Ancient Monuments Laboratory
Report 7/99

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Summary

Wingfield College was founded in AD 1362, although the date of the extant building is not known with certainty. Three early phases of construction have been hypothesised in recent studies of the building, and it was hoped that dendrochronological study might be able to confirm their veracity and date them more accurately. Unfortunately, most of the trees felled for this building were under fifty years old and only three timbers dated, their felling date range suggesting a period for the construction of the third proposed phase in the early AD 1380s. It is suggested that a programme of tree-ring studies is needed in this region to improve the chances of successful dendrochronological dating in the future.

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TREE-RING ANALYSIS OF TIMBERS FROM WINGFIELD COLLEGE, WINGFIELD, SUFFOLK

Introduction

This report details the dendrochronological investigation of oak timbers at Wingfield College, Wingfield, Suffolk (NGR TM 229768; Fig 1).

The building has attracted much interest previously, having been visited by many leading building historians, and has been discussed in several articles. Much of the following background information is drawn from Haslam (1982), Chance (1985), and an extensive report on the site by Aitkens (1997). Hewett (1980) illustrated a sketch of the open truss and a scarf joint in the arcade plate which he then attributed to the period *c*AD 1300 - 1320, but has subsequently shown to be in use throughout the fourteenth century.

Aitkens (1997) concludes that the two-storey wing was built first and that the aisled hall was added to it slightly later. The wing itself appears to have been built in two phases, the southern part first, then the northern section which has slightly more closely spaced studs and prolific use of curved diagonal windbraces. It is known that the college was founded in AD 1362 (Chance 1985) but is not clear when the extant buildings were constructed, although it seems likely from the stylistic evidence that both the wing and the aisled hall were built in the late-fourteenth century (Aitkens 1997). Four phases are recognised by Aitkens (1997) including one around AD 1520, whilst the college was still in use. This work on the college may be closely related with the construction of a large barn, some 40m to the south, that has recently been dated to AD 1527, or very soon thereafter (Bridge forthcoming (a)).

Aitkens' report (1997) makes a strong case for tree-ring analysis of the building to assist in the interpretation of the building, and English Heritage commissioned the present study both to help in the explanation of the architectural development of this building, and to help create a framework for dating similar raised-aisle homes in Suffolk. The brief for tree-ring work was to work on the initial phases of construction of the hall and wing.

Methodology

The site was visited in March 1998, when the timbers were assessed for their potential use in dendrochronological study. To be of use in this kind of study, the timbers need to have sufficient numbers of rings (preferably more than 50 per sample), sapwood should be present to indicate the proximity of the outer edge of the tree, and there should be a number of timbers representing each suspected phase of construction. Cores of several timbers were taken, the details and locations of which are given in Table 1 and shown in the figures (Figs 2, 3, 4, and 5).

Core samples were obtained using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis. The cores were prepared for measuring by sanding using an electric belt-sander with progressively finer grit papers down to 400 grit. Any further preparation necessary, eg where bands of narrow rings occurred, was done manually. The samples had their tree-ring sequences measured to an accuracy of 0.01 mm using a specially constructed system utilizing a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to an Atari desktop computer. The software used in measuring and subsequent analysis was written by Ian Tyers (pers comm 1992).

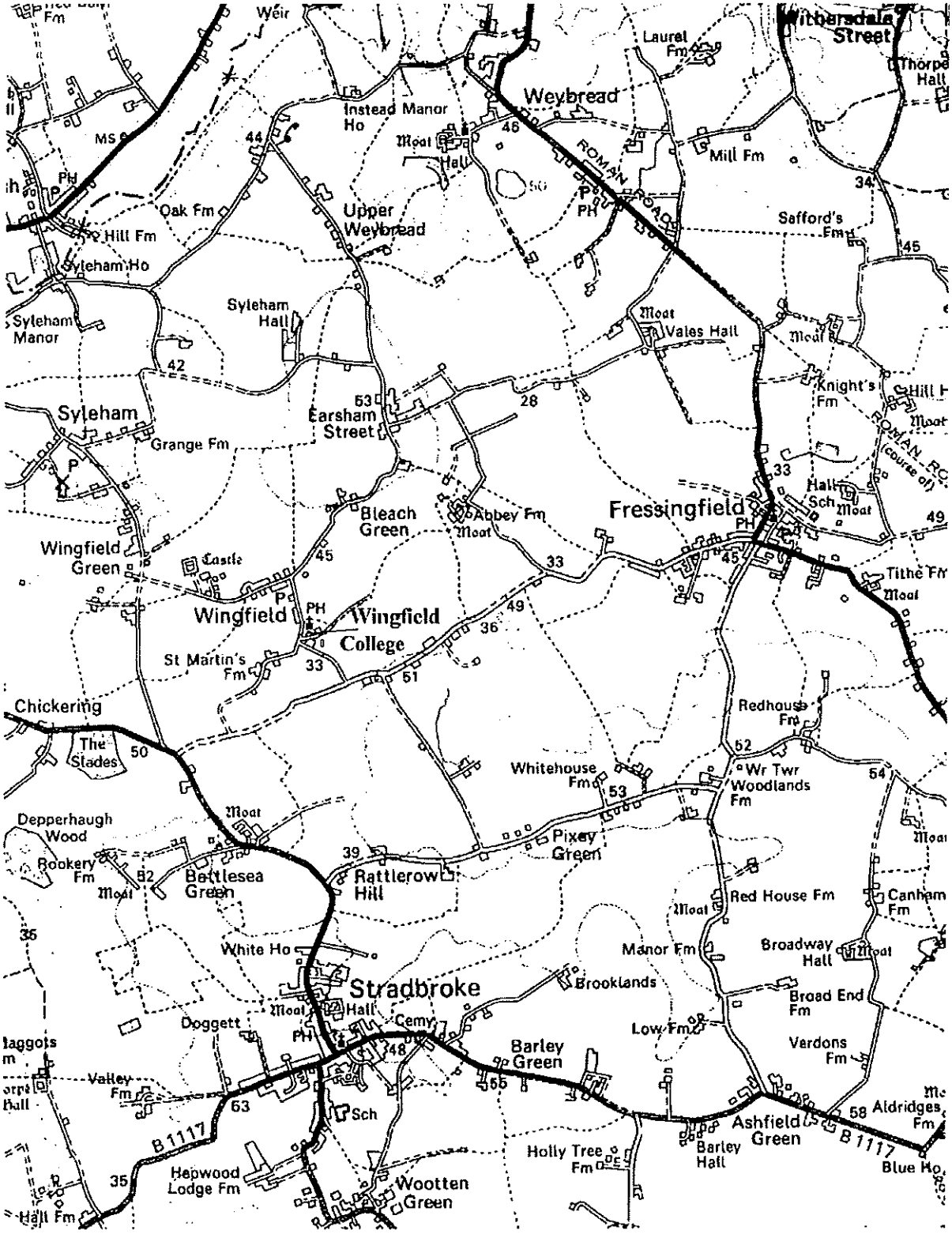

Figure 1: Map to show the general location of Wingfield College, Suffolk

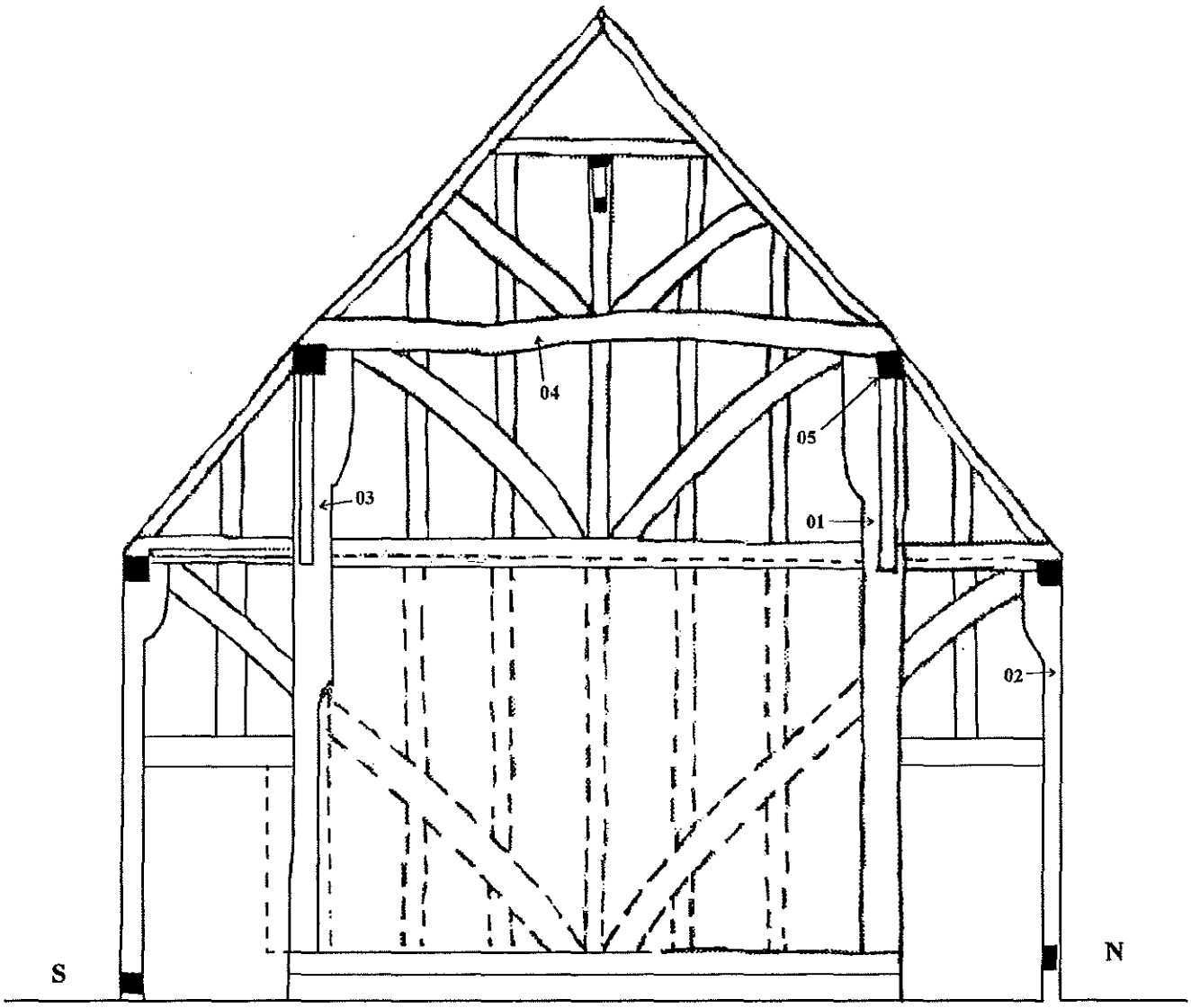

Figure 2: Sketch of the closed West truss to the hall at Wingfield College, Suffolk, showing the approximate locations of samples taken for dendrochronological investigation. Based on an original drawing by Aitkens (1997)

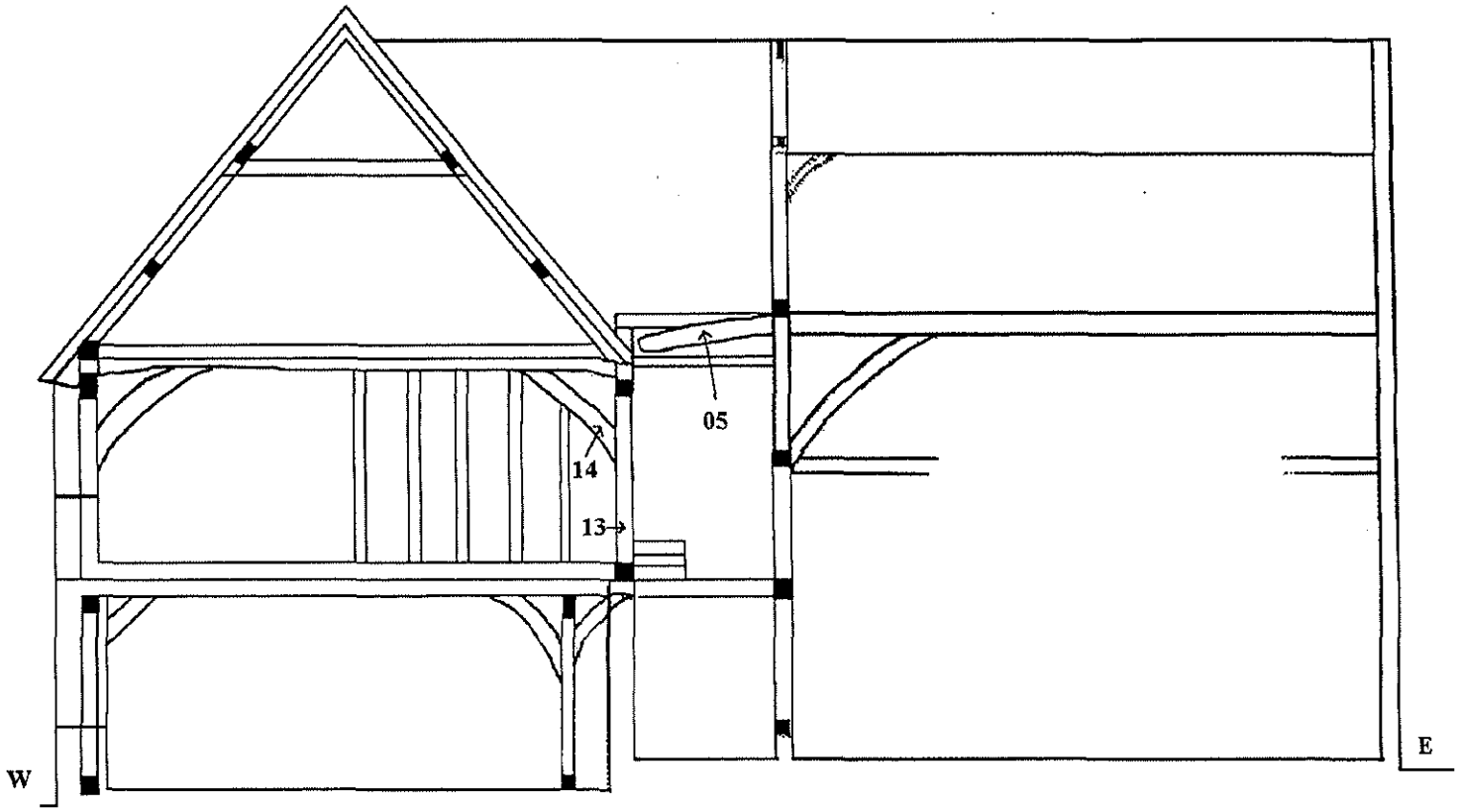

Figure 3: Sketch of the crosswing and hall at Wingfield College, Suffolk, showing the approximate locations of samples taken for dendrochronological investigation. Based on an original drawing by Aitkens (1997)

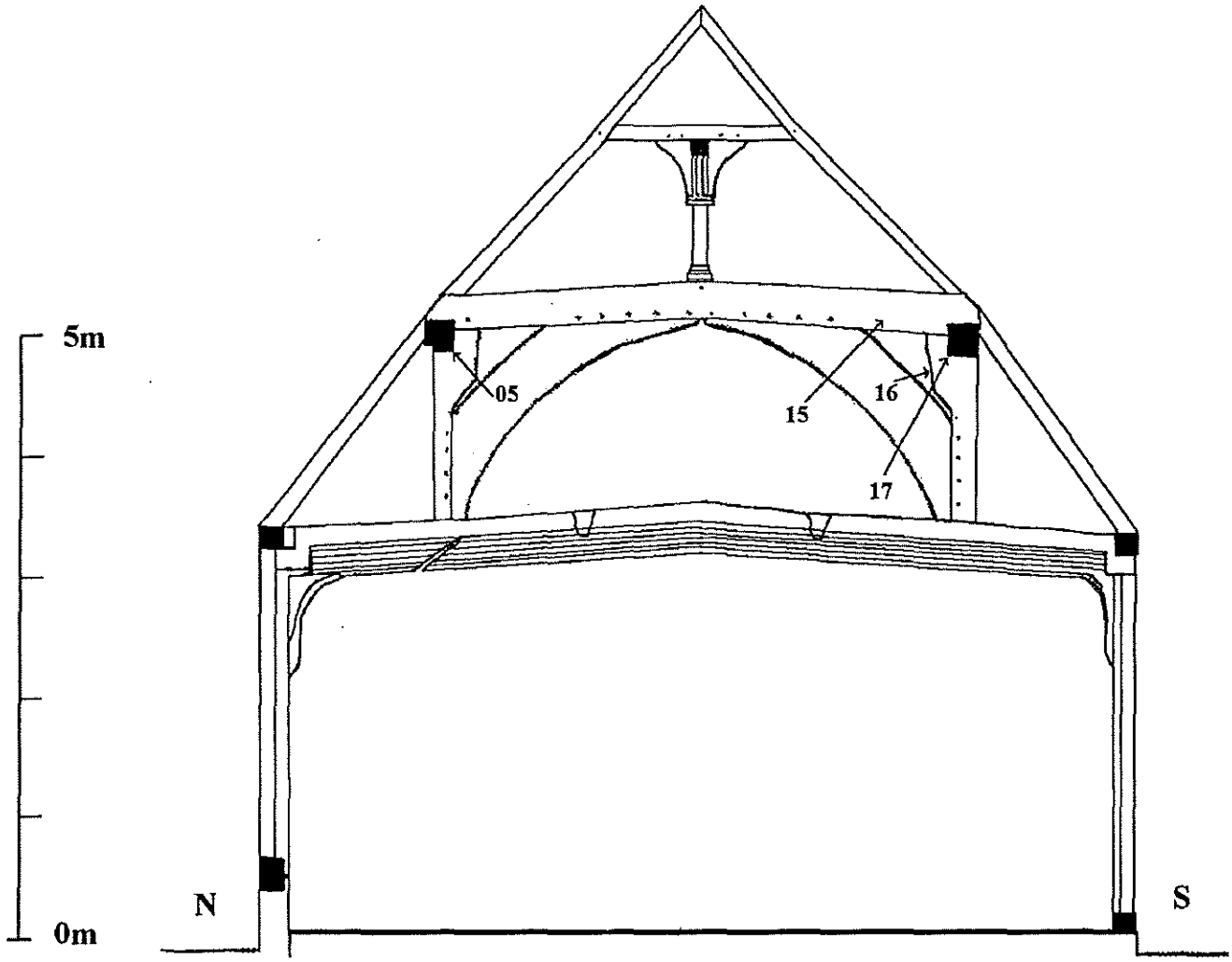

Figure 4: Sketch of the open central truss to the hall at Wingfield College, Suffolk, showing the approximate locations of samples taken for dendrochronological investigation. Based on an original drawing by Aitkens (1997)

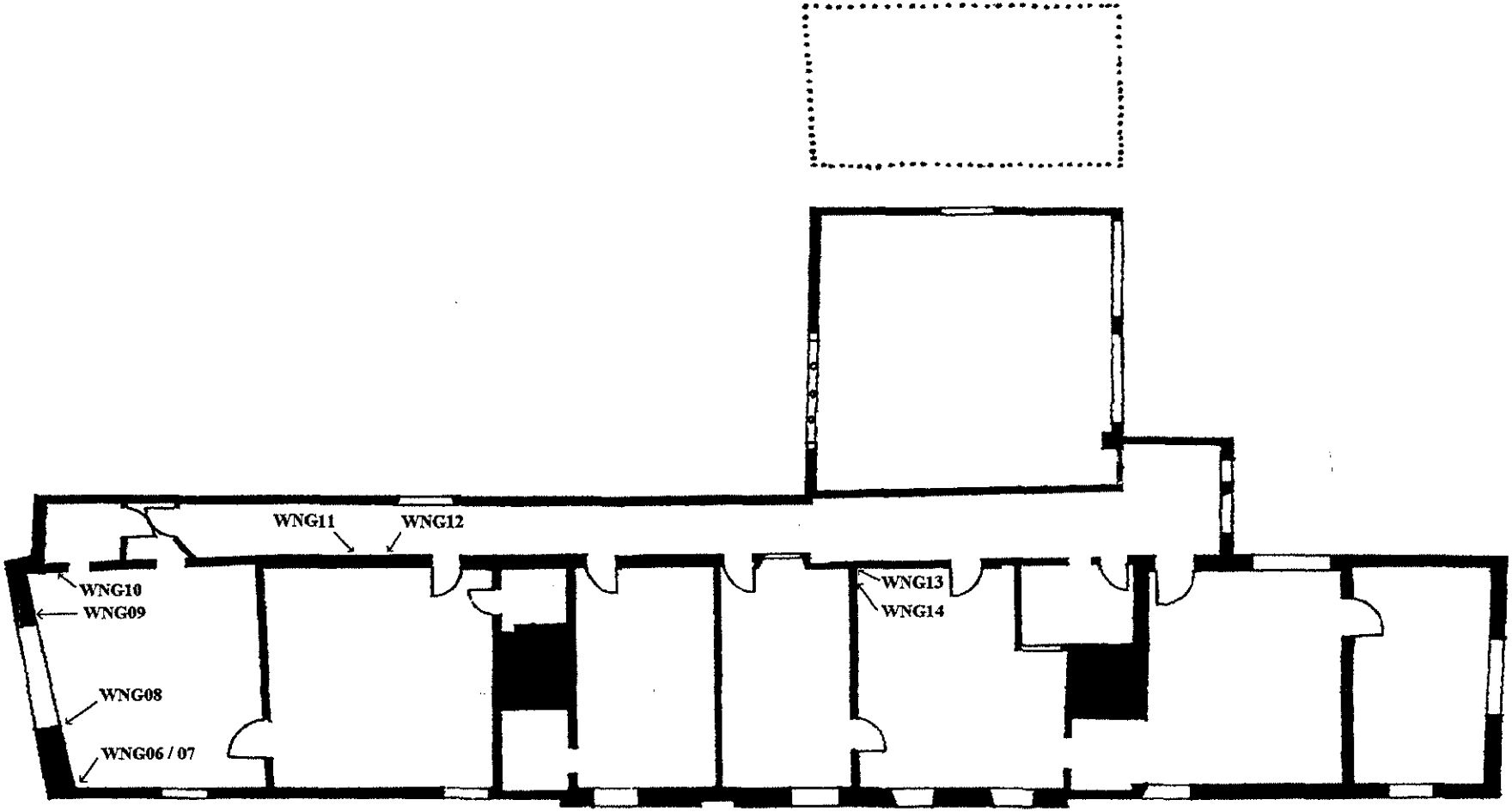

Figure 5: First floor plan of the front range of Wingfield College, showing the positions of dendrochronological samples from phases Ia and Ib. Based on an original drawing by Aitkens (1977)

Ring sequences were plotted on translucent semi-log graph paper to allow visual comparisons to be made between sequences on a light table. This activity also acts as a measure of quality control in identifying any errors in the measurements when the samples crossmatch. Statistical comparisons were made using Student's *t*-test (Baillie and Pilcher 1973; Munro 1984).). The *t*-values quoted below were derived from the original CROS program (Baillie and Pilcher 1973). Those *t*-values in excess of 3.5 are taken to be indicative of acceptable matching positions provided that they are supported by satisfactory visual matches, and give consistent matching positions.

When crossmatching between samples is found, their ring-width sequences are meaned to form an internal site mean sequence, which is then compared with a number of reference chronologies (multi-site chronologies from a region) and dated individual site masters in an attempt to date it. Individual long series which have not been include in the site mean(s) are also compared with the database to see if they can be dated.

Any dates thus obtained represent the time of formation of the rings available on each sample. Interpretation of these dates then has to be undertaken to relate these findings to the construction date of the phase under investigation. An important aspect of this interpretation is the estimate of the number of sapwood rings missing. In this instance, the sapwood estimates are based on those proposed for this area by Miles (1997), in which 95% of samples are likely to have from 9 to 41 sapwood rings. Where bark is present on the sample the year of felling of the tree used may be determined. It is also possible to determine the season of felling by looking at the anatomy of the final ring in detail.

The dates derived for the felling of the trees used in construction do not necessarily relate directly to the date of construction of the building. However, evidence suggests that, except in the re-use of timbers, construction in most historical periods took place within a very few years after felling (Salzman 1952; Hollstein 1965).

Results

The timbers were treated initially as having come from three possible phases of construction as outlined by Aitkens (1998) and sampled accordingly. Very few samples were available from phases 1a and 1b because most timbers exhibited too few rings. Although one would normally expect to sample at least eight samples per phase, few suitable timbers were found. The cores generally showed comparatively wide-ringed sequences, with sufficient growth between the pith and sapwood to provide usable trees of less than fifty years old, not good for dendro-chronology. The dates of these two phases were thought to be so close that it was hoped that there would be good overlap between the few samples available from both phases.

Many of the timbers sampled appear to be made from quartered trees, with the occasional sample, eg WNG05 an arcade plate in the hall, being of boxed-heart conversion.

Samples WNG02 and WNG05 crossmatch with each other ($t = 5.5$) and were combined into a new sequence WNG0205M which has 68 rings. This was compared with a number of regional master chronologies and individual site masters, giving consistent matching at a position equivalent to the date range AD 1310 - 1378 (Table 2). Sample WNG05 had traces of spring vessels of the following year (AD 1379) present, showing that the tree was felled early in the spring of that year.

The other sequences over 50 years long were compared individually with a range of regional and site master chronologies. Sample WNG15 (62 rings) gave consistent matches equivalent to

Table 1: Oak (*Quercus* spp.) timbers sampled at Wingfield College, Wingfield, Suffolk. h/s = heartwood-sapwood boundary. The phases relate to the study by Aitkens (1997)

Sample no	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of Sequence (AD)	Felling date of sequence (AD)
Phase I(a)						
WNG11	Stud to south of scarf	45	unmeasured	h/s?	unknown	unknown
WNG12	Stud	61	2.06	4	unknown	unknown
WNG13	Southeast post to open truss	44	unmeasured	1	unknown	unknown
WNG14	Southeast brace to open truss	47	unmeasured	-	unknown	unknown
Phase I(b)						
WNG06	Northwest corner post	41	unmeasured	-	unknown	unknown
WNG07	Inner post, northwest	56	2.20	1	unknown	unknown
WNG08	Window frame stud, north wall	16	unmeasured	-	unknown	unknown
WNG09	Tie, north wall	25	unmeasured	5	unknown	unknown
WNG10	East wall plate	29	unmeasured	-	unknown	unknown
Phase II						
WNG01	Northwest arcade post	*c*42	unmeasured	*c*21	unknown	unknown
WNG02	Northwest corner post	53	2.36	-	1316 - 1368	after 1377
WNG03	Southwest arcade post	36	unmeasured	-	unknown	unknown
WNG04	Collar to west truss	28	unmeasured	-	unknown	unknown
WNG05	North arcade plate	68	1.41	15 bark	1310 - 1378	spring 1379
WNG15	Upper tie	62	3.64	11 bark	1321 - 1382	early summer 1383
WNG16	Southeast aisle post	31	unmeasured	1	unknown	unknown
WNG17	South arcade plate	39	unmeasured	-	unknown	unknown

the date of the outermost complete ring being AD 1382 (Table 3). The earlywood vessels of the following year were present, showing that the tree was felled in early summer AD 1383.

There was also some weak matching with WNG0205M ($t = 3.5$) at this position. Consequently, these matches were accepted as a date, and the three series (WNG02, WNG05, and WNG15) were combined to form a site chronology, WINGCOLL. This series was then compared with the available data, the strongest results being shown in Table 4. The ring-width data for series WNG0205M, WNG15, and WINGCOLL are shown in Table 5, along with the other series over 50 rings which gave no consistent crossmatches with either the site chronology, or other data.

Table 2: Dating of the oak ring-width series WNG0205M from Wingfield College, Suffolk

	WNG0205M AD 1310 - 1378	
Dated reference or site master chronology	*t*-value	Overlap (yrs)
London1175 (Tyers unpubl)	4.7	68
Hants 97 (Miles unpubl)	3.9	68
Cann Hall, Essex (Tyers 1998)	5.9	68
Cressing2, Essex (Tyers 1993)	5.3	59
Woodham Walter, Essex (Tyers 1996)	5.0	62
Little Braxted, Essex (Bridge forthcoming (b))	4.9	65
Fyfield 2, Essex (Bridge 1998)	4.1	68

Table 3: Dating of the oak ring-width series WNG15 from Wingfield College, Suffolk

	WNG15 AD 1321 - 1382	
Dated reference or site master chronology	*t*-value	Overlap (yrs)
London1175 (Tyers unpubl)	4.4	62
Hants 97 (Miles unpubl)	3.7	62
Windsor Castle, Berkshire (Hillam and Groves 1996)	4.6	62
Dunmow, Essex (Bridge forthcoming (c))	4.3	53
Charlton Court Barn, Sussex (Miles pers comm)	4.2	62

Table 4: Dating of the oak site master series WINGCOLL from Wingfield College, Suffolk

	WINGCOLL AD 1310 - 1382	
Dated reference or site master chronology	*t*-value	Overlap (yrs)
London1175 (Tyers unpubl)	5.5	72
Hants 97 (Miles unpubl)	4.8	72
Cann Hall, Essex (Tyers 1998)	7.3	72
Woodham Walter, Essex (Tyers 1996)	5.0	62
Cressing2, Essex (Tyers 1993)	4.9	63
Fyfield 2, Essex (Bridge 1998)	4.9	72
Little Braxted, Essex (Bridge forthcoming (b))	4.8	69
Dunmow, Essex (Bridge forthcoming (c))	4.6	62

Interpretation and Discussion

The earliest phases of this building have been constructed using fast-grown young oaks (*Quercus* spp.), generally less than fifty years old. The few longer sequences found here could be dated using current methodologies, although nearly all matches were with chronologies from Essex. Only three timbers were dated in this study, all from Aitkens' Phase II. The felling dates for the timbers used in phase (II) were after AD 1377, spring AD 1379, and early summer AD 1383. This strongly suggests that the timbers used to construct the aisled hall phase were felled over a few years and that construction is likely to have taken place in the early years of the AD 1380s. This period fits the date suggested on stylistic grounds, and, if one accepts the AD 1362 date for the earliest phases of the college, it supports Aitkens' idea that this phase was constructed a short time after the range to the north.

Very few buildings have so far been dendrochronologically dated in Suffolk, and buildings in the neighbouring counties of Norfolk and Essex also often show the use of timbers of similar characteristics, making tree-ring dating very difficult at present. In recent years, work, most notably by Ian Tyers, now at the University of Sheffield, and to a lesser extent by the present author, has resulted in a number of Essex buildings being dated. It therefore appears that if sufficient resources are available and a large number of buildings can be studied, regional chronologies can be constructed that will improve the success rate of dendrochronological dating in the area. It should be noted that the Wingfield College timbers gave strong matches only against relatively local site chronologies.

In Essex, the work on the barns at Cressing (Tyers 1993) provided well replicated chronologies which helped considerably in dating other buildings in the area. A good strategy would therefore seem to be to start with the higher class buildings with large numbers of timbers in them, rather than at the truly vernacular buildings. One cannot dispute that Wingfield College provides one of the grandest timber framed buildings in the area, though according to Aitkens (1997) the cut and quality of the timbers is below the standard expected of in manor house construction.

The dating of the Great Barn at Wingfield (Bridge forthcoming(a)) showed that the ring-width patterns matched well against individual site chronologies from south eastern England, but gave poor results against the existing regional chronologies. It can be inferred from this that, during historic times, the oaks growing in this East Anglian region did not have their growth limited to the same extent by the climatic conditions as in other regions. This is supported by studies on living oaks in the region (Briffa *et al* 1986; Moir and Bridge unpubl) which show growth patterns different in nature to other parts of England.

Whilst this building was a strong candidate for dating using dendrochronological methods, the outcome strongly supports the need for a more intensive programme of dendrochronological studies in the county to provide local data which might date these relatively short sequences.

Acknowledgements

I would like to thank the owners of the building, Mr and Mrs Chance, for their hospitality during my visit to the site, and Mr Philip Aitkens and his assistant for his practical help and useful discussions about the building. Useful comments and suggestions on an earlier draft of this report were made by Cathy Groves (University of Sheffield) and these led to a reappraisal of the material. Finally I would like to acknowledge the enormous debt I owe my mother, who died unexpectedly whilst I was working at the site.

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Table 5: Ring-width data for the oak samples from Wingfield College, Wingfield, Suffolk

Year	ring widths (0.01mm)	No. of samples
WNG0205M AD 1311 - 1378		
AD1311	96 104 148 226 248 262 309 257 268 194	1 1 1 1 1 2 2 2 2 2
	206 174 142 136 132 92 193 220 281 210	2 2 2 2 2 2 2 2 2 2
	170 191 132 185 230 150 140 146 157 193	2 2 2 2 2 2 2 2 2 2
	246 188 160 135 246 193 186 125 131 183	2 2 2 2 2 2 2 2 2 2
AD1351	251 154 183 173 232 225 208 159 193 236	2 2 2 2 2 2 2 2 2 2
	121 197 233 210 242 202 152 185 161 162	2 2 2 2 2 2 2 2 1 1
	128 92 87 108 93 89 104 115	1 1 1 1 1 1 1 1
WNG07		
1	50 90 54 60 39 46 77 211 200 127	
	102 136 157 196 211 164 194 259 217 217	
	101 42 60 65 126 103 96 188 159 136	
	170 150 258 204 213 292 304 260 248 298	
	279 333 375 371 461 350 277 303 362 293	
51	288 461 477 477 406 533	
WNG12		
1	321 530 452 192 98 110 168 214 116 122	
	76 153 350 399 240 142 127 215 498 650	
	915 761 284 103 59 53 113 96 133 90	
	73 63 74 100 176 290 200 136 86 165	
	294 173 97 41 90 85 103 111 117 132	
51	209 120 144 155 191 103 305 217 286 209	
	227	
WNG15 AD1321 - 1382		
AD1321	581 771 768 530 521 308 626 450 680 483	
	399 427 377 491 449 367 413 386 452 507	
	477 646 416 322 381 318 321 471 455 641	
AD1351	535 481 505 452 427 250 427 366 350 490	
	244 308 247 253 170 143 163 204 173 163	
	114 133 125 160 153 164 124 141 130 189	
	166 181	
WINGCOLL AD1311 - 1382		
AD1311	96 104 148 226 248 262 309 257 268 194	1 1 1 1 1 2 2 2 2 2
	331 373 351 267 262 164 338 297 414 301	3 3 3 3 3 3 3 3 3 3
	247 270 214 287 303 222 231 226 256 298	3 3 3 3 3 3 3 3 3 3
	323 341 245 198 291 235 231 240 239 336	3 3 3 3 3 3 3 3 3 3
AD1351	346 263 291 266 297 233 281 228 245 321	3 3 3 3 3 3 3 3 3 3
	162 234 238 225 218 183 156 192 167 163	3 3 3 3 3 3 3 3 2 2
	121 113 106 134 123 127 114 128 131 190	2 2 2 2 2 2 2 2 1 1
	167 182	1 1