

possibility of a vineyard must be considered, even though the field is somewhat over-shadowed by the hill to the S. (in which there is a sand- or gravel-pit). There is a flattened boundary-bank running across the top of this field (33) and an enigmatic series of banks carrying on the line of the fishponds (34).

The easternmost field may mark the extremity of the monastic precinct and contains an industrial site (35) recently excavated by Trevor Rowley and Philip Rahtz, which was evidently set as far away from the church as possible, but kept within the precinct. It is difficult to define the course of the precinct boundary in this area; perhaps the large embanked triangular pond (35), created later to furnish power for a metal workshop which already existed, has obscured the precinct bank. The site of a mill, with stone footings just beneath the turf, can be recognized at (37); it might have operated either tilt-hammers for forging blooms or bellows to heat a forge. A channel conveying water along the base of the bluff S. of the precinct can be seen at (38), although it has been partly destroyed by recent pipe-laying operations.

E. of the industrial site there is a further linear hollow which probably represents the continuation of the original course of the river back to the River Arrow.

Around many of our monastic sites there are extensive areas of earthworks which have, as yet, been very rarely recorded or studied. Sketch surveys of sites in Worcestershire (Halesowen Abbey, Evesham Abbey, Dodford Priory, Cookhill Nunnery) and Warwickshire (Maxstoke Priory, Merevale Abbey, Kenilworth Abbey, Henwood Nunnery and Pinley Priory) have all revealed extensive areas of earthworks around the known and generally well-recorded stone buildings. Our knowledge of monasteries as economic units rather than architectural masterpieces could be considerably increased with detailed surveys of precinct areas, identifying features indicating water-control and utilization, tracing boundary-banks or walls of precincts, and locating outlying buildings. Surveys, such as this at Bordesley, inevitably pose a large number of questions and suggest many possible sites where special problems could be tackled by excavation.

M. ASTON

TWO EARLY CRUCK HOUSES IN NORTH BERKSHIRE IDENTIFIED BY RADIOCARBON (FIGS. 41-2)

The subject of this note stems from a programme which started in 1962 with Professor W. F. Libby's new radiocarbon laboratory at the University of California at Los Angeles. The object was to date some of the surviving medieval timber-framed buildings in or near Harwell in N. Berkshire. At that time there was a difference of opinion about the dates of cruck-framed buildings. Fox and Raglan had found stylistic evidence in Monmouthshire which led them to attribute most of the crucks there to the 16th century,³⁶ while Portman assigned the original cruck-framed part of Cruckfield Cottage in the parish of Long Wittenham, Berks., to the early 15th century, or possibly earlier.³⁷

Care was taken in planning this work to send samples for radiocarbon dating which were free from contamination with carbonaceous impurities and which also had a known growth allowance (that is the number of annual rings between the sample and the bark).³⁸ However, until 1966 no building-dates could be derived from the radiocarbon results, because the corrections to apply for the small, but important, variation in the carbon-14 levels in the atmosphere were not available. When some

³⁶ Sir Cyril Fox and Lord Raglan, *Monmouthshire Houses*, I (1951).

³⁷ D. Portman, *Berks. Archaeol. J.*, LVI (1958), 35.

³⁸ J. M. Fletcher, *Antiquity*, XLII (1968), 230.

values for this correction were published³⁹ and applied to our results, reasonable dates were derived for the five cruck houses that formed the first series of samples, taken in 1962.⁴⁰ The dates (the last five in TABLE I) were mainly in the 15th century.

TABLE I

Cruck Building	UCLA Ref. No.	Radiocarbon Age* (years before 1950)	Calendar Age (by correcting for secular variation)	Growth Allowance (years)	Date of Felling†
Harwell H. S. Baker's, Wellshead	1327	802 ± 50	1225	50	1275
Steventon Godfrey's, 83 The Causeway	{ 1384 1385	{ 829 ± 50 914 ± 50	{ 1220 1205	{ 55 75	{ 1275 1280 }
Harwell Lockton Farm, outhouse‡	1328	675 ± 50	1285	30	1325
Middle Farm, outhouse	1383	639 ± 50	1310	40	1350
Dell Cottage	267	561 ± 45	1405	20	1425
Le Carillon	235	582 ± 60	1390	40	1430
Long Wittenham Church Farm	238	577 ± 60	1395	50	1445
Tractor-shed	237B, 265 and 266	438 ± 35	1460	20	1480
Harwell School House	236	422 ± 60	1470	60	1530

* Based on half-life of 50720 years: includes correction for $\delta C 13$ when available, viz. in the first five items.

† For standard error, see text. ‡ Elm, others oak.

The second series of samples, taken in 1967–8 and measured by Professor R. Berger in 1968–9,⁴¹ included four further crucks from the same area (TABLE I, first four buildings). The results gave two dates in the 14th century and two in the 2nd half of the 13th century. They arrived just in time to be included (at proof stage) in the paper on crucks in the W. Berkshire and Oxford region that was issued at the end of 1969.⁴²

PROCEDURE; AND TESTING OF THE METHOD

The samples, each about 2 oz. (or 50 gm.) in weight, were taken from blocks of wood cut *in situ* from cruck blades. All were heartwood and any outside surfaces were removed. The number of annual rings covered by a sample varied from 8 to 28, with a mean of 17 years. On account of very short-term fluctuations in atmospheric carbon-14, it now seems desirable that there should be a spread of 10 to 12 years.⁴³

Confidence in the sampling procedure and radiochemical analysis was established by the consistency of the results (UCLA 237B, 265, 266) for three separate cruck blades in a former cottage (now a tractor-shed) at Long Wittenham. The three pieces of oak that were analysed should have the same age, as the growth allowance was about the

³⁹ M. Stuiver and H. E. Suess, *Radiocarbon*, viii (1966), 534.

⁴⁰ J. M. Fletcher in *Scientific Methods in Medieval Archaeology*, ed. R. Berger (Los Angeles, 1970), 141.

⁴¹ R. Berger, *ibid.*, 89.

⁴² J. M. Fletcher, *Oxoniensia*, xxxiii (1968), 71.

⁴³ J. G. Farmer, R. J. Stenhouse and M. S. Baxter, *Radiocarbon*, xiv (1972), 326.

same for each. In fact, the radiocarbon ages (based on the carbon-14 half-life being 5,720 years) were 441, 438 and 422 B.P., the standard deviation for the radiochemical analysis being given at that time as ± 60 years.⁴⁰

In the second series two samples were included from parts of the medieval parsonage, later known as Wellshead Farm, Harwell, for which there is evidence of the approximate dates on other grounds.⁴⁴ The first was from the tie-beam of truss III in its crown-post wing, dated on typological and historical grounds between 1300 and 1330; the second was from a rafter in the five-bay range (with close-studding) which replaced an earlier hall soon after the Reformation. The results, after correcting for the variation in secular carbon-14 and for growth allowance, gave dates within a decade or so of those expected:

TABLE II

	Radiocarbon Age (years B.P.)	Calendar Date of Sample	Growth Allowance (years)	Date of Building Phase
Crown-post wing (UCLA 1381)	743 \pm 50	1240	75	1315 \pm 60
Close-studding range (UCLA 1329)	319 \pm 40	1510	40	1550 \pm 50

The date of 1350 deduced for the cruck outhouse at Middle Farm, Harwell (TABLE I) also lies near the likely historical date, 1360-70, for the rebuilding of the manor house.⁴⁴

In parallel with these results, Horn⁴⁵ and Berger⁴⁷ were obtaining by a similar method the construction-dates for a number of English (and other) barns. Their results for the barn at Middle Littleton, near Evesham, Worcs., showed the consistency that can be achieved by radiocarbon dating in the late medieval period; the dates derived from five samples, some sapwood, some heartwood, were as close as 1265, 1255, 1265, 1240 and 1270, the mean being 1260.⁴⁶

THE TWO EARLY CRUCK HOUSES (FIG. 41)

The first two results in TABLE I (for H. S. Baker's, Wellshead, Harwell, and for Godfrey's, 83 The Causeway, Steventon) are of special interest in suggesting a date of construction in the 2nd half of the 13th century. Corroborative evidence for such dates is provided by certain structural oddities absent in the later cruck houses mentioned in TABLE I.

H. S. Baker's, Harwell. The surviving cruck truss, which is shaded solid at A in FIG. 41, was the W. gable of the house, as it is weathered on that side. It combines a tie-beam and two collars (the latter spaced only a foot apart), the lower being arch-braced. It also had two sets of purlins (and windbraces), the surviving (upper, S.) purlin being square in section. The doubling of the members that occurs here is well-known elsewhere in the 2nd half of the 13th century.

The alignment is parallel to the road and yet some 20 yd. back from it. This situation, and also its wide breadth (21 ft.), are attributed to its having been the gable of a two-bay hall. The central truss almost certainly had curved blades, the beam which tied them together probably being the one which survives *in situ* in the E. wall of the present house. Beyond this wall there is a heap of large sarsens which doubtless formed the plinth for the cruck house, now represented by only one bay of its hall.

⁴⁴ J. M. Fletcher, *Berks. Archaeol. J.*, LXII (1965-6), 45.

⁴⁵ W. Horn, *op. cit.* in note 40, 23.

⁴⁶ W. Horn and F. W. B. Charles, *J. Soc. Architect. Historians*, xxv (1966), 221.

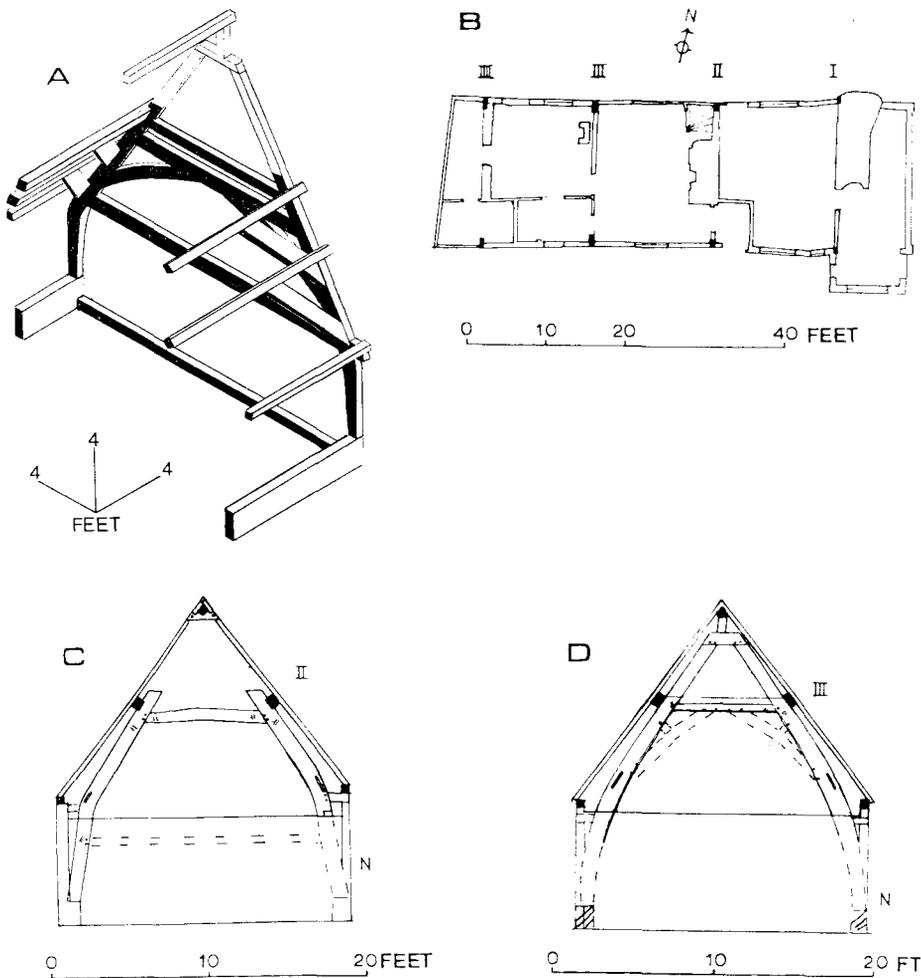


FIG. 41

CRUCK HOUSES IN NORTH BERKSHIRE

A. Gable cruck truss at H. S. Baker's house, Harwell; B, C, D. Plan and trusses nos. II and III respectively at 83 The Causeway, Steventon (pp. 138 ff.)

This hall would no doubt have had a cross-wing, perhaps of the three-bay crown-post type that was built in the village at Middle Farm and at Wellshead Farm,⁴⁴ as well as elsewhere in this part of Berkshire. The Wellshead area of Harwell is often mentioned in the title deeds of the property which passed to Magdalen College with Brounz's manor in Harwell. The area included the home of at least one freeman as well as the parsonage.⁴⁷

83, *The Causeway, Steventon* (B, C and D, FIG. 41). Here the structural evidence is more complex and suggests a 15th-century reconstruction of a late 13th-century house.

⁴⁷ Magdalen College, Oxford, Cal. Berks., Harwell, *passim*.

There are four cruck trusses, of which the E. faces of nos. I, II and III, which have contemporary assembly-marks, are visible.

The E. gable truss (I), like that at H. S. Baker's, had two closely-spaced collars; the upper alone survives, the position of the lower being shown by peg-holes. Above the upper collar was a king-post to the ridge, as at the Leadenporch House, Deddington, Oxon., built about 1300.⁴⁸ The next truss (II) has a single collar without arch-braces, and a mortise and peg for a tie-beam at about 5 ft. from the ground, with an assembly-mark of the same type as the others. Above the collar the crucks are cut off and the ridge is supported by a yoke dovetailed into rafters. Both sides of this truss, and the soffit of the yoke, are smoke-blackened, as are the adjoining rafters and purlins. It was thus at one time an open truss, despite the tie-beam. Truss III had an arch-braced chamfered collar. Peg-holes indicate that originally there were struts in the spandrels between the cruck blades and the arch-braces. Such struts are known outside Berkshire in late 13th- or early 14th-century work at St. Mary's, Chichester, Sussex, and at the barns at Leigh Court and Middle Littleton, Worcs. While the E. side of this truss is smoke-blackened, the W. side, together with the ridge and rafters of the W. bay, is not. It has, therefore, always been a partition. The presence of arch-bracing in a partition truss is unusual, but it also occurs at the White House, Munslow Aston, Salop,⁴⁹ and may well be an early feature, the arrangement in the gable truss at H. S. Baker's being similar in principle.

Other points of interest in this house are the original lodged floor, with joists aligned axially, in the W. bay, and the scarf-joint in the S. purlin, which is of a secret-played type. As this scarf-joint is not found elsewhere in the area before the 15th century, it may have belonged to a second phase, for which there is other evidence: (a), in the N. wall-plate, a secret-bridled scarf which is unlikely to be earlier than 1400; (b), in the W. bay, a windbrace which is apparently 15th-century, being four-centred, board-like and of low pitch; and (c) at truss II, an apex arrangement which belongs to the same period. The proposed explanation is that the crucks are those of a three-bay late 13th-century house with partitions at trusses II and III (FIG. 41, B). In the 15th century the house was remodelled, the partition at truss II being removed to enlarge the hall to two bays. At the same time, members such as the wall-plates and wind-braces were wholly or partly renewed and the apex of truss II altered.

DISCUSSION

Radiocarbon dating. One of the objects of this note is to draw attention to the value that radiocarbon measurements can have in identifying the period at which medieval developments in technology occurred. The dates for two of the cruck houses which contributed to this research turned out to be substantially earlier than had at one time been regarded as likely for this vernacular form of timber-framing. Yet it is now seen that there are physical features which link remarkably well with the dates indicated by radiocarbon results.

This is not surprising, because there are now about ten medieval or later buildings for which the dates, derived by making appropriate corrections⁵⁰ to the radiocarbon ages, lie within about 30 years of the expected date. In addition to the three examples (two at Wellshead Farm, one at Middle Farm, Harwell) cited earlier in this paper, there are the dates derived by Horn⁴⁵ and Berger⁴¹ for various barns and market-halls in England and France. They include:

⁴⁸ R. B. Wood-Jones, *Traditional Domestic Architecture in the Banbury Region* (Manchester, 1963), 32.

⁴⁹ J. W. Tonkin, *Trans. Shropshire Archaeol. Soc.*, LVIII (1966), 140.

⁵⁰ The corrections for secular variations in carbon-14 concentrations that have been used in TABLE I were the first to be published and were based on a limited number of measurements on wood dated by tree-rings. When the results of further research on comparable material are published, more accurate corrections for the medieval period should be available.

	<i>Derived Date</i>
Cressing Temple, barley barn	Late 11th or early 12th century
do., wheat barn	c. 1255
Parçay-Mesley, barn	c. 1250
Great Coxwell, barn	c. 1245

In others, the château at Sully-sur-Loire for example, the derived date was 50 years or more too early. If, as with our samples, the growth allowance is known to within 10 years, the standard error in the date derived for each sample should be no more than ± 5 years greater than that (currently ± 40 or 50 years⁴¹) which applies to the radiocarbon age.⁵¹

When multiple samples are analysed, as with the Middle Littleton barn and Godfrey's cruck house at Steventon, the standard error from the mean is reduced, in these two cases by $\sqrt{5}$ and $\sqrt{2}$ respectively. Thus the derived dates with their likely standard errors become 1260 ± 20 for Middle Littleton and 1275 ± 30 for Godfrey's.

Cruck houses. This research provides a basis for placing the construction of Baker's at Harwell and Godfrey's at Steventon before the end of the 13th century. The fact that in both houses the cruck blades consist of divided baulks suggests that they date from near the end of the century, as undivided baulks are usual in buildings of the 1270s and 1280s. With both houses, therefore, the dates derived from the radiocarbon ages may be too early by a decade or two.

Baker's, Harwell, is likely to have been a hall with a central base-cruck truss. Indeed, the earliest crucks and earliest base-crucks to be used in timber-framed buildings may well have been contemporary. The two examples are comparable in date with the earliest recorded cruck blades to be used in a stone hall, that at Stokesay Castle, built in the period 1285-1305,⁵² and also with the earliest known use of the term 'cruck', at Harlech in 1278.⁵³

However, a related form of structure, curved beams used as principals to bring part of the thrust from the roof on to the inside of stone walls, survives from earlier in the 13th century in some of the large stone barns which lie near the Cotswolds (FIG. 42) and are associated with religious foundations.

Such curved (and undivided) beams are present in the barns at Great Coxwell and Middle Littleton, and also in the Templars' barn at Siddington, which may well date from the 1st half of the 13th century, as Hewett has found notched lap joints on the curved beams.⁵⁴ References in the Liberate Rolls to the use of '*postes tortos*' in the kitchen at Windsor in 1236 and in an almonry at Kempton, Middlesex, in 1233 may imply similar timber-framing in stone structures.⁵⁵

Closer to Harwell and Steventon (and adjacent to the Coral Rag and Lower Calcareous Grit which provided stone in medieval times for an E.-W. band which included Abingdon and Oxford) are the curved posts of a 'base-cruck' structure in

⁵¹ Until recently, it was commonplace for radiocarbon laboratories to quote standard errors of ± 60 or ± 80 years, even though the error for the radiocarbon measurement itself was less (Berger, *op. cit.* in note 41, 104).

⁵² R. A. Cordingley, *Art Bulletin*, XLV (1963), 91.

⁵³ L. F. Salzman, *Building in England down to 1540* (Oxford, 1952), 195. N. W. Alcock and M. W. Barley in a recent paper (*Antiq. J.*, LII (1972), 143) state that crucks are recorded as early as the 12th century in a Glastonbury Abbey barn. They base this on the presence of the noun *furca*. The document (J. E. Jackson, *Inquisition of the Manors of Glastonbury Abbey in the Year 1189*, (London, 1882), 94) deals in detail with the storage of corn and hay in a large barn at Wrington, Somerset, having two doors on one of the lateral sides and consisting of at least five bays. However, the inquisition does not prove that there was a cruck or base-cruck construction in this building. As C.F. Innocent (*The Development of English Building Construction*, ed. R. de Z. Hall (Newton Abbot, 1971), 37) points out in his chapter on curved tree principals 'both the upright, straight posts and the slanting, curved crooks were "forks" to the medieval writers, and so it is impossible to say which kind was meant in the above quotations'—one of the quotations referring to the barn at Wrington.

⁵⁴ C. A. Hewett, *Country Life*, 30 Dec. 1971, p. 1844.

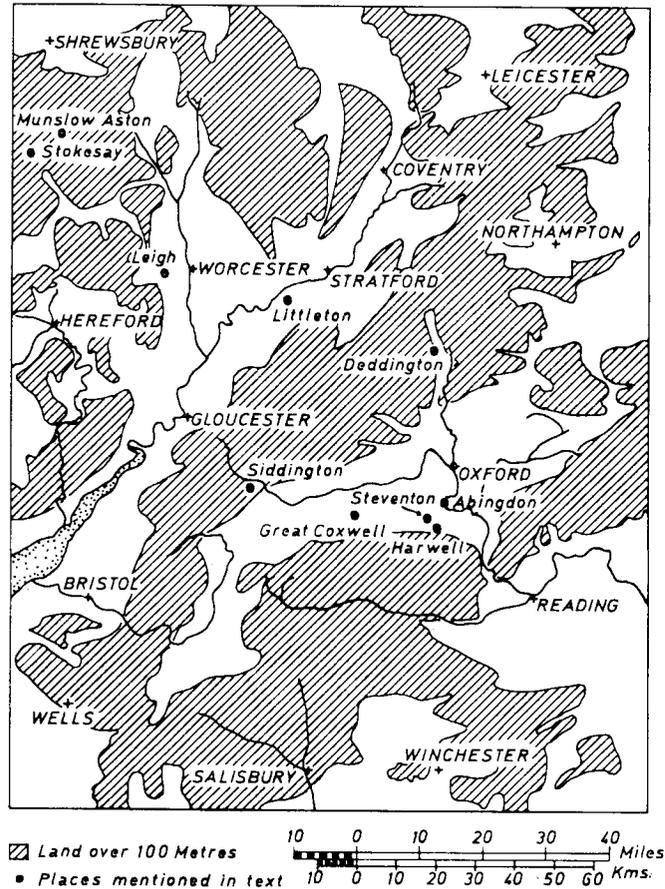


FIG. 42

MAP OF MIDLAND AND SOUTH-CENTRAL ENGLAND

showing the region where buildings appear which have features in common with those of the two early cruck houses in N. Berkshire (p. 141 f.)

a stone range built in the 2nd half of the 13th century in the administrative courtyard of Abingdon Abbey.⁵⁵ A technique making use of curved posts thus existed in the 13th century both locally and within 30 miles to the E. and W. It is therefore understandable that, before the end of the century, the wealthier tenants of Harwell and Steventon might build timber-framed houses incorporating both cruck and base-cruck trusses, and that the reeve in Harwell in 1311 should be named Reginald atte Cruck.⁵⁶

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⁵⁵ *Med. Archaeol.*, XIII (1969), 243.

⁵⁶ We are grateful to Mr. Martin Fletcher for cutting the samples and to Prof. R. Berger for making the radiocarbon measurements on them; to the owners of the several houses involved for permission to take samples and to make measurements; and to Mr. W. E. Godfrey for permission to reproduce the plan in FIG. 41.