

**CAMBRIDGE UNIVERSITY
NATURAL RADIOCARBON MEASUREMENTS VII**

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INTRODUCTION

The dates and activity measurements given below have been obtained during 1963 and 1964, and have been made with CO₂ at 3 atm pressure in a proportional gas-counter as described in previous contributions from this laboratory. We have again concentrated chiefly upon research projects pursued in the University Sub-department of Quaternary Research, but have continued final determinations also in the series of samples of CO₂ collected in the lower stratosphere and described in our date list VI.

We particularly wish to acknowledge the help of G. A. Sutton, Technical Assistant in the Radiocarbon Dating Laboratory and of the Scientific Assistants C. A. Raven and M. A. Hall. Dr. Willis has resigned his University Post to move to Isotopes Inc., Westwood, New Jersey and he has been succeeded by Dr. V. R. Switsur. Correction for fractionation error has been made in the case of a few samples specially indicated in the text.

SAMPLE DESCRIPTIONS

BRITISH ISLES

A. Post-glacial vegetational history

Bloak Moss series, Ayrshire, Scotland

Dr. Judith Turner, of the Cambridge Sub-dept. of Quaternary Research has been engaged in reconstructing, by means of very detailed pollen analyses at close vertical intervals, the effects of prehistoric forest clearance and early husbandry upon vegetational history. Bloak Moss, Ayrshire (55° 40' 45" N Lat, 4° 36' W Long; Grid ref. NS/363463) was selected as specially suited. A peat monolith was extracted and removed to the Cambridge lab., and after detailed pollen analyses had been completed, slices of peat 2 cm thick were cut at the crucial levels for C¹⁴ dating. Coll. Aug. 1962 by Judith Turner, St. Aidan's College, Univ. of Durham, England.

Q-727. Bloak Moss, Ayrshire, 183/5 cm **3825 ± 110**
1875 B.C.

Highly humified peat: beginning of continuous grass and *Plantago* pollen curves.

Q-726. Bloak Moss, Ayrshire, 165/7 cm **3320 ± 105**
1270 B.C.

Highly humified *Sphagnum-Calluna* peat: first temporary forest clearance.

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Q-725. Bloak Moss, Ayrshire, 133/5 cm **3050 ± 105**
1100 B.C.

Highly humified *Sphagnum-Calluna* peat: second temporary forest clearance.

Q-724. Bloak Moss, Ayrshire, 109/11 cm **3170 ± 105**
1220 B.C.

Weakly humified *Sphagnum imbricatum* peat: third temporary forest clearance.

Q-723. Bloak Moss, Ayrshire, 89/91 cm **2375 ± 90**
425 B.C.

Weakly humified *Sphagnum imbricatum* peat: fourth temporary forest clearance.

Q-722. Bloak Moss, Ayrshire, 79/81 cm **1535 ± 90**
415 B.C.

Weakly humified *Sphagnum imbricatum* peat: beginning of prolonged clearance with high grass pollen frequencies.

Q-721x. Bloak Moss, Ayrshire, 58/9 cm **1495 ± 90**
A.D. 455

Highly humified bog peat: adjacent to Q-721 and check upon it.

Q-721. Bloak Moss, Ayrshire, 55/7 cm **1370 ± 90**
1455 ± 90
A.D. 580
A.D. 495

Junction of weakly humified and highly humified peat: end of prolonged clearance began with Q-722 at 79/81 cm.

General Comment on Bloak Moss series: the C¹⁴ dates establish the time of minor forest clearances in late Neolithic, middle Bronze Age and early Iron Age times, and a more general clearance in early post-Roman time. The dates also make it apparent that in this bog there were phases of very slow peat accumulation (184 to 166 cm in ca. 600 yr and 110 to 90 cm in ca. 800 yr) as against phases of very rapid growth (160 to 110 cm and 80 to 56 cm in periods of the order of 1 or 2 centuries), but these show no clear relation to the (local) humification sequence, and there is a long time lapse represented by very fresh peat.

Duartbeg series, Sutherlandshire, Scotland

Sediments were taken from the N end of a small loch 1/4 mi S of Loch Duartbeg (58° 08' N Lat, 5° 02' 20" W Long: Grid ref. 166384), alt ca. 50 ft O.D. Coll. June 1963 by N. T. Moar and R. G. West (Cambridge Sub-dept. of Quaternary Research) and R. Cullingford; sampling by wide Hiller-type corer for one-shot C¹⁴ samples. Stratigraphic sequence is as follows: 560 to 575 cm base of organic deposits on stoney blue clay; 400 to 560 cm fine detritus mud; 315 to 400 cm coarse detritus mud; 0 to 315 cm coarse fibrous peat sharply cut off from underlying muds at 315 cm. Pollen analyses were made throughout by N. T. Moar and samples for carbon dating came from critical pollen frequency changes.

Q-753. Duartbeg, Sutherlandshire, 544/6 cm **5720 ± 130**
3770 B.C.

Fine detritus organic mud: Pollen Zone VIIa with preponderant *Betula*, frequent *Ulmus*, *Quercus*, *Alnus*, *Salix*, *Juniperus* and *Corylus*. beginning of rise in *Pinus*.

Q-748. Duartbeg, Sutherlandshire, 454/6 cm **5220 ± 115**
3270 B.C.

Fine detritus organic mud: Pollen Zone VIIa, as for Q-753, but with 35% *Pinus* max, end of *Juniperus* curve and beginning of rise in *Alnus* frequencies.

Q-741. Duartbeg, Sutherlandshire, 418/20 cm **3900 ± 105**
1950 B.C.

Fine detritus organic mud: top of Pollen Zone VIIa marked by steep decline of *Pinus* from maximum, and of *Ulmus*, and sharp rise of *Quercus*.

Q-757. Duartbeg, Sutherlandshire, 305/10 cm **3690 ± 110**
1740 B.C.

Coarse fibrous peat containing abundant *Sphagnum*, some *Betula*, *Myrica* and Carices: level of rapid decline in the AP/NAP ratio, primarily related to abrupt overgrowth of open water by peat-bog, but also showing initial maximum and continuing curve for *Plantago lanceolata*, indicative of clearance. *General Comment on Duartbeg series*: it seems possible that the dates for Q-753 and Q-748 give a further date for the "Upper Forestian" of Scottish peat-bogs. The big time gap between Q-741 and Q-748 (1300 yr) suggests a gap in the depositional sequence, possibly due to low water-levels. On chronology from England the clearance at 1740 B.C. (Q-757) would be early Bronze Age.

Bigholm Burn series, Dumfriesshire, Scotland

Three further samples are here reported from the series fully described in Cambridge date-list VI. From section on E bank of Bigholm Burn, Dumfriesshire (55° 07' 15" N Lat, 3° 04' 30" W Long), Natl. Grid ref. 316812, alt ca. 480 ft O.D. Coll. 1962 by N. T. Moar of Cambridge Sub-dept. of Quaternary Research, who also made pollen analyses.

Q-699. Bigholm Burn, Dumfriesshire, No. 6 **8650 ± 165***
6700 B.C.

Dark brown *Phragmites* peat, covering transition from brown organic muds, at very sharp decline in pollen of aquatic plants, and beginning of first rise of the AP/NAP ratio. Taken as opening of Zone IV, after transition Zone III/IV at opening of the Flandrian (Post-glacial). *Betula* becoming dominant in tree pollen with some *Juniperus* and low frequency of *Pinus* and *Salix*.

* (including correction for fractionation)

Q-700. Bigholm Burn, Dumfriesshire **7735 ± 155**
5785 B.C.

Phragmites peat, uppermost 10 cm of layer 40 cm thick of which Q-699 represents the base. Top of Pollen Zone IV with *Betula* dominant, infrequent *Pinus*, *Juniperus* and *Salix* and first low frequencies of *Corylus*.

Q-702. Bigholm Burn, Dumfriesshire **5475 ± 120**
3525 B.C.

Compressed wood peat (*Betula*), near base of a 70 cm thick layer and

immediately superjacent to Q-701 (Cambridge VI). Pollen-zone late VI, *Ulmus* and *Alnus* curves beginning, *Quercus* beginning to rise and *Corylus* at maximum.

General Comment on Bigholm Burn series: although the dates already published (Cambridge VI) for Late-Weichselian samples at this site (Q-694, 695) correspond with expectation based upon stratigraphy and pollen evidence, those from the organic layers above the Zone III solifluxion gravels (i.e. post-glacial) are all younger than expected. In comparison with the equivalent dated pollen zones at Scaleby Moss (Cambridge I, II) the Bigholm samples are too young: Q-697 by ca. 400 yr, Q-699 by ca. 1300 yr, Q-700 by ca. 1200 yr, Q-701 by ca. 1500 yr and Q-702 by over 3000. The Scaleby Moss dates are well supported internally and by other British and European dates, and as Bigholm and Scaleby are a very short distance apart it is highly unlikely that there has been so great a lag in the migration of successive woodland associations between them. It is more probable that there has been a massive contamination by younger carbon from above, a suggestion borne out by the great discrepancy of the uppermost sample (Q-702); the growth of many generations of trees *in situ* may well always be accompanied by downward growth of young roots causing effects of this kind.

Whixall Moss series, site 3, Shropshire

This raised bog has been the site of preliminary pollen analytic studies (Hardy, 1939) and recently by J. Turner (1964) who made large counts at vertical intervals of only 1 cm as a means of characterizing the effects of primitive clearance and husbandry upon the general vegetational cover. The site (52° 55' N Lat, 2° 46' W Long), shows a pine stump layer already dated (Q-383, 2307 ± 110), and a further sample 30 cm below it already published (Q-467, 3238 ± 115). Coll. 1960 by J. Turner, Univ. Sub-dept. of Quaternary Research, Cambridge.

**Q-466. Whixall Moss, Site 3, Shropshire, 2710 ± 90
65-66 cm 760 B.C.**

Highly humified *Sphagnum* peat, taken from a level indicating the end of a long period of maximum agricultural activity (Stages C, D and E of Turner), with high frequencies of grasses, *Plantago* and *Pteridium*, following big decreases in forest tree pollen, notably *Quercus*, *Ulmus* and *Tilia*.

**Q-468. Whixall Moss, Site 3, Shropshire, 2000 ± 90
42-43 cm 50 B.C.**

Highly humified *Sphagnum* peat, from end of a short period of agricultural activity (Stage H of Turner) marked by big decrease in pollen of *Quercus* and *Corylus* and much increased values of *Plantago*, *Pteridium* and grasses.

General Comment on Whixall Moss series: the four dates now available occur in the expected sequence and provide a time-scale for the vegetation changes identified by pollen analyses; the two dates here given confirm the earlier view of Turner that 1 cm of peat took 20 to 30 yr to form. The mean rate now seems about 27.5 yr/cm. the span of each separate pollen analysis. The stage of sustained agricultural activity identified by Turner (C, D, E) is shown to

extend from ca. 1280 to ca. 760 B.C., i.e., it falls in middle to late Bronze Age, whilst the minor clearance (possibly 250 yr long) is shown to end ca. 50 B.C., i.e., in the pre-Roman Iron Age. The pine stub layer presumably indicates a stage of dryness ca. 360 B.C.

B. Land- and Sealevel Changes

Continuing the research of the Univ. Sub-dept. of Quaternary Research, Cambridge there are two series of samples from SE England submitted by D. M. Churchill, two samples related to the '25 ft raised beach' of SW Scotland, and one from the Humber; they all extend the coastal datings given in Cambridge I, III, V, VI.

Tilbury Docks series

On the N shore of the Thames estuary at Tilbury Dock (51° 27' 26" N Lat, 0° 21' 54" E Long), excavations have afforded D. M. Churchill the means to study the sediments: peat beds alternating with estuarine and freshwater clays. Coll. Nov. 1963 by D. M. Churchill.

Q-790. Tilbury Docks, No. 1
 6940 ± 120
 7120 ± 120
 4990 B.C.
 5170 B.C.

Phragmites peat from a peat bed 6 ft thick overlying blue-grey silty clay with freshwater molluscs, and overlaid by soft grey peaty clay. From bore 8185, 50 ft from surface at -35 ft O.D. Pollen Zone VIIa.

Q-791. Tilbury Docks, No. 2
 5790 ± 120
 3840 B.C.

Phragmites peat with twigs, in a lens in peaty blue-grey clay of estuarine or marine origin. From bore 8185, 42 ft from surface and -27 ft O.D. Pollen Zone VIIa.

Q-811. Tilbury Docks, No. 3
 5530 ± 100
 3580 B.C.

Sandy wood and sedge peat from a peat bed 1 ft 3 in. thick with fine charcoal, overlying grey clayey sands flanking channel and overlain by peaty clay. From bore 8180, 29 ft from surface and -26 ft O.D. Pollen Zone VIIa.

Q-810. Tilbury Docks, No. 4
 4920 ± 100
 2970 B.C.

Sedge peat from a 2-ft peat bed with fine charcoal separated from Q-811 underneath by peaty clay and overlain by grey estuarine clay containing *Scrobicularia*. From bore 8180, 21 ft from surface and -18 ft O.D. Pollen Zone VIIa.

Q-792. Tilbury Docks, No. 5
 3940 ± 110
 3916
 1990 B.C.
 1966 B.C.

Phragmites peat from a peat bed, 2 ft thick, underlain by a blue-grey *Phragmites* peaty clay of estuarine origin, and overlain by grey estuarine

Scrobicularia clay. From bore 8182, 28.5 ft from surface and -16 ft O.D. Pollen Zone VIIIb.

Q-793. Tilbury Docks, No. 6

2467 ± 110

2390

517 B.C.

440 B.C.

Phragmites peat from uppermost peat bed 1 ft 6 in. thick overlying estuarine *Scrobicularia* clay, and overlain by grey clay, possibly estuarine. From bore 8182, 21 ft from surface and -8.5 ft O.D. Pollen Zone VIII.

Comments on Tilbury Docks series: the six samples come from three different bores and it is not easy on the basis of pollen analysis and lithology to correlate the peat beds. The C¹⁴ dates however are in the sequence of depth below mean sealevel, recording stages of a 35-ft marine transgression between ca. 5000 B.C. and the present day, including at least 18 ft since 3000 B.C. The dates accord with the previous dates of the three pollen zones involved.

Saddlebow series, King's Lynn, Norfolk

As part of continuing study of the stratigraphy and geological history of the Fenland basin of East Anglia (Godwin, 1960; Willis, 1961) four C¹⁴ dates have already been published (Cambridge III) for the upper and lower surfaces respectively of the so-called "Upper peat bed" that consistently overlies the "Fen Clay," and that is itself overlain by clays and silts of which the latter are known to be of Romano-British age. One of the important sites was an exposure in the bank of the new flood-relief channel of the River Great Ouse ca. 0.5 mi N of Saddlebow village (52° 42' 40" N Lat, 0° 23' 10" E Long). The date for the contact of the peat and overlying clay appeared to be ca. 0 A.D. (Q-549, 1875 ± 110; Q-550, 2070 ± 110), but at a similar site on the same channel and not far away (Magdalene Bend) a much greater age was obtained for apparently the same lithological contact (Q-547, 3305 ± 120). Fortunately the original monolith from Saddlebow had been retained, and now three further samples have been dated from the upper half of the peat bed. The whole monolith is unfortunately penetrated by vertical uncompressed rhizomes and rootlets of *Phragmites*.

Q-805. Saddlebow, King's Lynn, Norfolk, No. 3 **2495 ± 110**
545 B.C.

Fen peat from the top (0 to 1 in.) of the upper peat bed in contact with the overlying blue clay, and adjacent to Q-549.

Q-806. Saddlebow, King's Lynn, Norfolk, No. 4 **2275 ± 100**
325 B.C.

Fen peat from 5 to 6 in. below contact with overlying blue clay.

Q-807. Saddlebow, King's Lynn, Norfolk, No. 5 **2377 ± 100**
427 B.C.

Fen peat from 9 to 10 in. below contact with overlying blue clay.

Comment on the Saddlebow series: the three dates now reported are older than the two reported earlier. They are still much younger than the top of the same peat bed at Magdalene Bend, where possibly therefore erosion took place be-

fore or during deposition of the overlying clay. The absence of an age gradient in the 10 in. from Q-805 to Q-807 is unsatisfactory. It seems unsafe to deduce the onset of this marine transgression from these dates although they appear to indicate that it was in the pre-Roman Iron Age.

Q-818. Gatehouse of Fleet, Kirkcudbrightshire, No. 1 6244 ± 140
 4294 B.C.

Wood (*Quercus*) ($54^{\circ} 52'$ N Lat, $4^{\circ} 12'$ W Long), from the top of a lens of peat 2 ft thick and 80 ft diam overlain by 5 ft of dark grey silts which form an extensive flat at about +30 ft O.D., underlain by a variable thickness of 1.5 to 5.0 ft of loose gravel and below this 30 ft of grey clay. The clays are ascribed to the '25 ft raised beach', and this sample must represent a late stage in its formation. Coll. 1962 by W. W. Bishop, Uganda Mus., Kampala. *Comment*: this date agrees well with those from Lochar Moss (Q-638, 6645 ± 120) and Newton Stewart (Q-639, 6159 ± 120), which are also for samples near the top or above the 25-ft raised beach deposits (Cambridge V; Godwin, 1960).

Q-815. Redkirk Point, Dumfriesshire $10,300 \pm 185$
 8350 B.C.

Wood (*Populus*) (Grid ref. 35/056680; $54^{\circ} 59'$ N Lat, $3^{\circ} 28'$ W Long), from laminated peat bed covered by ca. 9 ft of sandy grey clay, succeeded by a higher peat bed, 9 in. thick, dated 8135 ± 150 (Q-637), which is overlain by ca. 12 ft of Carse clays. The sampled peat has abundant beetle remains, including several of northern or arctic type. Coll. 1962 by W. W. Bishop. *Comment*: the date indicates a late-Weichselian or very early post-glacial age for the peat bed in agreement with the fauna; it was long antecedent to the transgression of the 25-ft beach.

Q-715. North Ferriby, Yorks 3120 ± 105
 1170 B.C.

Wood ($53^{\circ} 42' 48''$ N Lat, $0^{\circ} 29' 52''$ E Long), from site on the foreshore of the N bank of the Humber, 12-yr old branch of *Alnus*, forming part of a wooden ramp underneath remains of a prehistoric 'sewn' boat, similar to that dated by BM-58 at 2700 ± 150 (BM II), and also excavated by E. V. Wright. The logs date the end of the use of this boat; they and the boat rested upon estuarine clay which in turn overlay a peat bed at a height of -2.5 ft O.D. The plant remains recovered from the top of the peat bed indicate formation in upper salt-marsh conditions. Coll. April 1963 by D. M. Churchill of Cambridge Univ. Sub-dept. of Quaternary Research. *Comment*: provides a date for a late marine transgression defined by relation to the contemporary tidal conditions, and gives a terminal age for the prehistoric boat in general according with that for the boat dated previously.

ATMOSPHERIC RADIOCARBON

Troposphere

Q-838.

ΔC^{14}

767 ± 20

Wheat (*Triticum*) grains harvested Sept., 1964. Grown 16 m SE of Cambridge. An average δC^{13} value of -21% is assumed.

Q-802. $\delta C^{14} + 20\%$

Wheat (*Triticum*) grains harvested in A.D. 1887, and kept sealed since, from laboratory of Messrs. Spiller & Co., Cambridge. Value expressed in relation to 1859 wood standard (cf. Willis, Tauber & Münnich, 1960).

Correction to Cambridge VI, Radiocarbon, vol. 6, p. 126.

Q-760. Weston Wood, Albany, Surrey, W.W.63. 'Albany' should read 'Albury'.

Date lists:

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