RADIOCARBON DATING CERTIFICATE

Sample sent for analysis by:

J S Dent
45 Grosvenor Terrace
York
YO3 7AG

Code: 199   HBMC

Laboratory Results:

1	2	3	4	5	6
HARWELL REF.	SENDERS REF.	TYPE	DC13 (o/oo)	AGE BP (YRS)	Cal RANGES (IML program, data of Stuiver & Reimer, 1986)
Har-8539	WK 017	Charcoal	-27.8	3980 ± 100	68% 2660 BC to 2380 BC and 95% 2880 BC to 2150 BC

Report:

Wet Wang Slack series

Charcoal Subm April 1987 by John S Dent.

This certifies that the sample given above has been analysed for CARBON-14
at this laboratory. The results, expressed as DC13, AGE BP and Cal RANGES,
are given in accordance with the method outlined in the accompanying
Notes Sheet, NS/2/88.

R.L.Otlet.

(16/ 8/89)

Revised notes on the method of reporting radiocarbon results in
the Radiocarbon Dating Certificate

Following recommendations at the 12th Radiocarbon Conference (1985,
Trondheim) reaffirmed at the 13th Radiocarbon Conference in Dubrovnik
(1988) concerning the procedure by which laboratories should report
results, it has been decided that the format of the certificates
issued by this laboratory should be changed accordingly. In altering the
certificate format to accommodate this change the opportunity has been
taken to revise the layout and ancillary information it provides. The
essential difference concerns dropping the use of lower case "ad", "bc"
and "bp" which are no longer acceptable for publications.

Calibrations, expressed as 68% and 95% confidence ranges have been added
and replace the earlier "bp-1950" which should no longer be used in
results specifications. Calibrated results should be expressed as "cal
AD" or "cal BC" as appropriate.

A further modification concerns the presentation, in Radiocarbon
publication style, of the notes originally provided with the submission
of the samples. If this report is acceptable to the submitter it can be
presented for publication (and entry on the Harwell data base) as it
stands. Alternatively, corrections and/or alterations can still be
included but in this case please return the form "Information for
Radiocarbon Publication and Database Entry", which is arranged in
numbered sections to facilitate computer entry, with the required
amendments marked in.

Explanation of the results presentation in the box section "Laboratory
Results on the Certificate" is detailed below:

1. Age BP (Column 5): is the conventional Radiocarbon Age calculated
using the following Standards and parameters.

    1.1 Half-life: The old (W. F. Libby) value 5570 years
         is used. This is in accordance with the decision of
         the Fifth Radiocarbon Dating Conference, Cambridge,
         1962 and reaffirmed at similar meetings since. It is
         also a requirement of the publishers of 'Radiocarbon',
         that this half-life value is used in dates reported
         therein.

    1.2 Modern Standard: The oxalic acid standard issued
         by the National Bureau of standards (NBS), Washington
         is used. Following the recommended practice, 'Modern'
         is taken as 0.95 times the activity of the standard
         after correction for fractionation during its preparation.
         Reference standards are routinely checked against freshly
         prepared samples of the NBS oxalic acid.

1.3 <u>Background Standards</u>: Background values are obtained from samples Marble, Coke or Fuel Oil routinely made using the full sample preparation process.

1.4 <u>Stable Isotope Correction</u>: This is expressed as DC13 (Column 4) and represents ^{13}C, the deviation per mil, of the ratio of the stable isotopes $^{13}C/^{12}C$ of the sample from that of an adopted standard (PDB). The 'Age BP' value quoted (Column 5) is already corrected for the ^{13}C value given in Column 4. If there is no measurement of ^{13}C, a value is assumed which causes zero correction to be applied in the 'Age BP' calculation, ie, -25.0 °/oo.

2. <u>Accuracy</u> in the measurement of 'Age BP' (Column 5), is expressed in the associated error term as $\pm$ 1 (standard deviation) inherent to the measurement process relative to the declared value of the modern standard, detailed above (1.2). It includes the laboratory's estimate of the full process reproducibility, which is based on counting statistics and other quantifiable parameters combined with the observed reproducibility in replicated background and modern samples (Otlet, 1979), ie, 68% of all identical replicate samples are expected to give results within the limits of $\pm$ 1 ; 95% are expected to give results within $\pm$ 2 . It is, however, not an error which can in any way allow for the integrity of the sample or any judgement based on geologic or archaeologic grounds, nor should it be applied unmodified to a calibrated result.

3. <u>Cal Ranges</u>: (Column 6) These ranges are computed during the results calculation procedure using a local IML program with the data files ATM20.C14 provided by Washington University, USA (Stuiver and Reimer, 1986) compiled by them from the recommended calibration data of Stuiver and Pearson, (1986) Pearson and Stuiver (1986) and Pearson et al (1986). The values are intended as an approximate guide to possible calibration solutions and are given with every individual result. Attention is drawn to the fact, however, that where a group of samples representing the same event is concerned, individual calibrations are inappropriate and the uncalibrated results should be amalgamated before making a single new calibration on the grouped mean. There are now numerous software packages on which more detailed probability results and graphical solutions can be obtained. These were reviewed by Aitchison <u>et al</u> at the 13th Radiocarbon Conference in Dubrovnik, 1988, where small, but in most cases not too significant, differences were seen between the various results and presentation formats but no definitive recommendation as to which should be adopted was forthcoming.

R. L. Otlet
Isotope Measurements Laboratory,
B.10.46
Harwell Laboratory.

December 1988

References

Aitchison, T C, Leese, M, Michczynska, D J, Mook, W, Otlet, R L, Ottaway, B S, Pazdur, M F, van der Plicht, J, Reimer, P J, Robinson, S W, Scott, E M, Stuiver, M and Weninger, B, in press, A Comparison of Methods Used for the Calibration of Radiocarbon Dates, paper presented at 13th Internatl Radiocarbon Conf, Dubrovnik, 1988, to be published in Radiocarbon, probably 1989.

Otlet, R L, 1979, An Assessment of Errors in Liquid Scintillation Counting, in Berger, R and Suess, H E, eds, Radiocarbon Dating, Internatl ^{14}C Conf, 9th, Proc: Berkeley, Univ California Press, p 256-267.

Pearson, Gordon W and Stuiver, Minze, 1986, High-Precision Calibration of the Radiocarbon Time Scale, 500-2500 BC, Radiocarbon, 28, No. 2B, p 839-862.

Pearson, G W, Pilcher, J R, Baillie, M G L, Corbett, D M and Qua, F, 1986, High-Precision ^{14}C Measurement of Irish Oaks to show the natural ^{14}C Variations from AD 1840-5210 BC, Radiocarbon, 28, NO. 2B, p 911-934

Stuiver, Minze and Pearson, Gordon W, 1986, High-Precision Calibration of the Radiocarbon Time Scale, AD 1950-500 BC, Radiocarbon, 28, No. 2B, p 805-838.

Stuiver, Minze and Reimer, P J, 1986, A Computer Program for Radiocarbon Age Calibration, Radiocarbon, 28, No. 2B, p 1022-1029