Ancient Monuments Laboratory
Report 76/98

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Summary

The primary phase of this barn was thought to date to the early sixteenth century, although the college with which it is associated is known to have fallen out of use in the first half of that century, making a more precise dating of the barn of great historical interest to the overall site. A single timber, from an original middle rail, was felled in AD 1527. A number of other dated timbers have sapwood rings or show the heartwood-sapwood boundary. All of these have estimated felling dates which include the year AD 1527. It therefore seems most likely that the barn was built in AD 1527 or within a few years thereafter. The data provide some of the first historical oak tree-ring series for Suffolk which should be useful for dating buildings in the county in the future.

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## Introduction

This report details the initial assessment of timbers in the Great Barn at Wingfield, Suffolk (NGR TM 229768; Fig 1) for their suitability for dendrochronological investigation and the further analysis of those timbers sampled subsequently. This grade II listed building is a queen-post and raised-aisle truss barn, and English Heritage commissioned this work to inform statutory casework decisions with regard to impending repair and reuse of the building, as well as to attempt to establish its chronological relationship with the nearby college buildings (Bridge forthcoming).

Much of the following background information is drawn from a report on the site by Aitkens (1997). This report suggests that tree-ring analysis of the barn would be very useful, if only to confirm whether or not it was built after the dissolution of the college, and suggests that a date in the 1560s or 1570s seems most likely on historical and stylistic evidence.

The north end of the barn lies about 40m south east of the college buildings which share the site, and were themselves the subject of a dendrochronological investigation (Bridge forthcoming). It was originally rectangular, 26m long and 6.5m wide (Aitkens 1997). It consists of five primary bays, thought to be of sixteenth century date on stylistic grounds, with two bays added on the north end, probably during the seventeenth century. Truss numbering follows that used by Feilden and Mawson (Architects) in a recent survey of the barn, in which the trusses are numbered from the southern end of the building. Figure 2 shows the form of frames 2, 3, and 6; Figure 3 the form of frame 5 which is largely infilled, and Figure 4 the form of the southern end frame (frame 1).

The open trusses are constructed with jowled-headed posts and archbraces up to tiebeams, upon which sit pairs of jowelled queen posts. The three closed trusses, at both gables and between bays 4 and 5, are slightly different. The braces which rise to the tiebeams are convex, and rather long. There is a queen-post truss as before, but the collar beam lacks the slight camber of the open truss beams, and does not have archbraces beneath it (Aitkens 1997). At the rear (east) the studding is of full height and quite widely spaced, but by contrast, the front (west) wall studding is divided by a middle rail above head height with much more closely-spaced studs above and below the rail (Aitkens 1997). Various alterations have been carried out over the years, eg flooring in the northern-most bays, a porch, and weatherboarding on the exterior have all been added.

The English Heritage brief was to attempt to date the primary phase of the barn only.

## Methodology

The site was visited in March 1998, when the timbers were assessed for their potential use in dendrochronological study. Cores were taken from only six timbers on this occasion, and more cores were collected in a second visit in June. Details of the locations of the samples are given in Table 2, and illustrated in the figures (Figs 2, 3, and 4).

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

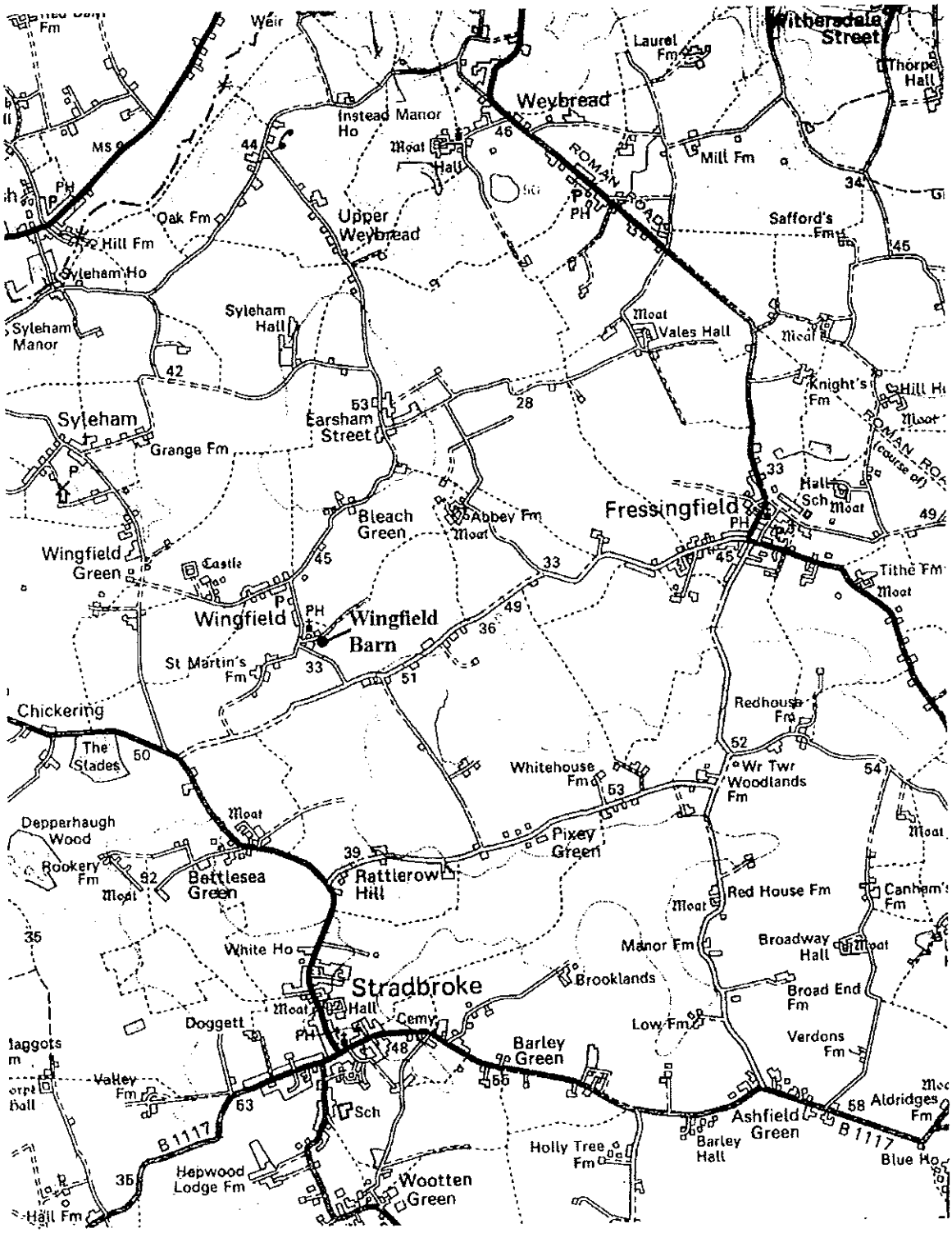


**Figure 1:** Map to show the general location of Wingfield Barn, Suffolk

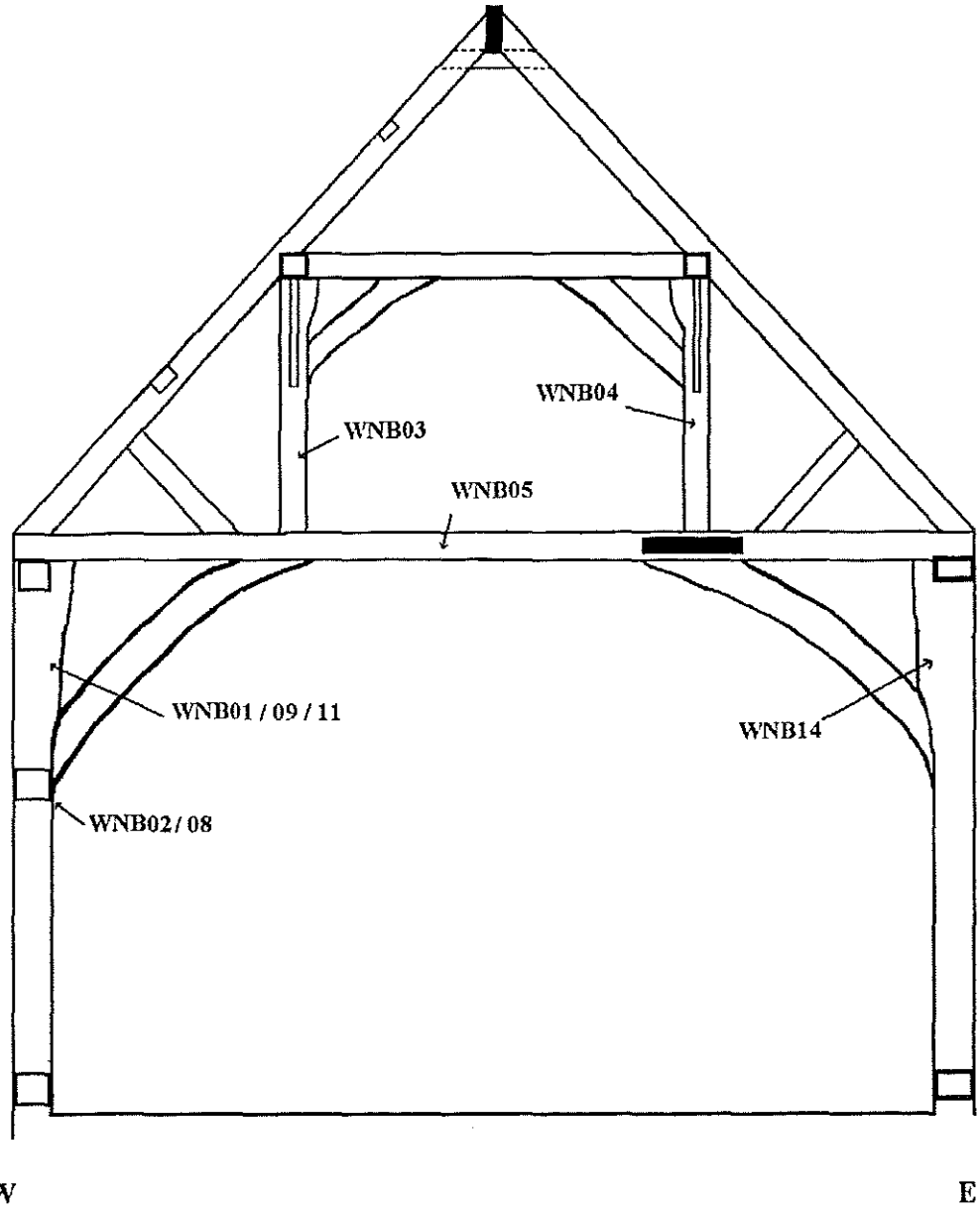


**Figure 2:** Drawing showing the form of trusses 2,3, and 6, Wingfield Great Barn, Suffolk, giving approximate locations of the samples taken for dendrochronology

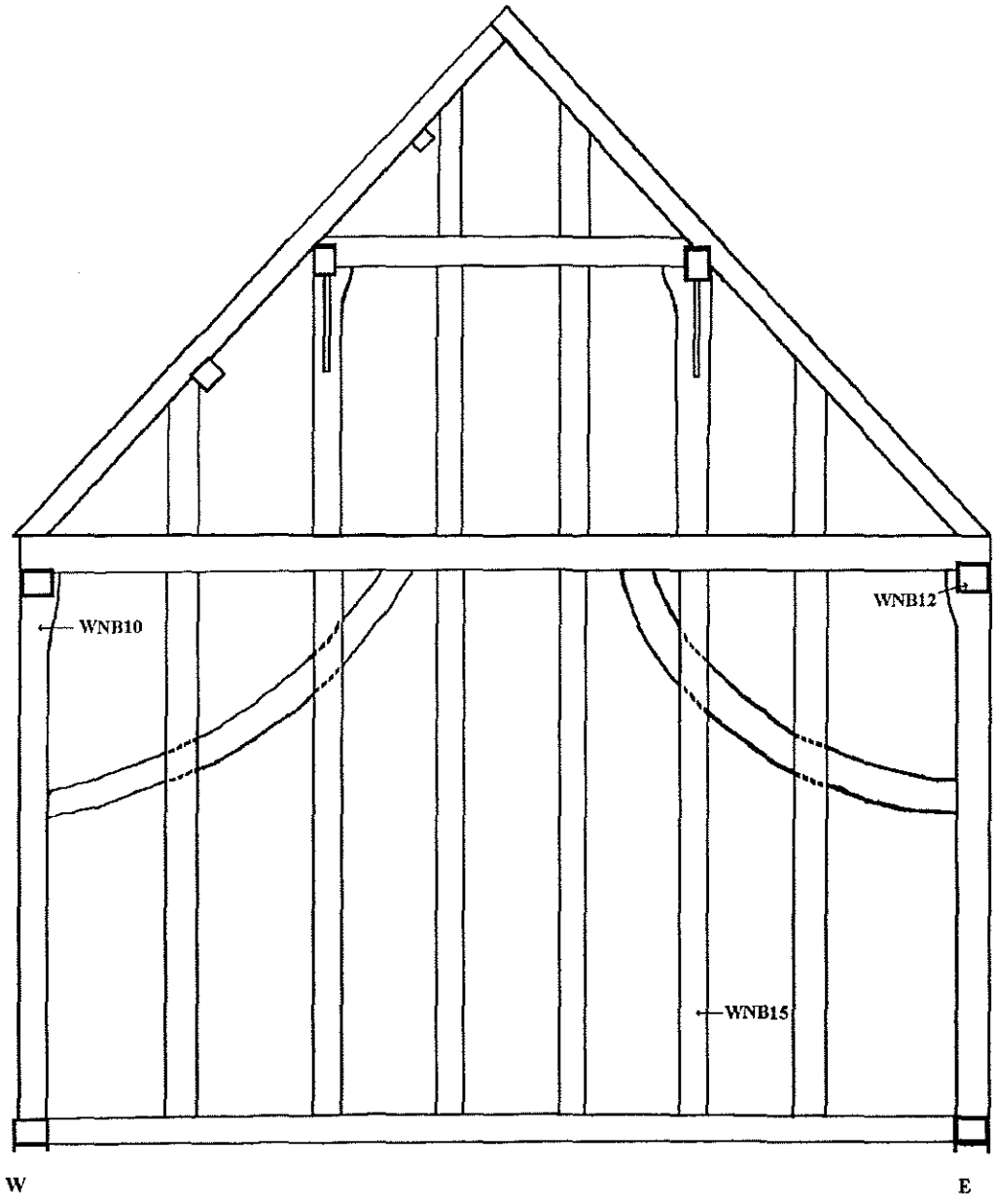


**Figure 3:** Drawing showing the form of truss 5, Wingfield Great Barn, Suffolk, giving approximate locations of the samples taken for dendrochronology

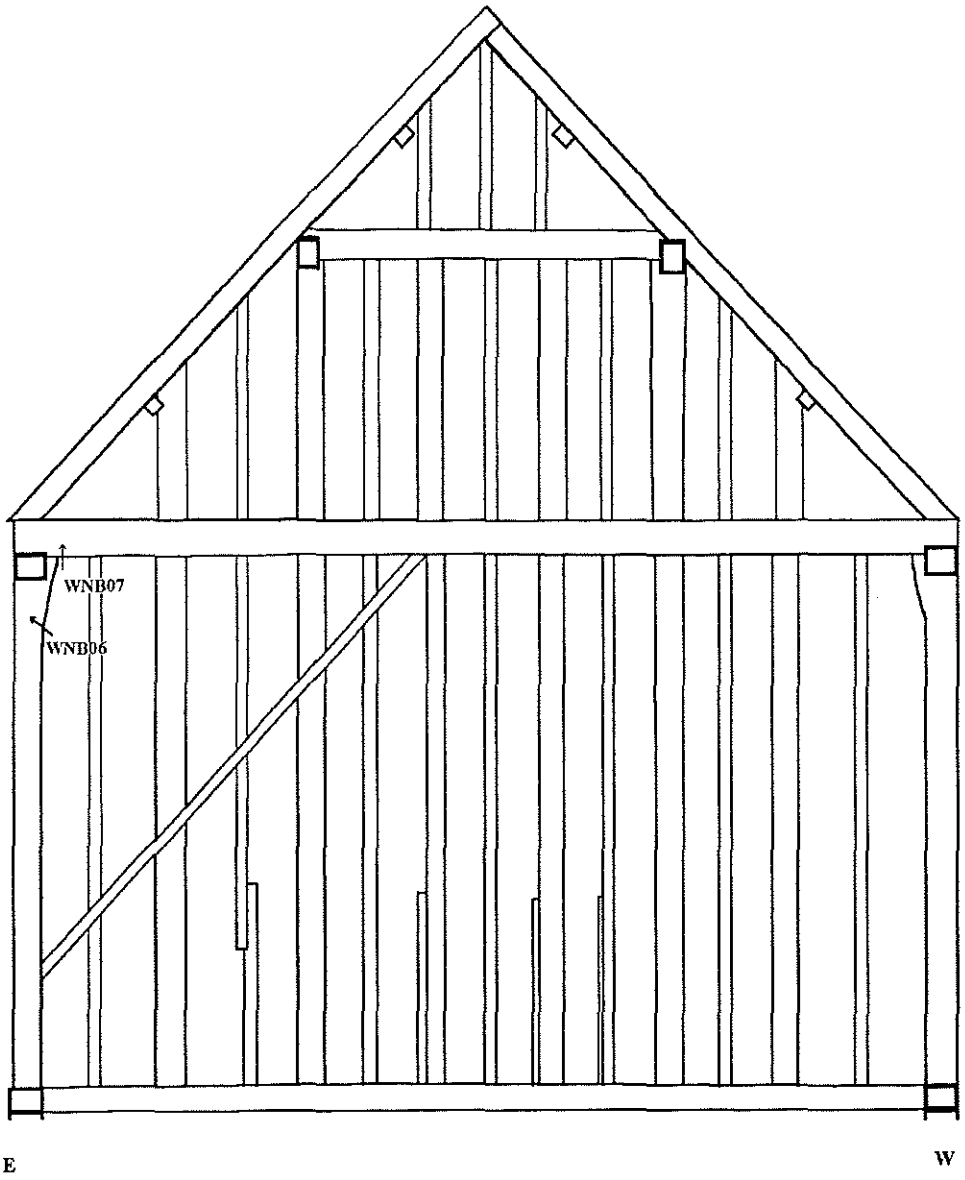


**Figure 4:** Drawing showing the form of the southern end truss, Wingfield Great Barn, Suffolk, giving approximate locations of the samples taken for dendrochronology

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).

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 are not included in the site mean(s) are also compared with the database to see if they can be dated.

The 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 exact date of felling of the tree used may be determined.

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).

Only six samples were taken on the initial visit to the barn, partly because of time constraints (work was being done on the college buildings on the same visit), and partly because the initial samples did not look very suitable, having relatively few rings. The subsequent dating of a single sample led to a further visit in the hope that other datable timbers might be found to confirm the date from sample WNB02.

## Results

A large number of the timbers used in the primary construction phase were found on close inspection to be of elm (*Ulmus* spp.). Those positively identified are listed in Table 1. Many of the oak (*Quercus* spp.) timbers were assessed as having too few rings for dendrochronological study, and hence the limited number of successful cores.

**Table 1:** Timbers found to be of elm (*Ulmus* spp.) in Wingfield Great Barn

| | |
|---|---|
| Frame 2: | tie beam, east post(?), |
| Frame 3: | tie beam, east post |
| Frame 5: | tie beam, east post |

The crossmatching between the ring-width data for WNB02 and a selection of site chronologies is given in Table 3. The data for this, the site chronology, and samples WNB03 and WNB06 are

**Table 2:** Oak (*Quercus* spp.) timbers sampled at Wingfield Great Barn.

h/s = heartwood-sapwood boundary

| Sample No | Origin of core | Total No of years | Average growth rate (mm $yr^{-1}$) | Sapwood details | Date of sequence AD | Felling date of timber AD |
|---|---|---|---|---|---|---|
| WNB01 | Frame 2, west post | 36 | *c* 4 | h/s | unknown | - |
| WNB02 | Bay 1, mid-rail, west side | 74 | 2.29 | 30 (bark) | 1454 -1527 | 1527 |
| WNB03 | Frame 6, west queen post | 50 | 2.60 | h/s | unknown | - |
| WNB04 | Frame 6, east queen post | 41 | not measured | h/s? | unknown | - |
| WNB05 | Frame 6, tie beam | 32 | not measured | h/s? | unknown | - |
| WNB06 | Frame 1, east post | 50 | 3.08 | 13 | unknown | - |
| WNB07 | Frame 1, tie beam | 37 | 4.10 | 9 | unknown | - |
| WNB08 | Bay 2, mid-rail, west side | 24 | not measured | - | unknown | - |
| WNB09 | Frame 4, west post | 51 | 2.88 | h/s | 1456 - 1506 | 1515 - 1547 |
| WNB10 | Frame 5, west post | 34 | not measured | - | unknown | - |
| WNB11 | Frame 6, west post | 34 | not measured | - | unknown | - |
| WNB12 | Bay 5, wall plate, east side | 52 | 2.03 | h/s | 1461 - 1512 | 1521 - 1553 |
| WNB13 | Bay 5, stud, east side | 37 | not measured | - | unknown | - |
| WNB14 | Frame 6, east post | 60 | 2.23 | h/s | 1451 - 1510 | 1519 - 1551 |
| WNB15 | Frame 5, lower stud, east side | 65 | 1.47 | 17 + 12 others* | 1451 - 1515 | 1527 - 1539 |

* additional sapwood rings not measured because of breaks in the core and insect damage

**Table 3:** Dating of sample WNB02 from Wingfield Great Barn, Suffolk

| | **WNB02 AD 1454 - 1527** | |
|---|---|---|
| **Dated reference or site master chronology** | *t*-value | Overlap (yrs) |
| Magdalen Laver (Tyers and Boswijk 1998) | 5.3 | 74 |
| Gosfield (Bridge 1998a) | 5.1 | 74 |
| Mary Rose 'original' (Bridge unpubl) | 4.9 | 50 |
| Sinai (Tyers 1997a) | 4.3 | 74 |
| Walmer Castle (Howard *et al* 1997) | 4.2 | 70 |
| Bruce 4 (Bridge 1998b) | 4.1 | 74 |

**Table 4:** Crossmatching between the dated components of the Wingfield Barn site chronology

***t* - values**

| **Sample no** | WNB09 | WNB12 | WNB14 | WNB15 |
|---|---|---|---|---|
| WNB02 | 3.9 | 3.3 | 3.3 | 3.3 |
| WNB09 | - | 4.3 | 4.8 | 3.6 |
| WNB12 | | - | 4.0 | 5.1 |
| WNB14 | | | - | 3.4 |

**Table 5:** Dating of the oak timbers from Wingfield Barn, Suffolk

| | **WINGFIELD BARN AD 1451 - 1527** | |
|---|---|---|
| **Dated reference or site master chronology** | *t*-value | Overlap (yrs) |
| Gosfield, Essex (Bridge 1998a) | 6.0 | 77 |
| Magdalen Laver, Essex (Tyers and Boswijk 1998) | 4.7 | 77 |
| Cann Hall, Essex (Tyers 1998) | 4.6 | 61 |
| Eastbury, Greater London (Tyers 1997b) | 4.0 | 77 |
| Wimpole1, Cambridgeshire (Bridge 1998c) | 4.0 | 59 |
| Mary Rose 'original' (Bridge unpubl) | 4.0 | 53 |

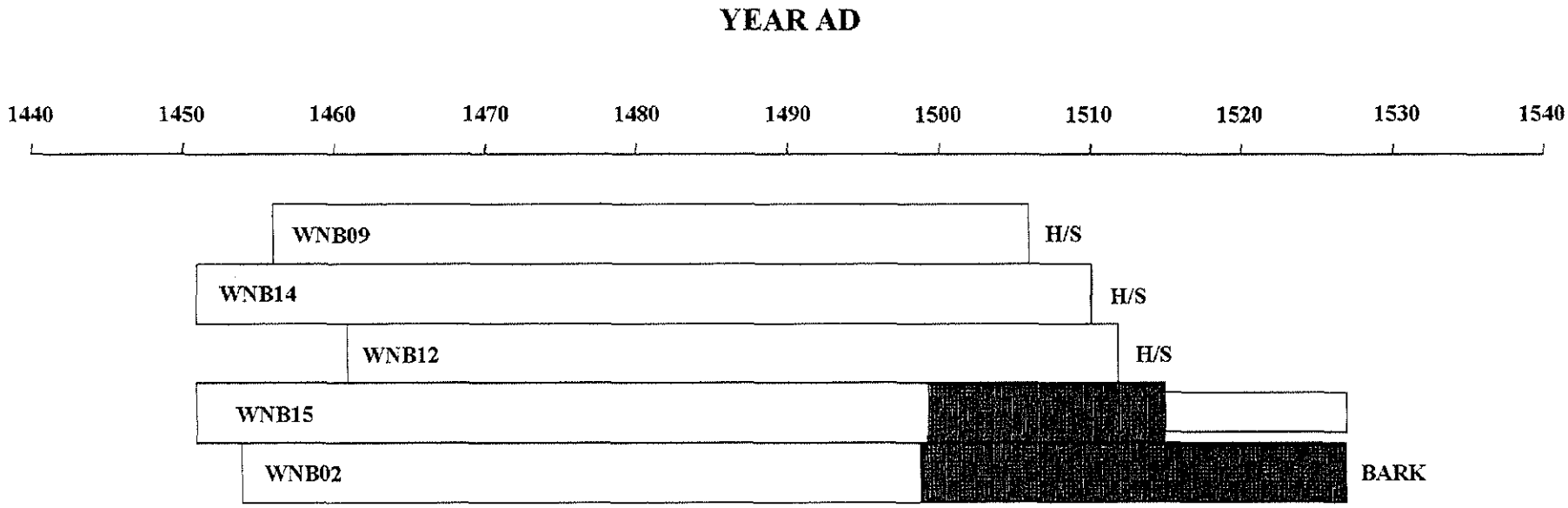


**Figure 5:** Relative positions of overlap of the dated oak samples from Wingfield Barn, Suffolk. H/S = heartwood - sapwood boundary, shaded areas represent sapwood, and the thin bar represents unmeasured sapwood rings

presented in Table 6. Series WNB03 and WNB06 did not crossmatched with each other or the subsequent site chronology, nor did they give any consistent crossmatches when compared with a number of other site and regional chronologies.

The second group of timbers again had very few rings, although four series did have more than 50 rings (WNB09, WNB12, WNB14, and WNB15). These were crossmatched and combined with the dated series WNB02. The crossmatching between the elements of the site chronology is statistically weak, many of the timbers having few overlapping rings (Fig 5), nevertheless it was judged acceptable using the visual plots.

The site chronology thus formed was only 77 years in length, but did date against a number of site chronologies from East Anglia (Table 5).

## Interpretation

The first sample dated (WNB02) gave a felling date for a single timber of AD 1527. Although this timber looked to be part of the original primary phase of the building, any date for the building based on a single timber would have to be viewed with great caution. Firstly there is the possibility that the timber was not part of the primary phase, but either re-used from an earlier structure, or used later in a repair. Secondly, it is possible that a single timber may have been stockpiled before use. Although the initial assessment of the timbers had suggested that very few were likely to yield long ring-width series suitable for dendrochronology, it was felt that a second sampling might be appropriate in order to try and confirm the dating from the single timber.

The grouping of the felling dates of the dated timbers suggests that they represent a single batch of timbers, and thus it seems likely that they were all felled in AD 1527, with the barn most likely being erected in this year or within a few years after.

## Discussion

Very few buildings in Suffolk have been dated using dendrochronology. One of the major reasons for this is that in this particular area, as well as in the neighbouring areas of Norfolk and Essex, oaks appear to grow very quickly, as reflected by the large average ring-widths at this site, and very young oaks are often used in construction. Dendrochronology relies on the successful crossmatching of ring-width series and short sequences often can not be matched with much certainty using current methodology. Tyers has made progress in dating Essex buildings in recent years (Tyers 1993), and it is hoped that as more buildings are studied in Suffolk, it will eventually be possible to increase the chances of successful crossdating here too.

The area will probably need its own regional chronology, as reflected by the fact that significant crossmatching could not be found with any of the existing regional chronologies, only site masters from neighbouring Essex and Cambridgeshire.

This study also raises interesting questions about the availability of oak in the early sixteenth century. The college buildings, typologically dated to the late fourteenth century, appear to be framed completely in oak, whilst the barn makes extensive use of elm (*Ulmus* spp.). Similarly, a building in south London dated to AD 1490, or very soon thereafter (Bridge 1998d) shows a mixture of elm and oak, as have others in southeast London dated on stylisitic evidence to the same period.

This investigation dates the barn some 30-40 years earlier than had previously been suggested on stylistic grounds, and is very significant in relation to the history of the overall site and the use of the college buildings.

**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 for his useful discussions about the barn. I thank Alex Bayliss and Cathy Groves for their helpful comments on an earlier draft of this report. 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 6:** Ring-width data for the oak samples from Wingfield Great Barn, Suffolk

| Year | ring widths (0.01mm) | | | | | | | | | | no of trees | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WNB02 AD 1454 - 1527** | | | | | | | | | | | | | | | | | | | | |
| AD1454 | | | | 262 | 272 | 336 | 291 | 400 | 392 | 440 | | | | | | | | | | |
| | 337 | 461 | 496 | 265 | 375 | 298 | 294 | 338 | 429 | 448 | | | | | | | | | | |
| | 325 | 421 | 254 | 407 | 351 | 215 | 360 | 261 | 370 | 380 | | | | | | | | | | |
| | 452 | 387 | 336 | 306 | 333 | 292 | 467 | 353 | 347 | 249 | | | | | | | | | | |
| | 211 | 197 | 174 | 166 | 145 | 182 | 121 | 65 | 95 | 98 | | | | | | | | | | |
| AD1501 | 81 | 105 | 77 | 82 | 76 | 112 | 56 | 57 | 87 | 70 | | | | | | | | | | |
| | 69 | 77 | 79 | 64 | 68 | 86 | 61 | 80 | 145 | 148 | | | | | | | | | | |
| | 81 | 156 | 168 | 112 | 97 | 108 | 95 | | | | | | | | | | | | | |
| **WINGFIELD BARN AD 1451 to AD1527** | | | | | | | | | | | | | | | | | | | | |
| AD1451 | 363 | 424 | 368 | 377 | 336 | 334 | 258 | 282 | 274 | 269 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 |
| | 252 | 272 | 278 | 187 | 260 | 243 | 227 | 225 | 246 | 289 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | 221 | 228 | 156 | 260 | 239 | 188 | 210 | 199 | 258 | 256 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | 292 | 262 | 226 | 173 | 176 | 199 | 295 | 247 | 312 | 248 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | 202 | 170 | 153 | 210 | 251 | 309 | 244 | 124 | 133 | 163 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| AD1501 | 197 | 182 | 159 | 165 | 196 | 192 | 134 | 137 | 171 | 134 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 |
| | 92 | 105 | 64 | 64 | 70 | 87 | 62 | 81 | 146 | 149 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| | 82 | 157 | 169 | 113 | 98 | 109 | 96 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | |
| **WNB03** | | | | | | | | | | | | | | | | | | | | |
| 1 | 594 | 467 | 521 | 559 | 525 | 420 | 370 | 367 | 310 | 241 | | | | | | | | | | |
| | 309 | 389 | 357 | 391 | 301 | 256 | 187 | 256 | 187 | 208 | | | | | | | | | | |
| | 235 | 200 | 172 | 176 | 197 | 121 | 133 | 176 | 168 | 183 | | | | | | | | | | |
| | 123 | 210 | 235 | 275 | 186 | 135 | 197 | 213 | 171 | 250 | | | | | | | | | | |
| | 273 | 317 | 214 | 219 | 97 | 135 | 224 | 161 | 169 | 197 | | | | | | | | | | |
| **WNB06** | | | | | | | | | | | | | | | | | | | | |
| 1 | 554 | 476 | 439 | 492 | 677 | 700 | 473 | 345 | 240 | 130 | | | | | | | | | | |
| | 338 | 348 | 409 | 326 | 343 | 197 | 286 | 309 | 452 | 382 | | | | | | | | | | |
| | 384 | 232 | 248 | 238 | 395 | 331 | 246 | 296 | 286 | 388 | | | | | | | | | | |
| | 359 | 235 | 302 | 189 | 129 | 239 | 266 | 198 | 214 | 208 | | | | | | | | | | |
| | 164 | 277 | 203 | 154 | 199 | 230 | 250 | 199 | 205 | 203 | | | | | | | | | | |