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NOTICE TO READERS AND CONTRIBUTORS

Since its inception, the basic purpose of Radiocarbon has been the publication of compilations of ^{14}C dates produced by various laboratories. These lists are extremely useful for the dissemination of basic ^{14}C information.

In recent years, Radiocarbon has also been publishing technical and interpretative articles on all aspects of ^{14}C. We would like to encourage this type of publication on a regular basis. In addition, we will be publishing compilations of published *and unpublished* dates along with interpretative text for these dates on a regional basis. Authors who would like to compose such an article for his/her area of interest should contact the Managing Editor for information.

Another section is added to our regular issues, "Notes and Comments". Authors are invited to extend discussions or raise pertinent questions to the results of scientific investigations that have appeared on our pages. The section includes short, technical notes to relay information concerning innovative sample preparation procedures. Laboratories may also seek assistance in technical aspects of radiocarbon dating. Book reviews will also be included for special editions.

Manuscripts of radiocarbon papers should follow the recommendations in *Suggestions to Authors** and *RADIOCARBON* Style Guide (R, 1984, v 26, p 152-158). Our deadline schedule is:

For	*Date*
Vol 27, No. 2, 1985	Jan 1, 1985
Vol 27, No. 3, 1985	May 1, 1985
Vol 28, No. 1, 1986	Sept 1, 1985

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 $\pm$ 30 yr, for the half life. This decision was reaffirmed at the 11th International Radiocarbon Conference in Seattle, Washington, 1982. 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 $\pm$ 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. In accordance with the decision of the Ninth International Radiocarbon Conference, Los Angeles and San Diego, 1976, the designation of AD/BC, obtained by subtracting AD 1950 from conventional BP determinations is discontinued in Radiocarbon. Authors or submitters may include calendar estimates as a comment, and report these estimates as AD/BC, citing the specific calibration curve used to obtain the estimate.

Meaning of $\delta^{14}C$. In Volume 3, 1961, we endorsed 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). The Ninth International Radiocarbon Conference, Los Angeles and San Diego, 1976, recommended that the reference standard, 0.95 times NBS oxalic acid activity, be normalized to $\delta^{13}C = -19‰$.

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.

* Suggestions to Authors of the Reports of the United States Geological Survey, 6th ed, 1978, Supt of Documents, U S Govt Printing Office, Washington, DC 20402.

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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 covers all published ^{14}C measurements through Volume 7 of RADIOCARBON, and incorporates revisions made by all laboratories. It is available to all subscribers to RADIOCARBON at $20.00 US per copy.

List of laboratories. The comprehensive list of laboratories at the end of each volume appears in the third number of each volume. Changes in names or addresses should be reported to the Managing Editor by May 1.

Annual Index. All dates appear in index form at the end of the third number of each volume. Authors of date lists are asked to supply indexed material of *archaeologic samples only* with their date lists.

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Radiocarbon

1984

RADIOCARBON DATING IN THE SOUTHERN LEVANT

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INTRODUCTION

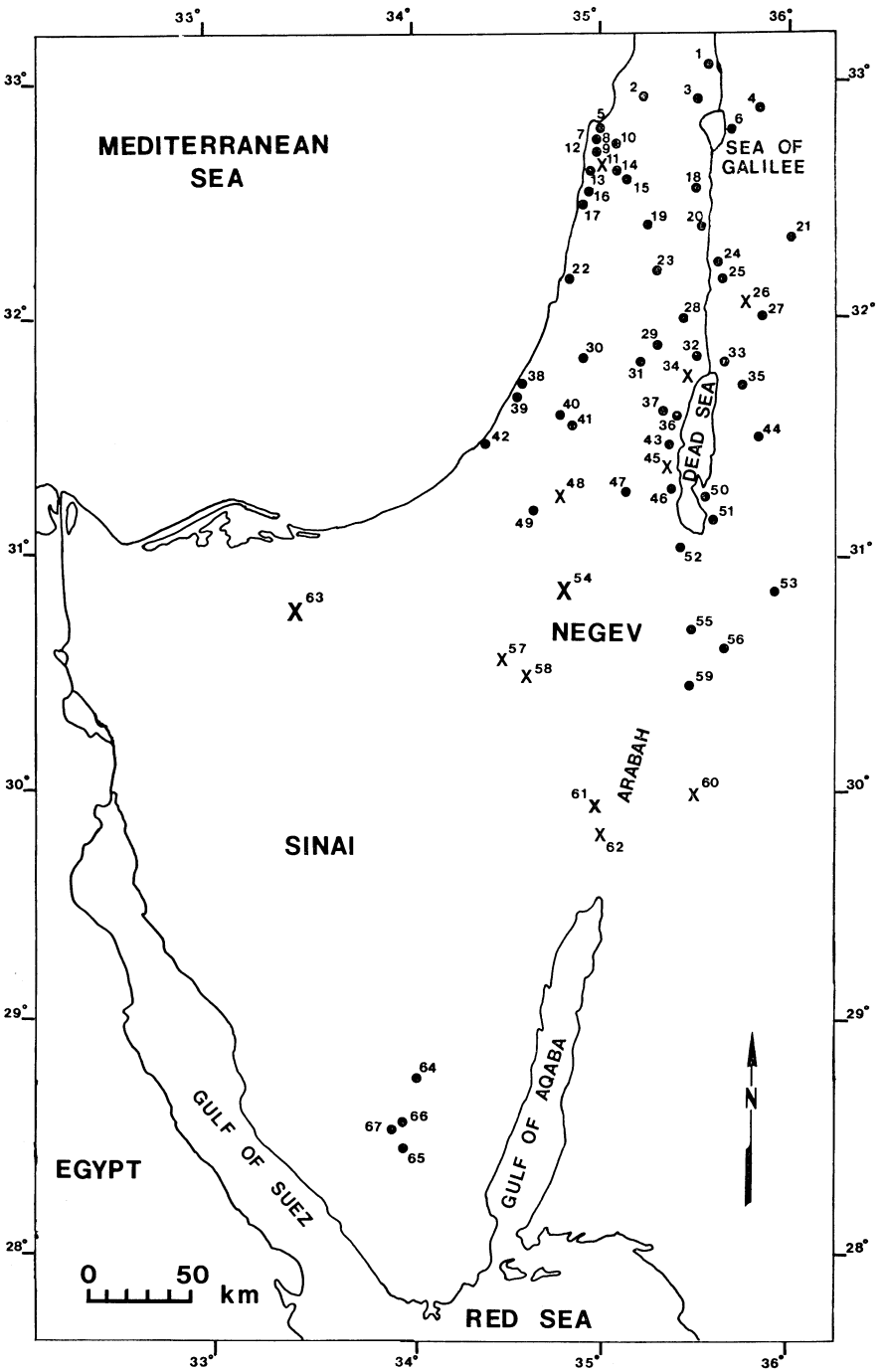
Radiocarbon dating provides the principal chronometric data for the Middle and Upper Palaeolithic, Epipalaeolithic, and Chalcolithic periods in the southern Levant. It is a secondary source of dating evidence for the Early Bronze age, when archaeological correlations with Syria and especially Egypt become available. For the Middle and Late Bronze age, Iron age, Persian, Hellenistic, Roman, and Byzantine periods, ^{14}C dating has only limited value because the technique is less precise than the normally available archaeologic and historic materials.

In recent years, there has been a proliferation of publications containing ^{14}C date lists for the southern Levant. Almost invariably, these lists have focused on the Neolithic and earlier materials (eg, Henry & Servello, 1974; Bar-Yosef, 1981a, p 405; 1981b, p 566-567; Henry, 1983, p 104-105). Only one list (Henry & Servello, 1974) offers an evaluation of the individual dates. The Chalcolithic period is devoid of any published date lists, and the Early Bronze age has but a single comprehensive corpus and interpretive study (Callaway & Weinstein, 1977; see also Mellaart, 1979). For the period from ca 2200 BC to the present, there are no compendia of dates and no analytical studies beyond those for a few individual sites.

Because interest in the ^{14}C data has been focused on the earliest periods, general surveys of the role of ^{14}C in the archaeology and history of this region and systematic studies of the problems that Palestinian archaeologists encounter in utilizing this technique are lacking. As a basis for such future investigations, this paper will (1) present a corpus of ^{14}C dates from the southern Levant, and (2) furnish a brief examination of the chronologic and archaeologic import of the data.

TABLE OF RADIOCARBON DATES

The accompanying table contains 474 dates from Israel, Jordan, the West Bank, Golan Heights, Gaza Strip, and Sinai. Three hundred assays (63.3% of the total) have appeared in the date lists of *Science, Radiocarbon* (through the final issue for 1984), and "Radiocarbon Measurements: Comprehensive Index, 1950-1965"; 150 (31.6%) derive from other sources, and 24 (5.1%) are unpublished. Absent from the table is a "modern" date furnished by a fake antiquity (Mendenhall, 1971, p 99; *cf* Naveh, 1982, p 53-54).


MEDITERRANEAN SEA
SEA OF GALILEE
DEAD SEA
ARABAH
NEGEV
SINAI
EGYPT
GULF OF SUEZ
GULF OF AQABA
RED SEA
N
0 50 km
33°
34°
35°
36°
28°
29°
30°
31°
32°

The dates are arranged by archaeologic period and, within each period, alphabetically by site. If a date could not be assigned to any period because of insufficient information or because the sample was misassociated, it has been relegated to a category entitled "Archaeological Period Unknown." For each entry, the corpus gives the provenience, material, 5568-year half-life BP and BC/AD determinations, the $\delta^{13}C$ measurement, calibrated date, laboratory number, and references. All of the sites are located on the map in figure 1.

Fig 1. Sites in the southern Levant represented by ^{14}C dates. A solid circle indicates an individual site. An "x" indicates an area with two or more sites.

1. Eynan
2. Hayonim Cave and Terrace
3. Amud Cave
4. Rasm Harbush
5. Geula Cave
6. Ein Gev I
7. Sea bed near Kibbutz ha-Hotrim
8. Sefunim Cave and Terrace
9. Nahal Oren Terrace
10. Rakefet Cave
11. Carmel caves:
    - El-Wad Cave and Terrace
    - Tabun Cave
12. Sea of Athlit
13. Newe Yam
14. Tell Qiri
15. Ein el-Jarba
16. Kebara Cave
17. Caesarea
18. Munhata
19. Dothan
20. Tell Tsaf
21. Tell er-Rumeith
22. Tel Michal
23. Shechem
24. Tell es-Saʿidiyeh
25. Deir ʿAlla
26. Baqʿah Valley:
    - Jebel al-Qesir
    - Khirbet Umm ad-Dananir
27. Tell Siran
28. Netiv Hagdud
29. Ai
30. Gezer
31. Gibeon
32. Jericho
33. Teleilat el-Ghassul
34. Qumran:
    - Qumran (settlement)
    - Ain Feshka: Cave IQ
35. Rujm Mekhayyat
36. Wadi Murabba ʿat
37. El-Khiam
38. Nizzanim
39. Ashkelon
40. Tell Areini
41. Lachish
42. Tell el-ʿAjjul
43. Nahal Hever
44. Dibon
45. Nahal Mishmar:
    - Caves 1, 2
46. Masada
47. Arad
48. Beersheba:
    - Bir es-Safadi
    - Horvat Beter
49. Shiqmim
50. Bab edh-Dhra
51. Numeira
52. Mazad Mazal
53. Wadi Hasa
54. Avdat/Aqev area:
    - Boker A
    - Boker BE
    - Boker Tachtit
    - D5
    - D101B
    - Ein Aqev (D31)
    - Nahal Divshon
    - Rosh Ein Mor (D15)
55. Jebel Khirbet en-Nahas
56. Wadi Feinan-Wadi Dana area
57. Kadesh Barnea:
    - Kadesh Barnea 3
    - Kadesh Barnea 8
    - Kadesh Barnea (no number)
58. Har Harif:
    - Abu Salem
    - Rosh Horesha
    - Har Harif G9
59. Beidha
60. Wadi Judayid Basin:
    - Wadi Judayid (J2)
    - Jebel Queisa (J24)
61. Uvda Valley:
    - Nahal Issaron
    - Site 6
62. Timna:
    - Sites 2, 30, 39, 200, 212, F2
    - Wadi Amram
63. Gebel Maghara:
    - Ain Abu Rugum I
    - Lagama IIID, VII, VIII
    - Mushabi I, V, XIV, XVI, XVII, XVIII, 103
64. Wadi Tbeik
65. Monastery of St Catherine
66. Abu Madi
67. Ujrat el-Mehed

The site and context of a sample follow the most recent archaeologic attribution, which frequently is not the one cited in a date list. On the other hand, the identification of the sample material (Column 2) follows the published or unpublished sources precisely. If a published date contains no notation as to the nature of the sample, but the material could be determined with some certainty, the identification is written within parentheses. Quotation marks in the "Material" column call attention to redated samples. The "Refs and Remarks" column also indicates redated samples as well as the application of different pretreatments to any of these samples.

In the third column, an adjustment has been made in computing the BC date whenever a primary publication has used a year other than AD 1950 as the datum year. In such cases, the author has disregarded the published BC date and retained the BP figure alone for subsequent calculations. This procedure is predicated on an assumption, which admittedly may not be justified in every case, that the published BP figure comes from the ^{14}C laboratory, while the BC date was computed by the excavator, who evidently used as the datum year either the year in which he made his calculations or the year in which the laboratory processed the sample. The following 19 entries have required adjustments:

I-616: AD 1961 used as datum year by Aharoni (1962, p 190).

I-285; I-353: AD 1961 used as datum year by Bar-Adon (1980, p 199).

I-1819: AD 1963 used as datum year by Bar-Adon (1980, p 199).

I-? (four dates): AD 1964 used as datum year by Aharoni (1967, p 238).

BONN-2356, -2357, -2359, -2360 to -2363: AD 1975 used as datum year by Conrad and Rothenberg (1980, p 179).

GX-1718: AD 1970 used as datum year by Seger (1972, p 31).

MP-?: AD 1957 used as datum year by Reed (1957, p 8, n 8) and Winnett and Reed (1964, p 49).

L-365: AD 1956 used as datum year by Free (1957, p 37).

RT-? (Crusader period date): AD 1973 used as datum year by Kedar and Kaufman (1975, p 37-38).

The fourth column present the "CRD-1σ" corrections for the conventional ^{14}C dates with BP values between 7230 and 940 years. The unpublished CRD-1σ table employs the same data set and statistical methods as the CRD-2σ table (Klein *et al*, 1982). For the few samples with BP determinations less than 940 years, Stuiver's (1982) high-precision calibration curve has been used.

The laboratory code and sample number appear in Column 5. When a sample number was not available, the laboratory code is followed by a question mark. The last column in the table supplies publication references, information on the provider(s) of unpublished data, miscellaneous archaeologic comments, identification of undersized samples, notes on which samples were re-runs, and notations on any publication errors. References are cited according to a modified social science system: the author's name(s) comes first, then the date of publication and page reference(s). ^{14}C dates published in *Radiocarbon* are cited as "R," followed

by the year of publication, volume number, and page(s). The citation "RMCI" refers to "Radiocarbon Measurements: Comprehensive Index, 1950-1965."

The abbreviations listed in the *Radiocarbon* Style Guide (1984, v 26, p 157-158) are supplemented in the table as follows:

ab—above	min—minimal
br—brick	n—note
bs—below surface	ph—phase
cent.—century	poss—possible, bly
ch—chamber	rm—room
col—column, s	sndg—sounding
confl—conflagration	st—stage
dest—destruction	str—stratum
fl—floor	tr—trench

THE RADIOCARBON DATA

Palaeolithic period

Radiocarbon dating has yielded mixed results in dating Palaeolithic remains in the southern Levant. The Lower Palaeolithic and much of the Middle Palaeolithic lie beyond the range of conventional ^{14}C dating systems, while many Middle and Upper Palaeolithic dates are either aberrant or only minimal values. Fortunately, there are several excellent groups of Upper Palaeolithic assays from southern Israel and northern Sinai.

Uranium series dates obtained from travertines in Zuttiyeh cave on the northwest side of the Sea of Galilee suggest that the Early Levantine Mousterian industry of the Middle Palaeolithic period stretches back to ca 90,000 to 100,000 years BP (Schwarcz *et al,* 1979; Schwarcz, Goldberg, & Blackwell, 1980). The termination of the Middle Palaeolithic is dated by a combination of ^{14}C dates from Boker Tachtit in the central Negev highlands and uranium series dates from travertine deposits in nearby Nahal Mor. These indicate that the Middle Palaeolithic ended ca 47,000 to 45,000 years BP (Marks, 1981a, table I).

There are 49 Middle Palaeolithic assays, associated either with caves in northern Israel (42 dates from Amud, Geula, Kebara, and Tabun caves) or open-air sites in the central Negev highlands (7 dates from Rosh Ein Mor and Boker Tachtit). Nearly all of the dates from Amud, Kebara, and Tabun caves are much too young, with those from the Amud and Kebara caves being extraordinarily low. These dates often show internal inconsistencies, eg, between LJ-2084 and -2090 from Tabun, or the inconsistent and stratigraphically inverted results from throughout the Kebara and Amud sequences. The small amount of carbon in the samples that were processed at the Hanover laboratory may have influenced the poor results obtained for the Middle and Upper Palaeolithic samples from Kebara cave (Schick & Stekelis, 1977, p 135*). Other anomalous dates may be due to an unfavorable environment for ^{14}C samples in the deposits of these caves, eg, recent vegetal growth, groundwater as well as alternating layers of humus and calcium carbonate at Amud (*cf* Hamada, 1970), bat guano

in El-Wad and Kebara caves, and the roof collapse and subsequent ingress of water at Tabun cave. Three ^{14}C assays from Tabun cave (GrN-7408 to -7410) provide an approximate date of ca 50,000 years BP for a late stage of the Middle Palaeolithic period. Finally, GrN-4121 (40,050 ± 1700 BC) from a Late Levantine Mousterian context at Geula cave looks somewhat too recent, based on the Boker Tachtit dates noted above.

In southern Israel, the 3 inconsistent dates from the Early Levantine Mousterian site of Rosh Ein Mor dates are only minimal values and, moreover, are much too recent based on the $^{230}Th/^{234}U$ dates from Nahal Aqev (Schwarcz *et al*, 1979; Marks, 1981a, p 288). On the other hand, 3 of the 4 Late Levantine Mousterian dates from Level 1 at Boker Tachtit and the uranium series dates from Nahal Mor are in good agreement (as noted above). Thus, the assays from Boker Tachtit and the 3 Tabun Cave dates are the only usable groups of Middle Palaeolithic dates in the southern Levant.

The Upper Palaeolithic period is represented by 29 dates. Although the sites of this period are now generally classified according to 1 of 2 industrial traditions, the Levantine Aurignacian or the Ahmarian (Belfer-Cohen & Bar-Yosef, 1981), the number of acceptable Upper Palaeolithic determinations is so small that it is wise to discuss them without regard for the industries they reflect.

The 7 ^{14}C dates from northern Israel are all aberrant. It has already been noted that the Kebara cave assays are inconsistent and much too young. The Hayonim and Sefunim cave dates are also too recent for the Upper Palaeolithic period, but here, the anomalous results may be due to misassociation of the samples (Belfer-Cohen & Bar-Yosef, 1981, p 38).

The earliest Upper Palaeolithic assemblage in the south is represented by Level 4 at Boker Tachtit. It yielded a single date (SMU-579) that is too recent, probably because of contamination by humates (Marks, 1981b, p 345). The 3 dates from Area A at Boker include 2 with minimal values (SMU-187, -260), and 1 at 35,970 ± 2810 BC (SMU-578). Levels I-III from the stratigraphically younger Area BE at Boker yielded a series of 7 dates, which (except for the outlier SMU-565) are nicely bracketed between ca 25,000 and 23,000 BC. In northern Sinai, Lagama VIII and VII have 3 dates between ca 32,000 to 29,000 BC, while Lagama IIID has a single date at ca 28,000 BC. Contemporary with the Lagama VIII and VII dates is Pta-2819 from an unpublished site at Kadesh Barnea in northeastern Sinai. Four of the 5 dates from the late Upper Palaeolithic site of Ein Aqev (D31) fit into the 16th millennium BC; only SMU-5 at 18,030 ± 1200 BC is evidently too early. Based on the overlapping of these 4 Ein Aqev determinations with Kebaran dates from Nahal Oren Terrace (Level IX) and Rakefet cave, the end of the Upper Palaeolithic period in the Negev may be contemporary with the early Epipalaeolithic period in the north (Marks, 1975, p 361).

Epipalaeolithic period

The principal industrial traditions of the Epipalaeolithic period are, in chronologic order, Kebaran, Geometric Kebaran A, and Natufian (Bar-

Yosef, 1975; 1981a; Henry, 1983). At Nahal Oren Terrace, these industries occur in stratigraphic succession (Noy, Legge, & Higgs, 1973).

The five Kebaran ^{14}C dates derive from three sites in northern Israel. These determinations range from 16,960 ± 330 BC (I-6865) to 13,750 ± 415 BC (GrN-5576). The small number and limited geographic distribution of the samples and the wide range of the dates give these assays an uncertain significance.

Geometric Kebaran A sites are more widely distributed than the Kebaran. However, the 13 assays for this industry all come from sites in the central and western Negev and northern Sinai. The 10 dates from Mushabi XIV (Level 2), XVI, XVII, and XVIII and Kadesh Barnea 8 fall within the 13th and 12th millennia BC. The 3 remaining samples, from Site D5, were small and the measurements inconsistent. Based on the other Geometric Kebaran A assays, SMU-7 is too early at 16,890 ± 680 BC. Tx-1121 may or may not be aberrant at 13,870 ± 1730 BC, but the standard deviation is too large to inspire confidence in the midpoint.

A recently identified Epipalaeolithic industry in the Negev and northern Sinai is the Mushabian. Although the Mushabian has a lithic inventory distinct from that of the Geometric Kebaran A, the 9 ^{14}C dates belonging to the former complex show that it has significant temporal overlap with the latter. Indeed, the midpoints of 7 Geometric Kebaran A and 7 Mushabian dates fall within the 12th millennium, with the latter entity possibly continuing on into the early 11th millennium BC. Another southern industry is the Negev Variant of the Kebaran, which on typological grounds appears to overlap both the Geometric Kebaran A and the succeeding Early Natufian. Unfortunately, there are no ^{14}C dates for the Negev Variant of the Kebaran.

The best known Epipalaeolithic industry is the Natufian, which develops out of the Geometric Kebaran A and appears widely over the southern Levant, especially in the Mediterranean hill zone. Nine of the 15 Early Natufian dates cluster within the 10th millennium BC. GL-69, -72, and possibly -70, which derive from the same stage and phase at Jericho as P-376 and BM-1407, are too early. These three samples were measured in 1958, and their 9th and early 8th millennia results may be due to inadequate laboratory pretreatment (Waterbolk, 1971, fig 3, legend). The three Wadi Judayid (J2) dates with midpoints falling in the 11th millennium BC, may be correct, but their uncertainties (± 800, ± 1000, and ± 659 years) are uncomfortably large.

The 5 Late Natufian dates are scattered. The oldest determination, I-5496 from Rosh Horesha, is clearly an outlier at 11,140 ± 200 BC. The two remaining dates from this site fall in the early-mid 9th millennium, while the Nahal Oren and El-Wad B_1 dates are late 9th to early 8th millennium. Overall, the Natufian appears to date ca 10,000 to 8500/8000 BC, but the end of this industry will remain uncertainly dated until more assays become available.

Two typologically late Epipalaeolithic industries are the Harifian in the Negev and northern Sinai, and the Khiamian, which has been identified at several widely scattered sites in Sinai and elsewhere in the

southern Levant. The absolute chronology of the Harifian is largely dependent on three remarkably homogeneous ^{14}C dates from a single site in the central Negev, Abu Salem. These assays (I-5498 to -5500) suggest that there may be a slight overlapping of the Harifian and the beginning of the Early Neolithic I period in the late 9th millennium BC, a conclusion not surprising considering the occurrence at Harifian sites of both Epipalaeolithic and Early Neolithic elements (Scott, 1977). As for the Khiamian, it has a single radiometric date (Pta-2699) from Abu Madi, an unpublished site in southern Sinai. The result is similar to the Harifian and earliest Early Neolithic I dates and corresponds nicely with the transitional late Epipalaeolithic-Early Neolithic character of the Khiamian (Bar-Yosef 1981a, p 402; 1981b, p 561-562).

Neolithic period

The Neolithic period is divided into four phases. Many archaeologists follow Kenyon (1979) in referring to these stages as Pre-Pottery Neolithic (PPN) A and B and Pottery Neolithic (PN) A and B. Moore (1982) has recently proposed Neolithic 1, 2, 3, and 4 for these divisions, while the author prefers Early Neolithic I and II and Late Neolithic I and II. Calibration of ^{14}C dates first becomes possible with the Late Neolithic period.

All but 2 of the 22 EN I dates (23 if the "Proto-Neolithic" assay is included) come from Jericho. Most of these dates came out in five series: 1 from the Geochronological Laboratory, London (measured in 1956), 3 from the British Museum, and 1 from Pennsylvania. The GL series is too young, probably because of inadequate sample pretreatment, and BM-105, -110, and -250 may be too old (Burleigh, 1984, p 760, fig 352, legend). The remaining Jericho dates range from ca 7800 to 7200 BC. One of the 2 Netiv Hagdud dates (RT-502A) comes at the upper end of this range, while the second assay (RT-502B) has a late 9th millennium measurement.

Early Neolithic II is represented by no less than 56 dates, 3 of which (Lv-358, M-1792, and Pta-3486) are clearly too young, and 1 (Pta-2700) is too old. The 17 Beidha assays, which run from ca 7100 to 6600 BC, present some internal inconsistencies. For example, GrN-5062 and P-1382 from late Level II are considerably earlier than K-1085, which comes from the same charcoal sample. In fact, these two dates are contemporary with K-1086 and -1410, which were collected from the stratigraphically later Level VI. Also, the four dates obtained from the carbonized trunk of a pistacia tree in Level IV cover the entire chronologic range of the site (though one of these samples, K-1083, may have been mislabeled). The 21 Jericho dates (except for 3 of the GL entries) cover roughly a 600-year period, from ca 7200 to 6600 BC.

Although it was long thought that the Early Neolithic period ended with a general abandonment of the settlements in the southern Levant, perhaps as the result of climatic dessication (Blake, 1969), new ^{14}C dates emanating from the southern Negev, the Arabah valley, and south Sinai suggest a somewhat different picture. Ten of the 11 dates from Mazad Mazal, Nahal Issaron, and Ujrat el-Mehed fall in the 2nd half of the 7th

millennium BC. If these determinations accurately reflect the age of these sites, then EN II had a life-span considerably longer than that of EN I, and the EN II period at Beidha and Jericho came to a close 400 to 500 years earlier than it did in some of the small desertic sites in the south.

There was evidently a gap in occupation at major Palestinian sites between the Early and Late Neolithic periods, but the extent of this discontinuity cannot be estimated with any confidence because of a paucity of LN I dates. The calibrated values of two isolated LN I dates (Hv-8509, Pta-2999) are in the 2nd and 3rd quarters of the 6th millennium BC. There is also a Late Neolithic date from Kadesh Barnea 3 (SMU-662), which, if it could be calibrated, would fall somewhere in the late 7th millennium BC. Such a figure seems much too early for a Late Neolithic site. Although it is not possible to correct the late EN II dates to get a true estimate of the time differential between EN II and LN I, one might hazard a guess that the break lasted for 500-700 years. Needless to say, further excavations and additional ^{14}C dates may show this "gap" to be much shorter than it now appears or to be of unequal duration in different parts of the southern Levant.

The three LN II dates from Newe Yam and Ein el-Jarba, and the single Late Neolithic/Early Chalcolithic determination from Tell Tsaf, have a wide scatter. The amount of collagen in GX-786 from Ein el-Jarba was small, so the result for this sample was understandably anomalous. The 5 Teleilat el-Ghassul samples listed under "Late Neolithic/Early Chalcolithic" come from levels considered early Chalcolithic by the excavator. However, considering the close links between the pottery and flaked stone tools found in these levels and in Late Neolithic contexts elsewhere in the Levant (Hennessy, 1982), it would not be surprising to see these dates, which cover the period from ca 5600 to 4900 BC, eventually classified as LN II assays.

Chalcolithic period

A dearth of well-stratified and fully published sites, difficulties in correlating the archaeologic assemblages between different areas in the southern Levant, an absence of closely datable foreign correlations, and the lack of a distinct stratigraphic or typologic boundary between Late Neolithic and early Chalcolithic has made Chalcolithic chronology a particularly vexing subject. Of 18 Chalcolithic ^{14}C dates, 3 (C-919, P-2572, and BM-1116) are clearly anomalous (the latter perhaps due to misassociation of the sample), and while many of the rest show no obvious deficiencies, cumulatively, they leave a disturbing gap between the end of the Chalcolithic period and beginning of the Early Bronze age.

There are 7 late Chalcolithic dates from the northern Negev. C-919 (a solid-carbon date) from Horvat Beter is much too old and the 3 Bir es-Safadi dates (M-864A to C) have uncomfortably large uncertainties, as does RT-554B from a small sample found at Shiqmim. The 2 remaining dates, W-245, from Horvat Beter, and RT-554A, from Shiqmim, have no apparent technical problems, but their calibrated results, like those from

Bir es-Safadi, leave a gap of several hundred years between the Chalcolithic and the beginning of the Early Bronze age.

Six late Chalcolithic dates also come from caves in the Judean desert. The 4 from Cave 1 at Nahal Mishmar are associated with that grotto's famous copper treasure. Except for BM-140, the assays cluster in the 2nd quarter of the 4th millennium BC, which is somewhat earlier than the date given the treasure on archaeologic grounds (Bar-Adon, 1980, p 199). I-1819, which comes from a piece of cloth found in a burial in nearby Cave 2, is slightly younger, but another short-lived sample, I-616 from the Cave of Horror at Nahal Hever, gave a result in the late 5th millennium.

RT-390A comes from a piece of wood found in a classic "Ghassulian" (*ie*, late Chalcolithic) level at Teleilat el-Ghassul. Since the sample was part of a larger piece of wood left in storage since the original 1928-1939 excavations at this site, too much significance should probably not be attached to the date (4445-4320 BC). SMU-804, a mid-5th millennium BC assay from the lower of two Chalcolithic layers at Jebel Queisa (J24), is reported to lie close to the mean of 21 dates from sites in Sinai associated with the Timnian industry of the late Chalcolithic period (Henry, 1982, p 443). RT-525 from late Chalcolithic Rasm Harbush in the Golan gave a slightly later date (4380-3880 BC).

Altogether, these dates are a mixed lot. They, together with the Late Neolithic/Early Chalcolithic dates, suggest that the Chalcolithic period is fairly long, beginning no later than perhaps the mid-5th millennium. However, many of the assays are simply too early for the late Chalcolithic era. That the period ends in about the 34th century BC can be deduced from the ^{14}C dates available from the following Early Bronze age IA. Little will be gained by further debate on the present assays: what is really needed are several series of dates from well-stratified Chalcolithic sites.

Early Bronze age

The Early Bronze age has four major divisions, designated Early Bronze (EB) I (with Phases A, B, and C), II (A and B), III (A and B), and IV (A, B, and C). (In this paper, the designations EB IVA, B, and C and Middle Bronze I, II, and III follow Dever, 1973, fig 1 and p 60, n 56.) There are 96 Early Bronze age dates, the largest of any period in Palestinian archaeology. Most come from 1 of 6 sites: Ai, Arad, Tell Areini, Bab edh-Dhra, Jericho, or Numeira.

The EB IA and IB periods are roughly synchronous with the late Predynastic period in Egypt and, as such, can be dated ca 3400 to 3200/3100 BC. Four of the 5 EB IA dates from Tomb A 94 at Jericho overlap and support this chronologic scheme. GL-24, which was measured in 1953, is an outlier. The mini-series SI-3310A, -3310B, and -3311 from Bab edh-Dhra is incongruous. The first and second samples came from a transitional EB IA/B tomb and produced an acceptable date (SI-3310A) of 3545-3345 BC and a date that is ca 2000 years too early (SI-3310B). The third sample came from an EB IA tomb and gave a "modern" reading.

The EB IC period is contemporary with the very end of the Predynastic period in Egypt and the first several reigns of Dynasty I, while EB II is contemporaneous with the remainder of Dynasty I, II, and part if not all of Dynasty III. Based on this correlation, EB IC dates ca 3200/3150 to 3000 BC, and EB II ca 3000 to 2750/2700 BC.

The two groups of EB IC and EB II dates from Arad are problematic. The Isotopes date from Stratum I is anomalous, perhaps because of contamination by surface vegetation, while the 3 other carbonized wood samples yielded ^{14}C ages that are virtually identical, despite the fact that they derive from 3 different strata (IV, III, and II). The problems are quite different with the Pennsylvania assays. Six of the 7 Pennsylvania dates come from short-lived samples. Two samples (P-2054 and -2055) were redated because their results were too early; the new determinations (P-2054A and -2109) were considerably lower. Another curious phenomenon is that the calibrated results for the 4 acceptable Stratum II dates (P-1742, -2054A, -2109, and -2110) cover a range of 530 years (3065 to 2535 BC), despite the fact that the samples belong near the end of the stratum.

Tell Areini has yielded 8 ^{14}C dates, including 7 from a British Museum series. Interestingly, the BP measurements for the 4 Stratum IV samples (BM-388, -389, 391, and W-916) average ca 200 years earlier than the 4 Arad Stratum II BP values. Since both groups derive from short-lived samples, and since Stratum IV at Tell Areini probably belongs early in EB II, while Stratum II apparently relates to the end of this period, the ^{14}C dates suggest a fairly long EB II period in Palestine. An extended EB II period has also been postulated by Dever (1982) on the basis of the archaeologic evidence from Arad.

The 23 EB IC, EB II, and EB III dates from Ai are a curious lot. Initially, 14 samples, both short-lived and long-lived, were sent to the Texas and Gakushuin laboratories. One of the resulting dates (GaK-2380) was acceptable; the other 13 (Tx-1026 to -1035, GaK-2379, -2381, and -2382) were too early by anywhere from 300 to 700 years. Subsequently, 9 more samples, all but 2 utilizing additional quantities of the same sample material taken out of the original collection containers, were run at Pennsylvania and Texas. This time the dates (P-2298 to -2304, Tx-2371 to -2372) agreed consistently with what was generally expected on archaeologic and historic grounds (Callaway & Weinstein, 1977, p 5-10). Since the same erroneous results would have shown up in the second batch of dates if the sample material used for both dating runs had originally been exposed to on-site contamination or sampling error, an explanation for the initial group of deviant dates is presumably to be sought in the handling or processing of the samples.

The longest phase of the Early Bronze age is the EB III period, which, on the basis of Egyptian and Syrian connections, can be dated from ca 2750/2700 to perhaps the late 24th century BC. Most of the assays relating to this period come from Bab edh-Dhra, Jericho, and Numeira.

The 2 Jericho series (BM-548 to -554, BM-1778 to -1781, -1783) corroborate the archaeologic evidence that EB III is the longest period of the

Early Bronze age. The first series ranges from 2925 to 2305 BC, while the second series extends from 2920 to 2310 BC. The one notable inconsistency is between BM-552 (2885-2635 BC) and BM-1780 (2430-2305 BC), which come from the same stage and phase, but this discrepancy may simply reflect the dating of wood of different ages.

The Bab edh-Dhra and Numeira dates present some interesting problems. For example, the entire series, SI-4134 to -4138, is anomalous. SI-4134 and -4135 from Bab edh-Dhra are more than 1000 years off. SI-4136 and -4138, which come from late EB III destruction debris at Numeira (Rast, 1981, p 37, 41), are several hundred years too early to pertain to the end of EB III, though they could certainly reflect the dating of early growth rings of older wood. As for SI-4137, the date, which is 500 to 600 years too old, comes from grapes which were collected in a water flotation device. Whether contaminants in the water could have affected the result so significantly must be left to others more qualified than the author to judge.

Six ^{14}C dates (M-2036 to -2037, SI-2497, -2499, -2501, and -2874) come from short-lived and long-lived samples deriving from several of the large charnel houses at Bab edh-Dhra. These assays cover a wide range, but there is nothing intrinsically wrong with them. Charnel houses A 8 and A 51 were first used in EB II and continued on through EB III (R T Schaub, pers commun), while A 55 began in EB II and was not finally abandoned until early EB IV (Rast & Schaub, 1978, p 24). Since the point in time when each of the samples got into the charnel houses cannot be determined, the chronologic range of all of the material in each tomb must be considered. Thus, 2 of the A 55 dates, SI-2501, at 3365-2925 BC, and SI-2497, at 2305-1905 BC, are equally likely to be correct. This situation illustrates an important problem in Near Eastern ^{14}C dating. Many contexts (especially constructional fills, pits, and multiple-burial tombs) contain jumbled materials of several different periods. In such situations it is difficult if not impossible to relate any organic substances not found in a datable container within the context to a specific archaeologic period. As a result, ^{14}C dates from these contexts often have little or no chronologic value, even though such sources normally yield much of the organic material (especially of the short-lived variety) found on Near Eastern sites.

The EB IV period lasts from ca 2350/2300 to 2000/1900 BC. Olive pits from an EB IVA context at Bab edh-Dhra yielded an excellent date (P-2573: 2335-2135 BC), while SI-2869 from the same period at this site is ca 1600 years too early. The pit in which the latter sample was found was partially cut out of the marl-limestone bedrock, but whether water running into the pit or some other contaminant may have influenced the date is a moot question. As for the EB IVB-C assays, the 2 from unpublished sites in the northern Sinai (RT-447B and -447A) have uncertainties that are too large to give the dates real chronologic value, while the 2 assays from EB IVC contexts at Jericho are in good accord with an archaeologic dating of this period to about the 21st or 20th century BC.

Middle and Late Bronze age

There are relatively few Middle Bronze age (ca 2000/1900 to 1550

BC) and Late Bronze age (ca 1550 to 1200 BC) ^{14}C dates. As explained above, after ca 2000 BC, historic and archaeologic data generally provide more precise dating evidence for most cultural remains and stratigraphic phases then can be obtained through ^{14}C dating.

The Middle Bronze (MB) I period (ca 1900 to 1750 BC) has no ^{14}C dates. Seven of the 8 MB II ^{14}C dates (ca 1750 to 1650 BC) come from tombs at Jericho. The samples were dated in the 1950's, and except for GL-6, the assays are quite satisfactory considering when they were produced. The eighth date, P-842 from Gibeon, is too young.

Late MB III (ca 1550 BC) contexts at Jericho, Lachish, and Shechem have each provided a single ^{14}C date. The Jericho assay (BM-1790) is too recent. The Lachish (Hel-809) and Shechem (GX-1718) samples derive from destruction debris associated with the end of the Middle Bronze age. The dates, though acceptable from a ^{14}C standpoint if the samples are from re-used wood or from the inner rings of older trees, are too early, at 1945-1675 BC and 2000-1700 BC, respectively, to have much archaeologic value. Unfortunately, although destruction debris in Palestinian Bronze and Iron age strata yields more wood and charcoal samples than any other contexts, the ^{14}C measurements from these types of samples rarely produce results of any significance for dating the destruction.

Only 6 ^{14}C dates can be assigned to the Late Bronze (LB) age alone: 2 from burial cave B3 at Jebel al-Qesir and 1 from the nearby settlement at Khirbet Umm ad-Dananir in Jordan's Baqᶜah valley, 2 from Lachish, and 1 from Deir ᶜAlla. The first 2 dates (P-3209 and -3210) are too early for the LB II (ca 1400 to 1200 BC) tomb in which they were discovered, but not nearly as early as the date of 2120-1865 BC (P-3219) from the settlement. The Lachish dates evidently come from cedar-wood architectural elements in a LB IIB (13th century) sanctuary, and though 1 of the 2 assays is more than 400 years too early, this is not unexpected in view of the nature of the sample. *Cedrus libani*, which was used extensively in the Levant during the Bronze age and Iron age for its excellent building properties, is extremely long-lived, with a potential life span of perhaps a millennium or more (Bryant Bannister, pers commun). Many supposedly anomalous dates derived from charcoal and wood of unidentified species are probably the result of the sample material being cedar or other long-lived wood. Unfortunately, few wood samples submitted for ^{14}C dating have been analyzed botanically. Moreover, the author has been able to find only one instance (BM-1222 from the Monastery of St Catherine) where the specific location in a section of a beam or trunk sampled for ^{14}C dating has been noted.

Iron age

Numerouts dates derive from the copper-mining installations at Timna on the western side of the southern Arabah. Nineteen are associated with Egyptian mining activity at Sites 2, 30, and 212 in the 13th and first half of the 12th centuries BC, *ie*, LB IIB and Iron age IA. BM-1368 from Site F2, entered in the corpus under "Chalcolithic Period (?)," also appears to belong to this time. The Hamburg series shows a peculiar

phenomenon. HAM-207 to -212 (except HAM-211) are consistent with archaeologic expectations, while HAM-213 to -215 are ca 1000-1200 years too early, and HAM-216 is perhaps several hundred years too old. Possibly some of the Site 212 samples were mislabeled, and they actually come from one of the EB II shaft-and-gallery systems at this site; if not, then a processing error must be considered as a possible explanation for these extraordinarily early dates. Incidentally, 3 ^{14}C dates (W-4051, -4054, and -4456) come from slag heaps found on the eastern side of the Arabah. These have had to be listed under "Archaeological Period Unknown" because the slag cannot be dated independently.

The Iron age proper (ca 1200 to 586 BC) consists of the Iron IA (ca 1200 to 1150 BC), IB (ca 1150 to 1000 BC), Iron IIA (ca 1000 to 900 BC), IIB (900 to 800 BC), and IIC (800 to 586 BC) periods. In terms of Biblical history, Iron age I is the time of the purported Israelite conquest, the Philistines, and the Judges, while Iron IIA witnesses the United Monarchy of David and Solomon, and Iron IIB-C is the time of the Divided Monarchy, which terminates with the Babylonian destruction of Jerusalem in 586 BC.

The Iron age has yielded more than 3 dozen ^{14}C dates, mostly from wood and charcoal samples, but few are of archaeologic or historic interest since they come from contexts already more closely dated than ^{14}C analysis can achieve. For example, no less than 12 assays are associated with Stratum 5 at Tell es-Saʿidiyeh. According to the ceramic evidence, this stratum belongs in the 8th century BC, but while 9 of the 12 assays overlap this century, the remaining 3 are younger. Similarly, only 1 of the 3 Lachish dates is consonant with the archaeologic evidence, and even this determination (Hel-1027) has too wide a range to be chronologically useful. The other 2 dates, which include 1 (Hel-1026) from the mid- to late 8th century BC level destroyed by the Assyrians in 701 BC, are too early for their contexts, but this is not unexpected, since both samples were wood (Hel-1025 being identified specifically as cedar).

The Tell er-Rumeith dates include several anomalous determinations, all on the young side. On ceramic grounds (Lapp, 1963; 1968) Stratum VIII at this site may be dated to the Solomonic age, so M-2031 is at least a century too young. The succeeding Stratum VII was destroyed at the beginning of the 9th century, so M-2029 and -2030 are too recent. The two Stratum VI assays are acceptable for a late 9th century archaeologic date, but M-2035 is much too young at 400 BC-AD 15 for Stratum V, the destruction of which has been related to the Assyrian invasion of 733 BC under Tiglath-pileser III.

Grain found inside a bronze bottle at Tell Siran in Amman furnished a ^{14}C date (P-2207: 440-395 BC) that is more recent than the date of 600 BC attributed to the Ammonite inscription on the bottle itself. Since the vessel was found in a context that also contained post-Iron age remains, the grain was possibly put in the bottle later on during the Persian period. An alternative explanation is that moisture and corrosion products inside the bottle contaminated the sample material (Thompson, 1983; *cf* Helback, 1974).

Persian period to the Modern era

Less than 50 dates relate to the long time span from 586 BC to the present day, and few of these have chronologic value either for archaeologists or ^{14}C specialists. For example, the Late Hellenistic/Early Roman and Roman period dates were produced mostly during the 1950's and early 1960's. The samples originated from important excavations on the west side of the Dead Sea, such as the settlement at Qumran, Qumran Cave I, the Cave of Horror at Nahal Hever, and the caves in the Wadi Murabba ᶜat. These assays vary widely in their accuracy and reliability, and are generally considered curiosities today rather than sources of useful chronologic information.

Ten dates are associated with buildings of the Persian (525-332 BC) and Hellenistic (332-37 BC) periods on the acropolis at Tell es-Saᶜidiyeh. Four of the dates are from grain and charcoal samples found beneath the floor of a large Persian period administrative building. P-1445 is an outlier; the other 3 dates are acceptable. A single date from within the building itself (P-1446: 405-180 BC) has too wide a range to be of much use. A Hellenistic building, probably of the 2nd century BC, yielded 5 dates, of which 4 derive from wood beams. It may be entirely fortuitous that the lower limits for 3 of the 5 dates are 180, 170, and 165 BC. The early result for P-1098 (410-370 BC) probably signifies nothing more than the dating of inner rings from an older tree.

A unique find made in 1980 off the coast of northern Israel is the bronze battering ram from a ship. The archaeologic date of this piece of naval architecture is uncertain and could in theory be almost anywhere within the period of the 4th to 1st centuries BC. Wood evidently taken from the covering of the ram gave a corrected reading of 625-370 BC, which may lend support to an earlier archaeologic date.

Two samples (Hv-2675, Hv-?) of unspecified material from hearths found at the top of the Natufian Stratum B at Hayonim cave yielded considerably later dates (AD 610-780, AD 35-230). These determinations show that the hearths are not connected with Stratum B, but should be connected with Late Roman-Early Byzantine Stratum A, above (Belfer-Cohen & Bar-Yosef, 1981, p 19-20).

St Catherine's Monastery in south Sinai was founded ca AD 530 by the Byzantine ruler, Justinian I. Within the monastery is the Church of the Transfiguration, from which 13 dates, derived from various architectural elements, have been published. The majority belong with the original construction of the church; the few that do not are evidently either aberrant (M-1677, as shown by the result for BM-1222) or possibly the result of restoration work carried out in the Church in more recent times (M-1812 and -1814).

Finally, there are 2 dates from organic inclusions in the mortar of city walls. The first (RT-?) relates to a known-age structure, the impressive Crusader wall at Caesarea, which has been dated on architectural grounds to the 13th century, possibly the 4-year period immediately following the Seventh Crusade (AD 1248-1250), when Louis IX of France was actively engaged in fortifying the Christian cities of Syria-Palestine. The assay,

AD 890-1235, indicates the usefulness of ^{14}C for dating walls bonded with mortar, but is not sufficiently accurate to place the Caesarea wall more precisely within the Crusader period. The foundations of the city wall at Ashkelon have been attributed to Late Roman or Byzantine times, the upper section to the Crusader period. A sample taken from 50 to 120cm above ground level yielded a date of AD 245-465 (GrN-7987). This suggests that at least part of the upper section of the wall may be earlier than previously supposed.

CONCLUSION

It seems appropriate to conclude this paper with a list of the principal problems and needs of ^{14}C dating as it applies to the southern Levant. The items noted below are those that the author, as an archaeologist, feels are most critical at this point. It is not unlikely that ^{14}C specialists will wish to delete some entries and substitute others.

1. More care is needed regarding the identification of natural contaminants on archaeologic sites and their effects on ^{14}C samples. This is especially necessary if samples collected from Palaeolithic caves are ever to yield useful chronologic results.
2. Additional series of dates are needed for most of the earliest periods, notably the Middle and Upper Palaeolithic, Epipalaeolithic (especially the Kebaran industry), Late Neolithic, and Chalcolithic. Accelerator dating systems would be especially appropriate for the Palaeolithic samples.
3. Archaeologists should publish more information in *Radiocarbon* on the stratigraphic position and archaeologic relationships of ^{14}C samples. Close to 150 dates from the southern Levant have appeared only in *Radiocarbon*, and the absence of detailed archaeologic data for many of these samples seriously limits their use for chronologic purposes.
4. More concern must be given for eliminating the systematic misdating of entire series of samples. Whether these errors arise through on-site contamination, mishandling and improper storage, or laboratory equipment failure, the fact is that large numbers of dates (from the Amud, Kebara, and Tabun caves, Ai, Bab edh-Dhra and Numeira, Timna, and Tell er-Rumeith) have genuine problems. Difficulties with the Palaeolithic assays may well be attributable to special conditions existing within the caves, and archaeologic misattribution or mislabeling may be responsible for problems with a few other dates, but such explanations will not suffice for the majority of the anomalous dates.
5. Botanical analysis of all wood and charcoal samples is essential, as is identification by the archaeologist of the precise location of the sample in the section of a beam or tree trunk.
6. ^{14}C samples should not be collected from Middle Bronze age or later contexts unless the archaeologic dating evidence is inadequate (eg, in the case of a furnace or slag heap unaccompanied by any pottery or inscriptions).
7. Archaeologists should limit their collection of samples to deposits possessing chronologically homogeneous remains; by-and-large, organic ma-

terials from pits, levelling and glacis fills, multi-period tombs, and even many destruction deposits should be ignored.

Radiocarbon dating has made major contributions to the archaeology of the southern Levant in dating isolated contexts, strata, whole sites, and even entire periods. With more help from scientists in the areas of natural and artificial contaminants and laboratory processing problems, and with more care on the part of archaeologists in collecting and submitting better samples and interpreting the resulting dates, this technique will become an even more valuable chronometric tool in the archaeology of the southern Levant.

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Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
		Middle Palaeolithic Period			
Amud Cave: Bed B4, basal	Organic material in black soil	10,600 ± 400 (8650)	---	TK-12	R (1969) 11: 511; Chinzei (1970): 46-48
Amud Cave: Bed B2, middle	Bone (carbonate)	10,500 ± 140 (8550)	---	TK-33a	R (1969) 11: 512; Chinzei (1970): 46-48; same sample as TK-33b & poss N-854 & -852 (see below)
Amud Cave: Bed B2, middle	" (20% H_2SO_4-leached portion)	4630 ± 470 (2680)	3900-2800 BC	TK-33b	R (1971) 13: 95; cf TK-33a
Amud Cave: Bed B2, middle	" (?) (collagen)	14,400 ± 350 (12,450)	---	N-854	Chinzei (1970): 46-47; R (1977) 19: 82; same sample as N-852; same sample no. as TK-33a
Amud Cave: Bed B2, middle	" (?) (carbonate)	13,100 ± 230 (11,150)	---	N-852	Chinzei (1970): 46-47; R (1977) 19: 82; cf N-854; same sample no. as TK-33a
Amud Cave: Bed B1, upper	Bone (carbonate)	5710 ± 80 (3760)	4590-4430 BC	TK-86a	Chinzei (1970): 46-48; R (1971) 13: 101
Amud Cave: Bed B2, middle	Bone (carbonate)	7030 ± 120 (5080)	6125-5555 BC	TK-86a'	Chinzei (1970): 46-47; R (1971) 13: 101-102
Amud Cave: Bed B1, lower	Bone (collagen)	9010 ± 160 (7060)	---	N-763	Chinzei (1970): 46-48; R (1977) 19: 81; same sample as N-786 and -785
Amud Cave: Bed B1, lower	" (collagen)	10,700 ± 190 (8750)	---	N-786	Chinzei (1970): 46-48; R (1977) 19: 81; cf N-763, diff pretreatment
Amud Cave: Bed B1, lower	" (carbonate)	11,700 ± 200 (9750)	---	N-785	Chinzei (1970): 46-48; R (1977) 19: 81-82; cf N-763

Amud Cave: Bed B1, lower	Bone (collagen)	7340 ± 150 (5390)	---	N-765	Chinzei (1970): 46-48; R (1977) 19: 81
Amud Cave: Bed B2, upper	Bone (collagen)	11,500 ± 250 (9550)	---	N-764	Chinzei (1970): 46-47; R (1977) 19: 82
Amud Cave: Bed B2, upper	Bone (collagen)	14,700 ± 310 (12,750)	---	N-766	Chinzei (1970): 46-47; R (1977) 19: 82
Amud Cave: Bed B2, middle	Bone (collagen)	15,700 ± 370 (13,750)	---	N-767	Chinzei (1970): 46-47; R (1977) 19: 82
Amud Cave: Bed B4, basal	Bone (collagen)	18,300 ± 400 (16,350)	---	N-768	Chinzei (1970): 46-47; R (1977) 19: 82
Boker Tachtit: Level 1, firepit	Charcoal	>45,490 (>43,540)	---	SMU-184	Marks (1977a): table 1-1; (1977b): 64; SMU-184, -259, -580, & GX-3642 from same firepit
Boker Tachtit: Level 1, firepit	Charcoal	44,930 ± 2420 (42,980)	---	SMU-259	Marks (1977a): table 1-1; (1977b): 64
Boker Tachtit: Level 1, firepit	Charcoal	47,280 ± 9050 (45,330)	---	SMU-580	Marks (1981b): table 1; Hietala & Marks (1981): 306 (cited as SMU-5081)
Boker Tachtit: Level 1, firepit	Charcoal	>35,000 (>33,050)	---	GX-3642	Marks (1977a): table 1-1; (1977b): 64; small sample
Geula Cave: Layer B1	Bone ash	42,000 ± 1700 (40,050)	---	GrN-4121	R (1967) 9: 119-120; Wreschner (1967): 84, 86; context of sample follows Wreschner
Kebara Cave: Upper Levalloiso-Mousterian level	Charcoal	>30,000 (>28,050)	---	L-336D	Broecker & Kulp (1957): 1330; small sample

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Kebara Cave: 2.5m bs	Charred wood or bone ("bone" fraction)	41,000 ± 1000 (39,050)	---	GrN-2561	R (1963) 5: 174; same sample as GrN-2551
Kebara Cave: 2.5m bs	" ("rest" fraction)	35,300 ± 500 (33,350)	---	GrN-2551	R (1963) 5: 174; cf GrN-2561
Kebara Cave: 4.5m bs	Charred wood	9725 $^{+1105}_{-925}$ (7775)	---	Hv-2666	Schick & Stekelis (1977): table 7
Kebara Cave: 4.85m bs	Ashes	8975 ± 1170 (7025)	---	Hv-2667	Schick & Stekelis (1977): table 7
Kebara Cave: 5.2m bs	Ashes	17,320 $^{+985}_{-815}$ (15,370)	---	Hv-2668	Schick & Stekelis (1977): table 7
Kebara Cave: 5.29m bs	Ashes	20,945 $^{+3430}_{-2125}$ (18,995)	---	Hv-2669	Schick & Stekelis (1977): table 7
Kebara Cave: 5.7m bs	Ashes	10,555 ± 1665 (8605)	---	Hv-2670	Schick & Stekelis (1977): table 7
Kebara Cave: 6.08m bs	Ashes	12,495 $^{+1365}_{-1105}$ (10,545)	---	Hv-2671	Schick & Stekelis (1977): table 7
Kebara Cave: 6.44m bs	Ashes	11,615 $^{+795}_{-700}$ (9665)	---	Hv-2672	Schick & Stekelis (1977): table 7
Rosh Ein Mor (D15): Test pit, 20-90cm bs	Ostrich egg shell	> 37,000 (> 35,050)	---	Tx-1119	R (1972) 14: 484; Crew (1976): 77
Rosh Ein Mor (D15): 20-30cm bs	Ostrich egg shell	>44,000 (>42,050)	---	Pta-543	Crew (1976): 77
Rosh Ein Mor (D15): 45-55cm bs	Ostrich egg shell	>50,000 (>48,050)	---	Pta-546	Crew (1976): 77

Tabun Cave: Layer B	Charcoal (probably charred bone)	39,700 ± 800	(37,750)	GrN-2534	R (1963) 5: 172
Tabun Cave: Layer C	Charcoal (probably charred bone)	40,900 ± 1000	(38,950)	GrN-2729	R (1963) 5: 172
Tabun Cave: Layer D	Same as two previous samples?	35,400 ± 900	(33,450)	GrN-2170	R (1963) 5: 172-173
Tabun Cave: Unit I	?	>47,900	(>45,950)	GrN-7408	Jelinek (1982): 1375, n2
Tabun Cave: Unit I	?	51,000 $^{+4800}_{-3000}$	(49,050)	GrN-7409	Jelinek (1982): 1375, n2
Tabun Cave: Unit I	?	45,800 $^{+2100}_{-1600}$	(43,850)	GrN-7410	Jelinek (1982): 1375, n2
Tabun Cave: Bed 30	Very black soil	23,000 ± 2500	(21,050)	LJ-2059	R (1972) 14: 371
Tabun Cave: Bed 15	Very black soil	30,500 ± 2500	(28,550)	LJ-2061	R (1972) 14: 371
Tabun Cave: Bed 15, top	Very black soil	31,400 ± 3500	(29,450)	LJ-2068	R (1972) 14: 371
Tabun Cave: Bed 7, basal	Very black soil	>30,000	(>28,050)	LJ-2070	R (1972) 14: 371
Tabun Cave: Bed 7, basal	Very black soil	31,500 ± 3200	(29,550)	LJ-2075	R (1972) 14: 371
Tabun Cave: Bed 18, basal	Very black soil	28,200 ± 3000	(26,250)	LJ-2078	R (1972) 14: 371
Tabun Cave: Bed 18	Very black soil	35,300 ± 2800	(33,350)	LJ-2082	R (1972) 14: 372

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Tabun Cave: Bed 42	Very black soil	38,800 ± 2400 (36,850)	---	LJ-2084	R (1972) 14: 372
Tabun Cave: Bed 21	Very black soil	24,900 ± 3000 (22,950)	---	LJ-2087	R (1972) 14: 372
Tabun Cave: Bed 42	Very black soil	28,500 ± 2400 (26,550)	---	LJ-2090	R (1972) 14: 372
		Upper Palaeolithic Period			
Boker A: Level 1	Charcoal	>33,400 (>31,450)	---	SMU-187	Marks (1977a): table 1-1; (1977b): 75; min sample
Boker A: Level 1	Charcoal	>33,420 (>31,470)	---	SMU-260	Marks (1977a): table 1-1; (1977b): 75; min sample
Boker A: Level 1	(Charcoal)	37,920 ± 2810 (35,970)	---	SMU-578	Marks (1981b): table 1
Boker BE: Level I	(Charcoal)	25,610 ± 640 (23,660)	---	SMU-186	Marks (1977a): table 1-1; (1981b): table 1
Boker BE: Level I	(Charcoal)	25,250 ± 345 (23,300)	---	SMU-566	Marks (1981b): table 1
Boker BE: Level II	(Charcoal)	24,630 ± 390 (22,680)	---	SMU-565	Marks (1981b): table 1
Boker BE: Level II	(Charcoal)	26,950 ± 520 (25,000)	---	SMU-227	Marks (1977a): table 1-1; (1981b): table 1
Boker BE: Level III	(Charcoal)	26,030 ± 600 (24,080)	---	SMU-228	Marks (1977a): table 1-1; (1981b): table 1
Boker BE: Level III	(Charcoal)	26,660 ± 500 (24,710)	---	SMU-229	Marks (1977a): table 1-1; (1981b): table 1
Boker BE: Level III	(Charcoal)	27,510 ± 1300 (25,560)	---	SMU-188	Marks (1977a): table 1-1; (1981b): table 1

Boker Tachtit: Level 4	Charcoal	35,055 ± 4100 (33,105)	---	SMU-579	Marks (1981b): table 1; "humates could not be extracted"
Ein Aqev (D31): Test pit, ca Levels 8-9, hearth	Charcoal	16,900 ± 250 (14,950)	---	I-5494	R (1973) 15: 295; Marks (1976a): table 9-1
Ein Aqev (D31): Test pit, ca Levels 9-10, hearth	Charcoal	17,510 ± 290 (15,560)	---	I-5495	R (1973) 15: 295; Marks (1976a): table 9-1 (17,520 ± 790 BP cited here)
Ein Aqev (D31): Levels 8 & 9	Charcoal	17,890 ± 600 (15,940)	---	SMU-6	R (1974) 16: 378-379; Marks (1976a): table 9-1
Ein Aqev (D31): Level 11	Charcoal	17,390 ± 560 (15,440)	---	SMU-8	R (1974) 16: 379; Marks (1976a): table 9-1
Ein Aqev (D31): Level 12	Charcoal	19,980 ± 1200 (18,030)	---	SMU-5	R (1974) 16: 379 (18,080 BC cited here); Marks (1976a): table 9-1
Hayonim Cave: Level D, hearth	Charred bone	16,240 ± 440 (14,290)	---	Hv-2676	Bar-Yosef & Goren (1973): 51
Kebara Cave: Layer 26	Ash	18,500 ± 300 (16,550) $\delta^{13}C = -29.0‰$	---	RT-227	R (1971) 13: 418-419
Kebara Cave: 4.85m bs	Charred wood	9860 ± 530 (7910)	---	Hv-2662	Schick & Stekelis (1977): table 7
Kebara Cave: 4.7m bs	Charred wood	11,565 $^{+\ 850}_{-\ 740}$ (9615)	---	Hv-2663	Schick & Stekelis (1977): table 7
Kebara Cave: 4.75m bs	Charred wood	7155 $^{+\ 860}_{-\ 745}$ (5205)	---	Hv-2664	Schick & Stekelis (1977): table 7
Kebara Cave: 4.62m bs	Charred wood	6490 ± 325 (4540)	5790-5060 BC	Hv-2665	Schick & Stekelis (1977): table 7

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Lagama IIID: Surface	Ostrich egg shell	30,050 ± 1240 (28,100)	---	SMU-118	R (1975) 17: 361-362; Gisis & Gilead (1977): 87; Bar-Yosef & Phillips (1977): tables 66-67
Lagama VIII: Surface	Ostrich egg shell	32,980 ± 2140 (31,030)	---	SMU-119	R (1975) 17: 362; Bar-Yosef & Phillips (1977): tables 66-67
Lagama VII: Vicinity of hearths	Charcoal impregnated with silt	34,170 ± 3670 (32,220)	---	SMU-172	R (1975) 17: 362; Bar-Yosef & Belfer (1977): 54; Bar-Yosef & Phillips (1977): 263, tables 66-67; small sample; same sample as SMU-185
Lagama VII: Vicinity of hearths	"	31,210 ± 2780 (29,260)	---	SMU-185	R (1975) 17: 362; Bar-Yosef & Belfer (1977): 54; Bar-Yosef & Phillips (1977): 263, tables 66-67; small sample; cf SMU-172
Lagama VII: Same provenience as SMU-172 & -185 (?)	Charcoal	>19,900 (>17,950)	---	RT-413A	Bar-Yosef & Belfer (1977): 54; Bar-Yosef & Phillips (1977): table 67; small sample
Kadesh Barnea: Hearth below Upper Palaeolithic site	?	"33,800-33,940 B.P."	---	Pta-2819	Belfer-Cohen & Goldberg (1982): 189
Sefunim Cave: Level 9	?	12,250 ± 65 (10,300)	---	Hv-4074	Ronen (1973): 62
		Epipalaeolithic Period: Kebaran			
Ein Gev I: Near burial	Charred bone	15,700 ± 415 (13,750) $\delta^{13}C = -22.2°/_{oo}$	---	GrN-5576	R (1972) 14: 49

Nahal Oren Terrace: Layer IX	Burned bone	18,250 ± 320 (16,300)	---	UCLA-1776C	Noy, Legge, & Higgs (1977): 77
Nahal Oren Terrace: Layer VIII	Burned bone	16,880 ± 340 (14,930)	---	UCLA-1776B	Noy, Legge, & Higgs (1973): 77
Nahal Oren Terrace: Layer VIII (from slightly ab UCLA-1776B)	Burned bone	15,800 ± 300 (13,850)	---	UCLA-1776A	Noy, Legge, & Higgs (1973): 77
Rakefet Cave: Kebaran level	Burned bone	18,910 ± 330 (16,960)	---	I-6865	Noy, Legge, & Higgs (1973): 96
		Epipalaeolithic Period: Kebaran (?)			
Har Harif G9: Hearth	Charcoal	5960 ± 100 (4010)	5080-4725 BC	Tx-1122	R (1972) 14: 484
Wadi Hasa: Terrace III, 1m bs	Charcoal	3950 ± 150 (2000)	2665-2295 BC	Q-729	R (1966) 8: 398; Vita-Finzi (1966): 388; Copeland & Vita-Finzi (1978): 12
		Epipalaeolithic Period: Geometric Kebaran A			
D5: Rodent hole, Unit 8	Charcoal	13,170 ± 230 (11,220)	---	I-5497	R (1973) 15: 296; Marks (1976b): 296, table 10-1; min sample
D5: Rodent hole, Unit 8	Charcoal	18,840 ± 680 (16,890)	---	SMU-7	R (1974) 16: 379; Marks (1976b): 296, table 10-1; min sample
D5: Firepits, Units 4 & 5	Charcoal	15,820 ± 1730 (13,870)	---	Tx-1121	R (1972) 14: 484; Marks (1976b): 296, table 10-1; min sample
Mushabi XIV: Level 2	Charcoal	14,330 ± 120 (12,380)	---	SMU-226	Haas (1977): table 66

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Mushabi XIV: Level 2	Charcoal	13,750 ± 285 (11,800)	---	QC-201	Bar-Yosef & Phillips (1977): table 67
Mushabi XIV: Level 2	Charcoal	13,830 ± 490 (11,880)	---	RT-447D	Bar-Yosef & Phillips (1977): table 67
Mushabi XIV: Level 2	Charcoal	13,690 ± 150 (11,740)	---	MC-992	Bar-Yosef & Phillips (1977): table 67
Mushabi XIV: Level 2	Charcoal	14,500 ± 100 (12,550)	---	RT-473B	Bar-Yosef & Phillips (1977): table 67
Mushabi XVI	Charcoal	13,060 ± 220 (11,110)	---	RT-447C	Bar-Yosef & Phillips (1977): table 67
Mushabi XVII	Charcoal	14,170 ± 480 (12,220)	---	SMU-661	Bar-Yosef (1981a): 405
Mushabi XVIII	Charcoal	13,930 ± 110 (11,980)	---	SMU-217	Haas (1977): table 66; Bar-Yosef & Goring-Morris (1977): 140
Kadesh Barnea 8: Level D/E	Charcoal	13,930 ± 120 (11,980)	---	Pta-2158	Bar-Yosef (1981a): 405
Kadesh Barnea 8: Level G	Charcoal	14,130 ± 160 (12,180)	---	Pta-2159	Bar-Yosef (1981a): 405
		Epipalaeolithic Period: Mushabian			
D101B: Level 8	Charcoal	13,530 ± 144 (11,580)	---	SMU-268	Marks (1977): 9; Kaufman (1983): 333
Mushabi I: Surface	Ostrich egg shell	13,310 ± 100 (11,460)	---	SMU-117	R (1975) 17: 362; Haas (1977): table 66; Phillips & Mintz (1977): 153
Mushabi V: Hearth	Charcoal	12,990 ± 110 (11,040)	---	SMU-171	R (1975) 17: 362; Phillips & Mintz (1977): 164; Haas (1977): table 66
Mushabi V	Charcoal	12,700 ± 90 (10,750)	---	Pta-2157	Bar-Yosef (1981a): 405

Mushabi XIV: Level 1	Charcoal	13,800 ± 150 (11,850)	---	RT-473A	Bar-Yosef & Phillips (1977): table 67; Bar-Yosef (1981a): 405
Mushabi XIV: Level 1	Charcoal	12,900 ± 235 (10,950)	---	QC-202	Bar-Yosef & Phillips (1977): table 67
Mushabi XIV: Level 1, hearth	Charcoal (Juniperus phoenicea)	13,260 ± 200 (11,310)	---	MC-993	Phillips & Mintz (1977): 170; Bar-Yosef & Phillips (1977): table 67
Mushabi XIV: Level 1, hearth	Charcoal (Juniperus phoenicea)	13,900 ± 400 (11,950)	---	RT-417	Phillips & Mintz (1977): 170; Bar-Yosef & Phillips (1977): table 67, pl 9, no. 4-6
Mushabi XIV: Level 1, hearth	Charcoal (Juniperus phoenicea)	13,800 ± 130 (11,850)	---	SMU-225	Haas (1977): table 66; Phillips & Mintz (1977): 170
		Epipalaeolithic Period: Early Natufian			
El-Wad Cave: Layer B_2	Bone	11,920 ± 660 (9970)	---	UCLA-?	Bar-Yosef (1981a): 405
El-Wad Terrace: Layer B_2	Bone	11,475 ± 600 (9525)	---	UCLA-?	Bar-Yosef (1981a): 405
Eynan: Level III, soil of House 51	Charcoal	11,310 ± 880 (9360)	---	Ly-1662	R (1979) 21: 442
Eynan: Level III, soil of House 51	Charcoal	11,740 ± 570 (9790)	---	Ly-1661	R (1979) 21: 443
Eynan: Level IV sol b, soil of House 131	Charcoal	11,590 ± 540 (9640)	---	Ly-1660	R (1979) 21: 443
Hayonim Terrace: Layer D	Charcoal	11,920 ± 90 (9970)	---	SMU-231	Henry & Leroi-Gourhan (1976): 394

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Jericho: Site E I, II, V, St/ph I.ii	Charcoal	9850 ± 240 (7900)	---	GL-69	Kenyon (1959): 8 & n4; Burleigh (1981): 502-503
Jericho: Site E I, II, V, St/ph I.ii	Charcoal	10,800 ± 180 (8850)	---	GL-70	Burleigh (1981): 503
Jericho: Site E I, II, V, St/ph I.ii	Charcoal	9800 ± 240 (7850)	---	GL-72	Kenyon (1959): 8 & n4; Burleigh (1981): 503
Jericho: Site E I, V, St/ph I.ii	Charcoal, ash	11,166 ± 107 (9216)	---	P-376	R (1963) 5: 84
Jericho: Site E I, II, V, St/ph I.ii	Charcoal	11,090 ± 90 (9140) $\delta^{13}C = -25.2°/_{oo}$	---	BM-1407	Burleigh (1981): 502-503; R (1982) 24: 166
Kebara Cave: Layer B	Bone	11,150 ± 400 (9200)	---	UCLA-?	Bar-Yosef (1981a): 405
Wadi Judayid (J2): Layer C	Charcoal	12,090 ± 800 (10,140)	---	SMU-805	Henry (1982): 437; Henry et al (1983): 12
Wadi Judayid (J2): Layer C	Charcoal	12,750 ± 1000 (10,800)	---	SMU-806	Henry (1982): 437; Henry et al (1983): 12
Wadi Judayid (J2): Layer C	Charcoal	12,784 ± 659 (10,834)	---	SMU-803	Henry (1982); 437; Henry et al (1983): 12
		Epipalaeolithic Period: Late Natufian			
El-Wad: Layer B_1	Bone	9795 ± 600 (7845)	---	UCLA-?	Bar-Yosef (1981a): 405
Nahal Oren Terrace: Layer V	Animal bone (collagen)	10,046 ± 318 (8096)	---	BM-764	R (1977) 19: 152
Rosh Horesha: Midden: 25-40cm	Charcoal	13,090 ± 200 (11,140)	---	I-5496	R (1973) 15: 295; Marks & Larson (1977): 196
Rosh Horesha: Feature 13: 45cm	Charcoal	10,490 ± 430 (8540)	---	SMU-9	R (1974) 16: 379; Marks & Larson (1977): 196

Rosh Horesha: Features 15 & 16: 35-45cm	Charcoal	10,880 ± 280 (8930)	---	SMU-10	R (1974) 16: 379; Marks & Larson (1977): 196
		Epipalaeolithic Period: Harifian			
Abu Salem: Midden: 15-25cm	Charcoal	9970 ± 150 (8020)	---	I-5498	R (1973) 15: 296; Marks & Scott (1976): 47; Scott (1977): 281; I-5498 to -5500 from same midden
Abu Salem: Midden: 25-30cm	Charcoal	10,230 ± 150 (8280)	---	I-5499	R (1973) 15: 296; Marks & Scott (1976): 47; Scott (1977): 281
Abu Salem: Midden: 45-55cm	Charcoal	10,230 ± 150 (8280)	---	I-5500	R (1973) 15: 296; Marks & Scott (1976): 47 (cited as I-5499); Scott (1977): 281
		Epipalaeolithic Period: Khiamian			
Abu Madi	Charcoal	10,110 ± 100 (8160)	---	Pta-2699	Bar-Yosef (1981b): 566
		Epipalaeolithic Period: Natufian/Early Neolithic			
Sefunim Terrace: Layer V, hearth	Ash	7730 ± 115 (5780)	---	Hv-2597	Ronen (1973): 62; Hv-2597 & -3368 from same hearth
Sefunim Terrace: Layer V, hearth	Ash	9395 ± 130 (7445)	---	Hv-3368	Ronen (1973): 62
		Early Neolithic Period: "Proto-Neolithic"			
Jericho: Site D I, St/ph VI A.x-xi	Charcoal	10,300 ± 200 (8350)	---	BM-106	R (1963) 5: 107; Burleigh (1981): 502-503

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
		Early Neolithic I Period			
Jericho: Site F I, St/ph IV.iiib	Charcoal	10,250 ± 200 (8300)	---	BM-105	R (1963) 5: 107; Burleigh (1981): 502, 504
Jericho: Site D II, St/ph IX.xxii-xxiii	Charcoal	10,180 ± 200 (8230)	---	BM-110	R (1963) 5: 107; Burleigh (1981): 502-503
Jericho: Site D I, St/ph IV A.iva	Charcoal	10,300 ± 500 (8350)	---	BM-250	R (1969) 11: 290; Burleigh (1981): 502-503
Jericho: Site D II, St/ph VI.via	Charcoal	9390 ± 150 (7440)	---	BM-251	R (1969) 11: 290; Burleigh (1981): 502-503
Jericho: Site D I, St/ph VIII A.xvia	Charcoal	9320 ± 150 (7370)	---	BM-252	R (1969) 11: 290; Burleigh (1981): 502-503
Jericho: Site F I, St/ph VIII A.xvib	Charcoal	9230 ± 80 (7280) $\delta^{13}C = -25.4°/_{oo}$	---	BM-1321	Burleigh (1981): 502, 504; R (1982) 24: 165
Jericho: Site F I, St/ph IV A.iiib	Charcoal	9380 ± 85 (7430) $\delta^{13}C = -24.0°/_{oo}$	---	BM-1322	Burleigh (1981): 502, 504; R (1982) 24: 166
Jericho: Site D I, St/ph VI A.x-xi	Charcoal	9380 ± 85 (7430) $\delta^{13}C = -25.1°/_{oo}$	---	BM-1323	Burleigh (1981): 502-503; R (1982) 24: 166
Jericho: Site E I, II, V, St/ph VI. xxvii	Charcoal	9430 ± 85 (7480) $\delta^{13}C = -24.9°/_{oo}$	---	BM-1324	Burleigh (1981): 502-503; R (1982) 24: 166
Jericho: Site F I, St/ph VIII A.xvib	Charcoal	9230 ± 220 (7280) $\delta^{13}C = -24.6°/_{oo}$	---	BM-1326	Burleigh (1981): 502, 504; R (1982) 24: 166
Jericho: Site F I, St/ph IV A.iiib	Charcoal	9560 ± 65 (7610) $\delta^{13}C = -25.4°/_{oo}$	---	BM-1327	Burleigh (1981): 502, 504; R (1982) 24: 166

Jericho: Site F, St/ph VIII A.xv	Charcoal	9280 ± 100 (7330) $\delta^{13}C = -26.0°/_{oo}$	---	BM-1787	R (1982) 24: 280; Burleigh (1984): 762-763
Jericho: Site F, St/ph IX.xx-xxia	Charcoal	9200 ± 70 (7250) $\delta^{13}C = -27.1°/_{oo}$	---	BM-1789	R (1982) 24: 280; Burleigh (1984): 762-763
Jericho: Site F I, St/ph VIII B.xviia	Charcoal	8770 ± 150 (6820)	---	GL-39	RMCI (1967): 31; Burleigh (1981): 502, 504; cf GL-40, -43, -46
Jericho: Site F I, St/ph VIII B.xviia	"	8690 ± 150 (6740)	---	GL-40	RMCI (1967): 31; Burleigh (1981): 502, 504; cf GL-39, diff pretreatment
Jericho: Site F I, St/ph VIII B.xviia	"	8895 ± 150 (6945)	---	GL-43	RMCI (1967): 31; Burleigh (1981): 502, 504; cf GL-39, diff pretreatment
Jericho: Site F I, St/ph VIII B.xviia	Humic extract	7300 ± 200 (5350)	---	GL-46	RMCI (1967): 31; Burleigh (1981): 502, 504; cf GL-39
Jericho: Site E I, II, V, St/ph IV. viii	Charcoal, ash, and/or gravel	9582 ± 89 (7632)	---	P-377	R (1963) 5: 84; Burleigh (1981): 503
Jericho: Site F I, St/ph IV A.iiib	Charcoal	9775 ± 110 (7825)	---	P-378	R (1963) 5: 84; Burleigh (1981): 503-504
Jericho: Site D I, St/ph VI A.x-xi	Charcoal	9655 ± 84 (7705)	---	P-379	R (1963) 5: 84; Burleigh (1981): 503
Netiv Hagdud: 80cm bs	Charcoal	9790 ± 380 (7840)	---	RT-502A	Bar-Yosef, Gopher, & Goring-Morris (1980): 201; Bar-Yosef (1981b): 566

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Netiv Hagdud: Pipe-line tr near edge of site	Charcoal (tamarisk)	10,180 ± 300 (8230)	---	RT-502C	Bar-Yosef, Gopher, & Goring-Morris (1980): 201; Bar-Yosef (1981b): 566
		Early Neolithic II Period			
Beidha: Level VI, debris	Charcoal (Quercus sp)	8940 ± 160 (6990)	---	K-1086	R (1968) 10: 323
Beidha: Level VI	Carbonized nuts (Pistacia atlantica)	8710 ± 130 (6760)	---	K-1082	R (1968) 10: 324; same sample as P-1379 & GrN-5063
Beidha: Level VI	"	8546 ± 100 (6596)	---	P-1379	R (1969) 11: 152; cf K-1082
Beidha: Level VI	"	8640 ± 50 (6690) $\delta^{13}C = -23.5°/_{oo}$	---	GrN-5063	R (1972) 14: 50 (cited as 860 ± 50 BP); cf K-1082
Beidha: Level IV, posthole	Carbonized tree trunk (Pistacia sp)	8810 ± 50 (6860) $\delta^{13}C = -22.5°/_{oo}$	---	GrN-5136	R (1972) 14: 50; same sample as BM-111, P-1380, & poss K-1083
Beidha: Level IV, posthole	"	8790 ± 200 (6840)	---	BM-111	R (1968) 10: 4-5; cf GrN-5136
Beidha: Level IV, posthole	"	9128 ± 103 (7178)	---	P-1380	R (1969) 11: 152; cf GrN-5136
Beidha: Level V (?), posthole (see "refs and remarks" column)	" (?)	8640 ± 160 (6690)	---	K-1083	R (1968) 10: 324; should be same sample as GrN-5136, but provenience said to be Level V
Beidha: Level IV, roof debris	Charcoal (Juniperus sp)	8730 ± 160 (6780)	---	K-1084	R (1968) 10: 324

Beidha: Late Level II, pit	Charcoal (Juniperus cf phoenicia)	9030 ± 50 (7080) $\delta^{13}C$ = -20.7°/₀₀	---	GrN-5062	R (1972) 14: 50; same sample as K-1085 & P-1382
Beidha: Late Level II, pit	"	8550 ± 160 (6600)	---	K-1085	R (1968) 10: 324; cf GrN-5062
Beidha: Late Level II, pit	"	8892 ± 115 (6942)	---	P-1382	R (1969) 11: 152; cf K-1085
Beidha: Level VI, posthole	Charred wood	8715 ± 100 (6765)	---	P-1378	R (1969) 11: 152 (8175 BP cited here; correct date confirmed by B Lawn, pers commun)
Beidha: Level VI, fill	Charcoal	8765 ± 102 (6815)	---	P-1381	R (1969) 11: 152
Beidha: Level VI	Charcoal	8850 ± 150 (6900)	---	K-1410	Bar-Yosef (1981b): 566
Beidha: Level VI	Charcoal	8770 ± 150 (6820)	---	K-1411	Bar-Yosef (1981b): 566
Beidha: Level VI	Charcoal	8720 ± 150 (6770)	---	K-1412	Bar-Yosef (1981b): 566
El-Khiam: Level Ib, Area IIb	Bones	2990 ± 250 (1040)	1540-1010 BC	Lv-358	R (1970) 12: 158
Jericho: Site E I, II, V, St/ph XII. xlviia	Charcoal	9170 ± 200 (7220)	---	BM-115	R (1963) 5: 107; Burleigh (1981): 502, 504
Jericho: Site E I, II, V, St/ph XIII. i	Charcoal	8710 ± 150 (6760)	---	BM-253	R (1969) 11: 291; Burleigh (1981): 502, 504
Jericho: Site M I, St/ph XI.1v	Charcoal	8540 ± 65 (6590) $\delta^{13}C$ = -20.4°/₀₀	---	BM-1320	Burleigh (1981): 502, 504; R (1982) 24: 165
Jericho: Site M, St/ph XI.1via	Charcoal	8700 ± 110 (6750) $\delta^{13}C$ = -23.3°/₀₀	---	BM-1769	R (1982) 24: 279; Burleigh (1984): 762-763

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Jericho: Site M, St/ph XI.lxa	Charcoal	8680 ± 70 (6730) $\delta^{13}C = -25.8°/_{oo}$	---	BM-1770	R (1982) 24: 279; Burleigh (1984): 762-763
Jericho: Site M, St/ph XIII.lxxa	Charcoal	8660 ± 260 (6710) $\delta^{13}C = -23.6°/_{oo}$	---	BM-1771	R (1982) 24: 279; Burleigh (1984): 762-763
Jericho: Site M, St/ph XIII.lxxiv-XIV.lxxv	Charcoal	8810 ± 100 (6860) $\delta^{13}C = -25.2°/_{oo}$	---	BM-1772	R (1982) 24: 279; Burleigh (1984): 762-763
Jericho: Site M, St/ph XIV.lxxvi	Charcoal	8730 ± 80 (6780) $\delta^{13}C = -26.4°/_{oo}$	---	BM-1773	R (1982) 24: 279; Burleigh (1984): 762-763
Jericho: Site D I, St/ph XIV.xxxvii	Charcoal	8660 ± 130 (6710) $\delta^{13}C = -25.5°/_{oo}$	---	BM-1793	R (1982) 24: 280; Burleigh (1984): 762-763
Jericho: Site E I, II, V, St/ph XIII.liv	Charcoal	8200 ± 200 (6250)	---	GL-28	Zeuner (1956): 197; Burleigh (1981): 502, 504
Jericho: Site E I, II, V, St/ph XIII.li	Charcoal	8390 ± 200 (6440)	---	GL-36	RMCI (1967): 31; Burleigh (1981): 502, 504
Jericho: Site F I, St/ph XVII.xxx	Charcoal (tamarisk)	7800 ± 160 (5850)	---	GL-38	Zeuner (1956) 197; RMCI (1967) 31; Burleigh (1981): 502, 504; same sample as GL-41, -42, Gro-942, GrN-942, Gro-963, & GrN-963
Jericho: Site F I, St/ph XVII.xxx	"	8670 ± 150 (6720)	---	GL-41	RMCI (1967): 31; Burleigh (1981): 502, 504; cf GL-38, diff pretreatment
Jericho: Site F I, St/ph XVII.xxx	"	8700 ± 200 (6750)	---	GL-42	RMCI (1967): 31; Burleigh (1981): 502, 504; cf GL-38, diff pretreatment

Jericho: Site F I, St/ph XVII.xxx	"	8900 ± 70 (6950)	---	Gro-942	de Vries & Waterbolk (1958): 1555; Burleigh (1981): 503; cf GL-38, -41, -42
Jericho: Site F I, St/ph XVII.xxx	"	9140 ± 70 (7190)	---	GrN-942	RMCI (1967): 35; Burleigh (1981): 503-504; corrected date for Gro-942
Jericho: Site F I, St/ph XVII.xxx	"	8785 ± 100 (6835)	---	Gro-963	de Vries & Waterbolk (1958): 1555; Burleigh (1981): 503-504; cf GL-38, -41, -42
Jericho: Site F I, St/ph XVII.xxx	"	9025 ± 100 (7075)	---	GrN-963	RMCI (1967): 35; Burleigh (1981): 503-504; corrected date for Gro-963
Jericho: Site D I, St/ph XV A. xxxviiia	Charcoal, ash	8610 ± 75 (6660)	---	P-380	R (1963) 5: 84; Burleigh (1981): 503-504
Jericho: Site E I, II, V, St/ph X. xliii	Charcoal, ash	8658 ± 101 (6708)	---	P-381	R (1963) 5: 84; Burleigh (1981): 503-504
Jericho: Site E I, II, V, St/ph XII. xlviia	Charcoal, ash	8956 ± 103 (7006)	---	P-382	R (1963) 5: 84; Burleigh (1981): 503-504
Mazad Mazal	Charcoal	8480 ± 70 (6530)	---	B-2737	Bar-Yosef (1981b): 566
Mazad Mazal	Charcoal	8070 ± 75 (6120)	---	KN-2443	Bar-Yosef (1981b): 566
Mazal Mazal	Charcoal	8240 ± 95 (6290)	---	Hv-9106	Bar-Yosef (1981b): 566
Mazad Mazal	Charcoal	8350 ± 75 (6400)	---	KN-2444	Bar-Yosef (1981b): 566
Mazad Mazal	Charcoal	8330 ± 75 (6380)	---	Hv-9107	Bar-Yosef (1981b): 566

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Mazad Mazal	Charcoal	8440 ± 80 (6490)	---	Hv-9108	Bar-Yosef (1981b): 566
Munhata: Level IVA, fireplace 644	Soil	7370 ± 400 (5420)	---	M-1792	R (1970) 12: 178
Munhata: Level IVB or V	Soil	9160 ± 500 (7210)	---	M-1793	R (1970) 12: 179
Nahal Divshon: Level 5/6, firepit	Charcoal	8170 ± 180 (6220)	---	Tx-1123	R (1972) 14: 484; Servello (1976): 250-251 (cited as Tx-1125); Tx-1123, I-5501, & SMU-3 from same firepit
Nahal Divshon: Level 6, firepit	Charcoal	8620 ± 140 (6670)	---	I-5501	R (1973) 15: 296; Servello (1976): 350-351
Nahal Divshon: Level 6, firepit	Charcoal	8900 ± 180 (6950)	---	SMU-3	R (1974) 16: 379; Servello (1976): 350-351
Nahal Issaron: Layer C	Charcoal	8430 ± 80 (6480)	---	Pta-3000	Goring-Morris & Gopher (1983): 159-160, n12
Nahal Issaron: Layer C	Charcoal	8050 ± 80 (6100)	---	Pta-3376	Goring-Morris & Gopher (1983): 159-160, n12
Nahal Issaron: Layer C	Charcoal	8180 ± 80 (6230)	---	Pta-3377	Goring-Morris & Gopher (1983): 159-160, n12
Nahal Issaron: Layer C	Charcoal	6130 ± 70 (4180)	5235-4955 BC	Pta-3486	Goring-Morris & Gopher (1983): 159-160, n12
Ujrat el-Mehed (Banana I): Loc 2	Charcoal	8220 ± 80 (6270)	---	Pta-2703	Bar-Yosef (1981b): 566
Wadi Tbeik: Loc 13, middle levels	Charcoal	10,350 ± 100 (8400)	---	Pta-2700	Bar-Yosef (1981b): 566; Tchernov & Bar-Yosef (1982): 19

		Late Neolithic I Period			
Nizzanim	Bones	6740 ± 90 (4790)	5790-5385 BC	Hv-8509	Yeivin & Olami (1979): 131
Nahal Issaron: Layer B	Charcoal	6460 ± 80 (4510)	5520-5235 BC	Pta-2999	Goring-Morris & Gopher (1983): 159-160, n12
		Late Neolithic II Period			
Newe Yam: Kiln	Charcoal	6310 ± 395 (4360)	5675-4880 BC	Hv-4256	Prausnitz & Wreschner (1971): 121, n*; Wreschner (1977): 271*
Ein el-Jarba: Phase IV	Animal bones (collagen)	4920 ± 240 (2970)	3895-3505 BC	GX-786	Kaplan (1969): 25, 27; Levy (1981): table 4:3; small collagen fraction
Ein el-Jarba: Phase IV, Pit 19	Charcoal	5690 ± 140 (3740)	4730-4415 BC	GX-787	Kaplan (1969): 25, 27; Levy (1981): table 4:3
		Late Neolithic Period			
Kadesh Barnea 3	?	7530 ± 100 (5580)	---	SMU-662	Goring-Morris & Gopher (1983): 160
Uvda Valley: Site C, temple courtyard, Basin 615	Charcoal	6560 ± 90 (4610)	5610-5285 BC	RT-?	Yogev (1983): 120
Uvda Valley: Site C, temple courtyard, Basin 615	Charcoal	6400 ± 200 (4450)	5515-5180 BC	RT-?	Yogev (1983): 120
		Late Neolithic/Early Chalcolithic Period			
Teleilat el-Ghassul: Area A III, 201.9 Pit A	Wood	6550 ± 160 (4600)	5620-5265 BC	SUA-732	Unpub; pers commun, J B Hennessy

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Teleilat el-Ghassul: Area A III, 201.12A	Wood	6370 ± 105 (4420)	5415-5200 BC	SUA-734	Unpub; pers commun, J B Hennessy
Teleilat el-Ghassul: Area A II, p.107.3 & 4	Wood	6430 ± 180 (4480)	5540-5195 BC	SUA-736	Unpub; pers commun, J B Hennessy
Teleilat el-Ghassul: Area E X, p.2.3a	Wood	6300 ± 110 (4350)	5350-5085 BC	SUA-738/1	Unpub: pers commun, J B Hennessy
Teleilat el-Ghassul: Area E X, p.3.3B.3c	Wood	6070 ± 130 (4120)	5235-4880 BC	SUA-739	Unpub; pers commun, J B Hennessy
Tell Tsaf: Lower of 2 pre-Ghassulian levels	Burned wood (Euphrates poplar)	6980 ± 180 (5030)	6125-5485 BC	RT-?	Gophna (1979): 56; Gophna & Kislev (1979): 112
		Chalcolithic Period			
Bir es-Safadi: Lower ph, Loc 309, f1	Burned wood (terebinth ?)	5420 ± 350 (3470)	4570-3850 BC	M-864A	R (1961) 3: 122; Perrot (1968): col 439
Bir es-Safadi: Middle ph, Loc 318, fireplace	Burned wood (terebinth ?)	5270 ± 300 (3320)	4435-3770 BC	M-864B	R (1961) 3: 122; Perrot (1968): col 439
Bir es-Safadi: Upper ph, Loc 325, silo	Burned wood (terebinth ?)	5120 ± 350 (3170)	4405-3535 BC	M-864C	R (1961) 3: 122; Perrot (1968): col 439
Horvat Beter: Str III	Charcoal	7420 ± 520 (5470)	---	C-919	Libby (1954): 734; (1955): 84; solid-carbon date
Horvat Beter: Str III, Pit 50	Charcoal	5280 ± 150 (3330)	4385-3880 BC	W-245	Rubin & Suess (1956): 448; Dothan (1956)

Jebel Queisa (J24): Layer B, hearth	Charcoal	5720 ± 149 (3770)	4740-4425 BC	SMU-804	Henry (1982): 439; Henry et al (1983): 15
Nahal Hever: Cave of Horror, grave	Charred mat	5460 ± 125 (3510)	4430-4115 BC	I-616	Aharoni (1962): 189-190; Levy (1981): table 4:3
Nahal Mishmar: Cave 1, treasure hoard	Reed mat (inner part)	5390 ± 150 (3440)	4425-3920 BC	BM-140	R (1968) 10: 4; Bar-Adon (1980): 199, 216, n2; cf W-1342, I-285
Nahal Mishmar: Cave 1, treasure hoard	" (outer edge)	4880 ± 250 (2930)	3885-3490 BC	W-1341	R (1965) 7: 396-397; Bar-Adon (1980): 199, 216, n2; cf BM-140
Nahal Mishmar: Cave 1, treasure hoard	" (outer edge)	4780 ± 100 (2830)	3675-3485 BC	I-285	Bar-Adon (1980): 199, 216, n2; cf BM-140
Nahal Mishmar: Cave 1	Wood	4760 ± 120 (2810)	3670-3475 BC	I-353	Bar-Adon (1980): 86-87: no. 115, 199
Nahal Mishmar: Cave 2, burial	Cloth	4725 ± 230 (2775)	3690-3350 BC	I-1819	Bar-Adon (1980) 6: 199
Rasm Harbush: House	Charred wood	5270 ± 140 (3320)	4380-3880 BC	RT-525	Epstein, (1979): 226; (1981): 116; Levy (1981): table 4:3
Shiqmim: Bldg 1, Fl 1	Charcoal	5250 ± 140 (3300)	4355-3870 BC	RT-554A	Levy (1981): 150, table 4:3
Shiqmim: Bldg 1, Fl 2	Charcoal	5050 ± 490 (3100)	4425-3355 BC	RT-554B	Levy (1981): 150, table 4:3; small sample
Teleilat el-Ghassul: Level III	Charred wood	5500 ± 110 (3550)	4445-4320 BC	RT-390A	Lee (1973): 329-330

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Tell Qiri: Loc 834, Level 61.40	Charcoal	3740 ± 230 (1790)	2425-1885 BC	P-2572	R (1978) 20: 226; archaeol date from A Ben-Tor, pers commun; small sample
Timna: Site 39, furnace	Charcoal	1945 ± 309 (AD 5) $\delta^{13}C$ = -25.0°/₀₀	390 BC-AD 410	BM-1116	R (1979) 21: 349; poss misassoc of sample
		Chalcolithic Period (?)			
Timna: Site F2, Sq 3, Str 3	Charcoal	3030 ± 50 (1080) $\delta^{13}C$ = -23.5°/₀₀	1400-1235 BC	BM-1368	R (1982) 24: 165; site poss LB IIB-Iron IA
		Early Bronze Age IA			
Bab edh-Dhra: Tomb A 78, SE ch	Powdery wood, ash	"Modern"	---	SI-3311	Unpub; pers commun, W E Rast & R T Schaub; "small sample, diluted"
Jericho: Tomb A 94	Charcoal	5210 ± 110 (3260)	4135-3870 BC	GL-24	Zeuner (1956): 196; Kenyon (1961): 25; same sample as BM-1329
Jericho: Tomb A 94	"	4500 ± 60 (2550) $\delta^{13}C$ = -24.0°/₀₀	3370-3050 BC	BM-1329	Burleigh (1981): 502, 504; R (1982) 24: 166; cf GL-24
Jericho: Tomb A 94	Charcoal	4570 ± 50 (2620) $\delta^{13}C$ = -23.7°/₀₀	3385-3165 BC	BM-1328	Burleigh (1981): 502, 504; R (1982) 24: 166
Jericho: Tomb A 94	Charcoal	4380 ± 50 (2430) $\delta^{13}C$ = -26.1°/₀₀	3175-2920 BC	BM-1774	R (1982) 24: 279; Burleigh (1984): 762-763
Jericho: Tomb A 94	Charcoal	4480 ± 50 (2530) $\delta^{13}C$ = -26.1°/₀₀	3370-3035 BC	BM-1775	R (1982) 24: 279; Burleigh (1984): 762-763
		Transitional Early Bronze Age IA/B			
Bab edh-Dhra: Tomb A 100, Ch E	Powdery wood	4630 ± 90 (2680)	3545-3345 BC	SI-3310A	Unpub; pers commun, W E Rast & R T Schaub

Bab edh-Dhra: Tomb A 100, Ch E	Powdery wood	6415 ± 110 (4465)	5480-5220 BC	SI-3310B	Unpub; pers commun, W E Rast & R T Schaub
		Early Bronze Age IB			
Gezer: Cave I.3A	Charcoal	4995 ± 180 (3045)	3945-3640 BC	GX-1873	Dever et al (1974): 18
		Early Bronze Age IB (?)			
Bab edh-Dhra: Field F.3, Loc 9, pit	Charcoal, soil	5000 ± 65 (3050)	3890-3760 BC	SI-2871	Unpub; pers commun, W E Rast & R T Schaub
		Early Bronze Age IC			
Ai: Ph III, Bldg C, wall timber, dest debris	Charred wood	4920 ± 90 (2970)	3875-3645 BC	Tx-1027	R (1972) 14: 483; Callaway (1972): 115
Ai: Ph III, Hearth area	Charred seeds	5120 ± 70 (3170)	3955-3795 BC	Tx-1034	R (1972) 14: 483 Callaway (1972): 115
Ai: Ph III, Bldg C, roof debris	Charred wood (Quercus calliprinos)	4320 ± 70 (2370)	3150-2895 BC	P-2302	R (1977) 19: 210; same sample as Tx-2372, -1032, GaK-2379, & probably -2381
Ai: Ph III, Bldg C, roof debris	"	4940 ± 90 (2990)	3880-3650 BC	Tx-1032	R (1972) 14: 483; Callaway (1972): 115; cf P-2302
Ai: Ph III, Bldg C, roof debris	"	4330 ± 80 (2380)	3170-2885 BC	Tx-2372	Callaway & Weinstein (1977): 8, table 2; cf P-2302
Ai: Ph III, Bldg C, roof debris	"	4980 ± 120 (3030)	3890-3660 BC	GaK-2379	R (1973) 15: 66; Callaway (1972): 115; cf P-2302

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Ai: Ph III, Bldg C, roof debris	"	5000 ± 120 (3050)	3900-3665 BC	GaK-2381	R (1973) 15: 66; Callaway (1972): 116, n†, 200; cf P-2302
Ai: Ph III, Tower C, dest debris	Charred wood	4550 ± 60 (2600)	3380-3160 BC	P-2303	R (1977) 19: 210; Callaway & Weinstein (1977): 9, table 2
Ai: Ph III, Tower C, dest debris	Charred wood	4360 ± 60 (2410)	3170-2910 BC	P-2304	R (1977) 19: 210; Callaway & Weinstein (1977): 9, table 2
Ai: Ph III, house, dest debris	Charred lentils	4250 ± 60 (2300)	3015-2865 BC	P-2300	R (1977) 19: 209; Callaway & Weinstein (1977): 8-9, table 2; same sample as Tx-2371 & -1035
Ai: Ph III, house, dest debris	"	4310 ± 130 (2360)	3175-2795 BC	Tx-2371	Callaway & Weinstein (1977): 8-9, table 2; cf P-2300
Ai: Ph III, house, dest debris	"	4810 ± 90 (2860)	3690-3495 BC	Tx-1035	R (1972) 14: 483; Callaway (1972): 116; cf P-2300
Arad: Str IV	Carbonized wood	4600 ± 220 (2650)	3655-3035 BC	I-?	Aharoni (1964): 159; (1967): 238
Tell Areini: Area N, below city wall	Charcoal	4470 ± 140 (2520)	3380-2930 BC	BM-392	R (1971) 13: 183
Tell Areini: Area N, below city wall	Charred grain	4450 ± 140 (2500)	3375-2915 BC	BM-393	R (1971) 13: 183
		Early Bronze Age II			
Ai: Ph IV, Bldg B, roof debris (EB IIA)	Charred wood	4800 ± 90 (2850)	3685-3490 BC	Tx-1028	R (1972) 14: 483; Callaway (1972): 158

Ai: Ph IV, Bldg B, roof debris (EB IIA)	Charred wood	4840 ± 130 (2890)	3810-3490 BC	GaK-2382	R (1973) 15: 66; Callaway (1972): 158-15
Ai: Ph V, Bldg B courtyard (EB IIB), dest debris	Charred wood	4740 ± 90 (2790)	3665-3370 BC	Tx-1026	R (1972) 14: 483; Callaway (1972): 200
Ai: Ph V or VI, near Tower A foundation trench, dest debris	Charcoal	4570 ± 120 (2620)	3390-3175 BC	Tx-1029	R (1972) 14: 483; Callaway (1972): 200
Ai: Ph V, house, in store-jar (EB IIB), dest debris	Charred lentils	4200 ± 70 (2250)	2925-2780 BC	P-2299	R (1977) 19: 209; Callaway & Weinstein (1977): 9, table 2; same sample as Tx-1030
Ai: Ph V, house, in store-jar (EB IIB), dest debris	"	4700 ± 50 (2750)	3650-3370 BC	Tx-1030	R (1972) 14: 483; Callaway (1972): 200; cf P-2299
Ai: Ph V, house (EB IIB), dest debris	Charred lentils	4270 ± 70 (2320) $\delta^{13}C_w$ = +1.82°/₀₀	3030-2875 BC	P-2301	R (1977) 19: 209; Callaway & Weinstein (1977): 9, table 2
Ai: Ph V, house (EB IIB), dest debris	Charred seeds	4730 ± 90 (2780)	3665-3370 BC	Tx-1031	R (1972) 14: 483; Callaway (1972): 200
Ai: Ph V, house (EB IIB), dest debris	Charcoal	4160 ± 120 (2210)	2920-2640 BC	GaK-2380	R (1973) 15: 66
Arad: Str III	Carbonized wood	4585 ± 220 (2635)	3650-3030 BC	I-?	Aharoni (1964): 159; (1967): 238
Arad: Str III, Loc 4610	Charred wood (Pistacia atlantica	4210 ± 60 (2260)	2935-2785 BC	P-2415	R (1977) 19: 211; Callaway & Weinstein (1977): 9, table 2

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Arad: Str II, Rm 2326, f1	Charred barley	4050 ± 50 (2100)	2675-2535 BC	P-1742	R (1977) 19: 210; Callaway & Weinstein (1977): 9-10, table 2; Amiran et al (1978): 116
Arad: Str II, Loc 4058-4071	Charred barley	4510 ± 60 (2560) $\delta^{13}C_w$ = +0.88°/₀₀	3375-3135 BC	P-2054	R (1977) 19: 211; Callaway & Weinstein (1977): 9, table 2; same sample as P-2054A
Arad: Str II, Loc 4058-4071	"	4230 ± 60 (2280) $\delta^{13}C_w$ = +4.07°/₀₀	2970-2795 BC	P-2054A	R (1977) 19: 211; Callaway & Weinstein (1977): 9-10, table 2; cf P-2054
Arad: Str II, Loc 4155-4158	Charred wheat	4910 ± 60 (2960) $\delta^{13}C_w$ = +3.54°/₀₀	3860-3650 BC	P-2055	R (1977) 19: 210; Callaway & Weinstein (1977): 9, table 2; same sample as P-2109
Arad: Str II, Loc 4155-4158	"	4070 ± 50 (2120) $\delta^{13}C_w$ = +2.23°/₀₀	2805-2545 BC	P-2109	R (1977) 19: 211; Callaway & Weinstein (1977): 9-10, table 2; cf P-2055; no NaOH pretreatment
Arad: Str II, Loc 4151	Charred barley	4310 ± 60 (2360) $\delta^{13}C_w$ = +3.15°/₀₀	3065-2890 BC	P-2110	R (1977) 19: 211; Callaway & Weinstein (1977): 9-10, table 2
Arad: Str II	Carbonized wood	4585 ± 220 (2635)	3650-3030 BC	I-?	Aharoni (1964): 159; (1967): 238
Arad: Str II, Loc 1240	Charcoal	4335 ± 65 (2385)	3160-2900 BC	GrN-4704	R (1967) 9: 139
Arad: Str I	Carbonized wood	2431 ± 200 (481)	805-380 BC	I-?	Aharoni (1964): 159; (1967): 238

Tell Areini: Area D, Str IV, Loc 4001	Carbonized wheat	4410 ± 250 (2460)	3375-2880 BC	W-916	R (1961) 3: 97; standard deviation reported with >1σ
Tell Areini: Area D, Str IV, Loc 4702, confl layer	Carbonized wheat	4340 ± 130 (2390)	3355-2870 BC	BM-388	R (1971) 13: 182
Tell Areini: Area D, Str IV, Loc 4702, confl layer	Carbonized wheat	4400 ± 130 (2450)	3365-2895 BC	BM-389	R (1971) 13: 182
Tell Areini: Area D, Str IV, Loc 4533, in jar	Carbonized olive stones	4430 ± 140 (2480)	3370-2905 BC	BM-391	R (1971) 13: 183
Tell Areini: Area D, Str II, Loc 2062, confl layer	Carbonized wheat	4500 ± 130 (2550)	3385-2965 BC	BM-387	R (1971) 13: 182
Tell Areini: Area D, Str II3, Loc 2301, confl layer	Charcoal	4200 ± 130 (2250)	3035-2635 BC	BM-390	R (1971) 13: 182
		Early Bronze Age II (?)			
Timna: Site 212, Mine S28	Charcoal	3890 ± 70 (1940)	2430-2305 BC	BONN-2362	Conrad & Rothenberg (1980): 179
Timna: Site 212, Mine S28	Charcoal	4000 ± 90 (2050)	2670-2505 BC	BONN-2363	Conrad & Rothenberg (1980): 179
		Early Bronze Age IA/III (?)			
Bab edh-Dhra: Field F3, Loc 13, occ debris	Charcoal, charred wood fragments, bits of burned bone	6615 ± 145 (4665)	5690-5305 BC	SI-2502	Unpub; pers commun, W E Rast & R T Schaub; "small sample, diluted and counted at reduced pressure"

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Bab edh-Dhra: Field F3, Loc 13, occ debris	Wood fragments in soil & ash	7235 ± 215 (5285)	---	SI-2877	Unpub; pers commun, W E Rast & R T Schaub; "small sample, diluted and counted at reduced pressure"
		Early Bronze Age IB-III			
Bab edh-Dhra: Field XIII, Loc 9, dest debris	Wooden beam	4205 ± 85 (2255)	3005-2765 BC	SI-2868	Rast & Schaub (1980): 46 (cited as SI-2686), table 3; corrected archaeol data from W E Rast & R T Schaub, pers commun
		Early Bronze Age II-III			
Bab edh-Dhra: Charnel house A 8, entryway	Burned cloth	4160 ± 180 (2210)	3035-2535 BC	M-2036	R (1970) 12: 179; Callaway & Weinstein (1977): 10, table 2
Bab edh-Dhra: Charnel house A 51, f1	Burned cloth, wood	4350 ± 180 (2400)	3365-2790 BC	M-2037	R (1970) 12: 179; Callaway & Weinstein (1977): 10, table 2
Bab edh-Dhra: Field XII.2, Loc 9	Powdery wood, ash	4245 ± 80 (2295)	3040-2785 BC	SI-2503	Rast & Schaub (1980): 46, table 3; corrected archeol date from W E Rast & R T Schaub, pers commun
Bab edh-Dhra: Field XII.2, Loc 13	Wood fragments	5080 ± 90 (3130)	3945-3775 BC	SI-2876	Unpub; pers commun, W E Rast & R T Schaub
		Early Bronze Age III			
Ai: Ph VIII, house, dest debris (EB IIIB)	Charred wood	4170 ± 70 (2220)	2905-2760 BC	P-2298	R (1977) 19: 209; Callaway & Weinstein (1977): 10, table 2; same sample as Tx-1033

Ai: Ph VIII, house, dest debris (EB IIIB)	"	4400 ± 80 (2450)	3360-2910 BC	Tx-1033	R (1972) 14: 483; Callaway (1972): 305-306; cf P-2298
Bab edh-Dhra: Field X.3, Loc 29 (late EB III)	Charcoal, soil	4320 ± 85 (2370)	3165-2880 BC	SI-2870	Unpub; pers commun, W E Rast & R T Schaub
Bab edh-Dhra: Field X.3, Loc 49, br fall (late EB III)	Charcoal	3805 ± 60 (1855)	2405-2165 BC	SI-2872	Unpub; pers commun, W E Rast & R T Schaub
Bab edh-Dhra: Field X.3, Loc 60 (late EB III)	Charcoal	3595 ± 70 (1645)	2140-1880 BC	SI-2875	Unpub; pers commun, W E Rast & R T Schaub
Bab edh-Dhra: Field XIV.4, Loc 9, occ surface	Charcoal	5070 ± 85 (3120)	3935-3770 BC	SI-4134	Unpub; pers commun, W E Rast & R T Schaub
Bab edh-Dhra: Field XII.5, Loc 24, beam on fl	Charcoal (dicot, sp unid.)	5030 ± 75 (3080)	3900-3770 BC	SI-4135	Unpub; pers commun, W E Rast & R T Schaub
Jericho: Tr III, St/ph XIV.xliva	Charcoal	4175 ± 48 (2225)	2910-2765 BC	BM-548	R (1977) 19: 152; Burleigh (1981): 502, 504
Jericho: Tr III, St/ph XV.li-lii	Charcoal	4204 ± 49 (2254)	2925-2780 BC	BM-549	R (1977) 19: 152; Burleigh (1981): 502, 504
Jericho: Tr III, St/ph XVI.lxi-lxii	Charcoal	4126 ± 50 (2176)	2890-2640 BC	BM-550	R (1977) 19: 152; Burleigh (1981): 502, 504
Jericho: Tr III, St/ph XVI.lxv-lxvi	Charcoal	4080 ± 42 (2130)	2870-2545 BC	BM-551	R (1977) 19: 152; Burleigh (1981): 502, 504
Jericho: Tr III, St/ph XVII.lxviiia	Charcoal	4115 ± 39 (2165)	2885-2635 BC	BM-552	R (1977) 19: 152; Burleigh (1981): 502, 504

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Jericho: Tr III, St/ph XVIII.lxxii	Charcoal	3922 ± 78 (1972)	2640-2305 BC	BM-553	R (1977) 19: 152; Burleigh (1981): 502, 504
Jericho: Tr III, St/ph XIX.lxxvi	Charcoal	4170 ± 42 (2220)	2905-2760 BC	BM-554	R (1977) 19: 153; Burleigh (1981): 502, 504
Jericho: Tr III, St/ph XVI.lxii-lxiii	Charcoal	4080 ± 70 (2130) $\delta^{13}C = -23.6°/_{oo}$	2870-2545 BC	BM-1778	R (1982) 24: 279; Burleigh (1984): 762-763
Jericho: Tr III, St/ph XVI.lxii-lxiii	Charcoal	4160 ± 80 (2210) $\delta^{13}C = -25.5°/_{oo}$	2920-2640 BC	BM-1779	R (1982) 24: 279; Burleigh (1984): 762-763
Jericho: Tr III, St/ph XVII.lxviiia	Charcoal	3890 ± 60 (1940) $\delta^{13}C = -25.7°/_{oo}$	2430-2305 BC	BM-1780	R (1982) 24: 279; Burleigh (1984): 762-763
Jericho: Tr III, St/ph XIX.lxxvi-lxxviia	Charcoal	4120 ± 40 (2170) $\delta^{13}C = -25.6°/_{oo}$	2885-2635 BC	BM-1781	R (1982) 24: 280; Burleigh (1984): 762-763
Jericho: Tr II, St/ph XVIII.lviii	Charcoal	3940 ± 80 (1990) $\delta^{13}C = -26.1°/_{oo}$	2645-2310 BC	BM-1783	R (1982) 24: 280; Burleigh (1984): 762-763
Numeira: SE 3/4, Loc 7, base of town wall, dest debris	Charcoal	4085 ± 55 (2135)	2875-2620 BC	SI-4136	Rast & Schaub (1980): 47, table 3
Numeira: SE 3/1, Loc 9, W of Wall 4, collected in water flotation system	Grapes (Vitis vinifera)	4310 ± 70 (2360)	3065-2890 BC	SI-4137	Rast & Schaub (1980): 46, table 3; additional data from W E Rast & R T Schaub, pers commun
Numeira: NE 3/1, Loc 15, dest debris	Charcoal	4130 ± 70 (2180)	2890-2640 BC	SI-4138	Rast & Schaub (1980): 47, table 3
Numeira: NE 4/4, Loc 16, dest debris	Charred grain	4090 ± 70 (2140) $\delta^{13}C_{PDB} = -26.32 \pm 0.26°/_{oo}$	2875-2620 BC	P-3367	Unpub; pers commun, W E Rast & R T Schaub

Numeira: SE 8/1, Loc 12, roof fall and occ debris	Roof thatching	4180 ± 60 (2230)	2910-2765 BC	P-3454	Unpub; pers commun, W E Rast & R T Schaub
		Early Bronze Age III (?)			
Gibeon: Sndg in Area 10-M-6, "Early Bronze level"	Charcoal, limestone	4501 ± 65 (2551)	3370-3050 BC	P-837	R (1965) 7: 194; Callaway & Weinstein (1977): 11, table 2
Bab edh-Dhra: Field VIII.IA, Loc 3, town wall collapse (loc not sealed)	Charcoal	1090 ± 45 (AD 860)	AD 875-1020	SI-2873	Unpub; pers commun, W E Rast & R T Schaub
		Early Bronze Age II-IVA			
Bab edh-Dhra: Charnel house A55, NW corner, left of doorway	Burned fabric, charcoal, ash	3680 ± 90 (1730)	2305-1905 BC	SI-2497	Unpub; pers commun, W E Rast & R T Schaub; "small sample, diluted"
Bab edh-Dhra: Charnel house A 55, fl, opposite doorway	Charcoal	4015 ± 75 (2065)	2660-2530 BC	SI-2499	Rast & Schaub (1980): 46-47, table 3
Bab edh-Dhra: Charnel house A 55, doorway	Charcoal	4420 ± 80 (2470)	3365-2925 BC	SI-2501	Unpub; pers commun, W E Rast & R T Schaub
Bab edh-Dhra: Charnel house A 55, NE corner	Charcoal	4320 ± 65 (2370)	3150-2895 BC	SI-2874	Rast & Schaub (1980): 46, table 3
		Early Bronze Age IVA			
Bab edh-Dhra: Field X, Ph 3	Olive stones	3770 ± 60 (1820)	2335-2135 BC	P-2573	R (1978) 20: 226

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Bab edh-Dhra: Field X.1, Loc 28	Charcoal	5090 ± 85 (3140)	3955-3775 BC	SI-2869	Unpub; pers commun
		Early Bronze Age IVB-C			
Mushabi 103	Charcoal	3800 ± 330 (1850)	2680-1765 BC	RT-447B	Bar-Yosef & Phillips (1977): table 67
Ain Abu Rugum 1	Charcoal	4180 ± 300 (2230)	3355-2395 BC	RT-447A	Bar-Yosef & Phillips (1977): table 67
Jericho: Tr III, St/ph XX.lxxxa	Charcoal	3560 ± 40 (1610) $\delta^{13}C$ = -26.2°/₀₀	2035-1855 BC	BM-1782	R (1982) 24: 280; Burleigh (1984): 762-763
Jericho: Tr II, St/ph XXI.lxviii-XXII.lxix(a)	Charcoal	3620 ± 40 (1670) $\delta^{13}C$ = -25.3°/₀₀	2155-1890 BC	BM-1784	R (1982) 24: 280; Burleigh (1984): 762-763
		Middle Bronze Age II (formerly MBA IIB)			
Gibeon: Sndg in Area 15-K-18, Level 4a	Charcoal, limestone	3154 ± 56 (1204)	1565-1375 BC	P-842	R (1965) 7: 195; for archaeol context, see Pritchard (1964): 42-43, 45-47
Jericho: Tomb J 14	Wood	3510 ± 110 (1560)	2000-1700 BC	GL-33	RMCI (1967): 31; Burleigh (1981): 502, 504
Jericho: Tomb B 35, funerary furniture	Wood	3270 ± 110 (1320)	1710-1425 BC	GL-5	Zeuner (1956): 196; Burleigh (1981): 502, 504
Jericho: Tomb B 35, funerary furniture	Wood	4100 ± 150 (2150)	2910-2530 BC	GL-6	Zeuner (1956): 196: Burleigh (1981): 502, 504
Jericho: Tomb J 19	Flesh	3220 ± 60 (1270)	1665-1415 BC	GL-30	Zeuner (1956): 196; Burleigh (1981): 502, 504

Jericho: Tomb G 73	Wood	3360 ± 150 (1410)	1885-1535 BC	GL-52	RMCI (1967): 31; Burleigh (1981): 502, 504
Jericho: Tomb G 73	Flesh	3370 ± 115 (1420)	1870-1570 BC	GL-56	RMCI (1967): 31; Burleigh (1981): 502, 504; same sample as GL-64
Jericho: Tomb G 73	"	3330 ± 90 (1380)	1770-1545 BC	GL-64	Burleigh (1981): 502, 504; cf GL-56
		Middle Bronze Age III (formerly MBA IIC)			
Jericho: Site H, St/ph XII.1i	Charcoal	3080 ± 40 (1130) $\delta^{13}C = -23.9°/_{oo}$	1430-1260 BC	BM-1790	R (1982) 24: 280; Burleigh (1984): 762-763
Lachish: Level VIII palace, dest debris	Charred wood	3450 ± 120 (1500)	1945-1675 BC	Hel-809	Ussishkin (1978): 90
Shechem: Field XIII, Rm D, dest debris (MB Ph IA)	Charcoal	3510 ± 120 (1560)	2000-1700 BC	GX-1718	Seger (1972): 31; lab no. from J D Seger, pers commun
Tell el-'Ajjul: Burial 1474	Horse bone (Equus caballus) (collagen)	8150 ± 300 (6200)	---	BM-2114	R (1984) 26: 69
		Late Bronze Age I/Iron Age IIC-Persian Period			
Khirbet Umm ad-Dananir: Field V, Area 2, Loc 18	Charcoal	3440 ± 60 (1490)	1890-1685 BC	P-3216	R (1984) 26: 223
Khirbet Umm ad-Dananir: Field V, Area A, Loc 18 (from lower level than P-3216)	Charcoal	3770 ± 70 (1820)	2335-2135 BC	P-3217	R (1984) 26: 223

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
		Late Bronze Age II			
Baq'ah Valley: Jebel al-Qesir, Cave B3	Charcoal	3200 ± 60 (1250)	1655-1405 BC	P-3209	R (1984) 26: 223
Baq'ah Valley: Jebel al-Qesir, Cave B3	Charcoal	3350 ± 70 (1400)	1760-1590 BC	P-3210	R (1984) 26: 223
Khirbet Umm ad-Dananir: Field V, Area 2, Loc 19, carbonized beams	Charcoal (olive)	3580 ± 70 (1630)	2120-1865 BC	P-3219	R (1984) 26: 223; material from Patrick McGovern, pers commun
		Late Bronze Age IIB			
Lachish: Level VI temple, roof beams	Charred wood (cedar)	3090 ± 120 (1140)	1545-1245 BC	Hel-810	Ussishkin (1978): 90
Lachish: Level VI temple, door paneling (?)	Charred wood (cedar)	3510 ± 120 (1560)	2000-1700 BC	Hel-1028	Ussishkin (1978): 90
		Late Bronze Age IIB (?)			
Deir 'Alla: LB temple, roof beam	Charred wood	3130 ± 60 (1180)	1550-1360 BC	GrN-4553	R (1967) 9: 140
		Late Bronze Age IIB-Iron Age I			
Timna: Site 2, Area E, Pit C	Charcoal	1350 ± 50 (AD 600)	AD 595-660	GrN-4381	R (1967) 9: 141
Timna: Site 2, Area F, hearth	Charcoal	3000 ± 40 (1050)	1380-1225 BC	GrN-4493	R (1967) 9: 141; Rothenberg & Lupu (1967): 69, n10 (3000 ± 50 cited here)
Timna: Site 212/1, Egyptian tunnel	Charcoal	2910 ± 70 (960)	1250-1035 BC	HAM-207	R (1976) 18: 286

Timna: Site 212/1, Egyptian tunnel	Charcoal	2910 ± 60 (960)	1250–1035 BC	HAM-208	R (1976) 18: 287
Timna: Site 212/1e, Egyptian tunnel	Charcoal	3050 ± 70 (1100)	1410–1245 BC	HAM-210	R (1976) 18: 287
Timna: Site 212/1g, Egyptian tunnel	Charcoal	2640 ± 60 (690)	840–780 BC	HAM-211	R (1976) 18: 287
Timna: Site 212/2, Egyptian tunnel	Charcoal	2780 ± 90 (830)	1110–810 BC	HAM-212	R (1976) 18: 287
Timna: Site 212/2, Egyptian tunnel	Charcoal	3890 ± 70 (1940)	2430–2305 BC	HAM-213	R (1976) 18: 287
Timna: Site 212/2a, Egyptian tunnel	Charcoal	4000 ± 90 (2050)	2670–2505 BC	HAM-214	R (1976) 18: 287
Timna: "Mining site, slag pile (Cut 25, Layer 2)"	Charcoal	4020 ± 100 (2070)	2680–2515 BC	HAM-215	R (1976) 18: 287; sample presumably from Site 30
Timna: Site 30, slag pile, Layer 1	Charcoal	3340 ± 60 (1390)	1750–1575 BC	HAM-216	R (1976) 18: 287
Timna: Site 2, Area E, Pit B	Charcoal	2840 ± 51 (890) $\delta^{13}C = -23.8°/_{oo}$	1115–880 BC	BM-1115	R (1979) 21: 349
Timna: Site 30, Area C5, Stratum I, slag	Charcoal inclusions	2480 ± 35 (530) $\delta^{13}C = -24.6°/_{oo}$	645–555 BC	BM-1162	R (1979) 21: 349
Timna: Site 30, Str 3	Charcoal	2790 ± 50 (840) $\delta^{13}C = -21.3°/_{oo}$	1095–830 BC	BM-1598	R (1982) 24: 165
Timna: Site 212, Mine S27	Charcoal	2910 ± 70 (960)	1250–1035 BC	BONN-2356	Conrad & Rothenberg (1980): 179
Timna: Site 212, Mine S27	Charcoal	2910 ± 60 (960)	1250–1035 BC	BONN-2357	Conrad & Rothenberg (1980): 179

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Timna: Site 212, Mine S18	Charcoal	3050 ± 70 (1100)	1410–1245 BC	BONN-2359	Conrad & Rothenberg (1980): 179
Timna: Site 212, Mine S19	Charcoal	2640 ± 60 (690)	840–780 BC	BONN-2360	Conrad & Rothenberg (1980): 179
Timna: Site 212, Mine S28	Charcoal	2780 ± 90 (830)	1110–810 BC	BONN-2361	Conrad & Rothenberg (1980): 179
		Late Bronze Age II/Iron Age I (?)			
Sea bed near Kibbutz ha-Hotrim: Poss shipwreck	Charcoal	2560 ± 360 (610)	1120–375 BC	P-3099	R (1984) 26: 222 for assoc archaeol finds, see Wachsmann & Raveh (1981)
Sea bed near Kibbutz ha-Hotrim: Poss shipwreck	Wood or charred wood	2500 ± 100 (550)	800–420 BC	P-3226	R (1984) 26: 222 for assoc archaeol finds, see Wachsmann & Raveh (1981)
		Iron Age IB			
Deir 'Alla: "One of 'first' seasonal layers"	Ash, chaff, charred grain	3290 ± 50 (1340)	1700–1545 BC	GrN-4748	R (1967) 9: 140
Deir 'Alla: Ph D	Charred beans, grain	3140 ± 35 (1190)	1545–1375 BC	GrN-4749	R (1967) 9: 140; Franken (1969): 245
Deir 'Alla: Ph J	Charcoal	3000 ± 40 (1050)	1380–1225 BC	GrN-4554	R (1967) 9: 140; Franken (1969): 245
		Iron Age I (12th century BC ?)			
Gibeon: Sndg in Area 10-M-3/4, Fl 4	Charcoal	3505 ± 59 (1555)	1970–1740 BC	P-843A	R (1965) 7: 194

Gibeon: Sndg in Area 10-M-3/4, below Fl 4	Charcoal limestone	3073 ± 48 (1123)	1425-1255 BC	P-941	R (1965) 7: 194
		Iron Age I/Early Arab Period			
Timna: Wadi Amram, Site 33, slag heap	Charcoal inclusions	1240 ± 36 (AD 710) $\delta^{13}C = -24.1°/_{oo}$	AD 635-875	BM-1163	R (1979) 21: 350
		Iron Age IIA			
Tell er-Rumeith: Str VIII, gateway, dest debris	Charcoal	2860 ± 160 (910)	1330-825 BC	M-2028	R (1972) 14: 218
Tell er-Rumeith: Str VIII, posts	Charcoal	2530 ± 150 (580)	825-420 BC	M-2031	R (1972) 14: 218
		Iron Age IIB-C			
Tell Areini: Area A, oven, "Middle Israelite layer"	Charcoal	2640 ± 140 (690)	905-750 BC	BM-394	R (1971) 13: 183
Deir 'Alla: Ph M, pit	Charcoal	2690 ± 60 (740)	890-765 BC	GrN-5283	R (1972) 14: 53
Deir 'Alla: Ph M, dest debris	Charred grain	2600 ± 50 (650) $\delta^{13}C = -23.3°/_{oo}$	820-765 BC	GrN-5633	R (1972) 14: 53
Dibon: Str IV, Area C, rm	Grain	2815 ± 165 (865)	1145-810 BC	MP-?	Reed (1957): 9; Winnett & Reed (1964): 49
Dothan: Level 6-A, Area 12, roof beams (?)	Charcoal	2760 ± 80 (810)	1100-805 BC	L-365	Broecker & Kulp (1957): 1330; Free (1957)
Jericho: Tr I (Sq C), St/ph XLVII. lxxii-lxxiii(1)	Charcoal	2040 ± 40 (90) $\delta^{13}C = -26.3°/_{oo}$	170 BC-AD 20	BM-1791	R (1982) 24: 280; Burleigh (1984): 762-763

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Lachish: Level IV, later ph	Charred wood	2830 ± 150 (880)	1255-815 BC	Hel-1027	Ussishkin (1978): 90
Lachish: Level III, Loc 3561	Charred wood	2940 ± 110 (990)	1360-1030 BC	Hel-1026	Ussishkin (1978): 90
Lachish: Level II, Loc 4084, shelves/ jar-stands	Charred wood (cedar)	2830 ± 110 (880)	1125-835 BC	Hel-1025	Ussishkin (1978): 90
Tell er-Rumeith: Str VII, posts in fort wall	Charcoal	2420 ± 140 (470)	785-390 BC	M-2029	R (1972) 14: 218
Tell er-Rumeith: Str VII, posts in fort wall	Charcoal	2580 ± 140 (630)	870-560 BC	M-2030	R (1972) 14: 218
Tell er-Rumeith: Str VI, dest debris	Charcoal	2610 ± 150 (660)	890-590 BC	M-2032	R (1972) 14: 219
Tell er-Rumeith: Str VI (?), dest debris	Charcoal	2820 ± 150 (870)	1145-810 BC	M-2033	R (1972) 14: 219
Tell er-Rumeith: Str V, kiln	Charcoal	2800 ± 150 (850)	1130-805 BC	M-2034	R (1972) 14: 219
Tell er-Rumeith: Str V, house, burned debris	Charcoal	2130 ± 140 (180)	400 BC-AD 15	M-2035	R (1972) 14: 219
Tell es-Sa'idiyeh: Str 5, ab Fl 2	Charcoal, sand, dirt	2596 ± 56 (646)	820-765 BC	P-829	R (1965) 7: 195
Tell es-Sa'idiyeh: Str 5, street with level of Fl 2	Charcoal, limestone	2572 ± 59 (622)	810-755 BC	P-830	R (1965) 7: 195

Tell es-Sa'idiyeh: Str 5, below street pavement	Charcoal, sand, limestone	2542 ± 46 (592)	800-600 BC	P-831	R (1965) 7: 195
Tell es-Sa'idiyeh: Str 5, Fl 2	Mildewed charcoal, sand, limestone	2406 ± 52 (456)	615-410 BC	P-832	R (1965) 7: 195
Tell es-Sa'idiyeh: Str 5, Fl 2	Mildewed charcoal, sand, limestone	2537 ± 52 (587)	800-600 BC	P-833	R (1965) 7: 195
Tell es-Sa'idiyeh: Str 5, Fl 2	Charcoal	2726 ± 157 (776)	1105-780 BC	P-834	R (1965) 7: 195
Tell es-Saidiyeh: Str 5, Fl 2	Charcoal, limestone	2418 ± 54 (468)	620-410 BC	P-835	R (1965) 7: 195
Tell es-Sa'idiyeh: Str 5, roof beam from ab Fl 2	Charcoal, dirt, limestone	2523 ± 53 (573)	795-585 BC	P-836	R (1965) 7: 195
Tell es-Sa'idiyeh: Str 5	Charcoal	2577 ± 53 (627)	810-760 BC	P-1099	R (1970) 12: 583
Tell es-Sa'idiyeh: Str 5, Fl 2, beam	Charcoal	2424 ± 57 (474)	620-410 BC	P-1100	R (1970) 12: 583
Tell es-Sa'idiyeh: Str 5, beam	Charcoal	2609 ± 58 (659)	825-770 BC	P-1101	R (1970) 12: 583
Tell es-Sa'idiyeh: Str 5, Fl 2	Charcoal	2633 ± 60 (683)	835-775 BC	P-1444	R (1970) 12: 583
		Iron Age IIB-C (?)			
Rujm Mekhayyat: Moabite fortress or watch tower, wall	Wood ("worm-eaten and partially charred")	2575 ± 100 (625)	825-600 BC	IVIC-108	R (1965) 7: 64; 8th cent. BC archaeol date suggested by James Sauer, pers commun

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Rujm Mekhayyat: Moabite fortress or watch tower, log in wall filling	Wooden log	2530 ± 100 (580)	805-555 BC	IVIC-109	R (1965) 7: 64; for archaeol date, see IVIC-108 above
Tell Siran: Area A, Sq 1, Loc 1, in bronze bottle	Grain	2350 ± 50 (400)	440-395 BC	P-2207	R (1977) 19: 211; Thompson (1983); for archaeol context, see Thompson (1973)
		Persian Period			
Deir 'Alla: Burned layer between Ph N & O	Charred grain	2410 ± 55 (460) $\delta^{13}C = -23.4°/_{oo}$	615-410 BC	GrN-5634	R (1972) 14: 53
Tell es-Sa'idiyeh: Sndg below Str 3 "palace"	Grain	2415 ± 54 (465)	620-410 BC	P-1442	R (1970) 12: 582
Tell es-Sa'idiyeh: Sndg below Str 3 "palace," furnace	Charcoal	2310 ± 100 (360)	440-375 BC	P-1443	R (1970) 12: 582
Tell es-Sa'idiyeh: Sndg below Str 3 "palace," House 4	Grain	2141 ± 55 (191)	255-145 BC	P-1445	R (1970) 12: 582
Tell es-Sa'idiyeh: Sndg below Str 3 "palace," Rm 5/1W	Grain	2485 ± 57 (535)	785-550 BC	P-1448	R (1970) 12: 582
Tell es-Sa'idiyeh: Str 3 "palace," Fl 1c	Charcoal	2226 ± 50 (276)	405-180 BC	P-1446	R (1970) 12: 582
		Persian Period (?)			
Tel Michal: Pit	Charcoal	230 ± 40 (AD 1720)	AD 1635-1665 (Stuiver corrected)	P-2718	R (1981) 23: 232

Sea of Athlit: Bronze ship's ram	Wood (silver fir)	2350 ± 130 (400)	625-370 BC	RT-?	Linder & Ramon (1981); sample poss from covering of ram, cf Steffy (1983): 235, 246, n4
		Hellenistic Period			
Tell es-Sa'idiyeh: Str 2 bldg, roof beam	Wood	2098 ± 55 (148)	190-15 BC	P-1095	R (1970) 12: 582
Tell es-Sa'idiyeh: Str 2 bldg, beam	Burned Wood	2199 ± 55 (249)	395-170 BC	P-1096	R (1970) 12: 582
Tell es-Sa'idiyeh: Str 2 bldg, beam	Charcoal	2179 ± 53 (229)	390-165 BC	P-1097	R (1970) 12: 582
Tell es-Sa'idiyeh: Str 2 bldg, beam	Charcoal	2267 ± 53 (317)	410-370 BC	P-1098	R (1970) 12: 582
Tell es-Sa'idiyeh: Str 2 bldg, ab Fl 1	Charcoal	2228 ± 48 (278)	405-180 BC	P-1447	R (1970) 12: 582
		Late Hellenistic/Early Roman Period			
Qumran: Period Ib or II, poss from rafters	Charred wood (date palm)	1940 ± 80 (AD 10)	40 BC-AD 85	GL-25	Zeuner (1956): 196; (1960): 27-28; RMCI (1967): 31; same sample as GL-47
Qumran: Period Ib or II, poss from rafters	"	1965 ± 80 (15)	160 BC-AD 70	GL-47	Zeuner (1960): 27-28; RMCI (1967): 31; cf GL-25, diff pretreatment
		Roman Period			
Masada: Roman rampart	Wood	2000 ± 90 (50)	170 BC-AD 55	TF-1002	R (1973) 15: 580

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Nahal Hever: Cave of Horror	Cloth (impregnated with blood & flesh)	1649 ± 100 (AD 301)	AD 230-560	Q-621	R (1962) 4: 70; same sample as Q-771
Nahal Hever: Cave of Horror	"	1795 ± 100 (AD 155)	AD 40-335	Q-771	R (1964) 6: 134; cf Q-621
Qumran (Ain Feshka): Cave IQ, poss scroll wrappings	Cloth	1917 ± 200 (AD 33)	175 BC-AD 245	C-576	Libby (1951): 291; (1955): 84; Sellers (1951a; 1951b); Crowfoot (1955): 27; solid-carbon date
Wadi Murabba'at: Cave 1 or 2 (precise cave not stated)	Woolen textile	1350 ± 60 (AD 600)	AD 595-660	GL-37	Zeuner (1960): 28; Crowfoot & Crowfoot (1961): 5, nl; RMCI (1967): 31; same sample as Gro (GrN)-940, -943, -965
Wadi Murabba'at: Cave 1 or 2	"	1665 ± 42 (AD 285)	AD 235-435	Gro-940	de Vries & Waterbolk, (1958): 1555; cf GL-37, diff pretreatment
Wadi Murabba'at: Cave 1 or 2	"	1910 ± 42 (AD 40)	1 BC/AD 1-AD 80	GrN-940	RMCI (1967): 35; corrected date for Gro-940
Wadi Murabba'at: Cave 1 or 2	"	1575 ± 50 (AD 375)	AD 375-575	Gro-943	de Vries & Waterbolk (1958): 1555; cf GL-37, diff pretreatment
Wadi Murabba'at: Cave 1 or 2	"	1815 ± 50 (AD 135)	AD 190-235	GrN-943	RMCI (1967): 35; corrected date for Gro-943

Wadi Murabba'at: Cave 1 or 2	"	1550 ± 75 (AD 400)	AD 410-585	Gro-965	de Vries & Waterbolk (1958): 1555; cf GL-37, diff pretreatment
Wadi Murabba'at: Cave 1 or 2	"	1790 ± 75 (AD 160)	AD 205-245	GrN-965	RMCI (1967): 35; corrected date for Gro-965
		Roman Period (?)			
Timna: Site 200, Nabataean furnace	Charcoal	2779 ± 55 (829) $\delta^{13}C = -13.8°/_{oo}$	930-825 BC	BM-1117	R (1979) 21: 349
		Late Roman/Byzantine Period			
Ashkelon: City wall, just S of E gate, 50-120cm ab ground level	Organic inclusions in mortar	1630 ± 50 (AD 320)	AD 245-465	GrN-7987	Kedar & Mook (1978)
		Late Roman-Early Byzantine Period			
Hayonim Cave: Hearth at top of Str B (= Natufian)	?	1310 ± 65 (AD 640)	AD 610-780	Hv-2675	Bar-Yosef & Goren (1973): 51; Belfer-Cohen & Bar-Yosef (1981): 19-20
Hayonim Cave: Hearth at top of Str B (= Natufian)	?	1845 ± 65 (AD 105)	AD 35-230	Hv-?	Bar-Yosef & Goren (1973): 51; Belfer-Cohen & Bar-Yosef (1981): 19-20
		Byzantine Period			
Monastery of St Catherine: Church of the Transfiguration, roof truss over nave	Wood	1435 ± 120 (AD 515)	AD 540-635	M-1673	R (1966) 8: 283

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
Monastery of St Catherine: Church of the Transfiguration, roof truss over nave	Wood	1215 ± 120 (AD 735)	AD 630-895	M-1674	R (1966) 8: 283
Monastery of St Catherine: Church of the Transfiguration, roof truss over nave	Wood	1315 ± 120 (AD 635)	AD 595-855	M-1675	R (1966) 8: 283
Monastery of St Catherine: Church of the Transfiguration, window chassis	Wood	1700 ± 120 (AD 250)	AD 215-440	M-1676	R (1966) 8: 283; cf entry below
Monastery of St Catherine: Church of the Transfiguration, window chassis	"	1500 ± 120 (AD 450)	AD 420-610	M-1676	R (1966) 8: 283; re-run of sample, no change in lab no.
Monastery of St Catherine: Church of the Transfiguration, roof truss over nave	Wood	150 ± 100 (AD 1800)	Too young to be meaningfully calibrated	M-1677	R (1966) 8: 283; cf entry below
Monastery of St Catherine: Church of the Transfiguration, roof truss over nave	"	0 ± 100 (AD 1950)	---	M-1677	R (1966) 8: 283; re-run of sample, no change in lab no.

Monastery of St Catherine: Church of the Transfiguration, withe from window armature	Wood	"Modern"	---	M-1812	R (1968) 10: 108
Monastery of St Catherine: Church of the Transfiguration, roof truss over nave	Wood	1280 ± 140 (AD 670)	AD 595-890	M-1813	R (1968) 10: 108
Monastery of St Catherine: Church of the Transfiguration, window	Wood	200 ± 100 (AD 1750)	AD 1630-1850 (Stuiver corrected)	M-1814	R (1968) 10: 108
Monastery of St Catherine: Church of the Transfiguration, roof truss over nave	Wood (sapwood, bark and branches visible)	1330 ± 40 (AD 620) $\delta^{13}C = -24.6°/_{oo}$	AD 605-765	BM-1222	R (1982) 24: 164
Monastery of St Catherine: Church of the Transfiguration, NW corner tower ceiling	Wood	1450 ± 50 (AD 500) $\delta^{13}C = -23.0°/_{oo}$	AD 560-615	BM-1223	R (1982) 24: 165
Monastery of St Catherine: Church of the Transfiguration, roof purlin over nave	Wood	1490 ± 60 (AD 460) $\delta^{13}C = -24.9°/_{oo}$	AD 445-600	BM-1224	R (1982) 24: 165

Provenience	Material	^{14}C date BP (BC)	CRD-1σ date	Lab no.	Refs and Remarks
		Crusader Period			
Caesarea: City wall, S of E gate	Organic inclusions in mortar (poss Phoenix dactylifera)	960 ± 160 (AD 990)	AD 890-1235	RT-?	Kedar & Kaufman (1975)
		Ottoman Period (?)			
Khirbet Umm ad-Dananir: Field V, Area 2, Surface of Loc 6	Dessicated wood	250 ± 50 (AD 1700)	AD 1540-1795 (Stuiver corrected)	P-3218	R (1984) 26: 223
		Modern Period (?)			
Bab edh-Dhra: Field H.3, Loc 4	Peach pit	"Modern"	---	QL-1558	Unpub; pers commun, W E Rast & R T Schaub
		Archaeological date unknown			
Caesarea: Burial, 125cm bs	Human bone (collagen)	240 ± 150 (AD 1710)	AD 1465-1700 (Stuiver corrected)	UCR-276	R (1982) 24: 64
Gibeon: Sndg in Area 10-N-4, Level 6	Charcoal, limestone	3164 ± 48 (1214)	1570-1380 BC	P-838	R (1965) 7: 194
Gibeon: Sndg in Area 10-N-4, Level 6	Charcoal	3148 ± 119 (1198)	1640-1340 BC	P-839	R (1965) 7: 194
Gibeon: Sndg in Area 10-M-4/4, Rm 2	Charcoal, dirt	3231 ± 57 (1281)	1670-1420 BC	P-840	R (1965) 7: 194
Jebel Khirbet en-Nahas: Slag pile	Charcoal	2540 ± 200 (590)	875-410 BC	W-4051	Overstreet, Grimes, & Seitz (1982): 97, 107, table 20

Jebel Khirbet en-Nahas: Slag pile	Charcoal	3220 ± 200 (1270)	1750-1270 BC	W-4456	Overstreet, Grimes, & Seitz (1982): 97, 124, table 20
Jericho: "1/3 to 1/2 of total depth of pit, 250 cm"	Charcoal	4200 ± 70 (2250)	2925-2780 BC	BONN-746	R (1973) 15: 36
Jericho: "Same location...350 cm"	Charcoal	5110 ± 110 (3160)	3965-3780 BC	BONN-747	R (1973) 15: 36
Jericho: Site M I, St/ph XIII.lxxiva	Charcoal	40,500 ± 2700 (38,550) $\delta^{13}C = -28.0°/_{oo}$	---	BM-1325	Burleigh (1981): 502; R (1982) 24: 166; "invalidated by misassoc"
Timna: "Grave" in "Wadi Fimnah"	Charcoal	2655 ± 65 (705)	870-785 BC	Gro-938	de Vries & Waterbolk (1958): 1555; "Fimnah" evidently a misprint for "Timnah"
Wadi Feinan-Wadi Dana area: slag pile	Charcoal	3000 ± 300 (1050)	1670-825 BC	W-4054	Overstreet, Grimes, & Seitz (1982): 97, 107, table 20

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Addendum

Two items came to the author's attention too late to be included in the article above. (1) Fourteen new dates (Hel-1417 to -1424, Pta-3320, -3336, -3364, -3368 to -3370) from Middle and Late Bronze age and Iron age strata at Lachish have just appeared in print (Ussishkin, 1983, p 164-165, tables 2-3). (2) Based on conversations with other archaeologists and remarks made in several recent publications, it would appear that there are at present 35-40 unpublished ^{14}C dates. They come from at least 6 sites in Jordan, southern Israel, and Sinai and derive mostly from Neolithic and Chalcolithic contexts, though there are a few Epipalaeolithic and EB IV dates.

[RADIOCARBON, VOL 26, NO. 3, 1984, P 367-383]

HAMBURG UNIVERSITY RADIOCARBON DATES IV

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This list consists of dates of soil samples from selected soil profiles in Tunisia, Sudan, and Argentina. The profiles from Tunisia were taken to elucidate ages of typic paleosols of paleoclimatic significance. The Sudan profiles increase our understanding of pedogenesis of Sudanese Vertisols. The existence of pedoturbation in these profiles is further explored and questioned. The profiles of Argentina were dated to supplement information from chemical and micromorphological studies.

ACKNOWLEDGMENTS

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SAMPLE DESCRIPTIONS

SOIL SAMPLES

Pretreatment of soil samples is described by Scharpenseel and Pietig (1969) and Scharpenseel (1972; 1977).

Tunisia

Dates are from genetic horizons or layers of soil largely characteristic of paleosols throughout Tunisia.

HAM-1029. **2420 ± 70**

Fossil gyttja, 12km NW of Degache, Chott el Rharsa (34° 5′ N, 8° 11′ E), 68cm depth.

HAM-1030. **22,730 ± 400**

Paleargid near Algerian border (33° 50′ N, 7° 43′ E), underlying fringes of dunes, 70 to 80cm depth.

HAM-1031. **8050 ± 100**

Oued Lakarit (34° 3′ N, 10° 2′ E), fA overlying fBt, 250cm depth.

HAM-1032. **3470 ± 70**

Buried Argixeroll, 12km before Ksour Essaf (35° 23′ N, 10° 54′ E), 90 to 100cm depth.

HAM-1033. **4550 ± 80**

Tirsoid Vertisol, Sta d'Amélioration des Parcours (36° 11′ N, 10° 29′ E) 200cm depth.

HAM-1034. **7960 ± 110**

Palexeroll, 18km before Tadjerouine (from Le Kef), (36° 5′ N, 8° 39′ E), 70cm depth.

HAM-1035. **8520 ± 180**

Same profile, fAh, 180 to 210cm depth. Samples coll and subm 1981 by H W Scharpenseel. *Comment*: results agree with previous soil dates from Tunisia, BONN-433 and -434, HAM-157, -174, and -258, -259 (R, v 12, p 33; v 18, p 282-283; v 19, p 172) regarding three main phases of age ca 2500, 4500-5000, and 8000 BP. HAM-1030 is important, representing soil formation in older pluvial.

Dates from paleosols of deep Tunisian soil profiles located in different climatic zones from perhumid to Saharian.

HAM-1222. **2790 ± 80**

Paleosol 20km W of Nefta (33° 48′ N, 7° 40′ E), exposed in sand dunes, 0.22% C, 0 to 20cm depth.

HAM-1223. **10,260 ± 120**

Same profile, 0.11% C, 60 to 80cm depth.

HAM-1224. **3350 ± 100**

Paleosol, N rim of Chott Djerid, 300m W, 13km to Nefta (33° 51′ N, 8° 31′ E), 0.23% C, 32 to 51cm depth.

HAM-1225. **4330 ± 90**

Same profile, 0.26% C, 73 to 90cm depth.

HAM-1226. **3980 ± 90**

Same profile, 0.15% C, 100 to 105cm depth.

HAM-1227. **1950 ± 60**

Humic layer in exposed gravel terrace, 7m towards Chott from HAM-1224, 40cm depth.

HAM-1229. **920 ± 80**

Paleosol, W bank, 300m N of streetbridge G P 16, Kebili to Gabès, 62km W of Gabès (33° 48′ N, 9° 36′ E), marl, 0.14% C, 50 to 80cm depth.

HAM-1233. **4810 ± 80**

Polyphasic steppe soil N of steep bank of Oued Ersifa, E St M C 107, Gabès-Matmata, ca 25km to Matmata (33° 46′ N, 10° 03′ E), 0.22% C, 0 to 20cm depth.

HAM-1234. **6260 ± 160**

Same profile, 0.04% C, fAh, 160 to 180cm depth.

HAM-1235. **5340 ± 90**

Same profile, 0.13% C, fAh, 220 to 237cm depth.

HAM-1236. **6420 ± 130**

Same profile, 1.15% C, fAh, 250 to 270cm depth.

HAM-1237. **5200 ± 160**

Fossil gleysoil, bank of Oued, 5km N of Remada, near G P 19 (32° 18′ N, 10° 20′ E), 0.04% C, 40 to 60cm depth.

HAM-1239. **5130 ± 80**

Same profile, 0.03% C, fGo, 90 to 120cm depth.

HAM-1240. **7010 ± 170**

Deep cut with several paleosols in bank of Oued Tatahouine, N of Foum Tatahouine, near St G P 19 (32° 58′ N, 10° 28′ E), steppe soil, fAh 0.04% C, 100 to 130cm depth.

HAM-1247. **13,490 ± 220**

Same profile, fossil Bv, 750 to 770cm depth.

HAM-1248. **7880 ± 130**

Cut in Quaternary sediments, 11m deep, with calcareous nodules, ca 300m SW of Matmata-Toujane St, 3.9km from Marhala-Hotel in Matmata (33° 35′ N, 10° 3′ E), 0.09% C, 160 to 200cm depth.

HAM-1249. **6570 ± 200**

Same profile, 0.03% C, 330 to 380cm depth. (Due to very low C concentration slight rejuvenation during handling cannot be excluded).

HAM-1251. **13,530 ± 370**

Paleosol, same profile, 430 to 500cm depth.

HAM-1261. **2820 ± 90**

Sequence of paleosols S of St M 201 Gafsa-Moulares, 18km from center of Gafsa, cut of bank Oued Melah (34° 31′ N, 8° 31′ E), 1.1% C, epipedon 0 to 15cm depth. Following samples are from same profile.

HAM-1264.	0.39% C, 68 to 79cm	3910 ± 80
HAM-1265.	0.5% C, 93 to 105cm	4320 ± 80
HAM-1266.	0.53% C, 105 to 131cm	2920 ± 80
HAM-1267.	2.25% C, 151 to 192cm	4490 ± 80
HAM-1268.	0.63% C, 192 to 200cm	4520 ± 80
HAM-1270.	0.66% C, 219 to 251cm	4340 ± 80
HAM-1271.	0.56% C, 251 to 264cm	3900 ± 80
HAM-1273.	0.58% C, 287 to 303cm	4510 ± 80
HAM-1274.	0.57% C, 319 to 339cm	5520 ± 80

HAM-1275. **117.0 ± 0.6% modern**

Polyphasic paleosol, W El Frouch, foot of Djebel Chambi, E of road to Serept (35° 13′ N, 8° 13′ E), lower part of "Historique layer," 0.26% C, 20 to 30cm depth. Following samples are from same profile.

HAM-1276.	fAh, 0.79% C, 30 to 80cm	1980 ± 70
HAM-1277.	fAh, 1.01% C, 80 to 110cm	1090 ± 70
HAM-1278.	fAh, 0.70% C, 110 to 160cm	5100 ± 80
HAM-1279.	fBt, 0.55% C, 160 to 200cm	7270 ± 90

HAM-1283. **4080 ± 80**

Red relic soil in crevices of rock, Sta Bordj Chambi, Djebel Chambi (35° 15′ N, 8° 40′ E), 1300m alt, 85 to 200cm depth.

HAM-1285. **1770 ± 80**

Polyphasic paleosol, ca 800m from HAM-1275-79 (35° 13′ N, 8° 43′ E), 0.65% C, 77 to 92cm depth. Following samples are from same profile.

HAM-1286.	fAh, 0.96% C, 92 to 144cm	1000 ± 70
HAM-1287.	0.51% C, 144 to 167cm	1900 ± 80
HAM-1289.	0.37% C, 192 to 225cm	3760 ± 90
HAM-1290.	1.25% C, 225 to 263cm	4880 ± 80
HAM-1292.	0.46% C, 287 to 312cm	4650 ± 80

HAM-1295. **103 ± 0.5% modern**

Cut in bank of Oued Bou Hamid, foot of Djebel Semmama (35° 15′ N, 8° 54′ E), 1.31% C, 10 to 20cm depth. Following samples are from same profile.

HAM-1296.	0.62% C, 40 to 90cm	2220 ± 80
HAM-1298.	0.44% C, 185 to 195cm	2460 ± 80
HAM-1300.	0.94% C, 230 to 240cm	2700 ± 80
HAM-1302.	0.56% C, 333 to 354cm	3270 ± 90
HAM-1303.	0.59% C, 354 to 460cm	2290 ± 80
HAM-1304.		3070 ± 90

Terrace material at foot of profile.

HAM-1305. **2610 ± 90**

Bank of Oued Bou Hamid, profile 200m downstream of HAM-1295-1304, 0.58% C, 52 to 67cm depth. Following samples are from same profile.

HAM-1306.	0.67% C, 67 to 105cm	3460 ± 90
HAM-1307.	0.58% C, 105 to 133cm	3260 ± 80
HAM-1308.	0.42% C, 133 to 169cm	3560 ± 90
HAM-1310.	0.23% C, 189 to 234cm	6860 ± 100
HAM-1311.	0.18% C, 288 to 321cm	14,530 ± 250

HAM-1312. **9920 ± 120**

Transition to terrace material at foot of profile, 0.03% C, 321 to 345cm (slight rejuvenation during processing of sample due to very low organic C content cannot be excluded).

HAM-1313. **900 ± 80**

Organic matter in terrace substrate of Oued Bou Hamid, opposite bank of river and HAM-1305-12, 0 to 40cm depth. Following samples are from same profile.

HAM-1314.	40 to 75cm	1650 ± 80
HAM-1315.	75 to 115cm	2930 ± 80
HAM-1316.	115 to 175cm	3110 ± 80
HAM-1317.	175 to 225cm	4140 ± 90
HAM-1318.	225 to 265cm	4670 ± 90

HAM-1319. **520 ± 70**

Douplex Vertisol, NW Jendouba, N of street to Chamtou, before Satfoura (Oued Bajer) (36° 33′ N, 8° 39′ E), 1.23% C, 63 to 100cm depth. Following samples are from same profile.

HAM-1319*.	HAM-1319 after 6 N HCl hydrolysis	2740 ± 80
HAM-1320.	0.34% C, 116 to 235cm	4840 ± 80
HAM-1321.	0.82% C, 235 to 250cm	4170 ± 100
HAM-1323.	0.45% C, 285 to 324cm	6760 ± 90
HAM-1324.	Flood deposited young material, 324 to 350cm.	1940 ± 80

HAM-1326. **1660 ± 60**

Polyphasic paleosol, bank of Oued Ogla, ca 2km W of street G P 17, Le Kef—Tadjerouine, N bank (36° 5′ N, 8° 38′ E), 0.74% C, 0 to 40cm depth. Following samples are from same profile.

HAM-1327.	1.15% C, 80 to 110cm	3100 ± 70
HAM-1329.	1.38% C, 146 to 178cm	5550 ± 80
HAM-1330.	0.88% C, 178 to 210cm	4270 ± 90

HAM-1333. **122.5 ± 0.7% modern**

Medjerdah alluvium, E Tebourba, S of street Tebourba to Tunis (36° 49′ N, 9° 53′ E), 0.84% C, 47 to 64cm depth. Following samples are from same profile.

HAM-1334.	0.49% C, 80 to 110cm	106.6 ± 0.5% modern
HAM-1335.	0.57% C, 110 to 140cm	1730 ± 80
HAM-1336.	0.37% C, 140 to 182cm	1240 ± 80

HAM-1337.	0.47% C, 182 to 212cm	2790 ± 80
HAM-1338.	0.75% C, 212 to 258cm	5620 ± 90
HAM-1339.	0.37% C, 252 to 306cm	5850 ± 90
HAM-1340.	0.25% C, 306 to 420cm	3350 ± 100

HAM-1341. **2420 ± 80**

Alluvium of Oued Miliane, N of street Pont du Fahs-Smindja, 10km from Pont de Fahs (36° 28′ N, 9° 56′ E), 0.40% C, 130 to 156cm depth. Following samples are from same profile.

HAM-1342.	0.78% C, 156 to 189cm	2830 ± 80
HAM-1343.	0.80% C, 225 to 258cm	3100 ± 80
HAM-1346.	0.19% C, 323 to 378cm	3350 ± 90

HAM-1347. **100% of modern**

Wadi with paleosols, N of G P 3, road from Kairouan to Sbeitla, 1300m W crossing Sbeitla-Kairouan-Tunis (35° 36′ N, 10° 1′ E), entrance to quarry, 0.32% C, 0 to 20cm depth. Following samples are from same profile.

HAM-1348.	0.33% C, 20 to 42cm	90 ± 80
HAM-1349.	0.32% C, 42 to 68cm	2030 ± 80
HAM-1350.	0.42% C, 68 to 87cm	2530 ± 80
HAM-1351.	0.57% C, 87 to 115cm	2650 ± 80
HAM-1352.	0.81% C, 130 to 172cm	4030 ± 90

HAM-1358. **4930 ± 90**

Cut in alluvium of Oued Melize, S of G P 6, Jendouba to Ghardimaou, near bridge (36° 28′ N, 8° 29′ E), fAh, 0.43% C, 290 to 340cm depth. Following samples are from same profile.

HAM-1360.	fAh, 0.36% C, 404 to 460cm	6560 ± 120
HAM-1361.	fAh, 0.76% C, 530 to 580cm	3510 ± 80
HAM-1362.	fAh, 0.77% C, 580 to 630cm	4460 ± 90
HAM-1363.	fAh, 0.60% C, 630 to 675cm	6420 ± 100
HAM-1364.	fAh, 0.34% C, 675 + cm	11,020 ± 130

HAM-1365. **146.5 ± 0.5% modern**

W of G P 1, Tunis—Sfax, km 84 to Sousse, near crossing, Hammamet R cut (36° 25′ N, 10° 28′ E), fAh, 0.19% C, 80 to 125cm depth. Following samples are from same profile.

HAM-1366.	0.19% C, 125 to 150cm	780 ± 80

HAM-1367. 0.67% C, 150 to 180cm 620 ± 80

HAM-1369. **1040 ± 80**

Paleosol in bank of Oued Guilene, E of G P 12, Haffouz to Maktar, near bridge (35° 50′ N, 9° 14′ E), fAh, 0.34% C, 40 to 60cm.

HAM-1371. **950 ± 80**

Paleosol in bank of Oued Hatab, S of G P 4, Maktar to Tebessa (35° 44′ N, 9° 3′ E), 300m before crossing with M C 71, 100m from street, fAhGr, 0.43% C, 380 to 450cm. Following samples are from same profile.

HAM-1372. 0.75% C, 450 to 497cm 2530 ± 70

HAM-1373. 0.89% C, 497 to 558cm 3880 ± 90

HAM-1374. 0.59% C, 558 to 586cm 3150 ± 90

HAM-1375. 0.35% C, 586 to 617cm 3450 ± 70

HAM-1376. 0.23% C, 617 to 650cm 6420 ± 100

HAM-1377. 0.32% C, 650 to 690cm 8080 ± 130

HAM-1378. **1790 ± 80**

Paleosol in N bank of Medjerdah R, 500m E of bridge Ghardimaou (36° 26′ N, 8° 22′ E), 0.26% C, 80 to 120cm. Following samples are from same profile.

HAM-1379. 0.40% C, 200 to 240cm 1420 ± 80

HAM-1380. 0.37% C, 270 to 400cm 3820 ± 80

HAM-1381. Parallel sample to HAM-1380, but 100m W. 15,000 ± 210

Samples coll and subm 1979 by H Schiffmann and H U Neue, Ordinariat f Bodenkunde, Univ Hamburg. *Comment*: most paleosols indicate origin during Rharbien/Holocene. Only HAM-1247, -1251, -1311, -1364, -1381 reach into late Soltanien/Würmian; HAM-1030, a buried Argid, suggests soil formation during Soltanien pluvial/Würmian high glacial.

In all other paleosol/sediment samples, ratio of organic to carbonate C was too low for reliable sample of 3g organic C after carbonate destruction. Our efforts were wasted, when we tried to produce datable samples from materials of low organic C but high carbonate C. The benzene method, requiring 2 to 3g C, is obsolete for such samples that contain <0.1% organic C.

Results further indicate, that depth of "Historique-layer" as well as of Rharbien/Holocene soils is often underestimated due to extensive fluvial transport during rainy season or torrential floods in ustic and xeric climate. Some anomalous dates, mostly at greater depth (HAM-1249, -1266, -1277, -1303, -1324, -1330, -1340, -1361, -1374) are explainable only by flood deposition of substantial lumps of soil at the flank of the riverbed. Another explanation, animal transport of younger organic matter cannot be excluded. The results confirm our hypothesis, that dating of

such sediments, eg, for paleoclimatic inf, is not very reliable when based on single or few samples. Layer by layer sampling and dating of 5 to 2cm intervals, including $\Delta^{13}C$, as we are doing now in connection with other sample collns, guarantees max resolution of C dynamics.

Results of Tunisia series including earlier dates (BONN-433 and -434; HAM-157 to -174, -258 and -259 (R, v 12, p 33; v 18, p 282-283; v 19, p 172) confirm strongly developed soil formation, frequently in several distinguishable phases during Rharbien (Scharpenseel & Zakosek, 1979; Scharpenseel *et al*, 1980; Scharpenseel *et al*, in press). Figures 1a and 1b are histograms of all available ^{14}C dates of Tunisian soil sediment and groundwater samples, indicating time intervals of higher humidity responsible for soil and groundwater formation. Since sampling was done rather randomly all over the country, the number of samples of certain ages may reflect, within limits of total number of samples, frequency of occurrence of different ages.

Sudan

Thirteen soil profiles of Vertisols from Gezira were measured. Instead of coordinates, which were not taken, sampling loci are according to figure 2. Samples are part of large sample colln including Vertisols of all continents (fig 3).

HAM-1407. **640 ± 80**

Profile 1, 1km SW of Wad Shawer, 0 to 20cm depth. Following samples are from same profile.

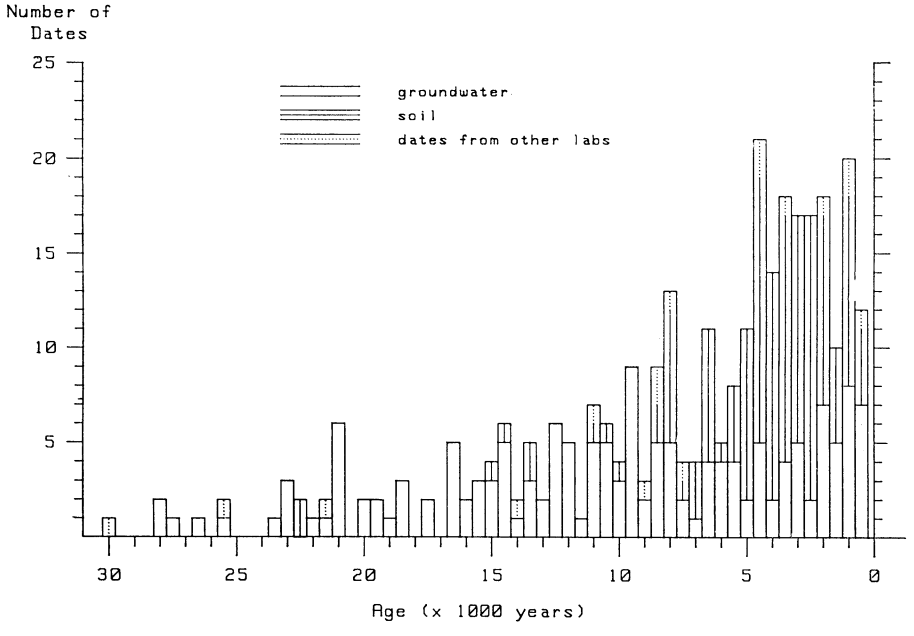

Fig 1a. ^{14}C dates of all available Tunesian groundwater and soil samples; histogram for 500 yr intervals (groundwater dates corrected according to Tamers (1967).

HAM-1408.	20 to 40cm	1720 ± 80
HAM-1409.	40 to 60cm	1870 ± 80
HAM-1410.	60 to 80cm	2640 ± 90
HAM-1411.	80 to 100cm	4660 ± 90
HAM-1412.	100 to 120cm	4680 ± 90
HAM-1413.	120 to 140cm	5190 ± 100
HAM-1414.	140 to 165cm	5580 ± 100
HAM-1415.	165 to 185cm	3390 ± 80
HAM-1416.	185 to 210cm	5050 ± 90
HAM-1417.	210 to 235cm	1900 ± 80
HAM-1418.	235 to 270cm	3470 ± 80
HAM-1419.	270 to 300cm	5770 ± 100
HAM-1420.	300 to 330cm	4780 ± 90

HAM-1424. **1570 ± 80**

Profile 2, Gezira Selemme Hum Dalik Minor/Wad Mahmoud Major, 0 to 15cm depth. Following samples are from same profile.

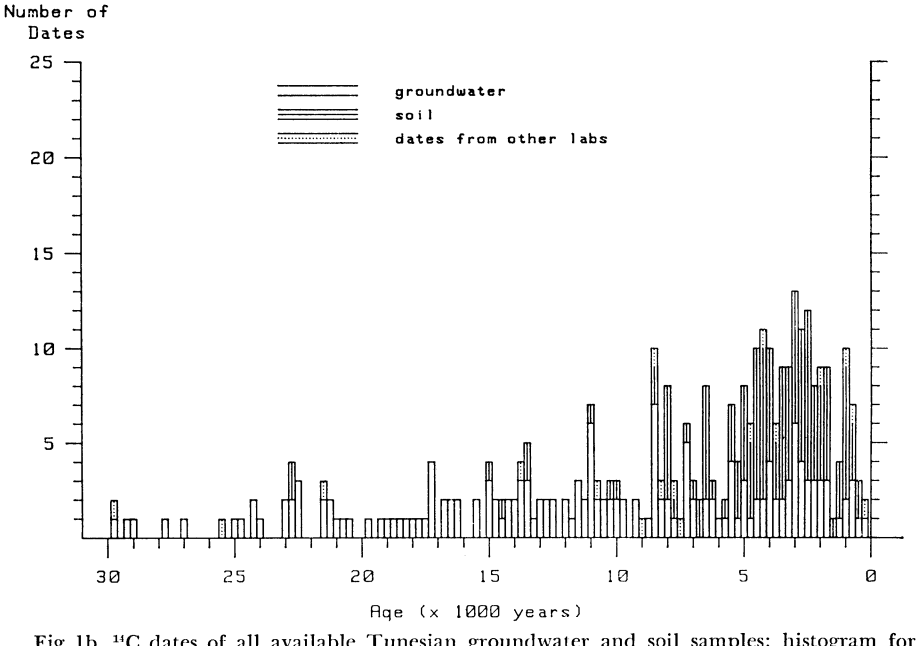

Fig 1b. ^{14}C dates of all available Tunesian groundwater and soil samples; histogram for 250 yr intervals (no groundwater date correction).

HAM-1425.	15 to 40cm	2210 ± 80
HAM-1426.	40 to 65cm	2040 ± 80
HAM-1427.	65 to 90cm	3240 ± 80
HAM-1428.	90 to 120cm	5330 ± 90
HAM-1429.	120 to 140cm	6250 ± 100
HAM-1430.	140 to 160cm	6290 ± 90
HAM-1433.	210 to 245cm	4690 ± 80
HAM-1434.	245 to 280cm	6300 ± 90

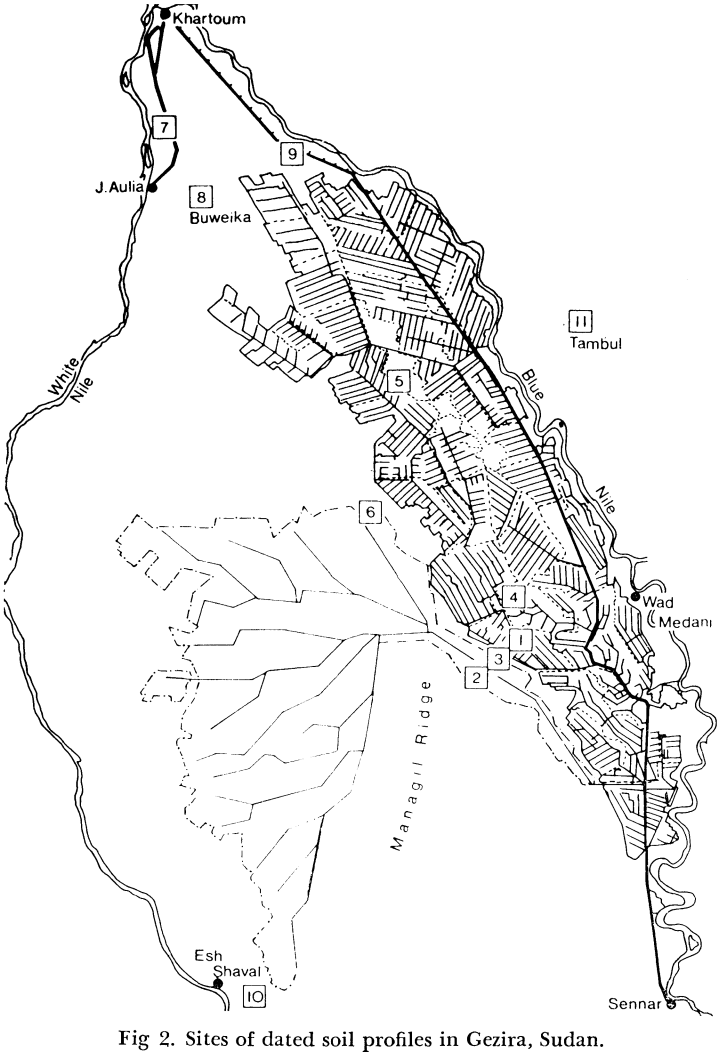

Fig 2. Sites of dated soil profiles in Gezira, Sudan.

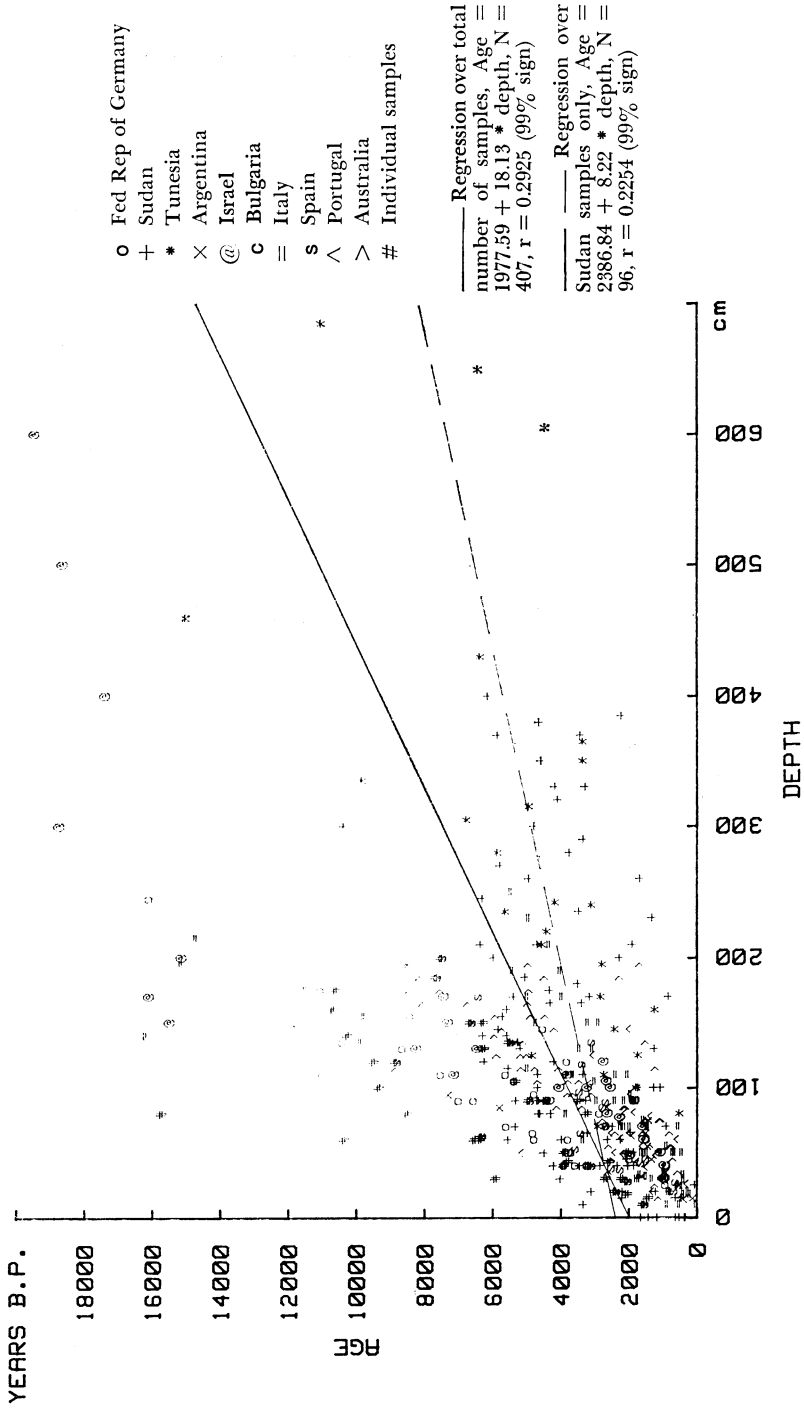

Fig 3. Age *vs* depth, Vertisols (world-wide), id by countries of origin.

HAM-1440. **106.5 ± 1% modern**

Profile 3, Vertisol, 400m W of Saraf Omeir Minor, 0 to 25cm depth. Following samples are from same profile.

HAM-1441.	25 to 45cm	70 ± 70
HAM-1442.	45 to 70cm	2070 ± 80
HAM-1443.	70 to 100cm	2500 ± 120
HAM-1445.	135 to 155cm	5270 ± 140
HAM-1446.	155 to 180cm	5710 ± 100
HAM-1447.	180 to 210cm	3500 ± 90
HAM-1448.	210 to 240cm	6360 ± 130
HAM-1451.	300 to 330cm	10,370 ± 150
HAM-1453.	370 to 400cm	5850 ± 180
HAM-1454.	400 to 430cm	6150 ± 170

HAM-1455. **540 ± 70**

Profile 4, Vertisol, Madina Block 15, 0 to 20cm depth. Following samples are from same profile.

HAM-1456.	20 to 40cm	1230 ± 80
HAM-1457.	40 to 60cm	2350 ± 80
HAM-1458.	60 to 80cm	2260 ± 80
HAM-1459.	80 to 100cm	4620 ± 90
HAM-1461.	120 to 140cm	4210 ± 90
HAM-1463.	165 to 175cm	4320 ± 120
HAM-1464.	175 to 205cm	4390 ± 120

HAM-1473. **370 ± 80**

Profile 5, Vertisol, 1km W of Meheiriba, 0 to 20cm depth. Following samples are from same profile.

HAM-1474.	20 to 40cm	2200 ± 80
HAM-1475.	40 to 65cm	3460 ± 90
HAM-1476.	65 to 90cm	3230 ± 90
HAM-1477.	90 to 115cm	4710 ± 100
HAM-1478.	115 to 145cm	5550 ± 100
HAM-1479.	145 to 170cm	5840 ± 100
HAM-1480.	170 to 200cm	5390 ± 120

HAM-1481.	200 to 230cm	5980 ± 170
HAM-1486.	350 to 380cm	4580 ± 180
HAM-1487.	380 to 410cm	4640 ± 190

HAM-1488. **1180 ± 80**

Profile 6, Vertisol, Qoz er Ruheid, 0 to 20cm depth. Following samples are from same profile.

HAM-1489.	20 to 40cm	1240 ± 80
HAM-1490.	40 to 70cm	2050 ± 80
HAM-1492.	100 to 130cm	1280 ± 80
HAM-1493.	130 to 170cm	1270 ± 100
HAM-1494.	170 to 200cm	3160 ± 80
HAM-1495.	200 to 230cm	2280 ± 110
HAM-1497.	260 to 300cm	4940 ± 250

HAM-1500. **152.8 ± 1.3% modern**

Profile 7, Vertisol in terrace of White Nile, SE rim of Tureina, 0 to 10cm depth. Following samples are from same profile.

HAM-1501.	10 to 30cm	3350 ± 80
HAM-1502.	30 to 50cm	4030 ± 90
HAM-1503.	50 to 70cm	4510 ± 90
HAM-1504.	70 to 90cm	5340 ± 100
HAM-1505.	90 to 110cm	3280 ± 90
HAM-1506.	110 to 140cm	3860 ± 90

HAM-1511. **147.5 ± 4% modern**

Profile 8, Vertisol, 1km W of Buweika, surface sample. Following samples are from same profile.

HAM-1512.	0 to 20cm	1660 ± 80
HAM-1513.	40 to 60cm	2870 ± 90
HAM-1514.	60 to 80cm	3600 ± 90
HAM-1515.	80 to 100cm	4310 ± 100

HAM-1521. **860 ± 80**

Profile 9, Vertisol, 8km W of Mesou dir Secondary scholl, Laota Block, 0 to 20cm depth. Following samples are from same profile.

HAM-1522.	20 to 40cm	3120 ± 90

HAM-1523. 40 to 60cm 4230 ± 250

HAM-1524. 60 to 80cm 5560 ± 100

HAM-1530. **320 ± 70**

Profile 10, Vertisol, 3km NE of Esh Shaval, 0 to 30cm depth. Following samples are from same profile.

HAM-1535. 150 to 180cm 4530 ± 80

HAM-1537. 210 to 240cm 5930 ± 120

HAM-1538. 240 to 285cm 5760 ± 100

HAM-1539. **120 ± 100**

Profile 11, Vertisol, 3km N of Tamsul, 0 to 25cm depth. Following samples are from same profile.

HAM-1540. 25 to 50cm 1780 ± 80

HAM-1541. 50 to 75cm 1930 ± 80

HAM-1542. 75 to 100cm 3220 ± 90

HAM-1543. 100 to 125cm 3850 ± 90

HAM-1544. 125 to 150cm 5260 ± 100

HAM-1545. 150 to 175cm 5190 ± 100

HAM-1546. 175 to 200cm 3660 ± 90

HAM-1547. 200 to 225cm 5320 ± 110

HAM-1012. **125.4 ± 1% modern**

Vertisol, sent by Gezira Admin, Hosh series, entic Pellustert, Ghabsaneblock, 0 to 15cm depth. Following samples are from same profile.

HAM-1013. 15 to 40cm 470 ± 80

HAM-1014. 40 to 90cm 1970 ± 80

HAM-1015. 90 to 135cm 3360 ± 90

HAM-1016. 135 to 180cm 3210 ± 90

HAM-1017. **1390 ± 70**

Vertisol, Seleimi clay, entic Chromustert, Gezira Research Sta, Wad Medani, fallow plot, 0 to 10cm depth. Following samples are from same profile.

HAM-1018. 10 to 30cm 430 ± 70

HAM-1020. 50 to 95cm 480 ± 70

HAM-1021. 95 to 140cm 1740 ± 80

Samples coll and subm 1979 by H Schiffmann and O Khodary, Ordinariat f Bodenkunde, Univ Hamburg and Soil Survey Admin Wad Medani, Sudan. *Comment*: 13 soil profiles of different depth, serving as cross-sec of Gezira Vertisols, reflect age gradients up to ca 10,000 BP, mostly 5000-6000 BP. This coincides with existing estimates (Greene, 1928; Tothill, 1946), placing origin of Gezira soils in Alleröd time, when allowance is made for slow development to climax of humic-C accumulation as well as for inevitable rejuvenation within cracking zone. Self-mulching, accompanied by above-mentioned crack formation during dry season can bring about inflections of age gradient with depth caused by modern organic matter dropping in deepest holes of cracks (profile 1, 5, 7). If below inflection trend of age *vs* depth increase continues, it confirms that pedoturbation ends with deepest point of age inflection (profile 2,11). Interruption of age *vs* depth trend can also be influenced by termite holes and droppings or individual deep roots. Within graph of dated Vertisols of worldwide origin, the correlation of age *vs* depth is highly significant, and dates of Sudanese Vertisols are located mostly below regression line in younger age *vs* depth bracket (see fig 3).

Argentina

Samples dated for genesis of Vertisols in Entre Rios prov, testing extent of vertic soil dynamics (pedoturbation).

HAM-1178. **2810 ± 70**

Soils from rolling pampa near Pergamino (33° 40′ S, 60° 3′ W), vertic Argiudoll, loess, Urquiza series.

HAM-1179. **2220 ± 70**

Typic Argiudoll (34° 13′ S, 60° 49′ W), loess, Rojas series.

HAM-1180. **1650 ± 60**

Typic Hapludoll (34° 53′ S, 60° 25′ W), sandy loess, Segui series.

HAM-1204. **300 ± 50**

Crossing Hwy La Paz to Feliciano street San Gustavo (30° 42′ S, 59° 26′ W), argillic Pelludert, 1.3% C, 15 to 30cm depth. Following samples are from same profile.

HAM-1205.	0.9% C, 30 to 50cm	1120 ± 60
HAM-1206.	0.8% C, 45 to 60cm	1650 ± 80
HAM-1207.	0.8% C, 60 to 75cm	2880 ± 80
HAM-1208.	0.6% C, 75 to 90cm	4440 ± 110

HAM-1209. **106 ± 0.9% modern**

Profile, Fac Agric, UNL near Paraná (31° 50′ S, 60° 32′ W), vertic Pelludert, 1.5% C, 0 to 17cm depth. Following samples are from same profile.

HAM-1210. 1.3% C, 17 to 43cm 240 ± 70

HAM-1211. 1.3% C, 43 to 60cm 440 ± 70

HAM-1212. 0.9% C, 80 to 100cm 2180 ± 90

HAM-1213. **108 ± 1% modern**

Fac Agric, UNL near Paraná (31° 50′ S, 60° 32′ W), Febré 2, vertic Argiudoll, 1.5% C, 0 to 17cm depth.

HAM-1214. **1120 ± 60**

10km SW of General Campos, near main street (31° 26′ S, 58° 25′ W), Yerna 1, argillic Pelludert, 1% C, 15 to 30cm depth. Following samples are from same profile.

HAM-1550. 2.7% C, 0 to 15cm 107 ± 1% modern

HAM-1551. 0.8% C, 30 to 45cm 2320 ± 60

HAM-1552. 0.7% C, 45 to 60cm 2610 ± 70

HAM-1553. 0.6% C, 60 to 75cm 2890 ± 70

HAM-1554. 0.4% C, 75 to 90cm 4140 ± 90

HAM-1666. 0.2% C, 90 to 105cm 3760 ± 70

HAM-1556. **1910 ± 60**

Oro Verde 2, 1.25km NW of Experimental Sta INTA, Paraná (31° 52′ S, 60° 27′ W), Campo anexo, aquic Argiudoll, 0.5% C, 45 to 65cm depth.

HAM-1549. **1110 ± 70**

Fac Agric, UNL near Paraná, Febré 2, vertic Argiudoll, 0.8% C, coord, see HAM-1213, 42 to 58cm depth.

Samples coll and subm by S Stephan, Inst f Bodenkunde, Univ Bonn. *Comment*: soils, investigated by micromorphology, scanning electron microscopy, EDAX and laser-induced mass spectroscopy, and ^{14}C dating show that process of pedoturbation is, at most, very slow and incomplete. ^{14}C age gradients in typical zone of crack formation in real Vertisols is not too pronounced for effective churning and self-mulching system (Stephan *et al,* 1983). As for most vertic soils, tested soil profiles are rather young.

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INSTITUT ROYAL DU PATRIMOINE ARTISTIQUE RADIOCARBON DATES X

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This list contains the results of ^{14}C determinations obtained at the laboratory in 1982-1983.

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GEOLOGIC SAMPLES

Belgium

Doel-Beveren series

Peat and wood from Doel-Beveren in O Vlaanderen (51° 18′ N, 4° 15′ E). Coll Sept 1981 and subm Oct 1982 by C Verbruggen, Univ Gent, Belgium.

IRPA-454. III **4900 ± 60**

Peat from base of thin clay layer at 350cm depth. *Comment* (CV): date is probably correct.

IRPA-455. I **2050 ± 70**

Peat from top of peat layer at 200cm depth. *Comment* (CV): date agrees with extension of *Fagus* in pollen diagram, typical for that period.

IRPA-456. I **3000 ± 70**

Wood from top of peat layer at 200cm depth. *Comment* (CV): date similar to IRPA-455 was expected.

IRPA-457. II **5350 ± 70**

Peat from top of thin layer at 338cm depth. *Comment* (CV): date is too old compared to IRPA-454 at base of layer.

IRPA-458. IV **5490 ± 80**

Peat from base of peat layer at 412cm depth. *Comment* (CV): date confirms onset of peat growth in lower Scheldt-basin.

Assenede series

Peat from Holocene sediment in de Schelde polders at Assenede in O Vlaanderen (51° 16′ N, 3° 47′ E). Coll and subm Sept 1982 by C Baeteman, Geol Service, Belgium.

IRPA-487. B1 **3130 ± 60**

Peat from 168 to 183cm.

IRPA-488. (1) B87 **3790 ± 60**

Peat from 155 to 180cm. Distillation product.

IRPA-488. (2) B87 **3900 ± 60**

Peat from 155 to 180cm.

IRPA-489. B5 **3090 ± 60**

Peat from 140 to 150cm.

IRPA-567. DB3 **4560 ± 70**

Peat from 155 to 160cm.

IRPA-568. DB4 **2230 ± 50**

Peat from 185 to 190cm.

General Comment (CB): IRPA-567 is much older than other dates, most probably due to boring (DB3) in strong micro-relief of top of cover sand. IRPA-568 is much younger than expected most probably due to contamination by younger roots.

Western coastal plain of Belgium series

Peat and wood from several levels of core in W Vlaanderen. Dated to study evolution of so-called surface peat (Baeteman *et al,* 1979; Baeteman, ms). Coll and subm 1982 by C Baeteman.

IRPA-524. Driegrachten 1-A **3610 ± 60**

Wood from 383 to 388cm at Noordschote (50° 57′ 45″ N, 2° 49′ 22″ E).

IRPA-529. Driegrachten 1-B **3540 ± 60**

Peat from 383 to 388cm at Noordschote (50° 57′ 45″ N, 2° 49′ 22″ E).

General Comment (LD): samples date slight increase of marine influence corresponding with end of peat formation in some parts of coastal plain.

IRPA-530. Driegrachten 2 **3790 ± 60**

Peat from 463 to 467cm at Noordschote (50° 57′ 45″ N, 2° 49′ 22″ E).

Comment (LD): dates possible dry period indicated by diatom analysis.

IRPA-531. Driegrachten 3 **5220 ± 70**

Peat from 611 to 617cm at Noordschote (50° 57′ 45″ N, 2° 49′ 22″ E).

IRPA-532. Pervijse Orthodoxe kerk 1 **5130 ± 70**

Peat from 408 to 411cm at Lampernisse (51° 03′ 20″ N, 2° 47′ 32″ E).

IRPA-538. Jacobs 1 **5360 ± 70**

Peat from 410 to 412cm at Oudekapelle (51° 01′ 11″ N, 2° 48′ 10″E).

General Comment (CB): samples date onset of freshwater predominance and early start of continuous peat growth in region. Dates are as expected. They coincide well and show that peat growth started slightly earlier in land areas than in surrounding areas.

IRPA-537. Jacobs 2 **1870 ± 60**

Peat from 217 to 220cm at Oudekapelle (51° 01′ 11″ N, 2° 48′ 10″ E). *Comment* (CB): age indicates that end of peat growth in area is later than in surrounding areas. Date agrees with expected ages as other ^{14}C dates indicated that in this area peat could grow much longer than in surrounding coastal plain.

IRPA-533. Pervijse Orthodoxe kerk 2 **7230 ± 70**

Peat from 882 to 885cm at Lampernisse (51° 03′ 20″ N, 2° 47′ 32″ E).

IRPA-534. Pervijse Orthodoxe kerk 3 **7110 ± 90**

Peat from 875 to 879cm at Lampernisse (51° 03′ 20″ N, 2° 47′ 32″ E).

IRPA-541. Dijk 1 **6680 ± 80**

Peat from 816 to 819cm at Oudekapelle (51° 01′ 11″ N, 2° 48′ 10″ E).

IRPA-542. Dijk 2 **6870 ± 80**

Peat from 833 to 836cm at Oudekapelle (51° 01′ 11″ N, 2° 48′ 10″ E).

General Comment (CB): top and base of basal peat showed that initial marine influence in area was already occurring at beginning of Atlantic period. Dates agree with expected ages in relation to depth.

Oostkerke series

Peat from Oostkerke, W Vlaanderen (51° 02′ 40″ N, 2° 47′ 30″ E). Coll and subm Sept 1982 by C Baeteman.

IRPA-535. 12.24 to 12.27m **6750 ± 80**

IRPA-536. 12.34 to 12.38m **7000 ± 80**

General Comment (CB): samples date top and base of deepest intercalated peat layer, as yet known, in coastal plain in first part of Atlantic period.

Avekapelle series

Peat from Avekapelle, W Vlaanderen (51° 03′ 55″ N, 2° 45′ 55″ E). Coll and subm Sept 1982 by C Baeteman.

IRPA-539. 983 to 990cm **3890 ± 70**

IRPA-540. 760 to 768cm **2680 ± 60**

General Comment (CB): both samples were coll from same tidal channel sequence at rather great depth (−5.7m and −3.5m). Ages show that peat is eroding from surface of upper regional peat layer and not from second regional peat layer occurring at greater depth (−2.5m).

Wulpen series

Peat from Wulpen in W Vlaanderen (51° 06′ N, 2° 42′ 45″ E). Coll and subm March 1982 by C Baeteman. Results used to study stratigraphy in Western coastal plain.

IRPA-527. Wulpen A-1 **3490 ± 60**

Base of upper peat layer at 117cm below surface.

IRPA-528. Wulpen A-2 **2970 ± 60**

Top of upper peat layer at 100cm below surface.

General Comment (CB): samples coll from top and base of upper part of "surface peat" in area divided by intercalated clay layer, corresponding with CIV-B transgression. Age of top coincides well with all other data indicating end of surface peat in W coastal plain. Age of base coincides with some dates of similar series in same area (Baeteman *et al*, 1979).

IRPA-512. Raversyde **2580 ± 60**

Peat from top layer at 349cm below surface in W Vlaanderen (51° 11′ 45″ N, 2′ 52′ 20″ E). Coll and subm Jan 1983 by C Baeteman.

Kallo series

Peat and wood from Kallo, Antwerpen (51° 15′ 45″ N, 4° 14′ 31″ E). Coll and subm May 1982 by D Ferguson, Univ Antwerpen, Belgium.

IRPA-547. Profile 1 **2530 ± 70**

Wood at 190cm below surface.

IRPA-544. Profile 2-1 **2810 ± 60**

Top of peat layer at 130cm below surface.

IRPA-545. Profile 2-2 **4240 ± 70**

Middle of peat layer at 227cm below surface.

IRPA-546. Profile 2-3 **6790 ± 80**

Base of peat layer at 347cm below surface.

Mark series

These results complete pub list (R, 1981, v 23, p 345-346; R, 1983, v 25, p 868-869) of samples from alluvial plain of Mark R in W Vlaanderen and Brabant. Coll and subm 1983 by W Huybrechts, Geol Inst, Free Univ Brussels.

IRPA-506. Galmaarden B80/6/36 Top **2580 ± 60**

Clayey peat 229 to 234cm below surface (50° 45′ N, 3° 57′ E).

IRPA-548. Galmaarden B80/6/36 Base **3260 ± 60**

Clayey peat 280 to 290cm below surface (50° 45′ N, 3° 57′ E).

IRPA-549. Galmaarden B82/6/16 Top **4330 ± 70**

Clayey peat 362 to 367cm below surface (50° 45′ N, 3° 57′ E).

IRPA-550. Galmaarden B81/6/16 Top **5730 ± 80**

Clayey peat 320 to 326cm below surface (50° 45′ N, 3° 57′ E).

IRPA-551. Galmaarden B81/6/16 Base **5770 ± 80**

Clayey peat 341.5 to 350cm below surface (50° 45′ N, 3° 57′ E).

IRPA-552. Herne B81/6/5 Middle **8890 ± 100**

Wood 622 to 625cm below surface (50° 43′ N, 4° 01′ E).

IRPA-554. Herne B81/6/5 Base 10,060 ± 110

Residues of wood 695 to 700cm below surface (50° 43′ N, 4° 01′ E).

IRPA-556. Herne B81/6/9 Base 2390 ± 60

Wood 195 to 200cm below surface (50° 43′ N, 4° 01′ 15″ E).

Other countries

IRPA-543. Hulst 3770 ± 70

Wood (trunk) from upper peat layer in Schelde Channel at Hulst, Zeeuws Vlaanderen, Netherlands (51° 22′ N, 4° 13′ E). Coll and subm March 1983 by S Dievoet.

Djelfa series

Calcareous crusts and organic material from Djelfa, Algeria. Coll and subm Feb 1981 by H Tsaki, Univ Oran, Algeria.

IRPA-451. DJI/E1DZ 7970 ± 370

Organic material from black soil horizon (34° 41′ N, 3° 15′ E) at 850cm in profile. Diluted: 26% sample. Expected age: 7000 to 10,000 BP.

IRPA-459. C107/1DCDZ 21,000 ± 350

Calcareous crust from 20cm depth (34° 52′ N, 3° 27′ E). Expected age: >20,000 BP.

IRPA-460. C88DCDZ 10,570 ± 120

Crusty calcareous tufa from 40cm depth (34° 50′ N, 3° 27′ E). Expected age: 10,000 to 15,000 BP.

IRPA-461. C13bis 1DCDZ >47,000

Calcareous crust from 10cm depth (34° 53′ N, 3° 26′ E). Expected age: >30,000 BP.

IRPA-462. C13/2DCDZ 26,000 ± 800

Crusty calcareous tufa from 25cm depth (34° 53′ N, 3° 27′ E). Expected age: >30,000 BP.

IRPA-463. C13/1DCDZ 14,910 ± 180

Calcareous crust from 10cm depth (34° 53′ N, 3° 27′ E). Expected age: >25,000 BP.

IRPA-464. DCI/ODZ 31,200 ± 1300

Calcareous and friable crust from 80cm depth (34° 53′ N, 3° 26′ E). Expected age: >30,000 BP.

IRPA-465. DCI/00DZ 31,600 ± 1300

Calcareous crust from 30cm depth (34° 53′ N, 3° 26′ E). Expected age: >30,000 BP.

IRPA-466. DCI/000DZ 22,200 ± 430

Calcareous crust from 10cm depth (34° 53′ N, 3° 26′ E). Expected age: >30,000 BP.

IRPA-467. C52DCDZ **25,100 ± 600**

Calcareous crust from 30cm depth (34° 51′ N, 3° 27′ E). Expected age: >20,000 BP.

IRPA-468. DJII/2DZ **34,400 ± 2100**

Calcareous crust from 20cm depth (34° 50′ N, 3° 20′ E). Expected age: >40,000 BP.

IRPA-469. DCI/3DZ **11,730 ± 140**

Calcareous and friable crust from 50cm depth (34° 51′ N, 3° 27′ E).

IRPA-470. DJII/7DZ **>48,000**

Calcareous crust, very powdery, from 180cm depth (34° 40′ N, 3° 20′ E). Expected age: >40,000 BP.

IRPA-471. DJII/4DZ **36,800 ± 2800**

Crusty calcareous tufa from 60cm depth (34° 40′ N, 3° 20′ E). Expected age: >40,000 BP.

General Comment (HT): all samples are of Würmian or Soltanien age in stratigraphy of North Africa, which indicate that crusts have been redeposited. This can be explained by running water during last period of rain. Chronology of layers follows: crusts (IRPA-460 and -469) and crusts (IRPA-459) of Tensifto-Amirien glacis from middle Quaternary are younger than crust (IRPA-462) and crust (IRPA-466) of Soleto-Moulouyenne outliers from lower Quaternary. Results confirm geomorphologic layers.

ARCHAEOLOGIC SAMPLES

Belgium

IRPA-526. Evergem **3480 ± 60**

Charcoal from Evergem, O Vlaanderen (51° 6′ 36″ N, 3° 42′ 32″ E). Coll and subm Dec 1982 by C Verbruggen. Archaeol date: Bronze age.

Destelbergen series

Charcoal from graves, Destelbergen, O Vlaanderen (51° 03′ 16″ N, 3° 46′ 40″ E). Coll and subm June 1982 by H Thoen, Univ Gent, Belgium.

IRPA-476. Grave 84 **2430 ± 50**

Sample from 64 to 94cm depth. Expected age: Bronze or Early Iron age.

IRPA-477. Grave 87 **2410 ± 50**

Sample from 67 to 77cm depth. Expected age: late Bronze or Early Iron age.

IRPA-505. Webbekom **2230 ± 70**

Charcoal from Webbekom, Brabant (50° 57′ 54″ N, 5° 04′ 26″ E). Coll and subm March 1982 by L Van Impe, Natl Service Excavations, Belgium. *Comment*: no NaOH pretreatment. Archaeol date: 2650 to 2300 BP.

Donk series

Samples from Donk, Limburg (50° 56′ N, 5° 07′ 30″ E). Coll and subm May 1983 by L Van Impe.

IRPA-507. 82DO554 **1010 ± 50**

Charcoal from 80 to 100cm depth. Expected date: 2400 to 2200 BP.

IRPA-508. 81DO507 **1220 ± 70**

Charcoal from 90 to 110cm depth. Diluted: 41% sample. Expected date: 3950 to 3450 BP.

IRPA-509. 80DO429 **1740 ± 80**

Charcoal from 70 to 80cm depth. Diluted: 57% sample. Expected date: 1700 to 1550 BP.

IRPA-510. 81DO515 **1440 ± 50**

Wood from well at 185 to 205cm below water-bearing bed. Expected date: 2650 to 1550 BP.

IRPA-511. 81DO505 **3110 ± 60**

Charcoal from 130 to 140cm depth. Expected date: 2650 to 2350 BP.

IRPA-503. 81 Wellin B2 **1420 ± 70**

Charcoal from Wellin, Luxembourg (50° 5′ 2″ N, 5° 6′ 54″ E), at 185cm below surface. Coll and subm Aug 1981 by A Matthys, Natl Service Excavations. Expected date: 1850 BP.

Ucimont series

Charcoal from Ucimont, Luxembourg (49° 49′ 54″ N, 5° 3′ 21″ E). Coll and subm 1982 by A Matthys. No archaeol data.

IRPA-522. UC79/n°2 **1390 ± 50**

IRPA-523. UC79/n°1 **Modern**

IRPA-525. 77 Cu 10 **Modern**

Charcoal from Cugnon, Luxembourg (49° 48′ 9″ N, 5° 12′ 14″ E), at 125cm below surface. Coll 1977 and subm 1982 by A Matthys.

IRPA-606. Karbonkelhuis **610 ± 50**

Timber from Karbonkelhuis, Antwerpen (51° 13′ 16″ N, 4° 23′ 60″ E). Subm Jan 1984 by P de Henau, Inst Royal Patrimoine artistique. *Comment*: dated to establish original building 16th century or 19th century rebuilding. Calibrated date (Klein *et al*, 1982): AD 1270-1410. Since sample was taken from beam, annual rings are missing; accounting also for drying time of wood, date agrees with 16th century construction.

Mortar series

Dating of mortars has been studied in our lab since 1980. With collaboration of Centre de Datation et d'Analyses isotopiques, Univ Claude Bernard, Lyon, France, we have followed a method based on those of

Folk and Valastro (1976). Results come from activity measurement of "hypothetical fraction" where no "dead carbonate" has reacted. Isotopic fractionation correction was made (Van Strydonck, Dupas, & Dauchot-Dehon, in press).

IRPA-296. St Lambert **1740 ± 60**

Mortar from St Lambert cathedral, Liège (50° 38′ 45″ N, 5° 34′ 30″ E). Coll and subm 1979 by H Danthine, Univ Liège. Sample was taken from underground remains of wall constructed between 7th and 13th century, at 1.8m below street level.

IRPA-490. Antwerpen **530 ± 50**

Mortar from "Onze-Lieve-Vrouw" cathedral, Antwerpen (51° 13′ 16″ N, 4° 23′ 60″ E). Coll and subm 1982 by M Van Strydonck. Sample was taken from column of bricks embedded in sandstone at 6m above street level. Column is loc in nave of church, built between 530 and 515 BP.

IRPA-496. Vrasene 1 **1600 ± 60**

Very powdery mortar from "Heilige-Kruis" church, Vrasene, O Vlaanderen (51° 13′ N, 4° 12′ E). Coll and subm 1982 by M Van Strydonck. Sample was taken from Romanesque bench surrounding pillar built between 800 and 767 BP.

IRPA-497. Vrasene 2 **870 ± 50**

Mortar from same church. Coll and subm 1982 by M Van Strydonck. Sample was taken from chalk blending used during construction period (ca AD 1350) at street level.

General Comment: IRPA-490 and -497 agree with historic age. IRPA-296 is too old but contamination by running water containing carbonate is possible because of location of sample. For IRPA-496, method of "hypothetical fraction" does not work probably because sample is very powdery. If we assume that at first approximation, measured $\delta^{13}C$ is proportional to abundance of "live" carbonate, we can calculate theoretical date which corroborated historic age, 980 ± 80 BP, (Van Strydonck, Dupas, & Dauchot-Dehon, in press).

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[RADIOCARBON, VOL 26, NO. 3, 1984, P 392-411]

UNIVERSITY OF LUND RADIOCARBON DATES XVII

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INTRODUCTION

Most of the ^{14}C measurements reported here were made between October 1982 and October 1983. Equipment, measurement, and treatment of samples are as reported previously (R, 1968, v 10, p 36-37; 1976, v 18, p 290; 1980, v 22, p 1045).

Age calculations are based on a contemporary value equal to 95% of the activity of NBS oxalic acid standard (No. 4990A) and on the conventional half-life for ^{14}C of 5568 yr. Results are reported in years before 1950 (years BP). Errors quoted with the dates are based on counting statistics alone and are equivalent to ± 1 standard deviation ($\pm\sigma$).

Corrections for deviations from $\delta^{13}C = -25.0‰$ in the PDB scale are applied for almost all samples; also for marine shells. The apparent age for marine material due to the reservoir effect must be subtracted from our dates on such samples.

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 samples is calculated from yield of CO_2 by combustion of gelatine remaining after treatment. 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

GEOLOGIC SAMPLES

Sweden

Sännen series

Water mosses and other coarse organic matter washed from sediment from SE corner of Lake Sännen, 13km N of Listerby, Blekinge (56° 19′ N, 15° 23′ E). Coll 1982 and subm by S Björck, Dept Quaternary Geol, Univ Lund. Dating is part of study of deglaciation chronology of S Sweden (Björck, 1979; 1981). Depths refer to water surface. All samples pretreated with HCl.

12,190 ± 80

Lu-2103. Sännen 1, 600 to 605cm $\delta^{13}C = -25.7‰$

Water mosses and other coarse organic matter from slightly muddy clay underlain by unvarved and varved clay, 260 to 265cm below sediment surface. Regional Pollen Assemblage Zone 2 corresponding to Older Dryas Chronozone (Björck, 1979, p 41-45 & p 126, fig 43a; 1981, p 18-19 & p 48, fig 42A). *Comment*: (3 1-day counts.)

12,080 ± 90

Lu-2104. Sännen 2, 595 to 600cm $\delta^{13}C = -25.4‰$

Water mosses and other coarse organic matter from clay, 255 to 260cm below sediment surface. Same pollen zone as Lu-2103, above. *Comment*: (3 1-day counts.)

11,960 ± 90

Lu-2105. Sännen 3, 590 to 595cm $\delta^{13}C = -26.2‰$

Coarse organic matter, mainly water mosses, from clay gyttja, 250 to 255cm below sediment surface. Regional Pollen Assemblage Zone 3 corresponding to 1st half of Allerød Chronozone. *Comment*: (3 1-day counts.)

11,630 ± 90

Lu-2164. Sännen 4, 580 to 585cm $\delta^{13}C = -26.3‰$

Coarse organic matter, mainly moss remains, 240 to 245cm below sediment surface. End of Regional Pollen Assemblage Zone 3. *Comment*: (3 1-day counts.)

10,790 ± 260

Lu-2165. Sännen 5, 570 to 575cm $\delta^{13}C = -25.0‰$

Coarse organic matter, mainly water mosses, 230 to 235cm below sediment surface. End of Regional Pollen Zone 4 corresponding to end of Allerød Chronozone. *Comment*: sample very small; diluted; 19% sample. (4 1-day counts.)

10,510 ± 80

Lu-2166. Sännen 6, 560 to 565cm $\delta^{13}C = -25.8‰$

Coarse organic matter, mainly water mosses, 220 to 225cm below sediment surface. Later part of Regional Pollen Assemblage Zone 5 corresponding to 1st half of Younger Dryas Chronozone. *Comment*: (3 1-day counts.)

Dags Mosse series II

Sediment and peat from S part of Dags Mosse, SW of Lake Tåkern, Östergötland (58° 19.5′ N, 14° 42′ E). Coll 1982 by H Göransson and T Persson; subm by H Göransson, Dept Quaternary Geol, Univ Lund. Dated as complement to Dags Mosse Series I (R, 1983, v 25, p 877-880). Depths refer to present bog surface. All samples pretreated with HCl.

7010 ± 70

Lu-2106. Dags Mosse 1982:I $\delta^{13}C = -29.9‰$

Coarse detritus gyttja, rich in rootlets, 503.5 to 506.5cm. Just below empirical *Tilia* limit.

7000 ± 70

Lu-2107. Dags Mosse 1982:II $\delta^{13}C = -27.5‰$

Coarse detritus gyttja, rich in *Phragmites* rootlets, 493.5 to 496.5cm. Empirical *Tilia* limit (*Tilia* increasing from 0.7 to 1.7%).

6970 ± 70

Lu-2108. Dags Mosse 1982:III $\delta^{13}C = -28.1‰$

Phragmites peat, 446 to 449cm. Rational *Tilia* limit (*Tilia* increasing from 2.7 to 6%).

General Comment (HG): date for rational *Tilia* limit (Lu-2108) agrees with dates for this limit from other studies. Unexpectedly small age differences between samples may be explained by very rapid sediment and peat accumulation, or by some rejuvenation of Lu-2106 and -2107 by penetrating rootlets, or both.

Håkulls mosse series (III)

Sediment from Håkulls mosse on hill ridge Kullaberg, NW Scania (56° 17′ N, 12° 31′ E). Alt ca 125m. Coll 1975 and subm by B E Berglund, Dept Quaternary Geol, Univ Lund. Samples are from Cores I and II taken with Livingstone sampler, 10cm diam. Depths refer to bog surface. For other dates from Håkulls mosse, see R, 1978, v 20, p 416-417; 1980, v 22, p 1049-1050. Pretreated with HCl. (3 1-day counts for all samples.)

11,370 ± 80

Lu-2119. Håkulls mosse 13, 827 to 829cm $\delta^{13}C = -22.7‰$

Clayey fine detritus gyttja, Core II. Middle part of Allerød zone.

11,240 ± 80

Lu-2120. Håkulls mosse 14, 819 to 821cm $\delta^{13}C = -22.0‰$

Clayey fine detritus gyttja, Core II. Later part of Allerød zone.

10,760 ± 80

Lu-2121. Håkulls mosse 15, 798 to 800cm $\delta^{13}C = -26.3‰$

Clay gyttja, Core II. Early part of Younger Dryas zone.

10,640 ± 80

Lu-2122. Håkulls mosse 16, 789 to 791cm $\delta^{13}C = -25.8‰$

Clay gyttja, Core II. Early part of Younger Dryas zone.

10,770 ± 80

Lu-2123. Håkulls mosse 17, 777 to 779cm $\delta^{13}C = -26.1‰$

Clay gyttja, Core II. Middle part of Younger Dryas zone.

10,400 ± 80

Lu-2124. Håkulls mosse 18, 761 to 763cm $\delta^{13}C = -26.4‰$

Clay gyttja, Core II. Later part of Younger Dryas zone.

10,430 ± 80

Lu-2125. Håkulls mosse 19, 743 to 745cm $\delta^{13}C = -25.6‰$

Clay gyttja, Core I. End of Younger Dryas zone. *Comment* (BEB): no exact depth correlation between Core I and Core II.

9530 ± 70

Lu-2126. Håkulls mosse 20, 695 to 697cm $\delta^{13}C = -25.6‰$

Fine detritus gyttja, Core I. Transition Pre-boreal/Boreal.

Vätlingmyr series

Pinus cones and small wood fragments washed from sediment rich in carbonate from core taken near former shore of Vätlingmyr, Austergårds, Stenkyrka parish, Gotland (57° 47′ N, 18° 31′ E). Coll 1982 and subm by N-O Svensson, Dept Quaternary Geol, Univ Lund. Dated as part of study of Late Weichselian and Early Holocene shoreline displacement on Gotland and in E Småland. Depths given are below present surface.

9080 ± 80

Lu-2133. Vätlingmyr, 138 to 148cm $\delta^{13}C = -26.1‰$

Pinus cones and small wood fragments. Immigration of *Corylus* 5cm below sample. *Comment*: no pretreatment; sample undersized; diluted; 89% sample. (3 1-day counts.). Burned at <600°C to avoid thermal decomposition of carbonate.

8800 ± 80

Lu-2131. Vätlingmyr, 133 to 138cm $\delta^{13}C = -25.0‰$

Pinus cones. Increase of *Ulmus* before immigration of *Alnus*. *Comment*: pretreated with HCl and NaOH.

8620 ± 70

Lu-2132. Vätlingmyr, 123 to 128cm $\delta^{13}C = -25.5‰$

Pinus cones. Just before immigration of *Alnus*. *Comment*: pretreated with HCl and NaOH. (3 1-day counts.)

General Comment: dates useful for chronology correlation using pollen stratigraphy in calcareous sediments unsuitable for ^{14}C dating.

Subfossil marine shell series

11,030 ± 100

Lu-2157. Flåghultsåsen $\delta^{13}C = +2.1‰$

Shells (*Mya truncata* and *Balanus porcatus*) from marine clay underlain by glaciofluvial material at S side of hill ridge Flåghultsåsen, N Bohuslän (58° 58.5′ N, 11° 25′ E). Coll 1982 and subm by Å Hillefors, Dept Phys Geog, Univ Göteborg. Dated as part of study of deglaciation chronology in area. *Comment*: outer 61% removed by acid leaching.

12,690 ± 110

Lu-2158. Svedaskogen 1982 $\delta^{13}C = -0.2‰$

Shells (small *Balanus* sp) from glacial-tectonized marine sediment overlain by wave-washed sand and gravel at Svedaskogen, Halland (57° 29′ N, 12° 11′ E). Alt 68m. Coll 1982 and subm by Å Hillefors. Dated as part of study of deglaciation of area. Site described by submitter (Hillefors, 1979, p 159 & fig 7, p 161). For other dates from Svedaskogen, see R, 1976, v 18, p 296; 1979, v 21, p 393. *Comment*: outer 46% removed by acid leaching.

General Comment: corrections for deviations from $\delta^{13}C = -25‰$ PDB are applied also for shell samples. No corrections are made for apparent age of shells of living marine organisms due to reservoir effect. Revised values of reservoir age for different areas pub by Håkansson (1983b, table 3, p 67).

Toppeladugård series

Sediment from ancient lake 0.7km NNE of Toppeladugård, S Scania (55° 36′ N, 13° 22.2′ E). Coll 1982 by S Björck, B Liedberg-Jönsson, and G Lemdahl; subm by B Liedberg-Jönsson, Dept Quaternary Geol, Univ Lund. Dated as part of joint palaeoecol study of Late Weichselian sediments from SW Sweden. Depths given are below present surface.

Lu-2182. Toppeladugård 1 **11,150 ± 100**
$\delta^{13}C = -27.2‰$

Carbonate-rich sand with <1.5% organic carbon, 2.38 to 2.43m, underlain by sand and overlain by slightly organic clay. *Comment*: carbonate removed completely by treatment with HCl before burning.

Lu-2183. Toppeladugård 2, insoluble **11,800 ± 110**
$\delta^{13}C = -27.7‰$

Insoluble organic fraction from clayey carbonate-rich algal gyttja, 2.105 to 2.155m, underlain and overlain by clay gyttja. Pollen analysis indicates Allerød Chronozone. *Comment*: sample pretreated with HCl and NaOH.

Lu-2183A. Toppeladugård 2, soluble **11,410 ± 100**
$\delta^{13}C = -27.7‰$

Acid-precipitated part of NaOH-soluble fraction from Lu-2183.

Atteköps mosse series

Limnetic brown-mosses and small amounts of terrestrial organic matter washed from sediment from Atteköps mosse, 4km NE of Grevie, NW Scania (56° 23′ N, 12° 51′ E). Coll 1982 and subm by B Liedberg-Jönsson. Dated as part of same study as Toppeladugård series, above. Depths given are below present surface. Samples pretreated with HCl.

Lu-2207. Atteköps mosse 2, 6.73 to 6.78m **12,980 ± 140**
$\delta^{13}C = -29.6‰$

Comment: sample undersized; diluted; 80% sample.

Lu-2208. Atteköps mosse 3, 6.78 to 6.83m **13,060 ± 120**
$\delta^{13}C = -30.0‰$

Lu-2209. Atteköps mosse 4, 6.83 to 6.88m **13,070 ± 120**
$\delta^{13}C = -29.6‰$

Nissunvagge series (II)

Organic matter from plant horizon buried by debris flow lobe from W slope of Nissuntjårro Mt, Nissunvagge valley (68° 16′ N, 18° 53′ E),

Abisko area, N Sweden. Coll 1982 and subm by R Nyberg, Dept Phys Geog, Univ Lund. Dated as complement to Nissunvagge series (R, 1982, v 24, p 197). Depths given refer to present surface.

310 ± 45

Lu-2161. Nissunvagge 1982:1, insoluble $\delta^{13}C = -26.2‰$

Insoluble organic fraction, depth 130cm, 175cm from lobe front. *Comment*: pretreated with HCl and NaOH.

320 ± 45

Lu-2161A. Nissunvagge 1982:1, soluble *Est* $\delta^{13}C = -26.1‰$

Acid-precipitated part of NaOH-soluble fraction from Lu-2161. *Comment*: no $\delta^{13}C$ measurement. $\delta^{13}C$ value estimated from values for Lu-2161 and -2162.

600 ± 45

Lu-2162. Nissunvagge 1982:2 $\delta^{13}C = -25.9‰$

Total organic fraction, depth 75cm, 160cm from lobe front.

Rakaslako series

Peat from mire with permafrost mounds (*sw* palsmyr) at Rakaslako, 5km W of Björkliden, N Sweden (68° 26′ N, 18° 34′ E). Coll 1982 and subm by B Malmström and J Åkerman, Dept Phys Geog, Univ Lund. Pretreated with HCl and NaOH.

8040 ± 80

Lu-2216. Rakaslako 1, insoluble $\delta^{13}C = -24.0‰$

Insoluble fraction of peat from 45cm below present surface in presumed fossil solifluction lobe.

7030 ± 90

Lu-2216A. Rakaslako 1, soluble $\delta^{13}C = -26.3‰$

Acid-precipitated part of NaOH-soluble fraction from Lu-2216. *Comment*: sample undersized; diluted; 69% sample.

2670 ± 50

Lu-2217. Rakaslako 2, insoluble $\delta^{13}C = -25.2‰$

Insoluble fraction of peat from 60cm below present surface, just above 2nd uppermost ice lens in permafrost mound (*sw* pals).

2210 ± 50

Lu-2217A. Rakaslako 2, soluble $\delta^{13}C = -27.1‰$

Acid-precipitated part of NaOH-soluble fraction from Lu-2217.

7360 ± 70

Lu-2211. Ängelholm $\delta^{13}C = -25.1‰$

Wood from ca 15 of outermost remaining annual rings of oak trunk with ca 300 annual rings from deposits of Rönneå R, town of Ängelholm, NW Scania (56° 14.7′ N, 12° 52.1′ E). Coll 1982 in connection with construction work for bridge; subm by E Lehmann, Cultural Council, Ängelholm. Pretreated with HCl and NaOH.

Norway

4570 ± 60

Lu-2206. Kåsi, Mysuseter, 1983 $\delta^{13}C = -25.6‰$

Wood from firmly rooted large pine stump from bottom of unintentionally drained small lake near Kåsi Mt, ca 1km N of Mysuseter, Rondane (61° 49′ N, 9° 40′ E). Alt ca 1000m. Coll 1983 and subm by A Lima-De-Faria, Dept Molecular Cytogenetics, Univ Lund. Other wood sample from same site dated at 4890 ± 65 BP (Lu-995, R, 1980, v 22, p 1051). Pretreated with HCl and NaOH.

Iceland

1600 ± 50

Lu-2101. Önundafjördur $\delta^{13}C = -27.7‰$

Wood (*Betula* sp) pieces from thin wood layer, 1m below present surface and 0.5m below present sea level at Vadall, Önundafjördur, NW Iceland (66° 05′ N, 23° 20′ W). Wood layer underlain by marine sand containing walrus remains and overlain by marine sand containing ill-preserved shell fragments. Coll 1981 and subm by L A Símonarson, Sci Inst, Univ Iceland, Reykjavík. Pretreated with HCl and NaOH.

Icelandic Subfossil Marine Shell Series II

Marine bivalve shells from SW Iceland. Coll 1980 and 1982 and subm by O Ingolfsson, Dept Quaternary Geol, Univ Lund. Dated as part of study of Late Weichselian glacial stratigraphy and chronology of lower part of Borgarfjördur region. For other shell dates from area, see R, 1983, v 25, p 882.

12,830 ± 110

Lu-2193. Melabakkar-Melaleiti 1 $\delta^{13}C = +1.8‰$

One shell valve (*Chlamys islandica*) from glacial-marine silt; ca +2m at Melabakkar, N of Akranes (64° 25′ N, 22° 02′ W). Silt probably overridden by last ice advance in area. *Comment*: outer 36% of shell removed by acid leaching.

12,460 ± 120

Lu-2192. Melabakkar-Melaleiti 2 $\delta^{13}C = +1.4‰$

Large shell fragments (*Chlamys islandica* and *Mya truncata*) from glacial-marine silt; ca +3.5m. Same site as Lu-2193, above. *Comment*: outer 15% removed by acid leaching. Sample undersized; diluted; 91% sample.

12,830 ± 110

Lu-2194. Grjóteyri $\delta^{13}C = +0.6‰$

Shell fragments (*Hiatella arctica, Mya truncata,* and *Macoma calcarea*) from glacial-marine drift, alt ca 20m, at Grjoteyri, E of Borgarnes (64° 32′ N, 21° 50′ W). Drift overridden by last ice advance in area (*cf* Ashwell, 1975). *Comment*: outer 18% removed by acid leaching.

12,870 ± 110

Lu-2195. 'Asbakkar $\delta^{13}C = +1.6‰$

Two shell valve parts (*Chlamys islandica*) from glacial-marine silt,

overlain by basal till; ca +2m at 'Asbakkar, N of Akranes (64° 24′ N, 22° 02′ W). *Comment*: outer 39% removed by acid leaching.

11,980 ± 130

Lu-2196. 'Asbakkar-'Asgil $\delta^{13}C = +1.1‰$

Shell fragments (*Mya truncata* and *Chlamys islandica*) from glacial-marine silt; ca +3m at 'Asbakkar, N of Akranes (64° 24′ N, 22° 02′ W). Silt underlain and overlain by basal till. Shell fragments not *in situ*. *Comment*: outer 11% removed by acid leaching. Sample undersized; diluted; 74% sample.

10,370 ± 90

Lu-2197. Skipanes $\delta^{13}C = +1.1‰$

Two shell valves (*Chlamys islandica*) found *in situ* in littoral sand; ca +4m at Skipanes, Melasveit, N of Akranes (64° 24′ N, 21° 54′ W). Sand probably deposited in connection with Holocene marine transgression in area. *Comment*: outer 17% removed by acid leaching.

General Comment: corrections for deviations from $\delta^{13}C = -25‰$ PDB are applied. No corrections are made for reservoir age of living marine mollusks. Reservoir age for coastal waters of Iceland pub by Håkansson (1983b) based on Icelandic recent marine shell series (R, 1983, v 25, p 881).

Spitsbergen

Bohemanflya series

Marine bivalve shells from Bohemanflya, Isfjorden, W Spitsbergen. Coll 1982 by C Hjort and E Lagerlund in connection with reconnaissance for study of shoreline displacement and till stratigraphy in area; subm by C Hjort, Dept Quaternary Geol, Univ Lund.

9440 ± 80

Lu-2136. Bohemanflya 1 $\delta^{13}C = +1.4‰$

Shell fragments (*Mya truncata*) from till at Bohemanflya (78° 28′ N, 14° 25′ E). *Comment*: outer 30% of shells removed by acid leaching.

8130 ± 80

Lu-2137. Bohemanflya 2 $\delta^{13}C = +0.4‰$

Shell fragments (*Mytilus edulis*) from beach gravel; ca +10m; between 2 distinct beach cuts at Bohemanflya (78° 26′ N, 14° 35′ E). *Comment*: outer 44% removed by acid leaching.

9630 ± 90

Lu-2138. Bohemanflya 3 $\delta^{13}C = +1.3‰$

Shells (*Mya truncata*) from silt, alt 18 to 20m, above uppermost distinct beach cut at Bohemanflya (78° 26′ N, 14° 34′ E). *Comment*: outer 50% removed by acid leaching.

4620 ± 60

Lu-2139. Bohemanflya 4 $\delta^{13}C = +1.3‰$

Shells (*Hiatella arctica*) from push-moraine at Bohemanflya (78° 28′ N, 14° 32′ E). *Comment*: outer 22% removed by acid leaching.

General Comment: corrections for deviations from $\delta^{13}C = -25‰$ PDB are applied. No corrections are made for reservoir age of living marine mollusks. Revised reservoir age for coastal waters of Spitsbergen pub by Olsson (1980, fig 6, p 673).

Northern Ireland

Sandelford series

Estuarine mud from E bank of R Bann 100m S of Sandelford Bridge, Coleraine, N Ireland (55° 07′ 30″ N, 6° 40′ 10″ W). Coll 1980 and subm by R W Battarbee, Palaeoecol Lab, Univ College London. Dated as part of study of sea-level change in area.

Lu-2127. Sandelford 1 **7440 ± 70**
$\delta^{13}C = -25.9‰$

Mud from 507 to 517cm below ground. Core SF VII.

Lu-2128. Sandelford 2 **6980 ± 70**
$\delta^{13}C = -22.8‰$

Mud from 467 to 477cm below ground. Core SF VII.

Lu-2129. Sandelford 3 **6430 ± 70**
$\delta^{13}C = -27.2‰$

Mud from 145 to 150cm below ground. From monolith tin (SF M).

Lu-2130. Sandelford 4 **6120 ± 70**
$\delta^{13}C = -25.9‰$

Mud from 105 to 110cm below ground. From monolith tin (SF M).

Czechoslovakia

Vernérovice series (II)

Peat from mire 0.5km S of village Vernéřovice near Broumov, N Czechoslovakia (50° 06′ N, 16° 15′ E). Alt ca 400m. Coll 1973 by M Peichlová, E Rybníčková, and K Rybníček; subm by M Peichlová, Dept Ecol Bot, Czechoslovak Acad Sci, Brno. Dated as complement to Vernéřovice series (R, 1982, v 24, p 202). Pollen zones according to Firbas (1949). Pretreated with HCl.

Lu-2199. Vernérovice BV-2-A, 32cm **2180 ± 50**
$\delta^{13}C = -28.3‰$

Highly humified peat with small wood fragments and other coarse plant remains. Depth 32cm. Boundary Sub-boreal/Sub-atlantic.

Lu-2200. Vernérovice BV-2-A, 45cm **3040 ± 50**
$\delta^{13}C = -25.7‰$

Slightly humified peat. Depth 45cm. Beginning of Sub-boreal with 1st traces of human activity.

Bulgaria

Tschokljovo Marsh Series II

Clay and peat from Tschokljovo marsh, W Bulgaria (42° 22′ N, 22° 50′ E). Alt 870m. Coll 1980 and 1982 and subm by E Bozilova, Biol Fac,

Univ Sofia. Dated as complement to Tschokljovo Marsh Series I (R, 1983, v 25, p 883-884). Lu-2169 pretreated with HCl. All other samples too small for pretreatment and, therefore, burned at <600°C to avoid thermal decomposition of carbonate. No $\delta^{13}C$ measurements available for this series. Estimated $\delta^{13}C$ value is based on previous measurements on 8 samples from same site. Standard deviation for dates increased accordingly.

8000 ± 110

Lu-2167. Tschokljovo I, 437 to 442cm *Est* $\delta^{13}C = -25.5‰$

Clay with ca 4.5% organic carbon. Depth 437 to 442cm. *Comment*: sample undersized; diluted; 62% sample.

4760 ± 80

Lu-2168. Tschokljovo I, 353 to 358cm *Est* $\delta^{13}C = -25.5‰$

Highly humified *Phragmites* and *Carex* peat. Depth 353 to 358cm. *Comment*: sample undersized; diluted; 67% sample.

1250 ± 50

Lu-2169. Tschokljovo 1982, 90 to 105cm *Est* $\delta^{13}C = -25.5‰$

Moderately humified peat with coarse plant material. Depth 90 to 105cm.

8520 ± 170

Lu-2170. Tschokljovo III, 360 to 365cm *Est* $\delta^{13}C = -25.5‰$

Clay with ca 1.5% organic carbon. Depth 360 to 365cm. *Comment*: sample undersized; diluted; 22% sample. (3 1-day counts.)

Jamaica

Black River Morass Series II

Peat from coastal wetland at Black R, S Jamaica (18° 05′ N, 77° 50′ W). Coll 1982 and 1983 (Lu-2201) and subm by G Digerfeldt, Dept Quaternary Geol, Univ Lund. Dating is part of study of development of coastal wetland and eustatic sea-level changes in area. For other dates from Black R Morass, see R, 1982, v 24, p 203. Depths given are below surface. All samples pretreated with HCl.

6500 ± 70

Lu-2072. Black R Morass B 1, 695 to 705cm $\delta^{13}C = -26.5‰$

Swamp forest peat, highly humified.

6120 ± 70

Lu-2096. Black R Morass B 1, 640 to 650cm $\delta^{13}C = -27.2‰$

Sedge peat, highly humified.

4760 ± 60

Lu-2095. Black R Morass B 1, 440 to 450cm $\delta^{13}C = -26.5‰$

Sedge peat, moderately humified.

3310 ± 50

Lu-2094. Black R Morass B 1, 240 to 250cm $\delta^{13}C = -26.7‰$

Sedge peat, highly humified.

Lu-2093. Black R Morass B 1, 140 to 150cm **2160 ± 50**
$\delta^{13}C = -27.3‰$
Mangrove peat, highly humified.

Lu-2077. Black R Morass B 2, 260 to 270cm **4140 ± 60**
$\delta^{13}C = -28.5‰$
Swamp forest peat, highly humified.

Lu-2189. Black R Morass B 2, 140 to 150cm **2020 ± 50**
$\delta^{13}C = -28.5‰$
Swamp forest peat, highly humified.

Lu-2069. Black R Morass B 3, 175 to 185cm **3590 ± 60**
$\delta^{13}C = -26.8‰$
Swamp forest peat, highly humified.

Lu-2070. Black R Morass B 4, 300 to 310cm **5470 ± 60**
$\delta^{13}C = -29.0‰$
Swamp forest peat, highly humified.

Lu-2092. Black R Morass B 4, 240 to 250cm **4470 ± 60**
$\delta^{13}C = -28.5‰$
Sedge peat, highly humified.

Lu-2091. Black R Morass B 4, 80 to 90cm **1240 ± 45**
$\delta^{13}C = -25.8‰$
Sedge peat, highly humified.

Lu-2076. Black R Morass B 5, 460 to 470cm **6080 ± 70**
$\delta^{13}C = -27.2‰$
Sedge peat, moderately humified.

Lu-2188. Black R Morass B 5, 340 to 350cm **4940 ± 60**
$\delta^{13}C = -26.4‰$
Sedge peat, highly humified.

Lu-2187. Black R Morass B 5, 140 to 150cm **2720 ± 50**
$\delta^{13}C = -27.1‰$
Sedge peat, highly humified.

Lu-2071. Black R Morass B 6, 190 to 200cm **4410 ± 60**
$\delta^{13}C = -42.3‰$
Sedge peat, highly humified.

Lu-2074. Black R Morass B 7, 670 to 680cm **6470 ± 70**
$\delta^{13}C = -29.6‰$
Mangrove peat, highly humified.

Lu-2099. Black R Morass B 7, 540 to 550cm **5490 ± 70**
$\delta^{13}C = -27.7‰$
Mangrove peat, highly humified.

Lu-2098. Black R Morass B 7, 340 to 350cm **3700 ± 60**
$\delta^{13}C = -27.6‰$
Mangrove peat, highly humified.

Lu-2097. Black R Morass B 7, 140 to 150cm **2100 ± 50**
$\delta^{13}C = -26.9‰$
Mangrove peat, moderately humified.

Lu-2075. Black R Morass B 8, 506 to 516cm — **6030 ± 70**; $\delta^{13}C = -28.2‰$
Sedge peat, highly humified.

Lu-2186. Black R Morass B 8, 440 to 450cm — **5680 ± 70**; $\delta^{13}C = -28.3‰$
Mangrove peat, moderately humified.

Lu-2185. Black R Morass B 8, 240 to 250cm — **4180 ± 60**; $\delta^{13}C = -27.2‰$
Mangrove peat, moderately humified.

Lu-2184. Black R Morass B 8, 140 to 150cm — **3240 ± 60**; $\delta^{13}C = -26.8‰$
Mangrove peat, moderately humified.

Lu-2078. Black R Morass B 9, 230 to 240cm — **3890 ± 60**; $\delta^{13}C = -23.2‰$
Mangrove peat, highly humified.

Lu-2191. Black R Morass B 9, 140 to 150cm — **2680 ± 50**; $\delta^{13}C = -27.3‰$
Mangrove peat, moderately humified.

Lu-2073. Black R Morass B 10, 700 to 710cm — **5950 ± 70**; $\delta^{13}C = -27.6‰$
Mangrove peat, highly humified.

Lu-2082. Black R Morass B 10, 640 to 650cm — **5760 ± 60**; $\delta^{13}C = -26.3‰$
Mangrove peat, moderately humified.

Lu-2081. Black R Morass B 10, 440 to 450cm — **4500 ± 60**; $\delta^{13}C = -21.5‰$
Sedge peat, highly humified.

Lu-2080. Black R Morass B 10, 240 to 250cm — **2700 ± 50**; $\delta^{13}C = -26.0‰$
Sedge peat, highly humified.

Lu-2079. Black R Morass B 10, 140 to 150cm — **1510 ± 45**; $\delta^{13}C = -27.8‰$
Mangrove peat, highly humified.

Lu-2089. Black R Morass B 11, 640 to 650cm — **6220 ± 70**; $\delta^{13}C = -28.7‰$
Sedge peat, highly humified.

Lu-2090. Black R Morass B 14, 610 to 620cm — **6320 ± 70**; $\delta^{13}C = -28.6‰$
Sedge peat, highly humified.

Lu-2088. Black R Lower Morass at Luana — **480 ± 45**; $\delta^{13}C = -27.9‰$
Sedge peat, 130 to 140cm, highly humified.

Lu-2086. Black R Upper Morass 2 — **3000 ± 50**; $\delta^{13}C = -29.1‰$
Sedge peat, 160 to 170cm, highly humified.

1470 ± 45

Lu-2201. Black R Upper Morass 2 $\delta^{13}C = -28.1‰$

Sedge peat, 60 to 70cm, highly humified.

1180 ± 45

Lu-2087. Black R Upper Morass 4 $\delta^{13}C = -26.4‰$

Sedge peat, 110 to 120cm, moderately humified.

Negril Morass Series III

Peat from coastal wetland at Negril, W Jamaica (18° 20′ N, 78° 20′ W). Coll 1982 and subm by G Digerfeldt. Dating is part of same study as Black River Morass Series II, above. For other dates from Negril Morass, see R, 1982, v 24, p 203-204; 1983, v 25, p 884-886. Depths given are below surface. All samples pretreated with HCl.

7720 ± 80

Lu-2083. Negril Morass N 9, 1370 to 1380cm $\delta^{13}C = -26.0‰$

Sedge peat, highly humified.

3560 ± 60

Lu-2084. Negril Morass, at E canal $\delta^{13}C = -28.5‰$

Swamp forest peat, highly humified, 140 to 150cm.

7880 ± 80

Lu-2085. Negril Morass $\delta^{13}C = -28.5‰$

Sedge peat, highly humified, 1185 to 1195cm, 175m E of Crystal Water.

ARCHAEOLOGIC SAMPLES

Sweden

Kyrkudden series

Charcoal and wood from excavation of medieval site at Kyrkudden, Hietaniemi parish, Norrbotten (66° 13′ N, 23° 43′ E). Coll 1978 to 1980 and subm by T Wallerström, Norrbottens Mus, Luleå. Dated as complement to unpub series dated by Lab for Isotope Geol, Stockholm.

440 ± 40

Lu-2058. Kyrkudden, F1856 $\delta^{13}C = -25.5‰$

Small pieces of wood (No. IV) from frame belonging to Carelian grave construction. *Comments*: mild pretreatment with HCl and NaOH. (3 1-day counts.) (TW): wood from same frame dated at 320 ± 110 BP (St-7762).

50 ± 45

Lu-2059. Kyrkudden, F2340 $\mathbf{D^{14}C^{*} = -6.0 \pm 5.1‰}$

$\delta^{13}C = -25.0‰$

Small pieces of wood from log in cultural layer. Log supposed to be part of nearby rampart construction. *Comments*: normal pretreatment with HCl and NaOH. (TW): sample obviously not from rampart construction. * $D^{14}C$ according to Stuiver and Polach (1977, p 357).

560 ± 45

Lu-2060. Kyrkudden, F2879 $\delta^{13}C = -24.3‰$

Charcoal from wall of burned building. Coordinates 987.71: 341.95. *Comment*: mild pretreatment with HCl and NaOH.

620 ± 45

Lu-2061. Kyrkudden, F3119 $\delta^{13}C = -24.4‰$

Charcoal from burned vegetation layer below clay floor. *Comments*: normal pretreatment with HCl and NaOH. (TW): other dates from same layer are: 610 ± 80 BP (St-7974), 665 ± 155 BP (St-7763), and 640 ± 90 BP (St-8097).

320 ± 45

Lu-2062. Kyrkudden, F2181 $\delta^{13}C = -24.8‰$

Charcoal from cultural layer close to defense rampart; coordinates 991.27:315.60. Sample supposedly derives from and dates superstructure of rampart. *Comment*: mild pretreatment with NaOH and HCl.

630 ± 45

Lu-2063. Kyrkudden, F2719 $\delta^{13}C = -25.4‰$

Charcoal from cultural layer in burned house; coordinates 984.75: 339.78. Sample supposedly comes from house walls or posts. *Comment*: mild pretreatment with NaOH and HCl.

410 ± 45

Lu-2064. Kyrkudden, F2891 $\delta^{13}C = -25.1‰$

Charcoal from wall of same building as Lu-2060 and -2063, above, derive from; coordinates 983.62:341.05. *Comment*: mild pretreatment with NaOH and HCl.

320 ± 45

Lu-2066. Västra Kikkejaure $\delta^{13}C = -25.2‰$

Wood from keel of sewn boat (Hallström, 1909) found after storm on shore of W Kikkejaure, Lappland (65° 40′ N, 19° 05′ E). Coll 1972 by H Wigenstam; subm by S Jansson, Skellefteå Mus, Skellefteå. *Comment*: pretreated with HCl and NaOH. 320 ± 45 BP corresponds approx to AD 1485 to AD 1640 according to calibration graphs by Stuiver (1982, p 8-9).

Skateholm Series III

Charcoal, wood, and human bone from settlement area (Early Ertebølle culture) with 2 settlements (Skateholm I and II) combined with grave fields at Skateholm, Tullstorp parish, S Scania (55° 23′ 10″ N, 13° 29′ E). Coll 1932 and 1982 by L Larsson, H Göransson (Lu-2110), and F Hansen (Lu-2156); subm by L Larsson, Inst Archaeol, Univ Lund. Preliminary excavation repts pub by submitter (Larsson, 1980; 1981; 1982). For other dates from area, see R, 1982, v 24, p 205-206; 1983, v 25, p 887. Bone collagen extracted as described previously (R, 1976, v 18, p 290), Lu-2109 with NaOH treatment and Lu-2156 without.

6270 ± 70

Lu-2109. Skateholm, Grave 37 $\delta^{13}C = -16.8‰$

Collagen from femur of human female from Grave 37 (Larsson, 1982,

p 22). *Comment*: organic carbon content: 2.5%. Sample undersized; diluted; 68% sample. (3 1-day counts.)

7030 ± 70

Lu-2110. Skateholm I, *Alnus* $\delta^{13}C = -28.7‰$

Wood from *Alnus* stem (id by T Bartholin) from level 230 to 244 in trench for pollen sampling. *Comment*: pretreated with HCl and NaOH.

6430 ± 70

Lu-2111. Skateholm, PII:1 $\delta^{13}C = -27.1‰$

Wood (*Alnus* sp) id by T Bartholin and unid. bark from sampling Point II. *Comment*: wood pretreated with HCl and NaOH; bark only pretreated with HCl.

6370 ± 70

Lu-2112. Skateholm, PII:2 $\delta^{13}C = -27.6‰$

Wood (*Corylus avellana*) id by T Bartholin from sampling Point II. *Comment*: no pretreatment; sample undersized; diluted; 78% sample. (3 1-day counts.)

6590 ± 70

Lu-2113. Skateholm II, x=200, y=221 $\delta^{13}C = -25.7‰$

Charcoal from cultural layer; x=200, y=221. *Comment*: pretreated with HCl and NaOH.

6910 ± 70

Lu-2114. Skateholm II, x=200, y=225 $\delta^{13}C = -26.5‰$

Charcoal from cultural layer; x=200, y=225, level 70 to 80cm. *Comment*: pretreated with HCl and NaOH.

6380 ± 70

Lu-2115. Skateholm II, x=200, y=220 $\delta^{13}C = -25.7‰$

Charcoal from cultural layer; x=200, y=220, level 35 to 50cm. *Comment*: pretreated with HCl and NaOH.

5990 ± 70

Lu-2116. Skateholm I, Grave 26 $\delta^{13}C = -25.5‰$

Charcoal (*Fraxinus, Corylus avellana,* & *Alnus* sp) id by T Bartholin from Grave 26 (Larsson, 1982, p 17). *Comment*: mild pretreatment with NaOH and HCl.

5850 ± 90

Lu-2156. Skateholm 1932 $\delta^{13}C = -18.6‰$

Collagen from human femur and tibia, id by O Persson, from grave structure. *Comment*: organic carbon content: 1.2%. Sample undersized; diluted; 43% sample.

1280 ± 70

Lu-2135. Transval, Åhus $\delta^{13}C = -19.3‰$

Collagen from human tibia from top of gravel pit wall at Transval, Åhus parish, E Scania (55° 55′ N, 14° 17′ E). Coll 1974; subm by J Callmer, Inst Archaeol, Univ Lund. *Comment*: collagen extracted as described previously (R, 1976, v 18, p 290) without NaOH treatment. Organic carbon content: 3.3%. Sample undersized; diluted; 48% sample.

Nymölla series (II)

Charcoal from coastal settlement areas (Middle Neolithic—Pitted Ware culture) at Nymölla 12^{35} and 12^{38}, Gualöv parish, NE Scania (56° 02′ N, 14° 28′ E). Coll 1981 and 1982 by B Wyszomirska and B Helgesson; subm by B Wyszomirska, Inst Archaeol, Univ Lund. Dated as complement to Nymölla series (R, 1982, v 24, p 210). No $\delta^{13}C$ measurements available for this series. Standard deviation for dates increased accordingly.

2400 ± 70

Lu-2140. Nymölla 12^{35}, Sq z17 *Est* $\delta^{13}C = -25.0‰$

Charcoal from Hearth No. 2, Sq z17, x=16.6, y=17.14, ca +3.6m. Assoc with flint implements and potsherds indicating Pitted Ware culture. *Comment*: mild pretreatment with NaOH and HCl. Sample undersized; diluted; 84% sample. Date much too late for assoc artifacts indicating re-use of site.

3880 ± 110

Lu-2141. Nymölla 12^{38}, Sq j10 *Est* $\delta^{13}C = -25.0‰$

Charcoal from occupation layer, Sq j10, x=9.5, y=9.5, ca +7.1m. Assoc with fragments of ground flint axes and potsherds indicating Pitted Ware culture. *Comment*: no pretreatment; sample undersized; diluted; 31% sample. (3 1-day counts.)

3800 ± 70

Lu-2142. Nymölla 12^{38}, Sq k10 *Est* $\delta^{13}C = -25.0‰$

Charcoal from occupation layer, Sq k10, x=10.5, y=9.5, ca +7.3m. Assoc with flint implements and Pitted Ware potsherds. *Comment*: mild pretreatment with NaOH and HCl. Sample undersized; diluted; 87% sample.

4170 ± 70

Lu-2143. Nymölla 12^{38}, Sq L10 *Est* $\delta^{13}C = -25.0‰$

Charcoal from occupation layer, Sq L10, x=11.5, y=9.5, ca +7.3m. Assoc with iron ocher, fragment of ground axe, flint implements, and potsherds. *Comment*: normal pretreatment with HCl and NaOH.

4470 ± 70

Lu-2144. Nymölla 12^{38}, Sq m10 *Est* $\delta^{13}C = -25.0‰$

Charcoal from occupation layer, Sq m10, x=12.5, y=9.5, ca +7.3m. Assoc with Middle Neolithic potsherds and flint implements. *Comment*: normal pretreatment with HCl and NaOH.

5390 ± 110

Lu-2198. Stenbocksvallar, Barsebäck $\delta^{13}C = -26.3‰$

Charcoal (*Corylus* & *Quercus*) id by T Bartholin from cultural layer (Ertebølle culture) at coastal site Stenbocksvallar, Barsebäck 38:3, Barsebäck parish, W Scania (55° 46′ N, 12° 55′ E). x=490, y=196, Layer 3. Coll 1982 and subm by K Jennbert-Spång, Inst Archaeol, Univ Lund. Assoc with pottery and flint waste. *Comment*: pretreated with HCl. Sample undersized; diluted; 33% sample. (3 1-day counts.)

Fosie Series I

Charcoal from settlement area with traces (*eg*, posthole marks) of houses from Stone, Bronze, and Iron ages (Björhem & Säfvestad, 1983) at Fosie, Lockarp parish, S Scania (55° 33′ N, 13° 03′ to 13° 04′ E). Coll 1979 and 1981 and subm by U Säfvestad, Inst Archaeol, Univ Lund. Excavation of area necessitated by exploitation of farmland for industry. Lu-2205 only pretreated with HCl; all other samples pretreated with HCl and NaOH.

7480 ± 70

Lu-2202. Fosie IV, Settlement I $\delta^{13}C = -24.0‰$

Charcoal from post holes and storage pit, Settlement I, Structures 193 (Sq C, Level I), 259, and 262 (Coordinate 200). Assoc with animal bones, flint, and pottery, indicating Late Bronze age. *Comment* (US): date earlier than expected from assoc material.

1640 ± 50

Lu-2203. Fosie IV, Settlement I, House II $\delta^{13}C = -26.0‰$

Charcoal from hearth in W part of House II, Settlement I. Assoc with pottery indicating Late Iron age. *Comment* (US): date somewhat earlier than expected.

1630 ± 50

Lu-2204. Fosie IV, Settlement IV, Sample 1 $\delta^{13}C = -25.8‰$

Charcoal from post holes, Settlement IV, House XLII (Iron age). *Comment* (US): date ca 400 yr earlier than expected, but acceptable, since datable finds are scarce on this site.

1660 ± 50

Lu-2205. Fosie IV, Settlement IV, Sample 2 $\delta^{13}C = -25.4‰$

Charcoal from post holes, Settlement IV, Houses LVI and LXII (Iron age). *Comment*: sample undersized; diluted; 91% sample.

4560 ± 70

Lu-2102. Ängdala 1981:MHM 6434 $\delta^{13}C = -25.9‰$

Charcoal from hearth-pit in area with Neolithic flint mines at Ängdala, S Sallerup parish, S Scania (55° 35′ 20″ N, 13° 07′ 20″ E). Coll 1981 by E Rudebäck; subm by M Larsson. *Comment*: no pretreatment; sample undersized; diluted; 36% sample. (4 1-day counts.)

4960 ± 70

Lu-2212. Ängdala 1983 $\delta^{13}C = -27.8‰$

Wood from flint mine (No. 25, Area C) in Senonian chalk at Ängdala, S Sallerup parish, S Scania (55° 35′ 20″ N, 13° 07′ 20″ E). Coll 1983 and subm by E Rudebäck, Malmö Mus. Assoc with bone and worked flint indicating Early Neolithic culture. For other dates from area, see R, 1980, v 22, p 1058; 1981, v 23, p 398, and Lu-2102, above. *Comment*: no pretreatment; sample undersized; diluted; 83% sample.

Fotevik Series II

Wood and fibrous calking material from pole and boat wreck assoc with Late Viking age stone blocking in entrance to bay Foteviken, SW

Scania (55° 28′ N, 12° 56′ E). Coll 1982 by Malmö Sjöfartsmuseum; subm by C Ingelman-Sundberg and P Söderhielm, Malmö Sjöfartsmus, Malmö. Preliminary repts pub by Ingelman-Sundberg and Söderhielm (1982) and Hårdh (1983). Dated as complement to Fotevik Series I (R, 1983, v 25, p 888).

Lu-2213. Fotevik, F82.V1.27 **1030 ± 45** $\delta^{13}C = -24.0‰$

Fibrous calking material from Board 2B, boat Wreck 1 (Ingelman-Sundberg & Söderhielm, 1982, p 5-14). *Comment*: sample charred in nitrogen atmosphere before burning.

Lu-2214. Fotevik, F82.V3.5 **950 ± 60** $\delta^{13}C = -27.4‰$

Wooden peg with wedge from boat rib, Wreck 3 (Ingelman-Sundberg & Söderhielm, 1982, p 18). *Comment*: no pretreatment; sample undersized; diluted; 70% sample.

Lu-2215. Fotevik, F82.s.54 **950 ± 45** $\delta^{13}C = -28.6‰$

Wood from Pole ARÖ near Wreck 2, N part of stone blocking (Ingelman-Sundberg & Söderhielm, 1982, p 16, fig 11). *Comment*: pretreated with HCl and NaOH.

Lu-2218. DRACO, Lund **2020 ± 60** $\delta^{13}C = -26.3‰$

Charcoal from hearth (Structure 7, Layer 1) excavated in rescue operation at DRACO industrial area, NE part of Lund, S Scania (55° 42′ 35″ N, 13° 13′ 15″ E). Coll 1983 and subm by B Bondesson, Mus Cultural Hist, Lund. Assoc with pottery indicating Bronze or Iron age. *Comment*: pretreated with HCl. Sample undersized; diluted; 68% sample.

Aaland

Otterböte series

Food remains from potsherds from Bronze age settlement at Otterböte, Kökar I., Aaland (59° 56′ N, 20° 52′ E). Coll 1950 during study of settlement by C F Meinander, M Dreijer, and B Schönbäck; subm by B Hulthén, Lab for ceramic and clay mineralogy, Dept Quaternary Geol, Univ Lund. Pottery indicates Late Bronze or Early Iron age. Mild pretreatment with NaOH and HCl.

Lu-2159. Otterböte, 200:218 **2790 ± 50** $\delta^{13}C = -27.6‰$

Food remains from potsherd No. 200:218.

Lu-2160. Otterböte, 200:153 **2850 ± 50** $\delta^{13}C = -27.2‰$

Food remains from potsherd No. 200:153.

Denmark

Jonstrupvang series

Collagen from mixture of animal bone fragments and teeth underlying layer of hand-sized granite chips in megalithic construction "Ting-

stedet" (Laumann Jörgensen, 1980, p 25-27) at Jonstrupvang (Afd 69), NW of Copenhagen (55° 46′ N, 12° 13.5′ E). Coll 1980 and subm by E Laumann Jörgensen, Vaerlöse Mus, Vaerlöse. Bone sample from other megalithic construction in area dated at 4500 ± 55 BP (Lu-1952, R, 1982, v 24, p 211). Collagen extracted as described previously (R, 1976, v 18, p 290) without NaOH treatment.

Lu-2017. Jonstrupvang, Sample 1 **170 ± 70**
$\delta^{13}C = -20.6‰$

Collagen from mixture of ill-preserved animal bone fragments. *Comment*: organic carbon content: 2.9% (1-day count.) No explanation for unexpectedly late date.

Lu-2163. Jonstrupvang, Sample 2 **150 ± 45**
$\delta^{13}C = -22.4‰$

Collagen from mixture of ill-preserved animal bone fragments and teeth from same collection as Lu-2017, above. Dated as check on Lu-2017 by request of submitter. *Comment*: organic carbon content: 2.8%. Sample undersized; diluted; 65% sample. (3 1-day counts.)

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QUEENS COLLEGE RADIOCARBON MEASUREMENTS IV

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The following list includes radiocarbon analyses of samples related to studies of Holocene sea levels completed since the publication of the last list (R, 1980, v 22, p 1073-1083). Sample preparation and counting for liquid scintillation samples remain the same. However, an additional gas-proportional facility was added in 1981 to handle the analyses of small samples, some of which are included in this list. The new system consists of two 660cc OFHC copper counters built at Queens College. Samples are counted over at least two 2800 minute intervals alternating with backgrounds and standards counted over 1400 minute intervals. Ages are based on the Libby half-life of 5568 years and include 1σ standard deviations of sample, standard, and background activities.

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New York

Marlboro Marsh series

This series was taken from Marlboro Marsh. All samples are basal peat, at coordinates (41° 36′ 40″ N, 73° 57′ 58″ W), and coll 1979 by J Miller, H Craig and L J Cinquemani except where noted.

QC-341. Marlboro Marsh 1 **2330 ± 240**

3.1 to 3.3m below mean high water.

QC-340. Marlboro Marsh 2 **3010 ± 120**

4.1 to 4.3m below mean high water.

QC-342. Marlboro Marsh 3 **4150 ± 100**

4.8 to 5m below mean high water.

QC-343. Marlboro Marsh 4 **4390 ± 220**

5.8 to 6m below mean high water.

QC-705. Marlboro Marsh 5 **4260 ± 130**

7.15 to 7.45m below mean high water. Coll by H Craig, S Jencius, and J Wilson.

QC-686. Marlboro Marsh 6 **4570 ± 110**

8.2 to 8.6m below mean high water. Coll by W S Newman, H Craig, S Jencius, and J Wilson. *Comment*: Marlboro 5 and 6 are on stiff clayey substrates and may not be valid sea level indicators.

Constitution Island series

This series was taken from Constitution I. Marsh. All samples are basal peat. Coordinates for Constitution I. marsh are: Constitution I. 2, 7, and 12 (41° 24′ 22″ N, 73° 56′ 53″ W), Constitution I. 5, 8, 11, and 13 (41° 24′ 40″ N, 73° 56′ 53″ W), and Constitution I. 1, 3, 4, 6, 9, 10, and 14 (41° 24′ 23″ N, 73° 56′ 30″ W).

QC-691. Constitution I. 1 **2320 ± 500**

1 to 1.3m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, and J Wilson. *Comment*: sample yields only freshwater diatoms; also some benzene evaporated.

QC-1039. Constitution I. 2 **2160 ± 130**

1.7 to 2.08m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, B Duffy, J Schneller, H Greenberg, and K Tessmer.

QC-690. Constitution I. 3 **1440 ± 100**

2.1 to 2.4m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, and J Wilson. *Comment*: sample yields only freshwater diatoms.

QC-695. Constitution I. 4 **2440 ± 100**

2.9 to 3.4m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, and J Wilson.

QC-226. Constitution I. 5 **2320 ± 100**

3.7 to 3.9m below mean high water. Coll 1976 by L J Cinquemani.

QC-693. Constitution I. 6 **3210 ± 110**

4.7 to 5.2m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, and J Wilson.

QC-1042. Constitution I. 7 **4660 ± 130**

5.8 to 6.1m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, B Duffy, J Schneller, H Greenberg, and K Tessmer.

QC-276. Constitution I. 8 **4110 ± 100**

5.95 to 6.15m below mean high water. Coll 1976 by L J Cinquemani.

QC-694. Constitution I. 9 **3760 ± 120**

6.1 to 6.6m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, and J Wilson.

QC-696. Constitution I. 10 **2460 ± 110**

6.7 to 7.2m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, and J Wilson. *Comment*: field notes suggest some sediment flowed into sample.

QC-227. Constitution I. 11 **4230 ± 120**

7.5 to 7.7m below mean high water. Coll 1976 by L J Cinquemani.

QC-1040. Constitution I. 12 **6030 ± 290**

7.9 to 8.3m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, B Duffy, J Schneller, H Greenberg, and K Tessmer.

QC-189. Constitution I. 13 **5570 ± 300**

9.25 to 9.45m below mean high water. Coll 1976 by L J Cinquemani.

QC-692. Constitution I. 14 **4660 ± 140**

9.35 to 9.75m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, and J Wilson. *Comment*: Marine Transgression appears more pronounced on E side of marsh.

QC-706. Manitou Marsh **3530 ± 110**

Basal peat, 3.65 to 4m below mean high water (41° 20′ 00″ N, 73° 58′ 00″ W). Coll 1979 by H Craig, S Jencius, and J Wilson.

Iona Island series

This series was taken from Ring Meadow, Iona Island. All samples are basal peat except where noted and at coordinates (41° 18′ 00″ N, 73° 58′ 50″ W).

QC-574. Iona I. 1 **390 ± 100**

0.94 to 1.14m below mean high water. Coll 1978 by W S Newman.

QC-763. Iona I. 2 **1040 ± 120**

0.6 to 1m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-764. Iona I. 3 **2240 ± 120**

Wood and peat, 1.7 to 2m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-575. Iona I. 4 **1460 ± 90**

1.98 to 2.18m below mean high water. Coll 1978 by W S Newman.

QC-1021. Iona I. 5 **3430 ± 120**

2.5 to 2.75m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, J Schneller, K Tessmer, and H Greenberg.

QC-765. Iona I. 6 **2140 ± 100**

2.7 to 3m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-576. Iona I. 7 **2830 ± 130**

Wood, 3.24 to 3.44m below mean high water. Coll 1978 by W S Newman.

QC-1022. Iona I. 8 **3510 ± 150**

3.41 to 3.71m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, J Schneller, K Tessmer, and H Greenberg.

QC-766. Iona I. 9 **2840 ± 110**

Peat, 3.6 to 3.9m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-1019. Iona I. 10 **4270 ± 260**

4.37 to 4.67m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, J Schneller, K Tessmer, and H Greenberg.

QC-274. Iona I. 11 **3610 ± 120**

4.4 to 4.6m below mean high water. Coll 1976 by L J Cinquemani and W S Newman.

QC-187. Iona I. 12 **3800 ± 160**

4.55 to 4.75m below mean high water. Coll 1976 by L J Cinquemani.

QC-577. Iona I. 13 **4520 ± 120**

4.89 to 5.09m below mean high water. Coll 1978 by W S Newman.

QC-767. Iona I. 14 **3140 ± 110**

4.9 to 5.3m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-1023. Iona I. 15 **4800 ± 190**

5.6 to 5.85m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, J Schneller, K Tessmer, and H Greenberg.

QC-768. Iona I. 16 **2960 ± 100**

6.1 to 6.5m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-1020. Iona I. 17 **4370 ± 270**

6.25 to 6.55m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, J Schneller, K Tessmer, and H Greenberg.

QC-1024. Iona I. 18 **5060 ± 270**

6.6 to 6.9m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, J Schneller, K Tessmer, and H Greenberg.

QC-775. Iona I. 19 **3870 ± 120**

Peat, 7 to 7.4m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-776. Iona I. 20 **2170 ± 100**

Peat, 7.6 to 8m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-777. Iona I. 21 **2570 ± 90**

Peat, 8.1 to 8.5m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-778. Iona I. 22 **4270 ± 120**

Peat, 9.6 to 10m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-186. Iona I. 23 **3940 ± 140**

10.55 to 10.75m below mean high water. Coll 1976 by L J Cinquemani.

General Comment: Iona I. samples 2, 3, 6, 9, 14, 16, 19, 20, 21, 22, and 23 coll along transect 100m S of other samples and yield considerably higher transgression rates. These samples appear to have been taken from SE block of Timp Fault.

Roa Hook series

This series was taken from tidal marsh at Roa Hook (Camp Smith). All samples are basal peat, at coordinates (41° 17′ 58″ N, 73° 56′ 50″ W); coll 1978 except where noted. Roa Hook 1-6 are W of E-facing buried (fault?) scarp; other samples of this series are E of scarp.

QC-511. Roa Hook 1 **126% modern**

From marsh surface. Coll by W S Newman.

QC-569. Roa Hook 2 **2490 ± 120**

1.94 to 2.14m below mean high water. Coll by W S Newman.

QC-722. Roa Hook 3 **2360 ± 100**

Wood and basal peat, 2.3 to 2.6m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-567. Roa Hook 4 **4280 ± 110**

3.83 to 4.03m below mean high water. Coll by W S Newman. *Comment*: result suspect because of data item omission.

QC-568. Roa Hook 5 **3170 ± 170**

4.01 to 4.21m below mean high water. Coll by W S Newman.

QC-1041. Roa Hook 6 **3190 ± 160**

4.25 to 4.55m below mean high water (41° 17′ 30″ N, 73° 56′ 00″ W). Coll 1980 by W S Newman, L J Cinquemani, B Duffy, J Schneller, H Greenberg, and K Tessmer.

QC-510. Roa Hook 7 **3140 ± 170**

4.8 to 5m below mean high water. Coll by W S Newman, R R Pardi, G Greengold, and H Craig.

QC-721. Roa Hook 8 **3320 ± 110**

5.5 to 5.8m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-723. Roa Hook 9 **3910 ± 130**

6.7 to 7m below mean high water. Coll 1979 by H Craig, S Jencius, and F Ciapetti.

QC-566. Roa Hook 10 **4660 ± 100**

Wood and peat, 6.87 to 7.07m below mean high water. Coll by W S Newman.

QC-1043. Roa Hook 11 **4450 ± 200**

7.5 to 7.95m below mean high water. Coll 1980 by W S Newman, L J Cinquemani, B Duffy, J Schneller, H Greenberg, and K Tessmer.

QC-565. Roa Hook 12 **5470 ± 140**

Wood and peat, 8.6 to 8.8m below mean high water. Coll by W S Newman.

QC-512. Roa Hook 13 **4120 ± 350**

8.8 to 9m below mean high water. Coll by W S Newman.

QC-509. Roa Hook 14 **4550 ± 130**

9.3 to 9.5m below mean high water. Coll by W S Newman, R R Pardi, G Greengold, and H Craig.

QC-573. Roa Hook 15 **6230 ± 120**

Wood, 10.8 to 11m below mean high water. Coll by W S Newman.

Stony Point series

This series was taken from tidal marsh S of Stony Point. All samples are basal peat, at coordinates (41° 14′ 40″ N, 73° 58′ 05″ W); coll 1978 by W S Newman, L J Cinquemani, H Craig, S Nelson, and V Newman except where noted.

QC-505. Stony Point 1 **3100 ± 110**

3.2 to 3.4m below mean high water.

QC-506. Stony Point 2 **3740 ± 200**

5.8 to 6m below mean high water.

QC-469. Stony Point 3 **4830 ± 110**

5.9 to 6.1m below mean high water. Coll 1977 by W S Newman, L J Cinquemani, H Craig, G Greengold, V Newman, and S Nelson.

Oscawana Island series

This series was taken from Tidal Marsh, Oscawana I. All samples are basal peat, at coordinates (41° 13′ 45″ N, 73° 55′ 50″ W); coll 1976 by L J Cinquemani except where noted.

QC-228. Oscawana I. 1 **1870 ± 90**

2.5 to 2.7m below mean high water.

QC-729. Oscawana I. 2 **330 ± 100**

5.6 to 5.9m below mean high water. Coll 1979 by H Craig and S Jencius. *Comment*: Oscawana 2 date seems inexplicable for its depth.

QC-221B. Oscawana I. 3 **4570 ± 120**

6.6 to 6.8m below mean high water.

QC-264. Oscawana I. 4 **4500 ± 100**

6.8 to 7m below mean high water.

QC-221A. Oscawana I. 5 **5150 ± 210**

7.3 to 7.5m below mean high water.

Cedar Pond series

This series was taken from Cedar Pond Brook Marsh. All samples are basal peat, at coordinates (41° 13′ 30″ N, 73° 58′ 00″ W); coll 1979.

QC-770. Cedar Pond 1 **800 ± 100**

0.7 to 1m below mean high water. Coll by H Craig, S Jencius, F Ciapetti, and H Greenberg.

QC-772. Cedar Pond 2 **1740 ± 100**

1.7 to 2m below mean high water. Coll by H Craig, S Jencius, F Ciapetti, and H Greenberg.

QC-712. Cedar Pond 3 **1940 ± 110**

2.5 to 2.8m below mean high water. Coll by H Craig and S Jencius.

QC-773. Cedar Pond 4 **2650 ± 100**

2.5 to 2.8m below mean high water. Coll by H Craig, S Jencius, F Ciapetti, and H Greenberg.

QC-771. Cedar Pond 5 **2890 ± 130**

Wood and peat, 3.1 to 3.4m below mean high water. Coll by H Craig, S Jencius, F Ciapetti, and H Greenberg.

QC-810. Cedar Pond 6 **3030 ± 100**

3.2 to 3.6m below mean high water. Coll by H Craig, S Jencius, J Gordon, F Ciapetti, and H Greenberg.

QC-709. Cedar Pond 7 **2220 ± 120**

3.25 to 3.6m below mean high water. Coll by H Craig, S Jencius, and S Olgun.

QC-774. Cedar Pond 8 **3090 ± 110**

3.4 to 3.7m below mean high water. Coll by H Craig, S Jencius, F Ciapetti, and H Greenberg.

QC-811. Cedar Pond 9 **2700 ± 120**

3.5 to 3.9m below mean high water. Coll by H Craig, S Jencius, J Gordon, F Ciapetti, and H Greenberg.

QC-710. Cedar Pond 10 **3660 ± 110**

3.85 to 4.2m below mean high water. Coll by H Craig and S Jencius.

QC-812. Cedar Pond 11 **3860 ± 150**

4.2 to 4.6m below mean high water. Coll by H Craig, S Jencius, J Gordon, F Ciapetti, and H Greenberg.

QC-711. Cedar Pond 12 **3630 ± 110**

5.1 to 5.5m below mean high water. Coll by H Craig and S Jencius.

QC-718. Cedar Pond 13 **4400 ± 130**

6.6 to 7m below mean high water. Coll by H Craig and S Jencius.

QC-719. Cedar Pond 14 **5080 ± 130**

6.7 to 7m below mean high water. Coll by H Craig and S Jencius.

Piermont series

This series was taken from Piermont Tidal Marsh, Tallman State Park. All samples are basal peat, at coordinates (41° 01′ 30″ N, 73° 54′ 00″ W); coll 1979 by H Craig and S Jencius except where noted.

QC-733. Piermont 1 **<90**

0.7 to 1m below mean high water.

QC-734. Piermont 2 **1420 ± 120**

1.4 to 1.7m below mean high water.

QC-735. Piermont 3 **2000 ± 110**

3 to 3.3m below mean high water.

QC-211. Piermont 4 **2300 ± 160**

2.8 to 3m below mean high water. Coll 1976 by B Cirolli, M Drillings, J Gordon, and M Balarazo.

QC-736. Piermont 5 **2550 ± 140**

4.5 to 4.8m below mean high water.

QC-732. Piermont 6 **2990 ± 100**

4.5 to 4.8m below mean high water.

QC-730. Piermont 7 **3050 ± 100**

5.2 to 5.5m below mean high water.

QC-738. Piermont 8 **3320 ± 140**

6.65 to 7m below mean high water.

QC-262. Piermont 9 **3460 ± 100**

4.85 to 5.05m below mean high water. Coll by L J Cinquemani.

QC-731. Piermont 10 **3530 ± 110**

Wood hash, 5.1 to 5.2m below mean high water. *Comment*: samples are not basal peat above Piermont 7.

QC-737. Piermont 11 **3730 ± 200**

5.6 to 5.9m below mean high water.

QC-739. Piermont 12 **3790 ± 90**

7.6 to 8m below mean high water.

QC-261. Piermont 13 **4610 ± 110**

8.34 to 8.54m below mean high water. Coll by L J Cinquemani.

QC-740. Piermont 14 **4300 ± 280**

8.6 to 9m below mean sea level.

QC-741. Piermont 15 **4720 ± 120**

9.6 to 10m below mean high water.

QC-742. Piermont 16 **5320 ± 170**

11.1 to 11.4m below mean high water. Coll by H Craig, S Jencius, and F Ciapetti.

QC-808. Piermont 17 **5480 ± 140**

11 to 11.5m below mean high water. Coll by H Craig, S Jencius, J Gordon, F Ciapetti, and H Greenberg.

QC-809. Piermont 18 **6840 ± 230**

11.5 to 12m below mean high water. Coll by H Craig, S Jencius, J Gordon, and H Greenberg.

QC-295. Pelham Bay Park **1800 ± 90**

Basal peat, 2.05 to 2.25m below mean high water (40° 52′ 06″ N, 73° 47′ 36″ W), Pelham Bay Park, Bronx. Coll 1976 by W S Newman, L J Cinquemani, and H Craig.

East River series

This series consists of commercial borehole samples taken from East R. All samples are basal peat, at coordinates (40° 47′ 45″ N, 73° 49′ 50″ W) and coll 1976 by Mueser, Rutledge, Johnson, and DeSimone, Consulting Engineers except where noted.

QC-267. College Point Marsh, Core B-206B4, Sample 3 **5650 ± 170**

12.7 to 13m below mean high water.

QC-306. Roosevelt Ave 1 **7980 ± 390**

15.5 to 15.7m below mean high water (40° 48′ N, 73° 48′ W). Coll by M Marty, Transit Authority.

QC-266. College Point Marsh, Core B-288, Sample 13 **7120 ± 240**

17.7 to 18m below mean high water.

QC-265. College Point Marsh, Core B-219, Sample 15 **6370 ± 100**

18.1 to 18.3m below mean high water.

QC-269. College Point Marsh, Core B-227, Sample 15 **8100 ± 100**

19.7 to 20.1m below mean high water.

QC-268. College Point Marsh, Core B-218, Sample 13 **12,400 ± 260**

20 to 20.3m below mean high water.

Westway series

This series was taken along lower W side of Manhattan I. All samples are organic-rich sediments overlying glacial gravels, sands, or rock. Coll 1979 by Mueser, Rutledge, Johnston, and DeSimone, Consulting Engineers except where noted.

QC-1399. Westway MJ0682-0012-057-BVB3 **2700 ± 150**

Peat, 1.7 to 1.8m below mean high water (40° 27′ 20″ N, 74° 10′ 45″ W).

QC-1381. Westway Core TT-412, Sample 300 **10,700 ± 180**

13.7 to 14.3m below mean high water (40° 45′ 10″ N, 74° 00′ 18″ W).

QC-1382. Westway Core VT-209, Sample 4D **2030 ± 150**

18.7 to 19.4m below mean high water (40° 43′ 28″ N, 74° 00′ 18″ W).

QC-1029. Westway Core HT-1270, Sample 130D **8190 ± 130**

Basal peat, 19.2 to 19.8m below mean high water (40° 43′ 31″ N, 74° 00′ 40″ W), from West Side Expressway-Holland Tunnel.

QC-1330. Westway Core VT-249, Sample 8D **490 ± 110**

Intrusive wood fragment probably from pier piling, 21.3 to 21.9m below mean high water (40° 43′ 50″ N, 74° 00′ 46″ W).

QC-1380. Westway Core VT-203, Sample 11D **8960 ± 270**

21.3 to 21.9m below mean high water (40° 43′ 28″ N, 74° 00′ 56″ W).

QC-1028. Westway Core HV-21, Sample 60D **8750 ± 170**

Basal peat, 21.3 to 22m below mean high water (40° 43′ 23″ N, 74° 00′ 59″ W), from West Side Expressway-Chambers St.

QC-1389. Westway Core VT-214, Sample 9D **7650 ± 190**

21.5 t o 22m below mean high water (40° 43′ 32″ N, 74° 00′ 57″ W).

QC-1027. Westway Core HV-13, Sample 11D **10,500 ± 500**

Basal peat, 22 to 22.6m below mean high water (40° 43′ 26″ N, 74° 00′ 58″ W), from West Side Expressway-Chambers St.

QC-1026. Westway Core HT-120, Sample 13D **9170 ± 230**

Basal peat, 22.9 to 23.5m below mean high water (40° 43′ 34″ N, 74° 00′ 43″ W), from West Side Expressway-Holland Tunnel.

QC-1184. Westway Core HT-124, Sample 19D 5540 ± 160

Shell probably allochthonous, 23.2 to 23.5m below mean high water (40° 43′ 33″ N, 74° 00′ 40″ W), from along Holland Tunnel, right-of-way on E side of Hudson R.

QC-1321. Westway Core TT-313, Sample 12D 7920 ± 200

24.4 to 25m below mean high water (40° 44′ 27″ N, 74° 00′ 40″ W).

QC-1374. Westway Core VT-215, Sample 15D 8690 ± 190

Organic rich sediment just above bedrock, 24.4 to 25m below mean high water (40° 43′ 30″ N, 74° 00′ 59″ W).

QC-1025. Westway Core HT-123U, Sample 27D 11,300 ± 220

Basal peat, 24.8 to 25.5m below mean high water (40° 43′ 32″ N, 74° 00′ 40″ W), from West Side Expressway-Holland Tunnel.

QC-1324. Westway Core TT-335, Sample 14D 11,100 ± 250

27.4 to 28m below mean high water (40° 44′ 30″ N, 74° 00′ 36″ W).

QC-1322. Westway Core TT-314, Sample 15D 11,420 ± 250

27.4 to 28m below mean high water (40° 44′ 27″ N, 74° 00′ 40″ W).

QC-1329. Westway Core TT-359, Sample 16D 11,990 ± 220

29 to 29.6m below mean high water (40° 44′ 36″ N, 74° 00′ 34″ W).

QC-1326. Westway Core TT-352, Sample 17D 11,620 ± 200

30.5 to 31.1m below mean high water (40° 44′ 35″ N, 74° 00′ 36″ W).

QC-1183. Westway Core RR-114, Sample 22D 9540 ± 120

Organic silt, 36.6 to 37.2m below mean high water (40° 45′ 39″ N, 74° 00′ 47″ W), from Amtrak Tunnel-E shore Hudson R. *Comment*: not basal peat.

QC-1182. Westway Core RR-126, Sample 27 10,200 ± 170

Wood fragments overlying glacial gravel, 38.2 to 38.9m below mean high water (40° 45′ 36″ N, 74° 00′ 45″ W); coll 1978. *Comment*: probably allochonthonous sample.

QC-1315. Westway Core WT-505, Sample 26D 12,280 ± 260

Lowest organic material above glacial gravel, 42.7 to 43.3m below mean high water (40° 45′ 35″ N, 74° 00′ 45″ W).

Caumsett Marsh series

This series was taken from Caumsett Marsh. All samples are basal peat, at coordinates (40° 56′ 30″ N, 73° 28′ 50″ W); coll 1979 by D Habib, W S Newman, L J Cinquemani, H Craig, S Jencius, and J Wilson.

QC-689. Caumsett Marsh 1 780 ± 120

0.9 to 1.1m below mean high water.

QC-687. Caumsett Marsh 2 **660 ± 120**

2.05 to 2.35m below mean high water.

QC-688. Caumsett Marsh 3 **760 ± 140**

2.06 to 2.36m below mean high water.

Eatons Neck series

This series are all basal peats from tidal marsh on Eatons Neck, at coordinates (40° 56′ 58″ N, 73° 23′ 43″ W). Coll 1979 by G Wisker.

QC-681. Eatons Neck 1 **370 ± 120**

0.65 to 0.95m below mean high water.

QC-679. Eatons Neck 2 **1590 ± 11**

1.4 to 1.55m below mean high water.

QC-682. Eatons Neck 3 **2520 ± 90**

4.85 to 5.05m below mean high water.

QC-190. Mt Sinai **2180 ± 100**

Peat, 4.2 to 4.9m below surface (40° 56′ 55″ N, 73° 01′ 50″ W), from Mt Sinai Harbor. Coll 1976 by L J Cinquemani.

Shelter Island series

This series was taken from Bass Creek, Shelter I. All samples are at coordinates (41° 02′ 47″ N, 72° 18′ 50″ W); coll 1980 by W S Newman, M Newman, B Duffy, L Bruno, and J Isby.

QC-1084. Shelter I. 1 **850 ± 150**

Salt marsh-*sphagnum* peat interface, 1.1 to 1.3m below mean high water.

QC-1083A&B. Shelter I. 2 **3590 ± 130**

Base of *sphagnum* peat sec above glacial drift. Peat and wood, 6.6 to 6.75m below mean high water.

QC-1082. Queens Mall, Core 5, Sample 14B **32,000 $^{+3800}_{-2600}$**

Peat, 22.8 to 23.5m below mean high water (40° 44′ 05″ N, 73° 52′ 30″ W), from Queens Mall, Rego Park, near intersec of Queens Blvd and Woodhaven Blvd. Coll 1973 by Woodward Moorehouse Assoc. *Comment*: sample in Flushing Formation (see Newman, 1977).

New Jersey

Cheesequake series

This series was taken from salt marsh in Cheesequake State Park. All samples are basal peat except Cheesequake 6, at coordinates (40° 26′ 05″ N, 74° 17′ 20″ W); coll 1979 by W S Newman, H Craig, S Jencius, H Greenberg, and R Ortner except where noted. Cheesequake 4 through 6 appear anomalous in age and/or elev.

QC-844. Cheesequake 1 **1210 ± 190**
2.6 to 2.8m below mean high water.

QC-847. Cheesequake 2 **1960 ± 130**
2.8 to 3.05m below mean high water.

QC-842. Cheesequake 3 **2080 ± 160**
3.3 to 3.5m below mean high water.

QC-848. Cheesequake 4 **930 ± 170**
4.5 to 4.8m below mean high water.

QC-846. Cheesequake 5 **530 ± 150**
9.25 to 9.65m below mean high water.

QC-845. Cheesequake 6 **4820 ± 100**
Peat, 10.9 to 11.15m below mean high water.

QC-896. Cheesequake 7 **7230 ± 190**
11.8 to 12.1m below mean high water. Coll by H Craig, S Jencius, H Greenberg, and K Tessmer.

Sea Island City series

This series was taken from Sea Island City. All samples are basal peat and coll 1979 by W S Newman, H Craig, S Jencius, H Greenberg, and R Ortner.

QC-849. Sea I. City 1 **<160**
0.7 to 0.9m below mean high water (39° 10′ 40″ N, 74° 43′ 45″ W). *Comment*: modern rootlet contamination.

QC-850. Sea I. City 2 **920 ± 160**
1.3 to 1.5m below mean high water (39° 10′ 30″ N, 74° 43′ 35″ W).

QC-851. Sea I. City 3 **2350 ± 100**
From layer 2.8 to 3m below mean high water (39° 10′ 15″ N, 74° 43′ 25″ W).

QC-852. Sea I. City 4 **2260 ± 100**
3.5 to 3.7m below mean high water (39° 10′ 00″ N, 74° 43′ 15″ W).

QC-853. Sea I. City 5 **2760 ± 100**
4.75 to 4.95m below mean high water (39° 09′ 45″ N, 74° 43′ 05″ W).

QC-854. Sea I. City 6 **3440 ± 110**
5.45 to 5.75m below mean high water (39° 09′ 40″ N, 74° 42′ 45″ W).

QC-855. Sea I. City 7 **3960 ± 110**
7.3 to 7.6m below mean high water (39° 09′ 30″ N, 74° 42′ 25″ W).

Connecticut

Indian River series

This series was taken from Indian River, Milford. All samples are basal peat at coordinates (41° 13′ 10″ N, 73° 02′ 12″ W); coll 1980 by W S Newman, H Greenberg, L J Cinquemani, K Tessmer, J Schneller, and W Krulish.

QC-1017A&B. Indian R 1 **2970 ± 100**
3.2 to 3.65m below mean high water.

QC-1012A&B. Indian R 2 **3500 ± 120**
4.25 to 4.45m below mean high water.

QC-1010A&B. Indian R 3 **3650 ± 100**
5.3 to 5.7m below mean high water.

QC-1016. Gulf Pond **1520 ± 190**
Basal peat, 2 to 2.2m below mean high water (41° 13′ 00″ N, 73° 12′ 00″ W), from Gulf Pond, Milford. Coll 1980 by W S Newman, L J Cinquemani, H Greenberg, K Tessmer, J Schneller, and W Krulish.

Oyster Creek series

This series was taken from Oyster Creek, Old Saybrook. All samples are basal peat at coordinates (41° 15′ 20″ N, 72° 21′ 00″ W); coll 1980 by W S Newman, L J Cinquemani, H Greenberg, K Tessmer, J Schneller, and W Krulish.

QC-1015A. Oyster Creek 1 **3970 ± 390**
3.87 to 3.97m below mean high water.

QC-1014. Oyster Creek 2 **4460 ± 160**
6.53 to 6.83m below mean high water.

QC-1014B&C. Oyster Creek 3 **3850 ± 240**
6.42 to 6.83m below mean high water.

QC-1013. Oyster Creek 4 **4780 ± 180**
6.95 to 7.15m below mean high water.

QC-1011. Oyster Creek 5 **5510 ± 130**
Shell in basal peat, 7.9 to 8.05m below mean high water.

Delaware

QC-807. Fowler Beach **290 ± 200**
Basal peat, 0.4 to 0.55m below mean high water (38° 53′ 00″ N, 74° 16′ 18″ W), from Fowler Beach. Coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

Maryland

Radcliffe Creek series

This series was taken from Radcliffe Creek Bridge. All samples are basal peat at coordinates (59° 12′ 00″ N, 76° 04′ 00″ W); coll 1979 by W S Newman, H Craig, S Jencius, H Greenberg, R Ortner, and G G Connally.

QC-859. Radcliffe Creek 1 **1230 ± 160**

1.8 to 2m below mean high water.

QC-857. Radcliffe Creek 2 **3370 ± 150**

Wood, small acorn, and basal peat, 5 to 5.3m below mean high water.

QC-856. Radcliffe Creek 3 **4510 ± 120**

10.7 to 11m below mean high water.

Blackwater series

This series was taken from Blackwater Wildlife Refuge. All samples coll 1979 by W S Newman, H Craig, S Jencius, H Greenberg, and R Ortner.

QC-860. Blackwater 1 **2840 ± 140**

Basal peat and some wood hash, 3.2 to 3.45m below mean high water (38° 23′ 32″ N, 76° 03′ 45″ W).

QC-861. Blackwater 2 **2490 ± 130**

Basal peat and some wood, 3.5 to 3.7m below mean high water (38° 23′ 23″ N, 76° 03′ 50″ W).

QC-862. Blackwater 3 **2650 ± 180**

Basal peat, 4 to 4.2m below mean high water (38° 23′ 15″ N, 76° 03′ 55″ W).

QC-863. Blackwater 4 **3750 ± 120**

Basal peat and wood hash, 5.4 to 5.7m below mean high water (38° 23′ 00″ N, 76° 04′ 00″ W).

North Carolina

Roanoke Island series

This series was taken from Baumtown, Roanoke I. All samples are basal peat at coordinates (35° 52′ 30″ N, 75° 39′ 00″ W); coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

QC-792. Roanoke I. 1 **760 ± 140**

0.4 to 0.6m below mean high water.

QC-805. Roanoke I. 2 **2950 ± 280**

1.1 to 1.3m below mean high water.

QC-804. Roanoke I. 3 **2630 ± 150**

1.4 to 1.7m below mean high water.

Croatan National Forest series

This series was taken from Croatan Natl Forest. All samples are basal peat at coordinates (34° 42′ N, 77° 06′ W); coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

QC-801. Croatan Forest 1 **1180 ± 190**

0.4 to 0.7m below mean high water.

QC-802. Croatan Forest 2 **1740 ± 110**

1.6 to 1.9m below mean high water.

Lilliput Creek series

This series was taken from Lilliput Creek, Rte 133 near Wilmington. All samples are at coordinates (34° 04′ 30″ N, 77° 57′ 27″ W); coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

QC-798. Lilliput Creek 1 **1450 ± 150**

Basal peat, 0.6 to 0.8m below mean high water.

QC-799. Lilliput Creek 2 **1390 ± 130**

Basal peat, 1.25 to 1.45m below mean high water.

QC-793A. Lilliput Creek 3 **3390 ± 110**

Wood, 3.1 to 3.3m below mean high water.

QC-793B. Lilliput Creek 4 **3400 ± 110**

Basal peat, 3.5 to 3.8m below mean high water.

QC-794. Lilliput Creek 5 **3600 ± 120**

Wood and peat, 4.2 to 4.5m below mean high water.

QC-795. Lilliput Creek 6 **3260 ± 190**

Basal peat, 4.5 to 4.9m below mean high water.

QC-796. Lilliput Creek 7 **3870 ± 180**

Basal peat, 5.45 to 5.95m below mean high water.

QC-797. Lilliput Creek 8 **5680 ± 250**

Wood and basal peat, 8.1 to 8.36m below mean high water.

South Carolina

Pee Dee River series

QC-603. Pee Dee R 1 **2630 ± 110**

Woody peat, 2.6 to 2.8m below mean high water. Coll 1978 by W S Newman and F Stapor.

QC-602. Pee Dee R 2 **3690 ± 150**

Basal peat, 3.4 to 3.6m below mean high water. Coll 1978 by W S Newman and F Stapor.

QC-815. Pee Dee R 3 **5300 ± 150**

Wood, in basal peat, 3.5 to 3.9m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

QC-604. Pee Dee R 4 **4680 ± 120**

Wood, 4.8 to 5m below mean high water. Coll 1978 by W S Newman and F Stapor.

QC-813. Pee Dee R 5 **5630 ± 130**

Peat, 6.58 to 6.8m below mean high water, 0.3m above sand stratum. Coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

QC-814. Pee Dee R 6 **6140 ± 200**

Basal peat, 6.65 to 7.1m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

Santee River series

This series was taken from Santee River Estuary near Rte 17. All samples are at coordinates (33° 11′ 36″ N, 79° 23′ 48″ W); coll 1978 by W S Newman and F Stapor.

QC-596-1. Santee R 1 **3110 ± 90**

Basal peat, 3 to 3.2m below mean high water.

QC-596-2. Santee R 2 **3140 ± 140**

Basal peat, 3 to 3.2m below mean high water. Repeat assay of Santee R 1.

QC-597. Santee R 3 **4550 ± 150**

Wood and peat, 3.87 to 4.15m below mean high water.

QC-595. Santee R 4 **4420 ± 410**

Basal peat, 4.05 to 4.35m below mean high water.

QC-598. Santee R 5 **3980 ± 280**

Wood in paleosol, 5.3m below mean high water.

Cooper River series

This series was taken from Cooper River Estuary. All samples are basal peat and coll 1978 by W S Newman and D J Colquhoun except where noted.

QC-583. Cooper R 1 **2040 ± 110**

Wood stump in basal peat on Cooper Marl, 1m below mean high water (32° 55′ 30″ N, 79° 53′ 42″ W).

QC-611. Cooper R 2 **2150 ± 110**

1.6 to 1.8m below mean high water (32° 58′ 30″ N, 79° 54′ 05″ W).

QC-585. Cooper R 3 **2700 ± 120**

Stump in basal peat on Cooper Marl, 2m below mean high water (32° 58′ 31″ N, 79° 53′ 40″ W).

QC-613. Cooper R 4 **2330 ± 140**
1.6 to 2.3m below mean high water (32° 58′ 30″ N, 79° 54′ 05″ W).

QC-584. Cooper R 5 **3100 ± 100**
2.5 to 2.7m below mean high water (32° 58′ 30″ N, 79° 54′ 05″ W).

QC-588. Cooper R 6 **4140 ± 70**
2.8 to 3.1m below mean high water (32° 59′ 50″ N, 79° 53′ 52″ W).

QC-587. Cooper R 7 **4290 ± 130**
3.4 to 3.7m below mean high water (32° 59′ 05″ N, 79° 54′ 00″ W).

QC-586. Cooper R 8 **5010 ± 140**
4.3 to 4.7m below mean high water (32° 58′ 45″ N, 79° 53′ 37″ W).

Wando River series

This series was taken from Hobcaw Creek, Wando River. All samples are at coordinates (32° 48′ 00″ N, 79° 53′ 00″ W) and coll 1979 by L J Cinquemani and H Craig.

QC-703. Wando R 1 **3100 ± 160**
Basal peat, 2 to 2.2m below mean high water.

QC-702. Wando R 2 **4670 ± 130**
Woody basal peat, 2.75 to 3.05m below mean high water.

QC-704. Wando R 3 **4760 ± 290**
Basal peat and wood hash, 3.9 to 4.2m below mean high water.

Combahee River series

This series was taken from Combahee River. All samples are peat at coordinates (32° 39′ 12″ N, 80° 40′ 30″ W); coll 1978 by W S Newman and F W Stapor except where noted.

QC-609. Combahee R 1 **2880 ± 110**
2.26 to 2.45m below mean high water.

QC-610. Combahee R 2 **3330 ± 130**
Woody peat, 2.75 to 2.9m below mean high water.

QC-828. Combahee R 3 **4430 ± 170**
Basal peat, 3.32 to 3.66m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

QC-594. Combahee R 4 **5620 ± 140**
3.65 to 3.8m below mean high water.

QC-593. Combahee R 5 **5280 ± 120**
4 to 4.2m below mean high water.

QC-589. Combahee R 6 **5400 ± 120**
4.15 to 4.35m below mean high water (32° 39′ 20″ N, 80° 40′ 14″ W).

Coosawatchie River series

This series was taken from Coosawatchie River. All samples are basal peat at coordinates (32° 35′ 00″ N, 80° 55′ 15″ W); coll 1979 by D Colquhoun, W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

QC-827. Coosawatchie R 1 **730 ± 110**

0.7 to 1m below mean high water.

QC-826. Coosawatchie R 2 **2130 ± 100**

1.28 to 1.58m below mean high water.

Savannah River series

This series was taken from Savannah River Estuary. All samples are at coordinates (32° 08′ 00″ N, 80° 59′ 30″ W); coll 1978 by F Stapor and W S Newman except where noted.

QC-825. Savannah R 1 **3130 ± 130**

Basal peat and some wood, 2 to 2.3m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

QC-600. Savannah R 2 **2320 ± 110**

Peat and some wood, 2.5 to 2.7m below mean high water.

QC-599. Savannah R 3 **3100 ± 100**

Basal peat, 2.7 to 2.9m below mean high water.

QC-821. Savannah R 4 **2440 ± 130**

Basal peat, 3.35 to 3.53m below mean high water. Coll 1979 by W S Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

QC-601. Savannah R 5 **3070 ± 190**

Peat and roots in paleosol, 4m below mean high water.

QC-822. Savannah R 6 **2060 ± 130**

Basal peat, 4.77 to 5.07m below mean high water. Coll 1979 by W Newman, H Craig, S Jencius, J Gordon, and H Greenberg.

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[RADIOCARBON, VOL 26, NO. 3, 1984, P 431-440]

SIMON FRASER UNIVERSITY RADIOCARBON DATES III

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This list reports measurements made on archaeologic and geologic samples by our laboratory from June 1982 to December 1983. Results of measurements made during that period which lack review by submitters will be reported in a subsequent date list. Sample preparation techniques and benzene synthesis remain as described previously (R, 1982, v 24, p 344-351). For low organic samples, such as sediments, we now use a combustion tube assembly. These samples are burned under oxygen flow in a quartz tube. To absorb sulfur and break up nitrous compounds, we pass combustion gases through a 50% mixture of MnO_2 and CuO wire heated to ca 500°C. The gas is then bubbled through a distilled water and $KMnO_4$ solution to remove chlorides before being introduced into our standard dry ice and CO_2 traps.

Benzene is now counted on an LKB-Wallac *Rackbeta* liquid scintillation spectrometer. For 5ml counting volumes our background level is 4.0 ± 0.03 cpm. The normalized oxalic activity (Aon) is 7.51 ± 0.03 cpm at a ^{14}C counting efficiency of 68%. Our laboratory standard continues to be ANU sucrose which is routinely calibrated against both oxalic standards. All dates are expressed in ^{14}C years relative to AD 1950 based on the Libby half-life for ^{14}C of 5568 yr. Unless otherwise stated, dates have been corrected for isotopic fractionation only when the $\delta^{13}C$ value is given. No corrections have been made for natural ^{14}C variations. The following descriptions of samples are based on information provided by submitters.

ACKNOWLEDGMENTS

We would like to thank Bob Drimmie and Tom Brown for their advice and assistance. C E Rees performed all $\delta^{13}C$ measurements quoted. Richard Shutler, Jr and Roy Carlson are members of the SFU Radiocarbon Laboratory Committee.

ARCHAEOLOGIC SAMPLES

Canada

British Columbia

Yale Series I

Charcoal from DjRi 7 site (49° 33′ 17″ N, 121° 26′ 0″ W) directly across river from Yale, British Columbia. Previous excavations (Borden, 1968; 1975) report basal date of 5240 ± 100 (I-8208). Samples coll and subm by Shawn Haley, Dept Archaeol, Simon Fraser Univ.

SFU-225. **4200 ± 380**

Charcoal from 0.79 to 0.85m below surface. *Comment* (SH): sample dates Pebble Tool tradition component.

SFU-238. **5900 ± 130**

Charcoal from 1.4m below surface. *Comment* (SH): sample dates base of microblade component in rock shelter.

SFU-248. **3130 ± 500**

Charcoal from 0.97m below surface. *Comment*: sample too small for base rinse. *Comment* (SH): sample provides basal date for culture-bearing deposit.

Kitselas Canyon Series II

Charcoal excavated from GdTc-16 site (54° 36′ 28″ N, 128° 25′ 04″ W), E side of Skeena R, Kitselas Canyon, 16km NE of Terrace, British Columbia. Samples subm to continue study of village site (R, 1983, v 25, p 901); coll and subm by Gary Coupland, Dept Anthropol, Univ British Columbia for Natl Mus Man, Ottawa.

SFU-255. **4060 ± 120**

Charcoal from 30cm below surface of housefloor excavation #1. Sample subm to date occupation of this floor. *Comment* (GC): result seems to be very early — may be re-deposited from earlier (microblade) component.

SFU-256. **4130 ± 90**

Charcoal from 140cm below surface, housefloor excavation #1. Sample assoc with microblades and thought to date microblade component in this excavation area. *Comment* (GC): result as expected.

SFU-257. **4250 ± 100**

Charcoal from 115cm below surface of housefloor excavation #2. *Comment* (GC): sample assoc with microblades; dates microblade component.

SFU-258. **4270 ± 200**

Charcoal from 95cm below surface of housefloor excavation #2. *Comment* (GC): sample dates microblade component in this excavation area.

SFU-259. **5050 ± 140**

Charcoal from 101cm below surface. *Comment* (GC): this is test midden excavation. Sample assoc with microblades. Result as expected.

SFU-260. **1330 ± 90**

Charcoal from 30cm below surface in housefloor hearth feature. *Comment* (GC): sample dates occupation of housefloor. Result as expected.

SFU-261. **4350 ± 320**

Charcoal from 205cm below surface housefloor excavation #3 from sterile beach deposit underlying cultural deposit. *Comment* (GC): result seems too late for beach deposit at this elev above river level.

Alexis Creek Series I

Charcoal from Sites FaRt 16 and FaRt 17, E side of Alexis Creek,

Chilcotin Plateau (52° 04′ 45″ N, 123° 18′ 10″ W). Samples coll and subm by Jean Bussey, Points West Heritage Consulting Ltd., Langley, British Columbia.

SFU-309. **700 ± 100**

Charcoal from FaRt 16. Sample subm to date lowest cultural layer in roasting pit feature. *Comment*: sample heavily contaminated by roots. No base rinse possible due to small size.

SFU-310. **500 ± 80**

Charcoal from FaRt 17. Sample subm to date circular cultural depression. *Comment*: heavy root contamination — no base rinse.

SFU-311. **620 ± 80**

Charcoal from FaRt 16. Sample subm to date use of roasting pit. *Comment*: heavy root contamination — no base rinse.

Namu Series II

Human bone collagen from Namu; prehistoric shell midden site, ElSx 1, E side of Fitzhugh Sound (51° 51′ 32″ N, 127° 51′ 50″ W). For additional inf on burial excavations, see Hester and Nelson (1978). Samples subm by Joanne Curtin, Dept Archaeol, Simon Fraser Univ.

SFU-341. **2530 ± 160**
$\delta^{13}C = -13.0‰$

Collagen from long bone and rib fragments. Sample from cairn burial 10 to 70cm below surface excavated in 1978 by R Carlson. *Comment* (JC): probably one of most recent burials from Namu and may show different pattern of burial from earliest remains.

SFU-342. **4680 ± 160**
$\delta^{13}C = -13.4‰$

Collagen from rib fragments and miscellaneous unid. bone. Sample from burial 7.5m below surface excavated by Hester in 1969 to 1970. *Comment* (JC): termination date for multiple internment involving at least 12 individuals.

SFU-343. **4390 ± 160**
$\delta^{13}C = -13.0‰$

Collagen from rib fragments. Sample from burial 2m below surface excavated by Hester 1969 to 1970.

SFU-344. **5590 ± 100**
$\delta^{13}C = -12.9‰$

Collagen from long bones sample from burial 1.5m below surface excavated by Hester 1969. *Comment* (JC): confirms stratigraphic evidence that this is 1 of 2 oldest burials from site.

Westbank Series I

Charcoal from DlQv 37 site (50° 53′ 00″ N, 119° 31′ 00″ W) on W

side of Okanagan Lake, British Columbia. Samples coll and subm by Mike Rousseau for Westbank Indian Council Heritage Proj.

SFU-302. **1080 ± 160**

Charcoal subm to date main occupation horizon of site.

SFU-350. **Modern**

Charcoal from hearth feature 78 to 85cm below surface. *Comment* (MR): possible charred root.

SFU-351. **1900 ± 80**

Charcoal assoc with main occupation horizon.

Alberta

Banff National Park Series I

Charcoal from EhPv 8 site in Bow Valley (51° 10′ 30″ N, 115° 38′ 40″ W). Samples coll and subm by Daryl Fedje for Parks Canada. *Comment*: all samples were heavily contaminated with carbonates; extensive acid treatment was used in their preparation.

SFU-314. **10,900 ± 270**

Charcoal from lowest cultural component.

SFU-316. **11,500 ± 300**

Charcoal from second lowest cultural component. *Comment*: sample indicates reversed stratigraphy compared to SFU-314.

SFU-317. **9400 ± 400**

Charcoal from lower cultural component.

SFU-318. **9800 ± 400**

Charcoal from lower cultural component.

SFU-346. **11,700 ± 290**

Charcoal from second lowest cultural component. *Comment*: sample supports SFU-316.

Manitoba

Stott Site Series I

Bison bone from Stott site (DlMa-1) near Brandon (49° 48′ 45″ N, 100° 5′ 36″ W). Site is bison kill and processing sta occupied at various times of year by small hunting groups. Samples were taken from loci within Grand Valley Prov Park. Samples subm by Historic Resources Branch, Manitoba.

SFU-224. **1140 ± 240**

Collagen extracted from *Bison bison* proximal left radius. Sample subm to date first exposed portion of major bone deposit.

SFU-229. **1100 ± 150**

Collagen extracted from *Bison bison* distal right humerus. Sample subm to date adjacent hearth feature.

United States

Kentucky

Lower Cumberland Archaeol Proj Series I

Lower Cumberland Archaeol Proj is long-term, multidisciplinary investigation of prehistory of extreme W Kentucky with special emphases on Archaic period. From 1978 to present, wood, charcoal, and charred hickory and walnut shell samples have been recovered from five sites in lower Tennessee-Cumberland-Ohio Valleys region. Samples coll and subm by Jack Nance. Research has been supported by grants from Social Sciences and Humanities Research Council of Canada.

SFU-271. **8220 ± 100**

Carbonized wood and hickory nut shell from Morrisroe site (37° 03′ 45″ N, 88° 24′ 30″ W), 165 to 185cm below surface. Site is Archaic midden on N bank of Tennessee R, Livingston Co. Cultural materials are incorporated in compact clay/silt floodplain sediments. Site represents first well-dated, stratified Archaic material reported for this part of Kentucky. Sample dates earliest known occupation of site. *Comment* (JN): date agrees with stratigraphy and with assoc cultural remains.

SFU-270. **7180 ± 130**

Carbonized wood and hickory nut shell from Morrisroe site, 45 to 55cm below surface. Sample provides terminal date for middle Archaic occupation. *Comment* (JN): date agrees with stratigraphy and with assoc cultural remains.

SFU-121. **7110 ± 250**

Charcoal from Morrisroe site, 94 to 108cm below surface. Sample provides terminal date for middle Archaic. *Comment* (JN): date agrees with stratigraphy; date agrees with SFU-270.

SFU-130. **7530 ± 150**

Charcoal from Morrisroe site, 137 to 140cm below surface. Sample dates lower portion of middle Archaic stratum. *Comment* (JN): date agrees with stratigraphy and assoc cultural remains.

SFU-221. **8500 ± 460**

Charcoal from Whalen site (37° 06′ 24″ N, 88° 12′ 56″ W), ca 300cm below surface. Site is Archaic deposit eroding from E bank of Cumberland R, Lyon Co. Three organic midden zones (lower, middle, and upper) are visible in cutbank. Stone artifacts, bone, and charred plant remains are present, as are human burials. Surface coll projectile points include Kirk, Eva, and variety of stemmed forms. Sample provides date for earliest

known occupation of site. *Comment* (JN): sample was coll with only approx control on depth measurement (see SFU-249).

SFU-249. **7670 ± 630**

Charcoal from Whalen site, 300cm below surface. Sample establishes earliest occupation of site. *Comment* (JN): both SFU-221 and -249 agree with stratigraphy and cultural materials coll from eroding river bank; presumably, both date same occupation. However, estimated error of determination and cultural materials known from site suggest that SFU-221 is more accurate date.

SFU-252. **7100 ± 600**

Charcoal from Whalen site 220cm below surface. *Comment* (JN): this date establishes date for middle zone and agrees with stratigraphy and with artifacts coll from cutbank.

SFU-253. **Modern**

Charcoal from Cox site (37° 11′ 24″ N, 88° 04′ 21″ W), large multicomponent habitation site and aboriginal chert quarry around cave and resurgent stream in Karst uplands, Caldwell Co. Features and artifacts suggest occupations ranging from Paleo-Indian to Mississippian, with major Archaic and Woodland components. Sample from 110cm below surface and dates sediment accumulated in mouth of cave. *Comment* (JN): modern date agrees with expectations.

SFU-250. **Modern**

Charcoal from Cox site, 150cm below surface, dates sediment accumulation in mouth of cave. *Comment* (JN): modern date agrees with expectations.

SFU-254. **1300 ± 160**

Carbonized wood and seed from Branstetter Shelter I site (37° 13′ 42″ N, 88° 19′ 02″ W), dense organic midden deposit >1m deep, in upland sandstone rockshelter N of Cumberland R, Livingston Co. Chipped stone and bone artifacts and ceramics suggest Woodland occupation. Sample from 80 to 90cm below surface. *Comment* (JN): date agrees with presence of limestone-tempered ceramics and suggests middle Woodland occupation (see SFU-251).

SFU-251. **4420 ± 280**

Charcoal from Branstetter site, 40 to 50cm below surface. *Comment* (JN): sample provides first date for rockshelter occupation in Lower Tennessee-Cumberland Valleys. Compared with SFU-254 sample suggests site is multicomponent and earlier component is late Archaic. Deposits have been disturbed by pothunters. Stratigraphic reversal suggests that disturbance has resulted in deposition of Archaic materials over Woodland component. Artifactual evidence for Archaic component is slim.

SFU-306. **1060 ± 100**

Charcoal from Gordon II site (37° 16′ 00″ N, 88° 29′ 30″ W), on

terrace of S bank of Ohio R, Livingston Co. Surface coll ceramics include Mississippian Plain, Bell Plain, Kummswick, and Tolu Fabric-Impressed, and Old Town Red. Sample 47 to 56cm below surface. *Comment* (JN): date agrees with Mississippian cultural assignment for site but appears to be 200 to 300 yr too early considering assoc ceramic assemblage.

GEOLOGIC SAMPLES

Canada

British Columbia

Stikine River Series I

Charcoal and carbonaceous silt from W side of Stikine R, 100m N of mouth of Ned Shears Creek (57° 58′ 23″ N, 131° 04′ 26″ W). Samples subm by Peter Read, Geotex Consultants Ltd, Vancouver, British Columbia, as part of hydroelectric feasibility studies for BC Hydro and Power Authority.

SFU-340. **25,100 ± 1900**

Carbonaceous silt; subm to date lava flow.

SFU-345. **>45,700**

Charcoal underlying top of exhumed Quaternary lava flow. *Comment* (PR): we are uncertain of stratigraphic loc of sediments enclosing sample, and although age ca 10,000 yr is possible, age beyond limit of ^{14}C dating is also possible because sediments as old as 0.45My are exposed in terraces along banks of Grand Canyon of Stikine R.

Iskut Project

SFU-246. **8730 ± 600**

Wood from drill core taken in Iskut Valley 65km upstream from confluence of Stikine and Iskut Rivers (56° 42′ 00″ N, 130° 36′ 00″ W). Sample subm by BC Hydro and Power Authority to date lava flow. *Comment*: sample agrees with SFU-161 from same site.

Alberta

Boone Lake Series I

Gyttja from 5cm diam sediment core taken near center of Boone Lake (53° 34′ 30″ N, 119° 25′ 30″ W). Depths are below sediment surface. Samples subm as part of paleo-ecologic study of ice-free corridor in Peace R Dist, Alberta (see also White, Mathewes, & Mathewes, 1979). Samples coll and subm by James White and Rolf Mathewes, Dept Biol, Simon Fraser Univ.

SFU-206. **7400 ± 130**
$\delta^{13}C = -22.0‰$

Gyttja from 3.7 to 3.8m level. *Comment* (JW): sample dates early postglacial birch peak.

5700 ± 120

SFU-207. $\delta^{13}C = -23.5‰$

Gyttja from 2.43 to 2.5m level. *Comment* (JW): sample dates end of mid-Holocene pine max.

SFU-208. **3430 ± 360**

Gyttja from 0.8 to 0.87m level. *Comment* (JW): sample provides chronologic control for influx pollen diagram.

9250 ± 180

SFU-209. $\delta^{13}C = -29.0‰$

Gyttja from 4.79 to 4.9m level. *Comment* (JW): sample dates early postglacial transition from aspen dominated to spruce-pine-birch dominated forest.

Spring Lake Series I

Gyttja from 5cm diam sediment core taken near center of Spring Lake (55° 30′ 36″ N, 119° 35′ 00″ W), 835m asl. Depths are below sediment surface. Samples subm by White and Mathewes as part of Boone Lake series study, above.

10,800 ± 180

SFU-210. $\delta^{13}C = -24.0‰$

Gyttja from 4.34 to 4.42m level. *Comment* (JW): sample dates early postglacial zonal change from aspen dominated to spruce-pine-birch dominated forest.

2400 ± 200

SFU-211. $\delta^{13}C = -25.1‰$

Gyttja from 0.95 to 1.04m level. *Comment* (JW): sample provides chronologic control for influx pollen diagram.

SFU-212. **5700 ± 270**

Gyttja from 2.93 to 3.01m level. *Comment* (JW): sample dates mid-Holocene pine max.

United States

Tennessee

Anderson Pond Series I

Sediment from two parallel cores, 76C and 76D, taken at Anderson Pond (36° 0′ 0″ N, 274° 30′ 0″ E) White Co. Depths are below sediment surface. Samples subm to determine ^{10}Be deposition rate during late Quaternary. Similar cores dated by Univ Arizona (Lund, 1981). Samples SFU-330, -333, and -336 were processed using wet oxidation. Samples subm, pretreated and combusted by Tom Brown, Dept Physics, Simon Fraser Univ.

SFU-320. **9200 ± 400**

130 to 135.3cm sec, Core 76C#1.

SFU-321. **11,600 ± 440**
140.6 to 145.9cm sec, Core 76C#1.

SFU-322. **13,400 ± 400**
151.2 to 156.6cm sec, Core 76C#1.

SFU-323. **13,900 ± 640**
209.7 to 216.9cm sec, Core 76C#1.

SFU-324. **11,900 ± 220**
237.4 to 286.8cm sec, Core 76C#2.

SFU-325. **18,600 ± 1100**
431.4 to 475.5cm sec, Core 76C#4.

SFU-326. **18,840 ± 1000**
523.5 to 571.7cm sec, Core 76C#5.

SFU-327. **19,400 ± 400**
726.1 to 657.9cm sec, Core 76C#6 & 76C#7.

SFU-328. **1160 ± 160**
59 to 66.7cm sec, Core 76D#1.

SFU-329. **3300 ± 300**
92.4 to 97.6cm sec, Core 76D#1.

SFU-330. **5600 ± 200**
101.2 to 106.3cm sec, Core 76D#1.

SFU-331. **3000 ± 480**
106.3 to 114cm sec, Core 76D#1.

SFU-332. **9300 ± 1300**
114 to 122.9cm sec, Core 76D#2.

SFU-333. **8400 ± 630**
122.9 to 128.8cm sec, Core 76D#2.

SFU-334. **11,300 ± 480**
134.7 to 140.6cm sec, Core 76D#2.

SFU-335. **11,500 ± 800**
140.6 to 146.5cm sec, Core 76D#2.

SFU-336. **12,600 ± 800**
187.2 to 193.1cm sec, Core 76D#2.

SFU-337. **13,300 ± 600**
193.1 to 199cm sec, Core 76D#2.

SFU-338. **15,400 ± 380**

339.1 to 383.2cm sec, Core 76D#3.

SFU-339. **12,900 ± 250**

295.5 to 333.5cm sec, Cores 76C#2 & 76C#3.

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[RADIOCARBON, VOL 26, No. 3, 1984, P 441-448]

VIENNA RADIUM INSTITUTE RADIOCARBON DATES XIV

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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. No $^{13}C/^{12}C$ ratios were measured. Sample descriptions have been prepared in cooperation with submitters.

ACKNOWLEDGMENTS

I express my thanks to Ing L Stein for excellent work in sample preparation and for careful operation of the dating equipment.

SAMPLE DESCRIPTIONS

GEOLOGIC AND BOTANIC SAMPLES

Austria

Hainburg series, NÖ

Wood from borings in Quaternary ballast of Danube R between Hainburg (48° 08′ N, 16° 57′ E) and Fischamend-Markt (48° 07′ N, 16° 37′ E), Lower Austria. Coll by Georg Gangl, Österr Donau-Kraftwerke AG, Vienna.

General Comment (GG): dated for chronology of fluvial ballast deposition.

VRI-644. Boring 51 **<260**

Boring 51 (48° 08′ 22″ N, 16° 53′ 04″ E) from −9 to −9.5m.

VRI-645. Boring 64 **3620 ± 80**

Boring 64 (48° 08′ 35″ N, 16° 53′ 43″ E) from −10 to −11.5m.

VRI-646. Boring 315 **34,000 $^{+2200}_{-1950}$**

Boring 315 (48° 07′ 11″ N, 16° 41′ 27″ E) from −8.2 to −10.4m.

VRI-647. Boring 321 **4060 ± 90**

Boring 321 (48° 08′ 03″ N, 16° 37′ 06″ E) from −7.8 to −8.4m.

VRI-648. Boring 370 **4730 ± 100**

Boring 370 (48° 07′ 37″ N, 16° 37′ 25″ E) from −11.5m.

VRI-822. Boring 919 **31,000 ± 1500**

Boring 919 (48° 08′ 20″ N, 16° 52′ 20″ E) from −20m.

VRI-758. Pyhrnpaβ, OÖ **1450 ± 80**

Cyperaceae peat at −33 to −38cm of uppermost part of 6.5m long profile of bog Vorderes Filzmoos at Wurzeralm, Warscheneck (47° 38′ 57″

N, 14° 17′ 12″ E), 1360m asl, near Pyhrnpaβ, OÖ. Coll 1982 by Friedrich Kral and Michael Oberforster; subm by F Kral, Univ Bodenkultur, Vienna. *Comment* (FK): dates period immediately before clearing, when *Picea-Abies-Fagus* woods were not yet influenced by men.

Gasteiner Naβfeld series, Salzburg

Peat from bog (47° 03′ 20″ N, 13° 03′ 45″ E), SH 1690m, Gasteiner Naβfeld, Salzburg. Coll 1982 and subm by Friedrich Kral.

General Comments (FK): dates for pollen analysis; (HF): no pretreatment.

VRI-756. 65-75cm **880 ± 80**

Sandy wood peat with wood detritus at −65 to −75cm from layer, 12cm thick, below Cyperaceae peat, above coarse sand layer. *Comment* (FK): dates palynologically detected clearing at slopes for pasturing.

VRI-757. Base **2230 ± 80**

Sandy wood peat with wood detritus from base of bog at −100 to −110cm. *Comment* (FK): dates palynologically detected older and weaker local human influence on woods at slopes.

VRI-805. St Alban, Salzburg **390 ± 70**

Wood sample Q-1 from oak stem 2.8m long, 60cm thick, −3m below gravel at St Alban (47° 59′ N, 12° 59′ E) near Lamprechtshausen, 6km NNE Oberndorf bei Salzburg. Coll 1982 and subm by Gottfried Tichy, Univ Salzburg. *Comment* (GT & HF): date contradicts expected Middle Atlanticum.

VRI-806. Salzburg **370 ± 80**

Wood detritus, −1m below surface, sporadically dispersed in fossil soil below old landslide at periphery of city of Salzburg (47° 48′ N, 13° 05′ E). Coll 1983 and subm by Hans Angerer, Magistrat Salzburg. *Comments* (HA): date is max for landslide. (HF): sample prepared from 22kg soil material and cleaned from rootlets and seeds still capable of germinating. No pretreatment.

Salzburg series

Peat from different horizons at periphery of Salzburg (47° 48′ N, 13° 05′ E). Coll 1982 and subm by Hans Angerer.

General Comment (HA): individual peat horizons separated by overriding landslips give max age for these events.

VRI-807. ABF2 **2430 ± 90**

Peat at −2m.

VRI-808. ABF3 **7800 ± 110**

Peat at −2.5m.

VRI-570a. Ampass 1, Tirol **>37,000**

Earthy peat from peat band, 3cm thick, *in situ* in sand layer ca 2m thick followed by 20m gravel overlain by 1 to 2m ground moraine and

recent soil. Coll 1976 near Ampass (47° 15′ 39″ N, 11° 27′ 28″ E), Inn Valley, Tyrol, 680m asl, and subm by Gernot Patzelt, Geog Inst, Univ Innsbruck. Repeat of VRI-570 (R, 1980, v 22, p 111) with new material. *Comment* (GP & HF): date is max age for gravel deposit in Inn Valley before last glaciation. No NaOH pretreatment.

Mieming series, Tirol

Peat from deposition on lacustrine sediments near Mieming (47° 17′ 13″ N, 10° 58′ 06″ E). Coll 1982 by Burgi Wahlmüller, subm by Sigmar Bortenschlager, Bot Inst, Univ Innsbruck.

General Comment (BW): dates palynologically detected events.

VRI-699. Mieming 1 **4430 ± 90**

Peat, cleaned from roots, at −437 to −444cm. *Comment* (BW): beginning of peat growth and 1st appearance of grain pollen.

VRI-700. Mieming 2 **1190 ± 80**

Radicella brown moss peat at −306 to −313cm. *Comment* (BW): beginning of clay deposition.

VRI-701. Mieming 3 **880 ± 80**

Cyperaceae *Radicella* peat, cleaned from roots, at −240 to −244cm. *Comment* (BW): end of clay deposition.

Zillertal series, Tirol

Peat and wood from bog (47° 01′ 33″ N, 11° 48′ 19″ E), 1875m asl, Waxeckalm, Zillertal. Coll 1982 by H Hüttemann, subm by Sigmar Bortenschlager.

General Comment (HH): dates palynologically detected events.

VRI-702. 60-65 **760 ± 80**

Detritus *Radicella* peat with charcoal pieces at −60 to −65cm. *Comment* (HH): dates burning horizon connected with intense cultural phase.

VRI-703. 95-100 **3450 ± 90**

Brown moss *Carex* peat with detritus at −95 to −100cm. *Comment* (HH): dates *Alnus* climax.

VRI-704. 150-154 **3600 ± 210**

Alnus root wood at −150 to −154cm.

VRI-706. 170-175 **5520 ± 100**

Radicella peat at −170 to −175cm. *Comment* (HH): dates climatic oscillation.

Kühtai series, Tirol

Peat samples from different depths of bog near Dortmunder Hütte (47° 12′ 20″ N, 11° 00′ 38″ E), ca 1980m asl, Kühtai, Tirol. Coll 1982 by H Hüttemann, subm by Sigmar Bortenschlager.

General Comment (HH): dates for pollen diagram.

VRI-708. 55-60 **3910 ± 100**

Carex-Eriophorum-Sphagnum peat at –55 to –60cm. *Comment* (HH): dates decreasing intensive cultural phase.

VRI-709. 75-80 **4170 ± 100**

Carex-Eriophorum-Sphagnum peat at –75 to –80cm. *Comment* (HH): dates beginning cultural phase.

VRI-710. 110-115 **5290 ± 100**

Cyperaceae peat at –110 to –115cm. *Comment* (HH): dates 1st appearance of beech.

VRI-711. 145-150 **6080 ± 100**

Cyperaceae peat at –145 to –150cm. *Comment* (HH): dates 1st appearance of fir.

VRI-712. 180-185 **7600 ± 130**

Detritus *Radicella* peat at –180 to –185cm. *Comment* (HH): dates initial spread of spruce.

Kufstein series, Tirol

Detritus gyttja from profile of Egelsee Lake (47° 37′ 29″ N, 12° 10′ 20″ E) near Kufstein. Coll 1982 by Burgi Wahlmüller, subm by Sigmar Bortenschlager.

General Comment (BW): dates for pollen diagram.

VRI-714. 165-175 **1820 ± 80**

Sample at –165 to –175cm. *Comment* (BW): dates elm decrease.

VRI-715. 311-319 **3990 ± 90**

Sample at –311 to –319cm. *Comment* (BW): dates 1st human influence.

VRI-786. 361-371 **5290 ± 100**

Sample at –361 to –371cm. *Comment* (BW): dates spread of *Abies*.

VRI-787. 570-580 **10,280 ± 140**

Sample at –570 to –580cm. *Comment* (BW): dates spread of warm phase plants.

Defereggental series, Osttirol

Peat (possibly contaminated by younger roots) from Jagdhausalm bog (46° 58′ 30″ N, 12° 09′ 30″ E), 2035m asl, upper Defereggental, East Tyrol. Coll 1982 and subm by Friedrich Kral.

General Comment (FK): dates for pollen diagram. No pretreatment.

VRI-799. Jagdhausalm II/52-58 **2220 ± 70**

Cyperaceae peat with small amounts of wood peat from middle part of profile at –52 to –58cm. *Comment* (FK): dates forest development relatively undisturbed by men immediately before human influence.

VRI-800. Jagdhausalm II/82-88 **3280 ± 80**

Cyperaceae wood peat from lower part of profile at –82 to –88cm. *Comment* (FK): dates completely undisturbed forest development immediately before 1st human influence.

CSSR

Spišska Kotlina series

Peat at different depths of Spišska Kotlina bog (49° 03′ N, 20° 18′ E), SH 670m, Hozelec near Poprad. Coll 1982 by Heinz Hüttemann, subm by Sigmar Bortenschlager.

General Comment (HH): dates for pollen diagram (Jankovska, 1972).

VRI-794. 75 **7500 ± 120**

Peat with lake marl at –75cm. *Comment* (HH): dates *Picea* max.

VRI-795. 100 **9020 ± 120**

Peat at –100cm. *Comment* (HH): dates sample rich in pollen of *Larix* sp and *Picea abies*.

VRI-796. 146-148 **11,010 ± 160**

Peat from base at –146 to –148cm. *Comment* (HH): dates beginning of bog development.

Vysoke Tatry series

Samples from bog near Trojhranne pleso lake (49° 13′ 15″ N, 20° 13′ 50″ E), 1650m asl, Vysoke Tatry. Coll 1982/83 by Heinz Hüttemann, subm by Sigmar Bortenschlager.

General Comment (HF): completes Vysoke Tatry series (R, 1982, v 24, p 225; R, 1983, v 25, p 939-940).

VRI-713. 157 **1750 ± 160**

Wood (*Salix* sp) at –157cm.

VRI-821. 70-75 **1480 ± 80**

Sphagnum peat at –70 to –75cm. *Comments* (HH): dated for evaluation of growth rate of bog, (HF): no NaOH pretreatment.

Greece

Archagelos-Aridea series

Clayey dy from bog near Archagelos-Aridea (41° 01′ N, 22° 17′ E), 1080m asl. Coll 1975 and subm by Nikolaos Athanasiadis, Inst Forstbot, Aristotelion Univ, Thessaloniki, Greece.

General Comment (NA): provides chronology for palynologic research. Extracted humic acids were used for dating.

VRI-753. 0.82-0.87 **1720 ± 80**

Dy at –0.82 to –0.87m.

VRI-754. 1.37-1.42 **2530 ± 80**

Dy at –1.37 to –1.42m.

VRI-755. 1.90-1.95 **2840 ± 120**

Dy at −1.90 to −1.95m.

Italy

VRI-834. Kastelruth **680 ± 70**

Wood, fossil pine, excavated during road-building at ca −1m near Church of St Virgilius at Kastelruth (46° 34′ N, 11° 34′ E), Italy. Coll 1983 and subm by Ludwig Nössing, Prüfanstalt Baustoffe Geol Dienst, Kardaun, Alto Adige, Italy. *Comment* (LN): date is max for burial of sample.

Algeria

VRI-872. **(5.2 ± 0.4)% modern**

Calcareous quartz sand encrustation in Algerian part of Sahara. Coll on surface by Eckhard Klenkler, Ettenheim, BRD. *Comment* (HF): ^{14}C concentration in clearly marked light-colored outermost layer of encrustation provides date of last growth phase. Tentatively assumed recent concentration, 85% modern (Münnich & Vogel, 1959; Geyh & Schillat, 1966) yields model age, 22,500 ± 600. Recent concentration, 100% modern, yields max age, 23,800 ± 600.

Dominican Republic

VRI-819. Cotui **<250**

Copal near surface in soil, near Cotui (19° 04′ N, 70° 11′ W), San Brano. Coll 1982 by local inhabitants, subm by Dieter Schlee, Mus Naturkunde, Stuttgart, BRD. No chemical pretreatment of hard yellowish transparent resin. *Comment* (HF): date reveals that resin is recent.

Colombia

VRI-820. **<220**

Copal from unknown locality. Coll 1982 by local inhabitants, subm by Dieter Schlee. No chemical pretreatment of hard yellowish transparent resin. *Comment* (HF): date reveals that resin is recent.

Japan

VRI-830. Mitsunami **33,100 +2000 −1600**

Fossil resin coll near Mitsunami ca 45km E of Gifu (35° 37′ N, 136° 46′ E), Honshu I. Details of colln unknown; subm by Dieter Schlee. *Comment* (DS): certain characteristics of Mitsunami amber suggest that its age is somewhere intermediate between copal and amber.

ARCHAEOLOGIC AND HISTORIC SAMPLES

Austria

VRI-804. Loitzendorf, NÖ **2240 ± 80**

Charcoal of old iron smelting site at −50cm, Loitzendorf (48° 18′ N, 12° 19′ E) near Maria Laach, Lower Austria. Coll 1982 and subm by Brigitte Cech, Inst mittelalterliche Realienkunde, Österr Akad Wiss. *Comment* (BC): dates smelting site.

Spital am Pyhrn series, Steiermark

Bones of cave bear at different depths in sediment of Bone Cave on Ramesch Mt, Warscheneck group, Totes Gebirge, 2000m asl, near Spital am Pyhrn (47° 40′ N, 14° 20′ E), Styria. Coll 1980/1982 and subm by G Rabeder and K Mais, Inst Paleontol, Univ Vienna.

General Comment (GR & HF): stone tools found in cave sediment. Collagen was extracted by method of Longin (1970). Dates verify uranium series dating on bones from strata of VRI-776 and -792: 36,100 $^{+3000}_{-2800}$, 38,900 $^{+2300}_{-2200}$, and 42,500 $^{+5300}_{-4900}$, obtained by P Hille and E Wild (pers commun).

VRI-776. 90-100 **34,900 $^{+1800}_{-1500}$**

Sample RK 80/II/D7/3/14/51-70 at −90 to −100cm.

VRI-792. 110-120 **37,200 $^{+1900}_{-1600}$**

Sample RK82/I-T15/2 at −110 to −120cm.

VRI-793. 150-160 **>40,700**

Sample RK 82/I-T16/7 at −150 to −160cm.

Kindberg series, Stiermark

Wood remains from Georgibergkirche (47° 30′ 07″ N, 15° 25′ 34″ E), Kindberg, Styria. Subm by Herbert Stolla.

General Comments (HS): provides chronology for history of church. (HF): only HCl pretreatment.

VRI-797. I/1982 **210 ± 70**

Wood of broken cross (?) in hole in top of stone altar. Coll 1982 by Thea Gladysz.

VRI-798. II/1976 **290 ± 130**

Decayed wood remains in octagonal post hole excavated in middle of nave. Coll 1976 by H Stolla. *Comment* (HS): hole was closed when Gothic style was changed to Baroque.

Spain

Hierro series, Canary Is.

Shells from different shell heaps, Hierro I. Coll 1982 and subm by H Novak, Inst Canarium, Hallein, Austria.

General Comment (HN): Canarian Neolithic. Dates periods of settlement.

VRI-790. Restinga **790 ± 70**

Shells at −0.35m; Malpais above Restinga.

VRI-791. El Julan **1820 ± 80**

Shells at −1.15m; Tagoror, El Julan.

VRI-789. La Palma, Canary Is. **1850 ± 100**

Charcoal, Belcamo III, –2.8m below bottom of Belcamo cave, La Palma I. Coll 1982 and subm by H Novak. *Comment* (HN): Canarian Neolithic. Dates settlement.

Peru

VRI-811. Zaña **3120 ± 80**

Burned plant remains in combustion shaft below pyramid at Cerro de Purulen (6° 45′ S, 79° 45′ W), Valley of Zaña, Lambayeque. Coll 1978, subm by Ferdinand Anders, Inst Völkerkunde, Univ Vienna. *Comment* (FA): construction and sample belong to Formative period.

Chao series

Plant remains and wood at Salinas de Chao (8° 35′ S, 78° 43′ W), Valley of Chao, Trujillo. Subm by Ferdinand Anders.

General Comment (FA): stone buildings and samples belong to Formative period.

VRI-812. Chao 1 **3600 ± 90**

Burned plant remains from bottom of stone structures, Cut 6, Unit C.

VRI-813. Chao 2 **3200 ± 90**

Wood within platform fill, Cut 21, Unit C.

Chavin series

Human bones in Tello pyramid, interior galleries, Chavin (9° 35′ S, 77° 15′ W). Coll 1982 by Kaufmann-Doig, subm by Ferdinand Anders.

General Comment (FA): burials may be contemporaneous.

VRI-814. Chavin 4 **2060 ± 90**

Skull bones.

VRI-815. Chavin 5 **2290 ± 90**

Skeleton.

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[RADIOCARBON, VOL 26, NO. 3, 1984, P 449-460]

RUDJER BOŠKOVIĆ INSTITUTE RADIOCARBON MEASUREMENTS VIII

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The following radiocarbon date list contains dates of samples measured since our previous list (R, 1982, v 24, p 352-371). As before, age calculations are based on the Libby half-life (5570 ± 30) yr and reported in years before 1950. The modern standard is 0.95 of the NBS oxalic acid activity. Sample pretreatment, combustion, and counting technique are essentially the same as described in R, 1971, v 13, p 135-140, supplemented by new techniques for groundwater processing (R, 1979, v 21, p 131-137).

Statistical processing of data has been computerized (Obelić & Planinić, 1977; Obelić, 1980). Sample descriptions were prepared with collectors and submitters. The errors quoted correspond to 1σ variation of sample net counting rate and do not include the uncertainty in ^{14}C half-life.

Calculations of age of speleothems and groundwaters are based on the initial activity equal to 0.85 of the NBS oxalic acid activity multiplied by 0.95.

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ARCHAEOLOGIC SAMPLES

Vindija series

Charcoal particles from Vindija cave, Gornja Voća near Ivanec (46° 20′ N, 16° 04′ E), NW Croatia. Coll and subm 1978 by M Malez, Yugoslav Acad Sci Arts, Zagreb (Malez & Ullrich, 1982).

Z-612. Vindija 1 **24,000 ± 3300**

Charcoal particles from Layer II/P-1.

Z-613. Vindija 2 **29,700 ± 2000**

Charcoal particles from Layer II/P-2.

Z-712. Ždrelo, Mitropolija **900 ± 90**

Charred wood from N part of apse of medieval metropolitan church Mala crkva, Ždrelo village (44° 18′ N, 21° 31′ E), central Serbia. Coll 1979 and subm by D Madas, Inst Preservation Cultural Monuments, Kragujevac.

Z-863. Hrustovača **12,000 ± 200**

Speleothem deposited on cranium of cave bear (*Ursus spelaeus*) ca 700m from entrance of Hrustovača cave near Sanski Most, W Bosnia. Coll

and subm 1979 by M Malez. *Comment* (MM): expected age: Upper Pleistocene.

Z-864. Plavi Majdan **>37,000**

Fragment of stratified bone breccia, 6m below ground from Plavi Majdan quarry at Duzluk near Slavonska Orahovica, NE Croatia. Coll and subm 1981 by M Malez. Sample dates cave bear occupation. *Comment* (MM): expected age: Middle Pleistocene.

Z-893. Pernice **1970 ± 100**

Charcoal from profile of forest soil; charcoal, layer 10 to 15cm thick, 40 to 50cm below ground mixed with soil near Pernice village (46° 38′ 12″ N, 15° 07′ 20″ E) at 1025m alt, N Slovenia. Date determines age of colluvium drift and human influence on forest. Coll and subm by B Anko, Inst Forestry Biol Fac, Ljubljana. *Comment* (BA): expected age: 400-500 BP.

Z-895. Pokrovnik **6300 ± 150**

Carbonized wheat (*Triticum monococum*), Layer P-I; 1m below ground level, from cultivated field near Drniš, Dalmatia (43° 49′ N, 16° 04′ E) at 260m alt, S Croatia. Coll and subm 1981 by Z Brusić, Mus Šibenik. *Comment* (ZB): expected age: ca 2400 BC.

Z-978. Varaždin **440 ± 100**

Wood from log cabin 4m below surface, Varaždin (46° 18′ N, 16° 20′ E), NW Croatia. Assoc with pottery. Coll and subm 1980 by J Tomičić, Town Mus Varaždin. *Comment* (JT): expected age: 14th century.

Z-982. Parti **4200 ± 110**

Wooden fragments of pile-dwelling post buried in calcareous sediment (lake chalk) at Ig near Ljubljana (45° 57′ 20″ N, 14° 32′ 10″ E), Slovenia. Dates pile-dwelling settlements in Lj Barje area (R, 1979, v 21, p 131). Coll 1981 by T Bregant, Fac Arts Sci, Ljubljana; subm by A Šercelj. *Comment* (AŠ): expected period: Eneolithic.

Z-983. Šafarsko **5050 ± 190**

Wooden particles mixed with soil from hearth, 0.8m below surface, Tr 8, Quad 6, Šafarsko near Ormož (46° 31′ 20″ N, 16° 16′ 45″ E), NE Slovenia. Coll 1981 by T Bregant; subm by A Šercelj. Date determines absolute age of culture.

Z-984. Rudnik **2950 ± 110**

Fragments of log buried in lake chalk, Tr IV, Rudnik near Ljubljana (46° 13′ 20″ N, 14° 32′ 45″ E), Slovenia. Coll 1981 by T Bregant; subm by A Šercelj.

Divje Babe series

Charcoal from Paleolithic site, Divje Babe cave near Šebrelje (46° 06′ 50″ N, 13° 54′ 50″ E) at 450m alt, SW Slovenia. Hearth in calcareous soil not affected by rootlets and groundwater. Coll and subm 1980 and 1981 by

M Brodar (1982), Archaeol Inst, Ljubljana. *Comment* (MB): expected period: end of Pleistocene.

Z-1032. Divje Babe A **17,500 ± 850**

Hearth A. *Comment* (MB): expected age older than Sample B.

Z-1033. Divje Babe B **>37,000**

Hearth B. Underlying layer: Mousterian.

Z-1036. Lukenjska jama **12,200 ± 250**

Charcoal from hearth, depth 3m in gravel and clay sediment, entrance of Lukenjska jama cave at Prečna near Novo Mesto (45° 49′ 10″ N, 15° 06′ 20″ E) at 186m alt, Slovenia. Sample from systematic excavations of younger Paleolithic site (Osole, 1982). Coll and subm 1982 by F Osole, Quaternary Inst, Univ Ljubljana. *Comment* (FO): expected age: ca 12,000 BP (Epigravettian).

Z-1041. Zaton **2130 ± 120**

Wooden beam from sunken boat 1.8m below sea level, buried in mud, 60cm depth, Zaton near Nin, Dalmatia (44° 13′ 40″ N, 15° 09′ 50″ E), S Croatia. Coll and subm 1982 by L Domijan, Inst Preservation Cultural Monuments, Zadar. Archaeol excavations of Roman harbor. *Comment* (LD): expected age: ca 2000 BP.

Ajdovska jama series

Charred wheat (*Triticum monococum*) and charcoal from Ajdovska jama cave near Nemška vas, Krško, E Slovenia. Coll 1982 by A Bregant, and subm by A Šercelj. Samples from systematic excavation of Neolithic site.

Z-1042. Ajdovska jama 1 **5120 ± 130**

Charred wheat from Grave 1 near Skeleton D/E. *Comment* (AŠ): expected age: ca 4500 BP.

Z-1043. Ajdovska jama 2 **5180 ± 150**

Charred wheat from Grave 2, left entrance near Skeleton 2.

Z-1044. Ajdovska jama 3 **5620 ± 130**

Charred wheat from Grave 1, left entrance near skeleton of child.

Z-1045. Ajdovska jama 4 **5340 ± 120**

Charcoal from hearth near Grave 2, Skeleton 2.

Z-1089. Citadella Zadar **420 ± 130**

Splinter of beam from town fortress (citadel), Zadar (45° 07′ N, 15° 15′ E), S Croatia. Coll and subm 1982 by L Domijan.

Pod series

Samples from prehistoric fortress Pod near Bugojno (44° 03′ 40″ N, 17° 26′ 30″ E) at 632m alt, central Bosnia (Čović, 1975). Coll and subm 1982 by B Čović, State Mus Bosnia and Hercegovina, Sarajevo.

Z-1091. Pod 1 **2420 ± 140**

Carbonized cereals from Horizon X, 1.09m depth between fortress walls. Cultural layer had no recent rootlets. *Comment* (BČ): expected age: ca 600 BC.

Z-1092. Pod 2 **2900 ± 140**

Carbonized wood from Tr III-13, deepest layer of prehistoric settlement "B", from space between bldg and ramparts, 2.15m depth. Cultural layer had no recent rootlets. *Comment* (BČ): expected age: ca 1000 BC.

Z-1093. Velika Gradina **3200 ± 140**

Charcoal from base level of burned house, 1.85m below ground level, Velika Gradina near village Varvari (43° 49′ N, 17° 29′ E), central Bosnia. Coll and subm 1978 by V Čović. *Comment* (BČ): expected age: ca 1600 BC. Layer out of reach of rootlets, but influence of groundwater is possible (Čović, 1978).

Z-1136. Ubli **1590 ± 130**

Wheat grains found in Roman amphora, 1.5m below ground level, at site of farmhouse. Sample from Roman settlement near Ubli, i Lastovo, Adriatic Sea (44° 45′ N, 16° 50′ E), S Croatia. Coll and subm by J Jeličić, Regional Inst Preservation Cultural Monuments, Split. *Comment* (JJ): expected period: 1st to 4th century AD.

Sisak series

Parts of wooden boat (monoxyl) (*Quercus robur*), 9m long, buried in mud, from Kupa R near Sisak (45° 30′ N, 16° 23′ E), Croatia. Samples assoc with Roman artifacts, coins, and ceramics. Coll by B Kraguljac, Mus Sisak and subm by A Sliepčević. *Comment* (BK): dates help determine Celtic or Roman occupation of site.

Z-1147. Sisak 1 **2040 ± 130**

Sample taken from outermost sec of trunk.

Z-1148. Sisak 2 **2330 ± 140**

Sample from trunk core.

GEOLOGIC SAMPLES

Fossil wood samples

Z-892. Dobrepolje **5800 ± 110**

Alluvial wood (unid.) from Layer 2, depth 70cm in profile dug near Videm-Podpeč Rd (45° 51′ N, 14° 42′ E) at 438m alt, central Slovenia. Coll by A Kranjc and subm 1981 by R Gospodarič, Inst Karst Research, Slovenian Acad Sci Arts. *Comment* (RG): expected period: Holocene.

Petišovci series

Fossil oaks (*Quercus robur*) from dry riverbed under 6 to 8m of gravel, presently below water table, at Petišovci near Lendava (46° 32′ 30″ N, 16°

28′ E) at 162m alt, NE Slovenia. Dendrochronologic measurements were made of fossil wood. Coll and subm 1981 by M Accetto, Inst Forestry Biol Fac, Ljubljana.

Z-896. Petišovci 1 **930 ± 100**

Fossil oak log, depth 6 to 8m under alluvium.

Z-897. Petišovci 2 **1520 ± 100**

Fossil oak log, 1.45m diam, depth 6 to 8m under alluvium.

Z-1086. Oroslavje **1680 ± 140**

Central tree rings of fossil oak (*Quercus robur*), 7m below present riverbed level, Krapina R near Oroslavje, Hrvatsko Zagorje (46° 00′ N, 15° 55′ E), NW Croatia. Coll and subm 1982 by A Gredičak, Oroslavje.

Ljutomer series

Fossil oaks buried in alluvium near Ljutomer (46° 31′ N, 16° 15′ E), NE Slovenia, exported to British timber import company TIMBMET, Oxford. Subm 1982 by J Burley, Univ Oxford.

Z-1015. Ljutomer 1 **4120 ± 120**

10 to 20 tree rings below trunk surface.

Z-1016. Ljutomer 2 **4280 ± 110**

70 to 87 tree rings below trunk surface.

Lipova greda series

Fossil oak (*Quercus robur*) found in Lipova greda gravel pit near Draksenić village at Bosanska Dubica (45° 12′ N, 16° 53′ E), NW Bosnia during low water level, Fall 1983. Coll by V Brežančić, Inst Preservation Cultural Monuments, Sarajevo and subm by A Sliepčević. *Comments* (VB): expected age: Holocene. (DS): trunks and stumps are scattered around pit. No records of original positions exist. Dates time span of wood growth.

Z-1154. Lipova greda 1 **270 ± 130**

Oak trunk, 35cm diam, protruding from gravel during low water level.

Z-1155. Lipova greda 2 **3080 ± 130**

Outer part of oak stump, 87cm diam, from gravel pit.

Z-1156. Lipova greda 3 **440 ± 130**

Oak trunk, 9m long, 126cm diam, from gravel pit. Sample taken from surface, partially rotten.

Z-1149. Bednja **1590 ± 130**

Fossil oak (*Quercus robur*) from bed of Bednja R near Bednja village, Hrvatsko Zagorje (46° 10′ N, 16° 15′ E), NW Croatia. Coll and subm 1983 by I Popijač, Bednja.

Peat samples

Lovrenško barje series

Peat from bore hole in Lovrenško barje peat bog, Pohorje Mts (15° 18′ N, 46° 29′ E) at 1300m alt, N Slovenia. Coll and subm 1983 by A Šercelj, Slovenian Acad Sci Arts, Ljubljana. Depth in cm below surface. *Comment* (AŠ): expected age: Holocene.

Z-1157. Lovrenško barje 1 **2350 ± 130**

Peat, 130 to 150cm.

Z-1158. Lovrenško barje 2 **3400 ± 140**

Peat, 200 to 230cm.

Z-779. Oborovo 2 **>37,000**

Clay containing carbonized organic detritus from bore hole, Oborovo near Zagreb (45° 41′ N, 16° 15′ E), NW Croatia. Coll and subm 1980 by A Sokač, Fac Min Geol and Petrol Eng, Univ Zagreb. *Comment* (AS): dating Quaternary sediments to determine tectonic dislocations. Expected period: Late Pleistocene.

Speleothem and tufa samples

Z-1021. Kamniška jama **>37,000**

Stratified speleothem from Kamniška jama cave, near Kamnik, Slovenia. Coll and subm 1982 by J Urban, Speleol Soc, Kamnik. Date determines periods of speleothem growth.

Slatina series

Tufa samples from Slatina near Banja Luka (44° 45′ N, 17° 15′ E), W Bosnia. Dated for geothermal investigations. Coll and subm by N Miošić, Geoinženjering, Sarajevo. *Comment* (DS): tufa is precipitated from geothermal springs, containing no ^{14}C in dissolved bicarbonates. Low activity could be attributed to contamination with recent carbon.

Z-1046. Slatina T-269 **34,400 $^{+4000}_{-3600}$**

Surface of massive tufa block overgrown with moss, lowermost point.

Z-1047. Slatina T-270 **28,300 ± 1800**

Surface of massive tufa block, uppermost point.

Z-1048. Slatina T-71 **>37,000**

Recently deposited tufa.

Z-1049. Slatina T-85 **22,200 ± 900**

Surface layer of tufa surrounding extinct thermal spring.

Banja Luka series

Tufa from various thermal springs near Banja Luka (44° 45′ N, 17° 10′ E), NW Bosnia. Samples coll and subm by D Hrustanpašić, Geoinženjering, Sarajevo. Geothermal exploration near Banja Luka.

Z-1164. Slatina **20,700 ± 900**

Stratified tufa 0.3 to 1m below ground level, thermal spring Slatina spa.

Z-1165. Priječani **17,800 ± 600**

Tufa covered by humus, 0.5 to 1m below ground level, Priječani.

Z-1166. Gornji Šeher **15,400 ± 500**

Porous tufa precipitated from thermal spring, Gornji Šeher, 0.5m below humus layer.

Z-1167. Laktaši **32,000 $^{+3800}_{-2900}$**

Stratified tufa contaminated with soil and moss around thermal spring Laktaši.

Krčić series

Tufa beds near Krčić waterfall, Kninsko polje (44° 01′ N, 16° 18′ E) at 280m alt, S Croatia. Brook flows intermittently but had steady flow in past and formed tufa barrier Topoljski buk 400m long and 15m high. Below this barrier is spring of Krka R. Coll and subm by A Pavičić, Geol Inst, Zagreb. Series dated to determine age of tufa beds and ancient flow patterns of ground water. *Comment* (DS): chronology of tufa deposits in this region agrees with our findings reported previously (Srdoč *et al*, 1982), proving that tufa is deposited during warm periods. Tufa samples having ^{14}C ages close to lower limit of measurement are probably much older (ca 100,000 yr) as shown by $^{230}Th/^{234}U$ analysis. Their ^{14}C ages are influenced by slight contamination with recent carbonates.

Z-1189. Krčić 1 **>37,000**

Surface tufa coll from stream 1km upstream from Topoljski buk barrier.

Z-1191. Krčić 2 **25,500 ± 1300**

Sample from entrance of cave, 3km upstream from Topoljski buk, 60m above stream bed.

Z-1192. Krčić 3 **25,000 ± 1200**

Tufa from dry barrier Krčić, 300m upstream from Topoljski buk barrier.

Z-1193. Krčić 4 **4570 ± 150**

Compact tufa, core from bore hole, overlying bedrock, Topoljski buk.

Z-1194. Krčić 5 **28,000 ± 1600**

Surface tufa from river terrace, E part of Kninsko polje near Orašnica R, right tributary of Krka R.

Loess samples

East Slavonia series

Series dated Pleistocene and Holocene loess and loess concretions

(loess dolls) from profiles near Danube R, Vukovar (Gorjanović profile) and profiles near Vinkovci (Dilj I and Dilj II), Privlaka, Mikanovci, and Djakovo. Sediments were dated for drafting of geologic map of Yugoslavia. Coll and subm 1982 and 1983 by I Galović and M Šparica, Geol Inst, Zagreb. Loess concretions and calcareous fractions of loess dissolved in diluted hydrochloric acid.

Profile Dilj I

Samples of loess concretions from profile, ca 14m deep, rich in fauna (mollusks) found in Slavko Knežević brickyard, SW of Vinkovci (45° 16′ N, 18° 46′ E), E Croatia. Sediment corresponds to marine environment.

Z-1076. Dilj I/1 **30,000 ± 2600**

Irregular loess concretions, 10cm long, 1 to 5cm diam, from deepest part of profile in brown clayey layer of silt, 1m thick, 13.5m below ground level. Sediment contains macrofossil fauna.

Z-1077. Dilj I/5 **5200 ± 170**

Tiny loess concretions of irregular shape in brownish-gray silt, 2.5m thick, depth to 3.7m. Assoc bones: *Bos taurus trachicensis, Equus coballus.*

Profile Dilj II

Samples of loess concretions and marl from profile, ca 15m deep, open in Slavonka brickyard, NE part of Vinkovci town.

Z-1078. Dilj II/1 **33,400** $^{+3400}_{-1700}$

Loess concretions of irregular shape, 1 to 4cm diam, overlying layer of clayey silt, 1.5m thick, depth 13.1m.

Z-1096. Dilj II/2 **34,700** $^{+6000}_{-4600}$

Loess concretions in dark-brown silt, 1.7 to 2m thick, depth 11.5m.

Z-1099. Dilj II/3 **32,000** $^{+3300}_{-2400}$

Sandy silt, depth 8m.

Z-1110. Dilj II/27 **27,000 ± 1900**

Sandy silt under groundwater level, depth 7m.

Z-1097. Dilj II/4 **15,600 ± 500**

Loess concretions, 1 to 4cm diam, from layer, 3.5m thick, with vertical fissures and microfauna, depth 6.8m.

Z-1109. Dilj II/28 **25,100 ± 1400**

Terrestrial loess with fossils, depth 5.6m.

Z-1098. Dilj II/5 **21,700 ± 1000**

Loess concretions from layer, 0.5m thick, with vertical fissures and microfauna, depth 5.5m.

Z-1108. Dilj II/30 **19,400 ± 1000**

Typical terrestrial loess with vertical fissures and terrestrial macrofauna, depth 3m.

Z-1150. Dilj II/30c **16,200 ±500**

Typical terrestrial loess with vertical fissures and terrestrial microfauna, depth 2.5m.

Z-1079. Dilj II/6 **3550 ± 160**

Loess concretions up to 10cm diam overlying layer of typical terrestrial loess, 2.5m thick, with vertical fissures and terrestrial microfauna, depth 1.8m.

Profile Gorjanović

Loess and loess concretions from various depths of profile, 18m deep, near Danube R at Vukovar (45° 20′ N, 19° 00′ E), E Croatia.

Z-1073. Gorjanović 1 **32,000 $^{+3500}_{-2800}$**

Loess concretions of irregular shape, up to 10cm long and several cm thick overlying layer of silt, 1m thick, depth 17.4m.

Z-1074. Gorjanović 2 **24,700 ± 1300**

Loess concretions of irregular shape, more than 20cm long overlying layer of loess, 3m thick, depth 13.2m. Fossil flora and fauna from colder climate found in layer.

Z-1107. Gorjanović 6 **22,200 ± 3700**

Typical loess, 7.5m below surface.

Z-1075. Gorjanović 3 **21,700 ± 1000**

Loess concretions 10 to 15cm diam overlying layer of loess, 6m thick, depth 6.8m.

Z-1103. Gorjanović 4 **18,800 ± 600**

Loess from layer, 4 to 5m thick, depth 1m.

Other loess profiles

Z-1080. Privlaka **6350 ± 200**

Loess concretions taken during digging channel near Bosut R, 1m below ground in clayey silt, Privlaka (45° 12′ N, 18° 50′ E), E Croatia.

Z-1104. Djakovo **7550 ± 200**

Loess concretions in clayey silt, depth 2.5m, Djakovo, Slavonia (45° 19′ N, 18° 25′ E), E Croatia.

Z-1105. Mikanovci **11,900 ± 300**

Loess concretions in clayey silt, depth 3.5m, Mikanovci (46° 17′ N, 18° 33′ E), E Croatia. Coll 1983 by I Galović, Geol Inst, Zagreb.

Z-1142. Sigečak Mali **5150 ± 170**

Loess concretions, depth 1.2m, Sigečak Mali near Ludbreg (46° 14′ N, 16° 39′ E), NW Croatia. Coll and subm 1983 by M Malez.

HYDROGEOLOGIC SAMPLES

Croatia

21.4 ± 0.7% modern

Z-868. Šmidhen, SM-1 **11,000 ± 300**

Mineral water from artesian well 800m deep, Šmidhen spa, near Samobor (43° 48′ N, 15° 43′ E), NW Croatia. Coll and subm July 1981 by INA Naftaplin staff, Zagreb. Dated to study hydrogeol properties of thermal waters.

3.9 ± 0.4% modern

Z-898. Šalata, SA-1 **24,800 ± 1200**

Groundwater from 950 to 1010m depth, Šalata, Zagreb (45° 49′ N, 16° 00′ E), NW Croatia. Coll and subm Feb 1982 by INA Naftaplin staff.

49.2 ± 0.7% modern

Z-1072. Križevci **4350 ± 160**

Groundwater, occasionally artesian water, near Vratno village (44° 08′ N, 16° 32′ E) at 200m alt, central Croatia. Sample from pumping sta of potable water for Križevci town. Coll and subm 1983 by J Krznar, Geotehnika.

5.3 ± 0.4% modern

Z-973. Topusko, TP-1 **22,000 ± 900**

Water from Topusko thermal spa (45° 18′ N, 15° 58′ E), central Croatia. Coll and subm Feb 1982 by Industroprojekt staff.

11.4 ± 0.4% modern

Z-981. Smrdan **16,000 ± 400**

Water from Topusko thermal spa. Coll and subm by Industroprojekt staff.

8.9 ± 0.4% modern

Z-1137. Sutinske toplice **18,000 ± 600**

Thermal water from main well, Sutinske toplice spa, NW Croatia (46° 03′ N, 16° 02′ E).

Slovenia

Z-962. Rogaška slatina, G-4 **89.4 ± 1.4% modern**

Water from Rogaška slatina spa, NE Slovenia (46° 14′ N, 15° 39′ E). Coll and subm Dec 1981 by Inst Jožef Štefan staff, Ljubljana.

14.1 ± 0.5% modern

Z-1013. Leženj **14,400 ± 400**

Water from bore hole PT-22/82, 220 to 400m deep, near Velenje (46° 24′ N, 15° 01′ E), N Slovenia. Coll and subm May 1982 by M Veselič, Geol Inst, Ljubljana.

Z-1014. Topolšica **>37,000**

Water from bore hole E-5 82, Topolšica spa near Velenje (46° 24′ N, 15° 01′ E), N Slovenia. Coll and subm May 1982 by M Veselič.

Bosnia

23.7 ± 0.5% modern

Z-878. Ribnica, RB-1 **10,200 ± 200**

Mineral water from Ribnica near Kakanj (44° 07′ N, 18° 05′ E), Bosnia. Coll and subm by N Miošić.

8.1 ± 0.4% modern

Z-974. Laktaši **20,000 ± 600**

Thermal artesian water from Laktaši near Banja Luka (44° 45′ 15″ N, 17° 09′ 35″ E), NW Bosnia. Coll and subm Feb 1982 by N Miošić.

9.5 ± 0.4% modern

Z-975. Šaranovića haus **17,600 ± 500**

Thermal water at Gornji Šeher near Banja Luka (44° 45′ 15″ N, 17° 45′ 15″ E) at 168m alt, NW Bosnia. Coll and subm Feb 1982 by D Hrustanpašić. Part of investigations of geothermal potential of Banja Luka region.

Z-976. Slatina, Kiseljak II **>37,000**

Thermal artesian water at Slatina spa near Banja Luka (44° 49′ 35″ N, 17° 18′ 15″ E), NW Bosnia. Coll and subm Feb 1982 by N Miošić.

3.3 ± 0.3% modern

Z-977. Slatina **26,000 ± 1400**

Thermal artesian water from Slatina spa near Banja Luka (44° 49′ 45″ N, 17° 18′ 10″ E) at 210m alt, NW Bosnia. Coll and subm Feb 1982 by D Hrustanpašić.

3.3 ± 0.4% modern

Z-979. Omarska **24,000 ± 1100**

Artesian water from bore hole Jezero 8 at Omarska near Prijedor (44° 53′ N, 16° 54′ E) at 155m alt. Coll and subm Feb 1982 by Geotehnika staff.

19.2 ± 0.5% modern

Z-1182. Sanska Ilidža **11,900 ± 400**

Water from drilled hole, depth 200m, at Sanska Ilidža near Sanski Most spa (44° 41′ N, 16° 46′ E), W Bosnia.

Slatina series

Subartesian thermal water (43°C) at Slatina spa near Banja Luka (44° 49′ N, 17° 19′ E), NW Bosnia. Coll and subm by N Miošić.

		1 ± 0.3% modern
Z-1184.	**Slatina Ilidža, SB-1**	**35,400 +4500 −3500**
		1.2 ± 0.3% modern
Z-1185.	**Slatina Ilidža, Kiseljak**	**34,500 +3700 −3000**

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	AALAND			
2850 ± 50	Bronze age	Lu-2160	3	409
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	ALGERIA			
1080 ± 130	Islamic	BM-2129	1	59
460 ± 50	"	-2130	"	"
65 ± 40	"	-2132	"	"
45 ± 35	"	-2133	"	"
Modern	"	-2134	"	"
	ARGENTINA			
9280 ± 310	Guanaco hunters	LP-62	1	132
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7850 ± 70	Traful Cave Indian	LJ-5133	"	96
6240 ± 60	"	5132	"	"
2620 ± 40	"	5131	"	"
2330 ± 40	"	5130	"	"
	AUSTRIA			
>40,700		VRI-793	3	447
37,200 $^{+1900}_{-1600}$		-792	"	"
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Modern		-525	"	"
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11,930 ± 310	Upper palaeolithic	-2127	"	66
8890 ± 340	Holocene	-2102	"	65
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5120 ± 120	Neolithic	-2098	"	62
4910 ± 110	"	-2097	"	"
4820 ± 70	"	-2099	"	"
4800 ± 170	"	-2124	"	"
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2820 ± 90		- 699	"	256
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2660 ± 90		-1826	"	272
2630 ± 50		-1634	"	271
2600 ± 60		-1653	"	273
2580 ± 80	Early Taltheilei	-1531	"	270
2530 ± 160		SFU-341	3	433
2530 ± 120		S-1843	2	275
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2490 ± 60		-1657	"	271
2480 ± 110		-1805	"	273
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2430 ± 60		-1831	"	281
2420 ± 70		S-1938	"	285
2400 ± 110		-1939	"	285
2360 ± 60		-1677	"	274
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2350 ± 60		-1656	"	271
2340 ± 120	Marpole/Lacarno Beach	- 790	"	260
2320 ± 50		-1613	"	269
2300 ± 70	Marpole/Lacarno Beach	- 787	"	260
2300 ± 60		-1677	"	274
2280 ± 150		- 890	"	258
2260 ± 130		-1834	"	282
2250 ± 50		-1642	"	269
2240 ± 170		- 695	"	256
2210 ± 120		-1673	"	274
2150 ± 140		- 798	"	256
2130 ± 750		-1247	"	265
2120 ± 70		-1453	"	269
2120 ± 70		-1652	"	273
2090 ± 70		-1456	"	269
2080 ± 50	Middle Woodland	-1639	"	272
2080 ± 60		-1806	"	273
2060 ± 100		-1804	"	"
2040 ± 70	Middle Woodland	- 895	"	261
2040 ± 50		-1669	"	273
2040 ± 200		-2017	"	289
2030 ± 50		-1580	"	271
2020 ± 230		-1838	"	282
2000 ± 50		-1636	"	273
2000 ± 60		-1668	"	"
1990 ± 100		- 896	"	261
1960 ± 70		-1824	"	272
1950 ± 80	Saugeen	- 776	"	258
1920 ± 90	Laurel	- 956	"	263
1920 ± 130	Beothuk	-1853	"	284
1910 ± 70	Besant	-1640	"	272
1910 ± 70		-2032	"	287
1900 ± 80		SFU-351	3	434
1890 ± 70		S- 926	2	262
1870 ± 270		-1821	"	280
1870 ± 110	Beothuk	-1862	"	284
1860 ± 120		-1444	"	268
1860 ± 200	Avonlea	-1765	"	279
1850 ± 50		-1715	"	277
1850 ± 120		-1836	"	282
1840 ± 280		-2000	"	280
1820 ± 60		-1861	"	283
1810 ± 200		-1853	"	"

Date	Culture or Period	Sample No.	No.	Page
	CANADA (continued)			
1800 ± 60		S-1670	2	273
1780 ± 40		-1637	"	272
1770 ± 100		-1445	"	268
1760 ± 270	Early Taltheilei	-2005	"	287
1750 ± 210		- 853	"	258
1750 ± 70		-1651	"	273
1750 ± 70		-1835	"	282
1740 ± 130		-1614	"	268
1710 ± 50	Besant	-1641	"	272
1710 ± 290		-1927	"	284
1700 ± 70		-1679	"	274
1700 ± 120		-1935	"	285
1690 ± 80		-1832	"	281
1680 ± 70		-1638	"	272
1670 ± 70		-1952	"	286
1650 ± 200	Laurel	- 959	"	263
1650 ± 70		-1675	"	274
1640 ± 310		-1256	"	256
1630 ± 200	Avonlea	-1764	"	279
1620 ± 110		-1833	"	282
1610 ± 60		-1825	"	272
1600 ± 110	Avonlea	-1318	"	267
1600 ± 80		-1998	"	280
1590 ± 120		- 946	"	263
1570 ± 60		- 704	"	257
1560 ± 160		-2053	"	290
1550 ± 60	Kamloops	-1454	"	269
1520 ± 160		-2001	"	280
1510 ± 200		- 939	"	263
1510 ± 70		-1443	"	268
1480 ± 110		- 622	"	255
1480 ± 120		-1252	"	266
1470 ± 120	Late Woodland	- 772	"	258
1460 ± 50		-1713	"	277
1460 ± 100		-1995	"	287
1440 ± 90		-1940	"	268
1400 ± 160		-2016	"	289
1390 ± 40		-1684	"	276
1380 ± 200	Avonlea	-1762	"	279
1380 ± 190	"	-1763	"	"
1380 ± 70		-2014	"	288
1340 ± 190		-1761	"	279
1350 ± 70		-2007	"	288
1330 ± 90	Laurel	-1248	"	266
1330 ± 90		SFU-260	3	432
1320 ± 90		S- 892	2	258
1320 ± 80		-1941	"	269
1320 ± 190	Prairie Side-notch	-1760	"	279
1290 ± 259		-1852	"	275
1290 ± 60		-1995	"	279
1280 ± 100		-1854	"	283
1280 ± 70		-2023	"	290
1250 ± 100		-1934	"	285
1220 ± 70	Middle Nesikep	-1455	"	269
1210 ± 60		-1813	"	280
1200 ± 130	Laurel	- 746	"	257
1200 ± 80	Pre-Kamloops	- 761	"	"
1190 ± 170	Avonlea/Prairie Side-notch	- 641	"	255
1190 ± 160		-1996	"	280
1180 ± 90	Terminal Woodland	-1839	"	282
1170 ± 60		-2022	"	290
1160 ± 100		-1830	"	281
1150 ± 60		- 891	"	258
1140 ± 240		SFU-224	3	434
1140 ± 70	Laurel	S-1079	2	264
1100 ± 150		SFU-229	3	435
1090 ± 70		S-2021	2	290
1080 ± 160		SFU-302	3	434
1080 ± 90		S-1823	2	273
1070 ± 70	Prairie Side-notch	- 640	"	255
1070 ± 110	Late Woodland	-1948	"	285
1070 ± 60		-2020	"	289
1050 ± 330		-2064	"	288
1030 ± 70		-2025	"	289
1020 ± 110		-1850	"	275
1010 ± 100	Clearwater Lake	- 966	"	259
1010 ± 230		-1931	"	284
1000 ± 50		-1685	"	276
990 ± 170		-1950	"	"
990 ± 40		-1688	"	"
990 ± 120		-2033	"	287
980 ± 140	Arctic Small Tool	- 778	"	259
980 ± 60		-1812	"	280
980 ± 80		-2008	"	288
970 ± 60		-1579	"	271
970 ± 70		-1937	"	285
950 ± 190		-1759	"	278

Date	Culture or Period	Sample No.	No.	Page
	CANADA (continued)			
940 ± 40		-1678	2	274
940 ± 60		-1681	"	"
920 ± 150	Laurel	- 744	"	257
920 ± 70		S-1711	2	277
910 ± 110		-1718	"	278
900 ± 60		-1686	"	276
900 ± 40		-1714	"	277
900 ± 60	Late Woodland	-1840	"	282
900 ± 80		-2015	"	288
890 ± 130		- 851	"	258
890 ± 70		-1687	"	276
870 ± 360	Saugeen	- 621	"	255
870 ± 110	Terminal Woodland	-1396	"	267
860 ± 80	Kamloops	- 759	"	257
840 ± 60	Thule	-2027	"	290
840 ± 60	"	-2026	"	"
830 ± 150		- 643	"	255
830 ± 70		-1676	"	274
820 ± 80	Thule	-2024	"	289
800 ± 110	Pre-Kamloops	- 762	"	258
800 ± 180	Laurel	- 957	"	263
800 ± 70		-1943	"	268
800 ± 40		-1712	"	277
790 ± 60		-1720	"	278
780 ± 70		- 942	"	263
780 ± 120		-1717	"	277
770 ± 70		-1820	"	280
770 ± 110		-1828	"	281
760 ± 130		-1219	"	265
760 ± 60		-1849	"	275
750 ± 150		-2019	"	289
730 ± 190		-1758	"	278
730 ± 510		-1928	"	284
720 ± 60		-2029	"	286
710 ± 40	Huron-Petrun	-1710	"	277
700 ± 100		SFU-309	3	433
690 ± 170		S-1949	2	276
670 ± 110	Terminal Woodland	-1397	"	267
670 ± 50	Late Thule	-1615	"	268
660 ± 70	Late Woodland	- 775	"	258
650 ± 100		-1254	"	265
630 ± 60	Late Thule	-1545	"	270
620 ± 100		- 925	"	262
620 ± 120		-1851	"	275
620 ± 150		-2018	"	289
620 ± 80		SFU-311	3	433
610 ± 60	Huron	S-1133	2	264
600 ± 40		-1581	"	271
590 ± 70	Kamloops	- 760	"	257
580 ± 190		-1757	"	278
580 ± 160		- 903	"	256
570 ± 70		-1829	"	281
560 ± 70	Kamloops	- 757	"	257
550 ± 80	Athapaskan	-1942	"	267
550 ± 70	Kamloops	- 758	"	257
540 ± 120		-1255	"	256
530 ± 80		-2012	"	288
510 ± 110		- 943	"	263
500 ± 80		SFU-310	3	433
490 ± 90	Blackduck	S-1080	2	264
490 ± 120	Huron	-1134	"	"
480 ± 60		-1683	"	276
480 ± 70		-1999	"	280
480 ± 50		-1822	"	281
480 ± 70	Iroquois	-2006	"	288
470 ± 170	Late Woodland	- 745	"	257
470 ± 70	Blackduck	-1076	"	264
470 ± 60		-1395	"	267
460 ± 100	Clearwater Lake	- 781	"	259
440 ± 40	Blackduck	-1246	"	265
430 ± 100		- 940	"	263
430 ± 50		-1819	"	281
430 ± 80	Iroquois	-2010	"	288
430 ± 70	"	-2011	"	"
410 ± 60	Late Thule	-1546	"	270
410 ± 100	Iroquois	-2009	"	288
400 ± 100		- 897	"	261
390 ± 90	Athapaskan	-1944	"	268
380 ± 80		- 225	"	255
380 ± 220		- 705	"	257
380 ± 50	Terminal Woodland	-1249	"	266
330 ± 80		-2030	"	278
320 ± 90		- 642	"	255
320 ± 90		- 852	"	258
310 ± 50		-1827	"	278
310 ± 70		-1951	"	286
300 ± 170	Clearwater Lake	- 965	"	264
290 ± 50		-1817	"	280
250 ± 70	Athapaskan	-1947	"	268

Date	Culture or Period	Sample No.	No.	Page
	CANADA (continued)			
240 ± 70		S-1078	2	259
240 ± 60		-1818	"	281
220 ± 50		-1742	"	278
220 ± 60		-1815	"	280
210 ± 100	Clearwater Lake	-1807	"	279
180 ± 140		- 774	"	258
180 ± 70	Athapaskan	-1945	"	268
160 ± 70	Blackduck	-1394	"	267
140 ± 50		-1582	"	271
> 100		-1848	"	275
> 100		-2003	"	287
> 100		-1936	"	285
90 ± 50	Clearwater Lake	- 968	"	259
90 ± 50	Huron	-1719	"	278
Modern		- 958	"	263
Modern		-1476	"	269
Modern		SFU-350	3	434
	CHILE			
9400 ± 160		P-2702	2	237
2300 ± 50		-2588	"	238
1720 ± 50		-2587	"	"
	CYPRUS			
9240 ± 130	Acermaic Neolithic	P-2972	2	213
8870 ± 500	"	-2976	"	"
8720 ± 400	"	-2785	"	214
8020 ± 400	"	-2974	"	213
8010 ± 360	"	-2973	"	"
7600 ± 100	"	-2781	"	214
7400 ± 260	"	-2978	"	"
7380 ± 100	"	-2784	"	"
7130 ± 410	"	-2783	"	"
7120 ± 90	"	-2779	"	"
6970 ± 310	"	-2975	"	213
6570 ± 290	"	-2977	"	"
6300 ± 80	"	-2781	"	"
5830 ± 60	Ceramic Neolithic	-2780	"	214
4330 ± 80	Middle Bronze	-2980	"	214
	DENMARK			
170 ± 70	Modern	Lu-2017	3	410
150 ± 45	"	-2163	"	"
	EGYPT			
4110 ± 100	6th Dynasty(?)	Fra-104	2	193
3860 ± 100	"	- 70	"	192
3850 ± 100	"	-100	"	193
3730 ± 100	"	- 92	"	"
3680 ± 115	7th Dynasty	UD- 73	"	293
3550 ± 100	6th Dynasty (?)	Fra- 87	"	193
3450 ± 100	"	- 71	"	"
2920 ± 60	Mummy	LJ-4995	1	96
2860 ± 40	Kushite-Saite	P-3112	2	218
2590 ± 60	"	-3113	"	217
2550 ± 50	"	-3111	"	218
2550 ± 50	"	-3114	"	"
2430 ± 100	"	Fra-80	"	193
2290 ± 40	Mummy	LJ-4915	1	96
2210 ± 59	Kushite-Saite	P-3115	2	218
2130 ± 60	Mummy	LJ-4996	1	96
	FRANCE			
2490 ± 50	Iron age	BM-2050	1	66
2480 ± 72	"	-2051	"	"
2370 ± 60	"	-2055	"	"
2310 ± 50	"	-2058	"	67
2300 ± 110	"	-2056	"	66
2235 ± 40	"	-2057	"	"
2220 ± 140	"	-2054	"	"
2130 ± 130	"	-2052	"	"
1710 ± 360	"	-2053	"	"
490 ± 100	Medieval	-2100	"	67
340 ± 100	"	-2101	"	"
	GERMANY			
$30,300^{+2500}_{-1900}$	Upper Pleistocene	Fra- 5a	2	190
5700 ± 130	Bronze age (?)	-69a	"	188
5640 ± 100	Middle Neolithic	-96	"	189
5630 ± 100	"	-97	"	"
5340 ± 130	Neolithic	-67	"	188
4560 ± 100	Bronze age (?)	-69b	"	"

Date	Culture or Period	Sample No.	No.	Page
	GERMANY (continued)			
4040 ± 100	Late Neolithic	-86		189
1970 ± 100	LaTène	-75	"	188
1970 ± 100	Bronze age (?)	-69c	"	"
1720 ± 100	Urnfield culture (?)	-74	"	187
1450 ± 100	Medieval	-55	"	"
1350 ± 100	Early Medieval	-94	"	189
1180 ± 100	Medieval	-72	"	187
1130 ± 100	"	-54	"	"
1100 ± 100	"	-64	"	"
1080 ± 100	Carolingian	-90	"	189
400 ± 100	Urnfield	-78	"	188
	GREECE			
5810 ± 410	Early Helladic	P-2846	2	215
4970 ± 270	"	-2854	"	"
4810 ± 280	"	-2848	"	"
4360 ± 350	"	-2850	"	"
4200 ± 240	Late Minoan	-3046	"	217
4150 ± 50	Middle Helladic	-2790	"	216
4100 ± 230	"	-2966	"	"
4090 ± 260	Early Helladic	-2853	"	215
4080 ± 60	Middle Helladic	-2961	"	217
4040 ± 210	"	-2958	"	216
4010 ± 230	"	-2965	"	"
4000 ± 280	Early Helladic	-2852	"	215
3930 ± 50	Middle Helladic	-2967	"	216
3900 ± 250	"	-2962	"	217
3870 ± 210	"	-2570	"	"
3770 ± 210	"	-2968	"	216
3720 ± 250	"	-2959	"	"
3620 ± 60	"	-2963	"	217
3550 ± 220	"	-2571	"	"
3510 ± 50	"	-2969	"	216
3470 ± 240	"	-2964	"	"
3420 ± 60	"	-2855	"	215
3160 ± 60	Middle Minoan	-2568	"	"
3070 ± 240	Middle Helladic	-2569	"	"
	GUATEMALA			
2880 ± 190	Preclassic	P-3208	2	237
2660 ± 190	AD 500	-3105	"	"
1970 ± 50	6th century AD	-3100	"	236
1970 ± 50	AD 500	-3089	"	"
1970 ± 170	6th century AD	-3101	"	237
1920 ± 40	Late Classic	-3062	"	"
1910 ± 60	AD 500	-3102	"	"
1830 ± 170	"	-3085	"	235
1830 ± 50	5th-6th century AD	-3098	"	236
1800 ± 50	AD 737-775	-3095	"	"
1730 ± 50	<AD 724	-3096	"	237
1640 ± 50	7th-9th century AD	-3108	"	"
1540 ± 210	8th century AD	-3106	"	"
1450 ± 50	AD 737-810	-3086	"	235
1440 ± 40	AD 724-737	-3087	"	236
1310 ± 40	7th-8th century AD	-3084	"	235
1290 ± 40	AD 737-810	-3088	"	236
420 ± 40	9th century AD	-3097	"	"
	HUNGARY			
5970 ± 100	Neolithic	Fra-108	2	192
5970 ± 100	"	- 95	"	"
5670 ± 100	"	- 77	"	"
5650 ± 110	"	- 76	"	"
	ICELAND			
360 ± 40		S-1577	2	270
330 ± 40		-1578	"	"
Modern		-1576	"	"
	INDIA			
2580 ± 200	Neolithic	P-3123	2	225
2120 ± 60	Early metallurgy	BM-2148	1	67
1920 ± 50	"	-2149	"	68
1530 ± 180	Medieval	P-3124	2	225
1390 ± 200	Neolithic-Iron Age	-3122	"	"
1300 ± 180	Medieval	-3125	"	"
750 ± 370	Giant tortoise	BM-2125	1	68
Modern		-2017	"	67
Modern		-2065	"	67

Date	Culture or Period	Sample No.	No.	Page
	IRAN			
>27,970	Upper Paleolithic	P-2862	2	218
>27,610	"	-2861	"	"
>27,260	"	-2866	"	"
$24,240^{+3010}_{-2180}$	"	-2863	"	"
$19,230^{+1590}_{-1340}$	"	-2865	"	"
$18,020^{+1630}_{-1360}$	"	-2864	"	"
5750 ± 60	Period I	-2864	"	220
5200 ± 70	"	-2774	"	221
5060 ± 320	"	-2623	"	220
5020 ± 70	"	-2765	"	222
4910 ± 70	"	-2764	"	"
4870 ± 70	"	-2763	"	"
4830 ± 60	"	-2619	"	"
4790 ± 60	Period II	-2759	"	"
4700 ± 50	"	-2766	"	"
4570 ± 60	"	-2711	"	220
3440 ± 70	"	-2621-A	"	"
4540 ± 60	"	-2709	"	"
4530 ± 60	"	-2707	"	"
4530 ± 50	"	-2760	"	"
4500 ± 50	"	-2773	"	222
4550 ± 60	"	-2715	"	221
4440 ± 50	"	-2708	"	219
4420 ± 50	"	-2617	"	221
4410 ± 60	"	-2767	"	222
4410 ± 60	"	-2699	"	221
4380 ± 70	"	-2710	"	219
4370 ± 70	"	-2700	"	221
4350 ± 50	"	-2615	"	"
4340 ± 60	"	-2704	"	"
4280 ± 70	"	-2698	"	"
4270 ± 60	"	-2703	"	220
4240 ± 70	"	-2706	"	221
3950 ± 60	"	-2618	"	219
3860 ± 60	"	-2701	"	220
3610 ± 70	"	-2620	"	219
	IRAQ			
3650 ± 40	Old Babylonian	BM-2110	1	68
3640 ± 40	Ur/Agade	-2112	"	"
3370 ± 40	Agade	-2109	"	"
3110 ± 200	"	-2113	"	"
	IRELAND			
3090 ± 100	Neolithic/Megalithic	Fra-60	2	191
3000 ± 100	"	-65	"	"
2470 ± 100	"	-63	"	"
1240 ± 100	"	-53	"	"
	ISRAEL			
2650 ± 110	1200 BC	P-3099	2	222
2550 ± 110	"	-3226	"	"
	ITALY			
11,040 ± 190	Upper Palaeolithic/ Mesolithic	LJ-4979	1	100
10,790 ± 210	"	-4978	"	"
9560 ± 140	"	-4982	"	"
9030 ± 120	"	-5098	"	"
6720 ± 100	Neolithic	-4649	"	99
6530 ± 260	"	-4981	"	100
6490 ± 140	"	-4650	"	99
6410 ± 150	"	-4980	"	100
6400 ± 80	"	-5095	"	99
6330 ± 90	"	-4651	"	"
6290 ± 80	"	-5096	"	"
6290 ± 90	"	-5097	"	100
6120 ± 80	"	-4983	"	99
2900 ± 400	Late Bronze age	UD-16	2	293
2700 ± 100	"	-58	"	294
2250 ± 100	"	-57	"	"
340 ± 30	Middle age	-33	"	"
	JORDAN			
3770 ± 70	Bronze age	P-3217	2	223
3580 ± 70	"	-3219	"	"
3440 ± 60	"	-3216	"	"
3350 ± 70	"	-3210	"	"
3200 ± 60	"	-3209	"	"
250 ± 50	Ottoman	-3218	"	"

Date	Culture or Period	Sample No.	No.	Page
	LEBANON			
3030 ± 250	Late Bronze age	P-2859	2	224
2950 ± 40	"	-2860	"	"
2930 ± 50	"	-2858	"	"
2480 ± 40	Hellenistic	-2857	"	"
	LYBIA			
7630 ± 250	Neolithic	UD-17	2	293
6500 ± 350	"	-1	"	"
	MEXICO			
860 ± 40		LJ-5301	1	92
	PALESTINE			
8150 ± 300	Early equid	BM-2114	1	69
	PAPUA NEW GUINEA			
Modern		BM-2093	1	69
Modern		-2094	"	"
Modern		-2138	"	"
	PERU			
3600 ± 90	Formative period	VRI-812	3	448
3200 ± 90	"	-813	"	"
3120 ± 80	"	-811	"	"
2530 ± 80	Amazon/Secoya Indian	LJ-4653	1	95
2430 ± 40	"	-4652	"	"
2290 ± 90		VRI-815	3	448
2140 ± 50	Amazon/Secoya Indian	LJ-4871	1	95
2060 ± 90		VRI-814	3	448
1920 ± 60	Amazon/Secoya Indian	LJ-4868	1	95
1890 ± 40	"	-4787	"	"
1250 ± 60	"	-4871	"	"
1180 ± 60	"	-4870	"	"
114.3% Modern	Misassoc	-4872	"	"
	POLAND			
12,680 ± 230	Late Palaeolithic	LOD-111	1	117
11,290 ± 280	"	-107	"	"
11,180 ± 220	"	-144	"	119
10,380 ± 220	"	-148	"	"
10,320 ± 220	"	-142	"	"
10,260 ± 210	"	-143	"	"
9650 ± 220	Early Mesolithic	-92	"	117
9150 ± 210	"	-149	"	119
8070 ± 180	Mesolithic	-150	"	"
6560 ± 190	Early Mesolithic	-39	"	115
6230 ± 170	"	-38	"	"
5870 ± 180	"	-151	"	120
5850 ± 170	"	-127	"	117
5530 ± 220	Middle Mesolithic	-93	"	"
5490 ± 140	"	-69	"	113
5430 ± 190	"	-145	"	119
5400 ± 240	"	-61	"	116
5380 ± 180	"	-146	"	119
5170 ± 180	"	-60	"	116
5160 ± 180	"	-110	"	119
4670 ± 380	Late Neolithic	-1	"	112
4630 ± 160	"	-147	"	119
4360 ± 210	"	-63	"	116
4320 ± 180	"	-20	"	112
4250 ± 180	"	-62	"	116
2480 ± 100		BM-2130	"	70
2460 ± 140		-2104	"	70
2450 ± 130	Early Iron age-LaTène	LOD-89	"	115
2440 ± 130	"	-88	"	"
2420 ± 130	"	-48	"	"
2400 ± 130	"	-46	"	"
2390 ± 110	"	-90	"	"
2390 ± 110	"	-42	"	"
2380 ± 130	"	BM-2107	"	70
2380 ± 110	Early Iron age-LaTène	LOD-45	"	115
2340 ± 90	"	-53	"	"
2320 ± 120	"	-50	"	"
2240 ± 100	"	-133	"	118
2230 ± 200		BM-2105	"	70
2190 ± 110	Middle LaTène	LOD-135	"	118
2190 ± 100	"	-131	"	"
2160 ± 100	"	-134	"	"
2160 ± 100	"	-130	"	"
2160 ± 110	"	-128	"	"
2150 ± 110	"	-137	"	119
2130 ± 110	"	-129	"	118
2110 ± 100	"	-138	"	119

Date	Culture or Period	Sample No.	No.	Page
	POLAND (continued)			
2110 ± 110	Middle LaTène	LOD-132	1	118
2070 ± 110	"	-136	"	"
1920 ± 110	Roman	-82	"	117
1920 ± 110	"	-70	"	116
1860 ± 110	"	-76	"	113
1860 ± 120	"	-3	"	112
1830 ± 100	"	-79	"	114
1800 ± 100	"	-66	"	113
1780 ± 100	"	-68	"	"
1760 ± 100	"	-75	"	"
1750 ± 120	"	-67	"	"
1740 ± 120	"	-6	"	"
1720 ± 110	"	-65	"	"
1710 ± 120	"	-7	"	"
1690 ± 110	"	-64	"	"
1670 ± 90	"	-4	"	"
1640 ± 120	"	-80	"	114
920 ± 90	Early Medieval	-124	"	118
920 ± 100	"	-51	"	114
900 ± 110	"	-56	"	"
870 ± 90	"	-125	"	118
860 ± 120	"	-54	"	114
840 ± 110	"	-59	"	"
840 ± 120	"	-52	"	"
830 ± 80	"	-5	"	"
800 ± 90	"	-126	"	118
770 ± 110	"	-57	"	114
760 ± 110	"	-58	"	"
760 ± 90	"	-9	"	"
740 ± 70	"	-72	"	117
730 ± 120	"	-55	"	114
660 ± 90	"	-73	"	117
650 ± 90	"	-74	"	"
150 ± 45	Historic	-2	"	112
140 ± 90	"	-141	"	119
140 ± 60	"	-71	"	116
130 ± 60	"	-81	"	"
	ROMANIA			
4710 ± 110	Early Bronze age	LJ-5232	1	101
4160 ± 90	"	-5233	"	"
4030 ± 90	"	-5231	"	"
3500 ± 90	Bronze age/Ottoman	-5262	"	"
	SARDINIA			
7530 ± 80	Faunal survival	BM-2139	1	70
	SOUTH AFRICA			
1410 ± 100	Early Iron age	Fra-82	2	193
1360 ± 100	"	-85	"	194
1320 ± 100	"	-88	"	193
290 ± 100	Late Iron age	-84	"	194
260 ± 100	"	-83	"	"
	SRI LANKA			
11,780 ± 220	Mesolithic	Fra-91	2	194
8700 ± 220	"	-93	"	"
	SPAIN			
3150 ± 300	Beaker	BM-1988	1	70
2820 ± 40		-2140	"	71
2440 ± 50		-2064	"	"
1850 ± 100	Canarian Neolithic	VRI-789	3	448
1820 ± 80	"	-791	"	447
790 ± 70	"	-790	"	"
175 ± 30	Olive wood	BM-2001	1	71
	SWEDEN			
7480 ± 70	Mesolithic	Lu-2202	3	408
7030 ± 70	"	-2110	"	406
6910 ± 70	Early Ertebølle	-2114	"	"
6589 ± 70	"	-2113	"	"
6430 ± 70	Mesolithic	-2111	"	"
6380 ± 70	Early Ertebølle	-2115	"	"
6370 ± 70	Mesolithic	-2112	"	"
6270 ± 70	Early Ertebølle	-2109	"	405
5990 ± 70	Ertebølle	-2116	"	406
5850 ± 90	"	-2156	"	"
5390 ± 110	"	-2198	"	407
4960 ± 70	Early Neolithic	-2212	"	408
4560 ± 70	Neolithic	-2101	"	"
4470 ± 70	Pitted Ware culture	-2144	"	407

Date	Culture or Period	Sample No.	No.	Page
	SWEDEN (continued)			
4170 ± 70	Pitted Ware culture	LU-2143	3	407
3880 ± 110	"	-2141	"	"
3880 ± 70	"	-2142	"	"
2440 ± 70	Early Iron age	-2140	"	"
2020 ± 60	Iron age	-2218	"	409
1660 ± 50	"	-2205	"	408
1640 ± 50	"	-2203	"	"
1630 ± 50	"	-2204	"	"
1280 ± 70	"	-2135	"	406
1030 ± 45	Viking age	-2213	"	409
950 ± 60	"	-2214	"	"
950 ± 45	"	-2215	"	"
630 ± 45	Historic	-2063	"	405
620 ± 45	"	-2061	"	"
560 ± 45	"	-2060	"	"
440 ± 40	"	-2058	"	404
410 ± 45	"	-2064	"	405
320 ± 45	"	-2062	"	"
320 ± 45	"	-2066	"	"
50 ± 45	Modern	-2059	"	404
	SWITZERLAND			
7890 ± 170	Medieval	Fra-106	2	190
5820 ± 140	Medieval (contaminated)	-107	"	191
	SYRIA			
28,800 ± 1300	Terqa/early 3rd m BC	LJ-5031	1	97
27,700 ± 1400	"	-5362	"	98
5700 ± 100	"	-4823	"	"
4870 ± 90	"	-4822	"	97
4660 ± 80	"	-5053	"	"
4220 ± 120		BM-2036	"	72
4210 ± 80	"	LJ-4821	"	97
4180 ± 90	"	BM-2039	"	72
4110 ± 70	"	LJ-5052	"	97
3510 ± 80	Terqa/18th-17th century BC	-5055	"	98
3460 ± 70	"	-4824	"	"
3420 ± 100	"	-5054	"	"
3310 ± 35		BM-2029	"	72
3140 ± 60		-2040	"	"
3000 ± 35		-2035	"	"
2925 ± 45		-2032	"	"
2720 ± 230		-2037	"	"
2700 ± 40		-2030	"	"
2415 ± 40		-2034	"	"
2390 ± 45		-2038	"	"
2200 ± 50		-203	"	"
	THAILAND			
7180 ± 70	Mesolithic?/Neolithic	P-2423	2	230
4830 ± 310	Neolithic?	-2265	"	226
4360 ± 240	"	-2419	"	233
4750 ± 240	"	-2452	"	229
4590 ± 300	"	-2266	"	227
4250 ± 290	"	-2263	"	228
3900 ± 70	Bronze age?	-2407	"	232
3790 ± 240	Neolithic/Bronze age?	-2242	"	226
3650 ± 220	Bronze age	-2456	"	230
3610 ± 230	Iron age	-2247	"	228
3580 ± 240	Neolithic/Bronze age?	-2451	"	230
3570 ± 230	"	-2245	"	227
3570 ± 230	"	-2271	"	228
3510 ± 210	Bronze age?	-2726	"	232
3360 ± 200	"	-2727	"	234
3270 ± 230	"	-2261	"	227
3270 ± 180	"	-2454	"	229
3240 ± 50	"	-2732	"	233
3240 ± 210	"	-2405	"	229
3240 ± 50	"	-2457	"	"
3220 ± 200	"	-2724	"	234
3170 ± 300	"	-2731	"	232
3130 ± 50	"	-2691	"	234
3130 ± 210	"	-2264	"	227
3120 ± 220	"	-2240	"	226
3090 ± 50	"	-2686	"	232
3080 ± 180	"	-2725	"	234
3050 ± 60	"	-2446	"	232
3040 ± 190	"	-2730	"	234
3040 ± 50	"	-2246	"	227
3020 ± 40	"	-2243	"	"
3000 ± 200	"	-2404	"	229
2950 ± 210	"	-2272	"	228
2860 ± 250	Neolithic?/Bronze age	-2418	"	233
2830 ± 50	Iron age?	-2455	"	229
2800 ± 50	Bronze age	-2668	"	230

Date	Culture or Period	Sample No.	No.	Page
	THAILAND (continued)			
2780 ± 50	Iron age?	P-2634	2	229
2760 ± 170	Bronze age?	-2445	"	232
2680 ± 210	Iron age?	-2939	"	231
2670 ± 170	"	-2723	"	234
2600 ± 60	Bronze age?	-2633	"	230
2520 ± 50	Iron age	-2665	"	228
2680 ± 240	Bronze age?	-2398	"	230
2460 ± 210	Iron age	-2941	"	232
2460 ± 170	Neolithic?/Bronze age	-2447	"	233
2440 ± 50	Iron age	-2938	"	231
2440 ± 50	Bronze age?/Iron age?	-2674	"	233
2410 ± 210	"	-2450	"	230
2340 ± 230	Iron age	-2940	"	232
2300 ± 50	"	-2664	"	228
2210 ± 190	"	-2944	"	231
2140 ± 60	"	-2416	"	233
2110 ± 40	"	-2244	"	228
2090 ± 230	"	-2262	"	226
2090 ± 40	"	-2241	"	"
2070 ± 170	"	-2945	"	232
2040 ± 50	"	-2694	"	233
1980 ± 180	"	-2943	"	231
1920 ± 50	"	-2675	"	233
1900 ± 200	"	-2448	"	"
1870 ± 190	"	-2417	"	"
1720 ± 190	"	-2406	"	226
	TURKEY			
4280 ± 120	Early Bronze age	LJ-5234	1	101
4250 ± 40	"	-5237	"	"
4230 ± 60	"	-5238	"	"
4190 ± 80	"	-5235	"	"
3910 ± 90	"	-5236	"	"
	UNITED STATES			
	California			
13,900 ± 500	Misassoc or contam	LJ-4999	1	78
8650 ± 110	LaJolla Indian	-4609	"	81
8600 ± 110	"	-4614	"	"
8450 ± 180	"	-4610	"	"
8420 ± 100	"	-4613	"	"
8290 ± 100	"	-4607	"	82
8030 ± 100	"	-4611	"	81
7720 ± 100	"	-4615	"	82
7400 ± 100	"	-4612	"	81
7230 ± 70	Early Milling	-5159	"	86
7110 ± 70	"	-5158	"	"
6820 ± 100	"	-5029	"	85
6770 ± 90	"	-5161	"	"
6770 ± 90	Early Milling/ Late Prehistoric	-5484	"	84
6650 ± 40	"	-5485	"	"
6570 ± 110		-4875	"	90
6520 ± 70	Early Milling	-5157	"	86
6490 ± 110	LaJolla Indian	-4616	"	82
6460 ± 80	Early Milling	-5028	"	85
6400 ± 70	"	-5156	"	"
6280 ± 100	"	-5030	"	"
6270 ± 70	Early Milling/ Late Prehistoric	-5299	"	83
6200 ± 70	Early Milling	-5155	"	85
6200 ± 70	"	-5160	"	"
6160 ± 50		-5665	"	88
6040 ± 40		=5668	"	"
6000 ± 70	Early Milling/ Late Prehistoric	-5483	"	84
5580 ± 80	Laguna Beach Indian	-5292	"	"
5460 ± 100		-4875	"	90
5390 ± 90		-4877	"	"
5360 ± 100		-4876	"	"
5140 ± 60	Laguna Beach Indian	-5293	"	80
5090 ± 100		-5002	"	78
5090 ± 100	Laguna Beach Indian	-5294	"	"
5040 ± 90	"	-4879	"	"
5040 ± 60	"	-5295	"	"
4620 ± 60	"	-5297	"	80
4530 ± 40	"	-5298	"	81
4500 ± 400	San Clemente I. Indian	-4172	"	86
4400 ± 90	Laguna Beach Indian	-4878	"	80
3930 ± 80	LaJolla Indian	-4608	"	81
3600 ± 110	"	-4565	"	91
3600 ± 110	"	-4566	"	"
3520 ± 320	San Clemente I. Indian	-5411	"	86
2730 ± 90	"	-5037	"	87
2640 ± 70		-4811	"	77

Date	Culture or Period	Sample No.	No.	Page
UNITED STATES (continued)				
California (continued)				
2610 ± 70	Laguna Beach Indian	LJ-5296	1	80
2540 ±210	San Clemente I. Indian	-5303	"	87
2480 ± 70		-4812	"	77
2540 ± 30		-5667	"	88
2340 ± 70	San Clemente I. Indian	-5306	"	"
1900 ± 50		-4810	"	77
1840 ± 60	San Clemente I. Indian	-4646	"	87
1770 ± 60		-4647	"	"
1610 ± 40		-5118	"	78
1600 ± 70	Luiseno Indian	-5427	"	83
1540 ± 70		-5500	"	77
1470 ± 70		-4880	"	82
1410 ± 70		-4569	"	84
1340 ± 60	San Clemente I. Indina	-5639	"	88
1320 ± 40	Late Prehistoric	-5000	"	79
1280 ± 60	San Clemente I. Indian	-5304	"	88
1230 ± 60		-4570	"	84
1040 ± 50		-5501	"	77
1000 ± 60	San Clemente I. Indian	-5640	"	87
960 ± 60	"	-4673	"	"
900 ± 50		-4567	"	84
890 ± 50	Late Prehistoric	-5001	"	79
870 ± 70	Canalino	S-1283	2	266
860 ± 50	Late Archaic	LJ-4851	1	79
850 ± 50	San Clemente I. Indian	-4672	"	87
820 ± 90		-4867	"	78
790 ± 60		-4754	"	83
720 ± 60	LaJolla Indian	-4563	"	89
670 ± 80	Late Prehistoric	-5129	"	91
600 ± 60		-5112	"	83
580 ± 90		-4753	"	82
570 ±130	LaJolla Indian	-5291	"	89
530 ± 50		-5115	"	83
520 ± 60		-5113	"	"
500 ± 70	San Clemente I. Indian	-5643	"	87
460 ± 40	Late Prehistoric	-5128	"	91
400 ± 50		-5114	"	83
380 ± 60	Kumeyaay Indian	-5094	"	91
360 ±100		-4756	"	92
330 ± 60	Luiseno Indian	-5270	"	82
310 ± 50	Kumeyaay Indian	-4648	"	92
310 ±180	San Clemente I. Indian	-5302	"	88
300 ±400	"	-4220	"	86
280 ± 60	Kumeyaay Indian	-5134	"	92
270 ±100		-4755	"	"
250 ± 40	Late Prehistoric	-5265	"	89
240 ± 50	"	-4997	"	79
240 ± 40		-5117	"	78
230 ± 60	Late Prehistoric	-4998	"	79
220 ± 50		-5499	"	77
210 ± 60	Late Prehistoric	-5266	"	89
180 ± 30	San Clemente I. Indian	-5641	"	88
110 ± 70	Late Archaic	-4852	"	90
90 ± 70	"	-4853	"	"
Illinois				
1670 ± 70	Middle Woodland	WIS-1492	1	135
970 ± 70	Effigy Mound Culture	-1493	"	136
Kentucky				
8500 ± 460	Archaic	SFU-221	3	435
8220 ± 100	"	-271	"	"
7670 ± 630	"	-249	"	436
7530 ± 150	"	-130	"	435
7180 ± 130	"	-270	"	"
7110 ± 250	"	-121	"	"
7100 ± 600	"	-252	"	436
4420 ± 280	"	-251	"	"
1300 ± 160	Woodland	-254	"	"
1060 ± 100	Mississippian	-306	"	"
Modern	Woodland	-250	"	"
Modern	"	-253	"	"
Minnesota				
390 ± 70	Kathio Phase	WIS-1502	1	136
New York				
200 ± 35	Iroquois	BM-2121	1	73
125 ± 40	"	-2122	"	"
80 ± 35	"	-2120	"	"

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UNITED STATES (continued)				
Oregon				
1510 ± 40	Clackamas Indian	LJ-5119	1	76
380 ± 60	Late Prehistoric/ Historic	-5267	"	"
300 ± 30	Shipwreck	-5646	"	"
260 ± 40	Indian	-5300	"	"
South Dakota				
1750 ± 70	Late Archaic	WIS-1496	1	136
1560 ± 70	"	-1495	"	"
1490 ± 70	"	-1497	"	"
970 ± 70		-1494	"	"
Wisconsin				
1930 ± 70	Early Woodland	WIS-1437	1	136
980 ±110	Oneota	S-802	2	260
860 ±120	"	-801	"	"
840 ±120	"	-799	"	"
830 ±120	"	-800	"	"
800 ±110	"	-803	"	"
500 ± 70	Late Woodland	WIS-1479	1	137
490 ± 70	"	-1480	"	"
470 ± 90	"	-1477	"	"
420 ± 70	"	-1476	"	"
< 200	"	-1478	"	"
USSR				
3310 ±140	Bronze age	LOD-49	1	116
TURKMENIA				
6140 ± 80	Early Neolithic Mesolithic	P-3081	2	225
4860 ± 60	Late Bronze age/ Early Iron age	-3079	"	224
4520 ±240	Early Neolithic	-3082	"	225
2170 ±210	"	-3080	"	224
1360 ±180	"	-3083	"	225
YUGOSLAVIA				
> 37,000	Upper Pleistocene	Z- 864	3	450
> 37,000	Paleolithic	-1033	"	451
29,700±2000	Upper Pleistocene	- 613	"	449
24,000±3300	"	- 612	"	"
17,500± 850	Paleolithic	-1032	"	451
12,200± 250	Epigravettian	-1036	"	"
12,000± 200	Late Glacial	- 863	"	449
6300 ± 150	Neolithic	- 895	"	450
5620 ± 130	"	-1044	"	451
5340 ± 120	"	-1045	"	"
5180 ± 150	"	-1043	"	"
5120 ± 130	"	-1042	"	"
5050 ± 190	"	- 983	"	450
4200 ± 110	Eneolithic	- 982	"	"
3200 ± 140		-1093	"	452
2950 ± 110		- 984	"	450
2900 ± 140		-1092	"	452
2420 ± 140		-1091	"	"
2330 ± 140	Celtic or Roman	-1148	"	"
2]30 ± 120	Roman	-1041	"	451
2040 ± 130	Celtic or Roman	-1147	"	452
1970 ± 100		- 893	"	450
1590 ± 130	Roman	-1136	"	452
900 ± 90	Medieval	- 712	"	449
440 ± 100	"	- 978	"	450
420 ± 130	"	-1089	"	451

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BM		
-2115	26/1	73
-2661	"	"
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-2255	26/2	197
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