizon; alluvium with gravel and pebbles (moraine); sand, containing peat and peat with lenses of sand; layer of woody, woody-*Equisetum* and *Equisetum* peats; clayey sapropel; aleurites and medium-grained sand. Sample from woody peat at depth 1.49 to 1.64 m. Inferred age from pollen data: upper climatic optimum of Mikulino [Eem] Interglacial (Orviku and Pirrus, 1965). Coll. 1963 by R. O. Pirrus, Acad. of Sci., Estonian SSR.

Mo-223. Keila-Ioa, Estonian SSR **7180 ± 270 [5230 B.C.]**

Gyttja from Keila-Ioa settlement [59° 15′ N Lat, 24° 25′ E Long], 20 km SW of Tallin. Sample is synchronous with formation of peat lens

20 to 34 cm thick, underlain by thin stratum of sand (up to 4 cm), and carbonaceous bedrock. Peat is 3 m below high water mark of old shoreline, 23 m above [present] sea level, and synchronous with shoreline of First Littorina Transgression. Age could correspond to beginning of Atlantic phase of Holocene. Coll. 1960 by Kh. Ya. Kessel.

Mo-222. Saaremaa Island, Estonian SSR **8400 ± 190** **[6450 B.C.]**

Woody peat and gyttja from Saaremaa Island [ca. 58° 30′ N Lat, 22° 30′ E Long], Estonian SSR. Solid mass ca. 20 cm long from buried peat deposit underlain with sand at 4 m above surface of carbonaceous bedrock, and 2.5 m beneath high water mark of ancient shoreline, 17 m above sea level. Peat deposit is synchronous with shoreline of 2nd Littorina Transgression; inferred age pre-dates this Transgression. Coll. 1960 by Kh. Ya. Kessel.

Sooniste Peat Bog series

Peat deposit of Sooniste (Eliste) [ca. 59° 35′ N Lat, 24° 45′ E Long], near Tallin, Estonian SSR. Bog is of upper [recent] type from which peat is currently extracted. After thorough cleaning, samples were taken from pit in 1962 by M. I. Neustadt, Geog. Inst., Acad. of Sci., USSR and R. P. Myannil' (at suggestion of K. K. Orviku). (Cf. Neustadt, 1965, p. 124-29. [*D.B.S.*])

Mo-363. **1160 ± 100** **[A.D. 790]**

Fuscum peat, sphagnous, depth 0.32 to 0.38 m. Decomposed, 5%. Inferred age: Sub-Atlantic.

Mo-365. **2450 ± 120** **[500 B.C.]**

Pine peat with carbonaceous layer, depth, 1.35 to 1.40 m, Boundary Horizon (Cf. Neustadt, 1965, p. 116-24).

Mo-366. **4630 ± 200** **[2680 B.C.]**

Reed peat, depth, 1.90 to 1.95 m. Decomposed, 20%. Inferred age: end of Atlantic.

Mo-367. **5960 ± 150** **[4010 B.C.]**

Wood and reed peat, depth, 2.70 to 2.75 m. Decomposed, 25%. Inferred age: Atlantic.

Mo-368. **9280 ± 200** **[7330 B.C.]**

Wood peat, depth, 3.57 to 3.62 m (base of peat body). Decomposed, 50%. Inferred age: Boreal.

Mo-369. **2860 ± 180** **[910 B.C.]**

Wood from stump at Boundary Horizon, depth 1.4 m. Inferred age: 4000 to 4500 yr.

Chyornaya River series

7140 ± 170
Mo-216. Chyornaya River, Leningrad Oblast [5190 B.C.]

Peat from buried deposit on left bank of Chyornaya R. [60° 12′ N Lat, 29° 33′ E Long], 7 km W of Zelyonogorsk, Leningrad Oblast. Peat stratum, with aggregate thickness 22 cm, is buried under sandy-pebbly deposits of shoreline [*beregovoy val*] with absolute elev. up to 16 m; underlain by compact dark-gray gyttja. Sample from upper part of peat stratum, 8 cm thick, at depth 4 m from crown of exposure, 6 m above water level of Chyornaya R. Inferred age: beginning or middle of Atlantic phase of Holocene. Coll. 1960 by L. R. Serebryannyy, Geog. Inst., Acad. of Sci., USSR.

7240 ± 170
Mo-217. Chyornaya River, Leningrad Oblast [5290 B.C.]

Wood from same cross section as Mo-216, 4.4 m from crown [of exposure], 5.6 m above water level of Chyornaya R. Sample from upper part of compact dark-gray gyttja ca. 2 m thick. Inferred age: beginning of Atlantic phase of Holocene.

Kovashi River series

7810 ± 170
Mo-218. Kovashi River, Leningrad Oblast [5860 B.C.]

Peat from right bank of Kovashi R. [ca. 59° 55′ N Lat, 29° 15′ E Long] at Sosnovyy Bor, Leningrad Oblast. Black, strongly-compacted peat 0.4 m thick is overlain by layer of sand with loamy streaks, and overlies sandy stratum. Sample at depth 1.8 m from crown of exposure and 0.7 m above water level of Kovashi R. Inferred age: beginning of Atlantic phase of Holocene. Samples Mo-218 and 220 coll. 1960 by L. R. Serebryannyy.

7720 ± 180
Mo-220. Kovashi River, Leningrad Oblast [5770 B.C.]

Wood peat from right bank of Kovashi R., E of highway bridge at Kalishche [59° 53′ N Lat, 29° 08′ E Long], Leningrad Oblast. Sample black, very compact, and saturated with plant remains; coll. at depth 8.2 m from crown of exposure, 1.8 m above water level of Kovashi R.; overlain by layer of sand with streaks of loam; overlies sands. Inferred age: beginning of Atlantic phase of Holocene.

Shuvalovo Peat Bog series

Peat from Shuvalovo bog [60° 00′ N Lat, 30° 20′ E Long], on outskirts of Leningrad. Samples are from buried peat layer, 10 cm thick, in W part of bog near Shuvalovo Peat Establishment settlement. Samples Mo-358, 359 coll. 1963 by N. A. Khotinskiy, Geog. Inst., Acad. of Sci., USSR. (Cf. Mo-319-325, Vernadsky Inst. I-IV, 1966).

3930 ± 200
Mo-358. Shuvalovo Peat Bog, Leningrad Oblast [1980 B.C.]

Peat from depth 0.10 to 0.15 m. Stratigraphic position suggests layer older than Shuvalovo Bog, lower horizons of which were formed ca. 9000 yr ago.

2040 ± 160
Mo-359. Shuvalovo Peat Bog, Leningrad Oblast [90 B.C.]

Peat from depth 0.15 to 0.20 m. *Comment*: assumption concerning relationship of buried peat deposit with initial deposition of Shuvalovo bog is not confirmed.

12,430 ± 400
Mo-374. Lovat' River, Pskov Oblast [10,480 B.C.]

Plant remains from right bank of Lovat' R. [56° 15′ N Lat, 30° 25′ E Long], at Ryzhakovo village, 7 km S of Velikiye Luki, Pskov Oblast. [Site located on W margin of glacial lake bordering Latgalian moraine (see map opp. p. 28, Zarrina, 1966).] Excavation exposed sandy deposits with inclusion of gravel and layers of silty sand and aleurites, interlayered with small- and coarse-grained sand and subsequently sandy clays. Total depth of excavation is 10 m. Sample taken at depth 4.7 m. Conjectured age is not more than 16,000 yr. Pollen diagram, by R. V. Fedorova, shows that time of sediment accumulation was characterized by flora with Arctic elements. Research was conducted to determine time of glacial recession from Valday in its SW part. Coll. 1963 by N. S. Chebotareva.

Vologda Oblast

2870 ± 180
Mo-376. Pudyozhka River, Vologda Oblast [830 B.C.]

Plant remains from cross section of flood plain on left bank of Pudyozhka R. [59° 20′ N Lat, 39° 40′ E Long] (right-hand tributary of Vologda R.), in basin of Sukhona R., 10 km NNW of Vologda. Sample from sand which forms terrace at depth 1.15 to 1.45 m, from stratum of gray and peaty sand. Coll. 1963 by N. S. Chebotareva and V. B. Sokolova.

10,860 ± 320
Mo-377. Vologda River, Vologda Oblast [8910 B.C.]

Plant remains from cross section of I terrace above flood plain on right bank of Vologda R. [59° 18′ N Lat, 39° 41′ E Long], at Marfino village, 14 km NW of Vologda. Coll. 1963 by N. S. Chebotareva and V. B. Sokolova, at depth 4.7 m from upper part of stratum, which forms base of cross section, consisting of bluish-gray loams and alluvia with plant remains.

10,000 ± 310
Mo-379. Sodima River, Vologda Oblast [8050 B.C.]

Peat from cross section of Vologda Basin exposed by Sodima R., tributary of Vologda R. Sample coll. 1963 by N. S. Chebotareva and

V. B. Sokolova from left bank, on SW edge of Vologda [59° 15′ N Lat, 39° 55′ E Long], at depth 1.2 m. Layers of peat several cm thick occur on riverbank cliff in layer of gray loam. Accumulation of sediments could have occurred during interstadial of Valday [Würm] Glaciation. Age [of cross section] according to pollen data, is not clear.

3720 ± 130
Mo-381. Toshnya River, Vologda Oblast **[1770 B.C.]**

Wood and plant remains from cross section of flood plain, left bank of Toshnya R. (basin of Sukhona R.), at Runovo [59° 15′ N Lat, 39° 40′ E Long], 18 km WSW of Vologda. Sample coll. 1963 by N. S. Chebotareva and V. B. Sokolova at depth 4.1 m in layer of dark-gray clay and thin layers of light yellow, fine-grained sand from 3rd and most extensive terrace of Toshnya R. valley.

Mo-401. Ema River, Vologda Oblast **>33,000**

Plant remains from cross section of terrace-like surface on left bank of Ema R. (basin of Sukhona R.) at Voskresenskoye, Vologda Oblast, 15 km SW of Vologda [59° 15′ N Lat, 39° 55′ E Long. Location relative to Vologda appears improbable; Ema R. is believed to be S of Vologda; most likely location of site is 59° 05′ N Lat, 40° 00′ E Long. (*D.B.S.*)] Sample coll. 1963 by N. S. Chebotareva and V. B. Sokolova from thinly layered silts and loam with streaks of peaty gyttja, at depth 6 m. *Comment*: according to pollen data, climatic conditions were cool at time deposits were accumulated, but date is not certain. Deposits could have accumulated either during last Interglacial (beginning or end) or during early interstadials of Valday [Würm] Glaciation. Age is not less than 30,000 yr.

Mo-402. Anchakovo, Vologda Oblast **>33,000**

Peat from Boring No. 2 on [Sukhona-Sheksnya] water divide with absolute alt. up to 161 m, from flat depression of surface at Anchakovo [59° 10′ N Lat, 39° 00′ E Long], Vologda Oblast, ca. 40 km SW of Vologda. Sample coll. 1963 by N. S. Chebotareva and V. B. Sokolova at depth 2.3 to 2.85 m. Accumulation of peat, overlain by sand and boulderless loess-type loams could have occurred during Mikulino [Eem] Interglacial, or during interstadial of Valday [Würm] Glaciation.

Polovetsk-Kupanskoye Bog series, Yaroslavl' Oblast

Bog [56° 45′ N Lat, 38° 25′ E Long] is in Pereslavl' Raion, Yaroslavl' Oblast. Gyttja accumulated during Valday [Würm] Glaciation. Samples subm. 1964 by N. A. Khotinskiy, Geog. Inst., Acad. of Sci., USSR. Inferred age from pollen data: 13,000 to 14,000 yr.

Mo-405. **>35,000**

Gyttja. Depth 8.30 to 8.80 m.

Mo-406. **>35,000**

Gyttja. From same cross section [as Mo-405], but at depth 8.80 to 9.4 m.

Mo-380. Sogozha River, Yaroslavl' Oblast **2400 ± 180 [450 B.C.]**

Wood from cross section of flood-plain terrace on left bank of Sogozha R. at Teleshovo [58° 45′ N Lat, 39° 15′ E Long], 60 km SW of Vologda. Sample coll. 1963 by N. S. Chebotareva and V. B. Sokolova, at depth 4.5 m, from stratum of light-blue clay containing plant remains and wood. This terrace is most extensive in Sogozha R. valley.

Mo-362. Kamennyy Ovrag peat deposit, Vladimir Oblast **>35,000**

Peat from Kamennyy Ovrag peat deposit [56° 22′ N Lat, 40° 22′ E Long], at Yakimanka village, 20 km N of Vladimir and 8 km SE of Suzdal', Suzdal' Raion, Vladimir Oblast. Deposit lies in layer of lake-bog deposits covering depression in surface of Dnepr moraine. Outlet of peat deposit is at base of left slope of Kamennyy Ovrag [Ravine], 1 km from mouth of ravine [and empties into] Nerl' R. From top to bottom cross section is as follows, thickness indicated:

a. superficial loams, 5 m.
b. light bluish-gray stratified alluvium, 1.2 m.
c. Blackish-brown peat with plant remains, 1.05 m (sample for C^{14} analysis was taken from lower 3rd of stratum).
d. peaty, brownish alluvium, 0.45 m.
e. blackish-green sapropel, 0.45 m.
f. stratified gray alluvium, 0.45 m.
g. fine-grained, water-bearing sand, 0.1 m.

Sample coll. 1963 by S. M. Tseytlin. Inferred age of peat deposit, according to palaeobotanical data: Mikulino [Eem] Interglacial. *Comment*: age of humus extracted from peat of this ravine is >45,000 yr (GIN-102a). [Note discrepancies in stratigraphy between Mo-362 and GIN-102a, Geol. Inst. I-III, 1968. (*D.B.S.*)]

Mo-241. Teysheb-baini fortress, Armenian SSR **2640 ± 100 [690 B.C.]**

Charred wheat from fortress of Teysheb-baini (ancient state of Urartu), [40° 11′ N Lat, 44° 35′ E Long], on Karmir-blur hill, 4 to 5 km from Erevan. Sample subm. by N. I. Khitarov. Inferred age: 6th century B.C. *Comment*: date agrees well with previous age determination of scorched wood from identical region: 2600 ± 135 yr (GIN-1, Geol. Inst. I-III, 1968).

Ancient mines, Armenian SSR

These samples are connected with development of mining in Armenia.

Mo-356. Agartsin River valley, Armenian SSR **1330 ± 140 [A.D. 620]**

Fragments of charcoal from large accumulation of slag, valley of Agartsin R. in Idzhevan Raion [Idzhevan City, 40° 52′ N Lat, 45° 10′ E Long], Armenian SSR. Sample coll. 1962 by S. E. Goginyan at depth 1 m in slag ca. 2 m thick. Sample from region of remains of metallurgical works and ancient settlement, probably center of birthplace of metallurgy [*sic*]. Objects found at site belong to 5th or 6th millennium B.C.

1540 ± 160
Mo-357. Gamzachiman, Armenian SSR **[A.D. 410]**

Piece of old pit-prop from ancient mine 30 m below surface at Gamzachiman village, Spitak Raion, [40° 50′ N Lat, 44° 40′ E Long], Armenian SSR. Archaeological information about this location is lacking. Mine probably was exploited for gold in 3rd to 6th centuries A.D. Sample coll. 1962 by S. E. Goginyan.

Ayat Peat Deposit series

Ayat peat bog [57° 00′ N Lat, 60° 15′ E Long] (formerly Chernov) is in Nev'yansk Raion, Sverdlovsk Oblast, 30 km NW of Sverdlovsk. Samples for C^{14} and pollen analysis from middle of bog in Pit No. 4, in recent (Neustadt, 1965, p. 124-129) *fuscum peat,* 5 to 6 m thick. Subm. 1963 by N. A. Khotinskiy.

3510 ± 90
Mo-386. **[1560 B.C.]**

Fuscum peat, depth, 1.70 to 1.75 m. Decomposed, 5%.

3960 ± 130
Mo-388. **[2010 B.C.]**

Fuscum peat with *Eriophorum vaginatum*. Depth, 2.55 to 2.60 m. Decomposed, 5 to 10%. Inferred age: 3000 to 4000 yr.

4630 ± 150
Mo-389. **[2680 B.C.]**

Wood from Boundary Horizon (Neustadt, 1965, p. 70). Depth, 2.65 m. Inferred age: 4000 to 4500 yr.

4720 ± 200
Mo-390. **[2770 B.C.]**

Pine, *Eriophorum vaginatum* peat from Boundary Horizon (Neustadt, 1965, p. 70), depth, 2.70 to 2.75 m. Decomposed, 30 to 40%. Inferred age: ca. 5000 yr.

6230 ± 150
Mo-394. **[4280 B.C.]**

Carex peat, depth, 3.45 to 3.50 m. Decomposed, 25%.

9110 ± 150
Mo-397. **[7160 B.C.]**

Carex-Hypnum peat, depth, 5.20 to 5.25 m. Decomposed, 20 to 30%. Inferred age: ca. 9000 yr.

9780 ± 210
Mo-398. **[7830 B.C.]**

Reedy-*Hypnum* peat with *Carex*. Depth, 5.40 to 5.45 m. Decomposed, 25%. Inferred age: 9000 to 10,000 yr.

Arctic Regions

Mo-382. Denmark Strait, Greenland Sea **>200**

Fossilized wood perforated by teredo molluscs from surface of sea bottom at depth 970 m in center Denmark Strait, 200 km N of Iceland [67° 55′ N Lat, 20° 15′ W Long]. Sample coll. 1959 by V. D. Dibner during bottom-charting voyage of research vessel "Sevastopol'" along with gravelly material evidently pertaining to deeply submerged bank.

810 ± 70
Mo-415. Hornsund Bay, Vest Spitsbergen **[A.D. 1140]**

Driftwood from marine terrace 38 m above sea level at Vest Spitsbergen, Treskelen Peninsula [? Torrell Land] on shore of Hornsund Bay [76° 58′ N Lat, 16° 20′ E Long]. Coll [n.d.] by D. V. Semevskiy. *Comment*: driftwood evidently was redeposited by a glacier.

5070 ± 100
Mo-416. Edgeöya, Spitsbergen **[3120 B.C.]**

Driftwood from marine terrace 50 m above sea level from Edzh Island [Edgeöya], on shore of Blåfjord, [ca. 78° 00′ N Lat, 20° 30′ E Long], S of Cape Pekhuel Lesha [?]. Coll. [n.d.] by V. N. Vasil'yev.

Barentsöya series

4060 ± 100
Mo-418. Barentsöya, Spitsbergen **[2110 B.C.]**

Driftwood from marine terrace 20 m above sea level at Barents Island, Talaver Peninsula [?] [ca. 78° 30′ N Lat, 20° 30′ E Long]. Coll. [n.d.] by V. N. Vasil'yev.

2400 ± 120
Mo-419. Barentsöya, Spitsbergen **[450 B.C.]**

Driftwood from cross section of marine terrace 5.5 m above sea level, at Barents Island, in region of Cape Barkham [78° 13′ N Lat, 20° 40′ E Long]. Coll. [n.d.] by B. A. Klubov.

3190 ± 130
Mo-420. Barentsöya, Spitsbergen **[1240 B.C.]**

Driftwood coll. by B. A. Klubov in same place as Mo-419, at elev. 11 m.

1550 ± 120
Mo-421. Alexandra Land Island, Franz Josef Land **A.D. 400**

Driftwood from surface of ledge among undisturbed marine deposits. Sample from Franz Josef Land, Alexandra Land Island on shore of Dezhnev Sound [80° 45′ N Lat, 47° 00′ E Long]. Absolute elev.: 5 m. Inferred age: 2500 to 3000 yr. Coll. 1964 by Yu. A. Lavrushin.

India

1460 ± 160
Mo-352. Kolar, India **[A.D. 490]**

Carbonaceous material from burned pit prop or bonfire from ancient gold mine at Kolar, India (13° 10′ N Lat, 78° 20′ E Long), 75 km

E of Bangalore, Sample belongs to period of early mining ca. 2000 yr ago. Subm. 1963 by A. I. Tugarinov.

Cuba

1000 ± 100

Mo-399. Aguas Gordas, Oriente Province, Cuba **[A.D. 950]**

Charred wood from Aguas Gordas, in Banes municipality, Oriente Prov. (21° 05′ N Lat, 75° 43′ W Long). [Text gives 20° 05′ N, which is not possible, since town of Banes lies almost exactly on 21st parallel. (D.B.S.)] Ten mounds were uncovered; sample taken from Mound 1 at depth 1.5 to 2 m. Cultural layer was 3.1 m thick. Tentative age estimation based on thickness of cultural stratum: 500 to 750 yr.

Mo-400. El Porvenir, Oriente Province, Cuba **<100**

Charred wood from El Porvenir, in Banes municipality, Oriente Province, 11 km from site of Mo-399 (21° 06′ N Lat, 75° 49′ W Long). Of 13 mounds discovered, several contained fragments of Spanish pottery, iron objects, and other finds of colonial period (16th century A.D.). Height of mounds less than at Aguas Gordas. Sample from Mound 11 at depth 0 to 0.25 m. *Comment*: since sample was taken from stratum close to surface, spurious selection is not to be ruled out.

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[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 465]

TARTU RADIOCARBON DATES I (REVISIONS)*

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TA-52. Age: 7375 ± 190
[5425 B.C.]

TA-26. Depth: 35 to 60 cm.

TA-36. Age: ≧30,000; also, "pollen of pine and birch predominate in pollen-analysis spectrum."

TA-50. Age: 15,500 ± 575
[13,550 B.C.]

TA-45. Age: ≧30,000

TA-46. Age: ≧30,000

TA-55. ". . . . , above the peat are coastal deposits of the Littorina Sea (L_{II})."

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* Revisions to TA dates published in Radiocarbon, v. 8, 1966, which appear in Grichuk *et al.*, 1966. Submitted as part of Radiocarbon Dates from Soviet laboratories, 1 January 1962-1 January 1966. See p. 417, this issue.

[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 466-467]

TBILISI RADIOCARBON DATES I*

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Uplistsikhe series

3075 ± 150

TB-1. Uplistsikhe, Georgian SSR **[1125 B.C.]****

Charcoal from Uplistsikhe village [unlocated], Katlanis Khevi. Archaeologic date: late Bronze age, 12th to 7th centuries B.C. Subm. [n.d.] by D. Khakhutashvili.

1985 ± 140

TB-2. Uplistsikhe, Georgian SSR **[35 B.C.]**

Charcoal from Uplistsikhe village [Cf. TB-1], Bambebi hamlet. Archaeologic date: early Hellenistic period, 5th to 3rd centuries B.C. [*sic*]. Subm. [n.d.] by D. Khakhutashvili.

Mt. Amiranis site series, Georgian SSR

3720 ± 165

TB-3. Mt. Amiranis **[1770 B.C.]**

Charcoal from Akhaltsikhe city, Mt. Amiranis [41° 38′ N Lat, 42° 58′ E Long], Habitation XX. Archaeologic date: early Bronze age, 30th to 26th centuries B.C. Samples TB-3, 4, and 9 subm. [n.d.] by T. Chubinishvili.

4835 ± 180

TB-4. Mt. Amiranis **[2285 B.C.]**

Charcoal from Habitation III. Archaeologic date: early Bronze age, 29th to 26th centuries B.C.

4625 ± 170

TB-9. Mt. Amiranis **[2340 B.C.]**

Charcoal from Habitation XXIX. Archaeologic date: early Bronze age, 28th to 24th centuries B.C. [Cf. TA-47, Tartu I, 1966; RUL-278, Inst. of Archaeol., 1965. (*D.B.S.*)]

3470 ± 190

TB-5. Chaladidi, Georgian SSR **[1520 B.C.]**

Charcoal from Chaladidi village [unlocated], Zurga. Archaeologic date: late Bronze age, 14th to 10th centuries B.C. Subm. [n.d.] by T. Mikeladze.

2600 ± 145

TB-6. Sakorkio, Georgian SSR **[650 B.C.]**

Charcoal from Sakorkio village [unlocated], Simagre. Archaeologic date: early Classical era, 6th to 4th centuries B.C. Subm. [n.d.] by T. Mikeladze.

* Submitted as part of Radiocarbon Dates from Soviet laboratories, 1 January 1962-1 January 1966. See p. 417, this issue.

** Information in brackets interpolated by translator (E.M.S.) and commentator (D.B.S.).

1480 ± 130
[A.D. 470]

TB-8. Mtskheta, Georgian SSR

Charcoal from Mtskheta city, [41° 52′ N Lat, 44° 43′ E Long]. Archaeologic date: Feudal, 4th to 5th centuries A.D. Subm. [n.d.] by A. Kalandadze.

Marneuli series, Georgian SSR

2870 ± 160
[920 B.C.]

TB-14. Marneuli

Charcoal from Geo-tepe [site] [41° 27′ N Lat, 44° 47′ E Long]. Archaeologic date: early Iron age, 6th to 7th centuries B.C. Subm. [n.d.] by T. Chubinishvili.

5920 ± 300
[3970 B.C.]

TB-15. Marneuli

Charcoal from Marneuli, Shulaver I mound; depth, 2.2 m. Archaeologic date: early Eneolithic, beginning of 5th millennium B.C. Subm. [n.d.] by A. Dzhavakhishvili.

6625 ± 210
[4675 B.C.]

TB-16. Marneuli

Charcoal from Marneuli, Shulaver I mound; depth, 4.4 m. Archaeologic date: early Eneolithic, beginning of 5th millennium B.C.

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[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 468-472]

MASS SPECTROMETRIC STUDIES OF CARBON 13 VARIATIONS IN CORN AND OTHER GRASSES

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Our experience in radiocarbon dating has shown that dates obtained from samples of corn cob and kernels are usually too young compared with dates from wood samples. Since other laboratories have also commented on the same problem, a study of C^{13}/C^{12} ratios in corn and other plant materials has been undertaken.

The fact that all plants discriminate against C^{13} in photosynthesis has been well documented (Wickman, 1952, Craig, 1953 and 1954). The range for δC^{13} relative to the Pee Dee belemnite (PDB) standard of the Univ. of Chicago has been established as −20 to −30‰, an average of −25‰, for wood and most terrestrial plant materials. Mass spectrometric analyses of corn cob and kernels have, however, shown a range of −10 to −12‰ (Stuiver and Deevey, 1962, Hall, 1967a and 1967b, Tauber, 1967), and some grasses have shown δC^{13} values of the same magnitude (Craig, 1954, Hall, 1967b, Tauber, 1967). This anomalous enrichment in the heavy isotope of carbon in corn relative to wood has usually been attributed to the release of carbon dioxide from limestone soils or to differences in microclimatic conditions. Carbon dioxide from ancient limestone soils should, however, make the radiocarbon age too old rather than too young.

Both modern and prehistoric corn samples, *Zea mays*, from a variety of locations have been analyzed and the C^{13}/C^{12} ratio has been found to be approximately constant (Table 1). These results are in agreement with the C^{13}/C^{12} values reported by other laboratories. Other grains and grasses grown on limestone soil adjacent to the corn were analyzed and it was found that soybeans, wheat, barley, timothy, and oats all had δC^{13} values in the same range as wood, −26.9 to −28.2‰ (Table 2). There was no apparent effect from limestone soil. One group of grasses, however, showed a consistent enrichment in C^{13} with δC^{13} similar to the corn; tropical grasses such as Sorghum, Sudan grass, sugarcane, and the millets (*Panicum miliaceum* and *Setaria italica*) showed δC^{13} values of −12.2 to −14.3‰ relative to the PDB standard, enriched in C^{13} compared to wood. Corn is itself a tropical grass.

Tropical grasses have been of much interest in recent years inasmuch as photosynthetic studies have demonstrated that the path of photosynthetic carbon dioxide fixation in sugarcane and other tropical grasses from several tribes of Gramineae differs from the mechanism operative in other plants (Kortschak, Hartt, and Burr, 1965, and Hatch, Slack, and Johnson, 1967). Moreover the rate of photosynthesis of tropical grasses is higher than the rate for grasses of temperate origin (El-Sharkawy and Hesketh, 1965). Such a pronounced difference in metabolism apparently also results in a difference in carbon isotopic fractionation.

TABLE 1

Mass Spectrometric Analyses of Corn Samples

Sample	Locality		δ_C C^{13} relative to PDB standard
Archaeologic samples			
charred corn kernels	Aztalan site, Dane County, Wisconsin (Middle Mississippian)		—11.1‰
charred corn cob	Clement site, McCurtain County, Oklahoma (McCurtain focus, Fulton aspect)		—12.4‰
charred corn cob	Marr site, Bryan County, Oklahoma (Bryan focus)		—12.6‰
corn cob (uncharred)	Aravaipa Canyon, Pinal County, Arizona (Hohokam)		—12.4‰
Modern sample			
corn cob (uncharred)	Price County, Wisconsin		—13.2‰
		average	—12.3‰

TABLE 2

Mass Spectrometric Analyses of Grasses (Gramineae) for C^{13}/C^{12} Ratios

Tribe	Genus	Species	Common name	δ_C C^{13} relative to PDB
Panicoideae sub-group				
Andropogoneae	*Saccharum*		Sugarcane	—13.7‰
Andropogoneae	*Sorghum*		Sorghum	—12.2‰
Andropogoneae	*Sorghum*	*sudanense*	Sudan grass	—13.0‰
Maydeae	*Zea*	*mays*	Corn	—11.1 to —13.2‰
Paniceae	*Paspalum*	*notatum*	Bahia grass	—13.2‰
Paniceae	*Digitaria*	*sanguinalis*	Crabgrass	—12.7‰
Paniceae	*Setaria*	*italica*	Millet	—13.3‰
Paniceae	*Setaria*	*viridis*	Green foxtail	—13.3‰
Paniceae	*Panicum*	*miliaceum*	Millet	—14.3‰
Paniceae	*Panicum*	*capillare*	Tumble panic grass	—14.5‰
Festucoideae sub-group				
Festuca	*Dactylis*	*glomerata*	Orchard grass	—26.6‰
Avena	*Avena*		Oats	—27.0‰
Hordea	*Triticum*	*sativum*	Wheat	—26.9‰
Hordea	*Hordeum*		Barley	—27.8‰
Agrostelia	*Phleum*		Timothy	—28.2‰

The grasses which have been shown by Hatch *et al.* (1967) to follow the photosynthetic pathway similar to sugarcane are taxonomically related and belong to the same two sub-groups, either the Panicoideae or the Chloridoideae (Stebbins, 1956, Prat, 1960). Wheat, oats, timothy, and barley are classified as belonging to the Festucoideae sub-group and their photosynthesis has been found to follow the Calvin cycle and not the sugarcane cycle. Other grasses analyzed on the mass spectrometer which belonged to the Festucoideae sub-group showed δC^{13} values of -26 to $-28‰$, those of the Panicoideae sub-group showed δC^{13} values of -11.1 to $-14.5‰$.

Since cereals and grasses have been extensively used for radiocarbon dating purposes, it is obvious that the material must be accurately identified or the carbon isotopic composition determined. Variations in the C^{14}/C^{12} ratio are accepted as being twice the variations in the C^{13}/C^{12} ratios (Rafter, 1955) and, as a result, an enrichment of about 13‰ in the C^{13} of corn used as a sample for radiocarbon dating would result in a 26‰ enrichment in C^{14} relative to wood; this would result in a radiocarbon age 210 years younger than wood of the same actual age.

The carbon isotope ratios were measured with a precision of $\pm$ 0.1‰ in $\delta_C C^{13}$ on carbon dioxide produced by combustion of the samples in a Parr bomb. All samples were treated with hot dilute HC1 to remove any occluded carbonates, washed with distilled water, and dried before combustion.

A Nuclide Corporation RMS6-60 isotope ratio mass spectrometer was employed in the comparison of the unknown CO_2 sample to a local tank standard. The resulting initial δ values were corrected for tailing of the m/e 44 peak, instrument background, and cross-contamination of samples through valve leakage. A shift of reference to the PDB standard was then made by comparing the local standard CO_2 with gas samples prepared by action of 85% and 100% phosphoric acid on a Pee Dee belemnite sample. The $\delta_C C^{13}$ values listed in Tables 1 and 2 were then calculated as described by Craig, assuming a value of 15‰ for $\delta 0^{18}$ for the combusted gas samples. Any error in these values due to lack of actual oxygen isotope ratio determinations, or to uncertainty in the instrument correction factors, can be expected to be negligible here.

In summary it should be noted that the variations in the C^{13}/C^{12} ratios in grasses depend upon the taxonomic relationships of the grasses and apparently not upon the soil or microclimate. Grasses from Tribes which are members of the Panicoideae sub-group may differ as much as +220 years and probably not less than +160 years in radiocarbon age from the average contemporary wood.

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[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 473-478]

UNIVERSITY OF WISCONSIN RADIOCARBON DATES V

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The radiocarbon dates obtained since August, 1967 are included in this report. The procedures followed have been described previously (Wisconsin II).

The reported dates have been calculated using 5568 as the half-life of C^{14}, 1950 as the reference year. Samples are run at least once in each of two counters at 3 atm pressure for a minimum of 15,000 counts. The standard deviation quoted includes only the 1σ of the counting statistics of background, sample, and standard counts.

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I. ARCHAEOLOGIC SAMPLES

A. Oklahoma

State School Land site, Delaware County (D1-64 and D1-65)

D1-64 (D1ScI) and D1-65 (D1ScII) are 2 spatially segregated occupation areas of School Land site, Delaware County, Oklahoma (36° 39′ N Lat, 94° 42′ W Long). Charcoal samples were excavated in 1939 and 1940 and subm. by D. A. Baerreis. Both units are predominantly Spiro focus components and fall within latter part of range of previously dated specimens from other sites of this complex in Delaware County, range being from A.D. 850 to A.D. 1280 (Wisconsin I: WIS-42, WIS-46, WIS-49; Wisconsin IV: WIS-243, WIS-246 to 247, WIS-249 to 253; Michigan V: M-819).

790 ± 60
WIS-255. Delaware County (D1-65) A.D. 1160

Specimen 34 from Sq. NE 34:1, Level 3, 8 to 12 in. below surface.

790 ± 55
WIS-257. Delaware County (D1-64) A.D. 1160

Specimen 450 from Sq. NE 14:18, Level 6, 24 to 30 in. below surface.

710 ± 55
WIS-258. Delaware County (D1-64) A.D. 1240

Specimen 453 from Sq. NE 10:3, Level 3, 8 to 12 in. below surface.

900 ± 50
WIS-259. Delaware County (D1-64) A.D. 1050

Specimen 1356 from Sq. NE 9:27, Ievel 2, 4 to 8 in. below surface.

870 ± 60
WIS-260. Delaware County (Dl-64) A.D. 1080

Specimen 1428 from Sq. NE 9:29, Level 4, 12 to 16 in. below surface.

560 ± 60
WIS-254. Cat Smith site, Oklahoma (Ms-52) A.D. 1390

Charcoal from Cat Smith site, Muskogee County, Oklahoma (35° 34′ N Lat, 95° 10′ W Long) coll. 1965 by T. P. Barr; subm. by D. A. Baerreis. Sample from House Pattern 1, charred post in Sq. O-N1, 18 in. depth. Artifacts included Woodward Plain, Maxey Noded Redware, and other clay-tempered pottery as well as such point types as Fresno, Washita, Reed, and Morris. Only 1 cultural component is present, apparently an early Fulton manifestation. Affiliations are with Fort Coffee focus (Wykoff and Barr, 1967).

500 ± 60
WIS-256. Sheffield site, Oklahoma (Sq-22) A.D. 1450

Charcoal from Sheffield site, Sequoyah County Oklahoma (35° 27′ N Lat, 95° 00′ W Long). Coll. 1966 by Don Wyckoff, Univ. of Oklahoma; subm. by D. A. Baerreis. Charcoal from Trench 1, Feature 4D, trash pit located in circular, semisubterranean house floor area. Site is single component and seems to be early Fort Coffee focus.

910 ± 55
WIS-261. Goff Shelter, Oklahoma (Ms-46) A.D. 1040

Charcoal from Goff Shelter, Muskogee County, Oklahoma (35° 36′ 45″ N Lat, 95° 16′ 11″ W Long). Coll. 1966 by F. Schneider; subm. by D. A. Baerreis. Sample from Feature 1, fire pit assoc. with late prehistoric (Fulton aspect) occupation. Bison was present along with shell-tempered pottery and small triangular arrow points.

B. Iowa

Broken Kettle site, Plymouth County, Iowa 13PM1

Soil samples, containing abundant charcoal which was subsequently removed by flotation, were obtained at Broken Kettle site, Plymouth County, Iowa (42° 38′ N Lat, 96° 36′ W Long). 13PM1, 1 of primary components for Big Sioux phase of Mill Creek culture, has been badly disturbed by early excavations. Samples coll. 1967 by R. Banks and D. A. Baerreis; subm. by D. A. Baerreis.

860 ± 55
WIS-272. Broken Kettle site (13PM1) A.D. 1090

Charcoal from soil sample in zone 0 to 6 in. above base of undisturbed cache pit in N margin of site.

930 ± 55
WIS-276. Broken Kettle site (13PM1) A.D. 1020

Material from soil sample coll. ca. 2 ft below top of midden in same area as WIS-272, 38 to 50 in. above base of deposit.

C. Missouri

WIS-266. Utz Site, Missouri 23SA2 **300 ± 55**
A.D. 1650

Charcoal from Utz site, Saline County, Missouri (39° 17′ N Lat, 93° 15′ W Long). Coll. 1950 by C. H. Chapman, Univ. of Missouri; subm. by D. R. Henning, Univ. of Missouri. Sample ca. 0.3 ft below plow zone in concentration near group of Oneota skeletons in excavation unit which yielded Oneota cultural materials.

D. Wisconsin

Walker-Hooper site series, Wisconsin 47GL65

Charcoal samples obtained from 1967 excavations conducted by Guy Gibbon at Walker-Hooper site in Green Lake County, Wisconsin (43° 42′ N Lat, 89° 09′ W Long). Walker-Hooper is type site for Grand R. focus, hitherto undated cultural unit within Oneota aspect (McKern, 1945).

WIS-268. Walker-Hooper site (47GL65) **710 ± 45**
A.D. 1240

Sample from cylindrical pit, Feature 8, Level 4.

WIS-270. Walker-Hooper site (47GL65) **720 ± 55**
A.D. 1230

Sample from bell-shaped pit, Feature 20, 1.5 to 2.0 ft below surface.

WIS-277. Walker-Hooper site (47GL65) **750 ± 55**
A.D. 1200

Charcoal from Feature 67, Test Pit 45, Level 4, 2 to 2.5 ft below plow zone.

Dietz site, Wisconsin 47DA12

Initial work in 1955 at Dietz site, Dane County, Wisconsin (43° 04′ N Lat, 89° 23′ W Long) suggested time of transition from Madison Cord-Impressed to Aztalan Collared pottery types (Baerreis and Nero, 1956). Sample coll. 1956 and subm. by D. A. Baerreis agrees with earlier date (Wisconsin III: WIS-193) of A.D. 1170.

WIS-273. Dietz site (47DA12) **830 ± 45**
A.D. 1120

Charcoal from storage pit, Feature 33.

II. GEOLOGIC SAMPLES

A. Wisconsin

Schimelpfenig Bog series, Dane County, Wisconsin

Samples coll. 1967 in conjunction with excavation of 2 mastodons (*Mastodon americanus*), under supervision of John E. Dallman, Univ.

of Wisconsin, in marl layer underlying peat deposit on Elmer Schimelpfenig farm, Dane County, Wisconsin (43° 04′ 45″ N Lat, 89° 04′ 45″ W Long).

WIS-264. Schimelpfenig Bog, Wisconsin **9600 ± 105** **7650 B.C.**

Tamarack (id. by R. F. Evert) embedded in peat, from Sample Column III, 30 to 32 in. below surface near interface with marl.

WIS-265. E mastodon, Schimelpfenig Bog, Wisconsin **9480 ± 100** **7530 B.C.**

Bone scraps from concentration of bone representing E mastodon.

WIS-267. W mastodon, Schimelpfenig Bog Wisconsin **9630 ± 110** **7680 B.C.**

Bone scraps from concentration of bone representing W mastodon.

B. Northwest Territories, Canada

Drainage Lake, N.W.T.

Two shallow beds of peat overlying sand in cold, dry, well-drained tundra area just N of Pelly Lake, Keewatin (66° 08′ N Lat, 101° 04′ W Long) where peat is not presently accumulating. Growth of material may reflect different climatic conditions. Pollen diagrams by H. Nichols (Nichols, 1967) show percentages of *Picea* and *Pinus* higher than modern surface counts. Coll. 1966 and subm. by H. Nichols.

WIS-263. Drainage Lake, N.W.T. **1060 ± 55** **A.D. 890**

Rootlet peat, 26 to 28 cm below modern surface, from 30 cm of peat accumulation on top of sand.

WIS-278. Drainage Lake, N.W.T. **940 ± 60** **A.D. 1010**

Rootlet peat 13 to 14 cm below modern surface. Dates cessation of peat growth which may reflect environmental or climatic change. Sample occurs just above change from lower coarse detritus mud to upper fibrous rootlet peat and at same level as increase of *Pinus* in pollen diagram.

WIS-275. Colville Lake, N.W.T. **6790 ± 75** **4840 B.C.**

Sedge peat, 205 to 210 cm below modern surface, which is basal organic material immediately overlying marl at 210 cm. Dates base of pollen diagram by H. Nichols and provides minimum date for deglaciation. Peat monolith cut from exposed peat face at Colville Lake, District of MacKenzie, N.W.T. (67° 06′ N Lat, 125° 47′ W Long). Coll. 1967 by J. A. Larsen, Univ. of Wisconsin; subm. by H. Nichols and R. A. Bryson.

WIS-262. Repulse Bay, N.W.T. **6480 ± 80** **4530 B.C.**

Shells, (*Hiatella arctica* L.), id. by Weston Blake, Jr., Canadian Geol. Survey, Ottawa, were obtained from slight depression in rocky tundra on ridge in Repulse Bay, N.W.T., Canada (66° 31′ N Lat, 86° 15′ W Long) 120 ft above present day level of Hudson Bay. Since shells occur at depths from low tide levels to 600 ft, their value in determining date of shoreline emergence is limited, but the date establishes chronology in sense that area had been under water to some undetermined depth and emergence occurred subsequently. Another date (GSC-286: 6850 ± 140) for same general area is given in Craig (Craig, 1965). Outer 20% of shell was removed by acid washing.

C. Central Canada

Samples coll. and dated for 2 purposes: 1) to date initiation of bog growth in sections used for pollen analysis; 2) to provide minimum dates for deglaciation in region with minimal radiocarbon control of deglaciation timing. Peace R. and Porcupine Mt. dates seem too late to indicate deglaciation, and Waskesiu sample dates only onset of bog conditions. Interpolation from existing dates to N and S suggests that deglaciation at Porcupine Mt. should have occurred prior to 9000 B.P. and that some time elapsed before kettle formed. Pollen data by H. Nichols suggest that the region was open spruce forest at dated time.

Peace R. date is for drainage of pro-glacial lake of considerable extent with ice front quite distant. Minimal ice retreat dates ca. 100 mi to SE are 8560 ± 170 B.P. (GSC-525, GSC VI) and 8320 ± 260 B.P. (GSC-500, GSC VI). Date given here appears consistent with opening of channel at Lake Athabasca which drained pro-glacial lake. Pollen analysis by H. Nichols of basal mud and clay indicates patches of vegetation on bare mineral soil.

2410 ± 60
WIS-269. Waskesiu, Saskatchewan **460 B.C.**

Coarse detritus mud overlying clay, 150 to 160 cm below modern surface of bog. Organic material immediately overlies glacial lake clay which begins at 158 cm with rather sharp transition from organic to clay. Mud may not be conformable with clay but date should indicate initiation of bog conditions in valley. Coll. 1967 from Waskesiu, Saskatchewan, Canada (53° 55′ N Lat, 106° 03′ W Long) by R. A. Bryson and H. Nichols; subm. by H. Nichols.

6770 ± 70
WIS-271. Porcupine Mountain, Manitoba **4820 B.C.**

Necron mud, basal organic material overlying blue clay, 205 to 210 cm below present surface of bog; clay at 207 cm and below. Date provides minimum age for formation of basin (kettle ?) and date for base of pollen diagram analyzed by H. Nichols. Sample coll. in 1967 at elev. ca. 2100 ft at Porcupine Mt., Manitoba (52° 31′ N Lat, 101° 15′ W Long) by R. A. Bryson and H. Nichols; subm. by H. Nichols.

WIS-274. Peace River, Alberta **6880 ± 85**
4930 B.C.

Detritus mud with clay, basal organic material from bottom of peat bog which overlies (conformably) pro-glacial lake clay. Sample from 171 to 173 cm below modern surface; provides minimum age for drainage of lake. Coll. 1967 from Peace R., Alberta (56° 17′ N Lat, 117° 20′ W Long) by R. A. Bryson, H. Nichols, and R. L. Steventon; subm. by H. Nichols.

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Date lists:

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WASHINGTON STATE UNIVERSITY NATURAL RADIOCARBON MEASUREMENTS I

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The College of Engineering Research Division radiocarbon dating laboratory began operating in November 1962 employing a Sharp Laboratories, Inc., CDL-14 system based upon the methane method of Fairhall, Shell, and Takashima (1961).

Dates reported herein are calculated using a 5568 yr C^{14} half-life. The modern standard is taken as 95% of the NBS oxalic acid C^{14} standard which is converted to CO_2 followed by conversion to CH_4 in the manner of Fairhall *et al.* The errors quoted are the 1 σ statistical errors.

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SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

A. Alaska

Chagvan Bay series, Alaska

Charcoal samples found in Kuskokwin Bay region of Alaska. Samples coll. and subm. 1963 by Dr. Robert Ackerman, Dept. of Anthropol., Washington State Univ.

1740 ± 60
WSU-102. Chagvan Bay Bluff site **A.D. 210**

Charcoal from hearth in House 1, 2.2′ below surface. Assoc. with hearth was check-stamped sherd. *Comment*: this type of pottery has been found in Norton cultural levels. Norton cultural stage.

1290 ± 250
WSU-117. Chagvan Bay Bluff site **A.D. 660**

Charcoal from Trench 2, 1.6′ below surface at base of brown gravel-sand layer that overlies yellow gravel which was sterile. *Comment*: sample comes from base of cultural zone. Check-stamp pottery was found at this level. Norton cultural stage.

230 ± 40
WSU-119. Chagvan Bay Beach site **A.D. 1720**

Charcoal from House 6, 2.0 to 2.3′ below surface. *Comment*: possible transitional stage following Norton cultural stage.

1330 ± 60
WSU-123. Chagvan Bay Beach site **A.D. 620**

Charcoal from House 1 by hearth, 1.7′ below surface in Square 1. *Comment*: later phase of Norton cultural stage.

WSU-121. Nanvak Bay, Alaska **100 ± 50**
A.D. 1850

Charcoal from hearth in House 3, 1.4′ below surface. *Comment*: later phase of Norton cultural stage. Sample coll. and subm. 1963 by Robert Ackerman.

WSU-285. Grouse Fort site, Alaska **Modern**

Charcoal from Test Pit 1, which was cut into midden material on bay (SW) side of House Pit 1 at Grouse Fort site (135° 13′ W Lat, 58° 14′ 20″ SE Long). Coll. at Ground Bay area of Icy Strait Region and subm. 1963 by Robert Ackerman.

WSU-412. Juneau, Alaska **10,180 ± 800**
8230 B.C.

Charcoal from clay that had been burned by fire. Taken from trench or top of low terrace 11.7 m above sea level. Sample came from fire hearth area 97 cm below datum in Section N-2-E-1-B of Trench 1. Horizontal location from 0 point, 3.45 m N of EW line, 0.42 m E of NS line. Contamination by rootlets and possible contamination by water coming from limestone deposit. Several artifacts in site were made of limestone or dolomite. Sample coll. and subm. by Robert Ackerman. *Comment*: dates lower component of Site GHB-2. Lower component is chipped stone and rests on glacial gravels (outwash). Dating of component vital to entry of man upon northern NW coast.

Samples From Combined Prehistoric Expedition to Egyptian and Sudanese Nubia
B. Egypt

Shell, charcoal, and bone found at sites in Egyptian and Sudanese Nubia. Collection of samples was started in May, 1963 and was subm. for dating by Dr. Fred Wendorf of Southern Methodist Univ., Dallas, Texas (Wendorf, 1965).

WSU-256. Dungal Oasis, Egypt **22,900 ± 600**
20,950 B.C.

Tufa from Boulder III, Wadi Gravel Bank, Dungal Oasis (23° 26′ N Lat, 31° 37′ E Long). Sample from top unit in sequence, 0.75 m below surface in exposed cutbank. Coll. 1963 from Site 8709-2-5 by J. Hester. *Comment*: dates marker bed in geologic sequence and Mousterian tools from same level.

WSU-257. Dungal Oasis, Egypt **10,300 ± 260**
8350 B.C.

Tufa from top unit of sequence of beds in pit dug for pollen profile Site 8702-2-6. Sample from surface of pit in clay beds of fossil spring. Coll. 1963 by J. Hester. *Comment*: dates flow of springs in area, geologic marker bed, and Neolithic culture contemporaneous with sample.

WSU-315. Tushka, Egypt **14,500 ± 490**
12,550 B.C.

Charcoal from entire occupation zone of Hearth Mound 2, Site 80, Tushka, (22° 30′ N Lat, 31° 45′ E Long). From average depth 1 m in mound from gray cemented dune sand, partially laminated, containing ash charcoal and a few artifactual flakes. Coll. 1965 by J. Hester. *Comment*: date is approx. for microlithic implements and minimum for highest silts of Sohaba formation.

WSU-316. Dungal Oasis, Egypt **7900 ± 150**
5950 B.C.

Charcoal from 10 × 20 cm hearth on surface of playa silt, 15 cm below present ground surface. Sample from Site 8723, Sebgon Desert, (23° 30′ N Lat, 31° 31′ E Long). Cultural rock was above and in hearth. Coll. 1963 by P. M. Hobler. *Comment*: expected to date site occupation and period of greatest use of playa.

WSU-318. Ballana, Egypt **18,600 ± 550**
16,650 B.C.

Charcoal from Site 8859-1-28C, Ballana (22° 15′ N Lat, 31° 35′ E Long) at 165 cm depth in rapidly accumulating dune with uniform culture from bottom to top. Artifacts and charcoal revealed in trench. Coll. 1965 by P. M. Hobler. *Comment*: expected to date industry found throughout dune and lower end of Sohaba formation.

WSU--327. Dungal Oasis, Egypt **3640 ± 180**
1690 B.C.

Charcoal from Site 8773-3-2d, Sibyon Desert site, 5 mi ENE of Dungal Oasis, (23° 28′ N Lat, 31° 35′ E Long). Sample from ash and charcoal concentration in floor of possible pottery kiln. Coll. 1963 beneath 50 cm of windblown sand, by P. M. Hobler. *Comment*: should date occupation.

WSU-328. Dungal Oasis, Egypt **4510 ± 255**
2560 B.C.

Charcoal from Site 8718-1-11, Sibyon Desert site, 8 mi WSW of Dungal Oasis. Sample from 25 cm below present dune surface in hearth immediately SW of Slob Rause (Feature 1). Coll. 1963 by J. W. Eddy. *Comment*: should date occupation of site and give minimum date for suitability of playa for herding.

WSU-329. Ballana, Egypt **14,000 ± 280**
12,050 B.C.

Charcoal from Site 8896, Ballana site, 2 mi W of Ballana, (22° 15′ N Lat, 31° 35′ E Long). Sample was buried by 2 to 6 cm of fill in hearth, part of which was exposed on surface. Coll. 1963 by J. J. Hestes. *Comment*: should date occupation of site and assoc. artifacts.

C. Sudan

WSU-103. Wadi Halfa, Sudan **5220 ± 50**
3270 B.C.

Charcoal from Wadi Halfa W at Site WHW-5, Sudan (22° 55′ E Lat, 57° 58′ N Long). Sample from Oven 2, 10 to 20 cm below surface. Coll. 1963 by Chmielewski. *Comment*: could be Neolithic.

WSU-106. El Ikhtyarhryia, Sudan **11,200 ± 150**
9250 B.C.

Shell (*Unio Willcocksi*) from Site 745 in 30 m flood-plain gravel bench. Coll. 1963 by J. de Heinzelin.

WSU-107. Debeira, Sudan **14,800 ± 100**
12,850 B.C.

Shell (*Corbicula fluminalis*) from 30 m flood plain at Location 319, Debeira W Ghana Concession, Site P-742. Coll. 1963 by J. de Heinzelin.

WSU-108. Abka, Sudan **5990 ± 100**
4040 B.C.

Shell (*Corbicula*) from 34 m flood plain at Site P-743, Location 280, Abka Island. Coll. 1963 by J. de Heinzelin.

WSU-109. Faras East, Sudan **12,250 ± 100**
10,300 B.C.

Shell (*Corbicula fluminalis*) from 20 m flood plain at Site P-744, Location 330, Faras E. Coll. 1963 by J. de Heinzelin.

WSU-110. South Buhen, Sudan **5120 ± 100**
3170 B.C.

Shell (*Unio*) from Site P-748, Location 235, at 50 × 50″ flood plain in S Buhen. Coll. 1963 by J. de Heinzelin.

WSU-112. Wadi Halfa, Sudan **3370 ± 50**
1420 B.C.

Shell from Layer 2 in Group "C" occupation level at Site WHW-7, Location 4-S/2K, Feature ½ at Wadi Halfa W. Coll. 1963 by Chmeilewski. Sample is not Neolithic.

WSU-142. Halfa Degheim, Sudan **9975 ± 280**
8025 B.C.

Charcoal mixed with sand and possibly gypsum from Site 1017, Point T-10-2-W, 5 km S of Halfa Degheim, (24° N Lat, 33° E Long). Sample was 60 cm below silt, which was 6 cm thick and 20 cm below surface. Coll. 1963 by A. E. Marks. *Comment*: should date early upper Paleolithic industry featuring high percentage of Levallois technique in stone plus large sample of animal bones.

WSU-144. Halfa Degheim, Sudan **11,000 ± 120**
9050 B.C.

Charcoal mixed with earth from partly scattered fire pit assoc. with single occupation from Site 1024-F-1, 5½ km S of Halfa Degheim (24°

N Lat, 33° E Long). Coll. 1963 by A. E. Marks. *Comment*: should date manifestation of Sebilian industry, may be equivalent to Vignard's Middle Sebilian.

4800 ± 120
WSU-147. Wadi Halfa, Sudan **2850 B.C.**

Charcoal mixed with sand in stone-lined hearth at Site 605-33-1, 15 km SW of Wadi Halfa, (24° N Lat, 33° E Long). Coll. 1964 by Shiner. *Comment*: should date early Neolithic industry. Ceramics very scarce, industry primarily lithic.

5600 ± 200
WSU-174. Diberia West, Sudan **3650 B.C.**

Charcoal from fire pit in Trench II in 5 m terrace on W bank, 13.5 km N of Wadi Halfa, from Site DIW-50. Coll. 1964 by R. Schild. *Comment*: dates pottery Neolithic site, containing numerous microliths as well as Neolithic tools. Particular Neolithic involved has not yet been defined. Should date possibly intrusive early Neolithic assemblage.

9390 ± 100
WSU-175. Diberia West, Sudan **7440 B.C.**

Charcoal scattered along base of 10 m terrace, Site DIW-1, on W bank of Nile, 13.5 km N of Wadi Halfa. Coll. 1964 by R. Schild. *Comment*: industry is Microlithic, characterized by scrapers made of flakes produced by bipolar technique and points.

7700 ± 120
WSU-176. Diberia West, Sudan **5750 B.C.**

Charcoal from fire pit in middle of 10 m terrace deposits on W bank of Nile, 13.5 km N of Wadi Halfa, Site DIW-51. Sample from Trench II cultural layer. *Comment*: assoc. industry is development out of DIWIA with less scrapers and introduction of ostrich shell.

10,925 ± 140
WSU-188. Khor Musa, Sudan **8975 B.C.**

Charcoal from Site 1024-3, from scattered fire pit, just subsurface, in center of Sebilian habitation, 2.5 km SW of Wadi Halfa airport building. *Comment*: this is 1st radiocarbon date for any Sebilian site and finally places Sebilian in time perspective.

11,410 ± 270
WSU-189. El Ikhtyarhryia, Sudan **9460 B.C.**

Shell from Site Ad-17, Location 35, P-745, from slab of gravel in channel cut into top of Diberia formation (30 m terrace), 15.2 km N of Wadi Halfa. *Comment*: channel also contained tools of Qada sequence; thus dates probable early phase of Qada sequence.

6430 ± 200
WSU-190. Mirghissa, Sudan **4480 B.C.**

Charcoal from fire pit in center of surface concentration of microlithic artifacts, on W bank of Nile, 13.7 km SW of Wadi Halfa, Site

605-49 at Flat 49. *Comment*: dates late phase of microlithic Qadan sequence.

WSU-201. Knor Musa, Sudan **16,500 ± 500**
14,550 B.C.

Charcoal from 2 adjacent earth ovens in habitation site of 60 cm depth. Site, 443-2, J-213, is located on W side of Khor Musa, 3 km W of Wadi Halfa airport building. It rests on sand dune banked against Diberia formation (30 m terrace). Coll. 1963 by A. E. Marks. *Comment*: should date early Mesolithic site.

WSU-202. El Ikhtyarhryia, Sudan **12,500 ± 460**
10,600 B.C.

Charcoal from decomposed plant remains *in situ* in top of Sahaba formation (20 m terrace), 15.2 km N of Wadi Halfa. Coll. 1964 by J. de Heinzelin. *Comment*: should date building of 20 m terrace.

WSU-203. Khor Musa, Sudan **20,900 ± 280**
18,950 B.C.

Charcoal from living floor in fluvial sand deposit covered by Nile silts, 57 cm below ground surface from Site 1017, 3.3 km SW of Wadi Halfa airport building. Coll. 1963 by A. E. Marks. *Comment*: should date early Upper Paleolithic assemblage.

WSU-215. Anquash, Sudan **17,800 ± 500**
15,850 B.C.

Charcoal from upper Paleolithic habitation layer resting on fossil sand dune covered by fluvial sands, 100 m W of village of Anquash, on W side of Nile, 4.5 km WS of Wadi Halfa at Site ANW3-25. Coll. 1964 by A. E. Marks. *Comment*: should date late Upper Paleolithic assemblage.

WSU-290. Wadi Halfa, Sudan **14,340 ± 500**
12,390 B.C.

Charcoal found just below brown soil, in sand with Upper Paleolithic culture on Level 6 at Site 440, 1⅓ km W of Wadi Halfa airfield. Coll. 1965 by J. Shiner. *Comment*: dates earliest upper Paleolithic site W. Halfa area. Should be earlier than any known Nile sediments.

WSU-332. Wadi Halfa, Sudan **19,150 ± 375**
17,200 B.C.

Charcoal mixed with sand and ash from partially deflated earth oven from Site 2014, 2.5 km W of Wadi Halfa airport, (21° 49′ 30″ Lat, 31° 16′ Long). Small bits of charcoal *in situ* from middle of oven, 5 to 10 cm below surface. Coll. 1965 by J. L. Shiner. *Comment*: dates occupation of relatively late Halfan peoples.

D. Idaho

Double-house series, Cottonwood, Idaho

Mussel shell (*Margaritifera m. falcata*) and charcoal from Double-house, stratified, 2-phase village site on high terrace in lower reach of

Rocky Canyon (45° 55′ N Lat, 116° 23′ W Long), 7 mi S of town of Cottonwood, in Camas Prairie region of N-central Idaho. Coll. and subm. 1963 by B. R. Butler, Idaho State Univ. Mus., Pocatello, Idaho.

WSU-124. Site 10-IH-80/4 **400 ± 50** **A.D. 1550**

Charcoal from surface of lower E house midden, 120 to 150 cm below 2e3, Level D. *Comment*: should date termination of accumulation of silt at site and provide solid carbon check on 10-IH-80/2 and 3.

WSU-125. Site 10-IH-80/2 **735 ± 60** **A.D. 1215**

Mussel shell from upper floor of lower W house, 90 to 125 cm below 2w5, Level 2d. *Comment*: should date upper floor of lower house and provide approx. terminal date for occupation of house and accumulation of silt sequence at site.

WSU-126. Site 10-IH-80/5 **Modern**

Charcoal from floor of upper W house, 20 cm below Datum 1w6, Level 3b. *Comment*: should date occupation of upper village at site.

WSU-127. Site 10-IH-80/3 **1770 ± 56** **A.D. 180**

Mussel shell from lower floor of lower W house, 130 to 160 cm below Datum 2w5. *Comment*: should date earlier than 10-IH-80/2 by ca. 100-500 yr.

WSU-253. Site 10-IH-80/F.S. 62/12 **280 ± 140** **A.D. 1670**

Charcoal from sandy loom deposit separating upper E house floor from lower E house floor, 37 to 46 cm below Datum 5e5. *Comment*: WSU-253 and WSU-254 should provide good checks on previously dated samples from the 2 sites and help firm up chronology established for this locality.

WSU-254. Site 10-IH-80/F.S. 64/7 **2040 ± 190** **90 B.C.**

Charcoal from hearth area, lower E house floor, 158 cm below Datum 5e4.

Cottontail Cave series, Blue Dome, Idaho

Charcoal samples from Cottontail Cave in Clark County, 4 mi E of Blue Dome, Idaho (44° 10′ N Lat, 112° 52′ W Long). Coll. 1961 by R. Bonnicksen and subm. 1963 by Dr. Earl Swanson, Idaho State Univ. Mus., Pocatello, Idaho.

WSU-133. Site 46565/10-CL-23 **150 ± 125** **A.D. 1800**

Charcoal from Test Pit 4, Level 5b, 46 to 64 cm below surface datum.

4420 ± 145
WSU-137. Site 45563/10-CL-23 **2470 B.C.**

Charcoal from Test Pit 2, Level 20, 290 to 303 cm below surface datum.

Jackknife Cave series, Howe, Idaho

Charcoal from Jackknife Cave in Butte County (43° 50′ N Lat, 112° 52′ W Long), 7.5 mi NE of Howe, Idaho. Coll. 1963 by B. R. Butler and subm. 1963 by B. R. Butler and Earl Swanson.

840 ± 125
WSU-134. Site 10-BT-46/105 **A.D. 1110**

Charcoal from Block B-5, Feature 3; fireplace assoc. with Level V.

160 ± 135
WSU-135. Site 10-BT-46/101 **A.D. 1790**

Charcoal from Block A-5, Feature 2; fire pit intrusive from Level VII into Level VIII.

6200 ± 155
WSU-136. Site 10-BT-46/117 **4250 B.C.**

Charcoal from Block L-6, Feature 1; fire pit intrusive from Level VIII into Level IX.

380 ± 125
WSU-138. Site 10-BT-46/148 **A.D. 1570**

Charcoal from Block K-5, Feature 1; fire pit intrusive from Level VI into Level VII.

6300 ± 100
WSU-255 Weis Rock-shelter, Cottonwood, Idaho **4350 B.C.**

Charcoal mixed with soil-humus from Site 10-IH-66, #125, Trench 3, 3.4 to 3.6 m below Datum O, Cottonwood Canyon near Cottonwood, Idaho. Coll. 1962 and subm. 1964 by R. B. Butler.

WSU-319. Eagle Creek site, Idaho **Modern**

Charcoal from Camas oven at depth 25 to 30 cm below surface. Site is located on N slope of Whitebird Hill, Idaho county, Idaho (45° 60′ N Lat, 116° 15′ W Long). Coll. 1964 and subm. 1965 by L. R. Gaarder, Idaho State Univ., Pocatello, Idaho. *Comment*: should provide *terminus ante quem* date for artifacts found above it.

Alpha and Beta Rock-shelter series, Shoup, Idaho

Shell and charcoal from Alpha and Beta Rock-shelters ca. 10 mi SW of Shoup, N of Salmon R. in Lemhi county, Idaho. Subm. 1965 by Earl Swanson.

4730 ± 202
WSU-358. Alpha Rock-shelter, 10-LH-23/18 **2780 B.C.**

Shell from balk between A-3 and A-4, Layer 6a. Coll. 1965 by P. Sneed, Idaho State Univ.

WSU-359. Alpha Rock-shelter, 10-LH-23/17 **7150 ± 231**
5200 B.C.

Shell from Block D-1, Layer 6c. Coll. 1965 by P. Sneed.

WSU-416. Alpha Rock-shelter, 10-LH-23/61 **12,410 ± 115**
10,460 B.C.

Shell from Block A-1, Layer 4b, 56 to 68 cm below ground surface. Sample column located 80 to 120 cm E of SW corner of Block A-1. Coll. 1965 by P. Sneed and K. Wood, Idaho State Univ.

WSU-402. Beta Rock-shelter, 10-LH-63/114 **8175 ± 230**
6225 B.C.

Charcoal from Block S-4, Layer 6d; depth 383 cm. Coll. 1965 by C. Chesbro, Idaho State Univ.

WSU-403. Beta Rock-shelter, 10-LH-63/204 **5600 ± 175**
3650 B.C.

Charcoal from Block S-5e and S-4e, Layer 6d, 380 to 390 cm below Datum 1. Coll. 1965 by M. Pavisic and C. Sims, Idaho State Univ.

WSU-404. Beta Rock-shelter, 10-LH-63/203 **5675 ± 175**
3725 B.C.

Shell from Block S-4e, Layer 5a. Coll. 1965 by P. Sneed, C. Chesbro, and C. Sims.

D. Nevada

Deer Creek Cave series, Jarbidge, Nevada

Charcoal and wood from Deer Greek Cave site, 4 mi N of Jarbidge, Elco county, Nevada (42° 56′ 00″ N Lat, 115° 25′ 15″ W Long). Coll. 1960 and subm. 1964 by Dr. Richard Shutler, Jr., Nevada State Mus., Carson City, Nevada.

WSU-244. Deer Creek Cave **715 ± 410**
A.D. 1235

Charcoal from Site 34 from Fire Hearth 1, Trench A, Cut 1; 2' S of W corner stake on top of hearth, 8" from surface. Hearth is 10″ in diameter and 3″ thick. *Comment*: should give idea of rate of midden accumulation in front of cave and date some assoc. metates and projectile points.

WSU-245. Deer Creek Cave **1510 ± 140**
A.D. 440

Wood from Site 196, Trench C, Pit 2; depth 12 to 18″. Assoc. with projectile points, scrapers, disc. beads, antler flakes, and fragments. *Comment*: should date assoc. artifacts.

Falcon Hill series, Nevada

Basketry samples from Falcon Hill, elev. 4249.5′ at NW end of Lake Winnemucca in Washoe county, Nevada (40° 19′ 20″ N Lat, 119° 20′ 40″ W Long). Coll. and subm. 1961 by Dr. Richard Shutler, Jr.

WSU-268. Falcon Hill **1480 ± 155**
A.D. 470

Basketry sample from Section D, 12 to 24″ below datum. Included was rat's nest at N wall of Site 28.

WSU-269. Falcon Hill **1400 ± 155**
A.D. 550

Basketry sample from Section D, Site 39. Same location and contents as in WSU-268.

WSU-270. Falcon Hill **5100 ± 180**
3150 B.C.

Basketry sample from Area 2, 17 to 24″ below surface, Cache 2 from tule-lined Cache pit at Site 61.

E. New Hebrides

Inmanhat series, Island of Aneityum, South New Hebrides

Charcoal from Island of Aneityum, S Pacific, (20° 10′ 2″ S Lat, 169° 42′ 0″ E Long). Samples call. 1963 and subm. 1964 by Dr. Richard Shutler, Jr.

WSU-139. Inmanhat/9 **Modern**

Charcoal from shell midden with fire hearths from Pit 1, 18 to 24″ level. *Comment*: should date shell edge, and together with WSU-140 should provide information on rate of midden accumulation.

WSU-140. Inmanhat/18 **Modern**

Charcoal from shell midden with fire hearths from Pit 1, 72 to 90″ level. *Comment*: should date earliest occupation of rock-shelter and island (Aneityum). Together with WSU-139 will provide information on rate of midden accumulation, and check internal consistency.

Island of Futuna series, South New Hebrides

Charred leaves and charcoal from Island of Futuna in Southern New Hebrides, S Pacific. Sites at Ipau are located ca. (19° 30′ 50″ S Lat, 170° 13′ 30″ E Long). Samples coll. 1964 and subm. 1964 by Dr. Richard Shutler, Jr.

WSU-184. Futuna/462 **905 ± 190**
A.D. 1045

Charred leaves mixed with charcoal from depth 18 in. from present surface, layer of leaves approx. ½ in. thick. *Comment*: sample from Lap-Lap cooking earth-oven. Lap-Lap is common Melanesian food made from vegetables and meats, cooked on leaves over hot rocks. Sample should date time when hearth was constructed and meal cooked.

WSU-196. Futuna/BPBM-457 **200 ± 190**
A.D. 1750

Charcoal assoc. with fragmented shell and bone from cultural deposit in Rock-shelter FU-RS-12, Trench 3, depth 36 to 42″. *Comment*: sample should date earliest occupation of site and probably that of Futuna.

Efate series, South New Hebrides

Charcoal from island of Efate, New Hebrides, S Pacific (17° 45′ 00″ S Lat, 168° 17′ 30″ E Long). Samples coll. and subm. 1964 by Dr. Richard Shutler, Jr.

WSU-197. Efate/BPBM-494 — **1225 ± 175** / **A.D. 725**

Charcoal from cultural deposit in Rock-shelter EF-RS-7, Trench E at depth 36 to 42″. *Comment*: should date earliest occupation of site.

WSU-198. Efate/BPBM-495 — **1090 ± 140** / **A.D. 860**

Charcoal from midden shallow, in coral bedrock at 12 in. depth; EF-3, Location B, Trench B, Pits 7, 8, and 9. *Comment*: should date pottery and worked shell.

WSU-199. Efate/BPBM-508 — **1020 ± 130** / **A.D. 930**

Charcoal from cultural deposit; EF-3, Location E, Pit 2 at depth 18 in. *Comment*: sample should date earliest occupation of village site and give maximum date for burial found just above hearth.

WSU-200. Efate/BPBM-499 and 500 — **815 ± 180** / **A.D. 1135**

Charcoal assoc. with fragmented shell from cultural deposit; EF-3, Location D, Pits 3 and 7, at depth 30 to 36 in. *Comment*: should date earliest occupation of old village site, worked shell, and fragmented shell.

Mangarisiu Village series, Tongoa Island, South New Hebrides

Charcoal from island of Tongoa, 1 mi N of village of Mangarisiu (16° 55′ 20″ S Lat, 168° 34′ 25″ E Long). Samples coll. 1965 by A. H. G. Mitchell, U.S. Geol. Survey and subm. 1964 by U.S. Geol. Survey for Dr. Richard Shutler, Jr.

WSU-219. Mangarisiu/1 — **2720 ± 200** / **770 B.C.**

Charcoal from 9 ft deep exposure pit dug in cliff top, 10 yds inland from sea-cliff edge, 4′4″ to 5′ below cliff top, from 1st cultural level. *Comment*: should date settlement by charcoal and pottery fragments which can be traced on several islands in Shepherd group. Should give maximum age to overlying volcanic ash, possibly connected with local legend of violent volcanic activity 300 to 400 yr ago.

WSU-220. Mangarisiu/2 — **2300 ± 200** / **350 B.C.**

Charcoal from same location as WSU-219, 8′ 10″ to 9′ 4″ below surface, from 2nd cultural level. *Comment*: should date charcoal and pottery fragments and give maximum age to overlying volcanic ash, and minimum age for underlying deposits.

F. Oregon

WSU-228. Cascadia, Oregon **7910 ± 280** **5960 B.C.**

Charcoal from 1 mi E of Cascadia, Oregon, N bank of S Santiam R., Linn county, (44° 24′ N Lat, 122° 28′ W Long). Coll. and subm. 1964 by T. M. Newman, Dept. of Anthropol., Portland State College, Portland, Oregon. *Comment*: dates Old Cordilleran culture, which cultural materials assoc. with this sample are expected to date for this part of NW. Is probably Altithermal in age.

WSU-284. Wildcat Canyon site, Oregon **4480 ± 360** **2530 B.C.**

Peat-like deposit from Site 35-GM-9/5 at Wildcat Canyon on Columbia R. Coll. summer, 1964 and subm. 1965 by D. L. Cole, Dept. of Anthropol., Univ. of Oregon, Eugene, Oregon.

Arlington series, Oregon

Charcoal from 7 to 19 mi outside Arlington, Oregon (45° 46′ N Lat, 120° 33′ W Long). Coll. 1964 by D. L. Cole and C. Calley and subm. 1965 by D. L. Cole.

WSU-298. Arlington/JD-64-2 **1740 ± 175** **A.D. 210**

Charcoal mixed with shell and bone from Site 35-GM-15, Area 13, from floor of large house (Feature 8), ca. 80 cm from present surface. *Comment*: should date house type and several related art forms.

WSU-299. Arlington/JD-64-3 **1170 ± 160** **A.D. 780**

Charcoal from burned structural timber on lowest of 2 floors of house (Feature 25) in Site 35-GM-3 (Hook site), 2 m below surface. *Comment*: should date house and certain artifacts.

WSU-300. Butte Creek Cave, Fossil, Oregon **400 ± 150** **A.D. 1550**

Hide sample from Site B.C.C.-1 at Butte Creek Cave ca. 8 mi NW of Fossil, Oregon, (45° 3′ N Lat, 120° 20′ W Long). Coll. 1946 by L. S. Cressman and id. by Wm. G. Hagg, Louisiana State Univ. Subm. 1965 by D. L. Cole. *Comment*: indicates time at which dog lived to secure information if smallness is indicative of earliest type of Indian dog; should secure date on use of Catlow twine basketry in area; should secure date on burial complex.

H. Washington

WSU-101. Ozette Lake, Washington **387 ± 80** **A.D. 1563**

Charcoal from deep fire pit in lowermost cultural stratigraphy. Coll. and subm. 1963 by S. T. Gwinn, Dept. of Anthropol., Washington State Univ., Pullman, Washington.

Marmes Rock-shelter series, Washington

Charcoal and shell from Marmes Rock-shelter in Franklin county, Washington. Samples, unless otherwise stated, were coll. and subm. 1963 and 1964 by Dr. R. D. Daugherty, Dept. of Anthropol., Washington State Univ. *Comment*: considered to be site of oldest human remains in W Hemisphere.

7550 ± 100
WSU-120. Marmes Rock-shelter/45-FR-50 5600 B.C.

Shell from location (25° N Lat, 190° W Long), 8 in. below surface of Unit 1.

1300 ± 60
WSU-205. Marmes Rock-shelter/45-FR-50 A.D. 650

Charcoal from Unit VI, Feature 6. Coll. 1964 by C. R. Nance, Dept. of Anthropol., Washington State Univ.

1110 ± 50
WSU-206. Marmes Rock-shelter/45-FR-50 A.D. 840

Charcoal from Unit VII, elev. 98.81 to 96.61 ft, 0.5 to 0.10 ft below surface, near top of unit (80° 85′ N Lat, 40° 48′ W Long). Subm. by C. R. Nance.

4200 ± 150
WSU-207. Marmes Rock-shelter/45-FR-50 2250 B.C.

Shell from Unit VII at Datum 96.26 to 95.36 ft, on same location as WSU-206. Subm. by C. R. Nance.

7400 ± 110
WSU-209. Marmes Rock-shelter/45-FR-50 5450 B.C.

Shell from Unit III at datum elev. 92.2 to 92.5 ft (85° N Lat, 45° 05′ W Long). Coll. 1964 by W. Moore; subm. by C. R. Nance.

7870 ± 110
WSU-210. Marmes Rock-shelter/45-FR-50 5920 B.C.

Shell from Unit II-III at datum elev. 89.6 to 89.8 ft (87° 88′ N Lat, 40° W Long). Coll. by W. Moore and subm. by C. R. Nance.

10,750 ± 90
WSU-211. Marmes Rock-shelter/45-FR-50 8800 B.C.

Shell from Burial 15 at datum elev. 88.27 ft (87° 88′ N Lat, 23° 24′ W Long).

1300 ± 140
WSU-212. Marmes Rock-shelter/45-FR-50 A.D. 650

Charcoal from Unit VII.

WSU-362. Marmes Rock-shelter/45-FR-50 Modern

Charcoal from hearth. Coll. by Dr. K. P. Oakley, British Mus., London, England.

10,810 ± 275
WSU-363. Marmes Rock-shelter/45-FR-50 **8860 B.C.**

Shell from Site F-65(5) 8-10A.

10,475 ± 270
WSU-366. Marmes Rock-shelter/45-FR-50 **8525 B.C.**

Shell from Site F-65(5) 8-10B.

Palouse River series, Washington

Shell and charcoal from Site 45-WT-2, Whitman county, Washington. Samples coll. summer, 1963 by C. R. Nance, unless otherwise stated.

7300 ± 180
WSU-170. Palouse River **5350 B.C.**

Shell from Pit CL-9 at 94.50 ft below datum, beneath layer of Mazama ash. *Comment*: confirms date of Cascade Point-type Archeological Complex found below volcanic ash.

150 ± 80
WSU-171. Palouse River **A.D. 1800**

Charcoal mixed with corn from Pit CL-13, 1 to 1.1 ft below surface. Coll. 1963 by W. Moore and J. Chatters, WSU Archeol. field crew.

2740 ± 110
WSU-187. Palouse River **790 B.C.**

Charcoal from Pit CL-5, 95.58 to 94.9′ below datum by fire hearth at Feature 6, (7° 2.5′ S Lat, 15° 1.5′ W Long). *Comment*: should date deposits below slump in this part of site.

Vashon Island series, Washington

Charcoal and shell from Leo Long property at InterQuartermaster Harbor on Vashon Is. Samples coll. 1965 by Dr. R. M. Chatters and subm. by Leo Long.

1670 ± 160
WSU-348. Vashon Island **A.D. 280**

Charcoal from upper midden on Vashon Is.

1890 ± 170
WSU-349. Vashon Island **A.D. 60**

Shell from lower midden on Vashon Is.

1740 ± 170
WSU-354. Vashon Island **A.D. 210**

Shell mixed with finely divided charcoal from lower midden on Vashon Is.

1720 ± 165
WSU-367. Tucannon River, Washington **A.D. 230**

Bone from mouth of Tucannon R., 5 mi S of Starbuck, Columbia county, Washington. Coll. by C. M. Nelson and subm. by Dr. R. D. Daugherty, Anthropol. Dept., Washington State Univ. *Comment*: provides date on lower part of loess.

Wawawai series, Washington

Shell and charcoal from site 3.5 mi down Snake R. from Wawawai, Whitman county, Washington. Coll. 1965 by Richard Sprague, Dept. of Anthropol., Washington State Univ.

7710 ± 150
WSU-409. Wawawai/45-WT-36-C10 **5760 B.C.**

Shell from Camas Prairie RR cut, near Thorn Thicket Creek; elev. 99.50 to 99.25 ft. *Comment*: indicates relative placement of geological deposits containing sample and its level.

470 ± 610
WSU-410. Wawawai/45-WT-36-F4 **A.D. 1480**

Charcoal mixed with shell from Camas Prairie RR cut; elev. 101.77 ft. *Comment*: indicates relative placement of component assoc. with feature.

834 ± 560
WSU-411. Wawawai/45-WT-36-F2 **A.D. 1116**

Charcoal from Camas Prairie RR cut near Thorn Thicket Creek, Feature 2, elev. 102.50 ft. *Comment*: indicates relative placement of component assoc. with feature.

II. GEOLOGIC SAMPLES

A. Idaho

3180 ± 210
WSU-283. Troy, Idaho **1230 B.C.**

Charcoal chunks covered by soil from hand-dug soil pit ca. 18 to 24 ft below surface, Site 64-IDA-2923, 5 mi NW of Troy, Latah county, Idaho. Soil enclosing sample is high in volcanic ash. Coll. 1964 by Lowell Garber; subm. by Maynard Fosberg, Dept. of Agricultural Biochem. and Soils, Univ. of Idaho, Moscow, Idaho.

B. Montana

1230 ± 160
WSU-369. Upper Yellowstone Drainage, Montana **A.D. 720**

Charcoal from Site 24, Pa 301, Occupation Level III, ca. 2 mi N of Gardiner, Montana, immediately N of Yellowstone Park (3° 45′ N Lat, 110° 41′ Long). Coll. by G. W. Arthur and subm. 1965 by Montana State Univ., Missoula, Montana.

C. Oregon

Blue Lake Crater series, Oregon

Charcoal from Blue Lake Crater area, Oregon. Samples are from interface cinders from Blue Lake Crater and ash from Sand Mt. volcano. Coll. and subm. by E. M. Taylor, Dept. of Geol., Washington State Univ. (Taylor, 1965).

3440 ± 250
WSU-291. Blue Lake Crater/T-13-S 1490 B.C.

Charcoal mixed with ash from road cut exposure at depth 15 ft from surface, from Site R-8-E, #S-16.

1590 ± 160
WSU-292. Blue Lake Crater/T-14-S A.D. 360

Charred tree roots from lava flow at Site R-7-E, #S-28.

2883 ± 175
WSU-364. McKenzie Pass, Oregon 933 B.C.

Charcoal mixed with volcanic ash 1 mi W of Dee Wright Observatory, McKenzie Pass, Oregon Cascades, Site TFJ-207. Coll. 1965 by E. M. Taylor.

2550 ± 165
WSU-365. Three Sisters area, Oregon 600 B.C.

Charcoal 1/8 mi E of Four-in-One Cinder Cone, Three Sisters area, Oregon Cascades, Site TS-374. Coll. 1965 by E. M. Taylor.

Three-Fingered Jack Quad series, Oregon

Charred wood and root from Three-Fingered Jack Quad area. Coll. and subm. by E. M. Taylor.

1950 ± 150
WSU-371. Three-Fingered Jack Quad A.D. 1

Charred wood near Jack Pine Road, S of Pass Highway. *Comment*: dates 1st eruptions of coarse cinders from Lost Lake Cones, which are among oldest of Sand Mt. volcanic field.

3850 ± 215
WSU-372. Three-Fingered Jack Quad 1900 B.C.

Charred root bark mixed with soil and rootlets near Old Santiam Wagon Rd. *Comment*: dates Fish Lake lava flow from Nash Crater, one of youngest flows of Sand Mt. lava fields.

D. Utah

5600 ± 170
WSU-246. Big Cottonwood Canyon, Utah 3650 B.C.

Marl from Big Cottonwood Canyon, S of Salt Lake City, Utah. Should date maximum of Lake Bonneville for Pinedale standard. Coll. and subm. by Roald Fryxell, Dept. of Geol., Washington State Univ. and U.S. Geol. Survey. *Comment*: will provide date closely corresponding to age of maximum Lake Bonneville stand during Pinedale time.

E. Washington

12,000 ± 310
WSU-155. Lower Grand Coulee, Washington 10,050 B.C.

Shell from Site LGC-2, abandoned quarry in Glacier Peak ash at E wall of Lower Grand Coulee, ca. 8 km N of Soap Lake, Washington. Coll. and subm. by Roald Fryxell.

10,210 ± 210
WSU-231. Round Lake, Washington **8260 B.C.**

Marl from NW side of Round Lake in Twin Lake area, Washington. Coll. and subm. by Roald Fryxell.

1440 ± 185
WSU-232. Willow Island, Washington **A.D. 510**

Wood from Willow Is., S of Whiskey Dick at Monolith site. Coll. and subm. by Roald Fryxell.

20,200 ± 550
WSU-243. Moran Prairie, Washington **18,250 B.C.**

Charcoal of "Miocene" oak from Moran Prairie, S of Spokane, Washington. Log buried by lava flow. Coll. and subm. by Kurt Lunum, Dept. of Forestry, Washington State Univ.

III. OCEANOGRAPHIC SAMPLES

A. Arabia, NE Africa

Red Sea series, between Arabia and NE Africa

Calcareous fragments cementing *Creseis* and planktonic *Foraminifera* from Red Sea from research vessel *Vema*. Coll. 1958 and subm. by Yvonne Herman, Dept. of Geol., Washington State Univ.

12,625 ± 715
WSU-374. Red Sea/V-14-120 **10,675 B.C.**

Sample at depth 70 cm at (20° 26′ N Lat, 38° 13′ E Long). *Comment*: WSU-374, 375, and 376 give absolute age for onset of unusual conditions which lead to precipitation of submitted "hard crust" in Red Sea. This is 1st instance that cemented calcareous rocks have been cored from ocean bottom. It is expected that precipitation of $CaCO_3$ took place at end of last glacial period as result of temperature increase and temporary separation of basin from Indian Ocean.

11,950 ± 150
WSU-375. Red Sea/V-14-117 **10,000 B.C.**

Sample at depth 40 cm at (18° 48′ N Lat, 39° 31′ E Long).

10,825 ± 845
WSU-376. Red Sea/V-14-119 **8875 B.C.**

Sample at depth 55 cm at (20° 50′ N Lat, 38° 17′ E Long).

IV. HYDROLOGIC SAMPLES

Pullman-Moscow Water Dating Project series, Washington-Idaho

Dates reported below resulted from study in which carbon-14 dating techniques were used as inventory technique and as means of contributing to basic knowledge of ground-water accumulation and movement.

In this study of Pullman (Washington) — Moscow (Idaho) ground-water basin of E Washington and W Idaho, data indicate that ground-

Summary of Pullman-Moscow Basin Ground-Water Analyses

Sample Number	Well Number	C^{14} Age	Detection Limits	Date Collected	Elevation Productive Zone	Type of Aquifer
156	14/44-14P1	7,650	± 250	4/15/64	2052-2252?	Basalt
158	14/44-14P1	6,850	± 240	4/28/64	2052-2252?	Basalt
342	14/44-21M1	18,000	± 400	6/18/65	2418-2423	Basalt
344	14/44-34C1	4,640	± 190	6/18/65	2257-2277	Basalt
311	14/45-3H2	Modern		5/11/65	2470-2475	Loess
307	14/45-3K1	19,550	± 400	5/5/65	2219-2224	Basalt?
153	14/45-4H1	11,800	± 220	4/9/64	2178-2188	Porous Basalt
172	14/45-4H1	14,900		5/22/64	2178-2188	Porous Basalt
346	14/45-4H1	13,500	± 410	6/28/65	2178-2188	Porous Basalt
182	14/45-4N1	6,550	± 150	6/4/64	2282-2287	Basalt
148	14/45-5B4	9,250	± 290	4/3/64	2257-2267 2105-2160	Basalt
149	14/45-5B4	8,550	± 280	4/7/64	2257-2267 2105-2160	Basalt
334	14/45-7F2	3,240	± 190	5/21/65	2250-2255	Soft Basalt
323	14/45-15B1	5,400	± 195	5/18/65	2394-2399	Basalt
309	14/45-28H1	Modern		5/7/65	2348-2363	Fine, white sand
322	14/46-8K1	37	± 150	6/10/65	2555-2560	Decomposed granite
345	14/46-19M1	2,410	± 180	6/21/65	2401-2402	Sand
159	15/44-15A2	Modern		5/1/64	2166-2174	Decomposed granite
160	15/44-15A2	Modern		5/2/64	2166-2174	Decomposed granite
340	15/44-15G1	9,550	± 230	6/17/65	2206-2228	Basalt
337	15/45-10F1	3,180	± 185	6/15/65	2506-2511	Basalt
312	15/45-14Q1	10,390	± 260	5/11/65	2247-2257	Basalt & Quartzite?
310	15/45-29G1	19,150	± 410	5/7/65	2204-2209	Basalt

Summary of Pullman-Moscow Basin Ground-Water Analyses (cont'd.)

Sample Number	Well Number	C^{14} Age	Detection Limits	Date Collected	Elevation Productive Zone	Type of Aquifer
336	15/45-30G4	15,900	± 370	6/8/65	2170-2195	Porous Basalt
157	15/45-32N2	6,150	± 260	4/23/64	1391-1946	Basalt
335	15/45-32N2	⩾32,000		6/9/65	1391-1946	Basalt
181	15/45-34L2	13,900	± 350	5/26/64	2138-2145	Basalt
306	15/45-35F1	2,110	± 190	4/30/65	2360-2402	Basalt?
339	16/45-27R1	1,685	± 190	6/17/65	2353-2356	Basalt
347	39/5W-4N1	9,160	± 300	6/18/65	2430-2434	Porous Basalt
165	39/5W-7E1	9,100	± 150	5/11/64	1877-1882	Basalt
314	39/5W-7E1	23,800	± 440	5/17/65	1276-1889	Basalt
352	39/5W-7C2	19,700	± 410	7/8/65	1257-1667	Basalt
305	39/5W-7J2	13,250	± 340	4/29/65	2313-2343	Basalt
313	39/5W-7P1	24,200	± 340	5/13/65	2278-2346	Basalt & Sand
161	39/5W-8F1	18,600	± 450	5/2/64	1282-1675	Basalt & Sand
304	39/5W-8F1	⩾31,000		5/23/65	1282-1675	Basalt & Sand
162	39/5W-15F1	7,340	± 270	5/7/64	2456-2459	Basalt
338	39/5W-15G1	7,800	± 240	6/16/65	2339-2469?	Basalt
341	40/5W-30L1	11,120	± 250	6/17/65	2296-2336	Decomposed granite

waters are distinctly stratified and display a well-defined relationship between water age and elevation of the productive zone.

The bulk of the ground-water appears to have been placed in storage by the closing phases of the Pleistocene glaciation. Some additional recharge has been occurring in the Pullman sub-basin since the thermal maximum about 6500 yr ago.

The carbon-14 data indicate that there has been no measurable recharge in the Moscow area in recent times. However, recharge in the Pullman sub-basin is estimated to be 108,000 gallons per year, or about 10% of the present pumping rate.

The samples were coll. by the ion-exchange technique between April, 1964 and July, 1965 and were subm. by J. W. Crosby, III, Albrook Hydraulic Lab. and R. M. Chatters, Radioisotopes and Radiations Lab, unless otherwise stated (Crosby and Chatters, 1965 a,b).

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[RADIOCARBON, VOL. 10, NO. 2, 1968, P. 499-507]

LABORATORIES

* Inactive Laboratories.

[1] The H^3—Laboratorium of this institute (directed by Klaus Fröhlich) should be addressed separately.

[2] This designation Gif supersedes both Sa (Saclay) and Gsy (Gif-sur-Yvette). The only Gsy date list to be published is Gsy I (Coursaget and Le Run, RADIOCARBON, v. 8).

[3] From January 1, 1961 the Gro numbers have been replaced by GrN numbers. "New" dates are referred to the NBS oxalic-acid standard.

[4] Early dates from this laboratory were given a code designation that represents the name of the sponsoring institution, e.g. I ((AGS) for American Geographical Society (Heusser, RADIOCARBON SUPPLEMENT, v. 1).

[5] Formerly Hazleton Nuclear; code designation HNS has been dropped.

[6] Some dates from this laboratory were published with the code designation S (Pringle and others, 1957, Science, v. 125, p. 69-70).

[7] See SM.

[8] See Gif.

[9] Some dates from this laboratory have been published with the code designation RC (Flint and Gale, 1958, AM. JOUR. SCI., v. 256, p. 698-714). The code designation MP published in volume 1 of the RADIOCARBON SUPPLEMENT (1959, p. 216) has been changed to SM in conformity with the wishes of the laboratory, and is explained by the change of the company's name from Magnolia Petroleum Company to Socony Mobil Oil Company, Inc.

[10] Formerly Texas-Bio-Nuclear, then Kaman Instruments. The laboratory is no longer operating.

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