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Summary

Nine oak timbers were examined dendrochronologically. A site master curve of 185 years was produced but absolute dating has not yet been obtained.

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Tree-ring analysis of Bronze Age timbers from the 1982 excavation at West Row Fen, Mildenhall, Suffolk

Tree-ring samples were taken from nine oak timbers (Quercus spp) found at the Bronze Age settlement site on West Row Fen in 1982 (MNL165). Three timbers had already been examined from the 1977 excavation (MNL130) but the analysis had failed to produce any dating (Hillam 1980). With the production of long tree-ring chronologies for both Ireland and Germany (see, for example, Hillam 1987; Pilcher et al 1984), it was hoped that absolute dating might now be possible.

Methods

The samples were prepared and measured following the method given by Hillam (1985a). Because the samples had very narrow rings which were often difficult to measure, an independent measure of the ring widths along a second radius was made by Cathy Groves. The two sets of measurements were then averaged to produce a single tree-ring curve for each sample. The data were plotted as graphs, which were compared one against the other to search for similarities. Those sequences which crossmatched were combined to make a site master curve, and this was tested by computer against other tree-ring chronologies which spanned part or all of the Bronze Age period (Table 1). The program used for crossmatching (Baillie & Pilcher 1973) calculates the correlation coefficient between two curves at each position of overlap. The significance of the correlation is then tested by applying Student's t-test. Generally values of 3.5 or above indicate a tree-ring match, provided that the visual match between the graphs is acceptable (Baillie 1982, 82-85).

Tree-ring dates relate to the rings on the sample, the date of the outer ring being equivalent to the felling date of the timber only when bark or bark edge is present. In the absence of bark, but where some sapwood is preserved, the felling date is estimated using a sapwood estimate of 10-55 rings. This represents the 95% confidence limits for the likely number of sapwood rings in British oaks over 30 years of age (Hillam et al 1987). Where all the sapwood has been lost, the felling date is expressed as a terminus post quem.

Results

The samples were slices taken through the timbers. Some of them, eg 4178, were in poor condition with their centres rotted away (Table 2). Three of them (4170, 4173, 4174) retained bark over all or some of their circumference, and it is possible that originally most of them were unworked pieces of timber. 4136, 4137 and 4177 were probably worked timbers.

Two samples (4136, 4160) were rejected because they had less than 50 rings which is generally insufficient for reliable dating (for further details, see Hillam et al 1987). 4177 was also rejected because, although it had many rings, they were too narrow to measure accurately. The remaining samples had 97-176 rings, all of which were relatively narrow in width. The average ring width for 4173, for example, was 0.39, which is exceptionally narrow and suggests that the tree was growing under very stressful conditions.

The two sets of measurements made by the author and Cathy Groves corresponded remarkably well considering the narrowness of the rings. (The t-value between the two radii of 4137, for example, was 15.4.) The only sections of the sequences which could not be verified were the outer 20-30 rings on 4173 and 4174. This was because the outer sapwood rings of the two samples had deteriorated too badly for measurement when the second set of measurements was taken.

Four of the curves (4137, 4142, 4173, 4178) matched each other initially (Table 3). These were combined to make the master curve, WRFM1. 4174 matched this master with a t-value of 3.8, but no match was found for 4170. A final site master, WRFM2, was made which includes the four sequences in WRFM1 plus 4174. (All the ring width data are given in the Appendix.) Although 4173 and 4174 seem to match along the complete length of overlap, the outer 20-30 rings match less well. This may be because of the narrowness of the rings but, in view of the uncertainties in measurement mentioned above, the outer 20-30 years of both masters, and of 4173 and 4174, should be used with caution.

Examination of the relative dating (Fig 1) shows that 4173 and 4174, both of which had bark, end within one year of each other. This could

indicate that 4174 was felled one year after 4173. Alternatively the two timbers could have been felled at the same time, the one year difference being due to difficulties encountered during measurement. The season of felling could not be determined on either sample. The remaining three samples did not have sapwood but they could have been felled at the same time as 4173 and 4174, since the number of missing rings would not be incompatible with the sapwood estimate of 10-55 rings.

The site master curves were tested against all the available Bronze Age chronologies (Table 1). No consistent results were obtained either for the complete masters or for edited versions which had their outer 25 rings ommitted. There was no match between the 1982 West Row Fen samples and 0499, the measured sample from the 1977 excavation.

The data was also sent to the Palaeoecology Centre, Belfast, where it was run against additional chronologies, such as the unpublished bog oak chronologies from East Anglia and Lancashire (Baillie & Pilcher 1988) or the northern German chronology (Delorme unpubl). No reliable crossmatching was found (Brown pers comm).

Discussion

The fact that five of the six measured ring sequences were crossmatched is encouraging, but it may be that the factors responsible for the exceptionally narrow rings are of a local nature, and this may prevent the crossmatching of the West Row Fen chronology with dated reference chronologies. Alternatively the lack of dating may be due to the absence of suitable local chronologies.

Further bog oak collection is to be carried out this summer in the Mildenhall area by workers from Belfast (Brown pers comm) as part of a larger research program to construct a long English tree-ring chronology (Baillie & Pilcher 1988). This may result in the production of a local Bronze Age chronology, against which the West Row Fen curve would be tested. In addition a major reassessment of all the Bronze Age data produced at Sheffield is currently underway, and some relative dating between site chronologies has been found (Hillam in prep). As more chronologies are produced and linked together, so the chances of dating site curves such as West Row Fen incease.

Conclusion

Of the nine samples from the 1982 excavation at West Row Fen (MNL165), six were suitable for measurement and five crossmatched to produce a 185-year chronology. The last 25 rings of the sequence should be used caution because of the narrowness of the rings. No matching was obtained with the measured sample from the 1977 excavation (MNL130), or with reference chronologies from England, Ireland and Germany.

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References

Baillie MGL 1982 Tree-ring dating and archaeology. London: Croom Helm.

Baillie MGL & Pilcher JR 1973 A simple crossdating program for tree-ring research, Tree-Ring Bulletin 33, 7-14.

Baillie MGL & Pilcher JR 1988 Make a date with a tree. New Scientist 117 (1604), 48-51.

Brown DM, Munro MAR, Baillie MGL & Pilcher JR 1986 Dendrochronology - the absolute Irish standard. Radiocarbon 28 (2A), 279-83.

Buckland PC 1979 Thorne Moors: a palaeoecological study of a Bronze Age site. Dept of Geography University of Birmingham Occasional Publication 8.

Hillam J 1980 Tree-ring analysis of fen oaks from the Bronze Age settlement at West Row Fen, Mildenhall, Suffolk. Ancient Monuments Laboratory report no 3003.

Hillam J 1985a Theoretical and applied dendrochronology - how to make a date with a tree. In P Phillips (ed), The Archaeologist and the Laboratory, CBA Research Report number 58, 17-23.

Hillam J 1985b Dendrochronology of the North Ferriby boats. In S McGrail & E Kentley (eds), Sewn Plank Boats, BAR S276, 145-62.

Hillam J 1987 Dendrochronology - 20 years on. Current Archaeology 9(12), 358-63.

Hillam J, Morgan RA & Tyers I 1987 Sapwood estimates and the dating of short ring sequences. In RGW Ward (ed), Applications of tree-ring studies - current research in dendrochronology and related areas, BAR S333 165-185.

Millett M & McGrail S 1987 The archaeology of the Hasholme logboat. Archaeological Journal 144, 69-155.

Morgan RA 1988 Tree-ring studies of wood used in Neolithic and Bronze Age trackways from the Somerset Levels. BAR 184, parts i, ii.

Pilcher JR, Baillie MGL, Schmidt B & Becker B 1984 A 7,272-year tree-ring chronology for western Europe. Nature 312, 150-52.

Salisbury CR, Whitley PJ, Litton CD & Fox JL 1984 Flandrian courses of the River Trent at Colwick, Nottingham. Mercian Geologist 9(4), 189-207.

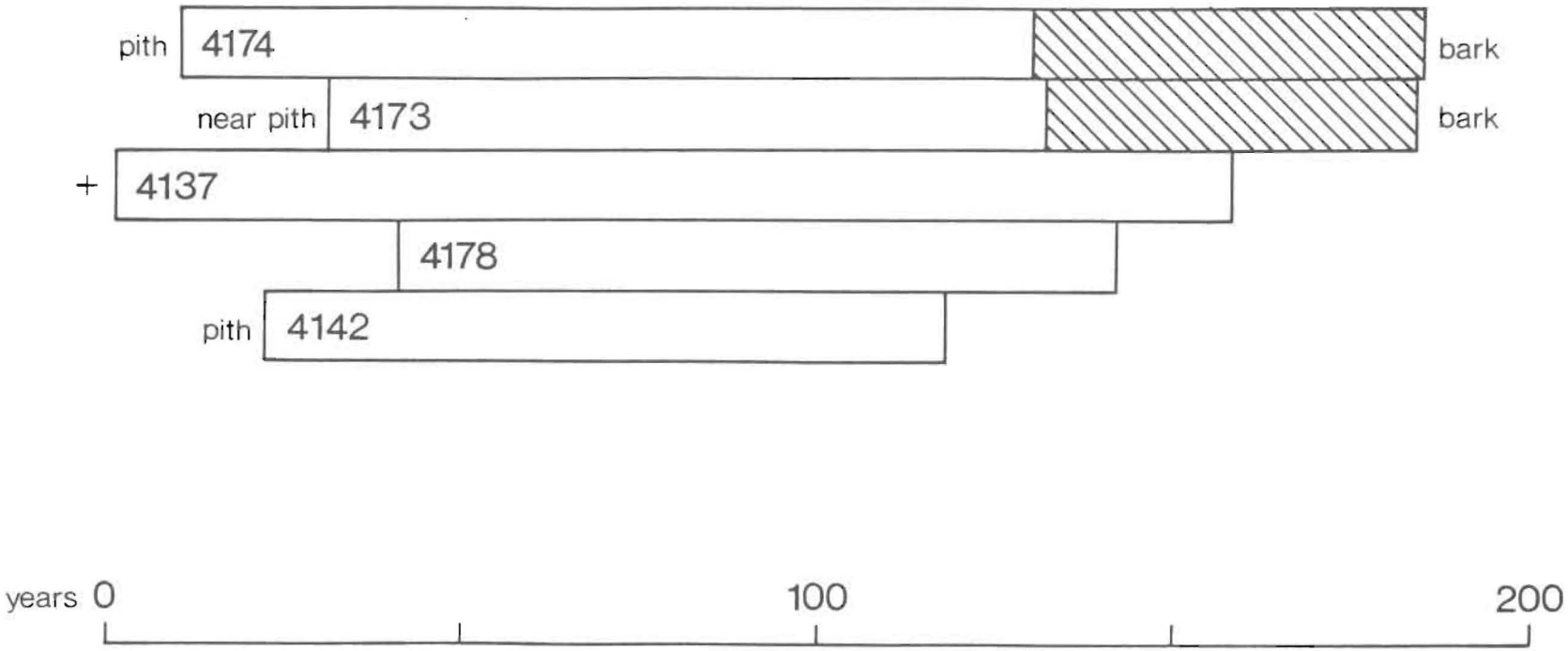

Fig 1: Bar diagram showing the relative positions of the West Row Fen ring sequences. The scale in years is relative and does not relate to calendar years. White bar - heartwood rings; hatching - sapwood + - unmeasured rings present.

Table 1: Tree-ring chronologies spanning all or part of the Bronze Age, and with which West Row Fen could be contemporary. Unless stated otherwise dating evidence is based on radiocarbon.

England

1. Bog oak chronologies from East Anglia and Lancashire under construction at Belfast, some of which have been absolutely dated (Baillie & Pilcher 1988).

2. Colwick, Nottingham. 252-year chronology from oak trunks found in former river channels of the Trent (Salisbury et al 1984). The samples are currently being re-examined at Belfast (Brown pers comm).

3. Ferriby, Humberside. Chronologies from the three North Ferriby boats: Ferriby 1 - 140 years, Ferriby 2 - 227 years, Ferriby 3 - 105 years (Hillam 1985b).

4. Hasholme, Humberside. Chronology dating to 1687-1326BC, from bog oaks found near the Hasholme logboat (Hillam in prep; Millett & McGrail 1987).

5. Somerset Levels, Meare Heath trackway. Original chronology - 152 years (Morgan 1988 ii 17), but data reworked to give a 133-year chronology (Hillam in prep).

6. Somerset Levels, Tinneys trackway - 246-year chronology (Morgan 1988 ii 22).

7. Somerset Levels bog oaks from various sites (Morgan pers comm).

8. Thorne Waste, South Yorkshire (Buckland 1979). Originally two chronologies of 164 and 204 years (Morgan pers comm). The samples have been remeasured and now give a single chronology of 250 years (Hillam in prep).

Germany

9. Absolutely dated chronology from southern Germany (Becker unpubl - see Hillam 1987; Pilcher et al 1984))

10. Dated chronology from northern Germany (Delorme unpubl - see Hillam 1987).

Ireland

11. Belfast long chronology, absolutely dated - see, for example, Brown et al 1986; Pilcher et al 1984.

Table 2: Details of the tree-ring samples. Sketches not to scale; shading indicates sapwood. All measurements are in mm.

sample no	no of rings	sapwood	average ring width	dimensions	sketch	comments
4136	38	1?	-	255 x 60		insufficient rings
4137	+158	-	0.63	170 x 110		inner rings too knotty
4142	97	-	0.83	170 x 130		pith present
4160	44	-	-	175 x 110		insufficient rings; knotty
4170	135	40	0.51	165 x 145		bark
4173	154	53	0.39	160 x 140		bark; near pith
4174	176	56	0.52	190 x 150		bark; pith
4177	-	-	-	125 x 50		many very narrow rings
4178	102	-	0.45	125 x 110		

Table 3: Matrix of *t*-values between the matching ring sequences.

	4137	4142	4173	4174	4178
4137	*	5.2	5.3	2.8	5.2
	4142	*	4.8	2.7	6.2
		4173	*	3.5	3.5
			4174	*	3.2
				4178	*

APPENDIX

Ring width data. Each individual sequence is the average of two sets of measurements; the master curves WRFM1 and WRFM2 are made up from 4 and 5 sequences respectively. (The outer 20-30 rings of 4173 and 4174 have not been duplicated and could contain errors, as could the outer 20-30 years of the two masters - see text.)

West Row Fen 4137

years	ring widths(0.02mm)									
1	19	23	36	20	20	37	29	41	49	61
11	65	33	40	49	56	69	63	49	73	72
21	53	36	34	45	44	35	22	21	57	35
31	34	24	33	32	103	57	43	29	39	26
41	36	26	44	35	30	40	28	39	32	23
51	27	53	39	38	24	21	34	27	20	36
61	30	24	21	23	18	20	19	24	27	31
71	24	26	23	19	19	24	27	31	42	58
81	35	33	26	35	26	24	25	31	43	39
91	31	24	18	18	20	15	20	19	23	30
101	26	23	28	18	20	23	28	50	25	20
111	19	16	17	20	18	18	24	24	20	28
121	23	24	22	17	16	23	22	20	23	22
131	28	20	20	18	17	25	38	35	30	26
141	37	33	24	33	21	22	51	31	37	50
151	60	42	30	21	31	20	29	30		

West Row Fen 4142

years	ring widths(0.02mm)									
1	35	50	30	35	55	33	28	36	28	16
11	20	23	33	72	34	31	27	43	55	44
21	41	70	60	36	65	38	50	39	25	33
31	63	58	56	52	51	54	42	39	63	56
41	30	32	39	19	17	25	34	38	31	33
51	36	36	35	23	44	63	57	53	69	64
61	50	37	48	33	25	27	29	48	63	78
71	55	45	34	29	23	28	42	45	66	54
81	57	71	58	39	57	45	21	37	34	31
91	44	39	37	25	24	33	36			

West Row Fen 4170

years	ring widths(0.02mm)									
1	40	28	26	29	39	28	42	35	56	21
11	32	56	55	36	50	50	62	66	38	43
21	23	26	14	24	33	50	48	22	21	19
31	23	19	16	13	22	22	24	28	26	18
41	16	19	20	17	27	19	21	24	38	23
51	18	17	25	32	28	42	27	29	24	21
61	18	17	20	22	44	29	21	21	33	33
71	23	21	25	28	33	27	23	28	19	20
81	14	12	23	21	18	27	21	15	20	22
91	25	22	14	20	25	30	20	18	16	19
101	22	25	17	17	21	19	15	15	17	14
111	19	15	21	29	34	20	30	28	23	26
121	28	22	34	26	22	20	16	15	17	25
131	22	27	22	15	20					

West Row Fen 4173

years	ring widths(0.02mm)									
1	29	17	19	18	29	30	21	33	38	50
11	32	31	38	28	23	33	31	30	26	21
21	27	31	21	16	18	15	23	18	17	22
31	21	14	17	20	14	17	23	22	16	24
41	20	27	27	20	24	26	34	25	22	19
51	15	15	18	22	12	15	12	14	17	19
61	14	13	15	12	15	15	21	25	22	19
71	26	18	20	23	27	22	24	21	19	19
81	16	14	21	15	13	13	18	18	13	16
91	13	11	13	13	12	12	13	12	18	15
101	12	12	13	12	14	20	22	21	15	18
111	22	33	25	26	22	12	22	16	15	23
121	15	27	17	27	22	15	14	32	27	21
131	17	25	19	15	11	23	13	10	12	15
141	14	11	10	11	13	15	12	22	20	13
151	12	11	10	11						

West Row Fen 4174

years	ring widths(0.02mm)									
1	40	48	35	54	55	39	51	29	20	35
11	31	25	22	35	34	25	26	53	27	23
21	30	44	29	40	45	47	38	34	46	58
31	51	41	48	54	43	43	50	38	39	41
41	28	37	43	27	27	21	23	35	27	28
51	28	37	27	28	31	26	37	33	34	30
61	31	34	40	31	23	29	31	36	31	33
71	30	29	27	18	33	21	17	25	20	20
81	28	24	15	15	17	22	17	20	28	32
91	27	26	26	31	26	29	33	32	26	24
101	28	26	23	25	24	19	20	22	25	26
111	30	20	24	34	31	27	30	32	30	25
121	19	25	20	19	24	22	26	27	27	22
131	20	28	32	25	20	18	17	18	17	19
141	23	18	10	11	11	8	9	8	8	10
151	9	6	6	9	7	7	12	8	12	8
161	15	11	10	8	7	6	14	9	8	9
171	11	14	7	12	13	14				

West Row Fen 4178

years	ring widths(0.02mm)									
1	56	49	51	44	28	37	42	44	29	23
11	22	41	28	24	21	28	29	41	17	43
21	43	23	20	26	14	11	18	29	22	32
31	32	21	22	23	21	41	41	30	25	25
41	30	22	16	36	20	16	17	24	22	24
51	22	14	19	16	13	13	17	18	17	23
61	18	15	17	16	14	16	14	12	11	8
71	14	11	12	11	10	11	11	11	15	14
81	13	17	14	16	13	21	19	16	17	21
91	17	12	20	22	15	14	38	23	33	21
101	25	21								

Site master curves

West Row Fen WRFM1

years	ring widths(0.02mm)									
1	19	23	36	20	20	37	29	41	49	61
11	65	33	40	49	56	69	63	49	73	72
21	53	35	42	37	39	45	27	24	46	31
31	26	20	25	27	68	40	31	29	40	43
41	42	36	50	41	29	43	34	40	31	23
51	27	47	36	33	28	28	35	32	23	41
61	37	22	22	27	16	16	21	27	25	29
71	27	27	27	24	21	33	41	35	35	42
81	36	30	24	35	22	20	20	24	32	36
91	36	26	24	20	19	16	21	26	26	34
101	31	28	34	28	25	29	27	26	23	20
111	20	21	22	20	16	16	21	22	16	19
121	16	17	16	15	13	18	18	16	19	19
131	19	14	17	17	15	19	32	26	26	21
141	28	29	24	29	21	17	36	23	26	36
151	37	34	23	24	26	17	21	31	27	21
161	17	25	19	15	11	23	13	10	12	15
171	14	11	10	11	13	15	12	22	20	13
181	12	11	10	11						

West Row Fen WRFM2

years	ring widths(0.02mm)									
1	19	23	36	20	20	37	29	41	49	50
11	56	34	47	52	47	60	46	34	54	51
21	39	30	39	36	34	38	35	25	38	30
31	30	22	28	31	62	39	31	33	44	45
41	41	38	50	41	31	44	34	39	33	24
51	29	46	34	31	26	27	35	31	24	38
61	37	23	23	27	18	20	23	28	26	29
71	28	29	27	23	22	32	40	34	34	39
81	34	29	22	34	21	19	21	23	29	34
91	33	23	22	19	19	16	20	26	27	32
101	30	27	33	27	25	29	28	26	23	21
111	21	21	22	20	16	16	21	22	18	21
121	17	18	20	19	16	21	21	19	20	19
131	20	15	17	18	16	20	30	26	25	20
141	28	29	24	26	20	17	30	21	23	31
151	30	26	19	19	20	14	16	23	18	15
161	11	15	14	11	9	17	10	11	10	15
171	12	10	9	9	9	14	10	15	14	12
181	13	9	11	12	14					