Some Post-Medieval Timbers from Bradbourne, Derbyshire

by Ruth Morgan, Martin Wildgoose and John Collis

In the winter of 1975-6, while engaged in land drainage in the bed of a disused dam connected with Bradbourne Mill, Mr. Ivan Naylor of Haven Grange, Bradbourne encountered a number of well-preserved timbers. As the timbers appeared ancient, he reported the find to Martin Wildgoose who undertook the excavation and recording of the timbers. The information was passed on to John Collis who arranged for the samples to be dated by Ruth Morgan in the Dendrochronology Laboratory of the Department of Prehistory and Archaeology in the University of Sheffield.

The site

At Springs Bridge (SK 205522) about a mile upstream from Bradbourne Mill, the Bradbourne Brook is diverted to form the mill race for the mill (Figs. 1 and 2). At the same point there are traces of earlier systems for controlling the stream. About 100 m downstream from the site where the timbers were found there is a breached dam which cuts across the valley. The second upper dam, [illegible] consists of a bank of clay 1.5 m high and 12 m across narrowing to 5-6 m where the timbers were found (Fig. 2). Behind the bank, though not running up to the stream is a shallow ditch 0.30 m deep. When found the timbers were slotted together as shown on Fig. 3. They were laid perfectly horizontally on a bed of gravel at a depth of 1.76 m below the modern surface, in the centre of a ditch behind the bank. The larger timber was parallel to the bank with the smaller timbers pointing to the east. Leading away from the dam at this point there is a channel, and presumably the bank was breached here at some time, where it narrows to about 5-6 m. As the dam is higher of either side, it would appear this cut was made into a pre-existing bank. The timbers may thus be the base-plate

for a sluice gate inserted to allow the dam to be emptied, though precisely how they functioned is unclear. The structure would seem to have been dismantled and the other timbers removed when the dam went out of use (around 1930?)

The timbers

The three timbers shown on Fig. 3 are all of oak, held together by dowels of unidentified wood. All three were black right through which suggested they were much older than proved to be the case. As a decision was needed on whether to preserve the timbers samples were taken by sawing off the ends, and these were submitted for C14 and dendrochronological dating.

The sections of extremely hard and blackened oak (Quercus sp.) were deep-frozen to consolidate any remaining sapwood, and the surface was cleaned with a surform plane to expose the growth rings. In oak they are remarkably clear, each being formed of a line of large spring vessels and a variable amount of dense summer wood. The ring-widths were measured to 0.1 mm under a binocular microscope with long travelling stage and an electronic measuring device, and the widths were then plotted on graph paper. The plotted curves for each timber can be compared visually by overlaying, and by computer which can ascertain the degree of similarity.

Details of the three timbers are given in Table 1. (It is not known whether the original cross-section of timber 1 was larger than that given). Timbers 1 and 3 retained some sapwood on outer corners, it being recognisable by its paler colour, unblocked spring vessels and overall width of about 30 mm. Its presence is very important for dendrochronological dating, as it indicates proximity to the bark and thus the date of felling of the tree. As in oak it maintains a fairly constant width of 20-30 rings, it is possible to estimate the felling date with some accuracy even if only one sapwood ring remains. In its absence, the felling date is unknown.

Valuable curves, in terms of number of rings and their variability in width from year to year, resulted from measurement of the Bradbourne timbers. Initial comparisons took place between the three curves; it was immediately obvious that timbers 1 and 2 had probably come from the same tree as their ring-width patterns were almost identical. The curve values were averaged together and the pair now labelled 1/2.

Timber 3 has a growth pattern which varies from year to year much less than 1/2 (see part of the former's curve in Fig. 5), and it is likely that they grew under different conditions. The match between the two is poor in quality, with a correlation value of Student's t = 3.37 (calculated by computer, a t value over 3.5 is of high significance; often values just below are found to be visually acceptable), and no confirmation has yet been found for the position which is shown in Fig. 4. The ring-width values are given in Table 2.

Since there was no dating evidence for the structure in which the timbers were used, it was difficult to decide initially with what reference material to compare the curves; absolutely dated reference curves are now available back to about AD 800 in south-eastern England, Northern Ireland, several regions of Germany and elsewhere, as well as shorter medieval curves for south Yorkshire and the West Midlands. Computer comparisons were made with much of this material as well as local undated curves, usually assuming a date somewhere between 1200 and 1600, but no results appeared.

The alternative was to submit a sample for radiocarbon dating in order to locate the approximate date for further tree-ring analysis. The outermost 20 sapwood rings were cut from timber 3 and processed at Harwell. The result was rather unexpected, giving a date of AD 1850 $\pm$ 70 (HAR 2260).

Having some idea as to date, it proved relatively easy to match the curve for timber 3 with a reference curve from Winchester (Barefoot, 1975) to between 1650 and 1836 with a t value of 3.21. This date was confirmed by a timber from Hickleton Hall near Doncaster which had been tentatively

dated to 1744 (t=2.23) and by the curve from a very aged Sherwood Forest tree (t=3.84), both of which had been examined at Sheffield. Several of these curves are shown in Fig. 5.

The appearance and width of the sapwood zone of timber 3 suggests that it has been preserved complete and that the tree was thus felled in the winter of 1836-37.

In the position shown in Fig. 4, timbers 1/2 would span the period 1697 to 1840, the tree having been felled in about 1850 to allow for missing sapwood. No confirmation for this date can be found in the reference material, but short of running a further C14 sample the match is accepted.

The realisation that the timbers were relatively modern was rather unexpected archaeologically, and also from the evidence of the wood itself which was blackened through to the pith. Oak heartwood is so hard that the blackening process under waterlogged conditions is usually quite slow - even Roman timbers may still be brown in the centre. The conditions here must have been exceptional. However, the results are extremely valuable dendrochronologically, as it has proved remarkably difficult to locate timbers of this date to provide a record of the growth pattern over the seventeenth and eighteenth centuries in northern England. The Bradbourne timbers help to fill this gap, and link the modern chronologies with the medieval.

Acknowledgements

We would like to thank Mr. Naylor for his assistance in the recording and recovery of the timbers, and to Mr. K. Connock who assisted in the excavation. Mr. C. Samson drew figures 1-3 for publication.

Summary

The timber structure, perhaps part of a sluice gate, proved to be of mid-nineteenth century date from the evidence of C14 and dendrochronology.

The sequence of tree rings, spanning 1650-1835, has provided important data for linking medieval and modern sequences.

References:

Barefoot, A.C. 1975 A Winchester Dendrochronology for 1635-1972 A.D. Its validity and possible extension. Journal of the Institute of Wood Science 7 25-32

List of Figs. and Tables

Addresses

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Mr. M. Wildgoose, Closes Farm, Kniveton.

Spring's Bridge ~~Mill~~, Bradbourne.

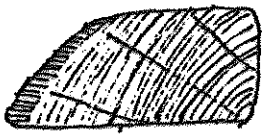
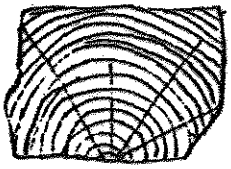
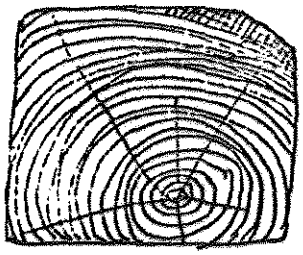
Timber no.	No.of rings	No.of sapwood rings	Dimensions cm	Cross-section	Ave. ring width mm
1	133	17	23 x 14 (+?)		1.95
2	111	-	25 x 19 radius 20.5		1.7
3	187	25	44 x 41 radius measured 31 to bark edge		1.72

Table.1. Details of the timbers examined, including rough sketches showing how they were cut from the tree. Timbers 1 and 2 came from the same tree.

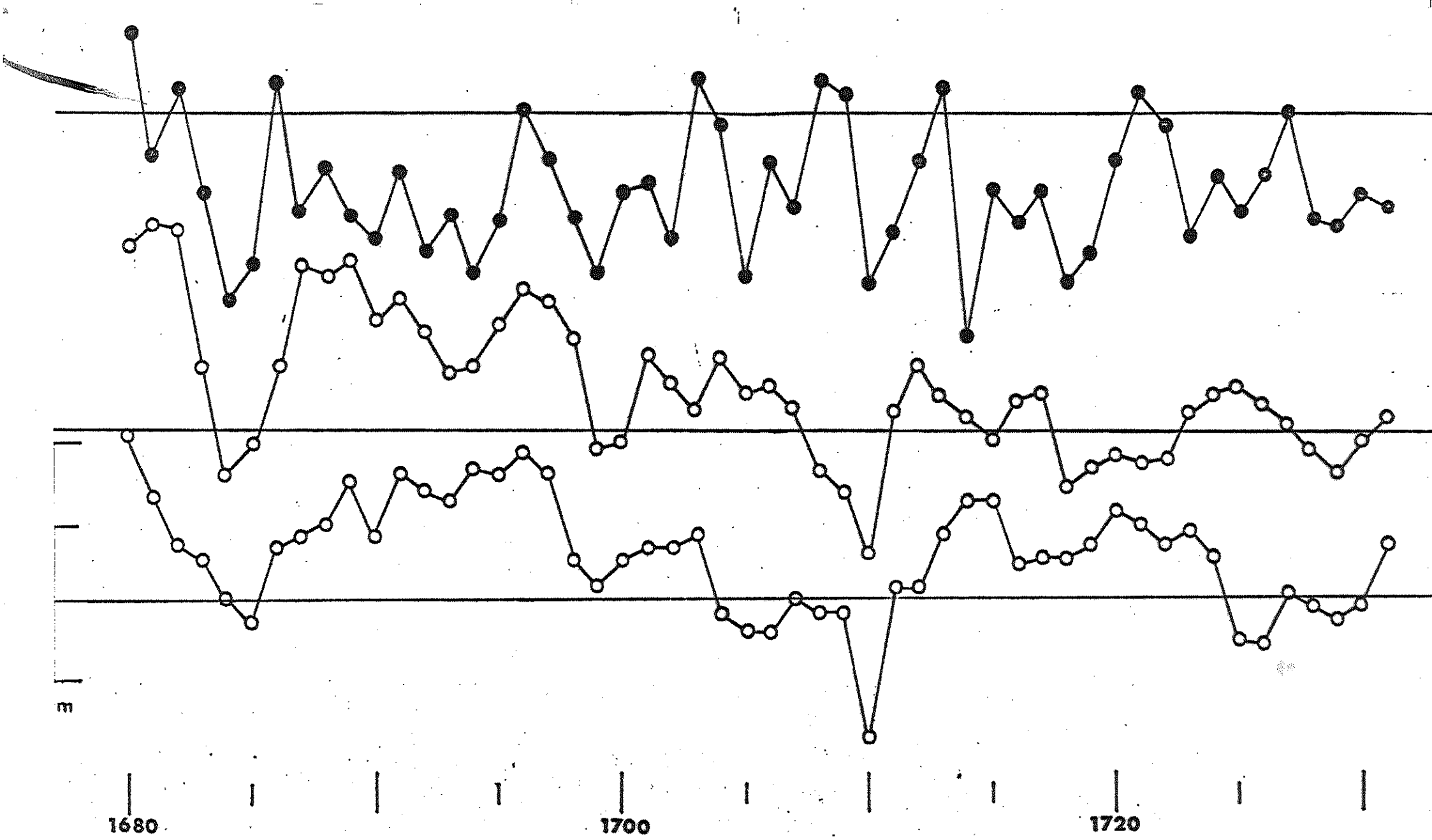


Fig. 25 Ring-width curves for: (top, solid circles) Winchester, (centre) Hickleton Hall and (lower) Bradbourne 3, between 1680 and 1730. Obvious signatures occur in the narrow rings of 1684-5, 1699 and 1710. Horizontal lines indicate a width of 1.5mm.

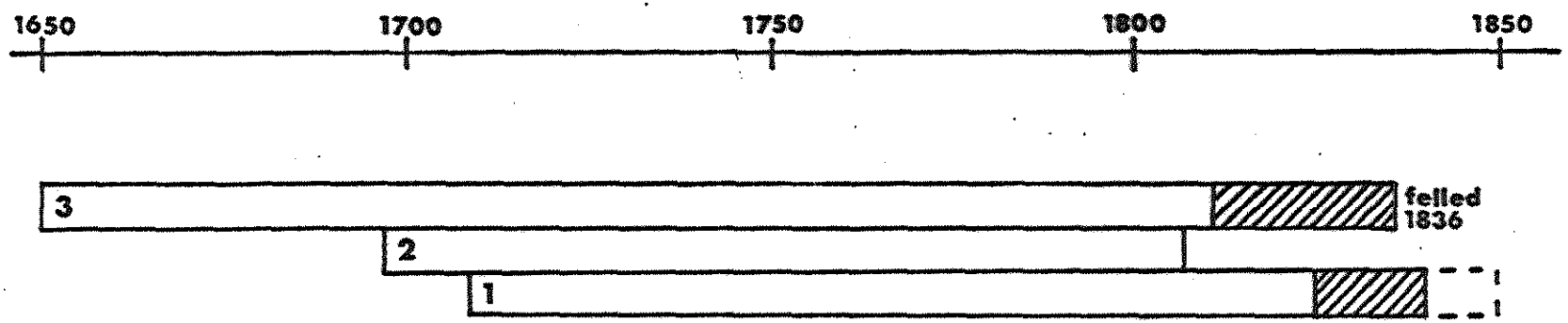


Fig. 4 Block diagram showing the years spanned by the Bradbourne timbers. Hatching indicates the presence of sapwood and the dotted line represents estimated missing sapwood. Timbers 1 and 2 probably came from the same tree and are treated together in the text.

BRADBOURNE
1/2
145

7	13	23	25	31	33	45	33	35	32	24	22	30	33	29	29	23	36	40	26	16	20	26	20	19
28	20	14	10	11	17	12	8	9	14	15	17	18	15	16	21	15	16	16	18	16	9	13	8	19
18	11	12	14	7	12	12	18	11	13	16	21	17	17	9	9	14	9	15	15	22	17	12	12	13
14	21	11	16	15	22	14	16	10	16	19	26	27	25	15	19	9	13	25	25	27	26	16	24	14
20	27	21	19	20	16	13	11	17	15	18	23	19	16	19	19	19	11	12	19	12	21	19	16	19
19	25	21	13	19	14	14	26	31	25	25	19	26	22	13	11	14	18	27	29					

BRADBOURNE
3
187

21	19	22	21	19	27	32	40	44	37	25	27	37	31	41	33	26	45	32	35	26	29	23	37	41
33	35	43	32	35	30	24	19	18	13	13	19	20	21	26	20	27	26	24	23	27	30	27	18	16
18	19	19	21	14	13	13	15	14	14	8	16	16	21	24	24	18	19	19	20	23	22	20	21	19
13	13	16	15	14	15	20	19	21	19	17	18	21	20	18	18	12	16	13	14	15	24	26	18	12
13	13	19	15	23	24	12	12	13	6	5	5	6	8	7	8	9	11	9	8	7	5	6	8	12
10	8	13	13	9	8	15	13	16	14	14	9	12	8	9	9	10	10	11	13	9	7	9	9	11
8	10	7	9	11	10	12	13	12	11	13	12	10	9	7	8	8	7	10	11	7	8	7	10	7
8	9	8	7	10	12	17	17	17	14	12	24													

Table 2. Ring-width values for the Bradbourne timbers in 0.1mm. Timbers 1 and 2 came from the same tree and their values have been averaged.

References:

Baillie, M.G.L. & Pilcher, J.R. 1973 A simple cross-dating program for tree-ring research Tree-Ring Bulletin 33 7-14

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