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HIGH-PRECISION CALIBRATION OF THE RADIOCARBON TIME SCALE, AD 1950–500 BC

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INTRODUCTION

Radiocarbon ages of dendrochronologically-dated wood spanning the last 4500 years were determined at both the Seattle and Belfast laboratories. The combined results are reported in this issue of *RADIOCARBON* in two papers, with this paper covering the AD 1950–500 BC interval, and the twin (Pearson & Stuiver, 1986) covering the 500 BC–2500 BC interval.

Specific discussion of detail effecting only one of the two laboratories is given in the paper which has, as the premier author, the person responsible for the particular laboratory's measurement. Factors effecting both laboratories can be in either paper, but are carefully referenced to the other. Outline details are given in both papers.

The construction of a calibration curve from ^{14}C ages with statistically limited precision is not a simple matter. Not only should the standard error in the determination be as small as possible, but the calculation of this error also has to be realistic in that it should account for all variability encountered in the laboratory procedures. Independent dendrochronologic calibration of the samples is also a must. Proof of accuracy has to come from a comparison of the results obtained in two or more facilities. It will be shown that the results obtained in Seattle and in Belfast on wood of the same age, but from different regions, give consistent replication within the quoted errors over the entire interval. The aspects of replication are first discussed, and are followed by the detailed calibration curves and tables.

DENDROCHONOLOGY AND SAMPLE TREATMENT

The trees used at Seattle for the AD interval were either Douglas Fir (*Pseudotsuga menziesii*) from the US Pacific Northwest, or Sequoia (*Sequoiadendron giganteum*) from California. Dendrochronologic work on these materials was discussed in Stuiver (1982). Most of the BC material measured in Seattle was obtained from Becker's South German Donau series (Becker, 1983). The amount of wood available near 500 BC was limited, and here the Seattle laboratory measured samples from the Irish Oak chronology (Pilcher *et al*, 1984). All Belfast measurements are on oak wood from this chronology, except for a few samples that came from Scotland and northern England (Pearson & Stuiver, 1986).

The Seattle wood samples were either 1) treated with dilute NaOH and HCl solutions to remove resins, sugars, and a portion of the lignin (de Vries method, Stuiver & Quay, 1980) or 2) subjected to a more rigorous extraction yielding alpha cellulose. The cellulose preparation procedure is similar to the ^{13}C sample treatment given in Stuiver, Burk and Quay (1984), with slight modifications due to the bulk of the ^{14}C samples. The de Vries method does not remove all components added after the year of growth, but our experiments show that the influence on a ^{14}C age of the incomplete removal of late additions is limited to 2 or 3 ^{14}C years (Stuiver & Quay, 1981). All Belfast samples were pretreated to reduce the sample to cellulose of which the details are given in the twin paper (Pearson & Stuiver, 1986). The treatment given to the Seattle samples is listed in Table 2.

TECHNIQUE AND LABORATORY REPRODUCIBILITY

By the early 1970s the counting of large numbers of samples with improved precision (ca 30 years for the standard error based on counting statistics alone) was applied at the Universities of Washington (Seattle), Miami, and Heidelberg to ocean water samples collected on the GEOSECS and METEOR cruises. The systematic high-precision measurements (standard errors in the 12- to 20-year range) of wood samples began at Seattle (M Stuiver) in December 1973, at Belfast (G W Pearson) in 1975, and at Heidelberg (K O Münnich) and Groningen (W G Mook) in 1977.

Different techniques are applied in Seattle and Belfast. CO_2 gas proportional counters are used at Seattle (Stuiver, Robinson & Yang, 1979), whereas the liquid scintillation counting of benzene is applied at Belfast (Pearson, 1983). The true error in the measurement of the ^{14}C activity of a sample is only partially determined by the propogated statistical uncertainty in the number of counts accumulated for the sample and standards. This counting uncertainty is expressed as a standard deviation which is

equal to the square root of the number of accumulated counts. Other factors sometimes more significant also play a role in the measuring process and will increase the standard deviation calculated from counting statistics alone. An exhaustive study of the parameters contributing to the error in ^{14}C measurements has been made for the Belfast liquid scintillation counting system (Pearson, 1979, 1980; Pearson *et al,* 1986). Taking into account the full spectrum of known uncertainties, the mean quoted error in a set of 55 individual measurements was determined to be 15.4 years at Belfast. However, replicate analysis of these samples at varying time intervals and assuming constant efficiency based on a mean standard count rate gives a calculated standard deviation of 19.0 years, suggesting that for a long-term series of measurements the quoted error is underestimated by ca 23% (Pearson *et al,* 1986). The ratio K = 19.0/15.4 or 1.23 is designated the "error multiplier" and is a convenient, if not the most accurate method of correcting for the inability to define exactly a sample counting efficiency and/or background even after all applicable corrections have been applied. All Belfast data used in this paper include the 1.23 error multiplier.

The traditionally quoted Seattle ^{14}C age error is based on the counting statistics of sample and standards only. The following estimates of the Seattle K value are available: 1) From a set of 30 comparisons of pairs of contemporaneous wood samples of different trees, all measured in the Seattle laboratory, K = 1.53 (Stuiver, 1982). The 1.53 value is an upper limit for laboratory reproducibility because part of the differences may also be due to differences in tree ^{14}C activity. 2) Tree-ring samples are usually counted for 4 days at Seattle. Samples are counted only once, but recounts are made when the measured sample activity deviates more than expected (eg, in a series of 6 samples the measured activity of 5 samples demonstrates a monotonic increase, but the 6th sample deviates). Seventy-five of these comparisons yielded K = 1.62. Again, this is an upper limit for laboratory reproducibility because there is a certain bias towards "outliers" in this data set.

From the above reproducibility tests we derive an error multiplier approaching 1.6 for Seattle. A rather "generous" K value of 1.6 has been incorporated in all Seattle data used in this paper. A more detailed discussion of the validity and accuracy of K factors is given elsewhere in this issue (Stuiver *et al,* 1986).

SYSTEMATIC DIFFERENCES BETWEEN LABORATORIES

The samples measured in the Belfast and Seattle laboratories span, respectively, 20-year and 10-year intervals. The mid-point of the Belfast samples occasionally may change from its 20-year rhythm by 10 years because successive 20-year blocks of wood were not always available. The starting years of the Seattle decadal wood and the Belfast bi-decadal wood also may differ (eg, a Seattle decade may start at 1971 BC and the corresponding Belfast bi-decade at 1970 BC). There also has been an ajdustment in dendrochronologic ages of some of the German oak samples which resulted in a shift of 71 years of "decadal" samples (Pilcher *et al,* 1984). The differences in timing are relatively small, however, and we have been able to average the Seattle decadal ^{14}C ages in such a manner that the mid-point of a Seattle bi-decade differs only in a few instances (see Table 1) by more than 1.5 years from the mid-point of the corresponding Belfast sample.

The weighted mean ^{14}C age difference of the Seattle and Belfast bi-decadal data set is -0.6 ± 1.6 years (with number of comparisons n = 214). Positive values for the mean indicate a younger Seattle data set. For the AD interval the difference is 2.6 ± 2.3 yr (n = 90); for the BC portion it is -3.4 ± 2.1 (n = 124). Clearly, the systematic differences in ^{14}C age are negligible between both laboratories.

The wood used to construct the calibration curve was collected from three geographic regions: Ireland, southern Germany, and the west Pacific coastal region of the United States. Irish oak wood, measured in Belfast, differs from German oak wood, measured in Seattle by -4.2 ± 2.4 yr (n = 106). Belfast-measured Irish oak wood differs from Seattle-measured US wood (Sequoia and Douglas Fir) by 2.4 ± 2.3 years (n = 87), and duplicate samples of Irish wood gave a mean difference between both laboratories of 3.2 ± 6 yr (n = 7).

The above results indicate that 1) systematic ^{14}C age differences are a few years or less between the Belfast and Seattle laboratories, and 2) ^{14}C ages of wood of the same age from Ireland, south Germany, and the northwest United States differ, on average, by only a few years.

SEATTLE-BELFAST COMPARISON OF VARIANCE

Proof was given in the preceding section that the systematic difference between the Belfast and Seattle ^{14}C determinations is negligible. It remains to be proven that the laboratory standard deviation in the single measurements is a realistic one.

Histograms of analytical results from repeat analyses of the same sample usually follow the normal (Gaussian) distribution. The procedures followed in determining a ^{14}C age may lead to a slight departure from the Gaussian distribution, resulting in some broadening at the top. For the calculations given here all variance is considered to be of the Gaussian variety.

The average Belfast standard deviation (which includes the 1.23 error multiplier) of the bi-decadal samples is 18.5 yr. For the Seattle bi-decadal averages the average standard deviation (which includes the 1.6 error multiplier) is 14.7 yr. The weighted average standard deviation in the ^{14}C age differences of contemporaneous samples, as measured in Seattle and Belfast, and calculated from the laboratory errors, is 22.9 yr.

The actual differences in ^{14}C ages (n = 214) are given in Figure 3. The Gaussian distribution for a 22.9-yr standard deviation is given by the solid curve. The observed sample variance yields a standard deviation of 25.6 years, which is only 1.12 times the predicted 22.9 years.

A portion of the 12% difference between observed and predicted standard deviation must be due to actual differences in wood ^{14}C activity. There are small differences in mid-point age of the "contemporaneous" 20-yr blocks of up to 1.5 yr. There are also differences in ring-thickness ^{14}C distribution between the Belfast and Seattle samples. For instance, if the first 5

yr of bi-decadal block A are relatively narrow, but wide in contemporaneous block B, the average ^{14}C activity of both samples may differ when the sample covers an interval of variable atmospheric ^{14}C levels. Of course, there could also be errors in wood splitting and dendrochronology.

The variance difference of 25.6^2–22.9^2 yr^2 gives an additional error source with a standard deviation of 11 yr that includes the differences in wood ^{14}C activity. We conclude:

1) The laboratory standard deviations assigned by both laboratories account for nearly 90% of the standard deviation in the end result.

2) The remaining 10% not accounted for by the laboratory measuring process includes the variability introduced by differences in wood ^{14}C activity.

The additional variance introduced by wood ^{14}C differences is so small that it has been neglected in the construction of the calibration curves. Increasing the standard deviation in the bidecadal means by 12% would have increased the 12.1-yr average standard deviation to 13.5 yr only.

CONSTRUCTION OF RADIOCARBON AGE CALIBRATION CURVES

The calibration curves were constructed from the set of ^{14}C ages obtained for samples each spanning a 20-yr interval, with some exceptions as noted in the Table 1 heading. The cal AD/BC (or cal BP) ages follow the mid-points of the Belfast bi-decadal series whenever possible, starting in AD 1840. The AD 1940–AD 1860 data set is based on the Seattle data alone; all other ^{14}C ages are based on the weighted Belfast/Seattle averages except when Belfast skipped a decade. Here the gaps were filled by averaging 30-yr blocks of Seattle data (see Table 1).

As discussed previously, the standard deviations in the ^{14}C age determinations of each laboratory are based on the reproducibility of the measurements within each laboratory and are larger than the errors usually quoted by both laboratories. For Belfast, where additional factors are used to calculate the routinely reported standard deviation beyond the counting statistics, the reproducibility tests indicate an error multiplier of 1.23. For Seattle, where the routinely reported standard deviations include only the error derived from counting statistics, the error multiplier is 1.6.

The standard deviation assigned to the curve (the vertical difference between center and outer curve) accounts for nearly 90% of the demonstrated standard deviation in the ^{14}C age differences of both laboratories. The mean standard deviation reported with the curves is 12.1 yr and is solely based on the Belfast and Seattle measuring reproducibility. The variance in the differences in ^{14}C ages of contemporaneous samples measured independently in Belfast and Seattle indicate a measure of uncertainty that is equivalent with an average standard deviation of 13.5 yr.

The wood used for the ^{14}C measurements came from the western United States, Ireland, and southern Germany (Table 2). Oak wood was used for the European chronologies (Becker, 1983; Pilcher *et al,* 1984) and Douglas Fir and Sequoia for the US portion. In the preceeding sections it was shown that contemporaneous wood from these trees differed, on average, by only a few ^{14}C years. Thus, although the curves are based on wood from different trees, identical results would have been obtained if all measurements had been made on a single tree from one locality.

THE AGE ERROR REPORTED WITH THE RADIOCARBON DATE

The international ^{14}C community follows strict calculation procedures when determining a conventional ^{14}C age (Stuiver & Polach, 1977). Unfortunately, age error calculations are much less bound by rules.

The error in any laboratory determination is a composite of 1) the Poisson statistical error based on the number of counts observed for sample and standards, assuming constant counting conditions, and 2) the errors associated with factors that cause deviation from the above constant counting conditions and other non-systematic errors which affect the reproducibility of the laboratory results. The latter can be derived from replicate sample measurements. Attempts to determine systematic errors are rarely made by the ^{14}C community. The reported sample age error (one standard deviation) is often based solely on Poisson statistics in the number of registered sample and standard counts. Such a substitute for a repeat-measurement derived standard deviation leads to an underestimate because it neglects other factors that add to the variance (Pearson, 1979, 1983).

When identical tree-ring samples (with approximate ages of ca 5000 ^{14}C yr) were measured by 20 laboratories (International Study Group, 1982) it was found that the reproducibility standard deviations in the submitted data set were substantially higher than the age errors reported by the laboratories. Systematic errors ranged from < 20 yr (3 laboratories) to 200 yr (1 laboratory).

When comparing the reproducibility standard deviation (obtained after removal of off-sets from the data set) with the laboratory reported error σ it was found that σ had to be multiplied with 1.3 for $\sigma < 20$ yr, with ca 2.0 for σ in the 20- to 80-yr range, and with 1.0 for $\sigma > 80$ yr (International Study Group). These multipliers are strictly laboratory-related and in principle independent of the magnitude of σ. Additional information on systematic errors is available for a set of samples in the 7000 to 8000 ^{14}C yr range measured in Seattle, La Jolla, Heidelberg, and Tucson (Stuiver *et al,* 1986). Off-sets of 29 ± 10, 27 ± 12 and 52 ± 8 yr were found, respectively, for Seattle-La Jolla, Seattle-Heidelberg, and Seattle-Tucson comparisons.

The above studies indicate that systematic errors may exist, and that the reported standard deviation of a ^{14}C age measurement is usually too low. The degree of under-reporting has only been determined so far for 20 odd laboratories for samples ca 5000 ^{14}C yr old. Unfortunately, the error multipliers determined in the above international group study cannot be applied to all age ranges because the multiplier values are age-dependent (Stuiver *et al,* 1986). Error multipliers also may change from year to year (or even day to day) at a specific laboratory with improving (or deteriorating) experimental conditions. It is recommended that the user of a ^{14}C date obtain additional information on reproducibility and systematic error determinations from the reporting laboratory. This information should lead to a realistic standard deviation in the age (based on repeat measure-

ments of test samples) although care must be taken in its use, particularly when determining 2σ and 3σ probabilities. Limitations on systematic error size also should be provided. A systematic error, of course, should not be part of the regular ± reported with the date.

In the absence of the above information, the user can only take as the ^{14}C age error the actual reported σ, with the understanding that this error is usually too small. In case the user would take twice the reported standard deviation it should be realized that 1) for some laboratories the actual error may be smaller than 2 σ, and 2) statistical rules (such as stating that only 1 event out of 20 would be outside 2 σ bounds) are not valid because, after all, the original σ is not a properly-defined standard deviation in many instances.

CALIBRATION INSTRUCTIONS

The Figure 1 calibration curves consist of three lines. The center line is the actual calibration curve whereas the outer lines indicate the one-sigma (standard deviation) uncertainty in the calibration curve. The calibration curve depicts the (non-linear) transformation of ^{14}C ages to calibrated AD/BC (or BP) ages. The nomenclature adopted for the dendro (calendar) year time scale is cal AD/BC or cal BP. The cal AD/BC ages are plotted along the lower horizontal axis and the cal BP ages along the upper one.

Cal BP ages are relative to the year AD 1950, with 0 cal BP equal to AD 1950. The relationship between cal AD/BC and cal BP ages is simple: cal BP = 1950 − cal AD, and cal BP = 1949 + cal BC. The switch from 1950 to 1949 when converting BC ages is caused by the absence of the zero year in the AD/BC chronology (when progressing from 1 BC to 1 AD, the cal BP ages should be without a gap).

The conversion of a ^{14}C age to a cal age is straightforward: 1) Draw a horizontal (parallel to the bottom axis) line (A) through the ^{14}C age to be converted, and 2) draw vertical lines through the intercept(s) of line A and the calibration curve (center line). The cal AD/BC ages can be read at the bottom axis, the cal BP ages at the top. A single ^{14}C age can correspond with multiple cal ages, due to past changes in atmospheric ^{14}C levels (see Stuiver, 1982 for illustration).

The user has to determine the calibrated ages from the Figure 1 graphs by drawing lines. An alternate approach is the use of Table 3, where the cal ages are listed for ^{14}C ages that increase by 20-yr steps. Obviously, the user has to interpolate between the 20-yr steps of ^{14}C ages and sigmas if further fine tuning is desired.

The conversion of the standard error in the ^{14}C age into a range of cal AD/BC (BP) ages is more complicated. The user should first determine whether he/she wants to use 1) the laboratory-quoted error (see previous section for a discussion), or 2) increase the quoted error by a known "error multiplier." Once the sample σ has been targeted, the curve σ (one standard deviation) should be read from the calibration curve by taking the difference in ^{14}C years between center curve and outer curve(s) in Figure 1. The $\frac{\text{curve } \sigma \text{ and sample } \sigma}{\sqrt{(\text{sample } \sigma)^2 + (\text{curve } \sigma)^2}}$ should then be used to calculate total σ = (Stuiver, 1982).

Horizontal lines should now be drawn through the ^{14}C age + total σ, and ^{14}C age − total σ value. The vertical lines, drawn through the intercepts with the CENTRAL curve, yield the outer limits of possible cal AD/BC (or BP) ages that are compatible with the sample standard deviation.

The above procedure was used to derive the "ranges" of cal AD/BC (BP) ages listed in Table 3.

The conversion procedure yields 1) single or multiple cal AD/BC (BP) ages that are compatible with a certain ^{14}C age, and 2) the range(s) of cal ages that corresponds to the standard deviation in the ^{14}C age. The probability that a certain cal age is the actual sample age may be quite variable within the cal age range. Higher probabilities are encountered around the intercept ages. Low, or near zero probabilities are encountered when part of the calibration curve 'snakes' outside the total σ boundaries. The non-linear transform of a Gaussian standard deviation around a ^{14}C age into cal AD/BC (BP) ages leads to a very complex probability distribution that can only be calculated with the aid of computers. We are currently developing suitable programs for these probability calculations, and plan to make these programs available in the near future.

The calibration data presented in this paper are to be used for samples formed in isotopic (^{14}C) equilibrium with atmospheric CO_2. Although the wood samples were collected from specific regions (Ireland, Germany, and western USA) the calibration data can be used for a large part of the Northern Hemisphere (Stuiver, 1982). However, systematic age differences are possible for Southern Hemispheric samples where ^{14}C ages of wood samples tend to be ca 30 yr older (Lerman, Mook & Vogel, 1970; Vogel, Fuls & Visser, 1986). Thus, ^{14}C ages of Southern Hemispheric samples should be reduced by 30 years before being converted into a cal AD/BC (BP) age.

SMOOTHING OF THE CALIBRATION CURVE

The Figure 1 points have a 20-yr time separation, *ie,* the calibration points are the mid-points of wood samples spanning 20 years. Samples submitted for dating may cover shorter (eg, seed samples) or longer intervals (eg, lake sediment samples). The decadal calibration results of the Seattle laboratory are available when better time resolution is needed (Stuiver & Becker, 1986). If less resolution is desired, the Figure 2 curves can be used. Here, a 5-point moving average (usually identical with a 100-yr moving average of the Figure 1 data set) was used to construct the curves. A single line is given in Figure 2 because the uncertainty in the 5-point moving average is only a few ^{14}C years. The instructions for determining the cal AD/BC (BP) ages are listed in the preceding section. Samples falling outside the ranges covered by the twin papers (Stuiver & Pearson, 1986; Pearson & Stuiver, 1986) can be provisionally converted using the curves provided by Pearson *et al* (1986) employing the same method outlined above.

MARINE SAMPLE AGES

The calibration curves should be applied only for age conversion of samples that were formed in equilibrium with atmospheric CO_2. Conventional ^{14}C ages of materials not in equilibrium with atmospheric reservoirs do not take into account the off-set in ^{14}C age that may occur (Stuiver & Polach, 1977). This off-set, or reservoir deficiency, has to be deducted from

the reported age before any attempt can be made to convert to cal AD/BC (BP) ages. The reservoir deficiency is time-dependent for the mixed layer of the ocean. Model-calculated calibration curves for marine samples are listed separately in this volume (Stuiver, Pearson & Braziunas, 1986).

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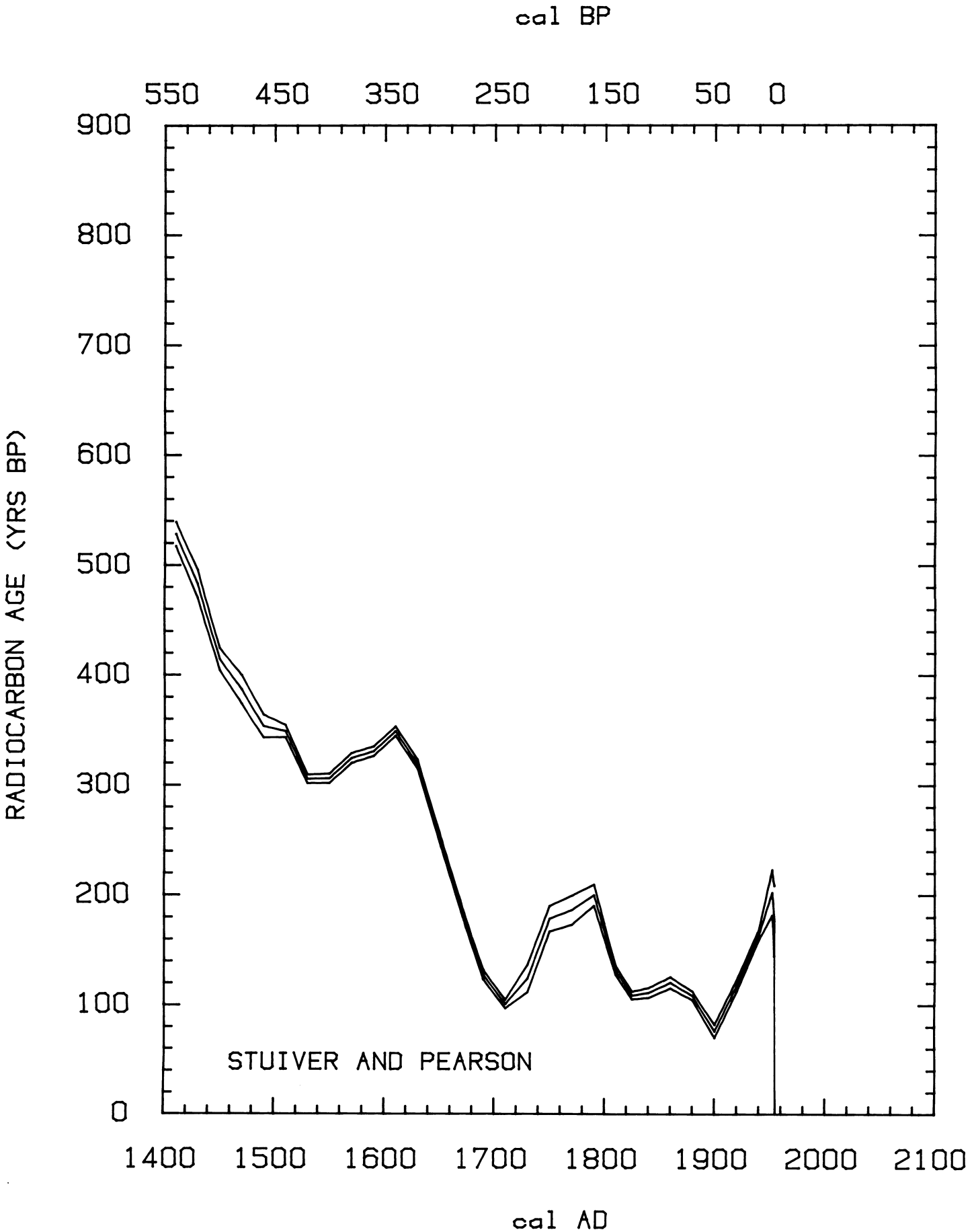

Fig 1A

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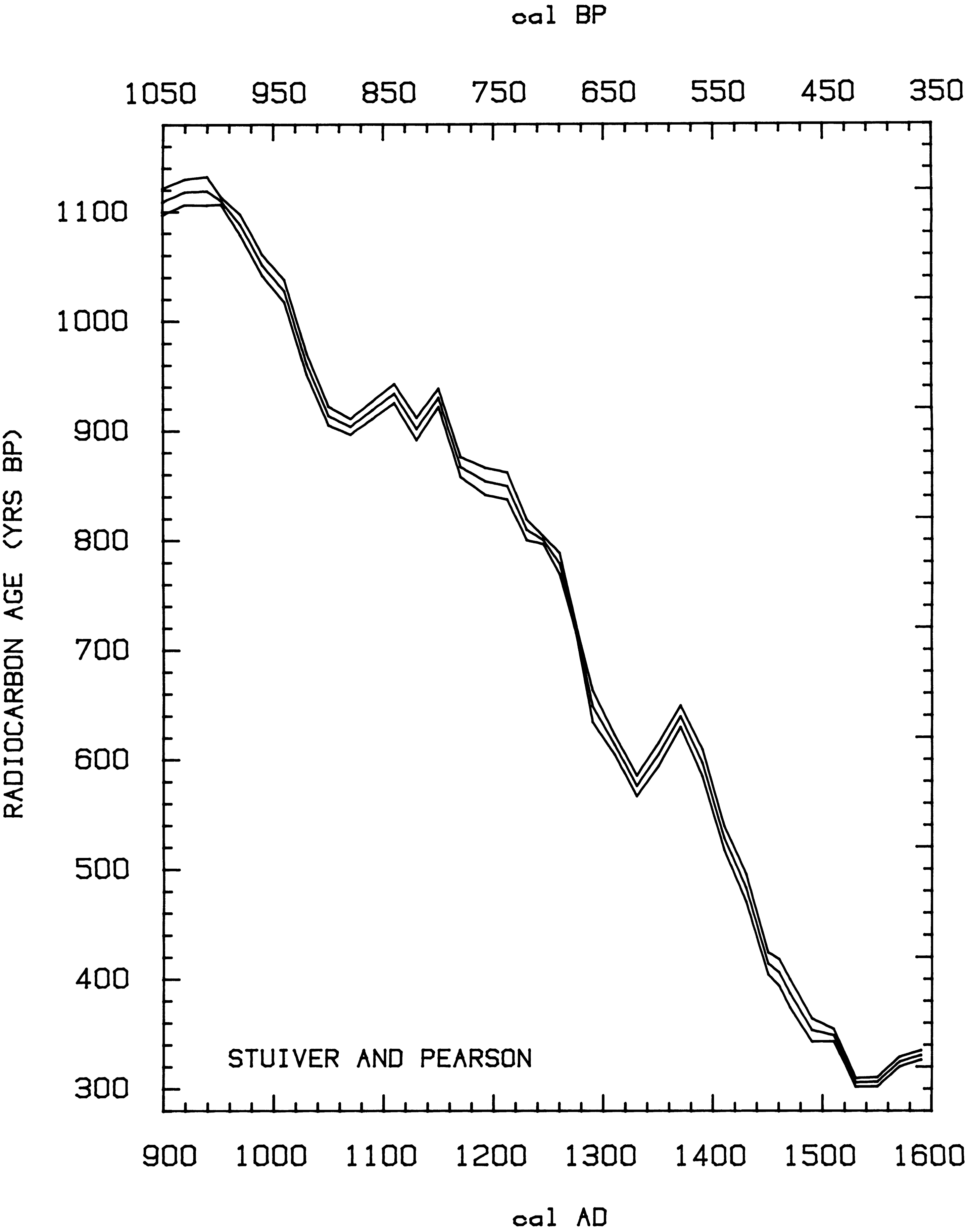

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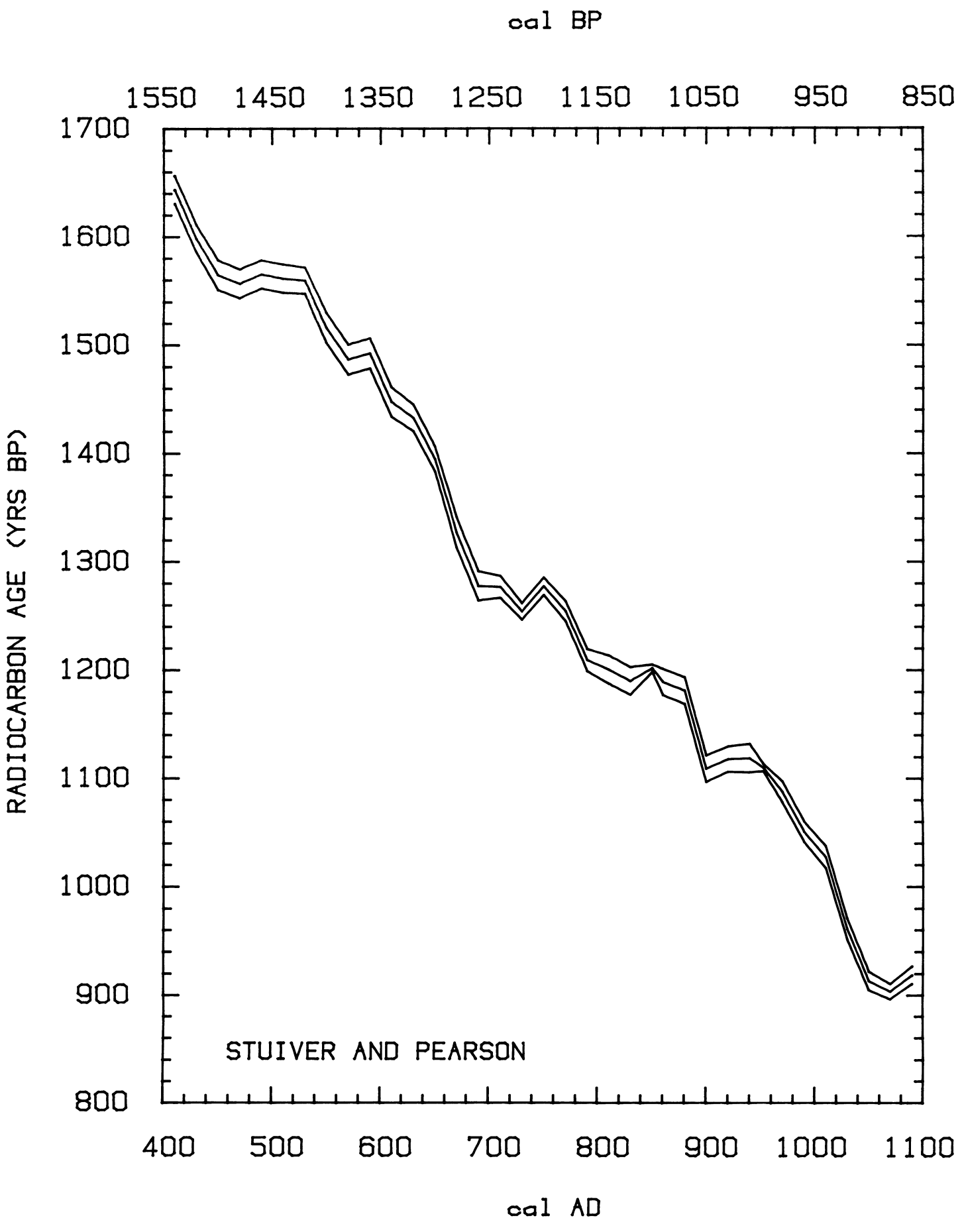

Fig 1C

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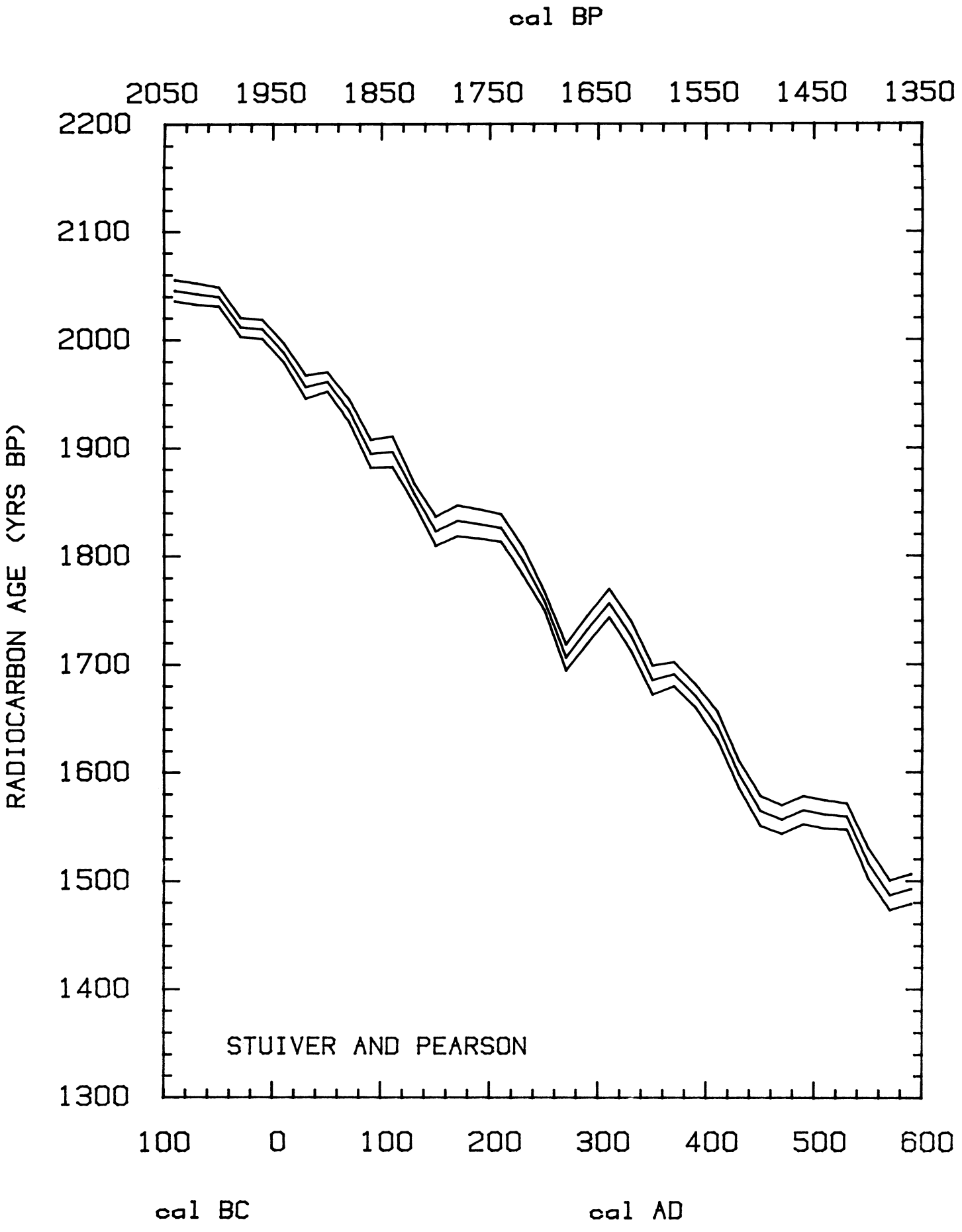

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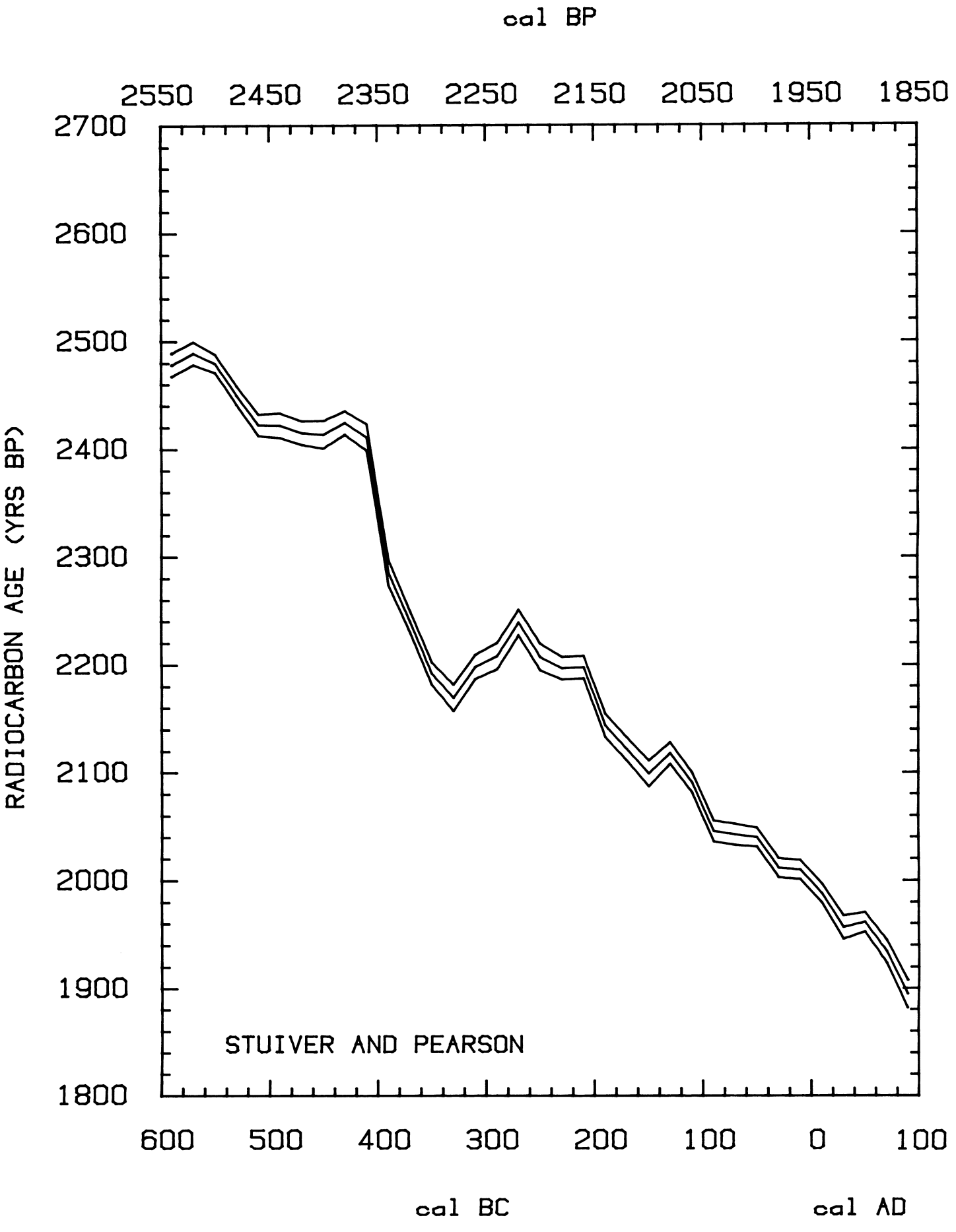

Fig 1E

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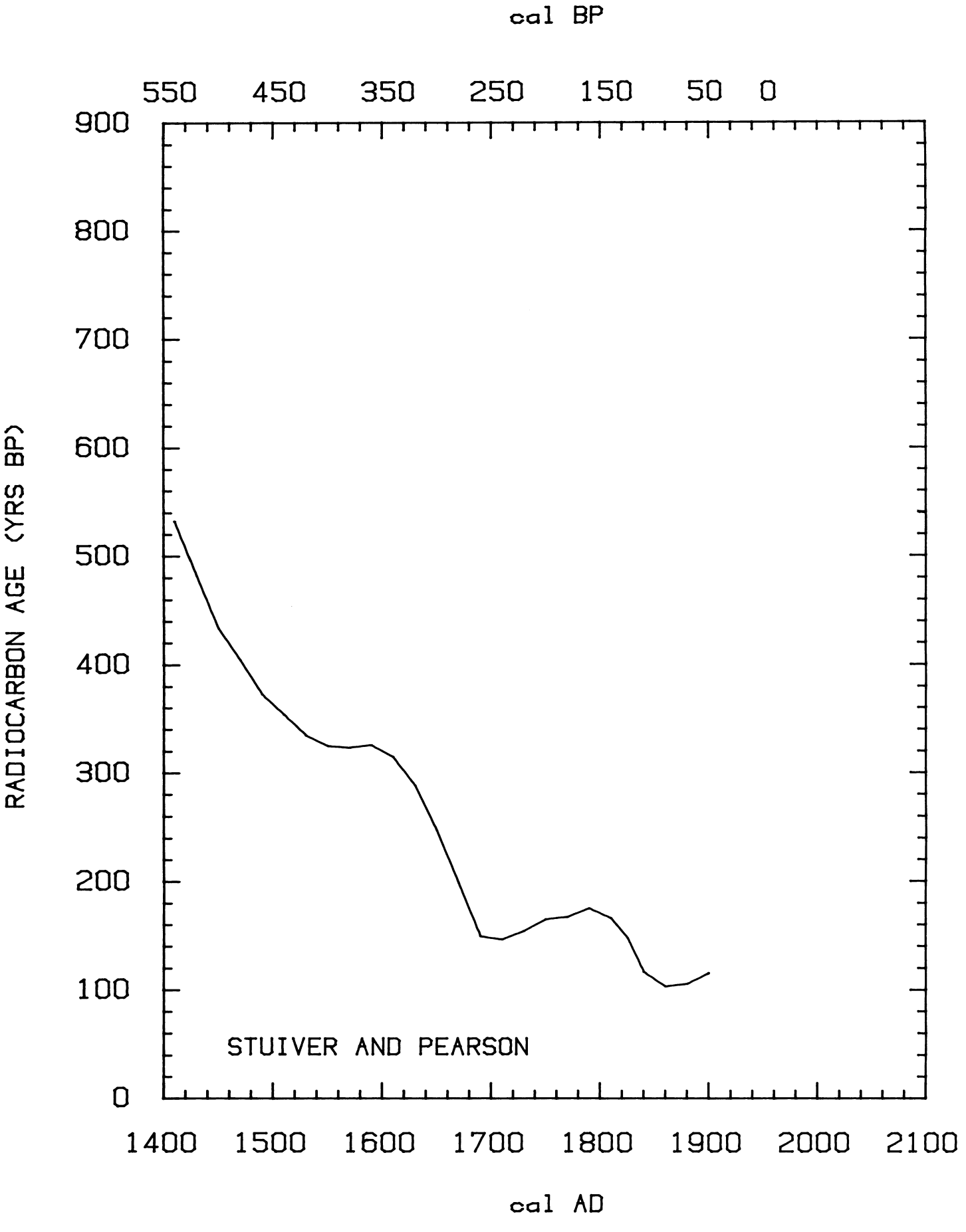

Fig 2A

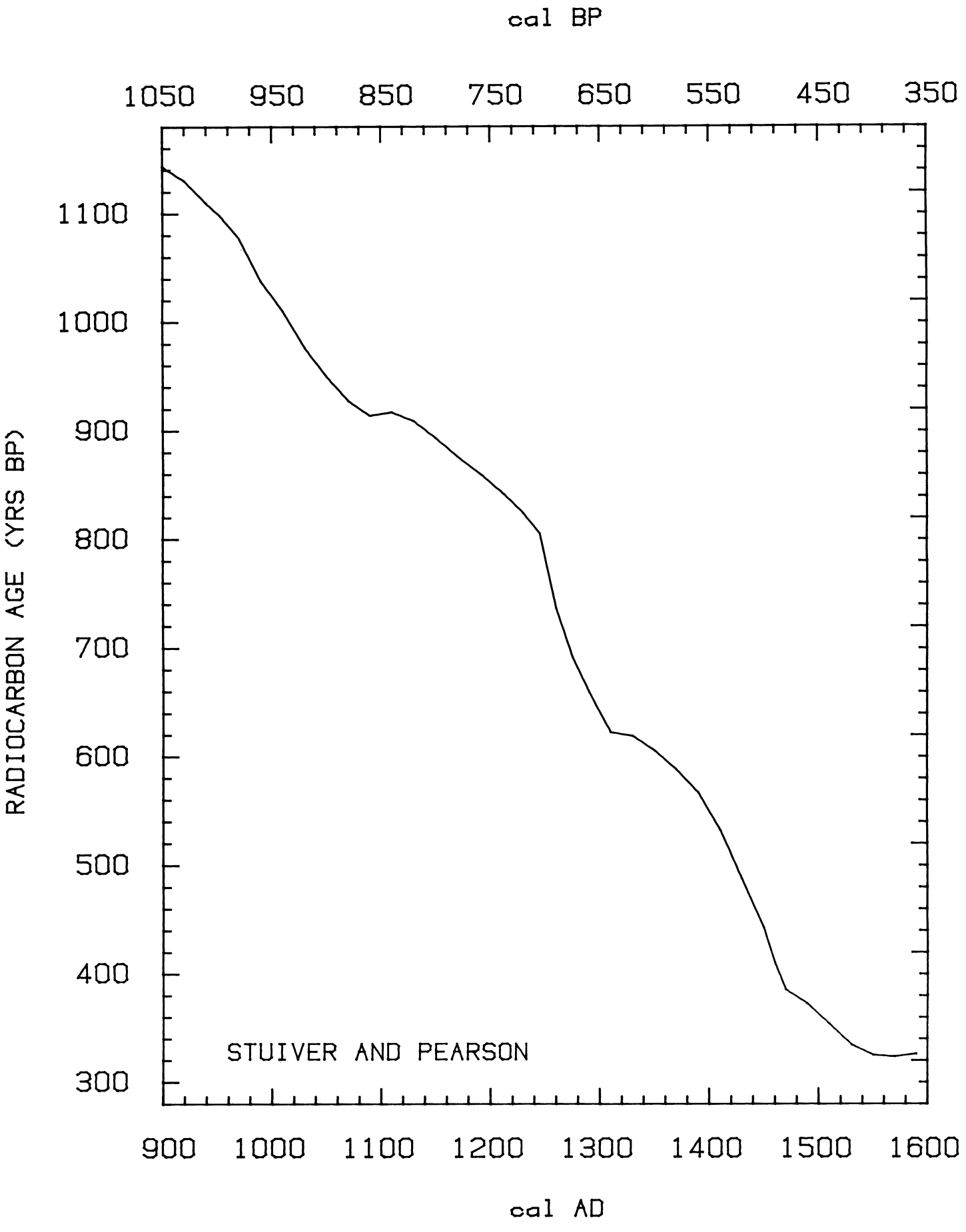

Fig 2B

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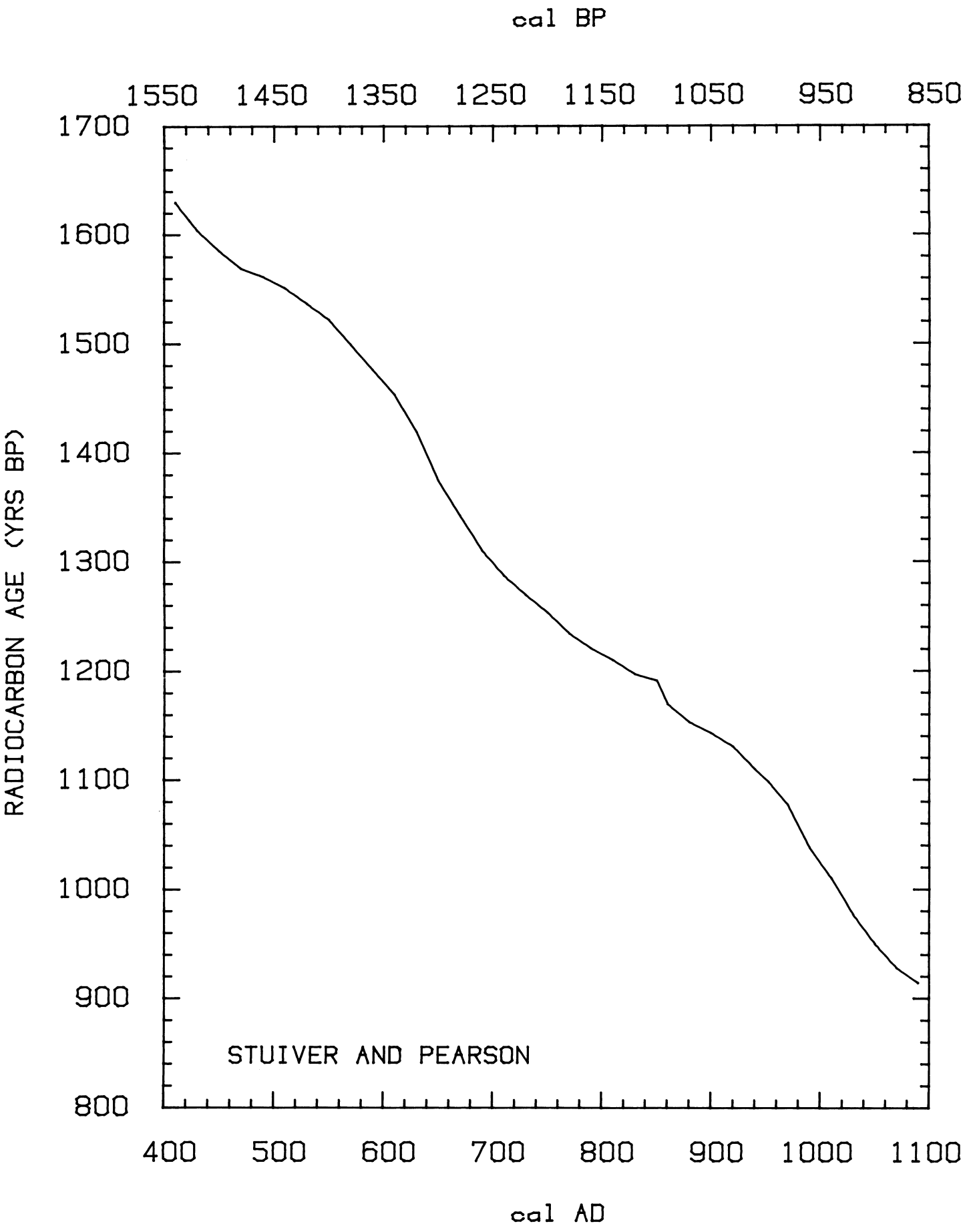

Fig 2C

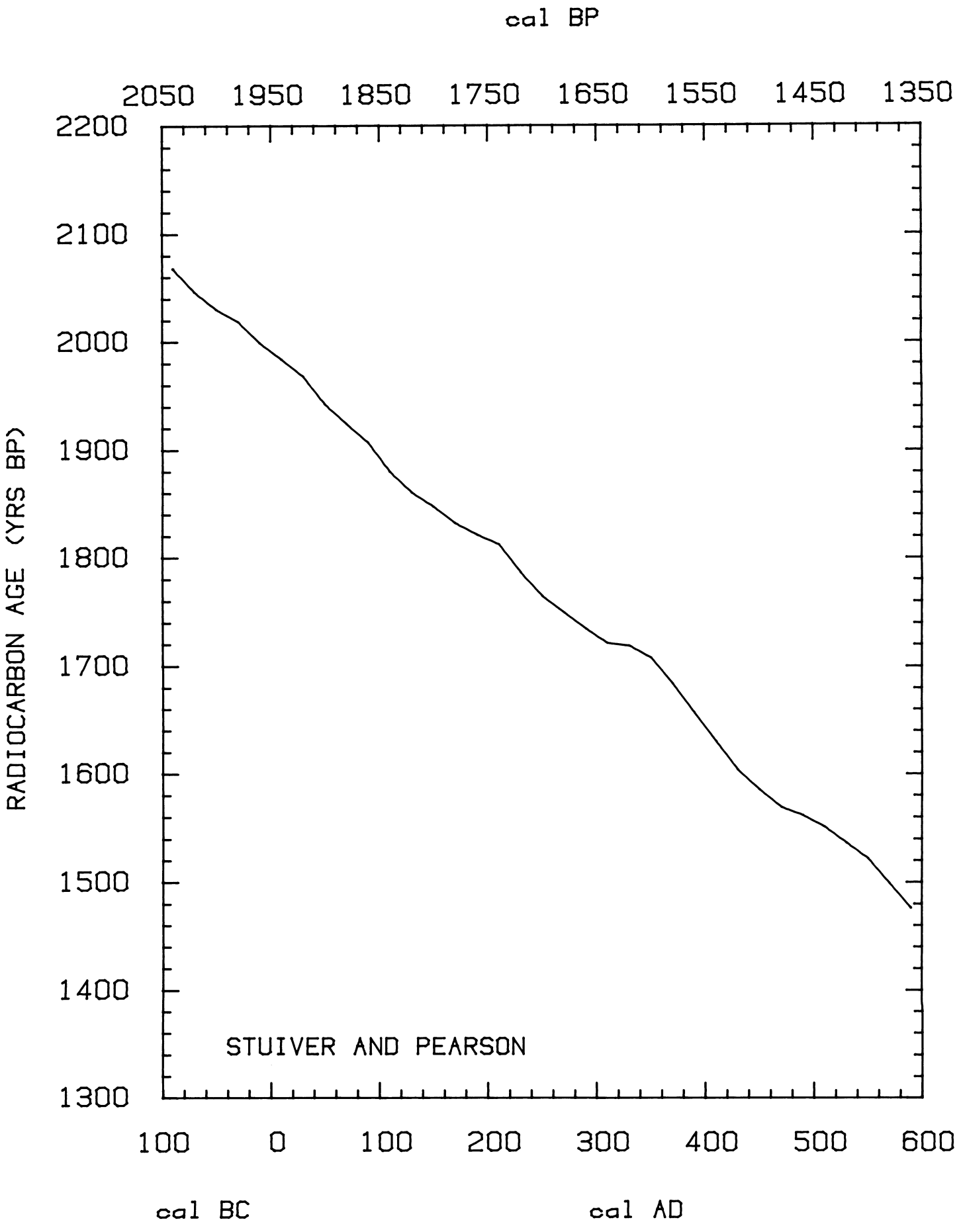

Fig 2D

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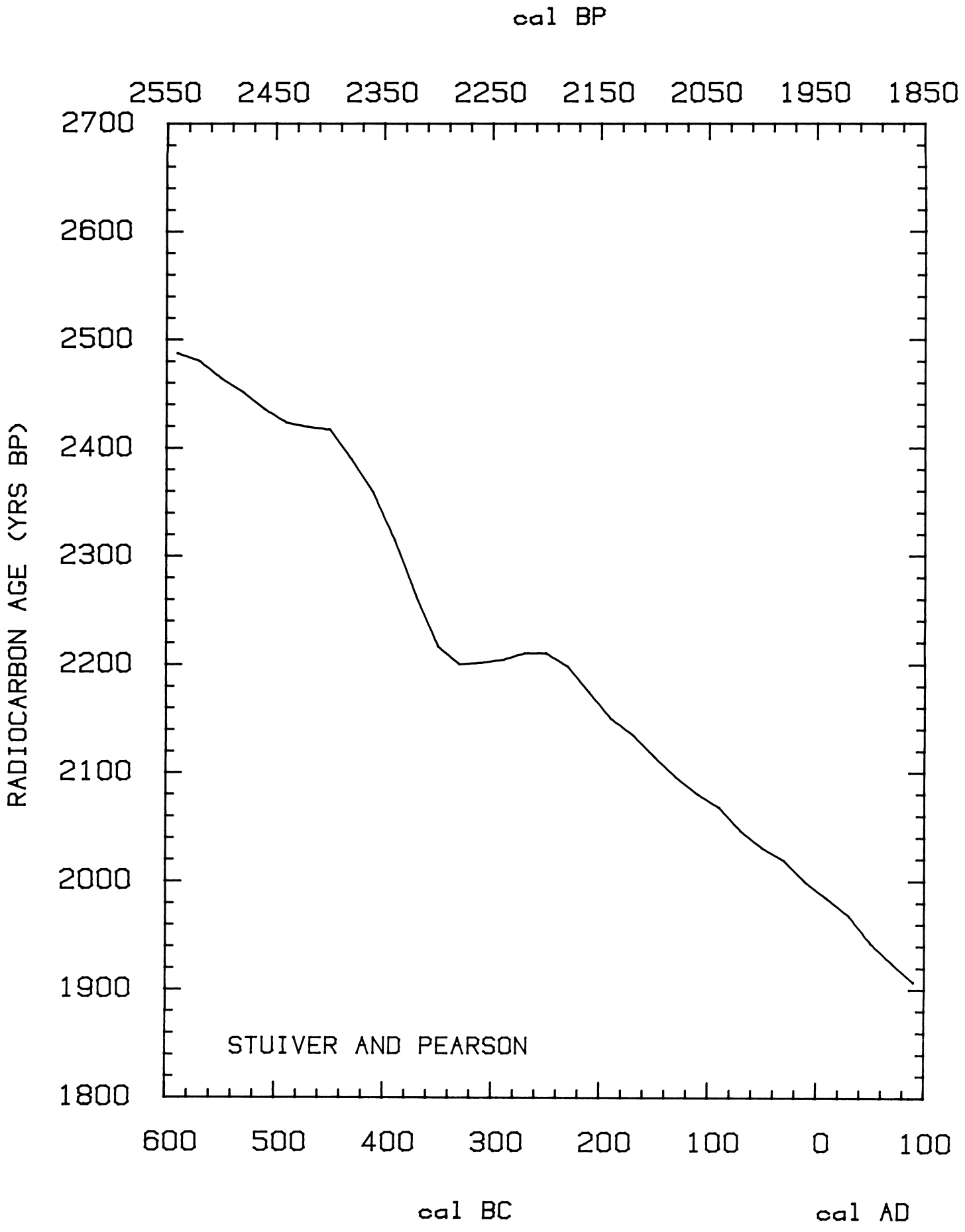


Fig 2E

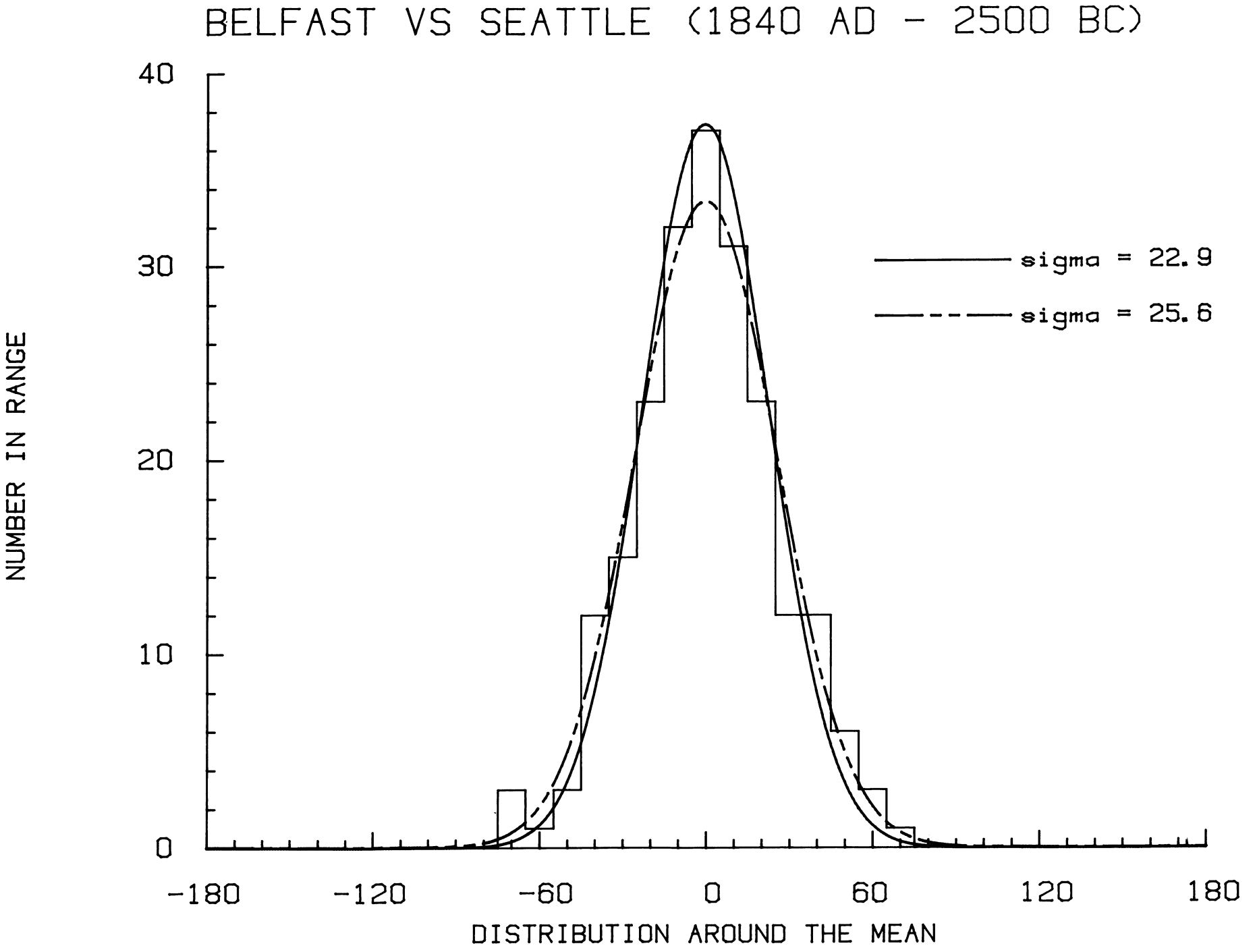


Fig 3. Differences in ^{14}C ages of contemporaneously formed wood samples measured in Belfast and Seattle. Belfast and Seattle laboratory errors predict a standard deviation of 22.9 yr in the differences. Observed distribution has a 25.6 yr standard deviation.

TABLE 1-A

The radiocarbon ages are the weighted averages of age determinations made at the University of Washington (Seattle) and the University of Belfast. The cal AD/BC (or cal BP) ages represent the mid-points of bi-decadal wood sections, except in a few instances, where Belfast skipped a decade (†). Here 3 10-year blocks of Seattle data were averaged to fill the gaps. Seattle bi-decadal results were also solely used for the AD 1940 to 1860 radiocarbon ages.

The cal AD/BC ages follow the mid-points of the Belfast bi-decadal series whenever possible, starting at AD 1840. The actual mid-points of the averages were occasionally slightly different. The differences have been neglected because the mid-points of the Seattle sample were always within 1.5 years of the mid-point of the corresponding Belfast sample, except for 3 samples denoted by *, where the Seattle/Belfast mid-points were 5 years apart. The standard deviation in the ages and Δ values include lab error multipliers of 1.23 for Belfast and 1.6 for Seattle. The trees used and sample treatments are listed in Table 2.

cal AD/BC cal BP	$\Delta^{14}C$	Radiocarbon age BP
AD 1940 BP 10	-19.0 ± .6	164 ± 5
AD 1920 BP 30	-10.9 ± .7	117 ± 5
AD 1900 BP 50	-3.4 ± .8	76 ± 6
AD 1880 BP 70	-5.1 ± .5	109 ± 4
AD 1860 BP 90	-4.1 ± .6	120 ± 5
AD 1840 BP 110	-.5 ± .6	111 ± 4
†AD 1825 BP 125	1.6 ± .4	109 ± 4
AD 1810 BP 140	.5 ± .5	132 ± 4
AD 1790 BP 160	-5.5 ± 1.2	200 ± 10
AD 1770 BP 180	-1.4 ± 1.6	186 ± 13
AD 1750 BP 200	2.0 ± 1.4	179 ± 12
AD 1730 BP 220	11.2 ± 1.6	124 ± 13
AD 1710 BP 240	16.6 ± .5	101 ± 4
AD 1690 BP 260	15.7 ± .5	128 ± 4
AD 1670 BP 280	10.6 ± .5	188 ± 4
AD 1650 BP 300	4.8 ± .5	253 ± 4
AD 1630 BP 320	-1.0 ± .5	319 ± 4
AD 1610 BP 340	-2.3 ± .5	349 ± 4
AD 1590 BP 360	2.4 ± .5	331 ± 4
AD 1570 BP 380	5.6 ± .6	324 ± 5
AD 1550 BP 400	10.3 ± .5	306 ± 4
AD 1530 BP 420	12.9 ± .5	306 ± 4
AD 1510 BP 440	9.8 ± .7	349 ± 6
AD 1490 BP 460	11.7 ± 1.3	354 ± 11
AD 1470 BP 480	10.0 ± 1.6	387 ± 13
AD 1450 BP 500	8.9 ± 1.3	414 ± 10
AD 1430 BP 520	2.8 ± 1.6	483 ± 12
AD 1410 BP 540	-.4 ± 1.4	528 ± 11
AD 1390 BP 560	-6.5 ± 1.5	597 ± 12
AD 1370 BP 580	-9.4 ± 1.2	639 ± 10
AD 1350 BP 600	-2.7 ± 1.3	605 ± 11
AD 1330 BP 620	3.3 ± 1.2	576 ± 9
AD 1310 BP 640	1.1 ± 1.1	613 ± 9
AD 1290 BP 660	-.9 ± 1.8	648 ± 14

TABLE 1-B

cal AD/BC cal BP	$\Delta^{14}C$	Radiocarbon age BP
†AD 1275 BP 675	-7.8 ± .4	719 ± 4
AD 1260 BP 690	-13.4 ± 1.2	779 ± 10
†AD 1245 BP 705	-14.2 ± .4	800 ± 4
AD 1230 BP 720	-13.6 ± 1.2	809 ± 9
*AD 1212.5 BP 737.5	-16.4 ± 1.5	849 ± 12
*AD 1192.5 BP 757.5	-14.5 ± 1.5	854 ± 12
AD 1170 BP 780	-13.4 ± 1.1	867 ± 9
AD 1150 BP 800	-18.8 ± 1.0	930 ± 8
AD 1130 BP 820	-12.9 ± 1.3	901 ± 10
AD 1110 BP 840	-14.5 ± 1.1	934 ± 9
AD 1090 BP 860	-10.3 ± 1.0	919 ± 8
AD 1070 BP 880	-6.0 ± .9	904 ± 7
AD 1050 BP 900	-4.8 ± 1.1	914 ± 9
AD 1030 BP 920	-8.3 ± 1.2	961 ± 10
AD 1010 BP 940	-14.1 ± 1.3	1027 ± 10
AD 990 BP 960	-14.6 ± 1.2	1051 ± 9
AD 970 BP 980	-16.7 ± 1.2	1088 ± 10
*AD 952.5 BP 997.5	-17.4 ± .4	1110 ± 3
AD 940 BP 1010	-17.0 ± 1.6	1119 ± 13
AD 920 BP 1030	-14.5 ± 1.5	1118 ± 12
AD 900 BP 1050	-11.0 ± 1.5	1109 ± 12
AD 880 BP 1070	-17.5 ± 1.5	1181 ± 12
AD 860 BP 1090	-16.1 ± 1.5	1189 ± 12
AD 850 BP 1100	-16.4 ± .4	1202 ± 3
AD 830 BP 1120	-12.6 ± 1.6	1190 ± 13
AD 810 BP 1140	-11.5 ± 1.6	1201 ± 13
AD 790 BP 1160	-10.2 ± 1.3	1209 ± 10
AD 770 BP 1180	-13.3 ± 1.2	1255 ± 9
AD 750 BP 1200	-13.8 ± 1.0	1278 ± 8
AD 730 BP 1220	-8.5 ± .9	1254 ± 8
AD 710 BP 1240	-8.9 ± 1.3	1277 ± 10
AD 690 BP 1260	-6.6 ± 1.7	1278 ± 13
AD 670 BP 1280	-10.3 ± 1.7	1327 ± 14
AD 650 BP 1300	-16.2 ± 1.4	1395 ± 11
AD 630 BP 1320	-18.5 ± 1.5	1433 ± 12
AD 610 BP 1340	-17.9 ± 1.7	1448 ± 14
AD 590 BP 1360	-21.1 ± 1.7	1493 ± 14
AD 570 BP 1380	-18.0 ± 1.7	1487 ± 14
AD 550 BP 1400	-19.2 ± 1.7	1516 ± 14
AD 530 BP 1420	-22.1 ± 1.5	1560 ± 12
AD 510 BP 1440	-20.0 ± 1.6	1562 ± 13
AD 490 BP 1460	-18.1 ± 1.6	1565 ± 13
AD 470 BP 1480	-14.6 ± 1.6	1557 ± 13
AD 450 BP 1500	-13.2 ± 1.7	1565 ± 14
AD 430 BP 1520	-15.0 ± 1.6	1598 ± 13
AD 410 BP 1540	-18.1 ± 1.6	1643 ± 13
AD 390 BP 1560	-19.1 ± 1.3	1671 ± 11
AD 370 BP 1580	-19.2 ± 1.4	1691 ± 11
AD 350 BP 1600	-16.1 ± 1.7	1685 ± 13
AD 330 BP 1620	-18.7 ± 1.7	1726 ± 14

TABLE 1-C

cal AD/BC cal BP	$\Delta^{14}C$	Radiocarbon age BP	cal AD/BC cal BP	$\Delta^{14}C$	Radiocarbon age BP
AD 310 BP 1640	-20.1 ± 1.6	1757 ± 13	BC 190 BP 2139	-8.1 ± 1.3	2144 ± 11
AD 290 BP 1660	-14.7 ± 1.6	1732 ± 13	BC 210 BP 2159	-12.3 ± 1.3	2198 ± 10
AD 270 BP 1680	-9.1 ± 1.5	1706 ± 12	BC 230 BP 2179	-9.8 ± 1.3	2197 ± 10
AD 250 BP 1700	-13.2 ± 1.1	1759 ± 9	BC 250 BP 2199	-8.7 ± 1.5	2207 ± 12
AD 230 BP 1720	-15.3 ± 1.6	1796 ± 13	BC 270 BP 2219	-10.2 ± 1.5	2239 ± 12
AD 210 BP 1740	-16.7 ± 1.6	1826 ± 13	BC 290 BP 2239	-4.0 ± 1.5	2208 ± 12
AD 190 BP 1760	-14.7 ± 1.7	1830 ± 13	BC 310 BP 2259	-.3 ± 1.4	2198 ± 11
AD 170 BP 1780	-12.7 ± 1.8	1833 ± 14	BC 330 BP 2279	5.7 ± 1.5	2169 ± 12
AD 150 BP 1800	-9.1 ± 1.7	1823 ± 13	BC 350 BP 2299	5.2 ± 1.3	2192 ± 10
AD 130 BP 1820	-11.0 ± 1.2	1857 ± 9	BC 370 BP 2319	1.8 ± 1.2	2240 ± 10
AD 110 BP 1840	-13.4 ± 1.8	1896 ± 14	BC 390 BP 2339	-1.6 ± 1.5	2286 ± 12
AD 90 BP 1860	-10.8 ± 1.6	1895 ± 13	BC 410 BP 2359	-14.7 ± 1.5	2411 ± 12
AD 70 BP 1880	-13.3 ± 1.3	1934 ± 10	BC 430 BP 2379	-13.9 ± 1.3	2424 ± 11
AD 50 BP 1900	-14.2 ± 1.1	1961 ± 9	BC 450 BP 2399	-10.2 ± 1.6	2413 ± 13
AD 30 BP 1920	-11.2 ± 1.3	1957 ± 11	BC 470 BP 2419	-8.0 ± 1.3	2415 ± 11
AD 10 BP 1940	-12.7 ± 1.1	1988 ± 9	BC 490 BP 2439	-6.4 ± 1.4	2422 ± 11
BC 10 BP 1959	-13.1 ± 1.1	2010 ± 9	BC 510 BP 2459	-4.1 ± 1.2	2422 ± 10
BC 30 BP 1979	-10.9 ± 1.1	2012 ± 9	BC 530 BP 2479	-5.0 ± 1.1	2450 ± 9
BC 50 BP 1999	-12.0 ± 1.1	2040 ± 9	BC 550 BP 2499	-6.3 ± 1.0	2480 ± 8
BC 70 BP 2019	-10.0 ± 1.2	2043 ± 10	BC 570 BP 2519	-5.1 ± 1.3	2489 ± 10
BC 90 BP 2039	-8.0 ± 1.2	2046 ± 10	BC 590 BP 2539	-1.4 ± 1.3	2478 ± 11
BC 110 BP 2059	-11.1 ± 1.1	2091 ± 9	BC 610 BP 2559	-1.9 ± 1.2	2502 ± 10
BC 130 BP 2079	-12.1 ± 1.3	2118 ± 10	BC 630 BP 2579	2.3 ± 1.2	2488 ± 10
BC 150 BP 2099	-7.4 ± 1.5	2099 ± 12	BC 650 BP 2599	7.3 ± 1.2	2468 ± 10
BC 170 BP 2119	-7.8 ± 1.3	2122 ± 11	BC 670 BP 2619	5.0 ± 1.8	2505 ± 15

TABLE 2

Lab code	Species	Dendro-ages used	Wood treatment*	Location	Dendro-chronology
C	Douglas fir	AD 1915–1954 (single year)	CL	Olympic Pennisula, WA (47°46′N, 124°06′W)	Ring counted only
A	Douglas fir	AD 1820–1913 (single year)	DV**	Olympic Pennisula, WA (47°46′N, 124°06′W)	Ring counted only
B	Douglas fir	AD 1690–1719 AD 1790–1819 (single year)	DV	Mt Rainier Natl Park, Washington (46°45′N, 121°45′W)	Ring counted only
F	Douglas fir	AD 1510–1699 (single year) AD 1505–1935 (decadal)	DV DV†	Coos Bay, OR (43°07′N, 123°40′W)	Ring counted only
R	Douglas fir	AD 1305–1505 (single year) AD 1505–1935 (decadal)	DV	Pierce County, WA (47°N, 122°W)	Ring counted only
S	Douglas fir	AD 945–1315 (decadal)	DV	Shawnigan Lake, Vancouver Island, BC Canada (48°40′N, 123°40′W)	Cross-dated by M Parker *et al*, Western Products Forestry, Vancouver, BC
RC	Sequoia	AD 265–935 (decadal)	DV	Sequoia Natl Park, CA (36.5°N, 118.5°W)	Cross-dated by H Garfinkel, University of Washington, Seattle
ECK	Oak	AD 705–765 (decadal)	DV	Northern Germany	Cross-dated by D Eckstein, University of Hamburg
SR	Sequoia	145 BC–AD 265 (decadal)	DV	Sequoia Natl Park, CA (36.5°N, 118.5°W)	Cross-dated by H Garfinkel
BK	Oak	495 BC–AD 45	CL	Southern Germany	Cross-dated by B Becker, University of Hohenheim, Stutgart, W Germany
BK‡	Oak	505–2495 BC (decadal)	CL	Southern Germany	Cross-dated by B Becker
PQ‡	Oak	515–625 BC (decadal)	CL	Ireland	Cross-dated by J R Pilcher, M G L Baillie, and G W Pearson, University of Belfast, Northern Ireland

* CL = cellulose method; DV = De Vries method
** Cellulose duplicates run for AD 1836, 1837, and 1853
† Cellulose treatment AD 1505 and 1515
‡ These trees were used for Pearson and Stuiver (1986)

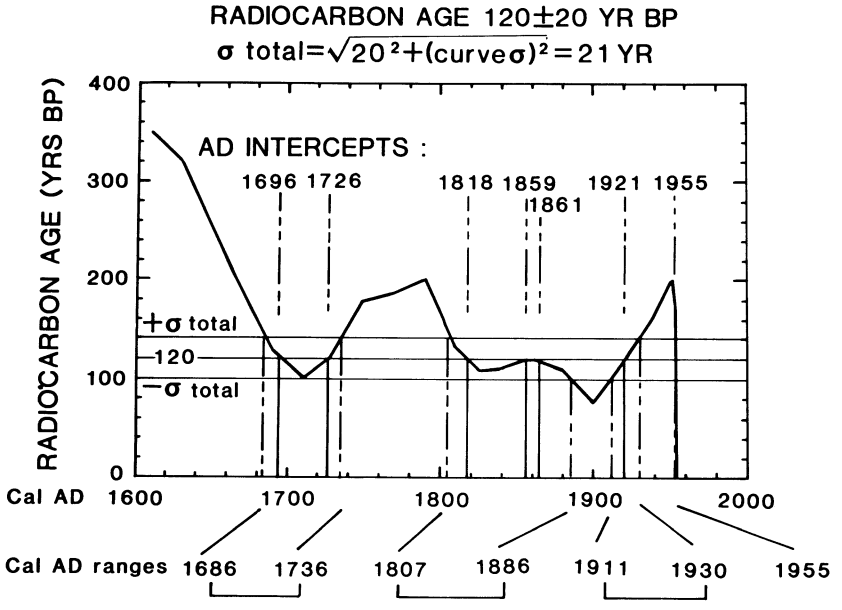
TABLE 3

The conversion of the radiocarbon ages to a series of ranges of cal AD/BC (*and* BP) dates is determined by the AD/BC intercepts of the sample radiocarbon age ± $\sqrt{(\text{sample } \sigma)^2 + (\text{curve } \sigma)^2}$ and the calibration curve. Intercepts of the radiocarbon age with the calibration curve are listed to the right. Sample σ is the standard error in the radiocarbon age.

The youngest point of the 20-year calibration curve is AD 1940 with a conventional radiocarbon age of 164 years BP. The curve has been extended to 1954 using data from Stuiver and Quay (1981). Nuclear bomb testing increased atmospheric ^{14}C substantially in 1955, resulting in the "vertical" portion of the Fig 1A calibration curve. Intercepts with this vertical portion yield the 1955*s of the table. In those instances where cal AD/BC ages, indicate "negative" BP ages, the BP age is given as 0* BP.

For sample sigmas and ranges larger or equal to 100 years the data were rounded to the nearest decade. When the gap between two successive ranges was less than 10 years, the two ranges were combined to a single one.

Illustrations of the above are given below.



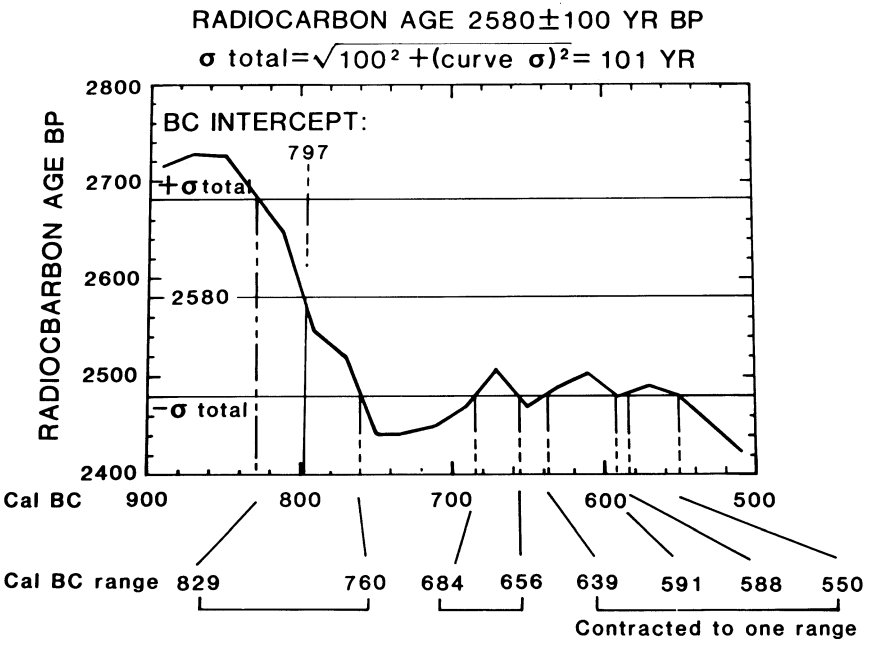


TABLE 3-A

RADIOCARBON AGE BP 80 CALIBRATED AGES: cal AD 1898, 1902, 1955*
cal BP 52, 48, 0*

Sample σ and cal AD(cal BP) ranges:

σ = 20	1709-1711(241-239)	1884-1913(66-37)	1955*
σ = 40	1695-1727(255-223)	1817-1922(133-28)	1955*
σ = 60	1686-1736(264-214)	1807-1930(143-20)	1955*
σ = 80	1679-1743(271-207)	1802-1939(148-11)	1955*
σ = 100	1672-1755(278-195)	1800-1955*(150-0*)	
σ = 120	1670-1955*(280-0*)		
σ = 160	1650-1955*(300-0*)		
σ = 200	1640-1955*(310-0*)		

RADIOCARBON AGE BP 100 CALIBRATED AGES: cal AD 1885, 1912, 1955*
cal BP 65, 38, 0*

Sample σ and cal AD(cal BP) ranges:

σ = 20	1694-1728(256-222)	1817-1922(133-28)	1955*
σ = 40	1686-1736(264-214)	1807-1930(143-20)	1955*
σ = 60	1679-1743(271-207)	1802-1939(148-11)	1955*
σ = 80	1672-1755(278-195)	1796-1955*(154-0*)	
σ = 100	1670-1955*(280-0*)		
σ = 120	1660-1955*(290-0*)		
σ = 160	1650-1955*(300-0*)		
σ = 200	1640-1955*(310-0*)		

RADIOCARBON AGE BP 120 CALIBRATED AGES: cal AD 1696, 1726, 1818, 1859, 1861, 1921, 1955*
cal BP 254, 224, 132, 91, 89, 29, 0*

Sample σ and cal AD(cal BP) ranges:

σ = 20	1686-1736(264-214)	1807-1886(143-64)	1911-1930(39-20)
	1955*		
σ = 40	1679-1743(271-207)	1802-1939(148-11)	1955*
σ = 60	1672-1755(278-195)	1796-1955*(154-0*)	
σ = 80	1666-1955*(284-0*)		
σ = 100	1660-1955*(290-0*)		
σ = 120	1650-1955*(300-0*)		
σ = 160	1640-1955*(310-0*)		
σ = 200	1523-1565(427-385)	1630-1955*(320-0*)	

RADIOCARBON AGE BP 140 CALIBRATED AGES: cal AD 1686, 1736, 1808, 1930, 1955*
cal BP 264, 214, 142, 20, 0*

Sample σ and cal AD(cal BP) ranges:

σ = 20	1679-1697(271-253)	1725-1744(225-206)	1801-1819(149-131)
	1855-1864(95-86)	1920-1939(30-11)	1955*
σ = 40	1672-1756(278-194)	1796-1886(154-64)	1911-1955*(39-0*)
σ = 60	1666-1955*(284-0*)		
σ = 80	1660-1955*(290-0*)		
σ = 100	1650-1955*(300-0*)		
σ = 120	1650-1955*(300-0*)		
σ = 160	1640-1955*(310-0*)		
σ = 200	1514-1600(436-350)	1620-1955*(330-0*)	

TABLE 3-B

RADIOCARBON AGE BP 160 CALIBRATED AGES: cal AD 1679, 1743, 1802, 1938, 1955*
cal BP 271, 207, 148, 12, 0*

Sample σ and cal AD(cal BP) ranges:

σ = 20	1672-1687(278-263)	1735-1759(215-191)	1795-1808(155-142)
	1929-1955*(21-0*)		
σ = 40	1666-1696(284-254)	1726-1818(224-132)	1857-1862(93-88)
	1921-1955*(29-0*)		
σ = 60	1660-1886(290-64)	1911-1955*(39-0*)	
σ = 80	1654-1955*(296-0*)		
σ = 100	1650-1955*(300-0*)		
σ = 120	1640-1955*(310-0*)		
σ = 160	1523-1565(427-385)	1630-1955*(320-0*)	
σ = 200	1490-1955*(460-0*)		

RADIOCARBON AGE BP 180 CALIBRATED AGES: cal AD 1673, 1754, 1796, 1945, 1954
cal BP 277, 196, 154, 5, 0*

Sample σ and cal AD(cal BP) ranges:

σ = 20	1665-1680(285-270)	1742-1803(208-147)	1937-1955*(13-0*)
σ = 40	1659-1687(291-263)	1735-1808(215-142)	1929-1955*(21-0*)
σ = 60	1654-1697(296-253)	1725-1819(225-131)	1856-1863(94-87)
	1921-1955*(29-0*)		
σ = 80	1648-1886(302-64)	1911-1955*(39-0*)	
σ = 100	1640-1955*(310-0*)		
σ = 120	1640-1955*(310-0*)		
σ = 160	1514-1601(436-349)	1620-1955*(330-0*)	
σ = 200	1470-1955*(480-0*)		

RADIOCARBON AGE BP 200 CALIBRATED AGES: cal AD 1666, 1790, 1951, 1952
cal BP 284, 160, 0*, 0*

Sample σ and cal AD(cal BP) ranges:

σ = 20	1659-1674(291-276)	1749-1797(201-153)	1944-1955*(6-0*)
σ = 40	1653-1680(297-270)	1742-1802(208-148)	1937-1955*(13-0*)
σ = 60	1647-1686(303-264)	1735-1808(215-142)	1929-1955*(21-0*)
σ = 80	1641-1697(309-253)	1726-1818(224-132)	1857-1863(93-87)
	1921-1955*(29-0*)		
σ = 100	1640-1890(310-60)	1911-1955*(39-0*)	
σ = 120	1523-1566(427-384)	1630-1955*(320-0*)	
σ = 160	1490-1955*(460-0*)		
σ = 200	1460-1955*(490-0*)		

RADIOCARBON AGE BP 220 CALIBRATED AGE: cal AD 1660
cal BP 290

Sample σ and cal AD(cal BP) ranges:

σ = 20	1654-1666(296-284)	1789-1790(161-160)	1951-1952(0*)
σ = 40	1648-1673(302-277)	1753-1796(197-154)	1945-1954(5-0*)
σ = 60	1642-1679(308-271)	1743-1802(207-148)	1938-1955*(12-0*)
σ = 80	1636-1686(314-264)	1736-1808(214-142)	1930-1955*(20-0*)
σ = 100	1523-1565(427-385)	1629-1696(321-254)	1726-1818(224-132)
	1859-1861(91-89)	1921-1955*(29-0*)	
σ = 120	1514-1600(436-350)	1620-1890(330-60)	1912-1955*(38-0*)
σ = 160	1470-1955*(480-0*)		
σ = 200	1450-1955*(500-0*)		

TABLE 3-C

RADIOCARBON AGE BP 240 CALIBRATED AGE: cal AD 1654
cal BP 296

Sample σ and cal AD(cal BP) ranges:

σ = 20	1648-1660(302-290)		
σ = 40	1642-1666(308-284)	1951-1952(0*)	
σ = 60	1636-1673(314-277)	1753-1796(197-154)	1945-1954(5-0*)
σ = 80	1523-1565(427-385)	1629-1679(321-271)	1743-1802(207-148)
	1938-1955*(12-0*)		
σ = 100	1514-1600(436-350)	1616-1686(334-264)	1736-1808(214-142)
	1930-1955*(20-0*)		
σ = 120	1490-1700(460-250)	1726-1818(224-132)	1859-1861(91-89)
	1921-1955*(29-0*)		
σ = 160	1460-1955*(490-0*)		
σ = 200	1440-1955*(510-0*)		

RADIOCARBON AGE BP 260 CALIBRATED AGE: cal AD 1648
cal BP 302

Sample σ and cal AD(cal BP) ranges:

σ = 20	1642-1654(308-296)		
σ = 40	1636-1660(314-290)		
σ = 60	1523-1565(427-385)	1629-1666(321-284)	1951-1952(0*)
σ = 80	1514-1600(436-350)	1616-1673(334-277)	1753-1796(197-154)
	1945-1954(5-0*)		
σ = 100	1490-1680(460-270)	1743-1802(207-148)	1938-1955*(12-0*)
σ = 120	1470-1690(480-260)	1736-1808(214-142)	1930-1955*(20-0*)
σ = 160	1450-1890(500-60)	1912-1955*(38-0*)	
σ = 200	1440-1955*(510-0*)		

RADIOCARBON AGE BP 280 CALIBRATED AGE: cal AD 1642
cal BP 308

Sample σ and cal AD(cal BP) ranges:

σ = 20	1636-1648(314-302)		
σ = 40	1523-1565(427-385)	1629-1654(321-296)	
σ = 60	1514-1600(436-350)	1616-1660(334-290)	
σ = 80	1486-1666(464-284)	1951-1952(0*)	
σ = 100	1470-1670(480-280)	1753-1796(197-154)	1945-1954(5-0*)
σ = 120	1460-1680(490-270)	1743-1802(207-148)	1938-1955*(12-0*)
σ = 160	1440-1700(510-250)	1726-1818(224-132)	1859-1861(91-89)
	1921-1955*(29-0*)		
σ = 200	1430-1955*(520-0*)		

TABLE 3-D

RADIOCARBON AGE BP 300 CALIBRATED AGE: cal AD 1636
cal BP 314

Sample σ and cal AD(cal BP) ranges:

σ = 20	1523-1566(427-384)	1629-1642(321-308)	
σ = 40	1514-1601(436-349)	1616-1648(334-302)	
σ = 60	1486-1654(464-296)		
σ = 80	1474-1660(476-290)		
σ = 100	1460-1670(490-280)	1951-1952(0*)	
σ = 120	1450-1670(500-280)	1753-1796(197-154)	1945-1954(5-0*)
σ = 160	1440-1690(510-260)	1736-1808(214-142)	1930-1955*(20-0*)
σ = 200	1420-1890(530-60)	1912-1955*(38-0*)	

RADIOCARBON AGE BP 320 CALIBRATED AGES: cal AD 1523, 1565, 1629
cal BP 427, 385, 321

Sample σ and cal AD(cal BP) ranges:

σ = 20	1514-1601(436-349)	1616-1636(334-314)	
σ = 40	1486-1642(464-308)		
σ = 60	1474-1648(476-302)		
σ = 80	1460-1654(490-296)		
σ = 100	1450-1660(500-290)		
σ = 120	1440-1670(510-280)	1951-1952(0*)	
σ = 160	1430-1680(520-270)	1743-1802(207-148)	1938-1955*(12-0*)
σ = 200	1410-1700(540-250)	1726-1818(224-132)	1859-1861(91-89)
	1921-1955*(29-0*)		

RADIOCARBON AGE BP 340 CALIBRATED AGES: cal AD 1514, 1600, 1616
cal BP 436, 350, 334

Sample σ and cal AD(cal BP) ranges:

σ = 20	1486-1524(464-426)	1565-1630(385-320)	
σ = 40	1474-1636(476-314)		
σ = 60	1460-1642(490-308)		
σ = 80	1448-1648(502-302)		
σ = 100	1440-1650(510-300)		
σ = 120	1440-1660(510-290)		
σ = 160	1420-1670(530-280)	1754-1796(196-154)	1945-1954(5-0*)
σ = 200	1410-1690(540-260)	1736-1808(214-142)	1930-1955*(20-0*)

RADIOCARBON AGE BP 360 CALIBRATED AGE: cal AD 1486
cal BP 464

Sample σ and cal AD(cal BP) ranges:

σ = 20	1472-1516(478-434)	1597-1618(353-332)	
σ = 40	1459-1524(491-426)	1563-1630(387-320)	
σ = 60	1448-1636(502-314)		
σ = 80	1442-1642(508-308)		
σ = 100	1440-1650(510-300)		
σ = 120	1430-1650(520-300)		
σ = 160	1410-1670(540-280)	1789-1790(161-160)	1951-1952(0*)
σ = 200	1400-1680(550-270)	1743-1802(207-148)	1938-1955*(12-0*)

TABLE 3-E

RADIOCARBON AGE BP 380 CALIBRATED AGE: cal AD 1474
cal BP 476

Sample σ and cal AD(cal BP) ranges:

σ = 20	1458-1488(492-462)		
σ = 40	1448-1515(502-435)	1598-1617(352-333)	
σ = 60	1442-1524(508-426)	1564-1630(386-320)	
σ = 80	1436-1636(514-314)		
σ = 100	1430-1640(520-310)		
σ = 120	1420-1650(530-300)		
σ = 160	1410-1660(540-290)		
σ = 200	1328-1333(622-617)	1390-1670(560-280)	1753-1796(197-154)
	1945-1954(5-0*)		

RADIOCARBON AGE BP 400 CALIBRATED AGE: cal AD 1460
cal BP 490

Sample σ and cal AD(cal BP) ranges:

σ = 20	1447-1476(503-474)		
σ = 40	1442-1487(508-463)		
σ = 60	1436-1515(514-435)	1599-1617(351-333)	
σ = 80	1431-1524(519-426)	1564-1630(386-320)	
σ = 100	1420-1640(530-310)		
σ = 120	1410-1640(540-310)		
σ = 160	1400-1650(550-300)		
σ = 200	1317-1347(633-603)	1390-1670(560-280)	1789-1790(161-160)
	1951-1952(0*)		

RADIOCARBON AGE BP 420 CALIBRATED AGE: cal AD 1448
cal BP 502

Sample σ and cal AD(cal BP) ranges:

σ = 20	1442-1463(508-487)		
σ = 40	1436-1475(514-475)		
σ = 60	1431-1487(519-463)		
σ = 80	1422-1514(528-436)	1599-1616(351-334)	
σ = 100	1410-1520(540-430)	1564-1630(386-320)	
σ = 120	1410-1640(540-310)		
σ = 160	1328-1333(622-617)	1390-1650(560-300)	
σ = 200	1306-1359(644-591)	1380-1660(570-290)	

RADIOCARBON AGE BP 440 CALIBRATED AGE: cal AD 1443
cal BP 507

Sample σ and cal AD(cal BP) ranges:

σ = 20	1436-1449(514-501)		
σ = 40	1430-1462(520-488)		
σ = 60	1422-1475(528-475)		
σ = 80	1413-1487(537-463)		
σ = 100	1410-1510(540-440)	1600-1616(350-334)	
σ = 120	1400-1520(550-430)	1565-1630(385-320)	
σ = 160	1317-1347(633-603)	1390-1640(560-310)	
σ = 200	1290-1650(660-300)		

TABLE 3-F

RADIOCARBON AGE BP 460 CALIBRATED AGE: cal AD 1437
cal BP 513

Sample σ and cal AD(cal BP) ranges:

σ = 20	1430-1443(520-507)		
σ = 40	1422-1449(528-501)		
σ = 60	1413-1461(537-489)		
σ = 80	1406-1475(544-475)		
σ = 100	1401-1487(549-463)		
σ = 120	1328-1333(622-617)	1390-1510(560-440)	1600-1616(350-334)
σ = 160	1306-1359(644-591)	1380-1640(570-310)	
σ = 200	1290-1650(660-300)		

RADIOCARBON AGE BP 480 CALIBRATED AGE: cal AD 1431
cal BP 519

Sample σ and cal AD(cal BP) ranges:

σ = 20	1421-1438(529-512)		
σ = 40	1413-1443(537-507)		
σ = 60	1406-1449(544-501)		
σ = 80	1400-1461(550-489)		
σ = 100	1327-1333(623-617)	1395-1474(555-476)	
σ = 120	1317-1347(633-603)	1388-1486(562-464)	
σ = 160	1290-1520(660-430)	1565-1630(385-320)	
σ = 200	1280-1640(670-310)		

RADIOCARBON AGE BP 500 CALIBRATED AGE: cal AD 1422
cal BP 528

Sample σ and cal AD(cal BP) ranges:

σ = 20	1412-1432(538-518)		
σ = 40	1406-1437(544-513)		
σ = 60	1400-1443(550-507)		
σ = 80	1327-1333(623-617)	1395-1449(555-501)	
σ = 100	1317-1347(633-603)	1388-1461(562-489)	
σ = 120	1306-1359(644-591)	1379-1474(571-476)	
σ = 160	1290-1510(660-440)	1600-1616(350-334)	
σ = 200	1280-1640(670-310)		

RADIOCARBON AGE BP 520 CALIBRATED AGE: cal AD 1414
cal BP 536

Sample σ and cal AD(cal BP) ranges:

σ = 20	1406-1424(544-526)		
σ = 40	1400-1431(550-519)		
σ = 60	1327-1334(623-616)	1395-1437(555-513)	
σ = 80	1317-1347(633-603)	1388-1443(562-507)	
σ = 100	1306-1359(644-591)	1379-1449(571-501)	
σ = 120	1290-1460(660-490)		
σ = 160	1280-1490(670-460)		
σ = 200	1270-1520(680-430)	1565-1629(385-321)	

TABLE 3-G

RADIOCARBON AGE BP 540 CALIBRATED AGE: cal AD 1407
cal BP 543

Sample σ and cal AD(cal BP) ranges:

σ = 20	1400-1415(550-535)	
σ = 40	1327-1334(623-616)	1394-1423(556-527)
σ = 60	1317-1348(633-602)	1388-1431(562-519)
σ = 80	1306-1359(644-591)	1379-1437(571-513)
σ = 100	1290-1440(660-510)	
σ = 120	1290-1450(660-500)	
σ = 160	1280-1470(670-480)	
σ = 200	1270-1510(680-440)	1600-1616(350-334)

RADIOCARBON AGE BP 560 CALIBRATED AGE: cal AD 1401
cal BP 549

Sample σ and cal AD(cal BP) ranges:

σ = 20	1326-1335(624-615)	1394-1407(556-543)
σ = 40	1316-1348(634-602)	1388-1414(562-536)
σ = 60	1306-1359(644-591)	1379-1423(571-527)
σ = 80	1294-1431(656-519)	
σ = 100	1290-1440(660-510)	
σ = 120	1280-1440(670-510)	
σ = 160	1270-1460(680-490)	
σ = 200	1260-1490(690-460)	

RADIOCARBON AGE BP 580 CALIBRATED AGES: cal AD 1328, 1333, 1395
cal BP 622, 617, 555

Sample σ and cal AD(cal BP) ranges:

σ = 20	1316-1348(634-602)	1387-1401(563-549)
σ = 40	1306-1360(644-590)	1378-1407(572-543)
σ = 60	1294-1414(656-536)	
σ = 80	1287-1423(663-527)	
σ = 100	1280-1430(670-520)	
σ = 120	1280-1440(670-510)	
σ = 160	1270-1450(680-500)	
σ = 200	1260-1470(690-480)	

RADIOCARBON AGE BP 600 CALIBRATED AGES: cal AD 1317, 1347, 1388
cal BP 633, 603, 562

Sample σ and cal AD(cal BP) ranges:

σ = 20	1305-1360(645-590)	1378-1396(572-554)
σ = 40	1294-1401(656-549)	
σ = 60	1287-1407(663-543)	
σ = 80	1283-1414(667-536)	
σ = 100	1280-1420(670-530)	
σ = 120	1270-1430(680-520)	
σ = 160	1260-1440(690-510)	
σ = 200	1240-1460(710-490)	

TABLE 3-H

RADIOCARBON AGE BP 620 CALIBRATED AGES: cal AD 1306, 1359, 1379
cal BP 644, 591, 571

Sample σ and cal AD(cal BP) ranges:

σ = 20	1293-1319(657-631)	1345-1390(605-560)
σ = 40	1287-1395(663-555)	
σ = 60	1283-1401(667-549)	
σ = 80	1279-1407(671-543)	
σ = 100	1270-1410(680-540)	
σ = 120	1270-1420(680-530)	
σ = 160	1260-1440(690-510)	
σ = 200	1230-1450(720-500)	

RADIOCARBON AGE BP 640 CALIBRATED AGE: cal AD 1295
cal BP 655

Sample σ and cal AD(cal BP) ranges:

σ = 20	1287-1308(663-642)	1357-1381(593-569)
σ = 40	1283-1318(667-632)	1346-1389(604-561)
σ = 60	1279-1395(671-555)	
σ = 80	1274-1401(676-549)	
σ = 100	1270-1410(680-540)	
σ = 120	1260-1410(690-540)	
σ = 160	1240-1430(710-520)	
σ = 200	1220-1440(730-510)	

RADIOCARBON AGE BP 660 CALIBRATED AGE: cal AD 1288
cal BP 662

Sample σ and cal AD(cal BP) ranges:

σ = 20	1283-1296(667-654)	1369-1371(581-579)
σ = 40	1279-1307(671-643)	1358-1380(592-570)
σ = 60	1275-1318(675-632)	1346-1389(604-561)
σ = 80	1270-1395(680-555)	
σ = 100	1260-1400(690-550)	
σ = 120	1260-1410(690-540)	
σ = 160	1230-1420(720-530)	
σ = 200	1180-1440(770-510)	

RADIOCARBON AGE BP 680 CALIBRATED AGE: cal AD 1283
cal BP 667

Sample σ and cal AD(cal BP) ranges:

σ = 20	1279-1288(671-662)	
σ = 40	1274-1295(676-655)	
σ = 60	1270-1307(680-643)	1358-1379(592-571)
σ = 80	1265-1317(685-633)	1346-1389(604-561)
σ = 100	1260-1390(690-560)	
σ = 120	1240-1400(710-550)	
σ = 160	1220-1410(730-540)	
σ = 200	1170-1430(780-520)	

TABLE 3-I

RADIOCARBON AGE BP 700 CALIBRATED AGE: cal AD 1279
cal BP 671

Sample σ and cal AD(cal BP) ranges:

σ = 20	1274-1284(676-666)	
σ = 40	1269-1288(681-662)	
σ = 60	1265-1295(685-655)	
σ = 80	1259-1307(691-643)	1359-1379(591-571)
σ = 100	1244-1317(706-633)	1346-1389(604-561)
σ = 120	1230-1390(720-560)	
σ = 160	1180-1410(770-540)	
σ = 200	1160-1420(790-530)	

RADIOCARBON AGE BP 720 CALIBRATED AGE: cal AD 1275
cal BP 675

Sample σ and cal AD(cal BP) ranges:

σ = 20	1269-1279(681-671)		
σ = 40	1265-1283(685-667)		
σ = 60	1259-1288(691-662)		
σ = 80	1245-1295(705-655)		
σ = 100	1225-1306(725-644)	1359-1379(591-571)	
σ = 120	1220-1320(730-630)	1347-1389(603-561)	
σ = 160	1170-1400(780-550)		
σ = 200	1047-1092(903-858)	1118-1143(832-807)	1150-1410(800-540)

RADIOCARBON AGE BP 740 CALIBRATED AGE: cal AD 1270
cal BP 680

Sample σ and cal AD(cal BP) ranges:

σ = 20	1264-1275(686-675)	
σ = 40	1259-1279(691-671)	
σ = 60	1244-1283(706-667)	
σ = 80	1225-1288(725-662)	
σ = 100	1217-1295(733-655)	
σ = 120	1180-1310(770-640)	1359-1379(591-571)
σ = 160	1160-1390(790-560)	
σ = 200	1040-1410(910-540)	

RADIOCARBON AGE BP 760 CALIBRATED AGE: cal AD 1265
cal BP 685

Sample σ and cal AD(cal BP) ranges:

σ = 20	1258-1270(692-680)		
σ = 40	1244-1275(706-675)		
σ = 60	1225-1279(725-671)		
σ = 80	1216-1283(734-667)		
σ = 100	1180-1290(770-660)		
σ = 120	1170-1290(780-660)		
σ = 160	1047-1092(903-858)	1118-1143(832-807)	1150-1320(800-630)
	1347-1388(603-562)		
σ = 200	1030-1400(920-550)		

TABLE 3-J

RADIOCARBON AGE BP 780 CALIBRATED AGE: cal AD 1259
cal BP 691

Sample σ and cal AD(cal BP) ranges:

σ = 20	1243-1265(707-685)	
σ = 40	1225-1270(725-680)	
σ = 60	1216-1275(734-675)	
σ = 80	1181-1279(769-671)	
σ = 100	1170-1280(780-670)	
σ = 120	1160-1290(790-660)	
σ = 160	1040-1310(910-640)	1359-1379(591-571)
σ = 200	1020-1390(930-560)	

RADIOCARBON AGE BP 800 CALIBRATED AGE: cal AD 1245
cal BP 705

Sample σ and cal AD(cal BP) ranges:

σ = 20	1225-1260(725-690)	
σ = 40	1216-1265(734-685)	
σ = 60	1181-1270(769-680)	
σ = 80	1166-1275(784-675)	
σ = 100	1160-1280(790-670)	
σ = 120	1047-1092(903-858)	1120-1280(830-670)
σ = 160	1030-1290(920-660)	
σ = 200	1020-1320(930-630)	1347-1388(603-562)

RADIOCARBON AGE BP 820 CALIBRATED AGE: cal AD 1225
cal BP 725

Sample σ and cal AD(cal BP) ranges:

σ = 20	1215-1247(735-703)	
σ = 40	1179-1260(771-690)	
σ = 60	1165-1265(785-685)	
σ = 80	1159-1270(791-680)	
σ = 100	1047-1092(903-858)	1120-1270(830-680)
σ = 120	1040-1280(910-670)	
σ = 160	1020-1290(930-660)	
σ = 200	1010-1310(940-640)	1359-1379(591-571)

RADIOCARBON AGE BP 840 CALIBRATED AGE: cal AD 1217
cal BP 733

Sample σ and cal AD(cal BP) ranges:

σ = 20	1177-1227(773-723)	
σ = 40	1165-1246(785-704)	
σ = 60	1159-1260(791-690)	
σ = 80	1047-1093(903-857)	1118-1265(832-685)
σ = 100	1040-1270(910-680)	
σ = 120	1030-1270(920-680)	
σ = 160	1020-1280(930-670)	
σ = 200	1000-1290(950-660)	

TABLE 3-K

RADIOCARBON AGE BP 860 CALIBRATED AGE: cal AD 1181
cal BP 769

Sample σ and cal AD(cal BP) ranges:

σ = 20	1165-1218(785-732)	
σ = 40	1159-1226(791-724)	
σ = 60	1047-1093(903-857)	1118-1246(832-704)
σ = 80	1039-1260(911-690)	
σ = 100	1030-1260(920-690)	
σ = 120	1020-1270(930-680)	
σ = 160	1010-1280(940-670)	
σ = 200	980-1290(970-660)	

RADIOCARBON AGE BP 880 CALIBRATED AGE: cal AD 1166
cal BP 784

Sample σ and cal AD(cal BP) ranges:

σ = 20	1159-1185(791-765)	
σ = 40	1047-1093(903-857)	1118-1217(832-733)
σ = 60	1039-1226(911-724)	
σ = 80	1030-1245(920-705)	
σ = 100	1020-1260(930-690)	
σ = 120	1020-1260(930-690)	
σ = 160	1000-1270(950-680)	
σ = 200	970-1280(980-670)	

RADIOCARBON AGE BP 900 CALIBRATED AGE: cal AD 1159
cal BP 791

Sample σ and cal AD(cal BP) ranges:

σ = 20	1047-1094(903-856)	1117-1166(833-784)
σ = 40	1038-1183(912-767)	
σ = 60	1030-1217(920-733)	
σ = 80	1024-1226(926-724)	
σ = 100	1020-1250(930-700)	
σ = 120	1010-1260(940-690)	
σ = 160	980-1270(970-680)	
σ = 200	960-1280(990-670)	

RADIOCARBON AGE BP 920 CALIBRATED AGES: cal AD 1047, 1092, 1119, 1143, 1153
cal BP 903, 858, 831, 807, 797

Sample σ and cal AD(cal BP) ranges:

σ = 20	1038-1160(912-790)	
σ = 40	1030-1166(920-784)	
σ = 60	1024-1183(926-767)	
σ = 80	1018-1217(932-733)	
σ = 100	1010-1230(940-720)	
σ = 120	1000-1250(950-700)	
σ = 160	970-1260(980-690)	
σ = 200	900-1270(1050-680)	

TABLE 3-L

RADIOCARBON AGE BP 940 CALIBRATED AGE: cal AD 1039
cal BP 911

Sample σ and cal AD(cal BP) ranges:

σ = 20	1030-1048(920-902)	1089-1120(861-830)	1142-1154(808-796)
σ = 40	1024-1160(926-790)		
σ = 60	1018-1166(932-784)		
σ = 80	1012-1182(938-768)		
σ = 100	1000-1220(950-730)		
σ = 120	980-1230(970-720)		
σ = 160	960-1260(990-690)		
σ = 200	890-1270(1060-680)		

RADIOCARBON AGE BP 960 CALIBRATED AGE: cal AD 1030
cal BP 920

Sample σ and cal AD(cal BP) ranges:

σ = 20	1024-1040(926-910)		
σ = 40	1018-1048(932-902)	1090-1119(860-831)	1142-1153(808-797)
σ = 60	1012-1160(938-790)		
σ = 80	999-1166(951-784)		
σ = 100	980-1180(970-770)		
σ = 120	970-1220(980-730)		
σ = 160	900-1250(1050-700)		
σ = 200	890-1260(1060-690)		

RADIOCARBON AGE BP 980 CALIBRATED AGE: cal AD 1024
cal BP 926

Sample σ and cal AD(cal BP) ranges:

σ = 20	1018-1031(932-919)		
σ = 40	1012-1039(938-911)		
σ = 60	999-1048(951-902)	1091-1119(859-831)	1142-1153(808-797)
σ = 80	985-1160(965-790)		
σ = 100	970-1170(980-780)		
σ = 120	960-1180(990-770)		
σ = 160	890-1230(1060-720)		
σ = 200	880-1260(1070-690)		

RADIOCARBON AGE BP 1000 CALIBRATED AGE: cal AD 1018
cal BP 932

Sample σ and cal AD(cal BP) ranges:

σ = 20	1012-1025(938-925)		
σ = 40	998-1031(952-919)		
σ = 60	985-1039(965-911)		
σ = 80	974-1048(976-902)	1091-1119(859-831)	1143-1153(807-797)
σ = 100	960-1160(990-790)		
σ = 120	900-1170(1050-780)		
σ = 160	890-1220(1060-730)		
σ = 200	810-1250(1140-700)		

TABLE 3-M

RADIOCARBON AGE BP 1020 CALIBRATED AGE: cal AD 1012
cal BP 938

Sample σ and cal AD(cal BP) ranges:

σ = 20	997-1019(953-931)		
σ = 40	984-1025(966-925)		
σ = 60	974-1031(976-919)		
σ = 80	960-1039(990-911)		
σ = 100	900-1050(1050-900)	1091-1119(859-831)	1143-1153(807-797)
σ = 120	890-1160(1060-790)		
σ = 160	880-1180(1070-770)		
σ = 200	790-1230(1160-720)		

RADIOCARBON AGE BP 1040 CALIBRATED AGE: cal AD 999
cal BP 951

Sample σ and cal AD(cal BP) ranges:

σ = 20	984-1013(966-937)		
σ = 40	974-1019(976-931)		
σ = 60	960-1025(990-925)		
σ = 80	897-1031(1053-919)		
σ = 100	890-1040(1060-910)		
σ = 120	890-1050(1060-900)	1091-1119(859-831)	1143-1153(807-797)
σ = 160	810-1170(1140-780)		
σ = 200	780-1220(1170-730)		

RADIOCARBON AGE BP 1060 CALIBRATED AGE: cal AD 985
cal BP 965

Sample σ and cal AD(cal BP) ranges:

σ = 20	973-1001(977-949)		
σ = 40	960-1013(990-937)		
σ = 60	897-1018(1053-932)		
σ = 80	891-1024(1059-926)		
σ = 100	890-1030(1060-920)		
σ = 120	880-1040(1070-910)		
σ = 160	790-1160(1160-790)		
σ = 200	725-735(1225-1215)	770-1180(1180-770)	

RADIOCARBON AGE BP 1080 CALIBRATED AGE: cal AD 974
cal BP 976

Sample σ and cal AD(cal BP) ranges:

σ = 20	959-986(991-964)		
σ = 40	897-1000(1053-950)		
σ = 60	891-1012(1059-938)		
σ = 80	886-1018(1064-932)		
σ = 100	880-1020(1070-930)		
σ = 120	810-1030(1140-920)		
σ = 160	780-1050(1170-900)	1091-1119(859-831)	1143-1153(807-797)
σ = 200	690-1170(1260-780)		

TABLE 3-N

RADIOCARBON AGE BP 1100 CALIBRATED AGE: cal AD 961
cal BP 989

Sample σ and cal AD(cal BP) ranges:

σ = 20	897-975(1053-975)		
σ = 40	891-985(1059-965)		
σ = 60	886-1000(1064-950)		
σ = 80	880-1012(1070-938)		
σ = 100	810-1020(1140-930)		
σ = 120	790-1020(1160-930)		
σ = 160	725-735(1225-1215)	770-1040(1180-910)	
σ = 200	680-1160(1270-790)		

RADIOCARBON AGE BP 1120 CALIBRATED AGE: cal AD 897
cal BP 1053

Sample σ and cal AD(cal BP) ranges:

σ = 20	891-963(1059-987)		
σ = 40	885-975(1065-975)		
σ = 60	880-986(1070-964)		
σ = 80	809-1000(1141-950)		
σ = 100	780-1010(1170-940)		
σ = 120	780-1020(1170-930)		
σ = 160	690-1030(1260-920)		
σ = 200	670-1050(1280-900)	1091-1119(859-831)	1143-1153(807-797)

RADIOCARBON AGE BP 1140 CALIBRATED AGE: cal AD 891
cal BP 1059

Sample σ and cal AD(cal BP) ranges:

σ = 20	885-898(1065-1052)	916-944(1034-1006)	
σ = 40	879-962(1071-988)		
σ = 60	809-975(1141-975)		
σ = 80	785-986(1165-964)		
σ = 100	780-1000(1170-950)		
σ = 120	724-735(1226-1215)	760-1010(1190-940)	
σ = 160	680-1020(1270-930)		
σ = 200	670-1040(1280-910)		

RADIOCARBON AGE BP 1160 CALIBRATED AGE: cal AD 886
cal BP 1064

Sample σ and cal AD(cal BP) ranges:

σ = 20	875-892(1075-1058)		
σ = 40	807-898(1143-1052)	920-941(1030-1009)	
σ = 60	785-962(1165-988)		
σ = 80	776-975(1174-975)		
σ = 100	724-736(1226-1214)	760-990(1190-960)	
σ = 120	690-1000(1260-950)		
σ = 160	670-1020(1280-930)		
σ = 200	660-1030(1290-920)		

TABLE 3-O

RADIOCARBON AGE BP 1180 CALIBRATED AGE: cal AD 880
cal BP 1070

Sample σ and cal AD(cal BP) ranges:

σ = 20	804-887(1146-1063)	
σ = 40	784-892(1166-1058)	
σ = 60	776-897(1174-1053)	933-940(1017-1010)
σ = 80	724-736(1226-1214)	764-961(1186-989)
σ = 100	690-970(1260-980)	
σ = 120	680-990(1270-960)	
σ = 160	670-1010(1280-940)	
σ = 200	650-1020(1300-930)	

RADIOCARBON AGE BP 1200 CALIBRATED AGES: cal AD 811, 847, 851
cal BP 1139, 1103, 1099

Sample σ and cal AD(cal BP) ranges:

σ = 20	784-881(1166-1069)	
σ = 40	776-886(1174-1064)	
σ = 60	724-736(1226-1214)	765-892(1185-1058)
σ = 80	689-897(1261-1053)	
σ = 100	680-960(1270-990)	
σ = 120	670-970(1280-980)	
σ = 160	660-1000(1290-950)	
σ = 200	650-1020(1300-930)	

RADIOCARBON AGE BP 1220 CALIBRATED AGE: cal AD 785
cal BP 1165

Sample σ and cal AD(cal BP) ranges:

σ = 20	775-816(1175-1134)	843-853(1107-1097)
σ = 40	724-736(1226-1214)	764-881(1186-1069)
σ = 60	689-886(1261-1064)	
σ = 80	681-892(1269-1058)	
σ = 100	670-900(1280-1050)	
σ = 120	670-960(1280-990)	
σ = 160	650-990(1300-960)	
σ = 200	640-1010(1310-940)	

RADIOCARBON AGE BP 1240 CALIBRATED AGE: cal AD 776
cal BP 1174

Sample σ and cal AD(cal BP) ranges:

σ = 20	723-737(1227-1213)	763-786(1187-1164)
σ = 40	689-814(1261-1136)	845-852(1105-1098)
σ = 60	681-881(1269-1069)	
σ = 80	673-886(1277-1064)	
σ = 100	670-890(1280-1060)	
σ = 120	660-900(1290-1050)	
σ = 160	650-970(1300-980)	
σ = 200	620-1000(1330-950)	

TABLE 3-P

RADIOCARBON AGE BP 1260 CALIBRATED AGES: cal AD 725, 735, 765
cal BP 1225, 1215, 1185

Sample σ and cal AD(cal BP) ranges:

σ = 20	688-777(1262-1173)	
σ = 40	681-786(1269-1164)	
σ = 60	673-812(1277-1138)	846-852(1104-1098)
σ = 80	666-881(1284-1069)	
σ = 100	660-890(1290-1060)	
σ = 120	650-890(1300-1060)	
σ = 160	640-960(1310-990)	
σ = 200	600-990(1350-960)	

RADIOCARBON AGE BP 1280 CALIBRATED AGE: cal AD 689
cal BP 1261

Sample σ and cal AD(cal BP) ranges:

σ = 20	679-769(1271-1181)	
σ = 40	672-777(1278-1173)	
σ = 60	666-786(1284-1164)	
σ = 80	660-814(1290-1136)	845-852(1105-1098)
σ = 100	650-880(1300-1070)	
σ = 120	650-890(1300-1060)	
σ = 160	620-900(1330-1050)	
σ = 200	600-970(1350-980)	

RADIOCARBON AGE BP 1300 CALIBRATED AGE: cal AD 681
cal BP 1269

Sample σ and cal AD(cal BP) ranges:

σ = 20	671-711(1279-1239)	748-752(1202-1198)
σ = 40	666-767(1284-1183)	
σ = 60	660-777(1290-1173)	
σ = 80	654-786(1296-1164)	
σ = 100	650-810(1300-1140)	845-852(1105-1098)
σ = 120	640-880(1310-1070)	
σ = 160	600-890(1350-1060)	
σ = 200	560-960(1390-990)	

RADIOCARBON AGE BP 1320 CALIBRATED AGE: cal AD 673
cal BP 1277

Sample σ and cal AD(cal BP) ranges:

σ = 20	665-683(1285-1267)	
σ = 40	660-696(1290-1254)	
σ = 60	654-767(1296-1183)	
σ = 80	647-777(1303-1173)	
σ = 100	640-790(1310-1160)	
σ = 120	620-810(1330-1140)	846-852(1104-1098)
σ = 160	600-890(1350-1060)	
σ = 200	550-900(1400-1050)	

TABLE 3-Q

RADIOCARBON AGE BP 1340 CALIBRATED AGE: cal AD 666
cal BP 1284

Sample σ and cal AD(cal BP) ranges:

σ = 20	659-674(1291-1276)	
σ = 40	654-682(1296-1268)	
σ = 60	647-690(1303-1260)	
σ = 80	636-766(1314-1184)	
σ = 100	620-780(1330-1170)	
σ = 120	600-790(1350-1160)	
σ = 160	560-880(1390-1070)	
σ = 200	540-890(1410-1060)	

RADIOCARBON AGE BP 1360 CALIBRATED AGE: cal AD 660
cal BP 1290

Sample σ and cal AD(cal BP) ranges:

σ = 20	653-667(1297-1283)	
σ = 40	646-674(1304-1276)	
σ = 60	636-682(1314-1268)	
σ = 80	619-690(1331-1260)	
σ = 100	600-770(1350-1180)	
σ = 120	600-780(1350-1170)	
σ = 160	550-810(1400-1140)	846-852(1104-1098)
σ = 200	461-478(1489-1472)	520-890(1430-1060)

RADIOCARBON AGE BP 1380 CALIBRATED AGE: cal AD 654
cal BP 1296

Sample σ and cal AD(cal BP) ranges:

σ = 20	645-661(1305-1289)	
σ = 40	636-667(1314-1283)	
σ = 60	619-674(1331-1276)	
σ = 80	604-681(1346-1269)	
σ = 100	595-689(1355-1261)	
σ = 120	560-770(1390-1180)	
σ = 160	540-790(1410-1160)	
σ = 200	440-880(1510-1070)	

RADIOCARBON AGE BP 1400 CALIBRATED AGE: cal AD 647
cal BP 1303

Sample σ and cal AD(cal BP) ranges:

σ = 20	635-655(1315-1295)	
σ = 40	618-661(1332-1289)	
σ = 60	604-667(1346-1283)	
σ = 80	595-673(1355-1277)	
σ = 100	560-680(1390-1270)	
σ = 120	550-690(1400-1260)	
σ = 160	461-479(1489-1471)	520-780(1430-1170)
σ = 200	430-810(1520-1140)	846-852(1104-1098)

TABLE 3-R

RADIOCARBON AGE BP 1420 CALIBRATED AGE: cal AD 637
cal BP 1313

Sample σ and cal AD(cal BP) ranges:

σ = 20	616-649(1334-1301)	
σ = 40	604-655(1346-1295)	
σ = 60	595-661(1355-1289)	
σ = 80	560-667(1390-1283)	
σ = 100	550-670(1400-1280)	
σ = 120	540-680(1410-1270)	
σ = 160	440-770(1510-1180)	
σ = 200	420-790(1530-1160)	

RADIOCARBON AGE BP 1440 CALIBRATED AGE: cal AD 620
cal BP 1330

Sample σ and cal AD(cal BP) ranges:

σ = 20	603-639(1347-1311)	
σ = 40	595-648(1355-1302)	
σ = 60	560-655(1390-1295)	
σ = 80	548-661(1402-1289)	
σ = 100	540-670(1410-1280)	
σ = 120	460-479(1490-1471)	520-670(1430-1280)
σ = 160	430-690(1520-1260)	
σ = 200	410-780(1540-1170)	

RADIOCARBON AGE BP 1460 CALIBRATED AGE: cal AD 605
cal BP 1345

Sample σ and cal AD(cal BP) ranges:

σ = 20	594-626(1356-1324)	
σ = 40	559-638(1391-1312)	
σ = 60	547-648(1403-1302)	
σ = 80	538-655(1412-1295)	
σ = 100	460-480(1490-1470)	520-660(1430-1290)
σ = 120	440-670(1510-1280)	
σ = 160	420-680(1530-1270)	
σ = 200	400-770(1550-1180)	

RADIOCARBON AGE BP 1480 CALIBRATED AGE: cal AD 596
cal BP 1354

Sample σ and cal AD(cal BP) ranges:

σ = 20	558-606(1392-1344)	
σ = 40	547-623(1403-1327)	
σ = 60	538-638(1412-1312)	
σ = 80	459-480(1491-1470)	514-648(1436-1302)
σ = 100	440-650(1510-1300)	
σ = 120	430-660(1520-1290)	
σ = 160	410-670(1540-1280)	
σ = 200	380-690(1570-1260)	

TABLE 3-S

RADIOCARBON AGE BP 1500 CALIBRATED AGE: cal AD 561
cal BP 1389

Sample σ and cal AD(cal BP) ranges:

σ = 20	546-598(1404-1352)	
σ = 40	538-606(1412-1344)	
σ = 60	458-481(1492-1469)	510-622(1440-1328)
σ = 80	440-637(1510-1313)	
σ = 100	430-650(1520-1300)	
σ = 120	420-650(1530-1300)	
σ = 160	400-670(1550-1280)	
σ = 200	340-680(1610-1270)	

RADIOCARBON AGE BP 1520 CALIBRATED AGE: cal AD 548
cal BP 1402

Sample σ and cal AD(cal BP) ranges:

σ = 20	537-564(1413-1386)	
σ = 40	457-482(1493-1468)	507-597(1443-1353)
σ = 60	440-605(1510-1345)	
σ = 80	429-622(1521-1328)	
σ = 100	420-640(1530-1310)	
σ = 120	410-650(1540-1300)	
σ = 160	380-660(1570-1290)	
σ = 200	265-281(1685-1669)	330-670(1620-1280)

RADIOCARBON AGE BP 1540 CALIBRATED AGE: cal AD 539
cal BP 1411

Sample σ and cal AD(cal BP) ranges:

σ = 20	452-487(1498-1463)	498-550(1452-1400)
σ = 40	440-562(1510-1388)	
σ = 60	429-596(1521-1354)	
σ = 80	420-605(1530-1345)	
σ = 100	410-620(1540-1330)	
σ = 120	400-640(1550-1310)	
σ = 160	340-650(1610-1300)	
σ = 200	257-297(1693-1653)	320-670(1630-1280)

RADIOCARBON AGE BP 1560 CALIBRATED AGES: cal AD 462, 477, 526
cal BP 1488, 1473, 1424

Sample σ and cal AD(cal BP) ranges:

σ = 20	439-541(1511-1409)	
σ = 40	428-549(1522-1401)	
σ = 60	420-562(1530-1388)	
σ = 80	411-596(1539-1354)	
σ = 100	400-600(1550-1350)	
σ = 120	380-620(1570-1330)	
σ = 160	265-281(1685-1669)	330-650(1620-1300)
σ = 200	250-660(1700-1290)	

TABLE 3-T

RADIOCARBON AGE BP 1580 CALIBRATED AGE: cal AD 441
cal BP 1509

Sample σ and cal AD(cal BP) ranges:

σ = 20	428-532(1522-1418)	
σ = 40	419-540(1531-1410)	
σ = 60	411-549(1539-1401)	
σ = 80	397-562(1553-1388)	
σ = 100	380-600(1570-1350)	
σ = 120	340-600(1610-1350)	
σ = 160	257-297(1693-1653)	320-640(1630-1310)
σ = 200	240-650(1710-1300)	

RADIOCARBON AGE BP 1600 CALIBRATED AGE: cal AD 429
cal BP 1521

Sample σ and cal AD(cal BP) ranges:

σ = 20	419-443(1531-1507)	
σ = 40	411-531(1539-1419)	
σ = 60	397-540(1553-1410)	
σ = 80	380-549(1570-1401)	
σ = 100	340-560(1610-1390)	
σ = 120	265-281(1685-1669)	330-600(1620-1350)
σ = 160	250-620(1700-1330)	
σ = 200	230-650(1720-1300)	

RADIOCARBON AGE BP 1620 CALIBRATED AGE: cal AD 420
cal BP 1530

Sample σ and cal AD(cal BP) ranges:

σ = 20	410-431(1540-1519)	
σ = 40	396-442(1554-1508)	
σ = 60	379-530(1571-1420)	
σ = 80	342-539(1608-1411)	
σ = 100	264-281(1686-1669)	330-550(1620-1400)
σ = 120	257-297(1693-1653)	320-560(1630-1390)
σ = 160	240-600(1710-1350)	
σ = 200	210-640(1740-1310)	

RADIOCARBON AGE BP 1640 CALIBRATED AGE: cal AD 412
cal BP 1538

Sample σ and cal AD(cal BP) ranges:

σ = 20	395-422(1555-1528)		
σ = 40	379-430(1571-1520)		
σ = 60	342-442(1608-1508)		
σ = 80	264-281(1686-1669)	333-464(1617-1486)	475-530(1475-1420)
σ = 100	257-297(1693-1653)	320-540(1630-1410)	
σ = 120	250-550(1700-1400)		
σ = 160	230-600(1720-1350)		
σ = 200	140-620(1810-1330)		

TABLE 3-U

RADIOCARBON AGE BP 1660 CALIBRATED AGE: cal AD 398
cal BP 1552

Sample σ and cal AD(cal BP) ranges:

σ = 20	377-413(1573-1537)	
σ = 40	342-421(1608-1529)	
σ = 60	264-281(1686-1669)	332-430(1618-1520)
σ = 80	257-297(1693-1653)	320-441(1630-1509)
σ = 100	250-460(1700-1490)	476-530(1474-1420)
σ = 120	240-540(1710-1410)	
σ = 160	210-560(1740-1390)	
σ = 200	130-600(1820-1350)	

RADIOCARBON AGE BP 1680 CALIBRATED AGE: cal AD 381
cal BP 1569

Sample σ and cal AD(cal BP) ranges:

σ = 20	341-400(1609-1550)	
σ = 40	264-282(1686-1668)	332-412(1618-1538)
σ = 60	257-297(1693-1653)	320-421(1630-1529)
σ = 80	249-430(1701-1520)	
σ = 100	240-440(1710-1510)	
σ = 120	230-460(1720-1490)	476-530(1474-1420)
σ = 160	140-550(1810-1400)	
σ = 200	120-600(1830-1350)	

RADIOCARBON AGE BP 1700 CALIBRATED AGE: cal AD 343
cal BP 1607

Sample σ and cal AD(cal BP) ranges:

σ = 20	263-284(1687-1666)	331-385(1619-1565)
σ = 40	256-298(1694-1652)	319-399(1631-1551)
σ = 60	248-412(1702-1538)	
σ = 80	238-421(1712-1529)	
σ = 100	230-430(1720-1520)	
σ = 120	210-440(1740-1510)	
σ = 160	130-540(1820-1410)	
σ = 200	90-560(1860-1390)	

RADIOCARBON AGE BP 1720 CALIBRATED AGES: cal AD 265, 281, 333
cal BP 1685, 1669, 1617

Sample σ and cal AD(cal BP) ranges:

σ = 20	256-299(1694-1651)	319-344(1631-1606)
σ = 40	248-382(1702-1568)	
σ = 60	238-399(1712-1551)	
σ = 80	227-412(1723-1538)	
σ = 100	210-420(1740-1530)	
σ = 120	140-430(1810-1520)	
σ = 160	120-460(1830-1490)	476-530(1474-1420)
σ = 200	80-550(1870-1400)	

TABLE 3-V

RADIOCARBON AGE BP 1740 CALIBRATED AGES: cal AD 257, 296, 321
cal BP 1693, 1654, 1629

Sample σ and cal AD(cal BP) ranges:

σ = 20	247-266(1703-1684)	278-335(1672-1615)
σ = 40	237-344(1713-1606)	
σ = 60	226-382(1724-1568)	
σ = 80	213-398(1737-1552)	
σ = 100	140-410(1810-1540)	
σ = 120	130-420(1820-1530)	
σ = 160	90-440(1860-1510)	
σ = 200	70-540(1880-1410)	

RADIOCARBON AGE BP 1760 CALIBRATED AGE: cal AD 249
cal BP 1701

Sample σ and cal AD(cal BP) ranges:

σ = 20	237-258(1713-1692)	294-323(1656-1627)
σ = 40	226-265(1724-1685)	280-334(1670-1616)
σ = 60	213-343(1737-1607)	
σ = 80	140-381(1810-1569)	
σ = 100	130-400(1820-1550)	
σ = 120	120-410(1830-1540)	
σ = 160	80-430(1870-1520)	
σ = 200	30-460(1920-1490)	477-529(1473-1421)

RADIOCARBON AGE BP 1780 CALIBRATED AGE: cal AD 238
cal BP 1712

Sample σ and cal AD(cal BP) ranges:

σ = 20	225-251(1725-1699)	
σ = 40	213-258(1737-1692)	295-322(1655-1628)
σ = 60	140-265(1810-1685)	280-334(1670-1616)
σ = 80	128-343(1822-1607)	
σ = 100	120-380(1830-1570)	
σ = 120	90-400(1860-1550)	
σ = 160	70-420(1880-1530)	
σ = 200	20-440(1930-1510)	

RADIOCARBON AGE BP 1800 CALIBRATED AGE: cal AD 227
cal BP 1723

Sample σ and cal AD(cal BP) ranges:

σ = 20	150-152(1800-1798)	212-240(1738-1710)
σ = 40	139-250(1811-1700)	
σ = 60	128-258(1822-1692)	295-322(1655-1628)
σ = 80	118-265(1832-1685)	280-334(1670-1616)
σ = 100	90-340(1860-1610)	
σ = 120	80-380(1870-1570)	
σ = 160	30-410(1920-1540)	
σ = 200	cal BC 1-cal AD 430(1950-1520)	

TABLE 3-W

RADIOCARBON AGE BP 1820 CALIBRATED AGE: cal AD 214
cal BP 1736

Sample σ and cal AD(cal BP) ranges:

σ = 20	138-230(1812-1720)	
σ = 40	128-240(1822-1710)	
σ = 60	118-250(1832-1700)	
σ = 80	87-258(1863-1692)	296-322(1654-1628)
σ = 100	80-270(1870-1680)	280-333(1670-1617)
σ = 120	70-340(1880-1610)	
σ = 160	10-400(1940-1550)	
σ = 200	cal BC 40-cal AD 420(1990-1530)	

RADIOCARBON AGE BP 1840 CALIBRATED AGE: cal AD 140
cal BP 1810

Sample σ and cal AD(cal BP) ranges:

σ = 20	127-216(1823-1734)	
σ = 40	118-228(1832-1722)	
σ = 60	87-239(1863-1711)	
σ = 80	77-250(1873-1700)	
σ = 100	70-260(1880-1690)	296-321(1654-1629)
σ = 120	30-260(1920-1690)	280-333(1670-1617)
σ = 160	cal BC 1-cal AD 380(1950-1570)	
σ = 200	cal BC 50-cal AD 410(2000-1540)	

RADIOCARBON AGE BP 1860 CALIBRATED AGE: cal AD 129
cal BP 1821

Sample σ and cal AD(cal BP) ranges:

σ = 20	117-142(1833-1808)	
σ = 40	86-215(1864-1735)	
σ = 60	77-228(1873-1722)	
σ = 80	65-239(1885-1711)	
σ = 100	30-250(1920-1700)	
σ = 120	10-260(1940-1690)	296-321(1654-1629)
σ = 160	cal BC 40-cal AD 340(1990-1610)	
σ = 200	cal BC 100-cal AD 400(2050-1550)	

RADIOCARBON AGE BP 1880 CALIBRATED AGE: cal AD 118
cal BP 1832

Sample σ and cal AD(cal BP) ranges:

σ = 20	86-130(1864-1820)	
σ = 40	76-141(1874-1809)	
σ = 60	65-215(1885-1735)	
σ = 80	27-228(1923-1722)	
σ = 100	10-240(1940-1710)	
σ = 120	cal BC 1-cal AD 250(1950-1700)	
σ = 160	cal BC 50-cal AD 260(2000-1690)	280-333(1670-1617)
σ = 200	cal BC 110-cal AD 380(2060-1570)	

TABLE 3-X

RADIOCARBON AGE BP 1900 CALIBRATED AGE: cal AD 87
cal BP 1863

Sample σ and cal AD(cal BP) ranges:

σ = 20	76-120(1874-1830)	
σ = 40	65-129(1885-1821)	
σ = 60	27-141(1923-1809)	
σ = 80	15-215(1935-1735)	
σ = 100	cal BC 1-cal AD 230(1950-1720)	
σ = 120	cal BC 40-cal AD 240(1990-1710)	
σ = 160	cal BC 100-cal AD 260(2050-1690)	296-321(1654-1629)
σ = 200	cal BC 151-149(2100-2098)	cal BC 120-cal AD 340(2070-1610)

RADIOCARBON AGE BP 1920 CALIBRATED AGE: cal AD 77
cal BP 1873

Sample σ and cal AD(cal BP) ranges:

σ = 20	64-89(1886-1861)	
σ = 40	27-119(1923-1831)	
σ = 60	14-129(1936-1821)	
σ = 80	cal BC 2-cal AD 141(1951-1809)	
σ = 100	cal BC 40-cal AD 210(1990-1740)	
σ = 120	cal BC 50-cal AD 230(2000-1720)	
σ = 160	cal BC 110-cal AD 250(2060-1700)	
σ = 200	cal BC 170-cal AD 260(2120-1690)	280-333(1670-1617)

RADIOCARBON AGE BP 1940 CALIBRATED AGE: cal AD 66
cal BP 1884

Sample σ and cal AD(cal BP) ranges:

σ = 20	26-78(1924-1872)	
σ = 40	14-88(1936-1862)	
σ = 60	cal BC 2-cal AD 119(1951-1831)	
σ = 80	cal BC 36-cal AD 129(1985-1821)	
σ = 100	cal BC 50-cal AD 140(2000-1810)	
σ = 120	cal BC 100-cal AD 210(2050-1740)	
σ = 160	cal BC 151-149(2100-2098)	cal BC 120-cal AD 240(2070-1710)
σ = 200	cal BC 190-cal AD 260(2140-1690)	296-321(1654-1629)

RADIOCARBON AGE BP 1960 CALIBRATED AGES: cal AD 28, 44, 51
cal BP 1922, 1906, 1899

Sample σ and cal AD(cal BP) ranges:

σ = 20	14-68(1936-1882)
σ = 40	cal BC 2-cal AD 78(1951-1872)
σ = 60	cal BC 37-cal AD 88(1986-1862)
σ = 80	cal BC 55-cal AD 119(2004-1831)
σ = 100	cal BC 100-cal AD 130(2050-1820)
σ = 120	cal BC 110-cal AD 140(2060-1810)
σ = 160	cal BC 170-cal AD 230(2120-1720)
σ = 200	cal BC 200-cal AD 250(2150-1700)

TABLE 3-Y

RADIOCARBON AGE BP 1980 CALIBRATED AGE: cal AD 15
cal BP 1935

Sample σ and cal AD(cal BP) ranges:
σ = 20 cal BC 3-cal AD 53(1952-1897)
σ = 40 cal BC 37-cal AD 67(1986-1883)
σ = 60 cal BC 56-cal AD 78(2005-1872)
σ = 80 cal BC 97-cal AD 88(2046-1862)
σ = 100 cal BC 110-cal AD 120(2060-1830)
σ = 120 cal BC 151-149(2100-2098) cal BC 120-cal AD 130(2070-1820)
σ = 160 cal BC 190-cal AD 210(2140-1740)
σ = 200 cal BC 340-322(2289-2271) cal BC 200-cal AD 240(2150-1710)

RADIOCARBON AGE BP 2000 CALIBRATED AGE: cal BC 1
cal BP 1950

Sample σ and cal BC(cal BP) ranges:
σ = 20 cal BC 37-cal AD 16(1986-1934)
σ = 40 cal BC 58-cal AD 28(2007-1922) cal AD 40-52(1910-1898)
σ = 60 cal BC 97-cal AD 66(2046-1884)
σ = 80 cal BC 105-cal AD 78(2054-1872)
σ = 100 151-149(2100-2098) cal BC 120-cal AD 90(2070-1860)
σ = 120 cal BC 170-cal AD 120(2120-1830)
σ = 160 cal BC 200-cal AD 140(2150-1810)
σ = 200 353-306(2302-2255) cal BC 240-cal AD 230(2190-1720)

RADIOCARBON AGE BP 2020 CALIBRATED AGE: cal BC 36
cal BP 1985

Sample σ and cal BC(cal BP) ranges:
σ = 20 cal BC 65-cal AD 1(2014-1949)
σ = 40 cal BC 97-cal AD 16(2046-1934)
σ = 60 cal BC 105-cal AD 28(2054-1922) cal AD 42-52(1908-1898)
σ = 80 151-149(2100-2098) cal BC 117-cal AD 66(2066-1884)
σ = 100 cal BC 170-cal AD 80(2120-1870)
σ = 120 cal BC 190-cal AD 90(2140-1860)
σ = 160 340-322(2289-2271) cal BC 200-cal AD 130(2150-1820)
σ = 200 362-282(2311-2231) cal BC 260-cal AD 210(2210-1740)

RADIOCARBON AGE BP 2040 CALIBRATED AGE: cal BC 50
cal BP 1999

Sample σ and cal BC(cal BP) ranges:
σ = 20 97-34(2046-1983)
σ = 40 cal BC 106-cal AD 1(2055-1949)
σ = 60 151-148(2100-2097) cal BC 117-cal AD 16(2066-1934)
σ = 80 cal BC 169-cal AD 28(2118-1922) cal AD 42-51(1908-1899)
σ = 100 cal BC 190-cal AD 70(2140-1880)
σ = 120 cal BC 200-cal AD 80(2150-1870)
σ = 160 353-306(2302-2255) cal BC 240-cal AD 120(2190-1830)
σ = 200 cal BC 370-cal AD 140(2320-1810)

TABLE 3-Z

RADIOCARBON AGE BP 2060 CALIBRATED AGE: cal BC 96
cal BP 2045

Sample σ and cal BC(cal BP) ranges:
σ = 20 106-49(2055-1998)
σ = 40 152-148(2101-2097) 117-35(2066-1984)
σ = 60 169-1(2118-1950)
σ = 80 cal BC 187-cal AD 16(2136-1934)
σ = 100 cal BC 200-cal AD 30(2150-1920) cal AD 42-51(1908-1899)
σ = 120 340-322(2289-2271) cal BC 200-cal AD 70(2150-1880)
σ = 160 362-282(2311-2231) cal BC 260-cal AD 90(2210-1860)
σ = 200 cal BC 380-cal AD 130(2330-1820)

RADIOCARBON AGE BP 2080 CALIBRATED AGE: cal BC 105
cal BP 2054

Sample σ and cal BC(cal BP) ranges:
σ = 20 153-147(2102-2096) 118-95(2067-2044)
σ = 40 169-49(2118-1998)
σ = 60 187-35(2136-1984)
σ = 80 196-1(2145-1950)
σ = 100 340-322(2289-2271) cal BC 200-cal AD 20(2150-1930)
σ = 120 353-305(2302-2254) cal BC 240-cal AD 30(2190-1920)
cal AD 43-51(1907-1899)
σ = 160 cal BC 370-cal AD 80(2320-1870)
σ = 200 cal BC 390-cal AD 120(2340-1830)

RADIOCARBON AGE BP 2100 CALIBRATED AGES: cal BC 151, 149, 117
cal BP 2100, 2098, 2066

Sample σ and cal BC(cal BP) ranges:
σ = 20 171-104(2120-2053)
σ = 40 188-96(2137-2045)
σ = 60 196-49(2145-1998)
σ = 80 340-322(2289-2271) 204-35(2153-1984)
σ = 100 354-305(2303-2254) 240-1(2190-1950)
σ = 120 362-282(2311-2231) cal BC 260-cal AD 20(2210-1930)
σ = 160 cal BC 380-cal AD 70(2330-1880)
σ = 200 cal BC 390-cal AD 90(2340-1860)

RADIOCARBON AGE BP 2120 CALIBRATED AGE: cal BC 168
cal BP 2117

Sample σ and cal BC(cal BP) ranges:
σ = 20 189-114(2138-2063)
σ = 40 197-104(2146-2053)
σ = 60 340-322(2289-2271) 204-96(2153-2045)
σ = 80 354-305(2303-2254) 238-49(2187-1998)
σ = 100 362-282(2311-2231) 260-40(2210-1990)
σ = 120 370-1(2320-1950)
σ = 160 cal BC 390-cal AD 30(2340-1920) cal AD 43-51(1907-1899)
σ = 200 cal BC 400-cal AD 80(2350-1870)

TABLE 3-AA

RADIOCARBON AGE BP 2140 CALIBRATED AGE: cal BC 187
cal BP 2136

Sample σ and cal BC(cal BP) ranges:

σ = 20	197-166(2146-2115)	131-129(2080-2078)
σ = 40	341-322(2290-2271)	204-116(2153-2065)
σ = 60	354-304(2303-2253)	238-105(2187-2054)
σ = 80	362-282(2311-2231)	258-96(2207-2045)
σ = 100	370-50(2320-2000)	
σ = 120	380-40(2330-1990)	
σ = 160	cal BC 390-cal AD 20(2340-1930)	
σ = 200	cal BC 400-cal AD 70(2350-1880)	

RADIOCARBON AGE BP 2160 CALIBRATED AGE: cal BC 196
cal BP 2145

Sample σ and cal BC(cal BP) ranges:

σ = 20	342-321(2291-2270)	204-184(2153-2133)
σ = 40	354-303(2303-2252)	239-167(2188-2116)
σ = 60	362-282(2311-2231)	259-116(2208-2065)
σ = 80	370-105(2319-2054)	
σ = 100	380-100(2330-2050)	
σ = 120	390-50(2340-2000)	
σ = 160	400-1(2350-1950)	
σ = 200	cal BC 400-cal AD 30(2350-1920)	cal AD 43-51(1907-1899)

RADIOCARBON AGE BP 2180 CALIBRATED AGES: cal BC 339, 323, 203
cal BP 2288, 2272, 2152

Sample σ and cal BC(cal BP) ranges:

σ = 20	355-300(2304-2249)	242-195(2191-2144)
σ = 40	362-281(2311-2230)	259-185(2208-2134)
σ = 60	371-167(2320-2116)	
σ = 80	379-116(2328-2065)	
σ = 100	390-100(2340-2050)	
σ = 120	390-100(2340-2050)	
σ = 160	400-40(2350-1990)	
σ = 200	cal BC 410-cal AD 20(2360-1930)	

RADIOCARBON AGE BP 2200 CALIBRATED AGES: cal BC 353, 306, 236
cal BP 2302, 2255, 2185

Sample σ and cal BC(cal BP) ranges:

σ = 20	363-337(2312-2286)	325-280(2274-2229)	260-202(2209-2151)
σ = 40	371-195(2320-2144)		
σ = 60	379-186(2328-2135)		
σ = 80	388-168(2337-2117)		
σ = 100	390-120(2340-2070)		
σ = 120	400-100(2350-2050)		
σ = 160	400-50(2350-2000)		
σ = 200	410-1(2360-1950)		

TABLE 3-BB

RADIOCARBON AGE BP 2220 CALIBRATED AGES: cal BC 362, 282, 258
cal BP 2311, 2231, 2207

Sample σ and cal BC(cal BP) ranges:

σ = 20	371-352(2320-2301)	311-210(2260-2159)
σ = 40	380-338(2329-2287)	324-203(2273-2152)
σ = 60	388-196(2337-2145)	
σ = 80	392-186(2341-2135)	
σ = 100	400-170(2350-2120)	
σ = 120	400-120(2350-2070)	
σ = 160	410-100(2360-2050)	
σ = 200	485-437(2434-2386)	420-40(2370-1990)

RADIOCARBON AGE BP 2240 CALIBRATED AGE: cal BC 370
cal BP 2319

Sample σ and cal BC(cal BP) ranges:

σ = 20	380-361(2329-2310)	284-256(2233-2205)
σ = 40	388-353(2337-2302)	309-233(2258-2182)
σ = 60	392-338(2341-2287)	323-203(2272-2152)
σ = 80	396-196(2345-2145)	
σ = 100	400-190(2350-2140)	
σ = 120	400-170(2350-2120)	
σ = 160	410-110(2360-2060)	
σ = 200	520-50(2470-2000)	

RADIOCARBON AGE BP 2260 CALIBRATED AGE: cal BC 379
cal BP 2328

Sample σ and cal BC(cal BP) ranges:

σ = 20	389-369(2338-2318)	271-269(2220-2218)
σ = 40	393-361(2342-2310)	283-257(2232-2206)
σ = 60	396-353(2345-2302)	308-234(2257-2183)
σ = 80	399-339(2348-2288)	323-203(2272-2152)
σ = 100	400-200(2350-2150)	
σ = 120	410-190(2360-2140)	
σ = 160	485-437(2434-2386)	420-120(2370-2070)
σ = 200	755-698(2704-2647)	540-100(2490-2050)

RADIOCARBON AGE BP 2280 CALIBRATED AGE: cal BC 388
cal BP 2337

Sample σ and cal BC(cal BP) ranges:

σ = 20	393-378(2342-2327)		
σ = 40	396-370(2345-2319)		
σ = 60	399-361(2348-2310)	283-257(2232-2206)	
σ = 80	402-353(2351-2302)	308-235(2257-2184)	
σ = 100	405-339(2354-2288)	320-200(2270-2150)	
σ = 120	410-200(2360-2150)		
σ = 160	520-170(2470-2120)		
σ = 200	760-683(2709-2632)	657-638(2606-2587)	592-586(2541-2535)
	550-110(2500-2060)		

TABLE 3-CC

RADIOCARBON AGE BP 2300 CALIBRATED AGE: cal BC 392
cal BP 2341

Sample σ and cal BC(cal BP) ranges:

σ = 20	396-386(2345-2335)		
σ = 40	399-378(2348-2327)		
σ = 60	402-370(2351-2319)		
σ = 80	405-361(2354-2310)	283-257(2232-2206)	
σ = 100	408-353(2357-2302)	308-235(2257-2184)	
σ = 120	486-437(2435-2386)	424-339(2373-2288)	320-200(2270-2150)
σ = 160	755-698(2704-2647)	540-190(2490-2140)	
σ = 200	760-120(2710-2070)		

RADIOCARBON AGE BP 2320 CALIBRATED AGE: cal BC 395
cal BP 2344

Sample σ and cal BC(cal BP) ranges:

σ = 20	399-392(2348-2341)		
σ = 40	402-387(2351-2336)		
σ = 60	405-378(2354-2327)		
σ = 80	408-370(2357-2319)		
σ = 100	486-437(2435-2386)	424-361(2373-2310)	283-258(2232-2207)
σ = 120	520-350(2470-2300)	307-235(2256-2184)	
σ = 160	760-683(2709-2632)	657-637(2606-2586)	592-586(2541-2535)
	550-200(2500-2150)		
σ = 200	770-170(2720-2120)		

RADIOCARBON AGE BP 2340 CALIBRATED AGE: cal BC 399
cal BP 2348

Sample σ and cal BC(cal BP) ranges:

σ = 20	402-395(2351-2344)		
σ = 40	405-392(2354-2341)		
σ = 60	408-387(2357-2336)		
σ = 80	487-436(2436-2385)	425-378(2374-2327)	
σ = 100	520-370(2470-2320)		
σ = 120	755-698(2704-2647)	540-360(2490-2310)	283-258(2232-2207)
σ = 160	760-340(2710-2290)	320-200(2270-2150)	
σ = 200	790-190(2740-2140)		

RADIOCARBON AGE BP 2360 CALIBRATED AGE: cal BC 402
cal BP 2351

Sample σ and cal BC(cal BP) ranges:

σ = 20	406-398(2355-2347)		
σ = 40	408-395(2357-2344)		
σ = 60	488-436(2437-2385)	425-392(2374-2341)	
σ = 80	524-387(2473-2336)		
σ = 100	755-698(2704-2647)	540-380(2490-2330)	
σ = 120	760-683(2709-2632)	657-637(2606-2586)	592-586(2541-2535)
	550-370(2500-2320)		
σ = 160	770-350(2720-2300)	307-235(2256-2184)	
σ = 200	790-200(2740-2150)		

TABLE 3-DD

RADIOCARBON AGE BP 2380 CALIBRATED AGE: cal BC 405
cal BP 2354

Sample σ and cal BC(cal BP) ranges:

σ = 20	409-401(2358-2350)		
σ = 40	489-398(2438-2347)		
σ = 60	524-395(2473-2344)		
σ = 80	755-698(2704-2647)	537-392(2486-2341)	
σ = 100	760-683(2709-2632)	657-637(2606-2586)	592-586(2541-2535)
	550-390(2500-2340)		
σ = 120	760-380(2710-2330)		
σ = 160	790-360(2740-2310)	283-258(2232-2207)	
σ = 200	800-340(2750-2290)	320-200(2270-2150)	

RADIOCARBON AGE BP 2400 CALIBRATED AGE: cal BC 408
cal BP 2357

Sample σ and cal BC(cal BP) ranges:

σ = 20	511-405(2460-2354)		
σ = 40	750-730(2699-2679)	524-402(2473-2351)	
σ = 60	755-697(2704-2646)	538-398(2487-2347)	
σ = 80	760-683(2709-2632)	657-637(2606-2586)	592-585(2541-2534)
	553-395(2502-2344)		
σ = 100	760-390(2710-2340)		
σ = 120	770-390(2720-2340)		
σ = 160	790-370(2740-2320)		
σ = 200	800-350(2750-2300)	307-235(2256-2184)	

RADIOCARBON AGE BP 2420 CALIBRATED AGES: cal BC 484, 438, 423
cal BP 2433, 2387, 2372

Sample σ and cal BC(cal BP) ranges:

σ = 20	750-726(2699-2675)	525-408(2474-2357)	
σ = 40	755-697(2704-2646)	538-405(2487-2354)	
σ = 60	760-683(2709-2632)	657-637(2606-2586)	592-585(2541-2534)
	553-402(2502-2351)		
σ = 80	765-399(2714-2348)		
σ = 100	770-400(2720-2350)		
σ = 120	790-390(2740-2340)		
σ = 160	800-380(2750-2330)		
σ = 200	810-360(2760-2310)	283-258(2232-2207)	

RADIOCARBON AGE BP 2440 CALIBRATED AGE: cal BC 523
cal BP 2472

Sample σ and cal BC(cal BP) ranges:

σ = 20	755-696(2704-2645)	538-478(2487-2427)	442-420(2391-2369)
σ = 40	760-683(2709-2632)	657-637(2606-2586)	592-585(2541-2534)
	553-408(2502-2357)		
σ = 60	765-405(2714-2354)		
σ = 80	770-402(2719-2351)		
σ = 100	790-400(2740-2350)		
σ = 120	790-400(2740-2350)		
σ = 160	800-390(2750-2340)		
σ = 200	810-370(2760-2320)		