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RADIOCARBON

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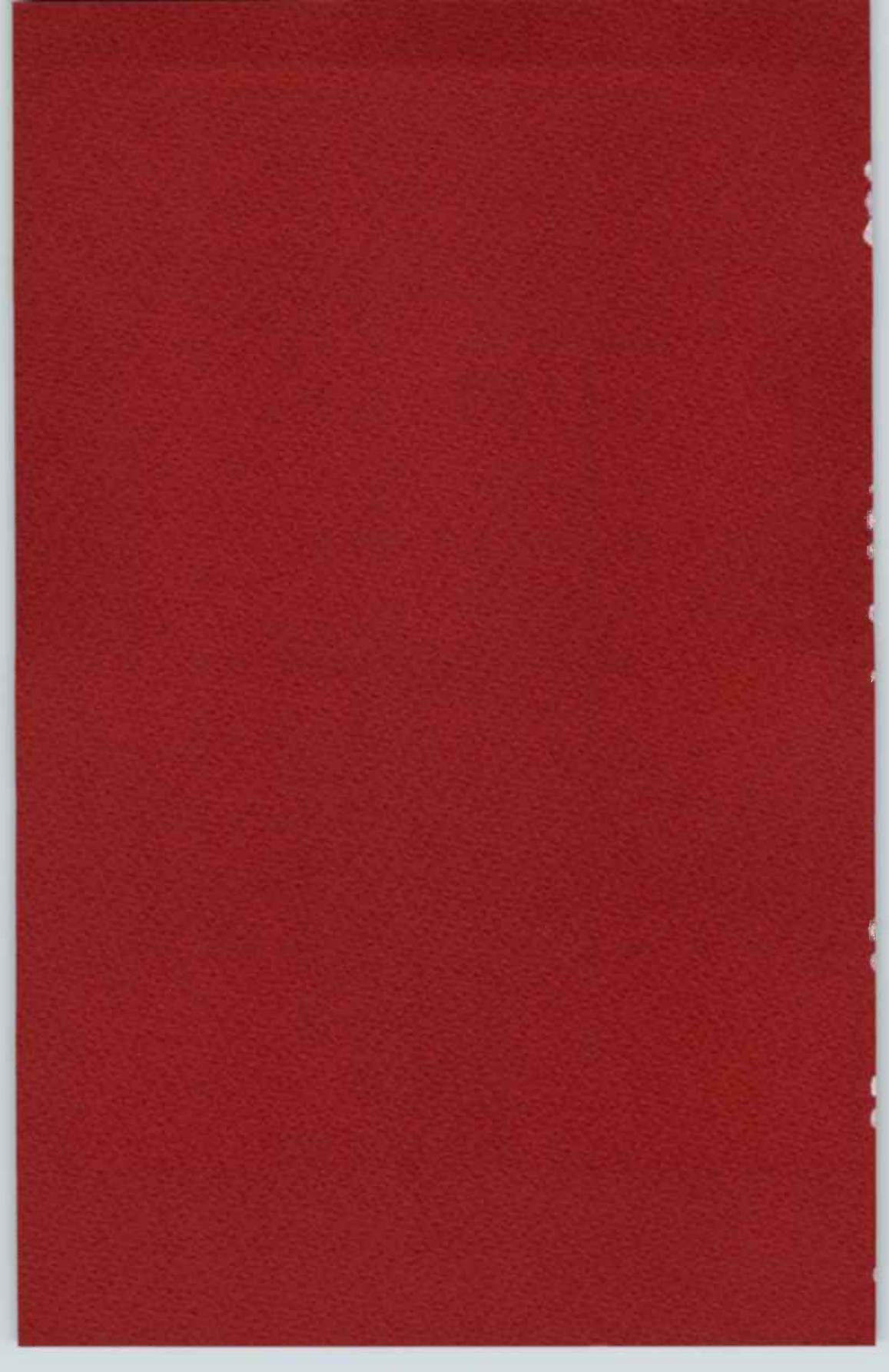

RADIOCARBON

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Editors: JOHN RODGERS, JOHN H OSTROM, AND PHILLIP M ORVILLE

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INSTRUCTIONS TO CONTRIBUTORS

Manuscripts of radiocarbon papers should follow the recommendations in *Suggestions to Authors*, 5th ed.* All copy (including the bibliography) must be typewritten in *double space*. Manuscripts for vol 18, no. 1 must be submitted in *duplicate* before June 1, 1975, for vol 18, no. 2 before October 1, 1975.

Descriptions 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, emphasis placed on significant comments. Date lists should therefore not be preceded by abstracts, but abstracts of the more usual form should accompany all papers (eg, 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 BP (before present, ie, before AD 1950) and, for finite dates, in years AD/BC. 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; use of metric system exclusively. Stratigraphic sequences should *not* be included. However, references that contain them can be cited.
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 sample no., journal (R for Radiocarbon), years, vol, and specific page (eg, M-1832, R, 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 implicity showing that the radiocarbon measurement was worth making, belongs here, as do technical matters, *eg,* chemical pretreatment, special laboratory difficulties, etc.

Illustrations should not be included unless absolutely essential. They should be original drawings, although photographic reproductions of line drawings are sometimes acceptable, and should accompany the manuscript in any case, if the two dimensions exceed 30cm and 23cm.

Reprints. Thirty copies of each article, without covers, will be furnished without cost. Additional copies and printed covers can be specially ordered.

Back issues. Back issues (vols 1-9) are available at a reduced rate to subscribers at $52.00 a set, including postage; vols 10-14 are $20.00 each for individual subscribers and $30.00 for institutions; vols 15-17 are $30.00 each for individuals and $45.00 for institutions; single back issues $10.00 each; comprehensive index $10.00 each.

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

NOTICE TO READERS

Half life of ^{14}C. 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 ± 30 yr,** for the half life. This decision was reaffirmed at the 8th International Conference on Radiocarbon Dating, Wellington, New Zealand, 1972. Because of various uncertainties, when ^{14}C measurements are expressed as dates in years BP the accuracy of the dates is limited, and refinements that take some but not all uncertainties into account may be misleading. The mean of three recent determinations of the half life, 5730 ± 40 yr, (**Nature,** v 195, no. 4845, p 984, 1962), is regarded as the best value presently available. Published dates in years BP, can be converted to this basis by multiplying them by 1.03.

AD/BC dates. As agreed at the Cambridge Conference in 1962, AD 1950 is accepted as the standard year of reference for all dates, whether BP or in the AD/BC system.

Meaning of $\delta^{14}C$. In Volume 3, 1961, we indorsed the notation Δ (Lamont VIII, 1961) for geochemical measurements of ^{14}C activity, corrected for isotopic fractionation in samples and in the NBS oxalic-acid standard. The value of $\delta^{14}C$ 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 editors as well as by authors, and recent papers have used $\delta^{14}C$ as the **observed** deviation from the standard. At the New Zealand Radiocarbon Dating Conference it was recommended to use $\delta^{14}C$ only for age-corrected samples. Without an age correction, the value should then be reported as percent of modern relative to 0.95 NBS oxalic acid. (Proceedings 8th Conference on Radiocarbon Dating, Wellington, New Zealand, 1972.)

In several fields, however, age corrections are not possible. $\delta^{14}C$ and Δ, uncorrected for age, have been used extensively in oceanography, and are an integral part of models and theories. For the present therefore we continue the editorial policy of using Δ notations for samples not corrected for age.

Citations. A number of radiocarbon dates appear in publications without laboratory citation or reference to published date lists. We ask that laboratories remind submitters and users of radiocarbon dates to include proper citation (laboratory number and date-list citation) in all publications in which radiocarbon dates appear.

Radiocarbon Measurements: Comprehensive Index, 1950-1965. This index, covering all published ^{14}C measurements through Volume 7 of RADIOCARBON, and incorporating revisions made by all laboratories, has been published. It is available to all subscribers to RADIOCARBON at $10.00 US per copy.

Publication schedule. Beginning with Volume 15, RADIOCARBON is published in three numbers: Winter, Spring, and Summer. The next deadline is June 1, 1975. Contributors who meet our deadlines will be given priority but not guaranteed publication in the following issue.

List of laboratories. The comprehensive list of laboratories at the end of each volume now appears in the third number of each volume.

Index. All dates appear in index form at the end of the third number of each volume.

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Radiocarbon

1975

INSTITUTE OF GEOLOGICAL SCIENCES RADIOCARBON DATES VI

E WELIN, L ENGSTRAND, and S VACZY

Radioactive Dating Laboratory, S-10405, Stockholm 50, Sweden*

This date list was compiled by the Institute of Geological Sciences (UK) incorporating data supplied under contract by E Welin, Radioactive Dating Laboratory, Stockholm. Unless otherwise stated, age figures are in ^{14}C years before AD 1950. The half-life of ^{14}C is taken as 5568 years and the error, based on counting statistics of sample, background, and modern, is given as one standard deviation. Correction for $^{13}C/^{12}C$ fractionation has been made.

IGS-C14/96. (St 3903) Brantingham, Yorkshire **21,835 ± 1660**
19,885 BC
$\delta^{13}C = -32.8‰$

Bone fragment from temporary excavation in sand and gravel SW of Brantingham (53° 45′ N, 0° 35′ W, Grid Ref SE 9385 2918). Depth 3.05m below surface. Coll 1970 and subm by G D Gaunt, Inst Geol Sci. *Comment*: bone occurred within or at base of littoral sediments attributed to maximum alt phase of Lake Humber. Date is Upper Devensian for this phase and stratigraphically supports approx contemporaneity with maximum Devensian ice advance into Vale of York.

IGS-C14/141. (St 4397) Abingdon By-pass, Berkshire **32,300 ± 1920**
30,350 BC
$\delta^{13}C = -27.3‰$

Wood from peat, peaty clay, and sand, 6m thick, infilling channels in Kimmeridge Clay and overlain by thin, poorly developed (? Plateau) gravels at Sugworth Lane Bridge cutting (51° 42′ N, 1° 15′ N, Grid Ref SP 5125 0076).

IGS-C14/142. (St 4385) Abingdon By-pass, Berkshire **41,760 ± 3470**
39,810 BC
$\delta^{13}C = -23.4‰$

Wood from same horizon as IGS-C14/141. *Comment* (BCC): samples are from same stratigraphic layer; either derivation or localized humic contamination has occurred.

* Published by permission of the Director, Institute of Geological Sciences, Exhibition Road, London SW7 2DE. The Institute is a contracting agency, not a dating laboratory, yet IGS at London is the "author" when needed for inter-laboratory communication.

IGS-C14/143. (St 4371) Redditch, Worcestershire **5430 ± 155**
3480 BC
$\delta^{13}C = -26.2‰$

Peat from auger borehole in peat bog at Ipsley Alders (51° 81′ N, 1° 53′ W, Grid Ref SP 0784 7655), depth 0.5 to 0.7m below surface. Coll 1972 and subm by B C Worssam, Inst Geol Sci.

IGS-C14/144. (St 4365) Redditch, Worcestershire **6350 ± 115**
4400 BC
$\delta^{13}C = -26.5‰$

Peat from same borehole as IGS-C14/143, depth 1.2 to 1.5m below surface, rests on alluvial fan sediments. Coll 1972 and subm by B C Worssam.

IGS-C14/145. (St 4370) Jersey, Channel Islands **3605 ± 120**
1655 BC
$\delta^{13}C = -27.1‰$

Peat from 7.4 to 8.0m below surface in borehole (49° 13′ N, 2° 13′ W, Grid Ref 7NW 2272 1172) some 300m NNW of St Ouen's Pond and 1100m SSE of IGS-C14/113. Coll 1971 and subm by R G Thurrell, Inst Geol. Sci. *Comment* (RGT): 1m peat with sand based at 1.8m is interbedded with sandy beach sediments of Ouen's coastal plain. Date corresponds with that for IGS-C14/113, confirming a stratigraphic correlation of sediments in W part of coastal plain at ca 2m.

IGS-C14/146. (St 4373) Pitsea, Essex **5065 ± 100**
3115 BC
$\delta^{13}C = -26.2‰$

Peat at −3.6m in borehole at Bowers Marshes (51° 31′ N, 0° 31′ E, Grid Ref TQ 7473 8641) from Flandrian alluvial sediments. Coll 1973 by M Sarginson and subm by K J Northmore, Inst Geol Sci.

IGS-C14/147. (St 4386) Sutton Courtney, Oxfordshire **33,190 ± 3450**
31,240 BC
$\delta^{13}C = -21.6‰$

Plant fragments from peaty silts at base of limestone gravel of Thames Floodplain Terrace, ca +48m (51° 38′ N, 1° 15′ W, Grid Ref: Su 520936). Coll 1971 and subm by D J Briggs, Leeds Polytechnic. *Comment* (DGB): suggests terrace aggraded during Upton Warren Interstadial period and that 1b facet of Thames Floodplain Terrace was formed earlier than 1a facet. Confirms separation of 2 facets on morphologic grounds.

2385 ± 115

IGS-C14/148. (St 4398, Fraction 1) **435 BC**

$\delta^{13}C = -4.5‰$

Wallasea, Essex.

2300 ± 115

(St 4400, Fraction 2) **350 BC**

Wallasea, Essex.

Shell band, largely comprising a life assemblage of *Ostrea edulis* (Linné) in Flandrian alluvial sediments from 7m depth in borehole on Wallasea I (51° 37′ N, 0° 48′ E, Grid Ref TQ 9375. Coll 1972 by R A Ellison and subm by P Grainger, Inst Geol Sci. *Comment* (B W Conway): *Ostrea edulis* is known to live offshore, on stable bottom, from about low-tide level to between −25 and −80m. Dates help determine sedimentation and/or subsidence rates.

Troon series, Ayrshire

Peat 0.3m thick from tunnel at Dundonald Rd (55° 33′ N, 4° 39′ W, Grid Ref NS 3361 3111). Overlain by sands and gravels of postglacial emerged beach and rests on humic pebbly sand of indeterminate origin. Coll 1973 and subm by S K Monro, Inst Geol Sci.

8015 ± 120

IGS-C14/149. (St 4372) **6065 BC**

$\delta^{13}C = -27.4‰$

From top 2cm peat band at +6.74 to +6.76m. *Comment* (SKM): date infers Flandrian transgression which may be closer to actual transgression than previous dates in Ayrshire.

9090 ± 320

IGS-C14/150. (St 4374) **7140 BC**

$\delta^{13}C = -26.8‰$

From basal 3cm of peat bed at +6.46 to +6.49m.

West Thurrock series, Essex

Peats and peaty clays from borehole at West Thurrock Power Sta (51° 28′ N, 0° 17′ E, Grid Ref TQ 58837700). Coll 1973 and subm by B W Conway, Inst Geol Sci.

3795 ± 115

IGS-C14/151. (St 4377) **1845 BC**

$\delta^{13}C = -25.5‰$

Peaty clay with wood from −1.35m.

4975 ± 120

IGS-C14/152. (St 4401) **4490 BC**

$\delta^{13}C = -25.9‰$

Peaty clay with wood from −3.40m.

General Comment (BWC): pollen analysis incomplete, but visual inspection suggests upper salt-marsh origin; samples therefore probably deposited 2 to 3m above mean sea level.

[RADIOCARBON, VOL. 17, NO. 2, 1975, P. 160-173]

ILLINOIS STATE GEOLOGICAL SURVEY RADIOCARBON DATES VI

DENNIS D COLEMAN and CHAO LI LIU

Illinois State Geological Survey, Urbana, Illinois 61801

All samples processed from February 1973 through January 1974 at the Illinois State Geological Survey Radiocarbon Dating Laboratory are reported here. The benzene liquid scintillation technique was used. Laboratory procedures used were the same as those previously reported by Coleman (1973, 1974).

All ages are calculated on the basis of a ^{14}C half-life of 5568 years, and the NBS oxalic acid standard is used as reference. Errors (1σ) reported account only for uncertainties in activity measurements of the sample, standard, and backgrounds. All age calculations have now been computerized with the assignment of modern and minimum ages based on the 4σ criteria as previously reported (Coleman, 1973). Activities for "modern" samples are given as % modern. No corrections have been made for isotopic fractionation or atmospheric ^{14}C fluctuations.

Requests for analyses were evaluated by a Radiocarbon Dating Committee consisting of J P Kempton, chairman, Charles Collinson, R E Bergstrom, J C Frye, and D D Coleman.

SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

A. Illinois

ISGS-172. Peabody Coal Mine boring **>43,400**

Wood from Gallatin Co, center Sec 15, T 9S, R 9E, 2.4km N of Shawneetown, Illinois (37° 44′ 37″ N, 88° 12′ 15″ W). From 12m depth in boring for vent in mine. Coll 1972 by D F McCarthy; subm by T C Buschbach and H B Willman, Illinois State Geol Survey. *Comment* (HBW): site is in ancient Lake Saline, close to shoreline (Frye *et al*, 1972). Sediments encountered are older than those previously reported and may represent local preservation in protected position.

ISGS-179. Jules Section **15,020 ± 300**
13,070 BC

Humus from $<2\mu$ clay fraction of soil A horizon from Cass Co, SE¼ SE¼ NE¼ Sec 13, T 18N, R 11W, 13km E of Beardstown, Illinois (40° 01′ 00″ N, 90° 16′ 30″ W). From buried Jules Soil. Coll 1972 by L R Follmer and D W Moore; subm by L R Follmer, Illinois State Geol Survey. *Comment* (LRF): agrees well with date, 15,640 ± 580 (ISGS-137: R, 1974, v 16, p 110) on shell material from same horizon at Cottonwood School S Sec. Date helps confirm stratigraphic correlation with major glacial retreat during Woodfordian.

12,740 ± 210

ISGS-195. Cottonwood School South Section 10,790 BC

Humus from <4μ clay fraction of soil A horizon from Cass Co, NW¼ NW¼ SW¼ Sec 12, T 18N, R 11W, 11km E of Beardstown, Illinois (40° 01′ 30″ N, 90° 17′ 30″ W). From buried Jules Soil, 0.3m thick, 1.5m below surface. Coll 1972 by L R Follmer and D W Moore; subm by L R Follmer. *Comment* (LRF): disagrees with previous dates ISGS-179 and -137. Cause of discrepancy unknown.

40,000 ± 1100

ISGS-211. Emerald Pond Section 38,050 BC

Wood from Vermilion Co, SW¼ SW¼ SW¼ Sec 33, T 20N, R 12W, 8km W of Danville, Illinois (40° 08′ 45″ N, 87° 43′ 50″ W). From Glenburn Till Member of Wedron Formation, 1.8m below Batestown-Glenburn contact. Coll 1973 by W H Johnson and R P Goldthwait; subm by W H Johnson, Univ of Illinois. *Comment* (WHJ): agrees with previous date, 38,000 (ISGS-15: R, 1970, v 12, p 505); shows wood in Glenburn Till antedates Woodfordian and suggests that Glenburn Till is Altonian in age. Dates, 20,500 ± 210 (ISGS-83) and 20,800 ± 130 (ISGS-81: R, 1973, v 15, p 79) on wood coll 0.4km SE of Emerald Pond Sec and stratigraphically below till thought to correlate with the Glenburn suggested a Woodfordian age. Thus, either the correlation is incorrect or older wood has been incorporated in the Glenburn Till at the Emerald Pond Sec.

37,600 ± 1300

ISGS-238. Carpentersville Pit 35,650 BC

Wood from Kane Co, NW¼ NE¼ SW¼ Sec 2, T 42N, R 8E, 0.75km NW of Carpentersville, Illinois (42° 08′ 42.5″ N, 88° 16′ 12.5″ W). From cross-bedded sandy silt 0.75m above top of Tiskilwa Till Member of Wedron Formation. Coll 1973 by J C Cobb and G S Fraser; subm by J C Cobb, Illinois State Geol Survey. *Comment* (JCC): silt is in erosional contact with top of Tiskilwa Till. Wood fragment evidently reworked from Altonian-age Plano Silt Member and redeposited in fluvial sediments containing clay pebbles of Tiskilwa Till.

B. Lake Michigan and shore area

Illinois Beach State Park area series

715 ± 75

ISGS-168. IBSP-1 AD 1235

Peat from Lake Co, Illinois, SW¼ SW¼ SE¼ Sec 27, T 46N, R 12E, 1.6km SE of Zion, Illinois (42° 25′ 50″ N, 87° 48′ 58″ W). From 0.3m thick Grayslake Peat overlying silty sand rich in organic material and ca 2m below mixture of muck, lacustrine clays, and peat. Coll 1972 and subm by N C Hester, Illinois State Geol Survey.

1165 ± 75

ISGS-169. IBSP-2 AD 785

Peat from Lake Co, Illinois, SW¼ SE¼ NE¼ Sec 22, T 46N, R

12E, 1.6km ENE of Zion, Illinois (42° 27′ 05″ N, 87° 48′ 45″ W). From 15cm thick Grayslake Peat, underlying 2.4m sands, clays, and muck. Overlying medium to coarse sand with scattered gravel. Coll 1972 and subm by N C Hester.

ISGS-170. IBSP-3 **600 ± 75** **AD 1350**

Muck from Lake Co, Illinois, NW¼ NW¼ NW¼ Sec 2, T 46N, R 12E, 2.3km NE of Winthrop Harbor, Illinois (42° 29′ 30″ N, 87° 48′ 11″ W). From ca 0.5m thick Grayslake Peat underlying 0.6m aeolian sand and overlying medium to coarse sand with scattered gravel. Coll 1972 and subm by N C Hester.

ISGS-182. IBSP-4 **540 ± 75** **AD 1410**

Peat from Lake Co, Illinois, NW¼ SW¼ SE¼ Sec 27, T 46N, R 12E, 1.7km SE of Zion, Illinois (42° 27′ 05″N, 87° 48′ 50″ W). From peat layer underlying silts, overlain by active bog. Coll 1972 by N C Hester and G S Fraser; subm by N C Hester.

ISGS-184. IBSP-5a **>33,200**

Wood from Kenosha Co, Wisconsin, NW¼ SE¼ NE¼ Sec 19, T 1N, R 23E, 5km NNE of Winthrop Harbor, Illinois (42° 31′ 53″ N, 87° 49′ 05″ W). From 1.3m below surface in cross-bedded sand. Coll 1973 and subm by N C Hester. *Comment* (NCH): wood apparently eroded from much older deposit and was transported into area.

ISGS-185. IBSP-6 **6350 ± 140** **4400 BC**

Wood from Kenosha Co, Wisconsin, NW¼ SW¼ SW¼ Sec 17, T 1N, R 23E, 1.8km E of South Kenosha (42° 32′ 20″ N, 87° 48′ 45″ W). From ripple-bedded sand originating near shore. Coll 1973 by N C Hester and G S Fraser; subm by N C Hester.

ISGS-187. IBSP-7 **7370 ± 90** **5420 BC**

Peat from Kenosha Co, Wisconsin, NW¼ SW¼ SW¼ Sec 8, T 1N, R 23E, 4km SE of Kenosha, Wisconsin (42° 33′ 15″ N, 87° 48′ 45″ W). From large scale trough cross-bedded sands deposited by longshore currents directly overlying basal till and below ripple-bedded sands dated by ISGS-185. Coll 1973 by N C Hester and G S Fraser; subm by N C Hester.

ISGS-189. IBSP-8 **5315 ± 75** **3365 BC**

Wood from Kenosha Co, Wisconsin, NW¼ NW¼ SW¼ Sec 8, T 1N, R 23E, 3.7km SE of Kenosha (42° 33′ 30″ N, 87° 48′ 50″ W). From clay zone rich in organic material overlying till and underlying cross-bedded sand. Coll 1973 by N C Hester and G S Fraser; subm by N C Hester.

780 ± 75

ISGS-206. South Port Park #2 AD 1170

Soil humus from Kenosha Co, Wisconsin, NE¼ NW¼ NW¼ Sec 17, T 1N, R 23E, 1km S of Kenosha (42° 33′ 00″ N, 87° 48′ 40″ W). From soil developed in beach sand ca 3m above present lake level and covered by recent dune sand. Coll 1973 by L R Follmer, N C Hester, and Curtis Larsen; subm by L R Follmer.

3130 ± 100

ISGS-217. Main Street core, 95 to 103cm depth 1180 BC

2980 ± 130

ISGS-218. Main Street core, 114 to 119cm depth 1030 BC

Organic silt and peat from Lake Co, Illinois, NE¼ SE¼ NW¼ Sec 10, T 46N, R 23E, immediately E of Winthrop Harbor, Illinois (42° 28′ 50″ N, 87° 49′ 00″ W). From Grayslake Peat in depression on sand plain. Coll 1973 by A M Jacobs and Curtis Larsen; subm by A M Jacobs, Illinois State Geol Survey.

2280 ± 130

ISGS-225. Camp Logan core, 100 to 105cm depth 330 BC

2275 ± 75

ISGS-224. Camp Logan core, 110 to 118cm depth 325 BC

Silt rich in organic material from Lake Co, Illinois, NE¼ NE¼ SE¼ Sec 15, R 46N, T 23E, 1km NE of Zion, Illinois (42° 27′ 50″ N, 87° 48′ 10″ W). From Grayslake Peat in depression on sand plain. Coll 1973 by A M Jacobs and Curtis Larsen; subm by A M Jacobs.

General Comment (GSF & AMJ): dates show progressively younger organic sediments s-ward, indicating age of beach ridge complex decreases in that direction (Hester and Fraser, 1973).

Lake Michigan bottom sediment series

Silt rich in organic material from cores in Lake Michigan Formation. Coll by J A Lineback and D L Gross; subm by D L Gross, Illinois State Geol Survey.

8075 ± 95

ISGS-208. Core 836-5B 6125 BC

From 19km SW of Benton Harbor, Michigan (42° 07′ 42″ N, 86° 43′ 30″ W). From Waukegan Member, interval 72 to 95cm below sediment/water interface. Coll 1971. *Comment* (DLG): from same core intervals as wood dated 910 ± 140 (ISGS-100: R, 1973, v 15, p 78), which is more reasonable for time of deposition. Cause of discrepancy unknown but may be result of older, detrital carbon, possibly from 13,000-yr-old till which forms shoreline in area.

11,110 ± 220

ISGS-226. Core 1002-3A 9160 BC

From 22km E of Waukegan, Illinois (42° 23′ 00″ N, 87° 34′ 54″ W). From Lake Forest Member, interval 90 to 100cm below sediment/

water interface. Coll 1973. *Comment* (DLG): indicates very low sedimentation rate along W side of S Lake Michigan. No major streams enter lake along this shore; hence sedimentation rates are lower than on E side of S lake basin.

ISGS-219. Core 1000-3C, 20 to 30cm interval **4070 ± 130**
2120 BC

ISGS-234. Core 1000-3C, 50 to 60cm interval **4400 ± 200**
2450 BC

ISGS-220. Core 1000-3C, 90 to 100cm interval **5140 ± 160**
3190 BC

From 25km NW of Benton Harbor, Michigan (42° 18′ 00″ N, 86° 42′ 00″ W). From Waukegan Member. Coll 1973. *Comment* (DLG): dates imply sedimentation rate for foreset beds of Waukegan Member of Lake Michigan Formation. On depth *vs* age plot, points approx straight line with slope of 61cm/1000 yr. In an earlier study, 7 dates from core in bottomset beds indicated sedimentation rate of 19cm/1000 yr (R, 1974, v 16, p 112). Although relative values of ages appear correct, absolute values are probably too old because plots do not intersect origin. Anomolously old ages may be caused by presence of older, detrital carbon.

C. New Mexico

Lake Alamagordo E Section series

Sec in De Baca Co, NE¼ SE¼ SE¼ Sec 36, T 5N, R 25E, 31km NW of Ft Sumner, New Mexico (34° 34′ 30″ N, 104° 18′ 30″ W). Coll by J C Frye and A B Leonard; subm by H D Glass, Illinois State Geol Survey.

ISGS-200. NMP-140 **29,470 ± 360**
27,520 BC

Pisolitic cap on 1m caliche within top of Ogallala Formation. Overlain by 1m of Pleistocene marl and caliche. Coll 1972.

ISGS-216. NMP-305 **20,490 ± 230**
18,540 BC

Caliche 10cm from top of sec. Within gradational zone between underlying marl and overlying caliche.

ISGS-221. NMP-306 **11,250 ± 150**
9300 BC

Platy caliche, overlying Pleistocene marl on Ogallala pisolitic caliche. Coll 1973.

Santa Rosa NW Section series

Sec in Guadalupe Co, NW cor Sec 36, T 9N, R 20E, 9.7km WNW of Santa Rosa, New Mexico (34° 58′ N, 104° 46′ W). Coll 1972 by J C Frye and A B Leonard; subm by H D Glass.

27,160 ± 540

ISGS-201. NMP-108 **25,210 BC**

Pisolitic caliche from top 10cm of 2.45m exposure of Ogallala Formation.

41,500 ± 1200

ISGS-203. NMP-109 **39,550 BC**

Massive caliche of Ogallala Formation from 1.5m below top of exposure.

Santa Rosa SE Section series

Sec in Guadalupe Co, SE¼ Sec 22, T 8N, R 22E, on E edge of Santa Rosa, New Mexico (34° 48′ N, 104° 32′ W). Coll by J C Frye and A B Leonard; subm by H D Glass.

32,160 ± 430

ISGS-205. NMP-145 **30,210 BC**

Pisolitic caliche 9cm from top of Ogallala Formation. Coll 1972.

33,680 ± 300

ISGS-240. NMP-308 **31,730 BC**

Massive caliche of Ogallala Formation, 1.5m below top of pisolitic caliche.

35,000 ± 850

ISGS-207. NMP-175 **33,050 BC**

Pisolitic caliche from Chaves Co, NE¼ SE¼ SE¼ Sec 8, T 9S, R 25E, 22km NE of Roswell, New Mexico (32° 30′ N, 104° 25′ W). From 9cm below top of Ogallala Formation. Coll 1972 by J C Frye and A B Leonard; subm by H D Glass.

30,880 ± 400

ISGS-212. NMP-125 **28,930 BC**

Caliche from De Baca Co, SW¼ NW¼ NW¼ Sec 20, T 3N, R 25E, 9.3km W of Ft Sumner, New Mexico (34° 28′ 30″ N, 104° 21′ W). From banded to massive caliche of Ogallala Formation, 15cm below surface, but stratigraphically 0.6 to 1.2m below top of pisolitic caliche. Coll 1972 by J C Frye and A B Leonard; subm by H D Glass.

27,400 ± 500

ISGS-213. Taiban Borrow Pit Section, NMP-159 **25,450 BC**

Caliche from Roosevelt Co, NE¼ SE¼ Sec 31, T 3N, R 30E, 16.3km E of Taiban, New Mexico (34° 11′ N, 103° 56′ W). From dense caliche at top of 5.2m exposure of Kansan deposit. Coll 1972 by J C Frye and A B Leonard; subm by H D Glass.

24,100 ± 300

ISGS-214. Santa Rosa W Section, NMP-301 **22,150 BC**

Caliche from Guadalupe Co, NW¼ Sec 10, T 8N, R 21E, on W edge of Santa Rosa, New Mexico (34° 58′ N, 104° 44′ W). From top 10cm of Pleistocene pond marl. Coll 1973 by J C Frye and A B Leonard; subm by H D Glass.

43,100 ± 1900

ISGS-227. Quay/Curry Co Line Section, NMP-370 41,150 BC

Caliche from Quay Co, SW¼ SE¼ SE¼ Sec 34, T 9N, R 36E, 14.5km N of Bellview, New Mexico (34° 56′ N, 103° 07′ W). From massive caliche of Ogallala Formation, 2.4m below top of pisolitic caliche. Coll 1973 by J C Frye and A B Leonard; subm by H D Glass.

Hagerman E Section series

Sec in Chaves Co, NE¼ Sec 18, T 14S, R27E, 5.6km ESE of Hagerman, New Mexico (33° 07′ N, 104° 15′ W). Coll 1973 by J C Frye and A B Leonard; subm by H D Glass.

26,190 ± 220

ISGS-228. NMP-377 24,240 BC

Caliche from top of platy zone capping Kansan terrace on E side of Pecos R.

31,700 ± 570

ISGS-232. NMP-378 29,750 BC

Caliche from massive zone, 1m below top of platy caliche capping Kansan terrace.

32,600 ± 400

ISGS-239. Santa Rosa E Section, NMP-316 30,650 BC

Caliche cemented sand from Guadalupe Co, NE¼ Sec 4, T 8N, R 22E, on E edge of Santa Rosa, New Mexico (34° 57′ N, 104° 35′ W). From Ogallala Formation, 3.1m below top of pisolitic caliche. Coll 1973 by J C Frye and A B Leonard; subm by H D Glass.

General Comment: caliche dates have been shown by Frye *et al* (1974) to substantiate clay-mineral data, which indicates that capping layer of Ogallala Formation has been significantly modified by dissolution and reprecipitation in late Pleistocene and probably Holocene time. Ages are only apparent and do not represent actual time of caliche deposition.

13,550 ± 170

ISGS-222. Lake Avalon Dam Section 11,600 BC

Unionid shell fragments from Eddy Co, NE¼ Sec 14, T 21s, R 26E, 10km NNW of Carlsbad, New Mexico (32° 30′ N, 104° 15′ W). From lowest terrace of Pecos R, below Lake Avalon Dam. Coll 1973 by J C Frye and A B Leonard; subm by J C Frye, Illinois State Geol Survey. *Comment* (JCF): dates molluscan fauna of lowest part of terrace complex just above Pecos R floodplain of lower Pecos Valley.

6420 ± 110

ISGS-223. Highway 31 Section 4470 BC

Unionid shell fragments from Eddy Co, S central Sec 11, T 23S, R 28E, 4km NE of Loving, New Mexico (32° 16′ N, 104° 02′ W). From second terrace of Pecos R Valley in S New Mexico. Coll 1973 by J C Frye and A B Leonard; subm by J C Frye. *Comment* (JCF): dates upper part of gravelly terrace above floodplain of Pecos R.

D. Other localities

ISGS-173. Lower Moreau terrace **9180 ± 210 / 7230 BC**

Alluvium rich in organic material from Cole Co, Missouri, NE¼ SW¼ NW¼ Sec 28, T 44N, R11W, 7.2km SE of Jefferson City, Missouri (38° 32′ 10″ N, 92° 08′ 38″ W). From base of lower terrace along lower Moreau R, 15cm above gravel layer, 6.6m below surface. Coll 1972 by R Ward and W H Allen, Jr; subm by W H Allen, Jr, Missouri Geol Survey, Rolla. *Comment* (WHA): represents near-maximum age for deposition of material on lower terrace. Coarseness of material at base indicates lower terrace unit was cut into former floodplain and then built up more slowly. Terrace is still being aggraded during floods.

ISGS-174. Lincoln Farm Section **3675 ± 85 / 1725 BC**

Wood and disseminated carbon in alluvial silt from Cole Co, Missouri, SW¼ SW¼ SE¼ Sec 30, T 44N, R 12W, 6.4km S of Jefferson City (38° 31′ 30″ N, 92° 10′ 35″ W). From silt inset into lower terrace along Lower Moreau R, ca 5m below surface. Coll 1972 by R Ward and W H Allen, Jr; subm by W H Allen, Jr. *Comment* (WHA): material deposited in abandoned sloughs and assoc with chert gravels indicates a major change in stream channel, occurring at numerous points along Lower Moreau R between 4000 and 3500 BP. Sloughs have now been filled and appear as normal dissected elements of lower terrace, except where exposed in vertical cuts of present-day channel.

ISGS-180. Sullivan Country Core #3 **16,540 ± 110 / 14,590 BC**

Organic material in $<2\mu$ clay fraction from Sullivan Co, Indiana, SW¼ SE¼ NE¼ Sec 13, T 9N, R 10W, 3.2km N of Scott City, Indiana (39° 14′ 06″ N, 87° 27′ 50″ W). From IIA_{1b} horizon of paleosol in 15cm sandy loess zone overlying 18cm pedisediment and underlying 125cm of loess. Coll 1973 and subm by A P Canepa, Indiana Univ, Bloomington. *Comment* (APC): dated material overlain by 125cm of Peoria Loess (15,000 to 22,000 BP). It is unlikely that the Peoria Loess, generally 150 to 170cm thick in the area, was deposited in 1500 yr, therefore dated material is probably contaminated.

Venezuela series

From Estdo Falcon, Venezuela. Coll and subm by M P Weiss, N Illinois Univ, De Kalb.

ISGS-186. Lagoon on Cayo Sal, #1 **2690 ± 75 / 740 BC**

Saline peat from ca 1km NE of Chichiriviche, Venezuela (10° 56′ 30″ N, 68° 15′ 30″ W). From peat 11cm thick, 93cm below Cayo Sal Salina. Coll 1972.

2980 ± 120

ISGS-188. Lagoon on Cayo Sal, #2 **1030 BC**

Peat from ca 1km NE of Chichiriviche, Venezuela (10° 56′ 40″ N, 68° 15′ 45″ W). From saline peat 50cm below Cayo Sal Salina. Coll 1973. *General Comment* (MPW): dates represent last time vegetation grew in lagoon prior to hypersaline conditions.

100.98 ± .51%

ISGS-194A. Cayo Peraza Beach **Modern**

98.63 ± .46%

ISGS-194B. Cayo Peraza Beach **Modern**

Calcareous beach rock from ca 1km E of Chichiriviche, Venezuela (10° 56′ N, 68° 15′ W). Halimeda-molluscan sand cemented by aragonite from 4th-most-recent beachrock of Cayo Peraza. *Comment*: 2 fractions of CO_2 coll for dating. First fraction A probably contained most of the carbon in the aragonite cement. Fraction B probably is predominately from the clastics.

II. ARCHAEOLOGIC SAMPLES

A. Illinois

Loy Site series

Carbonized wood from Greene Co, SE¼ SE¼ SE¼ Sec 9 and N½ NE¼ NE¼ Sec 16, T 9N, R 10W, 12km S of Greenfield, Illinois (39° 14′ 00″ N, 90° 12′ 02″ W). Coll 1971 and subm by K B Farnsworth, Univ Michigan.

1970 ± 75

ISGS-171. No 4-31c **20 BC**

From base of sandstone-lined pit hearth, 0.6m below ground surface, assoc with 11 Havana-Hopewell series and 2 Middle Woodland type indeterminate sherds and one lamellar flake blade.

2010 ± 85

ISGS-181. No 6-72b **60 BC**

From mass of charcoal near base of basin-shaped refuse pit, Feature 72, 36cm below surface. Sherds recovered from pit were 53 Havana-Hopewell series and 4 Middle Woodland type indeterminate. One Snyders style and 2 Norton projectile points, and 2 lamellar flake blades were also recovered.

General Comment (KBF): previous Middle Woodland period samples from lower Illinois Valley region were dated between ca 100 BC and AD 450. In light of hypothesis for move of late Middle Woodland settlement from Illinois Valley trench into larger tributaries like Macoupin Valley, where Loy site is located (Farnsworth, 1973), dates ca AD 100 to 300 were expected.

975 ± 75

ISGS-175. Collins Site, Feature 41 **AD 975**

Wood charcoal from Vermilion Co, SW¼ NW¼ SE¼ Sec 8, T 20N, R 12W, 9.7km NW of Danville, Illinois (40° 12′ 30″ N, 87° 44′ 30″ W).

From refuse of burned Late Woodland house set in basin. Grit-tempered pottery with simple and collared rims in lower part of fill. Coll 1972 by Matt Walter; subm by J G Douglas, Univ Illinois. *Comment* (JGD): 2 other dates from site were 930 ± 140 (ISGS-112) and 853 ± 75 (ISGS-113: R, 1974, v 16, p 114). Three dates provide reasonable range for occupation of Collins site, although artifacts within house are interpreted to postdate AD 1050.

Indian Springs Mound series

Charred wood from Vermilion Co, NE¼ NW¼ SE¼ Sec 8, T 20N, R 12W, 9.7km NW of Danville, Illinois (40° 12′ 30″ N, 87° 44′ 30″ W). Outer rings of charred cedar logs, which were part of Late Woodland crematory structure built on bluff adjacent to pre-existing earthen mound, fired with 5 bundle burials on central scaffold, covered with loess cap. Coll 1972 and subm by J G Douglas.

ISGS-176. Feature 1, RC-4 **1045 ± 75** **AD 905**

From unnumbered log chunk under E end of Log 23B.

ISGS-191. Feature 1, RC-6 **960 ± 75** **AD 990**

From unexposed underside of Log 9.

ISGS-193. Feature 1, RC-7 **950 ± 90** **AD 1000**

From unexposed underside of Log 6.

ISGS-196. Feature 1, RC-9 **890 ± 85** **AD 1060**

From unexposed underside of Log 169.

General Comment (JGD): dates are maximum for crematory. Comparison with ISGS-112, -113, and -175 confirms contemporaneity of Indian Springs Mound with Late Woodland Collins site. Slightly older age for ISGS-176 may be because chunk was more completely combusted and therefore date is on heartwood rather than sapwood.

ISGS-177. Pulcher site **1075 ± 80** **AD 875**

Acorns from St Clair Co, SE¼ SE¼ NW¼ Sec 32, T 1N, R 10W, 2.4km S of Dupo, Illinois (38° 29′ 40″ N, 90° 14′ 00″ W). From refuse pit at depth 70 to 80cm below surface. Coll 1972 by P A Dickinson; subm by G A Freimuth, Univ Illinois. *Comment* (GAF): date helps establish chronologic position of Pulcher site by other than ceramic comparisons.

ISGS-178. Cedar Creek Reservoir **2005 ± 80** **55 BC**

Wood charcoal from Jackson Co, SE¼ NW¼ SE¼ Sec 26, T 10S, R 2W, 11km SW of Carbondale, Illinois (37° 37′ 12″ N, 89° 17′ 35″ W). From 76cm below surface at base of rock-lined roasting pit 69cm deep.

Coll 1972 by Barry Konneker; subm by M J McNerney, S Illinois Univ Mus, Carbondale. *Comment* (MJM): although no ceramics were directly assoc with charcoal, site produced only Crab Orchard fabric impressed ceramics.

1115 ± 75

ISGS-183. Grammar site **AD 835**

Charcoal from Jackson Co, SE¼ NE¼ NE¼ Sec 12, T 10S, R 2W, 6.4km SW of Carbondale, Illinois (37° 40′ 09″ N, 89° 16′ 07″ W). From charcoal stain 9cm thick, 42cm below surface. Coll 1972 by William Cremin; subm by M J McNerney. *Comment* (MJM): ceramics assoc with sample are Late Woodland and conform to type Raymond cord-marked (Maxwell, 1951).

Koster Site series

Carbonized wood from Greene Co, SW¼ NW¼ SE¼ Sec 21, T 9N, R 13W, 8km NE of Hardin, Illinois (39° 12′ 30″ N, 90° 33′ 00″ W). Coll 1972 by R B McMillan; subm by R B McMillan, Illinois State Mus, Springfield, and J A Brown, Northwestern Univ, Evanston, Illinois.

4880 ± 250

ISGS-202. KO-503 **2930 BC**

From 5 to 10cm below top of Horizon 6.

5175 ± 85

ISGS-197. KO-508 **3225 BC**

From main stratum of Horizon 6.

5250 ± 250

ISGS-198. KO-509 **3300 BC**

From small hearth *in situ* in top of Horizon 6. Stratigraphically equivalent to ISGS-197.

5070 ± 90

ISGS-199. KO-510 **3120 BC**

From small hearth *in situ* in upper 10 cm of Horizon 6. Stratigraphically equivalent to ISGS-197 and -198.

5140 ± 75

ISGS-235. KO-521 **3190 BC**

From near center of Horizon 6. Stratigraphically equivalent to ISGS-197, -198, and -199 in main portion of Horizon 6.

5305 ± 75

ISGS-237. KO-541 **3355 BC**

From large feature (possibly Archaic house) near base of Horizon 6. *Comment* (JAB): sample belongs to either main stratum of Horizon 6 or underlying lower stratum. Date is consistent with this intermediate stratigraphic position.

5440 ± 100
ISGS-233. KO-531 **3490 BC**

From large feature (possibly Archaic house) near base of main portion of Horizon 6.

5720 ± 75
ISGS-209. KO-520 **3770 BC**

From pit originating from basal unit of Horizon 6. *Comment* (JAB): dates lower stratum of Horizon 6, which is stratigraphically distinct from main stratum of Horizon 6.

7630 ± 210
ISGS-210. KO-530. **5680 BC**

From Horizon sub-8. *Comment* (JAB): 2 previously determined dates on Horizon 8 were 6265 ± 180 (GX2401) and 7730 ± 190 (GX2402).

7910 ± 100
ISGS-229. KO-535 **5960 BC**

From upper stratigraphic unit of Horizon 9.

8430 ± 90
ISGS-230. KO-553 **6480 BC**

From top 5cm of Horizon 11.

8480 ± 110
ISGS-236. KO-546 **6530 BC**

From mid-portion of Horizon 11.

8430 ± 100
ISGS-231. KO-552 **6480 BC**

From bottom 5cm of Horizon 11. *Comment* (JAB): 2 previously determined dates of 7155 ± 220 (GX2102) and 7005 ± 360 (GX2103) do not agree with chronology established here.

General Comment (JAB): dates are remarkably consistent with each other and with site stratigraphy. Chronology established by this series is also consistent with archaeologic time markers from each horizon.

B. Other localities

Loma Alta site series

Wood charcoal from near Loma Alta, Ecuador, ca 24km upstream from mouth of Valdivia R. Coll 1972 by Presley Norton; subm by D W Lathrap, Univ Illinois.

3765 ± 85
ISGS-190. LA-8 **1815 BC**

From excavation Unit J-III in thin yellow clay buried by 2.1m cultural refuse of Valdivia culture. *Comment* (DWL): yellow clay lines

bottom of gully eroded through Valdivia II-III midden, subsequent to early Valdivia occupation. Gully was refilled with refuse of much later Valdivia VI reoccupation of Loma Alta hill. Only cultural material in fill is Valdivia VI. Date is ca 100 yr later than dates from cairns in Unit J-III.

ISGS-192. LA-7 **4590 ± 120**
2640 BC

From excavation Unit J-III, covered with 2.2m Valdivia II-III midden. Assoc with stone Cairn #8, at base of cultural deposit and containing earliest pottery so far id in Ecuador. *Comment* (DWL): date slightly later than other dates from cairns in J-III: ISGS-142: 5000 ± 190; ISGS-146: 4750 ± 120 (R, 1974, v 16, p 115); I-7075: 4920 ± 120; I-7076: 5010 ± 120. Further stylistic analysis of pottery in 16 cairns excavated in J-III may disclose minor chronologic variations among various cairns, but at present it is more reasonable to assume all 5 dates refer to same range of cultural events. Distinctive group of ceramics from cairns at Loma Alta site can be dated quite securely in 4750 to 4950 BP range. Dates are reasonable, as cairn pottery is demonstratably earlier, on stylistic grounds, than Valdivia pottery so far described from Valdivia site.

ISGS-204A. Brynjulfson Cave #1 **>27,000**

ISGS-204B. Brynjulfson Cave #1 **34,600 ± 2100**
32,650 BC

Collagen fraction of bone from Boone Co, Missouri, SW¼ NE¼ SW¼ Sec 16, T 47N, R 12W, 19km S of Columbia, Missouri (38° 51′ 07″ N, 92° 16′ 50″ W). Bone (*Platygonus compressus*) coll randomly throughout 1.5m cave fill for ca 12m. Coll 1962 by M G Mehl; subm by P W Parmalee, Illinois State Mus, Springfield. *Comment*: previous dates on collagen from bones of mixed species from Brynjulfson Cave #1 ranged from 9940 ± 760 (ISGS-70: R, 1973, v 15, p 84) to 21,150 ± 430 (ISGS-166D: R, 1974, v 16, p 116).

ISGS-215. Puna 004 **3995 ± 75**
2045 BC

Charcoal from Provincia de Jujuy, Argentina, 170km NW of Jujuy City, Argentina (23° 10′ 00″ S, 65° 50′ 30″ W). From remains of Indian fire. Coll 1973 and subm by Jorge Fernández, Mina Aguilar, Prov Jujuy, Argentina. *Comment* (JF): from Holocene sediments filling basin of Guatayok. Accompanied by grinding tools and lithic materials different from those characteristic of preceramic period of Argentine NW (industries of Saladillo, Ayampitin, etc). Artifacts are typologically related to those from Rio Colorado Basin and Pinto Basin site, Nevada, USA, *ie*, Pinto and Silver Lake type points. Culturally they correspond to context of superior hunters, established at a later date in the area.

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UNIVERSITY OF LUND RADIOCARBON DATES VIII

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INTRODUCTION

Most of the ^{14}C measurements reported here were made between October 1973 and October 1974. Equipment, measurement, and treatment of samples are the same as reported previously (R, 1968, v 10, p 36-37; 1970, v 12, p 534).

Age calculations are based on a contemporary value equal to 0.950 of the activity of NBS oxalic acid standard and on the conventional half-life for ^{14}C of 5568 yr. Results are reported in years before 1950 (years BP), and in the AD/BC system. Errors quoted ($\pm 1\sigma$) include standard deviations of count rates for the unknown sample, contemporary standard, and background. When measured activity is less than 2σ above background, minimum age is given. Basis for calculation of age limit is measured net activity plus 3σ. If net activity is negative, only $+3\sigma$ is used for age limit.

Corrections for deviations from $\delta^{13}C = -25.0‰$ in the PDB scale are applied for all samples; also for marine shells, because apparent age of recent marine shells is not always just counterbalanced by the effect of isotopic fractionation (*cf,* Recent marine shells series, R, 1973, v 15, p 506-507). $\delta^{13}C$ values quoted are relative to the PDB standard.

The remark, "undersized; diluted", in *Comments* means the sample did not produce enough CO_2 to fill the counter to normal pressure and "dead" CO_2 from anthracite was introduced to make up the pressure. "% sample" indicates amount of CO_2 derived from the sample present in the diluted counting gas; the rest is "dead" CO_2. Organic carbon content reported for bone sample is calculated from yield of CO_2 by combustion of pretreated collagen. Organic carbon lost during treatment is not included in calculated percentage.

The description of each sample is based on information provided by the submitter.

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

A. Sweden

Tuorkanådas series

Peat from palsa, *ie,* permafrost mound, SE of Tuorkanådas, Torne Lappmark, N Sweden (68° 30′ N, 19° 00′ E). Coll 1972 by N Å Andersson; subm by M Sonesson, Dept Plant Ecol, Univ Lund. Dating

is part of study on peat development in Torneträsk area (Sonesson, 1968, 1974).

Lu-833. Tuorkanådas, 14 to 15cm **9310 ± 180** **7360 BC**

$\delta^{13}C = -24.2‰$

Peat from 0 to 1cm above mineral substratum. *Comment*: mild pretreatment with HCl and NaOH; small sample; diluted; 43% sample.

Lu-832. Tuorkanådas, 13 to 14cm, peat **8960 ± 140** **7010 BC**

$\delta^{13}C = -23.6‰$

Peat from 1 to 2 cm above mineral substratum. *Comment*: normal pretreatment with HCl and NaOH; diluted; 55% sample.

Lu-832A. Tuorkanådas, 13 to 14cm, humic acid **8890 ± 90** **6940 BC**

$\delta^{13}C = -24.8‰$

Acid-precipitated part of NaOH-soluble fraction from Lu-832. *Comment*: diluted; 72% sample (3 1-day counts.) Agreement between fractions indicates contamination is absent or insignificant.

Södra Bergundasjön series

Sediment from Lake Södra Bergundasjön at town of Växjö, Central Småland (56° 51′ N, 13° 47′ E). Coll 1972 and subm by L Bengtsson, Dept Limnol, Univ Lund. Dated to determine rate of sediment deposition. Depths refer to sediment surface. Mild pretreatment with HCl and NaOH.

Lu-860. Södra Bergundasjön, 55 to 60cm **660 ± 55** **AD 1290**

$\delta^{13}C = -25.1‰$

Detritus gyttja. *Comment*: undersized; diluted; 87% sample.

Lu-861. Södra Bergundasjön, 120 to 125cm **620 ± 50** **AD 1330**

$\delta^{13}C = -25.1‰$

Detritus gyttja.

Trummen series

Sediment from Lake Trummen, Central Småland (56° 52′ N, 14° 50′ E). Coll 1974 and subm by G Digerfeldt, Dept Quat Geol, Univ Lund. Dates were part of study of Late glacial development of lake and surrounding landscape. Other dates in series were reported previously (R, 1968, v 10, p 40-43; 1969, v 11, p 434; 1970, v 12, p 535-536). Major results of Postglacial studies are pub by submitter (Digerfeldt, 1972). Depths refer to water surface. Water depth ca 1.7m. Sample Lu-944 consists of clayey gyttja; all other samples are clay gyttja. Pretreated with HCl. All samples except Lu-944 were undersized and therefore diluted. Amount of CO_2 from sample is given in *Comments* below as "% sample".

Lu-936. Trummen, 664 to 666cm — **11,670 ± 130**, **9720 BC**, $\delta^{13}C = -20.5‰$

Comment: 65% sample. (3 1-day counts.)

Lu-937. Trummen, 648 to 652cm — **12,330 ± 165**, **10,380 BC**, $\delta^{13}C = -19.0‰$

Comment: 53% sample. (3 1-day counts.)

Lu-938. Trummen, 636 to 640cm — **12,030 ± 135**, **10,080 BC**, $\delta^{13}C = -19.7‰$

Comment: 64% sample. (4 1-day counts.)

Lu-939. Trummen, 622 to 626cm — **11,820 ± 160**, **9870 BC**, $\delta^{13}C = -18.5‰$

Comment: 63% sample.

Lu-940. Trummen, 608 to 612cm — **11,390 ± 155**, **9440 BC**, $\delta^{13}C = -18.5‰$

Comment: 64% sample.

Lu-941. Trummen, 594 to 598cm — **10,990 ± 145**, **9040 BC**, $\delta^{13}C = -20.0‰$

Comment: 70% sample.

Lu-942. Trummen, 580 to 584cm — **10,670 ± 115**, **8720 BC**, $\delta^{13}C = -22.3‰$

Comment: 91% sample.

Lu-943. Trummen, 566 to 570cm — **10,300 ± 110**, **8350 BC**, $\delta^{13}C = -21.4‰$

Comment: 89% sample.

Lu-944. Trummen, 552 to 556cm — **10,120 ± 100**, **8170 BC**, $\delta^{13}C = -21.5‰$

Lu-989. Trummen, Complementary Sample 1 — **11,180 ± 145**, **9230 BC**, $\delta^{13}C = -21.8‰$

Comment: 55% sample. (3 1-day counts.)

Lu-990. Trummen, Complementary Sample 2 — **12,280 ± 185**, **10,330 BC**, $\delta^{13}C = -21.5‰$

Comment: 42% sample. (3 1-day counts.)

Lu-962. Barsebäcksmossen, 902.5 to 907.5cm — **6700 ± 75**, **4750 BC**, $\delta^{13}C = -22.0‰$

Brackish clayey gyttja from early part of AT 2. Coll 1969 and subm by G Digerfeldt. Main series from this site was pub previously (R, 1973, v 15, p 496-499). *Comment*: pretreated with HCl.

Järlasjön series

Sediment from Lake Järlasjön at Nacka, Stockholm (59° 18° N, 18° 06′ E). Coll 1972 and subm by G Digerfeldt. Dated as part of study on laminated sediments. Samples consist of clay gyttja. Pretreated with HCl.

Lu-905. Järlasjön 1 — **940 ± 65**, **AD 1010**, $\delta^{13}C = -28.0‰$

Comment: undersized; diluted; 56% sample.

Lu-906. Järlasjön 2 — **1360 ± 60**, **AD 590**, $\delta^{13}C = -27.4‰$

Comment: undersized; diluted; 69% sample.

Hinnasjön series

Sediment from Lake Hinnasjön, ca 7km E of town of Växjö, Central S Sweden (56° 53′ N, 14° 56′ E). Coll 1973 by Th Persson; subm by G Digerfeldt. Dated with study of Late Postglacial vegetational history of surrounding landscape. Dates also used to determine rate of sediment deposition to calculate absolute pollen frequency per cm² per year. Pollen analyses by Th Persson. Depths refer to sediment surface. Water depth at sampling point, 2.7m. All samples consist of fine detritus gyttja, and were pretreated with HCl and NaOH. Seven samples undersized; diluted. Amount of CO_2 from sample is given in *Comments* below as "% sample".

Lu-960. Hinnasjön, 311 to 316cm — **3590 ± 65**, **1640 BC**, $\delta^{13}C = -29.2‰$

Comment: 80% sample.

Lu-961. Hinnasjön, 241 to 246cm — **2700 ± 55**, **750 BC**, $\delta^{13}C = -29.8‰$

Decrease of *Quercus, Ulmus,* and *Corylus.*

Lu-959. Hinnasjön, 179 to 184cm — **2190 ± 70**, **240 BC**, $\delta^{13}C = -30.1‰$

Distinct increase of *Fagus. Comment*: 68% sample.

Lu-921. Hinnasjön, 144 to 149cm — **1950 ± 50**, **AD/BC 0**, $\delta^{13}C = -29.7‰$

Lu-920. Hinnasjön, 114 to 119cm — **1790 ± 55** / **AD 160** / $\delta^{13}C = -29.3‰$

Beginning of last maximum of *Quercus;* just below maximum of *Carpinus; Fagus* reaches 1%. *Comment*: 87% sample.

Lu-958. Hinnasjön, 90 to 92.5cm — **1400 ± 65** / **AD 550** / $\delta^{13}C = -29.8‰$

Decrease of *Alnus* and *Carpinus. Comment*: 60% sample.

Lu-864. Hinnasjön, 50 to 52.5cm — **1080 ± 60** / **AD 870** / $\delta^{13}C = -30.0‰$

Decrease of *Betula; Juniperus* reaches 1%. *Comment*: 69% sample.

Lu-863. Hinnasjön, 35 to 37.5cm — **930 ± 65** / **AD 1020** / $\delta^{13}C = -30.0‰$

Rational *Picea* limit. *Comment*: 59% sample.

Lu-862. Hinnasjön, 12.5 to 15cm — **600 ± 65** / **AD 1350** / $\delta^{13}C = -28.9‰$

Culmination of *Fagus*; further increase of *Picea* and *Juniperus. Comment*: 61% sample.

Härryda series

Wood from 2 exposures at Härryda, SW Sweden. Coll 1973 and subm by A Hilldén, Dept Quaternary Geol, Univ Lund. Dating is part of study on hydrology in area.

Lu-889. Härryda, Sample 1 — **3920 ± 60** / **1970 BC** / $\delta^{13}C = -27.0‰$

Wood fragments (*Alnus* sp) id by T Bartholin from light clay below 1.5m coarse river gravel at Hwy 40 bridge over Tvärån, Härryda (57° 41′ 33″ N, 12° 19′ 43″ E). *Comment*: pretreated with HCl.

Lu-888. Härryda, Sample 2 — **2260 ± 55** / **310 BC** / $\delta^{13}C = -28.3‰$

Wood from stump (*Alnus* sp) id by T Bartholin from light clay below 1.0m of coarse river gravel in new brook furrow, 350m ESE of Härryda church (57° 41′ 27″ N, 12° 19′ 00″ E). *Comment*: pretreated with HCl and NaOH.

Tomtabacken series

Åkerhultagöl is a mire pool, 1km SW of Tomtabacken, highest hill of South Swedish Upland (57° 29′ N, 14° 28′ E). Alt of pool: +303m; size: ca 300x100m. Samples are from core taken from mire surface in

SW part with Livingstone sampler (100mm diam). This is a Late Weichselian standard profile within a project on S Swedish paleoecology. It is part of study on deglaciation of this upland. Coll 1973 and subm by B E Berglund, Dept Quaternary Geol, Univ Lund. Depths refer to surface of mire. Pollen zones according to Nilsson (1961) and Berglund (1966). Some samples were undersized and therefore diluted. Amount of CO_2 from sample is given in *Comments* below as "% sample". All samples pretreated with HCl.

Lu-893. Tomtabacken 1, 519 to 522cm **12,610 ± 190**
10,660 BC
$\delta^{13}C = -21.4‰$

Muddy, silty clay. *Comment*: 0.18% carbonate content in sediment from 530 to 535cm. 47% sample. (3 1-day counts.)

Lu-894. Tomtabacken 2, 517 to 519cm **12,450 ± 130**
10,500 BC
$\delta^{13}C = -22.6‰$

Clay gyttja. Sample 1 and 2 should date *Betula* rise in pollen diagram. *Comment*: 74% sample. (3 1-day counts.)

Lu-895. Tomtabacken 3, 509 to 512cm **11,480 ± 115**
9530 BC
$\delta^{13}C = -23.2‰$

Clay gyttja. Upper part of *Betula* zone. *Comment*: no detectable carbonate in sample.

Lu-896. Tomtabacken 4, 506 to 509cm **11,150 ± 110**
9200 BC
$\delta^{13}C = -24.1‰$

Clay gyttja. Lower part of DR 3.

Lu-897. Tomtabacken 5, 491 to 493cm **10,440 ± 110**
8490 BC
$\delta^{13}C = -22.3‰$

Clay gyttja. Upper part of DR 3. *Comment*: 85% sample.

Lu-898. Tomtabacken 6, 489 to 491cm **10,920 ± 150**
8970 BC
$\delta^{13}C = -23.8‰$

Clay gyttja. Lower part of DR 3-PB. *Comments*: 52% sample. (3 1-day counts.) (BEB): for some reason this date deviates from the continuous chronologic order.

Lu-899. Tomtabacken 7, 486 to 487cm **10,150 ± 115**
8200 BC
$\delta^{13}C = -23.5‰$

Clay gyttja. Uppermost part of DR 3-PB. *Comment*: 82% sample.

Lu-900. Tomtabacken 8, 479 to 480cm — **9860 ± 85**, **7910 BC**, $\delta^{13}C = -27.3‰$

Clayey gyttja. Middle of PB. *Comment*: 92% sample. (3 1-day counts.)

Lu-901. Tomtabacken 9, 474 to 475cm — **9530 ± 95**, **7580 BC**, $\delta^{13}C = -27.7‰$

Clayey gyttja. Uppermost part of PB.

Lu-902. Tomtabacken 10, 468 to 469cm — **9120 ± 95**, **7170 BC**, $\delta^{13}C = -30.6‰$

Clayey gyttja. Middle of BO 1.

Lu-903. Tomtabacken 11, 462 to 463cm — **8470 ± 95**, **6520 BC**, $\delta^{13}C = -31.0‰$

Fine detritus gyttja. Lowermost part of BO 2. *Comment*: 93% sample.

Lu-904. Tomtabacken 12, 440 to 441cm — **7640 ± 80**, **5690 BC**, $\delta^{13}C = -30.3‰$

Fine detritus gyttja. Lower part of AT 1.

Lake Ämmern series

Sediment from Lake Ämmern, 600m NE of Tjärstad church, Östergötland (58° 07′ 30″ N, 15° 43′ 30″ E). Alt of lake: +86.1m. Coll 1972 and subm by H Göransson, Dept Quat Geol, Univ Lund. Lu-924 and -925 taken with 30mm and the rest with 60mm Livingstone core sampler. All samples consist of fine detritus gyttja. Depths are below sediment-water interface. Water depth at sampling point, 423cm. Samples represent characteristic levels in pollen diagram. Pollen analyses by submitter. Dating is part of study on vegetational development and human influence in area. See also Lake Striern and Lake Vån series (R, 1970, v 12, p 541-543; 1974, v 16, p 315-316, and below). All samples pretreated with HCl.

Lu-924. Ämmern, 369 to 379cm — **6140 ± 70**, **4190 BC**, $\delta^{13}C = -28.5‰$

Immediately below *Ulmus* decline and at *Tilia* decline; 1st find of *Triticum*.

Lu-925. Ämmern, 339 to 349cm — **5870 ± 70**, **3920 BC**, $\delta^{13}C = -28.5‰$

Low *Ulmus* and *Tilia* values after decline.

Lu-926. Ämmern, 314 to 318cm **5760 ± 70**
3810 BC
$\delta^{13}C = -27.3‰$

Ulmus and *Tilia* increasing; decline of *Populus* and *Pteridium.*

Lu-927. Ämmern, 256 to 260cm **5230 ± 70**
3280 BC
$\delta^{13}C = -27.9‰$

Second decline of *Ulmus.*

Lu-928. Ämmern, 210 to 214cm **4840 ± 65**
2890 BC
$\delta^{13}C = -28.2‰$

Further decline of *Ulmus;* rising *Pteridium.*

Lu-929. Ämmern, 155 to 160cm **3980 ± 60**
2030 BC
$\delta^{13}C = -28.2‰$

Falling *Quercetum Mixtum.* Increase of apophytes and anthropochors.

Lu-956. Ämmern, 97.5 to 102.5cm **3140 ± 55**
1190 BC
$\delta^{13}C = -27.5‰$

Empiric *Picea* limit. *Juniperus* strongly rising.

Lu-957. Ämmern, 85 to 90cm **2740 ± 55**
790 BC
$\delta^{13}C = -27.3‰$

Picea ca 6%; *Juniperus* 3 to 4%.

General Comment (HG): in Lake Ämmern, *Ulmus* declines at same age as in Lake Vån (*cf* R, 1974, v 16, p 316-317). $CaCO_3$ content in the till is very low around Lake Vån, but distinctly higher near Lake Ämmern (*cf* Gillberg, 1965, p 455). Sedimentation rate is very low in uppermost part of Ämmern profile and there is perhaps some hidden hiatus. Lake Ämmern was lowered ca 3m 100 yr ago.

Lake Striern Series II

Sediment from Lake Striern, ca 850m E of Hägerstad old church, Östergötland (58° 05′ N, 15° 47′ E). Alt of lake: +87.3m. Coll 1972 and subm by H Göransson. Taken with 60mm Livingstone core sampler. All samples consist of fine detritus gyttja. Depths are below sediment-water interface. Water depth at sampling point, 63cm. Dated as complement to Lake Striern and Lake Vån series (R, 1970, v 12, p 541-543; 1974, v 16, p 315-316). All samples pretreated with HCl.

Lu-951. Striern II, 430 to 435cm **7610 ± 80**
5660 BC
$\delta^{13}C = -30.4‰$

Empiric *Quercus* limit.

Lu-952. Striern II, 420 to 425cm — **7090 ± 80** / **5140 BC** / $\delta^{13}C = -30.2‰$

Empiric *Tilia* limit.

Lu-953. Striern II, 415 to 420cm — **6790 ± 75** / **4840 BC** / $\delta^{13}C = -30.1‰$

Rational *Tilia* limit.

Lu-954. Striern II, 380 to 385cm — **6050 ± 70** / **4100 BC** / $\delta^{13}C = -25.2‰$

Optimum of "Older Lime Period" (*sensu* Iversen, 1973, p 62).

Lu-955. Striern II, 340 to 345cm — **5620 ± 70** / **3670 BC** / $\delta^{13}C = -24.9‰$

Immediately below *Ulmus* decline; immediately above *Tilia* decline; strong rise of *Populus.*

Lu-950. Striern II, 320 to 325cm — **5250 ± 65** / **3300 BC** / $\delta^{13}C = -23.0‰$

Low values of *Ulmus* and *Tilia* after decline; high values of *Populus, Pteridium,* and *Rumex acetocella;* continuous curve for *Plantago lanceolata* (since 325cm); find of *Triticum.*

General Comment (HG): real radiocarbon age for *Ulmus* decline in Striern I (R, 1970, v 12, p 542) and Striern II seem exactly the same, considering dated sample in Striern I was from above and in Striern II below decline.

Lu-949. Striern I, 10 to 20cm — **500 ± 80** / **AD 1450** / $\delta^{13}C = -25.3‰$

Fine detritus gyttja, Sample 102+103, with high values of *Myriophyllum spicatum* and *M alterniflorum,* from Lake Striern, 900m NE of Hägerstad new church, Östergötland (58° 05′ N, 15° 47′ E). Coll 1966 and subm by H Göransson. Complement to Lake Striern series (R, 1970, v 12, p 541-543). Pretreated with HCl. Undersized; diluted; 39% sample. *Comment* (HG): because lake was lowered 100 yr ago, ^{14}C ages of uppermost part of Striern I core are wrong. Thus, it is not possible to determine a value for "hard water error" by extending the ^{14}C curve to the sediment surface. Also, ^{14}C values in lowered lakes in Southern Swedish Highlands without $CaCO_3$ in surroundings are too high (see, eg, Lu-862, Hinnasjön series, above).

Lu-945. Bönnarp — **11,490 ± 105** / **9540 BC** / $\delta^{13}C = -19.1‰$

Collagen from metatarsus (*Megaceros giganteus*) from small ancient

lake at Bönnarp, SE of Malmö (55° 32′ N, 13° 07′ E). Coll 1972 by Limhamn Mus; subm by R Liljegren, Dept Quaternary Geol, Univ Lund. *Comments*: collagen extracted as described previously (R, 1970, v 12, p 534). Organic carbon content: 4.2%. (RL): pollen study not possible, but result agrees well with date for antler of *Megaceros giganteus* from Hindby (Lu-824: 11,330 ± 110, R, 1974, v 16, p 317).

Bäckebol series, marine shells

Marine shells from E of pt 82, Bäckebol, Hisingen, SW Sweden (57° 46′ N, 11° 59′ 08″ E). Coll 1961 and subm by Å Hillefors, Dept Phys Geog, Univ Lund. Dated as part of study of chronology for terminal moraine lines at Swedish W coast.

Lu-876:2. Bäckebol, *Mytilus*, inner fraction **12,950 ± 125**
11,000 BC
$\delta^{13}C = -0.8‰$

Shells (*Mytilus edulis*) from sandy shell accumulation enclosed in till (*cf* Hillefors, 1969, p 154, 156: fig 139a). *Comment*: inner fraction (35% of shells) was used.

Lu-876:1. Bäckebol, *Mytilus*, outer fraction **12,780 ± 125**
10,830 BC
$\delta^{13}C = -0.8‰$

Outer fraction of shells used for Lu-876:2. *Comment*: outer fraction was 39% of shells; outermost 26% removed by acid leaching.

Lu-877. Bäckebol, *Hiatella* **12,580 ± 125**
10,630 BC
$\delta^{13}C = +1.2‰$

Shells (*Hiatella* [*Saxicava*] *arctica*) from wave-washed gravel overlying upper till boundary. *Comment*: outer 53% of shells removed by acid leaching.

General Comment: other pertinent dates are Lu-270: 12,880 ± 125; Lu-271: 12,960 ±135; Lu-281: 12,880 ± 145; Lu-507: 12,890 ± 130 (R, 1970, v 12, p 544-545; 1972, v 14, p 386). Corrections for deviations from $\delta^{13}C = -25.0‰$ in PDB scale are applied also for shell samples. No corrections are made for apparent age of shells of living marine mollusks. For apparent age, see Recent marine shells series below, and R, 1969, v 11, p 441; 1970, v 12, p 543.

Recent marine shells series

Lu-593. Slussen, Orust, Sample 1 **Apparent age: 420 ± 45**
$\delta^{13}C = -0.4‰$

Recent shells (*Nassa reticulata*) from seashore at Slussen, Orust, Bohuslän (58° 15′ 07″ N, 11° 45′ 05″ E). Coll 1942 by G Hillefors; subm by Å Hillefors.

Lu-594. Slussen, Orust, Sample 2 Apparent age: 380 ± 48
$\delta^{13}C = +0.8‰$

Recent shells (*Cardium edule, Nassa reticulata, Littorina obtusata,* and *Mytilus edulis*) from same collection as Lu-593.

Lu-878. Skagen, Jutland, Sample 1 Apparent age: 375 ± 44
$\delta^{13}C = +0.2‰$

Recent shells (*Mya arenaria*) from seashore between Skagen and Grenen, Jutland, N Denmark (57° 44′ N, 10° 37′ 40″ E). Coll 1937 by G Hillefors; subm by Å Hillefors. *Comment*: outer 25% removed by acid leaching.

General Comment: corrections are applied for deviations from $\delta^{13}C = -25.0‰$ in PDB scale and activity measurements are age-corrected between collection date and 1950.

Tertiary shell series

Tertiary shell fragments from exposure at mouth of Hallbjarnarstadaá, Tjörnes, Iceland (66° 11′ N, 17° 11′ W). Coll 1971 by I U Olsson, Inst Phys, Univ Uppsala, to test whether fossil shells remain uncontaminated by ^{14}C under favorable environmental conditions.

Lu-591. Hallbjarnarstadaá, inner fraction >43,400
$\delta^{13}C = +0.8‰$

Unid. Tertiary shell fragments. *Comment*: inner fraction (42% of shells) was used. (5 1-day counts.)

Lu-590. Hallbjarnarstadaá, outer fraction >43,600
$\delta^{13}C = +0.5‰$

Outer fraction of shells used for Lu-591. *Comment*: outer fraction was 38% of shells; outermost 20% removed by acid leaching. (5 1-day counts.)

General Comment: shells had no detectable contamination. Measured activity was almost exactly zero for both fractions. Three σ were used for calculation of minimum age.

B. Greenland

East Greenland series (IV)

Marine shells from emerged sediments, and terrestrial peat, from different parts of central E and NE Greenland (mainly from Hudson Land and Hold With Hope). Sample Lu-930 coll 1907 by *Danmark* Expedition; all others coll 1970 to 1973 by C Hjort, Dept Quaternary Geol, Univ Lund, who subm all samples as part of study of glaciation chronology and shoreline displacement in E Greenland. For other dates from area, see R, 1972, v 14, p 388-390; 1973, v 15, p 504-507; 1974, v 16, p 319-322. For apparent age of recent shells in area, see R, 1973, v 15, p 506-507 and Hjort (1973).

Lu-866. Forsblads Fjord, Sample 1 **7140 ± 75**
5190 BC
$\delta^{13}C = +0.7‰$

Shells (*Mya truncata, Hiatella arctica*) from silty sand at +21m, inner Forsblads Fjord (72° 24′ N, 26° 14′ W). Sediment also contained *Mytilus edulis* (Hjort & Funder, 1974). *Comment*: outer 62% of shells removed by acid leaching.

Lu-867. Loch Fyne, Sample 1 **6500 ± 75**
4550 BC
$\delta^{13}C = +0.1‰$

Shells (*Mytilus edulis*) from coastal cliff on W side of Loch Fyne (73° 40′ N, 21° 50′ W). Antedates shoreline at +7m to +8m (*cf* Hjort & Funder, 1974). *Comment*: outer 50% of shells removed by acid leaching.

Lu-868. Ankerbjaergelv **6460 ± 70**
4510 BC
$\delta^{13}C = -0.9‰$

Shells (*Mya truncata, Macoma calcarea, Clinocardium ciliatum*) from fine sand overlain by beach gravel at Ankerbjaergelv delta in Moskusoxefjord (73° 37′ N, 22° 21′ W). Coll at +2m and dates or closely antedates shore level at +6m. Also contained fragments of *Mytilus edulis (cf* Hjort & Funder, 1974). *Comment*: outer 44% of shells removed by acid leaching.

Lu-869. Knudshoved, Sample 1 **42,500 $^{+3600}_{-2500}$**
40,550 BC
$\delta^{13}C = +0.5‰$

Shell fragments (*Mya truncata, Hiatella arctica*) from silt at +50m on basalt hill with glacial striae at Knudshoved, Hold With Hope (73° 44′ N, 20° 32′ W). Probably postdates glaciation reaching outer coast and shelf (Kap Mackenzie Stadial; Funder & Hjort, 1973). *Comment*: outer 25% of shells removed by acid leaching. (4 1-day counts.)

Lu-882. Glommen **10,720 ± 150**
8770 BC
$\delta^{13}C = -4.1‰$

Shells (*Hiatella arctica*) from sandy silt at +45m along R Glommen, Hold With Hope (73° 33′ N, 20° 45′ W). Clearly antedates sea level at +50m. Same sediment reaches ca +60m, with no shells much above sample layer. *Comment*: outer 21% of shells removed by acid leaching. Undersized; diluted; 50% sample. (3 1-day counts.)

Lu-883. Stordalen **9220 ± 90**
7270 BC
$\delta^{13}C = +1.2‰$

Shells (*Mya truncata, Hiatella arctica*) from silt at +35m, at mouth of Stordalen, Hudson Land (73° 40′ N, 22° 00′ W). Age is minimum for

moraine system equivalent to shore level at +70m. Probably dates ice-contact delta rather closely at +60m. *Comment*: outer 16% of shells removed by acid leaching.

Lu-884. Myggbukta **6520 ± 70**
4570 BC
$\delta^{13}C = +0.6‰$

Shells (*Mya truncata, Tridonta* [*Astarte*] *borealis, Nicania* [*Astarte*] *montagui*) from fine sand at ca +6m, overlain by seaweed, organic detritus, and eolian sand at Myggbukta (73° 29′ N, 21° 37′ W). Probably closely dates distinct shore level at +7m. *Comment*: outer 21% of shells removed by acid leaching.

Lu-885. Tobias Dal **9540 ± 90**
7590 BC
$\delta^{13}C = +0.3‰$

Shells (*Mya truncata, Hiatella arctica*) from silty fine sand at +20m in Tobias Dal, Hold With Hope (73° 44′ N, 20° 45′ W). Sediment reaches +30m, the highest for shell-bearing known in this valley. *Comment*: outer 62% of shells removed by acid leaching.

Lu-886. Loch Fyne, Sample 2 **9290 ± 90**
7340 BC
$\delta^{13}C = +0.8‰$

Shells (*Mya truncata*) from fine sand at +35 to 40m on W side of Loch Fyne (73° 41′ N, 21° 50′ W). Equivalent to shore level at or above +52m. *Comment*: outer 63% of shells removed by acid leaching.

Lu-930. Store Koldewey **>40,400**
$\delta^{13}C = -0.7‰$

Shells (*Mya truncata, Hiatella arctica, Macoma calcarea, Clinocardium ciliatum, Serripes groenlandica, Tridonta borealis, Natica* sp, *Nucula* sp, *Portlandia arctica*) from clay on bedrock at +120m on S part of Store Koldewey Ö (76° 10′ N, 18° 35′ W). Coll during *Danmark* Expedition, 1907; described by Jensen (1917). Date is linked with age of glaciation reaching outer coast and shelf (*cf* Kap Mackenzie Stadial; Funder & Hjort, 1973). Alt compares with that of Lu-532 (R, 1973, v 15, p 504). Sample also contained *Cyrtodaria kurriana* (*cf* Símonarson, 1974, p 68). *Comment*: outer 10% of shells removed by acid leaching. Sample undersized; diluted; 78% sample. (3 1-day counts.)

Lu-972. Knudshoved, Sample 2 **2090 ± 60**
140 BC
$\delta^{13}C = -26.5‰$

Terrestrial sandy peat from river cutting at +35m, Knudshoved, Hold With Hope (73° 43′ N, 20° 34′ W). Coll at top of permafrost, into which these sediments continue; overlain by 2m alternating layers of same kind of peat and eolian sand. *Comment*: pretreated with HCl and NaOH. Diluted; 81% sample.

General Comment: corrections for deviations from $\delta^{13}C = -25.0‰$ in

PDB scale are applied also for shell samples. No corrections are made for apparent age of shells of living marine mollusks.

C. Spitsbergen

Nottinghambukta series

Marine shells and plant remains from cliff shore of Kvartsittsletta in Nottinghambukta near Werenskiold Glacier, N of Hornsund, S part of Vest-Spitsbergen (77° 04′ 20″ N, 15° 10′ E). Coll 1972 by J Szupryczyński and A Olszewski; subm by J Szupryczyński, Inst Geog, Polish Acad Sci, Toruń, Poland. Mollusks id by I Dmoch, N Copernicus Univ, Toruń. Depths refer to surface of "5 to 4m marine terrace". Results of studies from Hornsund area pub by Birkenmajer and Olsson (1971).

Lu-847. Nottinghambukta N-1, 0.5 to 1.2m **7290 ± 75 / 5340 BC**

$\delta^{13}C = +1.3‰$

Shells (*Tridonta* [*Astarte*] *borealis*) from gray and brown marine gravel and sand. Fauna in interval 0.5 to 1.2m also contained *Mytilus edulis. Comment*: outer 70% of shells removed by acid leaching.

Lu-848. Nottinghambukta N-2, 1.2 to 1.8m **7310 ± 75 / 5360 BC**

$\delta^{13}C = -0.1‰$

Shells (*Mytilus edulis*) from gray marine sand and gravel. Fauna in this interval also contained *Tridonta (Astarte) borealis. Comment*: outer 63% of shells removed by acid leaching.

Lu-849. Nottinghambukta N-3:1, 1.7 to 2:2m **7300 ± 75 / 5350 BC**

$\delta^{13}C = +0.4‰$

Shells (*Mytilus edulis*) from gray marine sand. *Comment*: outer 65% of shells removed by acid leaching.

Lu-850. Nottinghambukta N-3:2, 1.7 to 2.2m **7490 ± 75 / 5540 BC**

$\delta^{13}C = +1.6‰$

Shells (*Tridonta* [*Astarte*] *borealis*) from same deposits as Lu-849. *Comment*: outer 65% of shells removed by acid leaching.

Lu-812. Nottinghambukta N-4:1, 2.2 to 3.5m **7580 ± 75 / 5630 BC**

$\delta^{13}C = -1.1‰$

Shells (*Mytilus edulis*) from gray marine very fine sand. Fauna in this interval also included *Hiatella (Saxicava) arctica, Tridonta (Astarte) borealis, Mya truncata, Littorina littorea,* and unid. barnacles. *Comment*: outer 67% of shells removed by acid leaching.

Lu-813. Nottinghambukta N-4:2, 2.2 to 3.5m **7430 ± 75 / 5480 BC**

$\delta^{13}C = +0.1‰$

Barnacle shells from same deposits as Lu-812. *Comment*: outer 60% of shells removed by acid leaching.

Lu-851. Nottinghambukta N-4:3, 2.3 to 2.4m **7400 ± 80**
5450 BC
$\delta^{13}C = -20.0‰$

Remains of unid. littoral plants from top part of interval N-4. *Comment*: pretreated with HCl and NaOH.

General Comment: corrections for deviations from $\delta^{13}C = -25.0‰$ in PDB scale are applied also for shell samples. No corrections are made for apparent age of shells of living marine mollusks.

D. Poland

Lu-852. Grudziadz-Mniszek **>40,200**
$\delta^{13}C = -27.2‰$

Highly humified organic matter from boring at Grudziądz-Mniszek, lower Vistula valley, N Poland (53° 26′ N, 18° 44′ E). Sample from middle part of upper organic layer, ca 10 to 12m below surface of Vistula Terrace II, overlain by sand and alluvium (Drozdowski and Tobolski, 1972, p 77; p 88, fig 3). Coll 1969 and subm by E Drozdowski, Inst Geog, Polish Acad Sci, Toruń, Poland. *Comment*: normal pretreatment with HCl but only short treatment with NaOH at room temperature due to high humification.

Lu-852A. Grudziadz-Mniszek, humic acid **>39,600**
$\delta^{13}C = -25.7‰$

Acid-precipitated part of NaOH-soluble fraction from Lu-852.

E. Scotland

Lu-916. Rannoch Moor **5850 ± 70**
3900 BC
$\delta^{13}C = -24.9‰$

Wood from pine stump 30cm over base of rather humified peat layer (110cm deep) of gently sloping valley bog in W part of Rannoch Moor, 10km N of Loch Tulla, Argyll, Scotland (56° 39′ N, 4° 48′ W). Coll 1973 and subm by N Malmer, Dept Plant Ecol, Univ Lund. Sample was part of distinct stump horizon without contact with underlying mineral substratum of gravel. *Comment* (NM): stump horizon dates last time for formation of peat in this area. *Cf* previous dates for similar samples from Ireland (R, 1974, v 16, p 322-323). Pretreated with HCl and NaOH.

II. ARCHAEOLOGIC SAMPLES

Sweden

Dalkarlstorp series

Charcoal and soot from Stone age settlement at Dalkarlstorp, Kila parish, Västmanland (59° 50′ N, 16° 30′ 30″ E). Coll 1972 and 1973 and subm by S Welinder, Hist Mus, Univ Lund. Preliminary report pub by submitter (Welinder, 1973). All samples pretreated with HCl or H_2SO_4 (Lu-776, -776:S2) and NaOH.

Lu-748. Dalkarlstorp 1 **4080 ± 60**
2130 BC
$\delta^{13}C = -24.8‰$

Charcoal from Hearth-pit 492/9.

Lu-749. Dalkarlstorp 2 **1670 ± 50**
AD 280
$\delta^{13}C = -24.8‰$

Charcoal from Pit 580/40.

Lu-750. Dalkarlstorp 3 **5520 ± 65**
3570 BC
$\delta^{13}C = -23.5‰$

Charcoal from Hearth-pit 496/18.

Lu-776. Dalkarlstorp 4 **5870 ± 75**
3920 BC
$\delta^{13}C = -24.5‰$

Charcoal >1mm from sooty sand from Hearth-pit 275/24. *Comment*: sample undersized; diluted; 88% sample. Charcoal separated from ca 4.5kg sand by screening and subsequent immersion in ca 40% H_2SO_4 (heavy liquid separation).

Lu-776:S1. Dalkarlstorp 4, soot, Sample 1 **4150 ± 60**
2200 BC
$\delta^{13}C = -24.4‰$

Soot and other organic material <1mm, from another 1kg portion Lu-776. *Comment*: organic content enriched to ca 10% by rotation of suitable portions of sooty sand in distilled water, followed by decantation. Normal HCl pretreatment but only very short treatment with NaOH.

Lu-776:S2. Dalkarlstorp 4, soot, Sample 2 **4300 ± 105**
2350 BC
$\delta^{13}C = -23.8‰$

Soot and other organic material <1mm, from another 1kg portion of same sand as Lu-776. *Comment*: organic content enriched to ca 10% by immersion of suitable portions of sooty sand in ca 60% H_2SO_4. Short treatment with NaOH dissolved ca 65% of obtained organic matter. Sample therefore undersized; diluted; 45% sample.

Lu-776:S2A. Dalkarlstorp 4, soot, Sample 2A **4730 ± 70**
2780 BC
$\delta^{13}C = -24.2‰$

Acid-precipitated part of NaOH-soluble fraction from Lu-776:S2. *Comment*: undersized; diluted; 85% sample.

Lu-777. Dalkarlstorp 5 **1550 ± 50**
AD 400
$\delta^{13}C = -24.2‰$

Charcoal from Hearth-pit 275/29.

Lu-778. Dalkarlstorp 6 — **5540 ± 65** / **3590 BC** / $\delta^{13}C = -23.3‰$

Charcoal from Hearth-pit 321/20.

Lu-907. Dalkarlstorp 7 — **4010 ± 60** / **2060 BC** / $\delta^{13}C = -25.0‰$

Charcoal from Hearth-pit 494/7.

Gårdlösa series

Charcoal and bone from Gårdlösa, Smedstorp parish, SE Scania (55° 34′ N, 14° 08′ E). Coll 1973 and subm by B Stjernquist, Hist Mus, Univ Lund. Dated for study of continuity of settlement in Gårdlösa area. For other dates from area and references, see R, 1972, v 14, p 264-266, 392-393; 1973, v 15, p 510-511; 1974, v 16, p 326. Charcoal samples pretreated with HCl and NaOH. Bone collagen extracted by use of modified Longin method (1971) based on the solubility of collagen in slightly acidic hot water.

Lu-835. Gårdlösa 11, Grave 105 — **1270 ± 55** / **AD 680** / $\delta^{13}C = -25.1‰$

Charcoal from hearth near Grave 105. Depth ca 20cm. *Comment*: sample undersized; diluted; 80% sample. (BS): date shows that hearth and grave are of same age.

Lu-834. Gårdlösa 11, Grave 110 — **340 ± 50** / **AD 1610** / $\delta^{13}C = -23.9‰$

Charcoal from pit in Grave 110. Depth ca 30cm. *Comment (BS)*: unexpected young date; charcoal apparently not contemporaneous with grave.

Lu-853. Gårdlösa 11, Grave 111, Sample 1 — **1320 ± 50** / **AD 630** / $\delta^{13}C = -25.4‰$

Charcoal from pit at N side of Grave 111. Depth 15 to 30cm. *Comment* (BS): date shows that pit is younger than grave (see Lu-908 below) and probably connected to adjacent Migration-period features.

Lu-908. Gårdlösa 11, Grave 111, Sample 2 — **1930 ± 50** / **AD 20** / $\delta^{13}C = -20.3‰$

Collagen from human femur from Grave 111. Depth 40 to 45cm below top layer of grave. Assoc with pottery and iron awl. *Comment*: organic carbon content: 2.4%. (BS): date agrees well with time estimate based on assoc archaeol finds.

Lu-978. N Kverrestad 5[50], House 1 **1420 ± 50**
AD 530
$\delta^{13}C = -24.2‰$

Charcoal from hearth in pit-house at N Kverrestad 5[50], SE Scania (55° 32′ N, 14° 03′ 30″ E). Coll 1973 and subm by B Stjernquist. Assoc with stamp ornamented pottery. Pretreated with HCl and NaOH. *Comment* (BS): date of importance for dating of: 1) this type of settlement with pit-houses; 2) a special kind of stamp ornamented pottery.

Hindby Mosse series

Poorly preserved bone fragments of cloven-hoofed animals from Middle Neolithic occupation layer at Hindby Mosse, Fosie, Malmö (55° 34′ N, 13° 03′ E). Coll 1973 and subm by G Burenhult, Hist Mus, Univ Lund. Bone assoc with flint artifacts and pottery. Depth ca 50cm. Collagen extracted as described previously (R, 1970, v 12, p 534).

Lu-844. Hindby Mosse, Sample 1 **3540 ± 60**
1590 BC
$\delta^{13}C = -24.5‰$

Collagen from bone fragments from Sq 14/87. *Comment*: organic carbon content: 1.2%. Sample undersized; diluted; 70% sample. (3 1-day counts.)

Lu-845. Hindby Mosse, Sample 2 **3540 ± 60**
1590 BC
$\delta^{13}C = -22.7‰$

Collagen from rib fragments from Sq 13/87. *Comment*: organic carbon content: 1.7%.

General Comment (GB): date younger than expected since main part of finds from settlement area are Middle Neolithic. There were, however, also some Late Neolithic finds, which may explain the young date.

Lu-971. Tofta Högar **1180 ± 50**
AD 770
$\delta^{13}C = -25.3‰$

Charcoal from fire-layer beneath cairn at Tofta Högar, Hovs parish, Bjäre Peninsula, NW Scania (56° 28′ N, 12° 43′ E). Coll 1974 and subm by G Burenhult. Pretreated with HCl and NaOH. *Comment* (GB): Tofta Högar is primarily a Bronze age cult-place and burial ground. Date indicates secondary use in late Vendel time.

Hagestad series

Charcoal and bone from Hagestad 6[2] A, Löderup parish, Scania (55° 23′ N, 14° 09′ E). Coll 1973 and subm by M Strömberg, Hist Mus, Univ Lund. For other dates from Hagestad, see R, 1972, v 14, p 394-395; 1973, v 15, p 509; 1974, v 16, p 324. Charcoal samples pretreated with HCl and NaOH. Bone collagen extracted using the Longin method (1971) based on solubility of collagen in slightly acidic hot water.

Lu-909. Hagestad 6[2] A, Sample 1:HT73 — **2080 ± 50**, **130 BC**, $\delta^{13}C = -24.4‰$

Charcoal from House 1 on field at coast rd S of Rödkillebäcken.

Lu-917. Hagestad 6[2] A, Sample 3:HT73 — **1230 ± 50**, **AD 720**, $\delta^{13}C = -22.0‰$

Collagen from horse tibia over stone pavement in bog soil near Hagestad Bog; x = +5, y = +0. Assoc with pottery. *Comment*: organic carbon content: 5.0%.

Lu-918. Hagestad 6[2] A, Sample 4:HT73 — **2160 ± 50**, **210 BC**, $\delta^{13}C = -21.9‰$

Collagen from tibia of cattle from pit below stone pavement at same site as Lu-917; x = +7, y = +1. Assoc with pottery. *Comment*: organic carbon content: 4.7%.

Lu-919. Hagestad 6[2] A, Sample 5:HT73 — **2090 ± 55**, **140 BC**, $\delta^{13}C = -22.9‰$

Charcoal from hearth at Oven 3 in house foundation. Assoc with bone, pottery, and daub.

Lu-948. Hagestad 6[2] A, Sample 8:73-74 — **2140 ± 55**, **190 BC**, $\delta^{13}C = -20.3‰$

Collagen from tibia of cattle from lower peat layer in Trench A: Nov 73. Assoc with pottery. *Comment*: organic carbon content: 3.8%. *General Comment* (MS): all dates agree well with results based on archaeol investigation.

Valleberga series

Charcoal from settlement area with grave field at Valleberga, Scania (55° 24′ N, 14° 04′ E). Coll Oct 1973 to May 1974 and subm by M Strömberg. For other dates from Valleberga, see R, 1974, v 16, p 324-325. All samples pretreated with HCl and NaOH.

Lu-910. Valleberga 28[4], Sample 2:HT73 — **2660 ± 55**, **710 BC**, $\delta^{13}C = -25.0‰$

Charcoal from hearth connected with poorly developed occupation layer; Trench 2:Oct 1973. Assoc with pottery and flint objects from transition Middle Neolithic-Late Neolithic and overlain by layer with Bronze age artifacts.

Lu-947. Valleberga 5[2], Sample 6:73-74 — **2330 ± 55**, **380 BC**, $\delta^{13}C = -23.1‰$

Charcoal from hearth connected with occupation layer. Assoc with

flint objects and pottery from early Middle-Neolithic Funnel-Beaker culture. Hearth probably connected with Early Iron age burials on same field.

Lu-965. Valleberga 5[6], Sample 9b:73-74 **3090 ± 55**
1140 BC
$\delta^{13}C = -26.5‰$

Charcoal from oak trunk coffin (Grave I) in burial mound. Assoc with bronze objects from Period III.

Lu-966. Valleberga 5[6], Sample 10:73-74 **3140 ± 55**
1190 BC
$\delta^{13}C = -25.9‰$

Charcoal from oak trunk coffin (Grave II) in burial mound. Assoc with bronze fibula from Period III.

General Comment (MS): dates agree well with archaeol results based on artifact assemblage.

Lu-964. Ingelstorp 19, Sample 7:73-74 **1260 ± 50**
AD 690
$\delta^{13}C = -25.7‰$

Charcoal from hearth on grave field at Ingelstorp 19, Ingelstorp parish, Scania (55° 25′ N, 14° 03′ E). Coll 1974 and subm by M Strömberg. Assoc with millstone. *Comment* (MS): date confirms estimate based on type of millstone.

Stora Råby series

Charcoal from Settlement 2 at Stora Råby, Lund, Scania (55° 42′, N, 13° 14′ E). Coll 1973 and subm by M Wyszomirski, Hist Mus, Univ Lund. Pretreatment with HCl and NaOH.

Lu-911. Stora Råby, Pit 1 **2020 ± 50**
70 BC
$\delta^{13}C = -24.7‰$

Charcoal from big oval pit with Funnel-Beaker culture artifacts. Roman Iron age artifacts were found near pit.

Lu-912. Stora Råby, Pit 11 **1220 ± 50**
AD 730
$\delta^{13}C = -24.1‰$

Charcoal from ca 30cm deep post-hole; probably from part of house construction.

Lu-913. Stora Råby, Object 12 **1320 ± 50**
AD 630
$\delta^{13}C = -23.8‰$

Charcoal from base of hearth with brittle-burnt stones. Assoc with flint objects and potsherds.

Lu-914. Stora Råby, Object 21 **1250 ± 50**
AD 700
$\delta^{13}C = -26.8‰$

Charcoal from walls and bottom of ca 50cm deep stone-filled cylindrical pit.

General Comment (MW): dates younger than expected since settlement occupation layer contained much Early Funnel-Beaker culture material (Period A/B). In part of site, features from Migration period (Vendel time) were dug into this occupation layer. Disturbance caused by burrowing animals was noticed and may account for some mixing of material from different periods.

Lu-970. Fårabacken, Löddesborg **2820 ± 55**
870 BC
$\delta^{13}C = -24.3‰$

Charcoal from hearth in Construction 1974:I at Late Neolithic to Early Bronze age site Fårabacken, Löddesborg, Löddeköpinge parish, Scania (55° 45′ N, 12° 59′ E). For other dates from Löddesborg, see R, 1973, v 15, p 508; 1974, v 16, p 328. Coll 1974 and subm by J Callmer, Hist Mus, Univ Lund. Assoc with pottery, burnt bones, flint implements, and flint waste. Pretreated with HCl and NaOH. *Comment* (JC): from viewpoint of orthodox chronology, date may seem too late. *Cf*, however, Lu-837 from Norrvidinge, 2960 ± 55 (R, 1974, v 16, p 328) and dates from Layer I at Slettabø site, Ogna parish, Rogaland, Norway, 2900 ± 100 to 2840 ± 130 BP (Skjølsvold, 1972, p 68).

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[RADIOCARBON, VOL. 17, NO. 2, 1975, P. 196-215]

UNIVERSITY OF PENNSYLVANIA RADIOCARBON DATES XVIII

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INTRODUCTION

This date list includes most of the archaeologic samples dated in this laboratory since publication of our last date list (R, 1974, v 16, p 219-237), as well as some samples dated previously, which lacked adequate sample information. The BP ages are based on AD 1950, and have been calculated with the half-life value of 5568 yr. All samples were counted at least twice for periods of not less than 1000 min each. Errors quoted for each sample are derived from the measurement of the sample, the background, and several counts of our mid-19th century Oak sample, but do not include the half-life error. All samples were pretreated with 3N HCl and some, where noted, were given additional pretreatment with 2% NaOH for the removal of possible humic acid contaminants.

Our mid-19th century calibration samples have an average age of 139 yr. When corrected for this age, they have ^{14}C contents equal to 95% of the NBS oxalic acid standard. The average ^{13}C relationship between the Oak standard and the NBS limestone standard #20 is −25.7 ± 1.3‰ as measured on the Univ of Pennsylvania mass spectrograph.

The MASCA corrected dates, appearing in this date list, have been arrived at by applying appropriate correction factors to dates calculated with the 5730 half-life. For further explanation, see Univ of Pennsylvania Dates XVI (R, 1974, v 16, p 198-218) and Ralph *et al*, 1973.

I wish to thank Ray Costa and John Mayes for their careful work in processing these samples.

SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

A. Europe

1. Czechoslovakia

Bohemian series

Late Bronze age and Early Iron age samples from Bohemia, Czechoslovakia, especially selected and subm by Evžen Neustupný, Československá Akad Věd, Prague, Czechoslovakia, in an attempt to minimize discrepancies between traditional archaeol chronology and corrected radiocarbon dates.

P-1902. Chodouny, Grave 7 **3080 ± 60 / 1130 BC**

MASCA corrected date: 1400-1450 ± 70 BC

Charcoal, Sample 2, from Grave 7, belonging to Phase D of Reinecke's chronologic scheme for Central European Bronze age, in extensive cemetery of urn-graves of Late Bronze age, Lausitz culture, at Chodouny, N Bohemia, Litomeřice dist (59° 29′ N, 14° 16′ E), coll by

J Hrala. *Comment*: NaOH pretreatment. (EN): corrected date is 100 to 200 yr earlier than traditional estimates. Such a shift in absolute chronology would help to explain gap resulting from even more radical shift, of same direction, at beginning of Central European Bronze age.

Dneboh-Hrada, N Bohemia, Turnov dist (50° 32′ N, 15° 2′ E). Samples coll 1957 by E Plesová from late phase of Lausitz culture of partially excavated Late Bronze age village.

P-1904. Pit 300g **3000 ± 50**
1050 BC
MASCA corrected date: 1300 ± 60 BC

Charcoal, Sample 4, from Pit 300g. *Comment*: NaOH pretreatment.

P-1905. Pit 355 **3030 ± 60**
1080 BC
MASCA corrected date: 1340-1370 ± 70 BC

Charcoal, Sample 5, from Pit 355. *Comment*: NaOH pretreatment.

P-1906. Radonice, Pit 1/61 **3050 ± 50**
1100 BC
MASCA corrected date: 1370-1390 ± 60 BC

Charcoal, Sample 6, in fill of piriform storage pit, asssoc with characteristic pottery and animal bones, from Late Bronze age village of Knovíz culture, NW Bohemia, Louny dist (55° 23′ N, 13° 55′ E). Samples coll by Evžen Neustupný (Bouzek *et al*, 1966).

General Comment (EN): P-1904-1906, all belong to same period immediately succeeding P-1902, and are 100 to 200 yr earlier than usually expected. Other unpub dates for same period: LJ-2091: 2940 ± 100; LJ-2042: 2810 ± 100; UCLA-1485-A: 2860 ± 60; UCLA-1485-B: 2900 ± 60; UCLA-1485-C: 2885 ± 60, may suggest that P-1904-1906 cover earlier part of Hallstatt A.

P-1907. Vikletice, Hut 23 **2730 ± 60**
780 BC
MASCA corrected date: 940-980 ± 70 BC

Charcoal, Sample 7, in fill of pit in Hut 23, of large scale rescue operation at Vikletice, NW Bohemia, Chomutov dist (50° 20′ N, 13° 24′ E) which has unearthed hundreds of objects from all periods of prehistory, including several clusters of semisubterranean houses, including Hut 23, of late (Štítary) phase of Knovíz culture (Hallstatt B 2) (Bouzek *et al*, 1966). Samples coll 1962 by Drahomír Koutecký. *Comment*: NaOH pretreatment. (EN): corrected date is ca 100 yr earlier than archaeol estimates. It is in correct relationship with other dates of this series.

Provotín, S Bohemia, Pisek dist (49° 12′ N, 14° 13′ E). Samples coll 1971 by A Beneš. One of 2 barrows excavated at Provotín contained a 3m × 3m log cabin with uncremated internment and rich grave goods

(more than 20 vessels, a bronze torque, iron knife, etc). Grave is typical of Hallstatt D period (early part) of Early Iron age.

P-1908. Barrow 1 **3010 ± 40** **1060 BC**

MASCA corrected date: 1300-1360 ± 50 BC

Charcoal, Sample 8, Barrow No. 1, from uncharred beam in W part of grave chamber. *Comment*: NaOH pretreatment.

P-1909. Barrow 1 **2220 ± 60** **270 BC**

MASCA corrected date : 400 ± 70 BC

Charcoal, Sample 9, Barrow 1, from charred beam in NE corner of grave chamber. *Comment*: NaOH pretreatment.

General Comment (EN): P-1908 coincided with dates for Hallstatt A, common in barrows of this area. Barrow from which samples were taken was erected on deserted settlement of Hallstatt A period. P-1909 seems too late and dates are incompatible with each other, considering that they both came from same funerary structure sealed by body of barrow.

Manětín, W Bohemia, Pizen dist (50° 1′ N, 13° 15′ E). Site is extensive cemetery from Early Iron age consisting of 3 types of graves: barrows, cremations in pits, and inhumations in pits. Barrows form earliest group of finds (Hallstatt D, early part), cremation burials contain pottery and metal equipment (Hallstatt D, late), and inhumations are connected with La Tène culture. Samples coll 1967 by E Soudská.

P-1910. Grave 80 **1150 ± 50** **AD 800**

MASCA corrected date: AD 850-830 ± 60

Charcoal, Sample 10, from Grave 80, found among stones surrounding barrow grave, which consisted of small pit with sherds and cremated bones.

P-1913. Grave 164 **2630 ± 60** **680 BC**

MASCA corrected date: 820-840 ± 70 BC

Charcoal, Sample 13, from fill of pit of Grave 164 (simple cremation) also containing an iron spear-head, 2 iron points, a bronze sheet, and hand-made pot. *Comment*: NaOH pretreatment.

P-1914. Grave 173 **2550 ± 50** **600 BC**

MASCA corrected date: 790 ± 60 BC

Charcoal, Sample 14, from Grave 173 (cremation in pit) containing hand-made pot, 2 arm-rings, and blue beads. *Comment*: NaOH pretreatment.

General Comment (EN): P-1910 was too small for NaOH pretreatment and may have contained contaminating rootlets. No evidence exists that site was inhabited in 9th century AD. Graves of P-1913 and -1914 are archaeol very similar and almost identical radiocarbon dates fit into

relative sequence of this series, but their corrected age is unexpectedly high, suggesting error in traditional chronology (ca 6th century BC).

Kadan, NW Bohemia, Chomutov dist (50° 23′ N, 13° 18′ E). Excavation at Kadan revealed semisubterranean houses from Hallstatt D period and beginning of immediately following Early La Tène period. Excavation also unearthed N-most extent of direct imports from Greece (Late Black Figure pottery). Samples coll 1968 by V Kruta.

P-1915. Pit 12 **1560 ± 50** **AD 390**

MASCA corrected date: AD 410 ± 60

Charcoal, Sample 16, from fill of Pit 12, ca 1m below modern surface. *Comment*: NaOH pretreatment. (EN): additional dates for same sample are MOC-27: 1560 ± 80, and MOC-34: 1580 ± 80 (personal commun). Because all 3 dates differ from expected age, finds from pit were inspected and found to contain undecorated sherds from possibly 5th century AD.

P-1916. House 13 **2430 ± 50** **480 BC**

MASCA corrected date: 530, 690-710 ± 60 BC

Charcoal, Sample 17, House 13, from ca 1.4m below modern surface. *Comment*: NaOH pretreatment. (EN): one of possible corrected dates (530 BC) fits expectations exactly. Nearby archaeol feature contained fragment of imported Greek Black Figure pottery from end of 6th century BC. Date 530 BC suggests imported vessel was buried in Bohemia shortly after its production in Greece, not generations later as supposed by some archaeologists.

B. Mediterranean

1. Italy

Casalini series

Casalini (Artemesion), San Sosti, Italy (39° 35′ N, 16° 20′ E) is medieval site on top of mt in Calabria. Ruined church or sanctuary of Middle age was only building visible before excavation, which was done to find Iron age or Greek deposits. Samples coll 1970 by Marianne Maaskant; subm by Froelich Rainey, Dir, Univ Mus, Univ Pennsylvania, Philadelphia.

P-1724. Trench 1 D **1400 ± 50** **AD 550**

MASCA corrected date: AD 590 ± 60

Charcoal from Trench 1 D, depth 1m.

P-1725. Trench 1 C, 1 **1200 ± 50** **AD 750**

MASCA corrected date: AD 790-770 ± 60

Charcoal from Trench 1 C, 1, depth 70 to 115cm.

980 ± 50

P-1726. Trench 1 C, 2 **AD 970**

MASCA corrected date: AD 1000 ± 60

Charcoal from Trench 1 C, 2, depth 1.15m. *Comment*: NaOH pretreatment.

General Comment (FR): deepest deposit was alongside stone reservoir for rainwater. Reversal of strata probably occurred during refilling around original reservoir excavation, hence, reversal of ^{14}C dates.

7900 ± 100

P-1999. Casa San Paola **5950 BC**

Casa San Paola, near Gravina, Apulia, S Italy (40° 50′ N, 16° 45′ E) is a Neolithic site. Charcoal and soil, from Trench N-B-2-1, Lot 7, depth 1.10m in cave in wall of caliche. Sample coll 1972 by Nancy Whitney; subm by G F Bass, Univ Mus, Univ Pennsylvania, Philadelphia. Expected date: 3300 to 3500 BC. *Comment*: date is beyond range of MASCA correction factors now available (Oct, 1974). See R, 1974, v 16, p 198-218 and Ralph *et al* (1973).

2. Greece

Achilleion series

Achilleion is a strat Neolithic site near Farsala, Thessaly, Greece (39° 17′ N, 22° 23′ E). Excavation uncovered 3 consecutive Early Neolithic phases, Thessalian Pre-pottery, Frükeramikum and Proto-Sesklo, and 4 Middle Neolithic phases, Sesklo, exceptionally rich in finds, including house, ovens, 204 sculptures, offering table, etc. Phases are numbered from top. Samples coll 1973; subm by Marija Gimbutas, Univ California at Los Angeles, Los Angeles.

General Comment: dates in this series are beyond range of MASCA correction factors now available (Oct, 1974). See R, 1974, v 16, p 198-218 and Ralph *et al* (1973).

7080 ± 90

P-2130. Sample 10 **5130 BC**

Charcoal, Sample 10, from SQ D, QD2, Level 7, Phase 1.

7270 ± 80

P-2128. Samples 13 and 15 **5320 BC**

Charcoal, Sample 13, Sq A, QD2-4, Level 8, and Sample 15, Sq A, QD3, Level 8, Phase 2.

6960 ± 90

P-2125. Sample 74 **5010 BC**

Charcoal, Sample 74, from Sq B, QD4, Level 13, Phase 3a.

7090 ± 90

P-2124. Sample 69 **5140 BC**

Charcoal, Sample 69, from Sq A, QD2, Level 14, Phase 3a. *Comment*: sample undersized, 96.01%.

7450 ± 80

P-2123. Sample 62 **5500 BC**

Charcoal, Sample 62, from Sq A, QD3, Level 14, Phase 3a. *Comment*: NaOH pretreatment.

7110 ± 90

P-2122. Sample 101 **5160 BC**

Charcoal, sample 101, from Sq B, QD2, Level 16, Phase 3b.

7180 ± 90

P-2121. Sample 98 **5230 BC**

Charcoal, Sample 98, from Sq B, QD2, Level 17, Phase 3b. *Comment*: sample undersized, 88.89%.

7340 ± 70

P-2120. Sample 88 **5390 BC**

Charcoal, Sample 88, from Sq A, QD1, Level 18, Phase 4.

7270 ± 80

P-2117. Sample 113 **5320 BC**

Charcoal, Sample 113, from Sq A, QD1, Level 26, Phase 6.

7470 ± 80

P-2118. Sample 115 **5520 BC**

Charcoal, Sample 115, from Sq B, QD2, Level 26, Phase 6.

Franchthi Cave series

Franchthi Cave (37° 26′ N, 23° 8′ E) is near W tip of high, rugged headland, directly across bay from village of Koilada near Porto Cheli in S Argolid, Peloponnese, Greece. Site is especially important for its apparently continuous strat sequence from Late Paleolithic through Mesolithic and the critical transition to Neolithic. There are no strat prehistoric remains beyond Late Neolithic. Samples coll 1973; subm by T W Jacobson, Indiana Univ, Bloomington, and M H Jameson, Univ Mus, Univ Pennsylvania, Philadephia (Jacobsen, 1968; 1969a, 1969b, 1969c; 1973). For additional dates for this site, see R, 1971, v 13, p 364-367 and R, 1974, v 16, p 219-237.

General Comment: dates in this series are beyond range of MASCA correction factors now available (Oct, 1974). See R, 1974, v 16, p 198-218 and Ralph *et al* (1973).

6940 ± 90

P-2093. F/A Balk, Unit 129S **4990 BC**

Charcoal mixed with soil from F/A Balk, Unit 129S, relatively thin gray occupation layer, overlying P-1526, 8022 ± 76 and P-1527, 7897 ± 88 (R, 1971, v 13, p 366). Expected date: late Early Neolithic.

7930 ± 100

P-2094. F/A Balk, Unit 143S **5980 BC**

Charcoal mixed with sediments from F/A Balk, Unit 143S, near middle of relatively thick light gray occupation layer, below P-2093 (above).

7980 ± 110

P-2095. F/A Balk, Unit 146S **6030 BC**

Charcoal mixed with sediments from F/A Balk, Unit 146S, at base of relatively thick gray occupation layer. Below P-2094 (above).

9290 ± 100

P-2102. H-1, Quad B, Unit 126 **7340 BC**

Charcoal mixed with sediments from H-1, Quad B, Unit 126, hearth deposit in reddish brown occupation layer, below P-1665, 9477 ± 134, and P-1666, 8742 ± 114 (R, 1971, v 13, p 366). Date expected to be Mesolithic.

9300 ± 100

P-2103. H-1, Quad B, Unit 139 **7350 BC**

Charcoal mixed with sediments from H-1, Quad B, Unit 139, hearth deposit in reddish brown occupation layer, below P-2102 (above). Expected date: Mesolithic.

9270 ± 110

P-2104. H-1, Quad B, Unit 139 **7320 BC**

Charcoal from H-1, Quad B, Unit 139, coll by flotation in water-sieving device using mixture of fresh and sea water (Jacobsen, 1973, p 57; French, 1971). Date expected to be Mesolithic and comparable to P-2103 (above). *Comment*: NaOH pretreatment.

8710 ± 100

P-2096. F/A Balk, Unit 177N **6760 BC**

Charcoal mixed with sediments from F/A Balk, Unit 177N, near top of layer with considerable crushed shell and animal bone, below, P-2095 (above). Expected date: Mesolithic, earlier than P-1526, 8022 ± 76 (R, 1971, v 13, p 366) and comparable to P-2106 and -2107 (*cf*). *Comment*: NaOH pretreatment.

8730 ± 90

P-2106. F/A Balk, Unit 177N **6780 BC**

Charcoal from B/A Balk, Unit 177N, coll by flotation in water-sieving device (see P-2104, above). Expected date: Mesolithic, earlier than P-1526, 8022 ± 76 (R, 1971, v 13, p 366) and comparable to P-2096 (above) and P-2107 (*cf*). *Comment*: NaOH pretreatment.

8530 ± 90

P-2107. F/A Balk, Unit 177N **6580 BC**

Charcoal from F/A Balk, Unit 177N, coll by hand sorting among fine residue settling at bottom of sieve box, rather than flotation (see P-2104, above). Date expected to be Mesolithic, earlier than P-1526, 8022 ± 75 (R, 1971, v 13, p 366) and comparable to P-2096 and -2106 (above). *Comment*: NaOH pretreatment.

9150 ± 100

P-2097. F/A Balk, Unit 197N **7200 BC**

Charcoal mixed with sediments from F/A Balk, Unit 197N, small hearth near base of rocky reddish occupation layer, below P-2096, -2106, and -2107 (above). Date expected to be Mesolithic.

9250 ± 120

P-2108. F/A Balk, Unit 218N **7300 BC**

Charcoal from F/A Balk, Unit 218N, hearth deposit in dark brown occupation layer coll by flotation in water-sieving device (see P-2104, above). Expected date: Mesolithic. *Comment*: NaOH pretreatment.

Halieis

Ancient city of Halieis is near modern village of Porto Cheli in S Argolid, Peloponnese, Greece. Site is partially submerged in shallow water. Wood id by R C Koeppen, Forest Prod Lab, U S Dept Agric, Madison, Wisconsin. Samples coll 1973 under water and subm by M H Jameson, Univ Mus, Univ Pennsylvania, Philadelphia (1969, 1973).

1570 ± 50

P-2064. Sample 1 **AD 380**

MASCA corrected date: AD 400 ± 60

Wood (*Pinus* sp) from Temple of Apollo, beneath floor, now ca-2m. *Comment* (MHJ): date probably later than destruction of temple, as there was Roman occupation in 4th century AD.

3110 ± 50

P-2065. Sample 2 **1160 BC**

MASCA corrected date: 1460-1480 ± 60 BC

Wood (*Abies* sp) from area enclosed by city walls, in possible harbor, under 2m mud, —4.5m.

2510 ± 50

P-2066. Sample 3 **560 BC**

MASCA corrected date: 780 ± 60 BC

Charcoal (*Pistacea* sp) from beneath tile fall of final destruction of building, in middle room. Possible fragments from single roof beam, under ca .3m mud, ca —1.75m. *Comment*: NaOH pretreatment.

2460 ± 60

P-2067. Sample 4 **510 BC**

MASCA corrected date: 660-730 ± 70 BC

Charcoal, hard wood (perhaps *Olea* sp) from occupation level of middle room of temple under .3m mud, ca —1.75m.

1680 ± 50

P-2098. Olive pits **AD 270**

MASCA corrected date: AD 280 ± 60

Stones (*Olea europa*) and possibly other fruit stones and nut shells from under rubble wall N of city wall, —4.85m. From same area as P-2065 (above).

1820 ± 50

P-2099. **AD 130**

MASCA corrected date: AD 150 ± 60

Charcoal lumps separated from sample P-2098 (above).

2870 ± 60

P-1784. Kato Zakro **920 BC**

MASCA corrected date: 1110 ± 70 BC

Charcoal from Kato Zakro, coast of E Crete (35° 10′ N, 26° 15′ E), from NE entrance of palace believed to be MM IIIB to LM IA. Sample coll 1969 by Platon (1971), Univ Thessaloniki, Greece; subm by Leon Pomerance. *Comment*: NaOH pretreatment. (NEP): date expected to be 1600 to 1500 BC, based on manifold correspondence with Egypt and Orient.

C. Near East

1. Egypt

5010 ± 70

P-2049. Nile Delta **3060 BC**

MASCA corrected date: 3780 ± 90 BC

Carbonaceous silt enclosing skull of *Hippopotamus amphibus*, N-most occurrence in Nile valley, from Nile Delta, Egypt (30° 56′ N, 31° 57° E). Sample coll from excavation 4m below surface by Darwish Alfar, dir Geol Mus Cairo, Egypt; subm by Robert Giegengack. *Comment*: NaOH pretreatment.

2. Turkey

3500 ± 50

P-2041. Acem Höyük **1550 BC**

MASCA corrected date: 2000-2020 ± 60 BC

Charcoal from storage building contemporary with palace at Acem Höyük, a large Bronze age mound NW of Aksaray in central Turkey (38° 30′ N, 33° 55′ E). Sample coll 1971 by Nimet Özgüç, Univ Ankara, Turkey; subm by M J Mellink (Özgüç, 1968). For additional dates see: P-1555, 3611 ± 49 and P-1595, 3391 ± 58 (R, 1971, v 13, p 371-372). *Comment*: NaOH pretreatment.

Aphrodisias series

Aphrodisias, Turkey (37° 43′ N, 28° 48′ E) is ca 153km SE of Izmir and 129km E of ancient port of Miletus. Samples are from "Acropolis" and "Pekmez" mounds within larger area enclosed by Hellenistic/Roman walls of later classical site. "Acropolis" mound consists of Early and Middle Bronze age levels and evidence of later periods up to Ottoman times. "Pekmez" mound to W consists of Chalcolithic levels overlain by Early Bronze Age I and II materials, as well as more recent materials. Samples coll 1967 and 1970; subm by Karen Flinn and Barbara Kadish, New York Univ, New York (Kadish, 1969, 1971). For additional dates see R, 1971, v 13, p 369-371.

"Acropolis" mound

3800 ± 60

P-1774. Trench 3, Unit 228 **1850 BC**

MASCA corrected date: 2190, 2230-2290 ± 70 BC

Wood charcoal from hearth pit in Rm 2, Structure A, Complex II.

3800 ± 50

P-1775. Trench 3, Unit 228 **1850 BC**

MASCA corrected date: 2190, 2230-2290 ± 60 BC

Wood charcoal from bottom of hearth pit in Rm 2, Structure A, Complex II. *Comment*: NaOH pretreatment.

"Pekmez" mound

5450 ± 80

P-2029. Trench 2, Test Trench B **3500 BC**

MASCA corrected date: 4830 ± 90 BC

Charcoal, Unit 1589d, from lens of heavily blackened earth. Depth –6.55m below subdatum. *Comment*: NaOH pretreatment. (KF & BK): pottery of this level compares typologically with Late Chalcolithic period at Beycesultan; artifacts are similar to those of Chalcolithic Levels XVI, XV, and XII at Mersin.

4860 ± 80

P-2030. Trench 2, Test Trench B **2910 BC**

MASCA corrected date: 3690 ± 90 BC

Charcoal, Unit 1589d, from lens of heavily blackened earth. Depth –6.55m below subdatum. *Comment* (KF & BK): no NaOH pretreatment may account for different date from P-2029 (above).

5280 ± 70

P-2031. Trench 2, Test Trench B **3330 BC**

MASCA corrected date: 4100, 4180 ± 80 BC

Ash and wood charcoal, Unit 1599a and b, from clayey, gray-brown earth. Depth –7.97m below subdatum.

4610 ± 70

P-2040. Sakyol, Pulur **2660 BC**

MASCA corrected date: 3390, 3440 ± 80 BC

Charcoal from Level XI, Sakyol, Pulur, Keban area, E Turkey (38° 52′ N, 39° 7′ E) ca 45km NW of Elâzig. Coll 1970 by Hamit Koşay (1970), Ethnographic Mus, Ankara, Turkey; subm by M J Mellink. Expected date: Early Bronze age, 1st half of 3rd millennium BC.

D. Middle East

1. Pakistan

Gumla series

Gumla is a low, Bronze age mound between village of Gumla to N and Garhi Hayat to S, Dera Ismail Khan Dist, W Pakistan (31° 44′ N, 70° 47′ E). Samples coll 1971 and subm by A H Dani, Univ Islamabad, Pakistan (1973).

4340 ± 60
P-1810. Circle Grave 1 **2390 BC**
MASCA corrected date: 3110-3140 ± 70 BC

Charcoal, Sample 1 from Circle Grave 1, Period V, found with human bones. *Comment*: NaOH pretreatment. (AHD): expected date: 1600 to 2100 BC.

4080 ± 70
P-1812. Trench BO, Layer 11 **2130 BC**
MASCA corrected date: 2700, 2740, 2820 ± 80 BC

Charcoal, Sample 3, from Trench BO, Layer 11, Period II. *Comment*: NaOH pretreatment. (AHD): expected date: 3000 to 3500 BC.

4210 ± 150
P-1882. Location AO, Stratum 11 **2260 BC**
MASCA corrected date: 2930-2950 ± 160 BC

Charcoal from Loc AO, Stratum 11. *Comments*: sample undersized for Univ Pennsylvania counters; gas was sent to Isotopes, Inc for counting as I-6694 (85.9% in Isotopes counter). (AHD): expected date: 3000 to 3500 BC.

General Comment (AHD): much earlier dates expected for P-1812 and -1882 and much later dates for P-1810 and -1813 (*cf*).

4040 ± 60
P-1813. Hathala **2090 BC**
MASCA corrected date: 2630-2680 ± 70 BC

Hathala is a Bronze age mound, ca 27.4km S of Tank, Dera Ismail Khan Dist, W Pakistan (32° 1′ N, 70° 32′ E). Sample consisted of charcoal and ash mixed with earth from Trench Y, Layer 2; coll 1971 and subm by A H Dani, Univ Islamabad, Pakistan (1973). *Comment* (AHD): much later date expected: 1600 to 2100 BC.

E. Africa

1. Cameroon

Douloumi series

Douloumi is Iron age mound with ca 4m cultural strat, on Lake Douloumi in N Cameroon (9° 12′ N, 13° 39′ E). Samples coll 1969 by Frank Bartell; subm by N C David, Univ College London, England. For additional dates from site, see: P-1761, 1089 ± 41; P-1763, 1074 ± 47; and P-1764, 1412 ± 50 (R, 1973, v 15, p 376-377).

220 ± 50
P-1760. Strat Units 3 and 4 **AD 1730**
MASCA corrected date: AD 1640 ± 60

Charcoal and soil from Strat Units 3 and 4 of 2nd arbitrary level of Iron age assemblage. *Comment*: NaOH pretreatment.

1030 ± 50

P-1762. Strat Units 15 and 16 **AD 920**

MASCA corrected date: AD 950 ± 60

Charcoal and soil from Strat Units 15 and 16 of 8th arbitrary level of Iron age assemblage.

F. Arctic

1. Alaska

1610 ± 80

P-2090. St Lawrence I Eskimo cadaver **AD 340**

MASCA corrected date: AD 390-370 ± 90

Muscle tissue from leg and abdominal cavity of frozen human body washed out of cliff face by landslide in area of Kialegak SE Cape, St Lawrence I, Alaska (63° 30′ N, 169° 20′ W). Body was in tightly flexed position, with tattoo on dorsal aspect of lower right forearm, consisting of alternating pattern of lines and dots. Sample coll May 1973 by Z A Bradley, Natl Park Service; subm by M R Zimmerman, Depts Pathol & Anthropol, Univ Pennsylvania, Philadelphia. *Comment*: after normal acid pretreatment, sample was put in oven (110°C); rather than drying, sample became gelatinous. It was then pyrolyzed in a N_2 atm before combustion. After pyrolysis, sample was too small for Univ Pennsylvania counters; it was sent to Isotopes, Inc for processing and counting. A better procedure for handling such a sample would have been first N_2 pyrolysis and then acid treatment. Additional date for same cadaver: SI-1656, 1550 ± 70 (personal commun). (MRZ): frozen for 1600 yr, cadaver allowed unique opportunity for radiocarbon dating human tissue. Tissues were extremely well preserved, indicating body was frozen since death. Individual was elderly woman who appears to have suffered accidental inhumation, as distal air passages were packed with aspirated sod. Post-mortem exam also revealed coronary artery disease and chronic fungal infection (id in progress). Microscopic exam confirmed suffocation as cause of death.

Feniak Lake series

Feniak Lake site is .8km N of SE corner of Feniak Lake, USGS Howard Pass Quadrangle, Noatak drainage, N Alaska (68° 14′ N, 158° 16′ W). Site contains 1st known winter house from N Alaska interior, relating to well-known Ipiutak culture. Cultural finds are abundant, consisting of over 1200 recognizable artifacts, all assoc with single house. Lithic inventory is identical to that found at Point Hope Ipiutak site, but organic artifact types are almost completely dissimilar, suggesting differential Ipiutak winter/summer tools (assuming that Point Hope represents a summer Ipiutak sta) or regional variation. Samples coll 1972 and subm by E S Hall, Jr, State Univ New York at Brockport, Brockport, New York (1972; Anderson, 1968; Campbell, 1962; Giddings, 1967; Irving, 1962, 1964; Larsen, 1955, 1968; Larsen and Rainey, 1948; Rainey, 1971).

2220 ± 50

P-2056. Sample A **270 BC**

MASCA corrected date: 400 ± 60 BC

Sample A, from flooring, composed of small twigs (probably *Salix*) assoc with cultural material typical of site. *Comment*: NaOH pretreatment.

1960 ± 50

P-2057. Sample B **10 BC**

MASCA corrected date: AD 50-30 ± 60

Sample B, House wall Post F (probably *Picea*). *Comment* (ESH): house is of form not previously known for Ipiutak, though archaeol evidence strongly indicates house is directly assoc with Ipiutak cultural material.

1570 ± 50

P-2058. Sample C **AD 380**

MASCA corrected date: AD 400 ± 60

Sample C, flooring composed of small twigs (probably *Salix*), ca 1.8m from Sample A.

1530 ± 50

P-2143. Sample E **AD 420**

MASCA corrected date: AD 440 ± 60

Sample E, house fill consisting of bark (*Betula* and fragments of *Picea*). *Comment*: NaOH pretreatment.

1530 ± 50

P-2143-A. Sample E **AD 420**

MASCA corrected date: AD 440 ± 60

Sample E. *Comment*: same as P-2143, above, but no NaOH pretreatment.

1320 ± 50

P-2144. Sample F7 **AD 630**

MASCA corrected date: AD 650 ± 60

Sample F7 (probably *Picea*), from construction features mainly along house wall in floor fill. *Comment*: NaOH pretreatment.

1360 ± 40

P-2145. Sample G **AD 590**

MASCA corrected date: AD 620 ± 50

Sample G, bark (*Betula* and fragments of *Picea*). *Comment*: NaOH pretreatment.

Onion Portage series

Onion Portage is a strat archaeol site on Kobuk R, NW Alaska (67° 10′ N, 158° 30′ W), comprising > 70 distinct cultural layers. Site has complex depositional history spanning ca 10,000 yr of occupation, combining varve-like flood deposits, storm-derived aeolian deposits, and thick colluvial deposits, in addition to culturally derived materials. Organic preservation is mostly poor, and occupation horizons are marked

by thin continuous layers of charcoal, but no organic middens. Faunal remains are scarce, except for "yellowish" stains embedded in cultural strata. Cultural layers are sorted into tight clusters called bands, separated by thick colluvia derived from gullying activity on hillside immediately N of site. Interband colluvium decreases in thickness toward river edge. A levee of alternating silt and sand has built up along river edge of site. Separation of occupation levels is greatest on levee and strat units are numbered from secs from this area. In some cases occupation levels merge in higher part of site to N.

Bands 1 to 8 are numbered from top to bottom; occupation levels within each band are also numbered from top to bottom. Cultural and temporal gaps between deposition units indicate that deposits occurred at irregular rate. Samples coll 1961, 1964; subm by J L Giddings. Samples coll 1965, 1966; subm by D D Anderson, Brown Univ, Providence, Rhode Island (1968, 1970a, b, c; Giddings, 1952, 1962, 1965, 1967; Hamilton, 1970).

Band 1: Arctic Woodland Eskimos

P-593-A. House 5 **920 ± 50** **AD 1030**

MASCA corrected date: AD 1040 ± 70

Charcoal from floor of House 5, probably Eksaevik phase, coll 1961 (Giddings, 1952). *Comments*: NaOH pretreatment. Rootlets removed by hand. (DDA): date probably too early.

P-1112. House 13 **900 ± 50** **AD 1050**

MASCA corrected date: AD 1060 ± 60

Wood from floor of House 13, probably early Ahteut phase, coll 1965. *Comment*: NaOH pretreatment.

P-1064. House 13 **1490 ± 50** **AD 460**

MASCA corrected date: AD 530-490 ± 60

Wood from charcoal from floor of House 13, probably early Ahteut phase; coll 1965. *Comments*: NaOH pretreatment. Rootlets removed by hand. (DDA): date probably too early.

Band 2: Levels 1 to 4 are Itillik complex, Levels 5 to 12 are Ipiutak or Norton related.

P-594-A. Band 2 **1380 ± 60** **AD 570**

MASCA corrected date: AD 600 ± 70

Charcoal from one of lower levels, Band 2, coll 1961. *Comment*: NaOH pretreatment.

P-1065. Band 2 **1570 ± 50** **AD 380**

MASCA corrected date: AD 400 ± 60

Charcoal and sand from one of lower levels of Band 2; coll 1965.

General Comment: other dates from Band 2: K-836, 1570 ± 140 (R, 1968, v 10, p 320); GX-1503, 1350 ± 80; GX-1502, 1440 ± 110 (pers commun).

Band 3: Choris culture

2370 ± 50

P-1066. Band 2/3 **420 BC**

MASCA corrected date: 470 ± 60 BC

Charcoal from hearth in isolated cultural level between Bands 2 and 3; coll 1965. Late Choris. *Comment*: NaOH pretreatment. Rootlets removed by hand.

2430 ± 50

P-1067. Band 3, top level **480 BC**

MASCA corrected date: 510-540, 570-660 ± 60 BC

Charcoal and sand from hearth in top level of Band 3, coll 1965. *Comment*: NaOH pretreatment.

2450 ± 60

P-591-A. Band 3 **500 BC**

MASCA corrected date: 660-720 ± 70 BC

Charcoal from upper level of Band 3, probably Level 2, coll 1961. *Comment*: NaOH pretreatment. Rootlets removed by hand.

General Comment: other dates from Band 3: upper level, K-832, 2750 ± 140; "bottom" of Band 3, probably Level 5, K-835, 3170 ± 120 (R, 1968, v 10, p 320); Level 2, GX-1504, 1250 ± 90; Level 5, GX-1505, 1010 ± 100 (pers commun).

Band 4: Denbigh Flint Complex

3530 ± 60

P-1068. Band 3/4 **1580 BC**

MASCA corrected date: 2050 ± 70 BC

Charcoal and sand from isolated level between Bands 3 and 4, coll 1965. *Comment*: NaOH pretreatment. Rootlets removed by hand.

3640 ± 60

P-1069-A. Band 4, Level 1 **1690 BC**

MASCA corrected date: 2120-2140 ± 70 BC

Charcoal and sand from hearth in Band 4, Level 1, Classic Denbigh; coll 1965. *Comment*: rootlets removed by hand.

3860 ± 70

P-987. Band 4, Level 2 **1910 BC**

MASCA corrected date: 2350-2370, 2430-2460 ± 80 BC

Charcoal and sand from hearth in Band 4, Level 2, Classic Denbigh; coll 1964.

3700 ± 60

P-1109. Band 4, Level 3 **1750 BC**

MASCA corrected date: 2160 ± 70 BC

Charcoal and sand from hearth in Band 4, Level 3, Classic Denbigh; coll 1965. *Comment*: NaOH pretreatment.

P-988. Band 4, Level 4 **3850 ± 70**
1900 BC
MASCA corrected date: 2560 ± 80 BC

Charcoal and sand from Band 4, Level 4, Classic Denbigh; coll 1964.

P-998. Band 4/5 **3950 ± 70**
2000 BC
MASCA corrected date: 2560 ± 80 BC

Charcoal and sand from hearth between Bands 4 and 5, Classic Denbigh; coll 1964.

Band 5: Level 1, Proto-Denbigh; Levels 2 to 3, Portage complex

P-1070. Band 5, Level 1 **3710 ± 60**
1760 BC
MASCA corrected date: 2160 ± 70 BC

Charcoal and sand from house hearth, Band 5, Level 1, Proto-Denbigh; coll 1965. *Comment*: NaOH pretreatment.

P-1071. Band 5, Level 1 **3710 ± 60**
1760 BC
MASCA corrected date: 2160 ± 70 BC

Charcoal and sand from hearth in Band 5, Level 1, Proto-Denbigh; coll 1965. *Comment*: NaOH pretreatment.

P-1072. Band 5, Level 2 **4270 ± 70**
2320 BC
MASCA corrected date: 2970-2990 ± 80 BC

Charcoal and soil from hearth in Band 5, Level 2, Portage complex; coll 1965.

P-1030-A. Band 5, Level 3 **4340 ± 70**
2390 BC
MASCA corrected date: 3110-3140 ± 180 BC

Charcoal and sand from Band 5, Level 3, Portage complex; coll 1964. *Comment*: NaOH pretreatment.

P-1031. Band 5, Level 3 **4010 ± 70**
2060 BC
MASCA corrected date: 2610 ± 80 BC

Charcoal and sand from Band 5, Level 3, Portage complex; coll 1964.

P-1032. Band 5, Level 3 **3940 ± 70**
1990 BC
MASCA corrected date: 2560 ± 80 BC

Charcoal and sand from hearth in Band 5, Level 3, Portage complex; coll 1964.

3530 ± 100

P-1073. Band 5/6 **1580 BC**

MASCA corrected date: 2050 ± 110 BC

Charcoal from hearth in isolated level between Bands 5 and 6, transition between Portage and Palisades complexes; coll 1965. *Comments*: undersized sample, 56.88%. (DDA): date too recent.

3200 ± 60

P-1110. Band 5/6 **1250 BC**

MASCA corrected date: 1520-1560 ± 70 BC

Charcoal and soil from hearth in isolated level between Bands 5 and 6, transition between Portage and Palisades complexes; coll 1965. *Comment* (DDA): date too recent. GX-1506, 3690 ± 200 (pers commun) is also too recent.

4250 ± 60

P-999. Band 5/6 **2300 BC**

MASCA corrected date: 2970 ± 70 BC

Charcoal from isolated level between Bands 5 and 6, transition between Portage and Palisades complexes; coll 1964. *Comment*: NaOH pretreatment.

Band 6: Palisades Complex, Levels 1 to 13

4120 ± 80

P-1074. Band 6, Level 1 **2170 BC**

MASCA corrected date: 2850 ± 90 BC

Charcoal and sand from hearth in Band 6, Level 1; coll 1965. *Comment*: NaOH pretreatment. Undersized sample, 83.97%.

4640 ± 70

P-1026. Band 6, Level 7 **2690 BC**

MASCA corrected date: 3400, 3430, 3470 ± 80 BC

Charcoal and sand from hearth in Band 6, Level 7; coll 1964. *Comment*: NaOH pretreatment.

5320 ± 80

P-1075. Band 6, Level 8 **3370 BC**

MASCA corrected date: 4210-4250 ± 90 BC

Charcoal and sand from hearth in Band 6, Level 8; coll 1965.

5110 ± 70

P-1027. Band 6, Level 12 **3160 BC**

MASCA corrected date: 3900-3920 ± 80 BC

Charcoal and sand from Band 6, Level 12; coll 1964.

5070 ± 70

P-981. Band 6, Level 12 **3120 BC**

MASCA corrected date: 3850-3880 ± 80 BC

Charcoal and sand from hearth in Band 6, Level 12; coll 1964.

P-982. Band 6, bottom level **5270 ± 70 / 3320 BC**

MASCA corrected date: 4100, 4160-4180 ± 80 BC

Charcoal and sand from hearth in Band 6, bottom level; coll 1964. *Comment*: NaOH pretreatment.

General Comment: other dates from Band 6: Level 13, GX-1507, 5020 ± 150; lowest level, or Band 7, Level 3, GX-0261, 5680 ± 160 (pers commun).

Band 8: Kobuk complex

General Comment: Band 8 dates are beyond range of MASCA correction factors now available (Oct, 1974). See R, 1974, v 16, p 198-218 and Ralph *et al* (1973).

P-984-A. Band 8, Level 1 **7920 ± 100 / 5970 BC**

Charcoal and sand from hearth in Band 8, Level 1; coll 1964.

P-985. Band 8, Level 1 **8100 ± 160 / 6150 BC**

Charcoal and sand from Band 8, Level 1; coll 1964. *Comment*: NaOH pretreatment. Sample undersized, 53%, diluted with anthracite.

P-1076. Band 8, Level 1 **7900 ± 100 / 5950 BC**

Charcoal and soil from hearth in Band 8, Level 1; coll 1965. *Comment*: NaOH pretreatment.

P-1111. Band 8, Level 1 **7180 ± 90 / 5230 BC**

Charcoal and soil from hearth in Band 8, Level 1; coll 1965. *Comment* (DDA): date too recent.

P-1111-A. Band 8, Level 1 **7320 ± 100 / 5370 BC**

Same as P-1111, above. *Comment*: NaOH pretreatment. (DDA): date too recent.

General Comment: other date for Band 8: Level 3, GX-1508, 8195 ± 290 (pers commun).

Below Band 8: Akmak complex

General Comment: see K-1583, 9570 ± 150 (R, 1973, v 15, p 107).

II. GEOLOGIC SAMPLES

Arctic

Kobuk area peat samples

Peat samples from lakes near Onion Portage archaeol site (see above) on Kobuk R, NW Alaska (67° 10′ N, 158° 30′ W), coll 1965 by Sten Florin; subm by D D Anderson.

P-1093. Onion Lake **4230 ± 90 2280 BC**

MASCA corrected date: 2950-2970 ± 100 BC

Peat (*gyttja*) from lake bed core, 205 to 215cm below surface of Onion Lake, near Onion Portage. Coll 1965 by Sten Florin. *Comment*: undersized sample, 70.20%.

P-1094. Ishrakaklik Lake **6150 ± 50 4200 BC**

MASCA corrected date: 5100 ± 60 BC

Peat (*gyttja*) from lake bed core, 140 to 150cm below surface of Ishrakaklik Lake, NW of Onion Portage. Coll 1965 by Sten Florin.

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[RADIOCARBON, VOL. 17, No. 2, 1975, P. 216-218]

TEXAS A & M UNIVERSITY RADIOCARBON DATES III

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This date list is composed of the ages of tests of fossil populations of the foraminiferal species, *Amphistegina gibbosa,* and algal nodules collected from submerged banks in the N Gulf of Mexico. A Shipek grab sampler was used to collect the *Amphistegina gibbosa* and a few of the algal nodule samples. Algal nodules from the West Flower Garden Bank were obtained from cores at various intervals as indicated in Sec III.

All samples were acid leached to remove possible surface contaminants. Samples, analyzed using standard procedures (Kim *et al,* 1969; Mathews *et al,* 1972), were counted from 2000 to 3000 minutes. Ages are calculated using a ^{14}C half-life value of 5568 years and 0.95 of the present day activity of the NBS oxalic acid standard. All ages have also been corrected for the isotopic fractionation occurring in nature. Variations in the isotopic ratio, $\delta^{13}C$, are reported as the per mil (‰) deviation from the Chicago PDB Standard. Indicated errors refer to one standard deviation calculated from a statistical analysis of sample, standard and background count rates.

ACKNOWLEDGMENTS

We are indebted to S Valastro, University of Texas at Austin, for his assistance in helping us with an interlaboratory check.

I. INTERLABORATORY CHECK SAMPLE

TAM-184. West Flower Garden Bank, Gulf of Mexico — **4200 ± 150 / 2250 BC**

Calcium carbonate tests of fossil *Amphistegina gibbosa* populations from the West Flower Garden Bank (27° 52′ N, 93° 49′ W), coll from water depth 60m. Dated by Texas Radiocarbon Lab as 4160 ± 110, TX-1769 (S Valastro, written commun).

II. AMPHISTEGINA GIBBOSA SAMPLES

Samples were coll with a shipek grab sampler unless noted otherwise.

Sample no.	Bank	Water depth (m)	Location	$\delta^{13}C$ (‰)	^{14}C date BP (1950) AD/BC
TAM-190	Claypile	42	28°20′N, 94°10′W	+1.1	Modern
TAM-212	WFG**	60	27°52′N, 93°49′W	+1.2	4200 ± 150 2250 BC

* Present address: US Geological Survey, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543.

** West Flower Garden

Sample no.	Bank	Water depth (m)	Location	$\delta^{13}C$ (‰)	^{14}C date BP (1950) AD/BC
TAM-186	—	60	28°38′N, 89°33′W	+0.9	4780 ± 130 2830 BC
TAM-191	—	65-70	27°58′N, 92°23′W	+0.6	3690 ± 120 1740 BC
TAM-201	Flying Dutchman	71	27°58′N, 92°02′W	+0.8	3990 ± 130 2040 BC
TAM-193	Applebaum	77	27°50′N, 94°15′W	+0.7	3830 + 120 1880 BC
TAM-195	WFG	77	27°52′N, 93°49′W	+0.1	6370 ± 170 4420 BC
TAM-188	WFG	77	27°52′N, 93°49′W	+0.5	7490 ± 150 5540 BC
TAM-197	WFG	86	27°52′N, 93°49′W	+1.1	2540 ± 110 590 BC
TAM-199	—	87	28°01′N, 92°28′W	+1.1	3690 ± 110 1740 BC
TAM-192	WFG	86	27°52′N, 93°49′W	+1.0	11,830 ± 490 9880 BC
TAM-200	WFG	86	27°52′N, 93°49′W	+1.0	14,790 ± 650 12,840 BC
TAM-196	WFG	95	27°52′N, 93°49′W	+1.0	6220 ± 110 4270 BC
TAM-211	WFG	105	27°52′N, 93°49′W	+0.9	7140 ± 160 5190 BC
TAM-187	Sweet	132	27°51′N, 91°49′W	+1.0	12,570 ± 510 10,620 BC
TAM-189	Phleger	190	27°50′N, 91°54′W	+0.9	13,490 ± 560 11,540 BC

III. ALGAL NODULE SAMPLES

Sample no.	Bank	Water depth (m)	Location	$\delta^{13}C$ (‰)	^{14}C date BP (1950) AD/BC
TAM-209	—	53	28°06′N, 91°02W	+1.3	1190 ± 120 AD 760
TAM-203	—	62	28°03′N, 92°28′W	−33.9*	17,920 ± 710 15,970 BC
TAM-213	—	90	28°03′N, 92°28′W	−0.5	11,360 ± 250 9410 BC

Sample no.	Bank	Water depth (m)	Location	$\delta^{13}C$ (‰)	^{14}C date BP (1950) AD/BC
TAM-208	WFG core 45-55cm	91	27°52′N, 93°49′W	−4.1	19,300 ± 440 17,350 BC
TAM-207	WFG core 145-155cm	91	27°52′N, 93°49′W	−18.6	16,970 ± 380 15,020 BC
TAM-206	Alaminos	115	28°01′N, 91°46′W	+1.1	10,470 ± 260 8520 BC
TAM-210	Sweet	140	27°51′N, 91°49′W	+0.7	10,000 ± 200 8050 BC
TAM-219	WFG core 510-520cm	119	27°52′N, 93°49′W	+2.1	28,780 ± 1500 26,830 BC
TAM-220	WFG core 140-150cm	82	27°52′N, 93°49′W		>30,000
TAM-221	WFG core top	64	27°52′N, 93°49′W	+2.7	Modern
TAM-223	WFG core 55-65cm	119	27°52′N, 93°49′W		24,700 ± 1950 22,750 BC
TAM-224	WFG core 250-260cm	81	27°52′N, 93°49′W	+2.9	26,870 ± 1100 24,920 BC
TAM-225	WFG core top	82	27°52′N 93°49′W	+3.1	1970 ± 110 20 BC

* Sample enriched with iron.

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[RADIOCARBON, VOL. 17, NO. 2, 1975, P. 219-225]

TATA INSTITUTE RADIOCARBON DATE LIST XI

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This is the last installment of ^{14}C dates done at the Tata Institute; the lab has now shifted to the Physical Research Laboratory, Navarangpura, Ahmedabad-380 009, India.

The value $\tau 1/2 = 5568$ yr has been used to calculate all BP dates. Dates were converted to AD/BC scale by using 1950 as the reference year. The NBS oxalic acid was used as the modern standard.

We have measured the ^{14}C activity of the methane samples in gas proportional counters. The samples were converted to methane by using a reactor described earlier (R, 1971, v 13, p 442-449).

This date list includes dates on some old mining areas, some important Stone Age dates, and some measurements of various Quaternary processes including eustatic studies on the W coast of India. The hydrospheric samples include some dates done to study groundwater recharge problems in W India. The Pacific Ocean samples were measured to study the siltation and dissolution rates of calcareous particles in transit through a sea-water column. A series of Egyptian well-dated historic samples were measured to study the $^{14}C/^{12}C$ variations in the past.

*General Comment**: for the first time, an Upper Palaeolithic level has been dated to ca 20,000 BC (TF-1245) from U P. The microlithic occupation at Sarai Nahar Rai was dated ca 1000 BC (TF-1356, -1359) based on charred bones. Prehistoric deposits from a Ceylonese cave was dated to ca 6000 BC (TF-1074). A Painted Grey Ware, Iron age deposit from U P is dated ca 500 BC (TF-1228).

ACKNOWLEDGMENT

We are thankful to R K Pant for help in preparing the manuscript.

SAMPLE DESCRIPTIONS

I. ANCIENT MINING SAMPLES

TF-1199. Kolar, India, old gold works — **1260 ± 85 AD 690**

Charcoal from excavations of an old mine (12° 57′ N, 78° 16′ E), Dist Kolar. Subm by T G Varghese, Bhabha Atom Res Centre, Bombay.

Kumbaria old mining series, Gujarat

Kumbaria (24° 19′ N, 72° 51′ E), Dist Banaskantha. Subm by N C Shekhar, Min Expl Corp, Banaskantha. Samples assoc with slag of old smelting of copper, lead, silver, etc, lying on surface.

TF-1221. Charcoal — **520 ± 90 AD 1430**

Charcoal extracted from slags.

* For these comments, dates are based on $\tau 1/2 = 5730$ yr.

880 ± 85

TF-1222. Charcoal **AD 1070**

Charcoal extracted from slags.

II. ARCHAEOLOGIC SAMPLES

19,160 ± 330

TF-1245. R Belan, India, Gravel III **17,210 BC**

Shells from Gravel III on R Belan (24° 54′ N, 82° 2′ E), Dist Allahabad. Subm by Dir Inst Archael, Allahabad. *Comment*: an Upper Palaeolithic industry is assoc with Gravel III.

7640 ± 110

TF-1094. Beli Lena Athula, Ceylon, cave remains **5690 BC**

Carbonized kernels at .45m depth, from a prehistoric cave deposit (6° 56′ 5″ N, 80° 14′ 5″ E), near Maniyangama. Subm by Vishnu Mittre, Birbal Sahni Inst Palaeobot, Lucknow.

TF-1162. Gharluli, Afghanistan, Late Neolithic **Modern**

Charcoal from Gharluli (35° 45′ N, 65° 00′ E), Dist Maimana, Trench 1, Cut 2d^{e}, 6m, Sample 16/2d-600/8-9-69. Subm by L Dupree, Pennsylvania State Univ, Philadelphia. *Comment* (L D): nomads dug pits at site up to modern times, disturbing underlying deposits.

3090 ± 100

TF-1330. Inamgaon, India, Chalcolithic **1140 BC**

Wood charcoal from Inamgaon (18° 35′ N, 74° 32′ E), Dist Poona, a Chalcolithic site, Loc E7, Layer 4. Subm by Dir, Deccan College, Poona.

2420 ± 95

TF-1228. Khalaua, India, P G Ware level **470 BC**

Charcoal from Khalaua (27° 6′ N, 77° 52′ E), Dist Agra, Loc Khl-L, II-IV(a), Layer 9, depth 2.6m to 2.75m. Subm by Dir Gen, Archaeol, New Delhi.

TF-1356, **2860 ± 120**

TF-1359. Sarai Nahar Rai, India Microlithic(?) **910 BC**

Charred and semi-charred bones from Sarai Nahar Rai (25° 48′ N, 81° 50′ E), Dist Pratapgarh, a Mesolithic site, Hearth 1/A3 and 2/B4, depths 2 to 4cm to 5 to 6cm. Subm by Dir, Inst Archaeol, Allahabad. *Comment*: date younger than uncharred bones dated earlier (TF-1104: 10,050 ± 110).

3840 ± 130

TF-1301. Surkotada, India, Harappa culture **1890 BC**

Charcoal from Surkotada (23° 37′ N, 70° 50′ E), Dist Kutch, a fortified Harappan site, Loc B1, Qd 3, Layer 17, depth 5.65m. Subm by Dir Gen Archaeol, New Delhi.

III. EGYPTIAN HISTORIC SAMPLES

General Comment: these samples were measured to determine $^{14}C/^{12}C$ variations in the past. Though $\delta^{13}C$ values are given, dates are not corrected for this effect.

Egyptian Series I

Samples subm by W F Libby.

TF-562. Sneferu — **4310 ± 105** / **2360 BC** / $\delta^{13}C = -21.28‰$

Wood from tomb of Sneferu at Meydum. *Comment*: sample same as C-12 (Libby, 1965).

TF-563. Hemaka — **4580 ± 60** / **2630 BC** / $\delta^{13}C = -25.63‰$

Wood from tomb of Vizir Hemaka, contemporary of King Udimu, First Dynasty, at Sakkara. Average of 3 measurements: 4510, 4575, and 4610 yr. *Comment*: sample same as C-267.

TF-564. Sesostris III — **3570 ± 75** / **1620 BC** / $\delta^{13}C = -19.40‰$

Wood from funerary ship from tomb of Sesostris III. Average of 2 measurements: 3560 and 3570 yr. *Comment*: sample same as C-81.

TF-567. Zoser — **4180 ± 80** / **2230 BC** / $\delta^{13}C = -24.54‰$

Piece of *Acacia* wood from Zoser's Step Pyramid at Sakkara. Average of 2 measurements: 4135 and 4205 yr. *Comment*: sample same as C-1.

TF-568. Zoser — **4130 ± 50** / **2180 BC** / $\delta^{13}C = -26.41‰$

Piece of Sycamore wood from Zoser Step Pyramid at Sakkara. Average of 4 measurements: 4305, 4220, 4090, and 3830 yr.

Egyptian Series II

Well-dated historic samples from Egypt. Subm by Chairman, AEC, UAR.

TF-1208. Reeds — **3840 ± 135** / **1890 BC**

Reeds from tomb of Ones Re, No. 463, Old Kingdom, Luxor. *Comment*: archaeologic date ca 2100 BC.

TF-1209. Reeds — **3010 ± 80** / **1060 BC**

Reeds from wall of store room of temple Ramseum, Rameses II. *Comment*: archaeologic date ca 1250 BC.

2600 ± 100

TF-1211. Cloth **650 BC**

Cloth, 22nd Dynasty, Luxor.

2620 ± 125

TF-1212. Wood **670 BC**

Door of tomb Mono Mhat, No. 34, Assasee of 26th Dynasty. *Comment*: archaeologic date ca 700 BC.

IV. QUATERNARY SAMPLES

Quaternary sediment series, W Rajasthan

Samples subm by R P Dhir, Cent Arid Zone Res Inst, Jodhpur.

General Comment: samples measured to study onset of dessication in W Rajasthan.

+1985

TF-1214. Concretionary deposit **27,880**

−1605

25,930 BC

Calcium carbonate from 15km of Pokran, concretionary layer at 38 to 100cm below aeolian sand.

14,080 ± 170

TF-1215. Concretionary deposit **12,130 BC**

Calcium carbonate, Dodo-hill, piedmont slope, concretionary layer over rhyolite zone of weathering.

+4960

TF-1089. Panambur Harbour Area, India, coastal sediments **37,380**

−3100

35,430 BC

Carbonized wood from tree root, depth 12m, ancient coastal sediment (12° 56′ N, 74° 50′ E), Dist S Kanara. Subm by E V Nielson, Port Trust, Cochin. *Comment*: sample dated to study coastal siltation rates.

Coastal sediments series, Maharashtra

Samples subm by D P Agrawal and S Guzder, TIFR, Bombay.

General Comment: samples measured to study Quaternary eustatic changes on W coast, India (Agrawal *et al*, 1972). Wherever depths have been given below surface, there still is uncertainty about their exact relationship with HWL.

1520 ± 90

TF-555. Kolthara-Dabhol, coastal sediments **AD 430**

Shells from Kolthara-Dabhol (17° 39′ 10″ N, 73° 10′ 50″ E), Dist Ratnagiri, depth −1.8m, 105m inland from sea.

2500 ± 85

TF-556. Kolthara-Dabhol, coastal sediments **550 BC**

Shells, depth −3.8m.

TF-557. Kolthara-Dabhol, coastal sediments **1930 ± 100 AD 20**
Shells, depth −4.25m.

TF-558. Harnai, coastal sediments **2370 ± 80 420 BC**
Shells from Harnai (17° 49′ 10″ N, 73° 8′ 0″ E), Dist Ratnagiri, 0.5m above HWL.

TF-560. Harnai, coastal sediments **1860 ± 90 AD 90**
Shells, 1.7m above HWL.

TF-1365. Damle Wadi Guhagar, coastal sediments **2710 ± 105 760 BC**
Shells from Damle Wadi Guhager (17° 29′ 55″ N, 73° 13′ 35″ E), Dist Ratnagiri, depth −1.1m, 50 m inland from beach.

TF-1366. Damle Wadi Guhagar, coastal sediments **2160 ± 90 210 BC**
Shells, depth −2.20m.

TF-1367. Damle Wadi Guhagar, coastal sediments **2070 ± 125 120 BC**
Shells, 4m below surface.

TF-1368. Khare Wadi Guhagar, coastal sediments **3890 ± 110 1940 BC**
Shells from Khare Wadi Guhager (17° 29′ 25″ N, 73° 13′ 40″ E), Dist Ratnagiri, 4.9m below surface.

TF-1371. Devgad, coastal sediments **1950 ± 100 AD 0**
Shells from Devgad (16° 22′ 30″ N, 73° 24′ 50″ E), Dist Ratnagiri, 3 to 4m above HWL.

TF-1372. Malvan, coastal sediments **1080 ± 105 AD 870**
Shells from Malvan, Kolamb Bridge (16° 4′ 5″ N, 73° 30′ 30″ E), Dist Ratnagiri, 1.4m above HWL.

TF-1374. Malvan-Vaiyri, coastal sediments **2190 ± 145 240 BC**
Shells from Malvan-Vaiyri (16° 1′ 35″ N, 73° 31′ 50″ E), Dist Ratnagiri, 3m below surface.

Coastal sediments series, Australia

Samples subm by E D Gill, Nat Mus Victoria, Melbourne.

TF-1381. S Coast of New South Wales, coastal sediments **150 ± 80 AD 800**
Aragonitic shells from shell grit zone of headland between Norrawallee beach and Norrawalle inlet, off Ulladulla, ca 2m above MSL, covered with soil, No. 11/1772.

TF-1382. SW of Boggaley Creek, coastal sediments **340 ± 85 AD 610**

Mollusk shells from cemented calcarianite beach rock overlying a pebble bed, at SW end of a small prograded embayment SW of Boggaby Creek, Victoria, No. 12/1972.

V. HYDROSPHERIC SAMPLES

Gujarat groundwater series

Samples subm by B S Sukhija, TIFR, Bombay, to study recharge of aquifers in region.

Sample no.	Location	Well type	Depth	$\delta^{14}C$ % modern	Aquifer no.
TF-1184	Maktapur, Dist Mehsana (23°42′N, 72°30′E)	Tube-well	320m to 326m	37.4 ± 0.9	Single aquifer tapped
TF-1185	Sipor, Dist Mehsana, (23°40′N, 72°50′E)	-do-	65m	72.8 ± 0.9	Recharge area

Rajasthan groundwater series

Samples subm by V N Nijampurkar, TIFR, Bombay, to study aquifer recharge in area.

Sample no.	Location	Well type	Depth	$\delta^{14}C$ % modern	Aquifer no.
TF-1122	Ajasar, Dist Jaisalmer (27°15′N, 71°43′E)	Tube-well	100m to 117m	33.8 ± 0.8	Second
TF-1151	Chandan, Dist Jaisalmer (26°59′N, 71°18′E)	Tube-well	285m	56.6 ± 0.7	Mixed
TF-1154	Neron, Dist Jaisalmer (26°48′N, 71°28′E)	Dug-well	38m	85.3 ± 1.2	Mixed
TF-1155	Undu, Barmer (26°18′N 71°40′E)	Tube-well	118m	54.8 ± 1.5	

Pacific Ocean series

Subm by B L K Somayajulu, TIFR, Bombay.

General Comment: calcareous material trapped in spongin matrix from Pacific waters at depths 2300 to 3500m. The ratio $^{14}C/^{12}C$ corresponds to values observed in surface water in recent years resulting from additional man-made ^{14}C, thus indicating that calcareous particles resulted from recent biologic productivity. Results are related to mean settling rates and sizes and dissolution rates of biogenic calcareous particles in transit through a seawater column.

Sample no.	Location	Date	Depth at which water was flushed (m)	Weight of sponges (kg)	Volume of CO_2 (L)	$\delta^{14}C$ ‰	$\Delta^{14}C$ ‰
TF-812	Nova III (Sta 7) (16°00′N, 179°05.7′W)	6/22/67	2200-2300	4	1.20	149 ± 13	92 ± 12
TF-865	Nova VI (Sta 1) (31°41′S, 177°16.2′W)	9/21/67	3400-3500	5	3.00	57 ± 13	4.2 ± 12

Coral X-radiography series

Coral was analyzed to determine growth rates of several coral species. Comparison of growth rates with X-radiographs of same samples lends added evidence that bands observed are seasonal and may therefore be used as growth rate indicators. Subm by S Krishnaswamy, TIFR, Bombay.

Sample no.	Locality	Depth in vertical slice of coral	$\delta^{14}C$ % modern
TF-1317	Jamnagar	G1, 0-1cm	121.3 ± 2.0
TF-1318	"	" 1-2cm	124.0 ± 1.9
TF-1321	"	" 2-3cm	119.0 ± 1.4
TF-1322	"	" 3-4cm	111.6 ± 1.7
TF-1323	"	" 4-5cm	107.6 ± 1.6
TF-1324	"	" 5-6cm	107.2 ± 1.6
TF-1325	"	" 6-7cm	100.4 ± 1.7
TF-1326	"	" 7-9cm	100.9 ± 1.6
TF-1334	Sikai	G2, 0-1cm	121.9 ± 1.5
TF-1335	"	" 1-2cm	122.8 ± 1.4
TF-1336	"	" 2-3cm	121.6 ± 1.5

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BELFAST RADIOCARBON DATES VIII

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INTRODUCTION

Procedures of measurements and calculation remain as previously described. All samples are pretreated according to the methods described in R, 1971, v 13, p 103 and p 123 unless specified under the sample descriptions. Unless stated samples are from Ireland.

ACKNOWLEDGMENTS

We wish to thank Florence Qua and Annice Melville who have carried out pretreatments and the routine operation of the dating equipment. The Ministry of Finance supported the dating of the White Rocks samples and the Royal Society, London, supported the dating of the Exmore samples. We thank the archaeologists who submitted samples for their cooperation in the preparation of this report.

I. ARCHAEOLOGIC SAMPLES

White Rocks series, Co Antrim

Samples from old land surface in sand dunes at White Rocks, Ballymacrea Lower Td, 2.5km E of Portrush, Co Antrim (55° 12′ N, 6° 37′ W; Irish Grid Ref C 884406; alt ca 15m). Hearth in old land surface excavated 1971 by A E P Collins, Archaeol Survey N Ireland. Assoc flint work thought to be Neolithic. Subm 1971 by D M Waterman for Ministry Finance N Ireland.

UB-666. White Rocks, I — **3255 ± 730** / **1305 BC** / $\delta^{13}C = -20.2‰$

Human bones from pit-grave dug from supposed Neolithic land surface. Probably buried as loose bones rather than articulated skeleton. *Comment*: low collagen content of bones necessitated dilution of counting gas.

UB-667. White Rocks, II, hearth — **2100 ± 70** / **150 BC** / $\delta^{13}C = -25.6‰$

Charcoal, some of oak wood, from hearth in old land surface, assoc with flint and pottery thought to be Neolithic. *Comments*: date shows charcoal is not Neolithic; artifacts are either not assoc with charcoal or are not Neolithic.

General Comment: precision of UB-666 precludes detailed interpretation. Sample is clearly prehistoric and could be Neolithic; charcoal (UB-667) is clearly not Neolithic.

Crossnacreevy Ring Fort series, Co Down

Sample from ringfort (rath) in Crossnacreevy Td, 7km SW of Belfast,

Co Down (54° 34′ N, 5° 50′ W; Irish Grid Ref J 397702; alt ca 120m). Site excavated 1971 by A Harper, Archaeol Survey N Ireland. Palaeoecologic investigations of site by B Clayton, Palaeoecol Lab, Queen's Univ, Belfast.

UB-674. Crossnacreevy, post-hole **1350 ± 30** **AD 600**

$\delta^{13}C = -25.2‰$

Fine charcoal extracted from clay in post-hole on house platform. *Comment* (AH): result falls within expected range for this type of site, and is consistent with archaeologic dating of other finds. Sample dates assoc stone lamp. Lamp is 1st from stratified context in Ireland.

UB-751. Crossnacreevy, basal ditch fill **715 ± 65** **AD 1235**

$\delta^{13}C = -27.5‰$

Humic acid from bulk sample of basal 10cm of ditch fill. Coll 1972 and pretreated by B Clayton. *Comment* (BC): even allowing for some movement of humic acid within clay ditch filling, date is considerably younger than occupation of site indicated by UB-674. Taken with pollen analytic evidence, date suggests re-digging of ditch at later date.

UB-849. Crossnacreevy, ditch fill 50 to 56cm **540 ± 90** **AD 1410**

$\delta^{13}C = -28.1‰$

Humic acid extracted from clay of ditch fill from 50 to 56cm depth and 20cm above base (see UB-751). *Comment* (BC): date shows reasonable deposition rate for ditch and supports interpretation that it was re-dug.

UB-753. Crossnacreevy, buried soil charcoal **2750 ± 70** **800 BC**

$\delta^{13}C = -25.0‰$

Fine charcoal extracted from large bulk sample of soil under bank of ringfort. *Comment* (BC): clearly pre-dates construction considerably and demonstrates persistence of charcoal in surface layers of soil.

UB-848. Crossnacreevy, buried soil, humic acid **1910 ± 90** **AD 40**

$\delta^{13}C = -26.6‰$

Humic acid extracted from 14 to 20cm of monolith used for pollen analysis. Stratigraphically equivalent to UB-753. *Comment* (BC): while later than charcoal in soil, humic acid still seems considerably older than construction.

General Comment: UB-674 provides best estimate of utilization date. Bracket provided by pre-rath soil and ditch fill is too wide to be archaeologically useful. Dates for ditch fill reinforce pollen evidence for re-cut ditch for which there is no archaeologic evidence or explanation.

Rainsborough series, Northamptonshire, England

Samples from Rainsborough hillfort, Newbottle parish, 9.5km SE of Banbury, Northamptonshire, England (52° 00′ N, 1° 14′ W; Grid Ref SP 526348; alt 145m). Site excavated 1961 to 1965 by M Avery, Archaeol Dept, Queen's Univ, Belfast. Ref: Avery, Sutton, and Banks (1967).

UB-736. Rainsborough, RC '62, Samples 20 and 21 — **2460 ± 70 / 510 BC**

$\delta^{13}C = -25.5‰$

Charcoal from Pit K, Layers 1 and 2 combined. See Avery, Sutton, and Banks (1967, pl 18c). *Comment* (MA): Layer 2 was pit filling preceding burning horizon (Early Iron Age Phase 3a); Layer 1 probably included debris of that burning.

UB-737. Rainsborough, RC '64, Sample 4 — **2490 ± 35 / 540 BC**

$\delta^{13}C = -24.6‰$

Charcoal of oak, id by JRP, from N Guard Room, R Layer 6, 7 or 9a, see Avery, Sutton, and Banks (1967, pl 21a). *Comment* (MA): oak was probably a main support timber for guardroom roof, constructed in Early Iron Age Phase 2a, in use during Phase 2b, burnt in Phase 3a.

UB-853. Rainsborough, RC '64, Sample 45 — **2430 ± 75 / 480 BC**

$\delta^{13}C = -23.2‰$

Charcoal of ash wood, id by JH, branches ca 25 yr-old, from South Guard Room; see Avery, Sutton, and Banks (1967, fig 14, Timber B). *Comment* (MA): ash wood was probably used in construction of guard room roof; see comment on UB-737, above.

UB-854. Rainsborough, RC '62, Sample 1 — **2305 ± 115 / 355 BC**

$\delta^{13}C = -23.2‰$

Charcoal from L/hollow, Layer 3, see Avery, Sutton, and Banks (1967, fig 8). *Comment* (MA): pottery from layer (nos 91-99) suggests contamination (*ibid*, p 278-279).

UB-855. Rainsborough, RC '62, Sample L 23 — **2450 ± 75 / 500 BC**

$\delta^{13}C = -20.3‰$

Carbonized grain of hexaploid type wheat, id by JRP, from Cutting L 1, Post-hole 2, Layer 3 (Avery, Sutton, and Banks, 1967, figs 7 & 8; p 225). *Comment* (MA): post-hole was for 4-post structure possibly built over hollow dated by UB-854, above.

General Comment (MA): results for 5 samples are statistically indistinguishable. UB-737 and -853 both date growth of wood used in construction of guard-roomed fort in Early Iron Age Phase 2a; *cf* series from Dinorben (Savory, 1971, p 256) and Birm-185a, b from Croft Ambrey guard room (2410 ± 135, 2377 ± 136: R, 1971, v 13, p 153). Finds from

guard room floors (Avery, Sutton, and Banks, 1967, nos. 132-140, 154-173, and probably 128-131) are presumably a decade or so younger than construction date of roof. UB-736 and -855 are probably of Early Iron Age Phase 2a (Avery, Sutton, and Banks, 1967, p 262).

Fengate series, Northamptonshire, England

Samples from settlement site at Fengate, 0.5km E of Peterborough, Northamptonshire, England (52° 34′ 30″ N, 0° 13′ W; Grid Ref TL 212990; alt 3m). Site excavated by F M M Pryor, Royal Ontario Mus, Toronto, Canada. Coll and sub 1971 by FMMP.

UB-676. Fengate, Sample 1 **3230 ± 70** **1280 BC**

$\delta^{13}C = -24.4‰$

Charcoal from sandy clay from Padholme Road site, Area VIII, intersec of Ditch 3 with Feature 4, Layer 1. *Comment* (FMMP): should date main period of use of Ditch 3.

UB-677. Fengate, Sample 2 **2885 ± 135** **935 BC**

$\delta^{13}C = -24.7‰$

Wood of small branches of birch, id by J Hillam, from Padholme Road site, Area IX, Feature 4, Layer 5. *Comment* (FMMP): should date main use of Ditch 1.

UB-822. Fengate, Sample 4 **2290 ± 125** **340 BC**

$\delta^{13}C = -26.2‰$

Twigs from Vicarage Farm site, Area I, Feature 6, Layer 4. *Comment* (FMMP): sample from bottom of pit containing Early Iron age pottery.

General Comment (FMMP): UB-676 and -677 date main period of use of Ditches 1-4 (Pryor, 1974, fig 1). UB-822 dates pottery of Early Iron age type illustrated in Pryor (1974, fig 14, nos 1-21); this date would indicate a considerable degree of overlap between the 'early' and 'late' Iron age ceramic styles at Fengate (*cf* Pryor, 1974, p 38, Gak-4198).

UB-907. Knocknacarragh Mill, Co Galway **1355 ± 45** **AD 595**

$\delta^{13}C = -23.0‰$

Structural oak timber from horizontal mill in Knocknacarragh Td ca 3km from Galway, Co Galway (53° 16′ N, 9° 7′ W; Irish Grid Ref M 262237). Coll 1971 by A T Lucas, Nat Mus Ireland, Dublin. *Comment* (ATL): no Irish horizontal mills can be dated by assoc with artifacts or structures. Only one other has so far been dated by radiocarbon.

II. PALAEOECOLOGIC SAMPLES

Samples relating to palynologic study of postglacial vegetational history of SE Co Down, by SM Holland, Palaeoecol Lab, Queen's Univ. Stratigraphic depths are below bog surfaces.

Slieve Croob monolith series, Co Down

Blanket peat from near summit of Slieve Croob, 8.75km NNW of Castlewellan Co Down (54° 20′ N, 5° 59′ W; Irish Grid Ref J 318454), alt ca 560m.

UB-824. Slieve Croob monolith, 8 to 14cm **390 ± 60** **AD 1560**
$\delta^{13}C = -25.8‰$

Fine particulate fraction of blanket peat. Low tree pollen values and increase of grass and heath pollen.

UB-825. Slieve Croob monolith, 70 to 76cm **1440 ± 70** **AD 510**
$\delta^{13}C = -25.3‰$

Fine particulate fraction of blanket peat. Increase of plantain and heath pollen, cereal type pollen present.

UB-826. Slieve Croob monolith, 152 to 158cm **2605 ± 70** **655 BC**
$\delta^{13}C = -25.3‰$

Fine particulate fraction of blanket peat. Decrease in pollen concentration.

UB-827. Slieve Croob monolith, 171 to 175cm **2785 ± 75** **835 BC**
$\delta^{13}C = -25.3‰$

Fine particulate fraction of blanket peat. Marked reduction of tree pollen and high heath pollen values.

UB-828. Slieve Croob monolith, 202 to 206cm **3325 ± 75** **1375 BC**
$\delta^{13}C = -25.3‰$

Fine particulate fraction of transitional reedswamp peat. Increase of plantain pollen.

UB-829. Slieve Croob monolith, 223 to 227cm **3845 ± 80** **1895 BC**
$\delta^{13}C = -25.6‰$

Fine particulate fraction of reedswamp peat. Decrease of hazel pollen.

UB-830. Slieve Croob monolith, 242 to 246cm **3940 ± 85** **1990 BC**
$\delta^{13}C = -26.1‰$

Fine particulate fraction of reedswamp peat. Plantain pollen curve becomes continuous.

UB-831. Slieve Croob monolith, 250 to 254cm **4095 ± 85** **2145 BC**
$\delta^{13}C = -25.5‰$

Fine particulate fraction of reedswamp peat. Pine and elm pollen reduced to low values, maximum of ash pollen.

UB-832. Slieve Croob monolith, 256 to 260cm **4215 ± 85**
2265 BC
$\delta^{13}C = -23.9‰$

Fine particulate fraction of reedswamp peat. Oak and hazel pollen curves increase.

UB-833. Slieve Croob monolith, 264 to 268cm **4685 ± 85**
2735 BC
$\delta^{13}C = -25.8‰$

Fine particulate fraction of fine detritus mud. Decline of pine pollen values, cereal type pollen present.

Lackan Monolith I series, Co Down

Samples from raised bog in Lackan Td, 6km NE of Rathfriland, Co Down (54° 16′ N, 6° 5′ W; Irish Grid Ref J 242378), alt ca 75m.

UB-791. Lackan Monolith I, 3 to 5cm **2080 ± 65**
130 BC
$\delta^{13}C = -24.1‰$

Fine particulate fraction (see R, 1971, v 13, p 123) of *Sphagnum* peat. At onset of clearance phase with maximum values of heath pollen.

UB-792. Lackan Monolith I, 16 to 17cm **2330 ± 50**
380 BC
$\delta^{13}C = -24.8‰$

Sphagnum peat. Acid pretreatment. Regeneration following clearance phase with high values of grass, heath, and plantain pollen.

UB-793. Lackan Monolith I, 24 to 25cm **2590 ± 45**
640 BC
$\delta^{13}C = -24.0‰$

Sphagnum peat. Acid pretreatment. Clearance phase with high values of grass and plantain pollen.

UB-794. Lackan Monolith I, 44 to 45cm **2970 ± 40**
1020 BC
$\delta^{13}C = -24.3‰$

Sphagnum peat. Acid pretreatment. Increase of birch pollen values, decrease of plantain pollen values.

UB-795. Lackan Monolith I, 57 to 58cm **3320 ± 45**
1370 BC
$\delta^{13}C = -25.2‰$

Sphagnum peat. Acid pretreatment. At beginning of clearance phase with high values of grass and plantain pollen.

UB-796. Lackan Monolith I, 79 to 80cm **3590 ± 50**
1640 BC
$\delta^{13}C = -24.7‰$

Sphagnum peat. Acid pretreatment. Increase of plantain pollen values.

4105 ± 50

UB-797. Lackan Monolith I, 111 to 112cm **2155 BC**

$\delta^{13}C = -25.3‰$

Sphagnum peat. Acid pretreatment. Reduction in pine and elm pollen values.

4465 ± 50

UB-798. Lackan Monolith I, 124 to 125cm **2515 BC**

$\delta^{13}C = -25.7‰$

Sphagnum peat. Acid pretreatment. Elm pollen curve shows substantial increase at this level.

4605 ± 85

UB-799. Lackan Monolith I, 134 to 134.5cm **2655 BC**

$\delta^{13}C = -25.6‰$

Sphagnum peat. Acid pretreatment. Beginning of recovery of elm pollen curve.

4695 ± 50

UB-800. Lackan Monolith I, 149 to 149.5cm **2745 BC**

$\delta^{13}C = -26.3‰$

Sphagnum peat. Acid pretreatment. Elm pollen virtually absent. Beginning of continuous plantain pollen curve. Cereal type pollen present.

5085 ± 45

UB-801. Lackan Monolith I, 156 to 156.5cm **3135 BC**

$\delta^{13}C = -25.0‰$

Sphagnum peat. Acid pretreatment. Sample at level where elm pollen curve is falling rapidly, just before main elm decline.

5835 ± 55

UB-802. Lackan Monolith I, 169 to 170cm **3885 BC**

$\delta^{13}C = -25.5‰$

Sphagnum peat. Acid pretreatment. Pine pollen values reduced.

6975 ± 110

UB-803. Lackan Monolith I, 179 to 180cm **5025 BC**

$\delta^{13}C = -25.4‰$

Sphagnum peat. Acid pretreatment. Beginning of continuous alder pollen curve.

7375 ± 100

UB-804. Lackan Monolith I, 194 to 196cm **5425 BC**

$\delta^{13}C = -25.5‰$

Fine particulate fraction of reedy transitional peat. Pine pollen values high.

8305 ± 60

UB-805. Lackan Monolith I, 244 to 246cm **6355 BC**

$\delta^{13}C = -27.3‰$

Fine particulate fraction of reedswamp peat. Beginning of continuous curve for heath pollen.

UB-806. Lackan Monolith I, 308 to 310cm **8660 ± 70**
6710 BC
$\delta^{13}C = -26.7‰$

Fine particulate fraction of reedswamp peat from near base of organic deposits. Birch and willow pollen values high.

Carrivmoragh monolith series, Co Down

Samples from valley bog, 5km NW of Castlewellan, Co Down (54° 19′ N, 5° 59′ W; Irish Grid Ref J 315416), alt ca 260m. Stratigraphic depths are below present bog surface. All samples were alkali soluble, acid insoluble humic acid extracted from deposit (Fraction 'C' of R, 1970, v 12, p 296).

UB-864. Carrivmoragh monolith, 30 to 33cm **1700 ± 65**
AD 250
$\delta^{13}C = -27.0‰$

Organic mud. Upper limit of organic deposits.

UB-865. Carrivmoragh monolith, 52 to 55cm **3035 ± 50**
1085 BC
$\delta^{13}C = -27.3‰$

Organic mud. Sample just above clay layer and at end of high plantain pollen values.

UB-866. Carrivmoragh monolith, 66 to 70cm **3295 ± 50**
1345 BC
$\delta^{13}C = -27.3‰$

Organic mud. Just below clay layer and at marked increase of plantain pollen. Continuous curve for cereal type pollen starts and grass pollen curve rises.

UB-867. Carrivmoragh monolith, 76 to 79cm **3455 ± 45**
1505 BC
$\delta^{13}C = -26.4‰$

Organic mud. End of continuous curve for pine and elm pollen. Sudden decrease in fern spores.

UB-868. Carrivmoragh monolith, 89 to 92cm **3925 ± 60**
1975 BC
$\delta^{13}C = -26.8‰$

Organic mud. Marked decrease of elm pollen values and slight decrease of pine pollen values. Plantain and cereal type pollen present.

UB-869. Carrivmoragh monolith, 97 to 100cm **3795 ± 55**
1845 BC
$\delta^{13}C = -27.1‰$

Organic mud. Beginning of large increase in grass pollen values.

UB-870. Carrivmoragh monolith, 105 to 108cm **4750 ± 85**
2800 BC
$\delta^{13}C = -26.5‰$

Clay with organic content. Decreased elm pollen values and start of low pine pollen values. Plantain and cereal type pollen present.

UB-871. Carrivmoragh monolith, 116 to 120cm **5110 ± 60**
3160 BC
$\delta^{13}C = -26.8‰$

Organic mud. Decline in pine pollen values. Plantain pollen present.

UB-872. Carrivmoragh monolith, 131 to 134 **7495 ± 70**
5545 BC
$\delta^{13}C = -27.3‰$

Fine detritus mud. Start of continuous alder pollen curve.

UB-873. Carrivmoragh monolith, 156 to 160cm **8945 ± 85**
6995 BC
$\delta^{13}C = -26.7‰$

Reedswamp peat. High birch pollen values and increase in hazel pollen values. Base of organic deposits.

General Comment on samples from SE Co Down (SMH): monoliths were taken at each of sites listed above, pollen analyzed and radiocarbon dated. Radiocarbon samples were taken at levels of important vegetational change. Results are reasonably consistent and comparable with age determinations for similar vegetational changes elsewhere in Northern Ireland (Smith, 1973). The rational border of alder pollen was dated as 6975 ± 110 (UB-803, Lackan), and 7495 ± 70 (UB-872, Carrivmoragh), which is similar to determinations at Ringneil Quay, Co Down (Morrison, 1961). At Lackan, UB-801 (5085 ± 45), UB-800 (4695 ± 50) and UB-799 (4605 ± 85) date beginning, middle, and end of elm decline, respectively. Decreases in elm pollen percentages at Carrivmoragh and Slieve Croob were dated as 4750 ± 85 (UB-870) and 4685 ± 85 (UB-833), respectively. The pine pollen curve becomes discontinuous at Slieve Croob from 4095 ± 85 (UB-831), and at Lackan from 4105 ± 50 (UB-797). At Carrivmoragh, pine pollen percentages decrease to 1% at 3925 ± 60 (UB-868), but the pollen curve does not become discontinuous until 3455 ± 45 (UB-867). Deposition rates calculated for the 3 sites are being utilized for the calculation of absolute pollen influx.

Loch Garten series, Inverness-shire, Scotland

Samples of lake mud from Loch Garten, 11.5km SSW of Grantown-on-Spey, Moray, Scotland (57° 15′ N, 3° 42′ W, alt 220m). Samples from core coll using 3m Mackereth corer by P E O'Sullivan, Fac Humanities, The Polytechnic, Wolverhampton, England. Lake water depth 3.5m. Pretreatment by alkali and acid wash. Pollen analysis by P E O'S. Sample depths refer to position in core.

UB-850. Loch Garten, 80 to 90cm **3635 ± 205**
1685 BC
$\delta^{13}C = -27.6‰$

Dates main expansion of heathland and cultural pollen types at 83cm. Sample gas diluted with inactive methane.

UB-851. Loch Garten, 250 to 260cm **5860 ± 100**
3910 BC
$\delta^{13}C = -27.9‰$

Dates main Flandrian expansion of *Alnus* pollen at 255cm.

UB-852. Loch Garten, 270 to 282cm **7585 ± 335**
5635 BC
$\delta^{13}C = -28.2‰$

Dates base of sediment core coll. Sample gas diluted with inactive methane.

General Comment (PEO'S): date for UB-850, marking earliest pollen-analytic evidence for forest clearance in Speyside dist of E-Central Scottish Highlands, seems consistent with current archaeologic opinion on age of Clava Group of Chambered Tombs (Henshall, 1972). UB-851 date suggests main Flandrian expansion of *Alnus* occurs later on Speyside than proposed by Birks (1970), based on radiocarbon dates of tree-stump layers. Similarly, UB-852 date is minimum for Pine forest establishment on Speyside, before main rise of Alder. For full discussion of results, see O'Sullivan (1974).

UB-874. Gosford Castle Forest, peat layer **4380 ± 80**
2430 BC
$\delta^{13}C = -28.4‰$

Twigs from clay layer underlying peat in Gosford Castle Forest, 1km N of Markethill, Co Armagh (54° 18′ N, 6° 31′ W; Irish Grid Ref H 965408), alt ca 90m. Peat layer was covered by ca 1m boulder clay; might have been interglacial. Result shows peat is postglacial and presence of boulder clay was probably due to land-slip or human activity. Pretreatment by alkali and acid washes.

UB-856. Kinnegar, peat layer **9890 ± 100**
7940 BC
$\delta^{13}C = -26.6‰$

Peat layer at 9.3 m depth below surface, under estuarine clay at Kinnegar, 6.4km NE of Belfast, Co Down (54° 38′ 30″ N, 5° 50′ 45″ W; Irish Grid Ref J 387784), alt ca sea level. Bulk sample of peat layer coll by commercial corer from base of estuarine clay and above red clay. Peat thickness estimated at 5cm. Coll 1972 by P Medhurst, Palaeoecol Lab. Acid pretreatment. *Comment*: date shows peat and overlying estuarine clay being studied by PM covers most of postglacial period.

III. TIMBER SAMPLES

Samples of subfossil and other timbers taken to aid construction of floating tree-ring chronologies and to place these in a relative framework.

Mill Lough series, Co Fermanagh

Timbers from Mill Lough, Loughgare Td, Co Fermanagh (54° 13′ 30″ N, 7° 17′ W; Irish Grid Ref H 467313), alt 88m. Coll 1968 when lake level was artificially lowered. Lake dwelling exposed at this time dated by UB-267: 685 ± 80 (R, 1971, v 13, p 123).

UB-811. Mill Lough, Bog Oak 201 — **1620 ± 40** / **AD 330** / $\delta^{13}C = -23.3‰$

Yr 141 to 160 of 191-yr-old tree.

UB-812. Mill Lough, Bog Oak 215 — **1680 ± 45** / **AD 270** / $\delta^{13}C = -23.7‰$

Yr 220 to 239 of 256-yr-old tree.

UB-813. Mill Lough, Bog Oak 219 — **1985 ± 35** / **35 BC** / $\delta^{13}C = -22.5‰$

Yr 162 to 181 of 267-yr-old tree.

UB-814. Mill Lough, Bog Oak 227 — **6400 ± 60** / **4450 BC** / $\delta^{13}C = -23.5‰$

Yr 157 to 176 of 253-yr-old tree.

UB-815. Mill Lough, Bog Oak 228 — **5725 ± 40** / **3775 BC** / $\delta^{13}C = -23.5‰$

Yr 93 to 112 of 237-yr-old tree.

General Comment: timbers dredged from this lake clearly belong to a wide range of ages.

Blackwater series, Co Tyrone

Further samples from series of timbers dredged from R Blackwater near Verners Bridge, Co Tyrone (54° 29′ 30″ N, 6° 38′ W; Irish Grid Ref H 883615), alt 17m. Coll 1968. See also UB-287: 1025 ± 60 (R, 1971, v 13, p 123) and UB-550: 825 ± 35 (R, 1973, v 15, p 227).

UB-754. Blackwater, Bog Oak 54A — **1455 ± 50** / **AD 495** / $\delta^{13}C = -24.4‰$

Yr 106 to 126 of 176-yr-old tree.

UB-755. Blackwater, Bog Oak 59 — **1635 ± 40** / **AD 315** / $\delta^{13}C = -22.8‰$

Yr 72 to 86 of 215-yr-old tree.

UB-904. Derrylard, Site II, Bog Oak 1282 — **3640 ± 45** / **1690 BC** / $\delta^{13}C = -24.2‰$

Yr 65 to 79 of 263-yr-old tree from banks of R Bann at Derrylard Td, 11.5km NW of Portadown, Co Armagh (54° 30′ N, 6° 31′ W; Irish Grid Ref H 961627), alt 17m.

UB-758. River Bann, Bog Oak 892

2695 ± 50
745 BC
$\delta^{13}C = -23.8‰$

Yr 152 to 172 of 212-yr-old tree from R Bann at Ballynery, 5.5km N of Portadown, Co Armagh (54° 28′ N, 6° 26′ W, Irish Grid Ref J 014593), alt ca 20m. See also UB-687: 1405 ± 45 (R, 1973, v 15, p 607).

UB-808. Balloo Cottage, Bog Oak 1082

4510 ± 40
2560 BC
$\delta^{13}C = -23.5‰$

Yr 29 to 38 of 123-yr-sample from tree ca 300 yr from saddler's cottage in Balloo Td, 19km SE of Belfast, Co Down (54° 28′ N, 6° 34′ W; Irish Grid Ref J 486607), alt 50m. See also UB-756, -757 (R, 1974, v 16, p 275), and UB-620 (R, 1973, v 15, p 226) for other bog oak timbers from this cottage.

Fallahogy Bog Pine series, Co Londonderry

Bog pines from E end of bog in Fallahogy Td, 18.4km WNW of Ballymena, Co Londonderry (54° 54′ N, 6° 35′ W; Irish Grid Ref C 933073), alt ca 40m. See also UB-621 (R, 1973, v 15, p 226) and UB-722 (R, 1973, v 15, p 610).

UB-767. Fallahogy, Bog Pine 906

7970 ± 65
6020 BC
$\delta^{13}C = -22.2‰$

Yr 56 to 76 of 163-yr-old tree from E end of bog. Forms part of sequence of 307 yr.

UB-768. Fallahogy, Bog Pine 902

7065 ± 60
5115 BC
$\delta^{13}C = -23.6‰$

Yr 66 to 76 of 169-yr-old tree from E end of bog. One of group of cross-dated trees all showing fire damage.

UB-769. Lough Eyes, Bog Oak 968

515 ± 30
AD 1435
$\delta^{13}C = -23.3‰$

Oak timber from crannog (lake-dwelling) in Lough Eyes, 8.7km E of Eniskillen, Co Fermanagh (54° 20′ N, 7° 30′ W; Irish Grid Ref H 325433), alt 95m. Sample taken to determine whether timber belonged to crannog construction or to time of raising of water level in 17th century. Sample appears to date crannog.

UB-918. Rices Island, Bog Oak No. 1180

6015 ± 60
4065 BC
$\delta^{13}C = -21.2‰$

Bog oak from cut-off bog at Rices I, 18.5km SW of Ballymena, Co Antrim (54° 46′ N, 6° 30′ W; Irish Grid Ref H 962922), alt 20m. Yr 274 to 283 of 283-yr-old tree.

UB-809. Lisnisk, Bog Oak 1066 **4595 ± 60**
2645 BC
$\delta^{13}C = -23.2‰$

Bog oak from Lisnisk Td, 3.8km ENE of Rathfriland, Co Down (54° 15′ N, 6° 7′ W; Irish Grid Ref J 236349), alt 90m. Yr 143 to 162 of 325-yr-old tree.

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[RADIOCARBON, VOL. 17, No. 2, 1975, P. 239-246]

UNIVERSITY OF MIAMI RADIOCARBON DATES III

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The following radiocarbon measurements made since our last date list (R, v 17, p 112-120), are a partial list of projects and samples released for publication by the submitters. The technique employed is liquid scintillation counting of wholly synthesized benzene as described by Noakes *et al* (1965) and discussed in R, v 16, p 402-408. Errors are reported as one standard deviation. No correction factors are applied.

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SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

A. United States

UM-205. Broward County charcoal — **3945 ± 85** / **1995 BC**

Sample from 155cm beneath surface, 1.6km N of Hollywood Blvd, .8km W of State Rd #7, Broward Co, Florida (26° 01′ 59″ N, 80° 26′ 09″ W). Coll 1974 by W F Coleman; subm 1974 by F T Huna, Miami-West India Arch Soc, Miami, Florida. *Comment* (FTH): dates habitation by early S Florida Indians.

II. GEOLOGIC SAMPLES

A. United States

Shackelford Banks series

Two wood samples: SH-13 from 2.4km W of Cape Lookout Lighthouse, off coast of North Carolina (34° 39′ 28″ N, 76° 33′ 50″ W); SH-1 from W end of Shackelford Banks, 46m SW of Mullet Pond, near coast of North Carolina (34° 41′ 07″ N, 76° 38′ 45″ W). Coll 1973 and subm 1974 by K Susman, Duke Univ.

General Comment (KS): dates stratigraphic sequence for Shakelford Banks.

UM-187. Shakelford SH-1 — **12,280 ± 370** / **10,330 BC**

From 14m water.

UM-188. Shakelford SH-13 — **24,535 ± 800** / **22,585 BC**

From 23m water.

Snapper Point series

Mangrove peat from 4 cores, Snapper Point, Key Largo, Florida

(25° 19′ 57″ N, 80° 17′ 24″ W). Coll and subm 1974 by E R Rich, Dept Biol, Univ Miami.

General Comment: all peat samples were pretreated with 5% hot NaOH, 10% hot HCl, rinsed with deionized H_2O and dried.

General Comment (ERR): dates used as relative indicators of current processes in stable, land-mangrove areas. Cores 1, 3, and 4 have similar decay and environmental histories. Core 5 is from an anaerobic, offshore deposit, indicating an earlier shoreline. Visible root hairs were hand-picked by submitter.

UM-232. Core 1, 10 to 20cm **Modern**

Comment (ERR): questionable whether material at this interval was formed *in situ.*

UM-233. Core 1, 20 to 30cm **480 ± 85 AD 1470**

UM-234. Core 1, 40 to 50cm **775 ± 60 AD 1175**

UM-235. Core 1, 60 to 70cm **1130 ± 80 AD 820**

UM-236. Core 3, 10 to 20cm **270 ± 85 AD 1680**

UM-237. Core 3, 40 to 50cm **1110 ± 105 AD 840**

UM-238. Core 3, 70 to 80cm **1450 ± 145 AD 500**

UM-239. Core 4, 10 to 20cm **190 ± 95 AD 1760**

UM-240. Core 4, 30 to 40cm **505 ± 85 AD 1445**

UM-241. Core 4, 60 to 70cm **1465 ± 75 AD 485**

UM-242. Core 5, 0 to 10cm **1350 ± 80 AD 600**

Comment (ERR): sample from shallow bottom community containing live marine algae and other organisms.

Lake Okeechobee series

Lake samples studied to determine environmental effect of back-pumping on marsh areas; to reconstruct sedimentary environment of lake; to date onset of peat accumulation and end of marl deposition. Coll 1973 and subm 1974 by P J Gleason, C & S F Flood Control Dist, Palm Beach, Florida.

12,050 ± 210

UM-190. Lake Okeechobee, LO-1 **10,100 BC**

Marl from Lake Okeechobee bottom sediments, S lake Okeechobee, Florida (26° 52′ N, 80° 45′ W).

860 ± 120

UM-191. Lake Okeechobee, Core 11:0-2 **AD 1090**

Muck from 0 to 5cm, Kreamer I., Lake Okeechobee, Florida (26° 46′ N, 80° 44′ W). *Comment* (PJG): sample contained high ash content.

5000 ± 90

UM-192. Lake Okeechobee, Core 11:103-107 **3050 BC**

Peat from 262 to 272cm, same as UM-191. *Comment* (PJG): age is minimum for onset of peat deposition.

6470 ± 120

UM-193. Lake Okeechobee, Core 11:108-109 **4520 BC**

Calcitic marl from 274 to 276cm, same as UM-191. *Comment* (PJG): date represents end of marl deposition.

3055 ± 80

UM-194. Lake Okeechobee, Core 12:18-20 **1105 BC**

Sandy peat from 46 to 51cm, NE conservation Area 3, Broward Co, Florida (26° 15′ N, 80° 30′ W).

1445 ± 75

UM-195. Lake Okeechobee, Core 13:24-27 **AD 505**

Sandy peat from 61 to 69cm, N conservation Area 2B, Broward Co, Florida (26° 12′ N, 80° 24′ W).

3460 ± 80

UM-196. Lake Okeechobee, Core 14:9-11 **1510 BC**

Sandy peat from 23 to 28cm, S conservation Area 2B, Broward Co, Florida (26° 08′ N, 80° 22′ W).

DeSoto Canyon series

Two cores of silty clay, rich in calcareous faunas, from continental slope, DeSoto Canyon, Gulf of Mexico. Core GS-7102-5 from NW of canyon (29° 17′ N, 87° 15′ W). Core GS-7102-9 from SE of canyon (29° 00′ N, 87° 00′ W). Coll 1973 by S Gartner; subm 1973 by C Emiliani, RSMAS, Miami, Florida.

General Comment (CE): Core GS-7102-5 contains some detrital carbonate establishing maximum ^{14}C values for samples. Dates are part of study of paleoclimatology of Quaternary sediments from NE Gulf of Mexico. Because of upwelling, climatic record is preserved in greater detail than typical pelagic oozes.

12,925 ± 200

UM-61. GS-7102-5, 32 to 69cm **10,975 BC**

18,390 ± 205

UM-60. GS-7102-5, 132 to 169cm **16,440 BC**

		23,135 ± 410
UM-59.	GS-7102-5, 235 to 265cm	21,185 BC
		+1930
		30,145
		−2550
UM-58.	GS-7102-5, 385 to 415cm	28,195 BC
UM-57.	GS-7102-5, 485 to 515cm	>42,500
		5735 ± 75
UM-257.	GS-7102-9, 35 to 65cm	3785 BC
		8640 ± 190
UM-258.	GS-7102-9, 65 to 100cm	6690 BC
		10,865 ± 145
UM-259.	GS-7102-9, 100 to 120cm	8915 BC
		12,220 ± 140
UM-260.	GS-7102-9, 120 to 140cm	10,270 BC
		16,310 ± 200
UM-261.	GS-7102-9, 183 to 200cm	14,360 BC
		17,280 ± 195
UM-262.	GS-7102-9, 200 to 220cm	15,330 BC
		17,885 ± 170
UM-263.	GS-7102-9, 230 to 250cm	15,935 BC
		+500
		17,885
		−535
UM-264.	GS-7102-9, 250 to 270cm	15,935 BC
		+610
		20,625
		−660
UM-265.	GS-7102-9, 290 to 310cm	18,675 BC
		+390
		21,640
		−410
UM-315.	GS-7102-9, 310 to 330cm	19,690 BC
		+545
		25,040
		−585
UM-311.	GS-7102-9, 350 to 370cm	23,090 BC
		+590
		23,260
		−640
UM-312.	GS-7102-9, 370 to 390cm	21,310 BC

UM-313. GS-7102-9, 490 to 510cm **25,035 +550 −590 BC 23,085 BC**

UM-314. GS-7102-9, 510 to 530cm **27,560 +860 −965 BC 25,610 BC**

Edisto Beach series

Shell from 3 areas of Edisto I, Charleston Co, South Carolina: Edingsville samples from .8km offshore (32° 31′ N, 80° 16′ W); Bay Point Beach Ridge samples (32° 28′ N, 80° 20′ W); Botany Bay samples from intertidal zone (32° 33′ N, 80° 12′ W). *Mercenaria* valves from Privateer Creek, Seabrook I, Charleston Co, South Carolina (32° 34′ N, 80° 19′ W). Coll and subm 1974 by F W Stapor, Jr, South Carolina Wildlife & Marine Resources Dept.

UM-206. Edingsville C-1 **30,120 +1350 −1650 BC 28,170 BC**

Mercenaria valves from recrystallized calcarenite. Calcarenite is substrate for vermetid reef.

UM-207. Edingsville C-2 **>32,380**

Mercenaria valves. *Comment* (FWS): UM-206 and -207 date formation of vermetid substrate.

UM-225. Edingsville R-1 **560 ± 100 AD 1390**

Vermetid-serpulid tubes.

UM-226. Edingsville R-2 **575 ± 75 AD 1375**

Vermetid-serpulid tubes.

UM-227. Edingsville R-3 **800 ± 90 AD 1150**

Vermetid-serpulid tubes.

UM-251. Edingsville R-4 **3990 ± 90 2040 BC**

Vermetid-serpulid tubes.

UM-252. Edingsville R-5 **680 ± 80 AD 1270**

Vermetid-serpulid tubes.

UM-255. Edingsville R-5b **835 ± 75 AD 1115**

Outer chalky fraction of UM-252. *Comment*: less radiogenic than apparently unaltered inner fraction.

840 ± 65

UM-208. Bay Point A-1 **AD 1110**

Mercenaria shells from 1 to 2m beneath surface. Sample from oldest area of beach ridge-plain.

1540 ± 75

UM-229. Bay Point A-1b **AD 410**

Outer chalky fraction of UM-208. *Comment*: less radiogenic than apparently unaltered inner fraction.

1710 ± 85

UM-209. Bay Point A-2 **AD 240**

Mercenaria valves from 1 to 2m beneath surface. Sample from oldest area of beach-ridge plain.

3020 ± 70

UM-230. Bay Point A-2b **1070 BC**

Outer chalky fraction of UM-209. *Comment*: less radiogenic than apparently unaltered inner fraction.

2635 ± 80

UM-243. Bay Point A-3 **685 BC**

Mercenaria shells from 1 to 2m beneath surface. Sample from oldest area of beach-ridge plain.

2530 ± 75

UM-253. Bay Point A-3b **580 BC**

Outer chalky fraction of UM-243. *Comment*: more radiogenic than apparently unaltered inner fraction.

1490 ± 70

UM-210. Bay Point B-1 **AD 460**

Mercenaria valves from 1 to 2m beneath surface. Sample from 2nd oldest area of beach-ridge plain.

1390 ± 70

UM-211. Bay Point B-2 **AD 560**

Mercenaria valves from 1 to 2m beneath surface. Sample from 2nd oldest area of beach-ridge plain.

2525 ± 90

UM-212. Bay Point B-3 **575 BC**

Mercenaria shells from 1 to 2m beneath surface. Sample from 2nd oldest area of beach-ridge plain.

1550 ± 70

UM-213. Bay Point C-1 **AD 400**

Mercenaria shells from 2 to 3m beneath surface. Sample from 2nd youngest area of beach-ridge plain.

1685 ± 100

UM-214. Bay Point C-2 **AD 265**

Mercenaria shells from 2 to 3m beneath surface. Sample from 2nd youngest area of beach-ridge plain.

1915 ± 105

UM-231. Bay Point C-2b **AD 35**

Outer chalky fraction of UM-214. *Comment*: less radiogenic than apparently unaltered inner fraction.

+1370
31,915
−1650

UM-215. Bay Point C-3 **29,965 BC**

Mercenaria shells from 2 to 3m beneath surface. Sample from 2nd youngest area of beach-ridge plain. *Comment*: date anomalously older than expected.

990 ± 65

UM-216. Bay Point D-1 **AD 960**

Mercenaria shells from 1 to 2m beneath surface. Sample from youngest area of beach-ridge plain.

330 ± 65

UM-217. Bay Point D-2 **AD 1620**

Mercenaria shells from 1 to 2m beneath surface. Sample from youngest area of beach-ridge plain.

9145 ± 160

UM-220. Botany Bay **7195 BC**

Large pelecypod and gastropod shells.

3600 ± 85

UM-221. Botany Bay **1650 BC**

Small pelecypod and gastropod shells.

4830 ± 90

UM-218. Botany Bay **2880 BC**

Small pelecypod and gastropod shells.

8915 ± 170

UM-219. Botany Bay **6965 BC**

Small pelecypod and gastropod shells.

2475 ± 70

UM-247. Botany Bay **525 BC**

Anadara valves.

3480 ± 70

UM-248. Botany Bay **1530 BC**

Anadara valves.

3125 ± 80

UM-254. Botany Bay **1175 BC**

Outer chalky fraction of UM-248. *Comment*: more radiogenic than apparently unaltered inner fraction.

1200 ± 75

UM-249. Botany Bay **AD 750**

Dinocardium valves.

3030 ± 110
UM-250. Botany Bay **1080 BC**
Dinocardium valves.

5280 ± 110
UM-222. Seabrook Island Beach Ridge 1 **3330 BC**

+825
26,300
−920
UM-223. Seabrook Island Beach Ridge 2 **24,350 BC**

1250 ± 70
UM-224. Seabrook Island Beach Ridge 3 **AD 700**

1365 ± 75
UM-244. Seabrook Island Beach Ridge 4 **AD 585**

1170 ± 60
UM-245. Seabrook Island Beach Ridge 5 **AD 780**

+1370
31,920
−1650
UM-246. Seabrook Island Beach Ridge 6 **29,970 BC**

B. Territoire Français des Afars et des Issas

6565 ± 235
UM-228. Afar Depression **4615 BC**

Shell from Afar Depression, Territoire Français des Afars et des Issas (11° 35′ N, 42° 28′ E). Coll 1972 and subm 1974 by C G A Harrison and E Bonatti, RSMAS, Miami, Florida. *Comment* (EB): dates desiccation of this section of Afar Depression. Area is center of active extension and spreading, genetically connected to Sheba Ridge in Gulf of Aden. Hyaloclastites coll indicate an underwater eruption.

References

Noakes, J E, Kim, S M, and Stipp, J J, 1965, Chemical and counting advances in liquid scintillation age dating: 6th internatl ^{14}C and ^{3}H dating conf Proc, Pullman, Washington, June 7-11, 1965, p 68-92.

[RADIOCARBON, VOL. 17, No. 2, 1975, P. 247-254]

VIENNA RADIUM INSTITUTE RADIOCARBON DATES VI

HEINZ FELBER

Institut für Radiumforschung und Kernphysik der Österr Akademie der Wissenschaften, Vienna, Austria

Measurements have continued with the same proportional counter system, pretreatment procedure, methane preparation and measurement, and calculation, as described previously (R, 1970, v 12, p 298-318). Uncertainties quoted are single standard deviations originating from standard, sample, background counting rates and half-life. No C^{13}/C^{12} ratios were measured.

The following list presents most samples of our work in the last year. Sample descriptions have been prepared in cooperation with submitters.

ACKNOWLEDGMENTS

I express many thanks to Ing L Stein for excellent work in sample preparation, and to A Rasocha for careful operation of the dating equipment.

SAMPLE DESCRIPTIONS

I. GEOLOGY, GEOGRAPHY, SOIL SCIENCE, AND FORESTRY

A. Austria

VRI-322. Wallern, Burgenland **>36,000**

Wood, fragile fragments of oak; depth 7m, embedded in sand below gravel in subsoil water. Seewinkel between Wallern (47° 36′ N, 16° 56′ E) and Pamhagen, Burgenland. Coll 1971 by Fa Frank, well digger, in Frauenkirchen; subm by H Franz, Hochschule f Bodenkultur, Vienna.

Glacier Pasterze series, Kärnten

Pressed sandy humus from fossil autochthonous soil below 1 to 2m ground moraine. Forefield of glacier Pasterze within lateral moraine from 1856, erosion groove of E Seebach rivulet (47° 03′ 48″ N, 12° 45′ 22″ E), Glockner-Group, Hohe Tauern, Carinthia. Site thawed ca 20 yr ago (Patzelt, 1969). Coll 1971 and subm by G Patzelt, Inst Meteorolog Geophys, Univ Innsbruck.

General Comment (GP): samples date passage of advancing glacier over fossil soil. VRI-317 verifies glacier advance proved repeatedly in other areas (Patzelt, 1973). According to stratigraphy dates were expected. No contamination by recent rootlets. Only acid pretreatment was given.

VRI-316. Pasterze 1 **1310 ± 80** **640 BC**

Alt 2210m.

VRI-317. Pasterze 2 **1700 ± 100** **AD 250**

Alt 2220m.

31,600 ± 1400

VRI-393. Freibach, Kärnten **29,650 BC**

Deformed wood remnants in banded sand-clay sediment of former lake probably dammed by mud-flow cone. Site 7 to 10m below surface under moraine of former Freibach glacier and gravel. Left border of R Freibach (46° 29′ 18″ N, 14° 26′ 47″ E) S of bridge Pt 812 (Ö K 1:25000, Part 212/1 Zell Pfarre), Carinthia. Coll 1972 and subm by D van Husen, Inst Geol, TH Vienna.

5690 ± 100

VRI-396. Groβenzersdorf, N Ö **3740 BC**

Stem of Elm 10 in terrace gravel of R Danube dredged at −5m in underground water in gravel pit 2 km ENE Grossenzersdorf (48° 15′ N, 16° 35′ E), Lower Austria. Coll 1973, subm by J Fink, Geog Inst, Univ Vienna.

13,900 ± 200

VRI-391. Schwarzach, Salzburg **11,950 BC**

Wood at base of banded clay several m thick overlying coarse gravel, underlying sand. Artificial opening of R Salzach terrace, Schwarzach (47° 20′ N, 13° 10′ E), Pongau, Salzburg. Coll 1973 and subm by H Slupetzky, Geog Inst, Univ Salzburg. *Comment* (HS): 1st date of inner alpine terrace of R Salzach and of ice free period in this region.

Koralpe series, Steiermark

Peat from bogs of Mt Koralpe, Styria. Coll 1973 and subm by F Kral, Hochschule Bodenkultur, Vienna.

General Comment (FK): establishes chronology of pollen diagram and forest history.

5720 ± 140

VRI-387. Koralpe 1 **3770 BC**

Sphagnum peat, bog See-Eben near shelter Stoffhütte (46° 53′ 55″ N, 15° 01′ 25″ E), depth 300 to 310cm.

7000 ± 120

VRI-388. Koralpe 2 **5050 BC**

Wood peat, bog Filzmoos near Freiländer Alm (46° 54′ 50″ N, 15° 04′ 10″ E), depth 305 to 315cm.

11,930 ± 250

VRI-392. Bad Aussee, Steiermark **9980 BC**

Gyttja, base of bog between moraine ramparts. Schmiedgut (47° 37′ 15″ N, 13° 45′ 50″ E), Bad Aussee, Styria. Coll 1972 and subm by D van Husen. *Comment* (DvH): dates climatic deterioration recognized in pollen diagram.

Venter Tal series, Tirol

Cyperaceae peat from different depths of bog 130cm deep near Delorette-Weg (46° 49′ 51″ N, 10° 49′ 36″ E), Venter Valley, Ötztaler Alpes, Tyrol, alt 2735m. Coll 1971 by S Bortenschlager and G Patzelt;

subm by S Bortenschlager, Inst Bot Systematik Geobot, Univ Innsbruck. *General Comment* (SB): highest bog of E Alps palynologically analyzed. Observed age inversion probably caused by cryoturbation.

VRI-318. Delorette-Weg 127 to 130cm **6790 ± 140** **4840 BC**

Sample from base of bog; depth 127 to 130cm. *Comment* (SB): should date beginning of peat growth.

VRI-319. Delorette-Weg 117 to 119cm **7830 ± 130** **5880 BC**

Depth 117 to 119cm. *Comment* (SB): sample represents horizon characterized by alternation of peat layers.

VRI-349. Alpbachtal, Tirol **4990 ± 100** **3040 BC**

Wood from Filzmoos bog, depth 50cm. Alpbachtal, Lueger Graben, path S of Filzalpe, alt 1640 m (47° 20′ N, 12° 01′ E), Tyrol. Coll 1971 and subm by G Mutschlechner, Innsbruck.

VRI-359. Baumkirchen, Tirol **27,200 ± 900** **25,250 BC**

Wood with roots (*Alnus viridis*) in undisturbed site in alt 675m from banded clay of pit Baumkirchen (47° 18′ 25″ N, 11° 34′ 19″ E), Tyrol. Coll 1972 and subm by F Fliri, Geog Inst, Univ Innsbruck. *Comment* (FF): expected age (Fliri *et al*, 1970, 1971, 1972; Felber, 1971).

Untergurgl series, Tirol

Clay gyttja coll by boring from different depths of bog Piller Mösl (46° 54′ 04″ N, 11° 02′ 41″ E), alt 1780m, Untergurgl, Ötztal, Tyrol. Coll by G Patzelt and S Bortenschlager; subm by G Patzelt. Gyttja was extracted with NaOH, precipitated by HCl, and dated.

VRI-365. Piller Mösl, 497 to 500cm **9950 ± 290** **8000 BC**

Depth 497 to 500cm. *Comment* (GP): dates beginning of organic sedimentation and 1st recolonization by vegetation. Minimum age of ice retreat in this area.

VRI-366. Piller Mösl 485, 5 to 492cm **9520 ± 220** **7570 BC**

Depth 485, 5 to 492cm. *Comment* (GP): dates palynologically recognized postglacial climatic deterioration.

Imst series, Tirol

Wood frequently found in present working level of brickyard clay pit Imst (47° 13′ 51″ N, 10° 45′ 04″ E), alt ca 730m, Tyrol. Presumably secondary deposition; originally at least below 4m clay. Coll 1972 and subm by G Patzelt.

9890 ± 150

VRI-369. Imst 1 **7940 BC**

Branch (*Pinus* sp). *Comment* (GP): dates embedding of forest parts into clay. Age is minimum for ice retreat, clay deposition, and postglacial vegetation development in Imst basin.

9710 ± 140

VRI-370. Imst 2 **7760 BC**

Stem (*Pinus silvestris*). *Comment* (GP): determines contemporaneity of tree embedment.

Matrei series, Osttirol

Peat cutting Priel near Matrei (46° 58′ 30″ N, 12° 33′ E), alt 950m, E Tyrol. Coll 1971 by J Kalhs, subm by F Kral.

General Comment (FK): clarifies period of clearance in Valley of R Isel shown in pollen diagram.

800 ± 80

VRI-336. Matrei 1 **AD 1150**

Pine cones and wood remnants (alder?) from depth 55 to 58cm.

1030 ± 80

VRI-337. Matrei 2 **AD 920**

Dark brown sandy wood peat, possibly contaminated with younger rootlets from depth 58 to 66cm.

Rostocker Hütte series, Osttirol

Sand with fossil humus around shelter Rostocker Hütte (47° 03′ 20″ N, 12° 18′ 06″ E), alt 2210m, Maurertal, Venediger Group, E Tyrol, (Patzelt, 1973). Coll 1971 and subm by G Patzelt. Humic acids were extracted, precipitated, and dated.

2030 ± 80

VRI-367. Rostocker Hütte M-1 **80 BC**

Humus overridden by advancing glacier Simonykees and incorporated into moraine M of this advance. *Comment* (GP): age is maximum for overriding of fossil soil and older limit for glacier advance see VRI-368.

620 ± 80

VRI-368. Rostocker Hütte M-2 **AD 1330**

Humus of soil grown on moraine M of Simonykees before burial by subsequent glacier advances. *Comment* (GP): age is minimum for underlying moraine, and gives younger limit for deposition of moraine M see VRI-367.

3210 ± 90

VRI-397. Vienna **1260 BC**

Stem wood, oak, embedded in gravel horizon 10m thick; near recent R Danube, left bank, km 1922,500, inn "Roter Hiasl" (48° 10′ N, 16° 30′ E), Vienna 22. Position in profile unknown. Excavated by dredging 1973,

subm by J Fink. *Comment* (JF): a rounded off Roman brick was found in same stratigraphic location 500m upstream at base of this gravel horizon. Thus accumulation of gravel in broad area is quite irregular.

B. Italy, Saudi Arabia, Switzerland, and Spain

VRI-340. Wolfsgruben, Italy **12,310 ± 170** **10,360 BC**

5cm gyttja on coarse-grained glacial clay overlain by brown moss cyperaceous peat. Base of former lake in quartz-porphyritic depression located in relict pine woodland on Mt Signater Kopf/Ritten, alt 1260m (46° 31′ 00″ N, 11° 25′ 02′ E) near Wolfsgruben, prov Bozen/Bolzano (Alto Adige), Italy. Coll 1972 by R Schmidt; subm by S Bortenschlager. *Comment* (HF, RS): overlying 10cm peat had to be added for getting enough organic material. No NaOH pretreatment. Dates beginning of organic sedimentation and late glacial stadial.

VRI-341. Montiggl, Italy **12,850 ± 180** **10,900 BC**

Lowermost 15cm clayey gyttja, 20cm thick, overlying clay and underlying brown moss cyperaceous peat, 5m thick. Base of former lake in shallow quartz-porphyritic depression near Montiggl (46° 25′ 22″ N, 11° 17′ 03″ E), alt 495m, prov Bozen/Bolzano (Alto Adige), Italy. Coll 1972 by R Schmidt, subm by S Bortenschlager. *Comment* (RS): dates forest succession in this area.

Langtaufers series, Italy

Wood from bogs near Langtaufers, N Italy. Coll and subm by G Mutschlechner.

VRI-350. Langtaufers 1 **4120 ± 90** **2170 BC**

Bog "Moosiges Loch"; from −50cm. N hamlet Pazzin, alt 2380m (46° 51′ N, 14° 17′ E). Coll 1971.

VRI-351. Langtaufers 2 **6840 ± 110** **4890 BC**

Nameless bog; from −1m. Below Kappler See, alt 2520m (46° 51′ N, 14° 16′ E). Coll 1971.

VRI-353. Langtaufers 3 **2440 ± 80** **490 BC**

Small nameless hanging bog, N above Melag, alt 2070m (46° 50′ N, 14° 15′ E). Coll 1972.

VRI-352. Graun, Italy **4750 ± 100** **2800 BC**

Wood from bog, depth 50cm. Ochsenberg, SE Hut, alt 2300m (46° 49′ N, 14° 20′ E), NE Graun, Italy. Coll 1972 and subm by G Mutschlechner.

1090 ± 80

VRI-383. Persian Gulf, Saudi Arabia **AD 860**

Shell fossils in horizontal layer 1.3m above msl dividing 2 sand dunes of different age. Persian Gulf, W coast (26° 30′ N, 50° 03′ E), Saudi Arabia. Coll 1973 and subm by J Zötl, Inst Min Techn Geol, TH Graz. *Comment* (JZ): dates old shore line.

10,930 ± 160

VRI-321. Winterthur, Switzerland **8980 BC**

Wood (*Pinus silvestris* L) from Trunk 203 of buried *Pinus* forest, —7m in sand, silt, and clay of cut off "Urstromtal", near Winterthur (47° 31′ 15″ N, 8° 42′ E), Switzerland. Coll 1971 by F Kaiser; subm by S Bortenschlager. *Comment* (SB): dates forest burial.

Tenerife series, Canary Islands, Spain

Conifer wood under volcanic material. Tenerife, Canary Islands, Spain. Coll by T Bravo, subm by B Schwaighofer, Inst Bodenforschung, Hochschule Bodenkultur, Vienna.

VRI-323. Tenerife 1 **>36,000**

Wood in sediments similar to fanglomerate below layer 800m thick of alternating basalt and phonolite (Bravo, 1962). Coll 1961. La Guancha, Galeria El Laurel (28° 21′ N, 12° 57′ E). *Comment* (BS): gives younger limit for embedding sediment.

VRI-324. Tenerife 2 **>36,000**

Wood in clastic material similar Lahar below basaltic layer 400m thick of Series III (Bravo, 1962). Coll 1964, Valle de la Orotava (28° 20′ N, 15° 52′ E). *Comment* (BS): gives younger limit for embedding material.

II. ARCHAEOLOGIC SAMPLES

A. Austria

VRI-300. Nussdorf, O Ö **Modern**

Wooden piling, cross section ca 10 × 10cm², from bottom of lake Attersee, Latzl-bay, Nussdorf am Attersee (47° 53′ N, 13° 31′ E), Upper Austria. Coll 1971 by M Reiter, subm by J Reitinger, O Ö Landesmus, Linz. *Comment* (HF): date disagrees with supposition of Neolithic lake dwelling.

Mooswinkl series, Mondsee, O Ö

Soaked remnants of wooden pilings (*Picea abies*) near shore lifted from bottom of lake Mondsee, —3m, Gde Innerschwand, Mooswinkl (47° 48′ 50″ N, 13° 23′ 40″ E), O Ö. Coll 1972 and subm by J Offenberger, Bundesdenkmalamt, Wien.

General Comment (JO): dates prove Neolithic lake dwellings (R, 1973, v 15, p 433).

VRI-331. Mooswinkl 3 **4350 ± 90 / 2400 BC**

VRI-332. Mooswinkl 4 **4260 ± 90 / 2310 BC**

VRI-333. Mooswinkl 5 **4430 ± 110 / 2480 BC**

Hallein series, Salzburg

Wood fragments of fire sticks, props and tools in different parts of prehistoric salt mine Dürrnberg near Hallein (Schauberger, 1968) (47° 39′ 30″ N, 13° 05′ E), Salzburg. Subm 1970 by O Schauberger, Bad Ischl, O Ö.

VRI-268. Central group, 3/1 **1890 ± 90 / AD 60**

Fire sticks in "laistigem Heidengebirge" (deads of rock salt in form of plastic saliferous clay), S part of Central group, Georgenberg-horizon, Querschlag III, 80m from Wechsel, Site 3. Coll 1959 by O Schauberger.

VRI-269. Central group, 12a **2000 ± 80 / 50 BC**

Fire sticks and charcoal in "kernigem Heidengebirge" (deads of rock salt; salt fragments cemented to breccia by saliferous clay), W of Central group, Obersteinberg-horizon, Ferro-Schachtricht, Site 12a. Coll 1958 by O Schauberger.

VRI-288. Central group, 3/2 **2300 ± 90 / 350 BC**

Tool in "laistigem Heidengebirge", S of Central group, Georgenberg-horizon, Site 3. Coll 1970 by A Aschauer.

VRI-289. Central group, 13a **2420 ± 90 / 470 BC**

Prop, W of Central group, Werk O/9, Site 13a. Coll 1970 by A Aschauer.

VRI-290. Central group, 5 **2670 ± 80 / 720 BC**

Tool in "Heidengebirge", Central group, Georgenberg-horizon, Werk Platz, Site 5. Coll 1971 by A Aschauer.

VRI-291. S group, 1 **2090 ± 80 / 140 BC**

Fragment of prop in "kernigem Heidengebirge", S group, Kelb-horizon, Werk Schrempf, Site 1. Coll 1950 by O Schauberger.

VRI-292. S group, 3a **2390 ± 80 / 440 BC**

Fragment of prop in "kernigem Heidengebirge", S group, Georgenberg-horizon, Werk Brandner, Site 3a. Coll 1967 by O Schauberger.

2470 ± 90

VRI-293. S group, 3b **520 BC**

Fragment of prop in "kernigem Heidengebirge", S group, Georgenberg-horizon, Werk Mitterauer, Site 3b. Coll 1970 by A Aschauer.

B. Greece, Turkey

3670 ± 90

VRI-395. Aegina, Greece **1720 BC**

Charcoal from fortification of ancient Aegina, Aegina I. (37° 45′ N, 23° 25′ E), near Athens, Greece. Coll 1972 and subm by H Walter, Inst Klass Archäol, Univ Salzburg. *Comment* (HW): sample from habitation level of early Bronze age in 3rd millennium BC. Dates destruction of fortification. De Vries corrected date, 2100 BC, fits archaeologically determined age (Weinberg, 1967).

2390 ± 80

VRI-329. Ephesos, Turkey **440 BC**

Burnt remnants of wood 3m below loamy horizon excavated with pottery and bones in area between altar and temple of Diana (Bammer, 1972; Vetters, 1973) in Ephesos (37° 57′ N, 27° 20′ 10″ E), Turkey. Coll 1971 and subm by A Bammer, Österr Archäol Inst, Univ Vienna.

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